

In recognition of New Horizons' upcoming closest approach to Pluto, NASA EDGE sets out on their own parallel mission to Pluto, West Virginia. Along their journey, NASA EDGE interviews experts involved with this amazing mission, and they even meet the authors and illustrator of the popular children's book, "Pluto's Secret." Franklin talks to people on the street about Pluto's planetary status, and despite the Co-Host's struggles with basic navigation, both missions are right on track.

Transcript

Featuring:

New Horizons Mission

- Jim Green
- Alan Stern
- Chris Hersman
- David DeVorkin
- Margaret Weitekamp
- Diane Kidd

[Music]

BLAIR: Success! We just completed our driveby of the Neptune Statue in Virginia Beach, VA in what can be described as our parallel mission with New Horizons mission to Pluto. Our next stop, Pluto, an unincorporated township approximately 350 miles away.

FRANKLIN: Welcome to the NASA Edge galactic getaway.

CHRIS: In 2006, the International Astronomical Unit downgraded Pluto from a planet to a dwarf planet. We're going to go figure out if the Pluto Township was downgraded too.

[Paper rustling]

FRANKLIN: What are you doing with that map?

BLAIR: I'm just validating data.

CHRIS: Do you know how to get there?

FRANKLIN: Yeah, I have some GPS coordinates that will get us in the region.

CHRIS: While Blair's trying to figure out how to fold that map, I had a chance to sit down with Jim Green at NASA Headquarters. He gave us some great information on the New Horizons mission and Pluto. Check it out.

FRANKLIN: Hey dude, can you get that map out of my rearview mirror? I have to see whether or not a star destroyer is pulling up to my bumper.

[Chris laughing]

CHRIS: Jim, we have a cool mission that's approaching Pluto, New Horizons. How does New Horizons fit in the overall scheme of planetary science at NASA?

JIM: This is really going to be a historic moment. New Horizons will complete our initial investigation of our solar system. NASA has been to every planet in the solar system. Of course, Pluto, being that one furthest away, it's taken us a long time to get there; almost 10 years.

CHRIS: Was the launch back in 2007?

JIM: 2006. Yeah, January 2006.

CHRIS: It was traveling some 36,000 miles/hour to get there?

JIM: When it did take off, it was, at that time, the fastest vehicle ever. It got a swing by of Jupiter, so that increased it. Now it's moving at about 14.2 or 14.7 km/second. That's an incredible speed.

CHRIS: What's unique about Pluto that's different from the other planets in the solar system?

JIM: Pluto represents a brand new population of objects that we know almost nothing about. This is way out in the outer part of our solar system. We believe this is debris left over from the initial formation of the solar system. We're going to be visiting that population for the very first time. We call that the Kuiper belt. There are maybe hundreds of thousands of objects like that out there. Right now we've observed about 1500 of them but there's just a slew of them out there. Pluto is really the arch type. It's the top dog of the group.

CHRIS: When we were both in school, we learned Pluto was the 9th planet of the solar system.

JIM: True!

CHRIS: Since 2006, it's been demoted to a dwarf planet. What happened there?

JIM: The International Astronomical Union is the group that decides on naming conventions. From a NASA perspective, we don't care if it's a planet or not. It is a wonderful object well worth visiting because it represents one of those groups that we've not visited. You got terrestrial planets. You've got gas giants, and then you've got this third group, Kuiper belt objects. Pluto is going to be our first one we get to observe.

CHRIS: New Horizons has been well on its way to Pluto since 2006. During that transit time, what have we learned about Pluto?

JIM: What we've learned about Pluto is it's a very complicated system. It has 5 moons, not just Pluto and Charon. It's has the smaller moons that have been observed by Hubble. We've also had a lot of ground-based observations that continue to make occultation measurements. That's where Pluto will move in front of a very distant star. We want to make those measurements because they'll tell us where the surface of Pluto is but also if Pluto has an atmosphere. It turns out those observations clearly indicate that Pluto has a very nice but small atmosphere. Is it just from the gravity that it holds this material or is it an active body? Are there some sort of volcanoes or something for which the atmosphere gets replenished? By flying by, we'll get a much better idea how active that body is and whether there's a hydrological cycle of some sort. How extensive is that atmosphere? It's a top question we'd like to know.

CHRIS: Why do we want to study all of these new features about Pluto if it's so far away?

