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MISSION STATUS

Astronauts Eddie and Junko, your mission, if you choose to accept it, is to explore our **Solar System...** and beyond. It's an adventure that no human has attempted before!

Mission accepted!
A little danger
never scared me.

You better get your
suit on Eddie, we're
blasting off next!

Helmet

Radio
Headset

Drinking
Tube

Multi-
layered suit

Thick boots
and heated
gloves

Multi-
function
arms

Headlights

Heat-resistant
shell

Solar panels

Cargo hold

Engines

Probe and
camera

All-terrain tracks

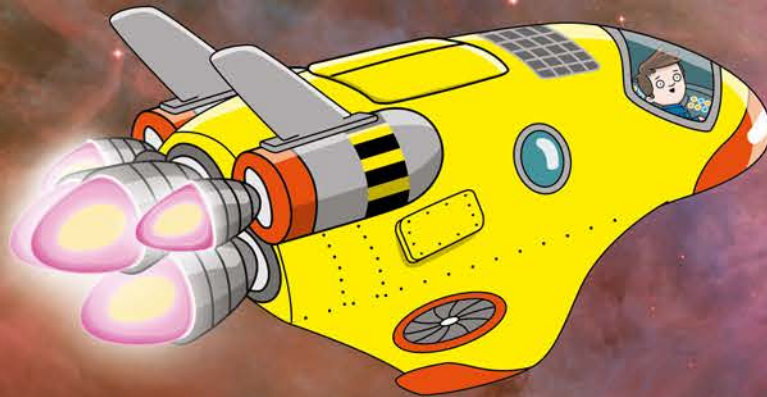
Air-tight hatch

Vertical take-off
engines

You'll encounter many dangers – but your high-tech suits and specially designed space mobile will help you survive temperature extremes, exploding stars and black holes. You'll also need to travel with a brave face and a strong stomach!

NEW STARS

Shh, don't wake the baby stars! Ahead is the Orion Nebula, a region where new stars are formed. We're now 1,500 light years from Earth. There are more than 3,000 stars within these vast clouds of dust and gas. The bright area in the centre is home to a group of stars known as the Trapezium.



This nebula is named Orion as it can be seen within the Orion **constellation** of stars in the sky above Earth.

The white arrow above shows the location of the nebula, just below Orion's belt.

I've used the tablet to zoom in on another nebula in this Orion constellation region. It's called the Horsehead Nebula because the dark clouds of dust look like a horse's head. The pink glow behind it is caused by hydrogen gas.

ORION NEBULA STATS

LOCATION: ORION NEBULA (ALSO CALLED MESSIER 42)

DISTANCE FROM EARTH: 1,500 LIGHT YEARS

DIAMETER: 25 LIGHT YEARS

AGE: 2 MILLION YEARS OLD

DISCOVERY DATE: 1610

STARS CURRENTLY BEING BORN IN THE NEBULA: AROUND 1,000

- A nebula is a giant cloud of dust and gas, mostly hydrogen and helium. Sometimes gravity can slowly draw this material together.
- As the clouds get denser, their gravity gets stronger. Eventually, the material collapses, creating heat. When the temperature reaches 4 million°C (18 million°F), a new star is born.



EXPLOSION!

How pretty! This may look like a flower, but it's not very delicate. We're looking at the remains of a supernova – the explosion of a star. As a massive star begins to run out of fuel, it weakens until it can no longer support its own weight. Finally, it collapses causing the biggest type of explosion in the universe: a supernova. KABOOM!

Average-sized stars gradually throw off their layers of gas, forming red giant stars. Eventually, they become strange glowing shapes called planetary nebulas. This one, called the Helix Nebula, looks like a giant eye.

When a supernova explodes, it sends lots of cosmic debris into space, including gamma rays and intense heat, which could be dangerous for us. It's much safer now, but there are still lots of X-rays being shot out by the old core of the star, which is called a neutron star. Good job the space mobile has a thick shell.

SUPERNOVA STATS

LOCATION: CASSIOPEIA A, SUPERNOVA REMNANT
DISTANCE FROM EARTH: 11,000 LIGHT YEARS
DIAMETER: 10 LIGHT YEARS
SPEED OF EXPLOSION: UP TO 40,000 KM A SECOND
(25,000 MI PER SECOND)
DATE THE EXPLOSION WAS VISIBLE FROM EARTH: 1680
ORIGINAL MASS OF THE STAR: 16 TIMES THE SIZE OF THE SUN



This supernova remnant is called Cassiopeia A. The clouds of debris that are blasted from the explosion drift off into space and may go on to form nebulas and new stars.

