PART ONE

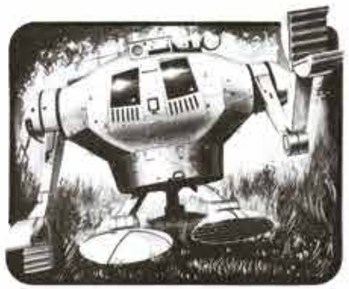
ROBOTS

SCIENCE & MEDICINE INTO THE 21ST CENTURY

Robot explorers

Already, automatic spaceprobes have landed on, or flown by, most of the planets in the Solar System. In the future, robot exploration teams like the one shown here could prepare the way for humans to follow. In this picture a group of robots is erecting the domes of a planetary base. By the time the human explorers arrive, their quarters will be warmed and ready to live in.

To the right, you can see a three-legged robot of a type which might be used for long-range reconnaissance.



INTRODUCTION

In the first section of this book, you can see some of the ideas which scientists are suggesting as ways to solve problems such as the energy crisis and global pollution.

Robots, which form the central theme, will help mankind run an increasingly complex world. Few of these machines, using advanced computers systems as their 'brains' will look like the popular image of a robot, a machine in the shape of a person. The real robtos will come in all shapes and sizes, according to the job they are designed for. An arithmetic robot of today, for example, does not look like a maths teacher – it is small, rectangular and its 'face' has buttons on. It is called an electronic calculator.

The word 'robot' comes from the Czech word 'robota' meaning 'labour'. The name was used in a 1920 play called R.U.R. – Rossum's Universal Robots, in which mass-produced robots in human form turn on their creators and exterminate them.

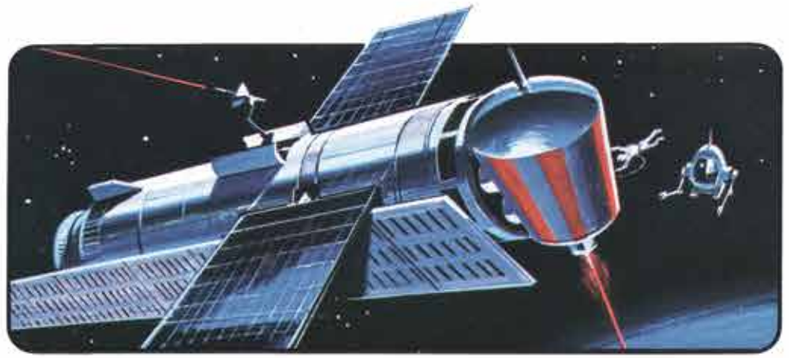
Since then, many stories have been written about warlike robots. If you count the guidance computers aboard nuclear missiles as simple robots, then those stories have, in part, come true.

LOOKING AFTER OUR WORLD

The best place to keep a watch over the Earth is from space. Satellites are already used to monitor Earth's vital natural resources and in the future their role will become even more varied and important.

'Eyes in space' can keep track of air and sea pollution and give advance warning of floods, drought and forest fires. By using special photographic equipment, pictures can show if crops are diseased or healthy.

There are thousands of man-made objects in orbit. Already space agencies have to plan carefully if they wish to put satellites into popular orbits. In the future, a rationing system may be set to avoid collisions.



▲ This 14-tonne satellite, which could be in orbit by 1985, is designed to observe pollution and resources. It has two lasers – one above the solar cell 'wings' for communication with other satellites; the other, pointed downwards, is used to check the distance between the satellite and the Earth, enabling the satellite to detect, for example, changes in water level for flood detection and control. The laser distance-checker would be sensitive enough to detect changes of as little as 30 cm.

▲ This colour picture shows fields of potatoes. Some of the crop has been affected by blight – diseased potatoes show up black. Satellite views can sometimes detect disease even before the farmer standing in his field.

▲ Forest fires cost thousands of millions of dollars a year in the USA alone. Satellites in orbit could detect and provide early warning of forests aflame. In this picture you can see a four-legged walking fire-fighting robot of the future attacking an outbreak with fire-smothering chemicals. Machines like this, alerted by satellite, could reduce the cost – and danger to life and property – of forest fires. The walking design would enable the robot to fight fires in all sorts of awkward places.

