



# ELECTRIC & HYBRID SOLUTIONS



**HamiltonJet**

**FUTURE READY**



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# ARE YOU ENERGIZED?

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## 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.

Hybridisation in particular offers the industry the best of both worlds. It combines the best electric benefits of low speed, silent running and station keeping with the high speeds achieved through diesel. Clever strategies to ensure diesel engines run for as little time as possible, and at higher loads to save fuel, will also come to the fore.

Technology is central to uptake. 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 act as a supplier or an integration partner or to take full responsibility for a completely integrated Electric & Hybrid Drive system. With over 60 years in business, 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.

# HYBRID ELECTRIC 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, which is already happening with short-run electric drive ferries in countries like Norway, the United States and New Zealand

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

Lower maintenance costs on diesel engines and simpler electric drive components

Electrification is also an ideal response to growing public and legislative pressures to reduce carbon footprints.

## Productivity

Electrification creates better vessels, through:

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

Fast response boost mode (in some hybrid installations)

Reduced need to tie-off or weigh anchor when working if integrated with our JETanchor system

Longer service intervals due to reduction of engine usage hours

Less time refuelling.

## 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.

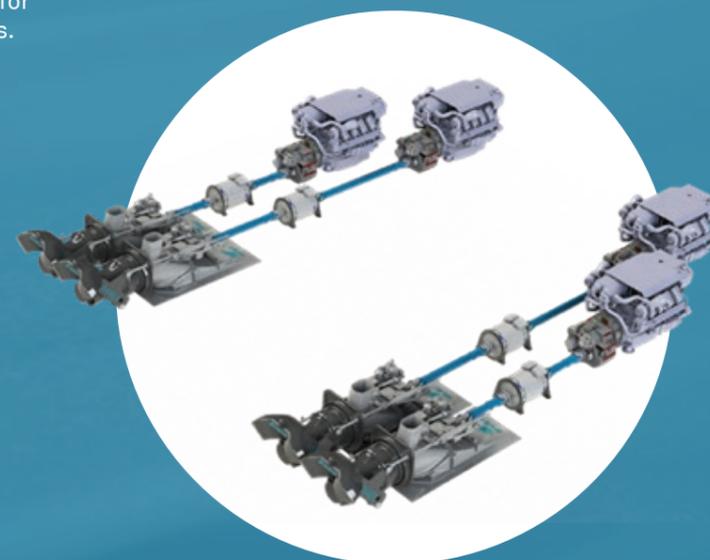


Photo courtesy of Perini Narvi

# TYPES OF ELECTRIC HYBRID SOLUTIONS

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

## 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 require lower speeds or short run times, like Fast Ferries.

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

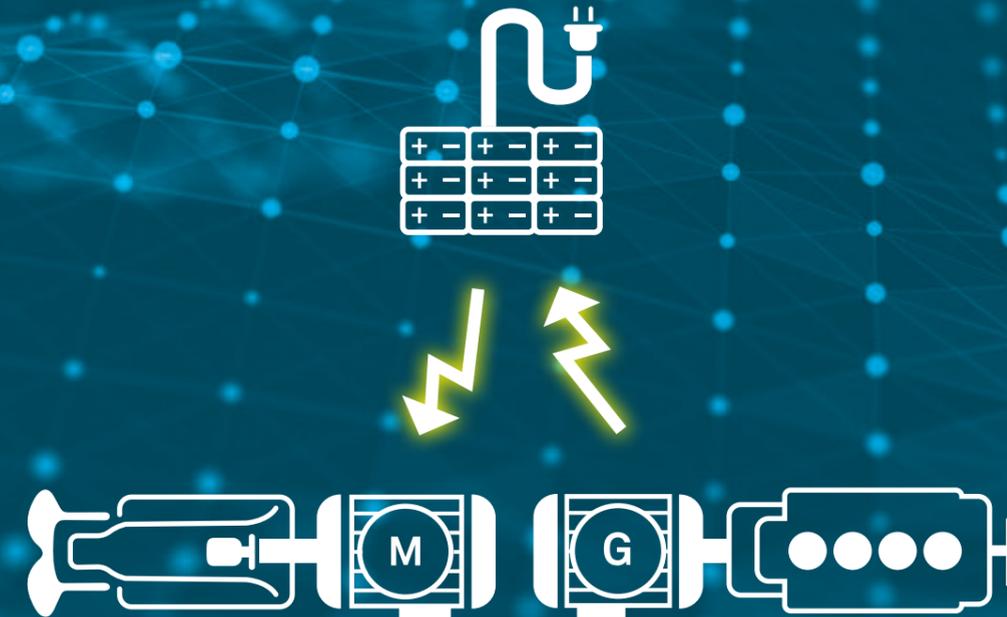


## Series Hybrid

This is a versatile arrangement allowing gensets to be installed anywhere in the hull. The gensets generate electricity which is used to power electric motors, with batteries acting as a buffer of energy. Gensets 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.