BLACK HOLES

Hey Eddie, did you know that after a huge star explodes in a supernova, the result is a deadly black hole? I've heard about these invisible dangers, but I think we might actually be about to experience one first-hand. If we get sucked in, not even the space mobile can save us. Yikes!

Oh no, TEDDY! What's happening to him? His arms are being stretched out and pulled towards the black hole.

This is called spaghettification! Because the pull of gravity is so intense, the part of Teddy's body closest to the hole will be pulled more strongly than the other side. He'll stretch and stretch until he snaps. And if he passes the point of no return, we'll lose him forever. PULL HIM BACK, SPACE MOBILE!

There's a supermassive black hole at the centre of the Milky Way galaxy, in a region called Sagittarius A.

A black hole forms when a dead star's core crushes in on itself. A massive star will collapse down to just a few kilometres across. Though small, it's incredibly dense with such a powerful gravitational pull that anything that gets close, even light, is pulled in and eventually disappears.

BLACK HOLE STATS

LOCATION: A BLACK HOLE AT THE CENTRE OF THE MILKY WAY

NUMBER OF BLACK HOLES IN THE MILKY WAY: TENS OF MILLIONS

NEAREST BLACK HOLE TO EARTH: 3,000 LIGHT YEARS AWAY

FIRST BLACK HOLE DISCOVERED: CYGNUS X-1, IN 1964

TYPES OF BLACK HOLE: PRIMORDIAL (SMALL), STELLAR (MEDIUM), SUPERMASSIVE (LARGE)

GLOSSARY

Atmosphere	The layer of gases that surrounds the Earth (and some other celestial bodies).
Carbon dioxide	A gas present in the atmosphere of Earth – and some other celestial bodies, including Venus – which traps the Sun's heat, raising temperatures.
Constellation	A group of stars arranged in a pattern, often named after how they look or a mythological creature.
Crater	A large hollow in the ground caused by the impact of a meteorite.
Equator	An imaginary line drawn around the centre of a planet or body that divides it into northern and southern hemispheres.
Flyby	When a spacecraft flies past a planet, or other body, but does not go into orbit or touch down on the surface.
Friction	A force that slows down two objects moving over each other.
Galaxy	A group of millions of stars and their orbiting planetary systems, plus gas and dust, all held together by gravity.
Gamma rays	High-energy waves that can't be seen by the human eye.
Geyser	A hot spring in the ground that sends out a tall column of liquid and steam into the air.
Gravity	The force that attracts two bodies towards each other. The greater the mass, the greater the pull of gravity.
Light year	The distance that light travels in one Earth year – around 9 trillion km (6 trillion mi).
Magma	Hot, molten rock under the surface of Earth or another celestial body.
Mass	The amount of material an object has, which on Earth also indicates how heavy it is.
Methane	A chemical compound which is usually a gas on Earth, but which can be a liquid or a solid in the freezing temperatures of the outer Solar System.

NASA	The National Aeronautics and Space Administration agency of the USA. It is the agency in charge of US space exploration.
Nuclear fusion	A process where atoms are pushed together to release huge amounts of energy.
Orbit	The curved path of an object around a star, planet or moon.
Orbiter	A spacecraft that goes into orbit – flying repeatedly around – a body.
Oxygen	A gas that is essential for animal life to occur.
Rover	A space vehicle that explores the surface of a planet or other body.
Sedimentary rock	A type of rock formed when fragments of other rock – often created by the action of flowing water – are deposited on top of each other in layers.
Solar panel	A panel that absorbs the Sun's light and turns it into electricity.
Solar System	The planets, moons and other smaller bodies that orbit the Sun or another star.
Spectrometer	A scientific instrument that measures light wavelengths.
Supernova	The explosion of a large star.
Ultraviolet	High-energy waves with a wavelength that means they sit just beyond the spectrum of light waves that humans can see.
Vacuum	Space that is empty of all matter.
X-ray	High-energy waves that can pass through many solid objects that visible light cannot.

