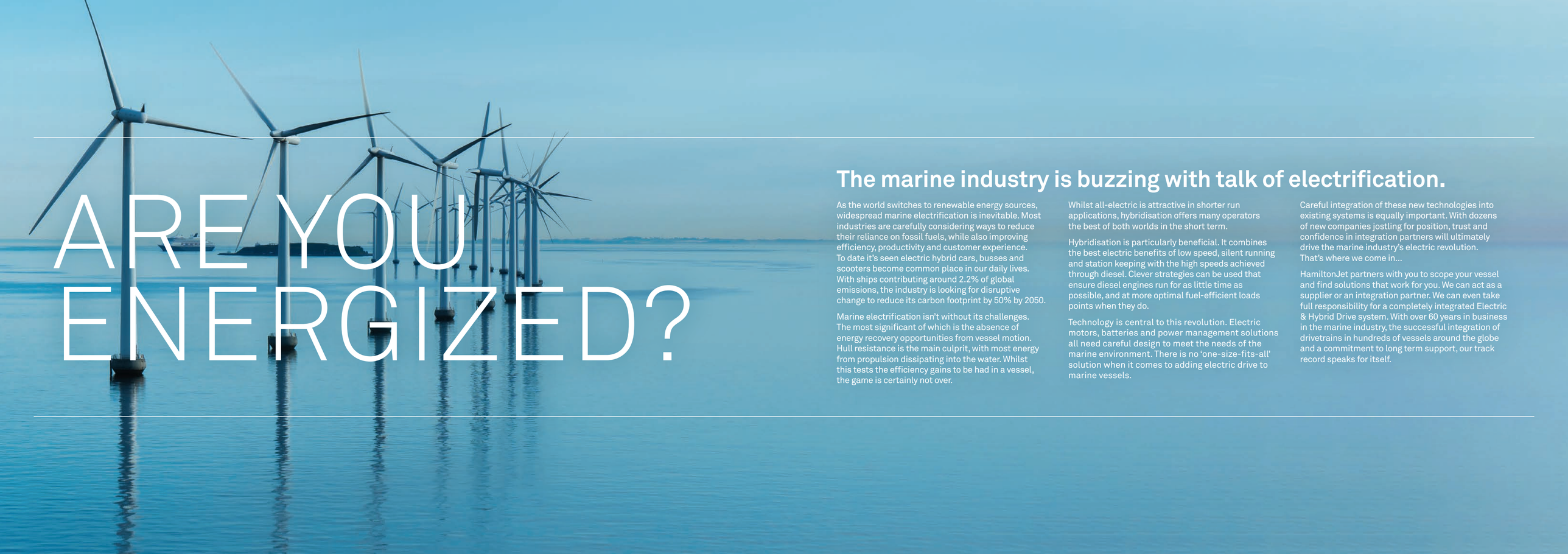

FUTURE
READY
HamiltonJet
Electric & Hybrid
Drive Solutions



ARE YOU ENERGIZED?

The marine industry is buzzing with talk of electrification.

As the world switches to renewable energy sources, widespread marine electrification is inevitable. Most industries are carefully considering ways to reduce their reliance on fossil fuels, while also improving efficiency, productivity and customer experience. To date it's seen electric hybrid cars, busses and scooters become common place in our daily lives. With ships contributing around 2.2% of global emissions, the industry is looking for disruptive change to reduce its carbon footprint by 50% by 2050.

Marine electrification isn't without its challenges. The most significant of which is the absence of energy recovery opportunities from vessel motion. Hull resistance is the main culprit, with most energy from propulsion dissipating into the water. Whilst this tests the efficiency gains to be had in a vessel, the game is certainly not over.

Whilst all-electric is attractive in shorter run applications, hybridisation offers many operators the best of both worlds in the short term.

Hybridisation is particularly beneficial. It combines the best electric benefits of low speed, silent running and station keeping with the high speeds achieved through diesel. Clever strategies can be used that ensure diesel engines run for as little time as possible, and at more optimal fuel-efficient loads points when they do.

Technology is central to this revolution. Electric motors, batteries and power management solutions all need careful design to meet the needs of the marine environment. There is no 'one-size-fits-all' solution when it comes to adding electric drive to marine vessels.

