Rosebank's Hybrid/Electric Drive

Expert Marine Engineer John Hendry talks us though his modificaton

Having read Andrew Hall's excellent article on electrifying his Stirling engined boat I thought I would write up my own experience in becoming involved in the electric boat scene

My venture into fitting an electric drive was prompted a couple of years ago when the bottom bolt of Rosebank's air pump worked loose and jammed the pump which in turn locked the engine.

In the calm waters of rivers, canals and lakes this ruins a day but out in larger reaches of water these incidents can be dangerous.

This incident concentrated the mind on finally sorting out a secondary propulsion system for Rosebank in case of breakdown.

The considerations were as follows;

1. Rosebank is quite heavy at around 2.5 tons .
2. She has a high freeboard making her very dry in bad weather but the weight and freeboard make her impossible to paddle.
3. The full headroom cabin makes her unsuitable for a sail
4. Petrol outboards are forbidden on Loch Katrine as are inboard i.c. engines.
5. The secondary system had to be totally independent of the main shaft in case of the shaft seizing up or main propeller damage due to taking an "overland route".

The only system fitting the criteria was an outboard as its prop could be lifted when not in use to stop the considerable drag of a trailing propeller

The choice was then gas or electric power.

I don't like gas cylinders in boats.

Therefore the ultimate choice came down to an electric outboard.

After some research there were basically two reliable makes one German and one (inevitably) Chinese.

Due to size considerations I eventually settled for the Chinese ePropulsion machine.

A period of research ensued and here I should mention Dave Ashton of Ashton Marine Services as he was unfailingly helpful taking me through his range of outboards and even letting us borrow a couple of his demonstration models for trials on Loch Katrine. I am deeply suspicious of manufacturers advertisements and really wanted to see if they actually did reflect the makers' claims. Dave, I have to say, was the only agent who carried a large stock and loaned us various models to try. Other agents were very vague about the one outboard they stocked and whether it could push Rosebank easily.

Armed with the smallest model (the 'Spirit') advertised at 1kW we made up a side bracket out of 4"x6" battens, clamped it and the outboard to the side of Rosebank and backed out of the boathouse. The outboard pulled us astern smoothly and we motored out into the loch at around 3 to 4 miles an hour. The motor performed above my expectations but its power was such that it was rapidly tearing the bracket apart, so after half an hour or so and with visions of the outboard and bracket falling off we switched over to steam power, "had a bit of a sail" followed up with the obligatory bacon roll in the firebox and suitably fortified returned to the boathouse to remove the remains of the bracket and take the outboard back home. We noted that 85% of the battery charge was left. The makers claims seemed to be accurate - it was powerful and had a very good battery reserve.

Stage two took place but this time with a "proper" outboard bracket on the stern. Performance again was well up to expectations; she handled well and with a stiff breeze on our bow we still managed 3 miles an hour which was good considering the windage of the cabin.

But:

Although I have no doubt the battery could have taken us the length of the loch (8miles) another battery would be needed for the round trip.

And:

An outboard clipped on the stern of a steam cabin launch looked ridiculous.

And:

due to the flush stern deck of Rosebank a precarious lean over the stern was needed to affix and detach the outboard.

So back to the drawing board:

1. I was now looking for a more powerful outboard
2. One hidden inside the boat
3. With longer range

The next outboard in the epropulsion range was 3 kw (about 6hp) (the 'Navy 3') shown right. The battery on this model was not integral and is a fair size with a weight of 30kgs. Considerable time was spent trying to figure out where/how to fit it.

Rosebank is based on a Selway Fisher Snow Bunting design with LOA of 25ft 6inches and a beam of 6ft 10inches.

- I wanted sleeping space for two and day sailer space of 6 person
- Room for a small galley/cooking area with cutlery & crockery drawers

- a cupboard for cleaning materials and a small fridge
- a small private toilet space for the fair sex

Plus technical necessities:

- a very large loco boiler and equally over sized engine
- Lockers for tools / fenders/ ropes and don't forget the coal bunker
- Space was already very tight
- So much head scratching took place.

The space was so limited that a wooden skeleton corresponding to the outboard overall dimensions was made up and tried in situ to ensure we had just enough clearances to meet the spec.

Finally space was made just behind the toilet on the Stbd side aft for the outboard. The stern locker was emptied of ballast and this conveniently housed the battery.

