
#NASASocial
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1
00:00:20,150 --> 00:00:18,390
hello everyone and welcome my name is

2
00:00:22,230 --> 00:00:20,160
catherine hamilton i'm with nasa's

3
00:00:24,470 --> 00:00:22,240
office of communication thank you for

4
00:00:26,710 --> 00:00:24,480
joining us today at kennedy space center

5
00:00:27,990 --> 00:00:26,720
here in florida uh to talk about the

6
00:00:30,310 --> 00:00:28,000
science that we'll be launching to the

7
00:00:32,630 --> 00:00:30,320
international space station dragon is

8
00:00:35,030 --> 00:00:32,640
just about packed and ready to launch

9
00:00:38,310 --> 00:00:35,040
atop of falcon 9

10
00:00:40,229 --> 00:00:38,320
tomorrow at 5 55 pm in the evening

11
00:00:42,549 --> 00:00:40,239
we will have time for a few questions as

12
00:00:44,630 --> 00:00:42,559
i bring each of our speakers up today

13
00:00:46,549 --> 00:00:44,640

for those on the phone you'll press star

14
00:00:49,190 --> 00:00:46,559
one to be entered into the queue and for

15
00:00:52,869 --> 00:00:49,200
those online please use the hashtag ask

16
00:00:56,950 --> 00:00:54,950
so here with me first i will have dr

17
00:00:58,310 --> 00:00:56,960
camille aleen with the program science

18
00:00:59,670 --> 00:00:58,320
office of the international space

19
00:01:01,189 --> 00:00:59,680
station program

20
00:01:03,349 --> 00:01:01,199
and ken shields from the center for the

21
00:01:04,710 --> 00:01:03,359
advancement of science and space

22
00:01:06,469 --> 00:01:04,720
otherwise known as cases the

23
00:01:07,910 --> 00:01:06,479
organization that manages the national

24
00:01:10,070 --> 00:01:07,920
lab

25
00:01:11,910 --> 00:01:10,080
all right camille and ken would you like

26
00:01:13,429 --> 00:01:11,920
to join us yes and camille's going to

27
00:01:16,230 --> 00:01:13,439
give us an overview of what's happening

28
00:01:17,270 --> 00:01:16,240
in the world of science on station and

29
00:01:19,670 --> 00:01:17,280
ken is going to tell us a little bit

30
00:01:21,830 --> 00:01:19,680
about what's going on with cases

31
00:01:23,749 --> 00:01:21,840
thank you catherine welcome everybody

32
00:01:25,830 --> 00:01:23,759
we're so excited to have you guys here

33
00:01:28,870 --> 00:01:25,840
today and we're really looking forward

34
00:01:31,990 --> 00:01:28,880
to the launch tomorrow the crs 11 will

35
00:01:34,469 --> 00:01:32,000
launch over 4 500 pounds of research

36
00:01:36,550 --> 00:01:34,479
supplies and science investigations

37
00:01:39,190 --> 00:01:36,560
including about 2 000 pounds of

38
00:01:40,950 --> 00:01:39,200

unpressurized cargo three science

39
00:01:42,950 --> 00:01:40,960
instruments that would be flying in the

40
00:01:45,590 --> 00:01:42,960
trunk of dragon you'll hear a little bit

41
00:01:48,389 --> 00:01:45,600
about that in a few minutes um it also

42
00:01:50,870 --> 00:01:48,399
has the capability to return samples for

43
00:01:53,190 --> 00:01:50,880
us and return payloads and it will in

44
00:01:56,709 --> 00:01:53,200
about 30 days will return will be

45
00:01:58,870 --> 00:01:56,719
returning about 1500 pounds of of that

46
00:02:01,389 --> 00:01:58,880
science uh experiments

47
00:02:04,870 --> 00:02:01,399
uh all this research is supporting over

48
00:02:07,910 --> 00:02:04,880
220 investigations currently going on

49
00:02:11,510 --> 00:02:07,920
during increment 5152 on board the space

50
00:02:14,070 --> 00:02:11,520
station and these experiments uh really

51
00:02:16,949 --> 00:02:14,080
support a number of disciplined

52
00:02:19,510 --> 00:02:16,959
scientific disciplines including biology

53
00:02:21,510 --> 00:02:19,520
and biotechnology you'd hear about that

54
00:02:23,589 --> 00:02:21,520
in the rodent research and fruit fly

55
00:02:26,550 --> 00:02:23,599
investigations we also have the

56
00:02:29,750 --> 00:02:26,560
capability to do physical sciences

57
00:02:31,910 --> 00:02:29,760
research in the area of combustion

58
00:02:34,710 --> 00:02:31,920
complex fluids and also material

59
00:02:37,830 --> 00:02:34,720
research we have experiments supporting

60
00:02:40,309 --> 00:02:37,840
the earth sciences and space science

61
00:02:42,470 --> 00:02:40,319
we also have some investigations that

62
00:02:44,309 --> 00:02:42,480
are developing technologies and

63
00:02:47,110 --> 00:02:44,319

advancing those for future space

64
00:02:49,350 --> 00:02:47,120
exploration and then we have a suite of

65
00:02:52,710 --> 00:02:49,360
science education

66
00:02:55,750 --> 00:02:52,720
experiments and activities from students

67
00:02:57,830 --> 00:02:55,760
not just across the u.s but across the

68
00:02:59,990 --> 00:02:57,840
world who will be flying things like

69
00:03:03,430 --> 00:03:00,000
cube satellites a constellation of cube

70
00:03:06,390 --> 00:03:03,440
satellites from six developing countries

71
00:03:08,869 --> 00:03:06,400
so to date we have had over 2 000

72
00:03:11,509 --> 00:03:08,879
investigations that have been conducted

73
00:03:14,550 --> 00:03:11,519
on board the space station and about 2

74
00:03:16,309 --> 00:03:14,560
000 researchers scientists and students

75
00:03:19,270 --> 00:03:16,319
who have done research

76
00:03:21,990 --> 00:03:19,280
from 93 countries around the world we

77
00:03:24,550 --> 00:03:22,000
use the space station to advance our

78
00:03:26,470 --> 00:03:24,560
scientific knowledge uh that has a

79
00:03:28,869 --> 00:03:26,480
benefit to improving the quality of our

80
00:03:31,910 --> 00:03:28,879
lives here on earth we also use it as a

81
00:03:34,470 --> 00:03:31,920
technology testbed and to do research on

82
00:03:37,270 --> 00:03:34,480
the human physiology to further our

83
00:03:40,470 --> 00:03:37,280
space exploration goals we are also

84
00:03:43,030 --> 00:03:40,480
using it to develop a marketplace in low

85
00:03:44,149 --> 00:03:43,040
earth orbit for commercial companies and

86
00:03:46,789 --> 00:03:44,159
finally

87
00:03:49,509 --> 00:03:46,799
it is really a great testbed uh for a

88
00:03:52,470 --> 00:03:49,519

blueprint for international corporation

89
00:03:55,270 --> 00:03:52,480
so that we know how to work and live

90
00:03:57,750 --> 00:03:55,280
with other countries uh as we further

91
00:03:59,509 --> 00:03:57,760
our exploration goals so with that i

92
00:04:01,350 --> 00:03:59,519
will turn it over to ken who will talk

93
00:04:04,070 --> 00:04:01,360
to you a little bit about the u.s

94
00:04:05,589 --> 00:04:04,080
national lab that's managed by the sign

95
00:04:07,509 --> 00:04:05,599
the center for the advancement of

96
00:04:09,190 --> 00:04:07,519
science in space

97
00:04:10,630 --> 00:04:09,200
that's great camille and thank you and

98
00:04:12,470 --> 00:04:10,640
and you could hear from camille's

99
00:04:14,149 --> 00:04:12,480
briefing all the great things that we're

100
00:04:15,910 --> 00:04:14,159
doing on space station through nasa and

101
00:04:17,270 --> 00:04:15,920
the international partnership

102
00:04:19,189 --> 00:04:17,280
i'm from kasis the center for the

103
00:04:21,590 --> 00:04:19,199
advancement of science and space and we

104
00:04:23,430 --> 00:04:21,600
are the non-profit non-governmental

105
00:04:25,670 --> 00:04:23,440
organization that manages the u.s

106
00:04:27,909 --> 00:04:25,680
national laboratory on board station

107
00:04:29,670 --> 00:04:27,919
now what does that mean exactly well we

108
00:04:31,909 --> 00:04:29,680
are the sponsor or the gateway or the

109
00:04:34,469 --> 00:04:31,919
front door for

110
00:04:36,469 --> 00:04:34,479
non-nasa related uses so

111
00:04:38,310 --> 00:04:36,479
our mission is not to necessarily fly

112
00:04:41,110 --> 00:04:38,320
things on the space station to further

113
00:04:43,510 --> 00:04:41,120

our exploration objectives or to go to

114
00:04:45,749 --> 00:04:43,520
the moon or to an uh visit an asteroid

115
00:04:47,510 --> 00:04:45,759
but we're trying to sponsor research on

116
00:04:49,749 --> 00:04:47,520
station that will have a direct benefit

117
00:04:52,150 --> 00:04:49,759
to life here on earth now this launch

118
00:04:53,909 --> 00:04:52,160
spacex 11 um

119
00:04:55,189 --> 00:04:53,919
terrific launch i think it represents

120
00:04:57,749 --> 00:04:55,199
another

121
00:05:00,469 --> 00:04:57,759
awesome example of the progression of

122
00:05:02,070 --> 00:05:00,479
the iss and the national lab as a

123
00:05:03,990 --> 00:05:02,080
wonderful platform for not only

124
00:05:05,430 --> 00:05:04,000
commercial innovation but also

125
00:05:07,590 --> 00:05:05,440
innovation from a number of different

126
00:05:09,029 --> 00:05:07,600
users we've got users on board this

127
00:05:12,390 --> 00:05:09,039
flight that represent other government

128
00:05:14,870 --> 00:05:12,400
agencies academia and quite a few in the

129
00:05:16,550 --> 00:05:14,880
area of stem education

130
00:05:18,550 --> 00:05:16,560
representing every science discipline

131
00:05:20,469 --> 00:05:18,560
that you can think of camille touched on

132
00:05:21,749 --> 00:05:20,479
several some very exciting payloads in

133
00:05:23,430 --> 00:05:21,759
the trunk in particular we're all

134
00:05:25,749 --> 00:05:23,440
looking forward to those

135
00:05:28,230 --> 00:05:25,759
but also we've got payloads from

136
00:05:30,070 --> 00:05:28,240
companies like procter and gamble

137
00:05:31,350 --> 00:05:30,080
matthew lynch from procter gamble is

138
00:05:33,189 --> 00:05:31,360

conducting

139
00:05:35,270 --> 00:05:33,199
a colloids experiment in microgravity

140
00:05:37,909 --> 00:05:35,280
with the aims of developing improved

141
00:05:39,749 --> 00:05:37,919
formulations for dozens of consumer

142
00:05:40,950 --> 00:05:39,759
products that we all utilize every day

143
00:05:43,749 --> 00:05:40,960
in our life

144
00:05:45,749 --> 00:05:43,759
another great example is from dr

145
00:05:48,230 --> 00:05:45,759
from ucla who is

146
00:05:50,310 --> 00:05:48,240
looking at improving a drug design or

147
00:05:52,790 --> 00:05:50,320
drug development that will

148
00:05:56,070 --> 00:05:52,800
repair bone or even prevent future bone

149
00:05:57,909 --> 00:05:56,080
loss once again great uh effect for an

150
00:06:00,230 --> 00:05:57,919
an improvement for life here on earth

151
00:06:02,309 --> 00:06:00,240
and lastly we have an investigator dr

152
00:06:04,309 --> 00:06:02,319
kovalevsky from oak ridge national

153
00:06:07,430 --> 00:06:04,319
laboratory who is doing a protein

154
00:06:09,110 --> 00:06:07,440
crystallization experiment aimed at

155
00:06:10,950 --> 00:06:09,120
increasing his understanding of an

156
00:06:13,909 --> 00:06:10,960
enzyme that is associated with the

157
00:06:15,670 --> 00:06:13,919
antidotes uh that we design and build to

158
00:06:17,830 --> 00:06:15,680
fight venom and chemicals that attack

159
00:06:20,550 --> 00:06:17,840
our nervous system once again very

160
00:06:22,230 --> 00:06:20,560
important uh and effective impact for

161
00:06:24,230 --> 00:06:22,240
life here on earth all of these are

162
00:06:26,230 --> 00:06:24,240
great examples of the utility and the

163
00:06:27,670 --> 00:06:26,240

importance of the space station we've

164
00:06:28,870 --> 00:06:27,680
got a video that we'd like to show you

165
00:06:30,230 --> 00:06:28,880
right now to tell you a little bit more

166
00:06:31,920 --> 00:06:30,240
about the oak ridge national laboratory

167
00:06:41,110 --> 00:06:31,930
experiment

168
00:06:46,309 --> 00:06:43,990
hundreds of thousands of people die

169
00:06:51,560 --> 00:06:46,319
in world every year

170
00:07:00,629 --> 00:06:59,029
[Music]

171
00:07:03,950 --> 00:07:00,639
crystals are

172
00:07:06,150 --> 00:07:03,960
symmetric collection of molecules

173
00:07:09,589 --> 00:07:06,160
[Music]

174
00:07:12,710 --> 00:07:09,599
so every next molecule in the crystal

175
00:07:17,430 --> 00:07:12,720
sits in exactly the same orientation and

176
00:07:19,749 --> 00:07:17,440
in the correct symmetry it's ordered

177
00:07:23,990 --> 00:07:19,759
by growing crystals on the base station

178
00:07:28,340 --> 00:07:24,000
we hope to grow better more uniform

179
00:07:32,070 --> 00:07:28,350
crystals that we cannot grow on earth

180
00:07:35,350 --> 00:07:34,309
once we get protein structure we can

181
00:07:38,150 --> 00:07:35,360
design

182
00:07:38,870 --> 00:07:38,160
better faster acting antidotes that can

183
00:07:42,309 --> 00:07:38,880
be

184
00:07:46,390 --> 00:07:42,319
used against pesticide and neuroagent

185
00:07:52,629 --> 00:07:48,790
it's very exciting to

186
00:07:54,629 --> 00:07:52,639
send my research to space we should keep

187
00:07:56,310 --> 00:07:54,639
pushing the frontiers

188
00:08:02,950 --> 00:07:56,320

of science

189
00:08:04,790 --> 00:08:02,960
[Music]

190
00:08:07,029 --> 00:08:04,800
so yeah just to wrap that up as you can

191
00:08:09,670 --> 00:08:07,039
see very important work here and i think

192
00:08:11,830 --> 00:08:09,680
it's a great example of of how the iss

193
00:08:14,469 --> 00:08:11,840
can really represent

194
00:08:15,830 --> 00:08:14,479
it's part research park part business

195
00:08:19,110 --> 00:08:15,840
incubator

196
00:08:22,150 --> 00:08:19,120
part laboratory in space that can serve

197
00:08:24,150 --> 00:08:22,160
a broad spectrum of interest in users

198
00:08:25,749 --> 00:08:24,160
it is of extreme value

199
00:08:27,990 --> 00:08:25,759
to us here in the united states and i

200
00:08:29,430 --> 00:08:28,000
think it underscores the importance of

201
00:08:31,430 --> 00:08:29,440
what we're looking to do next with

202
00:08:33,190 --> 00:08:31,440
future commercial space stations and how

203
00:08:35,110 --> 00:08:33,200
we're going to continue to develop this

204
00:08:36,230 --> 00:08:35,120
economy in low earth orbit that camille

205
00:08:37,509 --> 00:08:36,240
alluded to

206
00:08:39,190 --> 00:08:37,519
and that's all look forward to questions

207
00:08:40,870 --> 00:08:39,200
later on thank you

208
00:08:43,269 --> 00:08:40,880
we'll take questions from folks here in

209
00:08:45,990 --> 00:08:43,279
the room if there's any questions about

210
00:08:48,230 --> 00:08:46,000
the general science that ken and camille

211
00:08:52,310 --> 00:08:48,240
talked about before we get into our our

212
00:08:56,790 --> 00:08:55,430
the crystals they said that it was it

213
00:08:58,790 --> 00:08:56,800

was going to be used to protect against

214
00:09:01,190 --> 00:08:58,800
pesticides and other chemicals what does

215
00:09:03,509 --> 00:09:01,200
he mean by that is it going to be

216
00:09:05,190 --> 00:09:03,519
in some sort of filter system or

217
00:09:06,550 --> 00:09:05,200
the space suit

218
00:09:08,870 --> 00:09:06,560
what exactly are they going to be doing

219
00:09:11,030 --> 00:09:08,880
dr kovaleski is is really looking at is

220
00:09:13,350 --> 00:09:11,040
he's looking at the protime proteins

221
00:09:15,509 --> 00:09:13,360
that actually are the construct or the

222
00:09:17,990 --> 00:09:15,519
basis of the enzyme that's associated

223
00:09:20,150 --> 00:09:18,000
with the antidotes that we uh designed

224
00:09:22,230 --> 00:09:20,160
to fight some of these toxins that that

225
00:09:24,389 --> 00:09:22,240
might attack our nervous system so from

226
00:09:26,389 --> 00:09:24,399
an experimental standpoint it is a very

227
00:09:28,310 --> 00:09:26,399
basic research experiment he's going to

228
00:09:29,269 --> 00:09:28,320
grow these crystals in space because in

229
00:09:31,509 --> 00:09:29,279
space

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00:09:33,350 --> 00:09:31,519
we have a very quiescent environment we

231
00:09:35,910 --> 00:09:33,360
don't have a lot of surface tension it's

232
00:09:37,509 --> 00:09:35,920
just a very very nice place to grow very

233
00:09:38,949 --> 00:09:37,519
large and well-defined crystals those

234
00:09:40,310 --> 00:09:38,959
will be brought to the ground taken to

235
00:09:42,070 --> 00:09:40,320
oak ridge national laboratory for

236
00:09:43,590 --> 00:09:42,080
neutron diffraction and then they're

237
00:09:45,829 --> 00:09:43,600
going to use the geometry they're going

238
00:09:50,870 --> 00:09:45,839

to try to solve some geometry to

239
00:09:54,710 --> 00:09:52,949
it could be a serum yes it could be a

240
00:09:56,630 --> 00:09:54,720
serum it could be a pill i'm not sure

241
00:09:58,550 --> 00:09:56,640
what the delivery mechanism is but it's

242
00:10:01,910 --> 00:09:58,560
the basic building block for for what

243
00:10:06,150 --> 00:10:01,920
that antidote is what that drug is

244
00:10:09,910 --> 00:10:07,990
so i see that there are a lot of private

245
00:10:12,230 --> 00:10:09,920
companies that are putting in

246
00:10:13,670 --> 00:10:12,240
investments for

247
00:10:15,509 --> 00:10:13,680
experiments they'd like to have carried

248
00:10:17,590 --> 00:10:15,519
out on the space station i was wondering

249
00:10:19,590 --> 00:10:17,600
if there's a lot of companies expressing

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00:10:21,670 --> 00:10:19,600
interest in that right now or is it more

251
00:10:22,630 --> 00:10:21,680
of a novice thing that these companies

252
00:10:24,470 --> 00:10:22,640
that were mentioned there are

253
00:10:25,430 --> 00:10:24,480
groundbreaking and there's more to

254
00:10:27,350 --> 00:10:25,440
follow

255
00:10:30,230 --> 00:10:27,360
there are a number of companies uh there

256
00:10:31,990 --> 00:10:30,240
will be more to follow um to say there's

257
00:10:35,910 --> 00:10:32,000
a lot that's very subjective i can tell

258
00:10:37,350 --> 00:10:35,920
you when we started uh back in 2012 and

259
00:10:39,509 --> 00:10:37,360
we assumed managing the lab with

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00:10:40,949 --> 00:10:39,519
increment 37

261
00:10:42,389 --> 00:10:40,959
there weren't a lot of people with

262
00:10:44,230 --> 00:10:42,399
awareness particularly the private

263
00:10:46,710 --> 00:10:44,240

sector of what the opportunities were to

264
00:10:48,150 --> 00:10:46,720
use the international space station

265
00:10:50,069 --> 00:10:48,160
that's what we've been doing now for the

266
00:10:52,389 --> 00:10:50,079
past several years and we can see a very

267
00:10:53,350 --> 00:10:52,399
steady progression and a serious ramp up

268
00:10:54,790 --> 00:10:53,360
on the

269
00:10:56,389 --> 00:10:54,800
from the commercial sector and what's

270
00:10:58,069 --> 00:10:56,399
important and i think what's very

271
00:10:59,910 --> 00:10:58,079
interesting not only from a user or

272
00:11:01,590 --> 00:10:59,920
demand side but also from the supply

273
00:11:03,590 --> 00:11:01,600
side we're seeing a lot of companies

274
00:11:05,509 --> 00:11:03,600
wanting to put commercial facilities on

275
00:11:06,870 --> 00:11:05,519
station to host experiments you're going

276
00:11:10,069 --> 00:11:06,880
to see a presentation by one of the

277
00:11:10,079 --> 00:11:13,269
got another question over here

278
00:11:16,790 --> 00:11:15,030
it was mentioned that there are several

279
00:11:18,470 --> 00:11:16,800
schools from around the world that are

280
00:11:20,389 --> 00:11:18,480
sending up research i just wanted to

281
00:11:22,230 --> 00:11:20,399
know more about the process that led to

282
00:11:24,310 --> 00:11:22,240
your decisions about you know which ones

283
00:11:25,990 --> 00:11:24,320
went up and um what some of those

284
00:11:28,389 --> 00:11:26,000
experiments might be if you guys are

285
00:11:30,310 --> 00:11:28,399
aware so the space station is an

286
00:11:32,389 --> 00:11:30,320
international partnership right between

287
00:11:35,829 --> 00:11:32,399
the u.s japan canada

288
00:11:38,710 --> 00:11:35,839

russia and europe and so each of those

289
00:11:40,949 --> 00:11:38,720
partners have their own national goals

290
00:11:42,710 --> 00:11:40,959
and they select the research to support

291
00:11:44,630 --> 00:11:42,720
those national goals so the cube

292
00:11:47,030 --> 00:11:44,640
satellites i talked about is being led

293
00:11:48,470 --> 00:11:47,040
by jaxa and they have a program called

294
00:11:50,710 --> 00:11:48,480
the birds project that they're

295
00:11:51,990 --> 00:11:50,720
collaborating with in developing

296
00:11:56,550 --> 00:11:52,000
countries

297
00:11:58,069 --> 00:11:56,560
to space by developing

298
00:12:00,949 --> 00:11:58,079
cube satellites

299
00:12:03,910 --> 00:12:00,959
from the u.s perspective we we have a

300
00:12:05,509 --> 00:12:03,920
bunch of sponsors that actually select

301
00:12:07,430 --> 00:12:05,519
their own research

302
00:12:10,550 --> 00:12:07,440
cases is one of those for the u.s

303
00:12:12,150 --> 00:12:10,560
national lab around across nasa we also

304
00:12:15,190 --> 00:12:12,160
have like the science mission

305
00:12:17,350 --> 00:12:15,200
directorate and this uh space life and

306
00:12:19,110 --> 00:12:17,360
physical science office and then the

307
00:12:21,750 --> 00:12:19,120
space technology

308
00:12:24,470 --> 00:12:21,760
mission directorate that actually select

309
00:12:30,389 --> 00:12:24,480
their research in those areas

310
00:12:34,550 --> 00:12:31,750
the other countries that are sending

311
00:12:36,949 --> 00:12:34,560
cubesats up tomorrow oh so this

312
00:12:39,990 --> 00:12:36,959
project is a collaboration between

313
00:12:41,350 --> 00:12:40,000

students from japan nigeria ghana

314
00:12:44,710 --> 00:12:41,360
mongolia

315
00:12:47,030 --> 00:12:44,720
um bangladesh and thailand so it's 66

316
00:12:48,310 --> 00:12:47,040
developing countries flying five cube

317
00:12:50,629 --> 00:12:48,320
satellites

318
00:12:55,670 --> 00:12:50,639
you're welcome

319
00:13:01,030 --> 00:12:58,710
uh so you mentioned that the iss is the

320
00:13:02,949 --> 00:13:01,040
private contractors and such are ramping

321
00:13:04,870 --> 00:13:02,959
up and they want to put experiments onto

322
00:13:06,389 --> 00:13:04,880
the space station

323
00:13:08,550 --> 00:13:06,399
how do we see that moving if it's

324
00:13:10,790 --> 00:13:08,560
ramping up is that going to increase the

325
00:13:12,389 --> 00:13:10,800
life of the station because as of now

326
00:13:14,230 --> 00:13:12,399
there's only so many years left so let's

327
00:13:15,990 --> 00:13:14,240
hope that it stays

328
00:13:18,310 --> 00:13:16,000
like as a viable option is that

329
00:13:20,949 --> 00:13:18,320
something that this helps with

330
00:13:22,949 --> 00:13:20,959
kind of keeping the station alive longer

331
00:13:25,269 --> 00:13:22,959
that's a great question i i think it

332
00:13:27,110 --> 00:13:25,279
does but i'm probably not the the best

333
00:13:29,910 --> 00:13:27,120
equipped to answer that question and i'm

334
00:13:32,629 --> 00:13:29,920
biased i think we need it until 2050.