Careful integration of these new technologies into existing systems is equally important. With dozens of new companies jostling for position, trust and confidence in integration partners will ultimately drive the marine industry's electric revolution. That's where we come in...

HamiltonJet partners with you to scope your vessel and find solutions that work for you. We can act as a supplier or an integration partner. We can even take full responsibility for a completely integrated Electric & Hybrid Drive system. With over 60 years in business in the marine industry, the successful integration of drivetrains in hundreds of vessels around the globe and a commitment to long term support, our track record speaks for itself.

ELECTRIFICATION BENEFITS

Efficiency and Sustainability

Electrified drivetrains can be more efficient and reduce the use of fossil fuels, through:

Trading diesel consumption for increasingly green shore-power stored in batteries

Carefully optimising each system for its core job to reduce overall energy consumption

Lower maintenance costs on diesel engines and simpler electric drive components

Responding to growing public and legislative pressures to reduce carbon footprints

Productivity

Electrification creates better vessels, through:

Fast response boost mode (in some hybrid installations)

Reduced need to tie-off or weigh anchor when integrated with station keeping features (such as our JETanchor system)

Longer service intervals due to reduction of engine usage hours

Less time refuelling

Simple integration at the helm and seamless delivery of power, whatever the source

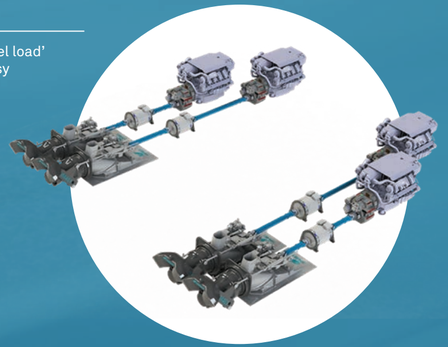
Improved Experience

Crew, passengers, bystanders and wildlife all stand to benefit from:

Low noise around harbours, coastal communities and wildlife

Near-silent operation when holding position for extended periods

Longer periods of 'hotel load' operation without noisy engines or generators



Yacht Tender with Hamilton HM571 jets and a hybrid drivetrain.

TYPES OF ELECTRIC HYBRID SOLUTIONS

While configurations vary greatly, there are FOUR broad types of hybrid electric solutions.

1. Fully Electric

The ultimate quiet, low-maintenance, solution. Fully electric boats are also the greenest option, particularly when electricity comes from renewable sources.

Fully electric is also very economical to run, despite the high initial investment in hardware. Due to the weight of batteries, fully electric boats tend to be used in applications that run medium to low speeds with shorter runs and predictable charging times, such as ferries. Lightweight structures such as carbon-fibre can be used to compensate.

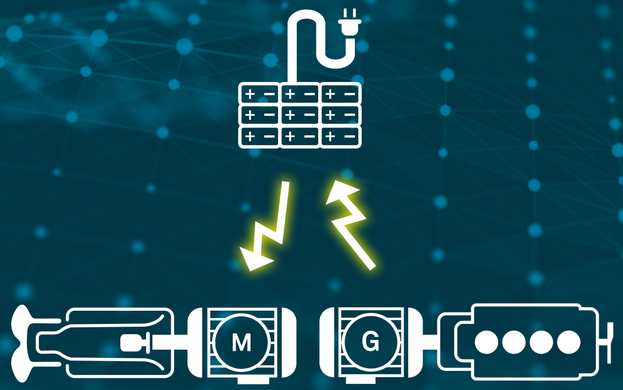
They are also very quiet, which is great for transit through populated areas and manoeuvring / docking in marinas.

2. Series Hybrid

This is a versatile arrangement allowing electrical generators to be installed anywhere in the hull. These generate electricity which is used to power electric motors, with batteries acting as a buffer of energy. The generators charge the batteries during low power demand. During high demand the batteries "top-up" power to the motors, leading to more constant diesel power and increases in efficiency.

Series Hybrid vessels can also run without diesel power for short periods and batteries can be charged on shore, saving fuel. Some of the gains in efficiency are offset by losses associated with the conversion of mechanical power into electricity in the genset and vice-versa in the electric motor.

Series Hybrid is commonly used on larger vessels with multiple electrically driven thrusters and higher hotel loads. Dive Support vessels are a good example.



