



1  
00:00:06,630 --> 00:00:04,230  
good afternoon i'm stephanie shearholtz

2  
00:00:08,870 --> 00:00:06,640  
from nasa's office of communications and

3  
00:00:10,950 --> 00:00:08,880  
we're here today at nasa's kennedy space

4  
00:00:13,030 --> 00:00:10,960  
center to talk with scientists and

5  
00:00:14,789 --> 00:00:13,040  
researchers about the important studies

6  
00:00:16,070 --> 00:00:14,799  
they will be conducting aboard the

7  
00:00:17,510 --> 00:00:16,080  
international space station in

8  
00:00:20,710 --> 00:00:17,520  
microgravity

9  
00:00:22,310 --> 00:00:20,720  
tomorrow at 4 33 pm eastern time spacex

10  
00:00:24,390 --> 00:00:22,320  
will launch its sixth commercial

11  
00:00:26,390 --> 00:00:24,400  
resupply services mission to the

12  
00:00:29,509 --> 00:00:26,400  
international space station it will

13  
00:00:31,429 --> 00:00:29,519

carry more than 4 300 pounds of supplies

14

00:00:35,670 --> 00:00:31,439

and payloads including critical

15

00:00:37,590 --> 00:00:35,680

materials to support about 40 of the 250

16

00:00:41,910 --> 00:00:37,600

experiments and investigations that will

17

00:00:43,830 --> 00:00:41,920

take place during expeditions 43 and 44.

18

00:00:45,830 --> 00:00:43,840

here to talk with us today about some of

19

00:00:48,790 --> 00:00:45,840

those science investigations

20

00:00:51,350 --> 00:00:48,800

are dr kirk costello international space

21

00:00:53,990 --> 00:00:51,360

station deputy chief scientist at nasa's

22

00:00:56,950 --> 00:00:54,000

johnson space center

23

00:00:58,869 --> 00:00:56,960

dr mike roberts senior research pathway

24

00:01:01,349 --> 00:00:58,879

manager for the center for the

25

00:01:03,510 --> 00:01:01,359

advancement of science in space known as

26

00:01:06,630 --> 00:01:03,520

cases

27

00:01:09,670 --> 00:01:06,640

dr paul reichert principal investigator

28

00:01:10,830 --> 00:01:09,680

for protein crystal growth 3 for merck

29

00:01:14,550 --> 00:01:10,840

research

30

00:01:16,950 --> 00:01:14,560

laboratories and dr lenoir rasmussen

31

00:01:19,030 --> 00:01:16,960

principal investigator for the synthetic

32

00:01:22,070 --> 00:01:19,040

muscle for prosthetics and robotics

33

00:01:23,830 --> 00:01:22,080

investigation from ras labs

34

00:01:25,670 --> 00:01:23,840

our intent today is to enable a

35

00:01:27,590 --> 00:01:25,680

discussion so we'll take questions

36

00:01:29,350 --> 00:01:27,600

throughout if you would like to ask a

37

00:01:30,870 --> 00:01:29,360

question please raise your hand get my

38

00:01:33,830 --> 00:01:30,880

attention

39

00:01:36,069 --> 00:01:33,840

we'll start with both dr costello and dr

40

00:01:38,469 --> 00:01:36,079

roberts talking about the partnership

41

00:01:40,230 --> 00:01:38,479

between nasa and the international space

42

00:01:43,030 --> 00:01:40,240

station and kasis and the national

43

00:01:44,630 --> 00:01:43,040

laboratory so um can you tell us a

44

00:01:46,630 --> 00:01:44,640

little bit about national lab and the

45

00:01:49,190 --> 00:01:46,640

space station program's goal in

46

00:01:51,350 --> 00:01:49,200

developing this relationship with cases

47

00:01:55,190 --> 00:01:51,360

sure thank you stephanie

48

00:01:57,670 --> 00:01:55,200

in 2005 congress designated the iss as a

49

00:02:00,149 --> 00:01:57,680

national laboratory the purpose of doing

50

00:02:02,310 --> 00:02:00,159

so was to make those resources available

51  
00:02:05,109 --> 00:02:02,320  
to our nation's researchers

52  
00:02:06,550 --> 00:02:05,119  
not just anymore to do research to

53  
00:02:08,949 --> 00:02:06,560  
better

54  
00:02:11,990 --> 00:02:08,959  
the understanding of how we explore our

55  
00:02:14,630 --> 00:02:12,000  
universe and human exploration in space

56  
00:02:17,110 --> 00:02:14,640  
but also to enable research that really

57  
00:02:19,190 --> 00:02:17,120  
does pay benefits for the human

58  
00:02:21,190 --> 00:02:19,200  
earthbound citizen

59  
00:02:23,589 --> 00:02:21,200  
so with that in mind

60  
00:02:26,150 --> 00:02:23,599  
nasa and cases have two

61  
00:02:29,190 --> 00:02:26,160  
different goals but we're utilizing the

62  
00:02:32,070 --> 00:02:29,200  
same laboratory space

63  
00:02:34,390 --> 00:02:32,080

cases is the manager for the national

64

00:02:37,110 --> 00:02:34,400

lab and as such they manage all of the

65

00:02:39,509 --> 00:02:37,120

research projects that really have as

66

00:02:41,110 --> 00:02:39,519

their main objective bettering our lives

67

00:02:42,790 --> 00:02:41,120

here on earth

68

00:02:45,350 --> 00:02:42,800

and what types of research can we do in

69

00:02:46,869 --> 00:02:45,360

space to really benefit humans on earth

70

00:02:47,750 --> 00:02:46,879

that's a great question

71

00:02:50,229 --> 00:02:47,760

so

72

00:02:51,990 --> 00:02:50,239

in space particularly in low earth orbit

73

00:02:53,670 --> 00:02:52,000

we have microgravity

74

00:02:56,309 --> 00:02:53,680

a microgravity environment in a

75

00:02:59,270 --> 00:02:56,319

microgravity environment there is no

76

00:03:01,030 --> 00:02:59,280

convection driven buoyancy forces

77

00:03:02,390 --> 00:03:01,040

that means fluids behave very

78

00:03:04,390 --> 00:03:02,400

differently

79

00:03:06,550 --> 00:03:04,400

that different behavior affects all

80

00:03:08,630 --> 00:03:06,560

fluidic systems whether those are

81

00:03:12,630 --> 00:03:08,640

material science type investigations

82

00:03:15,430 --> 00:03:12,640

we're doing and uh we want to see things

83

00:03:17,910 --> 00:03:15,440

not sediment out or develop more slowly

84

00:03:20,309 --> 00:03:17,920

over time as in protein crystallography

85

00:03:23,750 --> 00:03:20,319

and and crystallization

86

00:03:25,589 --> 00:03:23,760

or uh un systems cellular systems how it

87

00:03:28,070 --> 00:03:25,599

affects our biology

88

00:03:30,149 --> 00:03:28,080

those are two great uses that can

89

00:03:32,470 --> 00:03:30,159

translate to our human

90

00:03:34,949 --> 00:03:32,480

benefits back here on earth whether

91

00:03:36,470 --> 00:03:34,959

we're looking at various disease vectors

92

00:03:38,869 --> 00:03:36,480

and how they respond

93

00:03:40,949 --> 00:03:38,879

differently in space and identifying new

94

00:03:43,430 --> 00:03:40,959

pathways to attack those we're looking

95

00:03:46,390 --> 00:03:43,440

at material science type investigations

96

00:03:49,110 --> 00:03:46,400

to develop new materials for production

97

00:03:51,190 --> 00:03:49,120

back here on earth we also have exposure

98

00:03:53,910 --> 00:03:51,200

to the space environment and that

99

00:03:55,750 --> 00:03:53,920

capability allows us to launch cubesats

100

00:03:58,789 --> 00:03:55,760

and other small payloads

101  
00:04:01,350 --> 00:03:58,799  
to do technology development and again

102  
00:04:04,149 --> 00:04:01,360  
to look at the earth and provide that

103  
00:04:06,789 --> 00:04:04,159  
return earth imaging for us

104  
00:04:09,910 --> 00:04:06,799  
and dr roberts we've been discussing a

105  
00:04:11,910 --> 00:04:09,920  
couple of cases payloads already we'll

106  
00:04:13,750 --> 00:04:11,920  
be discussing two more can you talk to

107  
00:04:15,830 --> 00:04:13,760  
us about how these studies get selected

108  
00:04:18,310 --> 00:04:15,840  
and how long it takes

109  
00:04:20,310 --> 00:04:18,320  
certainly stephanie so as as dr costello

110  
00:04:21,830 --> 00:04:20,320  
mentioned you know cases perspective is

111  
00:04:23,590 --> 00:04:21,840  
slightly different

112  
00:04:26,070 --> 00:04:23,600  
than that of nasa in utilizing the

113  
00:04:27,270 --> 00:04:26,080

international space station national lab

114

00:04:29,270 --> 00:04:27,280

we like to look at it as the

115

00:04:31,909 --> 00:04:29,280

international space station is is one

116

00:04:34,870 --> 00:04:31,919

destination but we have many uses for it

117

00:04:37,189 --> 00:04:34,880

and in the case of cases our selection

118

00:04:39,189 --> 00:04:37,199

process is based on identifying research

119

00:04:41,749 --> 00:04:39,199

and technology development that

120

00:04:43,590 --> 00:04:41,759

translates the benefit here on earth

121

00:04:45,990 --> 00:04:43,600

nasa continues to fund and support

122

00:04:47,510 --> 00:04:46,000

research investigations along that line

123

00:04:49,510 --> 00:04:47,520

but they also use the international

124

00:04:51,270 --> 00:04:49,520

space station as a launching off point

125

00:04:53,510 --> 00:04:51,280

to go further into space

126  
00:04:55,350 --> 00:04:53,520  
cases however focuses directly on

127  
00:04:57,270 --> 00:04:55,360  
benefit here on earth

128  
00:04:59,830 --> 00:04:57,280  
so in selecting payloads that have

129  
00:05:01,670 --> 00:04:59,840  
access to that our goal at ksis is to

130  
00:05:03,670 --> 00:05:01,680  
increase the ability

131  
00:05:05,189 --> 00:05:03,680  
of researchers here in the united states

132  
00:05:07,189 --> 00:05:05,199  
to utilize the international space

133  
00:05:09,270 --> 00:05:07,199  
station as a national lab

134  
00:05:11,029 --> 00:05:09,280  
and in doing that our focus is in

135  
00:05:13,670 --> 00:05:11,039  
reaching out to new to space

136  
00:05:16,950 --> 00:05:13,680  
investigators as well as established

137  
00:05:19,189 --> 00:05:16,960  
investigators from academic schools from

138  
00:05:20,550 --> 00:05:19,199

research universities from commercial

139

00:05:22,469 --> 00:05:20,560

interest and from other government

140

00:05:24,550 --> 00:05:22,479

agencies and you're going to hear

141

00:05:25,430 --> 00:05:24,560

shortly examples from a couple of

142

00:05:27,510 --> 00:05:25,440

different

143

00:05:30,150 --> 00:05:27,520

commercial entities who are interested

144

00:05:32,070 --> 00:05:30,160

in in one case continuing to use the

145

00:05:34,230 --> 00:05:32,080

international space station

146

00:05:36,550 --> 00:05:34,240

as a research environment and another

147

00:05:38,790 --> 00:05:36,560

case from a company that's new to space

148

00:05:40,390 --> 00:05:38,800

that perhaps had not considered the use

149

00:05:42,310 --> 00:05:40,400

of space as an active research

150

00:05:44,469 --> 00:05:42,320

environment until the international

151  
00:05:45,430 --> 00:05:44,479  
space station was designated a national

152  
00:05:47,189 --> 00:05:45,440  
lab

153  
00:05:49,270 --> 00:05:47,199  
in order to fulfill our promise to the

154  
00:05:51,189 --> 00:05:49,280  
united states to increase utilization of

155  
00:05:53,590 --> 00:05:51,199  
the international space station and

156  
00:05:55,270 --> 00:05:53,600  
manage effectively the resources onboard

157  
00:05:58,550 --> 00:05:55,280  
the international space station national

158  
00:06:00,469 --> 00:05:58,560  
lab we have a selection process so

159  
00:06:02,469 --> 00:06:00,479  
proposals to utilize the international

160  
00:06:05,270 --> 00:06:02,479  
space station national lab can come to

161  
00:06:07,110 --> 00:06:05,280  
cases through either solicited avenues

162  
00:06:09,430 --> 00:06:07,120  
where we identify particular areas of

163  
00:06:11,350 --> 00:06:09,440

research we want to support or through

164

00:06:13,510 --> 00:06:11,360

unsolicited pathways

165

00:06:14,950 --> 00:06:13,520

where you as an investigator identify a

166

00:06:17,029 --> 00:06:14,960

particular area of research or

167

00:06:18,950 --> 00:06:17,039

technology development that you believe

168

00:06:20,230 --> 00:06:18,960

could benefit from exposure to the

169

00:06:22,950 --> 00:06:20,240

unique environment onboard the

170

00:06:25,110 --> 00:06:22,960

international space station

171

00:06:31,990 --> 00:06:25,120

great do we have questions from group

172

00:06:36,550 --> 00:06:34,390

elaine hermann [spaceheadnews.com](http://spaceheadnews.com)

