



1
00:00:00,000 --> 00:00:02,320
(Music)

2
00:00:02,340 --> 00:00:04,050
Brenden Sanborn: Robot designs are getting better

3
00:00:04,070 --> 00:00:05,910
and more capable all the time and this is

4
00:00:05,930 --> 00:00:08,760
essential for the future of space exploration.

5
00:00:08,780 --> 00:00:11,180
If you think about how much work goes on every day

6
00:00:11,200 --> 00:00:13,930
aboard the International Space Station, or ISS,

7
00:00:13,950 --> 00:00:16,240
it makes sense that NASA is developing specialized

8
00:00:16,260 --> 00:00:18,250
robots to help reduce the workload

9
00:00:18,270 --> 00:00:19,760
on the astronauts.

10
00:00:19,780 --> 00:00:21,920
Systems like Robonaut Two are already aboard

11
00:00:21,940 --> 00:00:23,930
the ISS and starting to demonstrate their

12
00:00:23,950 --> 00:00:25,930
potential and value.

13
00:00:25,950 --> 00:00:28,780

Join us as we discover how scientists at NASA Ames

14

00:00:28,800 --> 00:00:31,690

Research Center are working on the next generation

15

00:00:31,710 --> 00:00:34,090

of remotely controlled robot systems for

16

00:00:34,110 --> 00:00:37,590

future space missions.

17

00:00:37,610 --> 00:00:56,320

(Music)

18

00:00:56,340 --> 00:00:58,230

Brenden: To tell us more about their plans for

19

00:00:58,250 --> 00:01:00,660

robotics we're meeting with NASA Human Exploration

20

00:01:00,680 --> 00:01:03,640

Telerobotics Project Manager Terry Fong.

21

00:01:03,660 --> 00:01:05,750

So Terry, what exactly is the HET or

22

00:01:05,770 --> 00:01:07,610

Telerobotics Project?

23

00:01:07,630 --> 00:01:09,410

Terry Fong: The Telerobotics Project is all about

24

00:01:09,430 --> 00:01:11,310

looking at how remotely operated robots can

25

00:01:11,330 --> 00:01:14,330

improve future human deep space missions.

26
00:01:14,350 --> 00:01:16,850
It's a project we're doing here at NASA Ames with

27
00:01:16,870 --> 00:01:19,210
our partners at NASA Johnson in Houston and the

28
00:01:19,230 --> 00:01:21,540
Jet Propulsion Laboratory in Pasadena.

29
00:01:21,560 --> 00:01:23,190
It's really important to develop these robots

30
00:01:23,210 --> 00:01:25,080
because we're trying to find ways of improving

31
00:01:25,100 --> 00:01:27,310
human productivity in space.

32
00:01:27,330 --> 00:01:29,760
We want robots that can really work before,

33
00:01:29,780 --> 00:01:32,230
in support of and after humans, and we're

34
00:01:32,250 --> 00:01:34,270
trying to find ways of doing this, that really

35
00:01:34,290 --> 00:01:37,390
allows humans and robots to be a productive team.

36
00:01:37,410 --> 00:01:38,740
Brenden: Could you tell us some examples of the

37
00:01:38,760 --> 00:01:40,480
types of jobs these robots do?

38
00:01:40,500 --> 00:01:42,220

Terry: We want to try to use robots to do those

39
00:01:42,240 --> 00:01:44,650
things which are very repetitive or very tedious

40
00:01:44,670 --> 00:01:45,710
for humans to do.

41
00:01:45,730 --> 00:01:47,700
So, you know, basic chores, for example,

42
00:01:47,720 --> 00:01:49,620
on board spacecraft, in terms of monitoring

43
00:01:49,640 --> 00:01:52,320
experiments in terms of just doing

44
00:01:52,340 --> 00:01:53,510
routine maintenance.

45
00:01:53,530 --> 00:01:54,850
These are the kinds of things that robots are

46
00:01:54,870 --> 00:01:56,820
really good at because it requires a lot of

47
00:01:56,840 --> 00:01:59,420
repetition or precision and things that

48
00:01:59,440 --> 00:02:01,610
fundamentally, for you and I as humans,

49
00:02:01,630 --> 00:02:03,080
are very unproductive.

