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00:00:15,160 --> 00:00:20,270

From the John Hopkins Applied Physics Laboratory
in Laurel Maryland, welcome to NASA's New

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00:00:20,270 --> 00:00:21,930

Horizons countdown to Pluto.

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00:00:21,930 --> 00:00:26,220

I'm Mike Buckley from APL Communications and
Public Affairs, with the latest update from

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00:00:26,220 --> 00:00:27,520

Pluto's doorstep.

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00:00:27,520 --> 00:00:33,410

As we countdown to New Horizons historic flyby
of the Pluto system on July 14th, we're 14

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00:00:33,410 --> 00:00:38,900

days away from the Pluto flyby, just two weeks
and only 10 million miles from Pluto.

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00:00:38,900 --> 00:00:42,680

All the activities the team has practiced
for years are happening for real.

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00:00:42,680 --> 00:00:47,560

Now let's check in on some of those activities
with an operations update.

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00:00:47,560 --> 00:00:57,710

Now we get to say hello again to Alice Bowman,
the New Horizons Mission operations manager.

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00:00:57,710 --> 00:01:01,890

Alice, thank you for stepping away from the
console for a few minutes to join us in the

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00:01:01,890 --> 00:01:02,890

show.

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00:01:02,890 --> 00:01:03,890

Sure.

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00:01:03,890 --> 00:01:04,890

It's nice to be here.

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00:01:04,890 --> 00:01:06,020

We know that activity is picking up.

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00:01:06,020 --> 00:01:07,020

Right?

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00:01:07,020 --> 00:01:11,220

Can you give us an idea from the operations team, what's happening that indicates that

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00:01:11,220 --> 00:01:13,200

we're really close to the flyby?

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00:01:13,200 --> 00:01:14,200

Right.

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00:01:14,200 --> 00:01:19,490

So, if you've been looking at the pictures on the Web site, you can see that Pluto and

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00:01:19,490 --> 00:01:25,440

Charon are becoming more distinct, and their surface features, it's getting pretty exciting.

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00:01:25,440 --> 00:01:29,190

And every day is bringing new features into light.

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00:01:29,190 --> 00:01:34,030

From the missions operations point of view we've just transitioned to a set of commands

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00:01:34,030 --> 00:01:37,580

that we actually started planning in 2011.

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00:01:37,580 --> 00:01:40,970

This is called the approach phase 3.

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00:01:40,970 --> 00:01:45,170

And this current command set will get us to July 3rd.

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00:01:45,170 --> 00:01:48,850

So, these are commands that are sent to the spacecraft's computer that essentially tells

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00:01:48,850 --> 00:01:51,290

it what to do for a set period of time?

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00:01:53,290 --> 00:01:52,290

Yes.

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00:01:53,290 --> 00:01:57,280

You mentioned planning something for years in advance, again, in this case 2011 for the

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00:01:57,280 --> 00:01:59,090

load that's up on the computers now.

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00:01:59,090 --> 00:02:03,789

I guess it really indicates this is not as simple as just writing a few lines of code

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00:02:03,789 --> 00:02:05,110

and hitting a send button?

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00:02:05,110 --> 00:02:09,479

I mean especially for something like, you know, this is a one shot deal, if things have

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00:02:09,479 --> 00:02:10,479

to work.

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00:02:10,479 --> 00:02:14,530

Take us through how you actually plan and design commands that go to the spacecraft?

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00:02:14,530 --> 00:02:15,530

Sure.

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00:02:15,530 --> 00:02:22,000

So, the science team has a set of observations that they want to accomplish.

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00:02:22,000 --> 00:02:27,590

There's many of those that happen at closest approach, which is of course July 14th, but

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00:02:27,590 --> 00:02:32,200

there are also many that happen on this approach phase.

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00:02:32,200 --> 00:02:36,540

And the most intense observations are starting right now.

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00:02:36,540 --> 00:02:41,230

Not that it hasn't been intense but, you know, a lot of the group one and two observations

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00:02:41,230 --> 00:02:43,380

are really gearing up right now.

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00:02:43,380 --> 00:02:50,390

So, to build a command set that goes to the spacecraft involves the science team, the

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00:02:50,390 --> 00:02:55,450

guidance and control team, the mission design

team, the navigation team, the mission operations

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00:02:55,450 --> 00:02:59,400
team, the instrument analysis, all those people.

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00:02:59,400 --> 00:03:05,680
And so, it starts with the science team really
defining what kind of observations they want.

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00:03:05,680 --> 00:03:12,880
And then they--mission operations knows how
to operate the spacecraft, what kind of constraints

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00:03:12,880 --> 00:03:14,910
you have to take into account.