173

00:06:39,510 --> 00:06:36,560

i was wondering um there's always been

174

00:06:41,670 --> 00:06:39,520

concern about the supplies and uh having

175

00:06:44,070 --> 00:06:41,680

the space station fully supplied

176

00:06:47,749 --> 00:06:44,080

uh we're setting up on this mission uh

177

00:06:51,350 --> 00:06:47,759

the trunk is uh that's unpressurized on

178

00:06:54,070 --> 00:06:51,360

crs6 is empty i was wondering if

179

00:06:54,790 --> 00:06:54,080

there was any comment on that

180

00:06:56,309 --> 00:06:54,800

sure

181

00:06:57,749 --> 00:06:56,319

that's a very good question great

182

00:06:59,830 --> 00:06:57,759

observation

183

00:07:02,629 --> 00:06:59,840

but we're actually flying the trunk

184

00:07:05,510 --> 00:07:02,639

empty on this flight and eight in order

185

00:07:07,670 --> 00:07:05,520

to enable more science on board

186

00:07:09,990 --> 00:07:07,680

and the the reason behind that is we

187

00:07:11,749 --> 00:07:10,000

have a national lab investigation called

188

00:07:14,629 --> 00:07:11,759

rodent research two

189

00:07:16,469 --> 00:07:14,639

and during this investigation will be uh

190

00:07:19,990 --> 00:07:16,479

there's a follow-on investigation for

191

00:07:22,230 --> 00:07:20,000

novartis that cases is managing and this

192

00:07:23,909 --> 00:07:22,240

investigation requires a significant

193

00:07:26,230 --> 00:07:23,919

amount of crew time

194

00:07:28,790 --> 00:07:26,240

when we did have plans to

195

00:07:30,790 --> 00:07:28,800

fly a payload in the trunk that payload

196

00:07:33,029 --> 00:07:30,800

would have taken significant amounts of

197

00:07:35,430 --> 00:07:33,039

time to install on orbit as part of our

198

00:07:38,790 --> 00:07:35,440

international docking adapter system

199

00:07:41,430 --> 00:07:38,800

so instead the program manager made a

200

00:07:43,270 --> 00:07:41,440

command decision to move that payload to

201  
00:07:45,510 --> 00:07:43,280  
the next spacex mission

202  
00:07:47,589 --> 00:07:45,520  
and we are able to dedicate that crew

203  
00:07:50,070 --> 00:07:47,599  
time now to conducting the rodent

204  
00:07:51,990 --> 00:07:50,080  
research which of course has very tight

205  
00:07:54,550 --> 00:07:52,000  
time controls on when those operations

206  
00:07:58,230 --> 00:07:54,560  
occur on orbit

207  
00:08:00,309 --> 00:07:58,240  
i think there's another question here

208  
00:08:03,029 --> 00:08:00,319  
jim siegel i'm with the celebration news

209  
00:08:05,510 --> 00:08:03,039  
and with space flight insider i have a

210  
00:08:07,270 --> 00:08:05,520  
question about the fact that congress

211  
00:08:09,510 --> 00:08:07,280  
has designated

212  
00:08:11,510 --> 00:08:09,520  
the iss as a

213  
00:08:14,710 --> 00:08:11,520

national laboratory so what are the

214

00:08:17,670 --> 00:08:14,720

implications of that does that mean that

215

00:08:20,629 --> 00:08:17,680

there's more funding or that there is

216

00:08:22,390 --> 00:08:20,639

more access to it or so what does the

217

00:08:24,710 --> 00:08:22,400

average person

218

00:08:26,070 --> 00:08:24,720

why should that be important

219

00:08:29,749 --> 00:08:26,080

thank you that's a very good question

220

00:08:32,709 --> 00:08:29,759

and the answer to both of those is yes

221

00:08:34,790 --> 00:08:32,719

cases was created with funding annual

222

00:08:36,870 --> 00:08:34,800

funding provided by nasa the intent

223

00:08:39,990 --> 00:08:36,880

though is to wean ourselves off of that

224

00:08:41,829 --> 00:08:40,000

funding as we mature as an organization

225

00:08:43,750 --> 00:08:41,839

and part of that is going out to

226

00:08:45,430 --> 00:08:43,760

industry to increase interest and the

227

00:08:47,829 --> 00:08:45,440

use of the international space station

228

00:08:49,269 --> 00:08:47,839

as a national laboratory as i'm sure

229

00:08:51,350 --> 00:08:49,279

most of the audience is familiar

230

00:08:53,670 --> 00:08:51,360

national labs are a designation given to

231

00:08:55,829 --> 00:08:53,680

several labs across the united states

232

00:08:57,430 --> 00:08:55,839

primarily operated by contractors

233

00:08:59,670 --> 00:08:57,440

supporting the department of energy or

234

00:09:01,590 --> 00:08:59,680

department of defense in that case the

235

00:09:03,750 --> 00:09:01,600

international space station is operating

236

00:09:05,990 --> 00:09:03,760

in a similar way as a national lab the

237

00:09:08,230 --> 00:09:06,000

national labs were created to support

238

00:09:09,990 --> 00:09:08,240

research and technology development not

239

00:09:11,750 --> 00:09:10,000

only for government researchers but for

240

00:09:14,310 --> 00:09:11,760

academic researchers and commercial

241

00:09:17,190 --> 00:09:14,320

researchers who needed access to unique

242

00:09:19,590 --> 00:09:17,200

aspects usually equipment or facilities

243

00:09:21,990 --> 00:09:19,600

that were too expensive to maintain for

244

00:09:23,190 --> 00:09:22,000

certain operations there in that case

245

00:09:25,430 --> 00:09:23,200

the international space station

246

00:09:27,590 --> 00:09:25,440

represents a very unique a unique

247

00:09:29,509 --> 00:09:27,600

environment a unique platform

248

00:09:30,949 --> 00:09:29,519

that has been accessible to other

249

00:09:33,350 --> 00:09:30,959

government agencies and commercial

250

00:09:35,350 --> 00:09:33,360

investigators prior to the existence of

251  
00:09:36,470 --> 00:09:35,360  
the international space station even on

252  
00:09:38,470 --> 00:09:36,480  
the space shuttle

253  
00:09:40,470 --> 00:09:38,480  
but it was primarily pi driven

254  
00:09:42,470 --> 00:09:40,480  
hypothesis testing and it was sometimes

255  
00:09:43,990 --> 00:09:42,480  
difficult for researchers from other

256  
00:09:45,990 --> 00:09:44,000  
government agencies

257  
00:09:47,829 --> 00:09:46,000  
to develop their research in a timely

258  
00:09:50,070 --> 00:09:47,839  
manner in order to utilize that those

259  
00:09:51,590 --> 00:09:50,080  
unique aspects of that environment with

260  
00:09:53,750 --> 00:09:51,600  
the designation of the international

261  
00:09:56,150 --> 00:09:53,760  
space station as a national lab there

262  
00:09:59,829 --> 00:09:56,160  
are new pathways that are opened and

263  
00:10:02,230 --> 00:09:59,839

with the selection of cases as a 501c3

264

00:10:04,470 --> 00:10:02,240

we are a non-profit organization

265

00:10:06,470 --> 00:10:04,480

we can interact with business with

266

00:10:09,509 --> 00:10:06,480

industry with other government agencies

267

00:10:12,069 --> 00:10:09,519

in ways that nasa could not previously

268

00:10:13,990 --> 00:10:12,079

so the goal is to build the ability to

269

00:10:16,230 --> 00:10:14,000

utilize the station by leveraging the

270

00:10:18,949 --> 00:10:16,240

funding that nasa has invested that we

271

00:10:21,030 --> 00:10:18,959

as taxpayers have invested in nasa to

272

00:10:23,190 --> 00:10:21,040

create the international space station

273

00:10:25,829 --> 00:10:23,200

and to build an even larger research and

274

00:10:27,990 --> 00:10:25,839

technology development portfolio by

275

00:10:29,350 --> 00:10:28,000

utilizing funding provided by industry

276  
00:10:31,430 --> 00:10:29,360  
and directly from other government

277  
00:10:33,110 --> 00:10:31,440  
agencies for example one of the

278  
00:10:34,710 --> 00:10:33,120  
investigations on this particular

279  
00:10:36,870 --> 00:10:34,720  
mission is funded primarily by the

280  
00:10:39,750 --> 00:10:36,880  
national institutes of health and that

281  
00:10:41,509 --> 00:10:39,760  
investigation is sponsored by cases but

282  
00:10:43,670 --> 00:10:41,519  
involves significant funding not only

283  
00:10:45,590 --> 00:10:43,680  
from nasa and cases but also from the

284  
00:10:47,910 --> 00:10:45,600  
national institutes of health to the

285  
00:10:49,670 --> 00:10:47,920  
primary investigator and that's the type

286  
00:10:51,190 --> 00:10:49,680  
of model that will be built upon by

287  
00:10:52,630 --> 00:10:51,200  
other government agencies as we move

288  
00:10:53,750 --> 00:10:52,640

forward including the department of

289

00:10:55,670 --> 00:10:53,760

defense

290

00:10:56,870 --> 00:10:55,680

national science foundation and other

291

00:10:59,590 --> 00:10:56,880

institutes within the national

292

00:11:01,670 --> 00:10:59,600

institutes of health

293

00:11:02,470 --> 00:11:01,680

ken had a question

294

00:11:03,990 --> 00:11:02,480

hi

295

00:11:05,509 --> 00:11:04,000

ken kramer for america's space and

296

00:11:07,269 --> 00:11:05,519

universe today i just want to follow up

297

00:11:08,389 --> 00:11:07,279

a little bit on on mark's question

298

00:11:10,870 --> 00:11:08,399

actually

299

00:11:13,030 --> 00:11:10,880

the payload if i'm not mistaken on this

300

00:11:14,790 --> 00:11:13,040

on this flight is a little bit less i

301  
00:11:16,470 --> 00:11:14,800  
think on the last crs flight in the

302  
00:11:17,350 --> 00:11:16,480  
previous there was about five thousand

303  
00:11:21,590 --> 00:11:17,360  
pounds

304  
00:11:23,509 --> 00:11:21,600  
so as you don't have anything in the

305  
00:11:25,269 --> 00:11:23,519  
trunk i i'm wondering since you didn't

306  
00:11:27,990 --> 00:11:25,279  
put anything in there

307  
00:11:29,269 --> 00:11:28,000  
first why is the weight less and and

308  
00:11:31,910 --> 00:11:29,279  
were you able

309  
00:11:34,790 --> 00:11:31,920  
to pack more into the dragon capsule

310  
00:11:36,630 --> 00:11:34,800  
itself since you did not put anything um

311  
00:11:37,990 --> 00:11:36,640  
in into the trunk

312  
00:11:40,470 --> 00:11:38,000  
thanks

313  
00:11:43,269 --> 00:11:40,480

okay uh that's an interesting question

314

00:11:45,590 --> 00:11:43,279

of of course mass is not the only

315

00:11:48,230 --> 00:11:45,600

measure when you talk about installing

316

00:11:50,870 --> 00:11:48,240

cargo in a pressurized vehicle it's also

317

00:11:53,670 --> 00:11:50,880

a volumetric challenge so

318

00:11:56,949 --> 00:11:53,680

depending on the type of

319

00:11:59,269 --> 00:11:56,959

equipment resupplies cargo science we're

320

00:12:01,590 --> 00:11:59,279

bringing to station you get a different

321

00:12:04,150 --> 00:12:01,600

volume and in this case we've volumed

322

00:12:06,310 --> 00:12:04,160

out before we've hit our mass limits for

323

00:12:08,550 --> 00:12:06,320

for the spacex

324

00:12:11,590 --> 00:12:08,560

in this case though we are resupplying

325

00:12:13,509 --> 00:12:11,600

the space station with a large amount of

326

00:12:15,509 --> 00:12:13,519

crew resupply

327

00:12:17,509 --> 00:12:15,519

water and

328

00:12:20,470 --> 00:12:17,519

other items that the crew need to live

329

00:12:23,430 --> 00:12:20,480

and breathe on the space station and

330

00:12:26,069 --> 00:12:23,440

a large amount of science payload

331

00:12:28,629 --> 00:12:26,079

that that science payload is supporting

332

00:12:30,949 --> 00:12:28,639

around 40 of the investigations

333

00:12:32,470 --> 00:12:30,959

the 95 new investigations that we have

334

00:12:34,629 --> 00:12:32,480

this increment

335

00:12:36,829 --> 00:12:34,639

and that's that's a significant

336

00:12:38,470 --> 00:12:36,839

contribution for us

337

00:12:40,389 --> 00:12:38,480

again

338

00:12:42,150 --> 00:12:40,399

the the spacex

339

00:12:44,389 --> 00:12:42,160

is the only vehicle that provides us a

340

00:12:47,030 --> 00:12:44,399

down mass capability as well

341

00:12:49,269 --> 00:12:47,040

so we're looking forward to this spacex

342

00:12:51,190 --> 00:12:49,279

this dragon capsule docking so that we

343

00:12:53,670 --> 00:12:51,200

can not only conduct the research that

344

00:12:55,509 --> 00:12:53,680

it has on board but return those samples

345

00:12:57,190 --> 00:12:55,519

while they're still viable

346

00:12:59,509 --> 00:12:57,200

there's a question here

347

00:13:01,509 --> 00:12:59,519

hi michael doherty from the save sci-fi

348

00:13:03,190 --> 00:13:01,519

facebook page facebook page with here

349

00:13:05,509 --> 00:13:03,200

with the nasa social

350

00:13:07,750 --> 00:13:05,519

um before we get into any more very

351

00:13:09,350 --> 00:13:07,760

specifics i did want to ask a general

352

00:13:11,590 --> 00:13:09,360

question about the space station and the

353

00:13:13,030 --> 00:13:11,600

experiments done on it by cases and

354

00:13:15,030 --> 00:13:13,040

nasa in general

355

00:13:17,110 --> 00:13:15,040

um we have you guys have some amazing

356

00:13:19,269 --> 00:13:17,120

experiments that are going to hopefully

357

00:13:21,750 --> 00:13:19,279

help solve a lot of you know problems

358

00:13:23,750 --> 00:13:21,760

climate wise disease-wise

359

00:13:26,069 --> 00:13:23,760

and in other ways

360

00:13:28,470 --> 00:13:26,079

what about the fact that this iss is

361

00:13:30,710 --> 00:13:28,480

being supposedly decommissioned in 2020

362

00:13:31,910 --> 00:13:30,720

what are the plans after that because

363

00:13:33,590 --> 00:13:31,920

how are you guys going to be doing those

364

00:13:35,750 --> 00:13:33,600

experiments in microgravity without the

365

00:13:37,190 --> 00:13:35,760

space station in orbit

366

00:13:40,470 --> 00:13:37,200

okay

367

00:13:43,110 --> 00:13:40,480

first off the iss was extended to

368

00:13:45,670 --> 00:13:43,120

operate through 2024

369

00:13:47,829 --> 00:13:45,680

by the president earlier last year

370

00:13:50,069 --> 00:13:47,839

and we are still gathering our

371

00:13:52,310 --> 00:13:50,079

international partners cooperation to

372

00:13:54,710 --> 00:13:52,320

extend that date officially out to 2024

373

00:13:56,710 --> 00:13:54,720

with the whole partnership

374

00:13:59,430 --> 00:13:56,720

so we do have a little bit longer on the

375

00:14:01,829 --> 00:13:59,440

clock right now to go ahead and start

376

00:14:04,470 --> 00:14:01,839

you know really returning the investment

377

00:14:06,069 --> 00:14:04,480

of the american public in the science

378

00:14:07,590 --> 00:14:06,079

and the type of research that we can

379

00:14:10,230 --> 00:14:07,600

conduct on board

380

00:14:12,470 --> 00:14:10,240

there are hopes to go out further

381

00:14:15,509 --> 00:14:12,480

and to extend that again but for right

382

00:14:17,189 --> 00:14:15,519

now we are extended through 2024.

