

SUPER CAPACITOR CAR AN ENGINEERING COLLEGES APPROACH



Lecturers from engineering departments in 14 further Education colleges from across Wales attended two one-day TEP training courses in September. This is part of an ongoing programme of support from TEP for college based learning at level 2 and level 3.

Devised by TEP Associate Bob Cater, this assignment is designed to help raise awareness of engineering and to develop a range of skills in a motivating context. It involves designing and making a super capacitor powered car. The technology involved is now being explored by many car manufacturers in the production of hybrid cars.

The principal elements of car design involved are:

- Designing and manufacturing the chassis
- Designing and manufacturing the body shell
- Ensuring the power unit and gear box fit within the body shell
- Attaching the power unit and aligning the axles
- Designing the car colour scheme and placing sponsors logos

In doing this, team work is essential to design, make and assemble the different components and sub-assemblies. Decisions have to be made regarding the tasks that have to be accomplished and a team needs to organise itself to produce a plan to manufacture the car. Once the designing has been completed, production cells can be set up.

Production Cell work:

- Cut materials for the chassis and assemble it including axle mounts
- Prepare the super capacitor assembly
- Assemble the chassis, power unit, wheels and axles
- Design the body shell
- Draw prototypes
- Use a suitable CAD package to draw and colour the body
- Cut out and assemble the body
- Attach the body to the chassis.
- Test and adjust the car

These tasks will require overall project management and quality control will need to be built in at appropriate stages.

The project also addresses a wide range of generic skills development, including:

- Team work
- Team leadership
- Problem solving
- Communication skills
- Quality control
- Planning
- Key skills of numeracy and ICT
- Basic hand manufacturing
- Aesthetics

It also develops understanding in the areas of:

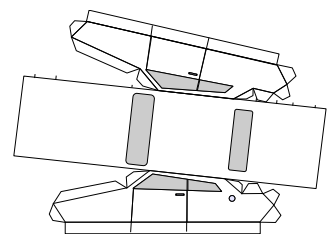
Applications of Scientific principles

- Mechanisms (gears, mechanical advantage, velocity ratio)
- Magnets and electromagnets
- How a motor works
- Voltage
- Capacitance
- Friction
- Materials



Functional and applied mathematics

- Measuring
- Estimating
- Weights of paper and card (e.g. 80gm/m²)
- Capacitance charge/discharge time
- Gear ratios
- Motor speed reduction
- Costing
- Reading data from tables (motor data)
- Nets (The Car Body)



Engineering principles and skills

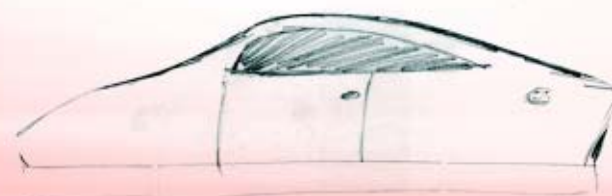
- Shaping and forming sheet material
- Reinforcing a frame with gussets
- Wheels and axles
- Gears and gearing
- Electric motors
- Super capacitor technology
- Interference and clearance fits
- Materials understanding
- Marking out
- Hand manufacturing skills
- Fitting and assembling
- CAD



Note the use of the Clunk-click gearbox with magnetic connectors

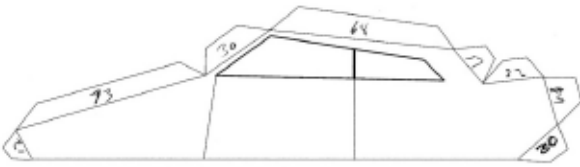
DESIGNING THE CAR BODY

- Agree the size of the chassis.
 - Sketch profiles of the car side elevation.
- Ensure there is enough clearance for the motor/gearbox.

