D STOCK TO D-TRAIN

by Piers Connor

D STOCK

There has been much publicity recently in the railway press about a company called Vivarail that has been set up to buy redundant D Stock as it gets displaced off the District Line by S7 Stock and convert it to diesel-electric operation. The idea is to use the converted stock on various routes currently suffering from rolling stock shortages or where the outmoded and much-hated, bus-style "Pacers" are still used. I am quite familiar with D Stock, having written much of the original instruction material for the stock and then doing much of the original training of its maintenance staff so, I thought it would be interesting to look at what has to be done to them to get them into shape for diesel-electric operation on the main line. Already, by the end of January 2015, 13 cars have gone to Long Marston – seven motor cars and six trailers – to undergo trial conversions.

FLEET SIZE

The D Stock fleet originally consisted of 75 x 6-car trains, with each train made up of two 3-car units. The standard formation is arranged so that driving cabs are only provided at the ends of the train, so each of the units in a train is "single-ended". The inner end of the unit couples to the inner end of another unit facing the other way round. This means that you need an even number of units of each type to make up complete sets of trains. However, some units are "double-ended", i.e. they have a cab at each end so that, in the event of a shortage of either type of single-ended unit, a double-ended unit can be used to replace it.

There are 65 west facing single-ended 3-car units and 65 east facing 3-car units. There are 20 double-ended 3-car units. The publicity says that Vivarail have purchased enough cars to make up 75 units in 2-car (DM-DM) or 3-car (DM-T-DM) formation. Vivarail themselves suggest 4-car units are possible. Unless they use UNDMs as 4th cars, the 4-car unit would be seriously underpowered.

D-TRAIN

Vivarail are calling their converted trains "D-Train". The D-Train concept proposes using the original car body (suitably modified) and the existing bogies and their traction motors. Each driving car will be equipped with two 200 h.p. 3.2 litre diesel engines as used in Ford Transit vans. Each engine will drive an alternator to provide electric power for the two traction motors on each bogie. Presumably, the auxiliary power will be derived in the same way. Of course, there aren't many details at this stage, but there are lots of unanswered questions. Here are some to whet your appetite.

TOP SPEED

This is set at 60mph. A Pacer can do 75mph and Class 170 will do 100mph. The modelling results published so far suggest a 4% increase in timings as a result. Not too bad but it could get worse for a heavily loaded train with long station stops. Only two of the existing doorways per car side will be used so the dwell times will be similar to the existing.

WEIGHT

A D Stock car weighs 30 tonnes. A pair of diesel engines will be heavier than the existing PCM traction equipment. I expect the weight of the motor car to go up by 5-7 tonnes. How a weight increase of over 20% will affect the bogie and ride performance is anyone's guess. Both suspension systems are solid rubber. I'm wondering where they will put the batteries. They are currently under the passenger seats.

VIBRATION

This is a big concern. Two underfloor diesel engines, operating independently will generate a lot of vibration and noise and this will require serious research and substantial mitigation. There is also the question of the car body harmonics and how these will be affected.

AIR CONDITIONING

There is no mention of air conditioning. It will be a passenger expectation that modern or upgraded trains will have it. Not to will be a significant omission. To fit this to the D Stock passenger saloon would require significant modification to the roof. The space along the ceiling would quickly get filled up with ducting and fan units.

TOILETS

The 3-car trains will have a trailer car between two motor cars and this is where the toilet will have to go. There is no room for the waste retention tank under the motor cars. Two-car units will not be able to have toilets. My own feeling is that all the trains should be 3-car sets. This offers flexibility and consistent performance. Also, these cars are 15% shorter than a Pacer, so they wouldn't have much capacity in 2-car format.

CAB CONTROLS

I know the D Stock cab well. I designed it – well the basic layout, anyway. The LU cab is completely different from what's seen on main line trains and it will be necessary to strip out the existing console and replace it with a new one. The LU driver's safety device (DSD) is in the controller handle, so there is no DSD pedal. That will have to be added. The desk displays and controls are completely different and there are no CCTV or computer screens in the cab so these will have to be added for Driver Only Operation (DOO).

CAB DOORS

The cab has four doors – front cab 'M' door, side cab doors ('N' and 'O') and 'J' door (to the passenger saloon). These are a nightmare for draughts. I would expect to see the front door ('M' Door) sealed closed and some serious draught proofing put in for the side doors. There are no drop-down windows. Fitting them might give problems for the door opening pocket. It will increase the draught proofing requirements. I don't think they will fit drop down windows.

HEATING

Currently, the D Stock heating is pathetic. Unless passengers and crews are not to freeze to death in the exposed northern wastes of the Settle & Carlisle line, there will have to be a serious upgrade of both the heating system and car body insulation of the D Stock.

DOO

I can't imagine these trains being accepted without Driver Only Operation (DOO) already fitted. For a modern train, you need bodyside cameras and in-cab CCTV à la Class 377. The LU system for DOO (One Person Operation [OPO] on LU) is based on platform-mounted equipment so the D-Trains will need the on-board systems added. This is not as simple as it sounds.

COUPLERS

It would be silly not to equip the outer ends of units with automatic couplers but I suspect that the LU type won't be suitable. It will be desirable to have longer trains on some routes and flexibility should be maximised. However, they're not cheap and there may be some difficult engineering to do to the ends of units to enable them to be fitted.

COST?

Always a difficult issue. In 2013, Angel Trains re-engineered a 4-car Class 317 EMU with a new traction system and new interior and they quoted a cost of £7million – that's £1.75million per car but it's a prototype, so there's lots of development costs in there too. Let's say Vivarail can get orders for 70 x 3-car units. This is 210 cars, a reasonable production run so, allowing for development and financing costs, there is probably a good business case if the cost per vehicle can be kept below £1million for a 20-year life. As always, the big risks are the technical unknown unknowns.

REFURBISHMENT PITFALLS

There's lots of other detailed technical stuff but this article gives a flavour for what's involved. I am sure that the Vivarail team, led by the very experienced railway manager Adrian Shooter, are familiar with all the pitfalls of train refurbishment but for those readers who aren't, I wrote about it a couple of years ago on my blog, so I've edited it and added it here for your amusement.

I wrote that, if you are thinking about refurbishing your rolling stock, here some valuable lessons, learned through bitter experience:

- Always have a clear and fixed remit agreed with the operators and regulators before going ahead with the design.
- Never assume new stuff will fit easily into the old trains. Even if it is specially designed, it probably won't.
- Avoid messing with wiring unless you strip it all out and replace it.

- Always assume you will find things you didn't expect when you strip out – you will, sometimes even when you're getting near the end of the job.
- Always expect things that are not supposed to be touched will be and will get damaged as a result.
- Always allow a long learning curve for the first few trains.
- Avoid changes in design or requirements mid-contract. It will be very expensive.
- Always expect it to cost more than you estimated.
- Always expect it to take longer than you estimated.
- Don't go for the lowest bid because it's the lowest. It will cost more in the end.
- Work with your contractors rather than against them. Openness and co-operation will be cheaper for both of you.

There are certainly more lessons I could add but these are the most pertinent. I offer these because, almost 20 years after I was first involved in train refurbishment, these mistakes are still being made. I heard recently that, a year into an overseas train refurbishment project, all the above lessons had been ignored, the contractor was forced into bankruptcy and the operator was left with a huge bill and a partly refurbished fleet that he now has to re-tender for, so he can get it all working again ….