THE INTRODUCTION OF HIGH OUTPUT WIRING TRAINS TO THE UK

Terry Walsh
OLE & Distribution Alliance
Wolverhampton Road
Penkridge
Staffordshire ST19 5AQ
UK
terry.walsh@olealliance.co.uk

KEYWORDS: electrification, multi purpose vehicle, overhead line, tensioning, train, wiring

ABSTRACT
Railtrack's requirements to replace over 700 tension lengths of wire on the West Coast Route Modernisation programme called for a major step change in the type of equipment used and the methodology. In May 1999 the OLE & Distribution Alliance was funded by Railtrack to Design and Build two high output wiring trains each capable of renewing a full tension length of wire in a short midweek possession.

As there was no equipment in use in Europe or the Far East that was suitable to import, the team set about putting together a specification that would meet the stringent performance criteria and the onerous requirements of the UK railway industry.

After discussions with several equipment suppliers, Windhoff, a German manufacturing company was selected as a partner in the development of the new trains. An order was placed in July 1999 and detailed design commenced. The equipment was ready for trials in June 2000 and shipped to the UK within two months.

Vehicle Acceptance Body (VAB) certification was achieved and the first wire run (tension length) was successfully replaced during November 2000. To date over 650 wire runs have been replaced, with the added achievement of a full replacement within a five and a quarter hour midweek possession.

High Output Wiring Train – Full Consist

INTRODUCTION

Two new wiring trains were introduced onto the West Coast Route Modernisation Project in the summer of 2000. After three months of intensive engineering and safety checks, confirmation of all design calculations, acceptance of operability and maintenance procedures being in line with Railway Group Standards and the Railway Safety Case, the dream was about to become reality.

The results of many and intensive hours producing ideas, concepts, designs, rethinks and finally manufacture now stood proudly before us – and we were holding in our hands the final piece in the process, the Vehicle Acceptance Body Certificate.

- Would the train perform as well as it was intended?
- Could the plant stand the rigours and demands of a relentless production programme, whilst maintaining a safe operational environment for those who would operate it?
- Would the operatives be able to perform their tasks as efficiently as our numerous “Timelines” were predicting?
- Was our operator training programme adequate in content and duration?
- Would our investment prove to be as beneficial as our forecasts?

The road ahead would soon start to answer all of the questions.

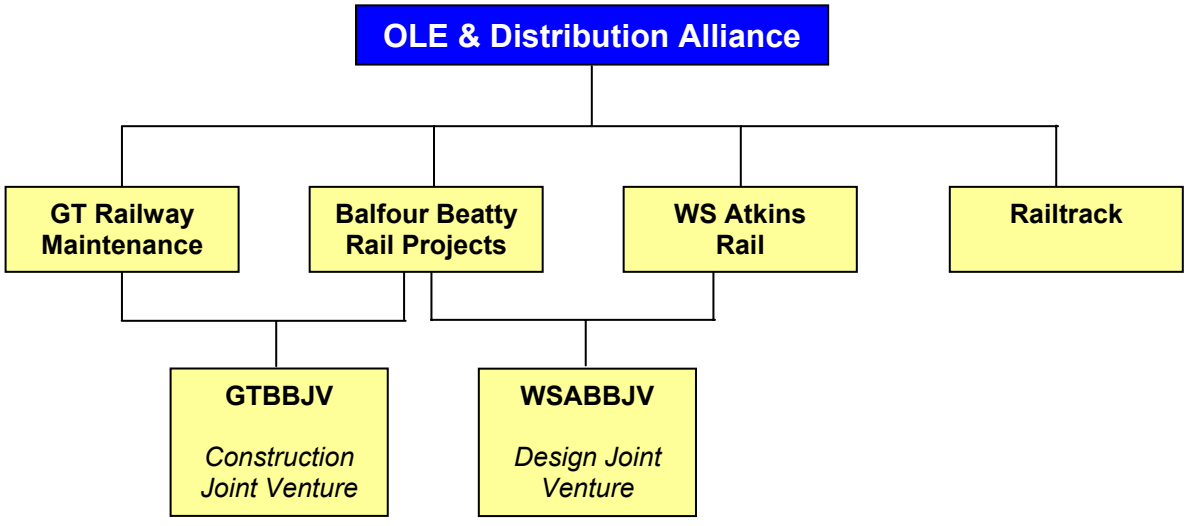
BACKGROUND

Railtrack had decided to upgrade the West Coast Main Line (WCML) railway, to allow higher speed trains to run, increase the volume of traffic and improve both the reliability and maintainability of the infrastructure.

