



1  
00:00:04,870 --> 00:00:02,550  
good afternoon i'm stephanie shearholtz

2  
00:00:06,630 --> 00:00:04,880  
from nasa's office of communications

3  
00:00:08,390 --> 00:00:06,640  
we're here at the kennedy space center

4  
00:00:10,629 --> 00:00:08,400  
today to talk with scientists and

5  
00:00:13,030 --> 00:00:10,639  
researchers about the important studies

6  
00:00:14,470 --> 00:00:13,040  
they will be conducting in microgravity

7  
00:00:16,390 --> 00:00:14,480  
it's a good day to be talking about

8  
00:00:19,590 --> 00:00:16,400  
space exploration and advancements in

9  
00:00:22,310 --> 00:00:19,600  
science today is the 54th anniversary of

10  
00:00:23,990 --> 00:00:22,320  
yuri gagarin's launch and the 34th

11  
00:00:24,950 --> 00:00:24,000  
anniversary of the first space shuttle

12  
00:00:28,310 --> 00:00:24,960  
launch

13  
00:00:30,470 --> 00:00:28,320

tomorrow at 4 33 pm eastern time spacex

14

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

will launch its sixth commercial

15

00:00:34,310 --> 00:00:32,399

resupply services mission to the

16

00:00:36,229 --> 00:00:34,320

international space station

17

00:00:38,229 --> 00:00:36,239

here today to talk with us about some of

18

00:00:40,470 --> 00:00:38,239

the approximately 40 science

19

00:00:41,670 --> 00:00:40,480

investigations directly supported by

20

00:00:44,389 --> 00:00:41,680

this launch

21

00:00:46,150 --> 00:00:44,399

are dr marshall porterfield division

22

00:00:48,869 --> 00:00:46,160

director space life and physical

23

00:00:50,709 --> 00:00:48,879

sciences nasa's human exploration and

24

00:00:52,549 --> 00:00:50,719

operations mission directorate at nasa

25

00:00:54,549 --> 00:00:52,559

headquarters

26

00:00:56,630 --> 00:00:54,559

dr kirk costello

27

00:01:00,150 --> 00:00:56,640

international space station deputy chief

28

00:01:01,029 --> 00:01:00,160

scientist at nasa's johnson space center

29

00:01:03,029 --> 00:01:01,039

dr

30

00:01:05,030 --> 00:01:03,039

noel clark professor of physics at the

31

00:01:07,590 --> 00:01:05,040

university of colorado boulder and

32

00:01:09,750 --> 00:01:07,600

principal investigator for the oasis

33

00:01:13,830 --> 00:01:09,760

investigation

34

00:01:16,149 --> 00:01:13,840

and dr paula devitti piovic associate

35

00:01:18,149 --> 00:01:16,159

professor of molecular and cell biology

36

00:01:20,950 --> 00:01:18,159

at the goldman school of dental medicine

37

00:01:22,789 --> 00:01:20,960

at boston university and the director of

38

00:01:24,950 --> 00:01:22,799

the bone cell core at massachusetts

39

00:01:28,390 --> 00:01:24,960

general hospital she's the principal

40

00:01:31,109 --> 00:01:28,400

investigator for osteo 4 investigation

41

00:01:32,950 --> 00:01:31,119

our intent today is to enable discussion

42

00:01:35,270 --> 00:01:32,960

so we'll take questions throughout our

43

00:01:37,190 --> 00:01:35,280

talk if you would like to ask a question

44

00:01:39,270 --> 00:01:37,200

please raise your hand

45

00:01:40,630 --> 00:01:39,280

dr porterfield can you start us off by

46

00:01:43,030 --> 00:01:40,640

telling us a little bit about some of

47

00:01:44,710 --> 00:01:43,040

the studies nasa space life and physical

48

00:01:45,590 --> 00:01:44,720

sciences division has flying on this

49

00:01:47,670 --> 00:01:45,600

mission

50

00:01:49,429 --> 00:01:47,680

yeah we're currently sponsoring uh seven

51  
00:01:50,870 --> 00:01:49,439  
payloads scientific payloads that will

52  
00:01:53,109 --> 00:01:50,880  
be launched on

53  
00:01:55,590 --> 00:01:53,119  
this resupply mission really excited

54  
00:01:57,749 --> 00:01:55,600  
about this three of these are

55  
00:01:59,350 --> 00:01:57,759  
related to the human research program

56  
00:02:00,389 --> 00:01:59,360  
uh the

57  
00:02:04,550 --> 00:02:00,399  
uh

58  
00:02:08,229 --> 00:02:06,550  
one experiments focusing on intracranial

59  
00:02:09,910 --> 00:02:08,239  
pressure and visual impairment fluid

60  
00:02:12,150 --> 00:02:09,920  
shifts experiment

61  
00:02:13,910 --> 00:02:12,160  
we also have studies looking at a

62  
00:02:16,470 --> 00:02:13,920  
diurnal cycle and the interaction

63  
00:02:18,470 --> 00:02:16,480

between light and gravity and sleep

64

00:02:21,589 --> 00:02:18,480

quality in the crew and we're also

65

00:02:26,710 --> 00:02:23,830

necessities needed to conduct a twin

66

00:02:28,630 --> 00:02:26,720

study working with uh scott and mark

67

00:02:31,110 --> 00:02:28,640

kelly who are twin pairs

68

00:02:33,110 --> 00:02:31,120

on a study that allows us to look at an

69

00:02:35,750 --> 00:02:33,120

astronaut in microgravity and his

70

00:02:38,229 --> 00:02:35,760

genetic twin on the ground over a year

71

00:02:39,830 --> 00:02:38,239

long period we also have two experiments

72

00:02:42,949 --> 00:02:39,840

in the physical sciences

73

00:02:44,949 --> 00:02:42,959

area the ace h1 payload

74

00:02:46,070 --> 00:02:44,959

and also the oasis experiment both of

75

00:02:48,470 --> 00:02:46,080

these are

76  
00:02:49,910 --> 00:02:48,480  
fluids and materials science research

77  
00:02:52,150 --> 00:02:49,920  
projects and we'll hear from dr clark

78  
00:02:54,309 --> 00:02:52,160  
later about his experiment he'll go in

79  
00:02:56,550 --> 00:02:54,319  
detail we also have two life sciences

80  
00:02:58,470 --> 00:02:56,560  
experiments one of them is involved with

81  
00:03:00,070 --> 00:02:58,480  
a microbial observatory

82  
00:03:01,670 --> 00:03:00,080  
initiative that we've developed out of

83  
00:03:03,830 --> 00:03:01,680  
headquarters over the last two years and

84  
00:03:06,149 --> 00:03:03,840  
allows us to look at microbes and how

85  
00:03:07,670 --> 00:03:06,159  
they respond to microgravity and how are

86  
00:03:08,949 --> 00:03:07,680  
they evolving are they being how are

87  
00:03:10,550 --> 00:03:08,959  
they adapting to the stress of the

88  
00:03:12,229 --> 00:03:10,560

microgravity environment and it's part

89

00:03:14,790 --> 00:03:12,239

of the environment as part of the

90

00:03:18,550 --> 00:03:14,800

environment of the iss and the other is

91

00:03:21,430 --> 00:03:18,560

the bric 21 experiment which actually is

92

00:03:23,350 --> 00:03:21,440

culturing bacteria that we will

93

00:03:25,270 --> 00:03:23,360

look at how they respond to the stress

94

00:03:26,470 --> 00:03:25,280

of the space flight environment and look

95

00:03:29,110 --> 00:03:26,480

at

96

00:03:31,270 --> 00:03:29,120

how they respond to how they how they

97

00:03:32,630 --> 00:03:31,280

become resistant to antibiotics and

98

00:03:35,190 --> 00:03:32,640

microgravity

99

00:03:36,630 --> 00:03:35,200

so you you mentioned um scott kelly and

100

00:03:39,430 --> 00:03:36,640

the twin study

101  
00:03:42,070 --> 00:03:39,440  
how does studying scott for a year in

102  
00:03:43,990 --> 00:03:42,080  
space help us with space exploration and

103  
00:03:45,270 --> 00:03:44,000  
future space exploration

104  
00:03:46,550 --> 00:03:45,280  
well i was lucky enough just a couple

105  
00:03:48,630 --> 00:03:46,560  
weeks ago to be at the launch in

106  
00:03:51,350 --> 00:03:48,640  
baikonur and i got to spend some time

107  
00:03:53,910 --> 00:03:51,360  
with with with mark his brother who is

108  
00:03:55,990 --> 00:03:53,920  
the one gravity control and

109  
00:03:58,309 --> 00:03:56,000  
um and this is very important in two

110  
00:04:00,550 --> 00:03:58,319  
ways one of them is because of the the

111  
00:04:03,270 --> 00:04:00,560  
fact that we have genetically paired

112  
00:04:05,270 --> 00:04:03,280  
subjects and the integration of the

113  
00:04:07,830 --> 00:04:05,280

10 investigations at the system's

114

00:04:09,509 --> 00:04:07,840

biology level we've really never

115

00:04:10,789 --> 00:04:09,519

attempted to do human research at this

116

00:04:11,830 --> 00:04:10,799

type of level

117

00:04:13,270 --> 00:04:11,840

of

118

00:04:15,030 --> 00:04:13,280

biotechnology

119

00:04:17,430 --> 00:04:15,040

the other part of it is the duration

120

00:04:19,270 --> 00:04:17,440

because it is a one-year experiment it's

121

00:04:20,949 --> 00:04:19,280

allowing us to make a leap from six

122

00:04:23,749 --> 00:04:20,959

months which is our typical crew time on

123

00:04:26,070 --> 00:04:23,759

the iss to a year and project out to

124

00:04:28,469 --> 00:04:26,080

what we will need to do to protect

125

00:04:30,710 --> 00:04:28,479

humans as we explore over longer periods

126

00:04:32,390 --> 00:04:30,720

of time perhaps mission to mars over

127

00:04:34,390 --> 00:04:32,400

multi-years

128

00:04:36,070 --> 00:04:34,400

so uh we'll take some questions from the

129

00:04:42,469 --> 00:04:36,080

from the group ken i think you had a

130

00:04:46,870 --> 00:04:44,790

hi ken kramer for uh america's space and

131

00:04:49,350 --> 00:04:46,880

universe today uh talk a little bit more

132

00:04:51,189 --> 00:04:49,360

specifically about what experiments are

133

00:04:53,590 --> 00:04:51,199

actually going up on this mission for

134

00:04:55,270 --> 00:04:53,600

the twin study please in some detail

135

00:04:57,270 --> 00:04:55,280

thanks

136

00:04:59,189 --> 00:04:57,280

um there's

137

00:05:00,870 --> 00:04:59,199

uh working with the human research

138

00:05:02,790 --> 00:05:00,880

program in the nasa space biomedical

139

00:05:05,110 --> 00:05:02,800

research institute at johnson space

140

00:05:07,270 --> 00:05:05,120

center we solicited for

141

00:05:08,629 --> 00:05:07,280

individual proposals but when they came

142

00:05:10,390 --> 00:05:08,639

in we saw how we could integrate them

143

00:05:12,469 --> 00:05:10,400

into a larger study

144

00:05:15,590 --> 00:05:12,479

so some of the proposals are actually

145

00:05:17,749 --> 00:05:15,600

looking at transcriptomic level changes

146

00:05:20,310 --> 00:05:17,759

so looking at from the genome flows

147

00:05:22,390 --> 00:05:20,320

information biological information as

148

00:05:24,870 --> 00:05:22,400

genes are transcribed into proteins

149

00:05:26,550 --> 00:05:24,880

ultimately or into messages so we now

150

00:05:28,629 --> 00:05:26,560

have the technology to look at all those

151  
00:05:30,310 --> 00:05:28,639  
messages so there's somewhere around 30

152  
00:05:32,070 --> 00:05:30,320  
000 genes to make up

153  
00:05:33,749 --> 00:05:32,080  
that make up the human genome that are

154  
00:05:35,270 --> 00:05:33,759  
part of the human genome

155  
00:05:37,590 --> 00:05:35,280  
and we can actually follow all of those

156  
00:05:39,590 --> 00:05:37,600  
so some of those are transcriptomics

157  
00:05:41,350 --> 00:05:39,600  
some of those we're using

158  
00:05:44,950 --> 00:05:41,360  
omix technology to look at the human

159  
00:05:45,749 --> 00:05:44,960  
microbiome so there's

160  
00:05:47,990 --> 00:05:45,759  
our

161  
00:05:50,710 --> 00:05:48,000  
body of knowledge in terms of how we are

162  
00:05:52,310 --> 00:05:50,720  
dependent upon our symbiotic

163  
00:05:54,629 --> 00:05:52,320

relationship with the microbes that live

164

00:05:57,350 --> 00:05:54,639

in and on us is continuing to expand and

165

00:05:59,590 --> 00:05:57,360

have huge health implications that touch

166

00:06:01,749 --> 00:05:59,600

touch everyone's life but so we're doing

167

00:06:04,230 --> 00:06:01,759

those types of studies with the twins to

168

00:06:07,510 --> 00:06:04,240

look at how does that shift associated

169

00:06:09,830 --> 00:06:07,520

with the stress of the micro uh

170

00:06:11,670 --> 00:06:09,840

microgravity environment so in addition

171

00:06:13,189 --> 00:06:11,680

to these integrated omics approaches

172

00:06:15,990 --> 00:06:13,199

which are allowing us to look at human

173

00:06:17,749 --> 00:06:16,000

subjects at this system's biology level

174

00:06:19,670 --> 00:06:17,759

for the first time we're also doing some

175

00:06:22,390 --> 00:06:19,680

physiological studies for example

176

00:06:26,150 --> 00:06:24,870

mental awareness and mental performance

177

00:06:27,430 --> 00:06:26,160

and how that may be changing in

178

00:06:30,390 --> 00:06:27,440

microgravity

179

00:06:32,710 --> 00:06:30,400

and in terms of payloads on this mission

180

00:06:34,950 --> 00:06:32,720

fluid shifts is directly supported with

181

00:06:36,390 --> 00:06:34,960

payload on that's launching tomorrow is

182

00:06:37,510 --> 00:06:36,400

that correct

183

00:06:39,189 --> 00:06:37,520

yes

184

00:06:41,590 --> 00:06:39,199

looking at

185

00:06:43,110 --> 00:06:41,600

human subjects in terms of the overall

186

00:06:44,950 --> 00:06:43,120

architecture of our bodies how they

187

00:06:47,189 --> 00:06:44,960

change in the microgravity environment

188

00:06:49,430 --> 00:06:47,199

fluid shift asp we've known for years

189

00:06:51,350 --> 00:06:49,440

astronauts get puffy in microgravity

190

00:06:53,189 --> 00:06:51,360

