



1
00:00:05,510 --> 00:00:03,189

okay i have the

2
00:00:07,909 --> 00:00:05,520

satellite positioning box up it's just

3
00:00:09,669 --> 00:00:07,919

waiting for me to push the enable button

4
00:00:11,509 --> 00:00:09,679

and release it here you go

5
00:00:13,669 --> 00:00:11,519

we are ready

6
00:00:15,509 --> 00:00:13,679

commander kevin ford getting set up for

7
00:00:17,590 --> 00:00:15,519

the spheres experiment that's about to

8
00:00:18,950 --> 00:00:17,600

take place on the space station and tell

9
00:00:20,950 --> 00:00:18,960

us a little bit more about what's going

10
00:00:23,429 --> 00:00:20,960

to be going on with spears today we have

11
00:00:25,750 --> 00:00:23,439

terry fong on the phone he's going to uh

12
00:00:28,390 --> 00:00:25,760

he's at the ames nasa's ames research

13
00:00:30,950 --> 00:00:28,400

center in california and he is the

14

00:00:33,110 --> 00:00:30,960

project manager for the human

15

00:00:35,110 --> 00:00:33,120

exploration telerobotics terry are you

16

00:00:37,670 --> 00:00:35,120

there yes i am good morning

17

00:00:40,470 --> 00:00:37,680

so tell us what uh what spheres has to

18

00:00:42,549 --> 00:00:40,480

do with human exploration telerobotics

19

00:00:43,670 --> 00:00:42,559

sure the human exploration tele robotics

20

00:00:46,869 --> 00:00:43,680

project

21

00:00:49,190 --> 00:00:46,879

is one that nasa is using to look at how

22

00:00:51,270 --> 00:00:49,200

remotely operated robots can really

23

00:00:53,029 --> 00:00:51,280

improve the way that we conduct human

24

00:00:55,110 --> 00:00:53,039

space flight missions

25

00:00:56,470 --> 00:00:55,120

and this project has a number of robots

26

00:00:58,630 --> 00:00:56,480

some people may be familiar with the

27

00:01:00,229 --> 00:00:58,640

robonaut 2 system which we've been

28

00:01:01,430 --> 00:01:00,239

testing for quite a while now on space

29

00:01:03,430 --> 00:01:01,440

station

30

00:01:05,670 --> 00:01:03,440

what we're doing today is is basically

31

00:01:07,429 --> 00:01:05,680

upgrading these spheres

32

00:01:08,789 --> 00:01:07,439

these are these mobile satellites these

33

00:01:10,310 --> 00:01:08,799

volleyball

34

00:01:12,870 --> 00:01:10,320

size free flyers which have been on

35

00:01:15,429 --> 00:01:12,880

station since 2006 uh to date they've

36

00:01:17,749 --> 00:01:15,439

been used primarily as a satellite test

37

00:01:19,749 --> 00:01:17,759

platform and today we are turning them

38

00:01:21,030 --> 00:01:19,759

into free flying robots

39

00:01:22,950 --> 00:01:21,040

so

40

00:01:25,350 --> 00:01:22,960

these these balls that we see floating

41

00:01:28,310 --> 00:01:25,360

here um on the screen in front of in

42

00:01:29,830 --> 00:01:28,320

front of kevin ford that's a robot

43

00:01:31,350 --> 00:01:29,840

well it's turning into a robot now i

44

00:01:33,670 --> 00:01:31,360

mean when when the spheres were

45

00:01:35,590 --> 00:01:33,680

originally built this was uh more than

46

00:01:37,350 --> 00:01:35,600

10 years ago they were actually created

47

00:01:39,429 --> 00:01:37,360

by mit

48

00:01:40,310 --> 00:01:39,439

they were meant to be these free-flying

49

00:01:42,950 --> 00:01:40,320

uh

50

00:01:45,670 --> 00:01:42,960

platforms for testing satellite control

51
00:01:48,310 --> 00:01:45,680
so they could do things like fly around

52
00:01:50,069 --> 00:01:48,320
in formations they could uh to approach

53
00:01:51,830 --> 00:01:50,079
and dock with one another

54
00:01:54,789 --> 00:01:51,840
but they're really you know meant to be

55
00:01:56,950 --> 00:01:54,799
these uh these moving test platforms for

56
00:01:58,870 --> 00:01:56,960
for just checking out basic uh flying