335
00:13:34,310 --> 00:13:32,639
um but that's probably not a reality uh

336
00:13:36,069 --> 00:13:34,320
i definitely think that this this space

337
00:13:37,509 --> 00:13:36,079
station this international space station

338
00:13:39,189 --> 00:13:37,519

is laying the groundwork and the

339
00:13:41,430 --> 00:13:39,199
foundation for the space stations that

340
00:13:42,949 --> 00:13:41,440
will come after it it's my own opinion

341
00:13:44,870 --> 00:13:42,959
that yes we're seeing a very nice

342
00:13:47,430 --> 00:13:44,880
progression of demand and utility and

343
00:13:49,189 --> 00:13:47,440
usefulness that i think will in fact

344
00:13:51,110 --> 00:13:49,199
bring about other space stations camille

345
00:13:53,670 --> 00:13:51,120
may have further yes so we have

346
00:13:55,990 --> 00:13:53,680
appropriate appropriated use of the

347
00:13:58,230 --> 00:13:56,000
space station to 2024 that's what

348
00:14:01,110 --> 00:13:58,240
congress said um there's life in the

349
00:14:04,230 --> 00:14:01,120
space station through 2028 and one of

350
00:14:08,150 --> 00:14:04,240
the things i mentioned is the expansion

351
00:14:11,030 --> 00:14:08,160
of this commercial marketplace in earth

352
00:14:13,110 --> 00:14:11,040
orbit so that once the space station the

353
00:14:15,110 --> 00:14:13,120
end of life comes there will be a

354
00:14:17,750 --> 00:14:15,120
commercial presence that nasa could

355
00:14:19,990 --> 00:14:17,760
actually or the u.s could buy

356
00:14:23,269 --> 00:14:20,000
services just like we're doing with our

357
00:14:25,910 --> 00:14:23,279
spacex or orbital buy services in earth

358
00:14:28,629 --> 00:14:25,920
orbit to further our research so that we

359
00:14:31,829 --> 00:14:28,639
can focus on going to other destinations

360
00:14:33,670 --> 00:14:31,839
beyond leo

361
00:14:37,430 --> 00:14:33,680
it will be a sad and joyous moment when

362
00:14:40,870 --> 00:14:38,870
thank you very much oh we've got one

363
00:14:44,389 --> 00:14:40,880

more question over here

364
00:14:47,590 --> 00:14:44,399
hey um let's get to the party favor

365
00:14:49,269 --> 00:14:47,600
uh so rosa a lot of excitement i think

366
00:14:51,910 --> 00:14:49,279
in the solar array industry on that

367
00:14:53,990 --> 00:14:51,920
you've got the old traditional kind in

368
00:14:55,430 --> 00:14:54,000
the background up there so with this

369
00:14:57,269 --> 00:14:55,440
megaflex

370
00:14:59,189 --> 00:14:57,279
um granted it's not going to be actually

371
00:15:00,710 --> 00:14:59,199
used in generating solar power on this

372
00:15:02,629 --> 00:15:00,720
mission it's just going to be i think

373
00:15:04,389 --> 00:15:02,639
just to see how it works and

374
00:15:06,710 --> 00:15:04,399
develops but what is potentially

375
00:15:09,829 --> 00:15:06,720
groundbreaking about this

376
00:15:12,150 --> 00:15:09,839
new megaflex solar array so hold that

377
00:15:14,790 --> 00:15:12,160
question because we we do have the rosa

378
00:15:16,550 --> 00:15:14,800
pi that will be making a presentation so

379
00:15:19,750 --> 00:15:16,560
you will get everything

380
00:15:24,550 --> 00:15:21,990
all right thank you camille and ken

381
00:15:27,189 --> 00:15:24,560
thank you next i'd like to welcome dr

382
00:15:28,310 --> 00:15:27,199
keith jendro and dr jason mitchell

383
00:15:30,629 --> 00:15:28,320
they're going to tell us about some

384
00:15:32,470 --> 00:15:30,639
hardware going up in the

385
00:15:34,870 --> 00:15:32,480
trunk of dragon that will look at the

386
00:15:37,829 --> 00:15:34,880
physics of the densest objects in the

387
00:15:42,710 --> 00:15:37,839
universe and may pave the way for future

388
00:15:45,110 --> 00:15:43,990

hi can i have the

389
00:15:47,829 --> 00:15:45,120
wide shot

390
00:15:50,069 --> 00:15:47,839
so nicer stands for the neutron star

391
00:15:51,990 --> 00:15:50,079
interior composition explorer it's a

392
00:15:53,749 --> 00:15:52,000
mission of opportunity that was selected

393
00:15:56,550 --> 00:15:53,759
as part of nasa's science mission

394
00:15:58,230 --> 00:15:56,560
directorate explorer program it's going

395
00:16:00,470 --> 00:15:58,240
to be the first space mission that's

396
00:16:02,870 --> 00:16:00,480
dedicated to the study of neutron stars

397
00:16:06,230 --> 00:16:02,880
which are really fantastic objects that

398
00:16:09,509 --> 00:16:06,240
were discovered 50 years ago this fall

399
00:16:12,310 --> 00:16:09,519
neutron star starts its life

400
00:16:15,269 --> 00:16:12,320
as a star like our sun but maybe

401
00:16:17,350 --> 00:16:15,279
10 to 20 times bigger and it burns

402
00:16:19,990 --> 00:16:17,360
through its nuclear fuel when it finish

403
00:16:21,670 --> 00:16:20,000
finishes burning its nuclear fuel

404
00:16:23,590 --> 00:16:21,680
the the star

405
00:16:25,670 --> 00:16:23,600
explodes in a supernova explosion the

406
00:16:29,269 --> 00:16:25,680
core of that that original star

407
00:16:30,870 --> 00:16:29,279
collapses into a small dense object

408
00:16:32,150 --> 00:16:30,880
that's about the size of a city so if

409
00:16:35,110 --> 00:16:32,160
you could please uh

410
00:16:37,670 --> 00:16:35,120
uh show the the neutron star video

411
00:16:40,230 --> 00:16:37,680
this this object is about the size of a

412
00:16:43,110 --> 00:16:40,240
city maybe 20 kilometers across yet it

413
00:16:44,870 --> 00:16:43,120

contains the mass of up to two suns

414
00:16:46,550 --> 00:16:44,880
it is the densest matter that we know in

415
00:16:49,269 --> 00:16:46,560
the universe and if that original star

416
00:16:51,189 --> 00:16:49,279
was a little bit more massive then

417
00:16:52,310 --> 00:16:51,199
the result of that supernova explosion

418
00:16:53,590 --> 00:16:52,320
would have been the production of a

419
00:16:56,230 --> 00:16:53,600
black hole

420
00:16:57,990 --> 00:16:56,240
now what nicer is going to do among many

421
00:16:59,829 --> 00:16:58,000
things one of the more important science

422
00:17:01,030 --> 00:16:59,839
objectives of nicer is to measure

423
00:17:02,949 --> 00:17:01,040
accurately

424
00:17:04,390 --> 00:17:02,959
five percent accuracy the radius of a

425
00:17:06,470 --> 00:17:04,400
neutron star this is an order of

426
00:17:09,909 --> 00:17:06,480
magnitude improvement compared to our

427
00:17:11,029 --> 00:17:09,919
state of the art knowledge right now

428
00:17:12,549 --> 00:17:11,039
and we're going to be doing this through

429
00:17:13,990 --> 00:17:12,559
a number of techniques but one of the

430
00:17:15,590 --> 00:17:14,000
more interesting techniques that we're

431
00:17:16,949 --> 00:17:15,600
going to be using

432
00:17:18,390 --> 00:17:16,959
is

433
00:17:19,590 --> 00:17:18,400
light curve

434
00:17:23,189 --> 00:17:19,600
modeling

435
00:17:25,510 --> 00:17:23,199
depend on is

436
00:17:26,949 --> 00:17:25,520
einstein's theory of general relativity

437
00:17:28,870 --> 00:17:26,959
and einstein's theory of general

438
00:17:31,590 --> 00:17:28,880

relativity says a lot of things that are

439
00:17:33,270 --> 00:17:31,600
really unusual um to our regular life

440
00:17:35,029 --> 00:17:33,280
here one of the things that it talks

441
00:17:37,669 --> 00:17:35,039
about is how matter

442
00:17:39,669 --> 00:17:37,679
um affects the local space time around

443
00:17:41,909 --> 00:17:39,679
it and that light rays of light will

444
00:17:44,070 --> 00:17:41,919
actually deflect a little bit as they're

445
00:17:46,310 --> 00:17:44,080
felt by the the gravity pull of that of

446
00:17:48,390 --> 00:17:46,320
the matter and for the matter that we're

447
00:17:50,230 --> 00:17:48,400
used to here on the earth which is you

448
00:17:51,270 --> 00:17:50,240
know very low density we don't really

449
00:17:52,630 --> 00:17:51,280
see

450
00:17:53,990 --> 00:17:52,640
light bending

451
00:17:56,310 --> 00:17:54,000
but if you take

452
00:17:58,710 --> 00:17:56,320
something like a neutron star

453
00:18:00,870 --> 00:17:58,720
where the densities are really huge

454
00:18:03,909 --> 00:18:00,880
you imagine something like

455
00:18:07,669 --> 00:18:03,919
mount everest squeezed into a sugar cube

456
00:18:09,669 --> 00:18:07,679
then the gravitational light bending is

457
00:18:11,430 --> 00:18:09,679
a very strong effect

458
00:18:12,870 --> 00:18:11,440
and so if you break up the hot spot

459
00:18:14,310 --> 00:18:12,880
video please

460
00:18:16,630 --> 00:18:14,320
i'll give you an idea of how we're going

461
00:18:18,870 --> 00:18:16,640
to use this in this video

462
00:18:20,470 --> 00:18:18,880
you see two stars that have the same

463
00:18:22,630 --> 00:18:20,480

mass and radius

464
00:18:24,549 --> 00:18:22,640
and the star to the left

465
00:18:26,470 --> 00:18:24,559
you see a hot spot that's rotating in

466
00:18:29,750 --> 00:18:26,480
and out of our field of view when the

467
00:18:30,789 --> 00:18:29,760
hot spot is near us it's bright

468
00:18:36,470 --> 00:18:30,799
and

469
00:18:38,310 --> 00:18:36,480
pulse goes from a very high brightness

470
00:18:40,310 --> 00:18:38,320
to zero brightness

471
00:18:41,909 --> 00:18:40,320
the image to the right we've actually

472
00:18:43,669 --> 00:18:41,919
turned on strong gravity bending and

473
00:18:45,590 --> 00:18:43,679
what that allows you to do is look at

474
00:18:48,070 --> 00:18:45,600
the far side of the neutron star so as

475
00:18:49,669 --> 00:18:48,080
that spot goes around you actually see

476
00:18:51,909 --> 00:18:49,679
light coming from the back side of the

477
00:18:55,110 --> 00:18:51,919
neutron star this affects our light

478
00:18:56,390 --> 00:18:55,120
curves so that you get a very subtle

479
00:18:58,870 --> 00:18:56,400
but measurable

480
00:19:01,430 --> 00:18:58,880
change in the shape of a light curve

481
00:19:02,549 --> 00:19:01,440
and so in order to do this to make this

482
00:19:03,669 --> 00:19:02,559
measurement we have to make an

483
00:19:05,110 --> 00:19:03,679
instrument

484
00:19:07,110 --> 00:19:05,120
which

485
00:19:08,789 --> 00:19:07,120
has enough sensitivity to give us high

486
00:19:12,630 --> 00:19:08,799
statistics of the shape of this light

487
00:19:16,230 --> 00:19:13,990
jason mitchell is going to show you a

488
00:19:18,789 --> 00:19:16,240

little model of our instrument right now

489
00:19:21,510 --> 00:19:18,799
it's it's in a stowed configuration like

490
00:19:23,110 --> 00:19:21,520
you see this dimension here is about 1.2

491
00:19:24,789 --> 00:19:23,120
meters

492
00:19:26,470 --> 00:19:24,799
we have some launch locks that are there

493
00:19:28,230 --> 00:19:26,480
to allow us to survive the launch on the

494
00:19:30,150 --> 00:19:28,240
falcon 9 rocket and go all the way to

495
00:19:31,430 --> 00:19:30,160
the space station when we get to the

496
00:19:33,029 --> 00:19:31,440
space station

497
00:19:35,029 --> 00:19:33,039
we're going to be robotically installed

498
00:19:36,230 --> 00:19:35,039
and put onto the top of space station at

499
00:19:38,789 --> 00:19:36,240
elc

500
00:19:40,150 --> 00:19:38,799
express logistics carrier site two

501
00:19:42,070 --> 00:19:40,160
at that point we're going to release our

502
00:19:44,870 --> 00:19:42,080
launch locks and the instrument will

503
00:19:48,310 --> 00:19:46,310
giving us

504
00:19:53,909 --> 00:19:48,320
eventually a view of the sky so if i can

505
00:19:56,870 --> 00:19:54,870
the

506
00:19:58,630 --> 00:19:56,880
what you see in this turntable video is

507
00:19:59,830 --> 00:19:58,640
that we have an additional two-axis

508
00:20:02,470 --> 00:19:59,840
gimbal

509
00:20:05,990 --> 00:20:02,480
that allows the the major instrument to

510
00:20:07,590 --> 00:20:06,000
have a very clear view of the sky

511
00:20:09,750 --> 00:20:07,600
the major part of this instrument is

512
00:20:11,110 --> 00:20:09,760
this big box structure

513
00:20:13,029 --> 00:20:11,120

it's got a collection of x-ray

514
00:20:17,270 --> 00:20:13,039
telescopes this is

515
00:20:19,590 --> 00:20:17,280
made at goddard space flight center

516
00:20:20,950 --> 00:20:19,600
we have 56 x-ray telescopes in there we

517
00:20:22,950 --> 00:20:20,960
chose that number because it's the

518
00:20:24,549 --> 00:20:22,960
maximum number we could fit in there and

519
00:20:25,430 --> 00:20:24,559
some of the objects that we're trying to

520
00:20:27,750 --> 00:20:25,440
do

521
00:20:29,110 --> 00:20:27,760
science with are relatively faint not

522
00:20:32,310 --> 00:20:29,120
all of them are like this but we want to

523
00:20:34,470 --> 00:20:32,320
get as much signal as possible

524
00:20:36,870 --> 00:20:34,480
so each one of these

525
00:20:39,510 --> 00:20:36,880
x-ray optics concentrates light onto a

526
00:20:41,750 --> 00:20:39,520
dedicated detector at the other end

527
00:20:43,270 --> 00:20:41,760
of the box

528
00:20:44,630 --> 00:20:43,280
the massachusetts institute of

529
00:20:46,630 --> 00:20:44,640
technology

530
00:20:48,230 --> 00:20:46,640
has built a really amazing instrument

531
00:20:50,470 --> 00:20:48,240
that makes use of commercial

532
00:20:52,070 --> 00:20:50,480
off-the-shelf silicon drift detectors

533
00:20:53,350 --> 00:20:52,080
from amtec

534
00:20:55,029 --> 00:20:53,360
to

535
00:20:57,029 --> 00:20:55,039
this instrument has a capability this

536
00:20:59,750 --> 00:20:57,039
detector system has a capability of

537
00:21:01,669 --> 00:20:59,760
detecting individual x-ray photons

538
00:21:03,669 --> 00:21:01,679

that are concentrated by our mirrors

539
00:21:05,830 --> 00:21:03,679
down onto the detectors individual x-ray

540
00:21:07,510 --> 00:21:05,840
photons and for every photon

541
00:21:08,630 --> 00:21:07,520
we measure the energy of that photon to

542
00:21:10,390 --> 00:21:08,640
2 percent

543
00:21:12,470 --> 00:21:10,400
we measure the arrival time of that

544
00:21:15,190 --> 00:21:12,480
photon to better than 100 nanoseconds

545
00:21:16,630 --> 00:21:15,200
compared to a gps time standard

546
00:21:19,430 --> 00:21:16,640
and we can do this throughout our

547
00:21:21,750 --> 00:21:19,440
mission so over an 18-month mission

548
00:21:23,669 --> 00:21:21,760
we can time coherently add photons

549
00:21:25,750 --> 00:21:23,679
collected at the beginning to the end to

550
00:21:27,510 --> 00:21:25,760
make these very

551
00:21:28,950 --> 00:21:27,520
statistically significant light curves

552
00:21:31,270 --> 00:21:28,960
that will allow us to do the light curve

553
00:21:32,710 --> 00:21:31,280
modeling among other things

554
00:21:34,950 --> 00:21:32,720
now

555
00:21:37,510 --> 00:21:34,960
this system

556
00:21:39,110 --> 00:21:37,520
has to point very well because we to

557
00:21:40,710 --> 00:21:39,120
collect our signal we have to look at

558
00:21:42,710 --> 00:21:40,720
the star so as the space station goes

559
00:21:45,270 --> 00:21:42,720
around the earth

560
00:21:47,430 --> 00:21:45,280
it's constantly tumbling to maintain a

561
00:21:50,390 --> 00:21:47,440
zenith direction and a nader direction

562
00:21:52,070 --> 00:21:50,400
for earth science and space science um

563
00:21:53,669 --> 00:21:52,080

so we have to compensate for that so we

564
00:21:55,430 --> 00:21:53,679
built i think perhaps the most

565
00:21:58,470 --> 00:21:55,440
sophisticated pointing system for

566
00:22:01,270 --> 00:21:58,480
astrophysics on space station this this

567
00:22:02,870 --> 00:22:01,280
box weighs about you know 400 pounds and

568
00:22:05,270 --> 00:22:02,880
we're going to point this at the arc

569
00:22:07,430 --> 00:22:05,280
minute level as these stars rise

570
00:22:09,190 --> 00:22:07,440
and to do this we have an international

571
00:22:10,310 --> 00:22:09,200
team that's helped us build this so we

572
00:22:12,549 --> 00:22:10,320
start with

573
00:22:14,870 --> 00:22:12,559
the denmark technical university dtu

574
00:22:16,950 --> 00:22:14,880
provided a star tracker to us

575
00:22:19,909 --> 00:22:16,960
which tells us where the instrument is

576
00:22:21,750 --> 00:22:19,919
looking at any time that data is sent to

577
00:22:24,070 --> 00:22:21,760
flight software made by goddard space

578
00:22:27,430 --> 00:22:24,080
flight center running on a computer made

579
00:22:28,630 --> 00:22:27,440
by moog a big producer of space flight

580
00:22:30,950 --> 00:22:28,640
hardware

581
00:22:31,990 --> 00:22:30,960
this flight software instructs our

582
00:22:33,990 --> 00:22:32,000
gimbals

583
00:22:35,990 --> 00:22:34,000
to actually adjust their position so

584
00:22:38,710 --> 00:22:36,000
that we can keep lock at the arc minute

585
00:22:41,430 --> 00:22:38,720
level on these stars

586
00:22:42,789 --> 00:22:41,440
every iss orbit about 90ish minutes

587
00:22:44,789 --> 00:22:42,799
we're going to be looking at between two

588
00:22:46,870 --> 00:22:44,799

and four objects and we're going to do

589
00:22:48,870 --> 00:22:46,880
this nearly continuously through our

590
00:22:51,590 --> 00:22:48,880
18-month mission on space station

591
00:22:53,830 --> 00:22:51,600
hopefully longer

592
00:22:55,990 --> 00:22:53,840
we worked very closely with the

593
00:22:56,870 --> 00:22:56,000
international space station program

594
00:22:58,789 --> 00:22:56,880
office

595
00:23:00,390 --> 00:22:58,799
we had tremendous support from johnson

596
00:23:02,710 --> 00:23:00,400
space flight center marshall space

597
00:23:04,710 --> 00:23:02,720
flight center folks here at kennedy to

598
00:23:06,230 --> 00:23:04,720
design an instrument that makes full use

599
00:23:08,789 --> 00:23:06,240
of the resources

600
00:23:10,310 --> 00:23:08,799
available to do our science

601
00:23:14,870 --> 00:23:10,320
we're getting the most science we can

602
00:23:20,310 --> 00:23:18,549
this instrument that we've produced has

603
00:23:22,310 --> 00:23:20,320
order of magnitude improvements and

604
00:23:24,230 --> 00:23:22,320
energy resolution time resolution and

605
00:23:26,630 --> 00:23:24,240
sensitivity compared to the last major

606
00:23:28,310 --> 00:23:26,640
x-ray timing mission that's flown

607
00:23:30,149 --> 00:23:28,320
which produced nearly 3 000

608
00:23:32,630 --> 00:23:30,159
peer-reviewed papers in its life so i'm

609
00:23:35,110 --> 00:23:32,640
expecting this to be a major paper

610
00:23:36,390 --> 00:23:35,120
producer of science on the international

611
00:23:39,029 --> 00:23:36,400
space station

612
00:23:41,190 --> 00:23:39,039
and we have a team of scientists from a

613
00:23:43,990 --> 00:23:41,200

number of uh

614
00:23:46,149 --> 00:23:44,000
