1
00:01:29,270 --> 00:01:16,190
[Music]

2
00:01:31,910 --> 00:01:30,149
hey everyone

3
00:01:33,990 --> 00:01:31,920
i'm antonia jaramillo with nasa

4
00:01:36,230 --> 00:01:34,000
communications and we are here at the

5
00:01:38,310 --> 00:01:36,240
kennedy space center in florida

6
00:01:40,710 --> 00:01:38,320
thank you so much for joining us today

7
00:01:42,149 --> 00:01:40,720
and welcome to our what's on board show

8
00:01:43,990 --> 00:01:42,159
where we will get to speak to some of

9
00:01:45,030 --> 00:01:44,000
the principal investigators of the

10
00:01:46,630 --> 00:01:45,040
science experiments

11
00:01:48,230 --> 00:01:46,640
that are being flown up to the

12
00:01:51,429 --> 00:01:48,240
international space station

13
00:01:52,630 --> 00:01:51,439

for nasa's and space texas crs 22

14
00:01:55,190 --> 00:01:52,640
mission

15
00:01:56,630 --> 00:01:55,200
this will be the 22nd cargo resupply

16
00:01:58,230 --> 00:01:56,640
services mission that will send

17
00:02:00,709 --> 00:01:58,240
technology demonstrations

18
00:02:02,230 --> 00:02:00,719
and research to the space station here

19
00:02:09,070 --> 00:02:02,240
are some of the science experiments that

20
00:02:27,240 --> 00:02:09,080
are being sent up

21
00:03:58,949 --> 00:02:40,880
[Music]

22
00:04:00,470 --> 00:03:58,959
we have some more exciting science to

23
00:04:03,990 --> 00:04:00,480
tell you about onboard

24
00:04:06,149 --> 00:04:04,000
crs 22 the african republic of mauritius

25
00:04:06,710 --> 00:04:06,159
a small island nation in the indian

26
00:04:09,270 --> 00:04:06,720
ocean

27
00:04:12,390 --> 00:04:09,280
east of madagascar will now become a

28
00:04:14,309 --> 00:04:12,400
space-faring nation

29
00:04:16,550 --> 00:04:14,319
a team of scientists developed the

30
00:04:19,270 --> 00:04:16,560
cubesat after winning an award from the

31
00:04:20,550 --> 00:04:19,280
japanese aerospace exploration agency in

32
00:04:22,469 --> 00:04:20,560
2018.