57
00:02:00,310 --> 00:01:58,880
and control maneuvers

58
00:02:03,590 --> 00:02:00,320
what we've been working on for the past

59
00:02:04,950 --> 00:02:03,600
year and a half is to turn them into

60
00:02:07,510 --> 00:02:04,960
what most people would consider to be

61
00:02:09,910 --> 00:02:07,520
robots that is we needed to add

62
00:02:12,150 --> 00:02:09,920
sensors like cameras uh we needed to add

63
00:02:13,430 --> 00:02:12,160

uh more modern computing

64

00:02:14,470 --> 00:02:13,440

these spheres when they were built more

65

00:02:16,470 --> 00:02:14,480

than 10 years ago as you can imagine

66

00:02:18,309 --> 00:02:16,480

it's a long time ago in computing terms

67

00:02:20,470 --> 00:02:18,319

you know had a pretty slow

68

00:02:23,350 --> 00:02:20,480

digital signal processor we wanted a a

69

00:02:25,350 --> 00:02:23,360

more high performance computing

70

00:02:27,750 --> 00:02:25,360

platform we wanted to also have high

71

00:02:28,949 --> 00:02:27,760

bandwidth wireless networking

72

00:02:30,550 --> 00:02:28,959

and all the sorts of things that you

73

00:02:32,070 --> 00:02:30,560

would find in you know just any robot

74

00:02:33,910 --> 00:02:32,080

you would find today whether it's you

75

00:02:35,030 --> 00:02:33,920

know in the home office or in the

76

00:02:36,550 --> 00:02:35,040

workplace

77

00:02:37,350 --> 00:02:36,560

wow that's really interesting

78

00:02:39,270 --> 00:02:37,360

so

79

00:02:41,350 --> 00:02:39,280

what you know what's the purpose of of

80

00:02:43,110 --> 00:02:41,360

having these on space station as far as

81

00:02:44,630 --> 00:02:43,120

you're concerned well i think that there

82

00:02:46,710 --> 00:02:44,640

are there are a lot of things that go on

83

00:02:48,470 --> 00:02:46,720

on space station um and it's great we

84

00:02:50,790 --> 00:02:48,480

can actually see kevin ford working

85

00:02:52,309 --> 00:02:50,800

setting up the spheres with the

86

00:02:53,910 --> 00:02:52,319

basically the upgrade and that's an

87

00:02:55,670 --> 00:02:53,920

interesting story in itself but but

88

00:02:57,350 --> 00:02:55,680

looking at free flyers the interesting

89

00:02:59,430 --> 00:02:57,360

thing about them is they can do things

90

00:03:01,509 --> 00:02:59,440

uh such as conduct

91

00:03:03,910 --> 00:03:01,519

interior environmental surveys

92

00:03:05,990 --> 00:03:03,920

part of the routine work that the crew

93

00:03:07,670 --> 00:03:06,000

has to do on space station is make sure

94

00:03:10,710 --> 00:03:07,680

that the environment is safe to live and

95

00:03:12,390 --> 00:03:10,720

work in so they routinely go around and

96

00:03:15,589 --> 00:03:12,400

they measure different things such as

97

00:03:17,509 --> 00:03:15,599

light sound levels radiation levels

98

00:03:19,030 --> 00:03:17,519

you know verify that there isn't build

99

00:03:21,110 --> 00:03:19,040

up of things like carbon dioxide in

100

00:03:22,710 --> 00:03:21,120

various places and of course in space

101
00:03:24,070 --> 00:03:22,720
station you can't just hang sensors

102
00:03:26,229 --> 00:03:24,080
everywhere because you need to have

103
00:03:27,910 --> 00:03:26,239
space for people to move around in

104
00:03:30,550 --> 00:03:27,920
and so what we're trying to do is use

105
00:03:33,030 --> 00:03:30,560
these free flying robots to do these

106
00:03:34,550 --> 00:03:33,040
sort of routine mundane but very

107
00:03:36,550 --> 00:03:34,560
important uh

108
00:03:38,869 --> 00:03:36,560
tasks such as you know monitoring the

109
00:03:40,789 --> 00:03:38,879
the environment inside space station

110
00:03:42,390 --> 00:03:40,799
okay and this is a just an experiment to

111
