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00:00:00,140 --> 00:00:03,430

BEUTEL: Dextre's full name is the "Special Purpose Dexterous Manipulator." I'm actually

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00:00:03,430 --> 00:00:04,899

glad we call it Dextre instead.

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00:00:04,899 --> 00:00:10,170

And we happen to have, obviously, a model of it right here. And it really does resemble,

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00:00:10,170 --> 00:00:11,170

honest to goodness --

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00:00:11,170 --> 00:00:12,510

PAYETTE: A little person.

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00:00:12,510 --> 00:00:18,900

BEUTEL: A little person with 11-foot arms and no head and a torso... Again, walk us

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00:00:18,900 --> 00:00:21,640

through, just use the model, how is Dextre going to work?

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00:00:21,640 --> 00:00:27,279

PAYETTE: Well first, as we saw on the graphics, Dextre is launched in pieces. And its pieces,

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00:00:27,279 --> 00:00:31,179

the two arms, the torso, and platforms to support experiments,

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00:00:31,179 --> 00:00:37,079

have never been actually hooked up together on the ground, because they can't support

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00:00:37,079 --> 00:00:41,379

their own weight if they are hooked up together

under the normal gravity of Earth.

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00:00:41,379 --> 00:00:45,379

So, this is the first time that Dextre is going to be assembled, is in space by the

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00:00:45,379 --> 00:00:50,719

spacewalkers. And that's going to be quite impressive to see. The arms are on the side.

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00:00:50,719 --> 00:00:56,480

They will be picked up by Canadarm2, which is the robotic arm of the space station. And

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00:00:56,480 --> 00:01:00,320

they will be assembled then and hooked up and connected by the astronauts.

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00:01:00,320 --> 00:01:08,750

Once Dextre is fully connected, it has the ability to change out very small pieces of

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00:01:08,750 --> 00:01:10,490

the equipment on space station.

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00:01:10,490 --> 00:01:16,200

It has the ability, it's so dexterous -- that's why it's called Dextre -- that it can change

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00:01:16,200 --> 00:01:21,280

out pieces as small as a phone book, and as big as a phone booth.

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00:01:21,280 --> 00:01:26,650

So this is the range of Dextre's manipulation it can do. It has two arms but only actually

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00:01:26,650 --> 00:01:31,439

uses one to extract and replace a piece of equipment.

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00:01:31,439 --> 00:01:37,009

What it does with the other one is it will stabilize itself. In microgravity, things

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00:01:37,009 --> 00:01:39,840

get very wobbly, so you need to anchor yourself.

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00:01:39,840 --> 00:01:43,950

Astronauts have to do that even on a spacewalk, to not be pushed away from the structure once

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00:01:43,950 --> 00:01:47,829

they start working. So one arm will be attached to the structure,

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00:01:47,829 --> 00:01:54,340

and the other arm will go and pick up and remove the piece of equipment. It has a platform,

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00:01:54,340 --> 00:02:00,240

so you'll have the new piece of equipment here -- the one to be replaced --

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00:02:00,240 --> 00:02:05,680

take the old one out, push it aside, pick the new one up and push it back in. We have

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00:02:05,680 --> 00:02:10,069

cameras all over so we can supervise the work of the robot.

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00:02:10,069 --> 00:02:14,690

It can be controlled from inside the space station by astronaut operators, or from the

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00:02:14,690 --> 00:02:17,180

ground.

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00:02:17,180 --> 00:02:22,480

And what is really nice is that you don't need any assistance from the spacewalker in

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00:02:22,480 --> 00:02:23,860

order to be able to do this job.

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00:02:23,860 --> 00:02:30,010

So it may be times when it will be very useful to use the robot to change out a piece of

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00:02:30,010 --> 00:02:36,220

faulty equipment on the space station without having a scheduled long spacewalk.

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00:02:36,220 --> 00:02:41,590

However, clearly it's a robot. It can't, it can't reason like a human being. So it can't

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00:02:41,590 --> 00:02:42,590

do everything.

