



## AUTONOMOUS SHIPS: THE FUTURE IS NOW

**In this bulletin we look to capture the vast array of developments, concerning both vessels and technology systems, that have been announced in the past few months since our last bulletin in June 2022.<sup>1</sup>**

New interdisciplinary collaborations have been established, navigational systems have been created or further developed, class notations have been granted and successful sea trials of various types of vessels with autonomous capabilities have been undertaken and completed. In addition, important Memorandum of Understanding's (MoUs) between different players in the shipping sector have been signed, which will generate autonomous technology work. Numerous orders have

<sup>1</sup> <https://www.hfw.com/Autonomous-ships-MASS-for-the-MASSes>

also been placed for automated navigation systems, to be installed in fleets of vessels.

It seems reasonable to expect that more orders will be placed, whether for types of Maritime Autonomous Surface Ships (MASS) or for equipment that can assist MASS operations, and that the speed with which this sector develops, and services are delivered, will increase rapidly as more and more participants demonstrate interest in this area. It has been estimated that the global autonomous ships market will roughly double from USD 6.55 billion in 2021 to USD 12.07 billion in 2028.<sup>2</sup>

Interestingly, news stories about MASS have not been limited to technology-related issues. One international incident has been reported between the US and Iran, involving the attempted confiscation of an unmanned surface vessel (USV). Further, so-called “narco-drones” have been recently located in Spain, which have the capacity of transporting multiple kilograms of drugs under water.

Events in Ukraine and attacks on critical infrastructure have prompted several possible theories, mechanisms and culprits. Putting attribution and blame to one side, the industry is potentially well placed to help police and patrol pipelines and cables that link Europe and the rest of the world. See our recently published bulletin for more on this subject.<sup>3</sup>

Finally, the UK Government has proposed amendments to the Merchant Shipping (Small Workboats and Pilot Boats) Regulations 2023 and an updated Code of Practice which will cover Remotely Operated Unmanned Vessels (ROUVs) which are either UK vessels wherever they may be, or vessels operating from UK ports whilst in UK waters. An ROUV is defined in the draft regulations as

*“a small vessel that is operated from a remote operation centre and is not carrying any person at the time it is operated”.*<sup>4</sup> We are reviewing the draft and a further update will follow setting out our thoughts on the potential implications for owners and operators in the UK.

## Industry update

### Singapore Maju 510

Maju 510, a 32-metre Harbour tug, is the first ship to receive Autonomous and Remote-Control Navigation Notation from the American Bureau of Shipping (ABS) classification society.<sup>5</sup> The tug, owned and operated by Keppel Smit Towage, is also the first Singapore-flagged ship to receive the Smart (Autonomous) Notation from the Maritime and Port Authority in Singapore (MPA) and the first joystick-controlled vessel from ashore in south Asia.

Maju 510 was equipped with ABB Ability Marine Pilot Vision and Marine Pilot Control, which deploy artificial intelligence to automate navigational observations.<sup>6</sup> The vessel demonstrated autonomous collision avoidance capabilities and operated smoothly in autonomous mode throughout various scenarios. The trials were supervised by a tug master on board and took place at Raffles Reserved Anchorage, off Singapore Island, in March 2022. During the trials Maju 510 avoided potential collisions with multiple ships with changing speeds and courses, as well as when in the vicinity of a vessel sailing erratically. The tug’s capabilities look promising for the future as safety can be increased and crews can be relieved of conducting tasks that can be automated.<sup>7</sup>

Romi Kaushal, Managing Director of Keppel Smit Towage, commented: *“particularly impressive was how the digital system identified one or several risks in the tug’s planned*

*path and responded to set the vessel on a new, safer course. The vessel performed as if it was operated by an experienced tug master.”*<sup>8</sup> In the 26th International Tug & Salvage Convention, Exhibition & Awards held 28-30 September 2022 in Istanbul, Turkey, Mr Kaushal, explained that “autonomous operation” does not mean “unmanned operation”, as there are multiple stages of autonomous operation involved. He stressed that *“the next plan by the port authorities would be to go into live traffic and see how we behave. Of course, the tugs will always be manned. There will always be crews on board to take action and override the systems”.*<sup>9</sup>