Tenders for the Overhead Line Replacement and Power Supplies Upgrade were received in the first quarter of 1998. The programme demanded innovation in equipment and methodology to achieve production outputs far in excess of any previously considered in the UK Rail Industry.

In rising to this challenge it was clear to the bidding Joint Venture (JV) team from GT Railway Maintenance and Balfour Beatty Rail Projects (BBRP), that here was an opportunity, and indeed a necessity, to develop new equipment to meet the demands of the project. However due to the short timescales in which the plant would be required to commence work, the team always kept a "let's not reinvent the wheel" philosophy and looked to utilise existing technology wherever possible.

In May 1999 Railtrack entered into a Project Development Agreement with the JV (which now included WS Atkins Rail and BBRP Design as OLE Design Engineers). This enabled the plant team to continue the design of the wiring train and in late summer of this year Railtrack gave the JV an instruction to purchase two of these new "high output" wiring trains.



OLE & Distribution Alliance Organisational Structure

KEY CHALLENGES AND PERFORMANCE CRITERIA
In evaluating the plant demand the Joint Venture considered a number of key areas:

- The auxiliary wire and contact wire were to be replaced
- The differing heights of the existing wires
- The line must be handed back at full operational speed to normal traffic at the end of every possession
- High production targets in limited time nightshift possessions - one wire run (a wire run is generally between 1000m and 1700m in length) per train per six hour midweek possession and two per train for the longer ten hour weekend possession
- Train capability to run at 100km per hour so that it could run in open traffic, and over the maximum gradients found on the WCML
- Meet the requirements of all relevant Railtrack Group Standards
- Maximum mechanisation for ease of use and accuracy of installation
- Slow speed control (from 0.5 to 5kms per hour) for running in possession
- Access to the plant
- The need to be able to split the plant units quickly to maximise the working periods
- Run out the new wire under tension
- Safety controls to protect from overtensioning and wire failure
- Safety controls to allow the train to operate adjacent to live lines
- Loading of new wire and unloading the scrap recovered wire
- Fuelling - capacity and practicality for refuelling
- No electrical interference with other equipment (eg signalling system, telecoms)
- Environmental effects - noise, light, engine emissions, waste oils
- Maintainability
- Stabling areas – locations, quality and length of track
- Length of train
- Independence - self reliance

DEVELOPMENT
The initial ideas for the train included many small self propelled platforms, taken to site in one consist and pulled by a single locomotive at the front and one at the rear, supported by road rail lorries. This was refined as more input from our experienced railway staff identified significant shortfalls in this method. By constantly questioning the method statements drawn up and evaluating the risks and benefits we eventually arrived at what was perceived as the ideal option.

The team evaluated equipment from Europe and Japan and decided on the following existing equipment as the starting point for the foundation of the new train:

- Cargo Sprinter from Germany, the pulling power and the Multi Purpose Vehicle (MPV) to build our train consist around.
- Tensioning equipment from Italy for running out the new wire. This equipment is used in the high voltage transmission line renewals around the world. As the specification was refined the team turned to an alternative German supplier who was better placed to assist in developing and refining the software interfaces needed.
- Silenced generators for our platform power packs.

Although these were crucial elements in the full train consist we still had to modify them to suit our operational needs, and design and build the following equipment to make the train complete:

- A hydrostatic drive for the MPV to allow slow control under wiring operations.