because the fluids shift up from your

191

00:06:55,670 --> 00:06:53,199

your feet up to your head and that

192

00:06:58,070 --> 00:06:55,680

recently we've been able to document how

193

00:06:59,830 --> 00:06:58,080

that is associated with increasing

194

00:07:01,430 --> 00:06:59,840

intracranial pressure which may be

195

00:07:03,510 --> 00:07:01,440

changing the shape of the eye and

196

00:07:05,670 --> 00:07:03,520

causing visual impairment we need to get

197

00:07:07,830 --> 00:07:05,680

a handle on those types of problems

198

00:07:09,510 --> 00:07:07,840

now so that we don't

199

00:07:11,589 --> 00:07:09,520

so that we can protect the crew in the

200

00:07:13,510 --> 00:07:11,599

future because that's you know directly

201  
00:07:15,990 --> 00:07:13,520  
needed in terms of crew performance our

202  
00:07:18,870 --> 00:07:16,000  
ability to see

203  
00:07:25,830 --> 00:07:19,670  
hi

204  
00:07:29,430 --> 00:07:25,840  
well the one year of

205  
00:07:30,950 --> 00:07:29,440  
scott kelly and his russian counterpart

206  
00:07:33,110 --> 00:07:30,960  
it's the first time americans have done

207  
00:07:34,950 --> 00:07:33,120  
a year in space but obviously the

208  
00:07:37,270 --> 00:07:34,960  
russians have previously done it with

209  
00:07:38,870 --> 00:07:37,280  
mir are there anything that is there

210  
00:07:40,150 --> 00:07:38,880  
anything that came up from these mere

211  
00:07:41,990 --> 00:07:40,160  
experiments

212  
00:07:44,230 --> 00:07:42,000  
that has triggered a further

213  
00:07:47,350 --> 00:07:44,240

investigation within this this new

214

00:07:49,029 --> 00:07:47,360

one-year period

215

00:07:51,029 --> 00:07:49,039

i think the russian scientists learned a

216

00:07:52,869 --> 00:07:51,039

lot during those times we worked

217

00:07:55,270 --> 00:07:52,879

directly with the institute for medical

218

00:07:58,390 --> 00:07:55,280

and biological problems in moscow

219

00:08:01,589 --> 00:07:58,400

and coordinating these studies so

220

00:08:03,830 --> 00:08:01,599

the uh years of experience that the

221

00:08:05,830 --> 00:08:03,840

the russians have developed in terms of

222

00:08:07,670 --> 00:08:05,840

supporting medical operations and

223

00:08:09,670 --> 00:08:07,680

medical research

224

00:08:12,629 --> 00:08:09,680

extending into these extreme long

225

00:08:14,230 --> 00:08:12,639

periods of times that were that were

226

00:08:16,309 --> 00:08:14,240

studied in mir

227

00:08:18,230 --> 00:08:16,319

did come to play um

228

00:08:21,350 --> 00:08:18,240

in terms of organizing

229

00:08:23,270 --> 00:08:21,360

our our joint studies associated with

230

00:08:24,710 --> 00:08:23,280

the one-year mission looking at the

231

00:08:26,790 --> 00:08:24,720

russian crew member and the american

232

00:08:28,070 --> 00:08:26,800

crew member a lot of that was

233

00:08:29,830 --> 00:08:28,080

coordinated

234

00:08:32,469 --> 00:08:29,840

was led by

235

00:08:33,589 --> 00:08:32,479

a multilateral research integration

236

00:08:34,550 --> 00:08:33,599

board

237

00:08:35,589 --> 00:08:34,560

that was

238

00:08:38,870 --> 00:08:35,599

headed up

239

00:08:41,350 --> 00:08:38,880

co-head led by the institute for medical

240

00:08:43,350 --> 00:08:41,360

and biological problems in moscow and

241

00:08:47,829 --> 00:08:43,360

the human research program at johnson

242

00:08:51,829 --> 00:08:49,829

that that was the coordinating board

243

00:08:53,350 --> 00:08:51,839

where we were able to bring in the the

244

00:08:54,389 --> 00:08:53,360

expertise of the russians and make sure

245

00:08:56,150 --> 00:08:54,399

that we are

246

00:08:56,949 --> 00:08:56,160

we're really approaching these studies

247

00:09:00,550 --> 00:08:56,959

in them

248

00:09:05,350 --> 00:09:02,870

another question here

249

00:09:07,269 --> 00:09:05,360

joshua evans with nasa social is there a

250

00:09:08,550 --> 00:09:07,279

psychological component to the

251  
00:09:10,550 --> 00:09:08,560  
experimentations that will be taking

252  
00:09:13,430 --> 00:09:10,560  
place in the twin study on the iss in

253  
00:09:15,509 --> 00:09:13,440  
terms of prolonged time and space flight

254  
00:09:17,910 --> 00:09:15,519  
differences between

255  
00:09:19,829 --> 00:09:17,920  
mr kelly on earth and mr kelly on the

256  
00:09:21,430 --> 00:09:19,839  
iss

257  
00:09:23,269 --> 00:09:21,440  
yeah that's always an important

258  
00:09:25,670 --> 00:09:23,279  
consideration if you look at crew health

259  
00:09:28,949 --> 00:09:25,680  
and crew performances how do you deal

260  
00:09:31,910 --> 00:09:28,959  
with confinement isolation those sorts

261  
00:09:33,670 --> 00:09:31,920  
of issues so that's part of our normal

262  
00:09:36,310 --> 00:09:33,680  
medical operations and crew support

263  
00:09:39,190 --> 00:09:36,320

operations but there are some aspects of

264

00:09:45,750 --> 00:09:39,200

the the twin study that'll take in the

265

00:09:49,590 --> 00:09:47,590

james in florida today and i'm just

266

00:09:50,710 --> 00:09:49,600

curious based

267

00:09:52,310 --> 00:09:50,720

on

268

00:09:54,070 --> 00:09:52,320

everything you studied so far you know

269

00:09:55,590 --> 00:09:54,080

with respect to the intracranial

270

00:09:58,070 --> 00:09:55,600

pressure what are some of the things you

271

00:10:00,790 --> 00:09:58,080

think can be done to to mitigate that

272

00:10:03,190 --> 00:10:00,800

because you know presumably you can't

273

00:10:04,949 --> 00:10:03,200

you know change the fluids uh rising and

274

00:10:06,150 --> 00:10:04,959

making heads puffier and all that so are

275

00:10:07,910 --> 00:10:06,160

there any things

276

00:10:09,910 --> 00:10:07,920

that you've tried so far that are

277

00:10:11,110 --> 00:10:09,920

helping or what kind of ideas do you

278

00:10:13,590 --> 00:10:11,120

have about that

279

00:10:14,949 --> 00:10:13,600

i think one of the

280

00:10:16,630 --> 00:10:14,959

techniques is

281

00:10:18,949 --> 00:10:16,640

it's a body suit that applies negative

282

00:10:21,430 --> 00:10:18,959

pressure to the lower extremities that's

283

00:10:22,870 --> 00:10:21,440

probably the one approach that's the

284

00:10:25,350 --> 00:10:22,880

russians have

285

00:10:26,870 --> 00:10:25,360

used this we use this the same approach

286

00:10:29,829 --> 00:10:26,880

for

287

00:10:31,910 --> 00:10:29,839

pilots that are

288

00:10:34,550 --> 00:10:31,920

doing extreme aerial maneuvers like

289

00:10:36,550 --> 00:10:34,560

fighter pilots use these suits that they

290

00:10:38,550 --> 00:10:36,560

can apply negative pressure to kind of

291

00:10:41,110 --> 00:10:38,560

pull the fluids out of the head so

292

00:10:42,710 --> 00:10:41,120

that's probably one of the um

293

00:10:45,110 --> 00:10:42,720

most important

294

00:10:46,550 --> 00:10:45,120

approaches but obviously

295

00:10:47,509 --> 00:10:46,560

the astronauts can't be in a negative

296

00:10:49,350 --> 00:10:47,519

pressure

297

00:10:51,509 --> 00:10:49,360

suit all the time and really perform

298

00:10:52,870 --> 00:10:51,519

what they need to do in microgravity

299

00:10:54,470 --> 00:10:52,880

is that you know

300

00:10:56,470 --> 00:10:54,480

as a crew member so

301  
00:10:57,910 --> 00:10:56,480  
um we are we do need to understand the

302  
00:10:59,910 --> 00:10:57,920  
problem more it's a little bit early to

303  
00:11:01,670 --> 00:10:59,920  
have talk you know really talk about

304  
00:11:03,509 --> 00:11:01,680  
counter measures because we do need to

305  
00:11:05,030 --> 00:11:03,519  
understand we actually need to make the

306  
00:11:06,470 --> 00:11:05,040  
the scientific connection between the

307  
00:11:08,310 --> 00:11:06,480  
intracranial pressure and visual

308  
00:11:10,470 --> 00:11:08,320  
impairment that hasn't been done yet so

309  
00:11:11,509 --> 00:11:10,480  
we're working towards that understanding

310  
00:11:15,269 --> 00:11:11,519  
and

311  
00:11:17,990 --> 00:11:15,279  
mechanistically so we can

312  
00:11:22,949 --> 00:11:18,000  
so then we can engineer counter measures

313  
00:11:27,509 --> 00:11:25,750

all right let's move on a little bit

314

00:11:30,150 --> 00:11:27,519

dr costello you're responsible for the

315

00:11:31,990 --> 00:11:30,160

management of the iss program scientists

316

00:11:33,829 --> 00:11:32,000

and for providing independent scientific

317

00:11:35,430 --> 00:11:33,839

advice to the international space

318

00:11:37,910 --> 00:11:35,440

station

319

00:11:39,670 --> 00:11:37,920

program nasa research international

320

00:11:41,350 --> 00:11:39,680

space station national laboratory

321

00:11:42,710 --> 00:11:41,360

research international research

322

00:11:44,069 --> 00:11:42,720

collaboration and scientific

323

00:11:45,509 --> 00:11:44,079

communications

324

00:11:48,150 --> 00:11:45,519

why are these commercial resupply

325

00:11:50,629 --> 00:11:48,160

missions so important to enabling

326

00:11:52,230 --> 00:11:50,639

studies in microgravity

327

00:11:54,310 --> 00:11:52,240

thank you stephanie that that's a great

328

00:11:56,230 --> 00:11:54,320

question because as you know we have

329

00:11:58,550 --> 00:11:56,240

multiple providers who are able to

330

00:12:00,150 --> 00:11:58,560

launch cargo into space

331

00:12:02,629 --> 00:12:00,160

several of those are international

332

00:12:05,430 --> 00:12:02,639

partners and their vehicles that do so

333

00:12:07,670 --> 00:12:05,440

but spacex is one of our key commercial

334

00:12:09,910 --> 00:12:07,680

partners and they're key because they

335

00:12:12,629 --> 00:12:09,920

support the capability to do sortie

336

00:12:15,750 --> 00:12:12,639

missions so sortie missions are missions

337

00:12:18,150 --> 00:12:15,760

where we have a difficult biological

338

00:12:20,790 --> 00:12:18,160

constraint or a temperature constraint

339

00:12:23,030 --> 00:12:20,800

need to get that science on orbit have

340

00:12:25,430 --> 00:12:23,040

it conducted quickly and return those

341

00:12:28,629 --> 00:12:25,440

samples to the ground right now spacex

342

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

is a real only provider that can provide

343

00:12:33,190 --> 00:12:30,959

us that return capability

344

00:12:34,949 --> 00:12:33,200

that's great and and research conducted

345

00:12:36,550 --> 00:12:34,959

on the space station spans a variety of

346

00:12:38,629 --> 00:12:36,560

scientific disciplines as we've started

347

00:12:39,910 --> 00:12:38,639

to hear already can you tell us about

348

00:12:42,550 --> 00:12:39,920

some of the disciplines that are

349

00:12:45,509 --> 00:12:42,560

conducting research in space sure

350

00:12:48,629 --> 00:12:45,519

the spacex 6 mission the crs-6 mission

351  
00:12:50,710 --> 00:12:48,639  
is a great example of how it's bringing

352  
00:12:53,150 --> 00:12:50,720  
science to the space station that

353  
00:12:55,269 --> 00:12:53,160  
emphasizes its capability as a

354  
00:12:56,710 --> 00:12:55,279  
multi-disciplinary lab

355  
00:12:58,710 --> 00:12:56,720  
it's bringing

356  
00:13:02,069 --> 00:12:58,720  
physical sciences

357  
00:13:04,629 --> 00:13:02,079  
samples to orbit as we heard about with

358  
00:13:07,590 --> 00:13:04,639  
oasis for dr noel clark that's a liquid

359  
00:13:09,750 --> 00:13:07,600  
crystal experiment it's also providing

360  
00:13:12,310 --> 00:13:09,760  
biological samples that will be going to

361  
00:13:14,710 --> 00:13:12,320  
orbit and biological investigations such

362  
00:13:17,509 --> 00:13:14,720  
as our rodent research 2 mission and the

363  
00:13:19,430 --> 00:13:17,519

osteocytes we'll hear about later

364

00:13:21,670 --> 00:13:19,440

it also enables a lot of the human

365

00:13:23,750 --> 00:13:21,680

research that we do on orbit by bringing

366

00:13:25,670 --> 00:13:23,760

up supplies and equipment to enable

367

00:13:27,670 --> 00:13:25,680

those studies like the twin studies and

368

00:13:30,389 --> 00:13:27,680

the fluid shift studies

369

00:13:32,310 --> 00:13:30,399

and so we get this question quite a bit

370

00:13:34,870 --> 00:13:32,320

how does this research in space benefit

371

00:13:37,590 --> 00:13:34,880

us here on earth and that's another

372

00:13:39,750 --> 00:13:37,600

really good question because the iss is

373

00:13:42,949 --> 00:13:39,760

a very unique vehicle

374

00:13:46,069 --> 00:13:42,959

it's it's unique in the aspect that

375

00:13:47,509 --> 00:13:46,079

for nasa vehicles it really serves two

376  
00:13:50,710 --> 00:13:47,519  
purposes

377  
00:13:52,790 --> 00:13:50,720  
it has a primary goal of being able to

378  
00:13:54,150 --> 00:13:52,800  
provide

379  
00:13:55,990 --> 00:13:54,160  
knowledge for our

380  
00:13:58,389 --> 00:13:56,000  
exploration mission for our continued

381  
00:14:01,030 --> 00:13:58,399  
exploration of the solar system

382  
00:14:02,870 --> 00:14:01,040  