### Avikus’ HiNAS 2.0

HiNAS 2.0 is an Artificial Intelligence (AI) based navigation system developed by Avikus that can assist with collision avoidance and optimal route and speed decisions. In our last bulletin, *MASS for the MASSes* which can be viewed [here](#), we considered the system’s installation on Prism Courage, a Liquefied Natural Gas (LNG) carrier. In August 2022, Avikus *“succeeded in commercialising the industry’s first phase 2 autonomous navigation solution for commercial vessels”* by securing contracts for the installation of HiNAS 2.0 on 23 ocean-going vessels.<sup>10</sup> The vessels include containerships and LNG carriers that are currently under construction.<sup>11</sup> The installation is scheduled to commence in 2023 and the company has also revealed plans to develop an autonomous system for recreational boating.<sup>12</sup>

The first version of HiNAS assisted the navigator by providing information in limited visibility conditions, such as at night or in sea fog. The system’s infrared cameras could be used to supply information on the location and speed of potential obstacles. The second version automatically

2 <https://www.fortunebusinessinsights.com/industry-reports/autonomous-ship-market-101797>

3 <https://www.hfw.com/NordStream-leaks-are-our-arteries-safe>

4 <https://www.gov.uk/government/consultations/the-merchant-shipping-small-workboats-and-pilot-boats-regulations-2023>

5 <https://new.abb.com/news/detail/94104/abb-and-keppel-om-verify-next-level-of-vessel-autonomy-with-collision-avoidance-trials>

6 <https://www.rivieramm.com/news-content-hub/owners-prepare-for-autonomous-tug-operations-72437>

7 <https://maritime-executive.com/article/next-level-of-vessel-autonomy-verified-on-singapore-tug>

8 <https://insurancemarineneews.com/insurance-marine-news/tug-performs-autonomous-collision-avoidance-in-port-of-singapore/>

9 <https://www.rivieramm.com/news-content-hub/its-2022-news-harbour-tug-pilot-project-advances-vessel-autonomy-73072>

10 <https://pulsenews.co.kr/view.php?year=2022&no=701547>

11 <https://www.thedigitalship.com/news/electronics-navigation/item/7992-avikus-secures-contracts-to-roll-out-autonomous-tech-on-23-large-ships>

12 <https://maritime-executive.com/article/first-automation-systems-to-be-installed-on-south-korean-ships-in-2023>



# “In July 2022, Spanish authorities seized three unmanned underwater vessels that were allegedly intended for drug trafficking use, and arrested 8 people in Cádiz, Málaga and Barcelona.”

detects objects around the vessel and her route for collision avoidance purposes.<sup>13</sup> Avikus' CEO Dohyeong Lim, has stated that the company will, *“in the future, strive to equip all large ships in the world with HiNAS 2.0 by obtaining approval from various shipping associations and countries”*.<sup>14</sup>

## Ocean Infinity's Armada Fleet

Ocean Infinity's Armada project concerns the construction of a fleet of 23 robotic vessels, some of which are currently under construction at Vard Vung Tao.<sup>15</sup> As part of Ocean Infinity's preparation for the vessels' readiness, a ship was mobilised in Sweden to collect hydrographic and geophysical data during a trial in June 2022. The company streamed the data collected, using satellite communications from the ship's location directly to Ocean Infinity's Remote Control Centre (RCC) in Southampton, UK. This enabled the RCC to have full control of the various payload sensors on board the ship and make any necessary changes to certain instruments. The successful completion of the trial was considered by Ocean Infinity as *“an important milestone towards*

*the readiness for full remote survey operations”*.<sup>16</sup>

The Armada vessels will be equipped with DNV's ShipManager fleet management software. The latter is used for planned maintenance as well as procurement and business intelligence. Valeport's sensor technology will also be used for sound velocity and bathymetric data.<sup>17</sup>

## New developments

### U.S. Navy blocks Iranian attempt to seize U.S. unmanned vessel

The Saildrone Explorer is a USV which undertakes data collection missions with an endurance of 365 days.<sup>18</sup> It is equipped with sensors, radars and cameras which assist with navigation and data collection.<sup>19</sup> It is a commercially available technology albeit without the capacity of storing sensitive or classified information.<sup>20</sup>

