As I forecast, Adrian Shooter’s ‘Dad’s Army’ of engineers are delivering a professional job

Informed Sources’ Fourth Law states: ‘When in doubt build a demonstrator’. This is particularly valuable when you are doing something radical.

My favourite example is the Turbinia, built by Charles Parsons to demonstrate the naval application of his newly-invented steam turbine. In 1887 Mr Parsons gate-crashed Queen Victoria’s Diamond Jubilee Review at Spithead. Turbinia raced up and down the lines of ships, easily outpacing a Royal Navy picket boat sent to shepherd the interloper away. Point made.

Equally mischievous, if less dramatic, was the ‘accidental’ parking of the proof-of-concept unpowered Leyland National bus-bodied rail vehicle outside British Rail Research when the press rolled up at Derby for the unveiling of APT-P on a rainy day in June 1979. Suddenly the precursor of the Pacer was upstaging BR’s new tilting super-train.

Which brings us neatly to Vivarail’s proposed Pacer replacement – the Class 230 diesel-electric multiple-unit (DEMU) created out of redundant London Underground District Line D78 stock. During August Mr Walmsley and I were among the 195 people who visited the Quinton Rail Technology Centre at Long Marston to experience the first converted vehicle on the test track and poke around the next two vehicles under conversion in the workshops.

During pre-election campaigning ministers rejected the Class 230 as a potential Pacer replacement. Local worthies rubbished making do with London’s cast-offs, drivers queried the safety aspects and Rail Minister Claire Perry declared they would not enter service on my watch. Yet nine days proved inadequate for all the train operators, leasing companies, MPs, Department for Transport and Office of Rail & Road officials, plus the all-important user groups, rail associations and representatives from Travel Watch, RailFuture and Transport Focus who wanted to see what Vivarail Chairman Adrian Shooter and his team had wrought. Three more demonstration days had to be arranged in September; clearly there is a lot of interest in the concept.

And despite Ms Perry’s robust view, subsequently renounced in a letter to Adrian Shooter, the First Great Western Direct Award Franchise agreement includes the requirement that, ‘subject to initial examination confirming likely viability’ proposals should be developed for ‘the trial deployment and, if successful, implementation of converted former London Underground D78 rolling stock on one or more selected branch lines within the franchise’.

SCEPTICAL

When I wrote up the Vivarail project in the December 2014 column, I admitted to being in a quandary.
On the one hand the D78 stock conversion proposed by the Yorkshire Train Company seemed a complete non-starter. On the other hand, Vivarail, Adrian Shooter - no mean engineer himself - had assembled a team of engineers for whom I have the highest regard.

So I wrote a technical description of Vivarail's proposed train, expressed some reservations over the ability of the Ford automotive engine to survive traction duties in a metal box under the floor and reserved further comment until I could see the D-Train when standing beside the vehicle.

As I was writing this down, Adrian Shooter came up and remarked over my shoulder 'before you write down "smelly exhaust" we will use a more usual configuration on future trains'; When I pointed out that some of us had queried the track level exhaust outlet, he replied: 'well, you can say "I told you so"'.

Inside the train, the five-cylinder engines purring away under the floor were less noticeable than, say, a Cummins in a Meridian. When we started two circuits of the test track, power pick-up was smooth and vibration free. You can find the sound level measurements in Mr Walmsley's column.

**SMELLY**

A temporary platform had been erected for visitors to board the single vehicle. As I climbed up the steps the smell of the exhaust from the idling underfloor engine was noticeable, strong enough to be objectionable when standing beside the vehicle.

**BIMBLING**

We bimbled around the track, reaching a maximum speed of 30-35mph. I would have liked to have stopped on the 'fastest' section and carried out a maximum acceleration start to check engine NVH (Noise, Vibration, Harshness - Ed) on full power.

However integration of the engine management software with the control software for the Strukton electric traction package is still at an early stage, so perhaps trying to induce wheel slip was not a good idea. But what I did notice was that when power was removed, the little Fords ran down like proper traction engines.

While the trip was short and on poor quality track, the ride was agreed by my fellow travellers to be better than a Pacer (not difficult). But my main interest was in the workshop, where conversion of the other two vehicles for the demonstration unit was advanced.

With the second powered vehicle on stands it was possible to examine the underfloor equipment layout. This was helped by the instructions on the underframe (you can see the mark ‘genset’ in my photo of the underframe).

There was one disappointment. It was not possible to look inside one of the engine modules produced by Revolve Technologies. However, Vivarail's ever helpful PR has provided the accompanying photograph of the engine module, which gives an indication of the packaging.