00:03:44,229 --> 00:03:42,400
see if it can do that at this point or

112
00:03:46,149 --> 00:03:44,239
is it actually we gonna use the data it

113
00:03:48,550 --> 00:03:46,159

gathers today today we're doing an

114

00:03:50,789 --> 00:03:48,560

experiment to really understand you know

115

00:03:52,309 --> 00:03:50,799

how this is uh practical uh one of the

116

00:03:53,910 --> 00:03:52,319

interesting things here is though even

117

00:03:56,550 --> 00:03:53,920

though kevin is in the middle of setting

118

00:03:57,830 --> 00:03:56,560

this up once everything is configured we

119

00:04:00,229 --> 00:03:57,840

are actually going to be operating these

120

00:04:02,229 --> 00:04:00,239

from mission control in houston uh one

121

00:04:04,630 --> 00:04:02,239

of my engineers mark missouri is

122

00:04:06,710 --> 00:04:04,640

actually sitting at mission control and

123

00:04:08,869 --> 00:04:06,720

once uh kevin gets all the upgrades

124

00:04:11,030 --> 00:04:08,879

installed then mark will take control

125

00:04:12,949 --> 00:04:11,040

and actually fly these uh these robots

126
00:04:15,030 --> 00:04:12,959
from the ground

127
00:04:15,990 --> 00:04:15,040
wow okay um

128
00:04:17,189 --> 00:04:16,000
so

129
00:04:20,550 --> 00:04:17,199
what

130
00:04:21,909 --> 00:04:20,560
um

131
00:04:23,749 --> 00:04:21,919
as i mentioned earlier one of the things

132
00:04:25,670 --> 00:04:23,759
we've done is we've we've taken these

133
00:04:27,590 --> 00:04:25,680
free flying satellites the spheres and

134
00:04:28,710 --> 00:04:27,600
and upgraded them and the experiment

135
00:04:30,629 --> 00:04:28,720
today is actually interesting we're

136
00:04:32,390 --> 00:04:30,639
calling it smart spheres and the reason

137
00:04:35,030 --> 00:04:32,400
we're calling it smart spheres is what

138
00:04:37,270 --> 00:04:35,040

we've added is a an off-the-shelf uh

139

00:04:38,870 --> 00:04:37,280

commercial smartphone so you take a

140

00:04:40,950 --> 00:04:38,880

smartphone and a sphere together and you

141

00:04:42,469 --> 00:04:40,960

have smart spheres

142

00:04:44,150 --> 00:04:42,479

the the smartphome of course you know

143

00:04:45,990 --> 00:04:44,160

it's something that that we all carry in

144

00:04:48,870 --> 00:04:46,000

our pockets these days they're wonderful

145

00:04:51,270 --> 00:04:48,880

little computing devices um they have a

146

00:04:53,749 --> 00:04:51,280

you know a one gigahertz processor it's

147

00:04:55,670 --> 00:04:53,759

got a nice touch screen display

148

00:04:57,830 --> 00:04:55,680

cameras wi-fi you know everything you

149

00:04:59,590 --> 00:04:57,840

need to make a robot accept you know

150

00:05:01,590 --> 00:04:59,600

something to move yourself around so

151
00:05:04,070 --> 00:05:01,600
that's what spherus gives us today

152
00:05:06,070 --> 00:05:04,080
um and so kevin has been spending um

153
00:05:07,670 --> 00:05:06,080
basically past hours so working to

154
00:05:09,990 --> 00:05:07,680
upgrade the spheres actually looks like

155
00:05:10,950 --> 00:05:10,000
he's managed to get everything installed

156
00:05:13,350 --> 00:05:10,960
at this point i think we're going

157
00:05:16,390 --> 00:05:13,360
through some checkout procedures

158
00:05:19,350 --> 00:05:16,400
in which mark at mission control is just

159
00:05:21,029 --> 00:05:19,360
verifying that he can use the smartphone

160
00:05:21,830 --> 00:05:21,039
to control the sphere

161
00:05:24,469 --> 00:05:21,840
so

162
00:05:26,469 --> 00:05:24,479
from mission control mark talks to

163
00:05:28,950 --> 00:05:26,479

uh you know with some software to the

164

00:05:30,790 --> 00:05:28,960

phone the phone is then cabled into the

165

00:05:33,749 --> 00:05:30,800

