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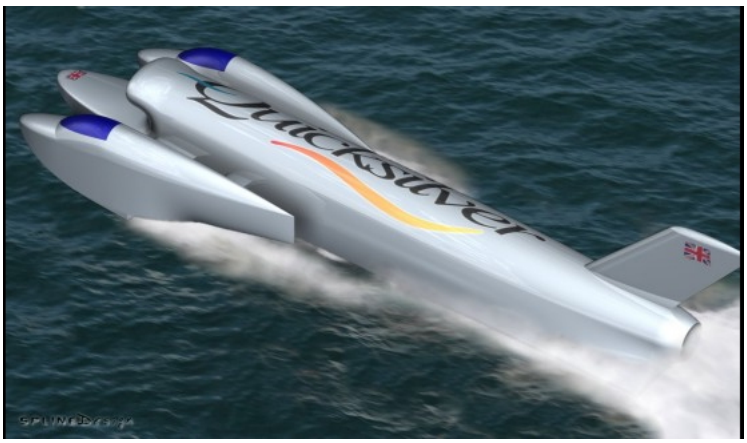
Quicksilver – Regaining the World Water Speed Record for Britain

Nigel MacKnight - Quicksilver Project Leader

Listening to this speaker was a personal déjà vu moment; a childhood that feasted on the joys of modern aircraft, strong memories of headlines and tragedies, an unsteady transition from education to business, and eventually a joy from discovering and conveying news of aircraft through writing. He wove the threads in a presentation that strode through time, and therefore be aware that this is also a chronology. It reaches 'Quicksilver' at its climax.



Artist's impression of Quicksilver travelling at speed

Our speaker has been the project's instigator and leader, fund-gatherer and manager, and aims also to be in the driving seat when 'Quicksilver' is prepared and eventually guided along Coniston Water at 380mph. He reviewed the lifetime of Sir Malcolm Campbell and his son, Sir Donald Campbell. Both father and son attained numerous World Speed Records, on land and water, A brief film, with the speaker's narration, encapsulated a wealth of information. Inevitably, and saddening, it reached the fateful day, 4 January 1967, when on Coniston Water in the Lake District, Sir Donald Campbell's Bluebird K7 was to became unstable at high speed and as it reared up and crashed into the lake he was killed instantly. It was an indelible memory for many in Britain.

Nigel MacKnight was a boy at the time, and described boyhood impressions, not just sad, but also invigorating. Seeing English Electric Lightnings as they overflew where he lived near Preston led to him joining the Air Training Corps and when 13 years old flew for the first time in Chipmunks at RAF Cosford. Also around this time Apollo missions were catching headlines and, by then, engineering fascinated him so much that he got closer to aircraft at air shows by posing as someone older and joined press teams. He submitted short stories to magazines, and those accepted provided attributions that allowed honest entry to Press facilities in later days.

His family moved often and when they settled at Bingham, Notts, he met Leo Villa. This renowned engineer was the technical confidant and Chief Mechanic who served Malcolm and Donald Campbell between 1922 and 1967. He was to be an inspiration to this young man, who in his words "was no good at anything really, but enthusiastic". At 21 years of age he took to being a full-time freelance author and wrote for a weekly magazine 'Look and Learn.' He produced articles and books – "on anything with engines, wings or wheels" – and broadened from there. With press accreditation he was able to attend the first Space Shuttle launch from Cape Canaveral on April 12, 1981.

His eclectic manner and enthusiasm for technical landmarks led to him writing a book about the Space Shuttle that, after it had been submitted, seemed set to be a major step forward, but the script was rejected. His tenacious manner saw no barriers and he published the book without sponsorship. This was a gamble, but it drew him towards publishing, and led to further books that included an early title on the Red Arrows. He cited this as "a career out of nothing …. based on a

love of words." He provided proof that an easy-to-read book will reach a far wider readership than a monotonous recitation of facts. A personal driver was that he had faced bankruptcy, but by self-publishing he succeeded in navigating that obstacle. He had realigned his career, and bolstered his confidence.

