

# The New Frontier

Series 1-5

## Episodic breakdown

### **Episode 1 - From There to Here**

Series introduction and the study of Earth from orbit. The sky above is littered with stars and countless galaxies. It is where we come from and where we are destined to return. The first phase of this journey is complete, now commences the second, with robotics, advanced technologies, and sheer daring we are now going where before we only dreamt.

### **Episode 2 - Return to The Moon**

The Moon, our closest celestial companion. Our indispensable dance partner through the cosmos. Lighting our night sky and gently tugging at our shores. Few have walked on her surface, though her allure remains strong, once again we are glancing her way with renewed interest and with a view to return very soon.

### **Episode 3 - The Inner Worlds**

They orbit between us and our Star, the inner worlds; hidden within the sun's glare often only visible at sunrise or sunset. Venus the first and brightest star in the evening sky, and Mercury fleeting across the solar disk. They are half of our solar system's terrestrial planets, yet we know so little. As we begin to take a closer look at our companions, they are posing more questions than answers.

### **Episode 4 - Next Stop Mars**

It has fired our imaginations for millennia, Mars, the God of War and the source of Man's science fictional demise. We know the dry barren planet was once flowing with vast reservoirs of water, the sky thick and filled with clouds and the tantalizing possibility of life. It is the only other place in our solar system than Man might one day call home.

### **Episode 5 - The Planet Makers**

From the beginnings of our Solar System four and half billion years ago there remains tantalizing clues to its evolution; remnant debris: asteroids and comets. They vary in size from grains of dust to mountain sides, footballs to planetoids. They were the building blocks of the planets and perhaps carry the origins of life itself. Now within our grasp these rocks of ice and dust are ready to give up their secrets.

**Episode 6 - The Ice Giants**

Beyond the asteroid belt lay the ice giants, some can be seen with the naked eye, others only glimpsed once by a passing probe. We are again sending cameras to the edge of the solar system giving us new insights into the evolution of our worlds.

**Episode 7 - The Moons of Olympus**

These are the Moons of the gas giants. Each a unique and mysterious world of its own. Some have oceans of water, geysers of Sulphur or atmospheres of plastic. Some are just now being seen at the outer rim of our solar system, all are worthy of much more scrutiny.

**Episode 8 - The Sun**

It powers the machinery of nature; our weather, encourages and sustains life on land and at sea. When it sets in the West it reveals to us its many billions of sibling stars populating the night sky. We study our Sun closely, and like a Rosetta stone it can reveal the secrets of all the other stars above.

**Episode 9 - Exo Planets**

As scientists and astronomers peer closer at nearby stars with ever more fidelity they are discovering planets; exo planets, worlds outside our own solar system. With technological advances and improved techniques scientists are discovering more and more worlds every day. With confidence scientists now calculated there could be as many as 40 billion Earth like planets in our Milky Way galaxy alone.

**Episode 10 - Edge of the Universe**

The night sky is a time machine. The further we look out into the universe the further back in time we reach. What we see in the night sky is only a small percentage of the contents of the Universe, most is dark matter and dark energy we know it exists; however, its nature eludes us for the moment.

\* \* \*

# The New Frontier

## Series 2

### **Episode 1 - The Astronauts**

One hundred kilometres above the Earth's surface lies an invisible frontier: the edge of space. This is the Karman Line, the boundary between our planet's atmosphere and what lies beyond. What does it take to cross that line?

### **Episode 2 - Getting There**

Launching payloads into space is a very difficult task, historically rocket launches are the proverbial 'swords into ploughshares' Missiles designed to carry atomic warheads now send satellites and probes into the solar system. Ironically, it's one of the few exploits Mankind undertakes that doesn't occur in nature.

### **Episode 3 - Orbit**

The International Space Station is undoubtedly the jewel in the crown of low Earth orbit, observation post, research lab and classroom. Equally however there are many other assets orbiting Earth that are even more important to our everyday lives; delivering communications, weather observation, global positioning, and resource management the list is growing with every year.

### **Episode 4 - Shore to Shore**

Our seafaring nature has translated well to the space age, seeking to sail out into the unknown in search of riches of one kind or another. While Europe and Asia continue their interest in the resource rich Moon, The United States and NASA have set their sights on nothing less than manned missions to Mars. Can they manage to go shore to shore on the most dangerous of unknown seas, deep space.

### **Episode 5 - Mars: Adapt or Leave**

As the latest successes and failures come and go Mars continues to give up her secrets. Invisible clouds are revealed with ultraviolet light and the search for the source of methane continues with ExoMars. As we prepare to land humans on the red planet, getting there is one thing; staying long term is another, can we really conquer this planet?

