



000 00:47:51

PAO

1  
00:00:03,270 --> 00:00:01,990  
hi welcome to mission control houston

2  
00:00:05,349 --> 00:00:03,280  
today we're talking with chris

3  
00:00:07,670 --> 00:00:05,359  
provencher who is the project manager

4  
00:00:09,589 --> 00:00:07,680  
for the spheres satellite project uh

5  
00:00:12,150 --> 00:00:09,599  
that is uh been on the space station for

6  
00:00:13,589 --> 00:00:12,160  
a while long and storied history i guess

7  
00:00:15,030 --> 00:00:13,599  
so um actually chris if you could just

8  
00:00:17,510 --> 00:00:15,040  
start by maybe giving us a little bit of

9  
00:00:19,590 --> 00:00:17,520  
a history of the program

10  
00:00:20,790 --> 00:00:19,600  
well my robotics group at nasa ames

11  
00:00:23,429 --> 00:00:20,800  
research center

12  
00:00:26,070 --> 00:00:23,439  
is investigating the use of robots to

13  
00:00:28,230 --> 00:00:26,080

work in human exploration missions so

14

00:00:30,470 --> 00:00:28,240

we're not looking to replace humans on

15

00:00:32,310 --> 00:00:30,480

their missions we're looking to enhance

16

00:00:33,110 --> 00:00:32,320

their missions and provide more value to

17

00:00:35,350 --> 00:00:33,120

them

18

00:00:37,270 --> 00:00:35,360

so specifically we're looking at the use

19

00:00:39,110 --> 00:00:37,280

of robotic free flyers so anything that

20

00:00:41,030 --> 00:00:39,120

they can float in space

21

00:00:43,670 --> 00:00:41,040

and we recognize that the spheres

22

00:00:46,549 --> 00:00:43,680

platform is a great opportunity for us

23

00:00:49,110 --> 00:00:46,559

to do some pre-flying uh robotic testing

24

00:00:51,830 --> 00:00:49,120

so the spheres is a free-flying

25

00:00:53,590 --> 00:00:51,840

satellite it's got um you know structure

26  
00:00:55,750 --> 00:00:53,600  
it's got a propulsion system it has some

27  
00:00:57,990 --> 00:00:55,760  
limited processing and

28  
00:00:59,349 --> 00:00:58,000  
can operate within a limited space on

29  
00:01:00,869 --> 00:00:59,359  
space station

30  
00:01:02,869 --> 00:01:00,879  
so it doesn't have everything to become

31  
00:01:04,630 --> 00:01:02,879  
a robotic free flyer

32  
00:01:06,390 --> 00:01:04,640  
but it is a great opportunity for us to

33  
00:01:07,990 --> 00:01:06,400  
do our testing

34  
00:01:09,510 --> 00:01:08,000  
where the idea to use this on the space

35  
00:01:11,990 --> 00:01:09,520  
station come from

36  
00:01:14,789 --> 00:01:12,000  
uh well the spheres predates my projects

37  
00:01:17,109 --> 00:01:14,799  
the spheres is a pr payload facility

38  
00:01:19,270 --> 00:01:17,119

that involves

39

00:01:21,830 --> 00:01:19,280

many different payload users whoever has

40

00:01:24,550 --> 00:01:21,840

a need to do some type of zero-g testing

41

00:01:25,990 --> 00:01:24,560

on a free-flying satellite can apply to

42

00:01:28,149 --> 00:01:26,000

do their testing with it so that's run

43

00:01:29,910 --> 00:01:28,159

by the spheres program um so i'm with

44

00:01:32,069 --> 00:01:29,920

the smart spheres project so we are one

45

00:01:34,950 --> 00:01:32,079

of the many users of that uh of that

46

00:01:36,469 --> 00:01:34,960

payload facility okay so smart spheres

47

00:01:38,469 --> 00:01:36,479

that's the the ones that use the

48

00:01:41,109 --> 00:01:38,479

smartphones how did that come about

49

00:01:43,830 --> 00:01:41,119

what's what's the point of that right so

50

00:01:46,950 --> 00:01:43,840

the the spheres um though it does have

51  
00:01:48,950 --> 00:01:46,960  
propulsion in some uh processing and

52  
00:01:51,190 --> 00:01:48,960  
navigation system

53  
00:01:52,789 --> 00:01:51,200  
it doesn't do much other than fly around

54  
00:01:53,749 --> 00:01:52,799  
and for it to be a robot it needs to

55  
00:01:55,749 --> 00:01:53,759  
provide

56  
00:01:58,149 --> 00:01:55,759  
some some useful tasks to the space

57  
00:02:00,550 --> 00:01:58,159  
station so to do that we need to

58  
00:02:02,630 --> 00:02:00,560  
communicate with it uh we need uh some

59  
00:02:03,910 --> 00:02:02,640  
more processing uh we need to be able to

60  
00:02:05,830 --> 00:02:03,920  
control it

61  
00:02:07,270 --> 00:02:05,840  
and then it needs appropriate sensors

62  
