Titan Lander

Teacher information

1 Pupils work in teams of 3 or 4.
2 No eggs to be available until the final test drop and then only one per team – even if failure occurs before launch!
3 'Value' eggs can be bought quite cheaply.
4 Even a modest height of 2-3m will break a dropped egg. If lots survive you will need to have timed each entry carefully to be sure of a fair winner.
5 If you have a bigger drop available, perhaps a stair-well, chocolate eggs can be used and assessed for crack damage.
6 Keep at least one of the bin liners for the landing site.
7 An awareness of budget constraints can be introduced either by using a points system eg each team can use up to 30 points for materials (brown paper 10 points per sheet, bin liner 20 points, sticky tape 5 points per metre, string 5 points per metre, newspaper 2 points per sheet etc).

Alternatively, translate each point into £100 000 and go for the cheapest design which lands safely. This could be a good option if you don't have an accurate stop-watch or if it isn't easy to have a formal judging session.

Hardness probe (penetrometer)
Available from Peter Chamberlain, 8 Kingsley Court, New Wanstaed, London E11 2SB.
Tel: 0208 518 8378 Fax: 0208 925 3663 Email: PtrChm@aol.com
Price £30 (no VAT)

Interface
The probes work with fast datalogging systems such as DrDAQ and other Pico Technology interfaces, Data Harvest's EasySense Fast and the Philip Harris datalogging system.

The DrDaq interface and software is available from Pico Technology Ltd. at £59 plus VAT.
(pico Technology Ltd., The Mill House, Cambridge St., St Neots, Cambs. PE19 1QB)
Find out more from the website www.picotech.com Look under 'Dataloggers', then 'More information' and 'Experiment ideas'. Choose 'Physics and DrDAQ' then 'Landing on a Saturn Moon' to find details of the use of the probe (penetrometer) for the Titan surface experiment.

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Using a probe and DrDAQ interface

First connect the probe to the interface and to the computer. Install the software following the supplier's instructions. Ask your IT support person for help if you are not sure how to do this. You may need to log on as Administrator with the requisite password so get this done in good time. Once loaded the software can stay in place so you don't need to install each time. The software turns your computer into an oscilloscope.

When you first open PicoScope, you should be sensing sound levels with the microphone.
Click on the relevant boxes and change to the following settings for probe use. When you click on Trigger you will get a message about crashing the system. Respond by clicking OK.
Set the options as follows:

10m/s	X1		A Volts B Off	X1 Off	C Off D Off	
O Stopped	Trigger	Single		Volts	Rising	200mv	--10%

Click on the grey space to the left of the word Trigger. A green 'Go' button will then appear. Click on this to start the experiment. The impact of the probe will trigger the trace. Repeat with the different samples.
Hint: If the interface scope screen freezes, try tapping the probe *gently* onto a hard surface.

You will need different surfaces to compare the output signals from the probe.
Use different size gravel, sawdust, soil etc in some pots – plastic flowerpots or empty plastic food tubs are fine. Cover with card so the contents are not easily seen and make a hole in the middle large enough for the probe to drop through. Four known samples for comparison and two or three unknown samples work well or else make all the samples 'unknown' and have reference traces available. Drop the probe from a standard height, for example 10cms.

It is possible to run this experiment as a complete investigation looking at the variables such as drop height, gravel size and texture, with opportunities for open-ended conclusions and lots of discussion. The probes are not suitable for use with liquids but it may be possible to use a range of soft material.

Notes and web addresses

- ESA is the European Space Agency, Both ESA and NASA have excellent websites with stunning images from space. Try www.nasa.gov./gallery/index.html
- You can find out how far Cassini has travelled on its 3.2 billion km journey by looking at the Cassini -Huygens website, www.jpl.nasa.gov/cassini/english/where/
- After travelling 3.2 billion kilometres, the mission should reach Saturn by July 2004. It hasn't gone directly to Saturn but has gained speed with assistance from gravity by flying by Venus (twice, in April 1998 and June 1999), Earth (August 1998) and Venus again (December 2000). These four gravity-assists have increased the speed of Cassini by 21 km/s so that it is travelling at 32 km/s - very,very fast.
- You can see video simulations of the mission including the landing of Huygens at www.jpl.nasa.gov/cassini/Movies/index.html or (same clips) www.jpl.nasa.gov/videos/solar_system/cassini.html
- There is a model of Cassini to make at www.jpl.nasa.gov/cassini/english/kids/simplemod.html
- Find out more about CLRC Rutherford Appleton Laboratory's involvement with Cassini-Huygens at http://sspg1.bnsc.rl.ac.uk/cassini.html and the Space Science and Technology Department (the largest space science department in Europe) more generally at www.sstd.rl.ac.uk
- There is an excellent resource pack called '**Mars in the Classroom'** developed by University College London Department of Geological Sciences with a grant from COPUS. Activities relating to Mars including impact cratering, volcanoes, chocolate rocks, Mars buggies and planning a complete mission to Mars. Some of these would be particularly relevant to 'Rocks and weathering' at KS3. The site also has a link to Sci-Kits, which gives details of free downloadable space models to make. www.ucl.ac.uk/GeolSci/MITC/
- The Particle Physics and Astronomy Research Council which funds much of the UK space programme has a good website and free posters for schools www.pparc.ac.uk/

Unknown samples for probe activity

1 sand
2 hard surface (marble)
3 sawdust
4 mousemat
5 big gravel
6 tiny gravel
7 crushed ice
8 soil

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