1
00:00:12,619 --> 00:00:10,850
this project is all about understanding

2
00:00:15,320 --> 00:00:12,629
how humans and robots can work together

3
00:00:17,210 --> 00:00:15,330
to improve future space exploration in

4
00:00:18,850 --> 00:00:17,220
this project you know we don't see it as

5
00:00:21,080 --> 00:00:18,860
a question of you know humans or robots

6
00:00:22,849 --> 00:00:21,090
humans and robots work very naturally

7
00:00:24,890 --> 00:00:22,859
together and they don't have to work

8
00:00:27,259 --> 00:00:24,900
just hand in hand they can have you can

9
00:00:28,580 --> 00:00:27,269
have robots working ahead of crew robots

10
00:00:30,349 --> 00:00:28,590
working in parallel the crew or in

11
00:00:32,330 --> 00:00:30,359
supportive crew and robots working after

12
00:00:34,340 --> 00:00:32,340
crew so there's this whole spectrum of

13
00:00:36,680 --> 00:00:34,350

how you can have robots really doing

14
00:00:39,229 --> 00:00:36,690
things to make humans more productive

15
00:00:41,270 --> 00:00:39,239
more efficient more effective in space a

16
00:00:43,639 --> 00:00:41,280
lot of things we see out there today and

17
00:00:45,319 --> 00:00:43,649
the world really are robots we just

18
00:00:47,810 --> 00:00:45,329
don't call them robots you pick up a

19
00:00:49,520 --> 00:00:47,820
cell phone for example smartphones is a

20
00:00:51,529 --> 00:00:49,530
ton of software in there that makes them

21
00:00:53,959 --> 00:00:51,539
you know very intelligent they can sense

22
00:00:55,819 --> 00:00:53,969
the world they know where you are they

23
00:00:57,680 --> 00:00:55,829
can provide you with information you

24
00:00:59,000 --> 00:00:57,690
know the recent phones you can speak to

25
00:01:00,860 --> 00:00:59,010
them and know if they'll you can ask

26
00:01:06,740 --> 00:01:00,870
them questions what's the probability of

27
00:01:08,150 --> 00:01:06,750
snow and that's very much the same sort

28
00:01:10,249 --> 00:01:08,160
of software that we're developing in our

29
00:01:12,980 --> 00:01:10,259
project to make robots more intelligent

30
00:01:15,949 --> 00:01:12,990
to really make them useful as as

31
00:01:18,169 --> 00:01:15,959
partners and really assistance of humans

32
00:01:20,240 --> 00:01:18,179
when astronauts perform tests there's a

33
00:01:22,130 --> 00:01:20,250
lot of setup before the task is actually

34
00:01:23,779 --> 00:01:22,140
started and a lot of teardown after the

35
00:01:25,550 --> 00:01:23,789
task is done particularly on Space

36
00:01:28,040 --> 00:01:25,560
Station setting up the tool setting up a

37
00:01:30,410 --> 00:01:28,050
variety of equipment if a robot can

38
00:01:32,180 --> 00:01:30,420

perform that task it allows the crew

39
00:01:33,800 --> 00:01:32,190
person to be much more efficient doing

40
00:01:35,779 --> 00:01:33,810
the things that only a crew person can

41
00:01:37,160 --> 00:01:35,789
do yeah so one of the interesting robots

42
00:01:40,219 --> 00:01:37,170
were working with is a system called

43
00:01:42,199 --> 00:01:40,229
spheres MIT developed this about 10

44
00:01:44,540 --> 00:01:42,209
years ago they've actually had three of

45
00:01:46,699 --> 00:01:44,550
these volleyball sized free-flying

46
00:01:48,589 --> 00:01:46,709
robots on station for the past four

47
00:01:50,779 --> 00:01:48,599
years and what we're doing right now is

48
00:01:52,130 --> 00:01:50,789
is adding an upgrade to these free

49
00:01:54,380 --> 00:01:52,140
flyers they're originally made as

50
00:01:56,960 --> 00:01:54,390
satellites we've added actually a

51
00:01:58,550 --> 00:01:56,970
smartphone sort of a brain upgrade if

52
00:02:01,130 --> 00:01:58,560
you want to think of it that way to give

53
00:02:03,710 --> 00:02:01,140
them cameras and onboard sensing and a

54
00:02:05,419 --> 00:02:03,720
Wi-Fi connection so now we can have not

55
00:02:07,219 --> 00:02:05,429
just us free flying satellite but our

56
00:02:08,510 --> 00:02:07,229
free flying robot one of the other

57
00:02:10,639 --> 00:02:08,520
really exciting robots we've been

58
00:02:12,170 --> 00:02:10,649
working with is Robonaut 2 which was

59
00:02:14,780 --> 00:02:12,180
jointly developed by the NASA Johnson

