Going electric

Emrhys Barrell describes the conversion of a 1930s gaffer from its original Stuart Turner auxiliary petrol engine to modern electric power

The project started inauspiciously, as is often the case. It was the last hour of the Beale Park Boat Show, and we were thinking about starting to pack up. Two people hurried past our Thames Electric Launch Company stand on their way to the exit, but stopped when they saw the sign for our Stuart Turner Replacement Package.

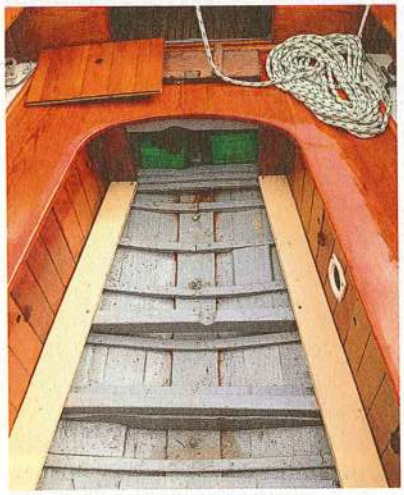
They had a friend with a boat which had once had a Stuart Turner petrol inboard, and as they knew he was having problems finding a suitable replacement, they thought our electric option might be an idea. They took one of our leaflets and we made a note of their friend's name, but we get many such enquiries at the show, and often they do not become real projects.

Two weeks later we received an email from the boat's owner, Richard Meynell. His 23ft boat *Withy* was built in the 1930s by Elkins Boatyard of Christchurch. It had apparently once had an inboard Stuart Turner engine, but since he had owned it the boat had used an outboard motor, hung on a transom bracket, for auxiliary power. Not only was this ugly, spoiling the delightful lines of the craft, but it was unreliable; and ever since Richard had had two hip replacements, it was proving impossible for him to lift on and off the bracket and start.

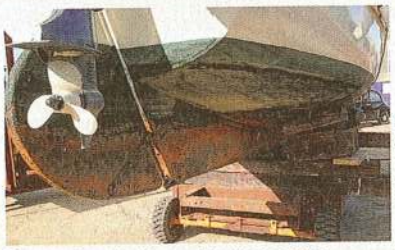
As usual in these cases, we asked if the shaft and stern tube were still in place, as if they are in good condition we can often reuse them, but Richard said he could not see any stern gear, and puzzlingly could not see where it might have been. So, the next step was to request some pictures of the boat. When these arrived, the mystery deepened. The shot of the cockpit with the sole boards removed confirmed there was no shaft remaining; but not only that, the depth available did not seem sufficient. The boat was just about to come

Richard and Clare in their 23ft *Withy*

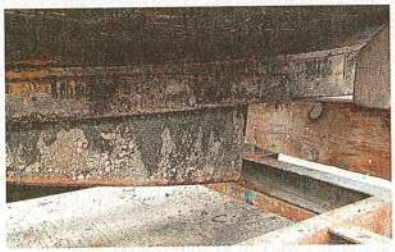
The saildrive bolts through the planking, with the cables being led up into the boat



***Withy*'s cockpit with the sole boards removed revealed no previous shaft**



No aperture in the rudder for a prop



Long, straight keel with centreboard

All pictures by Emrhys Barrell, Richard Meynell, Ian Rutter

out of the water to have its bottom scrubbed, so he then sent us an external picture. The boat had a long straight keel and a centreboard, giving it a shoal draught, but good windward performance. Most oddly, however, there appeared to be no aperture in the rudder for a prop.

At this point we had to admit that the inboard electric motor option was looking less feasible, as it would have required a new shaft and tube and would have intruded into the cockpit. Our next option would be a saildrive or pod motor, which bolts to the bottom of the boat and offers minimal intrusion into the boat: but this usually sits on the centreline, between the keel and the rudder, and again there was simply no space for this. Alternatively, it could be mounted as an outboard, but then we would be back to the visual impact. We have even bolted them to the rudder, but somehow we were not keen on this.

Mulling over the problem, we thought that it might be possible to mount the saildrive off-centre. While this might look odd, it would be no different from the wing engines that were popular between the wars. The question was whether the venerable hull planking would take the weight and, more importantly, the torque of the saildrive, as they are usually fastened through a solid keel or skeg, not shell planking.

Speed and range

The next question was how much speed and range Richard wanted. The more speed you need, the bigger the motor has to be; while the more range you require, the greater the number of batteries, with consequent space, cost and weight implications. Some people just want enough power to get themselves on and off the mooring, but Richard wanted to be able to get back from the mouth of Chichester harbour if the wind should fail, or even from the Solent on their occasional cruises to the Isle of Wight.