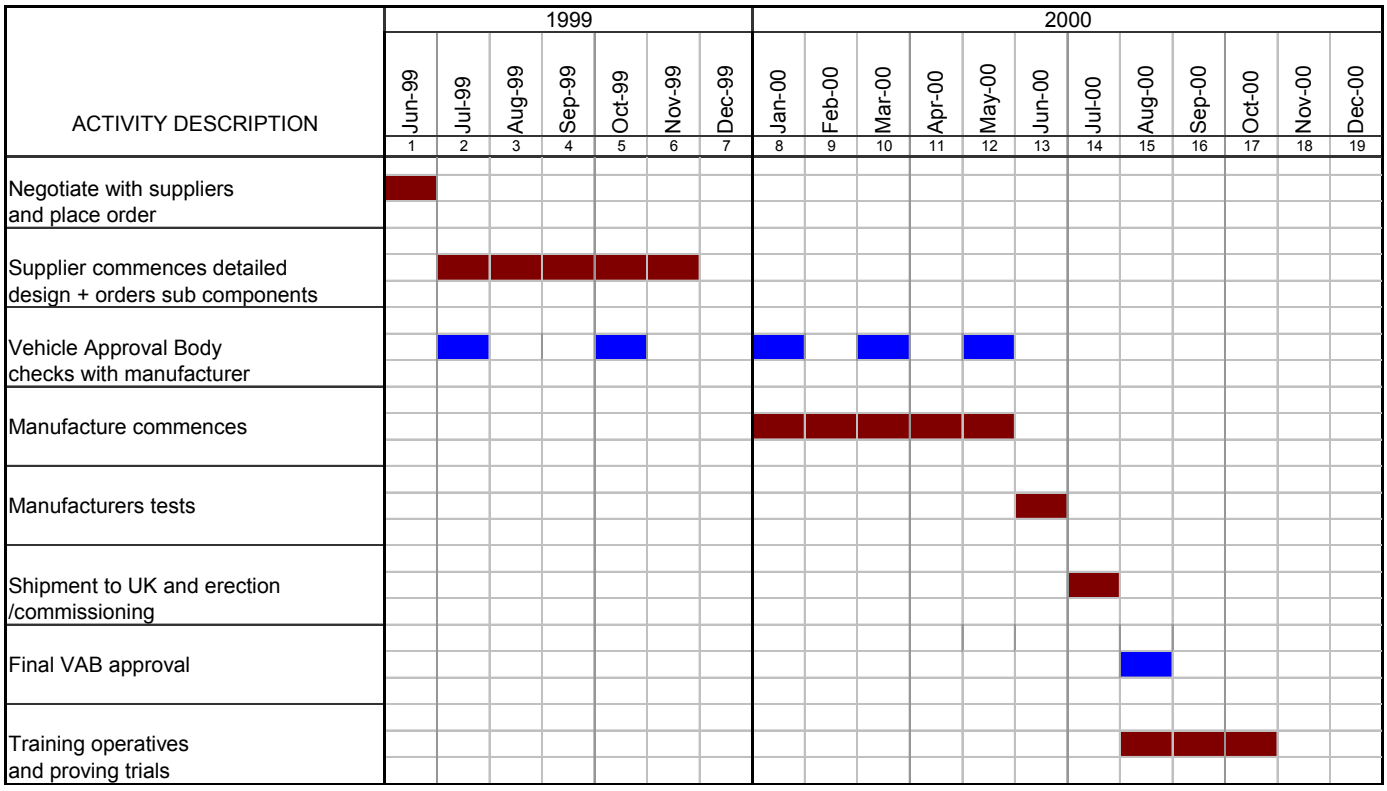
- Working platforms - the best length, giving vertical and horizontal adjustment, making allowance for track cant of up to 6 inches and having a non-slip surface.
- A system to operate the MPV from the platform.
- An independent drive system for the platforms.
- Interchangeability between MPVs to allow utilisation of equipment in the event of a breakdown.
- A measuring module to check the position of the wire after installation.
- Equipment to recover the old wire.
- Software to link the tensioning unit to the MPV to ensure overload could not occur, together with fault diagnosis to improve recovery time from breakdowns.
- Pneumatic and electrical power outlets to all stages of the train for power tools.

SUPPLIER CHOICE
Windhoff AG, a German company, was chosen as the preferred supplier.

Our team of overhead line engineers, plant engineers and planners joined forces with Windhoff's design and production engineers to finalise the detail, the layout, the other key suppliers, the manufacturing programme, the form of contract and the price.