33
00:04:24,710 --> 00:04:22,479
the satellite will deploy from jax's

34
00:04:27,030 --> 00:04:24,720
kibo cube called mirsat 1

35
00:04:28,790 --> 00:04:27,040
it has a 3d camera on board which will

36
00:04:30,550 --> 00:04:28,800
take pictures of the region

37
00:04:31,909 --> 00:04:30,560
the team developed the mission to help

38
00:04:33,990 --> 00:04:31,919

inspire young people

39
00:04:39,270 --> 00:04:34,000
to pursue future space and satellite

40
00:04:43,189 --> 00:04:41,189
all our participants including myself

41
00:04:45,510 --> 00:04:43,199
have been fully vaccinated

42
00:04:46,390 --> 00:04:45,520
now with us today we have dr jamie

43
00:04:48,469 --> 00:04:46,400
foster

44
00:04:50,390 --> 00:04:48,479
principal investigator for the umami

45
00:04:53,350 --> 00:04:50,400
experiment

46
00:04:56,790 --> 00:04:53,360
dr thomas boothby principal investigator

47
00:04:58,950 --> 00:04:56,800
for the cell science 04 mission

48
00:05:00,550 --> 00:04:58,960
and we also have joe blair and jonathan

49
00:05:02,870 --> 00:05:00,560
bonamart students from

50
00:05:04,710 --> 00:05:02,880
oak ridge city schools in tennessee who

51
00:05:05,350 --> 00:05:04,720
will be discussing the ramsat which is a

52
00:05:08,310 --> 00:05:05,360
cubesat

53
00:05:08,950 --> 00:05:08,320
on board the rocket jamie thomas joe and

54
00:05:10,469 --> 00:05:08,960
jonathan

55
00:05:12,310 --> 00:05:10,479
thank you so much for joining us here

56
00:05:13,830 --> 00:05:12,320
today now we've

57
00:05:15,510 --> 00:05:13,840
before we begin for those of you

58
00:05:16,070 --> 00:05:15,520
watching you can make sure to ask

59
00:05:18,550 --> 00:05:16,080
questions

60
00:05:19,909 --> 00:05:18,560
using the hashtag asknasa on social

61
00:05:22,870 --> 00:05:19,919
media

62
00:05:25,510 --> 00:05:22,880
now jamie can you tell us what exactly

63
00:05:27,830 --> 00:05:25,520

umami is i mean i'm seeing a squid there

64
00:05:28,870 --> 00:05:27,840
what is this experiment well this

65
00:05:30,790 --> 00:05:28,880
project's all about

66
00:05:32,310 --> 00:05:30,800
trying to understand how the effects of

67
00:05:35,430 --> 00:05:32,320
microgravity

68
00:05:37,670 --> 00:05:35,440
is impacting how beneficial microbes and

69
00:05:38,950 --> 00:05:37,680
animals talk to each other and we chose

70
00:05:41,749 --> 00:05:38,960
the squid

71
00:05:42,390 --> 00:05:41,759
we're sending these tiny squid into

72
00:05:44,629 --> 00:05:42,400
space

73
00:05:47,189 --> 00:05:44,639
to understand how the bacteria are

74
00:05:49,590 --> 00:05:47,199
actually colonizing and initiating

75
00:05:51,670 --> 00:05:49,600
a conversation at the molecular level

76
00:05:55,270 --> 00:05:51,680
with these animals

77
00:05:56,790 --> 00:05:55,280
wow um now thomas

78
00:05:59,110 --> 00:05:56,800
can you tell us a little bit more about

79
00:06:00,950 --> 00:05:59,120
the cell science 04 mission i mean i'm

80
00:06:02,070 --> 00:06:00,960
understanding there is something to do

81
00:06:06,070 --> 00:06:02,080
with water bears

82
00:06:09,189 --> 00:06:06,080
what's going on here absolutely so

83
00:06:11,670 --> 00:06:09,199
our our project is looking at how these

84
00:06:14,550 --> 00:06:11,680
tiny little microscopic animals

85
00:06:16,790 --> 00:06:14,560
called water bears or tardigrades are

86
00:06:19,350 --> 00:06:16,800
able to cope with the stresses of

87
00:06:20,870 --> 00:06:19,360
long-term space flight and we're using

88
00:06:22,790 --> 00:06:20,880

these animals because

89
00:06:24,150 --> 00:06:22,800
they're some of the toughest animals

90
00:06:27,350 --> 00:06:24,160
that we know of

91
00:06:28,790 --> 00:06:27,360
they can survive being dried out frozen

92
00:06:31,029 --> 00:06:28,800
heated up past the boiling point of

93
00:06:33,189 --> 00:06:31,039
water they can survive

94
00:06:34,150 --> 00:06:33,199
thousands of times as much radiation as

95
00:06:37,430 --> 00:06:34,160
you or i can

96
00:06:39,510 --> 00:06:37,440
and they can survive space flight and

97
00:06:41,029 --> 00:06:39,520
even exposure to the vacuum of outer

98
00:06:43,350 --> 00:06:41,039
space

99
00:06:44,070 --> 00:06:43,360
they sound like the ultimate survivors

100
00:06:46,550 --> 00:06:44,080
now for

101
00:06:48,070 --> 00:06:46,560
joe and jonathan can you tell us what

102
00:06:51,589 --> 00:06:48,080
the ramsat

103
00:06:54,629 --> 00:06:51,599
is so

104
00:06:57,510 --> 00:06:54,639
the ramsat is a cubesat

105
00:06:58,870 --> 00:06:57,520
sent up by robertsville middle school in

106
00:07:00,870 --> 00:06:58,880
oak ridge tennessee

107
00:07:02,230 --> 00:07:00,880
this will be one of the first satellites

108
00:07:05,270 --> 00:07:02,240
ever to be sent up

109
00:07:07,110 --> 00:07:05,280
by a public middle school so the mission

110
00:07:10,150 --> 00:07:07,120
of our satellite is that

111
00:07:13,589 --> 00:07:10,160
we're looking at the regrowth of

112
00:07:17,029 --> 00:07:13,599
wildfires in gatlinburg and california

113
00:07:18,950 --> 00:07:17,039

so the ones in gatlinburg were about

114
00:07:20,070 --> 00:07:18,960
four or five years ago so those are

115
00:07:22,629 --> 00:07:20,080
almost done but

116
00:07:24,230 --> 00:07:22,639
um we hope to still get a cool picture

117
00:07:27,270 --> 00:07:24,240
of the regrowth there

118
00:07:27,990 --> 00:07:27,280
and so the way it works is infrared

119
00:07:30,629 --> 00:07:28,000
light

120
00:07:31,350 --> 00:07:30,639
on the camera the plants pick it up as a

121
00:07:33,589 --> 00:07:31,360
white light

122
00:07:34,870 --> 00:07:33,599
and anything that's not living is like

123
00:07:37,749 --> 00:07:34,880
dark and black

124
00:07:39,270 --> 00:07:37,759
and so uh basically when we take the

125
00:07:41,110 --> 00:07:39,280
picture you'll be able to see white in

126
00:07:41,990 --> 00:07:41,120
like a black and white image but all the

127
00:07:44,790 --> 00:07:42,000
white will be

128
00:07:45,830 --> 00:07:44,800
life so basically there's a forest fire

129
00:07:48,869 --> 00:07:45,840
you'll see

130
00:07:51,270 --> 00:07:48,879
a nice blob of darkness

131
00:07:52,790 --> 00:07:51,280
and then the point is you keep going

132
00:07:54,469 --> 00:07:52,800
around the earth until you can take