JIM: As I mentioned, this is a brand new population. We want to know much more about it but in addition to that we want to compare those objects to other things that we do know about, like comets or terrestrial planets or like other moons. There is one period of time in our history of the evolution of our solar system where we believe interactions between Jupiter and the other planets; there was a push and pull, a tug, if you will, moving around. It rearranged our planets in their locations. In other words, the outer planets, the giant planets like Uranus, Neptune and Saturn were formed much closer to the sun than where they are today. Jupiter's interaction pushed them out and it brought the Kuiper Belt in. Are there objects right now orbiting our other planets, our big planets, our gas giants, that are actually Kuiper Belt objects? We don't know that. But it tells us, once we see Pluto and once we understand more about these bodies how that interaction could have happened and a little bit about the history of our solar system.

CHRIS: Jim Green did a great job getting us information on the New Horizons mission and Pluto. In fact, it's pretty stunning that the spacecraft will be traveling at 14 km/sec as it flies

by Pluto. That's kind of like going from our Neptune statue to the Township of Pluto in less than 30 seconds.

FRANKLIN: Man, that is a whole lot faster than we're traveling right now.

CHRIS: You'd better believe it.

FRANKLIN: it's great information but I'm distracted by the fact that Blair is still in my rearview space mirror with a sheet of paper and a legend.

BLAIR: Um, the important thing is I'm navigating. I don't think you understand that redundant systems are actually important to any mission.

FRANKLIN: Are you trying to become an Eagle Scout on this trip?

[Laughing]

BLAIR: I'm trying to verify, check and make sure we're on course, even though, it's very tricky to find Pluto on this map. I have to confess that.

FRANKLIN: We have the GPS that's going to get us in the vicinity of Pluto but we also have other technology on board that can take readings like the temperature. We have an altimeter. We have about two or three cameras less than New Horizons has on board because you can see me here, here, here, here and back there too.

CHRIS: Speaking of scientific instruments, you did mimic the same exact suite of instruments that New Horizons has on this vehicle. Right?

BLAIR: I had a slight budgetary limitation when I tried to outfit this vehicle. I wouldn't say I mimicked. In spirit, I tried to replicate some of the things. Actually, it would be near impossible to have actually mimicked what New Horizons is doing. As Alan Stern said when we talked to him at the Applied Physics Lab, there's so much Science they're going to be getting in this first close-up mission to Pluto that we're going to be amazed.

BLAIR: Allen, we're on the brink of this amazing New Horizons flyby, closest approach to Pluto. I'm wondering what kind of science is NASA going to get from New Horizons leading up to and through the flyby.

ALAN: The science that New Horizons is going to deliver is going to be mouth watering because we've never been to this third class of planet. We've certainly never been to the Pluto system, a planet and five moons. We're carrying the most sophisticated battery of scientific instruments ever brought to bear on a reconnaissance mission. We have nine

cameras, two spectrometers, two plasma instruments, radio sciences, and a student dust counter. We're going to produce geological maps, composition maps, thermal maps, and topographic maps. We're going to be searching for new satellites, searching for rings. We're going to be studying Pluto's atmospheric composition and its escape rate. We're going to study the temperature and pressure structure vertically through the atmosphere and a whole variety of other things. It's going to write the textbook.

BLAIR: It sounds like a huge amount of information. How does this compare to what we have for other planets in our solar system?

ALAN: It's a smaller amount of data than we have about other planets because we've sent so many missions there but in terms of a first mission, I'll give you a comparison. The kinds of data sets that we're obtaining at the Pluto system this summer, weren't obtain at Mars until we were 7 or 8 missions into the exploration of Mars, almost 20 years after the first Mars mission. The sensors we are carrying are built with modern 21st century technology. There much more sophisticated than what the pioneers, back in the 60s and 70s could field on those early reconnaissance missions. The seven instruments that are on this spacecraft combined weigh less than just the camera on the Cassini Saturn Orbiter. Together, all seven running at once draw 28 watts, which is about a nightlight; pretty impressive.

BLAIR: Wow. That's an accomplishment in itself not to mention that it's a gazillion miles away. I'm processing this. I know that's a new number but...

ALAN: It's a technical term.

BLAIR: Well, I'm a technical guy. How is that scientific data going to help us understand our solar system better?

ALAN: That's a great question. Every big planet used to be a small planet. Planets grow from small objects to successively larger objects. The earth use to be Pluto's size, as an example, so did Mars. By going to this new class of small planets, we have a chance to study the intermediate growth stage for the larger planets. It's going to help us connect the dots between the missions we've flown to comets, planetessimals and small things out of which small planets are built. Now we can see the intermediate size objects like Pluto and connect that to the understanding of the earth.