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00:02:42,590 --> 00:02:47,590

But for parts of the maintenance and the servicing of space station it will be very useful.

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00:02:47,590 --> 00:02:51,200

BEUTEL: And of course, the reason you don't want to always have as many spacewalks as

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00:02:51,200 --> 00:02:55,150

we do is because you are exposing astronauts to -- as great of a view as they get --

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00:02:55,150 --> 00:02:59,540

you are exposing them to space. You're getting them outside their home, and having a system

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00:02:59,540 --> 00:03:03,100

like this, you can do battery change-outs

and satellite work.

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00:03:03,100 --> 00:03:07,099

It's like Dextre allows you options we don't have right now.

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00:03:07,099 --> 00:03:12,230

PAYETTE: Correct. I mean, spacewalks are risky. They're riskier than staying inside the pressurized

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00:03:12,230 --> 00:03:13,819

environment of the space station.

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00:03:13,819 --> 00:03:20,959

But there will be also a task for Dextre to assist a spacewalk. And even on my flight,

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00:03:20,959 --> 00:03:24,209

on 127, the third flight of the Japanese element,

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00:03:24,209 --> 00:03:28,861

we will use Dextre as the supporting platform. We have a lot of equipment to change out,

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00:03:28,861 --> 00:03:29,920

batteries in particular,

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00:03:29,920 --> 00:03:35,330

and we'll have spacewalkers out there and the robot, so it'll be a team of three.

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00:03:35,330 --> 00:03:38,020

BEUTEL: And there's the extra spacewalker we were talking about. Now, you're going to

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00:03:38,020 --> 00:03:40,980

get some firsthand experience, pardon the pun,

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00:03:40,980 --> 00:03:44,250

working with Dextre when you're on your flight.
How has your training prepared you for that?

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00:03:44,250 --> 00:03:49,989

PAYETTE: Well, the training for a robotics operator is very generic at first. Some of

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00:03:49,989 --> 00:03:54,300

it is the concepts of manipulating a robot.

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00:03:54,300 --> 00:03:59,920

It's very similar across the various robots that we have in space -- the Canadarm on the

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00:03:59,920 --> 00:04:03,629

space shuttle, the Canadarm 2 which is on the space station permanently,

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00:04:03,629 --> 00:04:09,519

and we have also a small arm attached to the Japanese pressurized system. And they're all

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00:04:09,519 --> 00:04:11,670

somewhat on the same configurations.

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00:04:11,670 --> 00:04:17,000

So your generic training prepares you very well to then afterwards really do the specific

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00:04:17,000 --> 00:04:19,540

tasks. It's like driving a car.

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00:04:19,540 --> 00:04:23,330

If you've driven a car once, you can drive another kind of car even though the switches

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00:04:23,330 --> 00:04:26,990

are not in exactly in the same place. Just the concepts are the same thing.

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00:04:26,990 --> 00:04:30,270
BEUTEL: And we're actually, one of the things that you mentioned. You mentioned a lot of

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00:04:30,270 --> 00:04:33,770
the robotics, except for the Japanese "porch" facility that you talked about,

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00:04:33,770 --> 00:04:38,190
that the rest of the robotics work has been done by Canadian companies. That's been Canada's

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00:04:38,190 --> 00:04:40,540
contribution to the International Space Station.

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00:04:40,540 --> 00:04:47,990
What does Dextre mean to Canadians, as part of Canadarm2 and the other robotics systems

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00:04:47,990 --> 00:04:49,080
we have there?

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00:04:49,080 --> 00:04:54,170
PAYETTE: Well for us, the International Space Station, for us all, is an experimental facility.

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00:04:54,170 --> 00:05:00,380
This is the first time in the history of mankind that we've built such a big scientific outpost

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00:05:00,380 --> 00:05:04,830
in the environment of space, and we do it in collaboration with many nations.