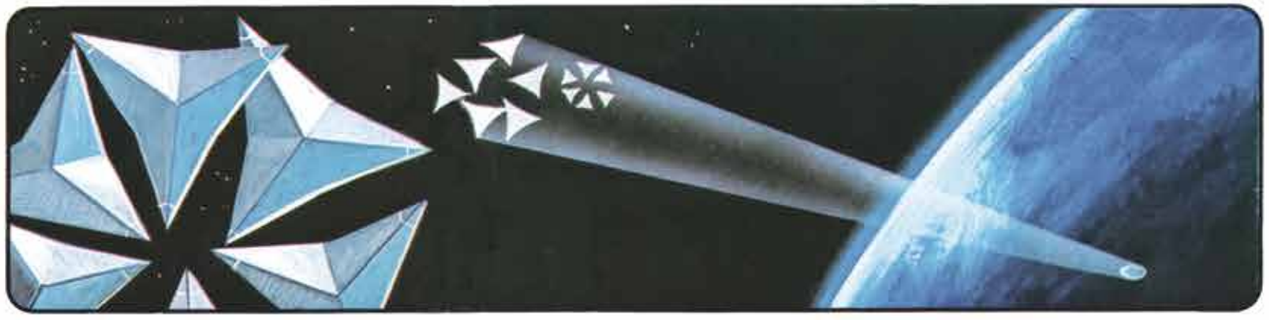
▲ Nearly 36,000 km above the equator, the Meteosat, put in orbit by the European Space Agency, provides a world weather watch. This picture, which shows Africa and South America, was taken on 9 December 1977. Satellites have provided the first means of reliable weather forecasting, even if only – at present – for very short periods ahead. In the future, long-range forecasting should become possible, though reliable ones of just a week ahead would make a good start.

▲ This satellite, shown being serviced by an astronaut-engineer, has a laser to measure the small movements in the Earth's crust which are early indicators of earthquakes. This one is focused on a reflector embedded in the ground near the San Andreas fault in Southern California, USA. This zone, which has had major earthquakes before, is a prime candidate for a serious upheaval in the future. Early warnings provided by satellite could save thousands of lives and millions of dollars.

▲ Early warnings, provided by satellites like the one on the left, would enable rescue teams to move quickly into disaster areas. In this picture, a Red Cross hoverjet swoops low over a doomed city to pick up survivors as buildings rock and crumble. The hoverjet is held aloft by four propellers, shrouded in circular ducts. For forward flight, the ducts swivel through 90 degrees to speed the craft to the nearest hospital. Its maximum speed would be about 450 kph.

▲ Finding places where water may be found is vital in countries affected by drought and famine. Even present-day satellites like Landsat can detect underground water sources and places where crops can grow in desert areas.

▲ Satellites can detect clouds of locusts and other similar insects as they swarm from their breeding grounds. Early warning alerts help pest-control teams wipe out the insects (a locust is shown above) before they totally destroy the crop.



▲ These triangular satellites, each one 300 metres across, are in fact giant mirrors made of reflective aluminium foil. They are designed to focus sunlight onto the nightside of the world. The mirrors' beams could be switched from place to place, wherever light might be required. On the ground, the mirrors would look like bright stars. The light provided would be about 100 times that of the full moon on a clear night, or about the same as the light level between lamp posts in a present-day city. Uses for such a system are varied. In a big power-failure, for example, they could be used to illuminate blacked-out towns and cities. They might be used to provide cheap lighting for major road junctions.

▲ This picture shows another use for space mirrors – illuminating fields for farmers to get the harvest in on time. As you can see, although there is enough light to work by, the sky remains completely dark with the stars out as usual.

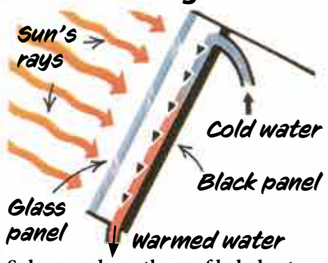
A HOUSE OF THE FUTURE

The features of this house, based on studies by the American space agency NASA, could well be found on most new houses built in the future.

The style of the house is only one architect's idea – around the world the basic 'look' would change according to local tastes.

