

AUTONOMOUS SOLUTIONS



HamiltonJet

FUTURE READY



FULL AHEAD...

The waters around us are changing.

We increasingly rely on the seas for commerce, energy, leisure and security. Traffic density is increasing and operators are zeroing in on advances in efficiency, productivity and safety.

Throughout history, mariners have benefited from advances in marine technology. Auto-pilot, electronic control systems, radar, GPS, AIS and accurate charting have all changed the way our work is done.

Modern vessels continue to become more sophisticated.

We've reached a point where highly capable 'smart systems' are reducing workload and assisting skippers. It's revolutionising the way vessels are operated and empowering those at the helm to focus on the most critical elements of their job.

For most, the adoption of advanced 'skipper assistance' tools will be enough for the foreseeable future. For others, full autonomy or remote control is a reality now, presenting them with an incredible opportunity to

work more effectively and remove people from harm's way.

HamiltonJet has been deeply immersed in this space for decades. Our first remote controlled vessel was commissioned in 1993. Since then we've worked in collaboration to equip a fleet of over 170 vessels with some form of autonomy or advanced skipper assistance across multiple regions, customers and applications.

LEVELS OF AUTONOMY



Autonomy means different things to different customers. At HamiltonJet we recognise there's no single solution. Instead, autonomy exists at different levels from skipper assistance to full autonomous remote operation.



Skipper Assistance

Tools assisting skippers to simplify tasks on board.

- Station Keeping / virtual anchor.
- Autopilot.
- Precision manoeuvring.
- Assisted situational awareness.
- Dynamic positioning integration.
- Firefighting assistance.



Partial Autonomy

Tools enabling skippers to hand-over some decision making to smart control systems while underway.

- Docking assist.
- 'Smart' autopilot integration.
- Collision alert and avoidance.



Full Autonomy

Total vessel autonomy. Potentially no skipper or crew on board.

- Full autonomous vessel control with collision detection and avoidance.
- 'Live' remote control.
- Programmable missions with remote monitoring and intervention.

