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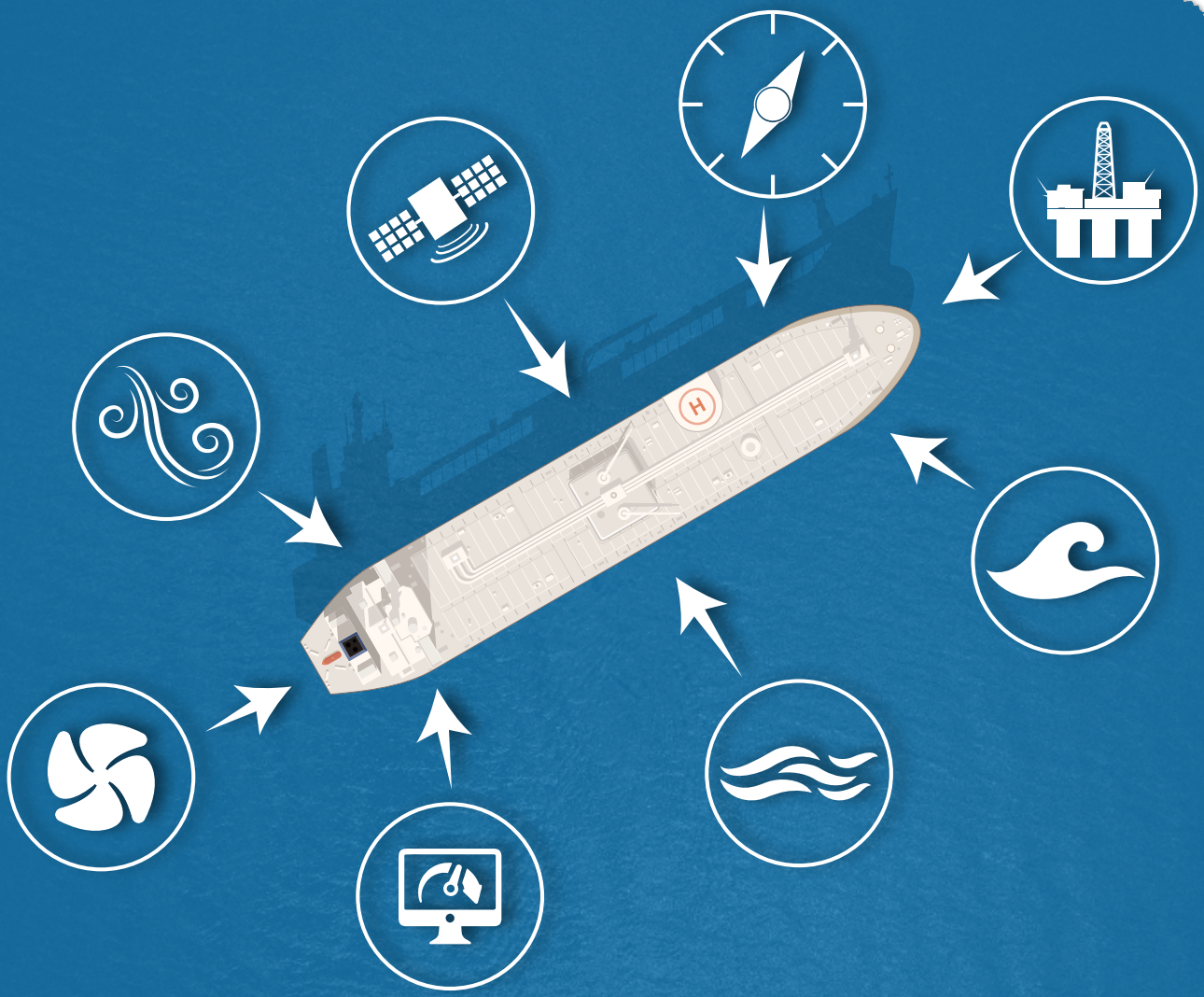

Maintaining Position

The art and science of dynamic positioning

The Nautical Institute

ROYAL INSTITUTE OF NAVIGATION

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NAV BRIEF

David Patraiko FNI
Director of Projects, The Nautical Institute

Pole position

Dynamic Positioning (DP) is a technology that automatically maintains a vessel's position and heading by using its own propellers and thrusters. It is increasingly being used by navigators on a wide range of vessels and for a large number of operations.

Traditionally used in the offshore industry where drilling, dive support and servicing offshore rigs relied on precise positioning, DP operations are now found in renewable energy, research, cable laying – and even on cruise ships and yachts that need to maintain position. In many cases, the use of DP has replaced situations where anchors have traditionally been employed but might damage the seabed or equipment on it.