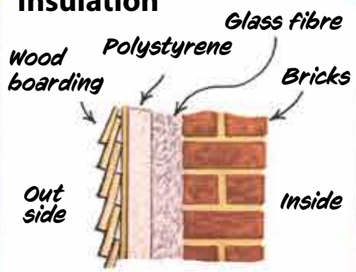
Size too, would vary according to the amount of money available. The house shown is a large one with a separate garage for an electric car, but even a one-bedroom house could share many of the energy saving design features.

Solar heating



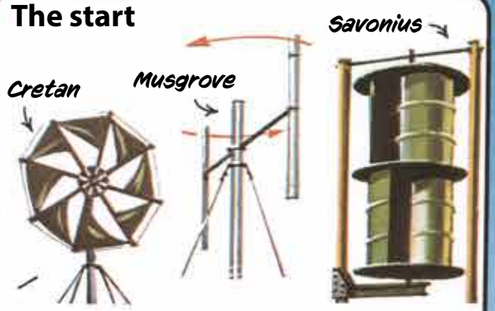
Solar panels on the roof help heat water for the house, saving energy. The panels take the chill off the mains water before an ordinary immersion heater boosts it to hot-bath temperatures.

Insulation



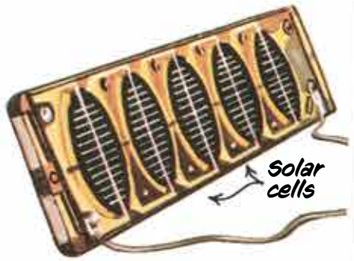
Latest studies indicate that really good insulation (just one type is shown above) can save huge quantities of energy. Energy savings mean that oil is saved, putting off the day when supplies run out.

The start



Three types of windmill are shown above, with a fourth in the picture. They could, in theory, provide a lot of electricity. They are scarcely attractive though, and a forest of windmills would be about as good-looking as electricity pylons.

Sunshine power



Solar cells are flat panes of silicon material which convert the energy in sunlight into electricity. A panel like this could help charge the car.

Self-sufficiency

Many countries have to import vast amounts of food. Tomorrow's towns could have lots of areas for people to grow food on. A house like this one, with its own garden, has lots of vegetable growing space. New seed varieties should ensure that even amateur gardeners get a good crop.

TV, radio and telephone reception will increasingly be via space satellites. Dish aerials like this could well be a common sight on rooftops of the 1990s.

Crime prevention should be a major concern for the 1980s and '90s. This lock is computerised – it scans and recognises the fingerprints of members of the family who have been 'keyed' into the computer's memory bank.

Cheap transport

Bicycles ought to be the most popular form of personal transport in tomorrow's towns. A bike equipped with a 'regenerative braking' dynamo should be useful. Its dynamo converts braking energy into electricity. The power would help the rider pedal up hills via a battery/electric motor system.

Many home functions will be controlled by the home computer, including alarm calls, breakfast preparation, lighting-up and, as shown here, lift-up doors on the garage. They open as the car approaches – the computer recognises a codetab attached to the car.

