SCALING THE SOLAR SYSTEM with MeterKid
Overview Ver. 2.5 09/15/10
Developed and written by Ben Shedd

Overview: MeterKid is a live presentation for digital planetariums using the dramatic digital capacity of dome projectors combined with the Digital Sky Program.

Story Themes: the Scale of the Solar System and Breaking the Celestial Sphere. Running Time" 44 minutes with pre-show and walk-in. Pre-show: 10 minutes - Walk-in: 5 minutes - Show: 24 minutes - Walk out: 5 minutes - Total RunTime: 44 min.

The program assumes the audience has a high degree of visual sophistication with media [TV, computer programs, the Internet, video games, movies] and a low to medium degree of knowledge about understanding the size and scale of our solar system. The audience is filled with excited kids and families and teachers, open and alert, and ready for potential fun and new ideas.

Content is appropriate for 9-14 year olds and parents/teachers. See Bibliography References for: Article in Planetarium Primer "Astronomy Learning & Student Thinking" by Jeanne Bishop using learning patterns by Jean Piaget and the Learning Cycle developed by Robert Karplus with the Lawrence Hall of Science; Benchmarks for Science Literacy; National Science Education Standards and Standards for School Mathematics for the backbone of this program.

Design Constraints: Works with Digital Sky Atlas, collateralizing the capabilities of the software and production suite tools. The program can dramatically, dynamically and rapidly move throughout high-resolution and accurately scaled images of the solar system. The program requires minimum additional animation objects and each show can be easily customized for the size and shape of each individual planetarium. Only a few graphic elements - mainly the MeterKid outline, a line profile of the theater, and Heads-Up Pop-up Windows - need to be added to the database.

The show is built from a series of pre-programmed journey segments/flight paths, to be manually started on cues by the Live Presenter. The Digital Sky program will be used to design pre-timed and pre-programmed elements for the different segments of the show. The segments will be set in motion by the Live Presenter and can be repeated if desired. The measurements will be customized for each theater's physical size.

The Live Presenter is a trained paid professional staff, leading a full half-hour program every hour or 90 minutes. The character of the Live Presenter is an enthusiastic and ever curious storyteller with a slightly different and interesting way to look at common things, in this case, to see and present relationships in the scale and size of the solar system. The Live Presenter is at ease with large numbers and makes such numbers seem knowable. The Live Presenter is easily in control of the complex computer system running the Planetarium and models a comfortableness with technology.

The Ticket for the show is a small CD with the program scalers - from MeterKid to AU [astronomical unit] - animated, so they can be viewed later. The CD ticket will have footnotes and/or web links. Included will be a list of web links with how the various planet diameters have been measured over time, from show triangulation to laser and cesium clock calculations.

Frameless visual space[1]: All the movements will be designed to be a series of illusions like the theater is moving. The goal is to fly the theater and the audience, floating into space, zooming sometimes at the speed of imagination and sometimes in serene arching, gravity free flight paths. The idea is to invoke a sense of awe rather than anxiety about falling or flying out of control.

This show works to embrace the historically interesting live planetarium show and the digital dome paradigm.

Sound design: The sound flies through the 3D space with objects, from back to front, side to side, dimensionally.

Combines a dome planetarium show and and preshow outside the theater on a digital flat screen. Is designed to operate like a operator run show.

New idea 012710: Use Google Earth/Google Moon/Google Mars layouts as part of the design and get sponsorship from Google. TBD

Because the entire program is built with digital elements and has a live presenter, the show will be custom designed for each marketplace/location, with added elements based on the specifics of each planetarium and State/Country location.

A Note about MeterKid: MeterKid is a signature idea created by Ben Shedd for the big screen, showing real and comparable scale. I have created it to become an open source idea to be used, developed and improved upon. If there are other uses of MeterKid in museum demos and planetarium shows, please use it and expand the idea, and please give an appropriate acknowledgment where it is used.

Development of this program was supported by the Denver Museum of Nature & Science's Gates Planetarium.