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00:02:03,100 --> 00:02:04,020
Brenden: What are some of the different types of

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00:02:04,040 --> 00:02:05,720

robots you are developing?

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00:02:05,740 --> 00:02:07,380

Terry: In the Telerobotics Project we're working

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00:02:07,400 --> 00:02:09,170

with a wide variety of robots.

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00:02:09,190 --> 00:02:11,020

At NASA Johnson for example we're working

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00:02:11,040 --> 00:02:12,490

with Robonaut 2, which is a

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00:02:12,510 --> 00:02:14,870

two-armed humanoid robot.

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00:02:14,890 --> 00:02:16,830

It's able to reach out and pick up things just

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00:02:16,850 --> 00:02:19,570

like you or I can use our hands and arms to move

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00:02:19,590 --> 00:02:20,980

things around.

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00:02:21,000 --> 00:02:23,070

Here at NASA Ames we're working with the SPHERES

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00:02:23,090 --> 00:02:26,270

robot, which is a volleyball sized free-flyer that

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00:02:26,290 --> 00:02:29,140

can fly around inside a spacecraft, carry cameras

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00:02:29,160 --> 00:02:32,630

or other sensors and do mobile monitoring tasks.

64
00:02:32,650 --> 00:02:35,090
Brenden: So Terry, what's next for the project?

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00:02:35,110 --> 00:02:36,650
Terry: We have been doing a lot of work with both

66
00:02:36,670 --> 00:02:39,100
Robonaut Two and SPHERES on space station, but

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00:02:39,120 --> 00:02:40,930
these are still in the experiment stage.

68
00:02:40,950 --> 00:02:42,680
Where we'd really like to be and we hope to be

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00:02:42,700 --> 00:02:45,070
within the next year or so, is at a point where

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00:02:45,090 --> 00:02:47,230
these robots become not just experiments but

71
00:02:47,250 --> 00:02:49,730
really tools and maybe even beyond tools

72
00:02:49,750 --> 00:02:50,820
as actual partners.

73
00:02:50,840 --> 00:02:52,610
So they're working day in and day out to help

74
00:02:52,630 --> 00:02:54,770
humans to be more productive in space.

75
00:02:54,790 --> 00:02:56,060
And for me, that's really what the future

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00:02:56,080 --> 00:02:57,330

of space exploration is:

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00:02:57,350 --> 00:03:00,410

humans and robots working together.

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00:03:00,430 --> 00:03:02,210

Brenden: To tell us more about that unusual

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00:03:02,230 --> 00:03:04,630

volleyball-sized robot being tested on the Space

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00:03:04,650 --> 00:03:07,860

Station is NASA Ames' SPHERES Engineering Manager

81

00:03:07,880 --> 00:03:09,820

Mark Micire.

82

00:03:09,840 --> 00:03:11,210

Mark Micire: This is the SPHERES, it was

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00:03:11,230 --> 00:03:13,550

originally developed by MIT, and it flew up to

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00:03:13,570 --> 00:03:16,370

station up in 2006.

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00:03:16,390 --> 00:03:19,330

SPHERES stands for Synchronized Position Hold,

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00:03:19,350 --> 00:03:22,600

Engage, and Reorient Experimental Satellites.

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00:03:22,620 --> 00:03:26,410

It's used for testing navigation and other

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00:03:26,430 --> 00:03:29,520

guidance algorithms on space station.

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00:03:29,540 --> 00:03:30,820

Brenden: How does SPHERES work, what does it have

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00:03:30,840 --> 00:03:32,120

inside of it?

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00:03:32,140 --> 00:03:34,040

Mark: It's all fully self-contained. It has its

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00:03:34,060 --> 00:03:36,450

own thruster system, computer system and an

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00:03:36,470 --> 00:03:39,210

ability to figure out where it is on station.