The Joint Venture was now confident that it had a contract with an organisation capable of the detail engineering and manufacturing processes to provide a complete integrated train that would meet all its performance criteria.

The final consist was agreed in July 1999 and production commenced to a tight programme agreed by all parties. This plant was to represent a major capital investment by Railtrack in advance of the contract award for the OLE Upgrade.



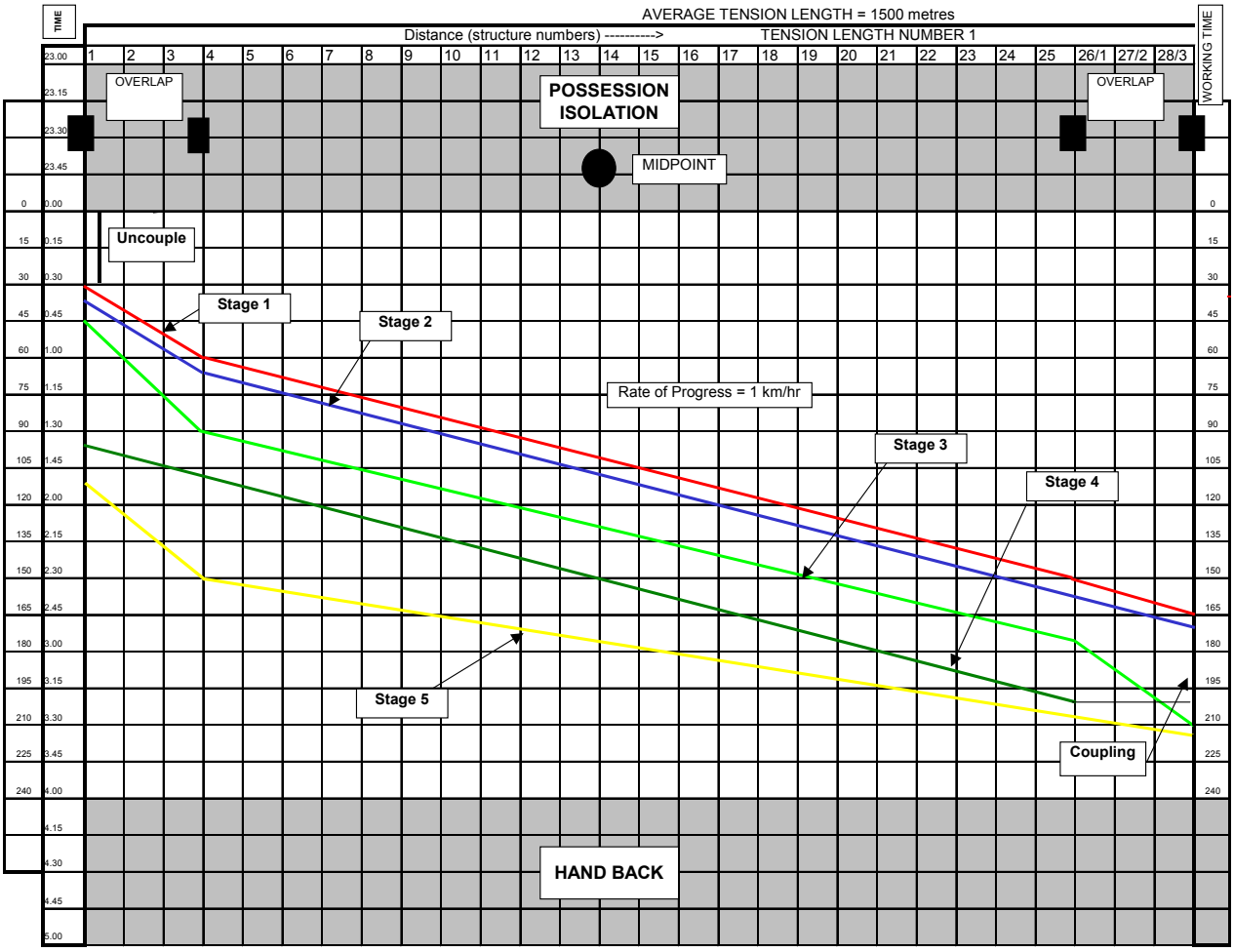
High Output Wiring Train – Plant Procurement and Lead In Activities