A PROVEN RECORD IN AUTONOMY AND SKIPPER ASSISTANCE

First vessel radio
remote control

1983

Autopilot and dynamic
positioning interfaces launched

2003

First HamiltonJets used
in an autonomous system

2007

First electronic control interface
to an autonomous system

2010

Launch of JETanchor, our low cost
dynamic positioning system

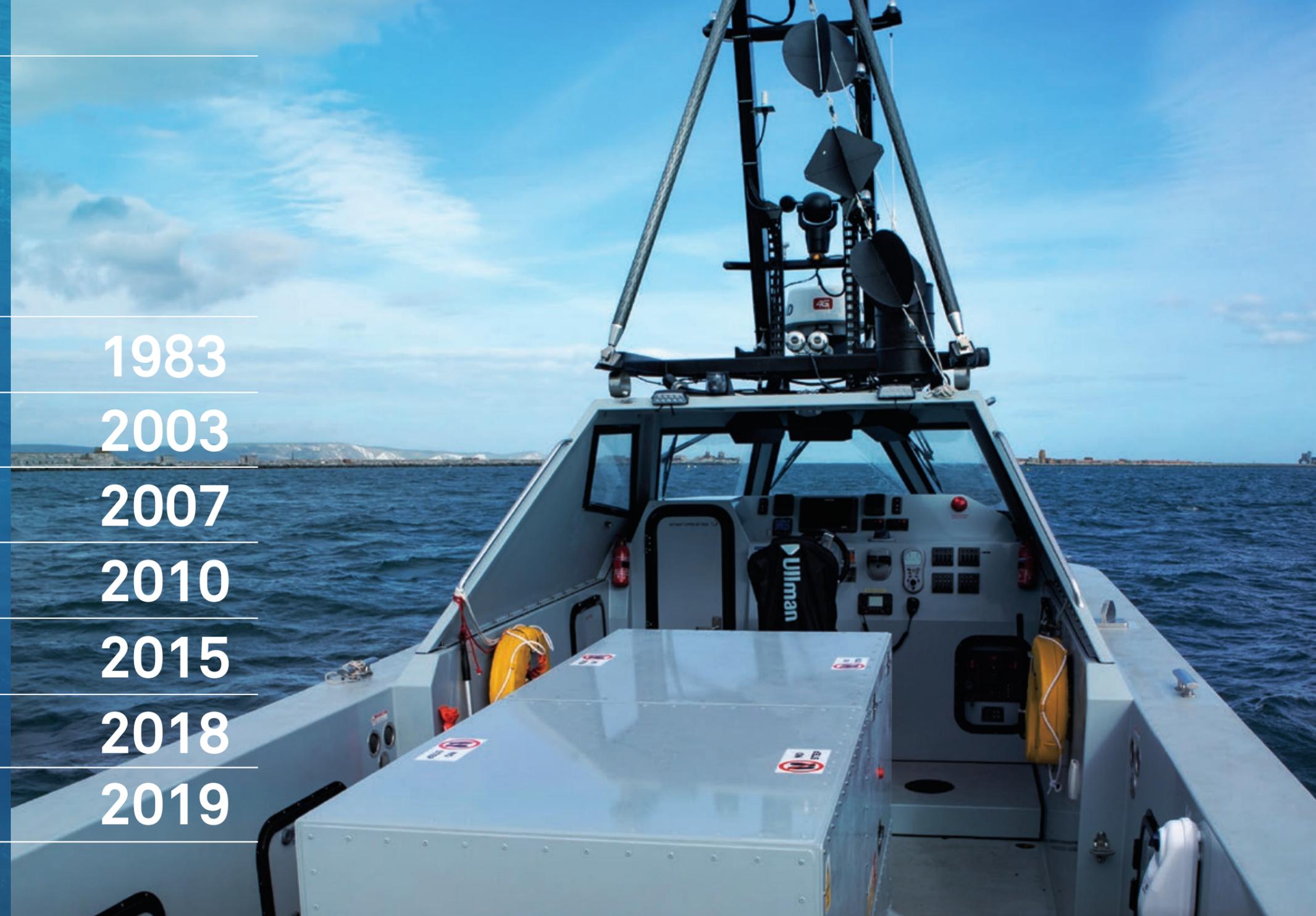
2015

First JETfighter commissioned to simplify
firefighting and reduce skipper workload

2018

Launch of GPS assisted precision
manoeuvrability

2019



DRIVERS FOR CHANGE

Autonomy and skipper assistance technologies have evolved to meet a variety of needs:



