



1
00:00:03,750 --> 00:00:01,990
station this is houston are you ready

2
00:00:08,070 --> 00:00:03,760
for the event

3
00:00:13,110 --> 00:00:11,509
wxo wtv this is mission control houston

4
00:00:16,310 --> 00:00:13,120
please call the station for a voice

5
00:00:22,390 --> 00:00:19,269
the station this is wxw tv how do you

6
00:00:25,189 --> 00:00:23,509
we have you

7
00:00:29,189 --> 00:00:25,199
loud and clear we're looking forward to

8
00:00:33,270 --> 00:00:31,509
all right

9
00:00:35,910 --> 00:00:33,280
we are joined this morning by a pair of

10
00:00:38,470 --> 00:00:35,920
very special guests astronaut astronauts

11
00:00:40,549 --> 00:00:38,480
jeff williams from winter wisconsin and

12
00:00:42,389 --> 00:00:40,559
kate rubins aboard the international

13
00:00:43,590 --> 00:00:42,399

space station thank you so much for

14

00:00:45,510 --> 00:00:43,600

joining us

15

00:00:47,670 --> 00:00:45,520

now i have to ask you seem to have the

16

00:00:50,150 --> 00:00:47,680

coolest job in the galaxy does that

17

00:00:54,869 --> 00:00:50,160

still resonate or does it get to be just

18

00:00:58,549 --> 00:00:56,389

well i don't think you could ever say it

19

00:01:00,950 --> 00:00:58,559

gets to be just a job after a while

20

00:01:04,229 --> 00:01:00,960

there's a the uniqueness never fades up

21

00:01:06,870 --> 00:01:04,239

here uh being able to uh to work and and

22

00:01:08,310 --> 00:01:06,880

and play in weightlessness and being

23

00:01:11,030 --> 00:01:08,320

able to view the earth it just never

24

00:01:12,390 --> 00:01:11,040

gets old it's a it's an incredible

25

00:01:14,149 --> 00:01:12,400

opportunity that

26
00:01:15,429 --> 00:01:14,159
i think none of us ever really take for

27
00:01:19,109 --> 00:01:15,439
granted no matter how long we've been

28
00:01:24,070 --> 00:01:20,630
and now kate you've just arrived on the

29
00:01:25,510 --> 00:01:24,080
iss what is a daily life like so far

30
00:01:27,749 --> 00:01:25,520
like if you get into an argument with

31
00:01:30,149 --> 00:01:27,759
another crew member can you can you slam

32
00:01:31,749 --> 00:01:30,159
a door an airlock or something and

33
00:01:34,630 --> 00:01:31,759
cool off a little bit i guess just give

34
00:01:39,590 --> 00:01:34,640
us an idea what kind of size of a of a

35
00:01:43,510 --> 00:01:41,270
well the first thing that we noticed as

36
00:01:45,270 --> 00:01:43,520
we approached the space station uh even

37
00:01:49,429 --> 00:01:45,280
despite all the training that we've been

38
00:01:51,429 --> 00:01:49,439

through is just how amazingly huge it is

39

00:01:53,510 --> 00:01:51,439

it's it's phenomenally impressive when

40

00:01:54,469 --> 00:01:53,520

you get up close to it and so there's

41

00:01:56,469 --> 00:01:54,479

actually

42

00:01:59,830 --> 00:01:56,479

an enormous amount of interior volume

43

00:02:01,670 --> 00:01:59,840

we've got a number of modules and we're

44

00:02:03,749 --> 00:02:01,680

also incredibly fortunate that we have

45

00:02:05,749 --> 00:02:03,759

an amazing crew so there's no need to go

46

00:02:07,510 --> 00:02:05,759

shut yourself off in the airlock

47

00:02:09,109 --> 00:02:07,520

or anything like that but there's a lot

48

00:02:10,710 --> 00:02:09,119

of space up here

49

00:02:12,229 --> 00:02:10,720

part of that's due to just the fact that

50

00:02:14,390 --> 00:02:12,239

we've got so many different nations

51
00:02:16,869 --> 00:02:14,400
working in this laboratory there's a lot

52
00:02:20,830 --> 00:02:16,879
of modules from different nations and a

53
00:02:25,030 --> 00:02:23,589
here yeah that is fantastic to hear now

54
00:02:27,350 --> 00:02:25,040
we reached out to some people for their

55
00:02:29,910 --> 00:02:27,360
questions uh here's one from uh nissa

56
00:02:31,910 --> 00:02:29,920
taunt on facebook who asks uh what's one

57
00:02:33,509 --> 00:02:31,920
thing for both of you about living in

58
00:02:40,070 --> 00:02:33,519
space or on the iss that you really

59
00:02:44,630 --> 00:02:42,070
yeah so we watch uh people from the

60
00:02:47,430 --> 00:02:44,640
ground all the time and you get a sense

61
00:02:49,030 --> 00:02:47,440
of how folks move around up here but one

62
00:02:51,190 --> 00:02:49,040
of the most interesting things for me

63
00:02:54,390 --> 00:02:51,200

and the challenges has been early on is

64

00:02:56,229 --> 00:02:54,400

just how you control yourself in all six

65

00:02:58,309 --> 00:02:56,239

axes in weightlessness and you can watch

66

