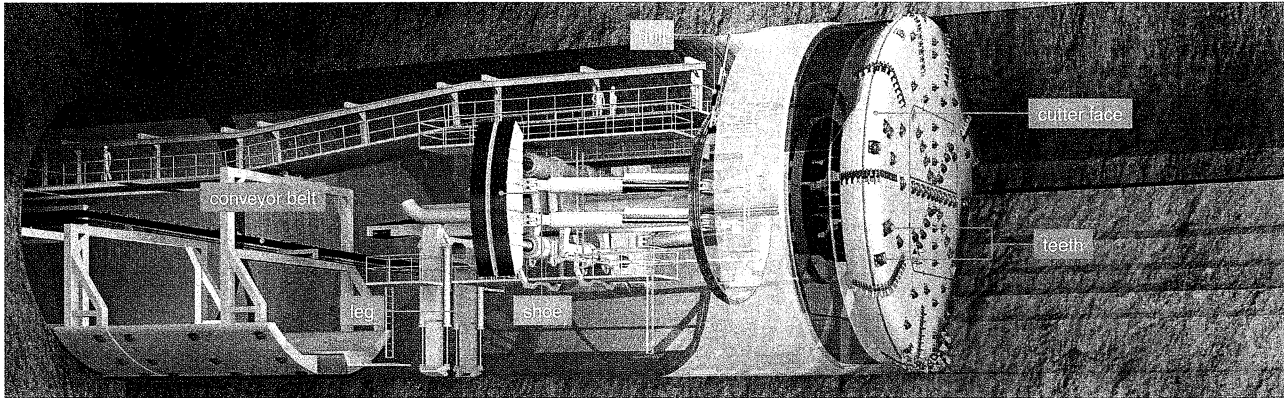



1 Infrastructure



Start here 1 What is this? What does it do? How does it work? Discuss with your partner.

Listening 2  12 Listen and complete the specifications chart.

Reading 3 Read this article and put these headings in the correct place.

MB471/316 Tunnel Drill Specifications

Length	
Diameter	
Speed	
Manpower needed	
Cost	

Collecting the rocks Controlling the movement Moving the cutter
Cutting the rock surface Strengthening the roof Supplying the electricity

THE MB471-316 TUNNEL DRILL - one of the largest hard-rock drills in the world

1 _____
The face of the cutter has 85 teeth. Each tooth is 60 cm long. The cutter face rotates about seven times a minute. When it rotates, the teeth cut large circles into the surface of the rock.

2 _____
Pieces of rock fall to the ground. They are collected by large scoops. They are then dropped into chutes. When the cutter face rotates upwards, the rocks fall onto conveyor belts. They are then carried to the rear of the machine.

3 _____
Hydraulic cylinders push the body of the cutter slowly forwards. As it moves forwards, steel shoes move outwards and grip the tunnel walls. At the same time, two legs push down and lift the machine off the floor.

4 _____
Fifteen electric motors supply the machine with 6,375 horsepower. The power is connected to the cutters by means of a 13,800-volt cable.

5 _____
There are two drills attached to steel arms. These are located immediately behind the cutters. When the machine moves forwards, holes are drilled into the roof of the tunnel. Then the holes are filled with bolts and cement. This strengthens the roof.

6 _____
The machine operator sits in a cabin at the heart of the machine. Here he/she controls its speed and direction. Video cameras monitor the cutter and the tunnel.

Vocabulary 4 Make a list of all the names of parts of the body and clothing in the text in 3.

5 List other technical contexts where the items in 4 are used.

Example: 'teeth' are also found on gears.

Language

In an active sentence, the subject = the agent. The subject does the action.

Subject = agent	Active verb	Object
Hydraulic cylinders	push	the cutter.
Large scoops	collect	the rocks.

In a passive sentence, the subject is NOT the same as the agent. The subject does not do the action. The agent does the action to the subject.

Subject	Passive verb		Agent
	be	Past participle	
The cutter	is	pushed	by hydraulic cylinders.
The rocks	are	collected	by large scoops.