**Episode 6 - Emissaries**

Our solar system is vast, from our own star the Sun to Earth is nearly 150 million kilometres or 1 Astronomical Unit. Jupiter is 5.2 AU distant and Pluto up to 48AU, the solar system extends far beyond this into interstellar space. We humans cannot yet travel that sort of distance, however we can and do send our robots and probes in our place; and the results are astounding.

**Episode 7 - Danger Asteroids Ahead**

The question often rises is the cost of space exploration worth it? Could the money be better spent elsewhere. If so one space program would have to remain. The planetary defence program, to locate identify and deflect a wayward asteroid from hitting Earth and destroying our civilization because at last count there were 15,000 possible dangerous candidates close to Earth.

**Episode 8 - First Light**

For an instrument first developed as recently as the 17<sup>th</sup> century, the telescope has travelled a long way. The latest version of the once-humble telescope will be going a lot farther - carrying us ever closer to the first light that ever bathed the Universe in which we live.

**Episode 9 - Stars Above**

Stars are a bit like human beings. They can be warm or cold, they come in all kinds of shapes and sizes... and, let's face it, they can be dim or bright. And recent discoveries suggest that the number of stars in our galaxy alone, the Milky Way, may exceed 200 billion. Just what are these citizens of the night sky?

**Episode 10 - The Dark Side**

Perhaps that American politician was right. There are indeed things we know we don't know. For instance, cosmologically speaking, we know we don't know much - and certainly not nearly enough - about two of the enduring mysteries of the Universe. Dark Matter and Dark Energy, it's little wonder that scientists are devoting so much grey matter and energy of their own to finding out as much as they can.

\* \* \*

# The New Frontier

## Series 3

### **Episode 1 - Living in Space.**

How do astronauts cope with living in space? The unique environment, the lack of taste in their food and the smell of canned air all contribute to the stresses of living and working in space.

### **Episode 2 - Atmosphere.**

Climate change and pollution are having dire consequences for the atmosphere of our planet, this episode updates the latest technology and science looking into the health of our air.

### **Episode 3 - Flight Status.**

The latest updates on the new space hardware about to launch us into the next generation of space flight some rockets and capsules are on time others not so fortunate.

### **Episode 4 - Invasion Mars.**

The EXO Mars and Curiosity continue their scientific discoveries as we prepare new missions both robotic and manned to the red planet Mars.

### **Episode 5 - Juno, Cassini and Beyond.**

The Cassini space craft has completed its mission over Saturn, Juno has reached its target and has commenced its scientific observations of the giant planet Jupiter. and New Horizons speeds on it its next encounter at the edge of the solar system.

### **Episode 6 - Slingshot.**

Sending probes throughout the solar system is a mathematicians dream and an engineer's nightmare, sling shotting probes around other planets to arrive at their destination, we checkout the latest probes about to slingshot about the solar system.

### **Episode 7 - Living Planet.**

With continuous observation of earth from orbit scientists have built a data set over time that reveals much about how the Earth breaths and life sustains itself on this living Planet.

**Episode 8 - Cosmic collisions.**

Cosmic and x rays, these mysterious and highly powerful particles from deep space are being investigated to finally discover where they come from.

**Episode 9 - Gravity.**

LISA pathfinder, has led the way for a space-based gravity wave detector, what are gravity waves and why are they so hard to detect?

**Episode 10 - Interface.**

The Ionosphere, where the Earth interfaces with space, is little understood, it effects radio communications, GPS signals and satellites alike, it changes between day and night and is influenced from space and from Earth, new satellites have been launched to study this zone.

\* \* \*

# The New Frontier

## Series 4

### **Episode 1 - The Cryosphere**

New satellites are being launched to continue detailed observations of Earth and its oceans and ice caps, they are finding that climate change is accelerating, and they have the data to prove it.

### **Episode 2 - Set Course for The Heart of The Sun**

NASA'S Parker Solar Probe Mission is on its way and will be shortly followed by Europe's Solar probe Mission. No spacecraft have travelled so fast or so close to a star before. It is hoped to reveal the source of the solar winds that affect us here on Earth.

### **Episode 3 - Tickets Please**

The commercial space flight companies are edging closer and closer to flight readiness. Paying customers will soon be launching into space; tourists and their money is thought to be a major step forward into space and beyond. Blue Origin flight tests have been a great success and may launch commercial flights as soon as year's end. Virgin Galactic is also smashing milestones towards flight certification. SpaceX and its Manned Dragon capsule in direct competition with Boeings moves closer to an ISS taxi service.

