VISIBLE SOLAR SYSTEM

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INSTRUCTIONS FOR USING VISIBLE SOLAR SYSTEM

You are the commander of a spaceship on a journey through our Solar System. The ship has a cruising range of over 1 billion miles and is packed with computerized equipment to help you bring home new and exciting discoveries.

Turn off your computer and install the Visible Solar System cartridge. When you plug in the Visible Solar System cartridge you will see a model of Mercury, Venus, Earth and Mars revolving around the Sun. Notice that the planets move in neatly ordered and nearly circular orbits around the Sun. A second feature of your ship will soon appear — a close view of the planet Earth and a few facts about its size and motion. You will be able to visit other planets of the Solar System as you continue on your trip. WHEN YOU SEE PRESS F1 TO START ON YOUR SCREEN PRESS F1 TO BEGIN.

NAVIGATION

This is your space flight control panel. It lets you monitor and change the position of your spaceship. From the center of screen outward are the orbits of Mercury, Venus, Earth, Mars and Jupiter. The associated numbers show the distance of the orbits of these planets in hundreds of millions of miles from the sun. The present position of your spaceship is shown in red. On the left top of the screen you see the altitude of the ship in millions of miles above the orbits of the planets.*
ANY TIME YOU WISH TO RETURN TO THIS SCREEN PRESS 'O' (ORBITS).

*Imagine the orbits neatly drawn on a piece of paper. The altitude is the distance of the spaceship above the paper.

Your ship is equipped with a rotating view camera which shows you the orbits and movement of the planets in three dimensional perspective as seen from the ship. The angle at which the camera is pointing is shown on the lower left of the screen. The little blue target shows you where the camera is pointing. An angle of 0 means the camera is looking straight down from the ship. As the angle increases the camera is being slowly tilted forward. When it reaches 80 it will be looking almost directly ahead of the ship.
TO VIEW THE ORBITS OF THE PLANETS FROM THE SHIP PRESS 'V' (VIEW).

From the center of the screen outward you see the orbits of Mercury, Venus, Earth, Mars and Jupiter. But this time as they actually appear in space from the spaceship.
TO RETURN TO YOUR INSTRUMENTS PRESS 'O'.

TO FLY YOUR SHIP USE THE KEYS SHOWN BELOW.

Move the RED TARGET, as explained below, to where you want your ship to go and THEN PRESS 'G' and your ship will go there.

The BLUE TARGET will reappear to show where your camera is pointing.

SPACESHIP CONTROLS

CRSR →	MOVE RED TARGET RIGHT
CRSR ↓	MOVE RED TARGET BACKWARD
←	MOVE RED TARGET LEFT
↓	MOVE RED TARGET FORWARD
G	MOVE SHIP TO RED TARGET
U	MOVE SHIP UP
D	MOVE SHIP DOWN
	CAMERA AHEAD
	CAMERA DOWN

In addition, two special animated spaceflights have been pre-programmed into your ship. Press 'S' and your ship will go to a low altitude and SCAN across the solar system. When the animation is done, press 'O'. Press 'A' and the ship will fly from 50,000,000 miles above Jupiter's orbit and approach the orbit of Earth. Press 'O' when this animation is done. (These animations leave your ship at an altitude of only 15 million miles above the solar orbits, lower than you can normally fly your ship. If you wish, you can stay at this low altitude and explore, or you can RESET to 30 million miles by pressing 'F3' and then 'F1'.)

CLOSE-UP ON THE PLANETS

The planets Earth, Mars, Jupiter and Saturn can be viewed at close range.
PRESS 'P' TO VIEW THE PLANETS CLOSE-UP.

To change planets press 'P' again.

On the top of the screen is a diagram of the Sun (left) and the seven nearest planets. The little blue star shows which planet you are looking at. ORBIT distance from the sun and RADIUS are in miles. YEAR is in days on Earth. DAY is in hours on Earth. Only some of the moons of Jupiter and Saturn are visible from your spaceship.

