The Sun Our Living Star Script
English

	English	Translation
	A new day begins on Earth. The Sun rises over our home planet — a blue oasis in a vast cosmic desert, the only place in the entire Universe where life is known to exist. This same Sun has shone constantly on our world for four and a half billion years. The light that warms our skin today has been felt by every person who's ever lived. It touched the backs of the dinosaurs, and it greeted the creatures that first left the ocean to brave the land. The Sun has witnessed everything that's happened here on Earth. But it is no passive observer. The Sun is in fact our planet's powerhouse, the source of the energy that drives our winds, our weather. It is the primary generator of the extraordinary web of life crawling, swimming and flying all over the world. All life on Earth depends, in some way or another, on our nearest star . . . the Sun.	
	As the Sun rises, it holds the Earth's lands and oceans in a warm embrace of light. Its nourishing rays rescue the planet from darkness and initiate astonishing choreographies of activity. Even deep underwater, the Sun's glow is crucial to life.	

	In oceans and on land, plants harness energy from sunlight, converting it into food, through a process called photosynthesis. This productivity drives many ecosystems on our planet.	
	It also releases precious oxygen into the atmosphere. This substance we breathe allows our cells to unlock energy from the food we eat. Long before we understood that our very existence depends on the Sun, humanity paid it close attention. The passage of its fiery disc across the sky — day by day, month by month — was for countless past civilisations the only way to keep track of time. The Sun's motion formed the basis of many ancient — and indeed modern — calendars, helping us chart our past and predict our future. The Sun drives the rhythms of our lives. The tilt of Earth's axis, letting daytime sunlight change in intensity and duration over the course of a year, gives rise to the seasons and their cycles of growth and decay.	
	Since the beginning of history, humans have grasped the Sun's vital importance. It has inspired mythological stories, and been worshiped in the guise of many different deities. Five thousand years ago, humans raised great slabs of stone, erecting the prehistoric monument of Stonehenge in England. The structure appears custom-built for astronomy and marking the Sun's annual movements across the sky. The ancient Greeks worshipped Apollo — the god of light, arts, and medicine, symbolised by the Sun. In what is now modern Mexico, the ancient Maya built monuments aligned with the Sun. Their Sun god had many aspects influencing daily life, and they kept meticulous records of the Sun's motion through the sky. In the ruins of the Inca city Machu Picchu, we find a shadow clock that tracks the daily course of their Sun God, Inti. Modern South Americans still celebrate Inti Raymi on the longest day of the year.	
	Some cultures reasonably, but incorrectly, placed the Earth at the centre of the cosmos, with the Sun, planets and stars revolving around our planet.	

	In the 16th century, however, the truth of our place in space began to emerge. European astronomer Nicolaus Copernicus put forth the heliocentric model of our Solar System, with the Sun at its centre. Our relationship with Sun was transformed. We soon learned that the Sun is not a perfect celestial body, as some had supposed.	
	In 1610, Italian astronomer Galileo Galilei was the first to use an instrument called a telescope to observe the Sun. Much to Galileo's surprise, he discovered huge black splotches marring its surface. These formations, now called sunspots, helped inspire the paradigm shift that triggered the scientific revolution. The heavens obey the same imperfect laws as we experience here on Earth! Gradually, science replaced mythology. With the passing centuries, our knowledge of the Sun has evolved as technology has advanced and more astronomers have turned their gaze towards our star to uncover its secrets.	
	We have measured the distance to the Sun, 150 million kilometres from the Earth. We can now estimate that it is just one of some 200 billion stars in the Milky Way galaxy. Just as we revolve around the Sun, so too, does the Sun revolve around the centre of our galaxy, completing a galactic orbit every 250 million years.	
	Within this grand structure, we have discovered thousands of planets in orbit around other stars. These exoplanets bask in the glow of their very own suns. Using telescopes in space and on the ground, such as ESO's 3.6-metre telescope, we're scouring the sky for ever more exoplanets. A planet has even been found around the Sun's nearest neighbour star, Proxima Centauri. We lack the technology so far to see if these strange, new worlds might support life. But over the next couple of decades, as our searches and studies continue, we may find we are not alone in the Universe.	
	The best places to look for alien life may be on planets encircling stars much like our own. As a star, our Sun is not exceptional. In fact, one could say that it is rather average.	

