1
00:00:04,550 --> 00:00:03,030
welcome to destination station the iss

2
00:00:05,990 --> 00:00:04,560
science forum i'll be your host today

3
00:00:07,430 --> 00:00:06,000
dan hewitt

4
00:00:09,669 --> 00:00:07,440
when the international space station

5
00:00:11,350 --> 00:00:09,679
launched back in 1998 it launched with a

6
00:00:13,030 --> 00:00:11,360
vision to one day become a

7
00:00:15,669 --> 00:00:13,040
one-of-its-kind orbiting laboratory in

8
00:00:17,510 --> 00:00:15,679
microgravity and it's not enough to just

9
00:00:19,349 --> 00:00:17,520
do science on this laboratory you know

10
00:00:20,950 --> 00:00:19,359
you need direction you need goals you

11
00:00:23,509 --> 00:00:20,960
need something to strive towards that's

12
00:00:25,910 --> 00:00:23,519
what we're here to talk about today

13
00:00:27,990 --> 00:00:25,920

back in 2011 the national academies of

14
00:00:30,390 --> 00:00:28,000
sciences released a decadal survey

15
00:00:32,150 --> 00:00:30,400
detailing a lot of research that it was

16
00:00:34,630 --> 00:00:32,160
suggested to take place on board the

17
00:00:37,110 --> 00:00:34,640
international space station this to

18
00:00:38,950 --> 00:00:37,120
focus nasa's efforts in space and also

19
00:00:41,030 --> 00:00:38,960
the efforts of different organizations

20
00:00:43,350 --> 00:00:41,040
taking place in the unique environment

21
00:00:45,110 --> 00:00:43,360
of the international space station so

22
00:00:47,430 --> 00:00:45,120
joining us here today i have a couple of

23
00:00:49,350 --> 00:00:47,440
panelists to help guide this discussion

24
00:00:51,270 --> 00:00:49,360
take some questions and tell us where we

25
00:00:53,430 --> 00:00:51,280
are now in the state of station science

26
00:00:54,869 --> 00:00:53,440
and where we're going in the future

27
00:00:57,189 --> 00:00:54,879
so for now i'll just introduce everybody

28
00:00:59,110 --> 00:00:57,199
real quick first immediately to my right

29
00:01:00,630 --> 00:00:59,120
i have betsy cantwell who is the

30
00:01:02,229 --> 00:01:00,640
director for mission development and the

31
00:01:04,070 --> 00:01:02,239
engineering directorate at livermore

32
00:01:06,230 --> 00:01:04,080
national laboratory and is also the

33
00:01:08,070 --> 00:01:06,240
co-chair of that decadal survey which

34
00:01:09,990 --> 00:01:08,080
was titled recapturing a future for

35
00:01:11,910 --> 00:01:10,000
space exploration

36
00:01:13,750 --> 00:01:11,920
just next to her we have julie robinson

37
00:01:16,230 --> 00:01:13,760
the chief program scientist here at nasa

38
00:01:17,830 --> 00:01:16,240

for the international space station

39
00:01:19,429 --> 00:01:17,840
then we have marshall porterfield who is

40
00:01:21,510 --> 00:01:19,439
the director of space life and physical

41
00:01:23,830 --> 00:01:21,520
sciences from nasa headquarters up in

42
00:01:25,830 --> 00:01:23,840
washington dc and finally the chief

43
00:01:27,830 --> 00:01:25,840
operating officer for cases duane

44
00:01:30,550 --> 00:01:27,840
ratliff cases against the center for

45
00:01:32,149 --> 00:01:30,560
advancement of science in space

46
00:01:33,910 --> 00:01:32,159
before we get into it with our panel

47
00:01:35,749 --> 00:01:33,920
here and the people in the room though

48
00:01:36,550 --> 00:01:35,759
we actually have a special guest joining

49
00:01:38,149 --> 00:01:36,560
us

50
00:01:40,390 --> 00:01:38,159
live from the international space

51
00:01:41,590 --> 00:01:40,400
station commander of expedition 40 steve

52
00:01:43,749 --> 00:01:41,600
swanson

53
00:01:45,109 --> 00:01:43,759
steve thanks so much for joining us it's

54
00:01:47,270 --> 00:01:45,119
great to talk to somebody actually

55
00:01:49,749 --> 00:01:47,280
taking care and doing this science

56
00:01:51,109 --> 00:01:49,759
actively on a day-to-day basis i really

57
00:01:54,950 --> 00:01:51,119
appreciate you being here with us today

58
00:01:58,550 --> 00:01:56,469
i have you loud and clear and i just

59
00:02:01,190 --> 00:01:58,560
like to say to everyone hello

60
00:02:02,870 --> 00:02:01,200
and also that i'm just proud and honored

61
00:02:04,149 --> 00:02:02,880
to be part of the team that perform

62
00:02:05,670 --> 00:02:04,159
science up here on the international

63
00:02:08,229 --> 00:02:05,680

space station

64
00:02:10,790 --> 00:02:08,239
over 600 scientists contributed to that

65
00:02:12,949 --> 00:02:10,800
decadal study and i have the lucky and

66
00:02:14,470 --> 00:02:12,959
much easier job of carrying out their

67
00:02:16,470 --> 00:02:14,480
work up here

68
00:02:18,229 --> 00:02:16,480
i heard do we have some questions i'm

69
00:02:20,229 --> 00:02:18,239
ready to go whenever you are

70
00:02:21,670 --> 00:02:20,239
yep we have steve for just a couple of

71
00:02:22,869 --> 00:02:21,680
minutes so we'll go ahead and start off

72
00:02:23,990 --> 00:02:22,879
we have a couple of students here in the

73
00:02:25,589 --> 00:02:24,000
audience that will be asking you a

74
00:02:27,110 --> 00:02:25,599
question we'll go ahead and get our

75
00:02:29,030 --> 00:02:27,120
first one now

76
00:02:31,110 --> 00:02:29,040
hello my name is sarah wagner and i'm

77
00:02:33,190 --> 00:02:31,120
from eighth grader at tucson academy and

78
00:02:35,670 --> 00:02:33,200
my question is since the iss is a

79
00:02:37,190 --> 00:02:35,680
national laboratory has the science

80
00:02:42,710 --> 00:02:37,200
duties increased or decreased for

81
00:02:46,710 --> 00:02:44,949
good question gail

82
00:02:48,550 --> 00:02:46,720
i believe it's increased i don't have

83
00:02:50,070 --> 00:02:48,560
the data to back that up but all i know

84
00:02:51,750 --> 00:02:50,080
for sure is that when we're up here we

85
00:02:54,710 --> 00:02:51,760
try to get as much science as we can

86
00:02:56,390 --> 00:02:54,720
done each and every day and one of the

87
00:02:58,390 --> 00:02:56,400
advantages of being a national lab is we

88
00:03:00,550 --> 00:02:58,400

get to help other agencies and then

89
00:03:02,229 --> 00:03:00,560
government and other companies perform

90
00:03:07,430 --> 00:03:02,239
science and do research and then that in

91
00:03:12,790 --> 00:03:10,070
all right next question

92
00:03:14,070 --> 00:03:12,800
i'm obviously not the student filling in

93
00:03:16,790 --> 00:03:14,080
for her i'm the teacher i'm kathy

94
00:03:19,990 --> 00:03:16,800
ducaney sarah's teacher

95
00:03:22,790 --> 00:03:20,000
and our question is we're growing pea

96
00:03:25,110 --> 00:03:22,800
plants uh pea shoots when our cases

97
00:03:26,949 --> 00:03:25,120
experiment goes up in october

98
00:03:29,910 --> 00:03:26,959
have you or any of the other astronauts

99
00:03:32,550 --> 00:03:29,920
been asked to taste any of the plants

100
00:03:34,710 --> 00:03:32,560
grown as part of a science experiment as

101
00:03:38,229 --> 00:03:34,720
some of your duties on the station thank

102
00:03:42,630 --> 00:03:40,390
good question as far as i know the

103
00:03:44,149 --> 00:03:42,640
answer to that is no we have not been

104
00:03:45,910 --> 00:03:44,159
asked right now we're doing an

105
00:03:47,670 --> 00:03:45,920
experiment called veggie and the idea

106
00:03:50,630 --> 00:03:47,680
that is just to prove that we can grow

107
00:03:52,869 --> 00:03:50,640
edible plants in space so we're going to

108
00:03:55,190 --> 00:03:52,879
harvest those take them down back down

109
00:03:56,869 --> 00:03:55,200
to earth and then study them and

110
00:04:01,110 --> 00:03:56,879
analyze them to make sure that they are

111
00:04:01,120 --> 00:04:07,110
all right next question

112
00:04:11,429 --> 00:04:09,509
hello my name is jesse quintanilla

113
00:04:13,990 --> 00:04:11,439

i go to crystal right jesuit

114
00:04:15,670 --> 00:04:14,000
high school my question is we saw some

115
00:04:17,909 --> 00:04:15,680
really beautiful pictures of you turning

116
00:04:19,270 --> 00:04:17,919
on the veggie experiment could you tell

117
00:04:23,990 --> 00:04:19,280
us more about what the experiment is

118
00:04:26,629 --> 00:04:25,350
you betcha

119
00:04:27,670 --> 00:04:26,639
as i mentioned earlier the veggie

120
00:04:28,870 --> 00:04:27,680
experiment

121
00:04:30,950 --> 00:04:28,880
is about

122
00:04:33,110 --> 00:04:30,960
proving that we can grow edible plants

123
00:04:34,469 --> 00:04:33,120
in a microgravity environment and this

124
00:04:36,710 --> 00:04:34,479
is something that is necessary of course

125
00:04:38,150 --> 00:04:36,720
for if you want to go on even longer

126
00:04:40,870 --> 00:04:38,160
duration flights like to mars or

127
00:04:42,629 --> 00:04:40,880
somewhere else that similar to that

128
00:04:44,550 --> 00:04:42,639
and also veggie

129
00:04:46,230 --> 00:04:44,560
is a

130
00:04:48,550 --> 00:04:46,240
prototype of a

131
00:04:51,189 --> 00:04:48,560
newer model coming out in a couple years

132
00:04:52,950 --> 00:04:51,199
uh called the advanced plat plant

133
00:04:54,870 --> 00:04:52,960
habitat and that's going to even have

134
00:04:56,629 --> 00:04:54,880
more functionality more capability to

135
00:04:59,749 --> 00:04:56,639
grow plants looking forward to that one

136
00:05:04,310 --> 00:05:01,270
all right and steve i think we got one

137
00:05:08,790 --> 00:05:06,310
uh hello my name is uh juan carlos

138
00:05:10,790 --> 00:05:08,800

galendo and i go to crystal ray jesuit

139
00:05:12,469 --> 00:05:10,800
um the question i wanted to ask is uh

140
00:05:14,790 --> 00:05:12,479
what kind of fluid samples are returned

141
00:05:17,590 --> 00:05:14,800
to earth for research purposes and is

142
00:05:22,870 --> 00:05:17,600
there a sub sub zero freezer available

143
00:05:27,830 --> 00:05:25,110
yes there is a freezer we call it melfi

144
00:05:29,909 --> 00:05:27,840
which is a minus 80 uh

145
00:05:31,830 --> 00:05:29,919
lab freezer and so as you can imagine it

146
00:05:34,390 --> 00:05:31,840
goes down to minus 80 degrees which is

147
00:05:35,590 --> 00:05:34,400
uh keeps all the samples very cold and

148
00:05:36,550 --> 00:05:35,600
in a good

149
00:05:38,469 --> 00:05:36,560
state

150
00:05:41,350 --> 00:05:38,479
we put in there of course

151
00:05:43,749 --> 00:05:41,360
samples from the plants we also do

152
00:05:46,469 --> 00:05:43,759
liquid samples such as urine blood

153
00:05:48,390 --> 00:05:46,479
saliva and all that's to be brought down

154
00:05:51,110 --> 00:05:48,400
back on to earth to be studied by the

155
00:05:53,670 --> 00:05:51,120
scientists and that helps

156
00:05:55,670 --> 00:05:53,680
them determine how an organism either a

157
00:05:58,390 --> 00:05:55,680
plant or a human uh reacts to this

158
00:06:00,790 --> 00:05:59,590
okay well i think that's all the

159
00:06:03,110 --> 00:06:00,800
questions that we're going to have for

160
00:06:04,390 --> 00:06:03,120
you today swanee i really appreciate you

161
00:06:05,510 --> 00:06:04,400
checking in know you're busy i think

162
00:06:07,350 --> 00:06:05,520
you're actually getting ready to go to

163
00:06:09,510 --> 00:06:07,360

bed pretty soon so we'll let you get

164
00:06:11,270 --> 00:06:09,520
back to that in life on orbit again

165
00:06:12,629 --> 00:06:11,280
really appreciate you checking in it's

166
00:06:14,309 --> 00:06:12,639
great to talk to again somebody

167
00:06:15,909 --> 00:06:14,319
implementing the science

168
00:06:19,430 --> 00:06:15,919
in real time onboard the international

169
00:06:19,440 --> 00:06:22,710
my pleasure have a good day

170
00:06:26,710 --> 00:06:24,790
station this is houston acr thank you

171
00:06:28,469 --> 00:06:26,720
that concludes our portion of the event

172
00:06:30,550 --> 00:06:28,479
all right well with that we'll go ahead

173
00:06:31,990 --> 00:06:30,560
and jump in with some questions to the

174
00:06:34,070 --> 00:06:32,000
panel here

175
00:06:35,510 --> 00:06:34,080
i'll start off again with a couple of

176
00:06:37,189 --> 00:06:35,520
questions from me then we'll go to the

177
00:06:39,189 --> 00:06:37,199
audience give you guys a chance to ask

178
00:06:41,029 --> 00:06:39,199
them some questions we're also taking

179
00:06:43,110 --> 00:06:41,039
questions actively from social media so

180
00:06:45,990 --> 00:06:43,120
if you're following along make sure to

181
00:06:48,150 --> 00:06:46,000
use the hashtag asknasa and we'll get

182
00:06:49,350 --> 00:06:48,160
your question in real time well let's

183
00:06:51,909 --> 00:06:49,360
jump right in

184
00:06:54,230 --> 00:06:51,919
so betsy i want to start off with you

185
00:06:55,909 --> 00:06:54,240
again you were the co-chair of that team

186
00:06:57,270 --> 00:06:55,919
that wrote the decadal survey which is

187
00:06:59,110 --> 00:06:57,280
influencing a lot of the work we're

188
00:07:00,070 --> 00:06:59,120

doing now and in the very near-term

189
00:07:01,909 --> 00:07:00,080
future

190
00:07:04,629 --> 00:07:01,919
can you briefly tell us uh some of the

191
00:07:06,230 --> 00:07:04,639
key aspects to come out of that study uh

192
00:07:08,309 --> 00:07:06,240
that were the key recommendations on

193
00:07:10,790 --> 00:07:08,319
behalf of you guys so i'm gonna take

194
00:07:13,110 --> 00:07:10,800
that uh uh and and shrink it down a

195
00:07:16,230 --> 00:07:13,120
little bit it was a 400 page study

196
00:07:19,189 --> 00:07:16,240
involving hundreds of scientists looking

197
00:07:20,550 --> 00:07:19,199
broadly at what research needed to be

198
00:07:22,629 --> 00:07:20,560
done in the physical sciences and the

199
00:07:25,430 --> 00:07:22,639
life sciences to underpin the future of

200
00:07:26,950 --> 00:07:25,440
space exploration so i think what i will

201
00:07:29,110 --> 00:07:26,960
take the liberty to talk about is a

202
00:07:30,629 --> 00:07:29,120
couple of recommendations that we made

203
00:07:32,790 --> 00:07:30,639
for the use of the international space

204
00:07:35,830 --> 00:07:32,800
stations obviously a critical science

205
00:07:38,469 --> 00:07:35,840
facility to move that science agenda

206
00:07:40,230 --> 00:07:38,479
forward and those two are actually both

207
00:07:42,550 --> 00:07:40,240
in the life sciences arena we

208
00:07:45,189 --> 00:07:42,560
recommended that

209
00:07:47,029 --> 00:07:45,199
because animal studies underpin so much

210
00:07:49,990 --> 00:07:47,039
of our knowledge and understanding of

211
00:07:52,869 --> 00:07:50,000
human health terrestrially that animal

212
00:07:55,110 --> 00:07:52,879
studies be supported more strongly in

213
00:07:57,589 --> 00:07:55,120

the space station science program and

214
00:08:00,309 --> 00:07:57,599
for the same reason