of uh universities nasa field centers

615
00:23:48,310 --> 00:23:46,159
national labs across the country and the

616
00:23:49,669 --> 00:23:48,320
world that are working to make this

617
00:23:51,190 --> 00:23:49,679
possible

618
00:23:53,430 --> 00:23:51,200
now the other partnership that's

619
00:23:55,110 --> 00:23:53,440
particularly exciting about

620
00:23:57,029 --> 00:23:55,120
nicer is

621
00:23:58,710 --> 00:23:57,039
it's a partnership between the science

622
00:24:00,070 --> 00:23:58,720
mission directorate at nasa headquarters

623
00:24:02,310 --> 00:24:00,080
and the space technology mission

624
00:24:04,310 --> 00:24:02,320
director at headquarters

625
00:24:06,950 --> 00:24:04,320
we're going to look at a subset of

626
00:24:08,149 --> 00:24:06,960
pulsars in the sky called millisecond

627
00:24:14,070 --> 00:24:08,159
pulsars

628
00:24:16,630 --> 00:24:14,080
see are so regular

629
00:24:19,590 --> 00:24:16,640
they remind us of atomic clocks the

630
00:24:21,750 --> 00:24:19,600
ticks come extremely regularly

631
00:24:23,830 --> 00:24:21,760
and you know you find atomic clocks as

632
00:24:25,110 --> 00:24:23,840
the basis of the global positioning

633
00:24:27,029 --> 00:24:25,120
system

634
00:24:27,990 --> 00:24:27,039
which allows you to navigate to this

635
00:24:31,669 --> 00:24:28,000
place

636
00:24:32,630 --> 00:24:31,679
using your gps receiver

637
00:24:33,990 --> 00:24:32,640
the

638
00:24:35,669 --> 00:24:34,000

cool thing about

639
00:24:37,510 --> 00:24:35,679
this technology demo that we're going to

640
00:24:39,990 --> 00:24:37,520
try to do with nicer is that neutron

641
00:24:42,070 --> 00:24:40,000
stars are distributed around the galaxy

642
00:24:44,070 --> 00:24:42,080
and and so we can actually build a

643
00:24:45,669 --> 00:24:44,080
system that allow us to navigate

644
00:24:47,750 --> 00:24:45,679
from low earth orbit into the solar

645
00:24:49,750 --> 00:24:47,760
system and beyond and this is a jason

646
00:24:52,870 --> 00:24:49,760
mitchell who is the

647
00:24:54,149 --> 00:24:52,880
the the lead for the pulsar navigation

648
00:24:56,310 --> 00:24:54,159
and he's going to tell you a little bit

649
00:24:58,950 --> 00:24:56,320
of that experiment thank you keith could

650
00:25:00,789 --> 00:24:58,960
i have the uh the navigation

651
00:25:02,549 --> 00:25:00,799
video

652
00:25:04,710 --> 00:25:02,559
so the name of the technology

653
00:25:06,149 --> 00:25:04,720
demonstration will be part of nicer is

654
00:25:08,630 --> 00:25:06,159
called sextant station explorer for

655
00:25:10,789 --> 00:25:08,640
x-ray timing and navigation technology

656
00:25:13,110 --> 00:25:10,799
so i think you'll see that

657
00:25:14,710 --> 00:25:13,120
pulsars from their initial discovery

658
00:25:16,549 --> 00:25:14,720
were immediately recognized for the

659
00:25:18,230 --> 00:25:16,559
utility navigation if you're familiar

660
00:25:19,669 --> 00:25:18,240
with the plaques that accompanied the

661
00:25:21,350 --> 00:25:19,679
pioneer

662
00:25:23,269 --> 00:25:21,360
and voyager missions you'll know that

663
00:25:25,590 --> 00:25:23,279

there's a graphic there indicating the

664
00:25:26,710 --> 00:25:25,600
location of earth with respect to

665
00:25:28,549 --> 00:25:26,720
pulsars distributed throughout the

666
00:25:31,190 --> 00:25:28,559
galaxy and so

667
00:25:33,510 --> 00:25:31,200
our ultimate goal with sexton is i'm

668
00:25:35,430 --> 00:25:33,520
glad keith defined gps so i can just use

669
00:25:37,190 --> 00:25:35,440
the acronym everyone's familiar with gps

670
00:25:38,950 --> 00:25:37,200
but our goal is to turn the g and gps

671
00:25:40,870 --> 00:25:38,960
into galactic make it a galactic

672
00:25:42,710 --> 00:25:40,880
positioning system

673
00:25:45,669 --> 00:25:42,720
the initial steps with this technology

674
00:25:48,390 --> 00:25:45,679
demonstration for sexton is on iss using

675
00:25:50,390 --> 00:25:48,400
nicer's real-time science feed on board

676
00:25:52,070 --> 00:25:50,400
with the software augmentation to try

677
00:25:54,149 --> 00:25:52,080
and maintain using only those

678
00:25:57,029 --> 00:25:54,159
observations the position knowledge of

679
00:25:58,789 --> 00:25:57,039
nicer to better than 10 kilometers

680
00:26:01,590 --> 00:25:58,799
that's a small step

681
00:26:03,510 --> 00:26:01,600
in proving compared to gps but it's a

682
00:26:05,669 --> 00:26:03,520
giant step for using

683
00:26:07,909 --> 00:26:05,679
only pulsar measurements and that will

684
00:26:09,669 --> 00:26:07,919
help us get into deep space

685
00:26:10,470 --> 00:26:09,679
and possibly even into the deeper solar

686
00:26:13,269 --> 00:26:10,480
system

687
00:26:14,310 --> 00:26:13,279
the the partnership between the space

688
00:26:15,990 --> 00:26:14,320

technology mission directorate and

689
00:26:19,029 --> 00:26:16,000
science mission directorate has allowed

690
00:26:21,110 --> 00:26:19,039
us to participate in a science-tuned

691
00:26:23,110 --> 00:26:21,120
instrument so the scalar design that

692
00:26:24,630 --> 00:26:23,120
keith mentioned for these 56 individual

693
00:26:27,190 --> 00:26:24,640
telescopes this is perfect for us

694
00:26:28,470 --> 00:26:27,200
because the iss environment

695
00:26:30,310 --> 00:26:28,480
is challenging from a navigation

696
00:26:32,230 --> 00:26:30,320
perspective because iss is moving around

697
00:26:34,149 --> 00:26:32,240
very fast so we would like from a deep

698
00:26:36,470 --> 00:26:34,159
space navigation perspective to stare at

699
00:26:39,350 --> 00:26:36,480
these pulsars for a very long time

700
00:26:41,110 --> 00:26:39,360
to maintain very very good accuracy

701
00:26:44,230 --> 00:26:41,120
for deep space uh potentially we'd like

702
00:26:46,149 --> 00:26:44,240
to see hundreds of meters of accuracy

703
00:26:48,710 --> 00:26:46,159
over the long run

704
00:26:50,870 --> 00:26:48,720
so this science tuned instrument allows

705
00:26:52,310 --> 00:26:50,880
us to think about shrinking down to a

706
00:26:54,149 --> 00:26:52,320
more realistic size instrument where

707
00:26:55,909 --> 00:26:54,159
instead of 56 detectors for this large

708
00:26:57,990 --> 00:26:55,919
collecting area for us to be successful

709
00:27:00,789 --> 00:26:58,000
uh in the iss orbit

710
00:27:03,350 --> 00:27:00,799
we can scale down to one two three and

711
00:27:05,350 --> 00:27:03,360
see the performance and i think uh to

712
00:27:06,710 --> 00:27:05,360
kind of wrap it up and stay on schedule

713
00:27:14,470 --> 00:27:06,720

the

714
00:27:16,070 --> 00:27:14,480
ability to do cutting-edge science and

715
00:27:17,750 --> 00:27:16,080
develop the techniques for navigation

716
00:27:19,830 --> 00:27:17,760
that will carry us perhaps out of the

717
00:27:21,510 --> 00:27:19,840
solar

718
00:27:23,029 --> 00:27:21,520
with that i'll open it up all right

719
00:27:25,269 --> 00:27:23,039
let's take some questions here in the

720
00:27:27,830 --> 00:27:25,279
room again for those on the phone you

721
00:27:29,990 --> 00:27:27,840
can press star one and use the hashtag

722
00:27:31,190 --> 00:27:30,000
online ask nasa we've got a question

723
00:27:31,990 --> 00:27:31,200
right over here

724
00:27:34,310 --> 00:27:32,000
so

725
00:27:35,830 --> 00:27:34,320
i'm very interested in the navigation

726
00:27:38,070 --> 00:27:35,840
aspects

727
00:27:39,750 --> 00:27:38,080
in in the future when you've refined

728
00:27:41,750 --> 00:27:39,760
everything would this be something where

729
00:27:44,149 --> 00:27:41,760
the uh the ship that was navigating

730
00:27:45,909 --> 00:27:44,159
would be communicating back to an array

731
00:27:48,710 --> 00:27:45,919
like this or would they be carrying

732
00:27:50,950 --> 00:27:48,720
something on their ship that was a

733
00:27:52,950 --> 00:27:50,960
descendant of this and using the pulsars

734
00:27:54,310 --> 00:27:52,960
directly for for navigation i realized

735
00:27:56,230 --> 00:27:54,320
this is way out in the science fiction

736
00:27:58,149 --> 00:27:56,240
world but i'm curious how what you're

737
00:27:59,029 --> 00:27:58,159
thinking ultimately uh the goal would be

738
00:28:01,269 --> 00:27:59,039

for this to be something that would be

739
00:28:03,350 --> 00:28:01,279
carried with uh with the the vehicle

740
00:28:05,029 --> 00:28:03,360
with the vessel uh so that um you can

741
00:28:07,029 --> 00:28:05,039
think about it as being able to maintain

742
00:28:08,950 --> 00:28:07,039
your navigation solution autonomously

743
00:28:10,710 --> 00:28:08,960
independent of any communication but of

744
00:28:12,070 --> 00:28:10,720
course you would be communicating back

745
00:28:13,990 --> 00:28:12,080
uh to some location that you would

746
00:28:15,269 --> 00:28:14,000
hopefully uh have a well-surveyed

747
00:28:16,789 --> 00:28:15,279
location you don't want to be off on

748
00:28:17,590 --> 00:28:16,799
your own for too long but yes it would

749
00:28:22,470 --> 00:28:17,600
be

750
00:28:22,480 --> 00:28:26,789
other questions

751
00:28:30,470 --> 00:28:28,630
got one right here

752
00:28:38,070 --> 00:28:30,480
just a second we'll bring mike over to

753
00:28:41,110 --> 00:28:39,510
i actually have two questions the first

754
00:28:43,990 --> 00:28:41,120
before the navigation would it be using

755
00:28:45,990 --> 00:28:44,000
a triangulation system to measure angles

756
00:28:47,909 --> 00:28:46,000
between two pulsars

757
00:28:50,070 --> 00:28:47,919
it would be more like trilateration you

758
00:28:51,190 --> 00:28:50,080
think about as keith pointed out these

759
00:28:53,669 --> 00:28:51,200
light curves we're looking to

760
00:28:55,750 --> 00:28:53,679
reconstruct those pulses we have models

761
00:28:57,590 --> 00:28:55,760
so we look at those models about where

762
00:28:59,350 --> 00:28:57,600
we think the pulse should have been when

763
00:29:00,789 --> 00:28:59,360

we constructed compared to what we

764
00:29:02,710 --> 00:29:00,799
actually constructed so that kind of

765
00:29:03,909 --> 00:29:02,720
becomes a line of sight measurement did

766
00:29:05,269 --> 00:29:03,919
it arrive a little early or a little

767
00:29:06,549 --> 00:29:05,279
late and then that's what we use to form

768
00:29:08,070 --> 00:29:06,559
the fundamental measurement to take the

769
00:29:09,669 --> 00:29:08,080
navigation and that's the challenge

770
00:29:11,029 --> 00:29:09,679
because then that processing is serial

771
00:29:12,950 --> 00:29:11,039
because you look for a long time at a

772
00:29:15,029 --> 00:29:12,960
pulsar get a measurement then you look

773
00:29:16,870 --> 00:29:15,039
at another pulsar and get a measurement

774
00:29:18,389 --> 00:29:16,880
okay and the second question was we're

775
00:29:19,669 --> 00:29:18,399
talking about like long exposures i'm

776
00:29:22,389 --> 00:29:19,679
picturing it almost you know like a

777
00:29:23,909 --> 00:29:22,399
camera being pointed at a pulsar what

778
00:29:27,590 --> 00:29:23,919
how long is an exposure that we're

779
00:29:30,710 --> 00:29:27,600
taking for one pulsar so on any given

780
00:29:33,510 --> 00:29:30,720
orbit of the iss we have maybe a couple

781
00:29:35,269 --> 00:29:33,520
thousand seconds that we can look at any

782
00:29:36,549 --> 00:29:35,279
particular object because the earth gets

783
00:29:38,710 --> 00:29:36,559
in the way

784
00:29:40,630 --> 00:29:38,720
but like i said every photon is time

785
00:29:42,070 --> 00:29:40,640
tagged absolutely and so that we can

786
00:29:44,149 --> 00:29:42,080
build up

787
00:29:46,230 --> 00:29:44,159
a lot of little exposures to have the

788
00:29:50,710 --> 00:29:46,240

mega second exposures that we need to do

789
00:29:50,720 --> 00:29:53,750
and we've got one

790
00:29:57,909 --> 00:29:55,990
right over here behind you

791
00:29:59,190 --> 00:29:57,919
um

792
00:30:00,549 --> 00:29:59,200
do you are you guys working with

793
00:30:02,789 --> 00:30:00,559
commercial partners on this i mean is

794
00:30:03,590 --> 00:30:02,799
there any tech transfer capability so

795
00:30:05,510 --> 00:30:03,600
that

796
00:30:07,909 --> 00:30:05,520
once the lab has had its use for it in

797
00:30:12,389 --> 00:30:07,919
space people could use this technology

798
00:30:17,590 --> 00:30:15,510
so there have been a number of companies

799
00:30:19,430 --> 00:30:17,600
that have helped develop some of this

800
00:30:21,669 --> 00:30:19,440
technology over time

801
00:30:23,269 --> 00:30:21,679
and there is a commercial interest in in

802
00:30:24,710 --> 00:30:23,279
making this available

803
00:30:26,470 --> 00:30:24,720
our interest is in building an

804
00:30:28,549 --> 00:30:26,480
instrument to do the science and

805
00:30:34,230 --> 00:30:28,559
demonstrate the capability and then pass

806
00:30:39,750 --> 00:30:37,110
all right thank you very much

807
00:30:41,750 --> 00:30:39,760
also heading up in the unpressurized

808
00:30:43,110 --> 00:30:41,760
trunk of dragon

809
00:30:45,510 --> 00:30:43,120
with nicer

810
00:30:48,870 --> 00:30:45,520
is a project to test a concept for solar

811
00:30:50,549 --> 00:30:48,880
arrays that unroll like a tape measure

812
00:30:55,510 --> 00:30:50,559
and here to tell us a bit more about

813
00:31:02,870 --> 00:30:57,830

thank you

814
00:31:07,509 --> 00:31:05,269
so the goal of rosa is to unfurl for the

815
00:31:08,950 --> 00:31:07,519
first time in space a new solar panel

816
00:31:11,430 --> 00:31:08,960
technology

817
00:31:12,710 --> 00:31:11,440
and while at the same time understanding

818
00:31:14,070 --> 00:31:12,720
better how this new deployment

819
00:31:15,190 --> 00:31:14,080
technology works in the space

820
00:31:17,190 --> 00:31:15,200
environment

821
00:31:19,430 --> 00:31:17,200
so

822
00:31:21,029 --> 00:31:19,440
the primary technology that we're

823
00:31:23,430 --> 00:31:21,039
demonstrating on orbit is what's called

824
00:31:25,350 --> 00:31:23,440
high strain composite mechanisms this is

825
00:31:27,430 --> 00:31:25,360
an example of one of the full-scale

826
00:31:29,190 --> 00:31:27,440
tubes the the full-scale structure

827
00:31:30,389 --> 00:31:29,200
that's used to deploy the wing or unfurl

828
00:31:35,669 --> 00:31:30,399
the wing

829
00:31:36,870 --> 00:31:35,679
and i will demonstrate it for you here

830
00:31:39,909 --> 00:31:36,880
so

831
00:31:41,750 --> 00:31:39,919
as you begin to unfurl the tube

832
00:31:43,750 --> 00:31:41,760
it naturally wants to unroll but yet

833
00:31:45,430 --> 00:31:43,760
it's compact when it's stowed which is

834
00:31:47,669 --> 00:31:45,440
the nature of the high strain is that it

835
00:31:49,029 --> 00:31:47,679
can be stowed to a compact package for

836
00:31:55,830 --> 00:31:49,039
launch

837
00:32:01,269 --> 00:31:57,430
on orbit we would deploy much slower

838
00:32:05,590 --> 00:32:02,789

deployment takes about four minutes on

839
00:32:07,909 --> 00:32:05,600
orbit um so there are several different

840
00:32:09,350 --> 00:32:07,919
science objectives we hope to achieve

841
00:32:11,110 --> 00:32:09,360
one of them is

842
00:32:14,950 --> 00:32:11,120
that we want to better understand this

843
00:32:20,149 --> 00:32:16,389
one of them is actually retraction so

844
00:32:23,269 --> 00:32:21,350
so we want to better understand the

845
00:32:24,310 --> 00:32:23,279
deployment behavior and the reason for

846
00:32:28,630 --> 00:32:24,320
this

847
00:32:30,070 --> 00:32:28,640
cannot really be tested on the ground

848
00:32:32,070 --> 00:32:30,080
they collapse under their own weight

849
00:32:33,909 --> 00:32:32,080
they're designed for space loads and not

850
00:32:35,830 --> 00:32:33,919
ground-based loads

851
00:32:37,669 --> 00:32:35,840
so engineers get around this today by

852
00:32:38,950 --> 00:32:37,679
adding some additional reinforcements to

853
00:32:39,750 --> 00:32:38,960
the structure

854
00:32:42,389 --> 00:32:39,760
but

855
00:32:44,149 --> 00:32:42,399
that always creates questions of whether

856
00:32:45,590 --> 00:32:44,159
this thing will actually deploy reliably

857
00:32:47,669 --> 00:32:45,600
once you get on orbit and you remove

858
00:32:49,190 --> 00:32:47,679
these additional supports

859
00:32:51,590 --> 00:32:49,200
so that's the reason why we really need

860
00:32:53,990 --> 00:32:51,600
the microgravity environment of space

861
00:32:55,669 --> 00:32:54,000
and it's the microgravity combined with

862
00:32:57,830 --> 00:32:55,679
the extreme temperature environment that

863
00:32:59,509 --> 00:32:57,840

we really need we really need space

864
00:33:03,509 --> 00:32:59,519
station we really need we really need on

865
00:33:06,070 --> 00:33:03,519
orbit flight to test and demonstrate

866
00:33:09,190 --> 00:33:06,080
so that's that's a full scale tube there

867
00:33:10,549 --> 00:33:09,200
this is a 110 scale model of the wing

868
00:33:13,830 --> 00:33:10,559
and it gives you a better sense i'll

869
00:33:16,870 --> 00:33:15,190
so that's

870
00:33:19,509 --> 00:33:16,880
essentially the

871
00:33:25,350 --> 00:33:19,519
deployed wing on orbit ours will be 15

872
00:33:29,029 --> 00:33:27,269
so deployment is one of the science

873
00:33:30,789 --> 00:33:29,039
objectives uh one of the other science

874
00:33:33,110 --> 00:33:30,799
objectives is to measure and understand

875
00:33:36,310 --> 00:33:33,120
the structural dynamics of this wing

876
00:33:38,630 --> 00:33:36,320
so when a satellite maneuvers on orbit

877
00:33:40,549 --> 00:33:38,640
it stresses whatever long structure is

878
00:33:42,789 --> 00:33:40,559
attached to it that could be a solar ray

879
00:33:45,029 --> 00:33:42,799
it could be a reflector antenna it could

880
00:33:47,029 --> 00:33:45,039
be a radar antenna it could be a long

881
00:33:50,310 --> 00:33:47,039
instrument boom

882
00:33:52,710 --> 00:33:50,320
it it stresses that array

883
00:33:54,630 --> 00:33:52,720
and that that long structure responds by

884
00:33:57,350 --> 00:33:54,640
vibrating i don't know if you can see

885
00:34:02,070 --> 00:33:59,509
but we really want to precisely

886
00:34:03,830 --> 00:34:02,080
characterize that vibration signature of

887
00:34:06,470 --> 00:34:03,840
this solar ray wing it's a

888
00:34:08,230 --> 00:34:06,480

characteristic of the stiffness and mass

889
00:34:10,389 --> 00:34:08,240
of the structure

890
00:34:11,829 --> 00:34:10,399
and the reason is because satellite

891
00:34:13,270 --> 00:34:11,839
designers are guidance navigation

892
00:34:15,829 --> 00:34:13,280