383

00:14:18,710 --> 00:14:17,199

and from case's perspective i'd just

384

00:14:20,949 --> 00:14:18,720

like to add that you know it's it's a

385

00:14:22,230 --> 00:14:20,959

platform unlike any other it's a unique

386

00:14:24,389 --> 00:14:22,240

national lab

387

00:14:26,550 --> 00:14:24,399

within our constellation of national

388

00:14:28,310 --> 00:14:26,560

labs across the united states and there

389

00:14:29,750 --> 00:14:28,320

has been a considerable investment from

390

00:14:31,430 --> 00:14:29,760

the u.s taxpayer as well as the

391

00:14:33,670 --> 00:14:31,440

international partners in building that

392

00:14:35,350 --> 00:14:33,680

so we are truly in the age of

393

00:14:37,430 --> 00:14:35,360

utilization of the international space

394

00:14:40,470 --> 00:14:37,440

station now and it's only the beginning

395

00:14:42,629 --> 00:14:40,480

we're seeking as an organization to

396

00:14:44,550 --> 00:14:42,639

create more demand than we can possibly

397

00:14:46,389 --> 00:14:44,560

support and then from that hopefully

398

00:14:48,790 --> 00:14:46,399

that will lead to further development of

399

00:14:50,550 --> 00:14:48,800

the next space station or improvement in

400

00:14:52,870 --> 00:14:50,560

existing capabilities on this space

401  
00:14:54,389 --> 00:14:52,880  
station the idea is to take it from this

402  
00:14:56,389 --> 00:14:54,399  
point and move forward and get the best

403  
00:14:58,389 --> 00:14:56,399  
science return from it that we can and i

404  
00:15:02,550 --> 00:14:58,399  
think we're making great progress in

405  
00:15:06,310 --> 00:15:03,990  
that leads directly to the question i

406  
00:15:07,590 --> 00:15:06,320  
wanted to ask is with the designation of

407  
00:15:09,829 --> 00:15:07,600  
the space station as a national

408  
00:15:11,829 --> 00:15:09,839  
laboratory how does that affect the fact

409  
00:15:15,110 --> 00:15:11,839  
that it is an international space

410  
00:15:19,829 --> 00:15:17,269  
well technically the the national

411  
00:15:23,750 --> 00:15:19,839  
laboratory designation means that those

412  
00:15:25,430 --> 00:15:23,760  
resources which are used resources for

413  
00:15:28,470 --> 00:15:25,440

nasa

414

00:15:30,550 --> 00:15:28,480

gets and gets shared between the cases

415

00:15:32,389 --> 00:15:30,560

research that's selected and the nasa

416

00:15:34,629 --> 00:15:32,399

research that's selected our

417

00:15:37,030 --> 00:15:34,639

international partners have rights to

418

00:15:38,949 --> 00:15:37,040

certain portions or allocations of the

419

00:15:40,949 --> 00:15:38,959

research capability of the station and

420

00:15:43,430 --> 00:15:40,959

they maintain those

421

00:15:45,030 --> 00:15:43,440

but between the national lab science

422

00:15:48,470 --> 00:15:45,040

that's selected in the nasa science

423

00:15:50,389 --> 00:15:48,480

that's selected we share our resources

424

00:15:51,990 --> 00:15:50,399

we're also working very hard to

425

00:15:54,710 --> 00:15:52,000

collaborate with our international

426  
00:15:57,829 --> 00:15:54,720  
partners on more and more investigations

427  
00:15:59,670 --> 00:15:57,839  
to conduct international research and to

428  
00:16:02,230 --> 00:15:59,680  
collaborate where appropriate between

429  
00:16:04,790 --> 00:16:02,240  
the nasa science program and the cases

430  
00:16:06,310 --> 00:16:04,800  
science program

431  
00:16:09,509 --> 00:16:06,320  
james

432  
00:16:11,430 --> 00:16:09,519  
costello i just want to follow up in

433  
00:16:12,310 --> 00:16:11,440  
your comment about uh road and research

434  
00:16:13,829 --> 00:16:12,320  
2

435  
00:16:15,269 --> 00:16:13,839  
um requiring more time i was just

436  
00:16:17,670 --> 00:16:15,279  
wondering if you could discuss a little

437  
00:16:19,590 --> 00:16:17,680  
more about what's different from

438  
00:16:21,030 --> 00:16:19,600

this roadm flight from the last one i

439

00:16:22,629 --> 00:16:21,040

was just trying to

440

00:16:23,430 --> 00:16:22,639

look it up quickly and there's reference

441

00:16:26,629 --> 00:16:23,440

to

442

00:16:27,590 --> 00:16:26,639

dissection of the rodents and i was

443

00:16:28,710 --> 00:16:27,600

wondering if that's something is that

444

00:16:30,949 --> 00:16:28,720

something that astronauts are actually

445

00:16:33,670 --> 00:16:30,959

going to have to do and if so is that

446

00:16:35,829 --> 00:16:33,680

would that be a first

447

00:16:37,189 --> 00:16:35,839

that is true the astronauts do dissect

448

00:16:39,430 --> 00:16:37,199

the animals

449

00:16:41,350 --> 00:16:39,440

at the end of the investigation that is

450

00:16:43,189 --> 00:16:41,360

not a first on orbit it was conducted

451  
00:16:45,910 --> 00:16:43,199  
during the first rodent research mission

452  
00:16:47,509 --> 00:16:45,920  
as well what is new to operations in

453  
00:16:49,910 --> 00:16:47,519  
this investigation are that the

454  
00:16:52,629 --> 00:16:49,920  
astronauts will also be doing

455  
00:16:54,550 --> 00:16:52,639  
dexa bone densitometry studies on the

456  
00:16:57,189 --> 00:16:54,560  
rodents so

457  
00:16:59,189 --> 00:16:57,199  
as part of the investigation the animals

458  
00:17:01,509 --> 00:16:59,199  
will be taken out and x-rayed for bone

459  
00:17:05,189 --> 00:17:01,519  
density and then returned to the habitat

460  
00:17:06,870 --> 00:17:05,199  
before they're dissected

461  
00:17:09,110 --> 00:17:06,880  
and if i could add that's a time course

462  
00:17:10,870 --> 00:17:09,120  
study this is an investigation

463  
00:17:12,789 --> 00:17:10,880

that's sponsored by cases for one of our

464

00:17:14,789 --> 00:17:12,799

commercial customers novartis institutes

465

00:17:17,029 --> 00:17:14,799

of biomedical research in cambridge in

466

00:17:19,270 --> 00:17:17,039

boston and their interest is in looking

467

00:17:21,110 --> 00:17:19,280

at a longitudinal study so they're going

468

00:17:22,630 --> 00:17:21,120

to be able to collect data from the mice

469

00:17:25,110 --> 00:17:22,640

with cumulative exposure to the

470

00:17:26,230 --> 00:17:25,120

microgravity environment onboard station

471

00:17:27,909 --> 00:17:26,240

so they're actually going to be able to

472

00:17:29,909 --> 00:17:27,919

perform dexa scans these bone

473

00:17:32,789 --> 00:17:29,919

densitometry scans

474

00:17:34,310 --> 00:17:32,799

in mice as they age upon

475

00:17:36,230 --> 00:17:34,320

an exposure to the microgravity

476

00:17:38,710 --> 00:17:36,240

environment so they'll be taking

477

00:17:41,270 --> 00:17:38,720

readings of loss of bone mineral density

478

00:17:42,950 --> 00:17:41,280

in these mice and muscle atrophy

479

00:17:47,270 --> 00:17:42,960

as they're exposed to the space

480

00:17:50,230 --> 00:17:47,280

environment for longer periods of time

481

00:17:52,470 --> 00:17:50,240

any other questions before we move on

482

00:17:55,430 --> 00:17:52,480

okay great so we'll move on to dr paul

483

00:17:58,630 --> 00:17:55,440

reichert who it has the protein crystal

484

00:18:00,549 --> 00:17:58,640

growth 3 study he's an experienced space

485

00:18:02,950 --> 00:18:00,559

research researcher who had

486

00:18:04,630 --> 00:18:02,960

investigations flown on 11 space shuttle

487

00:18:06,310 --> 00:18:04,640

missions as well

488

00:18:07,990 --> 00:18:06,320

so can you tell us a little bit about

489

00:18:10,549 --> 00:18:08,000

how your experiments vary from other

490

00:18:13,750 --> 00:18:10,559

protein crystal growth experiments

491

00:18:15,669 --> 00:18:13,760

i think most uh previous protein crystal

492

00:18:18,390 --> 00:18:15,679

growth experiments the

493

00:18:20,310 --> 00:18:18,400

main focus was on getting large single

494

00:18:22,390 --> 00:18:20,320

crystals for structure

495

00:18:24,950 --> 00:18:22,400

um where we differ and what we're doing

496

00:18:27,909 --> 00:18:24,960

in research laboratories is we're

497

00:18:30,310 --> 00:18:27,919

interested in looking at two of our

498

00:18:32,549 --> 00:18:30,320

investigational medicines a new class of

499

00:18:34,950 --> 00:18:32,559

drugs known as biologics

500

00:18:37,669 --> 00:18:34,960

which have its own unique problems

501  
00:18:40,789 --> 00:18:37,679  
and we're hoping that using the u.s

502  
00:18:43,669 --> 00:18:40,799  
national lab we can take advantage of

503  
00:18:45,190 --> 00:18:43,679  
of not only the weightlessness you know

504  
00:18:47,190 --> 00:18:45,200  
taking advantage of

505  
00:18:48,710 --> 00:18:47,200  
that these crystals as they grow they

506  
00:18:50,870 --> 00:18:48,720  
will not sediment

507  
00:18:53,110 --> 00:18:50,880  
uh we'd also like to take advantage of

508  
00:18:55,590 --> 00:18:53,120  
the fact that there's a uniform

509  
00:18:57,909 --> 00:18:55,600  
temperature environment as well as

510  
00:18:58,950 --> 00:18:57,919  
hopefully that the molecules will move

511  
00:19:00,950 --> 00:18:58,960  
slowly

512  
00:19:03,270 --> 00:19:00,960  
and the crystals the molecules that are

513  
00:19:06,070 --> 00:19:03,280

incorporated in these crystals

514

00:19:07,830 --> 00:19:06,080

will be more uniform more

515

00:19:10,710 --> 00:19:07,840

pure

516

00:19:13,830 --> 00:19:10,720

these two investigational drugs

517

00:19:16,950 --> 00:19:13,840

are for cancer indications

518

00:19:18,630 --> 00:19:16,960

and we're hoping that we can make

519

00:19:21,909 --> 00:19:18,640

more pure

520

00:19:24,470 --> 00:19:21,919

larger and more uniform particles that

521

00:19:27,270 --> 00:19:24,480

we can use for drug delivery

522

00:19:29,190 --> 00:19:27,280

for manufacture and in

523

00:19:30,549 --> 00:19:29,200

product development

524

00:19:31,990 --> 00:19:30,559

we do this

525

00:19:34,470 --> 00:19:32,000

to benefit

526

00:19:35,590 --> 00:19:34,480

the delivery of our our products to our

527

00:19:37,510 --> 00:19:35,600

patients

528

00:19:39,029 --> 00:19:37,520

and something that people forget about

529

00:19:42,230 --> 00:19:39,039

is the caretakers

530

00:19:42,950 --> 00:19:42,240

because with cancer a large part of

531

00:19:46,310 --> 00:19:42,960

of

532

00:19:48,549 --> 00:19:46,320

the problems with cancer fall on carrot

533

00:19:49,990 --> 00:19:48,559

takers so if you can come up with a

534

00:19:52,950 --> 00:19:50,000

better

535

00:19:53,990 --> 00:19:52,960

medications that could be delivered

536

00:19:55,350 --> 00:19:54,000

in a

537

00:19:57,750 --> 00:19:55,360

doctor's office

538

00:20:00,470 --> 00:19:57,760

rather than in a hospital setting that

539

00:20:01,430 --> 00:20:00,480

has a significant impact

540

00:20:02,230 --> 00:20:01,440

on

541

00:20:13,909 --> 00:20:02,240

the

542

00:20:13,919 --> 00:20:18,470

questions

543

00:20:23,990 --> 00:20:20,470

jim siegel again from the celebration

544

00:20:25,830 --> 00:20:24,000

news and from space flight uh insider uh

545

00:20:28,710 --> 00:20:25,840

i'm interested in

546

00:20:30,390 --> 00:20:28,720

uh exactly how you go from the crystal

547

00:20:33,110 --> 00:20:30,400

experiments that you're describing the

548

00:20:34,470 --> 00:20:33,120

protein crystals to a delivery system

549

00:20:35,750 --> 00:20:34,480

can you describe

550

00:20:37,510 --> 00:20:35,760

how that would work what kind of

551  
00:20:40,149 --> 00:20:37,520  
delivery system are you talking about

552  
00:20:42,630 --> 00:20:40,159  
and so on i think the best example

553  
00:20:44,149 --> 00:20:42,640  
no no it's not it's not proprietary at

554  
00:20:45,510 --> 00:20:44,159  
all it's something that's been used for

555  
00:20:48,870 --> 00:20:45,520  
60 years

556  
00:20:49,909 --> 00:20:48,880  
people have been injecting insulin

557  
00:20:51,909 --> 00:20:49,919  
you know

558  
00:20:54,470 --> 00:20:51,919  
crystalline suspensions

559  
00:20:57,190 --> 00:20:54,480  
basically porcine insulin for about 60

560  
00:20:58,390 --> 00:20:57,200  
years now and it hasn't been too

561  
00:21:00,950 --> 00:20:58,400  
recently

562  
00:21:02,950 --> 00:21:00,960  
where the pharmaceutical industry which

563  
00:21:05,470 --> 00:21:02,960

has been going through its own

564

00:21:07,669 --> 00:21:05,480

changes where now consider ourselves

565

00:21:09,909 --> 00:21:07,679

biopharmaceutical companies and there's

566

00:21:11,669 --> 00:21:09,919

a whole new class of drugs biologics

567

00:21:15,750 --> 00:21:11,679

that there's a real problem delivering

568

00:21:18,950 --> 00:21:15,760

them they can only be given in hospital

569

00:21:21,669 --> 00:21:18,960

settings as a constant infusion where a

570

00:21:23,990 --> 00:21:21,679

patient has to spend six hours

571

00:21:26,630 --> 00:21:24,000

getting an infusion

572

00:21:28,870 --> 00:21:26,640

and i would love to see an opportunity

573

00:21:31,190 --> 00:21:28,880

to come up with a

574

00:21:33,990 --> 00:21:31,200

a crystalline suspension that you could

575

00:21:35,350 --> 00:21:34,000

take as a single sub-q injection

576

00:21:38,230 --> 00:21:35,360

that you could either administer

577

00:21:40,230 --> 00:21:38,240

yourself or in a doctor's office

578

00:21:41,270 --> 00:21:40,240

to me that would have a significant

579

00:21:43,750 --> 00:21:41,280

impact

580

00:21:46,630 --> 00:21:43,760

on the ease of administration

581

00:21:49,110 --> 00:21:46,640

and the in the comfort of patients and

582

00:21:51,510 --> 00:21:49,120

takes a tremendous load off caregivers

583

00:21:54,470 --> 00:21:51,520

who are probably responsible for

584

00:21:56,549 --> 00:21:54,480

driving that patient back and forth to

585

00:21:59,830 --> 00:21:56,559

uh hospitals

586

00:22:02,230 --> 00:21:59,840

and uh and the uh the constant infusion

587

00:22:04,149 --> 00:22:02,240

basically is about half the cost

588

00:22:06,149 --> 00:22:04,159

of administering the drug

589

00:22:10,149 --> 00:22:06,159

so it has a significant

590

00:22:12,549 --> 00:22:10,159

uh financial benefit to it as well

591

00:22:15,510 --> 00:22:12,559

stuartmoney interspace.net and my

592

00:22:17,110 --> 00:22:15,520

question is do you foresee a a short

593

00:22:19,669 --> 00:22:17,120

jump towards

594

00:22:23,590 --> 00:22:19,679

industrial level manufacturer of these

595

00:22:25,350 --> 00:22:23,600

types of proteins in zero g or is this a

596

00:22:27,190 --> 00:22:25,360

research to find a better way to do it

597

00:22:28,710 --> 00:22:27,200

on earth i know this is something that

598

00:22:30,870 --> 00:22:28,720