215
00:08:02,869 --> 00:08:00,319
and also because microbial studies

216
00:08:04,790 --> 00:08:02,879
underpin how much we know about our

217
00:08:07,270 --> 00:08:04,800
terrestrial environment

218
00:08:10,790 --> 00:08:07,280
that microbial studies be beefed up in

219
00:08:13,749 --> 00:08:10,800
the form of of some long-term ability to

220
00:08:15,830 --> 00:08:13,759
study microbes in space on the iss

221
00:08:17,589 --> 00:08:15,840
so those were really the two key ones

222
00:08:18,469 --> 00:08:17,599
then that you wanted to touch on so

223
00:08:20,230 --> 00:08:18,479
julie

224
00:08:21,589 --> 00:08:20,240
now for you what are some of the

225
00:08:23,749 --> 00:08:21,599
experiments what are some of the steps

226
00:08:25,670 --> 00:08:23,759
that we're now taking right now and in

227
00:08:27,029 --> 00:08:25,680
the near term to meet these

228
00:08:28,469 --> 00:08:27,039
recommendations

229
00:08:30,309 --> 00:08:28,479
yeah so the one of the first things we

230
00:08:31,909 --> 00:08:30,319
did once we once nasa received the

231
00:08:33,430 --> 00:08:31,919
decadal surveys we went through all the

232
00:08:35,670 --> 00:08:33,440
recommendations and there were a large

233
00:08:37,829 --> 00:08:35,680
number we we followed their

234
00:08:39,909 --> 00:08:37,839
recommendations in some prioritization

235
00:08:41,990 --> 00:08:39,919
approaches and then we identified new

236
00:08:44,550 --> 00:08:42,000
facilities that we needed one of those

237
00:08:46,870 --> 00:08:44,560
was a facility for flying rodents for

238
00:08:48,870 --> 00:08:46,880

flying mice and eventually rats on the

239
00:08:50,630 --> 00:08:48,880
space station now we'd done that we had

240
00:08:53,030 --> 00:08:50,640
brought them to the space station before

241
00:08:54,790 --> 00:08:53,040
during assembly on shuttle flights but

242
00:08:56,870 --> 00:08:54,800
we needed to rebuild that hardware make

243
00:08:57,910 --> 00:08:56,880
some changes and especially make it able

244
00:08:59,670 --> 00:08:57,920
to allow

245
00:09:01,990 --> 00:08:59,680
the animals to be studied for a longer

246
00:09:04,310 --> 00:09:02,000
period of time not just a week or two as

247
00:09:06,310 --> 00:09:04,320
on past space shuttle missions

248
00:09:08,790 --> 00:09:06,320
you heard swanny talk about the plant

249
00:09:10,550 --> 00:09:08,800
habitats that are in development

250
00:09:11,910 --> 00:09:10,560
we did a number of

251
00:09:13,590 --> 00:09:11,920
surveys and discussions with the

252
00:09:15,590 --> 00:09:13,600
scientific community to look at the

253
00:09:17,030 --> 00:09:15,600
space station as a microbial observatory

254
00:09:19,030 --> 00:09:17,040
what are all the things we should do for

255
00:09:21,030 --> 00:09:19,040
that and then on the physical sciences

256
00:09:23,350 --> 00:09:21,040
side we really started looking at the

257
00:09:25,350 --> 00:09:23,360
whole suite of materials science work

258
00:09:26,870 --> 00:09:25,360
fluid physics and combustion and whether

259
00:09:29,190 --> 00:09:26,880
we needed certain kinds of upgrades on

260
00:09:31,190 --> 00:09:29,200
those facilities as well so all of that

261
00:09:33,030 --> 00:09:31,200
got put in place and what we're really

262
00:09:35,509 --> 00:09:33,040
seeing starting this year

263
00:09:37,430 --> 00:09:35,519

is that the those facilities are going

264
00:09:38,870 --> 00:09:37,440
to keep coming online one by one so

265
00:09:40,949 --> 00:09:38,880
veggie is sort of the first one out of

266
00:09:43,030 --> 00:09:40,959
the out of the gate but we have new cell

267
00:09:45,350 --> 00:09:43,040
culture hardware we'll have the rodent

268
00:09:46,949 --> 00:09:45,360
hardware flying in the fall and as each

269
00:09:49,110 --> 00:09:46,959
of those capabilities comes online

270
00:09:50,630 --> 00:09:49,120
they'll start being used every flight

271
00:09:51,990 --> 00:09:50,640
over and over on the space station for

272
00:09:53,110 --> 00:09:52,000
the next 10 years

273
00:09:54,389 --> 00:09:53,120
okay

274
00:09:56,150 --> 00:09:54,399
and then switching gears a little bit

275
00:09:57,670 --> 00:09:56,160
marshall over to you

276
00:09:59,430 --> 00:09:57,680
tell us a little bit about some of the

277
00:10:01,110 --> 00:09:59,440
life sciences research that we're doing

278
00:10:03,269 --> 00:10:01,120
on station and how that's going to fit

279
00:10:05,190 --> 00:10:03,279
into some of nasa's bigger goals such as

280
00:10:07,590 --> 00:10:05,200
you know going to mars and deep space

281
00:10:08,389 --> 00:10:07,600
locations

282
00:10:09,829 --> 00:10:08,399
well

283
00:10:11,590 --> 00:10:09,839
elizabeth talked about the decadal

284
00:10:13,750 --> 00:10:11,600
survey and within the decadal survey

285
00:10:15,990 --> 00:10:13,760
there are recommendations for research

286
00:10:18,790 --> 00:10:16,000
that is

287
00:10:21,190 --> 00:10:18,800
needed to further human exploration

288
00:10:22,790 --> 00:10:21,200

to do mars mission or research is

289
00:10:24,630 --> 00:10:22,800
enabled by space

290
00:10:26,150 --> 00:10:24,640
so those are the kind of two categories

291
00:10:27,910 --> 00:10:26,160
that we look at in terms of this the

292
00:10:29,030 --> 00:10:27,920
research that we're funding so if you

293
00:10:30,069 --> 00:10:29,040
look at

294
00:10:32,150 --> 00:10:30,079
the

295
00:10:33,910 --> 00:10:32,160
biomedical challenges that humans face

296
00:10:35,590 --> 00:10:33,920
in microgravity environment

297
00:10:38,069 --> 00:10:35,600
the space station right now is a perfect

298
00:10:40,230 --> 00:10:38,079
laboratory to do the long-duration types

299
00:10:43,030 --> 00:10:40,240
of studies and experiments so the

300
00:10:45,030 --> 00:10:43,040
ability to do rodent research for

301
00:10:46,389 --> 00:10:45,040
for more extended periods is really

302
00:10:49,350 --> 00:10:46,399
important

303
00:10:52,150 --> 00:10:49,360
we're also building hardware to support

304
00:10:53,990 --> 00:10:52,160
fruit fly research and fruit flies are

305
00:10:57,110 --> 00:10:54,000
an important biomedical model system

306
00:10:58,389 --> 00:10:57,120
because out of the 900 documented

307
00:11:01,910 --> 00:10:58,399
genes that are known to be associated

308
00:11:04,310 --> 00:11:01,920
with human disease about 700 of those

309
00:11:06,550 --> 00:11:04,320
are also documented in fruit flies so

310
00:11:07,990 --> 00:11:06,560
it's a really great model system you can

311
00:11:10,790 --> 00:11:08,000
grow them

312
00:11:13,030 --> 00:11:10,800
over multiple lifetimes and

313
00:11:14,630 --> 00:11:13,040

really get a lot of valuable data out of

314
00:11:15,750 --> 00:11:14,640
it and

315
00:11:17,990 --> 00:11:15,760
the other thing that we're doing in

316
00:11:20,310 --> 00:11:18,000
terms of the research that we're doing

317
00:11:22,150 --> 00:11:20,320
on stations we're trying to change the

318
00:11:23,590 --> 00:11:22,160
the model for how we do research too in

319
00:11:24,870 --> 00:11:23,600
order to get the most out of the space

320
00:11:26,949 --> 00:11:24,880
station

321
00:11:29,590 --> 00:11:26,959
the traditional model is to release an

322
00:11:31,590 --> 00:11:29,600
nra based on the decadal have

323
00:11:33,509 --> 00:11:31,600
investigators apply to that and you

324
00:11:35,670 --> 00:11:33,519
select a few of those and it takes

325
00:11:37,750 --> 00:11:35,680
literally years to or in the past it's

326
00:11:39,430 --> 00:11:37,760
taken years to fly one of those

327
00:11:41,750 --> 00:11:39,440
investigators experiments but now that

328
00:11:44,150 --> 00:11:41,760
we have on the life sciences side

329
00:11:46,310 --> 00:11:44,160
genomics and all the other

330
00:11:48,630 --> 00:11:46,320
advanced bioanalytical technologies we

331
00:11:49,750 --> 00:11:48,640
can measure so much from those samples

332
00:11:51,750 --> 00:11:49,760
what we're going to do is fly the

333
00:11:53,829 --> 00:11:51,760
experiment do all the measurements and

334
00:11:55,430 --> 00:11:53,839
then release the nra for

335
00:11:57,590 --> 00:11:55,440
potentially hundreds of investigators to

336
00:11:59,350 --> 00:11:57,600
be able to utilize space station

337
00:12:00,949 --> 00:11:59,360
science so we're really changing the

338
00:12:03,350 --> 00:12:00,959

model for how we do research is one of

339
00:12:05,269 --> 00:12:03,360
the key things we're doing okay

340
00:12:07,190 --> 00:12:05,279
and then now dwayne on to you your role

341
00:12:09,350 --> 00:12:07,200
is a little bit different from everybody

342
00:12:11,269 --> 00:12:09,360
that we've talked to so far betsy

343
00:12:13,269 --> 00:12:11,279
representing the group that

344
00:12:15,350 --> 00:12:13,279
came up with these recommendations

345
00:12:17,509 --> 00:12:15,360
julian marshall really how we make those

346
00:12:19,990 --> 00:12:17,519
recommendations happen with projects

347
00:12:22,069 --> 00:12:20,000
what exactly is kate yours and cases

348
00:12:23,670 --> 00:12:22,079
role in making this research happen

349
00:12:25,030 --> 00:12:23,680
onboard the international space station

350
00:12:27,350 --> 00:12:25,040
right well it's really interesting that

351
00:12:29,430 --> 00:12:27,360
the decadal survey was created and it

352
00:12:32,069 --> 00:12:29,440
had a targeted focus and how best can

353
00:12:34,629 --> 00:12:32,079
nasa utilize microgravity as an

354
00:12:36,629 --> 00:12:34,639
environmental platform for their mission

355
00:12:38,310 --> 00:12:36,639
focused elements with the the

356
00:12:40,230 --> 00:12:38,320
designation of the international space

357
00:12:41,670 --> 00:12:40,240
station as a national laboratory in

358
00:12:43,190 --> 00:12:41,680
essence what we've done is we've picked

359
00:12:45,509 --> 00:12:43,200
up on the opportunity to see how can

360
00:12:47,269 --> 00:12:45,519
that same environmental exposure uh

361
00:12:50,230 --> 00:12:47,279
microgravity the physics associated with

362
00:12:52,470 --> 00:12:50,240
that be used in supporting research

363
00:12:54,710 --> 00:12:52,480

initiatives that are important to to

364
00:12:56,150 --> 00:12:54,720
human health and other

365
00:12:58,870 --> 00:12:56,160
opportunities here on the ground so

366
00:13:01,030 --> 00:12:58,880
really our our difference if you will is

367
00:13:03,350 --> 00:13:01,040
that we're using the same environment

368
00:13:04,550 --> 00:13:03,360
to do the same type of research

369
00:13:06,310 --> 00:13:04,560
except the outcomes that we're looking

370
00:13:08,710 --> 00:13:06,320
for are targeted more towards how can we

371
00:13:09,590 --> 00:13:08,720
benefit mankind

372
00:13:11,269 --> 00:13:09,600
okay

373
00:13:12,949 --> 00:13:11,279
and then getting back to something you

374
00:13:14,629 --> 00:13:12,959
guys touched on a little bit earlier

375
00:13:16,389 --> 00:13:14,639
with the decadal talking about

376
00:13:17,910 --> 00:13:16,399
exploration and betsy i want to throw

377
00:13:19,670 --> 00:13:17,920
this to you first

378
00:13:21,990 --> 00:13:19,680
again the title of that decadal survey

379
00:13:23,829 --> 00:13:22,000
was recapturing a future for space

380
00:13:25,670 --> 00:13:23,839
exploration

381
00:13:27,750 --> 00:13:25,680
the stress that i want to put right now

382
00:13:30,230 --> 00:13:27,760
on that exploration word could you

383
00:13:32,069 --> 00:13:30,240
expand a little bit on the place that

384
00:13:34,550 --> 00:13:32,079
life and physical science research on

385
00:13:36,389 --> 00:13:34,560
the international space station has

386
00:13:38,629 --> 00:13:36,399
in future you know long duration

387
00:13:39,910 --> 00:13:38,639
exploration and how that research is

388
00:13:42,790 --> 00:13:39,920

supporting it

389
00:13:45,430 --> 00:13:42,800
sure so first let's just basically focus

390
00:13:46,710 --> 00:13:45,440
on what the few some of the key elements

391
00:13:48,870 --> 00:13:46,720
of the future

392
00:13:51,030 --> 00:13:48,880
of humans in space if we go beyond where

393
00:13:53,030 --> 00:13:51,040
we are now we're talking about longer

394
00:13:55,350 --> 00:13:53,040
distances away regardless of what the

395
00:13:57,189 --> 00:13:55,360
end point is longer periods of time for

396
00:13:58,790 --> 00:13:57,199
humans to be in

397
00:14:00,870 --> 00:13:58,800
the engineered environment that we

398
00:14:03,269 --> 00:14:00,880
create for them and periods of time

399
00:14:05,030 --> 00:14:03,279
potentially for humans on the surfaces

400
00:14:07,430 --> 00:14:05,040
of other bodies

401
00:14:08,870 --> 00:14:07,440
and so we focused on what are the

402
00:14:10,069 --> 00:14:08,880
critical

403
00:14:11,910 --> 00:14:10,079
uh

404
00:14:14,310 --> 00:14:11,920
fundamental studies in the physical

405
00:14:16,629 --> 00:14:14,320
sciences and in the life sciences and

406
00:14:20,069 --> 00:14:16,639
how could those fundamental studies be

407
00:14:21,829 --> 00:14:20,079
transitioned into mission design

408
00:14:24,629 --> 00:14:21,839
knowing that and what we were asked

409
00:14:26,150 --> 00:14:24,639
essentially because without those

410
00:14:27,509 --> 00:14:26,160
studies we probably won't be able to

411
00:14:30,230 --> 00:14:27,519
make i think everybody knows there are

412
00:14:32,470 --> 00:14:30,240
some pretty big grand challenges and in

413
00:14:34,790 --> 00:14:32,480

taking the next steps to get a lot

414
00:14:38,310 --> 00:14:34,800
further away with humans and we need the

415
00:14:39,829 --> 00:14:38,320
science portfolios to begin now in order

416
00:14:41,670 --> 00:14:39,839
to get there

417
00:14:43,590 --> 00:14:41,680
okay and now drawing things back in a

418
00:14:44,870 --> 00:14:43,600
little bit closer to home kind of like

419
00:14:46,150 --> 00:14:44,880
dwayne was saying where a lot of this

420
00:14:47,350 --> 00:14:46,160
research we like to say we're working

421
00:14:48,550 --> 00:14:47,360
off the earth for the earth that's

422
00:14:50,790 --> 00:14:48,560
something we've been throwing around a

423
00:14:52,069 --> 00:14:50,800
lot uh so julie

424
00:14:53,910 --> 00:14:52,079
what is some of the science that's

425
00:14:55,670 --> 00:14:53,920
having you know a real benefit down to

426
00:14:57,189 --> 00:14:55,680
life here on earth and how is that

427
00:14:58,389 --> 00:14:57,199
fitting into the direction that we're

428
00:14:59,910 --> 00:14:58,399
moving in

429
00:15:02,870 --> 00:14:59,920
one of the really exciting things that

430
00:15:05,189 --> 00:15:02,880
we see is the synergy between the basic

431
00:15:06,949 --> 00:15:05,199