133
00:07:56,550 --> 00:07:54,479
enough pictures and you can

134
00:07:58,390 --> 00:07:56,560
put them together and it'll look like a

135
00:08:01,909 --> 00:07:58,400
you'll see the life going in

136
00:08:03,110 --> 00:08:01,919
and working itself out so we created

137
00:08:07,350 --> 00:08:03,120
this satellite

138
00:08:10,469 --> 00:08:07,360

uh with scientists from our national lab

139
00:08:13,990 --> 00:08:10,479
if you'll show our video

140
00:08:14,000 --> 00:08:19,589
created this using uh

141
00:08:25,670 --> 00:08:23,670
parts from nanoracks as well as pumpkin

142
00:08:29,909 --> 00:08:25,680
space

143
00:08:33,190 --> 00:08:29,919
and this is the assembly of our

144
00:08:35,670 --> 00:08:33,200
solar panels uh here uh

145
00:08:37,110 --> 00:08:35,680
one thing i really enjoyed here was that

146
00:08:40,389 --> 00:08:37,120
everybody got to learn

147
00:08:43,029 --> 00:08:40,399
how to solder and so in this clip

148
00:08:44,070 --> 00:08:43,039
you can see we're putting the solar

149
00:08:46,630 --> 00:08:44,080
panels on

150
00:08:48,310 --> 00:08:46,640
and this specifically is where we're

151
00:08:50,949 --> 00:08:48,320
soldering the wires together

152
00:08:51,990 --> 00:08:50,959
and then when you see the heat gun we're

153
00:08:53,670 --> 00:08:52,000
putting heat wrap

154
00:08:55,430 --> 00:08:53,680
around the wires so it doesn't short

155
00:08:59,350 --> 00:08:55,440
anything out

156
00:09:02,389 --> 00:08:59,360
so along with our mission of tracking

157
00:09:05,269 --> 00:09:02,399
the forest fire regrowth we also hope to

158
00:09:06,310 --> 00:09:05,279
build curriculum for other middle

159
00:09:08,710 --> 00:09:06,320
schools and

160
00:09:09,509 --> 00:09:08,720
schools around the globe to create

161
00:09:12,550 --> 00:09:09,519
satellites

162
00:09:15,190 --> 00:09:12,560
and become more invested in space like

163
00:09:16,230 --> 00:09:15,200

all of our students are i think one

164
00:09:18,550 --> 00:09:16,240
thing about a

165
00:09:20,150 --> 00:09:18,560
satellite that's really cool is that

166
00:09:21,670 --> 00:09:20,160
it's not going to just be about the

167
00:09:23,750 --> 00:09:21,680
mission it's going to be about

168
00:09:24,949 --> 00:09:23,760
people be able to go into the class and

169
00:09:26,710 --> 00:09:24,959
say oh cool i'm

170
00:09:28,310 --> 00:09:26,720
i'm communicating with the satellite

171
00:09:30,790 --> 00:09:28,320
that's up there in space that

172
00:09:33,269 --> 00:09:30,800
our class sent up and that's how they're

173
00:09:35,190 --> 00:09:33,279
going to learn is based off of all those

174
00:09:36,710 --> 00:09:35,200
different sciences there's camera

175
00:09:38,949 --> 00:09:36,720
sciences and

176
00:09:40,470 --> 00:09:38,959
electronics and all this stuff that goes

177
00:09:43,670 --> 00:09:40,480
into it so

178
00:09:45,990 --> 00:09:43,680
anybody who takes the classes can be

179
00:09:47,030 --> 00:09:46,000
like satisfied by the different types of

180
00:09:48,829 --> 00:09:47,040
sciences in there

181
00:09:50,630 --> 00:09:48,839
and everybody can learn something from

182
00:09:55,590 --> 00:09:50,640
it

183
00:09:58,070 --> 00:09:55,600
now we have already our first questions

184
00:10:01,430 --> 00:09:58,080
from social media

185
00:10:02,069 --> 00:10:01,440
one mom is asking she says her son who

186
00:10:03,750 --> 00:10:02,079
is nine

187
00:10:05,190 --> 00:10:03,760
would like to know how you transfer

188
00:10:07,430 --> 00:10:05,200

items to the space station

189
00:10:09,030 --> 00:10:07,440
safely he's concerned the air will leak

190
00:10:10,389 --> 00:10:09,040
out i think maybe that question's for

191
00:10:12,310 --> 00:10:10,399
you jamie

192
00:10:13,430 --> 00:10:12,320
well that's a great question actually

193
00:10:16,710 --> 00:10:13,440
and it's a very

194
00:10:17,269 --> 00:10:16,720
important and we do do a lot spend a lot

195
00:10:20,389 --> 00:10:17,279
of time

196
00:10:21,430 --> 00:10:20,399
making sure our experiments are triple

197
00:10:23,190 --> 00:10:21,440
checked and

198
00:10:24,550 --> 00:10:23,200
and one of the ways that we do that is

199
00:10:27,590 --> 00:10:24,560
we do leak tests

200
00:10:29,030 --> 00:10:27,600
so just like that student asked we have

201
00:10:31,750 --> 00:10:29,040
for example

202
00:10:32,069 --> 00:10:31,760
the in in my case of the umami mission

203
00:10:36,150 --> 00:10:32,079
we

204
00:10:36,870 --> 00:10:36,160
have the tiny para larvae or juvenile

205
00:10:38,790 --> 00:10:36,880
squid

206
00:10:41,110 --> 00:10:38,800
that are going to go in these little

207
00:10:42,550 --> 00:10:41,120
bags that have these valves that will

208
00:10:44,710 --> 00:10:42,560
allow

209
00:10:46,470 --> 00:10:44,720
seawater to kind of move into these

210
00:10:47,269 --> 00:10:46,480
environments and we don't want them to

211
00:10:49,190 --> 00:10:47,279
leak so

212
00:10:50,550 --> 00:10:49,200
what we do is we do a whole series of

213
00:10:52,550 --> 00:10:50,560

checks where

214
00:10:54,310 --> 00:10:52,560
we do pressure tests and we check to

215
00:10:57,190 --> 00:10:54,320
make sure that there's no leaks

216
00:10:58,870 --> 00:10:57,200
so that the squid have plenty of water

217
00:11:01,110 --> 00:10:58,880
for the whole duration

218
00:11:02,470 --> 00:11:01,120
and so that's a really important

219
00:11:04,150 --> 00:11:02,480
question and we do

220
00:11:06,310 --> 00:11:04,160
practice these kinds of experiments all

221
00:11:09,990 --> 00:11:06,320
the time to make sure that

222
00:11:10,550 --> 00:11:10,000
um all of these uh components of the

223
00:11:14,550 --> 00:11:10,560
space

224
00:11:16,310 --> 00:11:14,560
hardware are intact and ready to go

225
00:11:17,750 --> 00:11:16,320
very important you know i understand

226
00:11:19,990 --> 00:11:17,760
you've been working

227
00:11:21,509 --> 00:11:20,000
all last night and still have tonight to

228
00:11:23,670 --> 00:11:21,519
work to make sure that

229
00:11:24,630 --> 00:11:23,680
everything's good to go is that correct

230
00:11:26,630 --> 00:11:24,640
absolutely so

231
00:11:28,310 --> 00:11:26,640
for example the tiny squid that we're

232
00:11:31,430 --> 00:11:28,320
going to be using was were