Electric car

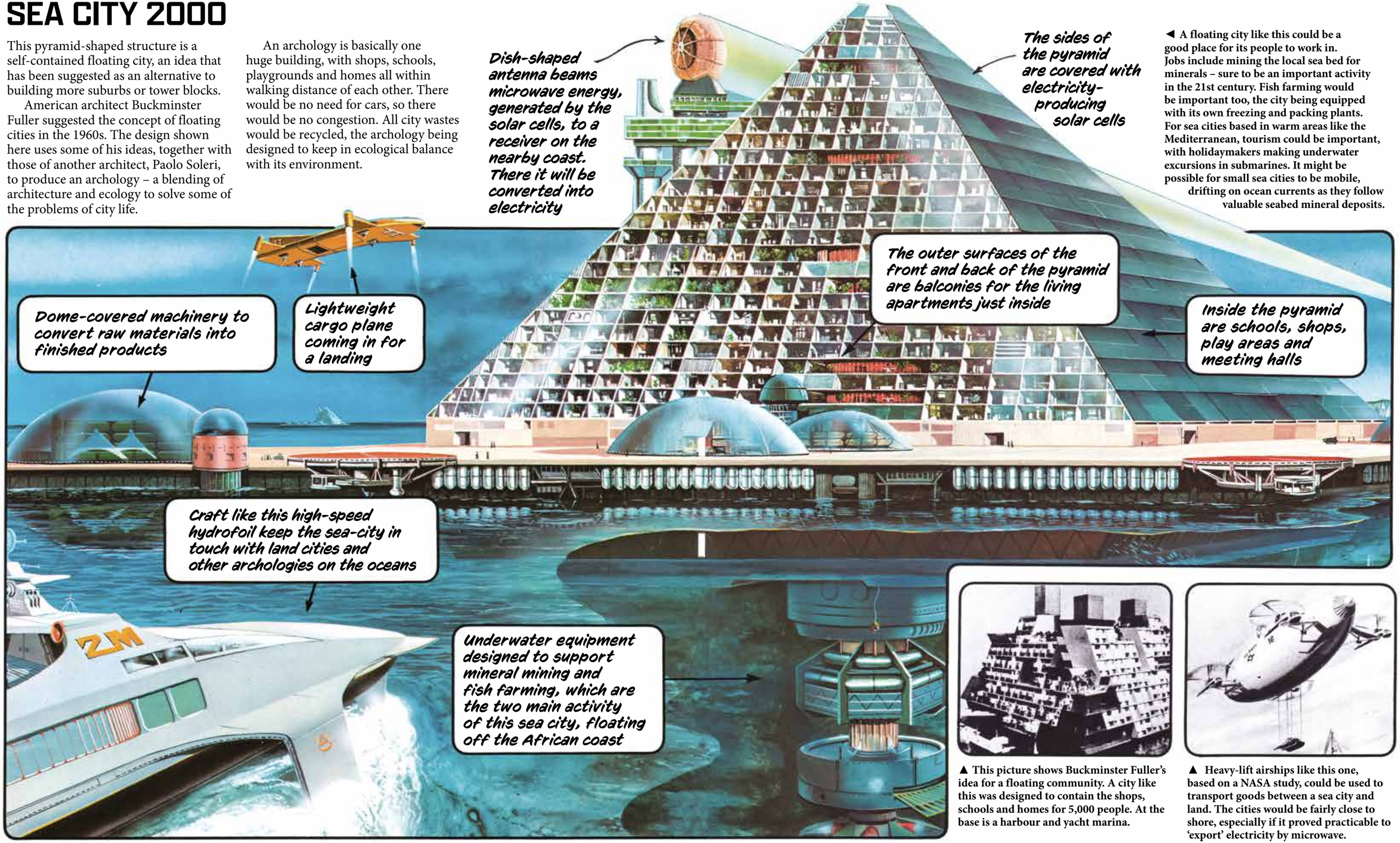
Small vehicles will probably be electric powered: petrol will be an increasingly rare and valuable commodity in the world of tomorrow.

SEA CITY 2000

This pyramid-shaped structure is a self-contained floating city, an idea that has been suggested as an alternative to building more suburbs or tower blocks.

American architect Buckminster Fuller suggested the concept of floating cities in the 1960s. The design shown here uses some of his ideas, together with those of another architect, Paolo Soleri, to produce an archology – a blending of architecture and ecology to solve some of the problems of city life.

An archology is basically one huge building, with shops, schools, playgrounds and homes all within walking distance of each other. There would be no need for cars, so there would be no congestion. All city wastes would be recycled, the archology being designed to keep in ecological balance with its environment.



◀ A floating city like this could be a good place for its people to work in. Jobs include mining the local sea bed for minerals – sure to be an important activity in the 21st century. Fish farming would be important too, the city being equipped with its own freezing and packing plants. For sea cities based in warm areas like the Mediterranean, tourism could be important, with holidaymakers making underwater excursions in submarines. It might be possible for small sea cities to be mobile, drifting on ocean currents as they follow valuable seabed mineral deposits.

▲ This picture shows Buckminster Fuller's idea for a floating community. A city like this was designed to contain the shops, schools and homes for 5,000 people. At the base is a harbour and yacht marina.

▲ Heavy-lift airships like this one, based on a NASA study, could be used to transport goods between a sea city and land. The cities would be fairly close to shore, especially if it proved practicable to 'export' electricity by microwave.