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1 See Ben Shedd's essays on designing for the dome, listed in the Bibliography, for a fuller explanation of "frameless visual space."

Bibliography
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Satellites: [find new link with info] [[I've got one on my iPod]]

Cassini, with trajectory: TBD

Digital Sky info. TBD

Science for All Americans: American Association for the Advancement of Science.
www.project2061.org/tools/sfaa/default.htm
See section on Scale.
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National Science Education Standards (National Academy of Sciences) & Principles and Standards for School Mathematics (National Council of Teachers of Mathematics)
Dr. Mary Urquhart at UT Dallas - contact for Science standards links.
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Visual Explanations by Edward R. Tufte. Graphics Press, Cheshire, Connecticut, 1997.

Links for the following papers are at: www.sheddproductions.com
Papers link: http://tinyurl.com/ye62vrw

Exploding the Frame. Essay by Ben Shedd 1989 & 1994-1197
http://tinyurl.com/5tuksnhttp

Design for the Dome System. Essay by Ben Shedd 1994/1997
http://tinyurl.com/67432h

Principles of Immersive Imagery - SIGGRAPH Course paper by Ben Shedd

Designing Effective Giant Screen Films
GSTA Conference paper by Ben Shedd
See in particular the section CREATING AN EFFECTIVE LEARNING ENVIRONMENT
http://tinyurl.com/5aeqe2

Shedd Productions, Inc. Mission Statement/Manifesto for Production:
http://tinyurl.com/yg5j397

SCALING THE SOLAR SYSTEM Ver 2.5 09/15/10

Script and Storyboard Developed and Written by Ben Shedd

Sequence Summary

1. Pre-show Presentation - Sequence Time: 10 minutes

Entering the Theater - Sequence Time: 3-5 minutes

2. MeterKid Measures the Dome - Sequence Time: 1 minute

3. Off into Space - Sequence Time: 6.5 minutes

4. Our Solar System - Sequence Time: 1.5 minutes

5. How Big is Big? Sequence Time: 5 minutes

6. The Cassini Huygens Journey to Saturn - Sequence Time: 3.5 minutes

7. The Size of Our Solar System - Sequence Time: 1.5 minutes

8. Busting the Celestial Sphere - Sequence Time: 2.5 minutes

9. Our Galaxy - Sequence Time: 1.5 minutes

10. Journey's End/Back Home - Sequence Time: 1 minute

Walk out - Sequence Time: 5 minutes

Total Running Time: 44 minutes
Pre-show presentation: 10 minutes + 5 minutes for entry
Show Running Time: 24 minutes
Walk Out: 5 minutes

SCALING THE SOLAR SYSTEM Ver 2.5 09/15/10

Script and Storyboard developed and written by Ben Shedd

1. Pre-show Presentation - Sequence Time: 10 minutes

Live Presenter on small stage at line entrance to planetarium, with props & large video monitor for display.

Live Presenter: *TBD Name of local planetarium/museum and presenter self introduction* **"We are headed on a tour of our Solar System like you've never seen before, and like any good map, we're going to need a way to keep track of the size of stuff. Here is our Map Scale."**

The Live Presenter unveils a cutout figure standing on the stage. MeterKid is an flat outline drawing of a unisex body shape, arms and feet outstretched, one meter tall. MeterKid is outlined with a thick white outline around a black background. The planetarium logo is on MeterKid's chest.

A kid one-meter tall is invited on stage and fits right into the outline. Then this MeterKid shape is televised on the large video monitor and superimposed on the dome computer model to show it's diameter.

Live Presenter: **"Let's measure the size of our dome."** [Example numbers below. To be customized for each particular dome where this program is used.]

A line of MeterKids, 17.5 of them unfolding like a noisy click-clack puzzle, draws a diameter across the graphic of the Planetarium Dome.