He wrote about 'world speed records,' and made contact with Ken and Lew Norris, the brothers who had designed and built cars and boats used by Donald Campbell up to the time when he attained the world land speed record in 1964. Their last water speed record boat was the Bluebird K7, used by Donald Campbell between 1955 and 1967. The K7 had been the first water speed record design based on hydroplane principles, and the first to use a jet engine (Metropolitan-Vickers F.2) for propulsion. That combination was used by others, but attainable speeds reached a plateau. The current, and very long-standing, record of 317.6 mph, was set in October 1978 by an Australian, Ken Warby. Two fatal attempts by American drivers took place in 1981 and 1989, and a drought of interest set-in. Nigel believed it was time to consider new levels of engineering. He encouraged his way of thinking, citing "new materials and new understanding."

Such enthusiasm, and a zest to consider seeing the world water speed record return to Britain, led to Ken Norris and Nigel MacKnight setting up a 50:50 joint ownership company. Ken took responsibility for designing a new craft and Nigel set about gathering funding. Alongside finding funds for development, build work and operations phases, he was also designated to be the 'driver.' In effect, this was the launch of the Quicksilver project.

The initial technical design was created by Ken Norris. Meanwhile Nigel, applying the philosophy that "do something for someone for free, and they will offer something in return" the project got underway. He quoted a relationship with Southampton University, where they were willing to examine concepts in their wind tunnels, the work being conducted by students as a part of practical projects for their final year MEng course. This came with little cost to him; craftily though, there was a hint that occasional pub lunches were on accounts.

Research results confirmed that progress depended on using new concepts. Although the long-standing configuration preferred by Ken Norris was not abandoned, changes seemed unavoidable. It was the speaker's great regret that Ken was not enamoured by the way that developments were progressing. Although they parted company on convivial terms, it was felt that Ken was particularly influenced by his memories of Donald Campbell's crash, and the fact that there had been two more drivers also lost in more recent attempts.

He spoke of the project in a manner that was honest and easy to digest. It started with description of a stationary boat. In order to float, all water-borne vessels are buoyant; meaning that they displace a mass of water equivalent to their own mass. A high-speed boat (hydroplane) has a lower surface designed to cause the vessel to rise as it gains speed. In the case of a water speed record boat it should only skim the surface, although it may seem to be above the water. The Norris brothers used two sponsons ('outriggers' on a trimaran) attached to a centre fuselage that stayed above the water. This housed the driver and propulsion system (engine and fuel).

Research has been conducted with the assistance of aerodynamicists, structural engineers, materials specialists, and many more. Some of these have been volunteers bringing essential expertise. Several radio-controlled 1/10 scale test models were built by team members. These incorporated small jet engines and throughout development they have provided invaluable performance and control information. The MoD allowed the team to take a step further, and supported examination of models towed on a gantry in a ¼mile long indoor tank at Haslar, near Portsmouth. Film of models as they were monitored from cameras mounted above and underwater provided film and path data derived on a 6 degree-of-freedom platform. Computational fluid

dynamics (CFD) programs have also provided 3D visualisation of flow properties, and added confidence to the configuration.

The definitive design is based on two crew members, a driver and an engineer/observer. Each is carried in one of the two sponsons, driver to the left and engineer/ observer to the right. They have identically profiled cockpits but with displays and controls specific to their roles. The centre fuselage accommodates the engine. Instead of being in the rear (as it was in the Bluebird K7) it is much further forward. The speaker spoke of 'fly-by-wire' linking crew inputs to the rudders, but there was no mention of this technology being used, as in aircraft, in an artificial stability role. A significant development from trials has been the adoption of a four-point contact configuration, whereas all previous boats have used a three-point layout. These design changes, retaining the original 'trimaran' layout of the Bluebird K7, have justified in trials the ability to deliver considerable safety and capability improvements.