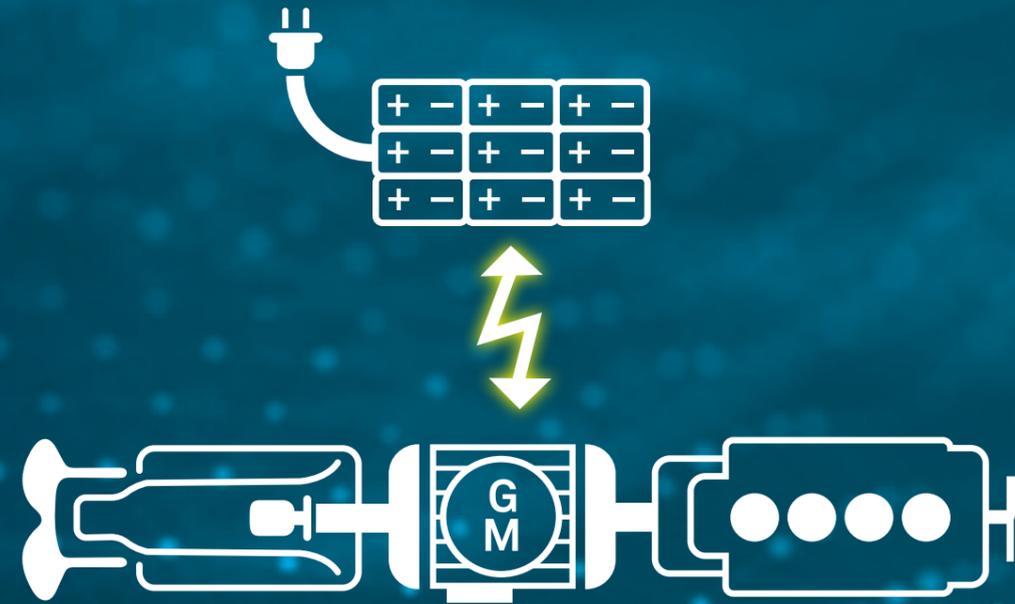
This Dive Support Vessel (DS) from Belov Engenharia Ltda features diesel electric propulsion and plant driving waterjet propulsors and bow thrusters.

## Parallel Hybrid

This option is the lightest of them all, thanks to the use of smaller electric motors and diesel engines. Similar to a hybrid car, with this solution both the electric motor and diesel engine can power the waterjet directly – together or individually. This combines the range of diesel power with the benefits of electric drives. The spare capacity of the diesel engine is used to charge the batteries while propelling the boat by using the electric motor as a generator. Batteries can also be charged on shore for fuel saving.

While Parallel Hybrid is the most elegant solution, it is complex, requiring high levels of integration and customised design. Parallel Hybrid gives you the best of both worlds.

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.



Leading New Zealand tourism attraction, Whale Watch Kaikoura, is committed to environmental sustainability. It has developed a parallel hybrid that enables it to provide the best possible experience for visitors and sea life alike.

## Other System Types

Operating requirements and vessel designs vary widely, so it is no surprise that hybrid solutions and technologies employed do as well. From novel ways to eliminate separate gensets on board, 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.



Inertia PM5 vessels from World Marine Offshore fall into the "other" category. They are crew transfer vessels featuring a hybrid hullform designed to reduce fuel consumption and emissions while ensuring a stable, comfortable platform for windfarm technicians to live on.

# THE IDEAL ELECTRIC HYBRID PLATFORMS

Electric-only and hybrid drive technologies are ideally suited to waterjets. The silence and economy of electric drive combine with the speed and range of diesel to offer the very best of both worlds.

As electrification sweeps across the marine industry, our waterjets and controls provide the perfect platform for the seamless integration of hybrid electric technologies.

## 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**  
HamiltonJets deliver consistent, predictable power consumption to deliver more capacity for electric power generation.