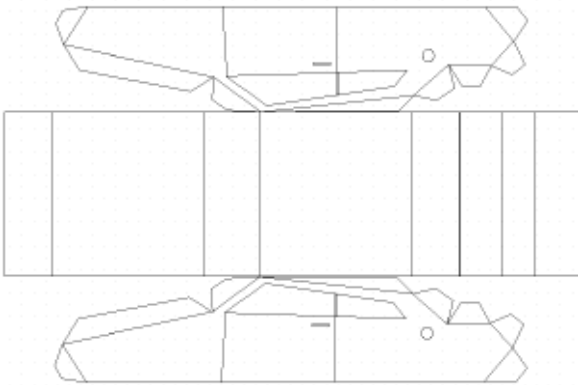




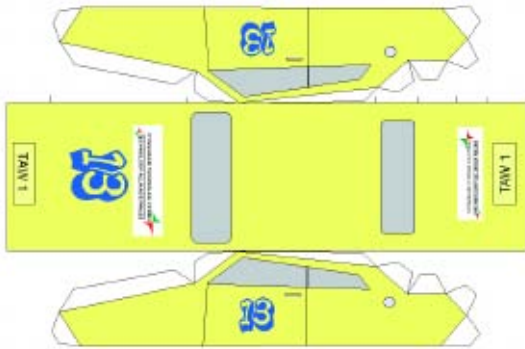
Refine the selected design



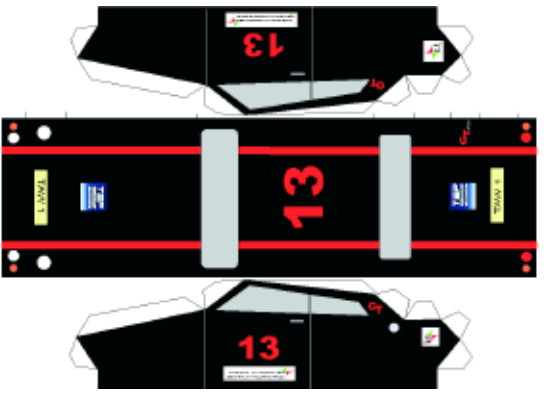
- Transfer this design to CAD in Open Office
- Work out the length of the roof/bonnet/boot strip by modelling in paper.
- Draw the complete car in Open Office including gluing (welding) tags



Add colour/logos and detail

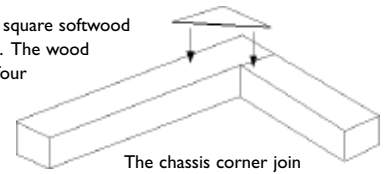


Print onto thin card



DEVELOPING AND CONSTRUCTING THE CHASSIS

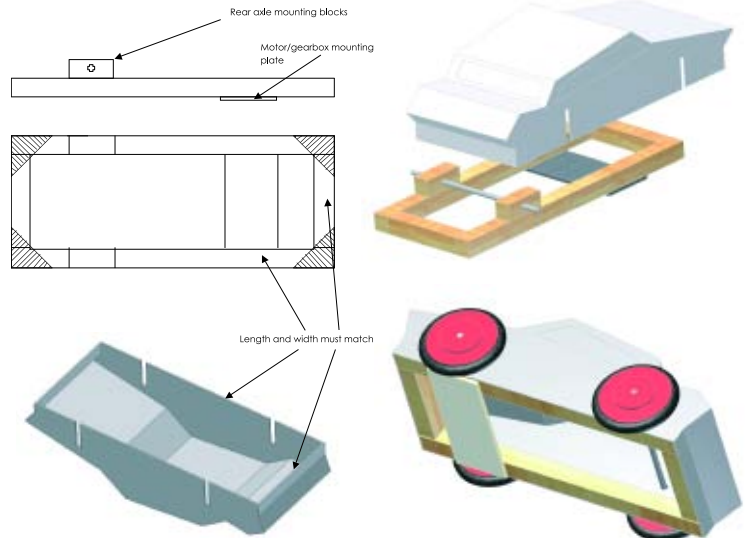
The chassis is made from 10mm square softwood (sheet metal could also be used). The wood chassis is formed by joining the four members together with a glue gun and reinforcing the corners with card gussets.



The completed chassis with wheels, axles and motor/gearbox

The motor/gearbox unit can be mounted on a mounting strip. This will dictate the height of the rear axle which will have to be supported on mounting blocks. Tyres are necessary to give enough ground clearance for the chassis. They also increase the friction between the wheels and the ground.

Orthographic drawings of the chassis



The car body shell must fit the chassis!

This work is already being used as an introductory group assignment for level 3 apprentices in some colleges. Initially this programme rolls out to over 2000 level 2 students across Wales as part of Engineering week in late November. Timed to coincide with the Rally GB round of the World Rally Championship in South Wales where the project finalist's cars will be on display and taking part in a final run off!

You can download further supporting PDF files from the TEP website under the What's New tab and the Engineering tab. To find out more about the free Open Office Draw software take a look at Bob's article from issue 11 of News and Views or log on to www.openoffice.org

The full workbook and introductory packs will shortly be available through TEP.