Back in the 1960s and '70s when DP systems were first being developed, they were highly expensive and only used for specific high-value operations. Now that much of the associated technology is more affordable, it is often only marginally more expensive to include DP capability onto ships at the build stage. This allows increasing numbers of vessels to take on new operations, as well as offering navigators with DP qualifications more opportunities.

DP systems can be used to maintain a vessel's position (sometimes within a metre) where it would not be humanly possible to react quickly and accurately enough. It might seem as if an automated navigation system like this would remove the need for a person. However, that is very much not the case. These systems cannot work without a highly trained and skilled DP operator (DPO).

A DPO must have an excellent understanding of how each of the systems and sensors work. Even more crucially, a DPO must know what to do when things start to go wrong. The nature of DP work involves keeping a ship in a very specific position, which is usually associated with a higher degree of risk. Should any part of the system begin to malfunction, the DPO must be prepared to take immediate action to put the vessel into a safe environment. This ability relies on good training, solid experience and continuous assessment.

Due to the risks associated with DP operations, the industry has developed and mandated its own high-quality training accreditation and certification scheme. This scheme was developed by The Nautical Institute working in association with flag states, the oil industry, the diving industry and offshore contractors to establish internationally accepted standards. It has been operational for the past 30 years and standards are regularly reviewed and updated.

This issue of *The Navigator* aims to provide mariners with insights around DP operations, issues and opportunities. To learn more about DP and how to become a qualified DPO, visit www.nialexisplatform.org/certification/dynamic-positioning/

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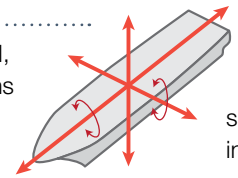

The Nautical Institute
200B Lambeth Road, London SE1 7JY, UK
Tel:+44 (0)20 7928 1351 Fax:+44 (0)20 7401 2817
navigator@nautinst.org www.nautinst.org

With support from: 1 Kensington Gore, London, SW7 2AT, UK
Tel: +44 (0)20 7591 3134 Fax: +44 (0)20 7591 3131
www.rin.org.uk

Editorial committee:
Editor Emma Ward
Design Phil McAllister
For The Nautical Institute
Steven Gosling AFNI, Lucy Budd, Aly Elsayed AFNI, David Patraiko FNI
For the RIN George Shaw FRIN

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ALL AT SEA

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Dynamic details

Seafarers with a deeper understanding of Dynamic Positioning and the technology and techniques behind it can often access a wider range of career opportunities. Here are some useful websites and online resources to help you increase your knowledge and skills.

If you spot any broken links, or would like to suggest resources that we have not included here, please do get in touch!

IMCA advice

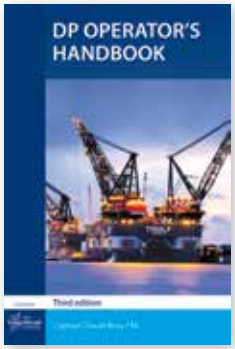
The International Marine Contractors Association (IMCA) website has lots of helpful information on DP and how to harness its technology for safety and efficiency at sea.
Check out here: https://www.imca-int.com

Safety flashes

Forewarned is forearmed. Stay up-to-date with the latest DP incidents, potential hazards and lessons that can be learned from them with this essential safety resource from IMCA.
Available at: https://www.imca-int.com/safety-flashes/

Want to become a DPO?

If you're thinking of becoming a DPO, the NI Alexis website contains information about the training scheme and seatime that you will need to undertake to qualify. There are several specialist certification and accreditation options to choose from. This resource will help you make sure you choose the right one.
Take a look: https://www.nialexisplatform.org/



Helpful handbook

Have you got a burning question that you always wanted to ask about DP? Perhaps you want to know more about what becoming a DPO entails, or get a headstart on your study. The Nautical Institute's DP Operator's Handbook is your friend!
Order your copy here: https://www.nautinst.org/shop/dp-operator-s-handbook-3rd-edition.html

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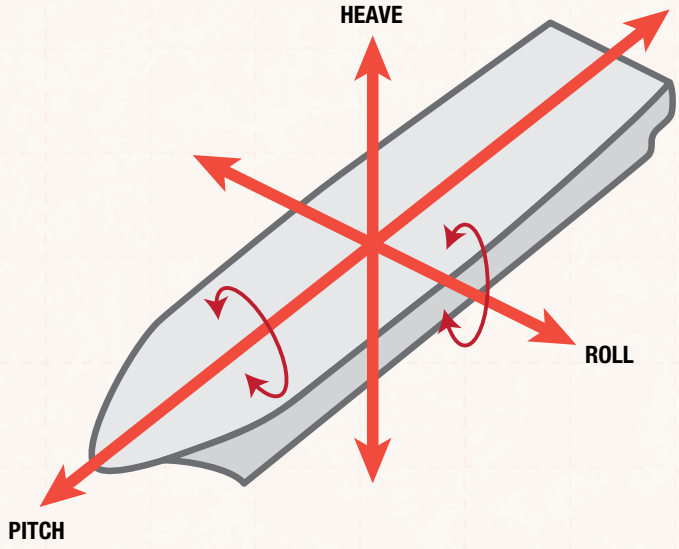
THE ART AND SCIENCE OF DYNAMIC POSITIONING

