ASTRONAUT **SCRIPT**

Stand anywhere on the Earth and space is never more than a mere 100 kilometres away, at this distance you are beyond Earth's atmosphere and are officially… an astronaut. 100 kilometres, that's less than some people commute to work each day and yet just 50 years ago this distance was out of reach.

Decades of research and development into spacecraft, has allowed us for the first time in the history of the human race to leave our planet and explore what is beyond.

Technology has given us the tools to break free of gravity and journey beyond our world, but what about the people involved? What does it take to be part of these incredible journeys? What does it take to become… an Astronaut?

Before anyone can become an astronaut years of mental and physical must be completed. The long process of developing the skills needed begins much closer to the ground, in fact underwater.

This is a Neutral Buoyancy Training Tank, a very deep swimming pool filled with underwater versions of spacecraft and robots. Neutral buoyancy is a state where an object neither sinks or floats. Using a combination of weights and flotation devices the astronauts are suspended in a kind of underwater weightlessness.

To replicate the conditions of an actual mission real spacesuits are used. Bulky and cumbersome, these suits provide limited mobility and prevent any tactile contact. Getting used to these restrictions allows astronauts to prepare for the complex tasks required in the harsh conditions and micro gravity of space.

Training of this type allows ‘missions’ to be performed hundreds of times without ever leaving the Earth. But to truly simulate weightlessness and experience its effects on the human mind and body we need to head upwards.

This is the KC 135 micro gravity training aircraft or the Vomit Comet as it is affectionately known. To simulate a near zero gravity environment on earth we have to counteract the gravitational forces that keep us on the ground. The vomit comet achieves this by climbing to high altitudes and then diving back to earth in an increasingly steep curve called a parabola.

In the midst of this freefall the aircraft matches the speed at which gravity is trying to force it back down to earth and a period of weightlessness is achieved. This is similar to the effect you feel when you drive too quickly over a humped backed bridge. Imagine if that brief sensation lasted for twenty seconds instead of one, and it is not hard to see why the Vomit Comet got its name.

A lack of gravity is not the only scenario astronauts have to train for. During a launch in to space and re-entry they are subjected to many times the gravitational forces of those here on Earth. Like a huge centrifuge the capsule on the end of this arm is gradually accelerated up to speed. The faster the arm rotates the more forces of gravity or g-forces are produced.

In a typical launch an astronaut will experience approximately three times the amount of gravity that we are used to on Earth. If you have ever been on a roller coaster at an amusement park you have probably already experienced close to 3g but only for the briefest of moments. During a launch astronauts have to endure these forces for eight crushing minutes.

If the g-forces are raised higher then greater problems can arise. Exposure for more than a few seconds at around 6g can cause vision to blur and narrow and eventually, you blackout.

With training complete you are finally ready to launch into the hostile environment of space and perform the tasks of an astronaut.

(pause)

With no air to breath and temperatures that range from freezing to boiling astronauts must wear specially designed suits to protect them from these extremes. Underneath these suits is a complex network of pipes which continually pump hot and cold water over the surface of the skin, regulating body temperature. The suit also acts as a mini pressure environment that supplies oxygen and protects against the vacuum of space

(pause)

Spacesuits can protect astronauts from the external effects of space, but what about the internal effects?

Humans have evolved over millions of years to be best suited to conditions here on earth. In the sudden absence of gravity the body starts to adapt.

An immediate result of this adaptation is a condition similar to sea sickness. Inside the inner ear there are thousands of little hairs and small crystals called otoliths. Their function is to constantly update the brain as to which way is up, but without gravity there is no up, or down. This confusion between what their eyes see and what their body feels results in almost two thirds of astronauts being ill. This space nausea can last up to three days until the astronauts get their space legs.

(pause)

Also within this time period the cardiovascular system is affected. On earth gravity forces blood to pool in the feet. Without gravity's help Blood and fluids pool in the chest, this causes the heart to swell and pump slower.

(pause)

As more time is spent in space the body has less need for dense bones and heavy muscles.