**Incredibly quiet**  
HamiltonJets are comparatively quiet, making them ideal for hybrid electric operations in densely populated areas and around wildlife.

**Much 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

AVX controls can be easily integrated with most hybrid electric systems.

The hero of AVX is JETanchor, which simplifies the job of holding station in open water. With JETanchor there is no need to tie-off or weigh anchor.

When it's combined with electric hybrid technologies, JETanchor can deliver hours of silent, stationery operation without the need to run the engine.

JETanchor + hybrid electric deliver the ultimate in low noise, low power, fuel efficient operations.



# LEADING THE CHARGE

## Electric hybrid integration specialists

HamiltonJet has long been the onestop shop for superior waterjets and control systems. 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.

We work with you to scope your vessel and find solutions that work for you.

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.

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

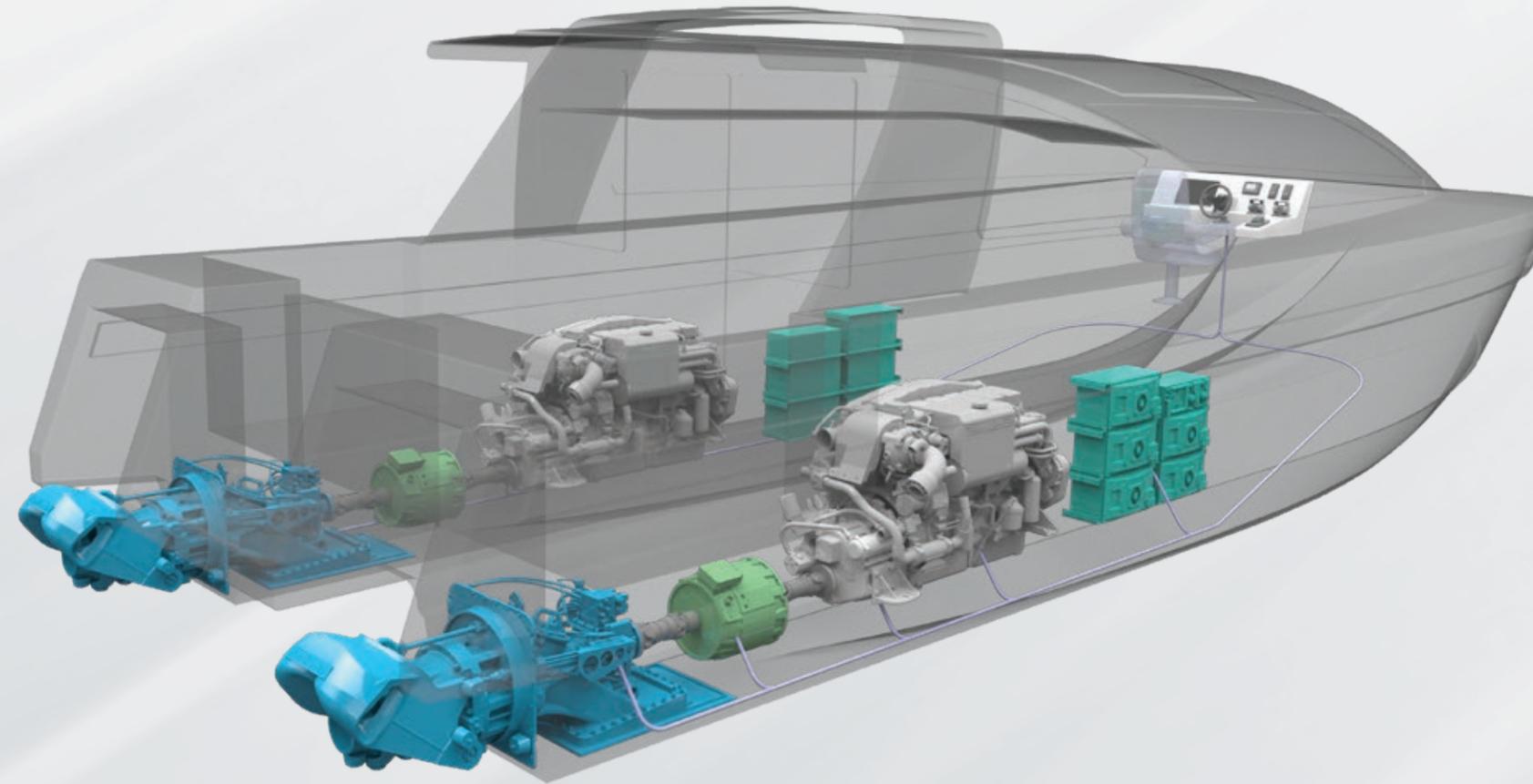
Fully integrated Hamilton Electro-Hybrid Drive system

