Passport to the Universe
Descriptive Transcript

Faint white lines and geometric symbols appear and slowly circle around the edge of the black domed screen above you. A title appears in white block letters: "Passport to the Universe." The title fades.

This is Tom Hanks. Welcome.

There are times in each of our lives when it first dawns on us that we are not the center of the universe – that we are part of something larger than ourselves. We are living in the golden age of astronomy. We are mapping the grand structure of the universe, finding our place in its great story. We are becoming citizens of the cosmos.

What you are about to see is not an artist's fantasy, but a three-dimensional map of the real universe.

Before we begin our journey, I need to run through a pre-flight check-list.

White concentric rings appear.

Planet program: Solar system orbits, planets, moons and rings, check.

Tiny stars appear on a grid.

Star program: Local star positions, colors and magnitudes, check.

Galaxies appear.

Galaxy program: Milky Way and galactic coordinates, gas and dust nebulas, check.

More stars fly in.

Universe program: Local Group of galaxies, Virgo Supercluster, check.

Late breaking astronomical images, check.

OK, we're ready to roll.

The screen fades to black. A few faraway stars, tiny dots of white light, glow in the blackness of outer space.

In the time before electricity, in a world lit only by fire, this was the sky that everyone knew. Back then, on a clear moonless night, it was always dark enough to see the faint band of the Milky Way arcing across the sky.

For a thousand generations, our ancestors looked at the night sky and wondered what it was. The sky looked like the inside of an enormous bowl, slowly turning around an Earth believed to be at its center. The stars were like tiny points of light stuck to the inside of the bowl, and not so very far away. The ancient sky seemed two dimensional.

Our ancestors imagined that the stars formed pictures in the sky. They named these

constellations after mythical creatures and heros.

Constellations fill the sky.

But what were the stars, really? What was the Milky Way? For that matter, what was the Earth? And where was it? We had no way to know, until we devised the methods and tools of science.

Numbered lines showing various measurements crisscross and encircle the screen.

Because our eyes are very small and the stars are far away, at best we can only see a few thousand of them, even on the darkest night. But for every star we can see with the unaided eye, the night hides fifty million others, in our Milky Way Galaxy alone.

Millions of tiny, white dots fill the dark sky. They are concentrated in a hazy white band

that arcs across the domed screen, mottled with dark and bright patches.

Using telescopes, we discovered that the sky has a third dimension – depth – and that the universe is far grander than anyone could have imagined.

Most of the stars fade away. A few faraway dots of light remain, twinkling against the black sky.

A simple image of Earth appears, encircled by shimmering white lines.

During the last four hundred years, in a series of astonishing discoveries, we filled out our Cosmic Address.

Earth becomes more detailed.

We learned that, far from being the center of the universe, the Earth is actually but one of the planets, moving in orbit around the Sun.

We zoom out to the solar system.

Our Sun in turn is just an ordinary star.

We zoom out to the Milky Way.

It is one of over a hundred billion stars in our Milky Way Galaxy. And our Milky Way Galaxy is one of several thousand galaxies in the Virgo Supercluster.

We zoom out to scattered clusters of tiny stars.

Finally, this vast supercluster of galaxies is but a tiny part of the Observable Universe.

We zoom out to a thick cloud of millions of tiny white dots, each representing a galaxy. Fade to black.

The Sun, a small, glowing white orb, rises over Earth's horizon. Earth's dark surface is

dotted with the soft orange glow of cities seen from space.

Using telescopes and the laws of physics, we are mapping the universe in three dimensions.

We zoom out. The Sun illuminates Earth.

And once you have a map, you can know where you are…

Earth fades into the distance.

…and where you're going.

We move past the glowing white Sun as we get closer to a tiny speck in the distance. The speck becomes a small, orange planet, half illuminated by the Sun.

That's Mars – after the Earth, the next planet out from the Sun.