it also

383  
00:14:04,710 --> 00:14:02,880  
by its designation as a national

384  
00:14:06,949 --> 00:14:04,720  
laboratory has taken on the unique

385  
00:14:09,670 --> 00:14:06,959  
challenge to provide benefits for

386  
00:14:11,030 --> 00:14:09,680  
humanity so the national lab science

387  
00:14:14,629 --> 00:14:11,040  
that's selected

388  
00:14:16,710 --> 00:14:14,639

is identified particularly for how

389

00:14:19,430 --> 00:14:16,720

study in these particular fields might

390

00:14:21,430 --> 00:14:19,440

be useful to develop treatments

391

00:14:23,750 --> 00:14:21,440

materials

392

00:14:25,189 --> 00:14:23,760

industry that will benefit life here on

393

00:14:32,470 --> 00:14:25,199

earth

394

00:14:37,350 --> 00:14:35,189

okay well phillips zero g news i was

395

00:14:38,710 --> 00:14:37,360

actually just curious obviously the iss

396

00:14:39,910 --> 00:14:38,720

has now been up there a significant

397

00:14:41,829 --> 00:14:39,920

period of time

398

00:14:43,590 --> 00:14:41,839

is um are there any experiments that

399

00:14:44,790 --> 00:14:43,600

have been coming through all the way

400

00:14:47,910 --> 00:14:44,800

through from

401

00:14:50,710 --> 00:14:47,920

uh when it was first

402

00:14:53,509 --> 00:14:50,720

started off as an actual research

403

00:14:56,310 --> 00:14:53,519

uh capability or if not what is the

404

00:14:58,470 --> 00:14:56,320

longest one that's been running up there

405

00:15:00,150 --> 00:14:58,480

that's a that's a good question um

406

00:15:01,829 --> 00:15:00,160

certainly we have been conducting

407

00:15:03,590 --> 00:15:01,839

experiments onboard the space station

408

00:15:06,069 --> 00:15:03,600

since the very first expedition was

409

00:15:08,389 --> 00:15:06,079

aboard and some of those longest running

410

00:15:09,990 --> 00:15:08,399

experiments have been uh human health

411

00:15:13,110 --> 00:15:10,000

related experiments

412

00:15:14,949 --> 00:15:13,120

so in order to get the

413

00:15:17,670 --> 00:15:14,959

scientific power you need for a lot of

414

00:15:19,910 --> 00:15:17,680

these analyses you need to have a number

415

00:15:22,710 --> 00:15:19,920

of subjects go through

416

00:15:23,509 --> 00:15:22,720

the investigation and right now many of

417

00:15:26,470 --> 00:15:23,519

our

418

00:15:28,550 --> 00:15:26,480

human health related investigations

419

00:15:29,509 --> 00:15:28,560

those that are there to address the

420

00:15:32,230 --> 00:15:29,519

risks

421

00:15:34,069 --> 00:15:32,240

for human space flight in the future are

422

00:15:36,069 --> 00:15:34,079

about midway

423

00:15:38,069 --> 00:15:36,079

through their investigation some have

424

00:15:41,030 --> 00:15:38,079

completed and that takes about 10

425

00:15:43,430 --> 00:15:41,040

expeditions so again those are typically

426  
00:15:45,670 --> 00:15:43,440  
our longest running investigations we

427  
00:15:48,389 --> 00:15:45,680  
have some investigations going on now

428  
00:15:50,870 --> 00:15:48,399  
like sprint which is a cardiovascular

429  
00:15:52,790 --> 00:15:50,880  
investigation that has had several

430  
00:16:00,550 --> 00:15:52,800  
subjects over the course of time and

431  
00:16:05,030 --> 00:16:02,790  
hi my name is jessica from the national

432  
00:16:06,790 --> 00:16:05,040  
nasa social

433  
00:16:08,710 --> 00:16:06,800  
since the space shuttle program has been

434  
00:16:10,069 --> 00:16:08,720  
retired and we've been using you know

435  
00:16:12,310 --> 00:16:10,079  
different different varieties of

436  
00:16:14,710 --> 00:16:12,320  
vehicles to get up there are we getting

437  
00:16:17,670 --> 00:16:14,720  
the same amount of payloads as we were

438  
00:16:19,590 --> 00:16:17,680

before or more

439

00:16:21,350 --> 00:16:19,600

um also a good question actually right

440

00:16:23,110 --> 00:16:21,360

now we're getting many more payloads

441

00:16:26,470 --> 00:16:23,120

than we have in the past and that's

442

00:16:28,949 --> 00:16:26,480

primarily from the fact that

443

00:16:31,590 --> 00:16:28,959

after the space station

444

00:16:33,910 --> 00:16:31,600

was completed the assembly was completed

445

00:16:35,829 --> 00:16:33,920

we were able to dedicate the the mission

446

00:16:37,990 --> 00:16:35,839

of our crew on board to performing

447

00:16:41,269 --> 00:16:38,000

science so the amount of crew time

448

00:16:43,829 --> 00:16:41,279

available has gone up significantly

449

00:16:46,470 --> 00:16:43,839

and enabled us to do more science on

450

00:16:48,790 --> 00:16:46,480

board compared to a shuttle mission

451  
00:16:50,870 --> 00:16:48,800  
which of course may have gone as long as

452  
00:16:52,230 --> 00:16:50,880  
17 days but now we're in orbit

453  
00:16:54,790 --> 00:16:52,240  
continuously

454  
00:16:57,590 --> 00:16:54,800  
and about how many hours a week is that

455  
00:17:00,710 --> 00:16:57,600  
that works out to about 35 hours a week

456  
00:17:02,790 --> 00:17:00,720  
of pure utilization time of course the

457  
00:17:04,789 --> 00:17:02,800  
time the crew spends exercising and so

458  
00:17:06,870 --> 00:17:04,799  
forth isn't counted into that but it

459  
00:17:10,630 --> 00:17:06,880  
does go into the data collection for a

460  
00:17:15,429 --> 00:17:12,470  
so we also have with us

461  
00:17:17,429 --> 00:17:15,439  
dr mike roberts who is here from

462  
00:17:19,510 --> 00:17:17,439  
cases the center for the advancement of

463  
00:17:21,829 --> 00:17:19,520

science and space can you tell us a

464

00:17:23,270 --> 00:17:21,839

little bit about how cases operates as a

465

00:17:25,270 --> 00:17:23,280

national laboratory

466

00:17:28,069 --> 00:17:25,280

thanks stephanie yes i'd like to so

467

00:17:30,310 --> 00:17:28,079

cases is a is a new player to this game

468

00:17:32,789 --> 00:17:30,320

cases is the center for the advancement

469

00:17:35,270 --> 00:17:32,799

of science and space as stephanie said

470

00:17:37,350 --> 00:17:35,280

we are a 501c3 that means we're a

471

00:17:39,990 --> 00:17:37,360

non-profit company that operates through

472

00:17:41,029 --> 00:17:40,000

a cooperative agreement with nasa

473

00:17:42,789 --> 00:17:41,039

we've been operating through that

474

00:17:44,390 --> 00:17:42,799

cooperative agreement going on almost

475

00:17:46,390 --> 00:17:44,400

four years now we're in our third year

476

00:17:48,150 --> 00:17:46,400

of flight operations and

477

00:17:51,029 --> 00:17:48,160

we call each of our years of flight

478

00:17:53,350 --> 00:17:51,039

operations advancing research knowledge

479

00:17:54,870 --> 00:17:53,360

arc 3 is our current

480

00:17:57,750 --> 00:17:54,880

current operation

481

00:17:59,430 --> 00:17:57,760

and our mission is to support research

482

00:18:01,909 --> 00:17:59,440

and technology development on the

483

00:18:04,310 --> 00:18:01,919

international space station national lab

484

00:18:06,950 --> 00:18:04,320

and provide that capability to

485

00:18:09,750 --> 00:18:06,960

new to space investigators and enable

486

00:18:11,510 --> 00:18:09,760

investigations from academic sectors as

487

00:18:13,909 --> 00:18:11,520

nasa continues to do

488

00:18:16,470 --> 00:18:13,919

in addition to open up new pathways for

489

00:18:17,750 --> 00:18:16,480

exploration art research and technology

490

00:18:19,909 --> 00:18:17,760

development of interest to the

491

00:18:21,350 --> 00:18:19,919

commercial sector and other government

492

00:18:22,390 --> 00:18:21,360

agencies and by other government

493

00:18:24,549 --> 00:18:22,400

agencies

494

00:18:26,070 --> 00:18:24,559

we mean comp we mean research

495

00:18:27,669 --> 00:18:26,080

institutions represented by the

496

00:18:29,750 --> 00:18:27,679

government who have interest in

497

00:18:31,510 --> 00:18:29,760

utilizing the unique environment of the

498

00:18:33,110 --> 00:18:31,520

space station one of those

499

00:18:34,390 --> 00:18:33,120

investigations that will be flying on

500

00:18:36,230 --> 00:18:34,400

this particular mission and you'll be

501  
00:18:38,070 --> 00:18:36,240  
hearing more about in a minute is an

502  
00:18:40,150 --> 00:18:38,080  
investigation sponsored by the national

503  
00:18:42,710 --> 00:18:40,160  
institutes of health that will be flying

504  
00:18:45,029 --> 00:18:42,720  
to station the distinction between what

505  
00:18:46,950 --> 00:18:45,039  
cases is doing and the market that we

506  
00:18:47,750 --> 00:18:46,960  
are growing and what nasa continues to

507  
00:18:49,029 --> 00:18:47,760  
do

508  
00:18:50,870 --> 00:18:49,039  
is that all of the research and

509  
00:18:54,230 --> 00:18:50,880  
technology development that case is

510  
00:18:56,390 --> 00:18:54,240  
sponsored has direct earth benefit so we

511  
00:18:59,590 --> 00:18:56,400  
seek to enable access to the unique

512  
00:19:02,950 --> 00:18:59,600  
environment of space to enable companies

513  
00:19:05,350 --> 00:19:02,960

academic academic academicians and

514

00:19:08,230 --> 00:19:05,360

those at other government agencies to

515

00:19:11,830 --> 00:19:08,240

utilize the unique environment of space

516

00:19:14,070 --> 00:19:11,840

to benefit us here on earth

517

00:19:16,070 --> 00:19:14,080

so if there's a scientist listening this

518

00:19:17,590 --> 00:19:16,080

listening and and wanting to know how

519

00:19:20,150 --> 00:19:17,600

they can conduct their

520

00:19:21,590 --> 00:19:20,160

research in space how would they go

521

00:19:23,669 --> 00:19:21,600

about doing that

522

00:19:25,590 --> 00:19:23,679

i think stephanie there are a variety of

523

00:19:28,070 --> 00:19:25,600

ways to interact with cases first and

524

00:19:32,270 --> 00:19:28,080

foremost is to contact us directly

525

00:19:36,310 --> 00:19:34,230

[www.isshyphencasis.org](http://www.isshyphencasis.org) or just google

526

00:19:37,830 --> 00:19:36,320

cases and center for its sign

527

00:19:39,029 --> 00:19:37,840

advancement of science in space and

528

00:19:41,110 --> 00:19:39,039

you'll find us

529

00:19:43,270 --> 00:19:41,120

so we support investigations through a

530

00:19:45,270 --> 00:19:43,280

variety of means one pathway are through

531

00:19:47,510 --> 00:19:45,280

solicited investigations

532

00:19:50,230 --> 00:19:47,520

those are formal requests for proposals

533

00:19:52,710 --> 00:19:50,240

where we define an area of research that

534

00:19:54,390 --> 00:19:52,720

we believe can benefit from exposure to

535

00:19:56,230 --> 00:19:54,400

microgravity or the radiation

536

00:19:58,310 --> 00:19:56,240

environment outside of station

537

00:19:59,590 --> 00:19:58,320

and we will fund those investigations to

538

00:20:01,430 --> 00:19:59,600

go to station

539

00:20:02,950 --> 00:20:01,440

the more important pathway for the new

540

00:20:04,549 --> 00:20:02,960

to space investigators and for

541

00:20:07,190 --> 00:20:04,559

commercial investigators is an

542

00:20:09,909 --> 00:20:07,200

unsolicited pathway and that's where at

543

00:20:12,630 --> 00:20:09,919

any time of the day or night 365 days a

544

00:20:14,549 --> 00:20:12,640

year you can contact cases with an idea

545

00:20:16,230 --> 00:20:14,559

where you believe that you can utilize

546

00:20:18,230 --> 00:20:16,240

the international space station national

547

00:20:20,310 --> 00:20:18,240

lab to benefit your research and

548

00:20:22,470 --> 00:20:20,320

technology development goals and in

549

00:20:24,549 --> 00:20:22,480

those types of solicit those unsolicited

550

00:20:26,470 --> 00:20:24,559

proposals we can work with you to

551

00:20:28,870 --> 00:20:26,480

develop not only the the type of

552

00:20:30,789 --> 00:20:28,880

research that can be supported we can

553

00:20:32,470 --> 00:20:30,799

put you in contact with implementation

554

00:20:34,789 --> 00:20:32,480

implementation partners to help you

555

00:20:36,950 --> 00:20:34,799

develop your payload so that you can

556

00:20:38,950 --> 00:20:36,960

maximize your science return on board

557

00:20:40,230 --> 00:20:38,960

the international space station

558

00:20:41,750 --> 00:20:40,240

and you also work with a number of

559

00:20:44,390 --> 00:20:41,760

student groups right

560

00:20:46,390 --> 00:20:44,400

that's also true everything that we do

561

00:20:49,990 --> 00:20:46,400

from a commercial or other government

562

00:20:51,750 --> 00:20:50,000

agency or academic sector has a stem

563

00:20:53,350 --> 00:20:51,760

wrapper around it stem as everyone is

564

00:20:55,110 --> 00:20:53,360

familiar with science technology

565

00:20:56,630 --> 00:20:55,120

engineering and mathematics

566

00:20:59,270 --> 00:20:56,640

in addition to the each of the

567

00:21:01,350 --> 00:20:59,280

individual pi directed payloads we also

568

00:21:03,510 --> 00:21:01,360

continue to support in partnership with

569

00:21:05,590 --> 00:21:03,520