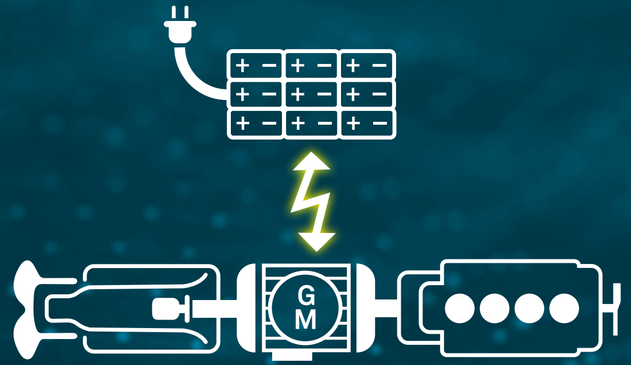
This Dive Support Vessel (DS) from Belov Engenharia Ltda features diesel electric propulsion and plant driving HamiltonJets propulsors and bow thrusters.

3. Parallel Hybrid

This option works similarly to most hybrid vehicles. Combining the extended range of a diesel engine with the benefits of electric assist, it is often the lightest weight option as well. Both the electric motor and the diesel engine drive the waterjet directly, either individually or together to boost power. The electric motor can also act as a generator, using the spare capacity of the diesel engine when it is operating at part loads. Batteries provide the buffer, and can also be charged onshore for fuel saving.

While Parallel Hybrid is an elegant best-of-both-worlds solution, it is complex and requires high levels of integration to work seamlessly at the helm.

Parallel Hybrid is the perfect partner for Wind Farm, Fast Ferries and Tourism boats which require extended range and quiet operations, combined with reduced emissions.



White Morph is a 14.8m Teknicraft foil-assisted catamaran achieving 43kts. HamiltonJet recently acquired this boat as a demonstration vessel. It will be fully operational with the EHX Parallel Hybrid System and available for demos in Christchurch by Q1 2021.

4. Other Solutions

Operating requirements and vessel designs vary widely, so it's no surprise hybrid solutions do too. From novel ways to eliminate on-board generators, to clever solutions that split power between purely diesel and electric drivelines on the same vessel.

With or without batteries, these solutions do not fall into the well-defined categories so are grouped here as 'other solutions'.

This "Inertia PM5" trimaran vessel from World Marine Offshore falls into the "other systems" category. It uses 3 diesel driven waterjets in the centre hull and one electrically driven jet in each of the outer hulls. These are driven by diesel generators and a 45kWh battery pack. This innovative Crew Transfer Vessel for offshore wind support uses these novel technologies and an a unique hull-form to reduce fuel consumption and emissions while ensuring a stable, comfortable platform for windfarm technicians.

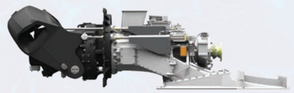
THE IDEAL ELECTRIC & HYBRID PLATFORMS

As electrification sweeps across the marine industry, our waterjet and control system products are ideally suited to electric and hybrid drive technologies.

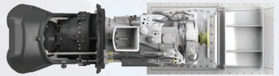
The silence and economy of these drives combines with our outstanding manoeuvrability and medium to high speed performance to create the perfect partnership.

Waterjets

Highly manoeuvrable
HamiltonJet boats turn on the spot, move sideways and perform rapid stops with ease - all without additional thrusters. This greatly simplifies hybrid electric installation.



Extremely efficient
Optimised hydrodynamic designs deliver outstanding efficiency, whilst also absorbing less power than a prop at intermediate engine speeds, giving a greater capacity for electrical generation.



Incredibly quiet
HamiltonJets are renowned for their low noise signature. This makes them ideal for quiet electric operation in densely populated areas or around wildlife.

Safer
Our impellers are safely contained within the body of the jet, nothing is exposed beneath the hull. This makes our jets an ideal solution for hybrid electric operations in shallower waters and around wildlife.

AVX Controls

Tightly integrated
AVX controls can be made to work with most hybrid electric systems. However, the best results are achieved when we take full responsibility for integration of the hybrid and electric functions, including battery management. This delivers a single user-interface which hides the complexity under the hood.

The hero of AVX is JETanchor, which provides effortless control. It simplifies the job of holding station and delivers pinpoint precise manoeuvring with GPS assistance. When combined with electric hybrid technologies, JETanchor can deliver hours of silent, efficient, stationary operation without the need to run the engine.