sphere and uses that to actually fly the

166

00:05:35,749 --> 00:05:33,759

sphere around inside of space station so

167

00:05:37,270 --> 00:05:35,759

not only is it controlled from the

168

00:05:39,510 --> 00:05:37,280

ground but it's controlled by a phone on

169

00:05:41,270 --> 00:05:39,520

the ground uh by a phone on on the

170

00:05:43,110 --> 00:05:41,280

sphere so we've actually taken a phone

171

00:05:44,870 --> 00:05:43,120

and attached it to the sphere itself

172

00:05:47,430 --> 00:05:44,880

okay i see

173

00:05:48,710 --> 00:05:47,440

okay and then um they're going to

174

00:05:51,670 --> 00:05:48,720

i guess

175

00:05:53,909 --> 00:05:51,680

command it to start taking photos or

176

00:05:55,350 --> 00:05:53,919

yeah so today we're as i said we're

177

00:05:57,430 --> 00:05:55,360

really interested in using these free

178

00:05:59,029 --> 00:05:57,440

flyers to do uh sort of routine

179

00:06:00,870 --> 00:05:59,039

environmental surveys

180

00:06:02,150 --> 00:06:00,880

uh our interior surveys so one of the

181

00:06:05,430 --> 00:06:02,160

things we're doing today is we're going

182

00:06:07,270 --> 00:06:05,440

to fly uh back and forth in sort of a

183

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

parallel line pattern you know a

184

00:06:11,189 --> 00:06:09,520

systematic kind of survey pattern and

185

00:06:13,990 --> 00:06:11,199

we're going to be using the camera on

186

00:06:16,629 --> 00:06:14,000

the smartphone one of the cameras uh to

187

00:06:20,150 --> 00:06:16,639

acquire a continuous imagery um as we're

188

00:06:22,309 --> 00:06:20,160

flying this represents using any sort of

189

00:06:24,629 --> 00:06:22,319

sensor or instrument to take routine

190

00:06:26,309 --> 00:06:24,639

measurements inside of an environment

191

00:06:28,150 --> 00:06:26,319

like space station

192

00:06:30,070 --> 00:06:28,160

okay and i guess that's um kind of a

193

00:06:32,070 --> 00:06:30,080

theme we've heard before with

194

00:06:34,070 --> 00:06:32,080

robonaut 2 as you mentioned you know

195

00:06:35,749 --> 00:06:34,080

we're hoping that we can get it working

196

00:06:37,590 --> 00:06:35,759

so that it can do

197

00:06:39,350 --> 00:06:37,600

some of the the more mundane tests and

198

00:06:41,110 --> 00:06:39,360

it's not really a good use of astronauts

199

00:06:43,590 --> 00:06:41,120

time to do and this sounds like the same

200

00:06:44,950 --> 00:06:43,600

idea yeah that's exactly right i mean

201

00:06:46,469 --> 00:06:44,960

uh there are certainly a lot of things

202

00:06:47,749 --> 00:06:46,479

to do in space and i think the routine

203

00:06:49,350 --> 00:06:47,759

stuff is not something we should be

204

00:06:51,830 --> 00:06:49,360

having humans do

205

00:06:53,749 --> 00:06:51,840

we have humans in space because we want

206

00:06:55,270 --> 00:06:53,759

to make use of their brains and the fact

207

00:06:57,110 --> 00:06:55,280

that there are some things that only

208

00:06:59,189 --> 00:06:57,120

humans can do but you know the very

209

00:07:01,110 --> 00:06:59,199

routine the repetitive the mundane

210

00:07:02,469 --> 00:07:01,120

things you know robots should take over

211

00:07:03,990 --> 00:07:02,479

those chores they should do all this

212

00:07:04,950 --> 00:07:04,000

kind of work so that humans don't have

213

00:07:07,189 --> 00:07:04,960

to

214

00:07:08,469 --> 00:07:07,199

absolutely yeah that's i think a lot of

215

00:07:12,070 --> 00:07:08,479

people on ground would like that to

216

00:07:16,230 --> 00:07:13,990

so i guess i know you're seeing a bit of

217

00:07:18,150 --> 00:07:16,240

a delay but at the moment the the

218

00:07:20,150 --> 00:07:18,160