Live Presenter: **"It's 17.5 meters across. 17.5 MeterKids across. And with a quick calculation using the multiplier pi - 3.14 - for getting the circumference of the dome from knowing the diameter, we get 3.14 times 17.5 meters equals 55 Meterkids around the whole edge of the dome."**

And another line of MeterKids, 55 of them unfold click-clack around the circumference of the Planetarium Dome. Now the dome vector drawing draws itself off to a blank screen.

Live Presenter: **"We're going to get an idea of how big the Earth is and how big our Solar System is using MeterKid. Let me show you what I mean. Here's a view of our city from the air - and here is our state. We usually measure these distances in miles. Let's measure the width of our state with MeterKids. Ready?"**

On the video screen we zoom out to see an image of the state and zoom to the eastern border, the start unfolding MeterKids, head to feet, as we zoom back out and show the whole State. The MeterKid line quickly becomes so small it is just a yellow line running across the state.

Live Presenter: **"Whoa. It takes **** thousand meter kids head to toe to measure the width of our State. Let's try it again, with a bigger object - our planetarium dome. We know how many MeterKids wide it is."**

[add kilometers , the times 1,000 meters????]

We zoom into the western border where we see MeterKids in a line and start in the other direction stamping out Domes, each 17.5 MeterKids wide. Sound effects: Bomp, bomp, bomp...faster and faster.

Live Presenter: **"Our state is 35,### domes wide."**

It's getting hard to see the details because of the size of the video screen. We zoom out from the State to see the entire Earth rotating slowly. There is a faint outline of the State as the Earth turns on its axis.

Live Presenter: **"Imagine if we tried to measure the width of the Earth. Whoa, we need a bigger image - let's go inside."**

And the Live Presenter leads us inside, altogether.

Entering the Theater - Sequence time: 3-5 minutes
We see a single MeterKid outline image, real size, 1-meter tall, floating and somersaulting around in the top of the giant dome as a weightless astronaut. This digital Screen-Saver tumbles and rolls and bounces around overhead as the audience gets seated.

Using a radio mike, the Live Presenter helps us get to our seats inside.

Live Presenter: **"Welcome to our theater. Our astronaut overhead is MeterKid and MeterKid is real size here. 1-meter tall."**

2. MeterKid Measures the Dome - Sequence time: 1 minute
MeterKid stops and then begins a whole series of flip-flop folds to draw longitude and latitude grid lines all over the dome. This happens in a whiz, with sound effects moving in spatial relationship with the character. MeterKid leaves 1-meter wide measurement marks all along the grid lines.

Two graphic signboards popup at the screen's lower edge, one on each side of the screen center. The signboards are circular in shape with the planetarium logo and museum logo on each of the signs. The popups appear to be flip-up boards which came from below the lip of the screens.

Live Presenter: **"Let's see how big the dome is again - real size."**

MeterKid swings up like an athletic gymnast and then flips around the circumference of the dome, until there are 55 MeterKids stretching around the dome. Sound effects fold out as these computer effects zip on. This imagery is a repeat of what we saw in the pre-show, but now it is big and to scale.

Live Presenter: **"That's easier to see - and its life size. And now let's see the size of the diameter."**

We move back from the dome line drawing to see a full view of our planetarium as one of the graphic sign post pops up and the circumference - 55 - is divided by pi - 3.14 - to get 17.5 Meterkids. And MeterKids unfold across the diameter of the dome image.

Live Presenter: **"This Planetarium dome is 17 and a half meters - 17.5 MeterKids - in diameter."**

Then, with a slight tug, we fly up and back from the dome sphere image and see it from afar in its entirety, a full half sphere. The Planetarium is drawn as a vector graphic image, surrounded by a faint outline of the museum. The Planetarium image looks like blueprint plans, with the seats and shape accurately to size, and the computer room nearby. The city skyline appear as a rough-sketch drawing in the background against the blackness of the dome. MeterKid is hanging by one hand from the bottom edge of the dome.