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00:03:14,910 --> 00:03:19,080
We'll talk with the guidance and control,
and so this is really like a dance.

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00:03:19,080 --> 00:03:25,370
You have to have all those observations intertwined
with the spacecraft commands.

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00:03:25,370 --> 00:03:31,030
And again, we can't just take science, we
have to turn and look to Earth, and communicate

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00:03:31,030 --> 00:03:34,690
with Earth, and bring back that science data.

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00:03:34,690 --> 00:03:41,380
So, it's kind of a push and pull, like where
you take science and where you turn back and

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00:03:41,380 --> 00:03:42,640
communicate with Earth.

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00:03:42,640 --> 00:03:47,250

And then of course, you mentioned communications,
and communications are critical, you know,

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00:03:47,250 --> 00:03:48,450
for these operations.

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00:03:48,450 --> 00:03:52,910
And that's the connection between New Horizons
and NASA's deep space network.

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00:03:52,910 --> 00:03:58,300
So, maybe remind us a bit, how long is the
one way time for a signal to reach Earth from

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00:03:58,300 --> 00:03:59,300
the spacecraft?

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00:03:59,300 --> 00:04:03,420
One way time is about four and a half hours.

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00:04:03,420 --> 00:04:08,270
Explain how you stay in touch with the spacecraft
over such long periods of time?

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00:04:08,270 --> 00:04:16,959
So, there are three DSM complexes; Madrid
Spain, Canberra Australia, and Goldstone California.

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00:04:16,959 --> 00:04:23,770
And so if you think of the path our spacecraft
New Horizons is travelling, it's going straight

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00:04:23,770 --> 00:04:26,479
out to Earth, right toward Pluto.

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00:04:26,479 --> 00:04:32,740
And the Earth on the other hand is rotating,
you know, once every 24 hours.

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00:04:32,740 --> 00:04:38,660

And as those different complexes come into view, you can use those antennas, those spots

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00:04:38,660 --> 00:04:43,880

on Earth to communicate with the one that's in view of the spacecraft.

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00:04:43,880 --> 00:04:48,950

Now I point out that people can follow that coverage online through DSN Now, the NASA

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00:04:48,950 --> 00:04:53,970

Web site that allows people to see when each deep space network antenna is either talking

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00:04:53,970 --> 00:04:57,830

to or listening to any spacecraft anywhere.

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00:04:57,830 --> 00:05:02,680

If I went to that Web site and checked New Horizons I might see one or two of those antenna

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00:05:02,680 --> 00:05:05,040

stations talking to the spacecraft?

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00:05:05,040 --> 00:05:06,040

Yes.

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00:05:06,040 --> 00:05:10,419

You'll see us communicating with the spacecraft when the spacecraft's not taking science.

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00:05:10,419 --> 00:05:17,340

And so, there's usually about three or four hours there in a period of maybe 12 hours

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00:05:17,340 --> 00:05:20,010

where we aren't in communication with the spacecraft.

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00:05:20,010 --> 00:05:22,410
But there are also some busier periods too.

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00:05:22,410 --> 00:05:23,410
Right?

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00:05:23,410 --> 00:05:26,540
During the flyby I think much of the deep space network is going to be focused on New

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00:05:26,540 --> 00:05:27,540
Horizons.

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00:05:27,540 --> 00:05:28,540
Tell us about that.

82
00:05:28,540 --> 00:05:29,540
Yeah.

83
00:05:29,540 --> 00:05:30,540
It's going to be pretty interesting.

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00:05:30,540 --> 00:05:35,600
We have the radio science experiment and what we do there is we uplink signal to the radio

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00:05:35,600 --> 00:05:42,210
science experiment and it will collect data, like form scan or occultation data.

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00:05:42,210 --> 00:05:48,111
So, when you--if you were to go to that DSN site and look at those antennas, there's a

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00:05:48,111 --> 00:05:50,900
total of 13 antennas.

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00:05:50,900 --> 00:05:56,230

And four and a half hours before closest approach
you'll see that New Horizons will be using

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00:05:56,230 --> 00:05:58,550

seven of those 13 antennas.

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00:05:58,550 --> 00:06:00,210

A busy day, a busy morning.

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00:06:00,210 --> 00:06:01,210

Yes.

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00:06:01,210 --> 00:06:02,210

Definitely.

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00:06:02,210 --> 00:06:05,490

And I'm not even sure there's been any other
spacecraft that has actually used that many

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00:06:05,490 --> 00:06:06,610

at one time.

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00:06:06,610 --> 00:06:10,729

Well then speaking of busy, what's next for
the operations team over the next week or

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00:06:10,729 --> 00:06:11,729

so?