LEADING THE CHARGE

Electric hybrid integration specialists

HamiltonJet has a long history of integrating the total driveline (jets, gearboxes and engines) into a single interface at the helm. Having now collaborated on a large number of electric hybrid projects around the globe, we've also become trusted, specialist integrators for hybrid electric technologies.

However, you can choose the level of support you'd like from us. We'll work with you in the way that suits you best.

We do so through offering three levels of assistance.

HamiltonJet Boat Builder

OPTION 1

LEAVE YOU TO IT

Waterjets and controls only

This is our light touch option. Here we provide you with our superior waterjets and vessel controls (if you need them). We leave you to integrate them with hybrid electric technologies from your preferred provider. This option is ideal for simpler hybrid electric systems, for example those using mechanical controls.

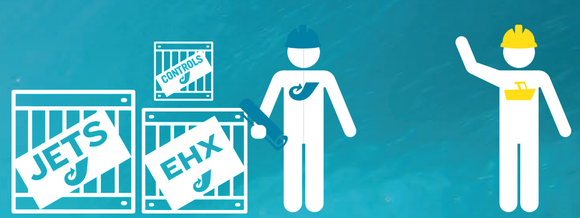
OPTION 2

DO IT WITH YOU

Waterjets and controls + integration expertise/support

Under this option we provide you with our superior waterjets and vessel controls, and help you integrate them with your chosen hybrid electric system. This way we can ensure they work well together and preserve some of the benefits of waterjets such as 3-axis control.

OPTION 3

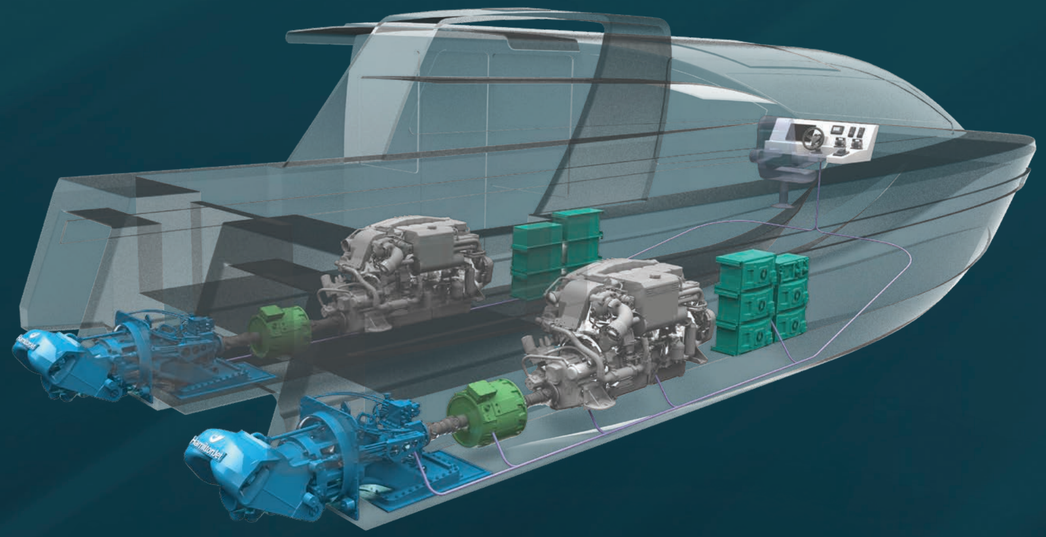


DO IT FOR YOU

Fully integrated Hamilton Electro-Hybrid Drive system

HamiltonJet provides our superior waterjets and controls, plus our fully integrated hybrid electric solution. This option involves a full system design optimization exercise. This is followed by a comprehensive integration and warranty of service to ensure your vessel works brilliantly and exactly the way you want it too.

HAMILTON ELECTRO-HYBRID DRIVE SYSTEM (EHX)



HamiltonJet's Electro-Hybrid Drive System is the culmination of our extensive waterjet knowledge and hybrid electric integration expertise.

EHX offers all the advantages of electric drive with the full capabilities of diesel. This unique system delivers lower fossil-fuel consumption* combined with the speed, manoeuvrability, efficiency and safety of waterjets.

We deliver the electric motors, power electronics and control system, alongside specialist expertise to ensure seamless integration with the waterjets, engines, gearboxes or clutches.