We fly over the mottled surface of Mars and into the blackness of space. The Sun disappears as we fly past stars. A white and gray striped planet appears in the distance.

The gas giant planet Jupiter is heavier than all the other planets put together. Its Great Red Spot is a storm that has raged for centuries. Each of its big moons is an unexplored world in its own right. One of them, Io, has volcanic eruptions at all times.

A yellow and orange moon crosses the screen.

Another, Europa, has a deep ocean of water hidden beneath an icy crust.

A pale gray and green moon follows the same path, disappearing into the darkness along with Jupiter.

A new planet comes into view. It is a pale yellow orb in the center of a flat disk of white rings.

The planet Saturn has hundreds of thin rings made of countless orbiting snowballs.

We circle around Saturn to see the Sun, a glowing dot in the distance.

With our computer on interplanetary drive, we've come this far in only a minute. Our fastest spacecraft actually take years.

We move away from Saturn until it becomes one of several indistinguishable pinpricks of light against the black sky. The Sun remains a small, glowing dot in the distance.

We've come a long way. Can you find the Earth? It's so small we can hardly see it from here.

It's that one – the pale blue dot. That's home.

A tiny circle appears right next to the Sun.

Everyone you ever knew – or ever heard of – came from that tiny spot.

The circle fades.

Seeing it like that always gets to me.

We begin slowly turning away from the Sun.

The planets of the solar system are huddled close to the Sun, like campers around a fire in a vast cold and dark plain.

From out here, it's obvious that our mighty Sun is just another star. But the familiar constellations still look the same, because even at this distance from Earth, the stars are still enormously far away.

The Sun disappears off the edge of the screen. Tiny pinpricks of white light twinkle against a black sky.

Connect the dots, and there's Orion the Hunter.

Thin lines form a person holding a hunting bow.

The three stars in the belt make this constellation easy to find in the winter sky. Below Orion's belt, you can see a faint wispy cloud. It doesn't look like much because it's so far away, but just wait.

Stars fly past as we move closer to Orion's Belt.

The stars are millions of times farther away than the planets.

The lines between the stars stretch out as we move closer.

To move among the stars, we'll have to shift to the interstellar drive. As we move out into our Galaxy, the old two-dimensional patterns

vanish, because the starry sky is three-dimensional.

The constellation fades as we move past it. Tiny dots of bluish white light fly past us on all sides. A small dot of reddish white light slowly grows closer.

We're heading for the Orion Nebula, about fifteen hundred light years from the Earth.

We continue moving towards the light. As we get closer, it resolves into a glowing white cloud surrounded by wisps of red.

The Orion Nebula is a recycling center for the stars of the Milky Way, a vast interstellar cloud of gas and dust, a place where stars are born.

We move closer to the nebula. Purplish red clouds, so dark they are barely visible against the black sky, surround a patch of clouds that glow bright white. Pinpricks of white light twinkle around this bright patch.

We're entering a virtual landscape of the nebula, assembled from observations with the Hubble Space Telescope. No one has ever seen the Orion Nebula like this before.

We enter the bright patch.

The brightest stars illuminate the surface of the nebula from which they were born. Our solar system was made in a place like this – a stellar nursery. That was a long time ago, of course, nearly five billion years, but it must have looked pretty much the same.

Wispy teardrops float inside the nebula.

Each of these teardrop-shaped clouds is a blanket of gas and dust swaddling a newborn star and, perhaps, a family of growing planets.

And what does all this have to do with us? Take a deep breath . . . No, I'm serious. Really, everybody, do it.

We rotate around teardrops and tiny stars.

Every atom of oxygen you just inhaled was made deep inside a star. The carbon in our muscles, the calcium in our bones, the iron in our blood – in fact, all the heavy elements – were cooked in the hearts of stars.

Fiery orange teardrops pass overhead.

As Carl Sagan said, we are starstuff.

The teardrops and tiny, bright stars are engulfed by clouds as we move out of the nebula.