control experts they really need to

893
00:34:16,950 --> 00:34:15,839
understand those vibration signatures so

894
00:34:18,470 --> 00:34:16,960
they don't lose control of their

895
00:34:20,550 --> 00:34:18,480
spacecraft

896
00:34:21,669 --> 00:34:20,560
so they have to precisely predict it so

897
00:34:23,030 --> 00:34:21,679
we are

898
00:34:25,109 --> 00:34:23,040
gathering data on the structural

899
00:34:25,909 --> 00:34:25,119
dynamics to refine our prediction models

900
00:34:29,750 --> 00:34:25,919
to

901
00:34:33,030 --> 00:34:31,349
so that's the second science objective

902
00:34:35,589 --> 00:34:33,040
the third one is we want to better

903
00:34:38,550 --> 00:34:35,599
understand how the wing behaves when it

904
00:34:40,470 --> 00:34:38,560
transitions from full shadow to full

905
00:34:41,589 --> 00:34:40,480
sunlight

906
00:34:45,349 --> 00:34:41,599
so

907
00:34:46,790 --> 00:34:45,359
mean these composites are only a few

908
00:34:48,550 --> 00:34:46,800
millimeters thick

909
00:34:50,869 --> 00:34:48,560
this this blanket material is only a few

910
00:34:52,790 --> 00:34:50,879
millimeters thick that means it heats up

911
00:34:54,790 --> 00:34:52,800
really fast

912
00:34:57,190 --> 00:34:54,800
when it moves from shadow to sunlight

913
00:34:59,349 --> 00:34:57,200

and that that that rapid heat up in a

914
00:35:01,430 --> 00:34:59,359
matter of you know dozens of degrees in

915
00:35:03,829 --> 00:35:01,440
a matter of a few seconds

916
00:35:04,950 --> 00:35:03,839
can again cause the wing to shutter a

917
00:35:08,470 --> 00:35:04,960
bit

918
00:35:13,829 --> 00:35:11,030
if rosa happens to be attached to

919
00:35:15,510 --> 00:35:13,839
a telescope like hubble

920
00:35:17,670 --> 00:35:15,520
well we don't want to bump the camera

921
00:35:19,349 --> 00:35:17,680
we'll just put it that way so

922
00:35:21,910 --> 00:35:19,359
so we want to make sure that there is no

923
00:35:25,109 --> 00:35:21,920
thermal snap behavior on rosa

924
00:35:26,230 --> 00:35:25,119
but rosa is primarily a power generating

925
00:35:28,150 --> 00:35:26,240
array

926
00:35:30,390 --> 00:35:28,160
so we also want to measure the power

927
00:35:31,990 --> 00:35:30,400
production performance of this wing and

928
00:35:33,589 --> 00:35:32,000
we're only populating it with about 10

929
00:35:35,670 --> 00:35:33,599
percent

930
00:35:36,630 --> 00:35:35,680
fill factor of cells which is about 300

931
00:35:38,710 --> 00:35:36,640
watts

932
00:35:42,870 --> 00:35:38,720
a full array of this size would be about

933
00:35:44,310 --> 00:35:42,880
300 or i'm sorry 3 kilowatts of power

934
00:35:47,030 --> 00:35:44,320
so we just want to make sure that those

935
00:35:49,109 --> 00:35:47,040
cells have survived launch which can be

936
00:35:51,510 --> 00:35:49,119
on the order of 50 times greater than

937
00:35:53,270 --> 00:35:51,520
than the accelerations on earth pretty

938
00:35:55,589 --> 00:35:53,280

violent

939
00:35:57,270 --> 00:35:55,599
so that's that's our science objectives

940
00:35:59,589 --> 00:35:57,280
as far as the

941
00:36:01,349 --> 00:35:59,599
on-orbit operations go

942
00:36:04,069 --> 00:36:01,359
we will be removed from the dragon trunk

943
00:36:06,230 --> 00:36:04,079
approximately nine days after docking

944
00:36:08,550 --> 00:36:06,240
after being removed the

945
00:36:11,349 --> 00:36:08,560
ground-based robotic arm operators will

946
00:36:13,109 --> 00:36:11,359
position rosa away from station

947
00:36:16,470 --> 00:36:13,119
we will command deployment after having

948
00:36:17,910 --> 00:36:16,480
checked out our initial flight computers

949
00:36:19,990 --> 00:36:17,920
like i said deployment will take about

950
00:36:21,670 --> 00:36:20,000
four minutes

951
00:36:23,270 --> 00:36:21,680
during deployment station cameras will

952
00:36:25,510 --> 00:36:23,280
be watching the wing we'll be looking

953
00:36:28,230 --> 00:36:25,520
for any unexpected movements and and

954
00:36:31,190 --> 00:36:28,240
motions we expect it to be a smooth

955
00:36:34,470 --> 00:36:31,200
linear slow deployment we'll be watching

956
00:36:36,710 --> 00:36:34,480
with station cameras anyway

957
00:36:39,670 --> 00:36:36,720
so after deployment we will begin our

958
00:36:41,349 --> 00:36:39,680
dynamics experiments and those dynamics

959
00:36:42,630 --> 00:36:41,359
experiments will be

960
00:36:43,589 --> 00:36:42,640
actuated

961
00:36:45,670 --> 00:36:43,599
by

962
00:36:46,950 --> 00:36:45,680
oscillating the base of the of the rosa

963
00:36:47,750 --> 00:36:46,960

payload

964
00:36:50,230 --> 00:36:47,760
so

965
00:36:59,430 --> 00:36:50,240
if you could bring up the stowed wing

966
00:37:04,230 --> 00:37:01,430
so there we go

967
00:37:07,349 --> 00:37:04,240
so at the at the base of that wing is a

968
00:37:10,230 --> 00:37:07,359
motor that oscillates the base

969
00:37:11,349 --> 00:37:10,240
back and forth at a specific frequency

970
00:37:13,829 --> 00:37:11,359
and

971
00:37:15,589 --> 00:37:13,839
what we're really doing is watching

972
00:37:18,550 --> 00:37:15,599
the tip of the wing

973
00:37:20,710 --> 00:37:18,560
moving back and forth as a as a response

974
00:37:21,990 --> 00:37:20,720
to that oscillation at the base

975
00:37:23,510 --> 00:37:22,000
and we'll be doing that with some

976
00:37:25,109 --> 00:37:23,520
accelerometers

977
00:37:27,349 --> 00:37:25,119
but primarily with a technique that we

978
00:37:29,030 --> 00:37:27,359
call photogrammetry

979
00:37:31,190 --> 00:37:29,040
which

980
00:37:32,710 --> 00:37:31,200
can move off of that image we'll get to

981
00:37:34,870 --> 00:37:32,720
the deployment in just a minute we have

982
00:37:37,270 --> 00:37:34,880
a deployment video for you

983
00:37:39,270 --> 00:37:37,280
so this is uh a sample of the actual

984
00:37:41,750 --> 00:37:39,280
blanket so you see it's an open weave

985
00:37:43,589 --> 00:37:41,760
mesh and there's a cap on joined to that

986
00:37:45,349 --> 00:37:43,599
mesh and then these these photovoltaic

987
00:37:46,550 --> 00:37:45,359
cells in this case they're aluminum mass

988
00:37:48,550 --> 00:37:46,560

simulators

989
00:37:50,310 --> 00:37:48,560
but you see those white targets there we

990
00:37:52,230 --> 00:37:50,320
were using those for a technique called

991
00:37:53,589 --> 00:37:52,240
photogrammetry where at least two

992
00:37:55,510 --> 00:37:53,599
station cameras will be looking at the

993
00:37:56,710 --> 00:37:55,520
wing at all times during these dynamics

994
00:37:58,390 --> 00:37:56,720
experiments

995
00:37:59,750 --> 00:37:58,400
and it'll be tracking the position of

996
00:38:01,670 --> 00:37:59,760
these targets

997
00:38:04,390 --> 00:38:01,680
so with a triangulation technique we can

998
00:38:06,310 --> 00:38:04,400
then back out later what the precise

999
00:38:08,310 --> 00:38:06,320
relative position of these targets is

1000
00:38:12,790 --> 00:38:08,320
and then reconstruct the vibration

1001
00:38:14,150 --> 00:38:12,800
frequencies and amplitudes of the wing

1002
00:38:16,630 --> 00:38:14,160
so we'll be running those dynamics

1003
00:38:18,870 --> 00:38:16,640
experiments in full sun and full shadow

1004
00:38:20,630 --> 00:38:18,880
and then during eclipse exit

1005
00:38:22,790 --> 00:38:20,640
and

1006
00:38:25,910 --> 00:38:22,800
that's basically our operations so why

1007
00:38:28,150 --> 00:38:25,920
don't we go to the deployment video

1008
00:38:29,430 --> 00:38:28,160
give you a real-time sense of how this

1009
00:38:31,910 --> 00:38:29,440
wing deploys

1010
00:38:34,470 --> 00:38:31,920
so that that's the actual speed there we

1011
00:38:35,990 --> 00:38:34,480
have some some dampers that restrain the

1012
00:38:36,950 --> 00:38:36,000
strain energy in those tubes a little

1013
00:38:38,150 --> 00:38:36,960

bit

1014
00:38:40,069 --> 00:38:38,160
so in the center there is that

1015
00:38:41,750 --> 00:38:40,079
photovoltaic blanket and you start to

1016
00:38:42,870 --> 00:38:41,760
see some of those mass simulators

1017
00:38:44,390 --> 00:38:42,880
unrolling

1018
00:38:46,630 --> 00:38:44,400
accelerated here

1019
00:38:47,829 --> 00:38:46,640
you see those white uh white targets

1020
00:38:50,310 --> 00:38:47,839
distributed on the blanket those

1021
00:38:52,230 --> 00:38:50,320
photogrammetry targets

1022
00:38:55,349 --> 00:38:52,240
and then near the end of deployment

1023
00:38:56,630 --> 00:38:55,359
uh the wing i'll slow it down again here

1024
00:38:58,470 --> 00:38:56,640
and

1025
00:39:00,150 --> 00:38:58,480
what you really see at the end is not

1026
00:39:04,150 --> 00:39:00,160
much

1027
00:39:05,829 --> 00:39:04,160
we we want the wing to be nice and

1028
00:39:07,349 --> 00:39:05,839
controlled and we don't want any subtle

1029
00:39:09,430 --> 00:39:07,359
dynamic motions near the end of

1030
00:39:11,829 --> 00:39:09,440
deployment so

1031
00:39:14,150 --> 00:39:11,839
so that's that's the rosa experiment i

1032
00:39:16,550 --> 00:39:14,160
did want to mention just briefly a

1033
00:39:18,270 --> 00:39:16,560
little bit about the applications

1034
00:39:20,870 --> 00:39:18,280
the fact that this is a really is a

1035
00:39:22,790 --> 00:39:20,880
multi-agency experiment

1036
00:39:24,710 --> 00:39:22,800
this wing has been developed by funding

1037
00:39:26,310 --> 00:39:24,720
from nasa stmd

1038
00:39:28,390 --> 00:39:26,320

from the air force space and missile

1039
00:39:30,470 --> 00:39:28,400
system center and of course afrl air

1040
00:39:33,829 --> 00:39:30,480
force research lab which is the primary

1041
00:39:37,109 --> 00:39:35,430
you know the reason all those agencies

1042
00:39:39,990 --> 00:39:37,119
are involved is because all satellites

1043
00:39:41,510 --> 00:39:40,000
need power all spacecraft need power and

1044
00:39:43,270 --> 00:39:41,520
the traditional method of generating

1045
00:39:45,829 --> 00:39:43,280
power is

1046
00:39:48,550 --> 00:39:45,839
solar panels that are constructed with

1047
00:39:50,230 --> 00:39:48,560
these these square plates that are

1048
00:39:52,230 --> 00:39:50,240
accordion folded and joined with these

1049
00:39:53,829 --> 00:39:52,240
mechanical hinges

1050
00:39:55,670 --> 00:39:53,839
but the problem is these these

1051
00:39:56,790 --> 00:39:55,680
traditional methods are

1052
00:39:58,790 --> 00:39:56,800
bulky

1053
00:40:01,030 --> 00:39:58,800
and they tend to be heavy and we just

1054
00:40:02,790 --> 00:40:01,040
can't make them any bigger today than we

1055
00:40:05,349 --> 00:40:02,800
then we just can't make them any bigger

1056
00:40:08,390 --> 00:40:05,359
that's what it comes down to so

1057
00:40:10,390 --> 00:40:08,400
so rosa solves this problem by reducing

1058
00:40:12,470 --> 00:40:10,400
mass by 20 percent

1059
00:40:13,510 --> 00:40:12,480
and reducing stowed volume by 400

1060
00:40:16,069 --> 00:40:13,520
percent

1061
00:40:17,589 --> 00:40:16,079
over these traditional approaches

1062
00:40:21,990 --> 00:40:17,599
so

1063
00:40:24,390 --> 00:40:22,000

uh the the commercial space industry

1064
00:40:26,790 --> 00:40:24,400
space systems loral for example is

1065
00:40:29,910 --> 00:40:26,800
considering rosa for

1066
00:40:33,030 --> 00:40:29,920
satellite tv for satellite internet and

1067
00:40:35,910 --> 00:40:33,040
communications spacecraft

1068
00:40:39,190 --> 00:40:35,920
the air force is considering it for to

1069
00:40:40,230 --> 00:40:39,200
increase availability and access of gps

1070
00:40:42,550 --> 00:40:40,240
and

1071
00:40:44,870 --> 00:40:42,560
perhaps more exciting is the fact that

1072
00:40:45,829 --> 00:40:44,880
rosa enables scale up to much larger

1073
00:40:47,990 --> 00:40:45,839
wings

1074
00:40:49,910 --> 00:40:48,000
so currently we're limited to about 15

1075
00:40:52,870 --> 00:40:49,920
kilowatts per wing

1076
00:40:55,190 --> 00:40:52,880
rosa can scale up to 30 100 or even 500

1077
00:40:57,109 --> 00:40:55,200
kilowatts per wing and that opens up

1078
00:40:58,950 --> 00:40:57,119
applications for things like solar

1079
00:41:00,870 --> 00:40:58,960
electric propulsion

1080
00:41:03,349 --> 00:41:00,880
you know nasa is considering that for

1081
00:41:04,710 --> 00:41:03,359
interplanetary missions

1082
00:41:07,670 --> 00:41:04,720
certainly the air force is interested

1083
00:41:09,750 --> 00:41:07,680
from a leo to geo transfer perspective

1084
00:41:11,990 --> 00:41:09,760
so there's some really cool applications

1085
00:41:13,990 --> 00:41:12,000
for rosa coming down the pike but

1086
00:41:15,430 --> 00:41:14,000
it's not just about solar rays actually

1087
00:41:16,630 --> 00:41:15,440
i mean these high strain composite

1088
00:41:18,069 --> 00:41:16,640

materials

1089
00:41:19,910 --> 00:41:18,079
are being considered for other

1090
00:41:22,710 --> 00:41:19,920
deployable structures like reflector

1091
00:41:25,990 --> 00:41:22,720
antennas and these radar antennas

1092
00:41:27,990 --> 00:41:26,000
solar sails even so

1093
00:41:30,309 --> 00:41:28,000
rose is a pretty cool technology that

1094
00:41:33,109 --> 00:41:30,319
we're really excited about the potential

1095
00:41:34,950 --> 00:41:33,119
applications coming down the pike

1096
00:41:36,710 --> 00:41:34,960
i believe you have an image to show

1097
00:41:38,390 --> 00:41:36,720
where it is on station

1098
00:41:41,510 --> 00:41:38,400
yes thank you

1099
00:41:43,589 --> 00:41:41,520
so this is a position of rosa on station

1100
00:41:46,069 --> 00:41:43,599
and if we go to the next image

1101
00:41:47,589 --> 00:41:46,079
you can see uh two of the cameras that

1102
00:41:48,950 --> 00:41:47,599
are pointing at the wing so this is for

1103
00:41:50,470 --> 00:41:48,960
the deployment and for the

1104
00:41:53,589 --> 00:41:50,480
photogrammetry

1105
00:41:55,109 --> 00:41:53,599
uh data measurements that i mentioned so

1106
00:41:57,030 --> 00:41:55,119
we'll just be hanging out

1107
00:41:58,390 --> 00:41:57,040
all right and i i know we have at least

1108
00:42:01,510 --> 00:41:58,400
one question

1109
00:42:04,309 --> 00:42:02,390
okay

1110
00:42:09,670 --> 00:42:04,319
you got it answered all right uh we've

1111
00:42:14,150 --> 00:42:11,589
so i'm curious since obviously you only

1112
00:42:15,750 --> 00:42:14,160
have the smaller models here with the

1113
00:42:18,470 --> 00:42:15,760

one that's actually going to be going to

1114
00:42:21,349 --> 00:42:18,480
the space station what is the width of

1115
00:42:22,630 --> 00:42:21,359
the wing when it's fully rolled out five

1116
00:42:23,750 --> 00:42:22,640
and a half feet

1117
00:42:25,990 --> 00:42:23,760
that's the

1118
00:42:28,069 --> 00:42:26,000
the width is five and a half feet oh i i

1119
00:42:29,109 --> 00:42:28,079
yes i meant to say the thickness

1120
00:42:33,750 --> 00:42:29,119
the

1121
00:42:35,829 --> 00:42:33,760
representative here it's really only

1122
00:42:37,349 --> 00:42:35,839
just a few millimeters thick even on the

1123
00:42:39,430 --> 00:42:37,359
space station

1124
00:42:40,950 --> 00:42:39,440
yes that's right it's it's a flexible

1125
00:42:43,190 --> 00:42:40,960
blanket that has to be

1126
00:42:46,550 --> 00:42:43,200
stiffened by tension mechanics

1127
00:42:50,470 --> 00:42:47,510
thank you

1128
00:42:52,950 --> 00:42:50,480
all right another one right there

1129
00:42:54,950 --> 00:42:52,960
so that's a beautiful design

1130
00:42:57,030 --> 00:42:54,960
i am curious because engineers always

1131
00:42:58,550 --> 00:42:57,040
plan for things that fail and part of

1132
00:43:00,950 --> 00:42:58,560
what you're looking at is

1133
00:43:02,470 --> 00:43:00,960
the things that can go wrong

1134
00:43:05,510 --> 00:43:02,480
what are the problems that you're kind

1135
00:43:07,349 --> 00:43:05,520
of anticipating and bracing for

1136
00:43:09,430 --> 00:43:07,359
it's a very good question so i i'm very

1137
00:43:11,430 --> 00:43:09,440
careful to explain this as an experiment

1138
00:43:13,910 --> 00:43:11,440

not a demonstration those they're very

1139
00:43:16,630 --> 00:43:13,920
different in an experiment we

1140
00:43:18,230 --> 00:43:16,640
we anticipate the unanticipatable so we

1141
00:43:19,349 --> 00:43:18,240
instrument the heck out of the thing so

1142
00:43:27,750 --> 00:43:19,359
that

1143
00:43:29,430 --> 00:43:27,760
so the dynamics is a big question mark

1144
00:43:31,510 --> 00:43:29,440
um how do how does the fundamental

1145
00:43:32,870 --> 00:43:31,520
frequency change when we move from

1146
00:43:35,109 --> 00:43:32,880
testing on the ground to testing on

1147
00:43:36,710 --> 00:43:35,119
orbit and even testing in full sun

1148
00:43:38,230 --> 00:43:36,720
versus full shadow

1149
00:43:39,750 --> 00:43:38,240
where is that center frequency going to

1150
00:43:40,550 --> 00:43:39,760
be and it's going to take some time for

1151
00:43:41,349 --> 00:43:40,560
us

1152
00:43:43,030 --> 00:43:41,359
to

1153
00:43:44,710 --> 00:43:43,040
oscillate the wing at just the right

1154
00:43:46,950 --> 00:43:44,720
frequency so that we can

1155
00:43:48,710 --> 00:43:46,960
excite it and capture that frequency and

1156
00:43:49,829 --> 00:43:48,720
that dynamics behavior so that's

1157
00:43:51,510 --> 00:43:49,839
probably one of the biggest

1158
00:43:52,790 --> 00:43:51,520
uncertainties now that we really hope to

1159
00:43:55,349 --> 00:43:52,800
learn

1160
00:44:00,390 --> 00:43:55,359
thank you all right we've got one up

1161
00:44:04,790 --> 00:44:02,309
so you had mentioned that this new um

1162
00:44:06,710 --> 00:44:04,800
this new design is able to do it um

1163
00:44:08,309 --> 00:44:06,720

longer and larger

1164
00:44:09,750 --> 00:44:08,319
and you said that the old traditional

1165
00:44:11,030 --> 00:44:09,760
wasn't able to do that what makes it so

1166
00:44:13,030 --> 00:44:11,040
different is it just the size of the

1167
00:44:14,870 --> 00:44:13,040
vehicle and if it is why not just make

1168
00:44:16,630 --> 00:44:14,880
the vehicle bigger so you fit more and

1169
00:44:18,470 --> 00:44:16,640
more solar panels

1170
00:44:21,030 --> 00:44:18,480
sure so there's two issues mass and

1171
00:44:25,750 --> 00:44:23,829
volume is the bigger limiter here and

1172
00:44:26,630 --> 00:44:25,760
if you notice the stowed form factor of

1173
00:44:28,230 --> 00:44:26,640
this

1174
00:44:29,109 --> 00:44:28,240
is is

1175
00:44:30,470 --> 00:44:29,119
short

1176
00:44:32,550 --> 00:44:30,480
but it is long

1177
00:44:35,270 --> 00:44:32,560
with a rigid panel array

1178
00:44:38,309 --> 00:44:35,280
