



HYBRID MARINE

Single Source Power For Multiple Ship Systems





Northern Lights Hybrid Marine Hybrid Propulsion and AC Power Solutions



Northern Lights/ BAE



Northern Lights Hybrid Marine is the result of the collaboration between two industry leaders in their fields:

Northern Lights, a pre-eminent global supplier of marine generator and propulsion solutions and BAE Systems, the leader in the field of power electronics.

This collaboration has resulted in the first commercially available single source, engineered, tested and fielded Hybrid Marine system on the market.

There are other suppliers of hybrid equipment, but none offer a comprehensive package for hybrid that is – from day one – engineered to be a complete, one source system.



Northern Lights Hybrid Marine

 Northern Lights has been providing fully engineered and tested generators and propulsion plants for the past 50 years and has gained a reputation for dependability, durability and quality.



 BAE has supplied over 4000 HybriDrive[®] systems for transit buses worldwide.

BAE SYSTEMS

 Utilizing the strengths and proven equipment from both companies, we have engineered and tested a complete Hybrid Marine system.



Project Evolution

- Northern Lights Hybrid Marine was initially launched as a hybrid propulsion solution.
- During the testing process we learned that the hybrid benefits were also available as a variable speed power production plant.
- The evolving needs of the marketplace have led us to even more hybrid applications. New projects can include commercial charter boats, ferries, tugs and even privately owned yachts and trawlers.









Northern Lights Hybrid Marine System Benefits

- Flexibility: Locate any or all components where they best suit your needs. The only components that requires a fixed location is the traction motor with the prop.
- Scalability: Build the system to provide electric propulsion, electric propulsion with ship board power or power all of the vessel's accessory / machinery requirements.

Optimized Engine Performance: Engine operates at optimal fuel curve at all times; RPM is a function of load demand. In no load and low load conditions, the engine operates only when the battery bank is depleted and only at the RPM required to satisfy the load.

- Maximized Fuel Efficiency
- Eliminated Wet Stacking
- Reduced Engine Usage
- Lower Maintenance Requirements
- Reduced Sound Signature
- Silent Operation: System provides the capability to run all ship service load and propulsion without engine operation
- Ease of Operation: System controls fit within existing vessel control system, while providing increased precision and accuracy
- Proven components with millions of trouble free operational hours of commercial service
- Sealed electrical components require no service with substantially reduced maintenance requirements
- Modular component replacement if required



Hybrid Marine System Architecture







How Hybrid Propulsion works

- DC Power is stored in the 45 KWH Energy Storage Module (ESM). DC Power has been provided by shore power connection or from the engine/generator and converted to variable frequency 3 phase ac power. This will drive the Alternating Current Traction Motor (ACTM) and the vessel's propeller shaft.
- When power is required by either the Ships Service or propulsion systems, DC power from the ESM is sent to the Propulsion Control System (PCS) and converted to variable frequency 3 phase AC to drive the Alternating Current Traction Motor (ACTM) and prop shaft. Some of this power is diverted to PCS 2 to provide ships service power.
- When the ESM reaches a predetermined State of Charge (SOC) the engine is started by the Traction Generator producing variable frequency three phase AC power to the PCS, where it is inverted and becomes nominal 610 VDC for charging the ESS.
- The engine only runs at the speed required to service the total load and only for as long as it takes to charge the ESM battery system. Once the batteries have been restored to the predetermined SOC, the engine is shut down and the system reverts again to clean, quiet battery power.



Hybrid Variable Speed Generator Options

- Load driven, as opposed to conventional drive, to produce efficiency and savings.
- Generator runs only when needed. Programmable to operate at peak efficiency at all times.
- Utilize during peak horsepower to maximize efficiency
- Allows for clean operation during low load cycles and reduces engine maintenance.



Why Hybrid Marine?

- **Optimized Engine Performance**: Engine operates at optimal fuel curve at all times, keeping emissions and fuel consumption at their absolute minimum levels. In no load and low load conditions, the engine operates only when the battery bank is depleted and only at the RPM required to satisfy the load.
 - Maximized Fuel Efficiency
 - Reduced Fuel Consumption
 - Eliminating Wet Stacking Emissions
 - Reduced Engine Operation
 - Lower Engine Maintenance Costs
 - Reduced Sound Signature
 - **Quiet Operation:** Operate propulsion and AC power generation silently using batteries to power loads. Reduced engine operation means overall reduction in sound signature
 - **Proven Components**: Both the engine and Hybrid Marine components are "off the shelf" engineered, tested, fielded and proven as a complete system. No "under development" parts. Both engine and power electronics have been proven over millions of miles and hours.
 - **Scalability**: System designed for your application Propulsion, Ships Service Power, Accessory power requirements to suit your vessels requirements.
 - **Modular Component Replacement**: Electronic components are plug and play. In the unlikely event of a problem, component replacement reduces downtime and simplifies service operations.
 - Fully Adjustable Operation: A data logger can be installed to record actual operations so that adjustments can be made to optimize the system even further. Modify engine on periods for at sea operation to assure that docking operations are conducted in totally quiet and completely clean conditions.



Why Hybrid Marine?

Cost savings and value assessment:

- Within the operational profile we can show an ROI in 3-4 years. Benefits will be seen in both fuel consumption savings and substantially reduced maintenance costs.
- Northern Lights Hybrid frequently represents the greenest available alternative for grant and federal funded projects.



Northern Lights Hybrid Marine System First Application

The Northern Lights Hybrid Marine system has been selected to power the new "floating schoolhouse" for the Maritime Aquarium in Norwalk, Conn.

The new 65-foot research vessel - designed by Incat Crowther - will be used throughout Long Island Sound to entertain and inform aquarium patrons. Installing the Hybrid Marine system allows the vessel the clean, reliable propulsion it needs to travel out into the Sound. By utilizing stored energy it can remain under quiet, eco-friendly power during extended periods of at-sea education. And because the same system provides the vessel's AC electrical power, it alleviates the need for running an additional genset.



The Maritime Aquarium annually provides 10,000 school children with the opportunity to learn more about the world's waterways in an at-sea application. Now, thanks to Northern Lights Hybrid Marine they can do so in a clean, economical, ecologically advanced manner.