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00:06:11,729 --> 00:06:16,650

Well we're going to be putting up the flyby
sequence on board the spacecraft in the next

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00:06:16,650 --> 00:06:21,290

couple of days, to both the primary and the
backup computers.

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00:06:21,290 --> 00:06:25,880

There's a possibility that we will be doing a trajectory correction maneuver, and of course,

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00:06:25,880 --> 00:06:33,190

getting down lots of science data, optical navigation data, so it's going to be great.

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00:06:33,190 --> 00:06:35,110

Well thanks Alice.

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00:06:35,110 --> 00:06:45,070

All right, now let's get a science update.

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00:06:45,070 --> 00:06:49,020

We managed to pull Deputy Project Scientist Cathy Olkin away from the images just long

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00:06:49,020 --> 00:06:53,430

enough to tell us about some of the amazing views New Horizons is getting of Pluto and

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00:06:53,430 --> 00:06:54,430

its moons.

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00:06:54,430 --> 00:06:55,699

So, Cathy thanks for joining us again.

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00:06:55,699 --> 00:06:57,630

Happy to be here.

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00:06:57,630 --> 00:06:59,680

Our view of Pluto is changing dramatically.

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00:06:59,680 --> 00:07:00,680

Right?

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00:07:00,680 --> 00:07:04,110

So, kind of--what are we seeing now that we weren't able to see a week or even two weeks

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00:07:04,110 --> 00:07:05,110

ago?

112

00:07:05,110 --> 00:07:06,110

Yeah.

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00:07:06,110 --> 00:07:09,850

There's features on Pluto that we were starting to see before, and they're coming in to sharper

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00:07:09,850 --> 00:07:11,540

and sharper focus.

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00:07:11,540 --> 00:07:14,820

We see a bright region on Pluto's North Pole.

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00:07:14,820 --> 00:07:16,960

So, it might be a polar cap.

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00:07:16,960 --> 00:07:20,360

We're looking to get closer and investigate that further.

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00:07:20,360 --> 00:07:26,680

We're seeing detailed images of the closest approach hemisphere we can look every time

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00:07:26,680 --> 00:07:30,570

it comes into view is Pluto rotates every six point four days.

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00:07:30,570 --> 00:07:35,270

And you can see it getting larger and larger and there's dark regions and bright regions,

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00:07:35,270 --> 00:07:37,290

and it's going to be really exciting.

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00:07:37,290 --> 00:07:39,340

I mean--and that's the one we're going to see close up to.

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00:07:39,340 --> 00:07:43,340

So, it's just enough of a tease to get a preview of what you're going to see when you get close

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00:07:43,340 --> 00:07:44,340

enough.

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00:07:44,340 --> 00:07:45,340

That's right.

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00:07:45,340 --> 00:07:49,259

The science team spent a lot of time looking at when to flyby Pluto, which involved, which

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00:07:49,259 --> 00:07:51,920

hemisphere we would be seeing at closest approach.

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00:07:51,920 --> 00:07:55,710

And we're all really excited that we choose this hemisphere, because it ends up being

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00:07:55,710 --> 00:07:57,009

really exciting.

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00:07:57,009 --> 00:08:01,020

Now, also starting to see details on Charon for the first time.

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00:08:01,020 --> 00:08:02,020

That's right.

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00:08:02,020 --> 00:08:03,020

It's very exciting.

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00:08:03,020 --> 00:08:09,169

We're seeing details on Charon we see a dark region and Charon pole, which is surprising

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00:08:09,169 --> 00:08:11,520

to me.

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00:08:11,520 --> 00:08:17,650

A lot of times on Polar Regions you see bright features like we do on Pluto, and Mars, and

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00:08:17,650 --> 00:08:22,800

Earth, where you have a bright polar cap, but this region is dark compared to the rest

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00:08:22,800 --> 00:08:23,800

of the surface.

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00:08:23,800 --> 00:08:25,380

And so it's very tantalizing.

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00:08:25,380 --> 00:08:28,509

And just waiting to get closer and see more about it.

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00:08:28,509 --> 00:08:29,509

Right.

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00:08:29,509 --> 00:08:30,509

Another mystery to solve.

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00:08:30,509 --> 00:08:31,509

That's right.

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00:08:31,509 --> 00:08:33,509

It's happening here too, something a little closer to your heart, because you work on

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00:08:33,509 --> 00:08:34,599

this instrument.

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00:08:34,599 --> 00:08:39,700

The Ralph Camera actually got some color readings of Pluto and Charon recently.

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00:08:39,700 --> 00:08:42,339

And from those we got our first New Horizons color movie.

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00:08:42,339 --> 00:08:43,339

Yeah.