they're long and wide and they're also

1179
00:44:40,550 --> 00:44:38,319
thick so you're really limited by

1180
00:44:42,230 --> 00:44:40,560
the the surface area of the bus that

1181
00:44:44,150 --> 00:44:42,240
you're mounting it to and you can only

1182
00:44:45,829 --> 00:44:44,160
stack so many panels up before you run

1183
00:44:47,589 --> 00:44:45,839
into the volume limitations of your

1184
00:44:48,630 --> 00:44:47,599
launch vehicle fairing

1185
00:44:51,109 --> 00:44:48,640
and you

1186
00:44:53,990 --> 00:44:51,119
you know even adding additional wings on

1187
00:44:55,270 --> 00:44:54,000
either side there's been demonstrated

1188
00:44:57,510 --> 00:44:55,280

uh

1189
00:44:59,109 --> 00:44:57,520
challenges on orbit challenges with

1190
00:45:02,150 --> 00:44:59,119
trying to deploy the wing in a complex

1191
00:45:05,349 --> 00:45:02,160
way using these simple mechanisms

1192
00:45:06,950 --> 00:45:05,359
one final point to answer your question

1193
00:45:08,710 --> 00:45:06,960
with these materials they're so much

1194
00:45:11,109 --> 00:45:08,720
different than traditional mechanisms in

1195
00:45:13,030 --> 00:45:11,119
that they have some flexibility to them

1196
00:45:15,030 --> 00:45:13,040
when they're when they're deploying

1197
00:45:16,069 --> 00:45:15,040
you know they have some give to them

1198
00:45:18,630 --> 00:45:16,079
so

1199
00:45:20,550 --> 00:45:18,640
that makes them um

1200
00:45:22,790 --> 00:45:20,560
much more amenable to much larger

1201
00:45:25,030 --> 00:45:22,800
deployments because you don't have the

1202
00:45:26,710 --> 00:45:25,040
risk of binding hundreds of different

1203
00:45:28,550 --> 00:45:26,720
hinges together because each hinge now

1204
00:45:32,309 --> 00:45:28,560
has a little bit of compliance to it a

1205
00:45:36,470 --> 00:45:34,870
we have other questions here in the room

1206
00:45:38,309 --> 00:45:36,480
again if you are following online and

1207
00:45:43,270 --> 00:45:38,319
have questions please use the hashtag

1208
00:45:46,790 --> 00:45:44,950
the um

1209
00:45:48,150 --> 00:45:46,800
as far as power production of this

1210
00:45:53,109 --> 00:45:48,160
design

1211
00:45:57,910 --> 00:45:55,430
and the big scale picture of human space

1212
00:46:00,630 --> 00:45:57,920
exploration in the future what does that

1213
00:46:01,829 --> 00:46:00,640

translate into as far as what we may be

1214
00:46:03,990 --> 00:46:01,839
able to accomplish that we can't

1215
00:46:07,349 --> 00:46:04,000
accomplish now and how did you guys come

1216
00:46:08,710 --> 00:46:07,359
up with the description party favor

1217
00:46:11,109 --> 00:46:08,720
party favor is a great one the other one

1218
00:46:13,430 --> 00:46:11,119
we've used is a paper towel roll with

1219
00:46:14,950 --> 00:46:13,440
two tape measures on either side so

1220
00:46:17,109 --> 00:46:14,960
that's whatever your

1221
00:46:17,829 --> 00:46:17,119
analogy is

1222
00:46:19,910 --> 00:46:17,839
so

1223
00:46:21,910 --> 00:46:19,920
the space exploration question is one

1224
00:46:24,069 --> 00:46:21,920
i'm not real qualified to answer since i

1225
00:46:26,470 --> 00:46:24,079
represent the air force not nasa

1226
00:46:29,270 --> 00:46:26,480
but what i would say is

1227
00:46:31,109 --> 00:46:29,280
solar electric propulsion is is a is a

1228
00:46:33,270 --> 00:46:31,119
great source of propulsion because it

1229
00:46:35,910 --> 00:46:33,280
requires so little fuel

1230
00:46:37,910 --> 00:46:35,920
um so you can you can travel much longer

1231
00:46:39,190 --> 00:46:37,920
just distances with as long as your wing

1232
00:46:41,510 --> 00:46:39,200
is large enough you can generate enough

1233
00:46:44,069 --> 00:46:41,520
power so that's i think one of the

1234
00:46:46,230 --> 00:46:44,079
simple answers to why it's it's a useful

1235
00:46:51,510 --> 00:46:46,240
technology for interplanetary type

1236
00:46:55,670 --> 00:46:53,829
all right thank you very much

1237
00:46:58,950 --> 00:46:55,680
a third payload going up in the

1238
00:47:00,710 --> 00:46:58,960

unpressurized trunk of dragon is a

1239
00:47:03,030 --> 00:47:00,720
project that will enable new

1240
00:47:05,109 --> 00:47:03,040
capabilities for earth imaging and also

1241
00:47:07,589 --> 00:47:05,119
sponsored by the national lab

1242
00:47:11,190 --> 00:47:07,599
paul galloway is here to

1243
00:47:12,390 --> 00:47:11,200
tell us more about that

1244
00:47:13,589 --> 00:47:12,400
good afternoon everyone i'm paul

1245
00:47:15,510 --> 00:47:13,599
galloway i'm with a company called

1246
00:47:16,550 --> 00:47:15,520
teledyne brown engineering huntsville

1247
00:47:19,270 --> 00:47:16,560
alabama

1248
00:47:21,589 --> 00:47:19,280
we've been building space hardware uh

1249
00:47:23,990 --> 00:47:21,599
and operating payloads for almost 50

1250
00:47:25,270 --> 00:47:24,000
years for nasa and solving complex net

1251
00:47:27,270 --> 00:47:25,280
problems for both nasa and the

1252
00:47:29,270 --> 00:47:27,280
department of defense i'm very excited

1253
00:47:31,750 --> 00:47:29,280
today to tell you about a payload that

1254
00:47:33,510 --> 00:47:31,760
our business decided to take a risk on

1255
00:47:34,390 --> 00:47:33,520
and go out there and extend ourselves go

1256
00:47:36,549 --> 00:47:34,400
a little bit further than we've ever

1257
00:47:39,910 --> 00:47:36,559
gone before and that payload is called

1258
00:47:40,950 --> 00:47:39,920
the multi-user system for earth sensing

1259
00:47:42,390 --> 00:47:40,960
so today what i'm going to tell you

1260
00:47:44,470 --> 00:47:42,400
about is i'm going to describe what is

1261
00:47:46,309 --> 00:47:44,480
muses i'm going to talk about the

1262
00:47:48,870 --> 00:47:46,319
commercial aspect of muses since that's

1263
00:47:50,470 --> 00:47:48,880

important to us as a company i'm going

1264
00:47:51,670 --> 00:47:50,480
to briefly describe the muse's

1265
00:47:53,270 --> 00:47:51,680
objectives

1266
00:47:54,950 --> 00:47:53,280
and then possibly talk about some

1267
00:47:58,390 --> 00:47:54,960
advantages of iss if i could have the

1268
00:48:01,829 --> 00:48:00,870
that's the muses platform

1269
00:48:06,710 --> 00:48:01,839
it's a

1270
00:48:07,990 --> 00:48:06,720
precise motors for pointing

1271
00:48:09,430 --> 00:48:08,000
it has a

1272
00:48:12,069 --> 00:48:09,440
star trackers

1273
00:48:14,630 --> 00:48:12,079
it has accommodations for up to four

1274
00:48:16,309 --> 00:48:14,640
instruments some of those uh

1275
00:48:18,549 --> 00:48:16,319
what you see on the pointing platform

1276
00:48:20,069 --> 00:48:18,559
there are some uh those conical shake

1277
00:48:21,270 --> 00:48:20,079
objects and then the

1278
00:48:24,309 --> 00:48:21,280
the smaller

1279
00:48:25,670 --> 00:48:24,319
triangular or recessed pyramids

1280
00:48:26,790 --> 00:48:25,680
those are our

1281
00:48:29,349 --> 00:48:26,800
are

1282
00:48:31,190 --> 00:48:29,359
basically our coarse and fine alignment

1283
00:48:33,190 --> 00:48:31,200
for installing payloads in the middle of

1284
00:48:34,710 --> 00:48:33,200
that you see a position for a mounting

1285
00:48:36,549 --> 00:48:34,720
stud and that's the attach point for the

1286
00:48:38,390 --> 00:48:36,559
payload there's also a with the yellow

1287
00:48:40,230 --> 00:48:38,400
covers there those are the the blind

1288
00:48:41,510 --> 00:48:40,240

mate data and power connectors for our

1289
00:48:42,790 --> 00:48:41,520
instruments that will be installed on

1290
00:48:44,309 --> 00:48:42,800
muses and i'll show a picture of that a

1291
00:48:45,430 --> 00:48:44,319
little bit later of actual instrument

1292
00:48:47,589 --> 00:48:45,440
installed

1293
00:48:50,230 --> 00:48:47,599
so we have four positions

1294
00:48:52,870 --> 00:48:50,240
too large and too small

1295
00:48:53,750 --> 00:48:52,880
muses has the ability to point and track

1296
00:48:58,150 --> 00:48:53,760
we

1297
00:49:00,630 --> 00:48:58,160
also go over that target and then look

1298
00:49:02,069 --> 00:49:00,640
backwards we also can skew port and

1299
00:49:03,829 --> 00:49:02,079
starboard so it gives us a lot of

1300
00:49:05,190 --> 00:49:03,839
versatility in these types of

1301
00:49:08,870 --> 00:49:05,200
instruments that want to go up and view

1302
00:49:10,950 --> 00:49:08,880
a single point on multiple locations

1303
00:49:12,549 --> 00:49:10,960
uh the space environment is is very

1304
00:49:14,870 --> 00:49:12,559
harsh as you know the vibration

1305
00:49:15,670 --> 00:49:14,880
environment is very severe for a spacex

1306
00:49:18,150 --> 00:49:15,680
so

1307
00:49:20,309 --> 00:49:18,160
our our payloads our instruments

1308
00:49:23,190 --> 00:49:20,319
uh are sensitive have a lot of mirrors

1309
00:49:25,349 --> 00:49:23,200
and small mining mechanisms sensitive

1310
00:49:27,510 --> 00:49:25,359
optics that have to be finely calibrated

1311
00:49:29,190 --> 00:49:27,520
on the ground so it's very difficult

1312
00:49:33,109 --> 00:49:29,200
for us to launch our instruments in the

1313
00:49:35,670 --> 00:49:33,119

trunk of muses so one of the the uh

1314
00:49:37,750 --> 00:49:35,680
great resources that station provides is

1315
00:49:39,990 --> 00:49:37,760
these repeated flights and these

1316
00:49:41,910 --> 00:49:40,000
repeated flights allows us to launch our

1317
00:49:44,069 --> 00:49:41,920
multiple instruments over time

1318
00:49:45,750 --> 00:49:44,079
it also allows us to give a soft ride to

1319
00:49:47,990 --> 00:49:45,760
these instruments we can pack these

1320
00:49:49,750 --> 00:49:48,000
instruments in foam and the the g

1321
00:49:52,630 --> 00:49:49,760
environment that they see

1322
00:49:54,790 --> 00:49:52,640
for launch is around three g's in packed

1323
00:49:57,349 --> 00:49:54,800
in foam versus about 20 gs for just

1324
00:49:59,670 --> 00:49:57,359
hardware that's basically fixed in the

1325
00:50:01,109 --> 00:49:59,680
trunks it's a very very big advantage

1326
00:50:04,470 --> 00:50:01,119
for the instruments that are flying

1327
00:50:09,270 --> 00:50:06,549
the commercial the commercial aspect of

1328
00:50:10,870 --> 00:50:09,280
muses is very important it's a private

1329
00:50:12,710 --> 00:50:10,880
public partnership that was developed

1330
00:50:13,990 --> 00:50:12,720
under a cooperative agreement

1331
00:50:16,230 --> 00:50:14,000
with nasa

1332
00:50:18,230 --> 00:50:16,240
and so we're to shared some shared risk

1333
00:50:20,950 --> 00:50:18,240
between nasa and our company

1334
00:50:22,470 --> 00:50:20,960
so there's some first about about muses

1335
00:50:24,870 --> 00:50:22,480
being a commercial payload it's the

1336
00:50:28,710 --> 00:50:24,880
first multi-user facility

1337
00:50:31,990 --> 00:50:28,720
for the iss specifically uh for the elcs

1338
00:50:34,069 --> 00:50:32,000

the express logistics carriers on iss so

1339
00:50:36,230 --> 00:50:34,079
what we have uh what muses will do is

1340
00:50:39,190 --> 00:50:36,240
actually have a multiplier effect we can

1341
00:50:41,589 --> 00:50:39,200
we make take one payload site on iss and

1342
00:50:43,190 --> 00:50:41,599
now provide four payload sites so it

1343
00:50:44,870 --> 00:50:43,200
greatly increases the payload

1344
00:50:46,470 --> 00:50:44,880
utilization of iss

1345
00:50:49,430 --> 00:50:46,480
four payloads that are in the range of

1346
00:50:56,309 --> 00:50:49,440
50 to 200 pounds

1347
00:50:56,319 --> 00:50:59,750
okay

1348
00:51:02,710 --> 00:51:01,030
the uh

1349
00:51:04,390 --> 00:51:02,720
the left side left side of that image

1350
00:51:06,549 --> 00:51:04,400
shows our four payload accommodation

1351
00:51:08,309 --> 00:51:06,559
sites what we do is we we've tried some

1352
00:51:09,829 --> 00:51:08,319
very generic resources for these

1353
00:51:11,990 --> 00:51:09,839
payloads things that you would use in

1354
00:51:13,990 --> 00:51:12,000
your in your home or office almost we

1355
00:51:15,030 --> 00:51:14,000
have 28 volt power

1356
00:51:17,829 --> 00:51:15,040
for the

1357
00:51:19,990 --> 00:51:17,839
instruments

1358
00:51:21,670 --> 00:51:20,000
and then we also provide ethernet

1359
00:51:23,109 --> 00:51:21,680
communications gigabit ethernet

1360
00:51:24,870 --> 00:51:23,119
communications for high speed data

1361
00:51:26,710 --> 00:51:24,880
communication so

1362
00:51:29,030 --> 00:51:26,720
by simplifying these interfaces for

1363
00:51:30,390 --> 00:51:29,040

these payloads we've greatly reduced the

1364
00:51:32,390 --> 00:51:30,400
number of interface requirements that

1365
00:51:34,950 --> 00:51:32,400
payloads have to have to meet to get on

1366
00:51:35,670 --> 00:51:34,960
iss we've reduced the barrier for entry

1367
00:51:37,510 --> 00:51:35,680
for

1368
00:51:39,750 --> 00:51:37,520
small companies that want to build

1369
00:51:42,309 --> 00:51:39,760
payloads to fly on iss

1370
00:51:44,390 --> 00:51:42,319
and this would essentially allow a small

1371
00:51:45,670 --> 00:51:44,400
country to have their own space program

1372
00:51:47,910 --> 00:51:45,680
they could build an instrument put it on

1373
00:51:50,069 --> 00:51:47,920
muses and start a space program at a

1374
00:51:52,870 --> 00:51:50,079
very very low cost by

1375
00:51:55,109 --> 00:51:52,880
by comparison to a dedicated flight on a

1376
00:51:56,230 --> 00:51:55,119
small rocket so it's very

1377
00:51:57,990 --> 00:51:56,240
very interesting

1378
00:51:59,190 --> 00:51:58,000
on the right side of that image we show

1379
00:52:01,190 --> 00:51:59,200
we have a star tracker and we have

1380
00:52:02,069 --> 00:52:01,200
inertial measurement unit those allow us

1381
00:52:03,910 --> 00:52:02,079
to

1382
00:52:05,670 --> 00:52:03,920
determine the rotational rate of our

1383
00:52:08,230 --> 00:52:05,680
pointing platform

1384
00:52:10,150 --> 00:52:08,240
we're also a very very early user of the

1385
00:52:11,670 --> 00:52:10,160
external wireless communications on iss

1386
00:52:13,589 --> 00:52:11,680
maybe the third user it's a new

1387
00:52:15,349 --> 00:52:13,599
capability on iss

1388
00:52:16,309 --> 00:52:15,359

the as you know

1389
00:52:17,270 --> 00:52:16,319
when you

1390
00:52:19,270 --> 00:52:17,280
generate

1391
00:52:21,510 --> 00:52:19,280
video or images on your home computer

1392
00:52:23,190 --> 00:52:21,520
you quickly fill up your hard drive so

1393
00:52:25,270 --> 00:52:23,200
this is a very data

1394
00:52:26,710 --> 00:52:25,280
intensive experiment these images

1395
00:52:29,349 --> 00:52:26,720
imagers that go on

1396
00:52:30,470 --> 00:52:29,359
on the muses so we had to tap into

1397
00:52:32,470 --> 00:52:30,480
multiple

1398
00:52:33,829 --> 00:52:32,480
data sources on iss we use every

1399
00:52:35,990 --> 00:52:33,839
possible data

1400
00:52:37,670 --> 00:52:36,000
data a link or communications link on

1401
00:52:39,270 --> 00:52:37,680
iss to get our imagery down we use the

1402
00:52:41,510 --> 00:52:39,280
low rate the medium rate and the high

1403
00:52:43,349 --> 00:52:41,520
rate and this wireless system also

1404
00:52:46,390 --> 00:52:43,359
enhances our ability to get the imagery

1405
00:52:48,309 --> 00:52:46,400
off our platform get it transferred over

1406
00:52:50,390 --> 00:52:48,319
to a server that we have in the us

1407
00:52:52,309 --> 00:52:50,400
laboratory and express rack commonly

1408
00:52:53,589 --> 00:52:52,319
used

1409
00:52:57,430 --> 00:52:53,599
next

1410
00:53:01,829 --> 00:52:59,349
all right let's talk about

1411
00:53:03,589 --> 00:53:01,839
our first instrument uh two years not

1412
00:53:05,829 --> 00:53:03,599
two years but two flights from now on

1413
00:53:07,670 --> 00:53:05,839

spacex 13 we'll be launching an

1414
00:53:10,630 --> 00:53:07,680
instrument called the diesis it's a

1415
00:53:13,430 --> 00:53:10,640
hyperspectral image imager it it detects

1416
00:53:15,990 --> 00:53:13,440
in the range of 400 to 1000 nanometer

1417
00:53:19,829 --> 00:53:16,000
it's a visible and near infrared system

1418
00:53:22,630 --> 00:53:19,839
what we do is we take that 400 that that

1419
00:53:24,630 --> 00:53:22,640
range and we slice that into two and a

1420
00:53:26,309 --> 00:53:24,640
half nanometer sections so what you get

1421
00:53:28,150 --> 00:53:26,319
is basically for each

1422
00:53:30,710 --> 00:53:28,160
uh image on the ground you end up with a

1423
00:53:32,710 --> 00:53:30,720
very large cube of data at very fine

1424
00:53:34,790 --> 00:53:32,720
spectral uh ranges

1425
00:53:36,470 --> 00:53:34,800
so as you can see

1426
00:53:38,710 --> 00:53:36,480
telescopes and optical instruments can

1427
00:53:40,549 --> 00:53:38,720
be quite long we can't fit this this

1428
00:53:42,549 --> 00:53:40,559
these kind of instruments into the trunk

1429
00:53:44,549 --> 00:53:42,559
they exceed the volume required and also

1430
00:53:46,549 --> 00:53:44,559
we talked about the optic the vibration

1431
00:53:48,790 --> 00:53:46,559
environment is severe so

1432
00:53:50,950 --> 00:53:48,800
even even for an instrument like this

1433
00:53:52,390 --> 00:53:50,960
it's 36 inches long you still have to

1434
00:53:53,910 --> 00:53:52,400
fold the optics in there to get the

1435
00:53:56,630 --> 00:53:53,920
resolution you want on the ground this

1436
00:53:58,630 --> 00:53:56,640
this detector will detect at 30 meters

1437
00:54:00,230 --> 00:53:58,640
or 100 meters on the ground

1438
00:54:02,150 --> 00:54:00,240

and if you were to turn on that

1439
00:54:03,589 --> 00:54:02,160
instrument through that six inch

1440
00:54:06,230 --> 00:54:03,599
aperture there

1441
00:54:08,470 --> 00:54:06,240
uh you if you turn your instrument on

1442
00:54:11,030 --> 00:54:08,480
let it image over say

1443
00:54:12,230 --> 00:54:11,040
20 seconds it basically paints a

1444
00:54:13,589 --> 00:54:12,240
100

1445
00:54:15,109 --> 00:54:13,599
foot wide

1446
00:54:16,230 --> 00:54:15,119
strip on the ground

1447
00:54:19,750 --> 00:54:16,240
and then you

1448
00:54:22,390 --> 00:54:19,760
you have a very long exposure time

1449
00:54:25,030 --> 00:54:22,400
for this maybe 30 second exposure

1450
00:54:27,750 --> 00:54:25,040
and that allows you to quickly

1451
00:54:29,829 --> 00:54:27,760
image the entire earth's surface

1452
00:54:31,109 --> 00:54:29,839
take these images characterize them

1453
00:54:31,829 --> 00:54:31,119
catalog them

1454
00:54:35,829 --> 00:54:31,839
and

1455
00:54:39,910 --> 00:54:35,839
only commercial customers but also

1456
00:54:43,589 --> 00:54:42,069
our objectives for the first for our