- 6 Change this set of instructions into a description of a process, using the passive and the words in the box.

finally first next now then

How to change the oil in a car

1 Run the engine for a few minutes.	5 Put the oil drain plug on
2 Switch off the engine.	6 Take off the oil filler cap.
3 Take off the oil drain plug.	7 Pour in the new oil.
4 Empty the old oil into a container.	8 Put the oil filler cap back on.

Begin: First the engine is run for a few minutes. Then it is switched off. Now the ...

- 7 Make a set of instructions about a process you know about. Then rewrite it as a process description in the passive.

Examples of processes: food manufacture, steel making, canning, assembling computer components, manufacturing a CD, dairy processing.

- 8 Fill in the gaps, using the correct form of the verbs in brackets.

- 1 Large drills _____ (make) holes in the roof of the tunnel. Then the holes _____ (fill) with bolts and cement.
- 2 A large propeller _____ (push) the hovercraft forwards. The propeller _____ (drive) by a powerful engine.
- 3 Hot water _____ (flow) from the engine into the radiator. Here it _____ (cool) by the fan.
- 4 The robot _____ (monitor) by a computer. This computer also _____ (control) all the other robots in the building.
- 5 First, the rusty machine parts _____ (bring) into the factory. Then they _____ (clean). Then the rust _____ (remove). Next the parts _____ (paint). Finally, they _____ (take) out of the factory again.

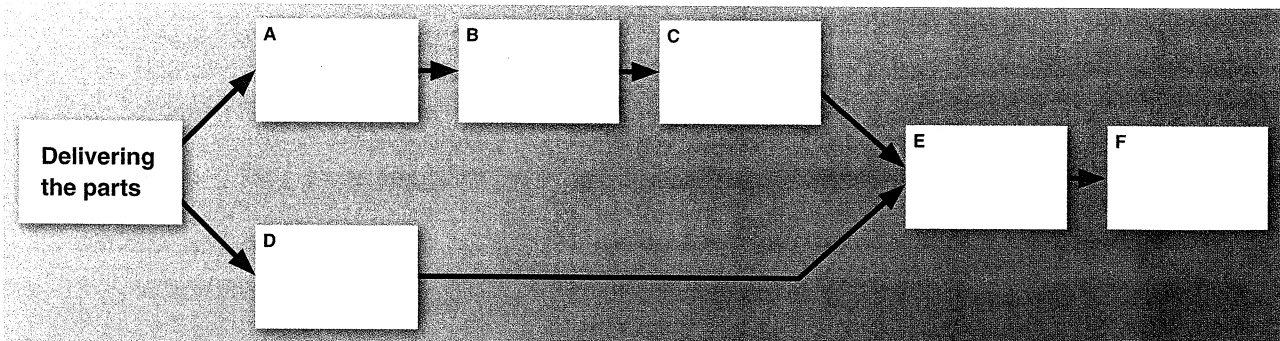
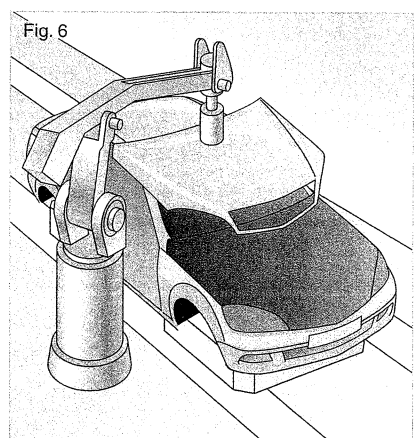
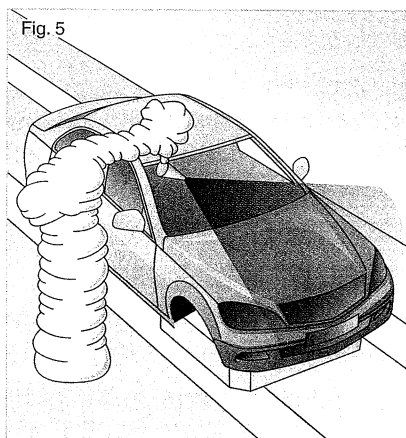
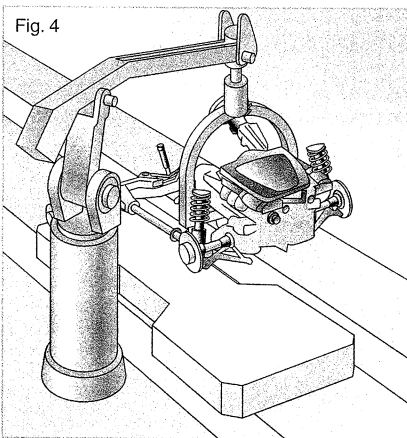
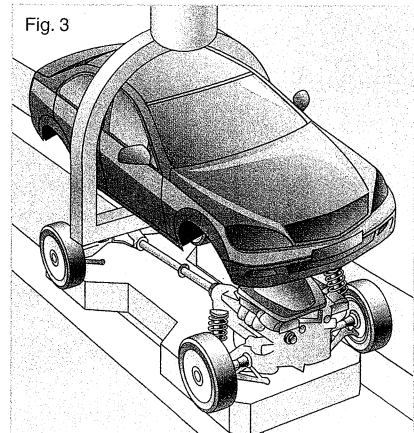
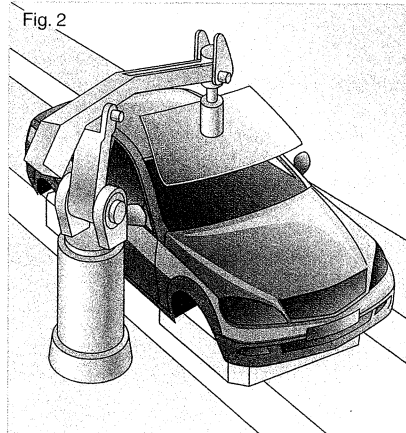
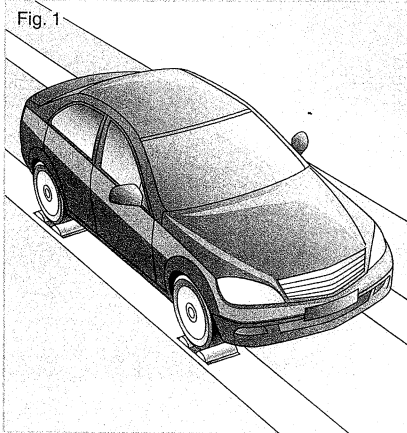
- 9 Make a list of headings for the main stages of a process you know about. Make each heading begin with a verb ending in **-ing**, like the ones in 3.