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STAR TRAVEL

GLOSSARY

ALIEN Stranger or foreigner. In this book, the word refers to creatures from other planets.

APOLLO Spaceship that took astronauts to the Moon between 1969 and 1972.

ASTEROID BELT Thousands of rocks, verying in size from a pinhead to hundreds of kilometres across, orbiting in space mainly between Mars and Jupiter.

BLOOD CLOTTING Thickening of blood that happens when the skin is cut. As the blood solidifies, it seals the cut.

CARBON FIBRE Very light, very strong material used at present in, for example, the fan blades of some jet engines.

CB SET Citizens' Band radio. Used, especially in the USA, by car and truck drivers to talk to each other from inside their vehicles, swapping information on road conditions.

COMET Comets are balls of ice, dust and rock, drifting in huge orbits around the Sun. Some develop tails milions of kilometres long as they near the Sun. The tails are long streamers of gas, resulting from frozen gases boiling from the heat of the Sun.

GALAXY Giant cluster of stars. Our own galaxy, the Milky Way, contains about 100,000 million stars.

HELIUM Gas used in modern airships. Unlike hydrogen it will not catch fire.

HYDROFOIL Ship with underwater wings, called foils, which raise the hull out of the water at speed.

INDUSTRIAL REVOLUTION Period in the 18th and 19th centuries during which powered machinery started to replace human and animal muscle power.

INTERSTELLAR The space between the stars. The word comes from the Latin 'inter' – between, and 'stella' – star.

ION DRIVE System of powering spacecraft using electrically charged particles to provide thrust.

LASER Intense beam of light, used for a variety of purposes, such as cutting, welding and as a replacement for some types of radio communication.

MICROWAVE A form of radio wave. Can be used as a power beam – a receiving antenna converts the energy in the beam to electricity.

MODULAR Device made up of various parts, modules, which fasten together. The different modules can be easily changed or rearranged.

MONORAIL Train which runs on one rail instead of two.

POLLUTION Literally, waste in the wrong place, causing unforeseen side effects, usually hazardous to health.

SENSOR Device to 'sense', or gather information about its surroundings.

SOLAR CELL Flat pane of silicon material which converts the energy in light to electricity.

SOLAR PANEL Glass-fronted black panel, mounted to face the Sun. The Sun's heat warms water flowing through tubes inside the panel.

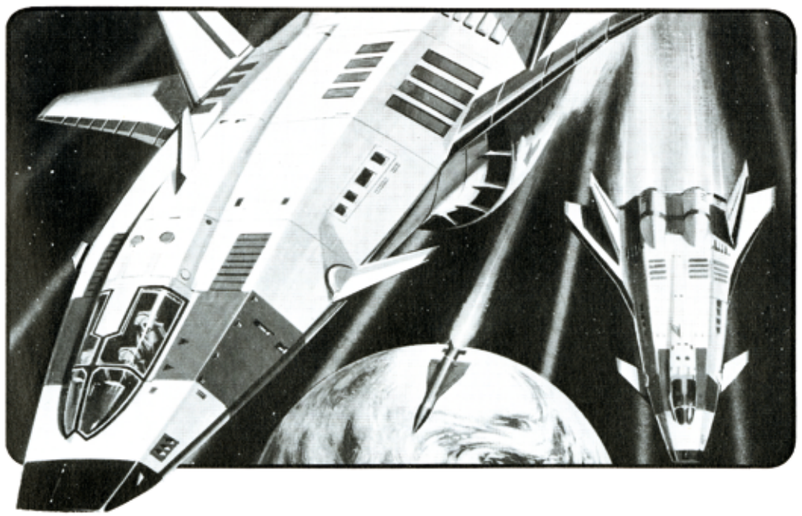
SPEED OF LIGHT Just under 300,000 kilometres a second. A light year is the distance light travels in a year.

WANKEL ROTARY ENGINE Type of engine in which, unlike an ordinary car engine where the pistons move up and down, a triangular piston spins round in a chamber.

ZERO-G Weightlessness, as felt in deep space or in orbit.

Computer counting answer

The word is JAB. It has been programmed into binary using the system 1 = A, 2 = B, and so on. People can use different coding systems (called programmes) depending on the problem they are working on.



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