BLAIR: One thing I am wondering, New Horizons continues after Pluto. Are there any plans for it to get more data about Pluto or about other objects that might be even further out there?

ALAN: That's a great question. We're going to be taking data for weeks after we make the flyby back looking at the Pluto system. Then, we'll spend about a year and 4 months getting all that data back to the earth. It takes a long time because there is so much data. Following that, we hope to fly on to flyby of small building block Kuiper Belt objects, much smaller than Pluto; a thousand times less massive. We have a couple of targets we could fly by in 2019 if the extended mission is approved. After that, New Horizons has the power to operate into the 2030s. It could fly a mission a lot like Voyager is flying now to explore the outer fringes of the heliosphere, even to get into interstellar space.

BLAIR: What are you most looking forward to on the day when all the data comes back? What are you most excited about?

ALAN: I'm excited about a number of things. You know scientifically, I'm excited about simply unwrapping this present under the tree. So many people have worked so hard for a very long time to accomplish and see what's inside; what's really there at the Pluto system. How complicated is Pluto? How fascinating are its satellites? What's it all about? I'm also excited because we have a chance with New Horizons because of the nature of exploration, the nature of going to a frontier to capture people's imaginations in new ways, to excite kids about science and engineering and space flight and to show the public, both here and abroad, the things only NASA can do.

FRANKLIN: People are absolutely excited about New Horizons. On our mission, we decided to stop by and talk to some men and women to get their views on Pluto.

FRANKLIN: All right Zach, what comes to mind when I mention to you the word Pluto?

ZACH: A planet.

MAN: The planet and the god.

REBECCA: The planet.

FRANKLIN: It is a planet, right?

REBECCA: Yes. Right? Isn't it? No, no.

FRANKLIN: So, Pluto is a planet?

MAN: Yeah. To me, it's a planet.

MAN: I just know it was a planet and it was declassified as a planet.

FRANKLIN: That's true. Now, it's been classified as a dwarf planet.

MAN: Technically, it kind of is a planet. It's just a loophole in the system, maybe.

FRANKLIN: That is the question. And that's going to be the debate that a lot of people will have for many years.

MAN: I mean, I grew up thinking it was a planet. I guess I'll just continue thinking it's a planet. You know?

FRANKLIN: How much larger is Pluto than the planet Earth?

WOMAN: I thought it was smaller. I might be wrong.

FRANKLIN: That was a trick question.

WOMAN: It was a trick question? So, it is a smaller?

FRANKLIN: Yes, absolutely.

WOMAN: Okay. All right. Cool.

FRANKLIN: What is it about seeing things you've never seen in the solar system that is cool?

ZACH: I think space exploration is important. Eventually, we're going to get hit by an asteroid or something. That's not necessarily directly related to this but I still think it's all very interesting.

REBECCA: I think it's wonderful. It's very important for us to understand what's going on, not only here on planet Earth but out in space around us and how those things can impact us ultimately. Just the sense of adventure in the exploration is wonderful.

FRANKLIN: Thanks, Rebecca. Now, we're going to look at an interview I did with Chris Hersman at the John Hopkins Applied Physics Laboratory about the New Horizons spacecraft.

FRANKLIN: Chris, New Horizons spacecraft has been flying 9 years. I can barely keep my car going. How do you develop a spacecraft that can last that long?

CHRIS: It all started in the very beginning planning the redundancy throughout the spacecraft. There's redundancy in the thrusters. There's redundancy in the Star cameras; even the instruments, although there is one of each, some instruments have internal

redundancies. Other instruments can back up the measurements with different types of observations. The redundancy is what makes the spacecraft last a long time. Fortunately, so far, we haven't had to use that redundancy but on board the autonomy system can actually switch the redundant components automatically when it detects a problem on board.

FRANKLIN: Based on the way New Horizons is flying using the Star tracker, if it gets off, will it automatically adjust itself?

CHRIS: Yes, as long as the star tracker is locked on the stars, we tell it in a command sequence where to point. It knows where it's pointed and it maneuvers to that position at the time we tell it to do so. For the encounter, it's a precisely choreographed operation. We've actually rehearsed that in the summer of 2013 to make sure the spacecraft could do all the operations that we planned for the encounter.

FRANKLIN: How long does it take to communicate with New Horizons?

CHRIS: When you send the signal from the ground, it takes 4 ½ hours for the signal to reach the spacecraft. If you want to hear it, find out what happened, whether it received the signal or not, it takes another 4 ½ hours. It takes about 9 hours for the signal to go up to the spacecraft and get the response down. As it turns out with the Earth rotating, often times we're receiving the signal on a different ground station from what we sent the commands to the spacecraft on. It's fortunate that the Deep Space Network has the 70-meter antennas on the ground spaced throughout the globe so we can get continuous coverage on the transmission and receipt of the signal.