00:03:00,710 --> 00:02:58,319

it on tv all day long

67

00:03:02,390 --> 00:03:00,720

but when you're actually trying to

68

00:03:03,910 --> 00:03:02,400

make sure that you can stabilize and do

69

00:03:08,070 --> 00:03:03,920

some work it's a lot harder than i

70

00:03:13,030 --> 00:03:11,110

and jeff andrew steger on facebook asks

71

00:03:14,869 --> 00:03:13,040

what sort of emotions for you go through

72

00:03:16,550 --> 00:03:14,879

your mind when you pass over the state

73

00:03:20,149 --> 00:03:16,560

of wisconsin i'm sure you've seen it a

74

00:03:24,550 --> 00:03:22,229

oh yeah i've seen it many times and i'm

75

00:03:26,869 --> 00:03:24,560

sure your listeners and viewers have

76

00:03:29,270 --> 00:03:26,879

seen some of the photography i've taken

77

00:03:30,309 --> 00:03:29,280

of wisconsin along with everywhere else

78

00:03:32,229 --> 00:03:30,319

in the world

79

00:03:34,390 --> 00:03:32,239

but when i pass over it brings back my

80

00:03:36,550 --> 00:03:34,400

my childhood years my growing up there

81

00:03:38,229 --> 00:03:36,560

and all the great memories i had there

82

00:03:40,789 --> 00:03:38,239

growing up on a farm just outside the

83

00:03:42,550 --> 00:03:40,799

village of winter a farm that my

84

00:03:44,949 --> 00:03:42,560

grandfather carved out of the woods

85

00:03:47,270 --> 00:03:44,959

after he emigrated from sweden

86

00:03:48,949 --> 00:03:47,280

my mother was born there she she passed

87

00:03:51,030 --> 00:03:48,959

away there in the same house the

88

00:03:52,390 --> 00:03:51,040

homestead still in the family

89

00:03:55,030 --> 00:03:52,400

so friends and

90

00:03:56,550 --> 00:03:55,040

and extended family are still there so

91

00:04:00,070 --> 00:03:56,560

all of those memories come back every

92

00:04:02,070 --> 00:04:00,080

time we pass over

93

00:04:03,670 --> 00:04:02,080

yeah jeff your photography is quite

94

00:04:05,350 --> 00:04:03,680

stunning you post a lot of those photos

95

00:04:07,110 --> 00:04:05,360

on your twitter account now is that just

96

00:04:08,550 --> 00:04:07,120

something that's developed as a hobby or

97

00:04:10,229 --> 00:04:08,560

is there something more you hope to

98

00:04:13,190 --> 00:04:10,239

achieve or or inspire with these

99

00:04:17,110 --> 00:04:14,869

well i learned the first time i went to

100

00:04:19,189 --> 00:04:17,120

space in the year 2000 that when you

101
00:04:21,509 --> 00:04:19,199
come back it a lot of times the the

102
00:04:22,950 --> 00:04:21,519
details of the experience happen so fast

103
00:04:24,710 --> 00:04:22,960
that you can't remember them all you

104
00:04:26,870 --> 00:04:24,720
can't capture them all in your memory

105
00:04:30,150 --> 00:04:26,880
and the memories fade away quickly but

106
00:04:32,469 --> 00:04:30,160
the photography captures the moment and

107
00:04:35,510 --> 00:04:32,479
so i grew in appreciation right off the

108
00:04:37,590 --> 00:04:35,520
but uh in later years i grew in the

109
00:04:39,430 --> 00:04:37,600
appreciation in appreciation to bring in

110
00:04:41,510 --> 00:04:39,440
the experience to people on earth and

111
00:04:43,909 --> 00:04:41,520
that's how i attempt to do it so i'm

112
00:04:46,070 --> 00:04:43,919
mostly motivated to take the photography

113
00:04:49,749 --> 00:04:46,080

to share the experience vicariously to

114

00:04:53,830 --> 00:04:51,749

yeah jeff now i know you know there's a

115

00:04:55,670 --> 00:04:53,840

storied tradition of space flight here

116

00:04:57,749 --> 00:04:55,680

in wisconsin deke slayton being both a

117

00:04:59,189 --> 00:04:57,759

key figure for both nasa and our

118

00:05:00,310 --> 00:04:59,199

heritage in the badger state what does

119

00:05:05,029 --> 00:05:00,320

it mean to you

120

00:05:09,189 --> 00:05:07,029

well i've always been proud to be from

121

00:05:10,790 --> 00:05:09,199

wisconsin wisconsin is a beautiful state

122

00:05:11,990 --> 00:05:10,800

the people are great

123

00:05:16,469 --> 00:05:12,000

it's got a great

124

00:05:18,629 --> 00:05:16,479

i'm proud to represent the people of

125

00:05:20,469 --> 00:05:18,639

wisconsin i love to go back there and

126

00:05:22,950 --> 00:05:20,479

speaking to folks i get back to the

127

00:05:24,629 --> 00:05:22,960

hometown to into the area in different

128

00:05:27,029 --> 00:05:24,639

parts of wisconsin actually speaking in

129

00:05:28,629 --> 00:05:27,039

different groups now and then and uh and

130

00:05:30,710 --> 00:05:28,639

