2. A model platform

Children build a model platform which must be a stable and rigid structure.

OBJECTIVES

- To build a model platform which meets specific criteria. To develop skills using construction kits, and learn about strong shapes.
- Using their observations and ideas to suggest answers to questions.

RESOURCES

- Pictures/posters of oil rigs and platforms
- Activity sheets 2 - 5
- Construction kits*
- Dowelling (approx. 30 cm lengths)
- Shoe box
- Camera (optional)

DISCUSSION

Begin by posing the questions:

- How do you think we can get oil from beneath the ground?
- What if the ground where we find oil is under the sea?

Show children Activity sheets 2 and 3, and any other pictures, posters or photographs you have which show oil rigs and platforms.

Activity sheet 2 shows an erect platform, and Activity sheet 3 shows a platform being towed out to sea, having been built on land. During discussion of the pictures, ask some of the following questions (see Background Information page):

- What is an oil platform for?
- How big do you think it is?
- Why is it so big?
- What is on top of the platform?
- How strong would it have to be? Why?
- What is it made from?
- How many legs has it got? Why?
- What is happening in the picture (Activity sheet 3)?
- Why is it being towed?

- Why is the platform built on land?
- What sorts of shapes can you see in the platform?
- Why do you think the platform has these shapes?

TASK

If children are not familiar with the chosen construction kits, they can begin with an exploratory session, in which they practice joining techniques and make use of the variety of components and tools available. This can also help loosen up tight joints on new construction kits[1].

Children are then challenged to make a platform on which the accommodation, represented by a weighted shoe box or similar, will be built.

The model must meet the criteria which are illustrated on Activity sheet 4 and listed below:

- Stands up by itself.
- Have long legs (to reach the sea bed).
- Not wobble (be stiff/rigid in all directions).
- Be strong, and able to support the weighted shoe box.
- You may decide to specify the weight that the model must hold, such as 5 or 10 class dictionaries.

Give the weights to the children at the start of the activity, so they can continually check the strength and stability of their model.

"Special needs children were able to use their practical skills to make models, which helped increase their self-esteem."

"Children enjoyed this challenge and worked enthusiastically on their models. Many models did 'wobble' at first, but children were keen to try out their models and modify accordingly"

1 Construction kits which allow triangular strengthening are most suitable for this activity. Brio Mec allows some strengthening of this nature. This is available from TTS Group Ltd Nunn Brook Rd, Huthwaite, Nottinghamshire, NG17 2HU
Tel: 01623 447 800 Fax: 01623 447999 Email: sales@ tts-group.co.uk

Note: Other resources, such as dowelling, art straws and rolled newspaper can also be used, but they require greater use of fine motor skills.

Have as many groups working on the challenge as resources will allow. For example, one set of Brio Mec will resource one group. Each group's model can be photographed, discussed and tested before it is dismantled. To test the models, place the shoe box on the top of structure. The shoe box will either contain the specified weight, or books will be added one at a time until the structure begins to sway or buckle.

VARYING THE TASK

The challenge can also be modified for each group, to maintain the children's interest and creativity, and for differing ability groups. Modifications can include:

- Specifying 3, 4, 5 or 6 legs.
- Specifying the incorporation of shapes (triangles, squares, rectangles).
- Specifying strengthening techniques (reinforcing sections, using triangular shapes).
- Specifying dimensions for the model, thus including measurement of length (standard or non-standard).

Activity sheet 5 shows a structure that has triangular sections incorporated. This can be used to support discussions with more able children about strengthening a structure. If these children did not add triangular strengtheners to their model, these can be added, tested and their effect discussed. Children can also evaluate the diagram and compare it with their own model. The plan view can be omitted for younger children.

Note: Not all construction kits can be used to add triangular sections. In these cases, children with developed fine motor skills can try to add pieces of dowelling or rolled newspaper to their structures.