The control system manages the hybrid energy flow between engines, batteries and motors while charging and discharging the batteries as required.

A simple automatic setting enables effortless vessel operation in a manner similar to driving a hybrid car.

Meanwhile, the manual setting delivers four different modes of operation - **Diesel Only, Electric Only, Charging or Electric Boost.**

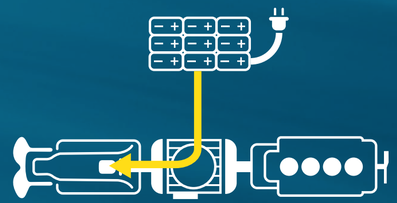
When it comes to hybrid electric solutions "one size fits all" simply doesn't exist. That is why EHX is scaleable to your vessel project with motors, battery capacity and components specifically selected to meet your needs. This ensures the lowest cost and best outcome for your project.

The same EHX system can also be configured for an electric-only vessel with the option of a fully integrated HamiltonJet solution.

*Reduced further when dock charging (as infrastructure allows).

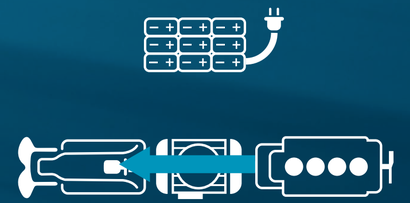
The EHX system integrates the key functions of the hybrid system into the main display of our AVX control system. Battery charge is displayed, as is the current mode of operation. The function keys allow the operator to switch between auto and manual selection of the four operating modes seen opposite.

EHX OPERATING MODES



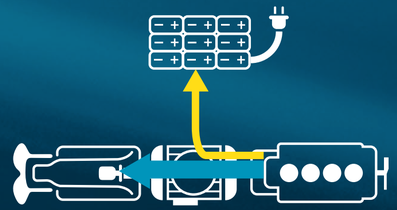
Electric Only

In this mode power flows from the batteries through the motor to the waterjet. This mode is suited to low speed, short range operations. It delivers quiet, zero-emission running.



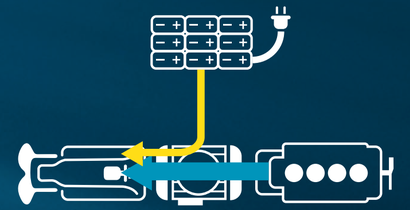
Diesel Only

In this mode, the vessel operates as per a typical diesel-powered waterjet. This mode is used to run at cruise speeds when the batteries are full.



Charging

This mode uses the spare capacity, that always exists when the diesel engine is running at medium speeds, to charge the batteries. This mode is used to run at cruise speeds when the batteries need charging.



Electric Boost

In this mode diesel and electric power are combined to maximise propulsion or to use battery charge to reduce fuel consumption. Electric boost is the fastest mode available. It's used to reach maximum speeds and to consume electricity from batteries prior to charging.

TOMORROW'S IDEAS

While battery technology will continue to improve, it's unlikely fully-electric boats will have the range of their diesel counterparts any time soon. This is because the energy density of batteries is still 30 times less than diesel.

However, with electric vessels set to become commonplace, shorter run ferries, yacht tenders and other occasional craft will grasp the benefits so trade-offs will be made in vessel speed and range - where they don't compromise vessel function.

In the long run, alternative 'clean' fuels like hydrogen offer the most hope for a fully electric future, although the challenges of hydrogen production and storage must still be overcome.

Ultimately though, no-one wants to get to their destination any slower so the need for faster vessel technologies with a longer range will drive a variety of innovative solutions.

This will see technologies continue to evolve, with cost and weight reduction the key factors.

As you would expect, HamiltonJet will be with you every step of the way.

The all-electric HamiltonJet powered ferry concept by EV Maritime.

CASE STUDY

Perini Navi
Hybrid Yatch Tender

Parallel Hybrid

This 25.5m Hybrid Yatch Tender is propelled by twin HM571 jets. The parallel hybrid vessel combines the extended range of diesel and speed of waterjets, with electric motors for generation, speed boost and silent low-speed operation. It can even operate by running one engine to drive both jets (one mechanically and the other electrically).

This Hybrid Yatch Tender breaks new ground for Perini Navi as the company continues to refine its product range to meet evolving demand for sustainable propulsion and clean emissions.