and i'm just i'm just

131

00:05:35,670 --> 00:05:30,720

proud to represent the state of the

132

00:05:39,430 --> 00:05:37,749

okay you're studying uh dna sequencing

133

00:05:41,270 --> 00:05:39,440

up there we're learning so much more

134

00:05:43,670 --> 00:05:41,280

about this and genetics but there's so

135

00:05:45,670 --> 00:05:43,680

much more we don't yet know

136

00:05:50,310 --> 00:05:45,680

what i guess do you hope to accomplish

137

00:05:53,670 --> 00:05:51,909

yeah we've got an amazing research

138

00:05:56,710 --> 00:05:53,680

program and it's really the

139

00:05:59,189 --> 00:05:56,720

collaborative efforts of about over 200

140

00:06:01,830 --> 00:05:59,199

different investigations so we're

141

00:06:04,550 --> 00:06:01,840

focusing on understanding genomics and

142

00:06:06,550 --> 00:06:04,560

what's going on in cells during space

143

00:06:09,430 --> 00:06:06,560

flight one of the things i just set up

144

00:06:11,590 --> 00:06:09,440

this morning actually was a work volume

145

00:06:13,670 --> 00:06:11,600

in order for us to study heart cells so

146

00:06:15,590 --> 00:06:13,680

we're interested in how

147

00:06:17,430 --> 00:06:15,600

cells behave in microgravity once

148

00:06:19,749 --> 00:06:17,440

they're in free fall what kind of

149

00:06:21,110 --> 00:06:19,759

signaling happens what happens to their

150

00:06:22,550 --> 00:06:21,120

structure and behavior and so we're

151

00:06:24,550 --> 00:06:22,560

going to start to understand a lot of

152

00:06:27,749 --> 00:06:24,560

that in the coming months and years

153

00:06:31,510 --> 00:06:29,350

and what sort of impact do you think

154

00:06:36,230 --> 00:06:31,520

that will have for research and human

155

00:06:39,590 --> 00:06:38,150

i think a lot of it is basic research so

156

00:06:42,469 --> 00:06:39,600

we're just getting some fundamental

157

00:06:44,390 --> 00:06:42,479

understanding about how things behave in

158

00:06:46,390 --> 00:06:44,400

microgravity and sometimes that might

159

00:06:48,870 --> 00:06:46,400

not seem like it's particularly relevant

160

00:06:50,629 --> 00:06:48,880

to life on earth but we can understand a

161

00:06:53,830 --> 00:06:50,639

lot of things about

162

00:06:55,749 --> 00:06:53,840

bone loss osteoporosis muscle wasting

163

00:06:57,990 --> 00:06:55,759

immune system changes there's a lot of

164

00:06:59,990 --> 00:06:58,000

diseases on earth that actually

165

00:07:01,749 --> 00:07:00,000

we have some some excellent ways to

166

00:07:03,350 --> 00:07:01,759

research that on station and some of

167

00:07:06,550 --> 00:07:03,360

these things we can only look at in

168

00:07:08,230 --> 00:07:06,560

microgravity so this is the only place

169

00:07:10,230 --> 00:07:08,240

i would say in the world but it's off

170

00:07:12,150 --> 00:07:10,240

the world this is the only place off the

171

00:07:14,309 --> 00:07:12,160

world that we can actually study gravity

172

00:07:18,070 --> 00:07:14,319

as a variable to understand important

173

00:07:22,150 --> 00:07:20,710

yeah that is certainly something amazing

174

00:07:24,230 --> 00:07:22,160

jeff with this mission i've read you'll

175

00:07:25,990 --> 00:07:24,240

set the record for the most cumulative

176

00:07:27,589 --> 00:07:26,000

days in space and we know nasa's

177

00:07:29,990 --> 00:07:27,599

studying the effects of long-term space

178

00:07:31,749 --> 00:07:30,000

flight on humans with the kelly brothers

179

00:07:37,749 --> 00:07:31,759

scott and mark but what have you noticed

180

00:07:40,469 --> 00:07:39,510

uh well

181

00:07:41,990 --> 00:07:40,479

and

182

00:07:43,909 --> 00:07:42,000

when i think about that i think about

183

00:07:45,510 --> 00:07:43,919

the space station itself and the

184

00:07:46,950 --> 00:07:45,520

achievement of the space station i was

185

00:07:49,110 --> 00:07:46,960

honored to be

186

00:07:50,869 --> 00:07:49,120

among the early crews when we first

187

00:07:53,110 --> 00:07:50,879

started building this and then came back

188

00:07:55,029 --> 00:07:53,120

halfway through and then came back about

189

00:07:56,629 --> 00:07:55,039

the time we were completing the assembly

190

00:07:57,510 --> 00:07:56,639

and now we're in the full utilization

191

00:07:59,510 --> 00:07:57,520

mode

192

00:08:02,469 --> 00:07:59,520

so what amazes me most about the

193

00:08:04,469 --> 00:08:02,479

experience i've had in my career is the

194

00:08:07,189 --> 00:08:04,479