This then required a trade-off between speed and range. The power curve of a displacement hull rises rapidly once you approach hull speed. Hull speed in knots is related to the length of the boat, being the square root of the waterline length in feet. In the case of *Withy* this meant a theoretical maximum of 4.7 knots, unless you piled in masses of power. However, as we have said, as you approach this speed, the power needed rises steeply.

To put this in perspective, for a given power to achieve 4.7 knots, if you double this power you only get a 0.6 knot increase: but if you drop back to 3.7 knots the power required halves, and hence your range doubles. At 2.7 knots, meanwhile, you use a quarter the power and get four times the range. The actual range you get is then dependent on the battery capacity installed. More range requires more batteries, which need more space to stow them and add more weight to the boat, as well as incurring extra cost to the project. The final figure is always a compromise, but we aim to give a useful range without overloading the boat.

In the case of *Withy* we chose enough batteries to give an estimated 25-mile range at 3.7 knots and a 50-mile range at 2.7 knots, enough to bring them back from the farthest destination. These added 240kg to the boat, which has barely affected the waterline. Incidentally, these were gel lead acid batteries, our preferred choice today. We will discuss the other options later.

Once the installation is complete we then carry out trials over the full range of speeds, and provide the owner with a chart of range against speed and motor current.

Power required

The next question is what power motor to use. Obviously a more powerful motor is larger and more expensive, and it is tempting to opt for the smallest you can get away with. However, we always give our owners enough power in reserve for manoeuvring and stopping; and, in the case of a sailing boat, punching into a head wind. There are also a finite number of power options available from the manufacturers, and in this case the nearest was a 5kW unit, which equates to approximately 6.5hp. Bearing in mind that the original Stuart would have either been a 1½hp or 4½hp, and this only at their teeth-rattling maximum rpm, you can see we would have plenty of power to spare.

Batteries

As we have said, these days we nearly always specify gel lead acid batteries. These are well-proven units, giving up to 12 years' life in private use if they are looked after, which means always keeping them charged up. They require no maintenance or topping up, which means they can be installed hidden away in any available space in the boat, tucked under lockers or floorboards. Under normal conditions they do not give off gas when charging, so can be located in the accommodation, provided it has

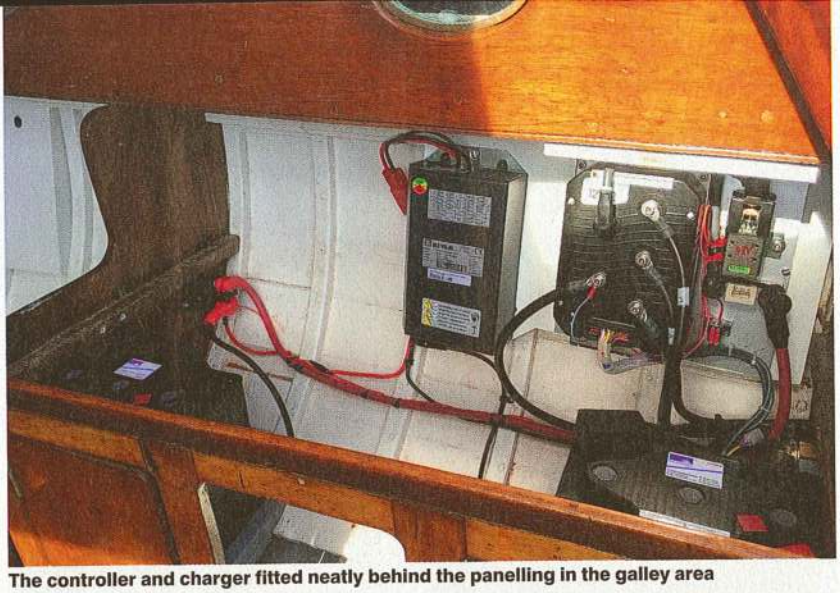
high-level ventilation to take any small amounts of gas which may escape if a battery should fail in exceptional circumstances.

They are robust, and can be regularly taken down to 20% capacity or beyond in emergencies. If needed to get you home, you can go right down to their theoretical zero capacity. In fact, if you then let them recover for 10 minutes and back the throttle right off you can get another 5-10% range. Provided you hook them up to their charger as soon as you get back to base, they will respond and recharge. They also have very low self-discharge, if you should forget to keep them charged up over winter. For most boats their weight is not an issue, and in fact many river launches already have additional ballast to keep them trimmed.

