

When world water speed record team Longbow wanted to develop a new craft that could achieve speeds of more than 300mph it turned to Manchester Metrology and its Faro Edge ScanArm HD to help design the cockpit. PES Reports.



In the wake of British hero Donald Campbell establishing the Outright World Water Speed Record in his jet hydroplane Bluebird K7 of 202.32mph back in 1955, the decades that followed witnessed a succession of international teams achieving ever quicker times.

The current record of 317.18mph was set by Australian Ken Warby in Spirit of Australia in 1978. The four decades since then represent the longest period that the record has remained unsurpassed.

With the ultimate intention of bettering this impressive speed, the Longbow hydroplane is being developed by a team of British experts brought together by project leader, David Aldred. Also on board is serving British military pilot, Lt. David-John Gibbs RN, who will be the driver of the craft.

It has been 50 years since a jet hydroplane has run at speed within the UK. Once constructed the craft will be a learning platform and basis for a credible attempt to challenge the Outright World Water Speed Record.

Mr Aldred explains: “A jet hydroplane can be described as a pure thrust gas turbine or rocket powered boat, with a hull designed in such a way that when high speeds are achieved, the craft only has a few square inches of its surface in contact with the water surface, which in turn reduces hydrodynamic drag to a minimum.”

Historically the governing body for such Outright World Water Speed Record attempts has been the Union Internationale Motonautique (UIM), similar to the FIA for certain Land Speed Record attempts. As part of the UIM rules there are guidelines for driver cockpits to comply with. The designers of the Longbow craft, with assistance from Swansea University, therefore require a non-uniform rational basis spline (NURBS) mathematical model of the driver cockpit to enable

investigations for structural integrity to be undertaken. NURBS provides high levels of precision and excellent flexibility for handling both analytic and modelled forms.

A major contributor to the Longbow project is Kevin Hardcastle, design engineer and founder of Aximo, a product and mechanical design consultancy. Mr Hardcastle's acknowledged expertise and considerable experience in a range of relevant 3D CAD and CAE tools, has been invaluable in assisting with the design of the craft.

Selecting a scanner

To enable Mr Hardcastle to produce the required drawings for analysis of the driver cockpit from the buck already fabricated, the assistance of Manchester Metrology's laser scanning services was enlisted.

Given the project's demanding accuracy requirements, Neil Blakeman of Manchester Metrology used a Faro Edge ScanArm HD to scan the drivers tub and to capture the required data for conversion into a NURBS format.

Mr Blakeman says: "Manchester Metrology offer specialist contract measurement services using the latest metrology technology and provide support both in the UK and worldwide. Given Longbow's challenging accuracy requirements we decided to use the Faro Edge ScanArm HD to scan the driver's cockpit, as it has an accuracy specification of $\pm 25\mu\text{m}$. The Edge combines the flexibility and functionalities of a Faro Edge measuring arm with the high-definition Laser Line Probe HD, the kind of powerful contact/non-contact portable measurement system that is ideal for challenging applications such as Longbow.



He adds: "Also, as each of Longbow's team of experts and technical contributors have day jobs and give their time voluntarily, it was important to use a technology that could capture and process the required precise data in a timely fashion. The Edge ScanArm HD proved perfect for the task of scanning Longbow's driver's tub. All of the essential data was collected precisely and quickly."

The Faro Edge ScanArm HD can be described as a complete measurement solution – it uses laser and hard probes to inspect freeform surfaces, significantly increasing the efficiency of inspection processes.

The Faro system delivers rapid point cloud collection with extreme resolution and high accuracy without the need for special coatings or target placement – all in a compact and easy-to-use system. The creation of an extra wide scan stripe and the benefit of a fast frame rate boost productivity by increasing coverage and reducing scanning time. Intricate components can be captured in fine detail as a result of the 2,000 actual points per scanline and the new blue laser featuring noise reduction technology. Users can dramatically reduce training time with the new crosshair feature and the existing LED Rangefinder functionality, which provides real-time scanning feedback.

3D surface inspection

The Edge ScanArm HD is an affordable, high performance contact/non-contact measurement system and is ideal for product development, inspection, and quality control and offers capabilities such as point cloud comparison with CAD, rapid prototyping, reverse engineering, and 3D modelling of free-from surfaces.

In addition to the arm's impressive accuracy specification, it has a rapid scanning speed of 280 frames/second, 280fps x 2,000 points/line = 560,000 points/second. The unit's extra wide scan stripe and fast frame rate boosts productivity by increasing coverage and substantially reducing scanning time. Now, intricate components can be captured in fine detail as a result of the 2,000 actual points per scanline.

The scanning arm is also able to seamlessly scan across diverse surface materials regardless of contrast, reflectivity or part complexity without the use of special coatings. This is due to of the improved its HDR (High Dynamic Range) Mode and the use of advanced software algorithms.

A new crosshair feature and existing LED rangefinder functionality dramatically reduce required training time and provide real-time scanning feedback, whilst the small size and friendly user-interface result in a versatile and intuitive tool.

Mr Aldred concludes: "Although we have already made significant progress, the Longbow project is still in its design and prototype phase. As this foundation period is fundamental to the ultimate success of the project, the considerable expertise and hard work of Kevin Hardcastle of Aximo Product Design Consultancy has been invaluable.

"In addition, the much appreciated assistance of Manchester Metrology and the company's use of Faro's Edge ScanArm HD has enabled the project to make another major leap forward."