Qasim Masood AFNI, Head of Qualifications Marine and Offshore at The Nautical Institute, looks at the technology behind Dynamic Positioning and explores the seven components that allow it to function

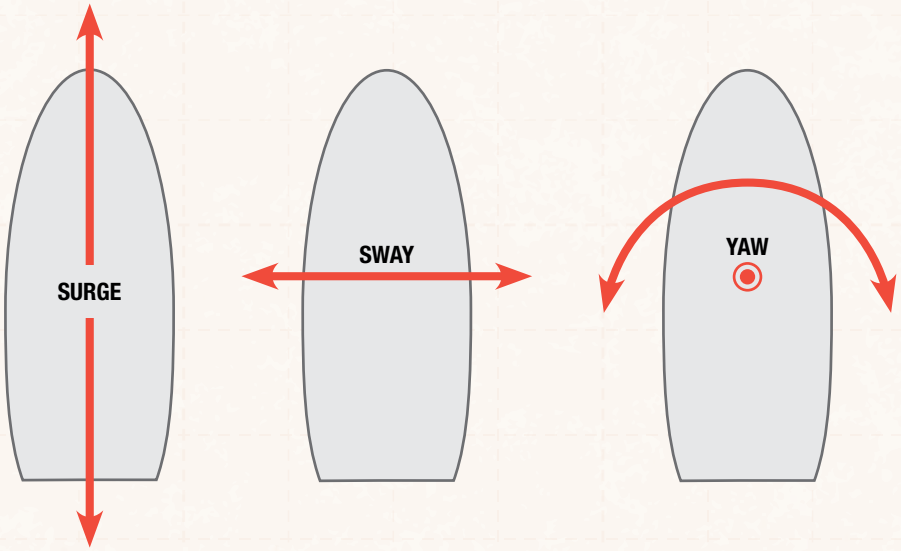


Dynamic Positioning (DP) is the art and science of keeping a vessel in a particular position or moving in a particular direction at a particular speed and a particular rate of turn with the help of the thrust generated by its own thrusters. The technology was first developed for scientific research and geological surveys in the 1960s, and was rapidly taken up by the offshore oil and gas industry. Today, it is used in many different sectors of the maritime industry around the world. It offers a wide range of opportunities for seafarers who can gain the necessary qualifications.

Although the DP system itself is controlled by a computer, that does not mean that there is nothing for the operator to do. On the contrary – the operator plays a vital role in managing safety, and has to be able to step in if the system fails. This is a safety-critical role that needs special training. That training starts with understanding the basics of what the system is doing and why.

Six degrees of freedom

Any freely floating structure, including a ship, will be affected by the forces of wind, wave and current. The movements take



place across two planes: the horizontal and vertical. On the horizontal plane, the vessel is subject to surge (forward and aft), sway (port and starboard) and yaw (around the horizontal axis)

On the vertical plane, the vessel is subject to heave, pitch and roll.

In order to maintain position, the DP system has to measure the position of the vessel, the forces acting on it and the movements of the vessel itself. It must then calculate and implement the forces necessary to counter them.

The DP system can be divided into seven components:

> Power
> Thrusters
> Environmental sensors
> Position reference sensors
> DP controller
> Hardware (generally referred to as the HMI, or human-machine interface)
> DP operator

When all components work well together, the DP systems function as one. The operator – that is, the human – is a key part of the system. To work well within it, is important to have the right training and skills – and to keep those skills updated.

Power

The power system consists of the prime mover (usually a diesel engine), alternator, cables, switchboard, bus tie breakers and power management system. DP vessels are divided into classes according to the level of redundancy that is built into their system. The higher the class of the vessel, the more complex and high-risk the tasks that it can carry out.

Thrusters

Modern-day DP vessels may be fitted with several thrusters. They may have different types of thrusters, depending upon the equipment class, design criteria and type of jobs they are engaged in.

Bow and stern thrusters are usually required to turn the vessel to control its yaw movements and sway moments. These are also called tunnel thrusters, as they are fitted inside a tunnel.

