1
00:00:00,000 --> 00:00:09,370
(Music)

2
00:00:09,370 --> 00:00:10,430
TERRY FONG: The Intelligent Robotics Group is

3
00:00:10,430 --> 00:00:12,930
developing new robotics technology to improve the

4
00:00:12,930 --> 00:00:15,770
way that humans can explore the solar system.

5
00:00:15,770 --> 00:00:17,900
A key part of that is looking at how humans and

6
00:00:17,900 --> 00:00:20,430
robots can work together as teams so that

7
00:00:20,430 --> 00:00:22,160
humans can support robots, and that

8
00:00:22,160 --> 00:00:24,370
robots can support humans.

9
00:00:24,370 --> 00:00:28,250
We want to interact with autonomous systems.

10
00:00:28,250 --> 00:00:30,820
We want to be able to create systems that we can

11
00:00:30,820 --> 00:00:34,690
trust, in all kinds of circumstances.

12
00:00:34,690 --> 00:00:36,790
Several years ago when we started working with

13
00:00:36,790 --> 00:00:38,890

these remotely operated robots,

14
00:00:38,890 --> 00:00:40,900
we needed a piece of software that would allow us

15
00:00:40,900 --> 00:00:43,330
to look at the terrain, to look at the sensor data

16
00:00:43,330 --> 00:00:44,370
coming from the robots, and

17
00:00:44,370 --> 00:00:46,860
understand its situation.

18
00:00:46,860 --> 00:00:49,030
And that led to the creation of VERVE.

19
00:00:49,030 --> 00:00:52,270
VERVE is a 3-D robot user interface.

20
00:00:52,270 --> 00:00:55,100
It allows us to see the 3-D world that

21
00:00:55,100 --> 00:00:58,030
the robots are operating in.

22
00:00:58,030 --> 00:01:00,710
It's been used with our K10 planetary rovers,

23
00:01:00,710 --> 00:01:03,060
our K-REX planetary rover,

24
00:01:03,060 --> 00:01:05,260
with SPHERES on the Space Station

25
00:01:05,260 --> 00:01:06,790
and with our new robot, the Astrobee,

26
00:01:06,790 --> 00:01:10,820
which will be on the Space Station in 2017.

27
00:01:10,820 --> 00:01:14,100
In 2013 we carried out a series of tests with

28
00:01:14,100 --> 00:01:17,240
astronauts on the International Space Station, and

29
00:01:17,240 --> 00:01:20,670
in those tests we had astronauts who were flying

30
00:01:20,670 --> 00:01:22,980
200 miles above the Earth remotely operate a

31
00:01:22,980 --> 00:01:25,400
robot, the K10 planetary rover,

32
00:01:25,400 --> 00:01:28,040
here in California.

33
00:01:28,040 --> 00:01:29,580
MARIA BUALAT: You cannot joystick a robot

34
00:01:29,580 --> 00:01:30,980
at the distance we're dealing with

35
00:01:30,980 --> 00:01:33,910
because of time delay.

36
00:01:33,910 --> 00:01:35,850
You need a robot that's very safe,

37
00:01:35,850 --> 00:01:37,450
that can operate on its own,

38
00:01:37,450 --> 00:01:40,070

can complete tasks on its own.

39
00:01:40,070 --> 00:01:41,890
On the other hand, you still want the human in the

40
00:01:41,890 --> 00:01:44,730
loop, because the human brings a lot of experience

41
00:01:44,730 --> 00:01:47,960
and very powerful cognitive ability that can deal

42
00:01:47,960 --> 00:01:49,840
with issues that the autonomy's

43
00:01:49,840 --> 00:01:52,500
not quite ready to handle.

44
00:01:52,500 --> 00:01:55,580
That's why NASA feels it's a very potent

45
00:01:55,580 --> 00:01:58,460
combination to use both the human capability

46
00:01:58,460 --> 00:02:04,680
and the robotic capability together.

47
00:02:04,680 --> 00:02:08,040
TERRY FONG: After our 2013 tests involving an

48
00:02:08,040 --> 00:02:10,540
astronaut on the Space Station remotely operating

49
00:02:10,540 --> 00:02:13,560
a robot here on Earth, we realized the software

50
00:02:13,560 --> 00:02:18,100
could be applied to lots of different uses.

51
00:02:18,100 --> 00:02:20,300
One of those uses happened to be supporting the

52
00:02:20,300 --> 00:02:24,480
operation of an autonomous vehicle.

53
00:02:24,480 --> 00:02:27,760
We were very excited when Nissan was interested in

54
00:02:27,760 --> 00:02:32,270
applying this to self-driving cars.

55
00:02:32,270 --> 00:02:34,180
EUGENE TU: One of the key goals of NASA is to

56
00:02:34,180 --> 00:02:36,640
transfer technology out to the commercial sector

57
00:02:36,640 --> 00:02:38,240
for broader use.

58
00:02:38,240 --> 00:02:40,840
When we engage in these type of partnerships we

59
00:02:40,840 --> 00:02:42,840
have a real opportunity to gain knowledge

60
00:02:42,840 --> 00:02:44,390
from them as well.

61
00:02:44,390 --> 00:02:46,890
Our collaboration with Nissan North America

62
00:02:46,890 --> 00:02:49,480
and with other self-driving car companies is an

63
00:02:49,480 --> 00:02:51,380

example of that.

64
00:02:51,380 --> 00:02:54,230
One of the things we gain is to learn how our

65
00:02:54,230 --> 00:02:56,520
autonomy is used and how humans

66
00:02:56,520 --> 00:02:59,460
interact with that.

67
00:02:59,460 --> 00:03:01,730
The need for autonomy and greater autonomy is

68
00:03:01,730 --> 00:03:03,500
always going be there for NASA missions

69
00:03:03,500 --> 00:03:04,940
in the future.

70
00:03:04,940 --> 00:03:06,720
But seeing it applied in a real world

71
00:03:06,720 --> 00:03:10,040
example of self-driving cars, for example,

72
00:03:10,040 --> 00:03:13,950
we will get that knowledge and benefit as well.

73
00:03:13,950 --> 00:03:15,290
TERRY FONG: I love robots.

74
00:03:15,290 --> 00:03:17,680
I help build and test them.

75
00:03:17,680 --> 00:03:22,030
In the future, I see robots everywhere.

76
00:03:22,030 --> 00:03:24,290
We have the potential of this technology reaching

77
00:03:24,290 --> 00:03:26,190
thousands or millions of people,