### **Episode 4 - Mercury or Bust**

The ESA - JAXA joint Bepi-Colombo Mission is moments away from launch. The target is Mercury which has been too long neglected; this mission will shed new light on this strange world of light and dark.

### **Episode 5 - Hyabusa 2**

The Japanese Asteroid sample return mission has reached its target and is surveying the space rock ready to dip down and take a sample. The return of asteroid material to Earth will aid scientists in the evolving asteroid planetary defence systems.

### **Episode 6 - Eyes to The Heavens**

Two new space telescopes are in orbit and completing their shakedown; Gaia and TESS they too will be joined by the James Webb Telescope. Together they will be opening a whole new vista into time and space.

**Episode 7 - Martian Attractions**

The Latest in Martian exploration from orbit and on the ground, new sources of water and planetary dust storms are a few of the stories unfolding on to the Red Planet.

**Episode 8 - Cubesats**

Cubesats the tiny Satellites are growing in mainstream popularity; they have even been sent to Mars with the Insight Mission.

**Episode 9 - Proving Einstein**

Some of the proof of Einstein's theories had long been elusive, beyond the capabilities of technology, until now. It appears that Einstein is once again triumphant with the latest in deep space observations.

**Episode 10 - Where Are All the Aliens?**

We're looking hard, but the numbers aren't stacking up, is life on other planets that hard to find? Even signals from an advanced race elude us. Maybe we really are alone in our neck of the galaxy!

\* \* \*



# The New Frontier

## Series 5

### **Episode 1 - Star Light, Star Bright**

The two current science missions to our star; the sun have made great leaps forward in the science of how stars work, how they generate solar winds and how they affect their orbiting planets. These insights let us look at other stars with a greater understanding.

### **Episode 2 - Moon Shine.**

The International drive to return to the Moon is gathering pace, this multi- nation effort is readying to return, stay and utilise the Lunar assets. We look at what resources scientists and engineers are looking to extract from Lunar regolith and Martian soil.

### **Episode 3 - Rising Tides.**

The next generation of Earth observation satellites are now in place maintaining the continuity of long-term climate data, in particular the planets rising temperatures and related ocean levels. Scientists are concerned the rate is increasing beyond expectations and glacier melting continues unabated.

### **Episode 4 - Earths Evil Twin.**

Venus is a planet closest to Earth in distance and size, it once may have been as hospitable to life as Earth is now. Then something changed and Venus became shrouded in hot dense toxic clouds. There are now plans to send advanced probes to the surface of Venus and find out what happened to our twin.

### **Episode 5 - Increasing Orbit.**

The ISS is the workhorse of the international spacefaring community, but its days are numbered. Replacement space stations are on the drawing board; these new stations will study pure science like the ISS however, with commercial interests these stations will add tourism and manufacturing to the mix.

**Episode 6 - Mountains in the dark.**

Asteroids, the debris from the early solar system hold tantalizing clues to planetary formation. The spacecraft Psyche readies to study a unique metallic asteroid. As Lucy is on its way to the trojan asteroids that share Jupiter's orbit, and the DART mission is testing the technology to move these mountains in the dark.

**Episode 7 - Oceans in the Sky.**

Juice and the Europa Clipper are two missions to our Solar System's largest planet. They will spend over four years studying Jupiter's atmosphere, magnetosphere and in particular the icy moons Europa, Callisto, and Ganymede, investigating whether these moons hold oceans that are suitable for life.

**Episode 8 - Webb of life.**

The James Webb Space Telescope is now operational. Launched aboard an Ariane 5 the 10-billion-dollar spacecraft has deployed successfully and reached its orbit around the Sun. Soon Webb will find the furthest galaxies, study the atmospheres of exoplanets, and pose new questions to be answered.

**Episode 9 - Peering into the Abyss.**

Imaging a black hole was a breakthrough in astronomy, now with the new satellite IXPE high energy telescope we will be looking at some of the most dramatic, and most violent objects in the universe: Colliding Black holes and Neutron Stars. The x-ray vision will reveal their hidden secrets.

**Episode 10 - The Next Big Leaps.**

Projects in the works. SunRISE, SPHEREx, NEOS and others, their mission to expand our knowledge of Earth, the surrounding space, Dark Matter, and the earliest galaxies. New ground-based telescopes are coming online ready to discover strange new worlds and engineers are studying new technologies to extend our reach into space.

\* \* \*