233
00:11:33,030 --> 00:11:31,440
hatched at 1 30 this morning so we've

234
00:11:35,030 --> 00:11:33,040
been processing and getting them

235
00:11:37,590 --> 00:11:35,040
together and putting them in their bags

236
00:11:40,069 --> 00:11:37,600
and into the hardware uh and that's

237
00:11:41,430 --> 00:11:40,079
taken a few hours so we're still in the

238
00:11:43,670 --> 00:11:41,440

leak test

239
00:11:45,670 --> 00:11:43,680
phase but we are about to turn it over

240
00:11:48,389 --> 00:11:45,680
to spacex

241
00:11:49,430 --> 00:11:48,399
so soon now we have a question for you

242
00:11:51,030 --> 00:11:49,440
joe and jonathan

243
00:11:52,790 --> 00:11:51,040
how do you feel knowing that your

244
00:11:55,990 --> 00:11:52,800
cubesat is going to space

245
00:11:58,230 --> 00:11:56,000
tomorrow honestly

246
00:11:59,750 --> 00:11:58,240
i really think it's really cool that

247
00:12:00,470 --> 00:11:59,760
something we've been working on for the

248
00:12:03,590 --> 00:12:00,480
past six

249
00:12:05,269 --> 00:12:03,600
seven years is finally going up i know

250
00:12:07,110 --> 00:12:05,279
about a year ago we were going to send

251
00:12:09,430 --> 00:12:07,120
it up and there was a short in the

252
00:12:10,629 --> 00:12:09,440
microprocessor so it got delayed a whole

253
00:12:13,350 --> 00:12:10,639
bunch of time now

254
00:12:14,389 --> 00:12:13,360
but it's about time now we can finally

255
00:12:16,629 --> 00:12:14,399
get to watch it

256
00:12:17,829 --> 00:12:16,639
and uh one thing is we haven't seen a

257
00:12:20,790 --> 00:12:17,839
launch before

258
00:12:22,150 --> 00:12:20,800
so it should be really fun yeah i feel

259
00:12:25,350 --> 00:12:22,160
ecstatic knowing

260
00:12:28,230 --> 00:12:25,360
that kids from robertsville

261
00:12:29,350 --> 00:12:28,240
who have gone on to be even sophomores

262
00:12:31,590 --> 00:12:29,360
in college

263
00:12:33,750 --> 00:12:31,600

now can see their hard work paying off

264
00:12:38,389 --> 00:12:33,760
starting from just an idea to

265
00:12:41,430 --> 00:12:38,399
actually a satellite going up into space

266
00:12:44,069 --> 00:12:41,440
absolutely you see here here's another

267
00:12:49,750 --> 00:12:44,079
video of students

268
00:12:53,190 --> 00:12:52,069
that's great a long time in the making

269
00:12:55,269 --> 00:12:53,200
for sure

270
00:12:56,470 --> 00:12:55,279
thomas we have a question for you how

271
00:12:59,750 --> 00:12:56,480
did water bears

272
00:13:00,310 --> 00:12:59,760
get their name oh that's a great

273
00:13:02,949 --> 00:13:00,320
question

274
00:13:05,190 --> 00:13:02,959
and i think we actually have a video of

275
00:13:07,430 --> 00:13:05,200
a water bear

276
00:13:08,470 --> 00:13:07,440
if we can play that but yeah the first

277
00:13:11,190 --> 00:13:08,480
time that they were

278
00:13:12,069 --> 00:13:11,200
discovered um the the scientists that

279
00:13:14,069 --> 00:13:12,079
saw them

280
00:13:15,750 --> 00:13:14,079
thought like that they they sort of

281
00:13:18,949 --> 00:13:15,760
walked and stepped

282
00:13:20,949 --> 00:13:18,959
like uh like the gate of a bear um and

283
00:13:23,350 --> 00:13:20,959
since they're aquatic organisms

284
00:13:24,230 --> 00:13:23,360
water bear was the the name that that he

285
00:13:26,949 --> 00:13:24,240
settled on

286
00:13:28,389 --> 00:13:26,959
um and their scientific name tardigrade

287
00:13:31,030 --> 00:13:28,399
uh actually means slow

288
00:13:34,069 --> 00:13:31,040

stepper so here's just kind of a an

289
00:13:35,269 --> 00:13:34,079
enlarged image of a tardigrade

290
00:13:37,190 --> 00:13:35,279
that you can see there but that's how

291
00:13:41,110 --> 00:13:37,200
they got their name

292
00:13:45,030 --> 00:13:42,710
jamie we have a question from our nasa

293
00:13:47,430 --> 00:13:45,040
social group have these symbiotic squids

294
00:13:49,670 --> 00:13:47,440
been to space before if so

295
00:13:51,990 --> 00:13:49,680
what did you learn yes they have been a

296
00:13:53,910 --> 00:13:52,000
space they went to space on the space

297
00:13:57,189 --> 00:13:53,920
shuttle atlantis and

298
00:13:59,990 --> 00:13:57,199
uh in 2011. and what we learned

299
00:14:01,670 --> 00:14:00,000
from that uh experiment was that the

300
00:14:02,069 --> 00:14:01,680
squid is probably going to be a really

301
00:14:05,910 --> 00:14:02,079
good

302
00:14:08,470 --> 00:14:05,920
model for looking at how early

303
00:14:09,350 --> 00:14:08,480
dialogues between microbes and animals

304
00:14:10,949 --> 00:14:09,360
start

305
00:14:12,629 --> 00:14:10,959
so when the squid and we have a couple

306
00:14:14,710 --> 00:14:12,639
photos um there's

307
00:14:16,150 --> 00:14:14,720
there's a video right now of the squid

308
00:14:17,829 --> 00:14:16,160
hatching

309
00:14:19,350 --> 00:14:17,839
and so when they're born they're born

310
00:14:21,750 --> 00:14:19,360
without bacteria

311
00:14:22,949 --> 00:14:21,760
and so when the they flew before we

312
00:14:25,910 --> 00:14:22,959
learned that they can

313
00:14:26,870 --> 00:14:25,920

colonize that even in microgravity you

314
00:14:28,550 --> 00:14:26,880
can have your

315
00:14:30,150 --> 00:14:28,560
proper symbionts your beneficial

316
00:14:30,790 --> 00:14:30,160
microbes find where they're supposed to

317
00:14:34,230 --> 00:14:30,800
go

318
00:14:36,470 --> 00:14:34,240
so they they were able to colonize the

319
00:14:37,509 --> 00:14:36,480
the squid has a special organ called the

320
00:14:39,509 --> 00:14:37,519
light organ

321
00:14:40,550 --> 00:14:39,519
and the bacteria colonize this light

322
00:14:42,870 --> 00:14:40,560
organ and they're

323
00:14:44,230 --> 00:14:42,880
luminescent they're bioluminescent so

324
00:14:47,269 --> 00:14:44,240
the squid has the ability to

325
00:14:49,430 --> 00:14:47,279
has the ability to glow in the dark so

326
00:14:50,310 --> 00:14:49,440
the squid uses that as an anti-predator

327
00:14:53,430 --> 00:14:50,320
behavior

328
00:14:57,110 --> 00:14:53,440
and what we learned from that first

329
00:14:59,350 --> 00:14:57,120
mission 10 years ago was that

330
00:15:00,629 --> 00:14:59,360
the squid is going to make a great model

331
00:15:03,829 --> 00:15:00,639
because the bacteria do