Example: Moulding and shaping steel – 1 Melting the steel; 2 Casting; 3 Cooling; 4 Rolling the steel; 5 Straightening; 6 Cutting.

- 10 Give a short talk to the class explaining your process. Use your headings.

2 Manufacturing

- Start here**
- 1 What do you know about cars? Discuss with a partner the location and function of these parts: *body, chassis, drive shaft, axle, transmission.*
 - 2 The photos show the main stages in assembling a car, but they are in the wrong order. Write the figure numbers in the correct boxes in the flow chart.



- 3 Make captions for the six photos with the verbs and nouns in the box. Use verbs ending in *-ing*.

add attach install paint test weld body chassis finished car parts

Example: Fig 6. Welding the body panels to the body frame.

Reading 4 Read this website of a car company and check your answers to 2 and 3.

Assembling a car

First, the parts are delivered by truck or rail to the *delivery area* of the car assembly plant. From here, some parts are taken to the body shop, and other parts are transported to the chassis line. The parts are carried around the plant by forklift trucks or conveyor belts.

In the *body shop*, the panels are welded to the frame to form the body of the car. This is done by more than 400 robots.

Then the body is taken to the *paint shop*. Here it is cleaned and painted by robots. Special clothing is worn by the robots to protect the paint. After this, the body is checked by human workers to look for faults.

Next, the painted body moves along a conveyor belt to the *trim line* and many parts are added to it. For example, the instrument panel, the air conditioning system, the heating system and the electrical wiring are all installed here. The windscreen is inserted by robots using laser guides.