All types of thrusters are controlled by the DP controllers with the help of signals. The DP controller sends an 'output signal', also known as the 'command signal' to the respective thruster. Once the command is activated, the thruster sends a 'feedback signal' to the DP controller. Comparing the command and feedback signal is an important method to see if the thrusters are functioning well.

What's the difference?

DP controller vs DP operator

> The DP controller is the computer which manages the system
> The DP operator is the person on the bridge

THE OPERATOR PLAYS A VITAL ROLE IN MANAGING SAFETY, AND HAS TO BE ABLE TO STEP IN IF THE SYSTEM FAILS

Environmental sensors

Environmental forces acting on the vessel make it move forward and aft, and port and starboard. These movements are measured by the position reference sensors, which then pass this information to the DP controller. In turn, the DP controller sends instructions to the thrusters to counter those movements and maintain the vessel's position.

The three most common environmental sensors are:

> Wind sensor: This measures the speed and direction of the wind. As the wind acts upon the ship's side, this may result in some movement (drift). The DP system must generate an equal and opposite thrust to counter this unwanted movement.
> Motion reference sensor: Movements in the vertical axis (roll, pitch and heave) may cause unwanted movements in the position sensors. A motion reference unit can measure all three movements so that the DP controller can counter them.
> Gyro compass: The gyro compass measures the heading and rate of turn of the vessel. A DP class 2 vessel is expected to have three gyro compasses to ensure redundancy.

Position reference sensors

These measure the ship's position, or movement on the horizontal plane. A DP system needs to have at least one position reference sensor to automatically control surge and sway movements.

DP controller

The DP computer/controller/process station (it has various names) is a computer that takes inputs from the various environmental and position reference sensors, then gives orders to the thrusters based on the information received. This output is known as the thrust allocation logic (TAL), and has four components:

> How much thrust?
> To which thrusters?
> In which direction?
> For how long?

Hardware/HMI

The hardware used by the DP operator to control the DP system as a whole is called the human-machine interface (HMI). This includes the display, the DP control station, the joystick for manual control of the thrusters, and so on. It is important that DP operators are thoroughly familiar with the HMI – this is your workstation! The HMI must be designed to make the operator's job easy and ergonomically safe.

The operator (That's YOU!)

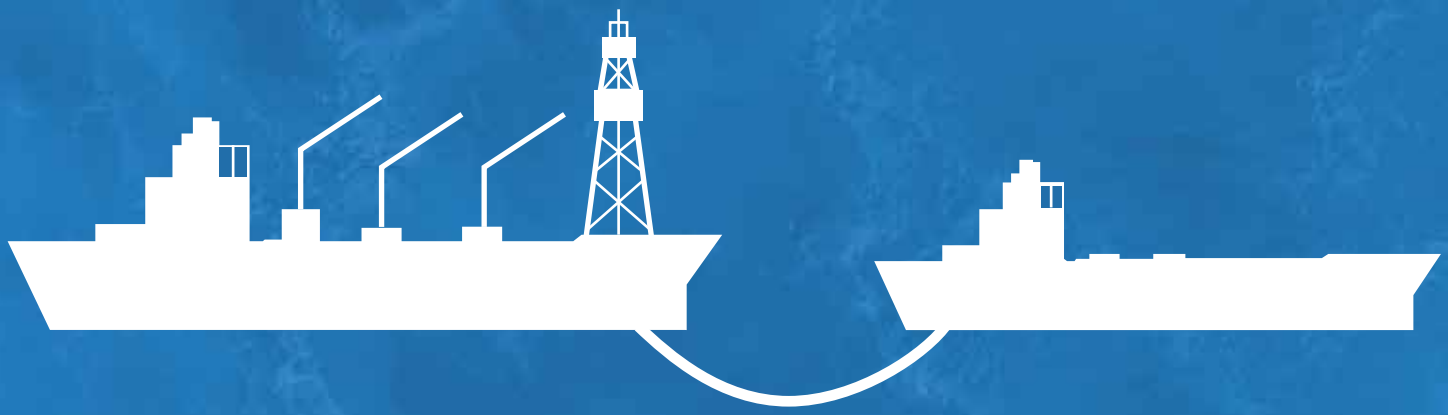
Last, but certainly not least, Dynamic Positioning operators (DPOs) are appropriately qualified and experienced personnel who operate the DP system. Usually, they are deck watchkeeping officers who have graduated to be DPOs after following a recognised training scheme.

DP qualification and training standards are set by The NI, in association with the DP Training and Executive Group, which is made up of representatives from major DP operators and training centres. Once the initial training has been completed, candidates must complete a set number of days of DP experience.

This is an important and complex role, and qualifications have to be renewed every five years to ensure your knowledge remains up-to-date.