our implementation partners and other

570

00:21:07,750 --> 00:21:05,600

government agencies payloads that are

571

00:21:10,470 --> 00:21:07,760

directed directly towards

572

00:21:11,510 --> 00:21:10,480

education enhancement so for students

573

00:21:13,270 --> 00:21:11,520

out there there are variety of

574

00:21:14,950 --> 00:21:13,280

opportunities that we have available

575

00:21:18,149 --> 00:21:14,960

each year through the national design

576  
00:21:20,149 --> 00:21:18,159  
challenge through other means where

577  
00:21:21,990 --> 00:21:20,159  
students in high schools and even

578  
00:21:24,230 --> 00:21:22,000  
younger k-12

579  
00:21:25,590 --> 00:21:24,240  
can promote and propose science

580  
00:21:27,990 --> 00:21:25,600  
experiments that can reach the

581  
00:21:29,430 --> 00:21:28,000  
international space station

582  
00:21:31,990 --> 00:21:29,440  
that's great do we have any questions

583  
00:21:34,310 --> 00:21:32,000  
from those in the room

584  
00:21:35,510 --> 00:21:34,320  
yes gina with nasa social and i was

585  
00:21:38,470 --> 00:21:35,520  
wondering if you could give me an

586  
00:21:39,669 --> 00:21:38,480  
example of some successful scientific

587  
00:21:41,350 --> 00:21:39,679  
research that

588  
00:21:43,510 --> 00:21:41,360

you know cases has been involved with

589

00:21:44,390 --> 00:21:43,520

that has benefited from the microgravity

590

00:21:45,990 --> 00:21:44,400

environment

591

00:21:47,909 --> 00:21:46,000

thank you yeah so on this particular

592

00:21:49,830 --> 00:21:47,919

investigation we're actually sponsoring

593

00:21:51,190 --> 00:21:49,840

two payloads that are returning to space

594

00:21:52,230 --> 00:21:51,200

one of them is a rodent research

595

00:21:53,830 --> 00:21:52,240

experiment

596

00:21:55,190 --> 00:21:53,840

um i believe that at the beginning of

597

00:21:57,110 --> 00:21:55,200

the conversation marshall mentioned the

598

00:21:59,110 --> 00:21:57,120

rodent research one experiment which

599

00:22:01,110 --> 00:21:59,120

flew on space x4

600

00:22:02,950 --> 00:22:01,120

we on that same investigation for rodent

601  
00:22:04,950 --> 00:22:02,960  
research one sponsored a commercial

602  
00:22:07,430 --> 00:22:04,960  
investigation from novartis institute's

603  
00:22:09,350 --> 00:22:07,440  
biomedical research they are now flying

604  
00:22:10,870 --> 00:22:09,360  
a second rodent research mission on

605  
00:22:12,470 --> 00:22:10,880  
spacex6

606  
00:22:14,630 --> 00:22:12,480  
so in the course of two missions they've

607  
00:22:15,510 --> 00:22:14,640  
been able to be a repeat customer to fly

608  
00:22:17,430 --> 00:22:15,520  
that

609  
00:22:19,029 --> 00:22:17,440  
in this particular investigation they're

610  
00:22:21,909 --> 00:22:19,039  
going to be leveraging upon some of the

611  
00:22:25,430 --> 00:22:21,919  
same data that the twin study is seeking

612  
00:22:28,149 --> 00:22:25,440  
to develop from the crew exploration of

613  
00:22:29,909 --> 00:22:28,159

life in space for length of a year the

614

00:22:31,270 --> 00:22:29,919

mice aren't going to stay up there for a

615

00:22:33,270 --> 00:22:31,280

year but the mice are going to be able

616

00:22:34,950 --> 00:22:33,280

to experience microgravity for longer

617

00:22:36,789 --> 00:22:34,960

than 45 days in this particular

618

00:22:39,190 --> 00:22:36,799

experiment which represents a

619

00:22:41,750 --> 00:22:39,200

significant portion of their lifespan

620

00:22:43,750 --> 00:22:41,760

we also have an investigation from merck

621

00:22:45,909 --> 00:22:43,760

pharmaceutical merck is flying their

622

00:22:47,909 --> 00:22:45,919

second experiment on a protein crystal

623

00:22:50,149 --> 00:22:47,919

growth experiment

624

00:22:52,470 --> 00:22:50,159

with cases and they are seeking to

625

00:22:54,070 --> 00:22:52,480

exploit the microgravity environment in

626  
00:22:55,110 --> 00:22:54,080  
ways that you'll hear more about in just

627  
00:22:57,110 --> 00:22:55,120  
a minute

628  
00:22:59,110 --> 00:22:57,120  
for the absence of buoyancy driven

629  
00:23:01,270 --> 00:22:59,120  
convection in that environment so as

630  
00:23:03,110 --> 00:23:01,280  
many of you may be familiar protein

631  
00:23:05,510 --> 00:23:03,120  
crystal growth was a very avid area of

632  
00:23:07,909 --> 00:23:05,520  
research during the shuttle program and

633  
00:23:09,830 --> 00:23:07,919  
the capabilities for continuing protein

634  
00:23:11,750 --> 00:23:09,840  
crystal growth experiments have expanded

635  
00:23:13,750 --> 00:23:11,760  
quite dramatically because of

636  
00:23:15,669 --> 00:23:13,760  
improvements in the hardware and the

637  
00:23:17,029 --> 00:23:15,679  
length of time that protein crystals can

638  
00:23:18,070 --> 00:23:17,039

be formed in the microgravity

639

00:23:19,990 --> 00:23:18,080

environment

640

00:23:22,070 --> 00:23:20,000

we're also sponsoring an investigation

641

00:23:24,230 --> 00:23:22,080

from a new to space company an

642

00:23:26,630 --> 00:23:24,240

entrepreneur startup company called ras

643

00:23:28,070 --> 00:23:26,640

labs they're interested in using the

644

00:23:30,470 --> 00:23:28,080

external environment of the

645

00:23:32,310 --> 00:23:30,480

international space station to determine

646

00:23:33,590 --> 00:23:32,320

the stability the resistance to

647

00:23:35,350 --> 00:23:33,600

degradation

648

00:23:38,630 --> 00:23:35,360

of an elastomer that they're going to be

649

00:23:40,470 --> 00:23:38,640

using in developing robotic systems

650

00:23:41,990 --> 00:23:40,480

and we'll hear more about both of those

651  
00:23:43,590 --> 00:23:42,000  
in the next panel

652  
00:23:50,470 --> 00:23:43,600  
following this one i think there was

653  
00:23:55,269 --> 00:23:52,549  
how have some young adults have you

654  
00:23:58,070 --> 00:23:55,279  
mentioned uh stem students involve

655  
00:23:59,190 --> 00:23:58,080  
themselves in cases

656  
00:24:01,350 --> 00:23:59,200  
very good question so there are a

657  
00:24:02,470 --> 00:24:01,360  
variety of of on-ramps to that we

658  
00:24:04,549 --> 00:24:02,480  
sponsor

659  
00:24:06,789 --> 00:24:04,559  
through our stem partners

660  
00:24:08,710 --> 00:24:06,799  
part of the national design challenge

661  
00:24:10,789 --> 00:24:08,720  
so what we've been doing today are

662  
00:24:12,789 --> 00:24:10,799  
pathfinder programs with schools in

663  
00:24:15,830 --> 00:24:12,799

certain areas colorado

664

00:24:16,950 --> 00:24:15,840  
massachusetts and texas to date

665

00:24:18,549 --> 00:24:16,960  
and what we offer there are

666

00:24:20,070 --> 00:24:18,559  
opportunities access to the

667

00:24:22,149 --> 00:24:20,080  
international space station through one

668

00:24:24,870 --> 00:24:22,159  
of our partners one of our partners in

669

00:24:26,390 --> 00:24:24,880  
those investigations is nanoracks as

670

00:24:27,430 --> 00:24:26,400  
many of your familiar nanoracks has

671

00:24:30,310 --> 00:24:27,440  
developed

672

00:24:33,110 --> 00:24:30,320  
a plug-and-play platform with an

673

00:24:35,430 --> 00:24:33,120  
identical form factor so it enables all

674

00:24:37,909 --> 00:24:35,440  
of the external parameters that are

675

00:24:39,990 --> 00:24:37,919  
required for building a payload to not

676  
00:24:41,830 --> 00:24:40,000  
be of concern to the payload developer

677  
00:24:43,990 --> 00:24:41,840  
or the the principal investigator who's

678  
00:24:45,350 --> 00:24:44,000  
developing an experiment therefore the

679  
00:24:47,029 --> 00:24:45,360  
students and their teachers and their

680  
00:24:48,710 --> 00:24:47,039  
mentors can focus on what type of

681  
00:24:53,269 --> 00:24:48,720  
science they would like to do inside of

682  
00:24:59,510 --> 00:24:56,549  
mark watch historical imagery canada

683  
00:25:02,070 --> 00:24:59,520  
could you tell me mankind has benefited

684  
00:25:05,269 --> 00:25:02,080  
so many ways

685  
00:25:07,990 --> 00:25:05,279  
in terms of what the iss has as has

686  
00:25:10,630 --> 00:25:08,000  
given back to mankind already in looking

687  
00:25:14,390 --> 00:25:10,640  
forward looking forward to orion and

688  
00:25:16,950 --> 00:25:14,400

beyond could you tell me what role iss

689

00:25:20,549 --> 00:25:16,960

will play in

690

00:25:24,950 --> 00:25:22,470

i could but it's a little outside of our

691

00:25:26,710 --> 00:25:24,960

focus area with cases we're focused

692

00:25:28,710 --> 00:25:26,720

solely on use of the international space

693

00:25:31,110 --> 00:25:28,720

station national lab for earth benefit

694

00:25:33,750 --> 00:25:31,120

as i mentioned so obviously there are

695

00:25:35,590 --> 00:25:33,760

lots of areas of dual use technology as

696

00:25:37,750 --> 00:25:35,600

as marshall mentioned

697

00:25:39,430 --> 00:25:37,760

where the types of investigations that

698

00:25:41,750 --> 00:25:39,440

we are interested in sponsoring that

699

00:25:43,430 --> 00:25:41,760

enable investigation of disease

700

00:25:45,350 --> 00:25:43,440

development the onset of progression of

701  
00:25:47,190 --> 00:25:45,360  
human disease here on earth are

702  
00:25:48,950 --> 00:25:47,200  
identical to the concerns that are

703  
00:25:50,549 --> 00:25:48,960  
experienced by nasa human research

704  
00:25:53,029 --> 00:25:50,559  
program and seeking to go beyond earth

705  
00:25:54,310 --> 00:25:53,039  
or low earth orbit and yeah dr

706  
00:25:56,470 --> 00:25:54,320  
porterfield you can weigh in a little

707  
00:25:58,710 --> 00:25:56,480  
bit yeah i'd be happy to address that

708  
00:26:00,789 --> 00:25:58,720  
the science that that nasa itself is

709  
00:26:02,870 --> 00:26:00,799  
sponsoring is really focused on using

710  
00:26:06,789 --> 00:26:02,880  
the iss as a laboratory

711  
00:26:08,950 --> 00:26:06,799  
um we we follow our marching orders from

712  
00:26:11,269 --> 00:26:08,960  
congress and uh the national academy of

713  
00:26:13,750 --> 00:26:11,279

sciences through a national research

714

00:26:15,990 --> 00:26:13,760

council decadal survey which basically

715

00:26:18,310 --> 00:26:16,000

is a inventory of the science that needs

716

00:26:19,909 --> 00:26:18,320

to be accomplished so we are focused on

717

00:26:21,750 --> 00:26:19,919

using the international space station to

718

00:26:24,470 --> 00:26:21,760

develop the science that's needed to

719

00:26:27,510 --> 00:26:24,480

advance human exploration out beyond low

720

00:26:29,590 --> 00:26:27,520

earth orbit that includes the human

721

00:26:31,029 --> 00:26:29,600

system in the biomedical operations

722

00:26:32,630 --> 00:26:31,039

biomedical research in the human

723

00:26:34,789 --> 00:26:32,640

research program but also in the

724

00:26:37,430 --> 00:26:34,799

physical sciences program developing new

725

00:26:39,669 --> 00:26:37,440

materials and capabilities like advanced

726  
00:26:43,269 --> 00:26:39,679  
cryogenic storage which could improve

727  
00:26:47,990 --> 00:26:45,750  
store propellants for long duration

728  
00:26:50,310 --> 00:26:48,000  
missions

729  
00:26:51,990 --> 00:26:50,320  
to for mars mission or an asteroid

730  
00:26:54,230 --> 00:26:52,000  
retrieval mission so yes we're very

731  
00:26:55,510 --> 00:26:54,240  
focused on that in terms of what we're

732  
00:26:58,070 --> 00:26:55,520  
doing from

733  
00:27:00,230 --> 00:26:58,080  
the nasa side and the space life and

734  
00:27:01,990 --> 00:27:00,240  
physical sciences research program

735  
00:27:04,710 --> 00:27:02,000  
and technology demonstrations as well

736  
00:27:07,110 --> 00:27:04,720  
you may have seen the video this earlier

737  
00:27:08,549 --> 00:27:07,120  
this week of the first 3d printed parts

738  
00:27:10,950 --> 00:27:08,559

that were returned from the space

739

00:27:12,870 --> 00:27:10,960

station and those will be tested against

740

00:27:14,870 --> 00:27:12,880

an identical set of parts that were on

741

00:27:15,750 --> 00:27:14,880

the ground to see what the differences

742

00:27:17,909 --> 00:27:15,760

are

743

00:27:20,070 --> 00:27:17,919

question here yes

744

00:27:21,909 --> 00:27:20,080

christian kisky with nasa social so

745

00:27:24,070 --> 00:27:21,919

presumably there are a lot more

746

00:27:25,190 --> 00:27:24,080

organizations and

747

00:27:27,190 --> 00:27:25,200

groups that

748

00:27:29,029 --> 00:27:27,200

want to do science on the iss then you

749

00:27:31,190 --> 00:27:29,039

have the capability of doing the science

750

00:27:33,110 --> 00:27:31,200

on the iss how what are the criteria

751  
00:27:34,549 --> 00:27:33,120  
that you use to decide which

752  
00:27:35,830 --> 00:27:34,559  
experiments get

753  
00:27:37,990 --> 00:27:35,840  
done

754  
00:27:40,389 --> 00:27:38,000  
that's an excellent question so one of

755  
00:27:41,510 --> 00:27:40,399  
the ways that nasa works with cases

756  
00:27:43,269 --> 00:27:41,520  