Meanwhile, in the *chassis line*, components are added to the chassis. First, the chassis is turned upside down, to make the work easier. Then the fuel system, the transmission, the suspension, the exhaust system, the axles and the drive shaft are all installed. Next the chassis is turned over (rightside up). The engine is lowered into the chassis and connected to it.

Now the chassis and the body move simultaneously to the *final assembly line*. Here the body is attached to the chassis, and all the final parts are added. The tyres and the radiator are added here. The hoses are connected, and the radiator and air conditioner are filled with fluid. The car's central computer is also installed here.

Lastly, the finished car and all electrical systems are tested. The car is filled with fuel and the engine is started for the first time. The car is put on special rollers to test the engine and the wheels. If it passes the test, the car is finally driven out of the assembly plant.

Language *to + verb* is used to talk or write about the purpose of an action.

*Why do you paint the car body? To protect it from rust.
The car body is painted to protect it from rust.*

Speaking 5 Match actions with their purposes. Refer to the text in 4.

- | action | purpose of action |
|---|--|
| 1 workers weld thin metal sheets to a frame | a) to check the movement of the wheels |
| 2 they turn the chassis upside down | b) to make the car body |
| 3 the robots wear special clothes | c) to inspect it for faults in the paint |
| 4 they turn the chassis rightside up | d) to protect the wet paint from dust |
| 5 workers put the finished car on rollers | e) to install the fuel system easily |
| 6 workers check the car body by hand | f) to lower the engine into it |

6 In pairs, ask and answer the questions in 5. Use the passive form in the question.

A: *Why are thin metal sheets welded to a frame?*
B: *To make the car body.*

7 Ask questions to get these answers. Refer to the text in 4.

- 1 They're delivered by truck or rail.
- 2 They're welded together in the body shop.
- 3 They're carried by forklift trucks or conveyor belts.
- 4 To look for faults in the paint.
- 5 It's done by human workers.
- 6 It's done using laser guides.

3 Communications

Start here 1 What do you know about communications satellites? Do this quiz with your partner. All the numbers are approximate.

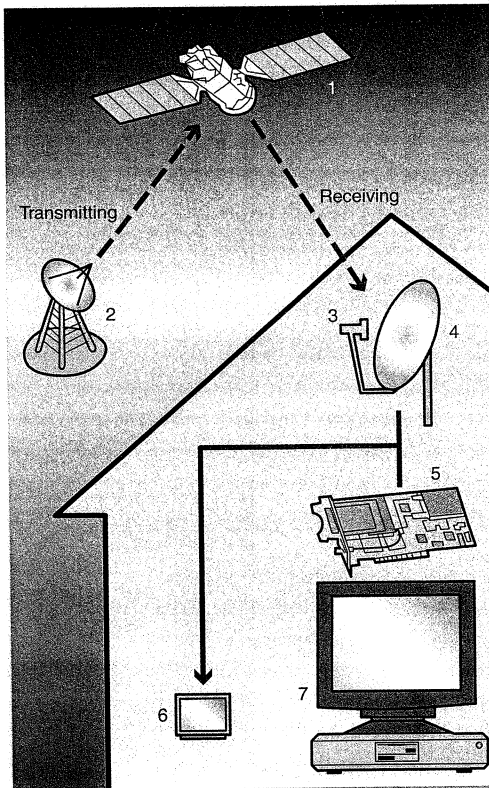
- 1 How high are communications satellites above the Earth?
a) 15,000 km b) 25,000 km c) 35,000 km d) 45,000 km
- 2 How fast do these satellites travel around the Earth?
a) 7000 km/h b) 11,000 km/h c) 15,000 km/h d) 21,000 km/h
- 3 What frequency are signals from a communications satellite to your satellite dish?
a) 12 GHz b) 1 GHz c) 500,000 MHz d) 5000 MHz
- 4 What frequency are the signals from your satellite dish to your TV?
a) 150 MHz b) 1500 MHz c) 15,000 MHz d) 150,000 MHz

Scanning 2 Practise your speed reading. Look for the information you need on the SPEED SEARCH pages (118–119). Try to be the first to complete this task.

Task: Check your answers to the quiz in 1.

