

THE ADVENT OF MARINE AI TECHNOLOGY

Jonathon Savill reports on the revolutionary impact artificial intelligence is about to have on all areas of life at sea



A new marine world is coming over the horizon

The technology for unmanned cargo ships already exists

Rapid digital developments are transforming maritime activity around the world

Innovative technology has always created fresh new chapters in how we approach sailing. You only have to look back at the most advanced and sophisticated navigation systems of the mid-twentieth century, such as Decca and LORAN, to see how they are now nothing more than half-forgotten marine curiosities, trampled into extinction by GPS and the plethora of electronic navigational devices born in its digital wake. Now though, it's time to prepare ourselves for what is likely to be the most fundamental technological change the marine environment has ever yet seen – the AI (artificial intelligence) transition – an advance that will touch and transform every aspect of life at sea, from naval operations and port operations to marina manoeuvres and search and rescue.

NAVAL OPERATIONS

Those sailing the waters of the Solent over the last year or so may have been lucky enough to witness the Royal Navy testing out its new fleet of swift airborne autonomous drones designed to rescue crew who have fallen overboard. The new drones can quickly locate a casualty,

drop a lifejacket down to them, then hover above to keep a steady mark of their location. The Senior Service has also been trialling new types of unmanned vessels along the south coast for potentially dangerous naval applications, such as mine hunting, where having a crewless vessel would always be preferable. The semi-autonomous boats, known as MADFOX (MARitime Demonstrator For Operational eXperimentation) are controlled by navy personnel using laptops and joysticks as they sit comfortably on a nearby beach.

SEARCH AND RESCUE

The UK's Maritime and Coastguard Agency (MCA), meanwhile, has just begun a partnership with AI specialist firm Faculty to create the next generation of search and rescue procedures. Faculty is said to be carrying out advanced analytics using AI machine learning technology to analyse historical data on more than 9,000 search and rescue calls received over the last three years. The results will then be used to inform the planning for the country's future helicopter search and rescue capability, which will be known as Search and Rescue Second Generation (UKSAR2G).

SMART SHIPPING

Britain, with its long and proud history of maritime technological development, is particularly keen on establishing itself as early as possible as the world's leading marine AI pioneer. Earlier this year, the UK government launched an £8 million fund to boost the country's position at the forefront of machine-learning maritime technology. The investment will be used to stimulate the development of a wide range of new digital assets, from self-driving boats to autonomous port operations, as stimulants for an improved sea-based economy and support for, often neglected, coastal communities. Money from the Smart Shipping Acceleration Fund will be used to develop smart marine technologies including AI, robotics and autonomous vessels. It's hoped port authorities will eventually be able to use AI to optimise commercial activity, increase safety, and reduce negative environmental impacts.

'Artificial intelligence will deliver real change in shipping and the marine environment with greater use of



Even sextants have now succumbed to the new digital age

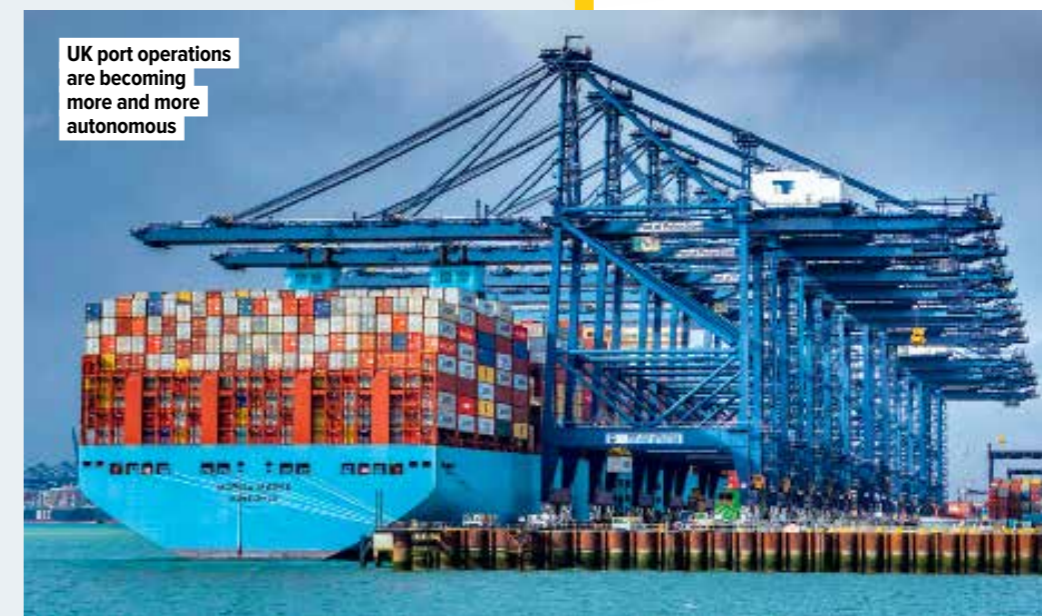
autonomous vessels and automated data analysis,' insists Peter Aylott, policy director at the UK Chamber of Shipping. 'These technologies will help generate jobs, improve supply chains and reduce greenhouse gas emissions.'