Dynamic Positioning as a system and as a technology is here to stay, and will grow more and more important as it finds new areas and applications. It is a fascinating and rewarding way to expand your skills as a seafarer.

How Dynamic Positioning helps offshore vessels remain stable and safe



Qasim Masood AFNI, Head of Qualifications Marine and Offshore at The Nautical Institute, examines the wide variety of ships, support vessels and specialist craft that use Dynamic Positioning to ensure their safety in the offshore oil and gas industry

The technology behind Dynamic Positioning (DP) has been gaining traction across many different industries and applications for decades now. One particularly key point in its development has been the critical part it has played – and continues to play – in keeping drilling and offshore oil and gas ships and vessels safe.

The use of DP as a safety tool has made the versatile technology extremely popular in the offshore sector. This article outlines just some of the specialist vessels employed in this sector that use DP, and ways in which that technology is important. This is not a comprehensive list – and there are many other DP applications in other sectors as well – but it gives some idea of the far-reaching impact of the technology and the opportunities that it offers.

Drill ships

A drill ship or vessel is mainly used for drilling operations, with some used for exploration, and some to help maintain existing oil wells. Traditionally, they can be bottom standing, self-elevating, moored or controlled by DP. Drill ships that use DP can hold their position extremely effectively. This offers a safer way of steadying the vessel, compared to traditional mooring methods and cumbersome anchor handling techniques.

There are economic advantages to using DP on drill ships too, such as weight savings due to not having to factor in heavy mooring arrangements. This adds value in deep-water, large-scale oil wells, as well as in small oil fields. There are still some safety factors to consider, however, such as the risk of the vessel losing its position due to a failure in the DP system. Preventative measures must be taken to mitigate against this risk.

Diving support vessels

Diving support vessels act as a base for offshore diving work. They are equipped with diving equipment and used to support underwater work, such as maintaining oil pipes and continuous intervention measures at subsea level.

Diving support vessels rely on DP to keep them steady in one position. This ensures the safety of the divers and the viability of the work being performed. Subsea launch/recovery work, whether it occurs in open waters or near an asset, is risky, and divers' lives may depend on the vessel remaining in one position (see incident report, p 7). Safety must be the top priority.

Remotely operated vehicle support vessel

A DP vessel acting as a support vessel for a remotely operated vehicle (ROV) in deep water will use position reference systems, wind sensors, motion sensors and gyro compasses to help it to keep track of the ROV. The DP systems help the DP vessel launch, operate and recover the ROV safely.

Depending upon the type of ROV being handled, it may have its own launching and recovery system. In order to track or follow the ROV during operations, the ROV support vessel uses a DP mode called 'follow target' or 'follow sub'.

It is important for the ROV control and the DPO to work closely together to avoid the ROV becoming entangled with the taut wire or hydroacoustic position reference (HPR) beacon/s connecting the support vessel to the ROV.

Cable layers and pipe layers

A cable layer, or cable-laying vessel, is used to position cables or repair those already in place. These vessels work in both shallow and deep waters and, in some cases, in ice waters. Onboard cable carousels can store thousands of tons of cable at any time.

THE USE OF DP AS A SAFETY TOOL HAS MADE THE VERSATILE TECHNOLOGY EXTREMELY POPULAR IN THE OFFSHORE SECTOR

While laying/repairing cable, the vessel uses DP in 'track follow' or 'auto track' mode to trace the cable exactly.

Pipe-layers, or pipe laying DP vessels require additional input over and above the usual DP sensors. The vessel's DP system must be able to sense and compensate for additional forces caused by pipes acting on the DP system, and has special sensors to allow for this. Pipe layers may also use support vessels and equipment such as ROVs, cranes, subsea cranes and survey and inspection activities.

Supply vessels

Offshore support vessels (OSVs) are speciality ships designed to provide logistical support to offshore facilities and platforms. It is extremely useful for a vessel to be able to hold position without mooring while supplies etc. are transferred. The class of DP used by each one is influenced by the types of supplies being carried, the size of the vessel in question and the regions in which it operates. What remains consistent, however, is the key role that DP plays in ensuring their safety and that of the offshore platforms they work alongside.

Well-stimulation vessels

Well-stimulation vessels provide offshore intervention by injecting high-pressure chemicals into an oil well to stimulate productivity, so keeping them stable and in one position is vital. These vessels may be fitted with chemical tanks and blenders.

Dredgers

Dredgers are used to dredge out a particular area, which may need to be a very specific shape and size – for example in port construction or maintaining or widening a channel. The accuracy of dredgers can be enhanced by using DP. The vessel's class may depend upon the type of dredging operation and the level of accuracy it requires.