research and the

432
00:15:08,069 --> 00:15:06,959
things that are applied for human health

433
00:15:09,590 --> 00:15:08,079
here on earth and things that are

434
00:15:11,509 --> 00:15:09,600
applied for astronaut health on an

435
00:15:14,550 --> 00:15:11,519
exploration mission a great example of

436
00:15:15,750 --> 00:15:14,560
that is osteoporosis research where

437
00:15:17,670 --> 00:15:15,760
you know we

438
00:15:19,189 --> 00:15:17,680

we as nasa need to make sure that

439
00:15:21,350 --> 00:15:19,199
astronauts arrive say on the surface of

440
00:15:23,350 --> 00:15:21,360
mars with healthy bones because wearing

441
00:15:24,629 --> 00:15:23,360
a multi hundred pound spacesuit and

442
00:15:26,629 --> 00:15:24,639
tripping on a rock could be life

443
00:15:28,150 --> 00:15:26,639
threatening if you have fragile bones so

444
00:15:30,150 --> 00:15:28,160
that's a huge mission risk we've got to

445
00:15:31,829 --> 00:15:30,160
address and we've been making incredible

446
00:15:34,550 --> 00:15:31,839
progress on that using research on the

447
00:15:36,870 --> 00:15:34,560
space station at the same time

448
00:15:39,110 --> 00:15:36,880
amgen in one of those earlier mouse

449
00:15:41,030 --> 00:15:39,120
flights i talked about used

450
00:15:42,230 --> 00:15:41,040
the space station to study the mechanism

451
00:15:43,910 --> 00:15:42,240
of a drug that they had under

452
00:15:45,430 --> 00:15:43,920
development we're able to test that on

453
00:15:46,949 --> 00:15:45,440
the space station help understand that

454
00:15:48,949 --> 00:15:46,959
mechanism and that drug is now on the

455
00:15:51,269 --> 00:15:48,959
market and that's helping people back

456
00:15:53,509 --> 00:15:51,279
here on earth so all of those things

457
00:15:55,829 --> 00:15:53,519
kind of combine together so as we're

458
00:15:57,350 --> 00:15:55,839
looking at our whole portfolio of human

459
00:15:59,590 --> 00:15:57,360
research especially with one year

460
00:16:01,910 --> 00:15:59,600
expeditions coming up the twin study

461
00:16:03,509 --> 00:16:01,920
between the kelly brothers and then all

462
00:16:05,509 --> 00:16:03,519
of the synergy between the new life

463
00:16:07,749 --> 00:16:05,519

sciences capabilities we're really

464
00:16:09,829 --> 00:16:07,759
seeing an opportunity for making

465
00:16:11,110 --> 00:16:09,839
biomedical advances over the next 10

466
00:16:11,990 --> 00:16:11,120
years

467
00:16:14,389 --> 00:16:12,000
okay

468
00:16:16,629 --> 00:16:14,399
and then marshall one more over to you

469
00:16:18,230 --> 00:16:16,639
and again touching on something that

470
00:16:19,990 --> 00:16:18,240
julie just said where we're able to use

471
00:16:21,430 --> 00:16:20,000
that microgravity environment to do

472
00:16:23,990 --> 00:16:21,440
something that wouldn't otherwise be

473
00:16:25,910 --> 00:16:24,000
done can you explain this a bit about

474
00:16:28,470 --> 00:16:25,920
how the space station being in that

475
00:16:30,389 --> 00:16:28,480
microgravity allows us to do research

476
00:16:31,749 --> 00:16:30,399
that we wouldn't otherwise be able to do

477
00:16:33,829 --> 00:16:31,759
here on earth can you give us a few

478
00:16:35,590 --> 00:16:33,839
examples

479
00:16:38,310 --> 00:16:35,600
so

480
00:16:39,749 --> 00:16:38,320
i think in the material science areas is

481
00:16:41,749 --> 00:16:39,759
really

482
00:16:43,350 --> 00:16:41,759
there's a lot of potential in terms of

483
00:16:45,269 --> 00:16:43,360
advancing

484
00:16:46,310 --> 00:16:45,279
that field based on the microgravity

485
00:16:47,910 --> 00:16:46,320
environment

486
00:16:49,670 --> 00:16:47,920
if you look at one of the experiments

487
00:16:52,389 --> 00:16:49,680
that was just recently conducted looking

488
00:16:54,949 --> 00:16:52,399

at complex fluids and colloids and how

489
00:16:56,790 --> 00:16:54,959
they behave in space if you look at the

490
00:16:58,470 --> 00:16:56,800
possibility of forming nanostructures

491
00:17:00,310 --> 00:16:58,480
nanomaterials

492
00:17:02,310 --> 00:17:00,320
in the microgravity environment that's

493
00:17:04,710 --> 00:17:02,320
another true possibility that may lead

494
00:17:05,909 --> 00:17:04,720
to discoveries for new

495
00:17:07,270 --> 00:17:05,919
new materials

496
00:17:09,029 --> 00:17:07,280
and the special thing about the

497
00:17:11,029 --> 00:17:09,039
microgravity environment

498
00:17:12,390 --> 00:17:11,039
in regards to that is it there's no

499
00:17:14,870 --> 00:17:12,400
sedimentation

500
00:17:17,270 --> 00:17:14,880
the influence of gravity is a race so

501
00:17:19,590 --> 00:17:17,280
structures that normally might be liable

502
00:17:21,270 --> 00:17:19,600
on the ground and influenced by shear

503
00:17:22,949 --> 00:17:21,280
and flow because of gravity on the

504
00:17:26,230 --> 00:17:22,959
ground

505
00:17:27,189 --> 00:17:26,240
don't have that limitation and that that

506
00:17:29,430 --> 00:17:27,199
also

507
00:17:32,230 --> 00:17:29,440
advances the fundamental life sciences

508
00:17:34,630 --> 00:17:32,240
looking at protein crystal growth which

509
00:17:36,630 --> 00:17:34,640
cases use looked at using that

510
00:17:38,789 --> 00:17:36,640
environment for the

511
00:17:41,510 --> 00:17:38,799
pharmaceutical industry

512
00:17:43,750 --> 00:17:41,520
we look at it more from the materials

513
00:17:45,669 --> 00:17:43,760

side but there's a lot of potential

514
00:17:47,190 --> 00:17:45,679
there we believe and that's why we're

515
00:17:49,029 --> 00:17:47,200
focusing on one of our open source

516
00:17:50,230 --> 00:17:49,039
science initiatives for the physical

517
00:17:51,830 --> 00:17:50,240
sciences site is actually called

518
00:17:52,870 --> 00:17:51,840
materials lab

519
00:17:55,350 --> 00:17:52,880
okay

520
00:17:56,630 --> 00:17:55,360
and then dwayne another one for you so

521
00:17:58,470 --> 00:17:56,640
within the past couple of years

522
00:18:01,029 --> 00:17:58,480
especially there's been a heavy emphasis

523
00:18:04,150 --> 00:18:01,039
on commercialization of space

524
00:18:05,669 --> 00:18:04,160
um and you know there could eventually

525
00:18:07,270 --> 00:18:05,679
be a space station built by a commercial

526
00:18:09,669 --> 00:18:07,280
enterprise for instance you know it's

527
00:18:11,110 --> 00:18:09,679
it's expanding wildly

528
00:18:14,070 --> 00:18:11,120
what do you see is the most what do you

529
00:18:15,830 --> 00:18:14,080
see as most promising for breakthroughs

530
00:18:17,190 --> 00:18:15,840
that might make this kind of reality

531
00:18:18,789 --> 00:18:17,200
possible this this increased

532
00:18:21,029 --> 00:18:18,799
commercialization especially through

533
00:18:22,310 --> 00:18:21,039
research right so and i think we're kind

534
00:18:25,430 --> 00:18:22,320
of hearing this in this conversation

535
00:18:27,990 --> 00:18:25,440
today and and quite frankly for us to be

536
00:18:29,750 --> 00:18:28,000
successful in demonstrating the value of

537
00:18:32,870 --> 00:18:29,760
a commercial entity wanting to to really

538
00:18:35,590 --> 00:18:32,880

kind of exploit and invest in

539
00:18:37,350 --> 00:18:35,600
use of microgravity or low earth

540
00:18:38,789 --> 00:18:37,360
environment laboratory we need to

541
00:18:41,669 --> 00:18:38,799
actually demonstrate that that value

542
00:18:43,430 --> 00:18:41,679
exists so clearly we do need to look at

543
00:18:45,110 --> 00:18:43,440
what's been done in the past

544
00:18:47,270 --> 00:18:45,120
and align that with the needs that we

545
00:18:48,710 --> 00:18:47,280
know of here on the ground and what

546
00:18:49,909 --> 00:18:48,720
really does bubble up to the surface if

547
00:18:51,110 --> 00:18:49,919
you will is that within the life

548
00:18:52,950 --> 00:18:51,120
sciences

549
00:18:54,630 --> 00:18:52,960
there clearly are a lot of

550
00:18:56,870 --> 00:18:54,640
health applications that can benefit

551
00:18:58,390 --> 00:18:56,880
from using microgravity in these

552
00:18:59,990 --> 00:18:58,400
research models

553
00:19:01,190 --> 00:19:00,000
in my opinion i think in the life

554
00:19:03,110 --> 00:19:01,200
sciences is where we probably will

555
00:19:05,029 --> 00:19:03,120
capitalize first

556
00:19:06,710 --> 00:19:05,039
but i agree with marshall that when we

557
00:19:08,470 --> 00:19:06,720
start to look at the physics and

558
00:19:09,909 --> 00:19:08,480
physical sciences and how they're

559
00:19:12,390 --> 00:19:09,919
impacted and affected not only by

560
00:19:14,230 --> 00:19:12,400
microgravity but perhaps also by the

561
00:19:15,590 --> 00:19:14,240
unique environment that it's in you know

562
00:19:17,669 --> 00:19:15,600
we have access to the outside of the

563
00:19:19,029 --> 00:19:17,679

international space station as well that

564
00:19:20,630 --> 00:19:19,039
we'll start to be able to understand

565
00:19:22,549 --> 00:19:20,640
that there may be

566
00:19:24,150 --> 00:19:22,559
value and and benefits from

567
00:19:25,590 --> 00:19:24,160
understanding how materials behave

568
00:19:27,190 --> 00:19:25,600
differently or may come together and

569
00:19:29,029 --> 00:19:27,200
form differently as a result of being

570
00:19:30,230 --> 00:19:29,039
exposed to that environment i think the

571
00:19:32,150 --> 00:19:30,240
key will be

572
00:19:33,750 --> 00:19:32,160
once we gain the knowledge how do we

573
00:19:35,669 --> 00:19:33,760
then translate that not only to

574
00:19:36,870 --> 00:19:35,679
application on the ground but answer

575
00:19:39,110 --> 00:19:36,880
some of the more difficult questions

576
00:19:41,510 --> 00:19:39,120
which are associated with do you then

577
00:19:43,190 --> 00:19:41,520
create a production capacity in space or

578
00:19:45,270 --> 00:19:43,200
do you bring it home and those are some

579
00:19:46,390 --> 00:19:45,280
of the challenges that that were at the

580
00:19:47,909 --> 00:19:46,400
point where we're asking the questions

581
00:19:49,669 --> 00:19:47,919
at the moment

582
00:19:51,350 --> 00:19:49,679
okay well i like to change things up a

583
00:19:53,909 --> 00:19:51,360
little bit so it's not just me talking

584
00:19:56,230 --> 00:19:53,919
if anybody in the audience would like to

585
00:19:57,750 --> 00:19:56,240
ask a question i mean certainly

586
00:19:59,510 --> 00:19:57,760
invite that now you just kind of raise

587
00:20:01,590 --> 00:19:59,520
your hand and we'll be able to give you

588
00:20:03,430 --> 00:20:01,600

a chance i think we can start right up

589
00:20:04,950 --> 00:20:03,440
here

590
00:20:09,350 --> 00:20:04,960
mark

591
00:20:11,909 --> 00:20:09,360
aviation week and i'm wondering if dr

592
00:20:14,470 --> 00:20:11,919
robinson could sort of explain you you

593
00:20:16,630 --> 00:20:14,480
said you want to introduce some rodents

594
00:20:18,549 --> 00:20:16,640
by the fall

595
00:20:20,310 --> 00:20:18,559
how many what kind

596
00:20:22,870 --> 00:20:20,320
where would you like this to go what can

597
00:20:24,789 --> 00:20:22,880
you accommodate reasonably and what

598
00:20:26,950 --> 00:20:24,799
sorts of investigations do you think

599
00:20:28,870 --> 00:20:26,960
might come from those that fit the

600
00:20:30,789 --> 00:20:28,880
themes that the

601
00:20:31,750 --> 00:20:30,799
national academy's decadal has played

602
00:20:34,070 --> 00:20:31,760
out

603
00:20:36,149 --> 00:20:34,080
sure yeah we are starting on the spacex

604
00:20:37,909 --> 00:20:36,159
4 flight will be the first test flight

605
00:20:41,510 --> 00:20:37,919
of the upgraded hardware

606
00:20:43,830 --> 00:20:41,520
and it will have 20 mice in the end our

607
00:20:44,789 --> 00:20:43,840
final capability will be 40 mice per

608
00:20:47,110 --> 00:20:44,799
flight

609
00:20:48,390 --> 00:20:47,120
and it will fly a combination of

610
00:20:50,070 --> 00:20:48,400
research that

611
00:20:52,549 --> 00:20:50,080
marshall porterfield's organization has

612
00:20:54,630 --> 00:20:52,559
selected by competitive peer review and

613
00:20:57,430 --> 00:20:54,640

research that the cases organization has

614
00:20:59,190 --> 00:20:57,440
selected for its economic value in

615
00:21:00,390 --> 00:20:59,200
industrial or pharmaceutical research

616
00:21:01,110 --> 00:21:00,400
and development

617
00:21:05,029 --> 00:21:01,120
so

618
00:21:06,789 --> 00:21:05,039
we're sure that we've got good animal

619
00:21:08,230 --> 00:21:06,799
husbandry good characteristics and how

620
00:21:09,830 --> 00:21:08,240
we're taking care of the animals but

621
00:21:12,070 --> 00:21:09,840
we'll also be combining experiments

622
00:21:13,590 --> 00:21:12,080
together so that we can get as much data

623
00:21:15,590 --> 00:21:13,600
as possible from the smallest number of

624
00:21:21,430 --> 00:21:15,600
animals

625
00:21:23,190 --> 00:21:21,440
and come back on space as opposed to

626
00:21:25,510 --> 00:21:23,200
stay on the station

627
00:21:27,830 --> 00:21:25,520
uh so there are two two options one is

628
00:21:29,110 --> 00:21:27,840
to launch um the animals on the spacex

629
00:21:30,789 --> 00:21:29,120
and bring them home in the spacex we're

630
00:21:32,470 --> 00:21:30,799
not going to be doing that quite yet

631
00:21:34,149 --> 00:21:32,480
because there's a fair amount of time as

632
00:21:35,669 --> 00:21:34,159
you know from splashdown until you can

633
00:21:36,470 --> 00:21:35,679
get back to the dock

634
00:21:43,110 --> 00:21:36,480
so

635
00:21:44,630 --> 00:21:43,120
euthanasia and dissecting on orbit

636
00:21:46,390 --> 00:21:44,640
okay and then i know we have quite a few

637
00:21:48,789 --> 00:21:46,400
members of the research community from

638
00:21:50,470 --> 00:21:48,799

local here in houston if you guys have

639
00:21:52,310 --> 00:21:50,480
any questions for them at this time i

640
00:22:00,390 --> 00:21:52,320
know they love to talk to you probably a

641
00:22:05,590 --> 00:22:03,190
medicine i'm excited to hear that all

642
00:22:08,310 --> 00:22:05,600
kinds of samples have been collected for

643
00:22:10,789 --> 00:22:08,320
genomics and their audio mixed studies

644
00:22:12,950 --> 00:22:10,799
my question was what type of

645
00:22:15,669 --> 00:22:12,960
infrastructure it's been set up for this

646
00:22:17,750 --> 00:22:15,679
kind of studies and also what have you

647
00:22:19,830 --> 00:22:17,760
found out

648
00:22:23,110 --> 00:22:19,840
so we are just

649
00:22:24,549 --> 00:22:23,120
at the final stages of

650
00:22:26,630 --> 00:22:24,559
releasing our strategic plan for what

651
00:22:28,390 --> 00:22:26,640