Background Information

Note: *This information is provided as a reference for the teacher. Most of the information is too difficult for 5-7 year olds to understand. Some aspects can be discussed, though these must be carefully selected to provide simple and appropriate discussion points with the children.*

THE FORMATION OF OIL

Oil is formed from the remains of small sea animals and plants from 50 million years ago. Immense pressure and heat over time changes these tissues physically and chemically into crude oil and natural gas.

SEARCHING AND DRILLING FOR OIL

Nobody knows precisely where oil can be found.

Geologists gather information about rock formations to make intelligent deductions about possible locations, often under the sea. Exploratory drilling then takes place, using a drilling rig. This is a tall structure with suspended steel pipes and a strong steel drill bit. Once oil is reached (sometimes as deep as 6000 metres below the sea bed) the drilling rig is replaced with a production platform - a more permanent structure in which the crew will live and work.

The platform must be strong enough to support its community and buildings, and withstand the severest storm conditions at sea. The platform is therefore made from a combination of steel and cement.

The North Sea has many oil rigs and platforms which have been built on the North East coast of Britain, and then towed out to the place where oil production will begin.

Rigs used for exploration are quite different from those erected for long term oil extraction. There are also a variety of platform designs for extracting the oil, which depend on the sea and weather conditions. For example, floating platforms are anchored in very deep seas. Others can sit on the sea bed with the legs of the structure deeply embedded. 'Feet' for a platform can be used on dry land, but the force of the sea water would still move the platform about in the water. For the children's activities, distinctions between different types of platforms are not made.

The rate of drilling depends largely on the hardness of the rock. In ideal conditions up to 60 metres an hour can be achieved; whereas extremely hard rock can reduce this rate to 60 metres in 24 hours. A typical drill bit varies in diameter from 30 to 60 cm, depending on the drill hole and depth. In very deep holes, the diameter of the drill bit can be as small as 12.5 cm. The bit has many individual teeth which are made from steel that has been toughened by adding chips of tungsten carbide. For exceptionally hard rock, the teeth are toughened using diamond.

To weigh down the drill bit, 'collars' are used. These are each 9 metres long and weigh 1.5 tonnes. Up to 20 in a 'string' can be added. Replacement of a worn drill bit can take 24 hours - 12 hours to bring it up, and 12 to take it down again.

WORKING ON A PLATFORM

100-200 people can work on one platform, though small or 'satellite' platforms have less. Due to the difficult travelling to and from work, most staff work 1-2 weeks on the platform, followed by 1-2 weeks on shore. People usually travel by helicopter, whilst supplies can travel by boat or helicopter. One helicopter typically transports 20 people.

The platform functions as a small community, so jobs vary widely, as in a village or town. As well as the production, maintenance and drilling team, there are cooking staff (head chef, baker, cooks, and stewards), cleaning staff, medical staff, radio operators, etc.

A typical weekly 'shopping list' for the platform crew includes:

100 kg butter	500 kg vegetables
350 kg flour	1,000 kg meat
500 kg fruit	2,000 litres milk

In addition to this food, a fresh supply of water must always be available. For this reason, a platform has its own desalination plant which converts sea water into fresh water. A typical demand for fresh water can be 30,000 litres per day!

TRANSPORTING THE OIL

Tankers are used to transport oil around the world. They are categorised according to the quantity of crude oil they carry. Very large crude oil carriers (VLCCs) can carry 300,000 tonnes, whilst the cargo of ultra large crude oil carriers (ULCCs) can be 500,000 tonnes. The largest tankers are 400 metres long - approximately 5 football pitches placed end-to-end. Often the crew use bicycles to travel around the ship.

These ships are too large to travel through the Suez Canal, and so their route from the Middle East to Europe takes them around the Cape of Good Hope. This journey takes 60 days, rather than the 40 days needed to travel through the Suez.

The oil is carried in several compartments in the ship. As a cargo is unloaded (in order to maintain the ship's stability) the compartments are filled with water for the return journey.

Smaller coastal tankers sail between refineries, and usually carry loads of 20,000 tonnes or less.