the incredible accomplishment that this

195

00:08:08,950 --> 00:08:07,199

international partnership has done

196

00:08:10,390 --> 00:08:08,960

in what we call the international space

197

00:08:11,510 --> 00:08:10,400

station there's going to be a lot of

198

00:08:13,510 --> 00:08:11,520

things that come out of the space

199

00:08:15,430 --> 00:08:13,520

station research program science

200

00:08:17,350 --> 00:08:15,440

programs and whatnot but probably the

201
00:08:19,350 --> 00:08:17,360
biggest achievement in my opinion is the

202
00:08:21,749 --> 00:08:19,360
space station itself being able to build

203
00:08:23,990 --> 00:08:21,759
it and operate it for so many years

204
00:08:25,670 --> 00:08:24,000
in a in an international way that we've

205
00:08:27,749 --> 00:08:25,680
been able to do it so

206
00:08:29,430 --> 00:08:27,759
and and that's going to build the future

207
00:08:33,029 --> 00:08:29,440
for speech

208
00:08:36,949 --> 00:08:34,790
yeah speaking of future exploration

209
00:08:38,310 --> 00:08:36,959
there's an international docking adapter

210
00:08:40,070 --> 00:08:38,320
that's being installed to make it easier

211
00:08:41,990 --> 00:08:40,080
for commercial flights now to dock at

212
00:08:46,630 --> 00:08:42,000
the station where you both see with this

213
00:08:51,110 --> 00:08:48,949

well certainly the near term future for

214

00:08:52,150 --> 00:08:51,120

the space station will be

215

00:08:56,710 --> 00:08:52,160

the

216

00:08:59,110 --> 00:08:56,720

commercial crew vehicles to rotate part

217

00:09:00,550 --> 00:08:59,120

of the crew from u.s soil and of course

218

00:09:02,710 --> 00:09:00,560

that's a

219

00:09:04,470 --> 00:09:02,720

very important for us

220

00:09:06,710 --> 00:09:04,480

that's the next step we're going to as

221

00:09:08,630 --> 00:09:06,720

you mentioned uh add a docking adapter

222

00:09:09,910 --> 00:09:08,640

that's going to be delivered here next

223

00:09:11,910 --> 00:09:09,920

week on the

224

00:09:13,750 --> 00:09:11,920

spacex dragon

225

00:09:15,910 --> 00:09:13,760

and then we'll go out kate and i will go

226

00:09:17,910 --> 00:09:15,920

out to do a spacewalk to install that

227

00:09:19,750 --> 00:09:17,920

thing and that will prepare

228

00:09:21,750 --> 00:09:19,760

the place for those commercial crew

229

00:09:23,509 --> 00:09:21,760

vehicles to dock and and that's a

230

00:09:25,190 --> 00:09:23,519

natural progression i think if you look

231

00:09:28,230 --> 00:09:25,200

at the history of aviation look at the

232

00:09:30,790 --> 00:09:28,240

history of other uh technologies uh it

233

00:09:33,350 --> 00:09:30,800

has started out very expensive and maybe

234

00:09:36,389 --> 00:09:33,360

not a market uh in it so it's the

235

00:09:38,630 --> 00:09:36,399

governments historically have done that

236

00:09:40,230 --> 00:09:38,640

basic development early development and

237

00:09:42,949 --> 00:09:40,240

then eventually it migrates over to the

238

00:09:44,949 --> 00:09:42,959

commercial world and ends up being you

239

00:09:47,110 --> 00:09:44,959

know working on a business model to be

240

00:09:48,790 --> 00:09:47,120

able to

241

00:09:50,790 --> 00:09:48,800

to exploit it

242

00:09:52,870 --> 00:09:50,800

in terms of economic systems and it and

243

00:09:54,949 --> 00:09:52,880

it's it's no different with this so

244

00:09:57,509 --> 00:09:54,959

that's uh that chapter of the future of

245

00:10:00,389 --> 00:09:57,519

course nasa and other uh government

246

00:10:02,870 --> 00:10:00,399

agencies are looking toward exploration

247

00:10:04,710 --> 00:10:02,880

beyond earth orbit going back perhaps to

248

00:10:06,630 --> 00:10:04,720

the moon and of course you hear about

249

00:10:08,550 --> 00:10:06,640

eventually getting to mars mars is a

250

00:10:10,230 --> 00:10:08,560

destination that's a little bit far away

251
00:10:11,030 --> 00:10:10,240
yet it's going to take some work to get

252
00:10:13,110 --> 00:10:11,040
there

253
00:10:15,750 --> 00:10:13,120
but in my opinion we'll end up doing

254
00:10:19,350 --> 00:10:15,760
something in lunar in the lunar system

255
00:10:22,710 --> 00:10:20,790
certainly exciting we look forward to

256
00:10:24,389 --> 00:10:22,720
following your progress jeff williams

257
00:10:27,430 --> 00:10:24,399
kate rubins thank you so much for

258
00:10:27,440 --> 00:10:31,509
it's been great to talk to you

259
00:10:36,630 --> 00:10:33,750
station this is houston acr that