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00:05:04,830 --> 00:05:12,890
Dextre is the first-ever servicing robot that has ever been designed. So this is something

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00:05:12,890 --> 00:05:17,350

that we don't really know exactly where it's going to be useful.

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00:05:17,350 --> 00:05:23,480

Maybe we'll find and we'll learn lessons about Dextre that will be applied later. And even

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00:05:23,480 --> 00:05:27,450

though it is science fiction today to think that there will be little robots

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00:05:27,450 --> 00:05:33,170

who will be able to go and service our weather satellites and our Earth observation satellites

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00:05:33,170 --> 00:05:38,790

one day -- well, it's completely, with that kind of robot, the first time,

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00:05:38,790 --> 00:05:42,740

that we'll learn whether or not we can do that. And then one day we'll be able to service

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00:05:42,740 --> 00:05:43,920

structures in space.

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00:05:43,920 --> 00:05:47,910

BEUTEL: These are the first steps. We have to take these first steps, and learn how to

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00:05:47,910 --> 00:05:49,270

use it for other things.

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00:05:49,270 --> 00:05:50,990

PAYETTE: That's exactly what station's about.

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00:05:50,990 --> 00:05:54,131

BEUTEL: And you mentioned, that's right, it's the international cooperation. We have all

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00:05:54,131 --> 00:05:56,750

these countries working together,

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00:05:56,750 --> 00:06:01,222

and one of the things we are learning to do
for longer-term exploration. You are a Canadian

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00:06:01,222 --> 00:06:04,640

Space Agency astronaut working within NASA.
What's that like?

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00:06:04,640 --> 00:06:12,230

PAYETTE: It's like being part of a big family.
What is amazing about NASA in particular,

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00:06:12,230 --> 00:06:15,660

because this is where I work as someone from
another country,

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00:06:15,660 --> 00:06:20,710

is that it doesn't matter who you are, which
country you were born, what language you spoke

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00:06:20,710 --> 00:06:25,590

when you were a kid, what color skin you have.
It is about who you are,

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00:06:25,590 --> 00:06:31,370

your qualifications, and what you can bring
to the team. We're a team, and we, the astronauts,

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00:06:31,370 --> 00:06:34,250

we sometimes are the most visible part of
the team,

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00:06:34,250 --> 00:06:40,520

but we're actually just a small part of that
team. Thousands of very, very competent, dedicated

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00:06:40,520 --> 00:06:43,820
people behind -- the people that design the
systems,

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00:06:43,820 --> 00:06:49,000
the people that manage the program, the people
that administer are important, without which

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00:06:49,000 --> 00:06:50,500
everything would crumple.

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00:06:50,500 --> 00:06:56,160
And we're just the ones that go and execute
the plan that was designed on the ground.

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00:06:56,160 --> 00:07:01,620
And I never feel like I'm Canadian, or I'm
not American, or I'm not Russian.

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00:07:01,620 --> 00:07:07,090
No, I'm part of an astronaut team, and we
have a mission to do, and it's a common one.

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00:07:07,090 --> 00:07:11,230
So it's a great job. If you want to sign up,
I encourage you.

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00:07:11,230 --> 00:07:15,480
BEUTEL: Probably past my prime, I guess. All
right, well actually this is the part of the

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00:07:15,480 --> 00:07:17,110
webcast that's audience participation,

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00:07:17,110 --> 00:07:22,381
where people have submitted questions at the
NASA.gov for you to answer. And a lot of them

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00:07:22,381 --> 00:07:24,710

are actually related to the number of spacewalks we have,

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00:07:24,710 --> 00:07:30,550

which makes a lot of sense since STS-123 has five spacewalks scheduled, more than any other

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00:07:30,550 --> 00:07:31,870

for a single station mission.

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00:07:31,870 --> 00:07:35,440

So we'll start off with Abigail from South Florida asking:

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00:07:35,440 --> 00:07:39,310

"Do spacewalking astronauts have to be certified SCUBA divers since their spacewalk training

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00:07:39,310 --> 00:07:40,460

takes place underwater?"