The force of gravity is different on each planet. WEIGHT shows how much you would weight on the planet if you weighed 160 pounds on Earth. AGE is how old you would be on the planet in YEARS OF THAT PLANET if you were 24 Earth years old. (Turn to TOUR OF THE PLANETS for more information.)

PLANETARY COMPUTER

If you want more information about the six closest planets; Mercury, Venus, Earth, Mars, Jupiter or Saturn (1-6), or wish to compare them with each other, use your ship's Planetary Computer.
TO ACCESS THE COMPUTER PRESS A NUMBER FROM 1-6.

On the top of the screen is the name of the planet, then its distance from the Sun in miles. Astrocalc is a special feature which lets you make comparisons between planets. Before demonstrating Astrocalc, let's take a look at the information on the left and center of the screen.

RADIUS in miles — is the distance from the surface of the planet to its center. The radii of Jupiter and Saturn are measured from the top of their dense layers of clouds.

YEAR in Earth Days — is the time it takes for the planet to complete one orbit around the Sun.

DAY in Earth Hours — is the time it takes for the planet to rotate once.

MOONS — is the number of moons that revolve around the planet.

ORBIT in Miles per Second — is the speed of the planet in its orbit.

ESCAPE velocity in Miles per Second — is a measure of how fast a rocket must travel to escape from the gravity of a planet.

TO ATM. in – degrees Farenheit — is the temperature at the top of the planets clouds.

WARM ATM. in + degrees Farenheit is the warmest atmospheric temperature.

SURFACE in + degrees Farenheit — is the surface temperature of the planet.

IF YOU SEE -*-, IT MEANS THAT THE PLANET IS NOT GENERALLY DESCRIBED BY THAT INFORMATION.

ASTROCALC

TO COMPARE PLANETS PRESS 'A'
until you see the planet you wish to compare under the word ASTROCALC. Here is an example.

You have selected planet 3; the Earth, and wish to compare Jupiter to the Earth. Press 'A' until JUPITER appears under ASTROCALC. Jupiter's year is 12.7 times as long as Earth's year. Jupiter is 5.0 times as distant from the Sun as is the Earth.

If you see -*- it means that ASTROCALC can not make the comparison. Look at the two planets individually.

TOUR OF THE PLANETS

Earth

The outline of the continents is seen. What countries can you identify? Can you identify any of the United States sea-coast states? Most of us have seen photographs of Earth from an orbiting spacecraft. On such photographs a portion of the Earth's surface is obscured by the clouds of the planet's weather patterns. On your screen the land masses are outlined in order to be seen clearly. About 2/3 of the Earth is covered with water. Can you name some of the Oceans and Seas?

The temperatures on our friendly planet are moderated by the atmosphere which keeps the heat of the surface from

escaping rapidly into space. Conditions on Earth are balanced for life. This is not so on any of the other planets. As an example, Venus has such a dense atmosphere that the heat from the sun which warms it gets trapped. The temperature on the surface of Venus is over 875 degrees F., which is even hotter than Mercury. Though there are a few other places in the Solar System where some kind of life could be possible, none has been found.

Earth's atmosphere consists mostly of a relatively inactive gas, nitrogen. There is about 20% oxygen, which animals breathe, and 2% carbon dioxide, which plants "breathe" during the day. Plants convert the carbon dioxide to oxygen, which is very nice for the animals. The animals, in turn, exhale carbon dioxide, which is important for the plants.

The Earth has one unusually large moon. Its radius is 1080 miles, 2/3 the size of the planet Mercury.

Mars

Mars is the fourth planet from the Sun. It is smaller than Earth and has little atmosphere to keep it warm. Its year is about twice that of Earth but its day is about the same. What you see on your screen is the pinkish color of the surface and some markings which are the major surface features discovered by our space probes. There are many craters, mountains, and tremendous volcanoes. There is a little water on Mars, mainly as frost at the two poles. The water and winds of the thin atmosphere have eroded the surface and large sand dunes have been photographed by spaceprobes that have landed on the surface of the planet. Mars has two small moons. During the day the surface temperature only rises to a little above 0 degrees F.

