Alewijnse Marine | 6541 CX Nijmegen | Netherlands

Emission free from A to Z

One of the first commercially viable fuel cell boats sails with Bachmann technology

bachmann.

A boats that does not emit any CO2, sulphur dioxide, and motor noises might seem very futuristic, however, boats that meet this criteria will soon be in service. This is all made possible by using hydrogen fuel. With its high energy content and minimal environmental impact, hydrogen is an interesting alternative to conventional fuels. A Dutch consortium has built one of the world's first commercially viable boats for service in Amsterdam's canals. The robustness and substantial redundancy possibilities of Bachmann's M1 System impressed Alewijnse Marine Systems when it came to choosing an automation system.

For more than 100 years the company Alewijnse in Nijmegen, Netherlands has been a successful and innovative system provider of electrical systems for ship building. As part of the consortium "Fuel Cell Boat BV," the company set the goal of building an emission free boat by the start of 2009. Along with Integral, Linde Gas, Marine Service North and the shipyard Lovers, four other renowned companies are working on this sustainable, future oriented project.

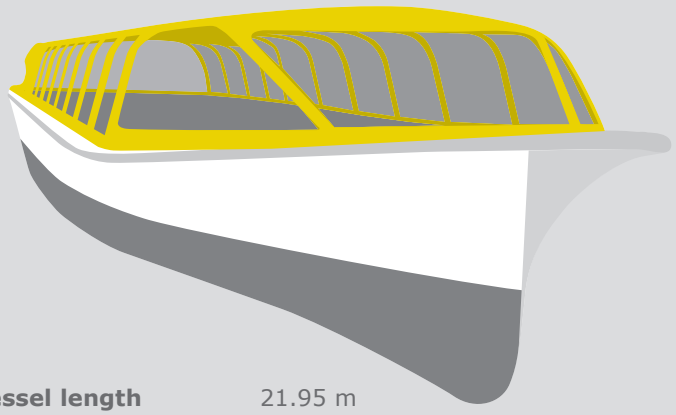
A new approach to public transportation

A few small hydrogen fueled boats already exist, however, they are used mostly for research purposes. Just one has been commissioned for commercial use, despite hydrogen's extreme energy efficiency in comparison to conventional fuels. The attainable efficiency of hydrogen engines is much higher than those of gasoline and diesel engines. The "Fuel Cell Boat" should be in service in Amsterdam's public transportation system by mid 2009, when it will transport commuters between the stations "Amsterdam Noord" and "Central Station". The boat's first customer may well be the energy firm 'Shell'. The company plans to use the boat to transport 600 employees between Amsterdam Main Station and its New Technology Center (NTC). The boat with a length of just under 22 meters and a width of a little over 4 meters has a maximum capacity of 100 people. When not transporting commuters the boat with its transparent roof will carry tourists on sightseeing tours along Amsterdam's canals.

Completely emission free

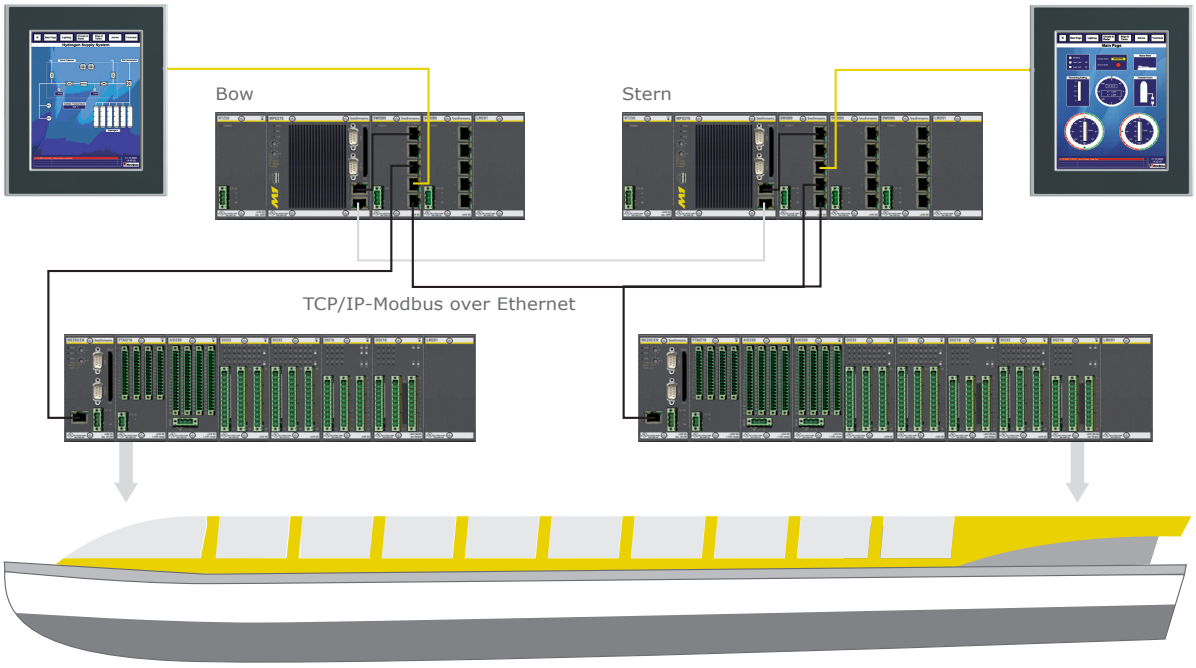
The electric energy needed to acquire the hydrogen by means of electrolysis comes from Shell's Nuon/Q7 wind park in the North Sea. "With that, the boat is truly emission free and designed completely around renewable energy," says Alwewijnse Marine Technology CEO Moritz Krijgsman.