was put forward

599

00:22:33,350 --> 00:22:30,880

decades ago as as this was going to be

600

00:22:35,190 --> 00:22:33,360

the the industrial key to space it

601  
00:22:37,270 --> 00:22:35,200  
sounds like you're a lot closer

602  
00:22:41,029 --> 00:22:37,280  
but could you address that i

603  
00:22:43,510 --> 00:22:41,039  
love that question because i we you know

604  
00:22:45,750 --> 00:22:43,520  
years ago that was the goal of our

605  
00:22:48,070 --> 00:22:45,760  
space shuttle you know missions was be

606  
00:22:50,549 --> 00:22:48,080  
able to do it in the scale

607  
00:22:53,029 --> 00:22:50,559  
that you can do manufacturing space for

608  
00:22:55,909 --> 00:22:53,039  
that product which was alpha interferon

609  
00:22:58,789 --> 00:22:55,919  
it was possible because the actual dose

610  
00:23:00,149 --> 00:22:58,799  
was nanograms very small amounts per

611  
00:23:02,630 --> 00:23:00,159  
dose

612  
00:23:04,789 --> 00:23:02,640  
the new class of biologics monoclonal

613  
00:23:07,430 --> 00:23:04,799

antibodies fortunately you have to give

614

00:23:08,870 --> 00:23:07,440

milligrams so a bigger so i think it's

615

00:23:11,669 --> 00:23:08,880

still possible

616

00:23:13,029 --> 00:23:11,679

it would just take a lot more research

617

00:23:15,029 --> 00:23:13,039

to do that

618

00:23:17,350 --> 00:23:15,039

but that personally that's one of the

619

00:23:19,270 --> 00:23:17,360

things that i i would love to see

620

00:23:22,070 --> 00:23:19,280

however you know

621

00:23:24,310 --> 00:23:22,080

our goal immediate goal is to learn is

622

00:23:26,470 --> 00:23:24,320

to produce unique

623

00:23:27,990 --> 00:23:26,480

crystalline suspensions that we can't

624

00:23:30,390 --> 00:23:28,000

unearth

625

00:23:31,909 --> 00:23:30,400

and we did that in my previous work we

626  
00:23:34,390 --> 00:23:31,919  
were able to

627  
00:23:37,110 --> 00:23:34,400  
actually by accident produce a

628  
00:23:38,950 --> 00:23:37,120  
uniform crystalline suspension

629  
00:23:42,230 --> 00:23:38,960  
that was so good that we used it for two

630  
00:23:45,190 --> 00:23:42,240  
years in primate studies so it moved our

631  
00:23:46,549 --> 00:23:45,200  
our research ability to to

632  
00:23:49,269 --> 00:23:46,559  
investigate

633  
00:23:51,830 --> 00:23:49,279  
uh delivery of this uh product much

634  
00:23:57,110 --> 00:23:51,840  
earlier two years we saved in cycle by

635  
00:24:01,669 --> 00:23:59,669  
mark gotch historical imagery canada

636  
00:24:05,269 --> 00:24:01,679  
could you tell me uh

637  
00:24:08,149 --> 00:24:05,279  
how has this crystalline experimentation

638  
00:24:10,549 --> 00:24:08,159

differed from that down on earth

639

00:24:12,630 --> 00:24:10,559

in the space station in terms of

640

00:24:15,990 --> 00:24:12,640

what different types of crystals has

641

00:24:18,950 --> 00:24:17,190

the

642

00:24:21,990 --> 00:24:18,960

to date

643

00:24:23,669 --> 00:24:22,000

on crs3 we're able to get larger

644

00:24:26,789 --> 00:24:23,679

crystals

645

00:24:27,750 --> 00:24:26,799

and the those studies were very limited

646

00:24:29,990 --> 00:24:27,760

in the

647

00:24:31,110 --> 00:24:30,000

amount of protein that we're trying to

648

00:24:33,029 --> 00:24:31,120

crystallize

649

00:24:35,269 --> 00:24:33,039

in this experiment our goal is to

650

00:24:38,070 --> 00:24:35,279

produce a lot of crystals

651  
00:24:39,669 --> 00:24:38,080  
and we're doing it under conditions that

652  
00:24:42,549 --> 00:24:39,679  
we have enough now

653  
00:24:45,029 --> 00:24:42,559  
to look at it for purification

654  
00:24:46,950 --> 00:24:45,039  
for particle size uh

655  
00:24:47,909 --> 00:24:46,960  
distribution

656  
00:24:49,029 --> 00:24:47,919  
and

657  
00:24:53,269 --> 00:24:49,039  
for

658  
00:24:55,110 --> 00:24:53,279  
ground-based experiment

659  
00:24:57,430 --> 00:24:55,120  
i'm really looking forward to see what

660  
00:25:00,789 --> 00:24:57,440  
we get i have a

661  
00:25:02,789 --> 00:25:00,799  
based on my previous shuttle experiments

662  
00:25:07,029 --> 00:25:02,799  
i have a

663  
00:25:09,430 --> 00:25:07,039

going to work out so i'm pretty excited

664

00:25:10,710 --> 00:25:09,440

about having this opportunity

665

00:25:13,510 --> 00:25:10,720

to fly

666

00:25:13,520 --> 00:25:17,830

question here

667

00:25:21,830 --> 00:25:20,470

val phillips zero g news uh you've

668

00:25:23,590 --> 00:25:21,840

mentioned obviously you've run

669

00:25:26,070 --> 00:25:23,600

experiments on shuttle

670

00:25:27,510 --> 00:25:26,080

um what's the

671

00:25:30,149 --> 00:25:27,520

have there been better benefits from

672

00:25:32,630 --> 00:25:30,159

running or shuttle compared to iss

673

00:25:34,070 --> 00:25:32,640

what's the differences and how long is

674

00:25:35,269 --> 00:25:34,080

this experiment going to be running on

675

00:25:37,510 --> 00:25:35,279

iss

676

00:25:40,070 --> 00:25:37,520

um we're going to be up for this is a

677

00:25:41,029 --> 00:25:40,080

sortie mission for us so it'll be up

678

00:25:43,510 --> 00:25:41,039

it'll

679

00:25:45,350 --> 00:25:43,520

come our experiment will come off dragon

680

00:25:48,310 --> 00:25:45,360

you go into the u.s

681

00:25:52,630 --> 00:25:48,320

national lab actually in an incubator

682

00:25:54,549 --> 00:25:52,640

um for we're hoping for up to 18 days

683

00:25:58,070 --> 00:25:54,559

and then it comes back and then we'll be

684

00:26:00,870 --> 00:25:58,080

able to do our characterization studies

685

00:26:03,830 --> 00:26:00,880

we always do a comparable ground

686

00:26:05,669 --> 00:26:03,840

experiment in the exact flight hardware

687

00:26:08,789 --> 00:26:05,679

that we're running so we have a good

688

00:26:12,310 --> 00:26:08,799

baseline of what actually we gain from

689

00:26:13,269 --> 00:26:12,320

the microgravity experiment

690

00:26:21,190 --> 00:26:13,279

i

691

00:26:23,430 --> 00:26:21,200

we were able to to when they approached

692

00:26:27,269 --> 00:26:23,440

us two years ago

693

00:26:29,430 --> 00:26:27,279

with the opportunity to do microgravity

694

00:26:30,630 --> 00:26:29,440

crystallization again

695

00:26:33,110 --> 00:26:30,640

they

696

00:26:35,029 --> 00:26:33,120

in a very quickly we were able to come

697

00:26:37,350 --> 00:26:35,039

up with a proposal

698

00:26:38,710 --> 00:26:37,360

where the you know the primary benefit

699

00:26:40,390 --> 00:26:38,720

had to be

700

00:26:44,070 --> 00:26:40,400

to human health

701  
00:26:45,029 --> 00:26:44,080  
and uh within six months we we had a

702  
00:26:47,909 --> 00:26:45,039  
plan

703  
00:26:49,430 --> 00:26:47,919  
um i think what helped tremendously

704  
00:26:51,669 --> 00:26:49,440  
is that

705  
00:26:53,990 --> 00:26:51,679  
at merck we already had experience with

706  
00:26:56,710 --> 00:26:54,000  
the certified hardware

707  
00:26:59,750 --> 00:26:56,720  
i think it's a disadvantage to

708  
00:27:01,590 --> 00:26:59,760  
investigators who are unfamiliar

709  
00:27:04,070 --> 00:27:01,600  
with what the available

710  
00:27:06,549 --> 00:27:04,080  
flight certified hardware is and

711  
00:27:08,789 --> 00:27:06,559  
adapting to that to that hardware i

712  
00:27:11,750 --> 00:27:08,799  
think that's a that's a significant

713  
00:27:14,070 --> 00:27:11,760

problem for researchers

714

00:27:17,190 --> 00:27:14,080

there's a significant difference between

715

00:27:19,590 --> 00:27:17,200

how you set up your experiment on earth

716

00:27:21,990 --> 00:27:19,600

and then transferring that into the

717

00:27:23,110 --> 00:27:22,000

limitations that you have

718

00:27:25,590 --> 00:27:23,120

time

719

00:27:26,630 --> 00:27:25,600

space and the hardware that you have to

720

00:27:29,669 --> 00:27:26,640

deal with

721

00:27:31,669 --> 00:27:29,679

in doing your experiments um in space in

722

00:27:34,070 --> 00:27:31,679

the microgravity i think that's the

723

00:27:37,430 --> 00:27:34,080

from my perspective that's the biggest

724

00:27:38,389 --> 00:27:37,440

challenge that you that you have

725

00:27:40,389 --> 00:27:38,399

and

726

00:27:43,029 --> 00:27:40,399

you know that that's also the most

727

00:27:44,710 --> 00:27:43,039

exciting part what can i do

728

00:27:46,070 --> 00:27:44,720

i've given this box i'm giving this

729

00:27:48,870 --> 00:27:46,080

opportunity

730

00:27:51,350 --> 00:27:48,880

what can i how much can i you know do to

731

00:27:54,310 --> 00:27:51,360

take advantage of that you know

732

00:27:57,510 --> 00:27:54,320

um and then designing it such that the

733

00:27:58,950 --> 00:27:57,520

experiment will will the crystallization

734

00:28:00,950 --> 00:27:58,960

will take place

735

00:28:02,870 --> 00:28:00,960

within that 18-day

736

00:28:05,510 --> 00:28:02,880

time frame

737

00:28:07,430 --> 00:28:05,520

and that the crystals that we get back

738

00:28:10,070 --> 00:28:07,440

don't degrade

739

00:28:10,789 --> 00:28:10,080

during that process and bring them back

740

00:28:12,549 --> 00:28:10,799

i'm

741

00:28:14,630 --> 00:28:12,559

laughing so much because usually the

742

00:28:16,950 --> 00:28:14,640

question i get all the time was well

743

00:28:18,950 --> 00:28:16,960

don't these crystals crack doesn't this

744

00:28:21,029 --> 00:28:18,960

you know the fact that their crystals

745

00:28:23,029 --> 00:28:21,039

come back don't they destroy them and i

746

00:28:25,029 --> 00:28:23,039

love that question because

747

00:28:27,190 --> 00:28:25,039

the crystals that we grow these protein

748

00:28:29,669 --> 00:28:27,200

crystals that we grow are actually like

749

00:28:31,590 --> 00:28:29,679

uh jello they're actually they're very

750

00:28:33,350 --> 00:28:31,600

soft and they're floating

751  
00:28:36,070 --> 00:28:33,360  
in this you know

752  
00:28:37,110 --> 00:28:36,080  
body of liquid and they're actually

753  
00:28:39,590 --> 00:28:37,120  
cushioned

754  
00:28:40,389 --> 00:28:39,600  
you know um and

755  
00:28:49,669 --> 00:28:40,399  
on

756  
00:28:51,430 --> 00:28:49,679  
in spite of the catastrophic events

757  
00:28:53,750 --> 00:28:51,440  
we did recover

758  
00:28:55,510 --> 00:28:53,760  
crystals from that so i use that as an

759  
00:28:56,389 --> 00:28:55,520  
example of how

760  
00:28:59,269 --> 00:28:56,399  
you know

761  
00:29:01,430 --> 00:28:59,279  
durable these crystals are and it's

762  
00:29:03,510 --> 00:29:01,440  
mostly due to being cushioned in the in

763  
00:29:05,990 --> 00:29:03,520

the in the solution that they're growing

764

00:29:09,350 --> 00:29:06,000

in and jello is a good thing

765

00:29:13,990 --> 00:29:11,350

any other questions

766

00:29:16,470 --> 00:29:14,000

okay we'll move on to dr rasmussen

767

00:29:18,630 --> 00:29:16,480

and the synthetic muscle for prosthetics

768

00:29:20,870 --> 00:29:18,640

and robotics investigation which is

769

00:29:22,230 --> 00:29:20,880

looking at material that contracts and

770

00:29:25,669 --> 00:29:22,240

expands like a muscle this is

771

00:29:29,350 --> 00:29:28,149

um my materials uh electroactive

772

00:29:31,430 --> 00:29:29,360

polymers

773

00:29:33,750 --> 00:29:31,440

are in a class of materials called smart

774

00:29:36,070 --> 00:29:33,760

materials smart materials respond to

775

00:29:37,350 --> 00:29:36,080

stimuli it can be light you know like a

776

00:29:39,029 --> 00:29:37,360

transition lens it could be a lot of

777

00:29:40,950 --> 00:29:39,039

different um things and in the case of

778

00:29:42,149 --> 00:29:40,960

electroactive polymers the stimulus is

779

00:29:43,430 --> 00:29:42,159

electricity

780

00:29:44,789 --> 00:29:43,440

my um

781

00:29:47,990 --> 00:29:44,799

electroactive polymers i'm just going to

782

00:29:50,149 --> 00:29:48,000

call them eaps respond to electricity by

783

00:29:52,070 --> 00:29:50,159

contraction then when i reverse the

784

00:29:54,389 --> 00:29:52,080

polarity make the positive negative and

785

00:29:57,350 --> 00:29:54,399

the negative positive i can get

786

00:29:59,029 --> 00:29:57,360

expansion i can control that

787

00:30:01,750 --> 00:29:59,039

and my linear range tends to be low

788

00:30:04,389 --> 00:30:01,760

between 0 and 50 volts with the low

789

00:30:05,909 --> 00:30:04,399

noise and heat signature as well

790

00:30:12,470 --> 00:30:05,919

the

791

00:30:14,310 --> 00:30:12,480

is in my case i'm very interested in

792

00:30:16,310 --> 00:30:14,320

this partly why i developed this this

793

00:30:18,470 --> 00:30:16,320

class of materials i'm very interested

794

00:30:20,549 --> 00:30:18,480

in prosthetics realistic prosthetics

795

00:30:22,389 --> 00:30:20,559

particularly for the hand and arm

796

00:30:24,470 --> 00:30:22,399

so i've developed materials that um

797

00:30:27,590 --> 00:30:24,480

basically contract and expand

798

00:30:29,430 --> 00:30:27,600

so they look act and even feel um very

799

00:30:31,269 --> 00:30:29,440

much like human tissue

800

00:30:32,630 --> 00:30:31,279

when they're activated by electricity

801  
00:30:34,950 --> 00:30:32,640  
there is a little bit of residual

802  
00:30:36,389 --> 00:30:34,960  
resistance so they even feel warm to the

803  
00:30:38,470 --> 00:30:36,399  
touch

804  
00:30:40,710 --> 00:30:38,480  
that said i'm very early stage i am a

805  
00:30:43,510 --> 00:30:40,720  
high tech early stage

806  
00:30:45,190 --> 00:30:43,520  
startup company

807  
00:30:47,909 --> 00:30:45,200  
my corporate experience is johnson

808  
00:30:50,070 --> 00:30:47,919  
johnson i have my phd is synthetic

809  
00:30:52,950 --> 00:30:50,080  
polymer chemistry

810  
00:30:54,870 --> 00:30:52,960  
then i have a masters in biophysics

811  
00:30:57,190 --> 00:30:54,880  
but what

812  
00:30:58,630 --> 00:30:57,200  
what i've note what's kind of been a

813  
00:31:00,310 --> 00:30:58,640

pleasant surprise for me is i'm

814

00:31:02,149 --> 00:31:00,320

receiving a lot of attention also from

815

00:31:05,029 --> 00:31:02,159

the robotics community because

816

00:31:06,149 --> 00:31:05,039

human-like grasp would be very very

817

00:31:08,149 --> 00:31:06,159

useful

818

00:31:10,310 --> 00:31:08,159

and how

819

00:31:12,789 --> 00:31:10,320

i ended up meeting cases actually was

820

00:31:14,710 --> 00:31:12,799

through the the global uh business

821

00:31:17,430 --> 00:31:14,720

accelerator called mass challenge i was

822

00:31:19,669 --> 00:31:17,440

one of the global finalists in 2013.

