



1: The experts at Bowman helped the TU Delft team develop an efficient heat exchanger  
 2: A CAD render of the Hydro Motion vessel  
 3: The boat's fuel cell must be kept within its optimum operating temperature window

# Cooling fuel cells

Pioneering hydrogen fuel cell vessels rely on sophisticated cooling technology

WORDS: JAMIE PRATT | IMAGES: TU DELFT SOLAR BOAT TEAM

There's an old saying that 'competition improves the breed', and over the years this has often proved to be true. Although competition may not be the main driver for renewable energy, the technology behind the Formula E racing championship will inevitably improve future roadgoing electric vehicles.

But competition isn't just reserved for the road - there are exciting developments happening on water too. Delft University of Technology in the Netherlands has multiple teams of talented student engineers and designers. Around 15 years ago, the university established a team to develop a solar-powered racing boat. The initiative gave the students real-world experience in the design and development of cutting-edge technology, as well as the process of bringing a battery-powered electric boat from concept to race-winning reality.

The team was successful from the start and has gone on to develop a series of boats that have not only won races, but also pushed the technological boundaries for electric propulsion, achieving speeds in excess of 55km/h, as well as introducing design features such as hydrofoils and multi-hulls.

For the TU Delft Solar Boat Team, 2019 was a landmark year that saw it crowned world champion in the Offshore Class at the Monaco Solar and Energy Boat Challenge.

For 2021, it hopes to repeat that success, despite facing perhaps its greatest challenge yet as it aims to develop a hydrogen-powered boat for the Monaco competition.

Known as Hydro Motion, the project is the next big step toward a sustainable, zero-emission future for the maritime industry, because although battery power continues to play a major role in marine propulsion, there are numerous applications where it isn't suitable, either due to distances



traveled or vessel weight. In such situations, hydrogen fuel cells could be the key to a more sustainable future.

One of the many challenges facing the team is cooling: the fuel cell (which transforms the chemical energy into electricity) generates much more heat than the total heat output of previous boats. However, keeping weight to an absolute minimum is vital to achieve the performance and efficiency required to win the competition.

Working in conjunction with its Dutch distributor KVT, Bowman and its technical experts were able to support the TU Delft Solar Boat Team, proposing an efficient heat exchanger to cool the fuel cell to its optimum temperature, while keeping weight to a minimum. Bowman also supplied a second heat exchanger that will be used to cool the motor, motor controller and DC-DC converter.

This summer, the TU Delft Solar Boat Team will again be competing at the Monaco Solar and Energy Boat Challenge in the Open Sea class - an international event open to students and professionals. To win, the team needs the highest score over three race sections: maneuverability, sprint and endurance (the longest distance that can be covered in six hours of sailing).

The team's progress will once again push technological boundaries to demonstrate the possibilities for hydrogen fuel cells and the opportunities for sustainable shipping. +