we're doing in this area so we haven't

652
00:22:30,470 --> 00:22:28,400
completely identified who

653
00:22:32,549 --> 00:22:30,480
we are going to be

654
00:22:33,909 --> 00:22:32,559
working with in terms of

655
00:22:35,510 --> 00:22:33,919
how we're actually going to process the

656
00:22:38,230 --> 00:22:35,520
samples

657
00:22:40,310 --> 00:22:38,240
we have we have a general landscape of

658
00:22:42,070 --> 00:22:40,320
what the sample processing requirements

659
00:22:43,510 --> 00:22:42,080
are going to be like

660
00:22:45,590 --> 00:22:43,520
stowage

661
00:22:48,470 --> 00:22:45,600
shelf life things like that but we

662
00:22:49,350 --> 00:22:48,480
haven't particularly identified if we're

663
00:22:57,430 --> 00:22:49,360

going to

664
00:23:00,149 --> 00:22:57,440
within nasa itself we want to partner

665
00:23:01,990 --> 00:23:00,159
with outside

666
00:23:04,149 --> 00:23:02,000
vendors we are in terms of the data

667
00:23:06,390 --> 00:23:04,159
storage we're talking right now with

668
00:23:07,990 --> 00:23:06,400
doe and their k-base capability that

669
00:23:10,310 --> 00:23:08,000
they just invested in i think it's a 60

670
00:23:13,029 --> 00:23:10,320
million dollar investment in their uh

671
00:23:15,669 --> 00:23:13,039
omix data storage capabilities and also

672
00:23:17,830 --> 00:23:15,679
nih so on the informatics side and the

673
00:23:19,270 --> 00:23:17,840
data side we're just looking at who

674
00:23:21,270 --> 00:23:19,280
we're going to partner with and of

675
00:23:22,549 --> 00:23:21,280
course too we're working with with cases

676
00:23:23,830 --> 00:23:22,559
and they brought

677
00:23:25,430 --> 00:23:23,840
other commercial

678
00:23:27,909 --> 00:23:25,440
entities the broad institute to the

679
00:23:30,390 --> 00:23:27,919
table and we have participation in terms

680
00:23:31,350 --> 00:23:30,400
of how we're organizing this

681
00:23:36,070 --> 00:23:31,360
from

682
00:23:36,789 --> 00:23:36,080
the traditional academic community so

683
00:23:40,870 --> 00:23:36,799
that

684
00:23:42,950 --> 00:23:40,880
gene lab project

685
00:23:45,350 --> 00:23:42,960
is a product that is going to fuel human

686
00:23:49,430 --> 00:23:45,360
exploration but also provide as much

687
00:23:53,590 --> 00:23:49,440
opportunity for translational and

688
00:23:55,590 --> 00:23:53,600

commercial participation also

689
00:23:56,630 --> 00:23:55,600
okay i think we might have had a couple

690
00:23:58,630 --> 00:23:56,640
more

691
00:24:01,029 --> 00:23:58,640
um i'm jessica scott from baylor college

692
00:24:03,350 --> 00:24:01,039
of medicine um and i'm interested in

693
00:24:04,470 --> 00:24:03,360
microgravity cell culture experiments so

694
00:24:06,950 --> 00:24:04,480
i'm wondering

695
00:24:08,870 --> 00:24:06,960
how does the hardware differ on doing

696
00:24:10,230 --> 00:24:08,880
cell culture in space and what are some

697
00:24:11,909 --> 00:24:10,240
of the challenges that you've faced in

698
00:24:14,070 --> 00:24:11,919
that area

699
00:24:16,310 --> 00:24:14,080
well i think the hardware

700
00:24:17,990 --> 00:24:16,320
differs to the degree that

701
00:24:19,909 --> 00:24:18,000
it's it's a different process if you

702
00:24:21,990 --> 00:24:19,919
will in order to conduct your experiment

703
00:24:23,190 --> 00:24:22,000
um the transportation other logistics

704
00:24:25,269 --> 00:24:23,200
associated with getting to that

705
00:24:26,470 --> 00:24:25,279
laboratory um obviously are quite

706
00:24:27,510 --> 00:24:26,480
different so

707
00:24:29,830 --> 00:24:27,520
you see

708
00:24:31,909 --> 00:24:29,840
differences in some of the hardware that

709
00:24:34,470 --> 00:24:31,919
is necessary to support the experiment

710
00:24:36,390 --> 00:24:34,480
to success such as incubation and power

711
00:24:37,750 --> 00:24:36,400
and things like that the general premise

712
00:24:39,990 --> 00:24:37,760
behind how you would conduct cell

713
00:24:41,750 --> 00:24:40,000

culture there is very similar

714
00:24:43,750 --> 00:24:41,760
we're working with several commercial

715
00:24:45,669 --> 00:24:43,760
companies that are helping us develop

716
00:24:47,590 --> 00:24:45,679
sort of the the cutting edge or latest

717
00:24:49,430 --> 00:24:47,600
gold standards if you will within cell

718
00:24:51,029 --> 00:24:49,440
culturing and that's a partnership with

719
00:24:52,710 --> 00:24:51,039
cases and nasa

720
00:24:55,029 --> 00:24:52,720
to develop that but at the end of the

721
00:24:57,190 --> 00:24:55,039
day our goal is to make sure that

722
00:25:00,070 --> 00:24:57,200
the science objective that the

723
00:25:02,390 --> 00:25:00,080
researcher has can be performed in space

724
00:25:09,830 --> 00:25:02,400
exactly as they would on the bench top

725
00:25:13,350 --> 00:25:11,669
you guys picked someone's dad carlos

726
00:25:16,070 --> 00:25:13,360
montecinos with astromed research

727
00:25:17,830 --> 00:25:16,080
institute we're a consortium of academia

728
00:25:19,430 --> 00:25:17,840
and private industry

729
00:25:20,710 --> 00:25:19,440
and not like if you wouldn't mind

730
00:25:22,870 --> 00:25:20,720
spending a minute or so talking about

731
00:25:24,630 --> 00:25:22,880
the differences between getting flight

732
00:25:27,510 --> 00:25:24,640
approval for protocols

733
00:25:29,430 --> 00:25:27,520
between the cases and cphs and other

734
00:25:31,669 --> 00:25:29,440
traditional nasa you know within asset

735
00:25:33,269 --> 00:25:31,679
mechanisms right well that's a great

736
00:25:34,710 --> 00:25:33,279
question and i think this is one of the

737
00:25:36,789 --> 00:25:34,720
the one of the most intriguing

738
00:25:38,950 --> 00:25:36,799

opportunities that we have as cases

739
00:25:40,789 --> 00:25:38,960
to support the national laboratory and

740
00:25:42,390 --> 00:25:40,799
again that designation

741
00:25:44,390 --> 00:25:42,400
in and of itself is what has opened up

742
00:25:45,830 --> 00:25:44,400
the opportunity for many researchers to

743
00:25:47,830 --> 00:25:45,840
even consider using the international

744
00:25:51,110 --> 00:25:47,840
space station as their research

745
00:25:52,789 --> 00:25:51,120
laboratory so at cases we have developed

746
00:25:54,230 --> 00:25:52,799
grant calls that are very similar to

747
00:25:56,710 --> 00:25:54,240
what you would see coming out of nasa or

748
00:25:58,310 --> 00:25:56,720
nih where there's a fairly rigid

749
00:25:59,830 --> 00:25:58,320
structure around what it is that we're

750
00:26:01,190 --> 00:25:59,840
looking to support from a research

751
00:26:03,669 --> 00:26:01,200
perspective

752
00:26:05,830 --> 00:26:03,679
we typically almost every quarter issue

753
00:26:07,990 --> 00:26:05,840
some call within the life sciences or

754
00:26:10,470 --> 00:26:08,000
physical or material sciences and remote

755
00:26:12,950 --> 00:26:10,480
sensing and enabling technologies

756
00:26:15,190 --> 00:26:12,960
but at the same time you know we have a

757
00:26:17,110 --> 00:26:15,200
significant challenge with respect to

758
00:26:18,950 --> 00:26:17,120
time and availability of the national

759
00:26:20,870 --> 00:26:18,960
laboratory to conduct all the necessary

760
00:26:22,789 --> 00:26:20,880
research that we think may have value

761
00:26:24,630 --> 00:26:22,799
and success so one of the things i think

762
00:26:26,549 --> 00:26:24,640
we do a little differently than what you

763
00:26:28,950 --> 00:26:26,559

see coming out of nasa or other large

764
00:26:31,830 --> 00:26:28,960
federal agencies is that we entertain

765
00:26:35,110 --> 00:26:31,840
the concept of ideas coming to us so if

766
00:26:37,190 --> 00:26:35,120
you will from an unsolicited manner we

767
00:26:38,950 --> 00:26:37,200
actually entertain a science or

768
00:26:40,310 --> 00:26:38,960
technology proposal

769
00:26:42,470 --> 00:26:40,320
and we'll actually work with an

770
00:26:44,310 --> 00:26:42,480
investigator to help them understand

771
00:26:45,029 --> 00:26:44,320
some of the necessary constraints if you

772
00:26:47,029 --> 00:26:45,039
will

773
00:26:49,909 --> 00:26:47,039
that are still in place in order to

774
00:26:52,549 --> 00:26:49,919
successfully conduct research on iss but

775
00:26:53,750 --> 00:26:52,559
make that a much less tedious process

776
00:26:55,029 --> 00:26:53,760
and one that doesn't necessarily

777
00:26:58,390 --> 00:26:55,039
constrain the objective at the end of

778
00:27:01,350 --> 00:26:58,400
the day so with cases we kind of

779
00:27:04,149 --> 00:27:01,360
consider ourselves as a customer service

780
00:27:07,029 --> 00:27:04,159
opportunity here where we can entertain

781
00:27:09,350 --> 00:27:07,039
grants we can entertain other

782
00:27:10,870 --> 00:27:09,360
research objectives and ideas but then

783
00:27:11,909 --> 00:27:10,880
hopefully foster that through the

784
00:27:13,590 --> 00:27:11,919
process

785
00:27:15,669 --> 00:27:13,600
our customer base is a little different

786
00:27:18,870 --> 00:27:15,679
we are actually trying to focus on

787
00:27:20,549 --> 00:27:18,880
commercial utilization so if you if you

788
00:27:22,310 --> 00:27:20,559

think about it we're actually trying to

789
00:27:24,310 --> 00:27:22,320
find customers who have quite frankly

790
00:27:26,070 --> 00:27:24,320
never thought about using iss as part of

791
00:27:28,630 --> 00:27:26,080
their research portfolio so there's a

792
00:27:30,549 --> 00:27:28,640
lot of early education that um and sort

793
00:27:36,710 --> 00:27:30,559
of help along the way that's necessary

794
00:27:42,230 --> 00:27:38,950
um angela carter from baylor college of

795
00:27:43,510 --> 00:27:42,240
medicine um i know you guys are

796
00:27:45,750 --> 00:27:43,520
the fact that you have rodents on that

797
00:27:47,190 --> 00:27:45,760
going on is really great so um with

798
00:27:48,630 --> 00:27:47,200
rodent models you can do multiple

799
00:27:50,389 --> 00:27:48,640
experiments and i was thinking not just

800
00:27:51,590 --> 00:27:50,399
the anatomical looking at you know

801
00:27:53,830 --> 00:27:51,600
expression of

802
00:27:55,110 --> 00:27:53,840
stress signals and hormones and such and

803
00:27:56,870 --> 00:27:55,120
osteoporosis but what about the

804
00:27:58,710 --> 00:27:56,880
neurocognitive

805
00:28:00,230 --> 00:27:58,720
aspects like doing behavioral and

806
00:28:01,590 --> 00:28:00,240
learning and memory assays especially

807
00:28:03,190 --> 00:28:01,600
for stuff

808
00:28:04,789 --> 00:28:03,200
for studies that

809
00:28:05,830 --> 00:28:04,799
could actually further the mission to

810
00:28:07,350 --> 00:28:05,840
mars i was wondering what you guys

811
00:28:09,269 --> 00:28:07,360
thought about that

812
00:28:11,430 --> 00:28:09,279
that's definitely an an important area

813
00:28:13,350 --> 00:28:11,440

in an area that nasa's focused on the

814
00:28:15,269 --> 00:28:13,360
risks even to astronauts in doing

815
00:28:18,630 --> 00:28:15,279
neurocognitive studies that's one of the

816
00:28:20,470 --> 00:28:18,640
reasons that we plan to eventually

817
00:28:21,510 --> 00:28:20,480
take advantage of the future capability

818
00:28:23,350 --> 00:28:21,520
of flying

819
00:28:25,190 --> 00:28:23,360
rats instead of mice

820
00:28:27,430 --> 00:28:25,200
normally you know you want to fly the

821
00:28:29,830 --> 00:28:27,440
smallest organism that you can to get

822
00:28:31,510 --> 00:28:29,840
the sample size but

823
00:28:33,750 --> 00:28:31,520
in a lot of different neurocognitive

824
00:28:36,149 --> 00:28:33,760
studies rats are a better model

825
00:28:38,389 --> 00:28:36,159
and so so we're expecting that that kind

826
00:28:40,230 --> 00:28:38,399
of research will either be selected by

827
00:28:43,430 --> 00:28:40,240
space life and physical sciences at nasa

828
00:28:47,190 --> 00:28:43,440
in the future or also be of interest to

829
00:28:51,510 --> 00:28:49,430
okay my name is blessed nation i'm from

830
00:28:53,350 --> 00:28:51,520
baylor college of medicine my question

831
00:28:55,190 --> 00:28:53,360
is when you do experiments on

832
00:28:56,950 --> 00:28:55,200
microgravity do you also especially the

833
00:28:58,789 --> 00:28:56,960
rodent experiment do you also have

834
00:29:01,750 --> 00:28:58,799
controls for cages where you can

835
00:29:02,710 --> 00:29:01,760
simulate 1g

836
00:29:04,630 --> 00:29:02,720
so

837
00:29:06,310 --> 00:29:04,640
that's it controls are a complicated

838
00:29:08,470 --> 00:29:06,320

question we do

839
00:29:09,909 --> 00:29:08,480
simultaneous ground controls or slightly

840
00:29:11,830 --> 00:29:09,919
delayed ground control so that we have

841
00:29:14,549 --> 00:29:11,840
the environmental

842
00:29:16,950 --> 00:29:14,559
situation matched and we also do those

843
00:29:19,350 --> 00:29:16,960
in the exact same kind of cage but when

844
00:29:21,590 --> 00:29:19,360
you if you start spinning something to

845
00:29:23,750 --> 00:29:21,600
produce artificial gravity you really

846
00:29:25,430 --> 00:29:23,760
start making if you don't do it right

847
00:29:27,510 --> 00:29:25,440
you create an amusement park ride which

848
00:29:29,669 --> 00:29:27,520
really isn't a control for anything

849
00:29:31,669 --> 00:29:29,679
so right now our japanese colleagues are

850
00:29:33,190 --> 00:29:31,679
working with us on a joint study of

851
00:29:35,350 --> 00:29:33,200
whether we might be able to add a

852
00:29:37,350 --> 00:29:35,360
centrifuge capability for some ground

853
00:29:39,909 --> 00:29:37,360
controls or for some for some spun

854
00:29:42,389 --> 00:29:39,919
controls on iss

855
00:29:44,950 --> 00:29:42,399
the struggle is to have that arm length

856
00:29:46,470 --> 00:29:44,960
big enough that it's a real control and

857
00:29:47,750 --> 00:29:46,480
and there's some debate as to whether or

858
00:29:49,590 --> 00:29:47,760
not there's such a thing as a real

859
00:29:51,190 --> 00:29:49,600
control when you're spinning because as

860
00:29:52,870 --> 00:29:51,200
you know

861
00:29:55,430 --> 00:29:52,880
the way that you feel when you're on an

862
00:29:56,870 --> 00:29:55,440
amusement park ride is not 1g it's

863
00:29:58,470 --> 00:29:56,880

different because those forces aren't

864
00:30:01,110 --> 00:29:58,480
evenly distributed across you the way

865
00:30:03,110 --> 00:30:01,120
they are here on earth

866
00:30:06,310 --> 00:30:03,120
does this cage also have capacity for

867
00:30:08,630 --> 00:30:06,320
reproduction so can you meet the animals

868
00:30:10,710 --> 00:30:08,640
can they deliver pups there

869
00:30:13,029 --> 00:30:10,720