The idea was to make a hole for the outboard leg and a professional boatbuilder would form an upstand to make a "moon pool" just big enough for the outboard leg so it could be lowered into the water when propulsion was required or withdrawn into the boat and the hole closed off with a plate when I wanted a smooth hull and speed.

Despite double and treble checking the sizes, fitting and refitting our template it was with considerable trepidation that we started cutting a hole through the hull. At that point I brought in a local boatbuilder to raise the upstand. His skill with fibreglass far exceeds mine and structural epoxy work is very tricky. (I did do a week's commercial course many years ago covering repair procedures for solid wall hovercraft which only made me realise how much knowledge is required for this work and how little I actually know).

Anyway, the hole was cut and we had to address the next problem which was the lifting mechanism. The normal lifting bracket for stern mounted outboards is a spring loaded trapezoidal affair which not only swings up and down it also moves horizontally and we did not have the space to accommodate the horizontal movement.

Further digging uncovered an Italian company. which made vertical rails on which a the outboard mounting plate could slide. Unfortunately the rails were too short for the range we needed. The solution was to buy two sets of rails cut them to the required length and then mount the rails very exactly on a heavy piece of marine ply. This piece of ply was also made to the exact dimensions of the aft cabin bulkhead to which it was epoxied and screwed. The extra strength obtained also stiffened the cabin bulkhead forming a solid assembly to avoid any misalignment when the outboard was passing over the joint between the top and bottom sections of the bracketing

Eventually the whole lot was brought together, the outboard placed on its bracket and it slid up and down smoothly. The lengths were correct inasmuch that it retracted completely into the hull but extended downwards sufficiently to let the prop spin in clear water. The wires were connected up and the Bluetooth controller 'paired' to the system and with the prop down everything tested correctly.

With some nervousness Rosebank was craned in and the system trialled within Rhu marina. More than a little surprisingly it all worked faultlessly first time. The outboard has enough power to push the hull easily. And with the outboard relatively close to the centreline Rosebank answers the main helm quite well. There was another handy feature that having the motor controlled by a Bluetooth controller I could sit at the front of the boat beside the steam engine controls and run the outboard from there, or indeed from any part of the boat without having wires trailing everywhere.

With initial trials over, next stop was loch Katrine and some serious runs in the area where she would normally be based.

Again all went astonishingly smoothly; we pushed the outboard to full power and achieved a steady 5 miles per hour against a stiff breeze; manoeuvring into the jetty was a doddle with no hesitation going ahead to astern. Most convenient, however, is the ease

of going to the boat, lowering the outboard, casting off and being able to glide away from the jetty without the wait to raise steam. After 45 minutes of outboard drive I have the boiler fired up and so turn off the outboard and crank up the steam engine and off we go as normal, really easy.

This is where an economy kicks in: instead of using half a bag of coal stationary at the jetty raising steam, the outboard has taken me a couple of miles up the loch by the time I've used my half bag of coal.

Which takes me on to the second very small economy.

Once I am underway on steam and up to 7km/hr; if I keep the outboard down the slipstream under the hull spins the outboard propeller and the motor then becomes a generator which trickle charges its battery.

Now its hopelessly inefficient, I will be the first to admit, but nonetheless it is still technically a steam/electric self charging hybrid thereby considerably enhancing my environmentally responsible credentials.

This has proved invaluable already as passengers en route past my mooring at Trossachs have occasionally criticised the negative effect on the climate of coal burning boilers.

Giving them the details of the self generating outboard they go on to enjoy their cruise on the Sir Walter Scott relaxed about our environmental care.

A cover plate with the outboard down to stop splashing from the top of the moon pool has been added, also a small rope block to ease lifting the outboard up or down and doubtless this year will see further tweaks and adjustment.

So what did it achieve.

- First: and most important, a secondary means of propulsion in the event of breakdown.
- Second: an easy way of jumping on the boat and going for a short sail if I don't have time to fire up the main plant
- Third: I do not break the pollution rules for reservoirs
- Fourth: I can honestly say to critics that Rosebank is a hybrid and does not make (much) pollution
- Fifth: Reduction in coal consumption as I use only 25kg of coal for the 13 mile round trip to Stronachlachar instead of 50kg without the outboard.

Overall, a pretty successful outcome.