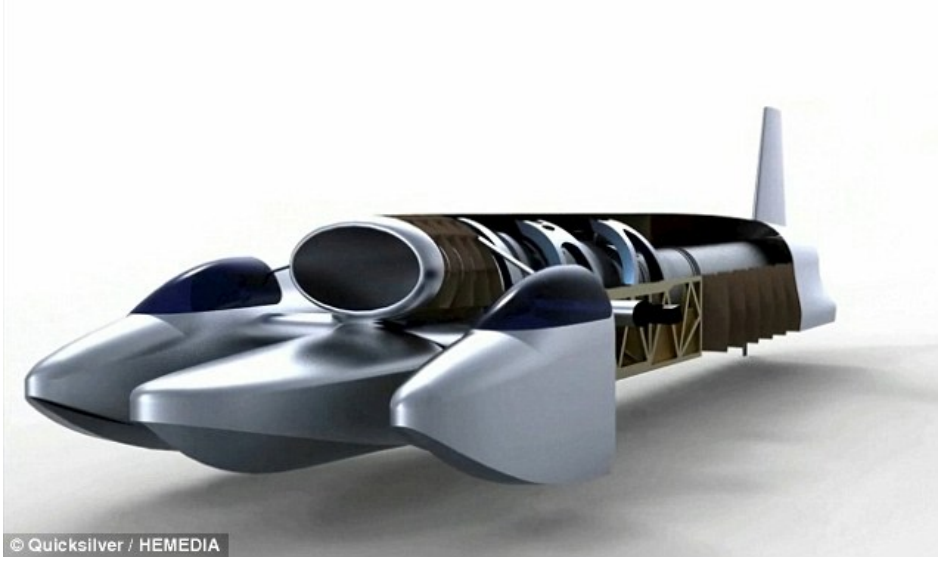


Diagram showing the major structural features of the centre fuselage, the engine and intake and exhaust layout, and the nose sections only of the two sponsons. Each sponson has a cockpit for pilot (nearest) and engineer (furthest).

Rolls Royce Spey Mk.101 turbofan engine (11,000lb thrust)

With data from model tests it was evident that the drag force would be much greater than on any predecessor boats, in part because of the fact that drag increase proportionally to the square of speed. This meant that a powerful engine, with a suitable capacity fuel system was necessary. The team purchased an ex-RAF Buccaneer for £20,000. They removed one of the two Rolls-Royce Spey Mk.101 turbofan engines, and keep the other as a spare. The engine will provide 11,000 lb thrust, will be controlled from the cockpit, and at full power will consume 1 litre fuel per second from a 417 litre (91 Imp Gall) capacity fuel tank.

The Blackburn Buccaneer Mk.2 now owned by the project. It was purchased complete. One engine is to be used in Quicksilver, the other will be a reserve.

Modern materials are being used, most of the external structure being carbon fibre or Kevlar (with some areas in the bow section incorporating balsa wood laminates). The centre fuselage incorporates a high-tensile steel spaceframe that runs along most of the length aft of the bow section, and in the lower half of the cross section. The engine installation is above the spaceframe. Air is admitted through a short straight intake and the exhaust is a conventional straight jet-pipe. There is a sizeable instrumentation system that will gather information invaluable to the land and boat crews to study events from the moment the boat docks. This will be data related to both on-board functions and trajectory parameters attained during a mission. Mention of debating this component with a supplier only a few hours before the presentation highlighted that the capability of this system is still under consideration, and this is a team that will take advantage of useful developments.

Salient data revealed the size of Quicksilver. It is 40ft (12.2m) long, 11ft (3.3m) wide across the sponsons, and the top of the fin stands almost 10ft (3m) above the waterline. It weighs 3.5 tons (3,556kg) of which about 1 ton is the engine. It is designed to attain up to 380mph (612km/hr), or 20 per cent above the current world water speed record.

An admission was that the project timescale is always under review, but he was able to say that construction is 85 per cent complete. Some aspects are still in development, and while it is detail that remains outstanding there was a reluctance to say that the boat will be on water in about two years, as that had been a statement that had been rolling forward year after year. However, he was confident by now that the best they could achieve had been done, there was confidence that the design was fit for the job, and he was ready to go. When the time does come, it will be on Coniston Water, the only inland stretch of water in Britain on which permission is granted for motor-powered boats to exceed 10 mph.

This was a session with a convivial and informative approach to a grand and technically innovative project. It was packed with data and associated comments and remembrance of events that came to us with a personal slant, sheer enthusiasm and a determination worthy of admiration. It seems inevitable that those present will be watching for news of the project in the future, and wishing to see success. The session was attended by around 150 people. It was clear from comments, the number of attendees who dashed to speak to him, and the atmosphere generated overall, that this was a very welcome presentation.

Lecture notes by Mike Hirst