***[add a sequence measuring the state by first creating KiloMeterKids - 1,000 kids for a this - what is the thing they measure? and then do the State by KiloMeterKids and also show the MeterKids measurement as well, but it gets very small. what is the shape of a KiloMeterKid - a line of 1,000 colored dashes? Or? TBD [set up the different colors and tones here for different relative measuring sticks, getting lower with each scale change.)*

Add this - NOTE: All these different Scalers are different colors and have a variety of musical sound effects, in different pitches, higher for eh many small objects, lower for the fewer big objects, which shift and repeat as he different elements appear.

Now the schematic lines turn off, leaving us almost in the dark, except for the faint western horizon...

3. Off into Space - Sequence time 6.5 minutes
From the center rising out in a circle, a full color image of the local skyline matching the sketch lines expands, filling the whole dome with an early evening sky.

It is dusk, then the night sky. A speed-up Planetarium end of the day into darkness, as stars can be seen.

Live Presenter describes how many stars are in the night sky, pauses as the sky darkens and then says: **"This is beautiful, and now let me speed up time a bit and get us out into space."**

The stars rotate to dawn and the day again, with a cloudy sky.

Live Presenter: **"Everybody ready. Seat-belts fastened. [check with B. Morgan for add'l copy] Well, imagine your seat-belts are fastened."**

We get the visual sensation of tilting back 90 degrees in our seats until we are looking straight up at clouds and we hear the amplified voice of our Presenter say: **"Launch time for Journey of Imagination, 10 seconds and counting"** and then the voice counts down, announcing **"Ignite Engines"** on the **"4"** count as the sky image begins to shake and on **"0"** we blast off. The room shutters with low frequency rumble and orange flames circle the dome edge, and we lay straight up on a space launch path, twisting slowly. Then, as the engine noise recedes away, we rotate slowly around as we travel and see the Earth with a Constellation spaceship and the International Space Station in the foreground receding away until we can barely see the spaceships and only see the full Earth against a dark sky of stars.

Out into orbit around the Earth, with the Moon in the background.

Live Presenter: **"We're out beyond the satellites, not as far as our Moon Landers."**

Looking at the Earth, we see day and night rotating by, and then the rotation speeds up though a whole year of the seasons. A brief riff of Vivaldi's Four Seasons/Spring music plays.

Live Presenter: **"We can change time using computer power - here's a whole year of the seasons in 10 seconds - but that's another story"** and the music stops, as the does the fast Earth rotation orbiting around the Sun.

An outline of our State appears on the Earth's surface.

Live Presenter: **"Ok, let's look at our State, in the North American Continent. How big is the Earth?"**

We zoom out to see a satellite compilation image of the Earth in space, with the Earth rotating in the light of the Sun. The shape of the State has become very small, almost invisible.

After two full rotations, the Earth turns into a wireframe/polygon model. We bring on our meter-size to Earth-size comparison key - MeterKid. We fly down an ever-growing diameter line of MeterKids, diving from one side of the Earth to the other, as a line of shapes digit out, fast paced with sound effects SWOOSH. Zap, zap, zap... a staggering repeating pattern at digital speed. And then we swing around and look at the Earth model. The MeterKid line has become just that, a tiny thread size line.

Live Presenter: **"How many MeterKids head to toe to head? 12,756,000 MeterKids. The measured diameter of the Earth. Wow!**

Let's try a different Map Key to make this clearer. Let's use the dome."

And again we fly along a rapidly growing line of dome images stretching across the center of the earth image.

Live Presenter: **"That's a little better, but not much. 728,966 of these theaters we are sitting in. We need almost a million of these domes to get a size of the Earth.**

Let's use our state - that's bigger."

[Customize] And 20.5 states unfold across the 3D Earth drawing, a much better ratio.

Live Presenter: **"The Earth is 20 and a half times as wide as our State. Big State. Big big planet."**

Now we see the wireframe planet image get digitally reskinned with its textured surface, with all the Earth's land and water, and we see sunlight on the Earth rotating around and around.