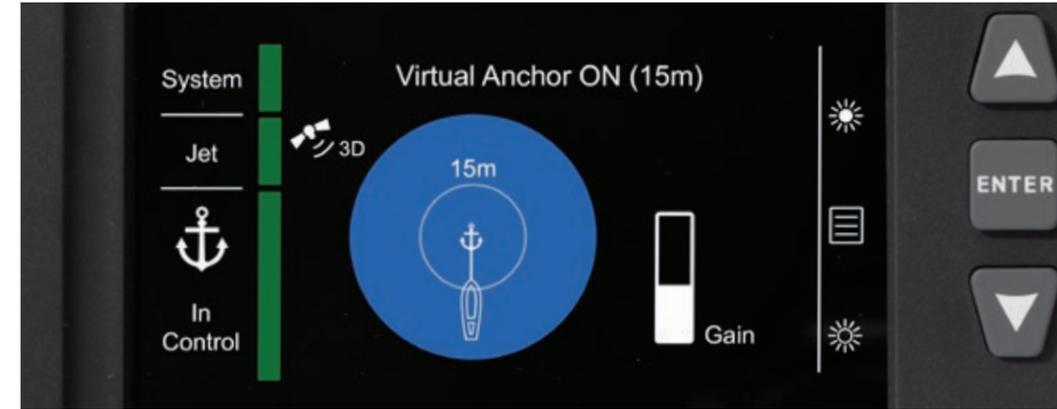
10.9m FFI
Polarcirkel USV
- NORWAY



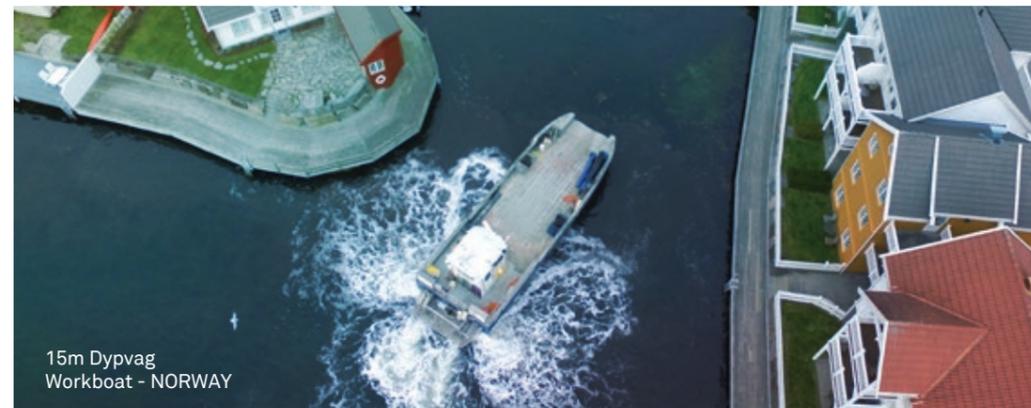
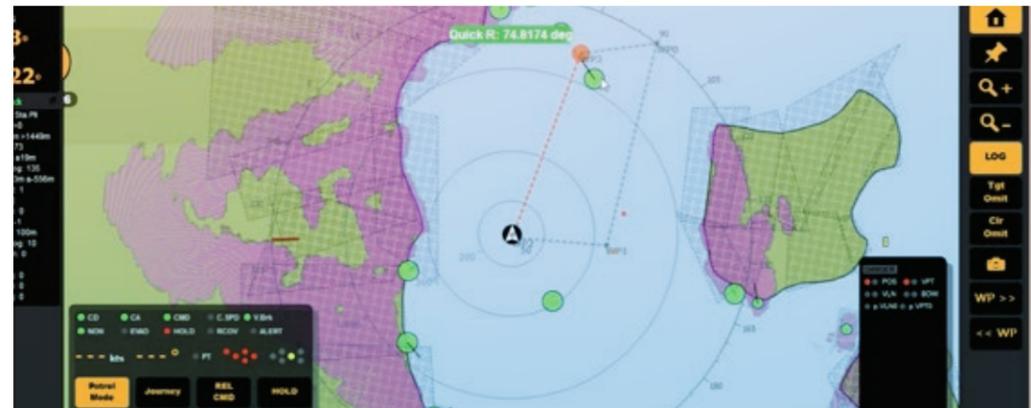
35m SCDF
Firefighting MRV
- SINGAPORE



Automation
of seabed
survey work



11m ARCIMS Mine
Sweeping ASV



15m Dypvag
Workboat - NORWAY



11.5m SHARKTECH
ASV

Keeping crews and vessels safe

- Minimising crew workload, fatigue and boredom.
- Keeping crew away from dangerous and dirty work (in some cases removing them from the boat entirely).
- Significantly improving vessel control, predictability, positional accuracy and precise manoeuvrability.

Improving decision-making

- Giving skippers improved information for better situational awareness.
- Allowing skippers to focus on mission completion rather than complex activities or routines.
- Relieving workload, and enabling better decisions, particularly under pressure.

Efficiency and productivity

- Lower fuel consumption through precise manoeuvring control and reduced overall vessel movement.
- Faster, more accurate work delivering better productivity.
- Potential for fewer crew to complete the same tasks.

Future-proof investment

- Operators want technology that moves with the times – systems must be modular, scalable and upgradable as technologies advance.
- Systems must stand the test of time – new features must be built on robust platforms with a commitment to long-term support.

PLATFORMS UNDERPINNING THE FUTURE

Our waterjets are the perfect platform for skipper assistance and autonomous technologies. They deliver end to end integration and interface simplicity.

Hamilton Waterjets

Ultimate manoeuvrability – jet boats turn on the spot, move sideways and perform rapid stops with ease - all without additional thrusters.

Fluid thrust delivery – changes in thrust direction are delivered with fluid movements of the control surfaces. It means pin-point accurate Station Keeping without noisy gear changes wearing out transmissions over long periods.