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

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# HAMILTON ELECTRO-HYBRID DRIVE SYSTEM

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**HamiltonJet's Electro-hybrid drive system is the culmination of our extensive waterjet knowledge and hybrid electric integration expertise.**

This system offers all the advantages of electric drive with the full capabilities of diesel. This unique system delivers lower CO2 emissions\* 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.

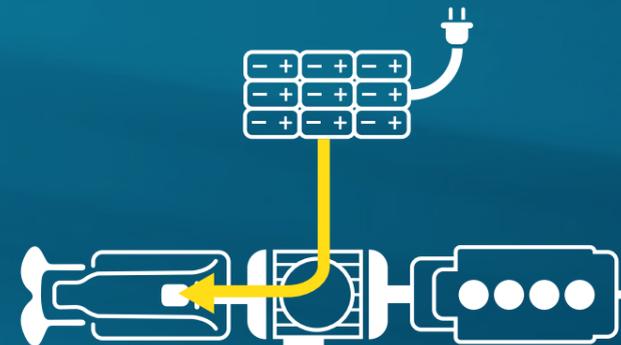
The control system manages the hybrid energy flow between engines, batteries and motors while charging and discharging the batteries as required.

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's why Hamilton Electro-Hybrid Drive tailors all the components to your specific needs, delivering the ideal outcome for your vessel.

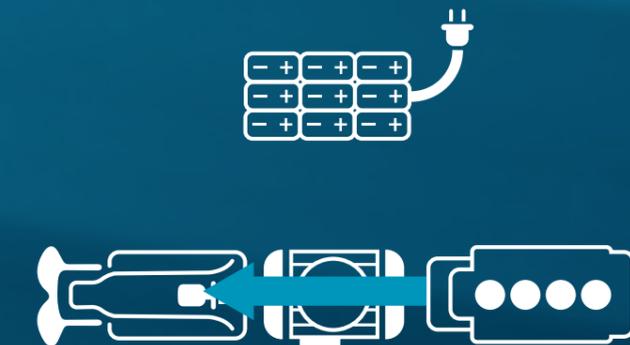
\*Reduced further when dock charging (as infrastructure allows).

# HAMILTON ELECTRO-HYBRID DRIVE MODES



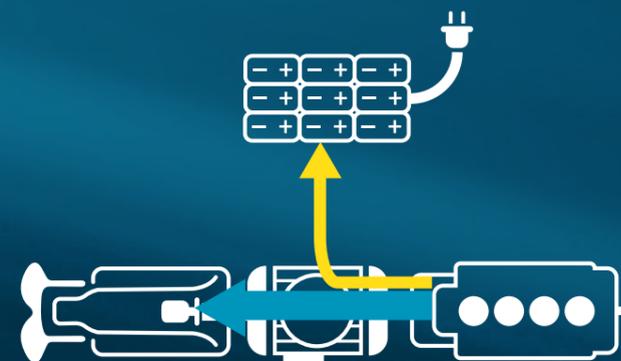
## Electric Only

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.



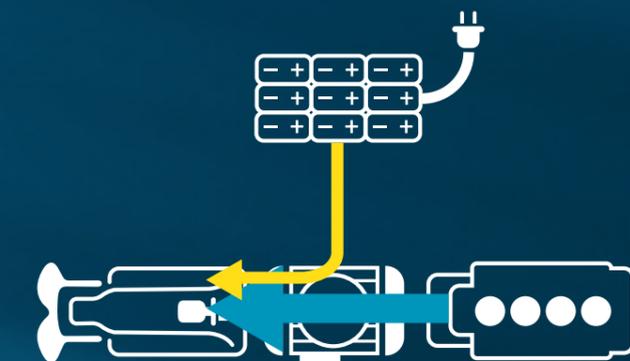
## Diesel Only

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 it's inevitable battery technology will continue to improve in the future, it's unlikely fully-electric boats will ever have the range of their diesel counterparts. 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 use 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.