00:02:09,910 --> 00:02:07,280  
for doing different types of tasks like

63  
00:02:11,750 --> 00:02:09,920

cameras or other things so everything i

64

00:02:14,150 --> 00:02:11,760

just described is what you'd find in a

65

00:02:16,390 --> 00:02:14,160

smartphone so that was really a really

66

00:02:19,190 --> 00:02:16,400

low cost approach for our project to

67

00:02:20,390 --> 00:02:19,200

upgrade the satellite from spheres to

68

00:02:22,550 --> 00:02:20,400

smart spheres

69

00:02:24,790 --> 00:02:22,560

without having to invest in a lot of

70

00:02:26,790 --> 00:02:24,800

development so okay and y'all have had

71

00:02:29,190 --> 00:02:26,800

that up there for a while right but now

72

00:02:31,350 --> 00:02:29,200

it's time for an upgrade yeah so we we

73

00:02:33,509 --> 00:02:31,360

did a massive smartphone in 2011 and

74

00:02:35,509 --> 00:02:33,519

we've been able to control that robot

75

00:02:38,869 --> 00:02:35,519

from the ground and have the iss crew

76

00:02:41,270 --> 00:02:38,879

control it and it's been very successful

77

00:02:43,350 --> 00:02:41,280

um but this new smartphone we have is is

78

00:02:45,509 --> 00:02:43,360

actually quite impressive

79

00:02:46,390 --> 00:02:45,519

so great show and tell yes show and tell

80

00:02:49,030 --> 00:02:46,400

so

81

00:02:51,030 --> 00:02:49,040

i did mention that the spheres uh is

82

00:02:52,470 --> 00:02:51,040

constrained to a very limited operating

83

00:02:54,229 --> 00:02:52,480

environment on the space station it's

84

00:02:56,630 --> 00:02:54,239

only like a two meter by two meter by

85

00:02:58,949 --> 00:02:56,640

two meter cube that it it works in

86

00:03:02,309 --> 00:02:58,959

uh this smartphone is called the project

87

00:03:04,790 --> 00:03:02,319

tango google just announced this um as a

88

00:03:07,270 --> 00:03:04,800

prototype release project tango project

89

00:03:09,589 --> 00:03:07,280

tango okay um so it's it's not

90

00:03:12,390 --> 00:03:09,599

available yet in stores but it's

91

00:03:14,790 --> 00:03:12,400

available to some uh android developers

92

00:03:16,710 --> 00:03:14,800

okay what's uh what's really impressive

93

00:03:19,190 --> 00:03:16,720

about this is that it's got an ir

94

00:03:22,630 --> 00:03:19,200

projector it's so it's similar to some

95

00:03:24,309 --> 00:03:22,640

games that can see you your body moving

96

00:03:26,630 --> 00:03:24,319

this phone has that as well so it has an

97

00:03:28,630 --> 00:03:26,640

ir projector and then an ir camera that

98

00:03:31,270 --> 00:03:28,640

can see that projection so basically

99

00:03:33,670 --> 00:03:31,280

this phone can see in 3d

100

00:03:36,630 --> 00:03:33,680

wow also it has a wide angle lens and

101  
00:03:38,149 --> 00:03:36,640  
then a processor dedicated uh to visual

102  
00:03:41,670 --> 00:03:38,159  
odometry so

103  
00:03:43,750 --> 00:03:41,680  
this camera can see things uh edges

104  
00:03:46,309 --> 00:03:43,760  
corners uh just anything that's not

105  
00:03:48,070 --> 00:03:46,319  
really playing background and then it

106  
00:03:50,470 --> 00:03:48,080  
tracks all of the features that it sees

107  
00:03:52,309 --> 00:03:50,480  
from frame to frame and as the phone is

108  
00:03:54,229 --> 00:03:52,319  
moving those features

109  
00:03:56,949 --> 00:03:54,239  
uh change position in each frame and

110  
00:03:58,710 --> 00:03:56,959  
they can calculate how far it has moved

111  
00:04:01,110 --> 00:03:58,720  
so with the the 3d mapping and the

112  
00:04:04,149 --> 00:04:01,120  
visual odometry this this smartphone is

113  
00:04:05,509 --> 00:04:04,159

capable of vision based navigation

114

00:04:07,990 --> 00:04:05,519

so i'm sorry what part is this

115

00:04:09,990 --> 00:04:08,000

smartphone here is it this or right so

116

00:04:11,990 --> 00:04:10,000

so actually the the white frame is what

117

00:04:14,710 --> 00:04:12,000

the regular smartphone looks like so

118

00:04:17,509 --> 00:04:14,720

we've modified this to operate on iss um

119

00:04:18,789 --> 00:04:17,519

we basically butterflyed this phone open

120

00:04:20,629 --> 00:04:18,799

so that all the things that are

121

00:04:22,069 --> 00:04:20,639

typically on the back of your phone are