Lithium batteries are the alternative, and we regularly have people coming up to us at shows asking about these, but we do not think they are appropriate for most of our boat applications. Firstly, they are expensive – around four times the price of lead acid – which on an average installation means £8,000 compared to £2,000.

Secondly, they cannot be taken down to zero capacity. If this happens, the cells go out of synchronisation and they have to be sent back to the manufacturer to be reset. To prevent this occurring, they have a very sophisticated battery management system – but this shuts them down completely when they reach 10% capacity, whether you are just about to reach your berth or enter a lock, and this is a permanent cut-off. No amount of waiting brings them back to life, as I can confirm with my electric car.

Finally, under certain conditions they can catch fire or explode – ask Boeing, Tesla or Samsung if you need confirmation. And if they catch fire, they can be difficult to extinguish. Yes, they are fine for the smallest outboards, provided you remember that a spare battery will set you back £450; but for all the above reasons we do not think they are appropriate for most of our larger installations.



The controller and charger fitted neatly behind the panelling in the galley area

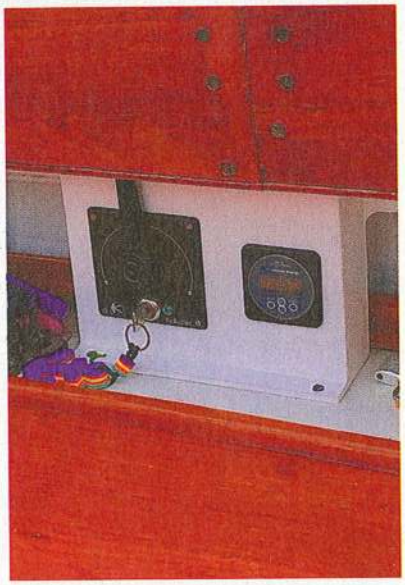
Charging

As we have said, the batteries must be regularly charged, and for practical purposes you need mains power alongside on anything bigger than a tiny installation. People toy with the idea of solar panels or wind generators, or even a portable generator, but realistically these do not deliver enough power for anything more than an electric outboard. We had assumed that *Withy* was in a marina so this would not be a problem, but we were concerned to find out that she was on a mud berth alongside a pontoon next to Birdham Pool Marina. This seemed to be an insurmountable problem, until Richard said that the pontoon had electricity on it.

We then worried that our saildrive would be sitting in the mud for 50% of its life. While these are robust, heavy-duty units, we did not think the manufacturer's warranty would stretch to being encased in Chichester mud. No problem, said Richard. 'I will get in with my waders on and dig out a nice pocket for it, as the boat always settles in the same place every tide.' Now that's the sort of practical customer you like to be dealing with!

The installation

To confirm that all our ideas were going to work we always like to see the boat in the flesh, so we made our way down to Birdham with a full-size hardboard cut-out of the motor we were planning to use. Richard suggested we came on the day that the marina held its annual classic boat and car show, as *Withy* would be out of the water then.

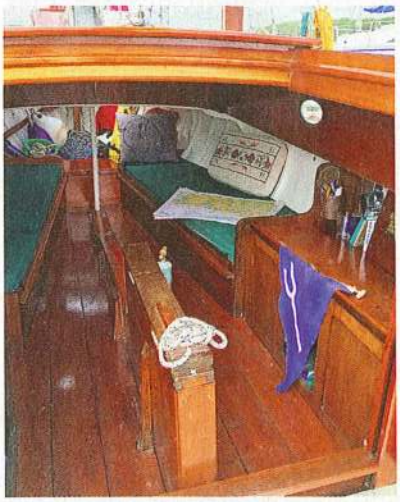


The throttle and multi-function meter tucked neatly and safely under the coaming

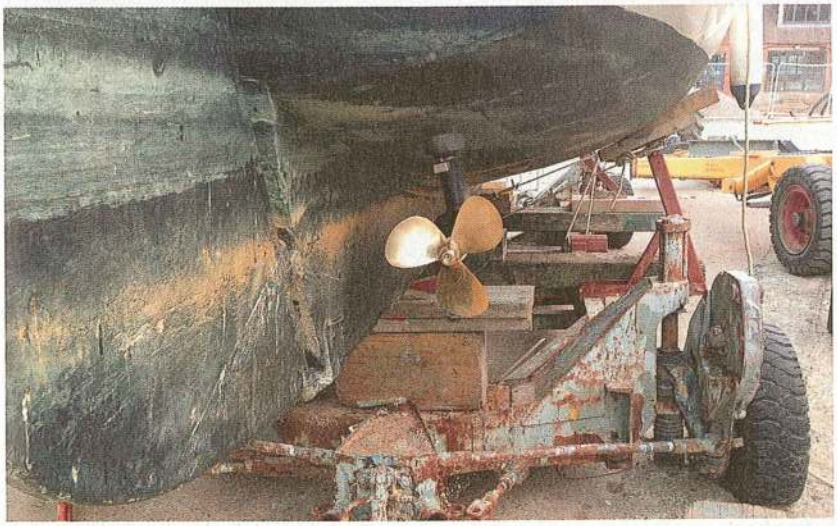
We fuelled up our Triumph Stag and made our way down through the Sussex countryside. On arrival we parked next to a very nice Morris Minor, which turned out to be Richard's daily-drive car for his