Jupiter

Jupiter is a giant gaseous, cold planet. Very little heat reaches it from the Sun. The picture on your screen shows some of the bands of dense clouds which entirely surround the planet. Jupiter is smaller than a star, but in some solar systems in the universe, a planet like Jupiter would grow to maybe 10 times its radius and become a second smaller star.

The planets from Jupiter outward are not at all like the four inner planets. The inner planets are small and rocky, while the outer planets are larger and consist mainly of gas with frozen surfaces. Jupiter's atmosphere is so deep and dense that it may not even have a definite surface. The pressure deep in the atmosphere changes the clear distinction between gas, liquid and solid material as we know it on Earth. The atmosphere of Jupiter is mostly hydrogen and helium like our Sun. A notable feature in the atmosphere is the giant red spot which is a tremendous atmospheric storm. There is a warm layer in the atmosphere which may reach a temperature of 60 degrees F., though elsewhere temperatures drop to under 200 degrees below zero F.

Saturn

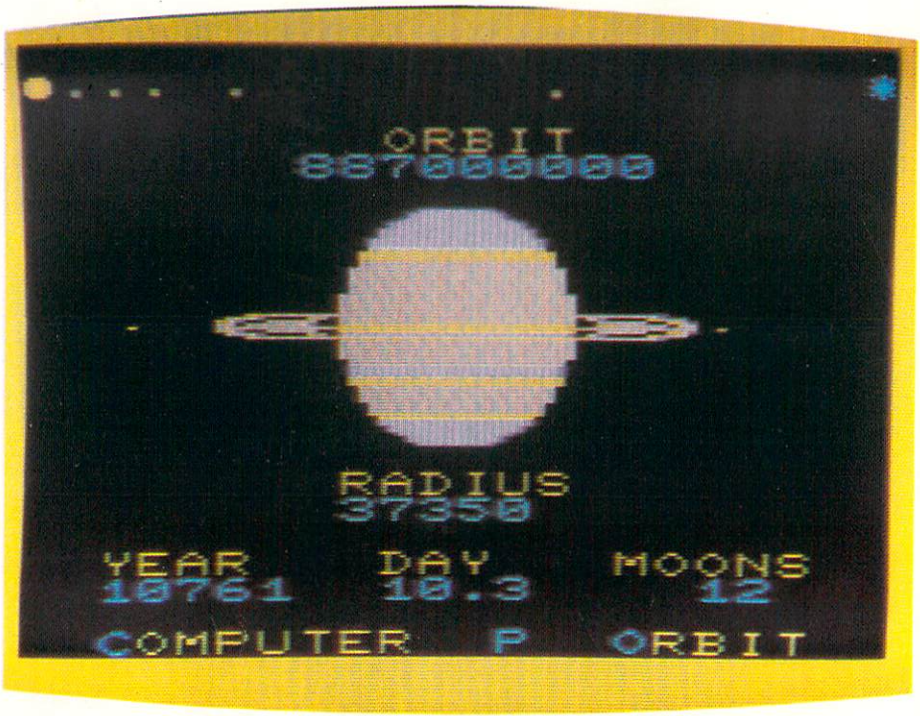
Saturn's surface is probably frozen ammonia and methane gasses. Like Jupiter, we see a banded, dense atmosphere. Saturn's distinctive feature is its ring system which was recently studied by the Voyager space probes. The rings are from 1 to 40 miles thick and are mainly small icy particles of frozen gas. The temperature on Saturn drops to 300 degrees below zero F.

Asteroids, Comets and Meteors

There are other objects in our Solar System besides the planets. Asteroids are smaller objects (as tiny as dust to several hundred miles in diameter) which travel around the Sun in an orbit between Mars and Jupiter.

Comets are small objects which travel in unusual elongated orbits that approach close to the Sun at one end. When they do, we see a long trail of debris which escapes from the comet when it gets heated by the Sun.

The debris can get trapped by the gravity of a planet. Most of the Meteors, or 'shooting stars' we see on Earth are from this debris burning up in our atmosphere.



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