so this is an important area that the

870
00:30:15,430 --> 00:30:13,039
decadal survey talked about and and

871
00:30:18,149 --> 00:30:15,440
recognized that that was fairly far down

872
00:30:19,750 --> 00:30:18,159
the road you know right now this we know

873
00:30:22,789 --> 00:30:19,760
and we've done i think

874
00:30:24,630 --> 00:30:22,799
over history there have been over 35

875
00:30:26,470 --> 00:30:24,640
cases of studies where mice have flown

876
00:30:28,230 --> 00:30:26,480
into space but they've never been more

877
00:30:30,710 --> 00:30:28,240
than about two weeks with a couple of

878
00:30:32,710 --> 00:30:30,720
small exceptions and so we need to be

879
00:30:34,789 --> 00:30:32,720
sure that we've got the animal husbandry

880
00:30:37,669 --> 00:30:34,799
right that we know how to sustain mice

881
00:30:39,430 --> 00:30:37,679
for 30 days or 60 days or even 90 days

882
00:30:41,029 --> 00:30:39,440
before you can start entering into

883
00:30:43,029 --> 00:30:41,039
looking at those those reproductive

884
00:30:44,630 --> 00:30:43,039
capabilities that it but that is

885
00:30:46,230 --> 00:30:44,640
something that the national academies in

886
00:30:47,909 --> 00:30:46,240
the in the scientific community has

887
00:30:48,870 --> 00:30:47,919
asked for and it's something that i

888
00:30:50,710 --> 00:30:48,880

think

889
00:30:51,909 --> 00:30:50,720
marshall may want to talk more about his

890
00:30:53,590 --> 00:30:51,919
strategic plan but it's definitely

891
00:30:55,909 --> 00:30:53,600
something in those out years towards the

892
00:30:57,750 --> 00:30:55,919
end of iss in the in the strategic plan

893
00:30:59,430 --> 00:30:57,760
as well development of biology is one of

894
00:31:01,350 --> 00:30:59,440
the key areas it was

895
00:31:03,190 --> 00:31:01,360
dealt with in by the decadal survey but

896
00:31:04,789 --> 00:31:03,200
we don't have to limit ourselves to

897
00:31:05,909 --> 00:31:04,799
rodent research in order to accomplish

898
00:31:08,630 --> 00:31:05,919
that

899
00:31:09,750 --> 00:31:08,640
fruit fly i mentioned before is an um an

900
00:31:11,750 --> 00:31:09,760
incredible

901
00:31:13,350 --> 00:31:11,760
research system that's really important

902
00:31:15,669 --> 00:31:13,360
to biomedical research and we are going

903
00:31:17,750 --> 00:31:15,679
to include centrifuge controls

904
00:31:19,190 --> 00:31:17,760
for fruit flies and also nematodes are

905
00:31:21,110 --> 00:31:19,200
great

906
00:31:23,190 --> 00:31:21,120
developmental biology systems and even

907
00:31:24,630 --> 00:31:23,200
plants we share a lot of genetic

908
00:31:27,830 --> 00:31:24,640
similarities with plants we can learn a

909
00:31:30,630 --> 00:31:27,840
lot of with plants in the european

910
00:31:34,389 --> 00:31:30,640
modular cultivation system that we

911
00:31:35,509 --> 00:31:34,399
partner with esa and having uspis do

912
00:31:38,389 --> 00:31:35,519
experiments on it actually has

913
00:31:39,990 --> 00:31:38,399

centrifuge for for plants also too so

914
00:31:41,350 --> 00:31:40,000
there are other systems that that

915
00:31:43,509 --> 00:31:41,360
provide that type of control but it

916
00:31:45,350 --> 00:31:43,519
really is important to get

917
00:31:47,190 --> 00:31:45,360
1g or partial g controls in the

918
00:31:49,350 --> 00:31:47,200
microgravity environment that greatly

919
00:31:51,430 --> 00:31:49,360
expands the value of the science that we

920
00:31:53,110 --> 00:31:51,440
get from it there is a really simple

921
00:31:54,950 --> 00:31:53,120
developmental biology experiment going

922
00:31:56,789 --> 00:31:54,960
on on iss right now which is using

923
00:31:59,509 --> 00:31:56,799
saccharomyces yeast that's brewer's

924
00:32:01,590 --> 00:31:59,519
yeast as a model organism and in the

925
00:32:03,669 --> 00:32:01,600
past some studies have been done that

926
00:32:05,909 --> 00:32:03,679
show that when the yeast divide they bud

927
00:32:07,750 --> 00:32:05,919
one one yeast cell turns into two and

928
00:32:10,149 --> 00:32:07,760
then and on earth they always bud in the

929
00:32:11,750 --> 00:32:10,159
same axis so there's a little scar where

930
00:32:13,590 --> 00:32:11,760
they separate and that's always in the

931
00:32:14,470 --> 00:32:13,600
same place but when they've been grown

932
00:32:16,310 --> 00:32:14,480
in space

933
00:32:18,389 --> 00:32:16,320
they have scars all over the place in

934
00:32:19,990 --> 00:32:18,399
every different orientation so that's

935
00:32:21,750 --> 00:32:20,000
one of these kind of preliminary results

936
00:32:23,269 --> 00:32:21,760
that really makes us as biologists

937
00:32:24,789 --> 00:32:23,279
scratch our heads and say wow you know

938
00:32:26,789 --> 00:32:24,799

what does that mean what does that mean

939
00:32:29,029 --> 00:32:26,799
for the way that the chromosomes are

940
00:32:30,789 --> 00:32:29,039
lining up at mitosis what does that mean

941
00:32:35,029 --> 00:32:30,799
for the development in the division of

942
00:32:39,830 --> 00:32:37,669
brian york baylor college of medicine

943
00:32:41,750 --> 00:32:39,840
as the demand for in vivo models for

944
00:32:44,070 --> 00:32:41,760
research whether it be the fruit fly or

945
00:32:45,590 --> 00:32:44,080
road models increase

946
00:32:48,070 --> 00:32:45,600
it's apparent that there's also going to

947
00:32:50,149 --> 00:32:48,080
be an increased demand for crew time to

948
00:32:51,830 --> 00:32:50,159
process these samples

949
00:32:54,549 --> 00:32:51,840
and the limitation now seems to be sort

950
00:32:57,110 --> 00:32:54,559
of 40 mice and the hands that can then

951
00:32:59,029 --> 00:32:57,120
dissect those store tissues

952
00:33:01,750 --> 00:32:59,039
and conduct the experiments so what are

953
00:33:05,110 --> 00:33:01,760
the plans long term for use of robotic

954
00:33:07,269 --> 00:33:05,120
dissection and robotic data collection

955
00:33:08,950 --> 00:33:07,279
on the international space station we

956
00:33:11,669 --> 00:33:08,960
actually have a phase a study right now

957
00:33:13,669 --> 00:33:11,679
looking at tele-robotic capabilities

958
00:33:16,230 --> 00:33:13,679
that that we

959
00:33:18,149 --> 00:33:16,240
have commissioned it's

960
00:33:21,029 --> 00:33:18,159
we've recognized for a long time that

961
00:33:22,710 --> 00:33:21,039
the issue of limitations and crew time

962
00:33:25,909 --> 00:33:22,720
there's lots there are many limitations

963
00:33:27,909 --> 00:33:25,919

in terms of usa iss utilization

964
00:33:29,190 --> 00:33:27,919
so it is a finite

965
00:33:31,110 --> 00:33:29,200
resource

966
00:33:33,590 --> 00:33:31,120
so we are looking at novel ways like

967
00:33:35,029 --> 00:33:33,600
that to offload some of the crew time

968
00:33:37,350 --> 00:33:35,039
requirements the other way that we're

969
00:33:39,830 --> 00:33:37,360
trying to

970
00:33:41,430 --> 00:33:39,840
increased iss utilization is through the

971
00:33:43,909 --> 00:33:41,440
open source science initiatives i talked

972
00:33:46,870 --> 00:33:43,919
about earlier gene lab and materials lab

973
00:33:49,269 --> 00:33:46,880
instead of flying an experiment for a

974
00:33:51,269 --> 00:33:49,279
single pi who has a limited number of

975
00:33:52,950 --> 00:33:51,279
hypotheses and a small number of things

976
00:33:55,110 --> 00:33:52,960
that they're actually going to measure

977
00:33:56,950 --> 00:33:55,120
use the the

978
00:33:58,950 --> 00:33:56,960
next generation biotechnology and

979
00:34:00,549 --> 00:33:58,960
bioanalytics that we have available now

980
00:34:02,870 --> 00:34:00,559
and measure everything and fly an

981
00:34:05,029 --> 00:34:02,880
experiment for a community populate an

982
00:34:07,269 --> 00:34:05,039
informatics database that's open to the

983
00:34:09,589 --> 00:34:07,279
scientific community to go into and we

984
00:34:11,669 --> 00:34:09,599
will fund researchers to do

985
00:34:13,270 --> 00:34:11,679
the ground-based derived experiments to

986
00:34:15,430 --> 00:34:13,280
understand the phenomena that they

987
00:34:18,790 --> 00:34:15,440
observe within those

988
00:34:20,230 --> 00:34:18,800

those um omics arrays basically we want

989
00:34:22,470 --> 00:34:20,240
to do

990
00:34:23,909 --> 00:34:22,480
integrated omics approaches in genelab

991
00:34:25,750 --> 00:34:23,919
so that's the other way that we're

992
00:34:27,190 --> 00:34:25,760
trying to work around those types of

993
00:34:29,270 --> 00:34:27,200
limitations

994
00:34:30,710 --> 00:34:29,280
the other thing we'll do is when we will

995
00:34:33,030 --> 00:34:30,720
eventually with spacex have a live

996
00:34:35,990 --> 00:34:33,040
return capability worked out and that

997
00:34:38,069 --> 00:34:36,000
will help for for systems that change

998
00:34:39,190 --> 00:34:38,079
slowly that will help us need less crew

999
00:34:41,109 --> 00:34:39,200
time and then we're also using

1000
00:34:42,710 --> 00:34:41,119
international collaboration with our

1001
00:34:45,109 --> 00:34:42,720
japanese our russian colleagues and

1002
00:34:46,710 --> 00:34:45,119
others to to um to help make that better

1003
00:34:50,310 --> 00:34:46,720
and then of course when we go to

1004
00:34:52,710 --> 00:34:50,320
commercial crew uh around 2017 that will

1005
00:34:53,990 --> 00:34:52,720
add another full crew member uh hands-on

1006
00:34:55,589 --> 00:34:54,000
to conduct research and that's going to

1007
00:34:56,869 --> 00:34:55,599
be very important for our scientific

1008
00:34:58,230 --> 00:34:56,879
community

1009
00:34:59,349 --> 00:34:58,240
i think that's a really good point

1010
00:35:01,990 --> 00:34:59,359
because

1011
00:35:04,069 --> 00:35:02,000
talking about the use of rodents as a as

1012
00:35:07,030 --> 00:35:04,079
an organism model for research um if

1013
00:35:08,950 --> 00:35:07,040

that proves to be quite valuable um and

1014
00:35:10,790 --> 00:35:08,960
and that you know added crew time or

1015
00:35:12,870 --> 00:35:10,800
human intervention is a necessity in

1016
00:35:14,950 --> 00:35:12,880
order to be successful this is really

1017
00:35:17,829 --> 00:35:14,960
informing us if you will on how we

1018
00:35:19,349 --> 00:35:17,839
create the the next generation

1019
00:35:21,670 --> 00:35:19,359
platform for research and development

1020
00:35:23,670 --> 00:35:21,680
and these are some pioneering efforts

1021
00:35:25,670 --> 00:35:23,680
that we're doing right now but i think

1022
00:35:27,670 --> 00:35:25,680
if we understand the need for more human

1023
00:35:29,589 --> 00:35:27,680
intervention and larger sample sizes and

1024
00:35:32,150 --> 00:35:29,599
rodents we're actually doing a great job

1025
00:35:34,310 --> 00:35:32,160
of trying to determine what the next iss

1026
00:35:35,589 --> 00:35:34,320
capabilities will be will be set up to

1027
00:35:38,069 --> 00:35:35,599
to do

1028
00:35:39,589 --> 00:35:38,079
if i can offer a follow-up um one of the

1029
00:35:41,109 --> 00:35:39,599
other things that we appreciate using

1030
00:35:43,829 --> 00:35:41,119
rodent models is while they're an

1031
00:35:45,190 --> 00:35:43,839
accelerated model for human disease

1032
00:35:47,430 --> 00:35:45,200
the time that's suggested for

1033
00:35:49,990 --> 00:35:47,440
experimentation on the space station is

1034
00:35:52,390 --> 00:35:50,000
still quite narrow in 60 days so what's

1035
00:35:53,190 --> 00:35:52,400
the plans moving forward to extend those

1036
00:35:54,950 --> 00:35:53,200
two

1037
00:35:57,430 --> 00:35:54,960
month long or if not year-long

1038
00:35:58,950 --> 00:35:57,440

experiments so that we can gather

1039
00:36:00,870 --> 00:35:58,960
sort of prudent information about

1040
00:36:03,829 --> 00:36:00,880
disease progression that then may have

1041
00:36:05,990 --> 00:36:03,839
applicability to human pathology i think

1042
00:36:07,349 --> 00:36:06,000
i can speak on behalf of of cases and

1043
00:36:09,430 --> 00:36:07,359
our customers who are actually

1044
00:36:11,589 --> 00:36:09,440
interested in in doing some of these

1045
00:36:13,109 --> 00:36:11,599
applied research studies

1046
00:36:14,550 --> 00:36:13,119
clearly duration is something that

1047
00:36:16,550 --> 00:36:14,560
they're they're very interested in as

1048
00:36:17,510 --> 00:36:16,560
julie pointed out earlier with these

1049
00:36:19,270 --> 00:36:17,520
earlier

1050
00:36:21,030 --> 00:36:19,280
experiments we're trying to demonstrate

1051
00:36:23,109 --> 00:36:21,040
number one the technical capability and

1052
00:36:24,310 --> 00:36:23,119
feasibility that this can be

1053
00:36:27,190 --> 00:36:24,320
a viable

1054
00:36:28,790 --> 00:36:27,200
model on iss but i i would say that it's

1055
00:36:31,270 --> 00:36:28,800
in our plans to actually increase the

1056
00:36:34,230 --> 00:36:31,280
duration as quickly as we can the system

1057
00:36:36,630 --> 00:36:34,240
that we've developed is flexible so

1058
00:36:38,150 --> 00:36:36,640
essentially you can fly extra cages and

1059
00:36:39,829 --> 00:36:38,160
you can just move the animals from one

1060
00:36:41,829 --> 00:36:39,839
cage to another and bag it to return it

1061
00:36:43,829 --> 00:36:41,839
and then clean it up and relaunch it so

1062
00:36:45,829 --> 00:36:43,839
it's a it's a kind of a recyclable

1063
00:36:47,670 --> 00:36:45,839

system for the hardware and so that

1064
00:36:49,510 --> 00:36:47,680
means there's no inherent limit in how

1065
00:36:51,030 --> 00:36:49,520
long a study could go it will eventually

1066
00:36:54,870 --> 00:36:51,040
just be determined by the scientific

1067
00:36:59,589 --> 00:36:57,190
i'm robert parham with clubspace.com and

1068
00:37:01,990 --> 00:36:59,599
space.com um

1069
00:37:03,510 --> 00:37:02,000
with with regards to crew time and also

1070
00:37:05,910 --> 00:37:03,520
with um

1071
00:37:08,150 --> 00:37:05,920
bringing on new hardware has there been

1072
00:37:09,109 --> 00:37:08,160
talk as well about the crew itself in

1073
00:37:12,069 --> 00:37:09,119
terms of

1074
00:37:13,510 --> 00:37:12,079
matching skill sets um if the in terms

1075
00:37:16,710 --> 00:37:13,520
of crew selection

1076
00:37:18,950 --> 00:37:16,720
about or what limitations exist um

1077
00:37:21,270 --> 00:37:18,960
having crew that may not be familiar

1078
00:37:23,510 --> 00:37:21,280
with the specific disciplines of science

1079
00:37:24,950 --> 00:37:23,520
that you're pursuing so what we do and

1080
00:37:27,510 --> 00:37:24,960
this has already been in place for a

1081
00:37:29,109 --> 00:37:27,520
while now is we have core life scientist

1082