823

00:31:22,389 --> 00:31:19,679

what i had done in the past is i had

824

00:31:24,630 --> 00:31:22,399

actually put my materials through

825

00:31:25,750 --> 00:31:24,640

extreme temperature experiments

826

00:31:27,110 --> 00:31:25,760

and

827

00:31:28,870 --> 00:31:27,120

there was a thought that if they were

828

00:31:31,350 --> 00:31:28,880

radiation resistant in this class of

829

00:31:33,269 --> 00:31:31,360

materials the methylate family does tend

830

00:31:34,549 --> 00:31:33,279

to lend itself to radiation resistance

831

00:31:37,029 --> 00:31:34,559

there were some thoughts that that could

832

00:31:40,789 --> 00:31:37,039

be used kind of dual purpose

833

00:31:42,950 --> 00:31:40,799

for both space exploration and for

834

00:31:44,310 --> 00:31:42,960

robotics on earth because often where

835

00:31:46,789 --> 00:31:44,320

you really

836

00:31:48,789 --> 00:31:46,799

really need a robot

837

00:31:50,630 --> 00:31:48,799

is um

838

00:31:53,029 --> 00:31:50,640

where you can't put a human and you

839

00:31:54,070 --> 00:31:53,039

wouldn't even want to put a dog

840

00:32:00,389 --> 00:31:54,080

so

841

00:32:02,470 --> 00:32:00,399

iss is it's a unique radiation

842

00:32:04,549 --> 00:32:02,480

environment because once you get above

843

00:32:05,590 --> 00:32:04,559

our atmosphere not only our atmosphere

844

00:32:06,789 --> 00:32:05,600

but

845

00:32:08,149 --> 00:32:06,799

our whole

846

00:32:09,990 --> 00:32:08,159

planet

847

00:32:12,950 --> 00:32:10,000

diffuses around it a lot of the

848

00:32:15,990 --> 00:32:12,960

electromagnet magnetism from the sun in

849

00:32:18,149 --> 00:32:16,000

particular once you get

850

00:32:20,710 --> 00:32:18,159

even at low orbital you're getting a lot

851  
00:32:21,990 --> 00:32:20,720  
of not only solar but cosmic radiation

852  
00:32:24,789 --> 00:32:22,000  
effects

853  
00:32:27,509 --> 00:32:24,799  
so um and i applaud

854  
00:32:28,710 --> 00:32:27,519  
cases not only for um

855  
00:32:31,029 --> 00:32:28,720  
the the

856  
00:32:32,789 --> 00:32:31,039  
taking the advances we've learned from

857  
00:32:35,029 --> 00:32:32,799  
space and applying them to earth but

858  
00:32:36,630 --> 00:32:35,039  
also from their insights for this whole

859  
00:32:38,470 --> 00:32:36,640  
process for me because i am one of the

860  
00:32:39,990 --> 00:32:38,480  
new investigators

861  
00:32:41,990 --> 00:32:40,000  
on the iss

862  
00:32:44,310 --> 00:32:42,000  
and being adaptable as the process went

863  
00:32:46,710 --> 00:32:44,320

along these materials this is just a

864

00:32:49,830 --> 00:32:46,720

mock-up this is a prototype of and it's

865

00:32:52,389 --> 00:32:49,840

a matrix of eight samples there's four

866

00:32:54,149 --> 00:32:52,399

of these matrices going up onto the iss

867

00:32:55,350 --> 00:32:54,159

and then four not this one because it

868

00:32:57,750 --> 00:32:55,360

has gone through the airport and stuff

869

00:32:59,430 --> 00:32:57,760

but four remaining at home is controls

870

00:33:01,269 --> 00:32:59,440

kind of like the twin experiment because

871

00:33:03,430 --> 00:33:01,279

it's up there and down here

872

00:33:05,830 --> 00:33:03,440

and um

873

00:33:07,350 --> 00:33:05,840

and of these four spots and you can come

874

00:33:09,750 --> 00:33:07,360

up and feel afterwards they're one by

875

00:33:11,509 --> 00:33:09,760

one kind of roughly one inch by one inch

876

00:33:13,669 --> 00:33:11,519

squares of synthetic muscle where this

877

00:33:16,230 --> 00:33:13,679

first spot has zero additive zero

878

00:33:18,230 --> 00:33:16,240

coatings the next two kind of mini

879

00:33:20,070 --> 00:33:18,240

experiment with an experiment has some

880

00:33:22,389 --> 00:33:20,080

additives

881

00:33:25,509 --> 00:33:22,399

the next one has a coating taken from

882

00:33:27,909 --> 00:33:25,519

the spacesuit technology

883

00:33:30,630 --> 00:33:27,919

so it's a mylar coating the next two

884

00:33:32,630 --> 00:33:30,640

coatings are actually from the us army

885

00:33:34,630 --> 00:33:32,640

from their mre or meals ready to eat

886

00:33:37,509 --> 00:33:34,640

program because my materials just like

887

00:33:39,590 --> 00:33:37,519

human muscle operate best moist

888

00:33:42,070 --> 00:33:39,600

so i'm very interested in coating these

889

00:33:43,750 --> 00:33:42,080

once i get out of naval or watery

890

00:33:46,230 --> 00:33:43,760

environments onto land

891

00:33:48,549 --> 00:33:46,240

applications and then the last two spots

892

00:33:51,029 --> 00:33:48,559

are combinations of the additives to

893

00:33:52,710 --> 00:33:51,039

enhance the radiation resistance

894

00:33:54,389 --> 00:33:52,720

and some of the

895

00:33:55,750 --> 00:33:54,399

the army coatings

896

00:33:57,750 --> 00:33:55,760

the

897

00:33:59,830 --> 00:33:57,760

what i applied cases for is what we

898

00:34:02,789 --> 00:33:59,840

found out last summer when we exposed a

899

00:34:06,950 --> 00:34:05,029

similar matrices and also just bulk

900

00:34:09,669 --> 00:34:06,960

materials to uh

901  
00:34:11,669 --> 00:34:09,679  
to one of their gamma radiation sources

902  
00:34:13,669 --> 00:34:11,679  
at the princeton plasma physics lab

903  
00:34:15,589 --> 00:34:13,679  
which is a u.s department of energy

904  
00:34:17,909 --> 00:34:15,599  
federal lab

905  
00:34:19,909 --> 00:34:17,919  
they held up very very well selected

906  
00:34:21,589 --> 00:34:19,919  
samples and plus we learned a lot just

907  
00:34:22,629 --> 00:34:21,599  
from the matrices of the additives and

908  
00:34:25,030 --> 00:34:22,639  
coatings

909  
00:34:27,829 --> 00:34:25,040  
so well in fact that the original plan

910  
00:34:29,669 --> 00:34:27,839  
on the iss was for a 30-day exposure up

911  
00:34:32,230 --> 00:34:29,679  
and down but we're extending it to 90

912  
00:34:34,589 --> 00:34:32,240  
days so on monday we'll be going up on a

913  
00:34:36,149 --> 00:34:34,599

spacex and then i'll be returning on the

914

00:34:37,909 --> 00:34:36,159

spacex7

915

00:34:41,349 --> 00:34:37,919

mid july

916

00:34:42,389 --> 00:34:41,359

and so it's we're i'm just

917

00:34:44,310 --> 00:34:42,399

thrilled

918

00:34:46,710 --> 00:34:44,320

that

919

00:34:48,230 --> 00:34:46,720

this is going to be tested in such a

920

00:34:51,430 --> 00:34:48,240

unique environment because you can test

921

00:34:54,310 --> 00:34:51,440

for radiation on earth for

922

00:34:55,829 --> 00:34:54,320

beta for gamma for alpha for things very

923

00:34:57,670 --> 00:34:55,839

damaging things

924

00:35:01,510 --> 00:34:57,680

in space you run into things called high

925

00:35:02,390 --> 00:35:01,520

energy linear high led particles

926

00:35:07,430 --> 00:35:02,400

you can

927

00:35:09,510 --> 00:35:07,440

use a particle accelerator for that to

928

00:35:11,589 --> 00:35:09,520

kind of mimic the high led particles but

929

00:35:13,750 --> 00:35:11,599

once you get up in space you have a lot

930

00:35:14,950 --> 00:35:13,760

of things going in all at once from the

931

00:35:17,510 --> 00:35:14,960

cosmos

932

00:35:19,910 --> 00:35:17,520

from the sun you also have that whole

933

00:35:22,550 --> 00:35:19,920

range of the electromagnetic spectrum we

934

00:35:24,870 --> 00:35:22,560

have your ionizing x-ray technology it's

935

00:35:27,829 --> 00:35:24,880

a unique environment

936

00:35:29,910 --> 00:35:27,839

and so um i'm really

937

00:35:31,990 --> 00:35:29,920

interested to see how it holds up in

938

00:35:32,950 --> 00:35:32,000

that particular environment but we did

939

00:35:35,349 --> 00:35:32,960

hit it

940

00:35:36,550 --> 00:35:35,359

very very hard here on earth last summer

941

00:35:38,230 --> 00:35:36,560

at princeton

942

00:35:40,150 --> 00:35:38,240

and some of the coatings i just wanted

943

00:35:41,829 --> 00:35:40,160

because this is so cool

944

00:35:43,349 --> 00:35:41,839

some of the coatings again it's us army

945

00:35:45,430 --> 00:35:43,359

from their meals ready to eat and this

946

00:35:48,310 --> 00:35:45,440

is a new coating that's been developed

947

00:35:50,310 --> 00:35:48,320

for them and it looks clear

948

00:35:51,349 --> 00:35:50,320

but it actually does have an aluminum

949

00:35:53,430 --> 00:35:51,359

coating

950

00:35:56,550 --> 00:35:53,440

just like this one but it's at a nano

951  
00:35:58,310 --> 00:35:56,560  
scale so the aluminum coating is there

952  
00:35:59,430 --> 00:35:58,320  
but there's such small particles that

953  
00:36:00,870 --> 00:35:59,440  
our eyes

954  
00:36:03,109 --> 00:36:00,880  
because they're smaller than the visible

955  
00:36:04,950 --> 00:36:03,119  
spectrum can't detect it and these have

956  
00:36:06,710 --> 00:36:04,960  
been tested on earth also i mean

957  
00:36:08,470 --> 00:36:06,720  
independently by us army and held up

958  
00:36:09,910 --> 00:36:08,480  
also very well to radiation so they're

959  
00:36:11,510 --> 00:36:09,920  
kind of being

960  
00:36:13,589 --> 00:36:11,520  
to see if they could even enhance and

961  
00:36:15,349 --> 00:36:13,599  
protect my materials a little better

962  
00:36:19,750 --> 00:36:15,359  
than not being coded

963  
00:36:22,470 --> 00:36:19,760

so that was that's my plug and

964

00:36:28,550 --> 00:36:22,480

i'm sure we have questions

965

00:36:33,030 --> 00:36:30,470

uh carl rasmussen of the hingham public

966

00:36:34,310 --> 00:36:33,040

schools the main thing i was wondering

967

00:36:36,150 --> 00:36:34,320

is

968

00:36:39,030 --> 00:36:36,160

your interest in prosthetics and i was

969

00:36:43,990 --> 00:36:39,040

wondering how a user would control

970

00:36:47,670 --> 00:36:45,750

that's a good question for the

971

00:36:49,430 --> 00:36:47,680

prosthetics we're looking at the market

972

00:36:51,030 --> 00:36:49,440

two ways one is it's simple shape

973

00:36:53,349 --> 00:36:51,040

morphine abilities it gets bigger and

974

00:36:56,710 --> 00:36:53,359

smaller with electric impulse

975

00:36:59,430 --> 00:36:56,720

so for the prosthetic liner socket where

976  
00:37:00,230 --> 00:36:59,440  
it attaches we're looking at contracting

977  
00:37:06,390 --> 00:37:00,240  
it

978  
00:37:09,510 --> 00:37:06,400  
during the course of the day

979  
00:37:12,310 --> 00:37:09,520  
to maintain a very comfortable

980  
00:37:13,670 --> 00:37:12,320  
fit so that the patient or the amputee

981  
00:37:15,349 --> 00:37:13,680  
is not

982  
00:37:17,589 --> 00:37:15,359  
having to fool with it mess it it can

983  
00:37:19,589 --> 00:37:17,599  
kind of conform

984  
00:37:21,430 --> 00:37:19,599  
with the patient as he goes about his or

985  
00:37:24,230 --> 00:37:21,440  
her daily life and our limbs all of our

986  
00:37:25,829 --> 00:37:24,240  
limbs do change not only even in weeks

987  
00:37:27,589 --> 00:37:25,839  
months years but even the course of day

988  
00:37:29,030 --> 00:37:27,599

we change roughly a shoe size between

989

00:37:31,270 --> 00:37:29,040

morning and night

990

00:37:33,750 --> 00:37:31,280

my big interest in developing those was

991

00:37:36,470 --> 00:37:33,760

linked actuation where this is two links

992

00:37:38,870 --> 00:37:36,480

and this is a simple hinge joint and

993

00:37:40,870 --> 00:37:38,880

i've begun researching that it is it's

994

00:37:44,069 --> 00:37:40,880

it's very early stage

995

00:37:45,829 --> 00:37:44,079

but it's working

996

00:37:48,710 --> 00:37:45,839

here's another question right there

997

00:37:50,390 --> 00:37:48,720

hi morgan turner from nasa social

998

00:37:52,950 --> 00:37:50,400

let me just begin by saying this is

999

00:37:55,589 --> 00:37:52,960

really interesting to me um especially

1000

00:37:57,990 --> 00:37:55,599

uh when how you're dealing with the the

1001  
00:38:00,310 --> 00:37:58,000  
effects of radiation on your materials

1002  
00:38:02,790 --> 00:38:00,320  
um i wanted to ask you

1003  
00:38:05,430 --> 00:38:02,800  
the purpose of this experiment is to see

1004  
00:38:07,270 --> 00:38:05,440  
how it holds up in space right how the