Rock-dumping vessels

A rock-dumping vessel covers entrenched pipeline or cables with rocks for safety purposes. Again, this requires DP support to maintain position and accuracy during operations. Technologically advanced rock-dumping vessels may also use ROVs to assist in this work.

Anchor-handling vessels

Anchor-handling vessels are used to control the anchor on offshore installations. They are more commonly known as AHV or AHTS.

Floating production storage and offloading vessels (FPSO) and shuttle tankers

An FPSO is used for producing and storing oil, which must then be offloaded to a shuttle tanker or a pipeline. Transfer to the tanker is simplified by the use of a DP system, which helps the FPSO maintain a riser angle for safe operations.

A shuttle tanker travels between shore and offshore to offload the oil produced by the FPSO. Both FPSO and shuttle tankers use a special mode of DP called 'weathervane mode' to maximise their safety during operations.

Heavy lift or crane vessels

Heavy lift or crane vessels are used in offshore industrial missions where large loads need to be picked up/placed down. Most large lift vessels work at surface level or at very shallow depths. Heavy lift/crane vessels must have special arrangements for ballasting and de-ballasting during lifting operations in order to ensure stability.

Accommodation barges / vessels

Accommodation vessels/barges provide accommodation to workers on an adjacent rig/vessel/facility. Sometimes, accommodation on the facility itself is insufficient or unsafe, so these barges are positioned nearby instead.

These are just a few of the operations where DP-enabled vessels vessels provide specialised services – and in each and every one of these cases, safety is the priority. *IMCA M 117 Code of Practice for The Training and Experience of Key DP Personnel* highlights the need for appropriate training for DP professionals worldwide.

WATCH-OUT

In this series, we take a look at maritime accident reports and the lessons that can be learned

DP system failure on diving support vessel leads to serious incident

What happened?

Two divers working from a dive support vessel were carrying out valve operations for barrier testing. While they were underwater, the vessel's DP system suffered a malfunction. This caused its alarms to activate, quickly followed by a loss of all analogue and digital signals. The vessel started to drift away from its position. The divers were pulled along with it and instructed to return to the bell staging immediately.

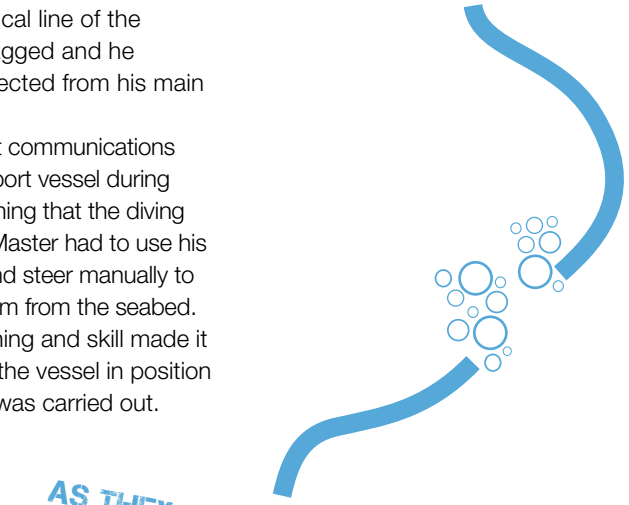
While the first diver was able to return to the dive support vessel safely, his colleague was not so fortunate. His umbilical line caught on a transponder bucket on the face of the drilling template, cutting off his main oxygen supply and severing communications. The Master steered the vessel manually to move as close as possible to the stranded diver, who was by now unconscious on the seabed. The diver who had made it back to safety returned to the water and rescued his colleague. Both divers were put in decompression chambers onboard the vessel and went on to make full recoveries.

Why did it happen?

- The DP system failed due to a number of technical faults, which caused a loss of communications between the control computer and its positioning references and environmental signals. The system's thruster command signals moved to zero thrust and the 'gyro ready' signals failed, leading to heading and position dropout and the vessel drifting off position.
- The movement of the ship dragged the divers away from where they were working underwater. As they were pulled along by the drifting vessel, the umbilical line of the second diver snagged and he became disconnected from his main oxygen supply.
- The diver also lost communications with the dive support vessel during the incident, meaning that the diving support vessel's Master had to use his locator beacon and steer manually to find and rescue him from the seabed.
- The Master's training and skill made it possible to keep the vessel in position while the rescue was carried out.

What changes have been made?

- Investigations and discussions were launched immediately after the incident, including a number of engagement sessions with key stakeholders.
- A project looking at improvements to diving and marine operations was also established, including examination of various aspects of bell staging, diving equipment and DP control systems.
- An educational film was made to highlight the issues arising from the incident and champion the bravery of those involved in the rescue.