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00:08:43,339 --> 00:08:47,050

Tell us a little bit about what was in those that we learned about Pluto and Charon that

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00:08:47,050 --> 00:08:48,560

we had some color views.

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00:08:48,560 --> 00:08:49,560

That's right.

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00:08:49,560 --> 00:08:54,740

So, there's a--we have a color movie of Pluto and Charon, and in it you can see that Pluto

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00:08:54,740 --> 00:08:56,800

is distinctly red compared to Charon.

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00:08:56,800 --> 00:08:59,009

Charon is more of a gray color.

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00:08:59,009 --> 00:09:04,931

And you can see as Pluto and Charon are both rotating that Pluto is more red on all the

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00:09:04,931 --> 00:09:07,850

faces compared to Charon being gray.

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00:09:07,850 --> 00:09:13,769

And so, this confirms what we knew from ground based observing, but it's giving us more and

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00:09:13,769 --> 00:09:15,720

more detail as we get closer and closer.

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00:09:15,720 --> 00:09:17,720

And plus it's just cool to see color.

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00:09:17,720 --> 00:09:19,379

It's really exciting to see color.

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00:09:21,379 --> 00:09:20,379

Yeah.

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00:09:21,379 --> 00:09:22,379

Are they true colors?

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00:09:22,379 --> 00:09:23,379

In what we saw.

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00:09:23,379 --> 00:09:24,379

They are true colors.

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00:09:24,379 --> 00:09:27,939

We worked really hard to try and make them as close to true color that the eye would

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00:09:27,939 --> 00:09:28,939

see.

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00:09:28,939 --> 00:09:31,379

So, that is a true color movie.

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00:09:31,379 --> 00:09:33,230

So it's defiantly a busy time.

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00:09:33,230 --> 00:09:35,629

The science team getting closer to Pluto.

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00:09:35,629 --> 00:09:39,230

What activities are on tap for the next week or two, leading up to flyby?

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00:09:39,230 --> 00:09:42,819

There are so many different activities coming up this week.

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00:09:42,819 --> 00:09:48,389

We have observation of Pluto and Charon continuing as they get larger and larger, we get closer

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00:09:48,389 --> 00:09:49,490

and closer.

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00:09:49,490 --> 00:09:55,240

We've got photometry of the small satellites of Pluto, we've got color images.

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00:09:55,240 --> 00:09:57,050

We've got infrared images.

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00:09:57,050 --> 00:09:59,649

The plasma sweep is busy doing its thing.

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00:09:59,649 --> 00:10:01,149

It's a very exciting time.

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00:10:01,149 --> 00:10:02,149

It sounds like it.

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00:10:02,149 --> 00:10:03,300

Well, Cathy thanks again for joining us.

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00:10:03,300 --> 00:10:04,300

Thank you.

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00:10:04,300 --> 00:10:09,269

You know, it's probably safe to say that every member of the New Horizons science team loves

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00:10:09,269 --> 00:10:11,100

Pluto, but probably for different reasons.

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00:10:11,100 --> 00:10:32,189

So, let's hear from another one, the real Plutophile.

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00:10:32,189 --> 00:10:36,119

I'm Fran Bagenal I'm at the University of Colorado in Boulder.

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00:10:36,119 --> 00:10:43,199

Back in oh, about late 1989 or so, there was a bunch of us who were really keen to go to

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00:10:43,199 --> 00:10:44,199

Pluto.

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00:10:44,199 --> 00:10:47,810

We wanted to have a mission that would get out there and make observations of this object

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00:10:47,810 --> 00:10:49,929

right on the edge of the solar system.

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00:10:49,929 --> 00:10:55,209

So, we realized to make this happen we had to get together and campaign hard to make

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00:10:55,209 --> 00:10:57,181

the case, to go there and explore.

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00:10:57,181 --> 00:11:02,209

So, it was a bit of an opportunity for young people to come in and say, hey where are we

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00:11:02,209 --> 00:11:03,230

going to go next.

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00:11:03,230 --> 00:11:06,980

What's the next great frontier that we should go explore?

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00:11:06,980 --> 00:11:08,119

And it was clear.

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00:11:08,119 --> 00:11:10,069

Out to the Kuiper Belt.

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00:11:10,069 --> 00:11:14,149

Pluto is a very exciting place, it's right at the edge of the solar system.

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00:11:14,149 --> 00:11:19,079

We've got a bunch of junk out there, and we don't know why it is there.

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00:11:19,079 --> 00:11:23,559

And current ideas are that it got there through the formation of the solar system.

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00:11:23,559 --> 00:11:27,259

And there's Pluto out there representing that junk.