And now we gently float out from the Earth and see the flight paths of jet airplanes, a familiar image from Airline magazines, sprouting out from cities all around the globe. The flight lines are quite close to the planet.

Live Presenter: **"How high are airplanes and satellites? Jet airplanes fly at 48,000 MeterKids high; the Shuttle/Constellation orbits at 300,000 MeterKids high. The International Space Station is 354,000 MeterKids above the Earth."**

We slowly pull back a little further and see Satellites orbiting the Earth, the Weather Satellites and Iridium groups in close to the Earth. The names for the satellites are turned on, and then we pull out further and see the Geo synchronous Satellites appear with their orbits.

Live Presenter: **"The Geo-synchronous Satellites are 35,800,000 MeterKid high and stay in one spot over the Earth. These aren't all the satellites circling the eArth, but this gives us a good idea of how many we are using everyday."**

All the labels and orbits go off, leaving just a ll the satellites rotating in their orbits, and then we fly out further until they can't be seen. Along the way, we see the Apollo flight path to the Moon trace itself out, with the landing site labeled "July 20, 1969."

Live Presenter: **"Here is as far as we humans have ever been out in space - to our Moon. We've sent our satellites to land on other planets - we've landed several on our nearest planet Mars."**

We travel along MeterKids unfolding as we follow a satellite and look back to see how many MeterKids there are. A parachute pops up filling our view and we abruptly beep around looking toward the planet watching this parachute open and the rover box bounce along the surface. As we land, the Rover is out.

Live Presenter: **"These Rovers - Opportunity and Spirit - have traveled a lot around the surface of Mars. And do you know how big they are? Where's MeterKid?"**

The MeterKid outline pops on floating a bit - much less gravity than Earth - and then stands next to and then lays down next to the Rover. We see that the rover is 1.5 MeterKids high, 2.3 MeterKids wide, and 1.6 MeterKids long.

Live Presenter: **"The Rovers have taken some wonderful images of the surface of Mars, including images of their tread tracks. And let's see how far the Rover traveled in this image."**

A rover image scans up from the bottom of the screen filling our view, and a MeterKid outline laying near the front edge and then a series of MeterKids flip flop out along the rover path.

Live Presenter: "**## MeterKids on this exploration, and here are some of the views."**

4. Our Solar System - Sequence Time: 1.5 minutes
Images pop up along the path, showing vistas as captured by the rover camera.

Live Presenter: **"Now let me show you our whole Solar System. In this computer program, we have all the names of he planets and their moons, and I going to turn the labels on as we see them. Here is Mars - where we may travel someday - and the inner planets Mercury and Venus, with their moons. And the Sun - and Jupiter and Saturn, with their many moons. Now Uranus, Neptune and finally Pluto. All the planets are in their orbits around the sun."**

We pull out from Earth and the Moon to show the whole solar system - Earth orbiting around the Sun and then the planets enlarged way out of scale with their orbit paths. The Live Presenter turns on all the names of the planets and the moons. This highly distorted view, with the planets shown as huge spheres, is familiar because it is often used to explain the workings of the solar system.

Live Presenter: **"The astronomy computer program has all of the planets and star in correct scale and size to each other. Right now I have all the planets showing at 10,000 times their real size compared to their orbits, and the Sun is showing at 1,000 times its real size. The orbits are also out of scale so we can see all the planets at the same time. Now I'm going to set the Sun and the planets to their real size. Here we go!"**

ON cue, the software program rescales all the Sun and planet sizes correctly and they shrink from view, leaving only then name labels visible traveling along the orbit pathways. The Sun is just barely visible, looking mostly like one more star in the sky.

Live Presenter: **"Wow, where did they go? Nowhere. They are now just the right size compared to each other.** [pause] **Space is big and vast."**

5. How Big is Big? Sequence Time: 5 minutes
Live Presenter: **"Let's go back to Earth at the speed of imagination and look at this again."**

Zoom, zap we rush to Earth in a computer graphic swoosh, coming to a smooth, but abrupt halt just over the aerial photo of our planetarium. The sensation is dizzying to say the least.