satellite the sphere satellite is kind

219

00:07:22,150 --> 00:07:20,160

of floating toward the ground and now up

220

00:07:24,150 --> 00:07:22,160

a little bit and all that is being

221

00:07:25,670 --> 00:07:24,160

controlled remotely yeah that's being

222

00:07:27,430 --> 00:07:25,680

controlled actually it looks like it's

223

00:07:30,070 --> 00:07:27,440

it's being controlled by

224

00:07:31,990 --> 00:07:30,080

by marked admission control in houston

225

00:07:33,589 --> 00:07:32,000

um the sphere it's a little hard to see

226

00:07:34,870 --> 00:07:33,599

in in the video that that you're seeing

227

00:07:36,390 --> 00:07:34,880

streaming because it's not quite high

228

00:07:37,990 --> 00:07:36,400

enough resolution but

229

00:07:40,950 --> 00:07:38,000

right now on the right side there's a

230

00:07:42,230 --> 00:07:40,960

little boxy uh shiny thing you see on

231

00:07:44,869 --> 00:07:42,240

the on the right side of the sphere

232

00:07:46,230 --> 00:07:44,879

that's actually the smartphone this is a

233

00:07:49,749 --> 00:07:46,240

this is a like i said it's an off the

234

00:07:52,309 --> 00:07:49,759

shelf um this is a a nexus s

235

00:07:54,309 --> 00:07:52,319

android powered smartphone it was uh i

236

00:07:56,710 --> 00:07:54,319

guess jointly developed by by google and

237

00:07:58,550 --> 00:07:56,720

samsung and this one was was off the

238

00:08:00,070 --> 00:07:58,560

shelf i mean we actually bought it at a

239

00:08:01,990 --> 00:08:00,080

store um

240

00:08:03,510 --> 00:08:02,000

and uh you can go out obviously you

241

00:08:04,710 --> 00:08:03,520

could have gone out this phone is now a

242

00:08:06,629 --> 00:08:04,720

couple years old i actually don't know

243

00:08:10,550 --> 00:08:06,639

if it's still sold commercially but it

244

00:08:12,469 --> 00:08:10,560

literally is a consumer device okay

245

00:08:14,629 --> 00:08:12,479

so and it's great that we're able to to

246

00:08:16,150 --> 00:08:14,639

make use of those sort of everyday

247

00:08:18,390 --> 00:08:16,160

things and turn them into something

248

00:08:19,830 --> 00:08:18,400

that's useful on the space station yeah

249

00:08:21,749 --> 00:08:19,840

and i think in particular things like

250

00:08:23,430 --> 00:08:21,759

smartphones um

251
00:08:25,350 --> 00:08:23,440
you know when we first started looking

252
00:08:27,270 --> 00:08:25,360
at what it would take to turn spheres

253
00:08:29,110 --> 00:08:27,280
from a satellite into a robot you know

254
00:08:31,029 --> 00:08:29,120
we sat down we looked at all of the

255
00:08:33,430 --> 00:08:31,039
requirements and we said well we need to

256
00:08:35,909 --> 00:08:33,440
have you know computing and a display

257
00:08:37,909 --> 00:08:35,919
and cameras and maybe other sensors like

258
00:08:40,149 --> 00:08:37,919
gyros and accelerometers and you add it

259
00:08:42,709 --> 00:08:40,159
all up and what you come up with is well

260
00:08:44,070 --> 00:08:42,719
um we need a smartphone for that and you

261
00:08:46,630 --> 00:08:44,080
know rather than go out and try to build

262
00:08:48,230 --> 00:08:46,640
our own custom uh engineered small

263
00:08:49,590 --> 00:08:48,240

little computing device let's go buy

264

00:08:51,350 --> 00:08:49,600

something off the shelf and just modify

265

00:08:52,389 --> 00:08:51,360

it for use in space

266

00:08:53,910 --> 00:08:52,399

you know there have been billions of

267

00:08:54,870 --> 00:08:53,920

dollars of engineering time and here's a

268

00:08:57,350 --> 00:08:54,880

good picture you can actually see the

269

00:08:58,389 --> 00:08:57,360

smartphone attached to the sphere now

270

00:09:00,070 --> 00:08:58,399