	Stars come in many sizes and colours, from tiny dwarfs to supergiants which could hold five billion Suns inside. Don't be fooled by the terminology… As a typical yellow *dwarf* star, our Sun could still comfortably fit over one million Earths inside it. The Sun's immense proportions dominate our Solar System. This luminous, titanic object is 500 times as massive as all the planets combined.	
	Almost five billion years old, our star is now well into its adulthood. Along with the rest of the Solar System, the Sun's story begins in a mammoth, rotating cloud of gas and dust that collapsed under the pull of gravity. The result: At its centre, an enormous ball of hot, glowing gas, composed mainly of hydrogen, and small amounts of heavier elements including carbon, nitrogen, oxygen, and iron. These elemental ingredients also compose our bodies and all other living things. The Sun is radically different from our world. Although it has no solid ground on which we could set foot, it does possess a visible surface. This region is known as the photosphere, and it appears to boil like a colossal pot of soup. The temperature of this visible surface is about 5500 degrees Celsius — more than 20 times hotter than the hottest kitchen oven.	
	But beneath its surface, temperatures at the Sun's core soar above an incredible 15 million degrees Celsius. If we can imagine seeing inside the Sun, we can understand where this energy comes from.	
	Within the Sun's core, almost all of the star's energy is generated. Extreme heat and pressure force hydrogen atoms together, producing helium and liberating tremendous amounts of energy in a process called nuclear fusion.	
	Fusion allows the Sun to consume 600 million tons of hydrogen each second, turning it into 596 million tons of helium. The missing four million tons of matter is converted into a tremendous amount of pure energy — one million times the amount of energy that the entire world uses in a year. Einstein's most famous equation, E equals MC squared, tells us how even a little mass can be turned into a lot of energy: Energy equals Mass times the speed of light, c, and times the	

	speed of light again. Since the speed of light is enormous — over one billion kilometres per hour — the amount of energy in just a gram of matter is almost unfathomable.	
	The energy liberated by fusion at the Sun's centre undertakes an arduous journey to find freedom. The crowded stellar interior only allows energy to travel about a millimetre before it encounters roadblocks in the form of atoms.	
	The energy is absorbed and re-emitted until, after many thousands of years, it emerges triumphant from the Sun's surface in the form of light and heat. From here it can finally journey unhindered through the Sun's tenuous atmosphere, called the corona, and out into the depths of space.	
	Let's follow a stream of light headed for Earth. It will take just eight minutes to arrive. Along the way, it may encounter the many solar sentries that humans have launched into space. The United States, Europe and Japan have built observatories such as STEREO, SOHO and the Solar Dynamics Observatory to provide scientists with a continuous view of the roiling Sun. These spacecraft study the Sun in X-ray, ultraviolet, and infrared wavelengths of light, which cannot be observed from Earth. Luckily, Earth's atmosphere absorbs these kinds of light; otherwise, harsh X-rays and ultraviolet would destroy the delicate tissues and cells in biological organisms. Hardy spacecraft such as SOHO use spectroscopy to study the Sun. By splitting its light up into different colours, we can identify each element's unique fingerprint in the starlight, revealing the Sun's chemical composition.	
	Unlike very energetic radiation such as X-rays, radio waves pass through Earth's atmosphere. These lower-energy forms of light can be observed by telescopes such as ALMA in northern Chile, which is able to study the solar atmosphere in ways not possible before. These space- and ground-based observatories have revealed our star's occasional bouts of violence. We now know that the sunspots discovered by Galileo lead to explosive ejections of high-energy particles, called solar flares, which can damage spacecraft and electrical power grids on Earth.	
	Observations of other stars like the Sun have uncovered a more dramatic danger — *superflares* of <u>terrible</u> strength.	

	These extreme eruptions would wreak havoc on life. The likelihood of such an outburst from our Sun is slim — but it *could* happen. Although awesomely powerful and potentially destructive, the Sun is overwhelmingly a force for good. The high-energy particles it throws into space can bring beauty to Earth. So-called “space weather” intensifies the ethereal northern and southern lights. These aurorae arise near Earth's poles, where Sun-blown particles — funneled by our protective magnetic field — interact with the atmosphere.	
	Besides animating our world and its menagerie of life, the Sun’s ample light can also be harvested by solar panels as a renewable, clean energy source for modern civilisation. Solar panels aren’t just handy on Earth. Spacecraft in orbit exploit abundant solar energy, extracting up to 30% of the energy hitting them.	
	Solar power takes energy directly from the Sun, but other energy sources rely on the Sun, too. The immense, but finite, reserves of fossil fuels — including coal and oil — have enabled the rise of the modern world. Those fuels formed from plants and sea creatures that thrived on the Sun’s nourishing output millions of years ago.	
	Our zest for burning fossil fuels that lay trapped beneath the ground for millions of years has changed our atmosphere’s chemistry, leading to global climate change and ecological peril. Some think that a long-term solution lies not with collecting the energy expelled from the Sun, but instead mastering the fusion process that takes place in its core.	
	The fuel needed for fusion is practically unlimited. It only requires hydrogen, the most abundant element in the Universe. On Earth, hydrogen can be readily found in the planet’s oceans, unlike the scarce uranium that is currently used in today’s nuclear fission power plants.	
	While it is hoped that fusion will sustain humanity by providing an essentially limitless power supply for our needs, the same cannot be said for the Sun. Eventually, its supply of fuel will dwindle and the fusion at its core will cease, prompting a spectacular, but deadly transformation.	

	Starved of fuel, the Sun will expand, and with its dying breaths it will almost certainly engulf the inner planets. Our star will consume the world it once nurtured!	
	Fortunately, this will happen in the far future — in 5 billion years. Until then life will continue to evolve on this small blue planet, drinking in the life-giving rays of a living star, our Sun.	