00:37:31,270 --> 00:37:29,119
training for every crew member just like

1083
00:37:33,430 --> 00:37:31,280
we have core robotics training and just

1084
00:37:35,990 --> 00:37:33,440
like we have core eva training so you

1085
00:37:38,630 --> 00:37:36,000
know no no astronaut comes in knowing

1086
00:37:39,910 --> 00:37:38,640
how to do space walks and an astronaut

1087
00:37:41,430 --> 00:37:39,920
doesn't have to come in knowing how to

1088
00:37:43,829 --> 00:37:41,440

do life sciences research we can teach

1089
00:37:45,750 --> 00:37:43,839
them so we're working our way through

1090
00:37:47,670 --> 00:37:45,760
the entire pre-flight astronaut core

1091
00:37:49,670 --> 00:37:47,680
making sure they have

1092
00:37:51,190 --> 00:37:49,680
all of those key skills to be able to

1093
00:37:53,270 --> 00:37:51,200
carry out this research they get in the

1094
00:37:55,030 --> 00:37:53,280
lab they learn how things work and then

1095
00:37:56,630 --> 00:37:55,040
we're also of course we also have

1096
00:37:58,550 --> 00:37:56,640
experiment specific training for all of

1097
00:37:59,829 --> 00:37:58,560
the crews before they fly so they know

1098
00:38:01,910 --> 00:37:59,839
the experiments that they'll be doing

1099
00:38:04,630 --> 00:38:01,920
and know all the specific skills they

1100
00:38:07,270 --> 00:38:04,640
might need

1101
00:38:09,349 --> 00:38:07,280
jason sakamoto from houston methodist if

1102
00:38:12,710 --> 00:38:09,359
we go after a proposal let's say uh via

1103
00:38:14,790 --> 00:38:12,720
cases or nasa how much uh crew time or

1104
00:38:16,870 --> 00:38:14,800
astronaut time can we anticipate to

1105
00:38:19,670 --> 00:38:16,880
interact with our experiments or must

1106
00:38:22,790 --> 00:38:19,680
they all be self-contained

1107
00:38:24,710 --> 00:38:22,800
so i i'll answer this first and and

1108
00:38:26,470 --> 00:38:24,720
i can't stress enough that one of the

1109
00:38:28,950 --> 00:38:26,480
things that we're trying to do is not

1110
00:38:30,870 --> 00:38:28,960
constrain the scientific objective so

1111
00:38:32,870 --> 00:38:30,880
whatever the research interest is or the

1112
00:38:34,710 --> 00:38:32,880
investigation interests is we really

1113
00:38:37,190 --> 00:38:34,720

want to understand what do you believe

1114
00:38:39,030 --> 00:38:37,200
is necessary to be successful

1115
00:38:41,990 --> 00:38:39,040
we don't want to put a limit on on any

1116
00:38:43,430 --> 00:38:42,000
of the resources

1117
00:38:45,270 --> 00:38:43,440
at that moment

1118
00:38:47,670 --> 00:38:45,280
but i will say that once we understand

1119
00:38:49,910 --> 00:38:47,680
the science objective and we enter into

1120
00:38:51,829 --> 00:38:49,920
some of these educational conversations

1121
00:38:53,750 --> 00:38:51,839
we do work very closely with nasa to

1122
00:38:54,790 --> 00:38:53,760
understand okay are there limits that we

1123
00:38:56,150 --> 00:38:54,800
may face

1124
00:38:57,829 --> 00:38:56,160
how do we work around these so that we

1125
00:39:00,069 --> 00:38:57,839
can still ensure success of the science

1126
00:39:01,670 --> 00:39:00,079
objective but maybe create a different

1127
00:39:04,550 --> 00:39:01,680
pathway if you will from a to b to get

1128
00:39:06,230 --> 00:39:04,560
there so it's it's something that um i

1129
00:39:07,589 --> 00:39:06,240
can't stress enough that we don't want

1130
00:39:09,589 --> 00:39:07,599
to constrain the science we want to

1131
00:39:11,510 --> 00:39:09,599
actually understand it as fully and as

1132
00:39:13,030 --> 00:39:11,520
capably as we can at the front and then

1133
00:39:14,630 --> 00:39:13,040
work very closely with our subject

1134
00:39:16,310 --> 00:39:14,640
matter experts on how to

1135
00:39:18,870 --> 00:39:16,320
how to have that success at the end

1136
00:39:21,190 --> 00:39:18,880
similar to how we run our nasa research

1137
00:39:25,030 --> 00:39:21,200
announcements we don't really ask that a

1138
00:39:27,589 --> 00:39:25,040

pi define the crew time and

1139
00:39:29,990 --> 00:39:27,599
and those types of research integration

1140
00:39:33,349 --> 00:39:30,000
issues we try to encourage the best

1141
00:39:34,470 --> 00:39:33,359
science possible and the peer review is

1142
00:39:36,310 --> 00:39:34,480
done

1143
00:39:37,510 --> 00:39:36,320
by experts in the field

1144
00:39:38,230 --> 00:39:37,520
and

1145
00:39:42,069 --> 00:39:38,240
the

1146
00:39:43,910 --> 00:39:42,079
be followed up by a technical

1147
00:39:46,390 --> 00:39:43,920
feasibility study so you have to look at

1148
00:39:49,190 --> 00:39:46,400
it does the hardware exist to fly the

1149
00:39:50,310 --> 00:39:49,200
experiment yes no and are there

1150
00:39:52,550 --> 00:39:50,320
are there potential crew time

1151
00:39:54,870 --> 00:39:52,560
limitations that would have to be

1152
00:39:57,190 --> 00:39:54,880
negotiated and looked at so

1153
00:39:59,030 --> 00:39:57,200
but to give you a range um experiments

1154
00:40:01,109 --> 00:39:59,040
that we fly today say of the 200 that

1155
00:40:05,349 --> 00:40:01,119
are on orbit right now they probably

1156
00:40:08,630 --> 00:40:05,359
range in time from 15 minutes to 130 140

1157
00:40:10,470 --> 00:40:08,640
hours now 140 hour experiments usually

1158
00:40:12,230 --> 00:40:10,480
are either with human subjects or with

1159
00:40:14,550 --> 00:40:12,240
rodents and then we we combine

1160
00:40:16,390 --> 00:40:14,560
investigators together whenever we can

1161
00:40:18,069 --> 00:40:16,400
we find those synergies so usually if

1162
00:40:19,109 --> 00:40:18,079
something takes 140 hours it's actually

1163
00:40:21,349 --> 00:40:19,119

meeting the needs of multiple

1164
00:40:22,710 --> 00:40:21,359
investigators and

1165
00:40:25,589 --> 00:40:22,720
there are some experiments that have

1166
00:40:27,349 --> 00:40:25,599
been recycled reflown reflown reflown

1167
00:40:29,109 --> 00:40:27,359
over time they can accumulate a fair

1168
00:40:31,750 --> 00:40:29,119
amount of time if the science is really

1169
00:40:33,589 --> 00:40:31,760
good i'm actually really impressed

1170
00:40:36,870 --> 00:40:33,599
i've been working with life sciences

1171
00:40:38,790 --> 00:40:36,880
payloads for over 15 years and it really

1172
00:40:40,630 --> 00:40:38,800
is impressive how automation

1173
00:40:42,069 --> 00:40:40,640
telemedicine if you will to some degree

1174
00:40:44,309 --> 00:40:42,079
um a lot of different workarounds have

1175
00:40:46,309 --> 00:40:44,319
been created um that actually

1176
00:40:48,470 --> 00:40:46,319
help with the the bottlenecks that we

1177
00:40:49,829 --> 00:40:48,480
actually have um one one of those being

1178
00:40:51,510 --> 00:40:49,839
crew time but

1179
00:40:53,349 --> 00:40:51,520
it's really kind of neat to see a

1180
00:40:54,790 --> 00:40:53,359
payload come together when

1181
00:40:55,589 --> 00:40:54,800
the investigator the customer if you

1182
00:40:57,349 --> 00:40:55,599
will

1183
00:40:59,190 --> 00:40:57,359
clearly understands the science but may

1184
00:41:00,390 --> 00:40:59,200
not have thought about the process that

1185
00:41:04,950 --> 00:41:00,400
might be a little different for doing it

1186
00:41:09,750 --> 00:41:07,270
i'm very interested in the old mix array

1187
00:41:11,430 --> 00:41:09,760
you just mentioned so can you explain a

1188
00:41:12,870 --> 00:41:11,440

little more about that what type of

1189
00:41:14,870 --> 00:41:12,880
fairy uh

1190
00:41:17,589 --> 00:41:14,880
are you thinking about doing how you can

1191
00:41:19,589 --> 00:41:17,599
do that so if you look at the genome and

1192
00:41:21,589 --> 00:41:19,599
the ability to sequence the genome we

1193
00:41:24,069 --> 00:41:21,599
now have transcriptomics so where you

1194
00:41:26,390 --> 00:41:24,079
can look at which of those messages in

1195
00:41:27,910 --> 00:41:26,400
the genome are being translated into

1196
00:41:29,670 --> 00:41:27,920
into messages

1197
00:41:32,550 --> 00:41:29,680
and then for messages in the proteins

1198
00:41:35,510 --> 00:41:32,560
and proteins into all the bio molecules

1199
00:41:36,790 --> 00:41:35,520
so proteome metabolome usually those are

1200
00:41:39,510 --> 00:41:36,800
done separate

1201
00:41:41,190 --> 00:41:39,520
and nih

1202
00:41:43,109 --> 00:41:41,200
stores

1203
00:41:44,630 --> 00:41:43,119
the data from

1204
00:41:46,550 --> 00:41:44,640
that the work that they support for

1205
00:41:47,829 --> 00:41:46,560
those in separate databases so none of

1206
00:41:50,790 --> 00:41:47,839
those channels talk to each other you

1207
00:41:52,710 --> 00:41:50,800
really can't see the multi-dimensional

1208
00:41:55,030 --> 00:41:52,720
landscape of how gene the flow of

1209
00:41:57,190 --> 00:41:55,040
biological information comes from genes

1210
00:41:58,550 --> 00:41:57,200
into biological activity and that's what

1211
00:41:59,990 --> 00:41:58,560
we want to capture we want to measure

1212
00:42:02,069 --> 00:42:00,000
all those different omics channels

1213
00:42:04,069 --> 00:42:02,079

together so it's relevant within the

1214
00:42:07,510 --> 00:42:04,079
context of a particular measurement or

1215
00:42:09,750 --> 00:42:07,520
experiment that way a researcher can see

1216
00:42:10,870 --> 00:42:09,760
how biological activity relates to

1217
00:42:12,790 --> 00:42:10,880
turnip

1218
00:42:13,829 --> 00:42:12,800
whether protein is phosphorylated or not

1219
00:42:14,870 --> 00:42:13,839
or gene

1220
00:42:17,030 --> 00:42:14,880
particular

1221
00:42:19,030 --> 00:42:17,040
gene or two is are turned on or off so

1222
00:42:21,430 --> 00:42:19,040
it's really the ability to integrate

1223
00:42:23,430 --> 00:42:21,440
those different omics layers in in a

1224
00:42:25,270 --> 00:42:23,440
multi-dimensional landscape is our

1225
00:42:28,630 --> 00:42:25,280
challenge so we're actually that's why

1226
00:42:30,790 --> 00:42:28,640
we're working with doe and nih and and

1227
00:42:32,790 --> 00:42:30,800
also talking to nist about how we

1228
00:42:37,510 --> 00:42:32,800
partner at the multi-agency level

1229
00:42:41,589 --> 00:42:40,390
goal but also too just in developing the

1230
00:42:43,109 --> 00:42:41,599
information you think of the next

1231
00:42:44,870 --> 00:42:43,119
generation informatics tools it's going

1232
00:42:45,910 --> 00:42:44,880
to take to be able to do that i believe

1233
00:42:48,230 --> 00:42:45,920
that there's

1234
00:42:49,670 --> 00:42:48,240
commercial

1235
00:42:51,030 --> 00:42:49,680
there should be there's going to be ip

1236
00:42:52,950 --> 00:42:51,040
development and commercial activity

1237
00:42:55,750 --> 00:42:52,960
related with that and that's why we're

1238
00:42:57,829 --> 00:42:55,760

working closely with our cases

1239
00:42:59,270 --> 00:42:57,839
partners in order to

1240
00:43:02,710 --> 00:42:59,280
bring this forward

1241
00:43:06,150 --> 00:43:04,150
so that challenge

1242
00:43:07,829 --> 00:43:06,160
of creating that also impacts our

1243
00:43:09,109 --> 00:43:07,839
ability to do personalized medicine in

1244
00:43:11,510 --> 00:43:09,119
the future too

1245
00:43:12,950 --> 00:43:11,520
so there is the direct biomedical so

1246
00:43:15,030 --> 00:43:12,960
it's not something that

1247
00:43:17,109 --> 00:43:15,040
necessarily would wouldn't

1248
00:43:18,710 --> 00:43:17,119
uh couldn't be done on the ground it

1249
00:43:21,349 --> 00:43:18,720
doesn't need we don't need space to do

1250
00:43:23,990 --> 00:43:21,359
this but our ability our need to utilize

1251
00:43:25,990 --> 00:43:24,000
the iss is accelerating the innovation

1252
00:43:27,670 --> 00:43:26,000
in in this in this new area of

1253
00:43:29,589 --> 00:43:27,680
integrated omics

1254
00:43:32,390 --> 00:43:29,599
but once that data is all together it's

1255
00:43:34,550 --> 00:43:32,400
so powerful right because because any

1256
00:43:36,230 --> 00:43:34,560
gene that anybody on earth is studying

1257
00:43:38,630 --> 00:43:36,240
you go to the database and see what

1258
00:43:40,790 --> 00:43:38,640
space normal is and you may learn that

1259
00:43:42,390 --> 00:43:40,800
that gene is doing something that it in

1260
00:43:44,710 --> 00:43:42,400
space that it doesn't do on earth and

1261
00:43:46,390 --> 00:43:44,720
that opens up a discovery mode that

1262
00:43:49,430 --> 00:43:46,400
isn't available any other way that's why

1263
00:43:52,390 --> 00:43:50,950

what about ips cells i mean have you

1264
00:43:53,750 --> 00:43:52,400
guys thought about that i mean rodent

1265
00:43:56,309 --> 00:43:53,760
models are great but if you want to be

1266
00:43:58,230 --> 00:43:56,319
more translational ips cells will be

1267
00:43:59,670 --> 00:43:58,240
the perfect you know and they're

1268
00:44:02,150 --> 00:43:59,680
immortalized after you collect the

1269
00:44:05,109 --> 00:44:02,160
tissue so have you guys thought about

1270
00:44:06,950 --> 00:44:05,119
yeah in fact cases just closed an rfp

1271
00:44:09,190 --> 00:44:06,960
looking at those opportunities i think

1272
00:44:11,670 --> 00:44:09,200
we awarded six or eight

1273
00:44:14,870 --> 00:44:11,680
studies that will begin to address

1274
00:44:17,589 --> 00:44:14,880
use of ips cells stem cells and other

1275
00:44:22,230 --> 00:44:17,599
you know below the whole organism models

1276
00:44:28,470 --> 00:44:24,870
so what are the plans to develop

1277
00:44:30,309 --> 00:44:28,480
the capabilities to drive omic platforms

1278
00:44:32,550 --> 00:44:30,319
on station

1279
00:44:34,870 --> 00:44:32,560
in other words not relying on the return

1280
00:44:37,190 --> 00:44:34,880
of the sample but the ability to

1281
00:44:38,150 --> 00:44:37,200
actually assay those samples in real

1282
00:44:40,950 --> 00:44:38,160
time

1283
00:44:43,349 --> 00:44:40,960
and use that information to

1284
00:44:45,589 --> 00:44:43,359
make countermeasures or actionable items

1285
00:44:47,510 --> 00:44:45,599
on station so is that a long-term goal

1286
00:44:50,630 --> 00:44:47,520
and and where do you see that going we

1287
00:44:52,150 --> 00:44:50,640
have not moved in that direction because

1288
00:44:55,109 --> 00:44:52,160

we have a lifetime

1289
00:44:56,150 --> 00:44:55,119
of issue with regard to the iss so hard

1290
00:44:57,510 --> 00:44:56,160
really

1291
00:44:58,550 --> 00:44:57,520
complicated hardware development

1292
00:45:00,630 --> 00:44:58,560
projects

1293
00:45:03,430 --> 00:45:00,640
like that like what you're saying would

1294
00:45:05,190 --> 00:45:03,440
require may be pushed out

1295
00:45:07,270 --> 00:45:05,200
towards the the end of the lifetime of