260
00:10:39,110 --> 00:10:36,640
concludes the wxo w tv portion of the

261
00:10:42,389 --> 00:10:39,120
event please stand by for a voice check

262
00:10:44,389 --> 00:10:42,399
from reuters science

263
00:10:45,910 --> 00:10:44,399

station this is irene klotz at the

264

00:10:48,069 --> 00:10:45,920

kennedy space center and julie

265

00:10:51,190 --> 00:10:48,079

steenheimsen in chicago with reuters how

266

00:10:55,750 --> 00:10:52,790

we hear you loud and clear it's great to

267

00:10:57,590 --> 00:10:55,760

talk to you today thank you you too

268

00:10:58,870 --> 00:10:57,600

commander williams i'd like to start

269

00:11:01,030 --> 00:10:58,880

with you

270

00:11:03,030 --> 00:11:01,040

what's the plan for installation of the

271

00:11:05,269 --> 00:11:03,040

commercial crew vehicle's docking

272

00:11:09,350 --> 00:11:05,279

adapter once it reaches the iss

273

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

well it'll come up in the external

274

00:11:14,470 --> 00:11:13,040

compartment of the dragon

275

00:11:16,949 --> 00:11:14,480

cargo vehicle

276

00:11:18,069 --> 00:11:16,959

the spacex will launch that next week as

277

00:11:20,630 --> 00:11:18,079

you said

278

00:11:22,630 --> 00:11:20,640

and after we get through the the track

279

00:11:24,550 --> 00:11:22,640

and capture of it and get it birthed to

280

00:11:25,910 --> 00:11:24,560

the international space station

281

00:11:27,350 --> 00:11:25,920

we've got a lot of science on board

282

00:11:28,389 --> 00:11:27,360

that's going to be the first priority

283

00:11:31,509 --> 00:11:28,399

but eventually

284

00:11:33,670 --> 00:11:31,519

we will get our spacesuits ready and

285

00:11:35,750 --> 00:11:33,680

prepare to go outside

286

00:11:38,310 --> 00:11:35,760

the ground will actually grab the

287

00:11:41,030 --> 00:11:38,320

docking adapter with the robotic arm and

288

00:11:43,590 --> 00:11:41,040

pluck it out of the dragon spacecraft

289

00:11:45,670 --> 00:11:43,600

and pre-position it very close to its

290

00:11:48,069 --> 00:11:45,680

final place which is going to be at the

291

00:11:50,150 --> 00:11:48,079

very front end of the space station

292

00:11:54,310 --> 00:11:50,160

on the mating adapter that the space

293

00:11:56,710 --> 00:11:54,320

shuttle used to uh launch or dock to

294

00:11:59,910 --> 00:11:56,720

and then we will go out uh in our

295

00:12:02,150 --> 00:11:59,920

spacesuits get out there and the ground

296

00:12:04,470 --> 00:12:02,160

will command the robotic arm to bring it

297

00:12:06,710 --> 00:12:04,480

uh very close probably with less than an

298

00:12:08,949 --> 00:12:06,720

inch away from its uh its mating

299

00:12:10,710 --> 00:12:08,959

interface uh and then we will do the

300

00:12:13,030 --> 00:12:10,720

work to uh to get it attached to the

301
00:12:15,670 --> 00:12:13,040
space station with the aid of the ground

302
00:12:18,389 --> 00:12:15,680
and that robotic arm uh once we get it

303
00:12:20,069 --> 00:12:18,399
attached we'll connect up data and power

304
00:12:23,030 --> 00:12:20,079
cables so then the hooks can be

305
00:12:25,190 --> 00:12:23,040
commanded so that its final sealing

306
00:12:27,269 --> 00:12:25,200
surface can be uh can be made it to the

307
00:12:29,670 --> 00:12:27,279
space station very important critical

308
00:12:30,389 --> 00:12:29,680
it's absolutely necessary

309
00:12:33,350 --> 00:12:30,399
for

310
00:12:35,190 --> 00:12:33,360
the the future activities of launch and

311
00:12:36,870 --> 00:12:35,200
commercial vehicles and docking to the

312
00:12:39,590 --> 00:12:36,880
space station

313
00:12:41,350 --> 00:12:39,600

thank you for dr rubens um what

314

00:12:43,269 --> 00:12:41,360

experiments are you personally most

315

00:12:47,590 --> 00:12:43,279

looking forward to working with while

316

00:12:47,600 --> 00:12:51,190

all of the science

317

00:12:54,790 --> 00:12:53,110

there's there's quite a bit uh actually

318

00:12:57,590 --> 00:12:54,800

it's a it's a phenomenal research

319

00:13:00,550 --> 00:12:57,600

program and obviously my background is

320

00:13:01,990 --> 00:13:00,560

molecular biology and life sciences so

321

00:13:04,230 --> 00:13:02,000

uh that's the part that i just

322

00:13:07,590 --> 00:13:04,240

understand from my previous work i'm

323

00:13:10,150 --> 00:13:07,600

really looking forward to experience on

324

00:13:12,230 --> 00:13:10,160

heart cells and also

325

00:13:13,269 --> 00:13:12,240

