

## **1. Everyone's Favorite Telescope**

[Man 1's voice] "Ask anybody the name of a telescope, Hubble is the name that always comes up"

[Man 2's voice] "The public, the general public seems to have a love affair with Hubble."

[Man 1's voice] "I mean this is the telescope that everybody recognizes, recognizes the images from this telescope, and uh, recognizes its importance, you know to, literally you know to everybody's life in the sense of inspiration."

## **2. The possibilities are endless**

[Woman's voice] "Twenty years after launching on a space shuttle and opening its instruments to the farthest reaches of space NASA's Hubble Space Telescope has become synonymous with exploration, discovery and even a bit of luck. "

[Man's voice – Dr. Mario Livio, Astrophysicist, STScI] "One of the things that Hubble has done is that it really taught us something about our place in the universe. And, and our role within it. We want to know how did the universe start, how did our galaxy start, how did the Earth start, how did life on Earth start. And we also want to know how will all of these things end."

## **3. Preparation and launch**

[Man's voice – George Diller, NASA Public Affairs] "When the telescope arrived there was a lot of anticipation because there was so much extraordinary effort required, at um, at KSC in order to, to assure that the telescope was gonna be able to maintain in the kind of environment that it had to be and, and that meant a cleanliness standard that was extremely pristine, far beyond anything that we had ever launched before."

[Woman's voice] "With years of design and construction behind it the Hubble was sealed inside of Discovery for liftoff. The Hubble Space Telescope flew into the national consciousness on April 24<sup>th</sup>, 1990, inside the payload bay of space shuttle Discovery."

#### **4. The beginning of the mission**

[Man 1's voice – "David Leksrone, NASA's Senior Project Scientist]  
"Hubble's all about imagery, it's all about taking clear, sharp beautiful pictures of the sky and doing fantastic science with, with those images." [Music]

[Man 2's voice – Ed Weiler, Assistant Administrator for NASA Missions]  
"The story of the Hubble Space Telescope launch is best uh, the way I like to describe it is uh, climbing to the top of Mount Everest, and then suddenly within a couple of months sinking to the bottom of the Dead Sea, the lowest point on Earth."

#### **5. Three months later, Hubble Trouble**

[Man 1's voice – Ed Weiler, Assistant Administrator for NASA Missions]  
"We had trouble focusing the telescope, and uh, we noticed that wide field camera pictures that were coming down, were fuzzy, fuzzy blobs instead of nice sharp points. And over the course of Ju... early June we started to get worried, maybe, maybe there is something wrong with the mirror itself. You can't believe how down every astronomer on the Hubble team was that day because we were about to announce to the world we, we messed up, and we don't have the telescope we thought."

[Man 2's voice – Douglas Broome, Program Manager] "The conclusion we've come to from that is that there's a significant spherical apparition appears to be present in the optics. And the simplest way of understanding it is that when you have a um, mirror that is focusing, the light all comes together at a single point, is the objective of the exercise, we want the light to come together and focus at a single point. When you have a spherical apparition that says that there is some disfigurement of that mirror that causes the light, instead of focusing on a single point, to be spread across a region of space."

[Man 1's voice] "And suddenly, in the press was born the term 'Hubble Trouble'."

#### **6. A small ray of hope**

[Man 1's voice – Ed Weiler, Assistant Administrator for NASA Missions]  
"John gave me this one ray of hope. It was that one little ray of hope that I glommed onto."

[Man 2's voice] "We played with it. We played with the model, and we realized that if the error were in the primary mirror, we could make our correction with a little mirror about the size of a nickel, inside our camera. So we purposely made the mirror inside our instrument, and therefore our whole camera out of focus with the minus sign. It was as profoundly out of focus as the Hubble Telescope was exactly. And that was not easy. We were finishing up the final optical lens and the NASA Administrator Dan Goldman visited JPL. He went to the clean room and said 'What's going on here?' Larry Simmons the project manager says, 'well, we're here to fix the Hubble telescope.' And his response was 'no, you're here to save the agency.' That was a clear message to us that it was important, we shall not fail."

[Man 3's voice – astronaut in space replacing original camera] "Uh, okay, are you ready to do that again?"

[Man 4's voice] "Shortly after uh, the mission was over we brought WICPIC 2 online."

[Man 2's voice] "We'd done everything, that we thought we had to do. But there's no substitute for seeing that it actually did work. The first image came and it looked really good, it looked just the way it should look. [Crowd in control room cheers, whoa, whoa, we did it!] We did like nine press conferences in a row, primarily WICPIC pictures. Every single one made front-page news across the world. It took this camera being put in the Hubble in 1993, to really start the career of Hubble. To turn Hubble from a national disgrace almost, to the great American come-back story."

## **7. Testing Chambers Part 1 of 2**

[Man's voice] "Here spacecraft and components suffer through a grueling battery of tests, all in an effort to see if they are truly capable of performing their mission, and surviving the rigors of space flight. [Electric music in background]"

As this centrifuge whips them around, they experience the kind of G-forces, or gravitational forces, that they can expect to see on launch.

Now this centrifuge is not for human use, it can go up to 30 G's, which is way more than a human being can stand.

They get shaken on any number of vibration tables to simulate the vibrations during launch. There's no sound in space, but the ride up

can be noisy enough to break things. [Sound of shuttle launch with rocket boosters]

Inside this acoustics chamber, the instruments are blasted with noise in order to make sure they'll be able to survive the rocket trip to space. [Music and alarm bells]

Some, like the new slick carrier, come to this static load test facility. Some call it the rack! Inside this frame, hydraulic actuators operated by a team of engineers push and pull the new composite payload carrier, testing its ability to withstand the pressures of launch and reentry. Based on the results from the thousand strain gauges placed on the carrier, it passed.

## **8. Testing Chambers Part 2 of 2**

[Man's voice] "In the electromagnetic interference test chamber radio waves are blasted at the instrument to see if they will disrupt its operations. The instruments are also tested to see if they produce any radio waves that could also interfere with other instruments or systems. [Sound effects]

This is the space environment chamber. [Epic music]

Inside this enormous tank, spacecraft and instruments, like the new wide field camera 3, experience the harshness of space. The air is pumped out to simulate the vacuum of space and then the real testing begins. This chamber can heat to a blazing 300 degrees Fahrenheit, and then drop to minus 310 degrees Fahrenheit. In here the spacecraft must endure the huge temperature extremes it will experience in orbit, as it travels from full sunshine to the darkness of Earth's shadow. A typical test can take many weeks. [Epic music fades out]

## **9. Exploring the Carina Nebula**

[Electronic and synthetic music as the camera fades into a Nebula viewed by the Hubble Telescope, music fades out at the end]

## **10. Trailer for the Webb Telescope**

[Drum Heavy Music] Captions read: Imagine, seeing, 13 billion years, into the past, imagine, seeing, the first stars..., galaxies evolve..., solar systems form, you will.

[Man's movie announcer voice] "Under construction is the premier telescope of the next decade, ah next generation space telescope. Designed to cause yet another giant leap forward in our understanding of the cosmos. It will carry some of the most advanced technologies ever placed on an orbiting observatory."

[Beeping sound effects] [Woman's electronic announcer voice] "18 beryllium mirror segments, 2.75 times the diameter of Hubble's primary mirror, micro shutters, wave front sensing and control subsystem, 12 by 18 meter, 5-layer Kapton based sunshield."

[Man's movie announcer voice] "The Webb Telescope, a revolutionary tool, able to study every phase in the history of our universe."

[Beeping sound effects] [Woman's electronic announcer voice] "The Webb Telescope."