1296
00:45:09,030 --> 00:45:07,280
iss so we only get it online for a very

1297
00:45:11,109 --> 00:45:09,040
short period of time that's also going

1298
00:45:13,349 --> 00:45:11,119
to create a potentially a bottleneck in

1299
00:45:15,990 --> 00:45:13,359
terms of crew time for processing the

1300
00:45:17,750 --> 00:45:16,000
samples and doing the analytics on orbit

1301
00:45:20,069 --> 00:45:17,760
plus you know how quickly these

1302
00:45:22,230 --> 00:45:20,079
technologies change they just are

1303
00:45:23,990 --> 00:45:22,240
changing so quickly that by the time you

1304
00:45:25,430 --> 00:45:24,000
got a piece of hardware flight certified

1305
00:45:27,510 --> 00:45:25,440
and got had the protocol and all the

1306
00:45:29,190 --> 00:45:27,520
kits that in it in order to be able to

1307
00:45:30,870 --> 00:45:29,200
use it it would be

1308
00:45:32,630 --> 00:45:30,880
two generations out of date compared to

1309
00:45:34,630 --> 00:45:32,640
what we could do on the ground so we're

1310
00:45:36,230 --> 00:45:34,640
not going to chase the technology in

1311
00:45:37,430 --> 00:45:36,240
space we're going to we're going to rely

1312
00:45:41,109 --> 00:45:37,440
on uh

1313
00:45:43,270 --> 00:45:41,119

sample stowage and and preparation and

1314
00:45:44,630 --> 00:45:43,280
rely on those kinds of capabilities on

1315
00:45:47,990 --> 00:45:44,640
orbit and then just bring the samples

1316
00:45:52,309 --> 00:45:50,309
what will the availability of the crew

1317
00:45:54,950 --> 00:45:52,319
themselves to be used as subjects in

1318
00:45:59,190 --> 00:45:54,960
neurocognitive experiments b

1319
00:46:02,150 --> 00:45:59,200
both on isi and iss and on earth

1320
00:46:04,630 --> 00:46:02,160
as a within subject control

1321
00:46:06,390 --> 00:46:04,640
so the way that our human research

1322
00:46:09,589 --> 00:46:06,400
program is set up that's nasa's research

1323
00:46:11,589 --> 00:46:09,599
program has we have a set of risks um

1324
00:46:13,589 --> 00:46:11,599
that are identified that are the risks

1325
00:46:15,990 --> 00:46:13,599
for future exploration beyond low earth

1326
00:46:18,309 --> 00:46:16,000
orbit and the entire program all of the

1327
00:46:20,710 --> 00:46:18,319
research opportunities are announced for

1328
00:46:23,109 --> 00:46:20,720
peer review to address those risks and

1329
00:46:25,430 --> 00:46:23,119
the the studies are selected according

1330
00:46:27,829 --> 00:46:25,440
to that risk model however there is the

1331
00:46:29,670 --> 00:46:27,839
opportunity for additional researchers

1332
00:46:31,990 --> 00:46:29,680
who see something not related to

1333
00:46:34,069 --> 00:46:32,000
exploration to go to cases and propose

1334
00:46:35,349 --> 00:46:34,079
to use the crew as subjects and then we

1335
00:46:37,510 --> 00:46:35,359
put those things together on a

1336
00:46:39,270 --> 00:46:37,520
non-interference basis so that both

1337
00:46:40,950 --> 00:46:39,280
kinds of research can be done

1338
00:46:42,630 --> 00:46:40,960

and in fact we've

1339
00:46:43,750 --> 00:46:42,640
just exercised that opportunity uh

1340
00:46:45,270 --> 00:46:43,760
recently

1341
00:46:48,550 --> 00:46:45,280
not necessarily neurocognitive but

1342
00:46:50,470 --> 00:46:48,560
looking at intracranial pressure

1343
00:46:51,510 --> 00:46:50,480
an excellent sort of

1344
00:46:54,309 --> 00:46:51,520
subject

1345
00:46:56,150 --> 00:46:54,319
pool if you will because of the the

1346
00:46:58,309 --> 00:46:56,160
microgravity and in the population that

1347
00:46:59,990 --> 00:46:58,319
the astronaut crew represents um but

1348
00:47:01,349 --> 00:47:00,000
directly focused on understanding this

1349
00:47:04,790 --> 00:47:01,359
for some

1350
00:47:09,030 --> 00:47:04,800
earth impacted value so um we we do that

1351
00:47:13,030 --> 00:47:10,950
any more here in the room we could take

1352
00:47:15,190 --> 00:47:13,040
a couple of social media questions real

1353
00:47:16,790 --> 00:47:15,200
quick i think we have a couple of social

1354
00:47:19,829 --> 00:47:16,800
media questions

1355
00:47:22,390 --> 00:47:19,839
so um on the topic of animals

1356
00:47:25,589 --> 00:47:22,400
we have uh someone asking about

1357
00:47:27,829 --> 00:47:25,599
what would be some of the obstacles

1358
00:47:30,390 --> 00:47:27,839
in sending animals to the space station

1359
00:47:33,990 --> 00:47:30,400
and doing long-term research and how can

1360
00:47:39,510 --> 00:47:35,990
so really the biggest obstacle is the

1361
00:47:41,349 --> 00:47:39,520
practical one of launches scrub

1362
00:47:43,430 --> 00:47:41,359
turnarounds

1363
00:47:45,190 --> 00:47:43,440

getting animals of the right age to

1364
00:47:47,109 --> 00:47:45,200
orbit on the right vehicle

1365
00:47:48,630 --> 00:47:47,119
and then we think we know pretty well

1366
00:47:49,990 --> 00:47:48,640
how to operate the hardware once they're

1367
00:47:51,990 --> 00:47:50,000
there

1368
00:47:54,630 --> 00:47:52,000
but it's just you know just like with

1369
00:47:57,270 --> 00:47:54,640
launching human crews uh you know they

1370
00:47:58,630 --> 00:47:57,280
get on they get on the spacecraft then

1371
00:48:00,549 --> 00:47:58,640
there's something wrong they get back

1372
00:48:02,069 --> 00:48:00,559
off the spacecraft so that's that's a

1373
00:48:05,030 --> 00:48:02,079
little tricky for our investigators to

1374
00:48:06,710 --> 00:48:05,040
get used to um but uh

1375
00:48:08,470 --> 00:48:06,720
but at least for these rodent models

1376
00:48:10,069 --> 00:48:08,480
it's something that is pretty well

1377
00:48:11,510 --> 00:48:10,079
understood from previous space flight

1378
00:48:13,589 --> 00:48:11,520
experience and what we're really doing

1379
00:48:16,470 --> 00:48:13,599
is pushing the time threshold rather

1380
00:48:19,030 --> 00:48:16,480
than doing something too new

1381
00:48:21,430 --> 00:48:19,040
we have another one here asking about 3d

1382
00:48:23,430 --> 00:48:21,440
printing wants to know

1383
00:48:26,309 --> 00:48:23,440
what do we hope to get out of 3d

1384
00:48:28,710 --> 00:48:26,319
printing experiments on space station

1385
00:48:30,069 --> 00:48:28,720
so i'll take that one since i'm sitting

1386
00:48:31,670 --> 00:48:30,079
on the national academies committee

1387
00:48:33,990 --> 00:48:31,680
that's looking at 3d printing in space

1388
00:48:36,150 --> 00:48:34,000

and i can't talk about that report

1389
00:48:38,309 --> 00:48:36,160
because it's not out yet but if you

1390
00:48:41,589 --> 00:48:38,319
think about the materials studies that

1391
00:48:42,470 --> 00:48:41,599
these gentlemen were talking about and

1392
00:48:44,710 --> 00:48:42,480
and

1393
00:48:46,309 --> 00:48:44,720
look at additive manufacturing or 3d

1394
00:48:48,630 --> 00:48:46,319
printing the state of the art and the

1395
00:48:51,349 --> 00:48:48,640
science side of that is the creation of

1396
00:48:53,349 --> 00:48:51,359
whole new types of materials by being

1397
00:48:55,349 --> 00:48:53,359
able to actually print things that have

1398
00:48:57,510 --> 00:48:55,359
never existed in nature before so if you

1399
00:49:00,470 --> 00:48:57,520
think about what the possibilities are

1400
00:49:03,430 --> 00:49:00,480
for doing that for

1401
00:49:05,270 --> 00:49:03,440
either in space or for space

1402
00:49:07,589 --> 00:49:05,280
it's really as exciting as the field of

1403
00:49:09,589 --> 00:49:07,599
3d printing itself however as early

1404
00:49:10,630 --> 00:49:09,599
stage as the field of 3d printing itself

1405
00:49:13,190 --> 00:49:10,640
is

1406
00:49:15,349 --> 00:49:13,200
lots of opportunity and i think the fact

1407
00:49:17,910 --> 00:49:15,359
that they'll be launching i believe

1408
00:49:19,589 --> 00:49:17,920
there'll be two 3d printers an italian

1409
00:49:22,309 --> 00:49:19,599
and an american

1410
00:49:23,589 --> 00:49:22,319
3d printer in the next year or so on the

1411
00:49:25,349 --> 00:49:23,599
station

1412
00:49:26,630 --> 00:49:25,359
demonstrating what we can and can't do

1413
00:49:28,150 --> 00:49:26,640

and giving us

1414
00:49:31,270 --> 00:49:28,160
printed

1415
00:49:33,270 --> 00:49:31,280
objects that we can study um is huge

1416
00:49:35,030 --> 00:49:33,280
it'll begin to

1417
00:49:37,109 --> 00:49:35,040
narrow that space of possibility to

1418
00:49:38,950 --> 00:49:37,119
something that really is useful you guys

1419
00:49:40,470 --> 00:49:38,960
must have thought about this well it's

1420
00:49:42,309 --> 00:49:40,480
it's so the concept of additive

1421
00:49:43,670 --> 00:49:42,319
manufacturing i mean if there's a common

1422
00:49:45,270 --> 00:49:43,680
theme that you hear

1423
00:49:47,190 --> 00:49:45,280
in this conversation today it's all

1424
00:49:49,910 --> 00:49:47,200
about logistics right

1425
00:49:51,829 --> 00:49:49,920
so the ability to actually create

1426
00:49:54,309 --> 00:49:51,839
your consumables or the resources that

1427
00:49:55,589 --> 00:49:54,319
you need for research or everyday living

1428
00:49:58,069 --> 00:49:55,599
for that matter

1429
00:50:00,549 --> 00:49:58,079
on iss is really sort of a compelling

1430
00:50:02,150 --> 00:50:00,559
idea so we look at

1431
00:50:05,109 --> 00:50:02,160
not necessarily the science aspect of it

1432
00:50:07,510 --> 00:50:05,119
but the applicability of 3d printing for

1433
00:50:09,109 --> 00:50:07,520
us in order to be sort of a logistics

1434
00:50:11,270 --> 00:50:09,119
problem solver

1435
00:50:13,910 --> 00:50:11,280
the exploration technology piece of it

1436
00:50:15,670 --> 00:50:13,920
is also important so right now today on

1437
00:50:17,270 --> 00:50:15,680
the space station we have almost all the

1438
00:50:18,630 --> 00:50:17,280

spare parts we think we could ever

1439
00:50:20,870 --> 00:50:18,640
urgently need

1440
00:50:23,190 --> 00:50:20,880
and if you're looking at a mars mission

1441
00:50:25,030 --> 00:50:23,200
scenario you can't take all of that mass

1442
00:50:27,190 --> 00:50:25,040
with you so the idea that you could take

1443
00:50:28,870 --> 00:50:27,200
precursor materials and then only make

1444
00:50:30,390 --> 00:50:28,880
the parts that you need it really

1445
00:50:31,670 --> 00:50:30,400
improves that mass equation and it

1446
00:50:33,589 --> 00:50:31,680
improves safety

1447
00:50:35,349 --> 00:50:33,599
and i have to add that i believe there's

1448
00:50:38,069 --> 00:50:35,359
a nasa-funded study at the moment

1449
00:50:40,790 --> 00:50:38,079
looking at how to recycle

1450
00:50:43,670 --> 00:50:40,800
objects that are already on the station

1451
00:50:45,510 --> 00:50:43,680
to be reused in 3d printing it's

1452
00:50:47,589 --> 00:50:45,520
simpler than it will probably end up

1453
00:50:51,270 --> 00:50:47,599
being but is a really interesting

1454
00:50:52,790 --> 00:50:51,280
approach to saving mass and volume

1455
00:50:55,270 --> 00:50:52,800
thank you for that we do have another

1456
00:50:57,750 --> 00:50:55,280
one here um this one is actually on the

1457
00:51:00,309 --> 00:50:57,760
uh new veggie experiment that went up on

1458
00:51:03,190 --> 00:51:00,319
spacex dragon and they're just wanting

1459
00:51:06,069 --> 00:51:03,200
to know if veggie is successful how does

1460
00:51:08,470 --> 00:51:06,079
this change um space travel

1461
00:51:09,349 --> 00:51:08,480
and what other obstacles do we face with

1462
00:51:11,430 --> 00:51:09,359
that

1463
00:51:14,069 --> 00:51:11,440

so nasa in the past has done a lot of

1464
00:51:16,470 --> 00:51:14,079
research on plant growth in space

1465
00:51:18,069 --> 00:51:16,480
based on the idea that for long duration

1466
00:51:19,270 --> 00:51:18,079
missions you would need to

1467
00:51:20,950 --> 00:51:19,280
be able to

1468
00:51:22,790 --> 00:51:20,960
create some of the materials you need to

1469
00:51:28,870 --> 00:51:22,800
support yourself along the way

1470
00:51:32,150 --> 00:51:29,990
is

1471
00:51:34,069 --> 00:51:32,160
problematic because of the radiation in

1472
00:51:36,790 --> 00:51:34,079
the spaceflight environment so the idea

1473
00:51:39,910 --> 00:51:37,910
what the veggie experiment will

1474
00:51:40,710 --> 00:51:39,920
demonstrate hopefully is that

1475
00:51:47,109 --> 00:51:40,720
the

1476
00:51:49,109 --> 00:51:47,119
spaceflight environment so this is

1477
00:51:51,829 --> 00:51:49,119
getting back to the idea of iss is a

1478
00:51:55,829 --> 00:51:51,839
microbial observatory it's really unique

1479
00:51:59,910 --> 00:51:57,990
bacteria that come into the environment

1480
00:52:01,990 --> 00:51:59,920
the ones that come on us or potentially

1481
00:52:03,430 --> 00:52:02,000
on the other materials we bring up so we

1482
00:52:05,750 --> 00:52:03,440
want to demonstrate that we can grow

1483
00:52:08,069 --> 00:52:05,760
salad vegetables in space

1484
00:52:09,670 --> 00:52:08,079
on at least a small scale show that

1485
00:52:12,150 --> 00:52:09,680
they're not

1486
00:52:14,790 --> 00:52:12,160
harboring any pathogenic bacteria so in

1487
00:52:17,430 --> 00:52:14,800
the future this is a supplement for

1488
00:52:19,910 --> 00:52:17,440

nutrition provide a source of fresh

1489
00:52:21,750 --> 00:52:19,920
vitamins and fresh nutrients

1490
00:52:24,230 --> 00:52:21,760
and it's also been shown in the past

1491
00:52:26,630 --> 00:52:24,240
that it provides psychological comfort

1492
00:52:29,190 --> 00:52:26,640
so you can't forget the fact that you're

1493
00:52:29,990 --> 00:52:29,200
you're gonna put people in a can for a

1494
00:52:30,829 --> 00:52:30,000
year

1495
00:52:33,829 --> 00:52:30,839
and

1496
00:52:36,470 --> 00:52:33,839
um i think pieces of the earth that we

1497
00:52:38,470 --> 00:52:36,480
can look at and touch and feel uh have

1498
00:52:43,270 --> 00:52:38,480
provide a lot of psychological comfort

1499
00:52:45,430 --> 00:52:43,280
for the um for astronauts and cosmonauts

1500
00:52:47,030 --> 00:52:45,440
okay well we're getting a little short

1501
00:52:48,870 --> 00:52:47,040
on time so there's one more question i

1502
00:52:50,150 --> 00:52:48,880
wanted to ask each of you just to pose

1503
00:52:52,230 --> 00:52:50,160
it real quick

1504
00:52:54,069 --> 00:52:52,240
and so as we you know we're moving

1505
00:52:56,390 --> 00:52:54,079
forward we have this guidance we have

1506
00:52:58,230 --> 00:52:56,400
all this research we're now looking for

1507
00:53:00,309 --> 00:52:58,240
that's not only going to help us here on

1508
00:53:02,150 --> 00:53:00,319
earth but help us get to mars and you

1509
00:53:04,630 --> 00:53:02,160
know let humans go further out into