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00:03:39,230 --> 00:03:42,520

Inside it has a small digital signal processor, so

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00:03:42,540 --> 00:03:45,670

it's like a small CPU that helps it do all of the

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00:03:45,690 --> 00:03:47,550

calculations it needs to figure out which

97

00:03:47,570 --> 00:03:49,590

thrusters to fire and how to get from point A

98

00:03:49,610 --> 00:03:51,200

to point B.

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00:03:51,220 --> 00:03:54,170

It also has an ultrasonic beacon system and the

100

00:03:54,190 --> 00:03:56,930

ultrasonics allow it to figure out very precisely

101

00:03:56,950 --> 00:03:59,510

where it is and what its orientation is.

102

00:03:59,530 --> 00:04:00,800

Brenden: That looks like a cell phone.

103

00:04:00,820 --> 00:04:02,730

What function does that serve?

104

00:04:02,750 --> 00:04:04,410

Mark: For this particular project we're using a

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00:04:04,430 --> 00:04:07,250

smartphone to control the SPHERE.

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00:04:07,270 --> 00:04:09,040

We were able to use the phone because

107

00:04:09,060 --> 00:04:11,100

it gives us good processing power,

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00:04:11,120 --> 00:04:13,710

it has lots of sensors, it has a camera,

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00:04:13,730 --> 00:04:16,210

and it's very easy for us to write software that

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00:04:16,230 --> 00:04:18,560

will be able to run on the phone and then control

111

00:04:18,580 --> 00:04:20,480

the SPHERE.

112

00:04:20,500 --> 00:04:22,530

The hope is that ground would be able to create a

113

00:04:22,550 --> 00:04:25,040

plan of things that they want the SPHERE to do,

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00:04:25,060 --> 00:04:27,640

that plan would be uploaded to the smartphone.

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00:04:27,660 --> 00:04:29,910

The smartphone then would monitor the progress of

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00:04:29,930 --> 00:04:32,210

the SPHERE as it moves through station and execute

117

00:04:32,230 --> 00:04:33,740

those tasks.

118

00:04:33,760 --> 00:04:36,490

The real benefit is it's able to do this without crew

119

00:04:36,510 --> 00:04:38,340

needing to attend it.

120

00:04:38,360 --> 00:04:39,650

Brenden: What's in store for the future?

121

00:04:39,670 --> 00:04:42,490

How do you see the goals for this project evolving?

122

00:04:42,510 --> 00:04:44,920

Mark: Well, I can definitely see a world in which

123

00:04:44,940 --> 00:04:47,100

human and robots are working together and working

124

00:04:47,120 --> 00:04:48,230

as a team.

125

00:04:48,250 --> 00:04:49,920

Where you have robots that are on the ground

126

00:04:49,940 --> 00:04:51,890

doing science and figuring out how to work

127

00:04:51,910 --> 00:04:53,450

in these harsh environments.

128

00:04:53,470 --> 00:04:56,820

I can also see crew working side by side with

129

00:04:56,840 --> 00:05:00,540

robots up in the space capsules with the robots

130

00:05:00,560 --> 00:05:03,100

doing a lot of the menial and kind of boring work

131

00:05:03,120 --> 00:05:04,890

to free up the crew for doing other more

132

00:05:04,910 --> 00:05:06,860

interesting things.

133

00:05:06,880 --> 00:05:09,140

This is definitely breaking new ground.

134

00:05:09,160 --> 00:05:11,850

Usually you think of it in terms of robots as a

135

00:05:11,870 --> 00:05:14,540

separate entity from humans, but I think it's really

136

00:05:14,560 --> 00:05:16,800

when you get the two working together that you have a

137

00:05:16,820 --> 00:05:19,010

really good combination for allowing us to go

138

00:05:19,030 --> 00:05:21,980

places we haven't been before.

139

00:05:22,000 --> 00:05:23,390

Brenden: Thanks for joining us!

140

00:05:23,410 --> 00:05:29,110

And meet us again on our next Destination Innovation.

141

00:05:29,130 --> 00:05:30,820

Brenden: For more information about NASA's

142

00:05:30,840 --> 00:05:34,340

Human Exploration Telerobotics Project, please visit

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00:05:34,360 --> 00:05:39,070

NASA-dot-gov-slash-telerobotics.