199

00:11:27,259 --> 00:11:29,470

Remnants of the formation of the solar system.

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00:11:29,470 --> 00:11:33,559

When I started is a professional scientist, planetary scientist.

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00:11:33,559 --> 00:11:38,250

Why does Pluto have this big exciting moon called Charon?

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00:11:38,250 --> 00:11:40,230

And then we found another one and another one.

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00:11:40,230 --> 00:11:44,249

We keep finding these moons, totally unexpected.

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00:11:44,249 --> 00:11:48,899

And a great surprise, so it will be very interesting to see what we find when we get there.

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00:11:48,899 --> 00:11:51,839

How many more are there?

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00:11:51,839 --> 00:11:58,351

I actually think we have no idea what we're going to find.

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00:11:58,351 --> 00:12:00,369

It could be completely different.

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00:12:00,369 --> 00:12:05,970

You see these fabulous paintings that people have drawn of icy surfaces, and clouds and

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00:12:05,970 --> 00:12:08,639

mist, and rocks and mountains.

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00:12:08,639 --> 00:12:11,420

It could be completely different.

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00:12:11,420 --> 00:12:16,610

Oh the satisfaction of the whole mission will come when we see those first pictures and

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00:12:16,610 --> 00:12:20,910

we actually get a glimpse of what that icy surface looks like.

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00:12:20,910 --> 00:12:25,720

It really tells us about our world, our solar system formed, and how it got to the way it

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00:12:25,720 --> 00:12:26,720

is.

215

00:12:26,720 --> 00:12:31,639

So, it's cool, let's go there.

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00:12:31,639 --> 00:12:35,019

Let's go explore it.

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00:12:35,019 --> 00:12:41,850

I'm really hoping that we can conserve enough fuel on the New Horizons spacecraft that we

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00:12:41,850 --> 00:12:46,629

can then use a little bit of extra power to change this spacecraft, deflect it a little

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00:12:46,629 --> 00:12:50,040

bit and then send it off to another object.

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00:12:50,040 --> 00:12:55,410

Because I'm pretty sure that Pluto is one of a whole family of very different types

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00:12:55,410 --> 00:12:56,410

of objects.

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00:12:56,410 --> 00:13:01,540

Different colors, different ices, different histories, different gases, and it would be

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00:13:01,540 --> 00:13:04,120

fun to go and see two, not just one.

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00:13:04,120 --> 00:13:07,269

I'm Fran Bagenal, and I'm a Pluto file.

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00:13:07,269 --> 00:13:13,259

And the reason is because Pluto is cool.

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00:13:13,259 --> 00:13:17,220

As we're just two weeks away from the Pluto flyby, we thought it was a great time to cover

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00:13:17,220 --> 00:13:19,089

the reason for the mission.

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00:13:19,089 --> 00:13:21,360

Why is New Horizons exploring Pluto?

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00:13:21,360 --> 00:13:23,649

And what's specifically is New Horizons going to learn?

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00:13:23,649 --> 00:13:28,070

And to answer that is Bill McKinnon a New Horizons co-investigator from Washington University

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00:13:28,070 --> 00:13:29,480

in St. Louis.

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00:13:29,480 --> 00:13:31,489

Bill thanks for joining us.

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00:13:31,489 --> 00:13:32,489

Thanks for having me.

234

00:13:32,489 --> 00:13:34,820

It's fantastic to be right here, right now.

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00:13:34,820 --> 00:13:38,570

I just can't even believe it's happening.

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00:13:38,570 --> 00:13:43,899

When Clyde Tombaugh first discovered Pluto, it was considered an odd ball, but we've learned

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00:13:43,899 --> 00:13:49,019

then and since over the decades that it was actually a harbinger of an entirely new class

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00:13:49,019 --> 00:13:51,319

of planets, in a new realm of the solar system.

239

00:13:51,319 --> 00:13:56,040

Kind of show us how the evolution of Pluto--how we got to where--how we think of Pluto today?

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00:13:56,040 --> 00:14:00,440

Well as you know, Clyde Tombaugh discovered Pluto in 1930.

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00:14:00,440 --> 00:14:05,239

And at the time, people thought it was the long-sought Planet X, the new world beyond

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00:14:05,239 --> 00:14:06,239

Neptune.

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00:14:06,239 --> 00:14:07,759

But, it was odd.

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00:14:07,759 --> 00:14:10,819

It wasn't as big as Uranus or Neptune.

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00:14:10,819 --> 00:14:12,589

And in fact, no one could figure out how big it was at all.

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00:14:12,589 --> 00:14:13,970

And it had this strange orbit.

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00:14:13,970 --> 00:14:15,300

It wasn't with the rest of the planets.