1457
00:54:45,829 --> 00:54:43,599
flight is

1458
00:54:48,230 --> 00:54:45,839
of course the successful robotic

1459
00:54:49,910 --> 00:54:48,240
installation on elc-4

1460
00:54:51,510 --> 00:54:49,920
it's paramount

1461
00:54:53,109 --> 00:54:51,520
we also have to

1462
00:54:54,549 --> 00:54:53,119
make sure that our gimbal systems are

1463
00:54:55,990 --> 00:54:54,559

working accurately and we're getting the

1464
00:54:58,309 --> 00:54:56,000
precision pointing that we want so

1465
00:55:00,710 --> 00:54:58,319
before we even unlock our launch locks

1466
00:55:02,069 --> 00:55:00,720
that we talked about earlier we will

1467
00:55:03,430 --> 00:55:02,079
move the gimbal to make sure we're

1468
00:55:05,589 --> 00:55:03,440
getting good feedback from the gimbal

1469
00:55:07,510 --> 00:55:05,599
system before we ever unlock it and then

1470
00:55:08,870 --> 00:55:07,520
robotic arm will come back over unlock

1471
00:55:10,710 --> 00:55:08,880
two launch locks

1472
00:55:12,309 --> 00:55:10,720
and then we'll we'll articulate our

1473
00:55:13,430 --> 00:55:12,319
gimbal the full range of motion which

1474
00:55:16,710 --> 00:55:13,440
would be

1475
00:55:21,190 --> 00:55:16,720
25 degrees four and a half of

1476
00:55:22,549 --> 00:55:21,200
five to starboard and 45 to port we

1477
00:55:24,150 --> 00:55:22,559
we also want to verify these

1478
00:55:25,990 --> 00:55:24,160
communications links that i talked about

1479
00:55:27,910 --> 00:55:26,000
to make sure that we're getting our data

1480
00:55:30,710 --> 00:55:27,920
through the iss to the server and then

1481
00:55:33,510 --> 00:55:30,720
to the ground that's a very important

1482
00:55:35,910 --> 00:55:33,520
part of our initial operations

1483
00:55:37,349 --> 00:55:35,920
uh another another objective is just to

1484
00:55:39,589 --> 00:55:37,359
get this thing launched i'll be honest

1485
00:55:41,430 --> 00:55:39,599
with you uh

1486
00:55:43,750 --> 00:55:41,440
when you spend five years of every

1487
00:55:45,750 --> 00:55:43,760
waking moment thinking about something

1488
00:55:47,589 --> 00:55:45,760

you're just glad to see it finished

1489
00:55:50,150 --> 00:55:47,599
and we want to get this thing lost we

1490
00:55:51,990 --> 00:55:50,160
need we need spacex to have a successful

1491
00:55:54,230 --> 00:55:52,000
launch

1492
00:55:56,710 --> 00:55:54,240
and we also we also need our robotic

1493
00:55:58,390 --> 00:55:56,720
operators to delicately remove muses

1494
00:56:01,829 --> 00:55:58,400
from the trunk and move it over to el

1495
00:56:03,109 --> 00:56:01,839
co4 elc4 and install it and then we're

1496
00:56:05,190 --> 00:56:03,119
going to turn it on and we're going to

1497
00:56:07,670 --> 00:56:05,200
be open for business on iss

1498
00:56:12,630 --> 00:56:09,589
all right do we have questions here in

1499
00:56:12,640 --> 00:56:18,630
we've got one over here

1500
00:56:23,750 --> 00:56:20,390
so you talked about the potential

1501
00:56:26,470 --> 00:56:23,760
mapping capabilities of this technology

1502
00:56:29,349 --> 00:56:26,480
do you have plans in place with this

1503
00:56:31,030 --> 00:56:29,359
current launch to do any mapping of the

1504
00:56:33,349 --> 00:56:31,040
earth surface or is this just testing

1505
00:56:35,510 --> 00:56:33,359
the technology more and

1506
00:56:37,750 --> 00:56:35,520
trying to get it into place

1507
00:56:39,829 --> 00:56:37,760
it's uh there's no detect no instruments

1508
00:56:41,510 --> 00:56:39,839
for ground detection on the initial

1509
00:56:43,910 --> 00:56:41,520
launch of muses so it's really just

1510
00:56:46,069 --> 00:56:43,920
testing the technology the data transfer

1511
00:56:49,270 --> 00:56:46,079
the point precision pointing system in

1512
00:56:51,829 --> 00:56:49,280
the future do you see this being used to

1513
00:56:53,910 --> 00:56:51,839

map the earth's surface in some way

1514
00:56:56,309 --> 00:56:53,920
absolutely the the iss

1515
00:56:58,309 --> 00:56:56,319
passes over 90 percent of the earth's

1516
00:56:59,990 --> 00:56:58,319
inhabited surface so that's that's a

1517
00:57:02,230 --> 00:57:00,000
great advantage of the iss plus we have

1518
00:57:04,470 --> 00:57:02,240
a low orbit so the purpose is to

1519
00:57:07,109 --> 00:57:04,480
completely map the earth's surface over

1520
00:57:09,190 --> 00:57:07,119
time and put these large amounts of data

1521
00:57:11,270 --> 00:57:09,200
into an archive and make it available

1522
00:57:13,430 --> 00:57:11,280
not only to academic

1523
00:57:15,109 --> 00:57:13,440
industry government customers but also

1524
00:57:17,589 --> 00:57:15,119
we have our part of our charter is to

1525
00:57:19,510 --> 00:57:17,599
provide data to a program called severe

1526
00:57:22,390 --> 00:57:19,520
it's for disaster response throughout

1527
00:57:23,589 --> 00:57:22,400
the throughout the developing world and

1528
00:57:25,030 --> 00:57:23,599
we will

1529
00:57:26,390 --> 00:57:25,040
anytime the

1530
00:57:28,230 --> 00:57:26,400
incident would occur on the earth we

1531
00:57:30,549 --> 00:57:28,240
could we could take that imagery and

1532
00:57:33,270 --> 00:57:30,559
make it available to people that are in

1533
00:57:35,510 --> 00:57:33,280
disaster response business it's just one

1534
00:57:37,349 --> 00:57:35,520
of many sources of data that's used for

1535
00:57:39,829 --> 00:57:37,359
responding to disasters on earth so it

1536
00:57:41,430 --> 00:57:39,839
has a very very useful applications for

1537
00:57:46,230 --> 00:57:41,440
our earth

1538
00:57:49,349 --> 00:57:48,309

you've spent five years of every waking

1539
00:57:51,270 --> 00:57:49,359
moment

1540
00:57:52,309 --> 00:57:51,280
how many man hours actually went into

1541
00:57:56,150 --> 00:57:52,319
that because i know you're not the only

1542
00:57:57,990 --> 00:57:56,160
person who worked on it no not at all

1543
00:58:00,150 --> 00:57:58,000
but it was done with a very small team

1544
00:58:02,069 --> 00:58:00,160
part of part of the commercial approach

1545
00:58:04,710 --> 00:58:02,079
is doing a lot with a small team so we

1546
00:58:06,069 --> 00:58:04,720
had a team of about 10 engineers

1547
00:58:09,829 --> 00:58:06,079
working over

1548
00:58:12,630 --> 00:58:09,839
some coming and going depending on their

1549
00:58:15,109 --> 00:58:12,640
expertise but average ten people

1550
00:58:16,950 --> 00:58:15,119
but uh i can't say enough about the

1551
00:58:18,870 --> 00:58:16,960
assistance that nasa provided we could

1552
00:58:21,430 --> 00:58:18,880
not done this without nasa

1553
00:58:23,030 --> 00:58:21,440
they gave us the launch they've given us

1554
00:58:25,349 --> 00:58:23,040
countless amount of hardware that we

1555
00:58:27,510 --> 00:58:25,359
need to do the testing our access to

1556
00:58:29,750 --> 00:58:27,520
test facilities so it was truly a

1557
00:58:33,510 --> 00:58:29,760
partnership between nasa and the small

1558
00:58:37,829 --> 00:58:34,789
do we have other questions we have one

1559
00:58:40,470 --> 00:58:37,839
back here

1560
00:58:42,309 --> 00:58:40,480
so since this platform is meant to

1561
00:58:43,589 --> 00:58:42,319
give other companies kind of a way to

1562
00:58:45,109 --> 00:58:43,599
get up there in countries and things

1563
00:58:47,349 --> 00:58:45,119

what's the functional lifetime of

1564
00:58:48,870 --> 00:58:47,359
something like this how long can it stay

1565
00:58:50,789 --> 00:58:48,880
up there and can it be reused if

1566
00:58:52,470 --> 00:58:50,799
something can you retire an instrument

1567
00:58:53,750 --> 00:58:52,480
put a new one on and how long does that

1568
00:58:55,510 --> 00:58:53,760
last

1569
00:58:57,190 --> 00:58:55,520
well we designed it for a five year life

1570
00:58:58,870 --> 00:58:57,200
but we fully expect based on the

1571
00:59:00,549 --> 00:58:58,880
hardware that we've installed on here

1572
00:59:02,630 --> 00:59:00,559
and the testing we went through we fully

1573
00:59:04,390 --> 00:59:02,640
expect to life last the life of space

1574
00:59:05,990 --> 00:59:04,400
station so

1575
00:59:07,829 --> 00:59:06,000
we'll be there as long as stations there

1576
00:59:08,870 --> 00:59:07,839
as long as we're operating

1577
00:59:11,829 --> 00:59:08,880
and

1578
00:59:15,589 --> 00:59:13,910
all right so thank you very much

1579
00:59:18,390 --> 00:59:15,599
another investigation heading to the

1580
00:59:20,549 --> 00:59:18,400
national lab will use rodents as model

1581
00:59:22,549 --> 00:59:20,559
organisms to help shed light on

1582
00:59:24,870 --> 00:59:22,559
osteoporosis

1583
00:59:28,870 --> 00:59:24,880
dr chia soo is here to tell us a bit

1584
00:59:33,430 --> 00:59:32,309
good afternoon hello everybody

1585
00:59:34,950 --> 00:59:33,440
so

1586
00:59:37,030 --> 00:59:34,960
we're going to i'm going to talk about

1587
00:59:39,190 --> 00:59:37,040
rodent research 5 which is systemic

1588
00:59:41,670 --> 00:59:39,200

therapy of no one for space flight

1589
00:59:44,150 --> 00:59:41,680
induced osteoporosis or in short we're

1590
00:59:46,549 --> 00:59:44,160
going to try and grow bone in space

1591
00:59:48,630 --> 00:59:46,559
and so i'll run briefly why it's

1592
00:59:51,430 --> 00:59:48,640
important to grow bone and a little bit

1593
00:59:54,390 --> 00:59:51,440
about the molecule nail one and then

1594
00:59:57,349 --> 00:59:54,400
i'll briefly describe our mission

1595
00:59:59,190 --> 00:59:57,359
and so why is it important to grow bone

1596
01:00:01,670 --> 00:59:59,200
well if you think about it everybody has

1597
01:00:03,589 --> 01:00:01,680
bone and you have cells in your body

1598
01:00:05,990 --> 01:00:03,599
that make bone and you have cells in

1599
01:00:08,309 --> 01:00:06,000
your body that destroy bone and if you

1600
01:00:10,470 --> 01:00:08,319
have an imbalance of the two you get

1601
01:00:13,109 --> 01:00:10,480
overall bone destruction and loss of

1602
01:00:15,270 --> 01:00:13,119
bone mass or bone mineral density and

1603
01:00:17,910 --> 01:00:15,280
then you can get osteoporosis and

1604
01:00:20,470 --> 01:00:17,920
osteoporotic fractures which is a huge

1605
01:00:22,630 --> 01:00:20,480
problem on earth and and potentially

1606
01:00:23,750 --> 01:00:22,640
even bigger problem in microgravity

1607
01:00:25,990 --> 01:00:23,760
conditions

1608
01:00:28,950 --> 01:00:26,000
just on earth alone

1609
01:00:30,309 --> 01:00:28,960
past the age of 50. one out of every two

1610
01:00:31,990 --> 01:00:30,319
to three women

1611
01:00:33,190 --> 01:00:32,000
is going to develop an osteoporotic

1612
01:00:35,510 --> 01:00:33,200
fracture

1613
01:00:37,430 --> 01:00:35,520

and one out of every four to five

1614
01:00:40,069 --> 01:00:37,440
men will develop an osteoporotic

1615
01:00:43,430 --> 01:00:40,079
fracture so it's a huge huge issue

1616
01:00:45,910 --> 01:00:43,440
and on average after age 50 on earth you

1617
01:00:47,829 --> 01:00:45,920
tend to lose about half a percent of

1618
01:00:51,589 --> 01:00:47,839
your bone mass per year

1619
01:00:53,270 --> 01:00:51,599
so half a percent per year but in space

1620
01:00:56,069 --> 01:00:53,280
in microgravity conditions the

1621
01:00:57,750 --> 01:00:56,079
astronauts can lose up to one to two

1622
01:00:59,750 --> 01:00:57,760
percent or on average one and a half

1623
01:01:02,549 --> 01:00:59,760
percent per month

1624
01:01:05,030 --> 01:01:02,559
so you can imagine the implications for

1625
01:01:05,990 --> 01:01:05,040
long-term space travel our mission to

1626
01:01:08,789 --> 01:01:06,000
mars

1627
01:01:11,349 --> 01:01:08,799
so for humans to be in microgravity

1628
01:01:14,069 --> 01:01:11,359
conditions for prolonged periods we have

1629
01:01:16,309 --> 01:01:14,079
to have a way to prevent development of

1630
01:01:18,630 --> 01:01:16,319
osteoporosis in a way to treat that when

1631
01:01:21,030 --> 01:01:18,640
they come back to earth or if they land

1632
01:01:23,589 --> 01:01:21,040
on a planet with gravity we cannot have

1633
01:01:25,829 --> 01:01:23,599
our astronauts sustaining a mission

1634
01:01:26,710 --> 01:01:25,839
debilitating fracture

1635
01:01:30,710 --> 01:01:26,720
so

1636
01:01:32,710 --> 01:01:30,720
working on at ucla is where nl1 was

1637
01:01:36,150 --> 01:01:32,720
discovered so this is our team

1638
01:01:37,309 --> 01:01:36,160

it was discovered by dr king ting

1639
01:01:39,510 --> 01:01:37,319
looking at

1640
01:01:41,589 --> 01:01:39,520
craniosynostosis patients so this is a

1641
01:01:45,589 --> 01:01:41,599
condition where in little babies they're

1642
01:01:48,150 --> 01:01:45,599
born with abnormal bone in their

1643
01:01:49,030 --> 01:01:48,160
skull that formed there prematurely so

1644
01:01:50,630 --> 01:01:49,040
probably

1645
01:01:52,789 --> 01:01:50,640
those of you who held a baby you know

1646
01:01:54,549 --> 01:01:52,799
the head feels kind of soft and that's

1647
01:01:56,950 --> 01:01:54,559
because the bone plates haven't fused

1648
01:01:58,870 --> 01:01:56,960
yet to give the brain room to grow so

1649
01:02:00,789 --> 01:01:58,880
certain babies are born with those bone

1650
01:02:02,309 --> 01:02:00,799
plates fused in a condition called

1651
01:02:04,230 --> 01:02:02,319
craniosynostosis

1652
01:02:06,230 --> 01:02:04,240
and that's also in and of itself a big

1653
01:02:08,549 --> 01:02:06,240
problem because of the brain does not

1654
01:02:11,270 --> 01:02:08,559
have enough room to grow so what dr king

1655
01:02:14,309 --> 01:02:11,280
at the time at ucla was trying to answer

1656
01:02:16,710 --> 01:02:14,319
the question what was causing this bone

1657
01:02:18,870 --> 01:02:16,720
to form during development and so the

1658
01:02:21,670 --> 01:02:18,880
answer was no one so there was too much

1659
01:02:23,430 --> 01:02:21,680
nl1 there and so this is about 20 years

1660
01:02:25,829 --> 01:02:23,440
ago and so since then we've been saying

1661
01:02:27,990 --> 01:02:25,839
well how do we harness nl1 and get it to

1662
01:02:28,710 --> 01:02:28,000
form bone where we want it to

1663
01:02:31,349 --> 01:02:28,720

so

1664
01:02:34,630 --> 01:02:31,359
that was how we started and uh with the

1665
01:02:37,910 --> 01:02:34,640
help of dr ben wu at ucla he engineered

1666
01:02:40,230 --> 01:02:37,920
now that nell one to make it last longer

1667
01:02:43,829 --> 01:02:40,240
and also a much more targeted delivery

1668
01:02:45,910 --> 01:02:43,839
to bone for this experiment on the iss

1669
01:02:49,270 --> 01:02:45,920
and then we also have dr jenny quack who

1670
01:02:50,789 --> 01:02:49,280
is our project manager for this

1671
01:02:54,789 --> 01:02:50,799
and then so i'll go over a little bit

1672
01:03:01,029 --> 01:02:57,670
so we are going to be sending off

1673
01:03:03,510 --> 01:03:01,039
40 rodents to the space station and

1674
01:03:06,230 --> 01:03:03,520
there's going to be 40 ground control

1675
01:03:07,829 --> 01:03:06,240
on kennedy space center and before

1676
01:03:09,349 --> 01:03:07,839
launch they're going to undergo a bone

1677
01:03:12,150 --> 01:03:09,359
scan

1678
01:03:15,270 --> 01:03:12,160
you can see in the green arrows and

1679
01:03:16,630 --> 01:03:15,280
after launch then

1680
01:03:18,950 --> 01:03:16,640
when they're in position we're going to

1681
01:03:20,710 --> 01:03:18,960
start nl1 therapy and the astronauts

1682
01:03:22,390 --> 01:03:20,720
will be administering nail 1 to the

1683
01:03:23,910 --> 01:03:22,400
animals on the international space

1684
01:03:26,710 --> 01:03:23,920
station and then we'll have the same

1685
01:03:27,910 --> 01:03:26,720
thing in the ground control here

1686
01:03:30,069 --> 01:03:27,920
and then so

1687
01:03:32,950 --> 01:03:30,079
overall the animals are supposed to

1688
01:03:34,950 --> 01:03:32,960

receive four doses of the drug every two

1689
01:03:36,390 --> 01:03:34,960
weeks and one of the interesting things

1690
01:03:38,549 --> 01:03:36,400
that we're going to be doing is after

1691
01:03:40,230 --> 01:03:38,559
two treatments half of the animals from

1692
01:03:42,789 --> 01:03:40,240
the international space station will be

1693
01:03:45,109 --> 01:03:42,799
coming back to earth for live return so

1694
01:03:47,910 --> 01:03:45,119
this will be the first ever american

1695
01:03:49,670 --> 01:03:47,920
live return and so that will allow us to

1696
01:03:51,430 --> 01:03:49,680
address some very critical issues that

1697
01:03:54,150 --> 01:03:51,440
is these animals have been in the

1698
01:03:56,230 --> 01:03:54,160
microgravity environment now for

1699
01:03:57,910 --> 01:03:56,240
approximately four weeks when they come

1700
01:04:00,230 --> 01:03:57,920
back to earth and we continue treating

1701
01:04:03,190 --> 01:04:00,240
with nl1 how well do they respond and

1702
01:04:05,510 --> 01:04:03,200
that will have implications for

1703
01:04:08,150 --> 01:04:05,520
humans who may be in microgravity

1704
01:04:10,069 --> 01:04:08,160
conditions and develop osteoporosis how

1705
01:04:12,870 --> 01:04:10,079
will they potentially respond to nail

1706
01:04:15,510 --> 01:04:12,880
one therapy when they're back on earth

1707
01:04:20,150 --> 01:04:17,589
and then overall then this the same

1708
01:04:21,910 --> 01:04:20,160
thing exact treatment will happen to all

1709
01:04:23,990 --> 01:04:21,920
the kennedy space station

1710
01:04:26,309 --> 01:04:24,000
animals except there will be a three-day

1711
01:04:28,630 --> 01:04:26,319
lag so what that means is then we will

1712
01:04:30,150 --> 01:04:28,640
know everything that happened on the iss

1713
01:04:35,430 --> 01:04:30,160

so then we can replicate those

1714
01:04:35,440 --> 01:04:38,630
next slide

1715
01:04:43,190 --> 01:04:41,029
and this is a rodent research hardware

1716
01:04:45,670 --> 01:04:43,200
system developed by nasa ames that

1717
01:04:48,870 --> 01:04:45,680
really makes all this work possible so

1718
01:04:51,829 --> 01:04:48,880
there's a transporter unit that is for

1719
01:04:53,990 --> 01:04:51,839
launch and then an animal access unit so

1720
01:04:56,549 --> 01:04:54,000
that we can get the astronauts can get

1721
01:04:57,910 --> 01:04:56,559
to the animals and then also a habitat

1722
01:04:59,910 --> 01:04:57,920
unit

1723
01:05:01,910 --> 01:04:59,920
for the animals to stay

1724
01:05:04,710 --> 01:05:01,920
in the

1725
01:05:06,470 --> 01:05:04,720
space station and um

1726
01:05:21,560 --> 01:05:06,480
after this i'm just going to show a

1727
01:06:20,950 --> 01:05:42,070
[Music]