Live Presenter: **"Want to see that swoosh again?"**

Audience (laughter): **"Yes."**

Live Presenter: **"Here we go back. Hold on."**

Swoosh out to the entire Solar System, with the barely visible planets and large labels continuing along their orbit paths.

Live Presenter: **"And back down to earth..."**

Swoosh back again to aerial view, a landing, and the tilt to see the night sky...

Live Presenter: **"Let's do some size comparisons to the Earth. When we look at the Sun and the Moon, they often look like they are about the same size in the sky."**

***** add distances sequence here*

[this needs changing from measuring diameters at first to measuring the distance to the moon and then its diameter, and then have it swallowed up by the earth size.]

The flip screens come up, one showing an overhead view of the Earth with its Moon orbiting and the second screen showing the Earth orbiting the sun, with a tiny Moon orbit around the Earth.

Live Presenter: **"The size of the Moon?"**

From overhead behind us, a MeterKid comes flying in slowly, and unfolds more copies left and right as it movies away from us toward the Moon. The growing line rapidly

increases in size, as we literally see millions of MeterKids zap out from the center. The diameter size of the Earth compared to Moon diameter - 3,474,800 MeterKids.

Then a dome size flies in from overhead and they too become so small we can no longer see them, only a label which points to a line and reads “198,560 planetarium domes.”

Then a large circular object comes lumbering in. It is a line drawing of the Earth and klunks around the Moon, surrounding it as we slowly move away from both of them, to see the full size of the Earth compared to the Moon inside it.

Live Presenter: **“The Moon is just over 1/4 the size of the Earth in diameter.”**

The Earth drawing slowly draws itself off, the lines collapsing into themselves, leaving just the Moon lit by the Sun.

Live Presenter: **“Let’s go look at the Sun, up close, like we can only do in our imagination. Ready to feel the heat?”**

We circle the moon and head toward the Sun and accelerate so fast that Venus and Mercury just fly by. We slow down as we approach the huge roiling boiling hydrogen ball of hot gas and the theater is filled with a low turbulating rumble - enhanced by the lowwwww rumble and fire hissing sound in the theater sound system.

With a cue, the Sun follows the now familiar pattern turning into a wireframe diagram version - ready for measuring. The Sun image continues to roil and boil only now it is a simple computer vector line drawing. Like with the moon, a line of MeterKids flies in from overhead, the line growing quickly in both directions from the center as it recedes so fast that they become a very narrow line across the sun. Then a growing row of planetarium domes fly in from overhead and also become a line, then in comes KiloMeterKid lines and it too becomes so small that their is no detail, and a row of our State outline fly in, all 2333 of them, and become vanishingly small. Each group has it’s associated sound effect fly in from overhead and go away off into the distance, moving with the line. Each line has the number of scale items, but each label recedes fast and quickly becomes sos small we can’t read it. *[IDEA: 013010 add several languages along each line, like with the planet names etc. make the piece automatically multilingual. [[grow the market from the get go]]]* Then Earth gloves fly in from overhead, side by side unfolding as spheres, and create a line across the diameter of the Sun diagram and remain visible to count because of their size. Only the Earth measurement scale remains big enough to see. The diameter size of the Sun compared to the diameter size of the Earth: 109 Earths across the Sun.

Live Presenter: **“*[TBD call out the various sizes one after another starting from MeterKids to KiloMeterKid to Domes to State to Earths]*..., 109 Earths would fit across the diameter of the Sun.”**

The Sun reanimates into a highly realistic looking ball of plasma - along with its roaring sound - once again becoming a very real object giving off light and a sense of heat. We gently fly out from the Sun, soon showing the Sun with the inner planets - Mercury, Venus, Earth, Mars - orbiting around it.