#### CASE STUDY

## Perini Navi Hybrid Yacht Tender

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### Parallel Hybrid

This 25.5m Hybrid Yacht Tender is powered by twin diesel engines from HamiltonJet, which are integrated with electric components. This combines the full range of diesel power and speed of waterjets while enabling flexible propulsion through offering four distinct drive modes: diesel-mechanical, hybrid, diesel-electric and zero emission.

This Hybrid Yacht 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.

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#### VESSEL SPECIFICATIONS

Service: Hybrid Yacht 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

This highly specialized Dive Support Vessel (DSV) is the latest development from Belov Engenharia Ltda.

Suitable for Unrestricted Navigation, classed by RINA, the vessel is fitted with a Dynamic Positioning System, diesel electric propulsion and plant driving water jet propulsors and bow thrusters. It also features 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 "this vessel features 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

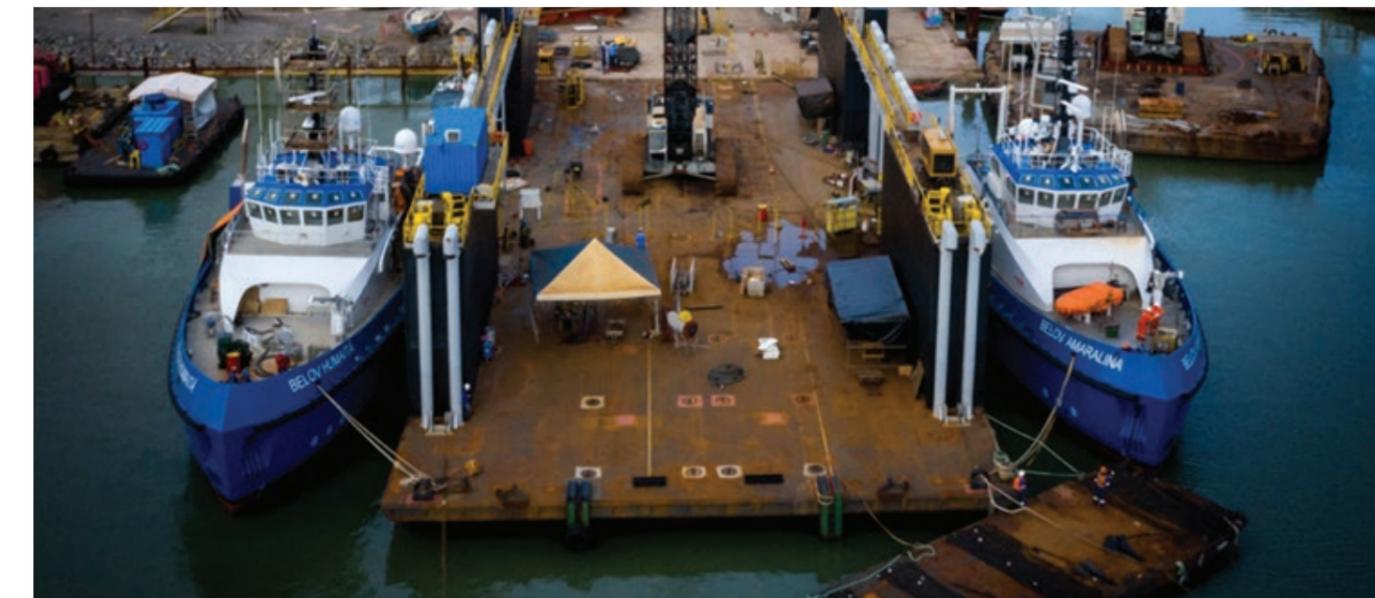
Length: 41m

Designer: Robert Allan Ltd, USA

Builder: Belov Engenharia, Ltda, Brazil

Owner: Belov Engenharia, Ltda, Brazil

HamiltonJet – Triple HM651 waterjets,  
series hybrid-electric





## CASE STUDY

# Wright Shipyard Patrol Vessel

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### 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 9m Patrol vessel combines a novel hull design, which maximises low speed efficiency, with Twin HJ241 waterjets for high speed 'sprint' capability.

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.

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### VESSEL SPECIFICATIONS

Service: Hybrid Patrol Vessel

Location: UK

Length: 9m

Designer: Chartwell Marine, UK

Builder: Wright Shipyard Co, UK

Owner: Wright Shipyard Co, UK

HamiltonJet – single HJ241 waterjet Hybrid-Electric



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# WORK WITH US

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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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