osteoblasts the kind of cells that

326

00:13:15,670 --> 00:13:13,279

generate

327

00:13:18,230 --> 00:13:15,680

bone they're constantly regenerating

328

00:13:20,310 --> 00:13:18,240

bone in your bone tissue i'm also really

329

00:13:21,430 --> 00:13:20,320

looking forward to some of the genomic

330

00:13:23,509 --> 00:13:21,440

analysis that we're going to be doing

331

00:13:24,790 --> 00:13:23,519

looking at the first dna sequencing in

332

00:13:27,190 --> 00:13:24,800

space

333

00:13:29,990 --> 00:13:27,200

there's been a lot of renewed interest

334

00:13:32,389 --> 00:13:30,000

in trying to understand what's going on

335

00:13:34,150 --> 00:13:32,399

at a molecular level when we're on board

336

00:13:35,509 --> 00:13:34,160

the space station and this is really the

337

00:13:37,269 --> 00:13:35,519

only lab

338

00:13:39,269 --> 00:13:37,279

that we can take a look at that this is

339

00:13:41,110 --> 00:13:39,279

the only place that we have these tools

340

00:13:43,509 --> 00:13:41,120

to actually look at gravity and the

341

00:13:45,430 --> 00:13:43,519

human body as a system

342

00:13:47,430 --> 00:13:45,440

thanks so i'm speaking of the dna

343

00:13:49,030 --> 00:13:47,440

sequencer have you seen or smelled

344

00:13:54,230 --> 00:13:49,040

anything on station yet that you'd

345

00:13:58,710 --> 00:13:56,550

we were joking because one of the things

346

00:14:01,590 --> 00:13:58,720

that a microbiologist does is they take

347

00:14:02,949 --> 00:14:01,600

surface samples everywhere and i think

348

00:14:04,069 --> 00:14:02,959

folks are a little bit worried that

349

00:14:05,269 --> 00:14:04,079

they're going to run out of samples

350

00:14:07,430 --> 00:14:05,279

while i'm up here because i'm going to

351

00:14:10,150 --> 00:14:07,440

be so interested in in doing some

352

00:14:12,629 --> 00:14:10,160

experiments but i think the our water

353

00:14:14,389 --> 00:14:12,639

system is a phenomenal example we've got

354

00:14:16,870 --> 00:14:14,399

wonderful clean water

355

00:14:19,269 --> 00:14:16,880

but we've got a water system that's been

356

00:14:21,590 --> 00:14:19,279

up here for 15 years so i think it's a

357

00:14:23,910 --> 00:14:21,600

really interesting question to see do we

358

00:14:25,910 --> 00:14:23,920

have any microbes that obviously aren't

359

00:14:27,670 --> 00:14:25,920

pathogenic to humans we've been fine up

360

00:14:29,990 --> 00:14:27,680

here but do we have any microbes living

361

00:14:32,310 --> 00:14:30,000

in this system and if so what kind of

362

00:14:35,829 --> 00:14:32,320

selection pressure have they been on

363

00:14:37,350 --> 00:14:35,839

living in space station for 15 years

364

00:14:40,150 --> 00:14:37,360

are you going to have an opportunity to

365

00:14:42,389 --> 00:14:40,160

do any of that analysis or are you going

366

00:14:45,269 --> 00:14:42,399

to be strictly limited to the samples

367

00:14:48,710 --> 00:14:45,279

that are flying up with the analyzer

368

00:14:51,670 --> 00:14:49,910

so we're going to start out with the

369

00:14:53,269 --> 00:14:51,680

samples that are flying up with the

370

00:14:54,790 --> 00:14:53,279

analyzer and

371

00:14:56,069 --> 00:14:54,800

we're just going to take a look at this

372

00:14:58,550 --> 00:14:56,079

piece of equipment it's really

373

00:15:00,550 --> 00:14:58,560

technology development to understand

374

00:15:01,670 --> 00:15:00,560

how this is working in the microgravity

375

00:15:03,750 --> 00:15:01,680

environment

376

00:15:05,350 --> 00:15:03,760

technology behaves differently up here

377

00:15:07,990 --> 00:15:05,360

fluids behave differently up here

378

00:15:09,829 --> 00:15:08,000

bubbles form in fluids and so it's going

379

00:15:11,269 --> 00:15:09,839

to be a really interesting piece of

380

00:15:13,590 --> 00:15:11,279

equipment just to check out and to

381

00:15:16,550 --> 00:15:13,600

understand and there's definitely future

382

00:15:18,550 --> 00:15:16,560

plans i know to use not just uh

383

00:15:21,030 --> 00:15:18,560

the sequencer but an entire suite of

384

00:15:23,670 --> 00:15:21,040

equipment we have developed up here jeff

385

00:15:25,750 --> 00:15:23,680

did some experiments recently to develop

386

00:15:28,150 --> 00:15:25,760

a couple different kinds of

387

00:15:29,430 --> 00:15:28,160

machines to look at pcr to look at

388

00:15:31,030 --> 00:15:29,440

single genes

389

00:15:33,269 --> 00:15:31,040

and so we are going to use those in the