Superior durability – impellers are safely contained within the body of the jet, nothing is exposed beneath the hull. This delivers shallow water or unseen debris capability without damage to the drivetrain. It also makes waterjets safer around people and marine life.



Our three electronic control systems each provide intuitive vessel control with options for dynamic positioning and autonomous integration.



HamiltonJet Control Systems

AVX – our latest generation of waterjet controls and our platform for the future. It is re-defining the operator experience and bringing reliability and safety to new levels.

blueARROW (bA) – sold through our distributor network, this versatile control system is ideal for non-class approved twin jet powered craft from 5 to 25m.

MECS – our system for larger, more complex vessels has been in production for over 20 years. It will ultimately be replaced by AVX but even today we're developing new features in response to customer demand. Even when phased out we'll continue to support MECS for an impressive 20 to 25 years, the same commitment we give to all our products.

TODAY'S SOLUTIONS

Our skipper assistance and autonomous solutions are modular and scaleable. Some stand alone, whilst others combine with external systems to provide even greater functionality.

Dynamic Positioning Interface (DPI)

Our DPI system enables high-end dynamic positioning systems to command our jets when operating in class-approved Station Keeping operations. Control is delivered at an individual propulsion line level, allowing class-approval up to DP3.

This feature underpins our dominance in waterjet powered oil & gas crew boats where we maintain over 80% market share. It is also used in dive support vessels and fireboats.

DPI is available for AVX* and MECS.

Station Keeping & Precision Manoeuvring

JETanchor is hands-free technology at its very best. Two operational modes simplify the job of holding station in open water:

- Station Keeping: automatically holds a vessel's position and heading, giving a high degree of positional accuracy.
- Virtual Anchor: sets off a virtual anchor point around which the boat will 'swing' with the prevailing conditions. In this mode the boat naturally settles into the most comfortable and fuel efficient heading.

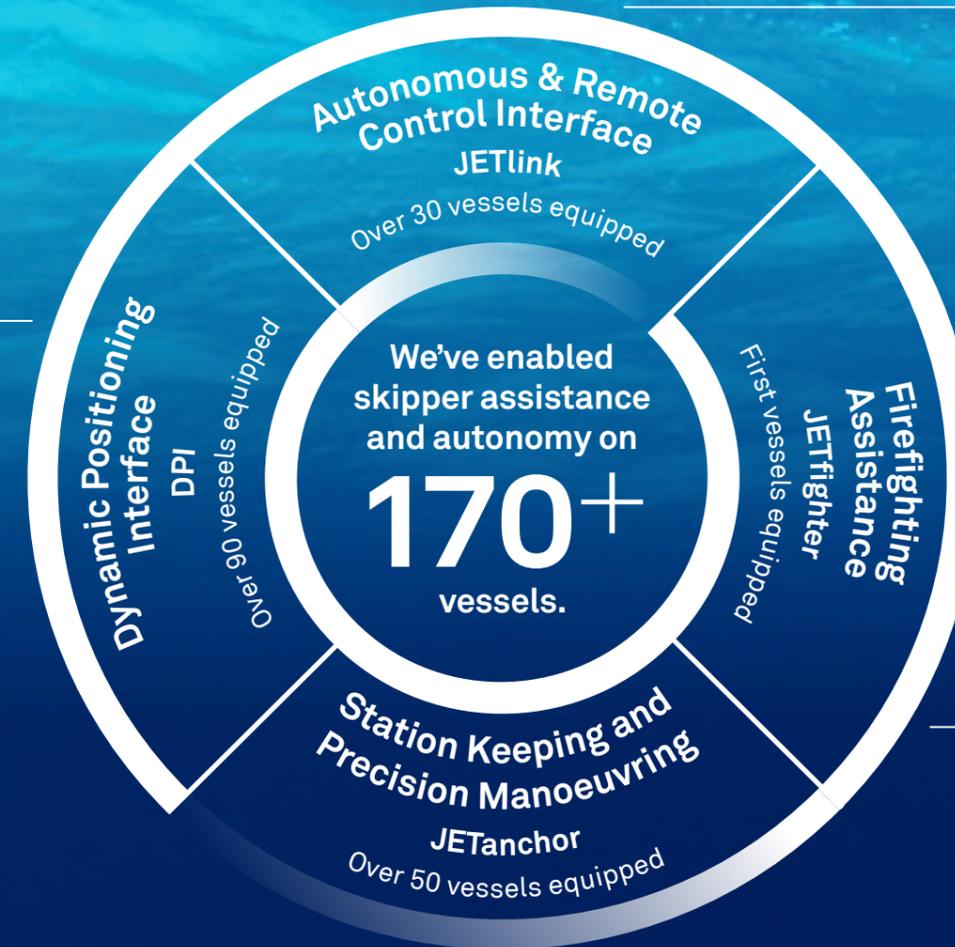
When JETanchor is selected with our latest AVX control system it can be used (with caution) in close proximity with other vessels and fixed objects. Station Keeping will simply hold position around the dock, however the