332
00:15:06,069 --> 00:15:03,839
find where they're going and they can

333
00:15:07,750 --> 00:15:06,079
uh initiate the colonization in the

334
00:15:09,350 --> 00:15:07,760
space environment and we can track that

335
00:15:12,150 --> 00:15:09,360
and we can follow that

336
00:15:14,949 --> 00:15:12,160
so that's why we're going again and

337
00:15:17,110 --> 00:15:14,959
looking at a little bit more

338
00:15:19,430 --> 00:15:17,120

deeper questions about the actual

339
00:15:20,069 --> 00:15:19,440
processes the fundamental processes of

340
00:15:21,670 --> 00:15:20,079
how

341
00:15:23,189 --> 00:15:21,680
the bacteria are starting our

342
00:15:25,670 --> 00:15:23,199
conversation with the animal tissue

343
00:15:27,910 --> 00:15:25,680
so we're building on those previous

344
00:15:30,310 --> 00:15:27,920
experiments from 10 years ago

345
00:15:32,389 --> 00:15:30,320
that's very interesting and also a long

346
00:15:34,710 --> 00:15:32,399
time in the making

347
00:15:36,310 --> 00:15:34,720
joe jonathan another question for you we

348
00:15:40,230 --> 00:15:36,320
want to know how many students

349
00:15:43,670 --> 00:15:40,240
worked on ramsat so a total of

350
00:15:47,189 --> 00:15:43,680
93 students have worked on ramsat

351
00:15:47,829 --> 00:15:47,199
and this includes uh former robertsville

352
00:15:51,030 --> 00:15:47,839
students

353
00:15:51,749 --> 00:15:51,040
two current eighth graders so all the

354
00:15:55,430 --> 00:15:51,759
way from

355
00:15:58,710 --> 00:15:55,440
sophomores in college two eighth graders

356
00:15:59,509 --> 00:15:58,720
have worked on this project set up the

357
00:16:02,710 --> 00:15:59,519
ideas

358
00:16:06,629 --> 00:16:02,720
given presentations and help

359
00:16:08,310 --> 00:16:06,639
make this dream become a reality

360
00:16:11,189 --> 00:16:08,320
yeah one thing i remember about working

361
00:16:13,189 --> 00:16:11,199
on it is in class at first it was just

362
00:16:14,790 --> 00:16:13,199
all the presentations like what does the

363
00:16:16,870 --> 00:16:14,800

magnetworker do what is

364
00:16:18,710 --> 00:16:16,880
the solar panels what what do all those

365
00:16:21,189 --> 00:16:18,720
things do in the satellite

366
00:16:22,870 --> 00:16:21,199
and so we all learned about it and so

367
00:16:24,790 --> 00:16:22,880
all these videos we had

368
00:16:27,430 --> 00:16:24,800
after school time that we all just went

369
00:16:29,590 --> 00:16:27,440
in and worked on the satellite

370
00:16:31,110 --> 00:16:29,600
all these were from after the first

371
00:16:33,990 --> 00:16:31,120
delay that we had

372
00:16:34,629 --> 00:16:34,000
and so i i just remember going in at all

373
00:16:36,550 --> 00:16:34,639
those

374
00:16:39,509 --> 00:16:36,560
after school times and helping to work

375
00:16:42,949 --> 00:16:39,519
on it i think that was really cool

376
00:16:44,069 --> 00:16:42,959
yep and this was all done thanks in part

377
00:16:47,749 --> 00:16:44,079
to our

378
00:16:52,310 --> 00:16:47,759
37 mentors who worked

379
00:16:56,629 --> 00:16:52,320
hard hours to help us

380
00:17:02,870 --> 00:17:00,230
help get this satellite up there

381
00:17:04,309 --> 00:17:02,880
absolutely and i believe you also have

382
00:17:06,789 --> 00:17:04,319
the names engraved of all the

383
00:17:09,829 --> 00:17:06,799
participants can you show us that

384
00:17:12,789 --> 00:17:09,839
yes here in our ballast we have actually

385
00:17:13,669 --> 00:17:12,799
the names of every student who's worked

386
00:17:16,870 --> 00:17:13,679
on it

387
00:17:17,350 --> 00:17:16,880
and on the side we have the names of all

388
00:17:20,549 --> 00:17:17,360

of the

389
00:17:21,429 --> 00:17:20,559
mentors as well as the name of our

390
00:17:25,189 --> 00:17:21,439
ramsat

391
00:17:28,390 --> 00:17:25,199
this is a this is one of our ballasts

392
00:17:31,190 --> 00:17:28,400
the actual ballast is on the ram set in

393
00:17:32,230 --> 00:17:31,200
about the middle so all the students who

394
00:17:35,110 --> 00:17:32,240
worked on it will

395
00:17:36,390 --> 00:17:35,120
get their names in space that's awesome

396
00:17:39,270 --> 00:17:36,400
you can officially say

397
00:17:41,110 --> 00:17:39,280
i have had my name fly in space uh

398
00:17:46,470 --> 00:17:41,120
thomas we have a question from twitter

399
00:17:49,270 --> 00:17:46,480
can water bears survive on mars

400
00:17:50,230 --> 00:17:49,280
that's a that's a great question um you

401
00:17:52,150 --> 00:17:50,240
know i think

402
00:17:54,070 --> 00:17:52,160
they've been shown to survive in the

403
00:17:57,029 --> 00:17:54,080
vacuum of outer space

404
00:17:59,190 --> 00:17:57,039
um in sort of a a metabolic or or a

405
00:18:02,230 --> 00:17:59,200
state of suspended animation

406
00:18:05,029 --> 00:18:02,240
so you know i think of if any uh

407
00:18:06,310 --> 00:18:05,039
organism or animal from earth could

408
00:18:09,669 --> 00:18:06,320
survive on mars

409
00:18:12,549 --> 00:18:09,679
tardigrades would be a great candidate

410
00:18:15,029 --> 00:18:12,559
well that's good to know jamie why do

411
00:18:17,270 --> 00:18:15,039
humans rely on microbes

412
00:18:18,310 --> 00:18:17,280
well microbes are essential for all

413
00:18:21,029 --> 00:18:18,320

parts of our

414
00:18:22,470 --> 00:18:21,039
normal development our behaviors our

415
00:18:25,990 --> 00:18:22,480
physiology

416
00:18:28,549 --> 00:18:26,000
we live in a microbial world and we have

417
00:18:29,669 --> 00:18:28,559
more microbial cells in our body than

418
00:18:33,590 --> 00:18:29,679
animal cells

419
00:18:35,990 --> 00:18:33,600
so we rely extensively on how

420
00:18:37,909 --> 00:18:36,000
that that microbe that we understand how

421
00:18:38,710 --> 00:18:37,919
these microbes are communicating with

422
00:18:42,070 --> 00:18:38,720
our bodies

423
00:18:44,230 --> 00:18:42,080
and so that it's a critical for us

424
00:18:45,270 --> 00:18:44,240
to ask these fundamental questions of

425
00:18:50,789 --> 00:18:45,280
how do you

426
00:18:53,110 --> 00:18:50,799
association with a beneficial microbe a

427
00:18:55,190 --> 00:18:53,120
lot of people focus on the pathogens

428
00:18:56,230 --> 00:18:55,200
but most of the microbes that associate