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00:14:15,300 --> 00:14:19,389

It had an eccentric loop that even took it inside the orbit of Neptune for a while during

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00:14:19,389 --> 00:14:21,269

its course around the Sun.

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00:14:21,269 --> 00:14:26,470

And it really wasn't until the 1990s that we fully grasped where Pluto belonged, in

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00:14:26,470 --> 00:14:32,579

a sense, what it was trying to tell us back in 1930 because in the early 1990s, we used

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00:14:32,579 --> 00:14:36,859

CCD technology, the kind of stuff we have in our cell phones now, and finally attached

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00:14:36,859 --> 00:14:38,230

it to a telescope.

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00:14:38,230 --> 00:14:42,769

And it's so sensitive that the first new Kuiper Belt object was discovered.

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00:14:42,769 --> 00:14:47,139

I say new one because, in a sense, we now know that Pluto was the first Kuiper Belt

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00:14:47,139 --> 00:14:48,930

body to be discovered in human history.

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00:14:48,930 --> 00:14:51,649

And so, now we know thousands of these bodies.

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00:14:51,649 --> 00:14:56,540

It's the last, you know, 20 or 30 years of astronomical observations have really filled,

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00:14:56,540 --> 00:14:57,810

you know, what's going on.

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00:14:57,810 --> 00:15:01,369

There's a whole new third zone of the solar system beyond Neptune.

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00:15:01,369 --> 00:15:04,680

It's like we really are then venturing into a new realm, right?

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00:15:04,680 --> 00:15:06,660

I mean a whole new realm in the Solar System.

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00:15:06,660 --> 00:15:08,360

Tell us a little bit about that.

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00:15:08,360 --> 00:15:11,920

Well, if you think about it, in some ways, the Kuiper Belt is like the asteroid belt.

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00:15:11,920 --> 00:15:14,709

You know, it's--the asteroid belt's a little inside Jupiter.

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00:15:14,709 --> 00:15:20,110

The Kuiper Belt's outside Neptune, but there's 1,000 times more stuff outside Neptune.

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00:15:20,110 --> 00:15:24,559

And the best part is that amongst all these

hundreds of thousands or millions of bodies

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00:15:24,559 --> 00:15:29,470

are big worlds, well, big in a relative sense.

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00:15:29,470 --> 00:15:31,670

They're all--they're small planets.

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00:15:31,670 --> 00:15:33,920

Pluto is actually the biggest of these, as far as we know.

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00:15:33,920 --> 00:15:34,949

And there are several others.

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00:15:34,949 --> 00:15:39,259

So, there's--it's like it's an entirely new Solar System, in a way.

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00:15:39,259 --> 00:15:40,259

And tell us about that.

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00:15:40,259 --> 00:15:44,239

I mean you mentioned Pluto is, of all these objects in that region in the Kuiper Belt,

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00:15:44,239 --> 00:15:47,799

Pluto is the brightest, the biggest that we know about so far.

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00:15:47,799 --> 00:15:51,919

So, tell us a little bit more about what kind of--like, this new kind of planet that Pluto

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00:15:51,919 --> 00:15:52,919

represents.

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00:15:52,919 --> 00:15:53,919

Yeah.

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00:15:53,919 --> 00:15:57,670

Well, if you look at Pluto, what you'll actually see is an icy world, but on the inside, it

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00:15:57,670 --> 00:15:59,230

has a rock heart.

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00:15:59,230 --> 00:16:02,309

And we think it's big enough and warm enough on the inside.

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00:16:02,309 --> 00:16:04,079

We believe that it could even have an ocean.

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00:16:04,079 --> 00:16:06,519

And, of course, it's not really alone.

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00:16:06,519 --> 00:16:07,519

It has a big moon.

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00:16:07,519 --> 00:16:09,660

In fact, it has five known moons.

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00:16:09,660 --> 00:16:12,399

So, it's like it's a miniature planetary system.

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00:16:12,399 --> 00:16:14,339

I mean, and you see those, too.

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00:16:14,339 --> 00:16:19,019

I think people are amazed that when New Horizons launched, right, there were three moons that

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00:16:19,019 --> 00:16:20,019

we knew about.

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00:16:20,019 --> 00:16:21,019

Yeah.

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00:16:21,019 --> 00:16:24,279

Two more since then, you start to learn a little bit more about what we can learn from

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00:16:24,279 --> 00:16:25,279

a system like that.

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00:16:25,279 --> 00:16:26,279

And there's some similarities.

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00:16:26,279 --> 00:16:30,990

I think we've thought along the way that some similarities between the Earth and Moon, and

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00:16:30,990 --> 00:16:33,470

Pluto and Charon and its other moons, even how they developed.