A tapered pad was bolted through the hull to level the motor fore-and-aft

A laminated oak backbone spread the weight and torque of the motor



The eight batteries stowed away neatly in various lockers around the boat



It turned out that the prop was in almost exactly the same position as that of the original wing engine, and because it spins under sail, has little perceptible effect on performance

architectural practice. Alongside this was an equally nice MGA, which he and his wife Clare use for European touring. At this point we heard the chuffing burble of an Ariel Square Four – unmistakable to any PBO readers over 65 – and the man himself had arrived.

Richard's Ariel Square Four motorbike

While we were there, Richard showed us the delightful Christchurch Scow, also built by Elkins, in which he learned to sail in Birdham Pool 55 years ago, plus a pretty Stuart Turner-powered clinker motor launch on a period trailer.

The next step was to meet the people who would be doing the woodwork required to fit the motor and batteries. Tim Gilmore has been restoring wooden boats for many years, and his company is based right alongside in the marina in the original Dolphin Quay boatyard. He had actually worked on *Withy* in the past, and he solved the mystery of the missing Stuart. It had been a wing engine all along, mounted to starboard in the cabin, and he even showed us the place in the hull where the shaft log would have been. So our saildrive was going to virtually replicate the location and power the boat had always had!

Looking at the size and weight of the saildrive, he recommended that his team made up a laminated oak backbone, clenched through the pine planking, that would spread the load between several frames and the keel.

He would also modify the lockers and furniture inside the cabin to take the eight batteries. As these are connected in series they can be sited all round the boat, being connected up daisy-chain fashion. The saildrive then required a shaped pad on the outside of the hull to level it up fore and aft.

The controller and battery charger fitted neatly behind the panelling in the galley area. These require good ventilation top and bottom as they generate some heat when operating. The throttle must be sited easily to hand but protected from direct rain and any stray ropes, so it was mounted neatly under the cockpit coaming to port, together with its multi-function ammeter, voltmeter and battery capacity meter.

Under way

The night before the first trials, I lay awake with the usual pre-trial panic. Would the motor be powerful enough? Would the boat be steerable? Would the offset prop drive it round to port all the time? Unfortunately, PBO's excellent article on wing engines had not been published then, which might have saved some of my anxiety. Before we even suggested this location I had worked out that if you were sailing downwind, with the boom right out, the centre of effort of the sail would be at least three or four feet to one side, and the rudder counteracts this; but I still agonised, and even considered whether we should have reversed the rotation of the motor to take a left-hand prop!

The next morning there was a distinct shortage of volunteers to take the boat for its first trials down the constricted fairway of Birdham Pool Marina, where we had carried out the installation, so it fell to me to take the helm. Fortunately I shouldn't have worried, as the boat handled excellently, turning easily either way, and even stopping reasonably straight. Manoeuvring into the marina lock was straightforward, with the lock-keeper suitably baffled as to how we were moving. Reversing any distance was not so clever, but it rarely is on any single-engined boat.

Out on the water, the motor proved to have more than enough power. We achieved a hull speed of 4.5 knots at roughly half power, giving plenty in reserve for punching into a head wind with the sails up, with just a slightly perceptible whir from the motor beneath us.

Subsequently, Richard has reported they have enjoyed a superb season, with the motor doing exactly what they wanted. It gives them immediate power for getting on and off their berth, or if they should need to manoeuvre up the narrow, winding channels of the harbour. If there is no wind they can still take the family out for the day and explore the creeks of this delightful cruising ground, while if they want to travel farther afield they have the confidence that they can get back.

So, all in all it seems to be a perfect match to take this classic boat towards its 80th birthday.

CONTACTS

- **Tim Gilmore: www.woodenboatsforever.co.uk**
- **The Thames Electric Launch Co: www.thameselectric.com**