1728
01:06:25,190 --> 01:06:23,190
thank you next slide

1729
01:06:26,309 --> 01:06:25,200
and so overall that just ran through our

1730
01:06:31,430 --> 01:06:26,319
studies

1731
01:06:35,670 --> 01:06:33,270
just some disclosures i'm a founder of a

1732
01:06:38,230 --> 01:06:35,680
company called bone biologics that is

1733
01:06:44,230 --> 01:06:38,240
working on developing nl1 into a human

1734
01:06:48,549 --> 01:06:46,230
and i want to thank everybody for your

1735
01:06:50,870 --> 01:06:48,559
attention this is a picture of our

1736
01:06:52,870 --> 01:06:50,880
mission patch and all of this work would

1737
01:06:54,710 --> 01:06:52,880
not have been possible without supports

1738
01:06:56,789 --> 01:06:54,720

of course from cases

1739
01:06:59,829 --> 01:06:56,799
as well as bioserve and taconic who

1740
01:07:01,829 --> 01:06:59,839
supplied the animals and spacex and also

1741
01:07:04,150 --> 01:07:01,839
very importantly the national institute

1742
01:07:06,069 --> 01:07:04,160
of health especially

1743
01:07:08,309 --> 01:07:06,079
nyams national institute of arthritis

1744
01:07:11,109 --> 01:07:08,319
and musculoskeletal and skin diseases as

1745
01:07:13,190 --> 01:07:11,119
well as national institute of dental and

1746
01:07:15,829 --> 01:07:13,200
cranial facial research who funded a lot

1747
01:07:18,309 --> 01:07:15,839
of the background work to make nl1 work

1748
01:07:20,230 --> 01:07:18,319
possible thank you

1749
01:07:21,589 --> 01:07:20,240
thank you let's take some questions for

1750
01:07:23,670 --> 01:07:21,599
dr sue

1751
01:07:24,470 --> 01:07:23,680
we've got one up here

1752
01:07:25,990 --> 01:07:24,480
okay

1753
01:07:28,870 --> 01:07:26,000
admittedly i do not know a whole lot

1754
01:07:31,349 --> 01:07:28,880
about rodent psychology but

1755
01:07:32,870 --> 01:07:31,359
them floating and being in microgravity

1756
01:07:34,309 --> 01:07:32,880
for the two weeks or however long

1757
01:07:36,549 --> 01:07:34,319
they're up there

1758
01:07:37,670 --> 01:07:36,559
wouldn't that

1759
01:07:39,750 --> 01:07:37,680
since they don't understand what's

1760
01:07:41,990 --> 01:07:39,760
happening with that stress on their

1761
01:07:43,670 --> 01:07:42,000
bodies their that physical and possibly

1762
01:07:45,750 --> 01:07:43,680
mental stress like i said i don't know

1763
01:07:47,109 --> 01:07:45,760

um possibly alter the way that the

1764
01:07:48,230 --> 01:07:47,119
experiment goes since that will be

1765
01:07:50,069 --> 01:07:48,240
something they are definitively

1766
01:07:52,309 --> 01:07:50,079
experiencing differently than the ones

1767
01:07:53,670 --> 01:07:52,319
on earth also they're taking two flights

1768
01:07:54,630 --> 01:07:53,680
while alive

1769
01:07:57,270 --> 01:07:54,640
and

1770
01:07:58,950 --> 01:07:57,280
you never know how that impacts

1771
01:08:01,109 --> 01:07:58,960
them and the way that they think because

1772
01:08:04,150 --> 01:08:01,119
we know that with people at least stress

1773
01:08:05,990 --> 01:08:04,160
can negatively impact your body yes

1774
01:08:08,230 --> 01:08:06,000
that's an excellent question and i think

1775
01:08:10,710 --> 01:08:08,240
a lot of them the groundbreaking work in

1776
01:08:13,109 --> 01:08:10,720
making this possible is really the work

1777
01:08:15,589 --> 01:08:13,119
by nasa ames who developed the whole

1778
01:08:17,829 --> 01:08:15,599
rodent research habitat system and

1779
01:08:21,430 --> 01:08:17,839
they've been tested on previous missions

1780
01:08:23,510 --> 01:08:21,440
so we're rr5 and so it's really a way to

1781
01:08:27,269 --> 01:08:23,520
have the animals stay healthy

1782
01:08:29,189 --> 01:08:27,279
happy engaged and so even on this round

1783
01:08:30,709 --> 01:08:29,199
would all of this is very carefully

1784
01:08:33,590 --> 01:08:30,719
approved by

1785
01:08:34,630 --> 01:08:33,600
animal research welfare and all of that

1786
01:08:36,829 --> 01:08:34,640
and

1787
01:08:39,510 --> 01:08:36,839
we were including things for animal

1788
01:08:41,590 --> 01:08:39,520

enrichment and um

1789
01:08:43,510 --> 01:08:41,600
the nasa ames people even had pictures

1790
01:08:45,510 --> 01:08:43,520
from earlier flights where with some of

1791
01:08:47,269 --> 01:08:45,520
the animals and they they seem to at

1792
01:08:48,789 --> 01:08:47,279
least the younger ones really enjoy

1793
01:08:52,149 --> 01:08:48,799
being in microgravity they're floating

1794
01:08:55,189 --> 01:08:52,159
around spinning in their cages and so so

1795
01:08:57,829 --> 01:08:55,199
there really has been a lot of work out

1796
01:09:00,149 --> 01:08:57,839
from the nasa ames crew in terms of how

1797
01:09:01,910 --> 01:09:00,159
do the animals stay fed how do they stay

1798
01:09:03,990 --> 01:09:01,920
you know relatively clean you know where

1799
01:09:06,789 --> 01:09:04,000
did all the poop and things go

1800
01:09:08,950 --> 01:09:06,799
and and do they have and yeah there's

1801
01:09:11,669 --> 01:09:08,960
things in the cage they can climb on and

1802
01:09:13,669 --> 01:09:11,679
so they have day and night cycles so all

1803
01:09:16,149 --> 01:09:13,679
of that has been worked out very well

1804
01:09:18,309 --> 01:09:16,159
and so we are our really our mission

1805
01:09:20,229 --> 01:09:18,319
would not be possible without all that

1806
01:09:22,630 --> 01:09:20,239
work that they did and all the previous

1807
01:09:24,870 --> 01:09:22,640
test flights before to evaluate the

1808
01:09:26,870 --> 01:09:24,880
system

1809
01:09:30,550 --> 01:09:26,880
we have one up here just a second we've

1810
01:09:36,309 --> 01:09:32,390
can you explain the mechanism of nell

1811
01:09:37,910 --> 01:09:36,319
one please definitely so it is an uh

1812
01:09:40,229 --> 01:09:37,920
extracellular

1813
01:09:42,789 --> 01:09:40,239

a secreted molecule

1814
01:09:46,229 --> 01:09:42,799
that um is excreted in the extracellular

1815
01:09:49,189 --> 01:09:46,239
space meaning outside of cells and so it

1816
01:09:51,430 --> 01:09:49,199
floats around and then specific cells

1817
01:09:54,070 --> 01:09:51,440
that have a specific receptor for nail

1818
01:09:56,709 --> 01:09:54,080
one null one can then bind to those

1819
01:09:59,669 --> 01:09:56,719
cells with the receptor and activate all

1820
01:10:03,430 --> 01:09:59,679
the signaling inside that tells the cell

1821
01:10:05,350 --> 01:10:03,440
that they need to grow bone

1822
01:10:06,470 --> 01:10:05,360
is that being used here on earth right

1823
01:10:09,510 --> 01:10:06,480
now

1824
01:10:12,070 --> 01:10:09,520
as a it's just experimentally in no no

1825
01:10:13,110 --> 01:10:12,080
it is still of it's only in pre-clinical

1826
01:10:13,990 --> 01:10:13,120
studies

1827
01:10:18,310 --> 01:10:14,000
so

1828
01:10:21,510 --> 01:10:18,320
into clinical into oh

1829
01:10:22,950 --> 01:10:21,520
usually for for a typical drug it's

1830
01:10:24,709 --> 01:10:22,960
anywhere

1831
01:10:26,149 --> 01:10:24,719
for you know on average at least 10

1832
01:10:30,070 --> 01:10:26,159
years

1833
01:10:34,550 --> 01:10:32,229
developing it as a drug

1834
01:10:37,030 --> 01:10:34,560
it's it's still in the initial stages

1835
01:10:38,870 --> 01:10:37,040
we're still in pre-clinical so a lot of

1836
01:10:41,669 --> 01:10:38,880
it for developing intro

1837
01:10:43,990 --> 01:10:41,679
into a drug involves the the human

1838
01:10:46,950 --> 01:10:44,000

studies so i would say we're probably

1839
01:10:49,590 --> 01:10:48,229
all right we've got one question over

1840
01:10:51,110 --> 01:10:49,600
here

1841
01:10:53,590 --> 01:10:51,120
how do you translate the results from

1842
01:10:55,990 --> 01:10:53,600
the rodents into the humans

1843
01:10:58,470 --> 01:10:56,000
so excellent question and so rodents

1844
01:11:00,229 --> 01:10:58,480
were really selected by nasa as a model

1845
01:11:01,510 --> 01:11:00,239
organism and i'm sure there's other

1846
01:11:04,149 --> 01:11:01,520
people here who can answer this even

1847
01:11:06,950 --> 01:11:04,159
better than i can that is because they

1848
01:11:09,990 --> 01:11:06,960
model so many things that humans

1849
01:11:12,709 --> 01:11:10,000
experience so a lot of the genes we have

1850
01:11:14,790 --> 01:11:12,719
are modeled on the rodents and so

1851
01:11:16,149 --> 01:11:14,800
so they're really one of the best models

1852
01:11:20,149 --> 01:11:16,159
and they're small

1853
01:11:21,669 --> 01:11:20,159
so so so that they make it feasible to

1854
01:11:23,510 --> 01:11:21,679
to perform these studies on the

1855
01:11:25,590 --> 01:11:23,520
international space stations but rodents

1856
01:11:27,669 --> 01:11:25,600
model several human can many human

1857
01:11:28,790 --> 01:11:27,679
conditions very very well

1858
01:11:30,229 --> 01:11:28,800
thank you

1859
01:11:32,709 --> 01:11:30,239
all right right here uh what is the

1860
01:11:34,950 --> 01:11:32,719
method for giving the mice the treatment

1861
01:11:36,229 --> 01:11:34,960
of no one is it like an injection is it

1862
01:11:37,430 --> 01:11:36,239
oral and then do you know which

1863
01:11:38,870 --> 01:11:37,440

astronaut is going to be doing that

1864
01:11:41,830 --> 01:11:38,880
administration

1865
01:11:44,709 --> 01:11:41,840
uh um

1866
01:11:48,229 --> 01:11:44,719
i i believe that they've already trained

1867
01:11:51,430 --> 01:11:48,239
that we don't i i don't recall the exact

1868
01:11:54,550 --> 01:11:51,440
i think it might be pamela

1869
01:11:56,390 --> 01:11:54,560
but peggy pig yes yes i believe so and

1870
01:11:58,470 --> 01:11:56,400
so that's where also the nasa ames crew

1871
01:12:02,790 --> 01:11:58,480
have been training and all of that and

1872
01:12:08,950 --> 01:12:06,070
did i see another hand somewhere

1873
01:12:10,790 --> 01:12:08,960
all right thank you very much

1874
01:12:14,149 --> 01:12:10,800
uh we actually do have another model

1875
01:12:17,030 --> 01:12:14,159
organism going up to station on dragon

1876
01:12:19,590 --> 01:12:17,040
we have fruit flies that are going to

1877
01:12:21,110 --> 01:12:19,600
help us learn more about mechanisms in

1878
01:12:22,950 --> 01:12:21,120
the human heart

1879
01:12:24,630 --> 01:12:22,960
here to tell us more about that is dr

1880
01:12:26,950 --> 01:12:24,640
karen okor

1881
01:12:28,550 --> 01:12:26,960
thank you hello everyone

1882
01:12:30,950 --> 01:12:28,560
the goal of the research that my

1883
01:12:33,430 --> 01:12:30,960
colleagues and i do at sbp medical

1884
01:12:35,590 --> 01:12:33,440
discovery institute is to understand

1885
01:12:36,630 --> 01:12:35,600
heart function in both health and

1886
01:12:38,550 --> 01:12:36,640
disease

1887
01:12:40,790 --> 01:12:38,560
and the goal of the work we're doing in

1888
01:12:43,030 --> 01:12:40,800

collaboration with nasa is to extend

1889
01:12:46,149 --> 01:12:43,040
that work to understand the role of

1890
01:12:48,390 --> 01:12:46,159
microgravity in cardiac function

1891
01:12:50,870 --> 01:12:48,400
the reason we look at heart function is

1892
01:12:53,830 --> 01:12:50,880
of course it's very important to your

1893
01:12:56,470 --> 01:12:53,840
ability to live but most the it's also

1894
01:12:59,110 --> 01:12:56,480
the most common cause of death uh heart

1895
01:13:02,149 --> 01:12:59,120
disease in the industrialized world

1896
01:13:03,510 --> 01:13:02,159
and there's also a number of

1897
01:13:05,430 --> 01:13:03,520
dysfunction

1898
01:13:07,510 --> 01:13:05,440
parameters that have been documented in

1899
01:13:10,470 --> 01:13:07,520
astronauts and so we would like to

1900
01:13:13,510 --> 01:13:10,480
understand the role of microgravity

1901
01:13:15,030 --> 01:13:13,520
on astronaut heart function in order to

1902
01:13:16,709 --> 01:13:15,040
try to prevent

1903
01:13:18,950 --> 01:13:16,719
long-term effects

1904
01:13:21,270 --> 01:13:18,960
when they are in space for long periods

1905
01:13:24,550 --> 01:13:21,280
and after they come back but there are

1906
01:13:27,110 --> 01:13:24,560
real world implications as well

1907
01:13:30,950 --> 01:13:27,120
for people who are spending long periods

1908
01:13:33,990 --> 01:13:30,960
of time in bed rest or immobilized we we

1909
01:13:36,709 --> 01:13:34,000
expect that what we find in our studies

1910
01:13:39,270 --> 01:13:36,719
on the iss will have implications for

1911
01:13:41,590 --> 01:13:39,280
maintaining cardiac function under those

1912
01:13:44,149 --> 01:13:41,600
sorts of situations

1913
01:13:46,790 --> 01:13:44,159

so we have developed at

1914
01:13:49,350 --> 01:13:46,800
our institute a number of ways to look

1915
01:13:51,030 --> 01:13:49,360
at heart function in the fruit fly

1916
01:13:53,910 --> 01:13:51,040
and we

1917
01:13:56,229 --> 01:13:53,920
will be using those to try to understand

1918
01:13:58,550 --> 01:13:56,239
what happens with respect to long

1919
01:14:00,630 --> 01:13:58,560
microgravity exposures when these flies

1920
01:14:03,110 --> 01:14:00,640
come back so they will be going up to

1921
01:14:05,510 --> 01:14:03,120
the iss for approximately half of their

1922
01:14:07,750 --> 01:14:05,520
lifespan and coming back where we will

1923
01:14:10,310 --> 01:14:07,760
then bring them into the lab and perform

1924
01:14:12,070 --> 01:14:10,320
a number of assays on them

1925
01:14:14,310 --> 01:14:12,080
so i'm sure you're all asking yourselves

1926
01:14:16,870 --> 01:14:14,320
why on earth would we like to look at

1927
01:14:19,750 --> 01:14:16,880
fruit flies as a model system

1928
01:14:22,790 --> 01:14:19,760
well one of the reasons is because fruit

1929
01:14:25,270 --> 01:14:22,800
flies share about 75 percent of

1930
01:14:27,669 --> 01:14:25,280
disease-causing genes with humans so we

1931
01:14:30,070 --> 01:14:27,679
have a very nice genetic model

1932
01:14:32,070 --> 01:14:30,080
in the fruit fly system

1933
01:14:33,750 --> 01:14:32,080
my colleague ralph bodmer also

1934
01:14:36,390 --> 01:14:33,760
discovered one of the first heart

1935
01:14:38,630 --> 01:14:36,400
developmental genes in the fruit fly he

1936
01:14:41,990 --> 01:14:38,640
called it tin man because when that gene

1937
01:14:44,149 --> 01:14:42,000
is mutated there is no heart formed but

1938
01:14:46,229 --> 01:14:44,159

it's been subsequently found to be very

1939
01:14:47,750 --> 01:14:46,239
important in human heart development so

1940
01:14:49,750 --> 01:14:47,760
there are very

1941
01:14:52,630 --> 01:14:49,760
great similarities between the way the

1942
01:14:55,110 --> 01:14:52,640
heart is formed in fruit flies and in

1943
01:14:57,669 --> 01:14:55,120
humans now the heart has a different

1944
01:14:59,910 --> 01:14:57,679
structure in fruit flies it's a linear

1945
01:15:01,990 --> 01:14:59,920
tube but i'm sure you probably didn't

1946
01:15:03,910 --> 01:15:02,000
know your heart starts out as a linear

1947
01:15:05,830 --> 01:15:03,920
tube and only twists later in

1948
01:15:07,510 --> 01:15:05,840
development to form the heart that

1949
01:15:10,149 --> 01:15:07,520
you're familiar with

1950
01:15:12,470 --> 01:15:10,159
and so we have a lot of similarities in

1951
01:15:14,149 --> 01:15:12,480
terms of genetic basis

1952
01:15:16,470 --> 01:15:14,159
it turns out that there's a lot of

1953
01:15:19,030 --> 01:15:16,480
functional similarities the rodent heart

1954
01:15:21,189 --> 01:15:19,040
beats about 10 times faster than the

1955
01:15:22,950 --> 01:15:21,199
human heart and the fruit fly heart

1956
01:15:24,950 --> 01:15:22,960
beats about the same as a human heart

1957
01:15:27,590 --> 01:15:24,960
and that means that many of the

1958
01:15:29,669 --> 01:15:27,600
important functional proteins in the fly

1959
01:15:32,470 --> 01:15:29,679
are more similar to the ones in our

1960
01:15:35,350 --> 01:15:32,480
heart than in a rodent heart

1961
01:15:37,750 --> 01:15:35,360
the other reason to do this is as was

1962
01:15:41,590 --> 01:15:37,760
just mentioned they're small in fact

1963
01:15:47,270 --> 01:15:44,390

we will be sending up approximately 90

1964
01:15:50,149 --> 01:15:47,280
vials like this and if you'll row the

1965
01:15:53,030 --> 01:15:50,159
roll the video you can see a close-up of

1966
01:15:55,510 --> 01:15:53,040
what i'm showing you here this is a vial

1967
01:15:57,430 --> 01:15:55,520
with food in the bottom and in the video

1968
01:15:59,750 --> 01:15:57,440
you can see there's quite a few fruit

1969
01:16:02,310 --> 01:15:59,760
flies climbing around

1970
01:16:03,270 --> 01:16:02,320
this is essentially a self-contained

1971
01:16:04,470 --> 01:16:03,280
unit

1972
01:16:07,110 --> 01:16:04,480
that can

1973
01:16:10,470 --> 01:16:07,120
house thousands of flies in fact we'll

1974
01:16:12,070 --> 01:16:10,480
be sending up approximately 4 000 to 6

1975
01:16:13,189 --> 01:16:12,080
000 eggs

1976
01:16:16,390 --> 01:16:13,199
that will

1977
01:16:18,390 --> 01:16:16,400
hatch on the iss and when they come back

1978
01:16:21,110 --> 01:16:18,400
we'll be able to analyze their heart

1979
01:16:23,110 --> 01:16:21,120
function having spent half their life in

1980
01:16:25,350 --> 01:16:23,120
microgravity

1981
01:16:27,590 --> 01:16:25,360
this is showing you our lab and this is

1982
01:16:30,390 --> 01:16:27,600
how we analyze heart function we take

1983
01:16:32,390 --> 01:16:30,400
movies of the heart beating

1984
01:16:34,149 --> 01:16:32,400
and we can then

1985
01:16:36,630 --> 01:16:34,159
using a computer program that we've

1986
01:16:39,830 --> 01:16:36,640
developed analyze in great detail the

1987
01:16:41,830 --> 01:16:39,840
function of these heart cells and in

1988
01:16:44,630 --> 01:16:41,840

addition to function we can then from

1989
01:16:46,630 --> 01:16:44,640
the same flies stain them and look at

1990
01:16:50,229 --> 01:16:46,640
the morphology of the heart so we can

1991
01:16:52,229 --> 01:16:50,239
see how microgravity affects the

1992
01:16:53,830 --> 01:16:52,239
contractile elements within the heart

1993
01:16:56,790 --> 01:16:53,840
muscle cells

1994
01:16:58,790 --> 01:16:56,800
we can also then do genetic analyses on

1995
01:17:01,669 --> 01:16:58,800
these hearts we've done

1996
01:17:04,709 --> 01:17:01,679
what's called rna-seq analysis on as few

1997
01:17:07,750 --> 01:17:04,719
as four to six hearts and i hope you can

1998
01:17:10,229 --> 01:17:07,760
imagine how small an amount of tissue

1999
01:17:11,590 --> 01:17:10,239
that might be

2000
01:17:13,030 --> 01:17:11,600
we

2001
01:17:14,470 --> 01:17:13,040
can analyze these hearts through

2002
01:17:16,790 --> 01:17:14,480
dissection

2003
01:17:17,590 --> 01:17:16,800
but when we try to do biochemistry on

2004
01:17:20,149 --> 01:17:17,600
them

2005
01:17:21,910 --> 01:17:20,159
size matters but we can with the

2006
01:17:24,070 --> 01:17:21,920
thousands of flies that we're going to

2007
01:17:25,910 --> 01:17:24,080
get back we'll be able to pool this

2008
01:17:28,149 --> 01:17:25,920
tissue

2009
01:17:31,189 --> 01:17:28,159
to varying degrees and and do more

2010
01:17:33,110 --> 01:17:31,199
extensive biochemical analyses

2011
01:17:35,669 --> 01:17:33,120
once they return

2012
01:17:39,030 --> 01:17:35,679
now our experiment will take

2013
01:17:41,510 --> 01:17:39,040

roughly 90 of those vials and we'll

2014
01:17:43,510 --> 01:17:41,520
put them into six boxes that look like

2015
01:17:45,830 --> 01:17:43,520
this these boxes were developed in

2016
01:17:47,270 --> 01:17:45,840
collaboration with our colleagues at

2017
01:17:50,149 --> 01:17:47,280
nasa ames

2018
01:17:52,149 --> 01:17:50,159
and they have a little viewing window so

2019
01:17:53,910 --> 01:17:52,159
it's possible to see what's going on

2020
01:17:56,310 --> 01:17:53,920
inside what you can see right now is

2021
01:17:59,590 --> 01:17:56,320
just the food but that will slowly get

2022
01:18:00,870 --> 01:17:59,600
eaten by the larva who eventually will

2023
01:18:03,990 --> 01:18:00,880
eclose

2024
01:18:06,790 --> 01:18:04,000
from pupa on the sides of those vials

2025
01:18:09,030 --> 01:18:06,800
and become adults and it's those adults

2026
01:18:11,030 --> 01:18:09,040
that we're interested in initially when

2027
01:18:12,390 --> 01:18:11,040
they come back to see what happened to

2028
01:18:14,870 --> 01:18:12,400
their hearts

2029
01:18:17,270 --> 01:18:14,880
but we're also interested in something

2030
01:18:20,229 --> 01:18:17,280
called epigenetics what happens to the

2031
01:18:22,870 --> 01:18:20,239
babies that those adults produce so once

2032
01:18:25,030 --> 01:18:22,880
they come back we'll let them have

2033
01:18:27,110 --> 01:18:25,040
offspring and we will raise those to

2034
01:18:29,510 --> 01:18:27,120
approximately the same age as the

2035
01:18:32,070 --> 01:18:29,520
parents that we analyzed and we will

2036
01:18:34,310 --> 01:18:32,080
then analyze their heart function to see

2037
01:18:36,709 --> 01:18:34,320
if there are lasting effects in

2038
01:18:40,070 --> 01:18:36,719

subsequent generations from

2039
01:18:41,830 --> 01:18:40,080
prolonged microgravity exposure

2040
01:18:43,910 --> 01:18:41,840
obviously these are all important

2041
01:18:47,189 --> 01:18:43,920
questions that most astronauts would

2042
01:18:49,750 --> 01:18:47,199
like to know but it's also important to

2043
01:18:52,229 --> 01:18:49,760
understand if there are environmental

2044
01:18:54,470 --> 01:18:52,239
kinds of influences that can affect

2045
01:18:56,310 --> 01:18:54,480
function in offspring and so these are

2046
01:18:59,590 --> 01:18:56,320
the sorts of things that

2047
01:19:01,830 --> 01:18:59,600
in more general basic science terms are

2048
01:19:03,110 --> 01:19:01,840
significant for people on the ground to

2049
01:19:05,270 --> 01:19:03,120
understand

2050
01:19:07,030 --> 01:19:05,280
and so um

2051
01:19:08,870 --> 01:19:07,040
these are the sorts of things we hope to

2052
01:19:09,669 --> 01:19:08,880
address with this mission

2053
01:19:12,950 --> 01:19:09,679
we

2054
01:19:15,830 --> 01:19:12,960
have already sent up on spacex3 a test

2055
01:19:18,149 --> 01:19:15,840
of this system we sent up one box we did

2056
01:19:19,990 --> 01:19:18,159
get live flies back and

2057
01:19:21,110 --> 01:19:20,000
some of the things we learned from that

2058
01:19:22,470 --> 01:19:21,120
mission

2059
01:19:25,189 --> 01:19:22,480
we are going to be

2060
01:19:26,310 --> 01:19:25,199
continuing to test on this mission so we

2061
01:19:28,310 --> 01:19:26,320
expect

2062
01:19:30,149 --> 01:19:28,320
quite a bit of genetic and functional

2063
01:19:32,310 --> 01:19:30,159

information uh when we're done with

2064
01:19:33,910 --> 01:19:32,320
these studies

2065
01:19:35,990 --> 01:19:33,920
and i think that's all

2066
01:19:37,990 --> 01:19:36,000
thank you we'll take some questions here

2067
01:19:41,110 --> 01:19:38,000
in the room we've got one over here

2068
01:19:43,669 --> 01:19:41,120
what is the lifespan of a fruit fly and

2069
01:19:45,830 --> 01:19:43,679
what percent do you expect in six months

2070
01:19:47,990 --> 01:19:45,840
uh to lose

2071
01:19:51,110 --> 01:19:48,000
so we they'll only actually be up there

2072
01:19:54,070 --> 01:19:51,120
for one month their span is two months

2073
01:19:56,550 --> 01:19:54,080
and so one week of a fruit fly life is

2074
01:19:57,750 --> 01:19:56,560
about a decade in human life

2075
01:19:59,030 --> 01:19:57,760
terms

2076
01:20:01,030 --> 01:19:59,040
so they will

2077
01:20:03,830 --> 01:20:01,040
the eggs that we send up will hatch

2078
01:20:05,910 --> 01:20:03,840
they'll come back after about

2079
01:20:08,550 --> 01:20:05,920
as an adult about three weeks so they'll

2080
01:20:10,550 --> 01:20:08,560
be roughly 30 35 years old

2081
01:20:12,470 --> 01:20:10,560
and so middle-aged

2082
01:20:15,669 --> 01:20:12,480
we're also sending up adults who will

2083
01:20:17,350 --> 01:20:15,679
have babies on the iss so they'll be a

2084
01:20:19,430 --> 01:20:17,360
little bit younger but we won't have

2085