FRANKLIN: The power source is good to run all the way into the 2030s. Is there a time before that we might not be able to communicate with New Horizons?

CHRIS: The power source is what would mostly likely be the limiting factor in communicating with the spacecraft. We designed the antennas and the communication system to have an adjustable data rates. As you get farther away, we can lower the data rate and still communicate. Even though, it's very, very far away, with the selection of the different antennas, and the operations we put the spacecraft in, we believe we can go as long as the power source can sustain the thermal environment within the spacecraft.

FRANKLIN: So, what you're saying is New Horizons will be able to ride and fly longer than I'll be able to drive.

[Laughing]

CHRIS: Yeah, I hope I'm still standing when it's reaching the end of its mission.

[Vehicle engine]

CHRIS: Boy, it's about time we made it to the border of West Virginia.

FRANKLIN: It took us a little while but we're here.

BLAIR: Wait a minute. There's a West Virginia?

CHRIS: Absolutely. Pluto, West Virginia, that's where we're going.

BLAIR: We need to make a quick stop. Just trust me. We need to make a quick stop.

BLAIR: Have you ever heard of Pluto, West Virginia?

MAN: What is it?

BLAIR: Have you heard of...?

MAN: I've heard of it but I can't place where it's at.

BLAIR: Do you know where Pluto, West Virginia is?

MAN: Pluto?

BLAIR: Pluto, West Virginia.

MAN: Pluto?

BLAIR: Pluto, like the planet.

BLAIR: I'm trying to find Pluto, West Virginia.

LADY: Good luck.

BLAIR: No, this is for real.

LADY: NASA EDGE.

BLAIR: NASA EDGE, yes. We're suppose to go to Pluto, West Virginia because we're doing a mission to go to Pluto, the planet. We were going to go to Pluto, West Virginia but we can't find it. I have the wrong map. My friends are waiting for me.

WOMAN: You're punking me?

BLAIR: No, I'm not. I swear to you.

WOMAN: You are. Yes, you are.

BLAIR: Do I look like the kind of guy?

MAN: Yeah.

BLAIR: Really, I do? I'm not the kind of guy that would punk.

MAN: Maybe he knows.

[Blair grunting]

CHRIS: I don't understand it. It's crazy. You all right, man?

BLAIR: Yep. Here we go. Yeah, that was helpful. In the spirit of honesty and good team's man ship, I have to say I can't with any confidence based on my understanding tell us exactly how we get to Pluto, West Virginia.

FRANKLIN: Of course. Ah, we've always had the information in our GPS and we put it in before we left the Neptune statue in Virginia Beach. We've been on schedule and on course ever since we left.

BLAIR: Let me get this straight, I wasn't a redundancy. I was irrelevant.

CHRIS: Yeah, that's right.

BLAIR: I've got to take some blame here. I really thought I could do it but we did get good stuff today. Right? It's not a total loss.

FRANKLIN: No, we got great stuff.

CHRIS: We did.

FRANKLIN: When I talked to the men and women on the street, those that knew about Pluto and New Horizons were excited about it. Those that didn't after we informed them about the new things NASA is doing with this mission, they became excited. I think all in all, it was a good trip. We were able to get out good information.

CHRIS: Speaking of New Horizons, I've got a little trivia. All right?

BLAIR: Oh, awesome.

CHRIS: Of course, Pluto was first invented in 1930.

BLAIR: Invented?

CHRIS: Not invented but discovered, I should say.

FRANKLIN: Okay.

CHRIS: At the Lowell Observatory in Flagstaff, Arizona. Who invented, not invented. You got me with this invented word. Who discovered Pluto?

BLAIR: Clyde Tumble.

CHRIS: Yeah, because we learned that earlier in the show. Do you realize that Clayton Kershal, the famous pitcher for the LA Dodgers throws a fast ball faster than New Horizons is traveling to Pluto?

BLAIR: That's fast.

CHRIS: That was his great uncle.

FRANKLIN: Awesome!

CHRIS: Isn't that pretty cool?

FRANKLIN: Yeah.

CHRIS: When New Horizons makes its closest approach on July 14th, that's the same day as the All Star game.

BLAIR: Wow.

CHRIS: I'm just saying the planets are aligning. All right.

BLAIR: NASA did not plan that, right? That was not planned.

CHRIS: No.