Live Presenter: **"One of the common measurements used in Astronomy is teh distance from the Sun to the Earth. It's called one Astronomical Unit. It takes too many Earths to show the size of this distance, so we won't even be able to see them. Let's use the size of the Sun's diameter to measure this distance."**

Zip, zip,out folds the Sun graphic, just like MeterKid/State/Earth have folded out before, with a zipping sound effect moving along the folding path, drawing al line of circle from the Sun to the Earth.

Live Presenter: **"72 times the size of the sun. 1 Astronomical Unit equals 72 Suns. How many MeterKids? 150 billion MeterKids, or - divide by 1,000 - 150 million KiloMeterKids, that's how many. Whew!"**

We hear the MeterKids sound zip out in a echo, but see no line after the first few MeterKids flew onto the screen and receded very rapidly into the distance - its just too small.

6. The Cassini Huygens Journey to Saturn - 3.5 minutes

We pull out from the inner planets as the label come on to be able to track them into the distance and we see the Solar System extended out to beyond Saturn.

Live Presenter: **"Let's use the AU - the Astronomical Unit - to find the distance from the Sun to Saturn."**

In the same flip out way, the AU distance measurement folds open to show the Saturn is 9.5 AUs from the Sun.

Live Presenter: **"The planet Saturn is 9.5 times the distance of the Earth to the Sun from the Sun. Right now there is a satellite orbiting Saturn so we can study that planet up close. The satellite is called Cassini Huygens and it took 7 years to travel to Saturn. It's was a 7 year 3.2 trillion MeterKid journey from the Earth to Saturn. Here's the flight path of Cassini Huygens and we're going to fly down and join it on its journey."**

Looking toward the Sun, all the planets resize to huge scale so they are visible. We see an overhead view of the Cassini Huygens flight trajectory launch out from Earth and see it travel in a loop twice by Venus and then by the Earth once more.

Live Presenter: **"By flying close to several planets, this satellite used the gravity of the planets like a sling to swing it faster along its journey."**

On the Pop-Up Windows, we see the launch date October 15, 1997 and then a rapidly accelerating calendar matching the journey.

We now fly down to catch up with Cassini aHuygens and follow it as it flies by Jupiter.

Live Presenter: **"Another gravity assist from Jupiter to speed Cassini Huygens along - and a great opportunity to get some close-up images as we zip by."**

We see these Jupiter close-ups of its band of clouds animated on the second PopUp Window, while we continue to follow Cassini Huygens past Jupiter on the large dome.

As it approaches Saturn, we stop and watch the satellite go into orbit, leaving a graphic travel line trail.

Live Presenter: **"I've speeded up time a lot on and here's how Cassini Huygens has orbited Saturn. In the planned mission, first 4 years long with 2 more years added, it's orbiting Saturn over 80 times*."**

We see marvelous orbiter patterns encircling Saturn.

Live Presenter: **" Time for a quick measurement."**

Saturn turns into a wire frame.

Live Presenter: **"And how big is Saturn? We'll use our Earth size to scale Saturn."**

... and 9 and a half Earth shapes unfold across it.

Live Presenter: **"Saturn is 9.4 times wider than Earth. Isn't tis digital planetarium fabulous? Ok, it's time to fly through the Cassini Division - the large gap between the rings first discovered by Jean Dominique Cassini through a telescope in 1675. Here we go."**

The full-color Saturn surface returns and we drop down and fly through the rings, with millions of small "dirty snowballs moonlets" fling by us. And then we rotate around to look at Saturn as we back away and soon see the whole Solar System, now a series of orbit rings with a tiny cross hair traveling for each planet. We're so far away to see the whole Solar System, the Sun is barely visible in the center.

[add sending digital signal back to earth? seen from space]

7. The Size of Our Solar System - 1.5 minutes

Live Presenter: "And now back out to the whole Solar System."

As we pull back, we again see the AU measurement scaler and it unfolds all across the breadth of our Solar System.