THE WIRING TRAIN
Each train was to consist of:

- Four power cars
- Three flatbed mounted hydraulic platforms
- Recovery and installation equipment

The train is almost 200 metres long when travelling to the worksite and moving into location under its own diesel powered Volvo engines. It can run over long distances as a single unit and is controlled by one driver in the forward driving cab. From this position the driver is able to control all four MPV units in the multi traction mode, monitored by a failsafe data bus system. The modular design incorporates Auxiliary Power Units with their own control panels, which interface with the Programmable Logic Control System on the MPVs.

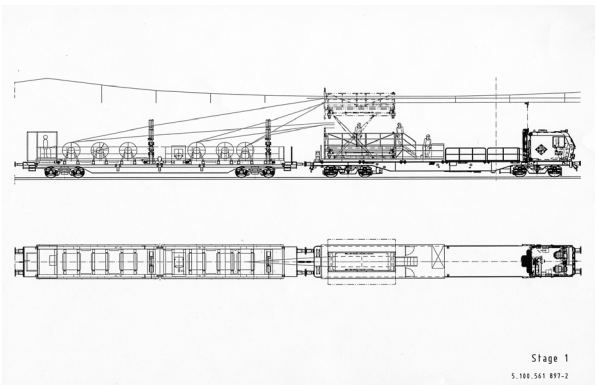
Once the train has reached its worksite and is in possession, it splits into five independently powered units, each with its own tasks. The work content for each unit has been carefully considered so that when all operations are working consecutively the overall speed and distances can be maintained between each operation. We have developed a production line, shown below, where the operators move along the work process, the opposite of a normal factory production line.



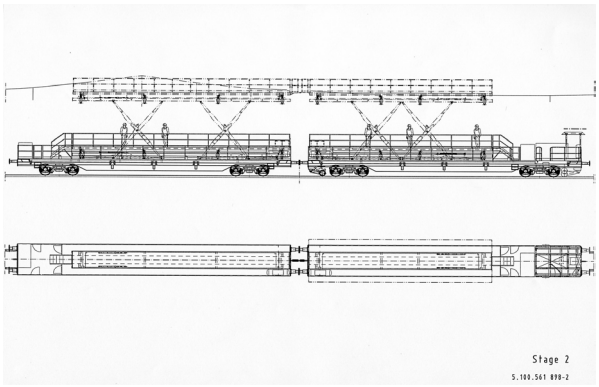
Stage 1	= RECOVERY UNIT
Stage 2	= CATENARY CLEAN UP / DROPPER UNIT
Stage 3	= RUNNING OUT / TENSIONING UNIT
Stage 4	= FINAL REGISTRATION UNIT
Stage 5	= MEASURING MODULE & QUALITY CONTROL

Construction Timeline for Replacement and Recovery of Contact Wire - one tension length completed in a four hour working time midweek possession

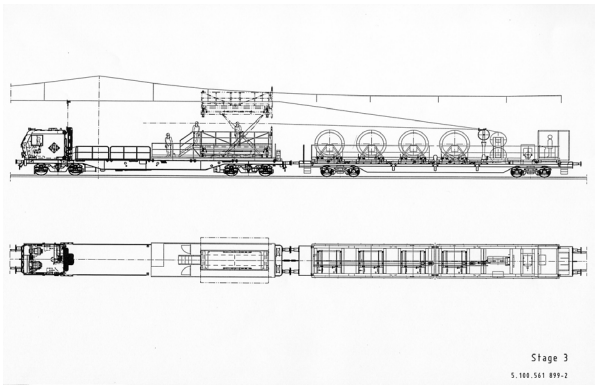
STAGE ONE
Recovery Unit - release old droppers and recover existing auxiliary and contact wires.