MARINA MANOEUVRES

In the realm of recreational boating UK-based marine technology specialist Raymarine recently launched Docksense, an AI supported system to help craft manoeuvre in a marina. The system uses sophisticated cameras and a joystick and is said to be particularly useful on any boat that can pivot, such as a yacht with a bow thruster. While not fully autonomous, it has, however, been designed to intervene and prevent any chance of a collision, with the system allowing the skipper to select a berth on a screen and then hand over control of the boat to the computer. I have watched a demo of it. It was efficient but on the fourth attempt it was fooled by a fast-moving tide. It then, very sensibly, moved the boat clear and had another go, which was finally successful. As a helmsman I would have tried it

and almost certainly have failed. The system can be fitted to new boats, but not retrofitted, at a cost of around £15,000 for a three camera setup.

UK port operations are becoming more and more autonomous



CROWDED WATERS

Raymarine has also developed a second new consumer AI product, Neubot, which can be mounted on the top of a yacht's mast to help the boat navigate through crowded waters using six cameras to guide propulsion and steering, whilst displaying the information on an Axiom chartplotter. If, for instance, you want to moor up a couple of miles upstream, the software will use AI to plot a course shown as a blue line on the screen, then avoid any floating objects and low bridges. 'This AI system provides a virtual buffer zone around the vessel,' explains Jamie Cox, product director at Raymarine. 'It will be especially useful for larger boats where the skipper has no direct view of the entire hull.' The Neubot system, like Dockwise, costs around £15,000. →



Raymarine's Docksense on an Axiom 12 screen

ITALIAN COASTGUARD

Meanwhile, over in the Mediterranean, the Italian Coastguard has successfully deployed an autonomous lifeboat and drone combination, as part of a large search and rescue exercise. Sensors on board the drone were able to detect casualties floating in the water, then guide the unmanned lifeboat directly to them. The drone has been equipped with optical and infrared cameras, a maritime radar, AIS receiver, and an emergency position indicating radio beacon antenna, to make it as optimal and autonomous as possible for future search and rescue and maritime surveillance missions.



A masthead SEA.AI machine-learning camera monitoring its surroundings



AI vision is now guiding this Fred. Olsen fast ferry through the seas of the Canary Islands

COLLISION AVOIDANCE

In August, the world's first passenger fast-ferry equipped with an AI vision system was launched in the Canary Islands. At present AIS can only show and identify maritime traffic superimposed over an electronic chart which, in turn, indicates fixed features such as buoys, beacons and other navigational marks. The new AI vision system, SEA.AI, takes this a step further, being able to alert navigators and bridge officers to anything floating in the water that hasn't been identified and recorded by the other systems. Crucially, SEA.AI's machine learning means that it can identify target objects and automatically determine whether they are a potential collision threat.