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00:07:40,460 --> 00:07:46,400

PAYETTE: Absolutely! That's an excellent question. Every astronaut is SCUBA-diving certified

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00:07:46,400 --> 00:07:51,400

because a lot of the preliminary analysis that we do,

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00:07:51,400 --> 00:07:55,870

we go SCUBA diving before we put the big suit, which is quite cumbersome, the visibility

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00:07:55,870 --> 00:07:56,870

is restricted.

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00:07:56,870 --> 00:08:01,970

Often we will try to think about how we're going to do a task by going SCUBA diving.

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00:08:01,970 --> 00:08:06,550

Much more easy for us to go around and look through all the angles,

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00:08:06,550 --> 00:08:12,960

and then we design a plan, which we then execute in the pool, trying to figure out if it works.

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00:08:12,960 --> 00:08:14,660

So SCUBA diving is very important.

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00:08:14,660 --> 00:08:18,300

BEUTEL: And of course the big pool we're talking about is in Houston, NASA's Johnson Space

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00:08:18,300 --> 00:08:21,380

Center has the big pool where you do a lot of the full mockups and the training.

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00:08:21,380 --> 00:08:26,120

PAYETTE: Yeah. The closest we get to microgravity, to weightlessness. It's not exact, but it's

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00:08:26,120 --> 00:08:27,810

as close as we get.

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00:08:27,810 --> 00:08:30,440

BEUTEL: And at least it's more convenient than having to wait till you go to space to

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00:08:30,440 --> 00:08:31,440

do it.

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00:08:31,440 --> 00:08:34,680

George from Moon Township asks: "How exactly does the tether system work when astronauts

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00:08:34,680 --> 00:08:36,201

do their spacewalks on the space station?"

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00:08:36,201 --> 00:08:41,970

PAYETTE: Another very good question. Clearly, spacewalkers are always, always, always tethered

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00:08:41,970 --> 00:08:45,450

to the space station and any given time.

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00:08:45,450 --> 00:08:50,130

For the good reason that if for some reason they would push away from station without

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00:08:50,130 --> 00:08:55,160

being, without holding, if they weren't tethered and they had nothing else to hold on,

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00:08:55,160 --> 00:08:58,900

they would start floating in outer space as their own satellite, and that's not a good

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00:08:58,900 --> 00:08:59,900

thing.

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00:08:59,900 --> 00:09:00,900

BEUTEL: That would be bad, yes.

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00:09:00,900 --> 00:09:05,640

PAYETTE: So the tether, of course, the astronaut is tethered to the station with a reel. And

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00:09:05,640 --> 00:09:13,530

as they move along the station, the reel unreels a little wire, a very sturdy wire,

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00:09:13,530 --> 00:09:17,760

and they check on the wire all the time. We practice this in the pool a lot, to check

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00:09:17,760 --> 00:09:22,090

on your wire and your tether. It's very important.
If it gets entangled,

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00:09:22,090 --> 00:09:28,010

you go and detangle it. If for some reason
it curves into a place you don't like, you

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00:09:28,010 --> 00:09:30,810

go and make sure it's all nicely routed.

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00:09:30,810 --> 00:09:35,710

Because it's your lifesaver, if needed. However,
we do have a backup system.

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00:09:35,710 --> 00:09:39,440

BEUTEL: We do have what we call our "SAFER"
system that's got a little jetpack that if

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00:09:39,440 --> 00:09:40,440

you do, I guess, push away or something happens

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00:09:40,440 --> 00:09:46,310

PAYETTE: And then you always have the robotics
operator. I mean, Canadarm2 has a 55-foot

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00:09:46,310 --> 00:09:50,200

reach. Who knows, if an astronaut would start
floating about,

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00:09:50,200 --> 00:09:55,270

maybe the operator could go fetch them out
of space. But these are really farfetched

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00:09:55,270 --> 00:09:57,440

scenarios. We've never been there, and hopefully
never will.