AS THEY WERE PULLED ALONG BY THE DRIFTING VESSEL, THE UMBILICAL LINE OF THE SECOND DIVER SNAGGED AND HE BECAME DISCONNECTED FROM HIS MAIN OXYGEN SUPPLY

Read the full report at: https://www.imca-int.com/safety-events/serious-dp-diving-incident/

The Nautical Institute's Mariners' Alerting and Reporting Scheme (MARS) - *https://www.nautinst.org/resource-library/mars.html* - comprises a fully searchable database of incident reports and lessons, updated every month. If you have witnessed an accident or seen a problem, email Captain Paul Drouin at mars@nautinst.org and help others learn from your experience. All reports are confidential – we will never identify you or your ship.

From Dynamic Positioning to marine consultancy

Tow Master and Marine Consultant **Tom Feakins** discusses the career opportunities that his DP training has given him

What led you to pursue a career at sea?

Initially, I went to work at sea as an AB as it was a good opportunity to both travel and work. Once I started at sea, I realised that I really enjoyed the work, culture and learning a great deal from different ship types. I then went on to study for my OOW and by the time I had my Master's Certificate of Competency, I had worked on a wide variety of ships, including as an Senior Dynamic Positioning Operator (SDPO) in the North Sea. I now run a marine consultancy business. Working at sea for me has been, and continues to be, a great career, with many opportunities.

Where do you see yourself in five years' time? Ten?

In five years' time, I aim to still be working as a tow master and marine consultant with increased project and tow exposure Also to be providing legal advice on shipping disputes. I have recently started work on a few projects with The Nautical Institute, which is enjoyable and allows me to put back time and enthusiasm into an industry that has provided me with so much. Hopefully this will also develop in the next five years. I am also keen to assist wherever I can in spreading the knowledge of careers at sea to others, including the opportunities that DPO training can bring.

What do you think are the main advantages for ships operating a DP system?

For prolonged, accurate position-keeping, DP is very good. However, I would also say that DP operators need to have good knowledge of ship handling in order to fully understand the vessels they are working on. I was fortunate to work on ships before DP was quite as prevalent as it is now, so I learnt how to drive ships manually and then went on to discover how DP was able to help with this.

What career opportunities and openings have your own training and skills in DP provided you with to date?

My SDPO experience provided me with a wealth of knowledge about DP operations. This has been very useful in helping me understand the risks and opportunities around towing, decommissioning and marine operations in the oil and gas and wind industries. DP is an extremely interesting part of the maritime industry, and one which exposes operators to a wide variety of vessel types and operations.

DP OPERATORS NEED TO HAVE GOOD KNOWLEDGE OF SHIP HANDLING IN ORDER TO FULLY UNDERSTAND THE VESSELS THEY ARE WORKING ON

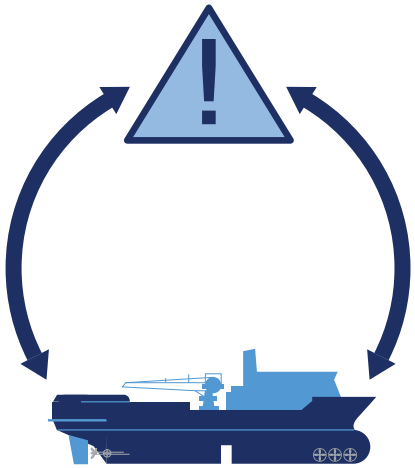
Taking back control

George Shaw from the Royal Institute of Navigation looks at feedback control systems in DP and asks what safety lessons can be learned from the marine and aviation sectors when it comes to their use

Feedback control systems occur widely in the natural world. A sensor detects what's happening in a given situation and feeds back the information to the system it is linked to. This feedback is then used to inform and make adjustments to correct an error or achieve a desired result. For decades, autopilot technology has made use of feedback control systems to support safe navigation of aircraft and ships. However, despite long experience of using them, outcomes can still go spectacularly awry.

When it comes to marine vessels, DP usually controls two or more of the ship's dynamical parameters: position displacements, rotations or rates of change. While skilled mariners can readily disengage the autopilot setting on their ship whenever they need to take over manual navigation, taking back control during a DP operation can be problematic due to the tighter tolerances involved. The limited speed of human reactions and the precision required to make incredibly accurate corrections may prevent a DP operator from continuing operations manually in certain circumstances – exiting the operation safely may be the best option. Safety must come first – all interventions must primarily safeguard the vessel, personnel, equipment and infrastructure.

The feedback control systems used in DP have their own inherent limitations, even when they are fault-free. Sensor measurements may not consistently meet tight position tolerances, which could be less than a metre. In challenging environments such as strong gusts of wind or freak waves, a ship's thrusters may have insufficient power to meet the demands made of them by the system. The dynamics can become uncontrollable. In adverse circumstances, the control loop itself can become unstable, causing the dynamic responses to oscillate or move the vessel away from its intended position.