you know billions of dollars of

271

00:09:01,190 --> 00:09:00,080

engineering spent on creating these

272

00:09:04,630 --> 00:09:01,200

wonderfully

273

00:09:07,030 --> 00:09:04,640

high performance low power compact uh

274

00:09:08,230 --> 00:09:07,040

rugged devices called smartphones so you

275

00:09:10,949 --> 00:09:08,240

know we want to take advantage of that

276

00:09:12,310 --> 00:09:10,959

and not try to reinvent the wheel

277

00:09:13,829 --> 00:09:12,320

and this is going to be the first test

278

00:09:15,670 --> 00:09:13,839

of that right yeah

279

00:09:17,269 --> 00:09:15,680

this was these smartphones were actually

280

00:09:18,949 --> 00:09:17,279

the first uh

281

00:09:19,829 --> 00:09:18,959

smartphones to be certified for use in

282

00:09:20,710 --> 00:09:19,839

space

283

00:09:22,550 --> 00:09:20,720

they're

284

00:09:23,829 --> 00:09:22,560

in the space station they've been there

285

00:09:26,230 --> 00:09:23,839

since actually the last shuttle flight

286

00:09:29,430 --> 00:09:26,240

they were carried up on sts-135

287

00:09:31,670 --> 00:09:29,440

um you know back in july 2011. um last

288

00:09:33,190 --> 00:09:31,680

year actually just about a year ago we

289

00:09:34,630 --> 00:09:33,200

did our first checkout with the phones

290

00:09:37,269 --> 00:09:34,640

to verify that they would work well in

291

00:09:39,829 --> 00:09:37,279

space and we logged lots of information

292

00:09:41,110 --> 00:09:39,839

from the phone just attached to a sphere

293

00:09:43,430 --> 00:09:41,120

but today is really our first

294

00:09:45,750 --> 00:09:43,440

opportunity to use the phone to control

295

00:09:47,350 --> 00:09:45,760

the the sphere itself so here like i

296

00:09:49,670 --> 00:09:47,360

said really now the combination of

297

00:09:51,670 --> 00:09:49,680

smartphone connected to spheres makes

298

00:09:53,750 --> 00:09:51,680

this this really this nice smartphone uh

299

00:09:55,509 --> 00:09:53,760

smart sphere is free flyer where'd this

300

00:09:57,829 --> 00:09:55,519

idea come from

301

00:09:59,269 --> 00:09:57,839

uh which idea the idea of using the

302

00:10:01,350 --> 00:09:59,279

smartphone on the satellite well

303

00:10:03,269 --> 00:10:01,360

honestly so i i distinctly recall a

304

00:10:04,389 --> 00:10:03,279

couple of years ago we were sitting in a

305

00:10:06,949 --> 00:10:04,399

conference room

306

00:10:09,030 --> 00:10:06,959

here at ames nasa ames uh trying to

307

00:10:09,750 --> 00:10:09,040

figure out what was going to be required

308

00:10:15,269 --> 00:10:09,760

to

309

00:10:16,870 --> 00:10:15,279

free-flying robot and you know we were

310

00:10:18,470 --> 00:10:16,880

working on a whiteboard writing up all

311

00:10:20,470 --> 00:10:18,480

the requirements and you know like i

312

00:10:22,150 --> 00:10:20,480

said okay we want a processor we want it

313

00:10:23,430 --> 00:10:22,160

just made sense all these things here

314

00:10:24,630 --> 00:10:23,440

and of course sitting around the room

315

00:10:26,230 --> 00:10:24,640

everybody's sitting there with their

316

00:10:27,910 --> 00:10:26,240

with their their phones checking their

317

00:10:29,110 --> 00:10:27,920

email right and somebody said oh we

318

00:10:30,470 --> 00:10:29,120

really need a small little device that

319

00:10:32,389 --> 00:10:30,480

you can know as well and everybody's

320

00:10:34,550 --> 00:10:32,399

like like oh let's use a phone

321

00:10:36,470 --> 00:10:34,560

well what about the idea to to use fears

322

00:10:38,389 --> 00:10:36,480

in this way to begin with to try and

323

00:10:40,310 --> 00:10:38,399

take some of the work off the astronauts

324