real magic happens when you start to move the vessel with the Mouseboat. The system continues to use GPS position and heading to deliver pinpoint accurate control around objects, harbours or marinas. Once the Mouseboat is released the boat is brought to a halt and returns to Station Keeping mode, eliminating any further vessel drift.

When operating in any of the JETanchor modes, the skipper must remain at the helm to ensure the safety of the vessel. However our customers continue to find new and creative ways to improve productivity and safety with this impressive system.

JETanchor has been deployed on fishing vessels, military, hydrographic survey and recreational craft.

It is available with our AVX and blueARROW systems.



*Inquire to confirm availability

Autonomous & Remote Control Interface

JETlink provides a standardised interface to modern autonomous and remote control systems. Available on all three of our electronic control systems, it uses a proprietary CAN protocol to allow external systems to command the driveline and perform most of the functions of an on board skipper.

The link is made through a compact on board interface box. The simple proprietary protocol can be made available once an NDA has been signed.

With over 10 years of field experience, JETlink has been deployed on military, law enforcement, fire & rescue and survey vessels.

It is available with our AVX*, blueARROW and MECS control systems.

Firefighting

JETfighter (AVX* and MECS) is a highly advanced control interface providing system integration for firefighting (FiFi) vessels. It automates and manages control of the main engine driving firefighting pumps while also allowing the main engine to control the vessel even when automatically Station Keeping.

JETfighter is transforming the way vessels respond to fire emergencies, reducing operator workload and increasing safety.

TOMORROW'S IDEAS

Our mission is to continually optimise performance, efficiency and safety through innovation. With technology evolving at a rate of knots, we intend to exploit these advances to bring you products and solutions that improve your operation.

We're working on growing our control solutions to solve common problems in how to:

- manoeuvre and dock safely and efficiently
- create a safe and stable platform for work
- improve vessel directional stability at low and high speed
- simplify route planning and following
- detect potential collisions and avoid them
- improve overall skipper situational awareness

Automation is one of three technology trends in the marine industry, along with **electrification** of the drivetrain; and the **digitisation** of bridge systems, connecting them to each other and the outside world.

All three trends are building momentum and HamiltonJet is innovating rapidly in each area.





CASE STUDY

Military / Patrol - ARCIMS

“The autonomous minesweeper offers a commander the ability to defeat mines that cannot be countered by current hunting techniques. It significantly reduces the risk to crew members in pressured and time-constrained operations. The system offers greater flexibility and upgradability allowing the Royal Navy to respond better to the sea-mine threat in the long term and operate more effectively around the world.”

Neal Lawson – Director Ships Support for the UK MOD’s procurement organisation, Defence Equipment and Support.

ARCIMS – autonomous minesweeping capability in collaboration with Atlas Elektronik UK.

ARCIMS is a modern, remotely controlled system designed to safely and efficiently hunt and clear sea mines in hostile environments.

This collaboration has delivered a vessel platform capable of full autonomy, remote control or fully manned operations. This world-leading minesweeping system is steering the UK armed forces towards a future of removing people from harm’s way.

It’s been achieved through the integration of Atlas Elektronik’s remote control system through HamiltonJet’s intelligent JETlink interface. This allows the Atlas system to operate the jets via HamiltonJet’s proven blueARROW controls just as if someone were on board the vessel.