429
00:18:58,390 --> 00:18:56,240
with our bodies are

430
00:19:00,150 --> 00:18:58,400
good for us they're beneficial microbes

431
00:19:02,470 --> 00:19:00,160
and so we're trying to

432
00:19:03,750 --> 00:19:02,480
expand our knowledge about what all

433
00:19:06,150 --> 00:19:03,760
microbes are doing

434
00:19:07,510 --> 00:19:06,160
uh with our with the body and how the

435
00:19:09,990 --> 00:19:07,520
space environment

436
00:19:10,950 --> 00:19:10,000
might be impacting positively or

437
00:19:13,590 --> 00:19:10,960
negatively

438
00:19:15,909 --> 00:19:13,600

on those associations right i mean do

439
00:19:17,590 --> 00:19:15,919
you have any idea on

440
00:19:19,909 --> 00:19:17,600
whether or not the space environment

441
00:19:21,909 --> 00:19:19,919
does have a positive or negative impact

442
00:19:24,710 --> 00:19:21,919
well we have a lot there are a lot of

443
00:19:27,590 --> 00:19:24,720
studies to show that microbes do change

444
00:19:29,590 --> 00:19:27,600
their behavior their physiology in space

445
00:19:30,950 --> 00:19:29,600
and so a lot of the work well in the

446
00:19:34,310 --> 00:19:30,960
case of the squid

447
00:19:36,150 --> 00:19:34,320
symbiosis we have a lot of ground-based

448
00:19:37,590 --> 00:19:36,160
studies and now we want to validate a

449
00:19:40,710 --> 00:19:37,600
lot of our hypotheses

450
00:19:44,230 --> 00:19:40,720
by flying him in space and seeing if

451
00:19:45,590 --> 00:19:44,240
if our our ideas that we have on the

452
00:19:47,350 --> 00:19:45,600
ground or our

453
00:19:49,590 --> 00:19:47,360
results from the ground are going to

454
00:19:50,789 --> 00:19:49,600
actually be validated in the space

455
00:19:53,990 --> 00:19:50,799
environment

456
00:19:56,630 --> 00:19:54,000
well let's hope joe jonathan

457
00:19:59,270 --> 00:19:56,640
how will your cubesat generate energy as

458
00:20:01,750 --> 00:19:59,280
it orbits earth

459
00:20:03,590 --> 00:20:01,760
it's actually pretty cool so the solar

460
00:20:06,070 --> 00:20:03,600
panels on the outside

461
00:20:07,669 --> 00:20:06,080
whenever it's in the sunlight part of

462
00:20:09,909 --> 00:20:07,679
the earth because it's going

463
00:20:11,270 --> 00:20:09,919

well like 17 000 miles an hour it's

464
00:20:14,470 --> 00:20:11,280
really fast so

465
00:20:17,270 --> 00:20:14,480
a day goes by really fast for it but

466
00:20:18,710 --> 00:20:17,280
in those few minutes or hours of time

467
00:20:21,590 --> 00:20:18,720
whatever it takes for it

468
00:20:23,029 --> 00:20:21,600
to be in the sun part the solar panels

469
00:20:25,830 --> 00:20:23,039
charge the battery

470
00:20:26,710 --> 00:20:25,840
this is a real uh version of the battery

471
00:20:30,470 --> 00:20:26,720
here

472
00:20:33,430 --> 00:20:30,480
and um it'll it'll charge the batteries

473
00:20:34,070 --> 00:20:33,440
and power it if somebody happens to send

474
00:20:37,190 --> 00:20:34,080
the request

475
00:20:38,950 --> 00:20:37,200
to take a picture but

476
00:20:40,870 --> 00:20:38,960
if it's in the dark the battery's

477
00:20:41,830 --> 00:20:40,880
charging it or yeah the battery is

478
00:20:44,710 --> 00:20:41,840
powering it

479
00:20:45,590 --> 00:20:44,720
so it's this big cycle of when it gets

480
00:20:47,270 --> 00:20:45,600
in the

481
00:20:49,270 --> 00:20:47,280
when it gets into the sun the solar

482
00:20:52,310 --> 00:20:49,280
panels are charging it and then

483
00:20:55,029 --> 00:20:52,320
it just cycles we can actually

484
00:20:57,190 --> 00:20:55,039
monitor the amount of voltage that the

485
00:21:00,390 --> 00:20:57,200
solar panels are producing

486
00:21:01,510 --> 00:21:00,400
through the solar cells and the flight

487
00:21:04,549 --> 00:21:01,520
computer

488
00:21:06,310 --> 00:21:04,559

that's on our satellite cool

489
00:21:07,590 --> 00:21:06,320
will you get will you guys be one of the

490
00:21:13,270 --> 00:21:07,600
um

491
00:21:14,390 --> 00:21:13,280
observing or monitoring that voltage

492
00:21:16,789 --> 00:21:14,400
once

493
00:21:17,830 --> 00:21:16,799
ramsack goes up in space yeah uh one

494
00:21:19,430 --> 00:21:17,840
thing we were saying we were talking

495
00:21:21,350 --> 00:21:19,440
about the after school meetings uh i

496
00:21:22,710 --> 00:21:21,360
think we're still gonna do those and one

497
00:21:25,750 --> 00:21:22,720
cool thing we're gonna do is

498
00:21:28,549 --> 00:21:25,760
keep checking all those telemetry values

499
00:21:30,070 --> 00:21:28,559
like for one thing the ramsay sends out

500
00:21:31,830 --> 00:21:30,080
a beacon like all satellites

501
00:21:34,549 --> 00:21:31,840
if you know sputnik everybody knows that

502
00:21:36,630 --> 00:21:34,559
satellite has the recognizable like beep

503
00:21:38,549 --> 00:21:36,640
and that's the telemetry being set out

504
00:21:40,070 --> 00:21:38,559
like the battery voltage and where it's

505
00:21:43,350 --> 00:21:40,080
at

506
00:21:45,190 --> 00:21:43,360
facebook

507
00:21:48,070 --> 00:21:45,200
is this the first time water bears are

508
00:21:53,990 --> 00:21:50,950
uh it actually is not so water bears

509
00:21:57,350 --> 00:21:54,000
have been up in space before

510
00:21:57,990 --> 00:21:57,360
and we know that these really tough

511
00:22:01,029 --> 00:21:58,000
robust

512
00:22:03,830 --> 00:22:01,039
animals are able to survive

513
00:22:05,270 --> 00:22:03,840

not only space flight but also in the

514
00:22:07,590 --> 00:22:05,280
vacuum of outer space

515
00:22:08,470 --> 00:22:07,600
but what we don't know is how they're

516
00:22:11,669 --> 00:22:08,480
doing that

517
00:22:14,870 --> 00:22:11,679
so one of the things that our mission um

518
00:22:18,149 --> 00:22:14,880
is is looking at is how these really

519
00:22:21,029 --> 00:22:18,159
tough robust animals respond to being

520
00:22:24,390 --> 00:22:21,039
in this really stressful environment um

521
00:22:26,470 --> 00:22:24,400
for a prolonged period of time

522
00:22:27,590 --> 00:22:26,480
i understand your um your the main

523
00:22:29,830 --> 00:22:27,600
experience to figure out

524
00:22:31,029 --> 00:22:29,840
how they're being able to survive do you

525
00:22:35,430 --> 00:22:31,039
have any

526
00:22:39,190 --> 00:22:35,440
ideas any preconceived maybe