BLAIR: When they plan that chart and send a spacecraft out, they've got that think nailed down pretty solid.

FRANKLIN: But you know if they'd want to they could. They are that good.

[Laughing]

BLAIR: Yeah, they are that good.

CHRIS: How are we doing getting to Pluto? In about an hour?

FRANKLIN: About an hour or so. We're on schedule.

BLAIR: Before we get there, I did want you guys to see the interview I did at the National Air and Space Museum with the authors of *Pluto's Secret*, which is the really interesting kid's book. Let's check it out.

BLAIR: David, what was the inspiration for telling Pluto's secret as a story?

DAVID: Once every three years, I go to a meeting called the general assembly of the International Astronomical Union where astronomers get together to decide things; about what to call planets, what to call stars, a lot on nomenclature issues. In Prague, 2006, they demoted Pluto and I watched. I was absolutely fascinated, filled with all sorts of stories about the experience because it really was quite a bit of tension and a lot of concern. I came back and wanted to tell everybody about it.

MARGARET: He came back to the museum and was telling us that story and writing an academic paper about astronomers but he was calling it *Pluto, the Problem Planet*. I had a three year old at the time. I spent a lot of time reading children's stories, telling children's stories. I just thought *Pluto the Problem Planet* just sounds like a children's story.

BLAIR: As you thought about this, what did you think was important to tell about Pluto, particularly to kids?

MARGARET: One of the things about telling stories to my son is in order to keep myself from going crazy, I would play around with point of view. I could tell the same story, *Goldilocks and the Three Bears*, from Momma Bear's perspective or Poppa Bear's perspective or Goldilocks' perspective just to mix it up for myself. It turned out that the insight that made *Pluto's Secret* really work was that we needed to tell the story from Pluto's perspective. To turn it around and make it not about the scientists and what they were trying to figure out but to realize Pluto has been the same the whole time. Pluto was fine with what it is. It really was about a story about the scientists trying to learn more about Pluto than changing how they named and classified things.

BLAIR: Diane, you illustrated *Pluto's Secret*. How did you personify Pluto?

DIANE: I decided to give Pluto a face. With children, I think it is important for them to understand that Pluto was like a person, like they are. People didn't understand what he

was all about. He was sort of different than all the other planets. I know there are some little kids that feel the same way. They don't really fit into the usual format of what is considered to be typical. Pluto is a feisty little planet and it kind of knew what it was all about and that's what I did.

BLAIR: What exactly is Pluto's secret?

DAVID: You want me to give away the answer?

BLAIR: Without totally spoiling the book, what is Pluto's secret?

DAVID: Finding Pluto in 1930 at a time when we didn't really have the sustained capability to really know what was out there. It was, in a way, a fluke and Pluto knew it and knew it was king of the Kuiper Belt. It wasn't named Kuiper Belt yet but it was part of a whole new part of the solar system that nobody realized existed. From time to time, it would reveal little parts of its secret to us so we could learn and finally realize the solar system isn't what we thought it was.

BLAIR: Awesome. Now that you have a book, are there plans for episodes.

DIANE: Yes! I hope so. There are more planets out there to discover. I think that it would be great. The thing is, when we go out and talk to children at libraries and schools, they're really interested. It is a different way at approaching astronomy that's more child-friendly and more developmentally appropriate. It makes really hard facts and Science more accessible to young children, which is what we're trying to do.

BLAIR: What's next for Pluto or what New Horizons may find?

MARGARET: When we put the book together, we knew New Horizons was on it's way to Pluto and that we'd be finding out so much more about what it looked like, about its moons. Actually the New Horizons mission created a couple of problems for this book, because when we wrote the book, Pluto had three moons. Part way through the writing of the book, they found P4, the fourth moon, and right as the book was going to press, I was getting frantic calls from the press saying, Where's the manuscript? They found a fifth moon. Each time we had to rewrite some of the text & redraw some of the illustrations to make sure we were completely current. We're very excited about what New Horizons might continue to reveal about this little former planet that we've become so found of.

[Car doors closing]

[Car engine]

BLAIR: Okay guys, according to all the data we've collected, it's clear that Pluto, West Virginia is definitely an unincorporated town.

FRANKLIN: Well, we came out, checked it out. It wasn't a bad trip.

BLAIR: No, a great trip.

FRANKLIN: What's next?

CHRIS: To the Kuiper Belt and beyond.

FRANKLIN: You know there's a Pluto, Texas.

BLAIR: How much gas do we have in the tank?

FRANKLIN: About a half tank.

CHRIS: Make it so.