Between the 29th and 30th of August 2022 Iran's Islamic Revolutionary Guard Corps Navy (IRGCN) attempted to confiscate the vessel. IRGCN's support ship Shahid Baziar commenced towing the USV in international waters of the Arabic Gulf, but the operation was

prevented by the U.S. Navy patrol coastal ship USS Thunderbolt.<sup>21</sup> The IRGCN ultimately disconnected the towing line to Saildrone Explorer and departed from the area around 4 hours later. The U.S. Navy continued its operations, and no further incidents were reported but Vice Adm. Brad Cooper, commander of U.S. Naval Forces Central Command, U.S. 5th Fleet and Combined Maritime Forces, stated: *“IRGCN's actions were flagrant, unwarranted, and inconsistent with the behavior of a professional maritime force”*.<sup>22</sup>

### Narco-drones located in Spain

In July 2022, Spanish authorities seized three unmanned underwater vessels that were allegedly intended for drug trafficking use, and arrested 8 people in Cádiz, Málaga and Barcelona.<sup>23</sup> The remote-controlled “narco-drones”, “narco-sub” or “underwater drones” could each be capable of transporting around 200kg of drugs.<sup>24</sup> As this development may pave a new way for drug trafficking, it seems critical that states cooperate to create an international legal framework to address this issue. The questions of who will be criminally liable, which

13 <https://maritime-executive.com/article/hyundai-plans-first-ocean-going-autonomous-ship-voyage-by-year-s-end>

14 <https://maritime-executive.com/article/first-automation-systems-to-be-installed-on-south-korean-ships-in-2023>

15 <https://maritime-executive.com/article/shell-signs-on-to-test-all-robotic-platform-for-subsea-inspection>

16 <https://oceaninfinity.com/remote-survey-system-testing/>

17 <https://www.offshore-energy.biz/ocean-infinity-trials-remote-survey-system-for-armada-fleet/>

18 <https://www.naval-technology.com/projects/saildrone-explorer-unmanned-surface-vessel-usv-usa/>

19 <https://www.maritime-executive.com/article/video-u-s-navy-foils-iranian-attempt-to-capture-unmanned-vessel>

20 <https://www.navalnews.com/naval-news/2022/08/u-s-navy-foils-iranian-attempt-to-capture-saildrone-usv/>

21 <https://www.navalnews.com/naval-news/2022/08/u-s-navy-foils-iranian-attempt-to-capture-saildrone-usv/>

22 <https://www.maritime-executive.com/article/video-u-s-navy-foils-iranian-attempt-to-capture-unmanned-vessel>

23 <https://www.theguardian.com/world/2022/jul/04/spanish-police-seize-underwater-drones-designed-to-carry-drugs>

24 <https://worldnationnews.com/narco-drones-are-the-newest-form-of-drug-trafficking-our-laws-are-not-yet-ready-to-counter-them/>

state will have jurisdiction and whether a “narco-drone” qualifies as a ship are likely to be the main focus points.<sup>25</sup> At the same time, definitions - or the lack of - of what constitutes a “ship” or “vessel” as well as considering who qualifies as a “master” or “seafarer” for uncrewed vessels’ purposes can also create challenges in this rapidly growing and, to an extent, unregulated area. See our [previous bulletin](#) which addresses these issues.<sup>26</sup>

### **Sea Machines’ autonomy system on tug gains ABS approval**

The tug Rachael Allen of Foss Maritime Company will use the Sea Machines Robotics SM300 autonomy system which has recently earned ABS approval. SM300 is the result of collaboration between a software company (Sea Machines), a marine transportation provider (Foss Maritime) and a classification society (ABS). Currently, Rachael Allen is operated by Foss in California, providing tanker escorts and vessel assistance for the company’s clients.<sup>27</sup>

The autonomy system will initially be employed for routine transit and standby operations and then be tested for remote piloting from a shore-based control centre.<sup>28</sup> It offers “operational domain awareness, telemetry and attitude to a remote commander via a chart-based user interface, tracked targets, video and warnings. These are generated by cameras, sensors and other equipment located on and off the vessel. On board machinery, instrumentation and payload data also stream to the user interface”.<sup>29</sup>