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00:09:57,440 --> 00:10:00,410

BEUTEL: All right. Well it's good to have

the backup plans, that's why we do it. Let's

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00:10:00,410 --> 00:10:01,530

see, we do have, let's see,

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00:10:01,530 --> 00:10:05,190

Gain from Rapid City asks: "How do astronauts deal with the fear that must be present at

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00:10:05,190 --> 00:10:06,190

launch?"

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00:10:06,190 --> 00:10:08,670

And, actually, that you mentioned, floating away, throughout the entire mission?

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00:10:08,670 --> 00:10:16,890

PAYETTE: This is a risky business, to go and put humans in space and bring them back safely.

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00:10:16,890 --> 00:10:20,380

We've only been at this for 40-some years.

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00:10:20,380 --> 00:10:27,940

It's very recent in the history of mankind. Rocket propulsion has its risks, and we understand

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00:10:27,940 --> 00:10:33,870

them, but that's our job. And the privilege of going to space,

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00:10:33,870 --> 00:10:42,190

the interest of working at such a cutting edge of technology, in an international collaboration,

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00:10:42,190 --> 00:10:46,570

far outweighs the risk. And we're certainly willing,

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00:10:46,570 --> 00:10:52,620

and there's a lot of people that would be.
Without risk we can't advance, we can't discover.

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00:10:52,620 --> 00:11:00,170

I often quote -- I wonder if we could go and
interview Christopher Columbus today, in the

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00:11:00,170 --> 00:11:06,150

NASA news, and say, "Well, you're embarking
on this voyage across the ocean, and you don't

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00:11:06,150 --> 00:11:09,090

know where you're going to end up. Aren't
you fearful?"

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00:11:09,090 --> 00:11:12,100

And that would be interesting, to see what
he had to say.

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00:11:12,100 --> 00:11:16,000

BEUTEL: Let's see. Dan from Kennewick wants
to know, "Do astronauts have a hard time sleeping

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00:11:16,000 --> 00:11:18,550

or resting in space?" How'd you sleep nine
years ago?

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00:11:18,550 --> 00:11:24,030

PAYETTE: Well, first, we sleep in sleeping
bags because we float. We don't have a mattress,

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00:11:24,030 --> 00:11:26,800

we don't have a bed, because we wouldn't be
able to stay on it.

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00:11:26,800 --> 00:11:32,940

So in our sleeping bag we can put our sleeping
bag vertical, diagonal, upside-down, or horizontal

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00:11:32,940 --> 00:11:33,940

as we wish,

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00:11:33,940 --> 00:11:39,180

and we just anchor it on a wall somewhere
so we don't drift while we sleep. We sleep

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00:11:39,180 --> 00:11:43,610

actually very well. And we're so busy during
the mission.

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00:11:43,610 --> 00:11:50,970

We work 16-, 17-, 18-hour days. By the time
you get into the sleeping bag, it takes very

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00:11:50,970 --> 00:11:56,470

few minutes before you fall asleep, and it's
very comfortable. I slept very well.

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00:11:56,470 --> 00:12:01,400

BEUTEL: So exhaustion helps. Okay, that's
good. Actually Julie, that was our final question.

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00:12:01,400 --> 00:12:03,440

I want to thank you for joining us and thank
you for your insight.

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00:12:03,440 --> 00:12:06,850

We are looking forward to covering your mission,
STS-127, next year.

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00:12:06,850 --> 00:12:10,890

PAYETTE: Well we're going now in a few hours.
Go Endeavour!

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00:12:10,890 --> 00:12:13,910

BEUTEL: Indeed. Actually as a matter of fact,
we'd like to thank our Web viewers for their

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00:12:13,910 --> 00:12:15,700

participation in today's program.

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00:12:15,700 --> 00:12:21,220

Remember to tune in to NASA's home on the Internet, www.nasa.gov/shuttle, for live launch

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00:12:21,220 --> 00:12:23,680

and landing blogs and updates throughout the flight of