00:10:41,829 --> 00:10:40,320

well um you know ever since this project

325

00:10:43,430 --> 00:10:41,839

the human expression telerobotics

326

00:10:45,030 --> 00:10:43,440

project started

327

00:10:46,470 --> 00:10:45,040

that's been almost three years now you

328

00:10:49,269 --> 00:10:46,480

know we've been really looking at this

329

00:10:52,310 --> 00:10:49,279

common theme of you know how can we

330

00:10:54,870 --> 00:10:52,320

make astronauts lives uh more productive

331

00:10:56,150 --> 00:10:54,880

how can we really offload tasks that

332

00:10:57,350 --> 00:10:56,160

fundamentally is

333

00:10:58,630 --> 00:10:57,360

you know unproductive or things that

334

00:11:00,470 --> 00:10:58,640

they just you know really should not be

335

00:11:01,670 --> 00:11:00,480

spending their time doing and so we've

336

00:11:04,069 --> 00:11:01,680

been looking at a variety of different

337

00:11:06,150 --> 00:11:04,079

robots i mentioned robonaut 2 and and

338

00:11:07,829 --> 00:11:06,160

the smart spheres obviously and it's

339

00:11:10,470 --> 00:11:07,839

clear to us that that robots come in all

340

00:11:12,389 --> 00:11:10,480

kinds of different sizes and shapes and

341

00:11:13,910 --> 00:11:12,399

they carry different sort of tools and

342

00:11:16,470 --> 00:11:13,920

instruments

343

00:11:18,790 --> 00:11:16,480

robonaut 2 is a really great robot that

344

00:11:21,590 --> 00:11:18,800

we've been using for manipulation so it

345

00:11:23,829 --> 00:11:21,600

has arms and hands can reach out uh you

346

00:11:25,430 --> 00:11:23,839

know touch and grab things

347

00:11:26,630 --> 00:11:25,440

but there are other situations where you

348

00:11:28,710 --> 00:11:26,640

might want to move quickly or you want

349

00:11:31,350 --> 00:11:28,720

to just be in free space

350

00:11:33,190 --> 00:11:31,360

and for that we've been looking at the

351

00:11:34,310 --> 00:11:33,200

need for a free flyer

352

00:11:36,069 --> 00:11:34,320

there have been some free fire

353

00:11:38,550 --> 00:11:36,079

experiments you know as many years ago

354

00:11:41,430 --> 00:11:38,560

there was the the air cam sprint flight

355

00:11:43,590 --> 00:11:41,440

experiment that nasa johnson did

356

00:11:45,590 --> 00:11:43,600

outside in space and

357

00:11:47,670 --> 00:11:45,600

because we've seen that inside of space

358

00:11:50,150 --> 00:11:47,680

station the spheres have been a really

359

00:11:51,590 --> 00:11:50,160

wonderful you know test platform for

360

00:11:53,269 --> 00:11:51,600

many years now

361

00:11:55,350 --> 00:11:53,279

it really just made sense to us to see

362

00:11:57,509 --> 00:11:55,360

could we turn these into robots and use

363

00:12:00,150 --> 00:11:57,519

them to do useful work inside a space

364

00:12:02,870 --> 00:12:00,160

station okay well thanks terry one last

365

00:12:04,310 --> 00:12:02,880

question before you go um what where do

366

00:12:06,150 --> 00:12:04,320

you how do you see this project going

367

00:12:08,230 --> 00:12:06,160

forward what's the next step

368

00:12:10,790 --> 00:12:08,240

so the next step i think for us

369

00:12:12,150 --> 00:12:10,800

with all of our systems and robonaut 2

370

00:12:14,150 --> 00:12:12,160

and smart spheres are only a couple of

371

00:12:16,310 --> 00:12:14,160

them is really as we're doing these

372

00:12:18,069 --> 00:12:16,320

experiments really learning you know how

373

00:12:19,750 --> 00:12:18,079

they work um what things we need to

374

00:12:21,030 --> 00:12:19,760

improve that's going to allow us to go

375

00:12:22,870 --> 00:12:21,040

to the next part which is really

376

00:12:25,190 --> 00:12:22,880

actually making functional robots that