SM300 is available for sale and installation in new builds or retrofits for a wide range of applications in the marine sector.<sup>30</sup>

### **DARPA’s Defiant**

The U.S. Military’s Defence Advanced Research Projects Agency (DARPA), is proceeding to Phase 2 of the No Manning Required Ship (NOMARS) programme, aiming to build, test and demonstrate a medium sized unmanned surface vessel.<sup>31</sup> In Phase 1, Serco Inc. was selected to develop a novel Design Space Exploration (DSX) toolset. Using the DSX tool they produced a set of vessel designs of different tonnages and then refined these into one ship for the first design review, which was named Defiant. As part of Phase 2, Serco will finalise the design, construct the vessel and perform testing activities before the sea trials commence.

The Defiant, the first of its kind, will be a 210-metric tonne Medium and Large Unmanned Surface Vessel (MUSV) class ship and DARPA’s objective is for the vessel to “maximize performance, reliability, and maintenance efficiency while still carrying significant payloads at tactically useful ranges”. DARPA contemplates that the reliability target will be achieved by the integration of “distributed hybrid power generation, podded propulsors, and high-capacity batteries”.<sup>32</sup>

### **Vard’s SeaQ Remote**

Vard Electro has launched SeaQ Remote, which offers centralised remote operation of automated vessel control systems and deck machinery.<sup>33</sup> This technology enables, among other things, lean manning, enhanced safety and sustainability and 24/7 support with an expert in the loop to ensure the smooth running of the system.<sup>34</sup> Additional benefits of SeaQ Remote include condition monitoring, optimised

operational performance and fleet-wide overview.

The product will be installed on 14 newbuild robotic vessels that will be constructed by Vard and will be operated remotely. It is planned to unify the existing SeaQ’s automation systems into a single user interface that can remotely control vessels from the shore.<sup>35</sup> The product “extends smart data-driven functionality to operational technology in the vessel hull as it enables remote operation of existing machinery systems such as engines, propellers and thrusters”.<sup>36</sup> Importantly, the remote operator will be in a position to switch between different operating modes and handle potential crises in real time as the machinery involved will be connected to sensors that can send real-time data.<sup>37</sup>

### **SeaShuttle project**

ENOVA, a Norwegian state enterprise, has agreed to provide funding of NOK150 million (approx. USD15 million) for the construction of two remotely operated autonomous containerships.<sup>38</sup> The vessels will be hydrogen-powered, and their delivery is scheduled for 2025. The project will be led by Ocean Infinity and the Dutch intermodal transport company Samskip. The vessels will operate between Oslofjord in Norway and Rotterdam in the Netherlands.<sup>39</sup>

In an effort to achieve zero emissions, the containerships, each with 500 TEU capacity, will be equipped with a propulsion system that can be powered by hydrogen fuel. Specifically, the vessels will be powered by a 3.2 MW hydrogen fuel cell but a diesel electric propulsion plant will also be installed on board as back-up. Are Gråthen, CEO

25 <https://maritime-executive.com/editorials/opinion-narco-drones-are-here-and-maritime-laws-aren-t-ready>

26 <https://www.hfw.com/downloads/HFW-BRIEFING-Autonomous-ships-successfully-navigating-through-the-shallows.pdf>

27 <https://www.marinelog.com/technology/sea-machines-autonomy-system-on-board-foss-tug-gains-abs-ai-p/>

28 <https://sea-machines.com/sea-machines-sm300-system-onboard-foss-tug-earns-abs-approval/>

29 <https://sea-machines.com/sm300/>

30 <https://sea-machines.com/sea-machines-sm300-system-onboard-foss-tug-earns-abs-approval/>

31 <https://maritime-executive.com/article/darpa-moves-forward-to-build-and-demonstrate-medium-unmanned-ship>

32 <https://www.navalnews.com/naval-news/2022/08/darpa-to-build-test-demonstrate-first-nomars-usv/>

33 <https://www.vard.com/articles/stepping-up-investment-for-autonomous-ship-operations>