through the cooperative agreement to

757  
00:27:45,510 --> 00:27:43,279  
sort of prime that pump is

758  
00:27:47,029 --> 00:27:45,520  
nasa has provided to cases half of the

759  
00:27:48,549 --> 00:27:47,039  
upmass that's going to the international

760  
00:27:50,149 --> 00:27:48,559  
space station national lab on the

761  
00:27:52,389 --> 00:27:50,159  
operating segment so

762  
00:27:55,029 --> 00:27:52,399  
we have a considerably

763  
00:27:56,710 --> 00:27:55,039

great bandwidth in order to to support

764

00:27:59,029 --> 00:27:56,720

experiments going to station we also

765

00:28:01,110 --> 00:27:59,039

have access to half of the crew time

766

00:28:03,590 --> 00:28:01,120

that's going to be devoted to science

767

00:28:04,870 --> 00:28:03,600

research on board station we have now

768

00:28:06,549 --> 00:28:04,880

already reached a point where we're

769

00:28:08,710 --> 00:28:06,559

starting to fill those pathways up

770

00:28:10,870 --> 00:28:08,720

because there is significant commercial

771

00:28:12,950 --> 00:28:10,880

interest as well as building interest

772

00:28:15,029 --> 00:28:12,960

from other government agencies that have

773

00:28:16,710 --> 00:28:15,039

worked with nasa previously to utilize

774

00:28:18,870 --> 00:28:16,720

that the international space station as

775

00:28:21,190 --> 00:28:18,880

a unique environment so the way that

776

00:28:23,909 --> 00:28:21,200

cases prioritizes the research that's

777

00:28:26,149 --> 00:28:23,919

selected is based on a defined review

778

00:28:27,590 --> 00:28:26,159

process that the entire process is

779

00:28:30,149 --> 00:28:27,600

transparent it's available on our

780

00:28:32,070 --> 00:28:30,159

website but each of the investigations

781

00:28:33,909 --> 00:28:32,080

that we support whether they're

782

00:28:36,310 --> 00:28:33,919

unsolicited or through the solicited

783

00:28:38,470 --> 00:28:36,320

pathway have to pass through a formal

784

00:28:40,950 --> 00:28:38,480

review process that includes both an

785

00:28:43,350 --> 00:28:40,960

operational feasibility review

786

00:28:45,510 --> 00:28:43,360

as well as a technical review based on

787

00:28:48,149 --> 00:28:45,520

scientific merit and for that scientific

788

00:28:49,830 --> 00:28:48,159

merit review we like nasa utilize

789

00:28:51,750 --> 00:28:49,840

external panels of subject matter

790

00:28:55,430 --> 00:28:51,760

experts in that area

791

00:28:57,590 --> 00:28:55,440

since one of our goals at cases is to

792

00:28:59,510 --> 00:28:57,600

increase the return on investment that

793

00:29:02,149 --> 00:28:59,520

we as u.s taxpayers have made in the

794

00:29:03,830 --> 00:29:02,159

station we also have an economic review

795

00:29:04,630 --> 00:29:03,840

component that proposals have to go

796

00:29:06,630 --> 00:29:04,640

through

797

00:29:08,789 --> 00:29:06,640

and that can be

798

00:29:10,389 --> 00:29:08,799

used as a metric both for tangible

799

00:29:11,750 --> 00:29:10,399

return on investment where there's a

800

00:29:13,830 --> 00:29:11,760

product

801  
00:29:15,909 --> 00:29:13,840  
or an improvement in a level of

802  
00:29:18,549 --> 00:29:15,919  
technology that can be returned it can

803  
00:29:20,389 --> 00:29:18,559  
also include intangible benefit where

804  
00:29:22,870 --> 00:29:20,399  
there is significant potential for

805  
00:29:24,789 --> 00:29:22,880  
discovery even at a fundamental level

806  
00:29:26,870 --> 00:29:24,799  
that can lead to additional discoveries

807  
00:29:28,710 --> 00:29:26,880  
later on and all of those review

808  
00:29:31,669 --> 00:29:28,720  
criteria are viewed at through the lens

809  
00:29:33,110 --> 00:29:31,679  
again of having earth benefit so as

810  
00:29:35,430 --> 00:29:33,120  
marshall

811  
00:29:37,669 --> 00:29:35,440  
pointed out nasa continues to fund

812  
00:29:40,149 --> 00:29:37,679  
fundamental investigation in space life

813  
00:29:42,950 --> 00:29:40,159

and physical sciences they also continue

814

00:29:45,350 --> 00:29:42,960

to support exploration related research

815

00:29:47,110 --> 00:29:45,360

our research portfolio at cases again is

816

00:29:49,430 --> 00:29:47,120

focused entirely on research and

817

00:29:54,950 --> 00:29:49,440

technology development that can benefit

818

00:30:00,549 --> 00:29:57,750

hi uh enzo vito with nasa social and

819

00:30:02,310 --> 00:30:00,559

embry riddle prescott um

820

00:30:04,710 --> 00:30:02,320

orbital sciences is the other uh

821

00:30:06,630 --> 00:30:04,720

commercial resupply contractor uh are

822

00:30:08,789 --> 00:30:06,640

there differences between the orbital

823

00:30:12,789 --> 00:30:08,799

science vehicle and the spacex vehicle

824

00:30:15,510 --> 00:30:12,799

that can better suit cases payloads

825

00:30:17,430 --> 00:30:15,520

well yeah i can answer briefly and then

826

00:30:19,269 --> 00:30:17,440

and can jump in the primary one is

827

00:30:21,990 --> 00:30:19,279

science return a lot of the

828

00:30:23,990 --> 00:30:22,000

investigations that cases has supported

829

00:30:26,149 --> 00:30:24,000

we support both physical sciences and

830

00:30:27,909 --> 00:30:26,159

life sciences experiments and from the

831

00:30:29,350 --> 00:30:27,919

commercial sector and many of the other

832

00:30:31,190 --> 00:30:29,360

government agency sectors there's a

833

00:30:32,549 --> 00:30:31,200

premium on return

834

00:30:34,149 --> 00:30:32,559

of the payload to you and the only

835

00:30:36,870 --> 00:30:34,159

vehicle that can currently do that is

836

00:30:39,269 --> 00:30:36,880

the spacex vehicle so for vehicles that

837

00:30:41,669 --> 00:30:39,279

have needs for sample return in addition

838

00:30:43,750 --> 00:30:41,679

to data that's our ride up and our ride

839

00:30:45,350 --> 00:30:43,760

down orbital offers some unique

840

00:30:47,110 --> 00:30:45,360

capabilities though in that there's the

841

00:30:49,350 --> 00:30:47,120

trunk that's available for outside

842

00:30:51,430 --> 00:30:49,360

investigations and there are i think

843

00:30:53,190 --> 00:30:51,440

some features coming up on the when

844

00:30:54,630 --> 00:30:53,200

orbital returns to flight that will be a

845

00:30:58,789 --> 00:30:54,640

significant advantage to some of our

846

00:31:02,230 --> 00:31:00,710

that that's a good point mike i think

847

00:31:05,269 --> 00:31:02,240

the other thing to point out between the

848

00:31:07,750 --> 00:31:05,279

two commercial providers is uh the the

849

00:31:09,430 --> 00:31:07,760

spacex system the dragon capsule has

850

00:31:10,389 --> 00:31:09,440

developed an environmental control

851  
00:31:12,710 --> 00:31:10,399  
system

852  
00:31:15,509 --> 00:31:12,720  
so that's what enables our capability to

853  
00:31:17,190 --> 00:31:15,519  
fly live samples to space particularly

854  
00:31:20,230 --> 00:31:17,200  
rodents

855  
00:31:22,789 --> 00:31:20,240  
and then orbital itself has a large

856  
00:31:24,710 --> 00:31:22,799  
cargo capacity so some of our

857  
00:31:26,149 --> 00:31:24,720  
particularly heavy payloads fit well

858  
00:31:29,750 --> 00:31:26,159  
into the orbital

859  
00:31:29,760 --> 00:31:35,590  
was there another question on the back

860  
00:31:40,549 --> 00:31:38,630  
hi i'm morgan turner with nasa social

861  
00:31:42,070 --> 00:31:40,559  
a lot of the experiments that we've been

862  
00:31:43,990 --> 00:31:42,080  
discussing

863  
00:31:45,990 --> 00:31:44,000

touch on human physiology and pathology

864

00:31:48,710 --> 00:31:46,000

but i was wondering whether or not any

865

00:31:50,789 --> 00:31:48,720

of the iss experiments focus on

866

00:31:52,870 --> 00:31:50,799

climate change or the sustainability of

867

00:31:56,630 --> 00:31:52,880

earth's resources in regards to the

868

00:32:00,470 --> 00:31:58,630

uh from cases perspective we don't

869

00:32:03,350 --> 00:32:00,480

currently have any on this next spacex

870

00:32:04,950 --> 00:32:03,360

mission but we have supported

871

00:32:06,950 --> 00:32:04,960

use of the international space station

872

00:32:09,190 --> 00:32:06,960

as a remote sensing platform

873

00:32:11,350 --> 00:32:09,200

so we have supported investigations that

874

00:32:13,669 --> 00:32:11,360

use data from the hico sensor for

875

00:32:15,190 --> 00:32:13,679

example as well as other imaging

876

00:32:17,110 --> 00:32:15,200

capabilities where the international

877

00:32:19,350 --> 00:32:17,120

space station can essentially be used as

878

00:32:21,110 --> 00:32:19,360

a satellite bus that's looking back at

879

00:32:23,269 --> 00:32:21,120

the earth from different vantage points

880

00:32:25,190 --> 00:32:23,279

every day so on this current mission

881

00:32:28,070 --> 00:32:25,200

though we don't have anything that's of

882

00:32:29,590 --> 00:32:28,080

a remote sensing capability but we have

883

00:32:31,029 --> 00:32:29,600

in the past and we have some other

884

00:32:35,269 --> 00:32:31,039

projects that are in development that

885

00:32:39,110 --> 00:32:37,509

and the fourth spacex

886

00:32:41,750 --> 00:32:39,120

commercial resupply services mission

887

00:32:44,710 --> 00:32:41,760

delivered the iss rapid scat payload

888

00:32:46,710 --> 00:32:44,720

which is a remote earth sensing

889

00:32:48,870 --> 00:32:46,720

investigation as well

890

00:32:50,870 --> 00:32:48,880

let's move on we have dr clark here to

891

00:32:53,350 --> 00:32:50,880

talk to us about his investigation

892

00:32:55,590 --> 00:32:53,360

called oasis he's from the university of

893

00:32:57,830 --> 00:32:55,600

colorado boulder your study is looking

894

00:33:01,190 --> 00:32:57,840

at how liquid crystals

895

00:33:02,950 --> 00:33:01,200

such as those in display screens

896

00:33:03,909 --> 00:33:02,960

which probably most people are watching

897

00:33:05,750 --> 00:33:03,919

us on

898

00:33:07,430 --> 00:33:05,760

behaving microgravity can you tell us a

899

00:33:09,110 --> 00:33:07,440

little bit about liquid crystals and why

900

00:33:12,389 --> 00:33:09,120

microgravity is a good place to study

901  
00:33:14,950 --> 00:33:12,399  
them sure stephanie thanks um

902  
00:33:18,789 --> 00:33:16,470  
our project

903  
00:33:23,269 --> 00:33:21,269  
a collaboration between our group and in

904  
00:33:24,389 --> 00:33:23,279  
boulder and

905  
00:33:27,509 --> 00:33:24,399  
grew group at the university of

906  
00:33:29,190 --> 00:33:27,519  
magdeburg in germany and

907  
00:33:35,509 --> 00:33:29,200  
a group

908  
00:33:40,310 --> 00:33:37,669  
so

909  
00:33:41,190 --> 00:33:40,320  
liquid crystals are

910  
00:33:50,830 --> 00:33:41,200  
a

911  
00:33:52,710 --> 00:33:50,840  
in solids

912  
00:33:56,470 --> 00:33:52,720  
so

913  
00:33:58,310 --> 00:33:56,480

in these displays for example

914

00:34:00,470 --> 00:33:58,320

solids have a

915

00:34:03,990 --> 00:34:00,480

optical property called birefringence

916

00:34:08,069 --> 00:34:06,230

in solids it's kind of a fixed quantity

917

00:34:10,710 --> 00:34:08,079

in in lewis crystals since they're

918

00:34:11,589 --> 00:34:10,720

liquids you can manipulate it

919

00:34:13,589 --> 00:34:11,599

and

920

00:34:15,109 --> 00:34:13,599

being able to manipulate it enables you

921

00:34:19,510 --> 00:34:15,119

to make a

922

00:34:22,790 --> 00:34:19,520

so when i was starting out in the

923

00:34:25,669 --> 00:34:22,800

crystal business uh

924

00:34:27,270 --> 00:34:25,679

one of the holy grails was to make to

925

00:34:28,790 --> 00:34:27,280

make displays

926  
00:34:30,389 --> 00:34:28,800  
uh

927  
00:34:33,030 --> 00:34:30,399  
and

928  
00:34:35,190 --> 00:34:33,040  
over that time the the field

929  
00:34:37,510 --> 00:34:35,200  
managed to

930  
00:34:38,470 --> 00:34:37,520  
achieve this

931  
00:34:41,030 --> 00:34:38,480  
with

932  
00:34:43,190 --> 00:34:41,040  
of course a lot of

933  
00:34:45,990 --> 00:34:43,200  
technology development and development

934  
00:34:46,790 --> 00:34:46,000  
of electronics

935  
00:34:49,669 --> 00:34:46,800  
but

936  
00:34:51,430 --> 00:34:49,679  
another part of this is a real

937  
00:34:55,030 --> 00:34:51,440  
uh

938  
00:34:59,589 --> 00:34:55,040

sort of blossoming of basic science of

939

00:35:00,470 --> 00:34:59,599

of lewis crystals really understanding

940

00:35:02,870 --> 00:35:00,480

how

941

00:35:04,150 --> 00:35:02,880

this combination of fluid fluids and

942

00:35:06,230 --> 00:35:04,160

solids

943

00:35:07,430 --> 00:35:06,240

actually works

944

00:35:11,270 --> 00:35:07,440

uh

945

00:35:14,069 --> 00:35:11,280

so oasis is is an experiment in

946

00:35:16,950 --> 00:35:14,079

sort of this spirit

947

00:35:18,230 --> 00:35:16,960

understanding basic liquor crystal

948

00:35:19,750 --> 00:35:18,240

physics

949

00:35:21,109 --> 00:35:19,760

uh and

950

00:35:23,510 --> 00:35:21,119

uh

951  
00:35:25,589 --> 00:35:23,520  