VESSEL SPECIFICATIONS

Service: Hybrid Yatch Tender
Location: Italy
Length: 25.5m
Designer: Perini Navi, Spa
Builder: Perini Navi, Spa
Owner: Private
HamiltonJet - twin HM571 waterjets, parallel hybrid electric

CASE STUDY

Belov Engenharia Ltda
Dive Support Vessel

Series Hybrid

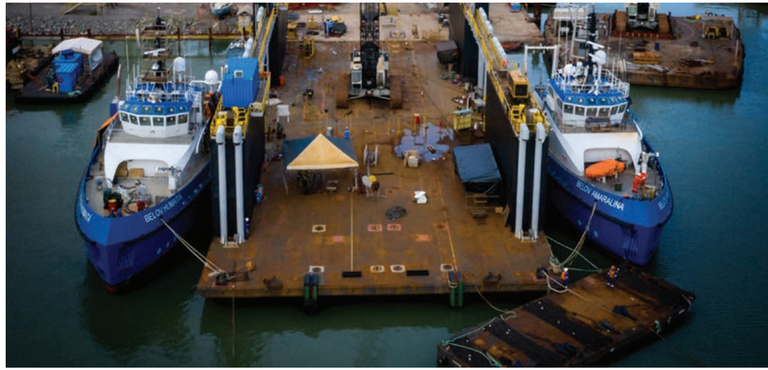
These highly specialized Dive Support Vessels (DSV) are the latest development from Belov Engenharia Ltda.

Suitable for Unrestricted Navigation, classed by RINA, they are fitted with a Series Hybrid diesel electric propulsion system. On-board generators power electric motors that drive triple HamiltonJets and bow thrusters, delivering the required propulsion and dynamic positioning capabilities. They also feature an ROV LARS (Launch and Recovery System), an aft mounted A-Frame to operate the diving bell, a decompression chamber to support the divers, and more spacious crew quarters.

Marcos Parahyba Campos, Belov's Project Manager says "these vessels feature waterjets from HamiltonJet to ensure diver safety. Further, because waterjets are typically used on higher speed vessels, extensive self-propelled CFD analysis was performed in-house by Robert Allan Ltd to verify resistance and thrust at the slower speeds that this design will operate at, with very pleasing results".

VESSEL SPECIFICATIONS

Service: Dive Support Vessel
Location: Brazil
Length: 41m
Designer: Robert Allan Ltd, USA
Builder: Belov Engenharia, Ltda, Brazil
Owner: Belov Engenharia, Ltda, Brazil
HamiltonJet – Triple HM651 waterjets, series hybrid electric



CASE STUDY

Wight Shipyard
Patrol Vessel

Parallel Hybrid

Chartwell Marine worked closely with HamiltonJet to develop a propulsion package tailored to suit a new class of hybrid patrol boat.

The Chasewell Patrol Vessel uses twin Volvo D3 engines, ZF gearboxes, HJ241 waterjets and the Transfluid HM560 hybrid system.

Andy Page of Chartwell Marine says “waterjets were selected for this vessel to achieve shallow draft and high manoeuvrability from a compact package. HamiltonJet provided valuable data that enabled Chartwell to specify a suitable battery bank and electric motor for this application. Furthermore, the waterjets fitted neatly into the vessel when coupled up to the hybrid driveline.”

The vessel has set the benchmark for patrol and pilot vessels that need to keep pace with changing environmental requirements while still being able to switch easily between variable speeds when required.

VESSEL SPECIFICATIONS

Service: Hybrid Patrol Vessel
Location: UK
Length: 9m
Designer: Chartwell Marine, UK
Builder: Wight Shipyard Co, UK
Owner: Wight Shipyard Co, UK
HamiltonJet – single HJ241 waterjet hybrid electric

WORK WITH US

Over the decades we've become trusted partners to boat builders, naval architects and marine operators around the globe. They tell our story better than we do, so if you'd like some references, please get in touch.

Our network is global. Wherever you are, you'll find experienced distributors supported by our own regional office staff to assist you with your project. We'll walk you through the process and can deliver simple or complex projects.

Our market experience is extensive. It covers offshore, pilot, rescue, fire, military, patrol, windfarm, fast ferry, fishing, aquaculture and recreational applications.

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