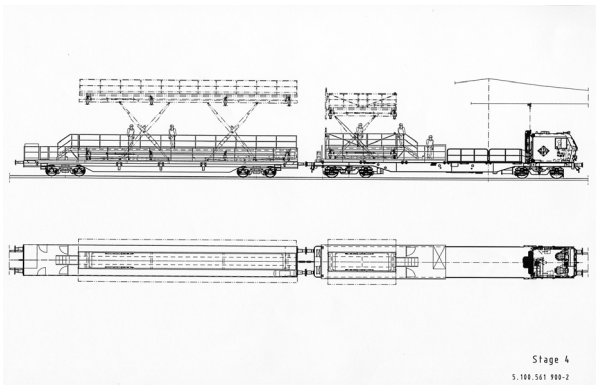


STAGE TWO
Catenary Clean Up / Dropper Unit - remove old droppers and install new droppers.

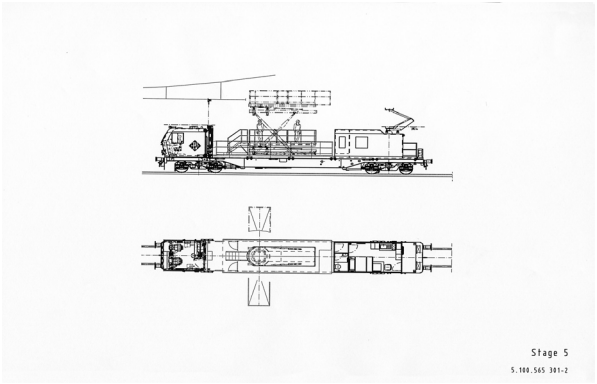


STAGE THREE
Running Out / Tensioning Unit - install new contact wire under tension.





STAGE FOUR
Final Registration Unit - secure new droppers.



STAGE FIVE
Measuring Module & Quality Control Unit - check and record measurements of the new contact wire.

FLEXIBILITY
The various work modules, tensioning equipment and platforms mounted on the MPVs or flatbed wagons use standard container twistlocks. This enables the plant and equipment in each stage or between either train to be interchanged to suit. The MPV units are arranged so that they can carry combinations of platforms, messing facilities or workshops.

RESOURCE AND TRAINING
Each train requires a team made up of a wiring engineer, two supervisors, twenty one operatives, one train driver and three MPV operators.

There were no experienced personnel to call on from the rail industry that either had used this type of equipment or achieved the outputs we were looking for so we decided to recruit from outside the rail industry.

A training course specifically tailored to developing skills for a role we titled "Erector" had been developed in house and was of five weeks' duration. A further training course was simultaneously developed to train our MPV drivers.

Working on our trains today we have only one member from the teams with prior experience of the railway, and that includes the engineers and supervisors.

As the first train was ready for testing in Germany in May 2000 we decided that this would be the ideal learning environment for our staff. We built a specialised overhead system alongside an existing single track outside the Windhoff factory near Rheine, approximately 800 metres long. Three visits were made, each a minimum of one week's duration, which allowed our staff to familiarise themselves with the

equipment by continually running out new wire and recovering it. Having the Windhoff engineers on hand to make any adjustments to improve the system or make running repairs was an ideal scenario.

The HMRI was invited to visit these trials to offer their comments or concerns about anything they saw in the process. A member of HMRI took up the offer and several suggestions were taken into consideration and implemented in advance of the train arriving in the UK.

PERFORMANCE

There are in excess of 700 wire runs to replace in the first phase of the project.

Historically to remove and replace one tension length of wire, working from the roof of one of the old existing wiring trains and supplemented by a number of additional platform units, would take on average sixteen hours. This would also have involved hiring in locomotives to pull the wiring wagons and several road lorries with lifting attachments to bring in the access platforms.

As this duration of possession is only available at weekends then only one wire per week per train could be achieved - unthinkable! Assuming two trains were available then a seven year programme would have been required.

We now had a piece of plant that would get to site under its own power from anywhere in the UK, and complete a wire replacement in less than five hours in a possession.

CONCLUSION

Both wiring trains have exceeded expectations and by the end of February 2003 over 650 wire runs have been completed.

The new equipment performed extremely well when it was tested by Virgin Trains' Class 390 Pendolino travelling at 125mph, on a test section of the West Coast Main Line at Nuneaton.

The team celebrates completion of the 500th wire run on 27 June 2002