using microgravity

952  
00:35:28,150 --> 00:35:25,599  
using the the sort of the unique

953  
00:35:28,950 --> 00:35:28,160  
properties of microgravity to

954  
00:35:31,190 --> 00:35:28,960  
uh

955  
00:35:34,150 --> 00:35:31,200  
you know to do experiments that were are

956  
00:35:36,550 --> 00:35:34,160  
otherwise uh not possible

957  
00:35:40,710 --> 00:35:38,230  
so uh

958  
00:35:42,230 --> 00:35:40,720  
i can see i have a couple slides here if

959  
00:35:43,910 --> 00:35:42,240  
i could

960  
00:35:46,390 --> 00:35:43,920  
you want the slide or the video uh i

961  
00:35:49,510 --> 00:35:46,400  
think the slide

962  
00:35:51,109 --> 00:35:49,520  
okay so uh

963  
00:35:54,069 --> 00:35:51,119

what we're going to be doing is making

964

00:35:56,790 --> 00:35:54,079

bubbles in space so you can think of

965

00:35:57,910 --> 00:35:56,800

you can think of soap bubbles so

966

00:36:01,349 --> 00:35:57,920

uh

967

00:36:03,910 --> 00:36:01,359

the drawing on the top is

968

00:36:05,589 --> 00:36:03,920

a cross-section of a soap bubble

969

00:36:07,670 --> 00:36:05,599

on a frame

970

00:36:09,430 --> 00:36:07,680

you know soap is a mixture a soap bubble

971

00:36:11,589 --> 00:36:09,440

is a mixture of

972

00:36:15,430 --> 00:36:11,599

soap and water so

973

00:36:20,230 --> 00:36:17,430

makes a thin film the water's on the

974

00:36:23,030 --> 00:36:20,240

inside the soap is on the surface making

975

00:36:26,630 --> 00:36:25,190

now if you make a soap bubble you you

976  
00:36:28,790 --> 00:36:26,640  
know that

977  
00:36:30,710 --> 00:36:28,800  
they have these very nice colors

978  
00:36:32,390 --> 00:36:30,720  
and the colors are coming

979  
00:36:36,390 --> 00:36:32,400  
from the fact that

980  
00:36:40,470 --> 00:36:39,349  
so the water flows in back and forth

981  
00:36:43,270 --> 00:36:40,480  
inside

982  
00:36:46,390 --> 00:36:43,280  
the the soap film and makes it thicker

983  
00:36:49,829 --> 00:36:46,400  
some places thinner and others

984  
00:36:52,870 --> 00:36:49,839  
and so that's shown on this uh

985  
00:36:54,390 --> 00:36:52,880  
in in the top drawing

986  
00:36:56,870 --> 00:36:54,400  
so

987  
00:36:59,510 --> 00:36:56,880  
the bottom drawing shows uh

988  
00:37:02,630 --> 00:36:59,520

a similar bubble that you would make out

989

00:37:07,270 --> 00:37:02,640

of a smectic liquid crystal so in oasis

990

00:37:09,750 --> 00:37:07,280

the word the letter s means smectic so

991

00:37:12,470 --> 00:37:09,760

on the lower film

992

00:37:14,710 --> 00:37:12,480

the thickness is

993

00:37:17,270 --> 00:37:14,720

always a number of

994

00:37:18,710 --> 00:37:17,280

molecular layers thick

995

00:37:21,750 --> 00:37:18,720

so

996

00:37:23,829 --> 00:37:21,760

typically in the space experiment

997

00:37:27,589 --> 00:37:23,839

the bubbles we're going to be making

998

00:37:30,550 --> 00:37:27,599

will be two molecular layers thick

999

00:37:32,790 --> 00:37:30,560

so that corresponds to  $n$  equals two in

1000

00:37:34,870 --> 00:37:32,800

that drawing

1001  
00:37:36,870 --> 00:37:34,880  
so that's kind of the solid part of the

1002  
00:37:38,390 --> 00:37:36,880  
liquid crystal in this case it wants to

1003  
00:37:40,069 --> 00:37:38,400  
be in layers

1004  
00:37:41,190 --> 00:37:40,079  
but these layers are two dimensional

1005  
00:37:43,990 --> 00:37:41,200  
liquids

1006  
00:37:47,750 --> 00:37:44,000  
they flow just like

1007  
00:37:52,069 --> 00:37:49,510  
so if you make a bubble then you can

1008  
00:37:54,069 --> 00:37:52,079  
make it two layers thick but some places

1009  
00:37:56,710 --> 00:37:54,079  
it may have a different thickness

1010  
00:37:59,589 --> 00:37:56,720  
some places it may be five layers thick

1011  
00:38:03,109 --> 00:37:59,599  
so these thicker places show up as

1012  
00:38:04,870 --> 00:38:03,119  
circular disks as they look like islands

1013  
00:38:08,230 --> 00:38:04,880

moving on the bubble and i'll show you a

1014

00:38:12,790 --> 00:38:09,910

in a minute

1015

00:38:17,109 --> 00:38:15,109

oasis is

1016

00:38:21,109 --> 00:38:17,119

an experiment where we make

1017

00:38:26,870 --> 00:38:23,750

quant films quantized in thickness

1018

00:38:28,069 --> 00:38:26,880

and then look at the physics of

1019

00:38:30,470 --> 00:38:28,079

of

1020

00:38:33,589 --> 00:38:30,480

thicker parts islands on

1021

00:38:35,990 --> 00:38:33,599

on the surface of the bubble

1022

00:38:38,950 --> 00:38:36,000

now you may be familiar with the uh

1023

00:38:41,270 --> 00:38:38,960

the videos of uh

1024

00:38:43,030 --> 00:38:41,280

the astronauts playing with water in

1025

00:38:46,150 --> 00:38:43,040

space they're

1026  
00:38:47,750 --> 00:38:46,160  
really fantastic

1027  
00:38:49,349 --> 00:38:47,760  
and you know they just

1028  
00:38:50,550 --> 00:38:49,359  
show you

1029  
00:38:53,270 --> 00:38:50,560  
a the

1030  
00:38:55,430 --> 00:38:53,280  
you know how different for a fluid

1031  
00:38:56,230 --> 00:38:55,440  
microgravity can be

1032  
00:39:01,750 --> 00:38:56,240  
than

1033  
00:39:03,109 --> 00:39:01,760  
you know in in our experiments we have

1034  
00:39:04,310 --> 00:39:03,119  
the same

1035  
00:39:07,109 --> 00:39:04,320  
you know

1036  
00:39:08,870 --> 00:39:07,119  
kind of with the the space station opens

1037  
00:39:10,790 --> 00:39:08,880  
the same kind of

1038  
00:39:12,550 --> 00:39:10,800

possibilities it

1039

00:39:15,829 --> 00:39:12,560

yet

1040

00:39:17,190 --> 00:39:15,839

just enables a whole different class of

1041

00:39:19,430 --> 00:39:17,200

of uh

1042

00:39:23,589 --> 00:39:19,440

of experiments

1043

00:39:28,390 --> 00:39:25,750

one of our bubbles so this is a bubble

1044

00:39:32,710 --> 00:39:31,270

15 millimeters in diameter

1045

00:39:34,710 --> 00:39:32,720

this is actually

1046

00:39:37,510 --> 00:39:34,720

a video taken in cleveland that's in

1047

00:39:40,150 --> 00:39:37,520

technology in the prototype you know in

1048

00:39:43,430 --> 00:39:40,160

the experimental hardware

1049

00:39:45,349 --> 00:39:43,440

at glenn nasa research

1050

00:39:49,750 --> 00:39:45,359

so you see the

1051

00:39:53,910 --> 00:39:51,670

six nanometer thick

1052

00:39:56,710 --> 00:39:53,920

liquid films two molecular layers thick

1053

00:39:59,349 --> 00:39:56,720

and then the little bright discs are the

1054

00:40:00,150 --> 00:39:59,359

islands these are the the thicker layers

1055

00:40:02,470 --> 00:40:00,160

so

1056

00:40:05,190 --> 00:40:02,480

we circulated the bubble with air which

1057

00:40:08,150 --> 00:40:05,200

is one of the experiments and we created

1058

00:40:10,630 --> 00:40:08,160

emulsion of an emulsion of of islands

1059

00:40:11,910 --> 00:40:10,640

and one of the experiments is to

1060

00:40:15,270 --> 00:40:11,920

see how

1061

00:40:19,109 --> 00:40:15,280

this emulsion evol evolves over time now

1062

00:40:27,030 --> 00:40:19,119

you can see right now that

1063

00:40:30,950 --> 00:40:28,950

so in this video the bottom of the

1064

00:40:32,390 --> 00:40:30,960

bubble is actually the top of the

1065

00:40:33,510 --> 00:40:32,400

display

1066

00:40:34,470 --> 00:40:33,520

okay

1067

00:40:36,950 --> 00:40:34,480

so

1068

00:40:38,950 --> 00:40:36,960

and you can see in in the image

1069

00:40:41,990 --> 00:40:38,960

that right at the top there are these

1070

00:40:43,990 --> 00:40:42,000

thicker regions which are colored

1071

00:40:46,790 --> 00:40:44,000

so they have many many

1072

00:40:49,510 --> 00:40:46,800

uh spectic layers

1073

00:40:53,589 --> 00:40:49,520

okay so now we circulate the bubble

1074

00:40:57,910 --> 00:40:55,589

once we stop then you can immediately

1075

00:41:00,309 --> 00:40:57,920

see that the colored regions the thicker

1076  
00:41:02,309 --> 00:41:00,319  
regions start moving toward the top so

1077  
00:41:04,870 --> 00:41:02,319  
they're sedimenting to the bottom of the

1078  
00:41:07,510 --> 00:41:04,880  
bubble so

1079  
00:41:09,750 --> 00:41:07,520  
we need the space station to

1080  
00:41:11,750 --> 00:41:09,760  
eliminate this kind of

1081  
00:41:13,750 --> 00:41:11,760  
sedimentation

1082  
00:41:15,990 --> 00:41:13,760  
another important class of experiments

1083  
00:41:17,190 --> 00:41:16,000  
are called

1084  
00:41:19,190 --> 00:41:17,200  
are

1085  
00:41:21,829 --> 00:41:19,200  
exploring the thermal capillary thermal

1086  
00:41:23,829 --> 00:41:21,839  
capillarity so this is we know that

1087  
00:41:26,470 --> 00:41:23,839  
there are

1088  
00:41:29,109 --> 00:41:26,480

strong effects on fluids fluids from

1089

00:41:34,309 --> 00:41:29,119

from buoyancy that is gravity coupling

1090

00:41:40,870 --> 00:41:35,270

but

1091

00:41:43,430 --> 00:41:40,880

flow so if you have a fluid with that's

1092

00:41:45,190 --> 00:41:43,440

warm in some places and cooler in others

1093

00:41:46,829 --> 00:41:45,200

there's an inherent tendency for the

1094

00:41:49,829 --> 00:41:46,839

fluid to

1095

00:41:51,270 --> 00:41:49,839

move which buoyancy which gravity

1096

00:41:55,510 --> 00:41:51,280

effects

1097

00:41:58,309 --> 00:41:55,520

strongly complicate the study of so

1098

00:42:01,270 --> 00:41:58,319

one class of experiments is to apply

1099

00:42:03,829 --> 00:42:01,280

temperature gradients to these bubbles

1100

00:42:07,510 --> 00:42:03,839

and watch the corresponding flow you try

1101  
00:42:08,470 --> 00:42:07,520  
to do this kind of experiment on earth

1102  
00:42:10,470 --> 00:42:08,480  
the

1103  
00:42:11,670 --> 00:42:10,480  
gravity driven convection

1104  
00:42:16,309 --> 00:42:11,680  
totally

1105  
00:42:18,470 --> 00:42:16,319  
so we have quite a variety of different

1106  
00:42:19,750 --> 00:42:18,480  
uh experiments directed toward

1107  
00:42:21,910 --> 00:42:19,760  
understanding

1108  
00:42:22,950 --> 00:42:21,920  
the the basic science of this kind of

1109  
00:42:25,190 --> 00:42:22,960  
system

1110  
00:42:28,150 --> 00:42:25,200  
a question here

1111  
00:42:29,510 --> 00:42:28,160  
ah christian kisky nasa social

1112  
00:42:31,750 --> 00:42:29,520  
with this research are you testing

1113  
00:42:34,550 --> 00:42:31,760

specific hypotheses or are you just

1114

00:42:36,230 --> 00:42:34,560

doing are you looking at it and and just

1115

00:42:39,190 --> 00:42:36,240

seeing what happens well it's a

1116

00:42:40,630 --> 00:42:39,200

combination of the two i mean um

1117

00:42:43,430 --> 00:42:40,640

since we've never done you know we've

1118

00:42:45,190 --> 00:42:43,440

never made this kind of you know system

1119

00:42:46,790 --> 00:42:45,200

i mean

1120

00:42:48,630 --> 00:42:46,800

we're not even sure lego crystals have

1121

00:42:50,069 --> 00:42:48,640

ever ever been you know experimented

1122

00:42:51,910 --> 00:42:50,079

with in space

1123

00:42:53,349 --> 00:42:51,920

but

1124

00:42:54,069 --> 00:42:53,359

uh

1125

00:42:56,950 --> 00:42:54,079

so

1126

00:42:59,190 --> 00:42:56,960

part of it will just be

1127

00:43:01,990 --> 00:42:59,200

doing you know it was set sort of

1128

00:43:03,910 --> 00:43:02,000

we sort of scripted the first 15 plays

1129

00:43:05,030 --> 00:43:03,920

if you will

1130

00:43:07,190 --> 00:43:05,040

you know we're going to do certain

1131

00:43:10,510 --> 00:43:07,200

things and watch what happens

1132

00:43:13,270 --> 00:43:10,520

uh but then for example in the case of a

1133

00:43:14,630 --> 00:43:13,280

thermocapillarity there are you know

1134

00:43:16,470 --> 00:43:14,640

there are

1135

00:43:19,109 --> 00:43:16,480

theoretical predictions of what should

1136

00:43:19,829 --> 00:43:19,119

happen and you know we'll do experiments

1137

00:43:31,510 --> 00:43:19,839

to

1138

00:43:34,870 --> 00:43:31,520

could you tell me

1139

00:43:36,630 --> 00:43:34,880

are there currently lcd screens in use

1140

00:43:37,510 --> 00:43:36,640

in the iiss

1141

00:43:38,550 --> 00:43:37,520

and

1142

00:43:46,950 --> 00:43:38,560

has

1143

00:43:50,390 --> 00:43:46,960

acted on them adversely thus far

1144

00:43:52,790 --> 00:43:50,400

i don't i think there are numerous lego

1145

00:43:54,870 --> 00:43:52,800

crystal displays on the iss

1146

00:43:57,670 --> 00:43:54,880

um and

1147

00:43:59,750 --> 00:43:57,680

i don't think microgravity has been uh a

1148

00:44:02,230 --> 00:43:59,760

problem for that technology for the

1149

00:44:03,510 --> 00:44:02,240

living crystal technology the the

1150

00:44:07,910 --> 00:44:03,520

they're

1151

00:44:09,910 --> 00:44:07,920

the lc the crystal is in a gap in a very

1152

00:44:12,390 --> 00:44:09,920

narrow gap between

1153

00:44:15,829 --> 00:44:12,400

between solid plates and

1154

00:44:16,870 --> 00:44:15,839

and it completely fills the space so

1155

00:44:19,270 --> 00:44:16,880

and the

1156

00:44:21,349 --> 00:44:19,280

you know the

1157

00:44:23,910 --> 00:44:21,359

the voltage-induced changes that make

1158