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00:16:33,470 --> 00:16:34,470

Yeah.

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00:16:34,470 --> 00:16:37,470

You know, if you look in a book, sometimes you'll find the Earth and the Moon described

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00:16:37,470 --> 00:16:38,529

as a double planet.

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00:16:38,529 --> 00:16:41,249

But, the Moon's only 1 percent of the Earth's mass.

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00:16:41,249 --> 00:16:43,309

Pluto's moon is 12 percent of its mass.

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00:16:43,309 --> 00:16:47,319

So, it's the true binary planet in the Solar

System.

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00:16:47,319 --> 00:16:51,839

And in fact, when we watch it, as we approach with the New Horizons cameras, we actually

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00:16:51,839 --> 00:16:56,500

see Pluto and Charon both moving, both orbiting their mutual balance point, like a sort of

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00:16:56,500 --> 00:16:57,839

asymmetric barbell.

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00:16:57,839 --> 00:17:01,850

So, in fact, that's one of the reasons, of course, we're studying it, because it's going

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00:17:01,850 --> 00:17:04,919

to help us understand really in a sense how our own Moon formed.

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00:17:04,919 --> 00:17:09,459

So, I mean that--the Moon formation aspect of it is one.

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00:17:09,459 --> 00:17:13,439

So, let's--specifically, what is New Horizons going to learn in the Pluto System?

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00:17:13,439 --> 00:17:14,689

What's it going to teach us about Pluto?

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00:17:14,689 --> 00:17:17,280

Well, we're going to learn so much.

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00:17:17,280 --> 00:17:19,800

I could hardly tell you all the things at once.

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00:17:19,800 --> 00:17:21,130

But, the mission goals, what--?

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00:17:21,130 --> 00:17:24,440

--Well, you know, there's--we've actually set it up in a sort of hierarchy, where there's

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00:17:24,440 --> 00:17:28,050

stuff that's absolutely required to do, the stuff that, you know, you don't even have

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00:17:28,050 --> 00:17:30,010

to be a rocket scientist to understand what we're doing.

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00:17:30,010 --> 00:17:34,470

We're going to take lots of pictures, understand the global geology, understand what's on the

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00:17:34,470 --> 00:17:35,790

surface, the composition.

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00:17:35,790 --> 00:17:38,010

That way we can infer what's underneath.

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00:17:38,010 --> 00:17:40,740

And of course, Pluto, of course, is a very complicated world.

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00:17:40,740 --> 00:17:41,890

It has an atmosphere.

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00:17:41,890 --> 00:17:44,470

It's actually an atmosphere that's slowly leaking off into space.

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00:17:44,470 --> 00:17:48,400

So, we're going to, you know, probe this atmosphere in every way we can with our instruments and

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00:17:48,400 --> 00:17:52,950

learn all about it and learn about this fundamental process that affected, actually the early

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00:17:52,950 --> 00:17:54,470

Earth, atmospheric escape.

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00:17:54,470 --> 00:17:55,830

So, there's different goals.

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00:17:55,830 --> 00:18:00,460

As the mission was laid out to see what the science community really wanted New Horizons--any

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00:18:00,460 --> 00:18:02,670

mission to Pluto and the Kuiper Belt to learn.

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00:18:02,670 --> 00:18:04,750

You mentioned, there's different levels, different priorities.

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00:18:04,750 --> 00:18:08,740

So, there is a tops on your list of what we--the mission needs to get.

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00:18:08,740 --> 00:18:12,830

And then, I guess it goes to another level below, and then levels below that, that--.

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00:18:12,830 --> 00:18:13,830

Yeah.

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00:18:13,830 --> 00:18:16,830

So, I talked to you--I talked a little bit about what's absolutely required of the mission.

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00:18:16,830 --> 00:18:19,510

And then, there's just a lot of important stuff to do.

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00:18:19,510 --> 00:18:23,350

It's important because we have the cameras
and we have the technology that will take

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00:18:23,350 --> 00:18:25,490

very high resolution pictures.

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00:18:25,490 --> 00:18:27,190

We'll also take overlapping pictures.

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00:18:27,190 --> 00:18:29,680

And that way, we can get stereo and really
learn the topography.

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00:18:29,680 --> 00:18:33,870

And we can, of course, measure the temperature,
not just in the atmosphere, but on the surface.

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00:18:33,870 --> 00:18:36,140

In fact, we can do this three separate ways.

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00:18:36,140 --> 00:18:37,400

That's fantastic.

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00:18:37,400 --> 00:18:41,620

And if you--and if I--not to interrupt, but
if we keep going, there's even stuff that

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00:18:41,620 --> 00:18:42,620

are--isn't required.