(pause)

On earth the skeleton is for support, protection and locomotion, strong dense bones are essential to prevent injury. Micro gravity reduces the demands placed on the skeleton, as a result bone density is slowly reduced. The porous structure of the bone becomes thinner as the calcium literally fizzes away. For every month spent in space up to two percent of bone density can be lost, as a result bones become brittle, similar to the effects of osteoporosis.

(pause)

Muscle loss also occurs in space. Without the need to constantly overcome the forces of gravity the demands on the muscles are much lower.

To combat bone and muscles loss and prevent any long term effects on return to Earth astronauts must exercise everyday in specially designed space gymnasiums.

(pause)

Micro gravity and its affect on the human body aren't the only obstacles to overcome, greater and more immediate dangers lurk in space.

This is Chad, our test subject. Chad has been 'volunteered' to demonstrate just how dangerous space really is.

Space is a vacuum, which means there is no air, And when there is no air Chad will not be able to breath.

(pause)

If by some accident Chad is detached from his spacecraft, then he could drift away and never be seen again. If Chad's suit is torn or punctured whilst in space, his career as an astronaut would soon be over.

It is incredibly cold in space, around -150 degrees Celsius. Without a specially designed suit Chad would freeze solid in seconds.

Space is mostly empty, however there are some objects out there that Chad needs to look out for.

(pause)

Micro meteoroids are tiny rocks speeding through space. They are too small to be detected and difficult to avoid.

(pause)

Larger meteors are also hurtling through the solar system. However, their size makes them easier to detect and avoid.

(pause)

Almost everything that has ever been launched into space is still out there. There are nearly four million individual pieces of space junk orbiting the earth.

(pause)

As well as heat, the sun emits electromagnetic radiation like a microwave oven. On earth our atmosphere filters out these harmful rays. Sun tan lotion, sun glasses, and a hat is all you need.

(pause)

However in space without the protection of a real spacesuit, Chad would quite literally cook.

A more sinister type of radiation comes from deep space in the form of cosmic rays. These cannot be avoided or shielded against and are capable of mutating or destroying DNA.

(pause)

However the most dangerous place for an astronaut isn't in space at all but right here on earth. More injuries and fatalities have been caused on the launch pad or shortly after blast off than at any other time.

In the beginning of the space age astronauts spent relatively short periods of time in space. Missions were brief, typically lasting no more than a few days. The Construction of space stations means much longer can now be spent living and working in space. But what do astronauts do once they are in space and how do they cope with day to day life in this unique environment?

(pause)

Everyday tasks that we take for granted on earth become much more difficult. This is how water behaves in space. Imagine trying to take a shower or use the toilet when liquids just float away.

A major part of an astronaut's job is to perform scientific experiments and conduct research. Micro Gravity provides the opportunity to study science in a way that is impossible on earth.

(pause)

Keeping fit is vital for an astronauts health. They have to exercise for at least two and a half hours everyday to minimise the long term effects of being in space.

(pause)

It is essential that regular maintenance and upgrades are performed to preserve the fragile environment of the space station. The smallest problem can very easily become a life threatening situation.

The knowledge we have gained through space exploration in the last few decades alone has had an immense impact on all of our lives. Instant global communication, advanced materials, and computer technology are just some of the tangible by-products of the space age.

(pause)

Each step further out into space we take alters our perception of what is possible. The exploration of space extends across borders and serves to unite us all in a single common goal of discovery. How different would our lives be today if our ancestors had not embraced such challenges and ventured out into the unknown?

Exploration has always been a dangerous and high-risk enterprise. The passion to explore has driven humankind throughout history to discover new frontiers.

(pause)

With this spirit explorers have always had a relationship with the stars. They have been their constant companions, always present and unreachable. Once they guided sailors across vast oceans in their search for earthbound new worlds.

(pause)

But what will the future hold for the pioneers of tomorrow. Will our desire to constantly reach out into the unknown allow us one day to not just look up at the stars…

(pause)

…But to travel amongst them.