01:20:22,709 --> 01:20:19,440
them quite so precisely

2086
01:20:24,470 --> 01:20:22,719
age so it turns out aging just like in

2087
01:20:26,709 --> 01:20:24,480
humans has an effect on the heart and

2088
01:20:28,790 --> 01:20:26,719

the fruit fly and the heart function

2089
01:20:31,510 --> 01:20:28,800
gets worse as they get older so we want

2090
01:20:32,790 --> 01:20:31,520
to get them reasonably young so that we

2091
01:20:34,709 --> 01:20:32,800
can

2092
01:20:37,990 --> 01:20:34,719
separate the aging effects from the

2093
01:20:42,390 --> 01:20:38,000
microgravity effects

2094
01:20:46,470 --> 01:20:44,229
so i know that a lot of times when you

2095
01:20:48,470 --> 01:20:46,480
send stuff up into space you get results

2096
01:20:50,070 --> 01:20:48,480
back that are exactly the opposite of

2097
01:20:52,310 --> 01:20:50,080
what you were anticipating like with the

2098
01:20:55,750 --> 01:20:52,320
recent telomere studies

2099
01:20:57,830 --> 01:20:55,760
what in the the previous uh experiment

2100
01:20:59,990 --> 01:20:57,840
were you surprised by and you're double

2101
01:21:01,189 --> 01:21:00,000
checking this time yes so there were

2102
01:21:03,590 --> 01:21:01,199
some um

2103
01:21:06,870 --> 01:21:03,600
structural changes in the heart that we

2104
01:21:09,189 --> 01:21:06,880
hadn't anticipated we expected um

2105
01:21:11,590 --> 01:21:09,199
we expected that there would be

2106
01:21:13,110 --> 01:21:11,600
different size hearts in these flies

2107
01:21:15,990 --> 01:21:13,120
that came back because that's been

2108
01:21:19,189 --> 01:21:16,000
documented some subtle changes in

2109
01:21:22,070 --> 01:21:19,199
astronaut heart size and we we did see

2110
01:21:25,110 --> 01:21:22,080
that but then there's um there's

2111
01:21:27,510 --> 01:21:25,120
extracellular matrix kinds of changes

2112
01:21:29,910 --> 01:21:27,520
that we didn't anticipate and so we're

2113
01:21:31,990 --> 01:21:29,920

testing exactly that

2114
01:21:33,430 --> 01:21:32,000
on this flight and

2115
01:21:35,350 --> 01:21:33,440
there's a few genes that were

2116
01:21:39,669 --> 01:21:35,360
misregulated that we're

2117
01:21:42,629 --> 01:21:39,679
investigating further so stay tuned

2118
01:21:44,870 --> 01:21:42,639
all right thank you very much so future

2119
01:21:47,030 --> 01:21:44,880
space explorers will not only need to

2120
01:21:49,189 --> 01:21:47,040
combat the effects of microgravity they

2121
01:21:51,910 --> 01:21:49,199
will also need a robust life support

2122
01:21:54,310 --> 01:21:51,920
system to sustain them on their journeys

2123
01:21:56,709 --> 01:21:54,320
through space uh with us now we have

2124
01:21:58,870 --> 01:21:56,719
miriam sanjay singh and she's going to

2125
01:21:59,990 --> 01:21:58,880
tell us about an investigation that may

2126
01:22:02,070 --> 01:22:00,000
improve

2127
01:22:04,470 --> 01:22:02,080
life support systems for future space

2128
01:22:09,110 --> 01:22:04,480
exploration by looking at how liquid and

2129
01:22:09,120 --> 01:22:13,030
go ahead and play the video

2130
01:22:15,510 --> 01:22:14,470
this is how you're gonna drink your

2131
01:22:17,430 --> 01:22:15,520
coffee

2132
01:22:19,270 --> 01:22:17,440
future space calling us will drink their

2133
01:22:25,990 --> 01:22:19,280
coffee this way they will make their

2134
01:22:30,950 --> 01:22:28,310
that is so cool

2135
01:22:31,990 --> 01:22:30,960
good to the last drop

2136
01:22:34,870 --> 01:22:32,000
sleeve

2137
01:22:35,990 --> 01:22:34,880
you know while it's fun to drink uh

2138
01:22:38,229 --> 01:22:36,000

from a cup

2139
01:22:38,950 --> 01:22:38,239
these these cups are actually a test bed

2140
01:22:42,390 --> 01:22:38,960
for

2141
01:22:45,510 --> 01:22:42,400
looking at ways to make fluids flow

2142
01:22:52,950 --> 01:22:45,520
in this microgravity environment

2143
01:22:58,629 --> 01:22:55,910
and we can go ahead and put that image

2144
01:23:00,310 --> 01:22:58,639
back on of the life support process

2145
01:23:02,550 --> 01:23:00,320
so capillary structures for exploration

2146
01:23:05,189 --> 01:23:02,560
life support which we call c cells

2147
01:23:08,790 --> 01:23:05,199
um is actually an x project that was

2148
01:23:12,629 --> 01:23:08,800
granted by johnson space center in 2016

2149
01:23:15,430 --> 01:23:12,639
with the goal of bringing a technology

2150
01:23:18,070 --> 01:23:15,440
demonstration or experiment

2151
01:23:21,030 --> 01:23:18,080
that was sponsored by a nasa agency

2152
01:23:23,030 --> 01:23:21,040
to space station uh within one year um

2153
01:23:24,709 --> 01:23:23,040
so we had a very quick turnaround

2154
01:23:28,550 --> 01:23:24,719
um and

2155
01:23:29,750 --> 01:23:28,560
i kind of jumped on on this proposal um

2156
01:23:33,990 --> 01:23:29,760
i think

2157
01:23:36,790 --> 01:23:34,000
being able to take some concepts that

2158
01:23:38,229 --> 01:23:36,800
seem simple enough to make create a cup

2159
01:23:40,550 --> 01:23:38,239
in space

2160
01:23:43,350 --> 01:23:40,560
and really apply those to life support

2161
01:23:46,870 --> 01:23:43,360
systems was is very exciting to me

2162
01:23:49,910 --> 01:23:46,880
so what this does is it actually

2163
01:23:52,629 --> 01:23:49,920

brings a very complicated problem which

2164
01:23:54,950 --> 01:23:52,639
is fluid management in microgravity

2165
01:23:56,709 --> 01:23:54,960
which we currently deal with using

2166
01:23:59,110 --> 01:23:56,719
rotating systems

2167
01:24:01,669 --> 01:23:59,120
and membranes

2168
01:24:04,229 --> 01:24:01,679
special coatings

2169
01:24:05,990 --> 01:24:04,239
those systems tend to fail one way or

2170
01:24:07,830 --> 01:24:06,000
another eventually

2171
01:24:11,270 --> 01:24:07,840
and this is just due to either phase

2172
01:24:13,510 --> 01:24:11,280
separation or or old age wear

2173
01:24:15,590 --> 01:24:13,520
and so what these capillary structures

2174
01:24:17,189 --> 01:24:15,600
do is essentially take that problem and

2175
01:24:19,590 --> 01:24:17,199
make it very simple by

2176
01:24:20,870 --> 01:24:19,600
simply relying on geometry

2177
01:24:23,110 --> 01:24:20,880
and that is something that don pettit

2178
01:24:24,149 --> 01:24:23,120
was showing in his cup experiment

2179
01:24:26,709 --> 01:24:24,159
um

2180
01:24:31,750 --> 01:24:29,990
if we go back to that that picture what

2181
01:24:33,830 --> 01:24:31,760
this is showing

2182
01:24:35,110 --> 01:24:33,840
kind of yesterday's coffee to tomorrow's

2183
01:24:37,350 --> 01:24:35,120
coffee

2184
01:24:40,390 --> 01:24:37,360
we've got the waste collection system

2185
01:24:44,310 --> 01:24:40,400
which is collecting urine

2186
01:24:46,310 --> 01:24:44,320
and bringing it to a water processor in

2187
01:24:48,470 --> 01:24:46,320
this case we're wanting to have a

2188
01:24:50,870 --> 01:24:48,480

capillary evaporator so what this

2189
01:24:51,669 --> 01:24:50,880
evaporator does and here's an example of

2190
01:24:54,070 --> 01:24:51,679
one

2191
01:24:56,149 --> 01:24:54,080
is hold the

2192
01:24:59,669 --> 01:24:56,159
pre-treated urine in the capillary

2193
01:25:02,149 --> 01:24:59,679
structure and allow air to flow over the

2194
01:25:04,390 --> 01:25:02,159
many surfaces that the structure would

2195
01:25:07,110 --> 01:25:04,400
allow but and then what that does is it

2196
01:25:10,070 --> 01:25:07,120
pulls the humidity from the urine

2197
01:25:11,590 --> 01:25:10,080
leaving the undesirables behind in the

2198
01:25:13,350 --> 01:25:11,600
capillary structure

2199
01:25:15,189 --> 01:25:13,360
that air is then moved on to a

2200
01:25:16,950 --> 01:25:15,199
condensing heat exchanger in the air

2201
01:25:18,790 --> 01:25:16,960
revitalization system

2202
01:25:20,629 --> 01:25:18,800
and then it kind of takes a turn down

2203
01:25:22,470 --> 01:25:20,639
into the water processor so what the

2204
01:25:23,830 --> 01:25:22,480
water processor does is then make

2205
01:25:27,270 --> 01:25:23,840
drinkable water

2206
01:25:30,550 --> 01:25:27,280
and so from that ciao lundgren is able

2207
01:25:31,910 --> 01:25:30,560
to create his sort of keurig

2208
01:25:33,990 --> 01:25:31,920
space cup

2209
01:25:35,910 --> 01:25:34,000
aspect and be able to

2210
01:25:37,669 --> 01:25:35,920
really enjoy the smell and taste of

2211
01:25:39,510 --> 01:25:37,679
freshly brewed coffee on the space

2212
01:25:41,030 --> 01:25:39,520
station

2213
01:25:43,750 --> 01:25:41,040

another thing that happens with the air

2214
01:25:45,270 --> 01:25:43,760
though not to forget is

2215
01:25:47,830 --> 01:25:45,280
being able to scrub that air so they can

2216
01:25:50,550 --> 01:25:47,840
be reused over and over again

2217
01:25:53,590 --> 01:25:50,560
and so in this case what this

2218
01:25:56,070 --> 01:25:53,600
part here is a very fundamental

2219
01:25:57,910 --> 01:25:56,080
demonstration unit of the fluid

2220
01:25:59,510 --> 01:25:57,920
mechanics that would go into a carbon

2221
01:26:01,910 --> 01:25:59,520
dioxide removal system actually a

2222
01:26:04,629 --> 01:26:01,920
regenerable one so

2223
01:26:06,070 --> 01:26:04,639
the a liquid absorbent would be flown

2224
01:26:09,350 --> 01:26:06,080
through a

2225
01:26:11,830 --> 01:26:09,360
contactor and that would then provide a

2226
01:26:13,910 --> 01:26:11,840
very um direct

2227
01:26:15,910 --> 01:26:13,920
interface between that liquid sorbent

2228
01:26:17,990 --> 01:26:15,920
and air that sorbonne would then pull

2229
01:26:20,470 --> 01:26:18,000
out the co2 from the air

2230
01:26:22,149 --> 01:26:20,480
and pull it away bringing it to another

2231
01:26:24,629 --> 01:26:22,159
chamber where it would then be

2232
01:26:26,229 --> 01:26:24,639
regenerated pulling the co2 off and

2233
01:26:28,310 --> 01:26:26,239
sending it off to another system or

2234
01:26:30,709 --> 01:26:28,320
dumping it and then allowing that fluid

2235
01:26:33,510 --> 01:26:30,719
to be continuously used to scrub carbon

2236
01:26:34,790 --> 01:26:33,520
dioxide from the air

2237
01:26:37,110 --> 01:26:34,800
and so

2238
01:26:39,030 --> 01:26:37,120

these systems are

2239
01:26:40,390 --> 01:26:39,040
very simple

2240
01:26:41,510 --> 01:26:40,400
you pour it in it's kind of like a

2241
01:26:44,390 --> 01:26:41,520
bucket

2242
01:26:46,470 --> 01:26:44,400
and sort of like a slick wall

2243
01:26:50,390 --> 01:26:46,480
in this case

2244
01:26:52,470 --> 01:26:50,400
system with only one pump

2245
01:26:53,910 --> 01:26:52,480
and basically we're kind of like going

2246
01:26:56,070 --> 01:26:53,920
blowing our mind the minds of our

2247
01:26:57,910 --> 01:26:56,080
engineers um

2248
01:26:59,430 --> 01:26:57,920
back in you know kind of

2249
01:27:00,709 --> 01:26:59,440
jc ksc

2250
01:27:02,390 --> 01:27:00,719
marshall

2251
01:27:06,149 --> 01:27:02,400
because we're not using the typical

2252
01:27:06,870 --> 01:27:06,159
technologies to manage the fluids

2253
01:27:10,310 --> 01:27:06,880
these

2254
01:27:13,430 --> 01:27:10,320
technologies only work in space

2255
01:27:15,510 --> 01:27:13,440
sort of kind of with some various tweaks

2256
01:27:17,590 --> 01:27:15,520
they can work in

2257
01:27:18,790 --> 01:27:17,600
on terrestrial grounds like earth and

2258
01:27:20,709 --> 01:27:18,800
mars

2259
01:27:24,070 --> 01:27:20,719
but these are specifically designed to

2260
01:27:27,350 --> 01:27:26,310
with very minimal

2261
01:27:29,750 --> 01:27:27,360
waste

2262
01:27:33,990 --> 01:27:31,350
how do we get to mars we get smaller

2263
01:27:36,550 --> 01:27:34,000

lighter and we become more reliable

2264
01:27:38,709 --> 01:27:36,560
this is how flat

2265
01:27:40,070 --> 01:27:38,719
our water recovery system for about a

2266
01:27:42,709 --> 01:27:40,080
third of a liter

2267
01:27:44,629 --> 01:27:42,719
would be going up and then being thrown

2268
01:27:50,629 --> 01:27:44,639
away as opposed to

2269
01:27:50,639 --> 01:27:59,350
so if we go on to the next slide

2270
01:28:05,110 --> 01:28:02,870
again these are just two portions of the

2271
01:28:07,590 --> 01:28:05,120
entire experiment the experiment

2272
01:28:08,950 --> 01:28:07,600
actually has six different experiments

2273
01:28:10,870 --> 01:28:08,960
included

2274
01:28:12,950 --> 01:28:10,880
three of them are focused on carbon

2275
01:28:14,709 --> 01:28:12,960
dioxide removal

2276
01:28:15,510 --> 01:28:14,719
and so from

2277
01:28:17,189 --> 01:28:15,520
uh

2278
01:28:19,189 --> 01:28:17,199
right left to right

2279
01:28:21,110 --> 01:28:19,199
the first one is actually a science

2280
01:28:24,470 --> 01:28:21,120
article this is going to allow portland

2281
01:28:27,350 --> 01:28:24,480
state university to really evaluate how

2282
01:28:29,910 --> 01:28:27,360
fluids will flow into

2283
01:28:32,310 --> 01:28:29,920
four parallel wedges

2284
01:28:34,550 --> 01:28:32,320
which are open to air and then recombine

2285
01:28:36,550 --> 01:28:34,560
and be brought around

2286
01:28:38,950 --> 01:28:36,560
the next experiment

2287
01:28:41,669 --> 01:28:38,960
next two actually combine together

2288
01:28:43,270 --> 01:28:41,679

really demonstrate the carbon dioxide

2289
01:28:45,750 --> 01:28:43,280
removal system

2290
01:28:48,870 --> 01:28:45,760
so the more complex is the two

2291
01:28:51,350 --> 01:28:48,880
contactors being run in series

2292
01:28:54,070 --> 01:28:51,360
the item in the middle bottom middle

2293
01:28:56,390 --> 01:28:54,080
is a simpler version that is intended to

2294
01:28:58,550 --> 01:28:56,400
show that we can actually flow fluids of

2295
01:29:00,310 --> 01:28:58,560
different viscosities and surface

2296
01:29:02,470 --> 01:29:00,320
properties

2297
01:29:04,870 --> 01:29:02,480
and really understand how they flow and

2298
01:29:08,709 --> 01:29:04,880
be able to predict how they flow

2299
01:29:10,870 --> 01:29:08,719
up on top are the ones that are more

2300
01:29:13,189 --> 01:29:10,880
associated with the capillary

2301
01:29:14,870 --> 01:29:13,199
evaporators so the one in the middle you

2302
01:29:17,189 --> 01:29:14,880
see right here which is a demonstration

2303
01:29:19,830 --> 01:29:17,199
unit of a capillary evaporator we'll

2304
01:29:22,950 --> 01:29:19,840
fill it with an erzatz and then use a

2305
01:29:26,950 --> 01:29:22,960
fan to dry that out over five days and

2306
01:29:29,270 --> 01:29:26,960
watch how it dries in its container

2307
01:29:31,590 --> 01:29:29,280
the first one is a science article so

2308
01:29:34,149 --> 01:29:31,600
what this is is looking at various

2309
01:29:36,709 --> 01:29:34,159
shapes to see how different dimensions

2310
01:29:39,510 --> 01:29:36,719
like height width shape of the

2311
01:29:40,950 --> 01:29:39,520
individual capillary flow pores will

2312
01:29:44,790 --> 01:29:40,960
impact

2313
01:29:47,750 --> 01:29:44,800

fluid stability and the evaporation rate

2314
01:29:49,590 --> 01:29:47,760
and then finally on the very end is a

2315
01:29:51,030 --> 01:29:49,600
foam infill demonstration so this is a

2316
01:29:53,669 --> 01:29:51,040
piece of foam

2317
01:29:56,149 --> 01:29:53,679
that we're going to use to show that

2318
01:29:58,470 --> 01:29:56,159
fluids will be actually able to wick

2319
01:30:00,870 --> 01:29:58,480
into that foam structure and free up

2320
01:30:04,310 --> 01:30:00,880
space for air to flow over the surface

2321
01:30:05,990 --> 01:30:04,320
of that foam for evaporation process

2322
01:30:07,830 --> 01:30:06,000
we're going to have about 50 hours of

2323
01:30:09,590 --> 01:30:07,840
crew time this is a very crew intensive

2324
01:30:11,430 --> 01:30:09,600
experiment we wanted them to have fun

2325
01:30:13,030 --> 01:30:11,440
and really see

2326
01:30:14,310 --> 01:30:13,040
the science that's happening with this

2327
01:30:15,590 --> 01:30:14,320
experiment

2328
01:30:17,669 --> 01:30:15,600
and then out of that we're beginning

2329
01:30:20,950 --> 01:30:17,679
we're going to get more than 500 hours

2330
01:30:22,629 --> 01:30:20,960
of science out of this kit and then one

2331
01:30:25,990 --> 01:30:22,639
little thing to note

2332
01:30:28,070 --> 01:30:26,000
so again we're trying to keep it simple

2333
01:30:31,350 --> 01:30:28,080
while the eventual technologies will be

2334
01:30:33,270 --> 01:30:31,360
using some more complex fluids we wanted

2335
01:30:35,270 --> 01:30:33,280
the crew to be able to feel free to

2336
01:30:36,790 --> 01:30:35,280
experiment and so we're using our

2337
01:30:40,629 --> 01:30:36,800
wonderful

2338
01:30:43,030 --> 01:30:40,639

erzatz of kool-aid

2339
01:30:44,310 --> 01:30:43,040
very easy to see very nice to work with

2340
01:30:47,990 --> 01:30:44,320
and if there's any spill they can kind

2341
01:30:49,590 --> 01:30:48,000
of just suck it up

2342
01:30:51,590 --> 01:30:49,600
any questions all right thank you let's

2343
01:30:53,750 --> 01:30:51,600
take some questions here in the room

2344
01:30:56,709 --> 01:30:53,760
again if we have folks on the phone it's

2345
01:30:58,950 --> 01:30:56,719
star one and uh using the hashtag ask

2346
01:31:01,430 --> 01:30:58,960
nasa if you are online

2347
01:31:03,750 --> 01:31:01,440
this ask nasa question um if these

2348
01:31:05,350 --> 01:31:03,760
systems are uh only really work in

2349
01:31:07,189 --> 01:31:05,360
microgravity how do you test them before

2350
01:31:09,669 --> 01:31:07,199
you send them to space very good

2351
01:31:11,110 --> 01:31:09,679
question so there are actually

2352
01:31:13,910 --> 01:31:11,120
quite a few experiments that are

2353
01:31:17,590 --> 01:31:13,920
happening in order to evaluate uh these

2354
01:31:20,709 --> 01:31:17,600
systems for the evaporator we actually

2355
01:31:23,030 --> 01:31:20,719
created some microgravity versions of

2356
01:31:25,590 --> 01:31:23,040
these containers that have a bottom

2357
01:31:28,310 --> 01:31:25,600
um and then we evaluate the surface

2358
01:31:29,270 --> 01:31:28,320
evaporation from sort of the crenellated

2359
01:31:30,470 --> 01:31:29,280
edges

2360
01:31:32,790 --> 01:31:30,480
here

2361
01:31:34,550 --> 01:31:32,800
and then we also work with portland

2362
01:31:36,950 --> 01:31:34,560
state university that has a drop tower

2363
01:31:39,350 --> 01:31:36,960

so we get about two seconds of

2364
01:31:41,430 --> 01:31:39,360
microgravity data and we've been able to

2365
01:31:43,430 --> 01:31:41,440
show on some of the subscale

2366
01:31:46,070 --> 01:31:43,440
mock-ups of these different technologies

2367
01:31:47,830 --> 01:31:46,080
how how the containers fill how they

2368
01:31:49,830 --> 01:31:47,840
flow

2369
01:31:51,270 --> 01:31:49,840
for the capillary zorban there's

2370
01:31:53,430 --> 01:31:51,280
actually a

2371
01:31:55,750 --> 01:31:53,440
space act agreement that nasa has with

2372
01:31:57,430 --> 01:31:55,760
honda that's developing a very similar

2373
01:32:00,149 --> 01:31:57,440
technology for

2374
01:32:02,550 --> 01:32:00,159
their hybrid cars in order to

2375
01:32:04,470 --> 01:32:02,560
clean their air and reduce their power

2376
01:32:06,629 --> 01:32:04,480
draw on their batteries

2377
01:32:08,870 --> 01:32:06,639
so that's one application where we're

2378
01:32:12,950 --> 01:32:08,880
actually using the very very similar

2379
01:32:16,790 --> 01:32:14,470
thank you do we have other questions

2380
01:32:20,790 --> 01:32:16,800
here in the room

2381
01:32:25,990 --> 01:32:23,910
um so you said that you get 500 hours of

2382
01:32:29,910 --> 01:32:26,000
science out of that i'm curious what

2383
01:32:31,910 --> 01:32:29,920
exactly that entails like research-wise

2384
01:32:33,750 --> 01:32:31,920
so um actually

2385
01:32:35,990 --> 01:32:33,760
the way that we're collecting data here

2386
01:32:37,669 --> 01:32:36,000
is through video and

2387
01:32:40,629 --> 01:32:37,679
still imagery uh really time-lapse

2388
01:32:43,189 --> 01:32:40,639

imagery um and so for each of the

2389
01:32:43,910 --> 01:32:43,199
experiments for the carbon dioxide this

2390
01:32:47,030 --> 01:32:43,920
is

2391
01:32:49,430 --> 01:32:47,040
very very handsy so we're collecting

2392
01:32:50,950 --> 01:32:49,440
video imagery as the crew is performing

2393
01:32:54,629 --> 01:32:50,960
the experiment

2394
01:32:56,149 --> 01:32:54,639
for the evaporation experiments

2395
01:32:58,470 --> 01:32:56,159
we have

2396
01:32:59,830 --> 01:32:58,480
enough for

2397
01:33:02,229 --> 01:32:59,840
six

2398
01:33:03,830 --> 01:33:02,239
seven different evaporation experiments

2399
01:33:06,070 --> 01:33:03,840
and each of those would happen between

2400
01:33:07,189 --> 01:33:06,080
three to five days at a time and we're

2401
01:33:09,189 --> 01:33:07,199
going to be taking time lapse

2402
01:33:13,430 --> 01:33:09,199
photography over the entire evaporation

2403
01:33:15,750 --> 01:33:14,870
all right any other questions here in

2404
01:33:18,310 --> 01:33:15,760
the room

2405
01:33:20,950 --> 01:33:18,320
we've got one over here

2406
01:33:23,110 --> 01:33:20,960
so um when you were showing how how

2407
01:33:24,149 --> 01:33:23,120
small that collapsed

2408
01:33:27,430 --> 01:33:24,159
um

2409
01:33:29,270 --> 01:33:27,440
you said something about uh

2410
01:33:31,110 --> 01:33:29,280
the throwing them away would would these

2411
01:33:33,350 --> 01:33:31,120
be reusable things would you send up

2412
01:33:35,110 --> 01:33:33,360
multiple filters so that's actually

2413
01:33:37,030 --> 01:33:35,120

something that we are currently

2414
01:33:38,470 --> 01:33:37,040
evaluating we're going to be doing the

2415
01:33:40,870 --> 01:33:38,480
trade study

2416
01:33:42,709 --> 01:33:40,880
so the first pass very very simple is

2417
01:33:44,149 --> 01:33:42,719
that we would fill it once

2418
01:33:45,189 --> 01:33:44,159
let it dry

2419
01:33:48,870 --> 01:33:45,199
and then

2420
01:33:50,629 --> 01:33:48,880
throw the residual contaminants away

2421
01:33:52,470 --> 01:33:50,639
currently we're working with

2422
01:33:54,950 --> 01:33:52,480
the brine that's generated from the

2423
01:33:57,350 --> 01:33:54,960
urine processor assembly which is about

2424
01:34:00,070 --> 01:33:57,360
25

2425
01:34:02,629 --> 01:34:00,080
of the water that was

2426
01:34:05,430 --> 01:34:02,639
in total collected from the urine

2427
01:34:07,430 --> 01:34:05,440
and flush water so it's kind of thick to

2428
01:34:09,750 --> 01:34:07,440
begin with however if we were going to

2429
01:34:12,229 --> 01:34:09,760
use a less

2430
01:34:14,950 --> 01:34:12,239
a more dilute solution we'd want to go

2431
01:34:17,510 --> 01:34:14,960
ahead and reuse these

2432
01:34:19,510 --> 01:34:17,520
and so one of the kind of cool things is

2433
01:34:22,709 --> 01:34:19,520
that once these get dirtied up they

2434
01:34:25,270 --> 01:34:22,719
actually wet a lot better um so we will

2435
01:34:27,830 --> 01:34:25,280
probably be able to contain the fluids

2436
01:34:30,470 --> 01:34:27,840
better and hopefully we can uh maybe

2437
01:34:34,550 --> 01:34:30,480
whisper to peggy woods and to try the up

2438
01:34:37,030 --> 01:34:35,910

were there any other questions here in

2439
01:34:38,629 --> 01:34:37,040
the room did i see another hand

2440
01:34:39,669 --> 01:34:38,639
somewhere

2441
01:34:41,830 --> 01:34:39,679
all right

2442
01:34:43,910 --> 01:34:41,840
thank you very much

2443
01:34:45,750 --> 01:34:43,920
uh so thank you all for for joining us

2444
01:34:49,189 --> 01:34:45,760
today we'll be broadcasting the

2445
01:34:51,030 --> 01:34:49,199
pre-launch news conference today at 4 pm

2446
01:34:53,830 --> 01:34:51,040
to hear more about the mission launch

2447
01:34:55,109 --> 01:34:53,840
operations and then be sure to tune in

2448
01:34:57,030 --> 01:34:55,119
tomorrow

2449
01:35:00,870 --> 01:34:57,040
for live launch coverage starting at 5

2450
01:35:03,030 --> 01:35:00,880
15 p.m you can visit nasa.gov spacex for

2451
01:35:04,229 --> 01:35:03,040
more information and to follow along

2452
01:35:07,350 --> 01:35:04,239
with our researchers and their