122

00:04:23,510 --> 00:04:22,079

on the same side as the touch screen so

123

00:04:25,670 --> 00:04:23,520

that they're all facing out and away

124

00:04:27,990 --> 00:04:25,680

from spheres okay um and then we built

125

00:04:30,390 --> 00:04:28,000

this bracket as well to to mate it to

126  
00:04:32,790 --> 00:04:30,400  
sphere i see okay and uh it seems like

127  
00:04:33,990 --> 00:04:32,800  
the the main um

128  
00:04:35,350 --> 00:04:34,000  
the main thing you're wanting to get out

129  
00:04:37,270 --> 00:04:35,360  
of this is the 3d

130  
00:04:39,270 --> 00:04:37,280  
camera is that right it's the navigation

131  
00:04:41,270 --> 00:04:39,280  
the navigation right which uses the 3d

132  
00:04:44,390 --> 00:04:41,280  
camera and why is that special well if

133  
00:04:46,870 --> 00:04:44,400  
you want a a robotic free flyer to do

134  
00:04:48,710 --> 00:04:46,880  
useful work on iss it needs to

135  
00:04:49,749 --> 00:04:48,720  
pretty much fly anywhere on the space

136  
00:04:51,590 --> 00:04:49,759  
station

137  
00:04:54,070 --> 00:04:51,600  
and so to do that it needs a very robust

138  
00:04:55,590 --> 00:04:54,080

navigation system and we think this

139

00:04:56,950 --> 00:04:55,600

might be it

140

00:04:58,790 --> 00:04:56,960

okay but i guess

141

00:05:00,550 --> 00:04:58,800

you i if i understand correctly you've

142

00:05:03,350 --> 00:05:00,560

actually already tried this in zero

143

00:05:04,870 --> 00:05:03,360

gravity on a on an airplane flight here

144

00:05:06,629 --> 00:05:04,880

in houston and i think we actually have

145

00:05:07,990 --> 00:05:06,639

some video of that that we can show but

146

00:05:10,390 --> 00:05:08,000

how how did that go what did you do

147

00:05:13,270 --> 00:05:10,400

right so this this um this one was

148

00:05:15,189 --> 00:05:13,280

actually built to work on earth okay and

149

00:05:16,710 --> 00:05:15,199

it actually relies on a gravity vector

150

00:05:19,430 --> 00:05:16,720

so we've had to do some a lot of

151  
00:05:20,230 --> 00:05:19,440  
modifications to the software to remove

152  
00:05:22,469 --> 00:05:20,240  
um

153  
00:05:24,070 --> 00:05:22,479  
uh gravity from the equation so we're

154  
00:05:26,550 --> 00:05:24,080  
doing some zero-g parabolic flight

155  
00:05:28,230 --> 00:05:26,560  
testing out at ellington field and uh so

156  
00:05:30,230 --> 00:05:28,240  
far the tests are going real well we we

157  
00:05:32,390 --> 00:05:30,240  
still have yet to analyze the data and i

158  
00:05:34,150 --> 00:05:32,400  
guess what we're seeing here is the the

159  
00:05:35,830 --> 00:05:34,160  
smartphone attached to one of the sphere

160  
00:05:37,990 --> 00:05:35,840  
satellites right that's that's exactly

161  
00:05:40,629 --> 00:05:38,000  
what you're seeing and as we hit zero g

162  
00:05:43,830 --> 00:05:40,639  
we uh we release it in the in the cabin

163  
00:05:47,189 --> 00:05:43,840

of the aircraft and uh and let it try to

164

00:05:48,310 --> 00:05:47,199

localize itself in zero g so okay and

165

00:05:49,670 --> 00:05:48,320

you said it went well well we're

166

00:05:51,189 --> 00:05:49,680

collecting the data we'll see how well

167

00:05:53,830 --> 00:05:51,199

it's working uh probably once we get

168

00:05:55,510 --> 00:05:53,840

back to ames okay well once you've had a

169

00:05:57,270 --> 00:05:55,520

chance to take a look at that

170

00:05:58,790 --> 00:05:57,280

assume it assuming it went well what's

171

00:06:00,150 --> 00:05:58,800

the next step when do you go to the

172

00:06:03,110 --> 00:06:00,160

space station the next step is space

173

00:06:05,510 --> 00:06:03,120

station and um we are supposed to launch

174

00:06:07,270 --> 00:06:05,520

on may 1st on orbital 2 and then this

175

00:06:09,510 --> 00:06:07,280

summer we'll have two activities with

176

00:06:11,430 --> 00:06:09,520

the iss crew to to see how well it can

177

00:06:13,189 --> 00:06:11,440

navigate through the space station okay

178

00:06:14,870 --> 00:06:13,199

well we look forward to seeing that in

179

00:06:15,990 --> 00:06:14,880

space and thanks so much for visiting us

180

00:06:17,510 --> 00:06:16,000

and telling us about this it sounds like