527
00:22:40,149 --> 00:22:39,200
yeah so right so one of the the sort of

528
00:22:42,870 --> 00:22:40,159
two main

529
00:22:43,909 --> 00:22:42,880
stressors um during spaceflight uh are

530
00:22:47,270 --> 00:22:43,919
microgravity

531
00:22:50,470 --> 00:22:47,280
and increased radiation so we'll be

532
00:22:51,190 --> 00:22:50,480
looking to see what genes what parts of

533
00:22:57,909 --> 00:22:51,200
the

534
00:23:00,630 --> 00:22:57,919
space flight

535
00:23:01,110 --> 00:23:00,640
and so for example we would suspect that

536
00:23:04,470 --> 00:23:01,120
things

537
00:23:07,750 --> 00:23:04,480
involved with you know dna repair

538
00:23:08,070 --> 00:23:07,760

or other other mechanisms for coping

539
00:23:10,470 --> 00:23:08,080
with

540
00:23:11,909 --> 00:23:10,480
say increased radiation would would be

541
00:23:14,070 --> 00:23:11,919
upregulated or

542
00:23:15,510 --> 00:23:14,080
or you know turned on more by these

543
00:23:17,190 --> 00:23:15,520
animals to cope with those sort of

544
00:23:19,590 --> 00:23:17,200
stresses

545
00:23:21,830 --> 00:23:19,600
well that'll be interesting to find out

546
00:23:23,190 --> 00:23:21,840
jamie i heard your handover or turnover

547
00:23:24,710 --> 00:23:23,200
it's happening tonight

548
00:23:26,390 --> 00:23:24,720
can you tell us a little bit more about

549
00:23:27,029 --> 00:23:26,400
the last minute preparations that are

550
00:23:28,789 --> 00:23:27,039
needed

551
00:23:30,950 --> 00:23:28,799
before you can send your experiment up

552
00:23:33,350 --> 00:23:30,960
to space absolutely so

553
00:23:34,710 --> 00:23:33,360
the animals are very young they just

554
00:23:37,590 --> 00:23:34,720
were hatched

555
00:23:39,590 --> 00:23:37,600
about seven or eight hours ago and so we

556
00:23:42,070 --> 00:23:39,600
are trying to prepare them

557
00:23:43,830 --> 00:23:42,080
by putting them inside their their

558
00:23:44,710 --> 00:23:43,840
little flight hardware here these little

559
00:23:46,630 --> 00:23:44,720
bags

560
00:23:49,590 --> 00:23:46,640
and we're getting ready and assembling

561
00:23:52,549 --> 00:23:49,600
the hardware as we speak and doing

562
00:23:53,350 --> 00:23:52,559
leak tests as we mentioned before and so

563
00:23:55,430 --> 00:23:53,360

all of that

564
00:23:56,950 --> 00:23:55,440
will be done in the next couple hours

565
00:23:59,029 --> 00:23:56,960
and then it'll be

566
00:24:00,230 --> 00:23:59,039
traveled over to the spacex rocket and

567
00:24:02,549 --> 00:24:00,240
put into

568
00:24:04,310 --> 00:24:02,559
the the heart the flight hardware will

569
00:24:06,070 --> 00:24:04,320
be put into the rocket and will be ready

570
00:24:08,390 --> 00:24:06,080
to go in a couple hours

571
00:24:10,630 --> 00:24:08,400
how does it feel to know that you are so

572
00:24:13,190 --> 00:24:10,640
close to kind of giving away

573
00:24:13,830 --> 00:24:13,200
you know this experiment that's sort of

574
00:24:17,110 --> 00:24:13,840
your

575
00:24:18,710 --> 00:24:17,120
pet project it has been a long i mean as

576
00:24:20,870 --> 00:24:18,720
we talked about on the shuttle flight

577
00:24:24,310 --> 00:24:20,880
it's been 10 years since the last and

578
00:24:26,149 --> 00:24:24,320
and it takes a long time to to kind of

579
00:24:28,470 --> 00:24:26,159
make sure everything's right to get your

580
00:24:30,950 --> 00:24:28,480
scientific ideas validated and checked

581
00:24:31,990 --> 00:24:30,960
and and so it's a long process so it's

582
00:24:35,190 --> 00:24:32,000
very rewarding

583
00:24:35,990 --> 00:24:35,200
and very exciting to know that we're

584
00:24:39,110 --> 00:24:36,000
just uh

585
00:24:40,630 --> 00:24:39,120
hours away now from actually seeing some

586
00:24:44,710 --> 00:24:40,640
great science happen

587
00:24:46,630 --> 00:24:44,720
um up on the uh spacex and on station

588
00:24:48,310 --> 00:24:46,640

that is that's very exciting i can only

589
00:24:50,149 --> 00:24:48,320
imagine you are very much looking

590
00:24:53,269 --> 00:24:50,159
forward to launch tomorrow

591
00:24:57,830 --> 00:24:53,279
uh joe jonathan now we want to know how

592
00:25:01,190 --> 00:24:57,840
big is the cubesat or ram set exactly

593
00:25:04,390 --> 00:25:01,200
so our ram set is

594
00:25:06,070 --> 00:25:04,400
100 millimeters by 100 millimeters by

595
00:25:09,110 --> 00:25:06,080
200 millimeters

596
00:25:11,830 --> 00:25:09,120
or to put it in imperial terms four

597
00:25:13,269 --> 00:25:11,840
inches by four inches by eight inches

598
00:25:14,789 --> 00:25:13,279
one thing we were talking about if you

599
00:25:16,789 --> 00:25:14,799
want in comparison to that it's

600
00:25:19,590 --> 00:25:16,799
basically the size of a little milk jug

601
00:25:22,710 --> 00:25:19,600
one of those half gallon ones

602
00:25:24,870 --> 00:25:22,720
it's a very small satellite but it

603
00:25:28,310 --> 00:25:24,880
performs all of its functions

604
00:25:30,310 --> 00:25:28,320
to the best of its ability and

605
00:25:32,390 --> 00:25:30,320
we're excited to see it go up this is a

606
00:25:35,430 --> 00:25:32,400
one one to one scale model

607
00:25:38,310 --> 00:25:35,440
if you're wondering that's awesome

608
00:25:40,310 --> 00:25:38,320
uh jamie ashley from twitter is asking

609
00:25:43,029 --> 00:25:40,320
her three-year-old cousin wants to know

610
00:25:45,510 --> 00:25:43,039
why baby squid glow in the dark

611
00:25:47,269 --> 00:25:45,520
so the bacteria so they have a special

612
00:25:49,510 --> 00:25:47,279
relationship with a bacterium

613
00:25:50,710 --> 00:25:49,520

called vibrio fischeri and the vibrio

614
00:25:52,470 --> 00:25:50,720
fischeri

615
00:25:53,830 --> 00:25:52,480
is the powerhouse behind the

616
00:25:56,390 --> 00:25:53,840
glow-in-the-dark squid

617
00:25:56,870 --> 00:25:56,400
it's a bioluminescent bacteria that is

618
00:25:59,190 --> 00:25:56,880
found

619
00:26:00,230 --> 00:25:59,200
normally in the environment but it only

620
00:26:02,230 --> 00:26:00,240
starts to glow

621
00:26:03,830 --> 00:26:02,240
inside the squid when there's enough of

622
00:26:06,549 --> 00:26:03,840
them growing inside

623
00:26:07,350 --> 00:26:06,559
the light organ here of this of this

624
00:26:10,310 --> 00:26:07,360