00:44:23,920 --> 00:44:28,069

you know

1159

00:44:31,670 --> 00:44:29,670

well you could ask is it a problem on

1160

00:44:33,750 --> 00:44:31,680

earth because you know but they they

1161

00:44:35,750 --> 00:44:33,760

have very little density difference and

1162

00:44:37,750 --> 00:44:35,760

so they don't seem to be it doesn't seem

1163

00:44:43,349 --> 00:44:37,760

to be a problem

1164

00:44:46,470 --> 00:44:45,030

ken kramer america's space universe

1165

00:44:48,069 --> 00:44:46,480

today can you talk a little bit about

1166

00:44:50,150 --> 00:44:48,079

how these experiments are going to be

1167

00:44:51,589 --> 00:44:50,160

done are they are they uh done remotely

1168

00:44:54,230 --> 00:44:51,599

from the ground are the are the

1169

00:44:56,470 --> 00:44:54,240

astronauts uh intervening are they are

1170

00:44:58,390 --> 00:44:56,480

they running the experiment and are you

1171

00:44:59,910 --> 00:44:58,400

getting the data back in real time or is

1172

00:45:05,589 --> 00:44:59,920

it coming back at the end of the mission

1173

00:45:09,589 --> 00:45:07,589

so the

1174

00:45:12,230 --> 00:45:09,599

like the experiment i showed on tape for

1175

00:45:14,630 --> 00:45:12,240

example watching the bubble and then

1176

00:45:16,710 --> 00:45:14,640

turning on an air jet and turning and

1177

00:45:18,870 --> 00:45:16,720

watching what happens and then deciding

1178

00:45:22,390 --> 00:45:18,880

what to do next that will all be done

1179

00:45:24,950 --> 00:45:23,750

so the

1180

00:45:30,309 --> 00:45:24,960

this

1181

00:45:34,390 --> 00:45:33,430

video imaging hardware and recording

1182

00:45:35,829 --> 00:45:34,400

uh

1183

00:45:36,630 --> 00:45:35,839

and then the

1184

00:45:40,309 --> 00:45:36,640

the

1185

00:45:41,910 --> 00:45:40,319

you have to inflate a bubble and you're

1186

00:45:43,190 --> 00:45:41,920

we're making we're creating the bubbles

1187

00:45:44,069 --> 00:45:43,200

in space

1188

00:45:45,670 --> 00:45:44,079

um

1189

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

so that will also be done remotely from

1190

00:45:50,069 --> 00:45:47,839

the ground

1191

00:45:51,750 --> 00:45:50,079

the bubble and its immediate

1192

00:45:54,230 --> 00:45:51,760

hardware are

1193

00:45:58,390 --> 00:45:54,240

contained in sort of small

1194

00:46:00,550 --> 00:45:58,400

sealed chambers about that size

1195

00:46:02,390 --> 00:46:00,560

so these will be exchanged

1196

00:46:04,710 --> 00:46:02,400

installed in

1197

00:46:05,750 --> 00:46:04,720

and there are four different uh

1198

00:46:07,349 --> 00:46:05,760

separate

1199

00:46:08,150 --> 00:46:07,359

samples to be looked at so four

1200

00:46:10,069 --> 00:46:08,160

different

1201

00:46:12,069 --> 00:46:10,079

of these chambers so these will be

1202

00:46:14,710 --> 00:46:12,079

exchanged by the astronauts but that

1203

00:46:16,470 --> 00:46:14,720

will be their only

1204

00:46:18,630 --> 00:46:16,480

i guess i think that's their only

1205

00:46:21,430 --> 00:46:18,640

planned

1206

00:46:25,990 --> 00:46:23,270

then the image that you saw on the

1207

00:46:27,670 --> 00:46:26,000

screen that will be relayed down in real

1208

00:46:29,030 --> 00:46:27,680

time

1209

00:46:31,829 --> 00:46:29,040

but

1210

00:46:32,950 --> 00:46:31,839

you can see that it's

1211

00:46:35,670 --> 00:46:32,960

you know the

1212

00:46:36,870 --> 00:46:35,680

the video quality is not that great so

1213

00:46:39,430 --> 00:46:36,880

but the

1214

00:46:40,950 --> 00:46:39,440

the these images will also be recorded

1215

00:46:43,349 --> 00:46:40,960

on hard drives

1216

00:46:46,069 --> 00:46:43,359

on the experiment and then

1217

00:46:47,670 --> 00:46:46,079

they'll be returned on spacex with the

1218

00:46:49,510 --> 00:46:47,680

you know with the return flight so

1219

00:46:51,270 --> 00:46:49,520

that's also an element

1220

00:46:53,670 --> 00:46:51,280

in this experiment

1221

00:46:55,270 --> 00:46:53,680

be a lot a lot of video data how often

1222

00:46:56,710 --> 00:46:55,280

would the astronauts

1223

00:46:59,109 --> 00:46:56,720

exchange

1224

00:47:02,710 --> 00:46:59,119

maybe once every two or three weeks or

1225

00:47:07,750 --> 00:47:05,589

okay so let's move on to dr pivovich

1226  
00:47:10,710 --> 00:47:07,760  
the osteo 4 investigation can you tell

1227  
00:47:12,630 --> 00:47:10,720  
us a little bit about this investigation

1228  
00:47:16,470 --> 00:47:12,640  
so the oso4 is osteocyte

1229  
00:47:18,630 --> 00:47:16,480  
mechanotransduction and osteocytes for

1230  
00:47:20,630 --> 00:47:18,640  
the one of you they're not aware are the

1231  
00:47:22,630 --> 00:47:20,640  
most abundant cells in bone and these

1232  
00:47:24,870 --> 00:47:22,640  
are the cells deeply

1233  
00:47:26,950 --> 00:47:24,880  
embedded within the mineralized matrix

1234  
00:47:28,549 --> 00:47:26,960  
of the bone and the current view is that

1235  
00:47:30,390 --> 00:47:28,559  
these are the cells that can sense the

1236  
00:47:32,150 --> 00:47:30,400  
mechanical forces applied to the

1237  
00:47:35,109 --> 00:47:32,160  
skeleton and then transform these

1238  
00:47:37,349 --> 00:47:35,119

mechanical forces into biological signal

1239

00:47:39,910 --> 00:47:37,359

so it's it is well known that during

1240

00:47:42,710 --> 00:47:39,920

this use for example during bad rest of

1241

00:47:44,710 --> 00:47:42,720

paralysis or during reduced loading like

1242

00:47:47,109 --> 00:47:44,720

in space flight there is a

1243

00:47:49,030 --> 00:47:47,119

substantial bone loss and the current

1244

00:47:51,190 --> 00:47:49,040

view is that osteocytes are indeed the

1245

00:47:53,030 --> 00:47:51,200

cells within the bone they can sense the

1246

00:47:55,270 --> 00:47:53,040

mechanical forces that can sense the

1247

00:47:57,589 --> 00:47:55,280

load and then signal to the other bone

1248

00:47:59,349 --> 00:47:57,599

cells like osteoblasts or bone forming

1249

00:48:02,870 --> 00:47:59,359

cells or osteoclasts to either either

1250

00:48:05,589 --> 00:48:02,880

make more bone or uh reduce bone

1251

00:48:09,190 --> 00:48:05,599

so the goal of the osteo formation is

1252

00:48:11,030 --> 00:48:09,200

actually to study uh ostracize and the

1253

00:48:14,230 --> 00:48:11,040

mechanism of mechanos transduction at

1254

00:48:17,109 --> 00:48:14,240

the cellular level so we will flow uh we

1255

00:48:18,150 --> 00:48:17,119

will fly uh isolated osteocytes and this

1256

00:48:20,069 --> 00:48:18,160

will be the first time that our

1257

00:48:21,829 --> 00:48:20,079

societies are flown in space this

1258

00:48:24,309 --> 00:48:21,839

project was

1259

00:48:27,430 --> 00:48:24,319

being supported by grant from nih has

1260

00:48:29,670 --> 00:48:27,440

been supported by cases and also by nasa

1261

00:48:31,589 --> 00:48:29,680

the kennedy space center and is part of

1262

00:48:33,990 --> 00:48:31,599

the biomedical research

1263

00:48:36,470 --> 00:48:34,000

on the international space station or

1264

00:48:39,109 --> 00:48:36,480

biomed iss that is a collaborative

1265

00:48:40,150 --> 00:48:39,119

project between nih and nasa

1266

00:48:42,710 --> 00:48:40,160

and

1267

00:48:44,630 --> 00:48:42,720

our goal is to really identify at the

1268

00:48:45,990 --> 00:48:44,640

cellular level both the gene and

1269

00:48:48,309 --> 00:48:46,000

proteins that are differentially

1270

00:48:50,069 --> 00:48:48,319

regulated in microgravity in an effort

1271

00:48:52,230 --> 00:48:50,079

to then identify

1272

00:48:54,630 --> 00:48:52,240

potential nova therapeutic that can be

1273

00:48:57,910 --> 00:48:54,640

used both on earth on his space to

1274

00:49:00,790 --> 00:48:57,920

prevent bone loss or either to try to

1275

00:49:02,710 --> 00:49:00,800

rebuild bones once it's lost

1276

00:49:04,309 --> 00:49:02,720

so can you get talk a little bit more

1277

00:49:05,670 --> 00:49:04,319

about how you'll grow the cells on orbit

1278

00:49:08,549 --> 00:49:05,680

i think you brought something to show us

1279

00:49:09,829 --> 00:49:08,559

yes so uh we actually we developed the

1280

00:49:11,990 --> 00:49:09,839

cells that we've been flown in space

1281

00:49:14,710 --> 00:49:12,000

i've been developing my laboratory and

1282

00:49:16,950 --> 00:49:14,720

these are also said being isolated from

1283

00:49:19,990 --> 00:49:16,960

a long bone of genetically modified

1284

00:49:22,309 --> 00:49:20,000

animals mice we will grow cells in a

1285

00:49:25,270 --> 00:49:22,319

three-dimensional scaffold and then we

1286

00:49:27,910 --> 00:49:25,280

will house carefully in fully

1287

00:49:30,870 --> 00:49:27,920

enclosed bioreactors that are like this

1288

00:49:32,309 --> 00:49:30,880

one for who is interested and

1289

00:49:34,710 --> 00:49:32,319

three of these bioreactors will be

1290

00:49:36,549 --> 00:49:34,720

integrated into a fully automated fluid

1291

00:49:38,870 --> 00:49:36,559

pathway they will provide not only the

1292

00:49:41,270 --> 00:49:38,880

nutrients for the cells but a certain

1293

00:49:42,790 --> 00:49:41,280

time during the mission will fix and

1294

00:49:45,910 --> 00:49:42,800

preserve the cells

1295

00:49:48,150 --> 00:49:45,920

and we will have a three uh

1296

00:49:50,950 --> 00:49:48,160

pathway so for a total of nine

1297

00:49:53,270 --> 00:49:50,960

bioreactors there will be uh terminated

1298

00:49:55,829 --> 00:49:53,280

a different time uh during the flight we

1299

00:49:58,470 --> 00:49:55,839

will have astronaut re remove this

1300

00:50:00,790 --> 00:49:58,480

bioreactor after three five and seven

1301  
00:50:02,549 --> 00:50:00,800  
days of microgravity and that will be

1302  
00:50:05,109 --> 00:50:02,559  
stored at cold temperature and that will

1303  
00:50:07,349 --> 00:50:05,119  
be the sample frozen sample will will be

1304  
00:50:09,270 --> 00:50:07,359  
returned to our laboratory and then we

1305  
00:50:11,190 --> 00:50:09,280  
will set them once they return

1306  
00:50:13,990 --> 00:50:11,200  
and this was developed by calm

1307  
00:50:16,230 --> 00:50:14,000  
technology that is from

1308  
00:50:18,710 --> 00:50:16,240  
kingston ontario in collaboration with

1309  
00:50:21,270 --> 00:50:18,720  
the canadian space agency and this will

1310  
00:50:23,950 --> 00:50:21,280  
be the fourth time that the osteo is

1311  
00:50:27,829 --> 00:50:23,960  
flying in space and also actually is for

1312  
00:50:30,150 --> 00:50:27,839  
osteoporosis experiment in orbit

1313  
00:50:32,230 --> 00:50:30,160

other questions

1314

00:50:35,910 --> 00:50:32,240

sir

1315

00:50:40,549 --> 00:50:38,069

jim siegel i'm with the celebration news

1316

00:50:43,270 --> 00:50:40,559

and space flight insider i'm

1317

00:50:46,230 --> 00:50:43,280

particularly interested doctor in the

1318

00:50:49,190 --> 00:50:46,240

experiments that you described uh and my

1319

00:50:51,670 --> 00:50:49,200

understanding was that eventually

1320

00:50:54,630 --> 00:50:51,680

uh not overnight of course

1321

00:50:56,390 --> 00:50:54,640

that these experiments will benefit

1322

00:50:57,349 --> 00:50:56,400

people who may have

1323

00:51:02,470 --> 00:50:57,359

uh

1324

00:51:04,630 --> 00:51:02,480

afflictions like that and i wonder if

1325

00:51:05,510 --> 00:51:04,640

you could explain a little bit about how

1326

00:51:08,790 --> 00:51:05,520

this

1327

00:51:11,270 --> 00:51:08,800

experiment fits in with the over overall

1328

00:51:14,470 --> 00:51:11,280

goal of of helping people like that here

1329

00:51:16,309 --> 00:51:14,480

on earth what other kinds of things

1330

00:51:18,309 --> 00:51:16,319

what other kinds of experiments need to

1331

00:51:21,109 --> 00:51:18,319

be done and also

1332

00:51:23,510 --> 00:51:21,119

how specifically does the results of

1333

00:51:24,870 --> 00:51:23,520

this experiment help in furthering that

1334

00:51:26,790 --> 00:51:24,880

knowledge

1335

00:51:29,430 --> 00:51:26,800

so we are actually

1336

00:51:32,069 --> 00:51:29,440

particularly interested in osteocytes

1337

00:51:34,870 --> 00:51:32,079

and now this cells can sense unloading

1338

00:51:37,190 --> 00:51:34,880

or reduced loading so for example if you

1339

00:51:39,910 --> 00:51:37,200

are a prolonged bad rest or a paralysis

1340

00:51:41,910 --> 00:51:39,920

is know that you're losing bone rapidly

1341

00:51:43,589 --> 00:51:41,920

and we know the osteoclasts they are the

1342

00:51:44,470 --> 00:51:43,599

cells the reduced bone are the one that

1343

00:51:45,270 --> 00:51:44,480

actually

1344

00:51:47,349 --> 00:51:45,280

uh

1345

00:51:49,270 --> 00:51:47,359

destroy your bone but

1346

00:51:52,390 --> 00:51:49,280

we still don't know what are the signal

1347

00:51:54,150 --> 00:51:52,400

that go from ostracized to osteoclasts

1348

00:51:56,549 --> 00:51:54,160

and we still don't know how actually

1349

00:51:58,950 --> 00:51:56,559