60
00:02:17,000 --> 00:02:14,790
Space Center and General Motors now

61
00:02:18,670 --> 00:02:17,010
Robonaut 2 is a two-armed dexterous

62
00:02:20,890 --> 00:02:18,680
humanoid robot which

63
00:02:22,690 --> 00:02:20,900

means it can reach out and grab objects

64
00:02:24,759 --> 00:02:22,700
and manipulate them move them around

65
00:02:27,490 --> 00:02:24,769
just like you and I can it's very very

66
00:02:29,199 --> 00:02:27,500
agile very capable and what it can do in

67
00:02:31,630 --> 00:02:29,209
terms of the way it works with forces

68
00:02:33,819 --> 00:02:31,640
and being able to pick up and move

69
00:02:36,039 --> 00:02:33,829
things around so we're trying to make

70
00:02:37,780 --> 00:02:36,049
use of Robonaut to to do things that

71
00:02:40,390 --> 00:02:37,790
humans currently have to do those

72
00:02:42,280 --> 00:02:40,400
routine very repetitive perhaps long

73
00:02:44,559 --> 00:02:42,290
duration tasks that you just need to get

74
00:02:47,500 --> 00:02:44,569
done things such as say filter change

75
00:02:48,970 --> 00:02:47,510
out basic maintenance these are classic

76
00:02:51,309 --> 00:02:48,980
things that require a human level

77
00:02:52,720 --> 00:02:51,319
dexterity and for the very first time we

78
00:02:55,720 --> 00:02:52,730
have a robot that actually can do those

79
00:02:58,659 --> 00:02:55,730
things so hopefully this project will

80
00:03:00,009 --> 00:02:58,669
lower the workload on crew there's a lot

81
00:03:02,890 --> 00:03:00,019
of tasks that they do that are very

82
00:03:05,379 --> 00:03:02,900
boring in dull one is that they have to

83
00:03:07,089 --> 00:03:05,389
take radiological sensors and go around

84
00:03:09,520 --> 00:03:07,099
the station essentially measuring

85
00:03:10,629 --> 00:03:09,530
radiation the other is audio dissymmetry

86
00:03:12,789 --> 00:03:10,639
so they have to figure out the amount of

87
00:03:14,920 --> 00:03:12,799
noise on the station the hope is that

88
00:03:16,089 --> 00:03:14,930

much like your Roomba you can turn it on

89
00:03:18,490 --> 00:03:16,099
and it will run around your house and

90
00:03:20,229 --> 00:03:18,500
clean your your house for you that the

91
00:03:21,819 --> 00:03:20,239
sphere would eventually be able to fly

92
00:03:24,189 --> 00:03:21,829
around station and do some of these dull

93
00:03:25,509 --> 00:03:24,199
tasks for astronauts and there are a lot

94
00:03:27,580 --> 00:03:25,519
of good reasons for wanting to use

95
00:03:29,649 --> 00:03:27,590
robots in a VA it is a dangerous

96
00:03:32,199 --> 00:03:29,659
environment it is a place that requires

97
00:03:34,929 --> 00:03:32,209
the use of lots of oxygen and other

98
00:03:37,449 --> 00:03:34,939
things that we can't easily replace

99
00:03:39,129 --> 00:03:37,459
especially on a deep space mission so if

100
00:03:41,319 --> 00:03:39,139
we're able to create a robot that can do

101
00:03:43,719 --> 00:03:41,329
some of this work in a VA that has huge

102
00:03:45,939 --> 00:03:43,729
benefits to human exploration this

103
00:03:48,520 --> 00:03:45,949
project is really meant to look at how

104
00:03:50,289 --> 00:03:48,530
do you best use robots to improve human

105
00:03:52,240 --> 00:03:50,299
exploration especially for deep space

106
00:03:54,009 --> 00:03:52,250
missions and one of the things we're

107
00:03:56,020 --> 00:03:54,019
really trying to do is make sure that

108
00:03:57,699 --> 00:03:56,030
the robotic Hardware the robotic

109
00:04:00,339 --> 00:03:57,709
software and the way we operate the

110
00:04:02,770 --> 00:04:00,349
robots is really appropriate for looking

111
00:04:04,990 --> 00:04:02,780
at future missions our tests over the

112
00:04:06,580 --> 00:04:05,000
next two years really are designed to

113
00:04:08,860 --> 00:04:06,590

help us understand what are all the

114
00:04:11,259 --> 00:04:08,870
issues associated with using robots for

115
00:04:13,839 --> 00:04:11,269
human spaceflight having robots work

116
00:04:16,089 --> 00:04:13,849
with humans and so I think really all of

117
00:04:17,800 --> 00:04:16,099
our testing is driven by and our desire

118
00:04:19,360 --> 00:04:17,810
to create systems that really improve