“We use the blueArrow JETlink because it provides a simple CAN interface for propulsion control which is now well proven after many years of use”.

Carl Stone - Head of Sales and Product Management

VESSEL SPECIFICATIONS

Service: Royal Navy Mine Sweeping
Location: UK
Length: 11.2m
Designer: Atlas Elektronik
Builder: Ice Marine, UK
Owner: Royal Navy, UK

HamiltonJet - JETmove, blueARROW controls and twin HJ322 waterjets

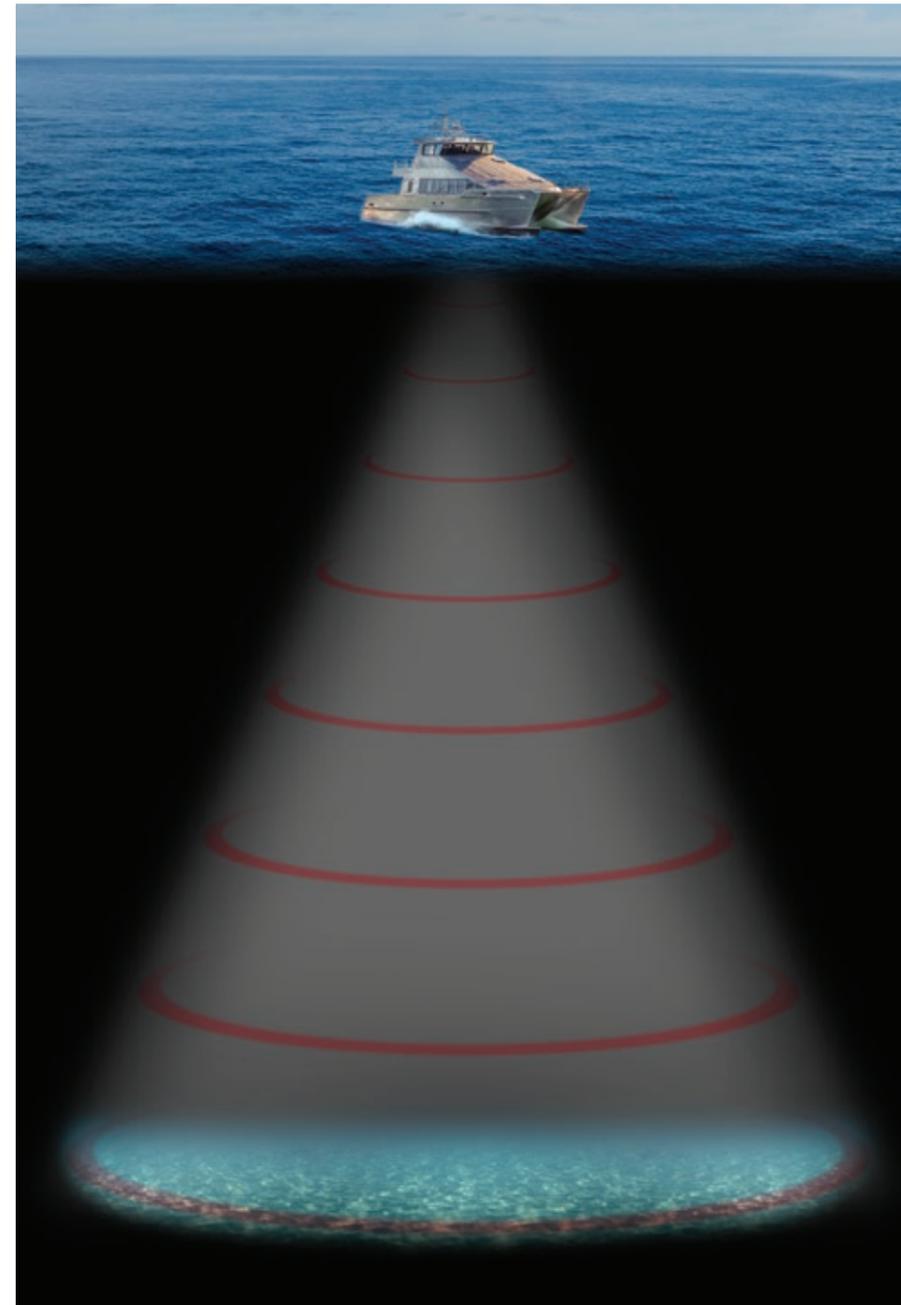


CASE STUDY

Survey / Work Boats - TenSeventy

“JETanchor is such a convenient system to have when undertaking survey work. It's transformed my missions at sea and improved my business. I'm very happy with it. I wouldn't build a boat without it.”