390

00:15:36,069 --> 00:15:33,279

future to look at microbes

391

00:15:37,910 --> 00:15:36,079

to look at cells in the human body

392

00:15:40,069 --> 00:15:37,920

to look at any kind of system that can

393

00:15:42,310 --> 00:15:40,079

have a microgravity influence thank you

394

00:15:44,790 --> 00:15:42,320

very much and i'm turning over to julie

395

00:15:48,550 --> 00:15:46,629

hi kate i'd like to

396

00:15:50,790 --> 00:15:48,560

expand a little bit more on that i'm

397

00:15:52,629 --> 00:15:50,800

curious to know what's the first

398

00:15:55,030 --> 00:15:52,639

experiment that you're going to do using

399

00:15:59,670 --> 00:15:55,040

the dna sequencer and when do you plan

400

00:16:05,189 --> 00:16:01,430

yeah so we're going to be doing that

401
00:16:06,870 --> 00:16:05,199
shortly after spacex 9 arrives and the

402
00:16:09,269 --> 00:16:06,880
ground teams have come up with an

403
00:16:11,269 --> 00:16:09,279
incredibly well thought out first set of

404
00:16:14,550 --> 00:16:11,279
experiments and what we're going to do

405
00:16:16,629 --> 00:16:14,560
is sequence the genome of a virus lambda

406
00:16:18,790 --> 00:16:16,639
phase which is not a pathogenic virus

407
00:16:20,710 --> 00:16:18,800
it's a standard one used in the lab

408
00:16:23,110 --> 00:16:20,720
we're going to sequence the bacteria

409
00:16:25,030 --> 00:16:23,120
again not harmful just one that we

410
00:16:26,870 --> 00:16:25,040
standardly use in the lab and we're

411
00:16:28,710 --> 00:16:26,880
going to sequence mouse genome and those

412
00:16:31,110 --> 00:16:28,720
are all three mixed together so that we

413
00:16:33,269 --> 00:16:31,120

can determine how the sequencer works on

414

00:16:35,749 --> 00:16:33,279

these different organisms

415

00:16:37,829 --> 00:16:35,759

and i understand that um like your

416

00:16:39,910 --> 00:16:37,839

calling sarah wallace was hoping for

417

00:16:41,829 --> 00:16:39,920

something a little more exotic but you

418

00:16:43,269 --> 00:16:41,839

sort of steered her into using some some

419

00:16:46,870 --> 00:16:43,279

very uh

420

00:16:49,110 --> 00:16:46,880

uh common place um pathogens that are

421

00:16:53,189 --> 00:16:49,120

not pathogens but samples so why was

422

00:16:56,470 --> 00:16:55,189

so i think people always look at my

423

00:16:58,710 --> 00:16:56,480

background and think i'm going to do

424

00:17:01,110 --> 00:16:58,720

something crazy science fiction on space

425

00:17:02,949 --> 00:17:01,120

station but we do have a lot of controls

426

00:17:04,710 --> 00:17:02,959

up here anything that we bring up to the

427

00:17:06,710 --> 00:17:04,720

space station has to be checked for

428

00:17:09,270 --> 00:17:06,720

safety because we're living in a closed

429

00:17:11,189 --> 00:17:09,280

loop environment so we're very careful

430

00:17:12,870 --> 00:17:11,199

to maintain all of those safety controls

431

00:17:15,189 --> 00:17:12,880

so we don't harm the occupants of the

432

00:17:17,029 --> 00:17:15,199

space station but because it is a closed

433

00:17:18,949 --> 00:17:17,039

loop environment that also provides some

434

00:17:20,470 --> 00:17:18,959

of the really interesting

435

00:17:23,510 --> 00:17:20,480

scientific questions that we want to

436

00:17:25,189 --> 00:17:23,520

answer we recycle our air we recycle our

437

00:17:27,110 --> 00:17:25,199

water and we've been doing that

438

00:17:29,510 --> 00:17:27,120

constantly as long as we've had human

439

00:17:31,669 --> 00:17:29,520

presence on board the space station

440

00:17:34,230 --> 00:17:31,679

so we balance the safety concerns and

441

00:17:36,310 --> 00:17:34,240

then we've also got a fantastic research

442

00:17:39,430 --> 00:17:36,320

environment to really learn some

443

00:17:41,029 --> 00:17:39,440

completely novel things about how human

444

00:17:42,710 --> 00:17:41,039

beings behave in a closed-loop

445

00:17:44,390 --> 00:17:42,720

environment

446

00:17:46,549 --> 00:17:44,400

you know i'm curious to know

447

00:17:48,630 --> 00:17:46,559

i mean this is a very portable device

448

00:17:51,430 --> 00:17:48,640

which is it's something kind of unique

449

00:17:54,150 --> 00:17:51,440

for a dna sequencer have you used this

450

00:17:55,909 --> 00:17:54,160

uh device before i know that it was used

451
00:17:57,110 --> 00:17:55,919
for example in congo

452
00:17:59,190 --> 00:17:57,120
uh

453
00:18:03,830 --> 00:17:59,200
for ebola and you were there is it