1005  
00:38:08,950 --> 00:38:07,280  
rate of deterioration

1006  
00:38:10,950 --> 00:38:08,960  
of your of your material or whether or

1007  
00:38:11,910 --> 00:38:10,960  
not it does deteriorate

1008  
00:38:13,990 --> 00:38:11,920  
um

1009  
00:38:16,230 --> 00:38:14,000  
when exposed to radiation what i wanted

1010  
00:38:18,390 --> 00:38:16,240  
to ask is do you think it's possible

1011  
00:38:19,510 --> 00:38:18,400  
that you could use your material for

1012  
00:38:21,750 --> 00:38:19,520  
future

1013  
00:38:24,390 --> 00:38:21,760

astronaut clothing like

1014

00:38:26,069 --> 00:38:24,400

inside as a protective layer

1015

00:38:28,230 --> 00:38:26,079

actually that's a very good question and

1016

00:38:30,230 --> 00:38:28,240

one thing we are very much interested

1017

00:38:31,990 --> 00:38:30,240

with space exploration not just my

1018

00:38:34,310 --> 00:38:32,000

materials but robotics in general is

1019

00:38:37,190 --> 00:38:34,320

human assist and with human assist it

1020

00:38:39,510 --> 00:38:37,200

does have to be comfortable it has to be

1021

00:38:41,829 --> 00:38:39,520

it can't be so strong it hurts the human

1022

00:38:44,710 --> 00:38:41,839

interacting with it so this is a very

1023

00:38:46,470 --> 00:38:44,720

gentle approach to helping the astronaut

1024

00:38:49,510 --> 00:38:46,480

with whatever they're trying to do to do

1025

00:38:51,109 --> 00:38:49,520

very human-like um grasping and gloving

1026  
00:38:53,910 --> 00:38:51,119  
something that that as a potential

1027  
00:38:58,069 --> 00:38:53,920  
application is as an assist kind of

1028  
00:38:59,990 --> 00:38:58,079  
exoskeleton type application yes

1029  
00:39:03,670 --> 00:39:00,000  
i think there's another question way in

1030  
00:39:07,829 --> 00:39:05,670  
yes my name is gina clifford with nasa

1031  
00:39:09,750 --> 00:39:07,839  
social and i'm not i'm not sure if this

1032  
00:39:11,349 --> 00:39:09,760  
question is exactly what you're

1033  
00:39:13,510 --> 00:39:11,359  
describing but

1034  
00:39:15,670 --> 00:39:13,520  
i i honestly want to know would you

1035  
00:39:18,069 --> 00:39:15,680  
consider this technology

1036  
00:39:21,109 --> 00:39:18,079  
similar or maybe even equivalent to

1037  
00:39:25,670 --> 00:39:23,109  
or self-replicating structures when you

1038  
00:39:26,390 --> 00:39:25,680

add energy to a material and to get it

1039

00:39:27,750 --> 00:39:26,400

to

1040

00:39:29,990 --> 00:39:27,760

do something

1041

00:39:32,150 --> 00:39:30,000

from the material perspective yeah this

1042

00:39:34,710 --> 00:39:32,160

this material at least right now as it's

1043

00:39:36,710 --> 00:39:34,720

designing is not self assembled but i am

1044

00:39:38,390 --> 00:39:36,720

working on um

1045

00:39:40,829 --> 00:39:38,400

the material science of it so it can be

1046

00:39:42,390 --> 00:39:40,839

what's called self healing

1047

00:39:44,390 --> 00:39:42,400

um with

1048

00:39:46,069 --> 00:39:44,400

some good results but um but for the

1049

00:39:47,589 --> 00:39:46,079

self-assembly it's not exactly

1050

00:39:49,910 --> 00:39:47,599

self-assembled but there are some

1051  
00:39:52,310 --> 00:39:49,920  
analogies as we work with architecture

1052  
00:39:54,390 --> 00:39:52,320  
though particularly as we miniaturize

1053  
00:39:56,630 --> 00:39:54,400  
that could come into play because we are

1054  
00:39:58,790 --> 00:39:56,640  
looking at going smaller and very

1055  
00:40:01,990 --> 00:39:58,800  
interested in nanotech

1056  
00:40:08,470 --> 00:40:02,000  
technology in this area

1057  
00:40:12,309 --> 00:40:11,270  
hi courtney peterson with nasa social my

1058  
00:40:15,030 --> 00:40:12,319  
question is

1059  
00:40:17,750 --> 00:40:15,040  
are there any other applications for the

1060  
00:40:21,270 --> 00:40:17,760  
radio or the radiation material and

1061  
00:40:23,270 --> 00:40:21,280  
protecting um maybe cancer patients that

1062  
00:40:25,349 --> 00:40:23,280  
are getting radiation maybe laying this

1063  
00:40:27,030 --> 00:40:25,359

on them so it's not maybe impacting

1064

00:40:28,630 --> 00:40:27,040

other parts of their body is there any

1065

00:40:31,670 --> 00:40:28,640

other application other than what you're

1066

00:40:33,990 --> 00:40:31,680

using right now um actually

1067

00:40:35,430 --> 00:40:34,000

it's not an application i

1068

00:40:38,470 --> 00:40:35,440

have thought of but some of the

1069

00:40:39,349 --> 00:40:38,480

additives um

1070

00:40:41,349 --> 00:40:39,359

are

1071

00:40:43,829 --> 00:40:41,359

used to kind of mitigate radiation

1072

00:40:44,950 --> 00:40:43,839

effects part of what goes on

1073

00:40:46,870 --> 00:40:44,960

with high

1074

00:40:48,309 --> 00:40:46,880

radiation effects is even in a moist

1075

00:40:50,470 --> 00:40:48,319

environment like i said a lot of these

1076

00:40:53,430 --> 00:40:50,480

are watery it affects our human tissues

1077

00:40:55,270 --> 00:40:53,440

as well you get the the peroxide

1078

00:40:57,910 --> 00:40:55,280

formation which can

1079

00:40:59,829 --> 00:40:57,920

cause cellular damage or i

1080

00:41:01,670 --> 00:40:59,839

was worried about material damage so i

1081

00:41:04,230 --> 00:41:01,680

actually some of the additives have very

1082

00:41:07,109 --> 00:41:04,240

strong free radical

1083

00:41:09,430 --> 00:41:07,119

inhibitor properties so potentially that

1084

00:41:11,270 --> 00:41:09,440

could be an application it doesn't

1085

00:41:13,990 --> 00:41:11,280

necessarily need to be electroactive but

1086

00:41:17,990 --> 00:41:14,000

some of that additive type technology

1087

00:41:20,550 --> 00:41:18,000

in a moist matrix could be useful

1088

00:41:23,510 --> 00:41:20,560

question here mark gotch historical

1089

00:41:26,790 --> 00:41:23,520

imagery canada could you tell me

1090

00:41:28,950 --> 00:41:26,800

in your experimentation hopes with this

1091

00:41:31,190 --> 00:41:28,960

synthetic muscle mass

1092

00:41:34,470 --> 00:41:31,200

would you expect it to have much

1093

00:41:37,190 --> 00:41:34,480

different properties in space and if

1094

00:41:39,829 --> 00:41:37,200

those properties were to be let's say

1095

00:41:42,390 --> 00:41:39,839

better than that on earth how would you

1096

00:41:45,750 --> 00:41:42,400

expect expect to replicate those

1097

00:41:48,550 --> 00:41:45,760

properties here back on earth

1098

00:41:52,230 --> 00:41:48,560

do you mean in terms of motion material

1099

00:41:55,430 --> 00:41:53,910

seeking yes

1100

00:41:58,710 --> 00:41:55,440

actually just

1101  
00:42:00,309 --> 00:41:58,720  
one thing that excites me about space

1102  
00:42:02,309 --> 00:42:00,319  
is that

1103  
00:42:03,430 --> 00:42:02,319  
you don't have the as much of the

1104  
00:42:06,550 --> 00:42:03,440  
resistance

1105  
00:42:08,550 --> 00:42:06,560  
via gravity you know or or you know

1106  
00:42:11,190 --> 00:42:08,560  
air kind of a thing

1107  
00:42:13,349 --> 00:42:11,200  
and with the micro environment i expect

1108  
00:42:14,309 --> 00:42:13,359  
it to work obviously just like we work

1109  
00:42:16,630 --> 00:42:14,319  
better

1110  
00:42:18,630 --> 00:42:16,640  
in space then on earth because a little

1111  
00:42:20,309 --> 00:42:18,640  
bit of force

1112  
00:42:23,270 --> 00:42:20,319  
gets gets a lot of motion because

1113  
00:42:26,470 --> 00:42:23,280

there's no very little drag down

1114

00:42:28,069 --> 00:42:26,480

from that so i'm expecting it

1115

00:42:30,309 --> 00:42:28,079

when i get to the point of exploring

1116

00:42:31,990 --> 00:42:30,319

this is a static experiment based on you

1117

00:42:34,069 --> 00:42:32,000

know

1118

00:42:35,430 --> 00:42:34,079

material science when i get to the point

1119

00:42:37,190 --> 00:42:35,440

though of putting a little battery pack

1120

00:42:39,190 --> 00:42:37,200

and having it do motion i expect it to

1121

00:42:41,349 --> 00:42:39,200

just like the astronauts found when they

1122

00:42:43,190 --> 00:42:41,359

throw something that you know they can

1123

00:42:44,470 --> 00:42:43,200

use a little bit of force to get it to

1124

00:42:46,230 --> 00:42:44,480

shoot that

1125

00:42:48,630 --> 00:42:46,240

basket

1126

00:42:50,710 --> 00:42:48,640

how will that apply to earth

1127

00:42:52,950 --> 00:42:50,720

actually what's interesting is because

1128

00:42:54,870 --> 00:42:52,960

this does expand and contract in the xyz

1129

00:42:57,589 --> 00:42:54,880

direction through an osmotic flow of the

1130

00:43:01,190 --> 00:42:59,510

the neat thing in space is that's a pure

1131

00:43:03,430 --> 00:43:01,200

environment

1132

00:43:05,030 --> 00:43:03,440

the microgravity is basically the xy

1133

00:43:06,150 --> 00:43:05,040

direction is very pure and we're

1134

00:43:08,309 --> 00:43:06,160

actually interested in the fluid

1135

00:43:10,230 --> 00:43:08,319

dynamics of this phenomena

1136

00:43:11,750 --> 00:43:10,240

and that type of exploration would be as

1137

00:43:13,829 --> 00:43:11,760

a scientist

1138

00:43:16,470 --> 00:43:13,839

would be marvelous because you don't

1139

00:43:18,069 --> 00:43:16,480

have the artifacts if you will

1140

00:43:21,030 --> 00:43:18,079

you have like a pure

1141

00:43:25,750 --> 00:43:21,040

xyz direction expansion without that

1142

00:43:32,230 --> 00:43:27,430

ken

1143

00:43:34,069 --> 00:43:32,240

today i'm curious could this have any

1144

00:43:36,069 --> 00:43:34,079

application in the robonaut that's

1145

00:43:37,510 --> 00:43:36,079

already there and maybe especially on

1146

00:43:40,150 --> 00:43:37,520

the exterior

1147

00:43:41,670 --> 00:43:40,160

uh version of the robot robot increasing

1148

00:43:43,829 --> 00:43:41,680

its dexterity and could it have

1149

00:43:46,390 --> 00:43:43,839

application also in mars rovers

1150

00:43:49,990 --> 00:43:46,400

manipulating samples to get the samples

1151  
00:43:52,309 --> 00:43:50,000  
um collected and analyzed by the

1152  
00:43:55,190 --> 00:43:52,319  
analytical instruments thanks

1153  
00:43:57,750 --> 00:43:55,200  
um i am hoping it will be useful for

1154  
00:43:59,589 --> 00:43:57,760  
space robots and the amount of radiation

1155  
00:44:02,630 --> 00:43:59,599  
at least in terms of gamma that we hit

1156  
00:44:04,790 --> 00:44:02,640  
with it at princeton last summer

1157  
00:44:07,750 --> 00:44:04,800  
at the princeton physics lab was

1158  
00:44:09,910 --> 00:44:07,760  
one one experiment was the equivalent of

1159  
00:44:12,230 --> 00:44:09,920  
mars and back the next experiment was

1160  
00:44:13,510 --> 00:44:12,240  
jupiter and beyond

1161  
00:44:15,270 --> 00:44:13,520  
just in terms of gamma there's a lot of

1162  
00:44:17,270 --> 00:44:15,280  
other stuff going up there but that is

1163  
00:44:18,790 --> 00:44:17,280

our hope is to

1164

00:44:20,870 --> 00:44:18,800

augment

1165

00:44:22,790 --> 00:44:20,880

with life like robotics the space

1166

00:44:25,109 --> 00:44:22,800

program and i would love to put my stuff

1167

00:44:28,309 --> 00:44:25,119

on mars

1168

00:44:29,990 --> 00:44:28,319

i have a space junkies

1169

00:44:32,870 --> 00:44:30,000

have you given any thought

1170

00:44:35,829 --> 00:44:32,880

with regards to prosthetics as to how

1171

00:44:37,829 --> 00:44:35,839

this material might interact with human

1172

00:44:42,950 --> 00:44:37,839

biology

1173

00:44:44,790 --> 00:44:42,960

yes but not at this point not as a

1174

00:44:46,790 --> 00:44:44,800

at this point we're going for external

1175

00:44:49,270 --> 00:44:46,800

devices we

1176

00:44:51,270 --> 00:44:49,280

partly because of fda compliance issues

1177

00:44:53,030 --> 00:44:51,280

that would be further down the road when

1178

00:44:55,589 --> 00:44:53,040

uh

1179

00:44:56,550 --> 00:44:55,599

as far as going subdermal

1180

00:45:00,390 --> 00:44:56,560

so

1181

00:45:02,390 --> 00:45:00,400

further down the road right now we're

1182

00:45:04,470 --> 00:45:02,400

focusing more on the external class one

1183

00:45:06,470 --> 00:45:04,480

devices

1184