It achieves this by using externally mounted high-resolution cameras capable of operating in the lowest light and contrast situations along with two highly accurate thermal cameras. The cameras are all gyro- and digitally-stabilised to provide a constant watch

360° around the vessel. The cameras are able to eliminate the digital 'noise' of the seascape to determine potential targets in real time. The visual and thermal signatures of the targets are then compared to those within SEA.AI's ever-growing database of millions of annotated marine objects. The results can be shown on a display on the bridge or a computer or tablet. Once potential collisions have been determined, SEA.AI will automatically alert the crew. The system is stand-alone and requires no internet connection. The cameras can identify large vessels not fitted with AIS up to 7.5km away; smaller craft such as fishing boats, dinghies and inflatables up to 3km away; and buoys, flotsam and MOB casualties up to 700m away.

'AI vision is the next safety standard in the marine world and is now being used on commercial vessels and recreational yachts,' explains Solenn Gouerou, head of marketing at Sea.Ai. 'AI technology will undoubtedly save lives at sea.'

OCEAN RACING

High-speed ocean racing yachts are also now using SEA.AI machine learning technology. In April this year, the Transat CIC singlehanded transatlantic race saw 20 of the 33-strong IMOCA fleet equipped with SEA.AI technology as they departed Lorient, France, headed for New York. 'SEA.AI is a great tool,' enthused Nicolas Lunven, skipper of the IMOCA HOLLICIM-PRB, at the startline. 'It will be an extremely important tool for ocean racing in the future. Just two years ago it helped me avoid a serious collision with a small fishing boat as I raced along the African coast.'



AI saved IMOCA HOLLICIM-PRB from a serious offshore collision

Baltic Yachts is now using AI technology throughout its design process

BETTER BOATBUILDING
Over in Finland, luxury yacht builder Baltic Yachts has also now started incorporating AI technology into all of its latest designs. 'By integrating cutting-edge machine learning AI technology into the design of our yachts, we are not only enhancing safety but also increasing the comfort aboard our yachts whilst at sea,' explains Henry Hawkins, Baltics Yachts' vice president.



AUTONOMOUS SHIPS
According to a recent report by Lloyds Register, the global AI marine market is now worth \$1.5 billion a year – a figure expected to double within five years. Big business is therefore extremely keen to promote the use of Marine Autonomous Surface Ships (MASS), which can sail, berth and perform manoeuvres without any human intervention at all, in order to reduce costs while increasing efficiency and profits. Every part of the technology required to achieve this aim is currently available – the only hold-up right now is the establishment of international regulatory agreement, something the IMO (International Maritime Organization) is urgently wrestling with. How, for instance, will they regulate the use of what are, in effect, robot ships roaming the seas of their own accord? And what will the insurance implications be, should anything ever go wrong?

The Armada Ships as they are known, have been equipped with advanced marine electronics to carry out remote deep sea operations, including collecting offshore sea bed data with minimal environmental impact. The onshore-controlled vessels will initially use a skeleton crew on board, but the near-future plan is for the vessels to be capable of working with no personnel on board at all.

AUGMENTED REALITY
The USA, of course, isn't far behind in the marine AI stakes. Notable among its latest yachting AI navigational aids is the new Lookout system designed to be fitted to medium size recreational craft. Lookout uses a camera sited high on the boat, then bringing together radar, AIS, electronic charts and machine learning to create a 3D augmented reality view of the craft's surroundings

SKELETON CREW
In Norway, the first of eight highly advanced 78m offshore research vessels have been launched to perform tech-enabled lean-crewed operations.



Lookout's augmented reality view of a harbour approach



How soon until search and rescue and pilot operations are fully autonomous?

on a tablet, phone or helm MFD. Coming in at around £11,000, it can also see through low visibility, spotting lobster buoys or casualties in the water at a distance of 50 metres.

BRIGHT FUTURE
The possibilities and fundamental change marine AI and autonomous systems

now promise are, without doubt, enormous. And while the sight of large cargo ships travelling at speed into Southampton or Felixstowe with not a single human being on board may be a few years off yet, it's more than likely, in the foreseeable near future, that smaller vessels, such as tug boats, light cargo ships, search and rescue craft, and even the role of highly experienced harbour pilots, will all become remotely operated. And not by some salty old seafarer, but by a keyboard operator tapping away at a laptop, or twiddling a joystick, in a nondescript room, miles, many miles, possibly many hundreds of miles, from the sea itself.