squid

625
00:26:10,950 --> 00:26:10,320
and so once the light is generated the

626
00:26:14,230 --> 00:26:10,960
squid

627
00:26:15,190 --> 00:26:14,240
actually uses it as a way to hide from

628
00:26:17,669 --> 00:26:15,200
predators

629
00:26:20,070 --> 00:26:17,679
it can act like a cloaking device so

630
00:26:20,710 --> 00:26:20,080
that the squid casts no shadow in the

631
00:26:23,430 --> 00:26:20,720
water

632
00:26:23,750 --> 00:26:23,440
and any predator looking up can't see

633
00:26:29,750 --> 00:26:23,760
the

634
00:26:32,630 --> 00:26:29,760
animal

635
00:26:33,830 --> 00:26:32,640
to hide itself and uh protect itself

636
00:26:36,230 --> 00:26:33,840
from predators

637
00:26:37,029 --> 00:26:36,240
wow i can only imagine if humans had

638
00:26:39,269 --> 00:26:37,039

that same

639
00:26:40,070 --> 00:26:39,279
it's glowing in the dark harry potter

640
00:26:43,350 --> 00:26:40,080
cloaking device

641
00:26:45,029 --> 00:26:43,360
right here exactly uh thomas

642
00:26:47,190 --> 00:26:45,039
can you tell us a little bit more about

643
00:26:51,190 --> 00:26:47,200
why space flight is considered such a

644
00:26:55,590 --> 00:26:54,549
yeah absolutely so uh so organisms like

645
00:26:58,230 --> 00:26:55,600
like ourselves

646
00:27:00,710 --> 00:26:58,240
that evolved here on earth are used to

647
00:27:03,029 --> 00:27:00,720
the the conditions here on earth so we

648
00:27:04,390 --> 00:27:03,039
are used to the the gravity that we

649
00:27:06,630 --> 00:27:04,400
experience here on earth

650
00:27:08,070 --> 00:27:06,640
and the relatively low levels of

651
00:27:11,190 --> 00:27:08,080
background radiation

652
00:27:13,750 --> 00:27:11,200
but when you go up into space um you

653
00:27:14,710 --> 00:27:13,760
you're in a microgravity environment and

654
00:27:17,590 --> 00:27:14,720
there's much more

655
00:27:19,029 --> 00:27:17,600
radiation so so organisms that aren't

656
00:27:21,110 --> 00:27:19,039
used to that

657
00:27:22,789 --> 00:27:21,120
that can be an extremely stressful uh

658
00:27:24,870 --> 00:27:22,799
sort of environment and so

659
00:27:26,789 --> 00:27:24,880
by understanding how these really tough

660
00:27:28,149 --> 00:27:26,799
little tardigrades are able to survive

661
00:27:30,870 --> 00:27:28,159
in those conditions

662
00:27:33,029 --> 00:27:30,880
we're hoping to be able to develop

663
00:27:35,350 --> 00:27:33,039

strategies or counter measures

664
00:27:36,789 --> 00:27:35,360
to safeguard astronauts from those

665
00:27:38,549 --> 00:27:36,799
stresses

666
00:27:39,990 --> 00:27:38,559
well that's good news i know i'd like to

667
00:27:42,470 --> 00:27:40,000
go to space one day

668
00:27:43,430 --> 00:27:42,480
um joe jonathan we have one more

669
00:27:46,870 --> 00:27:43,440
question for you

670
00:27:50,389 --> 00:27:46,880
will ramsay stay in space forever

671
00:27:53,190 --> 00:27:50,399
uh no unfortunately um about 12 months

672
00:27:53,669 --> 00:27:53,200
12 to 14 months is about how long it'll

673
00:27:55,750 --> 00:27:53,679
last

674
00:27:56,789 --> 00:27:55,760
in space until it just disintegrates in

675
00:27:58,389 --> 00:27:56,799
the atmosphere

676
00:28:00,230 --> 00:27:58,399
but we should be able to get a whole

677
00:28:02,470 --> 00:28:00,240
bunch of use out of that

678
00:28:04,230 --> 00:28:02,480
that's great now we have one final

679
00:28:05,029 --> 00:28:04,240
question from social media for all of

680
00:28:09,510 --> 00:28:05,039
you

681
00:28:11,029 --> 00:28:09,520
from tomorrow

682
00:28:12,710 --> 00:28:11,039
jamie if you want to go first i'm going

683
00:28:14,870 --> 00:28:12,720
to be at the the vab

684
00:28:16,149 --> 00:28:14,880
the vertical assembly building uh just

685
00:28:18,149 --> 00:28:16,159
right across the road here

686
00:28:19,990 --> 00:28:18,159
so i'm very excited about that that's

687
00:28:23,350 --> 00:28:20,000
very are you going to be on the roof

688
00:28:26,710 --> 00:28:23,360

i don't i do no not that i know of

689
00:28:28,549 --> 00:28:26,720
but i will talk afterwards

690
00:28:29,750 --> 00:28:28,559
uh joe jonathan if you want to guys if

691
00:28:32,470 --> 00:28:29,760
you guys want to go next

692
00:28:33,269 --> 00:28:32,480
our group that we were building the

693
00:28:34,710 --> 00:28:33,279
satellite

694
00:28:38,070 --> 00:28:34,720
our whole group is going to be at the

695
00:28:41,110 --> 00:28:38,080
jetty park to watch it

696
00:28:43,269 --> 00:28:41,120
i'm going to be with jonathan so that's

697
00:28:46,070 --> 00:28:43,279
a great that's a great viewing location

698
00:28:47,990 --> 00:28:46,080
and how about you thomas

699
00:28:49,750 --> 00:28:48,000
uh well i was hoping to uh to get to

700
00:28:51,029 --> 00:28:49,760
florida but i think i'll be watching it

701
00:28:53,510 --> 00:28:51,039
online

702
00:28:54,950 --> 00:28:53,520
but enjoying it nonetheless well you can

703
00:28:57,029 --> 00:28:54,960
make sure to watch our live coverage

704
00:28:59,269 --> 00:28:57,039
tomorrow

705
00:29:00,870 --> 00:28:59,279
thank you all so much again for sharing

706
00:29:03,510 --> 00:29:00,880
the science that will you will be

707
00:29:05,430 --> 00:29:03,520
conducting for this mission and thank

708
00:29:08,310 --> 00:29:05,440
you to everyone who

709
00:29:09,830 --> 00:29:08,320
was watching us today for those who want

710
00:29:11,750 --> 00:29:09,840
to learn more about the science that's

711
00:29:15,590 --> 00:29:11,760
being sent up to the space station

712
00:29:18,070 --> 00:29:15,600
you can go to nasa.gov forward slash iss

713
00:29:18,710 --> 00:29:18,080

dash science or follow along on social

714
00:29:21,990 --> 00:29:18,720
media

715
00:29:23,269 --> 00:29:22,000
at iss underscore research you can also

716
00:29:25,909 --> 00:29:23,279
join us later today

717
00:29:27,190 --> 00:29:25,919
at 1 30 pm for our pre-launch news

718
00:29:30,070 --> 00:29:27,200
conference

719
00:29:30,470 --> 00:29:30,080
launch is tomorrow at 1 29 pm eastern

720
00:29:32,389 --> 00:29:30,480
time

721
00:29:34,230 --> 00:29:32,399
here at kennedy space center's launch

722
00:29:36,750 --> 00:29:34,240
complex 39a

723
00:29:39,430 --> 00:29:36,760
live coverage will begin at 1pm at