osteocytes can sense there is a reduced

1350

00:52:00,790 --> 00:51:58,960

loading applied to the skeleton so our

1351  
00:52:03,030 --> 00:52:00,800  
ultimate goal is if we can understand

1352  
00:52:05,750 --> 00:52:03,040  
what are the genes and proteins they are

1353  
00:52:07,910 --> 00:52:05,760  
regulated at the ostracized by

1354  
00:52:10,390 --> 00:52:07,920  
loading or unloading we can then

1355  
00:52:12,309 --> 00:52:10,400  
envision that we can in situations like

1356  
00:52:17,670 --> 00:52:12,319  
a

1357  
00:52:19,589 --> 00:52:17,680  
trick the bone trick the osteocytes to

1358  
00:52:22,630 --> 00:52:19,599  
tell them you're still loaded while

1359  
00:52:25,910 --> 00:52:22,640  
you're not and then therefore not induce

1360  
00:52:28,390 --> 00:52:25,920  
bone loss and then is could also benefit

1361  
00:52:31,510 --> 00:52:28,400  
people affect by osteoporosis you can

1362  
00:52:33,750 --> 00:52:31,520  
try to rebuild bone but again these are

1363  
00:52:37,910 --> 00:52:33,760

quite long-term

1364

00:52:41,349 --> 00:52:38,950

is that

1365

00:52:43,910 --> 00:52:41,359

this gentleman here

1366

00:52:46,630 --> 00:52:43,920

christian kiskey with nasa social

1367

00:52:48,390 --> 00:52:46,640

all the experiments that i know of so

1368

00:52:49,670 --> 00:52:48,400

far on the astronauts of course have

1369

00:52:52,390 --> 00:52:49,680

been full grown

1370

00:52:53,589 --> 00:52:52,400

mature humans are is there any plans for

1371

00:52:55,430 --> 00:52:53,599

studying

1372

00:52:58,470 --> 00:52:55,440

immature cells obviously we're not going

1373

00:53:00,790 --> 00:52:58,480

to send children into space but

1374

00:53:03,190 --> 00:53:00,800

perhaps do some experiments on bones

1375

00:53:05,270 --> 00:53:03,200

that are still growing to to see how

1376

00:53:07,030 --> 00:53:05,280

that could compare well that's a that's

1377

00:53:08,710 --> 00:53:07,040

an excellent question of course it would

1378

00:53:11,190 --> 00:53:08,720

be very interesting to understand also

1379

00:53:13,270 --> 00:53:11,200

not just what are the mechanism of bone

1380

00:53:15,430 --> 00:53:13,280

loss but also to see bone development of

1381

00:53:18,230 --> 00:53:15,440

bone growth but that's

1382

00:53:19,750 --> 00:53:18,240

i guess will be down the line experiment

1383

00:53:21,270 --> 00:53:19,760

down the line

1384

00:53:22,710 --> 00:53:21,280

there have been some investigations in

1385

00:53:25,270 --> 00:53:22,720

the past looking at

1386

00:53:27,910 --> 00:53:25,280

development of mice pups and they they

1387

00:53:29,589 --> 00:53:27,920

do have significant changes in the

1388

00:53:30,309 --> 00:53:29,599

bone structure and also in their ability

1389

00:53:32,470 --> 00:53:30,319

to

1390

00:53:34,870 --> 00:53:32,480

sense gravity and write themselves so

1391

00:53:36,309 --> 00:53:34,880

they're severely impaired after being

1392

00:53:38,549 --> 00:53:36,319

developmentally exposed to the

1393

00:53:41,270 --> 00:53:38,559

microgravity environment

1394

00:53:43,750 --> 00:53:41,280

and actually if i can add even

1395

00:53:46,150 --> 00:53:43,760

the joint will be probably affected by

1396

00:53:48,790 --> 00:53:46,160

microgravity so not just bone but also

1397

00:53:51,030 --> 00:53:48,800

all the joint can be affected by lack of

1398

00:53:54,470 --> 00:53:51,040

exposure to gravity during during

1399

00:53:59,430 --> 00:53:56,390

question here

1400

00:54:01,510 --> 00:53:59,440

mark gotch historical imagery canada can

1401

00:54:04,790 --> 00:54:01,520

you tell me thus far

1402

00:54:07,589 --> 00:54:04,800

has human both bone growth growth of

1403

00:54:09,430 --> 00:54:07,599

human bone cells been very successful

1404

00:54:11,510 --> 00:54:09,440

here on earth

1405

00:54:13,270 --> 00:54:11,520

would you expect that the

1406

00:54:15,109 --> 00:54:13,280

the growth that you're planning to do in

1407

00:54:16,309 --> 00:54:15,119

the iss would be

1408

00:54:17,829 --> 00:54:16,319

far more

1409

00:54:20,549 --> 00:54:17,839

you know uh

1410

00:54:22,390 --> 00:54:20,559

increasingly or quicker growth than is

1411

00:54:23,430 --> 00:54:22,400

currently done on earth or is it being

1412

00:54:25,589 --> 00:54:23,440

done here

1413

00:54:27,510 --> 00:54:25,599

uh so actually we are not expecting that

1414

00:54:30,390 --> 00:54:27,520

there will be an accelerated growth of

1415

00:54:32,230 --> 00:54:30,400

bone in microgravity but we will really

1416

00:54:33,750 --> 00:54:32,240

need to use the international space

1417

00:54:37,670 --> 00:54:33,760

station to

1418

00:54:39,750 --> 00:54:37,680

to test on the in a isolated osteocytes

1419

00:54:42,069 --> 00:54:39,760

what are the effects of microgravity

1420

00:54:44,230 --> 00:54:42,079

because we do have some analog that we

1421

00:54:47,030 --> 00:54:44,240

can use in the laboratory so for example

1422

00:54:49,589 --> 00:54:47,040

nasa developed this as low rotating

1423

00:54:52,150 --> 00:54:49,599

bioreactor that can mimic microgravity

1424

00:54:54,950 --> 00:54:52,160

on on earth but for us to really

1425

00:54:56,710 --> 00:54:54,960

validate that the system that we have on

1426  
00:54:59,109 --> 00:54:56,720  
earth is really working we really need

1427  
00:55:00,950 --> 00:54:59,119  
to study all societies in microgravity

1428  
00:55:03,829 --> 00:55:00,960  
so the expectation is not that not the

1429  
00:55:06,230 --> 00:55:03,839  
cells we grow faster in microgravity but

1430  
00:55:07,990 --> 00:55:06,240  
is really to see what are the direct

1431  
00:55:10,309 --> 00:55:08,000  
effects of microgravity or reduced

1432  
00:55:12,710 --> 00:55:10,319  
loading in osteocytes and at the moment

1433  
00:55:15,829 --> 00:55:12,720  
we really don't have ideal

1434  
00:55:17,750 --> 00:55:15,839  
ground-based model and i think that

1435  
00:55:19,829 --> 00:55:17,760  
the data that we will get back from this

1436  
00:55:21,750 --> 00:55:19,839  
experiment will not just help us to

1437  
00:55:23,030 --> 00:55:21,760  
understand also sites but can be a

1438  
00:55:26,549 --> 00:55:23,040

really

1439

00:55:28,470 --> 00:55:26,559

system that we have

1440

00:55:33,109 --> 00:55:28,480

in the lab

1441

00:55:36,789 --> 00:55:35,109

yeah ken kramer universe today in uh

1442

00:55:39,670 --> 00:55:36,799

america's space and kind of a general

1443

00:55:41,430 --> 00:55:39,680

question on this bone loss uh issue i i

1444

00:55:43,349 --> 00:55:41,440

think the way the astronauts prevent

1445

00:55:45,910 --> 00:55:43,359

bone loss right now is mainly through

1446

00:55:48,069 --> 00:55:45,920

exercise is that right or is there any

1447

00:55:50,470 --> 00:55:48,079

medicines they are taking and as your

1448

00:55:51,829 --> 00:55:50,480

research hopefully going to develop some

1449

00:55:54,549 --> 00:55:51,839

pharmaceutical

1450

00:55:56,710 --> 00:55:54,559

to to minimize or prevent bone loss is

1451

00:55:57,750 --> 00:55:56,720

that part of it at all thanks

1452

00:55:59,670 --> 00:55:57,760

well i

1453

00:56:02,390 --> 00:55:59,680

you will corrupt me if i'm if i'm wrong

1454

00:56:04,069 --> 00:56:02,400

i think that some astronauts are

1455

00:56:06,710 --> 00:56:04,079

on some uh

1456

00:56:09,510 --> 00:56:06,720

osteoporosis treatment and these i think

1457

00:56:10,630 --> 00:56:09,520

they are biphosphonate if i'm not wrong

1458

00:56:13,270 --> 00:56:10,640

these are

1459

00:56:15,510 --> 00:56:13,280

drugs that they will prevent bone loss

1460

00:56:17,510 --> 00:56:15,520

and they can work but they all have side

1461

00:56:19,829 --> 00:56:17,520

effect they will work really well for

1462

00:56:21,910 --> 00:56:19,839

astronaut or when you have a bone loss

1463

00:56:25,030 --> 00:56:21,920

that you know is going to occur what we

1464

00:56:27,430 --> 00:56:25,040

are hoping also to identify is some

1465

00:56:29,829 --> 00:56:27,440

therapeutics some drug they will

1466

00:56:31,910 --> 00:56:29,839

actually help you rebuild the bones once

1467

00:56:33,990 --> 00:56:31,920

you have lost it because that's the one

1468

00:56:35,670 --> 00:56:34,000

that we are still currently we don't

1469

00:56:37,270 --> 00:56:35,680

have because these are the drugs that

1470

00:56:38,710 --> 00:56:37,280

will benefit people affected by

1471

00:56:40,950 --> 00:56:38,720

osteoporosis

1472

00:56:42,870 --> 00:56:40,960

so to go back to your question there are

1473

00:56:45,430 --> 00:56:42,880

some good treatment for prevent bone

1474

00:56:47,910 --> 00:56:45,440

loss in astronaut but i think that there

1475

00:56:49,349 --> 00:56:47,920

is a still room for more

1476

00:56:50,390 --> 00:56:49,359

that's correct and the only thing i

1477

00:56:51,670 --> 00:56:50,400

would add is that we've studied the

1478

00:56:53,990 --> 00:56:51,680

bisphosphonates but we haven't

1479

00:56:55,349 --> 00:56:54,000

incorporated it into our normal medical

1480

00:56:57,109 --> 00:56:55,359

operations

1481

00:56:58,630 --> 00:56:57,119

is in terms of a countermeasure so

1482

00:56:59,990 --> 00:56:58,640

mainly is

1483

00:57:01,430 --> 00:57:00,000

based on the

1484

00:57:02,549 --> 00:57:01,440

exercise

1485

00:57:04,710 --> 00:57:02,559

programs

1486

00:57:06,710 --> 00:57:04,720

i think i'd add to that that nutritional

1487

00:57:08,630 --> 00:57:06,720

supplements such as vitamin d are also

1488

00:57:10,150 --> 00:57:08,640

used in the astronaut program

1489

00:57:12,710 --> 00:57:10,160

and

1490

00:57:14,390 --> 00:57:12,720

the the bone loss problem in crew

1491

00:57:17,589 --> 00:57:14,400

members to some extent has been

1492

00:57:19,829 --> 00:57:17,599

ameliorated by the uh the addition of a

1493

00:57:22,789 --> 00:57:19,839

resistive exercise device on the space

1494

00:57:26,789 --> 00:57:22,799

station uh known as the a-red and so the

1495

00:57:29,510 --> 00:57:26,799

resistive exercise device

1496

00:57:31,990 --> 00:57:29,520

vitamin d and also bisphosphonates and

1497

00:57:33,990 --> 00:57:32,000

under some studies have been shown to

1498

00:57:36,630 --> 00:57:34,000

help the crew maintain their overall

1499

00:57:39,349 --> 00:57:36,640

bone density over a six-month mission we

1500

00:57:41,510 --> 00:57:39,359

don't know yet what happens in extended

1501  
00:57:43,670 --> 00:57:41,520  
missions and that's part of the one year

1502  
00:57:45,990 --> 00:57:43,680  
space flight program that we're engaging

1503  
00:57:48,150 --> 00:57:46,000  
in now to try and find out what happens

1504  
00:57:50,630 --> 00:57:48,160  
do we know do we know anything from the

1505  
00:57:53,990 --> 00:57:50,640  
russian to four russian astronauts about

1506  
00:57:56,230 --> 00:57:54,000  
their bone loss beyond six months

1507  
00:57:57,910 --> 00:57:56,240  
we do know some things about it but they

1508  
00:58:00,150 --> 00:57:57,920  
did not have the same controls that we

1509  
00:58:02,789 --> 00:58:00,160  
have on station in terms of exercise

1510  
00:58:06,230 --> 00:58:02,799  
devices dietary controls and so forth so

1511  
00:58:08,230 --> 00:58:06,240  
it's very hard to draw conclusions

1512  
00:58:10,309 --> 00:58:08,240  
again what we're looking for is how are

1513  
00:58:13,349 --> 00:58:10,319

we going to be able to maintain that

1514

00:58:16,230 --> 00:58:13,359

bone mass as we go all the way from

1515

00:58:18,549 --> 00:58:16,240

low earth orbit to maybe mars orbit and

1516

00:58:20,390 --> 00:58:18,559

to build that story we need to know what

1517

00:58:22,549 --> 00:58:20,400

kind of exercise

1518

00:58:24,630 --> 00:58:22,559

exercise devices we can take with us

1519

00:58:27,349 --> 00:58:24,640

what kind of dietary supplements whether

1520

00:58:29,349 --> 00:58:27,359

they exist or are sustained over long

1521

00:58:31,510 --> 00:58:29,359

periods of time

1522

00:58:34,630 --> 00:58:31,520

great thank you all for joining us today

1523

00:58:36,549 --> 00:58:34,640

um we will be back in about an hour at 3

1524

00:58:38,309 --> 00:58:36,559

30 pm eastern time to learn about a

1525

00:58:39,750 --> 00:58:38,319

couple more investigations that will be

1526

00:58:42,309 --> 00:58:39,760

conducted on the international space

1527

00:58:44,069 --> 00:58:42,319

station and delivered with this mission

1528

00:58:46,150 --> 00:58:44,079

with the launch tomorrow and then at 5

1529

00:58:47,910 --> 00:58:46,160

pm eastern we'll have the pre-launch

1530

00:58:49,270 --> 00:58:47,920

news conference

1531

00:58:51,030 --> 00:58:49,280

so you can follow along with our

1532

00:58:53,190 --> 00:58:51,040

researchers both

1533

00:58:55,030 --> 00:58:53,200

in orbit and these studies online at

1534

00:58:57,589 --> 00:58:55,040

nasa.gov

1535

00:59:00,390 --> 00:58:57,599

station and find all the news related to

1536

00:59:01,750 --> 00:59:00,400

the launch and the mission at nasa.gov