34 <https://www.vard.com/products-and-services/seaq-remote>

35 <https://www.vard.com/articles/stepping-up-investment-for-autonomous-ship-operations>

36 <https://www.thedigitalship.com/news/electronics-navigation/item/7921-var-d-steps-up-investment-for-autonomous-ship-operations>

37 <https://www.vard.com/products-and-services/seaq-remote>

38 <https://www.marinelog.com/news/seashuttle-autonomous-containership-project-set-to-move-ahead/>

39 <https://maritime-executive.com/article/hydrogen-powered-autonomous-containership-receives-15m-in-funding>

# “This joint development is meaningful in that it includes shipyards, autonomous solution companies, classification, and flag states to commercialize autonomous navigation solutions.”

of Samskip Norway, stated that *“Securing this funding provides a platform to make emissions-free container shipping a reality. Together, Samskip and Ocean Infinity will also accelerate their plans to advance autonomous ship technologies, and remote operation of ships and cargo handling equipment. These ships are the first part of an exciting collaboration with Ocean Infinity.”*<sup>40</sup>

## **KR, SHI and KLCSM sign MoU for autonomous navigation certification**

In June 2022, the Korean Register (KR), Samsung Heavy Industries (SHI) and Korea Leading Company of Ship Management (KLCSM) signed a memorandum of understanding (MoU) to carry out research and approve the application of autonomous navigation systems for medium to large-sized ships.<sup>41</sup> According to the MoU, Samsung Autonomous Ship (SAS), the autonomous navigation system developed by SHI, will be installed on KLCSM's vessels and KR will provide technical support for the project. Risk assessments will be undertaken and SAS will also enable the development and certification of cyber-security systems.<sup>42</sup>

In addition, the parties to the MoU have also agreed to collaborate to commercialise autonomous navigation systems through the Marine Equipment Directive (MED) certification. Yeon Kyujin, head of KR's Plan Approval Center is confident that this collaboration *“will accelerate the commercialisation of autonomous ship equipment and technology, and enhance the quality and competitiveness of the equipment by establishing an actual ship-based autonomous operating system”*.<sup>43</sup>

## **DNV, HHI, Avikus and LISCR sign MoU to collaborate on autonomous ship technology developments**

Classification society Det Norske Veritas (DNV), Hyundai Heavy Industries (HHI), Avikus and the Liberian International Ship & Corporate Registry (LISCR) have agreed to undertake a study on autonomous navigation systems on board vessels, entering into a MoU to develop autonomous ship technologies. The entities concerned will concentrate on the development of autonomous solutions in a maritime context that will comply with DNV's rules on autonomous operations. Meanwhile Avikus is aiming to obtain approval in principle

from both DNV and the Liberian flag Administration.<sup>44</sup>

Avikus is a subsidiary of HHI and, as mentioned above, has developed the Hyundai intelligent Navigation Assistant System (HiNAS 2.0).<sup>45</sup> Dohyeong Lim, CEO of AVIKUS, has commented that *“This joint development is meaningful in that it includes shipyards, autonomous solution companies, classification, and flag states to commercialize autonomous navigation solutions. Based on the results of this project, we will successfully commercialize HiNAS 2.0 and contribute to the improvement of navigation safety and fuel savings”*.<sup>46</sup>

## **Fugro's Blue Prism**

Fugro, a leading geo-data specialist engaged in, among others, the development and deployment of remote and autonomous solutions, has contracted Kooiman Engineering and Van Oossanen Naval Architects for the design of Blue Prism, a USV to be used for autonomous and sustainable geophysical surveys.<sup>47</sup> The vessel will be part of Fugro's next generation of USVs and will operate in coastal as well as offshore environments. Some of its main characteristics include an ultra-low carbon footprint, high quality data

<sup>40</sup> <https://smartmaritimeneetwork.com/2022/06/24/funding-secured-for-autonomous-ready-seashuttle-green-container-ship/>

<sup>41</sup> <https://container-news.com/kr-klcsm-and-shi-sign-agreement-on-autonomous-navigation-systems/>