Fuel Cell Boat



Vessel length	21.95 m
Vessel width	4.25 m
Draft	1.12 m
Rudder	1 electric steel rudder on the stern and on the bow
Capacity	approx. 100 people (86 seats)
Propulsion system	Hybrid thruster with 2 hydrogen cells (total power: 60 kW)
Speed	max. 8.6 Knots
Energy storage	55 Batteries (total power: 70 kW)
Hydrogen storage	24 kg
Operating time	9 h at 7 Knots

▼ High-capacity controller system: Redundant main stations are placed in the bow and astern of the boat.



High demands on the control technology

As the system integrator, Alewijnse Marine Systems carries the complete responsibility for the generation, distribution, and storage of electrical energy. The electric propulsion system, the electric thruster, and the electric system integration of the hydrogen fuel cells also come under Alewijnse's list of expertise. On top of all that the company has also taken care of the automation, safety, alarm, and monitoring systems including the navigation, communication and entertainment systems.

The boat will be certified by Germanischer Lloyd which dictates that the boat must still remain operational even after a partial flooding.
"That's why there are extraordinary demands on both hardware and software with regards to the control system," says Moritz Krijgsman. Talking about the selection of components for the controller and monitoring system he adds, "The robustness of the hardware as well as the redundancy possibilities with regards to networks, controllers and software modules impressed us and were the decisive factors for choosing Bachmann's M1 System."

Based on a redundant system

The boat is completely controlled and monitored by two M1 Systems. One controller system is located in the front (bow) of the boat and the second in the back (stern). Each system consists of a central station and a remote station which operate in redundancy mode. Therefore, should a failure in a central station occur, all of the boats control functions will be sustained. Using a second independent Ethernet connection, the redundancy comparison of both systems is provided.
Even in the case of a total network failure between the main and remote station, the emergency program can independently keep the boat in operation. Because the propulsion systems are completely independent of each other, the ship can be fully operated even with a flood or a total failure of a relevant boat section.

◄ High-capacity controller system: Redundant main stations are placed in the bow and astern of the boat.

System with remote intelligence

A system is composed of a central station and a remote station. Each station has the required input and output modules and an associated alarm and monitoring system. The main station takes over the steering, open/closed loop control and monitoring of the boat as well as the communication with the external systems like the fuel cell, propulsion, navigation (GPS), power converter, battery system, and HVAC system. The interface to the individual external systems is implemented with Modbus over TCP/IP. The remote, operation and monitoring stations are also connected to the main station with Modbus over TCP/IP. For safety reasons, they also have a comprehensive local intelligence.

Power management can be modeled and ported directly onto the controller

The automation solution includes all forms of control from the complex and comprehensive power management (energy generation and distribution), the propulsion system, load compensation, monitoring and alarming, as well as the HVAC control and the other onboard systems. Working in collaboration with the University of Dortmund the power management was simulated on a real model already during the planning phase. "Thanks to Bachmann's M-Target for Simulink®, we were able to port the models and projections created in MATLAB®/Simulink® directly onto the M1 Automation System. This saved us a lot of money and time," reports project leader Nico van der Hoeven.

Optimal engineering

In order to meet the required engineering requirements, the Bachmann SolutionCenter was identified as the ideal tool. The complete solution offered Alewijnse the best possible performance, maximum user-friendliness and highest efficiency.

"The powerful process visualization and the highly efficient engineering greatly lightened our development workload," confirms project leader John Klerkx as a further important argument for choosing Bachmann electronic's system. CEO Moritz Krijgsman adds: "With this we were able to make an important contribution within the consortium to the successful realization of the entire project."