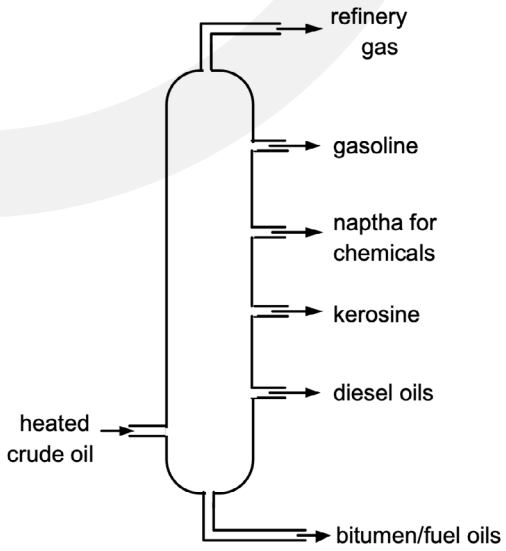
In addition to tankers, pipelines are used to carry crude oil from platforms in the North Sea to shore. Oil can be transported from several platforms to the shore by one pipeline. Pipelines are also used within the UK to transport oil products, such as petrol, to large consumers and distribution centres. For example, nearly 90% of Esso oil and gas products are transported by pipeline. A network of 1100 km of pipelines runs from the Esso refinery near Southampton to centres such as Manchester, London, Birmingham and Gatwick Airport. It is the safest means of transportation, as spillages are rare. It is also environmentally friendly, as pressures on road transport are reduced, and the only visible signs of the pipeline are small markers along its length - similar to those seen on street corners for gas pipelines.

The pipeline consists of sections of steel pipe welded together. When being laid, the newly-welded joints are cleaned, X-rayed, wrapped and waterproofed before the pipeline is covered over. To ensure no leakage occurs, the entire pipeline is regularly tested by running high pressure water through its length.

Road tank vehicles are used to carry oil products to smaller distribution centres, such as petrol stations, and to some customers. These tankers can weigh 38 tonnes and carry 35,000 litres of petrol, though smaller vehicles are used for less accessible places.

SEPARATING CRUDE OIL

Crude oil is a mixture of components which can be separated by heating. This process is called 'distillation'. The process relies on the fact that each component in the mixture changes from a liquid to a gas at a different temperature. The crude oil mixture is heated up to 400°C before being passed into a tall tower (about 80m high). Some of this mixture is now a liquid, but most of it has turned into gases. As the mixture enters the tower, the liquid falls to the bottom, and the gases rise up the tower. As the gases rise they cool down, and one by one they become liquids. As each gas becomes a liquid, it is drawn away from the tower by pipeline. The diagram overleaf shows the main components of the mixture. These components are often further distilled, or refined, to provide a wider range of products.



USES OF OIL

In the 1860s the main use of oil was as a fuel for domestic lighting (paraffin lamps). However, the demands for lubrication grew as industry developed, for lubricating wheels, pulleys and engines. In the 1960s the main use was for producing heat. Today, the main demands on oil are fuels for transportation, a wide range of lubricants, and for the production of chemicals.

A variety of oil products provide fuels, such as aviation fuels, diesel oil and petrol. Each product is tailor-made for its use, be it a heavy grade of fuel oil for use in ships, or kerosene used to heat large buildings such as hospitals, or liquefied petroleum gas (LPG) for camping gas stoves. In many countries these fuels are also used for cooking.

Similarly, products for lubrication vary - from a fine clear liquid to thick grease for the rollers in a steel mill. Paraffin wax is extracted from oil during lubricant manufacture. It is used to make candles and waxed containers for packaging.

Fine oils and greases are used in cosmetics and medicines.

Bitumen is used for road surfacing and for waterproofing roofs, dams and tunnels. This list is not exhaustive, and oil products are found in many applications - such as plastics, ointments, polishes and a wide range of chemicals. In the children's activities the distinction between crude oil and its many products is not made. It is sufficient to say that crude oil is changed in 'factories' (oil refineries) to make many types of oil and products.