Only a few bright pinpricks of light against a black sky remain. A hazy line appears, stretching across the sky.

Stars are born in batches – with dozens in every litter. The sibling stars of our Sun are now spread throughout the spiral arms of the Milky Way galaxy.

We approach the galaxy – a glowing, cloudy strip of deep red.

As we leave our Galaxy, the individual stars appear to blend together.

We move above the galaxy, and the strip becomes a flat spiral with a glowing white spot in the center.

Our Milky Way is really a vast spiral galaxy – a congregation of hundreds of billions of suns. But you have to get out here, outside the galaxy, to see the whole thing. We've never had this view before.

The galaxy slowly rotates.

Remember back on Earth, where we could only see a few thousand stars? Well, all of them lie within that tiny part of the Galaxy.

A tiny yellow circle marks a spot on one side of the galaxy, and then fades. The galaxy

continues rotating. Its curved arms are made of countless pinpricks of deep blue and red light, and they branch out from a glowing white spot in the center.

Dots of light rush past as we move through the galaxy's outer edge and away from the galaxy. It grows small in the distance.

Every one of those spots isn't a star, but a whole galaxy with billions of stars.

Text reading "Virgo Supercluster" briefly appears on screen. The Milky Way becomes just a tiny patch of brightness, no bigger than the other pinpricks of light scattered across the black sky.

We're now in intergalactic drive, moving through virtual space at millions of lightyears per second.

A small flat disc flies by.

That's the Andromeda Galaxy, our nearest neighboring spiral galaxy. It's the largest member of the so-called Local Group – a collection of a few dozen galaxies. Our Local Group is a small part of the Virgo Supercluster – a vast gathering of several thousand galaxies. From out here, it's hard to spot our own Milky Way Galaxy.

Well, it's that one. That's home.

A small yellow circle appears around a distant dot.

Our supercluster of galaxies is only a tiny part of the Observable Universe. On the largest scale we can see, the superclusters form the knots of a tangled network or web. The brightest knots are entire superclusters of thousands of galaxies, with each galaxy containing billions of suns. This is the last line of our Cosmic Address, for now, anyway.

Bright dots fill the sky.

We may be just little guys, living on a speck of dust. But we don't think small. We managed to figure this much out. And we're still figuring. There are about a hundred billion galaxies in the universe we can see. But there are parts we can't see.

Even more dots continue to appear.

And -- who knows? -- it may be that all this, the entire observable universe, is one tiny bubble in an infinite universe hidden beyond our cosmic horizon.

Countless pinpricks of bright, white light fill the sky.

It's time to be heading back. Let's see if we can find a black hole around here somewhere.

Black holes are places where gravity is so strong that not even light can get out. Some theories imagine that they provide short-cuts to connect distant parts of the universe. No one knows

what it might look like inside, so we're free to imagine it.

A dark hole appears, warping the dots of light around it. It grows to fill the screen, engulfing us. We fly at high speed past millions of dots of light. The sky goes black as we approach and fly through a spiral galaxy. More stars streak past. We enter a tunnel of wispy white clouds that grow thicker as we approach the dark opening at the end of the tunnel.

We emerge into the blackness of space.

Well, we got off in the right neighborhood.

As we move past a bright patch of light, Earth appears in the distance, half illuminated. We move closer to it, the vibrant blue of the oceans visible beneath the swirling white clouds that cover its surface.

Welcome home, fellow citizens of the cosmos. Your passports are now good everywhere in the universe…

We quickly zoom out from Earth.

…among the planets of our solar system, the stars of our Milky Way galaxy, the other galaxies of our Supercluster, and on out to our cosmic horizon.

Next time you look up at the clear night sky, remember – you, me, and everybody – we are starstuff. We are in the universe, and the universe is in us. In the deepest sense, we are citizens of the cosmos.

In the blackness of space, tiny dots of light fly by as we travel forward.

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