00:45:09,750 --> 00:45:06,480

question here josh evans nasa social

1185

00:45:12,069 --> 00:45:09,760

i've heard you mention applications to

1186

00:45:15,030 --> 00:45:12,079

possibly protective layers also for

1187

00:45:18,790 --> 00:45:15,040

external layering on space robots do you

1188

00:45:20,550 --> 00:45:18,800

think that there's any application for

1189

00:45:22,550 --> 00:45:20,560

a device that would

1190

00:45:24,630 --> 00:45:22,560

amplify the ability of astronauts or

1191

00:45:26,950 --> 00:45:24,640

other humans to increase their strength

1192

00:45:28,470 --> 00:45:26,960

or dexterity as they're operating using

1193

00:45:32,550 --> 00:45:28,480

a device that's connected them using

1194

00:45:34,790 --> 00:45:32,560

these materials yes partly to help but

1195

00:45:37,190 --> 00:45:34,800

also and this gets more like perhaps

1196

00:45:38,870 --> 00:45:37,200

military applications but also space

1197

00:45:41,589 --> 00:45:38,880

applications where you see something you

1198

00:45:44,710 --> 00:45:41,599

want to explore but you may want not to

1199

00:45:47,270 --> 00:45:44,720

want to risk your hand putting it there

1200

00:45:48,710 --> 00:45:47,280

so yes we have some thoughts on that

1201  
00:45:51,990 --> 00:45:48,720  
so

1202  
00:45:54,470 --> 00:45:52,000  
val philip zero g news um

1203  
00:45:55,589 --> 00:45:54,480  
as a first time participant

1204  
00:45:57,829 --> 00:45:55,599  
um

1205  
00:46:00,069 --> 00:45:57,839  
having something put up into space

1206  
00:46:02,069 --> 00:46:00,079  
would you possibly explain a bit more

1207  
00:46:04,710 --> 00:46:02,079  
about the process for someone else who

1208  
00:46:05,990 --> 00:46:04,720  
has you know probably has a dream

1209  
00:46:07,109 --> 00:46:06,000  
but

1210  
00:46:09,990 --> 00:46:07,119  
doesn't know

1211  
00:46:11,430 --> 00:46:10,000  
how possibly to get to to where you are

1212  
00:46:14,150 --> 00:46:11,440  
now

1213  
00:46:16,950 --> 00:46:14,160

um yes my first thing once you engage is

1214

00:46:18,630 --> 00:46:16,960

to be patient um my

1215

00:46:22,069 --> 00:46:18,640

internal goal

1216

00:46:24,950 --> 00:46:22,079

for this uh payload was i was trying to

1217

00:46:25,750 --> 00:46:24,960

hit the october orbital launch

1218

00:46:27,510 --> 00:46:25,760

and

1219

00:46:29,190 --> 00:46:27,520

was kind of bummed earlier in that

1220

00:46:32,069 --> 00:46:29,200

october because it's like oh i wish mine

1221

00:46:34,150 --> 00:46:32,079

was going up and then like a lot

1222

00:46:37,510 --> 00:46:34,160

many of us um it was

1223

00:46:40,390 --> 00:46:37,520

tragic that i mean i'm glad nobody was

1224

00:46:43,670 --> 00:46:40,400

hurt or harmed but all that

1225

00:46:46,630 --> 00:46:43,680

effort that you know just disappeared um

1226

00:46:48,710 --> 00:46:46,640

so then i was like thank goodness i

1227

00:46:51,349 --> 00:46:48,720

totally underestimated how much

1228

00:46:53,670 --> 00:46:51,359

paperwork is involved dealing with with

1229

00:46:55,910 --> 00:46:53,680

nasa but i would say to continue to

1230

00:46:57,349 --> 00:46:55,920

engage with whether it's cases whether

1231

00:46:59,109 --> 00:46:57,359

it's nasa you know

1232

00:47:00,069 --> 00:46:59,119

whatever your vehicle

1233

00:47:01,829 --> 00:47:00,079

um

1234

00:47:03,510 --> 00:47:01,839

realize it's going to be a long process

1235

00:47:05,670 --> 00:47:03,520

to be patient

1236

00:47:07,270 --> 00:47:05,680

to and to engage with them particularly

1237

00:47:08,870 --> 00:47:07,280

if you don't know something or if you

1238

00:47:10,870 --> 00:47:08,880

are getting like a little frustrated to

1239

00:47:13,430 --> 00:47:10,880

kind of keep that communication going

1240

00:47:15,349 --> 00:47:13,440

and and push if you need to

1241

00:47:17,589 --> 00:47:15,359

and um but

1242

00:47:19,670 --> 00:47:17,599

all of us at rast labs we've been doing

1243

00:47:23,910 --> 00:47:19,680

like vulcan high fives and stuff because

1244

00:47:26,470 --> 00:47:23,920

we are all space junkie anybody remotely

1245

00:47:29,589 --> 00:47:26,480

affiliated with robotic robots tends to

1246

00:47:32,390 --> 00:47:29,599

be really into space

1247

00:47:34,470 --> 00:47:32,400

it's interesting to note too that

1248

00:47:36,630 --> 00:47:34,480

you mentioned the orbital three mishap

1249

00:47:38,230 --> 00:47:36,640

and the difficulty we had in losing many

1250

00:47:40,230 --> 00:47:38,240

of those payloads but many of those

1251  
00:47:43,109 --> 00:47:40,240  
payloads are coming back for instance

1252  
00:47:45,910 --> 00:47:43,119  
one of the investigations meteor

1253  
00:47:48,630 --> 00:47:45,920  
is a cases national lab investigation

1254  
00:47:51,190 --> 00:47:48,640  
that was originally on the orbital three

1255  
00:47:53,190 --> 00:47:51,200  
it was lost and we we are now re-flying

1256  
00:47:54,470 --> 00:47:53,200  
the spare to orbit

1257  
00:47:56,390 --> 00:47:54,480  
and i would add there were several

1258  
00:47:58,230 --> 00:47:56,400  
educational payloads on orb 3 that have

1259  
00:47:59,910 --> 00:47:58,240  
already reflown they've already been up

1260  
00:48:02,069 --> 00:47:59,920  
to station and back so

1261  
00:48:04,549 --> 00:48:02,079  
i would use that as an indication of the

1262  
00:48:06,790 --> 00:48:04,559  
new responsiveness of nasa

1263  
00:48:08,390 --> 00:48:06,800

and that's part of cases mission too

1264

00:48:10,470 --> 00:48:08,400

nasa is is

1265

00:48:13,670 --> 00:48:10,480

very supportive of cases efforts to go

1266

00:48:16,230 --> 00:48:13,680

out and build this as a usable platform

1267

00:48:17,349 --> 00:48:16,240

for a variety of different users and in

1268

00:48:19,190 --> 00:48:17,359

doing that

1269

00:48:21,430 --> 00:48:19,200

nasa is working very hard to make sure

1270

00:48:22,790 --> 00:48:21,440

that the facilities and the timelines

1271

00:48:24,390 --> 00:48:22,800

from the time

1272

00:48:26,230 --> 00:48:24,400

you're in contact with someone to

1273

00:48:28,309 --> 00:48:26,240

sponsor your payload until the time you

1274

00:48:30,630 --> 00:48:28,319

fly that that time is shortened

1275

00:48:33,190 --> 00:48:30,640

and that enables especially startups

1276

00:48:35,109 --> 00:48:33,200

where time is very precious

1277

00:48:37,829 --> 00:48:35,119

funding is very precious you can't be

1278

00:48:39,430 --> 00:48:37,839

waiting around either for

1279

00:48:40,790 --> 00:48:39,440

your funding to come through the door or

1280

00:48:42,790 --> 00:48:40,800

for you to get the results you need in

1281

00:48:44,470 --> 00:48:42,800

order to move to the next step

1282

00:48:46,309 --> 00:48:44,480

and that's where in order to realize the

1283

00:48:49,270 --> 00:48:46,319

value of the national lab

1284

00:48:52,630 --> 00:48:49,280

a lot of investment has been made from a

1285

00:48:55,109 --> 00:48:52,640

resource standpoint to enable

1286

00:48:56,790 --> 00:48:55,119

investigators to get to space faster and

1287

00:48:58,870 --> 00:48:56,800

then whether their investigation works

1288

00:49:00,309 --> 00:48:58,880

or not they have the opportunity to take

1289

00:49:01,589 --> 00:49:00,319

what they've learned and apply it to

1290

00:49:04,230 --> 00:49:01,599

another flight mission within a

1291

00:49:08,549 --> 00:49:04,240

reasonable amount of time

1292

00:49:10,790 --> 00:49:08,559

hi um michael doherty here um one of my

1293

00:49:12,390 --> 00:49:10,800

fellow page admins on facebook has a

1294

00:49:13,910 --> 00:49:12,400

question for you about your material he

1295

00:49:16,390 --> 00:49:13,920

was hoping to know

1296

00:49:19,829 --> 00:49:16,400

if it could be used as you know as a

1297

00:49:21,589 --> 00:49:19,839

covering on say robotic arm that

1298

00:49:23,430 --> 00:49:21,599

would then when picking an object up

1299

00:49:25,349 --> 00:49:23,440

could it help differentiate between

1300

00:49:27,589 --> 00:49:25,359

textures and such at some point and

1301

00:49:30,309 --> 00:49:27,599

transmit that information back to the

1302

00:49:32,950 --> 00:49:30,319

astronaut using it ah could it be a

1303

00:49:36,710 --> 00:49:32,960

sensor an effect and perhaps since even

1304

00:49:38,150 --> 00:49:36,720

prosthetics our interest is biofeedback

1305

00:49:41,589 --> 00:49:38,160

potentially

1306

00:49:44,950 --> 00:49:43,109

i'm not electrical engineer so you'll

1307

00:49:47,030 --> 00:49:44,960

have to bear with me but what i have

1308

00:49:48,630 --> 00:49:47,040

noticed with my materials is when

1309

00:49:50,549 --> 00:49:48,640

they're compressed even mechanically

1310

00:49:52,470 --> 00:49:50,559

compressed versus relaxed they have a

1311

00:49:54,950 --> 00:49:52,480

different electrical impedance

1312

00:49:57,349 --> 00:49:54,960

that can flow through them so that could

1313

00:49:58,870 --> 00:49:57,359

be taken into account

1314

00:50:00,069 --> 00:49:58,880

and this is conceptual but this is

1315

00:50:00,950 --> 00:50:00,079

something we we've actually had

1316

00:50:02,790 --> 00:50:00,960

something

1317

00:50:04,870 --> 00:50:02,800

some actually very in-depth

1318

00:50:07,349 --> 00:50:04,880

discussions with parties about

1319

00:50:09,510 --> 00:50:07,359

um it could potentially not only be your

1320

00:50:11,190 --> 00:50:09,520

electroactive polymer doing the motion

1321

00:50:14,230 --> 00:50:11,200

doing the life like what's also called

1322

00:50:17,349 --> 00:50:14,240

biomimetic motion but could pack perhaps

1323

00:50:20,950 --> 00:50:17,359

um with the controls in place also have

1324

00:50:22,790 --> 00:50:20,960

a dual use as a sensate or a sensor and

1325

00:50:25,190 --> 00:50:22,800

then in the prosthetics industry that

1326

00:50:27,750 --> 00:50:25,200

would be wonderful to tie in with the

1327

00:50:29,430 --> 00:50:27,760

you know the bio feedback

1328

00:50:31,270 --> 00:50:29,440

so

1329

00:50:33,589 --> 00:50:31,280

another question on the threat bro

1330

00:50:35,670 --> 00:50:33,599

stewardmoney interspace.net again and my

1331

00:50:37,190 --> 00:50:35,680

question is for mike and maybe for

1332

00:50:39,670 --> 00:50:37,200

both of you too as well could you

1333

00:50:42,230 --> 00:50:39,680

address the intellectual property

1334

00:50:44,470 --> 00:50:42,240

benefits of of working with cases i mean

1335

00:50:46,870 --> 00:50:44,480

that's got to be a major component of

1336

00:50:48,470 --> 00:50:46,880

the corporation's decision to to put the

1337

00:50:51,190 --> 00:50:48,480

kind of resources into it sort of the

1338

00:50:52,870 --> 00:50:51,200

guarantees and what it's

1339

00:50:55,910 --> 00:50:52,880

what is that environment from a from a

1340

00:50:59,829 --> 00:50:58,390

i think going into this we basically

1341

00:51:01,349 --> 00:50:59,839

said the emphasis should be on

1342

00:51:03,910 --> 00:51:01,359

publishing

1343

00:51:04,950 --> 00:51:03,920

and and not worry about the

1344

00:51:06,870 --> 00:51:04,960

ip

1345

00:51:08,390 --> 00:51:06,880

and the general agreement is is that the

1346

00:51:10,309 --> 00:51:08,400

research that we do

1347

00:51:12,069 --> 00:51:10,319

we're going to offer to the broader

1348

00:51:14,309 --> 00:51:12,079

research community

1349

00:51:16,950 --> 00:51:14,319

that that's what we went in from our

1350

00:51:19,190 --> 00:51:16,960

perspective going into this

1351  
00:51:21,109 --> 00:51:19,200  
and that's you know

1352  
00:51:23,589 --> 00:51:21,119  
that's how we handle it merck

1353  
00:51:26,470 --> 00:51:23,599  
okay for for a small startup high tech

1354  
00:51:28,630 --> 00:51:26,480  
um ip is our bread and butter it is what

1355  
00:51:31,270 --> 00:51:28,640  
we are so that was one thing i i did

1356  
00:51:33,910 --> 00:51:31,280  
have my um patent attorney vet

1357  
00:51:37,510 --> 00:51:33,920  
and um but actually the the cases

1358  
00:51:39,270 --> 00:51:37,520  
project was very respectful of raslab's

1359  
00:51:41,589 --> 00:51:39,280  
ip and

1360  