<sup>42</sup> <https://www.thedigitalship.com/news/electronics-navigation/item/7949-kr-klcsm-and-shi-sign-mou-to-commercialise-autonomous-navigation-systems>

<sup>43</sup> <https://www.ship-technology.com/news/kr-autonomous-navigation-systems-ships/>

<sup>44</sup> <https://www.ship-technology.com/news/dnv-partners-autonomous-ship-technology/>

<sup>45</sup> <https://www.dnv.com/news/dnv-signs-mou-with-hhi-avikus-and-liscr-to-develop-autonomous-ship-technology-229950>

<sup>46</sup> <https://www.dnv.com/news/dnv-signs-mou-with-hhi-avikus-and-liscr-to-develop-autonomous-ship-technology-229950>

<sup>47</sup> <https://www.fugro.com/media-centre/news/fulldetails/2022/07/04/fugro-expands-its-usv-fleet-with-the-development-of-the-blue-prism-for-autonomous-and-sustainable-geophysical-surveys>

collection, weather resilience and high endurance.<sup>48</sup> The USV will be available to clients in 2023 and will be capable of collecting bathymetry and sub-bottom data through hull-mounted sensors.<sup>49</sup> Fugro also expects that, in combination with the above features of Blue Prism, the company's smart data management software will also contribute in accelerating project delivery as well as reducing risk.<sup>50</sup>

### U.S. Navy's EPF 13

The future U.S. Navy ship, the "APALACHICOLA" (EPF 13) has successfully completed trials testing its autonomous capabilities and is scheduled for delivery to the U.S. Navy later this year.<sup>51</sup> The trials are split into acceptance and unmanned logistics prototype trials.<sup>52</sup> Acceptance trials include in-port and at-sea demonstrations enabling the Navy and the shipbuilder Austal USA to evaluate the vessel's systems and readiness prior to delivery. The unmanned logistics prototype trials test autonomous capabilities integrated into the shipboard configuration, indicating whether a large vessel can operate as a self-driving platform.<sup>53</sup>

EPF 13 transited from Mobile, Alabama, to Miami, Florida and the autonomous system installed completed a stress test in "high-traffic coastal areas by taking appropriate ship handling actions while operating around other ships, boats, sailboats, and craft". The ship operated autonomously about 85% of the time throughout the voyage.<sup>54</sup>

EPF 13 will be the 13th Spearhead-class vessel in the Navy's fleet and is a "multi-use military platform capable of rapidly transporting troops

and their equipment, supporting humanitarian relief or operational efforts, and can operate in shallow waters".<sup>55</sup> Adding an autonomous capability to the above-mentioned class creates new opportunities for the Navy. EPF 13 will be the first fully operational U.S. naval ship with autonomous capability that will also enable the ship to autonomously navigate in a commercial vessel traffic lane.<sup>56</sup>

### ASKO's autonomous freight ferries

Norwegian ASKO Maritime, a new division of Norway's biggest grocery distributor, christened in September 2022 two battery-electric, autonomously operated "sea drones".<sup>57</sup> The event marked the beginning of the vessels' two-year trial period to become fully certified for uncrewed operations. During the trial the vessels will sail with about 4 crew members including the captain, but the goal is, once the vessels are fully certified, to operate unmanned and be monitored from the shore in Horten, Norway. Masterly, a joint venture between Wilhelmsen and Kongsberg, will undertake the technical management of the vessels.<sup>58</sup>

The sea drones are designed to carry freight trailers between the Norwegian terminals Moss and Horten. They will mainly be employed to carry groceries for ASKO parent NorgesGruppen's chains, and each will be able to carry up to 16 trailers with maximum capacity of 29 tonnes per trailer.<sup>59</sup> The vessels were built at Cochin Shipyard in India and were funded, together with the required port infrastructure, by the Norwegian government as part of a project to promote emissions-free transportation across the Oslo Fjord.<sup>60</sup>

The vessels are expected to save 5,000 tonnes of CO2 emissions per year as well as reduce transportation costs. It is estimated that the sea drones will replace one million road kilometres of truck transport per annum, corresponding to approximately 16,600 driver hours per year.<sup>61</sup>

By way of comparison, the "YARA BIRKELAND" is expected to save around 1,000 tonnes of CO2 and reduce the number of road trips by around 40,000 diesel truck journeys per annum.<sup>62</sup>

### Round up

All in all, it has been a busy four months for the autonomous vessel sector. We will continue to monitor developments and bring you news of the latest changes in our next MASS bulletins. Meanwhile, watch out for our 'special editions' on how autonomous vessels could assist with critical infrastructure safety and our review of the proposed changes to the Merchant Shipping (Small Workboats and Pilot Boats) Regulations 2023 and updated Code of Practice.

