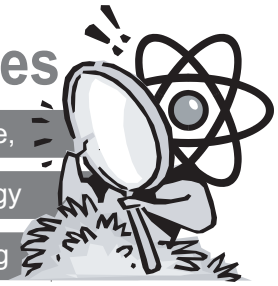
Introducing the Solar Detectives

The Solar Detectives

Investigating the science,
maths and technology
behind engineering



This project is based around Science, Mathematics and Design & Technology using state of the art solar cell technology.

The solar challenge will show how engineers need to be good communicators and scientists in utilizing a wide variety of skills in their everyday work. Pupils will research the science and maths behind solar car and boat racing models and design and build their own models. Pupils will be expected to engage in communicating their findings and work to a larger audience.

Aims:	Through providing expert guidance and support teachers will be encouraged to **a**) develop cross-curricular solar projects within their schools. **b**) Look at Science and Technology and its relationship to issues of sustainability.

Intended learning outcomes

Pupils – to be made aware of the relevance that science and mathematics has to engineering. To show that engineering provides a broad spectrum of careers that help to develop society. To enthuse children about careers in engineering, through providing an exciting and contemporary context of solar vehicles.

Teachers – mobilize teachers from the core subjects (Science, D&T, Mathematics and Citizenship) to work together in a mutually beneficial way.

A tailored project for KS3 teachers:

Engineering key ideas/concepts

For Technology teachers, the project can be tailored to support delivering key ideas at KS 3 such as drag and stability, density, buoyancy, remote control/electronics, steering, hull design, mounting a PV cell, and how to propel a boat.

For Science teachers, the project would support pupils in their work on scientific enquiry, forces, electricity and sustainable energy, all parts of core KS3 Science.

For Mathematics teachers, the project will help pupils with their geometry and data handling skills.

Beyond the Curriculum: Pupils taking part in the Solar Challenge will be encouraged to develop personal capability skills such as handling information, self-management, communication, working with others, creativity and problem solving. Teachers will be supported in this through specialist training in integrating personal capabilities within aspects of thematic cross-curricular projects.

It is important is that this project is a collaboration across a range of subject areas working together on a common themed project.

The way that this project is delivered within your school will depend partly on:

- timetabling issues
- pupil ability
- availability of facilities and resources in your school
- number of educational solar and boat kits
- involvement of teaching assistants
- support of extra curricular activities.

Technology Teacher support notes

Pupils will build solar buggies from kits as part of design technology. The key challenge that pupils will encounter is to investigate the construction of the wheels. This activity lends itself to design, build and review of results. Pupils will also investigate their constructed kits through a range of science based activities.

Notes and support for kit construction can be found at ***http://www.pluggingintothesun.org.uk/***

Pupils engaged in the design technology challenge of the Solar Detectives will be supported by a Maths for Young Engineers Booklet covering aspects of geometry for engineers. This booklet will endorse good numerical practice at KS3.

Science Teacher support notes

The tasks are activities supported by materials enabling teachers to assess pupil performance through a series of teacher assessment activities. These activities can be used as either assessment for or assessment of learning activities.

The Solar Detective activities are intended for use by schools with pupils of all abilities throughout KS3 but in particular as a Y7 project or as part of a revision programme prior to KS3 testing.

They are intended to be used flexibly, and not as 'tests'. Experience has shown us that pupils make most progress on the tasks if they are allowed to discuss issues with others during the completion of the activities.

The tasks are designed to provide assessment information that can be used alongside other assessment materials already collected by the school for teachers of pupils to make secure judgements that can contribute to pupils end of Key Stage teacher assessment. In themselves, the tasks will not provide a complete picture of pupil attainment, but they can provide additional evidence to back up your judgement about individual pupils.

Flexibility of application

The tasks are relatively flexible in how they can be used. However key to the successful use of the tasks is that they must be carried out following the pupils own assembly of solar buggies as part of design technology. The intention is to create a themed project where pupils provide their own context created in technology that they can then look at in science. The activities can be used in class or as an extra curricular science club during lunchtime or after school sessions. Each task is also designed to fit into a one, two or three 50-60 minute lesson. However pupils may take the opportunity to extend the activity beyond this time by being given the chance to work on tasks at home.

The tasks can be used to assess pupil performance in the following QCA KS3 SOW science units.

Unit 7I Energy resources

Case 1 'energy in short supply,' [2-3 hours]

Pupils look into the background of Solar Energy and communicate their findings back to their peers.

This activity provides an ideal opportunity to make use of a variety of media resources. By using a Learning Centre or school library the project can offer an alternative to lab based activities and create great atmosphere in which to have their own Solar Detective challenge. The emphasis to children should be made that as a teacher and class they will be collectively working on presentation skills. One way of doing this is to challenge your pupils to create a visual display showing an aspect of solar energy, as well as the visual display students are asked to give a mini presentation on what they have found out. Some of the first lesson in a project such as this will be spent establishing defined groups and clear goals and expectations for each of these groups. It is worth taking time out here to think about what groupings you wish to establish.

For some classes friendship groups will work but in many instances it will be necessary to establish groupings that share a whole classes skills. In a Learning Centre environment students can be given time to research, using all the available media resources of books, CD-ROM's, Internet and maybe video material too. Having done their research students are given a further time to prepare their presentations; we suggest one sheet of A1 paper and access to lots of creative arts materials. Finally pupils feed back their findings to the whole class by being given 5 minutes in which to describe their poster work. If the activity is repeated throughout a whole year group, it is possible to establish linked display work throughout school, showing off not only the skills of your pupils but also personal teaching and learning flair.

Unit 7J Electrical circuits.

Case 2 'handling data to find out answers,' [1 hour].

Pupils are provided with data on photovoltaic cell performance to handle and analyse.

Unit 7K Forces and their effects

Case 3 the **'Performance Challenge.'**

Pupils investigate the speed of their buggies. To do this pupils will need access to stopwatches, markers and measuring tapes or trundle wheels. To get the best results buggies should be run outside so as to maximise their performance by utilising natural sunlight. Pupils then analyse and evaluate their own results before comparing with those of their peers

Pupils engaged on Cases 2 and 3 of the Solar Detectives challenges will be supported by a Maths for Young Engineers Booklet covering aspects of data handling, using simple formulae, graph work and measuring speed. This booklet will endorse good numerical practice at KS3.

Engineering as a career

The above activities will be supported by a range of visual activities taken from the lives of the team that makes up the EPSRC DUSC (Durham University Solar Car) project. Both starter and plenary materials are available on DVD. The DVD will explore the career skills of an engineer. More about the Durham teams work can be found at http://www.noisenet.ws/articles/index.php?cid=5&aid=191