**QUICK CHANGE**

Each motored car has two of these power packs containing the 200hp engine driving an alternator, compressor, cooling system and battery. Each module weighs 800kg and is designed to be replaced in 10 minutes using an adapted pallet truck.

In my photo showing the ‘genset’ mark on the underframe, the engine module would be inserted and withdrawn from the far side, guided by the two sets of rails that you can see under the ‘genset’ marking. When fully in place it is lifted and dropped onto the locating pins shown in my ‘pin’ photo; an over-centre retaining device for each peg is then actuated to secure the module.

Examining this arrangement with me was David Keay, ORR Deputy Chief Inspector. He immediately sought confirmation from Adrian Shooter that some form of secondary restraint will be fitted. This is likely to be a wire rope.

Ten minutes to replace a module reminds me of some of the early forecasts for Deltic engine changes in Class 55 locomotives. Once the electrical connections and fuel pipe have been disconnected the retaining catches are released, the module is lifted and withdrawn from the side. Guides centre the replacement module between the rails as it is pushed in, lowered onto the pins and locked in place.
With the fuel and electrics reconnected, there will presumably have to be a functional test, including a handshake with the traction control electronics. That sounds more like a half-hour job to me.

Longer term, Vivarail is looking to add regenerative braking. The current technical solution would use a combination of battery and flywheel energy storage. Vivarail is talking to GKN-Hybrid Power, which acquired the Williams Formula 1 flywheel Kinetic Energy Recovery System (KERS).

**STEEL CAGE**

Early criticism of the Vivarail project focused on the lack of crashworthiness of the cab ends. Nor was the arch-critics' scepticism assuaged by the crash test organised by Vivarail and MIRA.

But from inside the cab the safety cage is massive and has been beefed up following the crash test (the results of the crash test are shown in the photo). As you can read further on, Mr Walmsley reckons it is superior to a Pacer and could even offer better protection than the Class 150 front end.

A safety cage is only as useful as the parts of the train to which it is bolted and this is where the beefing up has taken place. In the photo below you can see the extra steel floor plate bolted to the underframe which spreads the load for the cage beams. Similarly, in the photo of the cantrail level opposite note the horizontal beam extending back into the superstructure.

For the country version, Vivarail plans to blank-off the two inner pairs of doors. As built, these door pillars have a structural member that intrudes into the saloon – indicated by the helpful hand of Neil Bates of...
year. This gives a fuel saving of 4,000 litres per year for the Class 230.

GROCKLE TRAIN
Certification of the demonstrator three-car Class 230 is scheduled for the end this year. Testing in passenger service will follow ‘in the new year’. While Adrian Shooter would not be drawn on the location of the test service, informed sources expect it will be on First Great Western under the requirement in the Direct Award franchise agreement.

Bristol-Severn Beach had been suggested as the evaluation route, but FGW has settled on the Plymouth-Gunnislake branch with the unit based and maintained at Laira depot. This is the logical choice since the Gunnislake branch will be more demanding operationally and it will show Laira that the depot has not been forgotten in all the IEP excitement.

SPEND
So far Vivarail has spent around £4 million on the project and it shows in the quality of the engineering. Based on the capital rental figures in Table 1, I estimate the cost of a converted Class 230 vehicle at around £800,000, roughly half the price of a putative new DMU.

In Table 1 Vivarail used rolling stock leasing company and operator figures for the Class 150. Note that Vivarail makes no allowance for non-capital rental costs, which suggests that there is no provision for amortisation or major mid-life overhaul as would be the case with a new train. But note also that the Class 150 lease rental is determined by market pricing, as Mr Walmsley explains later.

FGW’s Class 150 DMUs, including those used on the Gunnislake branch, average around 8,000 miles a

TABLE 1: CLASS 230 COSTS COMPARED

<table>
<thead>
<tr>
<th></th>
<th>New regional DMU</th>
<th>Class 150</th>
<th>Class 230</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lease rental per car per month (£)</td>
<td>15,000</td>
<td>7,500</td>
<td>7,000</td>
</tr>
<tr>
<td>Non-capital lease rental per car per month (£)</td>
<td>6,000</td>
<td>3,000</td>
<td>0</td>
</tr>
<tr>
<td>Depot maintenance per car per mile (p)</td>
<td>60</td>
<td>70</td>
<td>40</td>
</tr>
<tr>
<td>Fuel consumption per car per mile (litres)</td>
<td>0.8</td>
<td>0.75</td>
<td>0.5</td>
</tr>
</tbody>
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Source: Vivarail