Reading 3 Read this instruction leaflet and label the diagram with the words in the box.

computer dish DTV card feed horn satellite TV TV station



How to receive satellite digital video broadcasts

Equipment needed

You will need a computer with a DTV (digital TV) card.

- 5 This is connected by cable to a satellite dish, which should be between 60 cm and 1.8 m in diameter. The dish must have a feed horn. This converts high-frequency signals to low-frequency ones.

How it works

- 10 There is a communications satellite in orbit high above the Earth. TV programmes are transmitted from TV stations up to the satellite, which then sends the signals down to Earth. These signals have a high frequency of several GHz.

- 15 Your dish receives the high-frequency signals and reflects them to the feed horn, which then converts the signal into a lower frequency.
- 20 The feed horn is connected via a cable to the DTV card, which processes the signal. It extracts the video and audio, and plays them via the PC monitor and speakers.

4 What does **which** refer to in the text?

- | | | |
|-----------|------------------|-----------------------|
| 1 line 5 | a) the cable | b) the satellite dish |
| 2 line 13 | a) the satellite | b) the TV stations |
| 3 line 17 | a) the frequency | b) the feed horn |
| 4 line 20 | a) the DTV card | b) the feed horn |

via = by means of

Language

Signals are transmitted to	the satellite. The satellite	then sends the signals to Earth.
	the satellite, which	

John reports to	Adel. Adel	is the training manager.
	Adel, who	

5 Join these pairs of sentences. Use *who* or *which*.

- 1 My computer has a DTV card. This is connected by cable to my satellite dish.
- 2 If your DTV card doesn't work, contact our technician. He will repair it.
- 3 The dish reflects the signal to the feed horn. This converts the signal to a lower frequency.
- 4 Please send any complaints to our customer service manager. She will then contact you.
- 5 The radio station sends signals to the satellite. This then transmits the signals to my dish.
- 6 My DTV card extracts the audio and video. These are then displayed on my PC monitor.

Example: 1 My computer has a DTV card, which is connected by cable to my satellite dish.

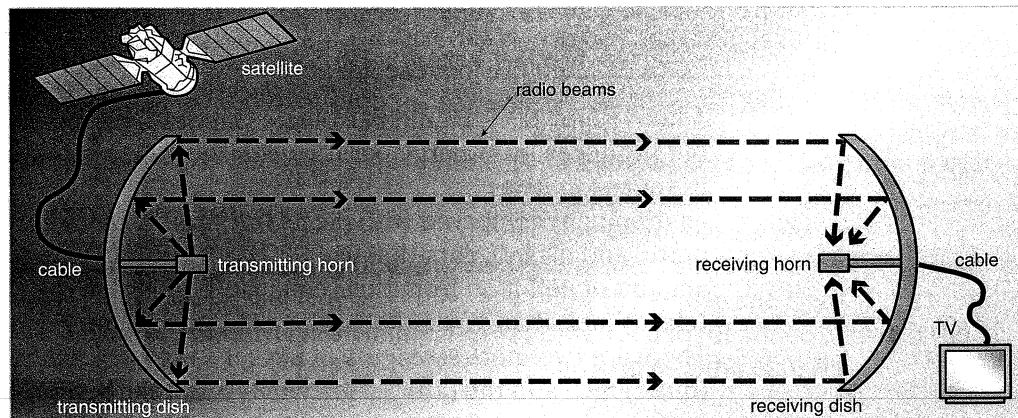
Vocabulary 6 Match words with the same or similar meaning.

transmit	receive	convert	get	send	take out
extract	display	operate	change	work	show

7 Complete the sentences. Notice the hyphens (-).

- 1 The signal has a high frequency. It's a high-frequency signal.
- 2 This pump uses high pressure. It's a _____ pump.
- 3 The fuse breaks at 13 amps. It's a 13-amp fuse. (Note: amps → amp)
- 4 The cable carries 13,800 volts. It's a _____ cable.
- 5 My satellite dish is 1.8 metres wide. It's a _____ dish.

Speaking 8 Draw a simple diagram and make notes about a setup you know about. If you prefer, use this satellite dish setup and make notes about the diagram.



9 Describe the setup and explain to the class how it works.