In the meantime, if HFW can assist with any queries, please contact a member of the team for assistance.

48 <https://www.offshore-mag.com/rigs-vessels/article/14279128/fugro-advances-blue-prism-offshore-wind-vessel-development>

49 <https://www.offshore-energy.biz/fugro-picks-team-for-next-gen-uncrewed-surface-vessel/>

50 <https://www.fugro.com/media-centre/news/fulldetails/2022/07/04/fugro-expands-its-usv-fleet-with-the-development-of-the-blue-prism-for-autonomous-and-sustainable-geophysical-surveys>

51 <https://www.navsea.navy.mil/Media/News/Article/3153532/the-future-usns-apolachicola-achieves-milestones-with-acceptance-trials-and-com/>

52 <https://www.marinelog.com/technology/epf-marks-acceptance-and-autonomy-double-milestone/>

53 <https://www.navsea.navy.mil/Media/News/Article/3153532/the-future-usns-apolachicola-achieves-milestones-with-acceptance-trials-and-com/>

54 <https://www.navsea.navy.mil/Media/News/Article/3153532/the-future-usns-apolachicola-achieves-milestones-with-acceptance-trials-and-com/>

55 <https://www.marinelog.com/technology/navy-conducts-unmanned-logistics-prototype-trials-with-pre-delivery-epf/>

56 <https://maritime-executive.com/article/u-s-navy-begins-testing-its-first-full-size-autonomous-ship>

57 <https://maritime-executive.com/article/electric-autonomous-ro-ro-freight-ferries-begin-service-in-norway>

58 <https://www.offshore-energy.biz/asko-maritime-names-two-fully-electric-autonomous-sea-drones/>

59 <https://www.marinelog.com/technology/asko-maritime-christens-first-two-sea-drone-autonomous-freight-ferries/>

60 <https://www.rivieramm.com/news-content-hub/news-content-hub/contracts-signed-for-two-new-autonomous-electric-ro-ro-vessels-60763>

61 <https://www.marinelog.com/technology/asko-maritime-christens-first-two-sea-drone-autonomous-freight-ferries/>

62 <https://www.hfw.com/Autonomous-ships-MASS-for-the-MASSes>



## Events

### Autonomous Ship Expo:

21-23 June 2022, Amsterdam, the Netherlands  
(details of the 2023 conference can be found here:  
<https://www.autonomousshipexpo.com>)

### Electric & Hybrid Marine Expo

21-23 June 2022, Amsterdam, the Netherlands  
(details of the 2023 conference can be found here:  
<https://www.electricandhybridmarineworldexpo.com/en>)

### The Seawork Commercial Marine Conferences

22 & 23 June 2022, Southampton, UK  
(<https://seaworkconnect-clone-1642498106-mercatormedia.expoplatform.com/page/conference-programme>) – details of the 2023 conference can be found here: <https://seawork.com/aboutseawork>

### OES Autonomous Underwater Vehicle Symposium (AUV 2022)

19-21 September 2022, Singapore, Singapore  
(<https://www.auv2022.org/>)

### Digital Ship Conference

19 October 2022, Athens, Greece  
(<https://www.athens.thedigitalship.com/>)

### Marine Autonomy Technology Showcase

8-10 November 2022, Southampton (and online)  
(<https://noc-events.co.uk/mats-2022>)

### Nor-Shipping 2023

6-9 June 2023, Oslo, Norway  
(<https://nor-shipping.com/about/>)

### Fourth International Ship Autonomy and Sustainability Summit

8 June 2023, Oslo, Norway  
(<https://nor-shipping.com/autonomy-summit/>)

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