454
00:18:08,070 --> 00:18:06,230
yeah so i've uh when i was running lab i

455
00:18:09,510 --> 00:18:08,080
actually used a little bit older style

456
00:18:11,909 --> 00:18:09,520
sequencing technologies because we

457
00:18:13,750 --> 00:18:11,919
didn't have to worry about having things

458
00:18:15,590 --> 00:18:13,760
that were so portable

459
00:18:17,669 --> 00:18:15,600
but this kind of device is something

460
00:18:18,549 --> 00:18:17,679
that you would use in the developing

461
00:18:19,909 --> 00:18:18,559
world

462
00:18:22,789 --> 00:18:19,919
you could use this in an outbreak

463
00:18:24,630 --> 00:18:22,799

situation you could use it in a clinic

464

00:18:26,830 --> 00:18:24,640

where you don't have a lot of resources

465

00:18:29,510 --> 00:18:26,840

necessarily to buy a full-scale

466

00:18:31,669 --> 00:18:29,520

sequencer but you can

467

00:18:33,590 --> 00:18:31,679

enable some some kinds of diagnostic

468

00:18:35,350 --> 00:18:33,600

tests in really resource-poor settings

469

00:18:37,590 --> 00:18:35,360

so i think there's going to be a lot of

470

00:18:40,310 --> 00:18:37,600

future development with these small

471

00:18:42,310 --> 00:18:40,320

portable technologies and space station

472

00:18:44,230 --> 00:18:42,320

is an amazing place to test that out we

473

00:18:45,909 --> 00:18:44,240

have constraints here like power

474

00:18:47,270 --> 00:18:45,919

constraints all of our powers from the

475

00:18:49,669 --> 00:18:47,280

solar arrays

476
00:18:51,990 --> 00:18:49,679
data constraints and we have to engineer

477
00:18:53,750 --> 00:18:52,000
devices that are going to work in space

478
00:18:56,710 --> 00:18:53,760
station those same things are going to

479
00:18:59,190 --> 00:18:56,720
work in the most remote regions on earth

480
00:19:01,669 --> 00:18:59,200
i'm curious to know how is this going to

481
00:19:06,230 --> 00:19:01,679
improve the health of astronauts in the

482
00:19:11,430 --> 00:19:08,470
well right now we take samples and then

483
00:19:13,270 --> 00:19:11,440
we send them down on on spacex which

484
00:19:15,750 --> 00:19:13,280
actually has the ability to send down

485
00:19:17,909 --> 00:19:15,760
cold and frozen samples and scientists

486
00:19:19,830 --> 00:19:17,919
can later analyze that but we have a

487
00:19:22,390 --> 00:19:19,840
little bit of a lag so we don't actually

488
00:19:24,870 --> 00:19:22,400

get to look at what's going on and we

489

00:19:27,510 --> 00:19:24,880

don't get to analyze everything that's

490

00:19:29,190 --> 00:19:27,520

happening to human beings or to cells

491

00:19:31,510 --> 00:19:29,200

really in real time

492

00:19:33,750 --> 00:19:31,520

these kinds of small portable genomic

493

00:19:36,230 --> 00:19:33,760

technologies are going to let us look in

494

00:19:38,390 --> 00:19:36,240

real time what's actually happening to

495

00:19:40,710 --> 00:19:38,400

bone degradation for example what's

496

00:19:43,110 --> 00:19:40,720

happening to your immune system what's

497

00:19:45,669 --> 00:19:43,120

happening to a population of microbes

498

00:19:47,510 --> 00:19:45,679

that you bring up in a culture flask

499

00:19:49,669 --> 00:19:47,520

all right um i'm going to wrap up i've

500

00:19:51,750 --> 00:19:49,679

got one more question um

501
00:19:57,029 --> 00:19:51,760
how can the sequencer be used to detect

502
00:20:01,029 --> 00:19:58,950
yeah so that's an interesting question

503
00:20:02,870 --> 00:20:01,039
and and is one of the things that nasa

504
00:20:04,630 --> 00:20:02,880
is very interested in technology

505
00:20:06,870 --> 00:20:04,640
development for

506
00:20:09,190 --> 00:20:06,880
and one of the first things that we need

507
00:20:10,950 --> 00:20:09,200
to prove is just how this technology

508
00:20:13,029 --> 00:20:10,960
operates in microgravity and so that's

509
00:20:15,669 --> 00:20:13,039
what we'll be doing the checkout uh when

510
00:20:17,830 --> 00:20:15,679
it comes up on spacex9 is how the fluid

511
00:20:20,470 --> 00:20:17,840
layer behaves what happens with bubbles

512
00:20:23,350 --> 00:20:20,480
forming and is this kind of technology

513
00:20:24,789 --> 00:20:23,360

something that we can use in space and

514

00:20:26,789 --> 00:20:24,799

that's one of the amazing things about

515

00:20:28,789 --> 00:20:26,799

space station is it's a proving ground

516

00:20:29,909 --> 00:20:28,799

for all of these future technologies

517

00:20:33,350 --> 00:20:29,919

that we're going to develop for