Live Presenter: **“The Solar System is 80 AUs wide, 80 Astronomical Units, 80 times the distance of our Earth to our Sun.”**

8. Busting the Celestial Sphere - Sequence time: 2.5 minutes
Live Presenter: **“Now back to Earth.”**

And we take a looping speedy zoom ride down to our planet Earth.

Live Presenter: **“Let’s rest for a minute. In real time, that ride we just took would have taken ** years traveling at ***KiloMeterKids per hour. We’ve got one more trip today, but for a moment, let’s just look at our night sky, tonight’s night sky.”**

Live Presenter points out a few particular things to see in tonight’s night sky, using a laser pointer.

Live Presenter: **“Here’s the North Star - and the Big Dipper ....”**

An outline of the Big Dipper links the stars.

Live Presenter: **“The stars we see are not all at the same distance from us, not as if they are projected on a planetarium dome like we see here, but they are at many difernt distances from us on earth. Hold onto your seats, put your imagination in gear, here we go...”**

As we rapidly pull out into the night sky, the Big Dipper constellation lines become elongated as they stay linked to their stars and we see the 3D depth between these stars, some closer and some very far from us on Earth - which along with the entire Solar System has shrunk down to where we just see the glimmer of the sun as one of millions of stars in the night sky. And we continue to pull out until this ball of lines and mass of stars recedes into the Spiral Arm of our Galaxy and we pull all the way out through our Milky Way Galaxy in a huge slowly rotating swirl.

9. Our Galaxy - Sequence Time: 1.5 minutes
Live Presenter: **“How big is the Galaxy compared to our Solar System? We can actually ask that question and come up with a measurement. Let’s use AUs to measure this.”**

AU distances come flying in overhead and unfold - and as before they recede into just a thin line all across the image of the Galaxy.

Live Presenter: **“154,000,000 [One hundred and fifty four million] AUs - or better still, let’s use the size of our Solar System - 80AUs - compared to the size across our Galaxy.”**

Solar System ring line drawing now fly in from overhead and unfold, and they too become a line.

Live Presenter: **"1,925,000 [One million, nine hundred and twenty five thousand] Solar Systems widths. We need almost 2 million of our Solar Systems to get a sense of the size of our Galaxy."**

The faint line of Solar System widths quietly fades away and we watch our Galaxy slowly, ever so slowly rotating.

Live Presenter: **"Here we are, looking at our Galaxy, from an image made of TBD. Pretty cool, huh? And pretty cool digital software and projection system, too. This Galaxy image has all the known real stars from hundreds of years of research with tools from our eyes to telescopes to satellites and uses a statistical calculation, based on the ways we've learned that stars develop, to fill in all the rest of these stars."**

We gently fly up over the Milky Way Galaxy and see the sweep and scope of the Universe, hundreds of thousands of Galaxies near and far.

10. Journey's End/Back Home - Sequence Time: 1 minute

Live Presenter: **"That's probably enough travel for MeterKid for one show. We've got plenty of imagination left, but let's stop here. And by the way, we've been distorting the time it takes to travel through space all over the place to make these comparisons. The show about time, that's another show about Black Holes. Ready to go home?"**

And we zoom back toward our home planet with burst of speed, as we slide down an almost infinitely long line of MeterKids and arrive back at Earth and then our wire frame line drawing of our planetarium dome.

Live Presenter: **"Whoa!!! Whew!! We're back. Thanks for joining this journey into space."**

A graphic logo of the planetarium comes onto the center screen, surrounded by smaller lines of type translating saying 'Thanks for coming on this journey into space" in 40 languages. Title credits come on the dome and the PopUp Window side screens, and the departure house-lights along the edge of the dome slowly come up. The planetarium logo flips over and becomes a MeterKid. MeterKids unfold all along the rim of he theater, then fill in until they cover the entire dome in an interlocking pattern. They all fold into one MeterKid who starts rotating and becomes a slowly floating 3D-screen saver Astronaut.

Live Presenter: **"Please exit up the stairs to the back. Thanks again for coming to the [name of] Planetarium and Museum."**