00:51:43,589 --> 00:51:41,599  
since some of this will be very kind of

1361  
00:51:45,670 --> 00:51:43,599  
theoretical as well that's what i tend

1362  
00:51:48,710 --> 00:51:45,680  
to do is publish theory republican

1363  
00:51:52,390 --> 00:51:48,720

theory and uh patent formulations and

1364

00:51:54,470 --> 00:51:52,400

actuators so um so i've kind of i split

1365

00:51:58,150 --> 00:51:54,480

my business into kind of two hats if you

1366

00:52:00,069 --> 00:51:58,160

will but cases has the the the whole uh

1367

00:52:02,309 --> 00:52:00,079

vehicle of it was very respectful of our

1368

00:52:03,990 --> 00:52:02,319

company's ip

1369

00:52:05,510 --> 00:52:04,000

yeah so from casey's perspective it

1370

00:52:06,950 --> 00:52:05,520

begins with the discussion what the

1371

00:52:08,549 --> 00:52:06,960

interests are and

1372

00:52:09,910 --> 00:52:08,559

the return on investment that we're

1373

00:52:12,309 --> 00:52:09,920

seeking to create on the international

1374

00:52:13,910 --> 00:52:12,319

space station in some cases that ties

1375

00:52:16,390 --> 00:52:13,920

directly back to publishing and getting

1376  
00:52:18,790 --> 00:52:16,400  
as much information available as you can

1377  
00:52:20,790 --> 00:52:18,800  
out to the community and in some cases

1378  
00:52:23,510 --> 00:52:20,800  
as paul just indicated industry is

1379  
00:52:26,150 --> 00:52:23,520  
strongly behind that in other cases as

1380  
00:52:27,910 --> 00:52:26,160  
as dr rasmussen just indicated there

1381  
00:52:29,430 --> 00:52:27,920  
needs to be protection up front for the

1382  
00:52:31,270 --> 00:52:29,440  
intellectual property that comes from

1383  
00:52:32,950 --> 00:52:31,280  
that and sometimes that intellectual

1384  
00:52:34,470 --> 00:52:32,960  
property protection

1385  
00:52:36,069 --> 00:52:34,480  
needs to stay with the company for a

1386  
00:52:37,430 --> 00:52:36,079  
very long time in other cases it just

1387  
00:52:39,349 --> 00:52:37,440  
needs to be embargoed for a certain

1388  
00:52:41,030 --> 00:52:39,359

amount of time so again it all begins

1389

00:52:42,549 --> 00:52:41,040

with a discussion about what your needs

1390

00:52:44,829 --> 00:52:42,559

are and what you need to protect and

1391

00:52:51,190 --> 00:52:44,839

then there are ways to work forward with

1392

00:52:55,510 --> 00:52:53,750

val phillips zero g news it's actually a

1393

00:52:57,430 --> 00:52:55,520

question about your particular

1394

00:52:59,910 --> 00:52:57,440

experiment this time out from my

1395

00:53:02,230 --> 00:52:59,920

understanding it's a dry version of your

1396

00:53:05,750 --> 00:53:02,240

of the individual materials

1397

00:53:07,190 --> 00:53:05,760

but long term it needs to be into a

1398

00:53:08,230 --> 00:53:07,200

moist solution

1399

00:53:10,790 --> 00:53:08,240

so

1400

00:53:11,910 --> 00:53:10,800

um how will that

1401

00:53:14,549 --> 00:53:11,920

isn't there going to be some kind of

1402

00:53:19,510 --> 00:53:14,559

differential into how that is going to

1403

00:53:23,349 --> 00:53:20,950

no no that's a good question i can

1404

00:53:25,670 --> 00:53:23,359

clarify um this is just one sample you

1405

00:53:27,990 --> 00:53:25,680

know one matrix and it's all of these

1406

00:53:29,589 --> 00:53:28,000

are moist and it's little climate there

1407

00:53:31,430 --> 00:53:29,599

will be four of them two of them are my

1408

00:53:33,670 --> 00:53:31,440

generation three material two of them

1409

00:53:36,790 --> 00:53:33,680

are my generation a fourth generation

1410

00:53:38,710 --> 00:53:36,800

material so two two and then of each

1411

00:53:40,470 --> 00:53:38,720

generation one is in a moist

1412

00:53:42,870 --> 00:53:40,480

microclimate one is in a dry

1413

00:53:44,470 --> 00:53:42,880

microclimate because i anticipate that i

1414

00:53:46,870 --> 00:53:44,480

will see some differences particularly

1415

00:53:49,190 --> 00:53:46,880

with some of the harder

1416

00:53:50,630 --> 00:53:49,200

particulate radiation between the moist

1417

00:53:51,589 --> 00:53:50,640

and the dry and i want to investigate

1418

00:53:53,750 --> 00:53:51,599

that

1419

00:53:57,430 --> 00:53:53,760

so to answer your question um it's a

1420

00:53:59,589 --> 00:53:57,440

good question it's it's a good

1421

00:54:01,349 --> 00:53:59,599

you'd be great at scientific designing

1422

00:54:05,349 --> 00:54:01,359

experiments and what we've done is we've

1423

00:54:07,109 --> 00:54:05,359

done we've we've been able to capture um

1424

00:54:08,230 --> 00:54:07,119

four different scenarios with a

1425

00:54:10,549 --> 00:54:08,240

different with

1426

00:54:12,549 --> 00:54:10,559

you know a whole matrix that they're

1427

00:54:14,630 --> 00:54:12,559

each going to go under um but we're

1428

00:54:16,950 --> 00:54:14,640

covering four different scenarios which

1429

00:54:17,910 --> 00:54:16,960

include include both a moist and a dry

1430

00:54:21,990 --> 00:54:17,920

exp

1431

00:54:25,750 --> 00:54:22,000

so we'll be able to analyze all that and

1432

00:54:28,069 --> 00:54:25,760

compare it to the experiment on earth

1433

00:54:31,190 --> 00:54:28,079

uh jim siegel from the celebration news

1434

00:54:34,150 --> 00:54:31,200

and from space flight and her insider a

1435

00:54:35,109 --> 00:54:34,160

question either for dr costello or dr

1436

00:54:38,069 --> 00:54:35,119

roberts

1437

00:54:41,430 --> 00:54:38,079

regarding getting back to the issue of

1438

00:54:43,670 --> 00:54:41,440

iss as a national laboratory

1439

00:54:44,710 --> 00:54:43,680

i'm interested in giving my readers some

1440

00:54:47,829 --> 00:54:44,720

sort of

1441

00:54:49,349 --> 00:54:47,839

perspective or metric or metrics

1442

00:54:50,390 --> 00:54:49,359

regarding

1443

00:54:53,349 --> 00:54:50,400

how many

1444

00:54:56,710 --> 00:54:53,359

experiments or solutions or whatever you

1445

00:54:59,030 --> 00:54:56,720

want to call them uh have come have been

1446

00:55:00,549 --> 00:54:59,040

launched or been done

1447

00:55:03,190 --> 00:55:00,559

from uh

1448

00:55:05,990 --> 00:55:03,200

from the point of view of benefiting

1449

00:55:07,589 --> 00:55:06,000

mankind rather than space exploration do

1450

00:55:10,870 --> 00:55:07,599

you measure those in

1451

00:55:13,109 --> 00:55:10,880

missions or in experiments or and how

1452

00:55:15,349 --> 00:55:13,119

many of those have been have been 10 100

1453

00:55:17,349 --> 00:55:15,359

1 000

1454

00:55:20,150 --> 00:55:17,359

roughly

1455

00:55:22,789 --> 00:55:20,160

that's a good question and uh the

1456

00:55:25,109 --> 00:55:22,799

statistics bear that out in the split

1457

00:55:27,589 --> 00:55:25,119

between the the national lab the the

1458

00:55:29,670 --> 00:55:27,599

cases investigations and then the nasa

1459

00:55:32,309 --> 00:55:29,680

investigations many of the nasa

1460

00:55:34,069 --> 00:55:32,319

traditional investigations have also had

1461

00:55:35,750 --> 00:55:34,079

earth benefits

1462

00:55:37,910 --> 00:55:35,760

in the last press conference we talked

1463

00:55:40,230 --> 00:55:37,920

about the nutrition investigation and

1464

00:55:42,789 --> 00:55:40,240

how that led to changes in the usda

1465

00:55:43,829 --> 00:55:42,799

requirements for vitamin d

1466

00:55:46,950 --> 00:55:43,839

so

1467

00:55:49,109 --> 00:55:46,960

but looking at the cases investigations

1468

00:55:51,109 --> 00:55:49,119

cases has been running for the past

1469

00:55:54,309 --> 00:55:51,119

several years three years and and

1470

00:55:57,030 --> 00:55:54,319

typically in that time 25 to

1471

00:55:59,750 --> 00:55:57,040

30 percent of the the crew time and

1472

00:56:02,309 --> 00:55:59,760

investigations have been

1473

00:56:04,230 --> 00:56:02,319

specifically case investigations focused

1474

00:56:07,109 --> 00:56:04,240

on those earth benefits and when you

1475

00:56:09,910 --> 00:56:07,119

figure out that we've got 150 to 200

1476  
00:56:12,870 --> 00:56:09,920  
investigations each increment pair that

1477  
00:56:15,510 --> 00:56:12,880  
means you've got 30 to 60 investigations

1478  
00:56:17,430 --> 00:56:15,520  
probably per increment pair

1479  
00:56:19,109 --> 00:56:17,440  
that are really focused on those goals

1480  
00:56:21,829 --> 00:56:19,119  
and then on top of all that we have the

1481  
00:56:23,750 --> 00:56:21,839  
nasa investigations which are being used

1482  
00:56:25,510 --> 00:56:23,760  
not only to help with our space

1483  
00:56:27,670 --> 00:56:25,520  
exploration goals but

1484  
00:56:28,950 --> 00:56:27,680  
what knowledge we do gain that benefits

1485  
00:56:31,190 --> 00:56:28,960  
people

1486  
00:56:33,190 --> 00:56:31,200  
the way we live down here on earth is

1487  
00:56:35,829 --> 00:56:33,200  
translated to the public

1488  
00:56:37,270 --> 00:56:35,839

so many experiments whatever i mean are

1489

00:56:41,430 --> 00:56:37,280

we talking about

1490

00:56:44,069 --> 00:56:41,440

hundreds since 2005 or thousands or 5

1491

00:56:46,710 --> 00:56:44,079

000 or can you say hundreds we've we've

1492

00:56:49,829 --> 00:56:46,720

had over a thousand experiments to date

1493

00:56:51,190 --> 00:56:49,839

uh on on the iss from the from the u.s

1494

00:56:53,829 --> 00:56:51,200

investigators

1495

00:56:56,230 --> 00:56:53,839

and uh we have over 1600 publications

1496

00:56:59,990 --> 00:56:56,240

already so with each increment pair

1497

00:57:02,549 --> 00:57:00,000

adding another 200 300 investigations

1498

00:57:05,589 --> 00:57:02,559

we're seeing that number increase

1499

00:57:07,670 --> 00:57:05,599

steadily and very quickly and cases is

1500

00:57:09,190 --> 00:57:07,680

is starting to fill out their allocation

1501

00:57:11,990 --> 00:57:09,200  
of 50 percent of the national lab

1502

00:57:13,190 --> 00:57:12,000  
resources and and they're coming along

1503

00:57:15,750 --> 00:57:13,200  
quickly

1504

00:57:17,670 --> 00:57:15,760  
yeah so as kurt said iss national lab is

1505

00:57:19,910 --> 00:57:17,680  
obviously you can tell from the timeline

1506

00:57:21,750 --> 00:57:19,920  
predates the existence of cases and what

1507

00:57:24,230 --> 00:57:21,760  
we're trying to do now is

1508

00:57:26,390 --> 00:57:24,240  
fill up our allocation that's given to

1509

00:57:28,470 --> 00:57:26,400  
us as nasa's fast as we can and i think

1510

00:57:30,230 --> 00:57:28,480  
we're succeeding wildly there

1511

00:57:32,069 --> 00:57:30,240  
we're starting to run up against some

1512

00:57:34,230 --> 00:57:32,079  
constraints on crew time

1513

00:57:35,910 --> 00:57:34,240

in that we've got more customers lined

1514

00:57:37,349 --> 00:57:35,920

up than we have crew time to support

1515

00:57:41,030 --> 00:57:37,359

their investigations and that's where

1516

00:57:42,549 --> 00:57:41,040

the prioritization part comes into it so

1517

00:57:43,829 --> 00:57:42,559

up until the time that we get to add

1518

00:57:46,230 --> 00:57:43,839

another crew member we're going to

1519

00:57:48,309 --> 00:57:46,240

continue to to push the the boundaries

1520

00:57:51,190 --> 00:57:48,319

of that envelope of crew time

1521

00:57:53,510 --> 00:57:51,200

as best we can

1522

00:57:56,309 --> 00:57:53,520

and its commercial crew will enable

1523

00:57:58,549 --> 00:57:56,319

adding another crew member

1524

00:58:00,630 --> 00:57:58,559

so that's all the time we have for today

1525

00:58:02,870 --> 00:58:00,640

thank you all for joining us

1526

00:58:05,349 --> 00:58:02,880

stay tuned to nasa television coming up

1527

00:58:07,430 --> 00:58:05,359

next at 5 pm eastern is our pre-launch

1528

00:58:09,430 --> 00:58:07,440

news briefing to update the status of

1529

00:58:12,789 --> 00:58:09,440

preparations for tomorrow's launch which

1530

00:58:14,470 --> 00:58:12,799

is scheduled for 4 33 pm eastern time

1531

00:58:16,950 --> 00:58:14,480

you can follow along with our

1532

00:58:20,870 --> 00:58:16,960

researchers and these studies in orbit

1533

00:58:25,190 --> 00:58:22,710

station and you can follow all the