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00:18:42,620 --> 00:18:45,160

It isn't necessary.

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00:18:45,160 --> 00:18:46,170

It isn't as important.

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00:18:46,170 --> 00:18:47,650

But, it's desired.

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00:18:47,650 --> 00:18:52,860

And that's things like looking for new moons or looking for rings.

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00:18:52,860 --> 00:18:56,720

And basically, all of the things we want to do, we're going to do them all.

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00:18:56,720 --> 00:18:58,340

And it's a full slate.

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00:18:58,340 --> 00:19:02,140

I mean, you have this opportunity, and you have a great spacecraft at your disposal to

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00:19:02,140 --> 00:19:06,710

get as much as you can possibly get in this one shot in the first time through the Pluto

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00:19:06,710 --> 00:19:07,710

system.

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00:19:07,710 --> 00:19:09,140

And so, you're going for the whole list.

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00:19:11,140 --> 00:19:10,140

Yes.

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00:19:11,140 --> 00:19:14,840

So, you've been working on a Pluto mission for a long time and really looking forward

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00:19:14,840 --> 00:19:15,870

to get here.

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00:19:15,870 --> 00:19:20,120

I just--personally, what are you looking forward to the most of learning at Pluto or just seeing

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00:19:20,120 --> 00:19:23,750

in that Pluto system as New Horizons goes by?

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00:19:23,750 --> 00:19:26,470

I've been interested in Pluto my whole life.

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00:19:26,470 --> 00:19:29,130

I've been working on it scientifically since the early '80s.

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00:19:29,130 --> 00:19:34,270

But, what I'm most interested in, I suppose, are in fact the details of its geology and

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00:19:34,270 --> 00:19:37,980

the geology of its big moon because they can both be active worlds.

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00:19:37,980 --> 00:19:38,980

And who knows?

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00:19:38,980 --> 00:19:42,360

Maybe there will be clues there for what's on the inside, like an ocean.

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00:19:42,360 --> 00:19:45,160

And even just in a basic sense, just seeing it up close for the first time, right?

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00:19:45,160 --> 00:19:50,210

I mean just the ideas of what it might be, but then to really see it, it just has to

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00:19:50,210 --> 00:19:51,210

be incredible.

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00:19:51,210 --> 00:19:52,210

Yeah.

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00:19:52,210 --> 00:19:54,440

I mean day by day, every image is just better than ever taken before.

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00:19:54,440 --> 00:19:56,200

Well, it's going to be a great ride.

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00:19:56,200 --> 00:19:57,200

Oh, yeah.

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00:19:57,200 --> 00:19:58,200

I'm looking forward to it.

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00:19:58,200 --> 00:19:59,200

Well, thanks, Bill.

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00:19:59,200 --> 00:20:00,200

Thanks for joining us.

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00:20:00,200 --> 00:20:01,200

Oh, pleasure to be here.

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00:20:01,200 --> 00:20:03,860

You know, a misconception of Pluto is that it's so dark.

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00:20:03,860 --> 00:20:08,720

But, really, for just a moment near dawn and dusk each day, the illumination on Earth actually

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00:20:08,720 --> 00:20:11,070

matches that of noon on Pluto.

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00:20:11,070 --> 00:20:12,220

And we call this Pluto time.

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00:20:12,220 --> 00:20:16,800

And a cool NASA Web program can help you find Pluto time in your area.

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00:20:16,800 --> 00:20:20,390

It's always Pluto time somewhere, and NASA wants to see your view.

381

00:20:20,390 --> 00:20:22,830

Visit the Pluto time Web site.

382

00:20:22,830 --> 00:20:25,270

Take a picture during your local Pluto time.

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00:20:25,270 --> 00:20:28,530

And share it to social media with the hashtag #Plutotime.

384

00:20:28,530 --> 00:20:31,990

Then check the Web to see if your view is among the most interesting shots from around

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00:20:31,990 --> 00:20:33,120

the world.

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00:20:33,120 --> 00:20:37,480

Of course, for the New Horizons team with just two weeks to go until the flyby, it's

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00:20:37,480 --> 00:20:38,970

really Pluto time.

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00:20:38,970 --> 00:20:42,300

Now, this wraps up our weekly updates from Pluto's doorstep.

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00:20:42,300 --> 00:20:47,350

We'll be back on July 7th to begin our daily

live updates that continue through the Pluto

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00:20:47,350 --> 00:20:48,350

flyby.

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00:20:48,350 --> 00:20:52,440

So, until then, I'm Mike Buckley from the
Johns Hopkins Applied Physics Lab.