1510
00:53:06,630 --> 00:53:04,640
space than ever before what do you think

1511
00:53:08,710 --> 00:53:06,640
in your own words will really be the

1512
00:53:11,030 --> 00:53:08,720
lasting legacy of the international

1513
00:53:12,870 --> 00:53:11,040

space station with all with all this

1514
00:53:15,349 --> 00:53:12,880
going on

1515
00:53:16,950 --> 00:53:15,359
what a great question to expound on but

1516
00:53:20,150 --> 00:53:16,960
but um

1517
00:53:22,630 --> 00:53:20,160
i think about that from say

1518
00:53:24,230 --> 00:53:22,640
a hundred years in the future when i'm

1519
00:53:27,030 --> 00:53:24,240
standing on the surface of mars looking

1520
00:53:29,430 --> 00:53:27,040
back at the planet what is the story

1521
00:53:32,549 --> 00:53:29,440
that that we will carry forward with us

1522
00:53:34,470 --> 00:53:32,559
and clearly to me if we do it right part

1523
00:53:36,790 --> 00:53:34,480
of the story will be that we solved some

1524
00:53:39,910 --> 00:53:36,800
of the intractable challenges associated

1525
00:53:42,390 --> 00:53:39,920
with things like long duration exposure

1526
00:53:44,069 --> 00:53:42,400
to radiation long-duration exposure to

1527
00:53:45,990 --> 00:53:44,079
microgravity we'll we'll have used the

1528
00:53:47,349 --> 00:53:46,000
station to solve those challenges i will

1529
00:53:49,430 --> 00:53:47,359
know that 100 years from now i'll

1530
00:53:51,829 --> 00:53:49,440
actually remember like we remember

1531
00:53:53,990 --> 00:53:51,839
stories about i think the nina the pinta

1532
00:53:55,589 --> 00:53:54,000
and the santa maria those are apocryphal

1533
00:53:57,510 --> 00:53:55,599
stories but i think that's what we'll

1534
00:53:58,870 --> 00:53:57,520
remember about the state

1535
00:54:00,069 --> 00:53:58,880
juliet

1536
00:54:01,750 --> 00:54:00,079
you know

1537
00:54:03,589 --> 00:54:01,760
there are a couple of things i could

1538
00:54:06,069 --> 00:54:03,599

talk about in life and physical sciences

1539
00:54:07,270 --> 00:54:06,079
but i'm going to pass on those because

1540
00:54:09,109 --> 00:54:07,280
there's a few disciplines we really

1541
00:54:11,109 --> 00:54:09,119
haven't talked about yet so we've got

1542
00:54:13,589 --> 00:54:11,119
the alpha magnetic spectrometer that

1543
00:54:16,150 --> 00:54:13,599
could be making the first observations

1544
00:54:17,750 --> 00:54:16,160
of strangelets you know these sub these

1545
00:54:20,069 --> 00:54:17,760
uh particles that

1546
00:54:21,589 --> 00:54:20,079
you can make in a in an atom smasher but

1547
00:54:23,349 --> 00:54:21,599
you never see in nature and so if

1548
00:54:25,030 --> 00:54:23,359
there's any instrument that we'll ever

1549
00:54:26,230 --> 00:54:25,040
be able to see these it's the alpha

1550
00:54:28,150 --> 00:54:26,240
magnetic spectrometer and that's

1551
00:54:30,150 --> 00:54:28,160
collecting data constantly

1552
00:54:32,470 --> 00:54:30,160
also this year we have

1553
00:54:34,390 --> 00:54:32,480
our first of an ongoing suite of earth

1554
00:54:36,549 --> 00:54:34,400
science instruments going up that will

1555
00:54:38,470 --> 00:54:36,559
be making all kinds of new observations

1556
00:54:40,789 --> 00:54:38,480
about the earth so the first instrument

1557
00:54:43,030 --> 00:54:40,799
to ever make measurements of the actual

1558
00:54:44,870 --> 00:54:43,040
depth of clouds is called cats it's

1559
00:54:47,109 --> 00:54:44,880
demonstrating a brand new technology

1560
00:54:49,829 --> 00:54:47,119
it'll be going up onto the space station

1561
00:54:52,390 --> 00:54:49,839
later this year rapidscat which fills a

1562
00:54:54,309 --> 00:54:52,400
gap in hurricane modeling data because

1563
00:54:57,030 --> 00:54:54,319

other wind measurement devices aren't

1564
00:54:59,349 --> 00:54:57,040
operating around the world right now and

1565
00:55:01,190 --> 00:54:59,359
opals which was just unpacked on space

1566
00:55:03,430 --> 00:55:01,200
on the last spacex flight

1567
00:55:04,710 --> 00:55:03,440
will be testing laser com so there are

1568
00:55:06,309 --> 00:55:04,720
all of these other things going on

1569
00:55:07,349 --> 00:55:06,319
outside the space station that actually

1570
00:55:09,109 --> 00:55:07,359
don't have anything to do with

1571
00:55:11,430 --> 00:55:09,119
microgravity and

1572
00:55:13,349 --> 00:55:11,440
it's amazing to realize what this

1573
00:55:15,510 --> 00:55:13,359
laboratory does how many different

1574
00:55:17,190 --> 00:55:15,520
disciplines it addresses there's never

1575
00:55:19,109 --> 00:55:17,200
been anything like it and i think we'll

1576
00:55:20,710 --> 00:55:19,119
look back and and realize that having

1577
00:55:22,710 --> 00:55:20,720
that all in one place it's like a

1578
00:55:23,910 --> 00:55:22,720
university all together with all the

1579
00:55:27,349 --> 00:55:23,920
disciplines and i don't know that we'll

1580
00:55:32,150 --> 00:55:29,910
i think one of the most important

1581
00:55:34,069 --> 00:55:32,160
um objectives that i have from my

1582
00:55:37,190 --> 00:55:34,079
perspective

1583
00:55:40,069 --> 00:55:37,200
and my role working with nasa is to

1584
00:55:42,150 --> 00:55:40,079
ensure that we get as much high quality

1585
00:55:43,990 --> 00:55:42,160
science accomplished on the space

1586
00:55:46,309 --> 00:55:44,000
station while we have it that is

1587
00:55:47,750 --> 00:55:46,319
responsive to the decadal

1588
00:55:49,670 --> 00:55:47,760

open source science credits

1589
00:55:51,430 --> 00:55:49,680
crowdsourcing initiatives are a way to

1590
00:55:52,630 --> 00:55:51,440
um

1591
00:55:53,589 --> 00:55:52,640
amplify

1592
00:55:55,829 --> 00:55:53,599
um

1593
00:55:58,470 --> 00:55:55,839
and multiply the research throughput but

1594
00:56:00,230 --> 00:55:58,480
also creates a competition and brings in

1595
00:56:02,950 --> 00:56:00,240
innovation and we're truly going to have

1596
00:56:05,190 --> 00:56:02,960
to drive innovation if we're going to

1597
00:56:10,230 --> 00:56:05,200
develop the next generation biomedical

1598
00:56:13,349 --> 00:56:11,510
technologies that come out of the

1599
00:56:15,589 --> 00:56:13,359
physical sciences program that are going

1600
00:56:19,190 --> 00:56:15,599
to advance human exploration now we

1601
00:56:20,630 --> 00:56:19,200
don't have our gene lab initiative fully

1602
00:56:21,750 --> 00:56:20,640
online yet

1603
00:56:23,109 --> 00:56:21,760
but

1604
00:56:24,390 --> 00:56:23,119
if you look at the studies that were

1605
00:56:25,990 --> 00:56:24,400
selected by

1606
00:56:28,470 --> 00:56:26,000
the human research program and by the

1607
00:56:30,630 --> 00:56:28,480
nasa space biomedical research institute

1608
00:56:32,870 --> 00:56:30,640
in support of the twin studies

1609
00:56:35,190 --> 00:56:32,880
loosely that that's been

1610
00:56:37,109 --> 00:56:35,200
integrated those pis those 11 projects

1611
00:56:39,190 --> 00:56:37,119
are integrated in a way that is

1612
00:56:41,270 --> 00:56:39,200
operating based in a way that's

1613
00:56:42,950 --> 00:56:41,280

analogous with the gene lab model so i

1614
00:56:44,950 --> 00:56:42,960
think that potentially the gene the twin

1615
00:56:47,589 --> 00:56:44,960
study having genetically similar

1616
00:56:49,270 --> 00:56:47,599
individuals and all the the data that

1617
00:56:50,870 --> 00:56:49,280
we're going to be able to collect using

1618
00:56:53,270 --> 00:56:50,880
advanced omics technologies that

1619
00:56:55,430 --> 00:56:53,280
database on its own may be one of the

1620
00:56:57,510 --> 00:56:55,440
most important biomedical

1621
00:56:59,510 --> 00:56:57,520
projects ever accomplished on the iss

1622
00:57:02,309 --> 00:56:59,520
and it will yield data and

1623
00:57:06,309 --> 00:57:02,319
the data that will be rich and useful

1624
00:57:08,309 --> 00:57:06,319
for years potentially decades to come

1625
00:57:10,789 --> 00:57:08,319
yeah i i really see

1626
00:57:12,710 --> 00:57:10,799
as magnificent of an endeavor and a

1627
00:57:13,510 --> 00:57:12,720
technological advancement that the iss

1628
00:57:15,270 --> 00:57:13,520
is

1629
00:57:17,349 --> 00:57:15,280
and and the wonderful returns that we're

1630
00:57:19,030 --> 00:57:17,359
already getting thus far and we have at

1631
00:57:21,109 --> 00:57:19,040
least 10 more years

1632
00:57:22,470 --> 00:57:21,119
to continue to discover

1633
00:57:24,309 --> 00:57:22,480
in my opinion

1634
00:57:26,630 --> 00:57:24,319
the iss will represent the beginning of

1635
00:57:29,750 --> 00:57:26,640
a pioneering effort in low earth orbit

1636
00:57:31,430 --> 00:57:29,760
and it will be the first of its kind and

1637
00:57:33,270 --> 00:57:31,440
hopefully set the stake in the ground if

1638
00:57:36,150 --> 00:57:33,280

you will for what we will continue to

1639
00:57:37,190 --> 00:57:36,160
enjoy years out into the future as betsy

1640
00:57:39,270 --> 00:57:37,200
stated

1641
00:57:41,030 --> 00:57:39,280
okay and i'm hearing we have one

1642
00:57:42,549 --> 00:57:41,040
question on the phone bridge real quick

1643
00:57:43,829 --> 00:57:42,559
so i think it's from university are you

1644
00:57:45,430 --> 00:57:43,839
there

1645
00:57:47,670 --> 00:57:45,440
hello elizabeth howell here thank you

1646
00:57:49,829 --> 00:57:47,680
very much uh this probably is for julie

1647
00:57:51,750 --> 00:57:49,839
i was seeing on real nasa that you have

1648
00:57:53,670 --> 00:57:51,760
four shoes that are going to be

1649
00:57:55,589 --> 00:57:53,680
being used very soon on the station can

1650
00:57:56,549 --> 00:57:55,599
you talk about any other sort of newer

1651
00:57:59,430 --> 00:57:56,559
human

1652
00:58:01,910 --> 00:57:59,440
science experiments that are happening

1653
00:58:03,270 --> 00:58:01,920
oh four shoes at first on the bridge it

1654
00:58:05,910 --> 00:58:03,280
sounded like you said horseshoes and i

1655
00:58:07,750 --> 00:58:05,920
couldn't think of that one

1656
00:58:10,309 --> 00:58:07,760
yeah so you know early on the space

1657
00:58:12,549 --> 00:58:10,319
station we had some force measurement

1658
00:58:14,710 --> 00:58:12,559
data that was collected clear back in

1659
00:58:16,470 --> 00:58:14,720
the single digit expeditions and and

1660
00:58:18,710 --> 00:58:16,480
from that we found that we were not

1661
00:58:22,150 --> 00:58:18,720
loading crews anywhere close to 1g when

1662
00:58:24,309 --> 00:58:22,160
they were on the treadmills um and that

1663
00:58:26,630 --> 00:58:24,319

led us to have to design new harnesses

1664
00:58:28,789 --> 00:58:26,640
design new backpack systems to design

1665
00:58:30,950 --> 00:58:28,799
new bungee systems and we really went

1666
00:58:32,549 --> 00:58:30,960
through a full stage of exercise

1667
00:58:34,230 --> 00:58:32,559
equipment development because the first

1668
00:58:35,910 --> 00:58:34,240
exercise equipment we flew on the space

1669
00:58:38,150 --> 00:58:35,920
station didn't work it was not

1670
00:58:40,390 --> 00:58:38,160
protecting bone the way it needed to do

1671
00:58:43,349 --> 00:58:40,400
so now on the space station we have that

1672
00:58:44,870 --> 00:58:43,359
next generation of hardware but the

1673
00:58:46,789 --> 00:58:44,880
force measurement that we had hoped to

1674
00:58:48,630 --> 00:58:46,799
get that was built into the hardware

1675
00:58:50,470 --> 00:58:48,640
didn't wind up working and so by taking

1676
00:58:52,789 --> 00:58:50,480
these four shoes onto iss we'll be able

1677
00:58:54,789 --> 00:58:52,799
to actually measure the forces and see

1678
00:58:56,470 --> 00:58:54,799
what loading we're getting that's really

1679
00:58:58,230 --> 00:58:56,480
hard to predict uh when you've got

1680
00:59:00,470 --> 00:58:58,240
somebody doing something as complicated

1681
00:59:03,910 --> 00:59:00,480
as running on a treadmill or doing squat

1682
00:59:05,349 --> 00:59:03,920
thrusts on our resistive exercise device

1683
00:59:08,710 --> 00:59:05,359
so by putting all of those things

1684
00:59:11,109 --> 00:59:08,720
together um we're really making progress

1685
00:59:12,950 --> 00:59:11,119
on the bone loss problem we we're now

1686
00:59:14,789 --> 00:59:12,960
finding the right combination of diet

1687
00:59:16,630 --> 00:59:14,799
and exercise to say protect bone mass

1688
00:59:18,390 --> 00:59:16,640

density that was published

1689
00:59:20,309 --> 00:59:18,400
in late 2011 in the journal of bone and

1690
00:59:21,910 --> 00:59:20,319
mineral research now we've got to focus

1691
00:59:23,750 --> 00:59:21,920
on the structure of the bone and be sure

1692
00:59:26,470 --> 00:59:23,760
that the bone that astronauts are

1693
00:59:28,630 --> 00:59:26,480
retaining or or rebuilding is still as

1694
00:59:30,549 --> 00:59:28,640
strong as as bone would be on earth and

1695
00:59:32,309 --> 00:59:30,559
so you can see how then all of those

1696
00:59:34,789 --> 00:59:32,319
that data the force data and so forth

1697
00:59:36,309 --> 00:59:34,799
both helps us know what kind of exercise

1698
00:59:38,470 --> 00:59:36,319
equipment to take to mars because it's

1699
00:59:39,750 --> 00:59:38,480
got to be compact but also then how to

1700
00:59:41,670 --> 00:59:39,760
take the things that we're learning

1701
00:59:44,390 --> 00:59:41,680
about rebuilding astronaut bones bring

1702
00:59:45,750 --> 00:59:44,400
that back down here to earth and help

1703
00:59:47,589 --> 00:59:45,760
people who are struggling with bone loss

1704
00:59:49,349 --> 00:59:47,599
themselves here

1705
00:59:51,190 --> 00:59:49,359
okay well i think that's going to do it

1706
00:59:53,910 --> 00:59:51,200
for us today this was again the first

1707
00:59:55,510 --> 00:59:53,920
destination station iss form i'd like to

1708
00:59:58,069 --> 00:59:55,520
again thank our panelists here for

1709
00:59:59,750 --> 00:59:58,079
joining us give us some great insight

1710
01:00:01,990 --> 00:59:59,760
the signs of today and the signs going

1711
01:00:03,829 --> 01:00:02,000
to be coming online tomorrow again for

1712
01:00:05,030 --> 01:00:03,839
all of our guests here in studio b

1713
01:00:07,109 --> 01:00:05,040

really appreciate your time and

1714
01:00:09,510 --> 01:00:07,119
questions uh as always you can always

1715
01:00:12,549 --> 01:00:09,520
find out more about station and station

1716
01:00:14,710 --> 01:00:12,559
science by going to nasa.gov station and

1717
01:00:17,109 --> 01:00:14,720
following us online on our multiple

1718
01:00:18,630 --> 01:00:17,119
social media outlets again thank you

1719
01:00:20,309 --> 01:00:18,640
again for everybody here in the room