SAFETY MUST COME FIRST - ALL INTERVENTIONS MUST PRIMARILY SAFEGUARD THE VESSEL, PERSONNEL, EQUIPMENT AND INFRASTRUCTURE

Lessons to be learned

The maritime sector can learn from the experiences of the aviation industry in terms of human factors interacting with dynamic control systems, and the effect this can have on safety. In 2018/19, problems with the Boeing 747 MAX stall-prevention MCAS (manoeuvring characteristics augmentation system) led to two tragic aircraft crashes that killed all 346 passengers and crew members onboard. In both situations, a single attitude sensor was set up to force the nose of the aircraft down if a stall condition was detected. The sole sensor failed and the aircraft's pilots struggled to intervene to correct (or even disengage) the misplaced demands of the MCAS. Irrecoverable flight instability ensued. The pilots' handbooks provided inadequate training to handle the situation and the cockpit system did not give sufficient warnings.

When propulsion control is used for DP and maritime navigation, it can improve manoeuvrability for larger ships, but it also has its own inherent control limitations. In November 2023, the *Spirit of Discovery* cruise vessel, fitted with innovative propulsion capable of vectoring thrust over a full 360°, encountered problems during a storm in the Bay of Biscay. As part of its safety response, the vessel veered sharply and stopped for a prolonged period. This action severely traumatised the passengers and injured around 100 people.

DP operators need to understand and closely monitor system behaviour and warnings, and continuously assess when and how it is necessary to intervene. Good seamanship is essential, as is enhanced training and experience.

As autonomous systems become more commonplace, control systems related to DP will become an increasingly significant part of navigation. Mariners actively seeking to improve their DP skills should be well placed to meet future challenges at sea and onshore.

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TAKE 10

AIS is a hugely important tool for vessel safety and navgation, and its evolution is both rapid and ongoing. Here are ten important things to remember about AIS.

1
Openings and opportunities
DP operations are a specialist skill-set that will enable navigators to expand their opportunities to work in many different areas of shipping. It requires a much more advanced skillset than the standard officer of the watch ticket.

2
Wide scope
As technology becomes cheaper, more ships are being built 'DP ready'. DP technology is used in offshore energy, diving support, cable/pipe laying and even cruise and yachts that need to 'anchor' without harming the seabed.

3
Feedback and control
The DP system measures the six 'degrees of freedom' – heave, pitch, roll, surge, sway yaw – and uses thruster power to counter them and hold the vessel in place or on track.

4
Redundancy and resilience
DP systems depend on redundancy for resilience. This can include separate engine rooms, bridges, electrical supplies, computer controllers and even multiple positioning sensors that do not rely on GNSS systems, which share a common weakness.

5
Human element
Although DP is essentially an automated technical system, human involvement is absolutely vital. DP operators must know how to use the system safely and correctly and what to do if something goes wrong.

6
Risk management
DP is often used in high-risk activities. This risk is managed by reliable technical systems and skilled human operators with advanced training and competencies – and it is important to maintain those skills.

7
Setting the standard
DP training is not covered in STCW (part A) training because the industry works together to self-regulate to a very high standard. The industry sets its own standards, accredits training centres and certifies its own operators.

8
Back to school
Learning lessons from incidents plays an important role in DP operations. A robust safety programme from the International Marine Contractors Association (IMCA) allows incidents to be reported, analysed and corrective action shared with the industry.

9
How can I become a DP Operator?
You will need a combination of training courses, validated seatime on DP vessels, assessment, and opportunities to maintain your skills through CPD and revalidation. **www.nialexisplatform.org**

10
Mentoring
Ask experienced DP operators questions about the systems and their experiences working on them (pick your moment well, though!) For experienced DP operators, share your knowledge with others to improve overall safety.

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#NavInspire

WIN AN IPAD

Just post a picture of you with your *Navigator* on Twitter, including the hashtag **#NAVsnap**, or send us a message on Facebook with your photo attached (www.facebook.com/thenauticalinstitute) and tell us the name of your ship or your college, if you have one. Let us know if you're a member of The Nautical Institute, too (everyone gets entered in the draw, whether you are a member or not!) Or send us the information in an email!

AND THE WINNER THIS ISSUE IS...

Congratulations to this month's winner, Marek Ginter. He sent this photo from on board his vessel, the chemical tanker *Thun Lundy*.

We love hearing from our readers – where are you sailing today?

Marek Ginter
NAVIGATOR CHAMPION

The Nautical Institute

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