Alan Drinkrow, TenSeventy vessel owner.



TenSeventy survey / crew boat in collaboration with Tecknicraft Design and Q-West.

This survey boat operates around the coastal areas of New Zealand's North Island, travelling up to 60 nautical miles off-shore. Its primary function is hydrographic survey missions involving side-scan sonar readings taken over several square-kilometres of sea bed.

The vessel also collects a set of seabed samples at multiple grid points. This involves hovering over a point while lowering a probe. Manually this process takes two days at sea to complete. With HamiltonJet's

JETanchor technology, this job is completed in a single 14-hour trip.

This represents a significant increase in productivity, requiring less time, less fuel and lower staff costs. Ultimately it provides a significant return on investment for the owner / operator.

VESSEL SPECIFICATIONS

Service: Survey

Location: NZ

Length: 18.85m

Designer: Tecknicraft Design

Builder: Q-West, NZ

Owner: Mr Alan Drinkrow

HamiltonJet - JETanchor, blueARROW controls and twin HJ403 waterjets



CASE STUDY

Fireboats – Singapore Civil Defence Force

“HamiltonJet’s firefighting technology has completely transformed the way fireboats respond to emergencies and made them much more effective. We would recommend this integrated technology to anyone commissioning us to build a fire boat.”

Firefighting boat in collaboration with Penguin Shipyards.

The Singapore Civil Defence Force launched two firefighting boats in 2018/19: Red Dolphin and Red Manta. These marine rescue and firefighting vessels are designed for fast response firefighting operations. High speed and flexible, these boats have capacity for 12 crew and up to 30 rescued passengers, who can be collected from the water at very close proximity.

Their tasks are simplified with HamiltonJet’s JETfighter technology which provides a completely integrated FiFi interface

for fire-pump engagement and operation. JETfighter simplifies the process of pump priming and pump speed optimisation, whilst enabling the vessels to manoeuvre and station-keep precisely using the same engines.

VESSEL SPECIFICATIONS

Service: Fire-fighting
Location: Singapore
Length: 34.9 m
Designer: BMT Nigel Gee, UK
Builder: Penguin Shipyards, Singapore
Owner: SCDF, Singapore

HamiltonJet – JETfighter, MECS controls and triple HM721 waterjets





WORK WITH US

Ideal partners

While we create standardised products for common, everyday situations, we're also very experienced in collaborating to create tailor-made, cutting-edge solutions where required.

These projects have seen us work with other leading suppliers in autonomous systems such as L3 ASV (formerly ASV Global), Atlas Elektronik, Sea Machines and ST-EE (Singapore Technologies).

Together with boat builders, naval architects and operators we've provided solutions for military, survey, fire boats, law enforcement, rescue and pleasure craft.

Trusted experience and support

We are backed by 70 years in business as the pioneer and market leader of waterjets. We have uncompromising standards, putting performance, reliability and durability at the heart of everything we do. As a result, HamiltonJet has set the benchmark in waterjet technology across the globe.

We are also the most trusted supplier when it comes to product support. Our parts stocking across the globe is truly class leading and our network of Regional Offices and over 50 appointed distributors means help is always on hand. Lastly, our products all come with a commitment to at least 20 years' support after the end of series production*.

Serious about security

We understand the potential cyber risks associated with new technologies such as vessel autonomy and we consider it an absolute imperative to keep our clients safe from cyber harm. As a result our systems are carefully designed using hazard analysis, failure mode analysis and rigorous testing. As a point of principle we keep our primary vessel control networks physically separated from the internet so you can be sure there is no chance for corruption or hacking.

*This applies to all HamiltonJet products which reach series production and can be extended longer if a particular project requires it. Beyond this point, we still endeavour to keep our clients moving where possible.

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