



1
00:00:07,349 --> 00:00:02,629
station this is houston are you ready

2
00:00:12,549 --> 00:00:09,110
houston this is the international space

3
00:00:14,470 --> 00:00:12,559
station ready for the event

4
00:00:15,990 --> 00:00:14,480
senator nelson this is mission control

5
00:00:19,750 --> 00:00:16,000
houston please call the station for a

6
00:00:26,950 --> 00:00:22,950
this is bill nelson i'm in the senate

7
00:00:33,750 --> 00:00:29,910
senator nelson i read you loud and clear

8
00:00:37,270 --> 00:00:35,510
dr marshburn

9
00:00:41,750 --> 00:00:37,280
you are

10
00:00:44,630 --> 00:00:41,760
one who joined nasa in 1994

11
00:00:46,869 --> 00:00:44,640
as a flight surgeon

12
00:00:48,069 --> 00:00:46,879
and ten years later you were selected to

13
00:00:51,430 --> 00:00:48,079

become

14

00:00:55,750 --> 00:00:51,440
a member of the astronaut office

15

00:00:57,510 --> 00:00:55,760
your sp first space flight came in 09

16

00:00:59,750 --> 00:00:57,520
aboard endeavour

17

00:01:01,750 --> 00:00:59,760
and now you're on your second trip to

18

00:01:03,590 --> 00:01:01,760
space

19

00:01:06,310 --> 00:01:03,600
you've spent the last four and a half

20

00:01:09,670 --> 00:01:06,320
months orbiting the earth

21

00:01:11,510 --> 00:01:09,680
on the station uh what is your specific

22

00:01:16,390 --> 00:01:11,520
location right now

23

00:01:20,230 --> 00:01:18,310
well senator right now i'm at the

24

00:01:22,630 --> 00:01:20,240
forward end of the space station i'm the

25

00:01:24,630 --> 00:01:22,640
japanese experiment module so our

26

00:01:27,109 --> 00:01:24,640

velocity vector is that way we're flying

27

00:01:28,870 --> 00:01:27,119

that way all around me and behind me is

28

00:01:30,630 --> 00:01:28,880

the vacuum of space behind me is

29

00:01:32,390 --> 00:01:30,640

actually an external platform that's

30

00:01:35,030 --> 00:01:32,400

encrusted with experiments looking at

31

00:01:36,550 --> 00:01:35,040

the earth and looking at space

32

00:01:38,310 --> 00:01:36,560

so this is a

33

00:01:40,149 --> 00:01:38,320

module like all the other laboratories

34

00:01:41,749 --> 00:01:40,159

here behind all the walls just filled

35

00:01:42,630 --> 00:01:41,759

with the experiments and racks that we

36

00:01:45,030 --> 00:01:42,640

work on

37

00:01:47,030 --> 00:01:45,040

so that's my location now and and you're

38

00:01:49,030 --> 00:01:47,040

right this is the uh come to the end of

39

00:01:50,789 --> 00:01:49,040

a four month mission feeling

40

00:01:52,069 --> 00:01:50,799

adapted feeling great

41

00:01:53,590 --> 00:01:52,079

it's been

42

00:01:54,950 --> 00:01:53,600

wonderful being able to be efficient and

43

00:01:57,990 --> 00:01:54,960

get a lot done up here it's very

44

00:02:03,510 --> 00:02:00,950

well in the early part of the space

45

00:02:05,429 --> 00:02:03,520

shuttle program we never had any time to

46

00:02:08,070 --> 00:02:05,439

get to the window

47

00:02:09,910 --> 00:02:08,080

because every minute was planned with

48

00:02:11,750 --> 00:02:09,920

our experiments or else we were supposed

49

00:02:13,990 --> 00:02:11,760

to be sleeping

50

00:02:16,710 --> 00:02:14,000

many times of which we didn't that's

51
00:02:19,830 --> 00:02:16,720
when we had time to get to the window

52
00:02:25,350 --> 00:02:19,840
uh do you have a lot of time to look

53
00:02:30,150 --> 00:02:27,350
well actually during the day not a lot

54
00:02:31,830 --> 00:02:30,160
of time uh now one of our experiments

55
00:02:34,790 --> 00:02:31,840
one of our payloads we call them that we

56
00:02:36,630 --> 00:02:34,800
are participating in is crew earth

57
00:02:38,550 --> 00:02:36,640
observations looking at uh flooding

58
00:02:40,630 --> 00:02:38,560
sites i was just we were just flying

59
00:02:41,830 --> 00:02:40,640
over saudi arabia earlier today looking

60
00:02:43,750 --> 00:02:41,840
at some of the flooding that's been

61
00:02:45,350 --> 00:02:43,760
occurring there getting photographs to

62
00:02:46,949 --> 00:02:45,360
the ground right away for disaster

63
00:02:48,390 --> 00:02:46,959

response or for a better understanding

64

00:02:51,270 --> 00:02:48,400

of what's going on in that part of the

65

00:02:53,110 --> 00:02:51,280

world so immediate immediate contact

66

00:02:54,550 --> 00:02:53,120

with the earth that's when we can see

67

00:02:56,630 --> 00:02:54,560

the earth have time to see the earth

68

00:02:59,270 --> 00:02:56,640

during the day but you're right it's at

69

00:03:01,030 --> 00:02:59,280

night time usually past the sleep time

70

00:03:02,630 --> 00:03:01,040

that we get a chance to float up to the

71

00:03:03,670 --> 00:03:02,640

window or with our colleagues and spend

72

00:03:05,830 --> 00:03:03,680

some time

73

00:03:11,030 --> 00:03:05,840

looking out the window and they're as

74

00:03:16,070 --> 00:03:13,910

well in the cupola

75

00:03:17,830 --> 00:03:16,080

i understand it's almost like three

76

00:03:19,990 --> 00:03:17,840

dimension

77

00:03:24,390 --> 00:03:20,000

what's it like to look back at the earth

78

00:03:29,190 --> 00:03:27,430

well i i wish every head of state around

79

00:03:32,630 --> 00:03:29,200

the world could come and see our earth

80

00:03:34,869 --> 00:03:32,640

from the cupola it is a 360 degree view

81

00:03:36,309 --> 00:03:34,879

and directly overhead overhead is the

82

00:03:39,270 --> 00:03:36,319

earth so we're actually from an earth

83

00:03:41,430 --> 00:03:39,280

standpoint to have our heads down

84

00:03:42,949 --> 00:03:41,440

but i've found that i've fallen in love

85

00:03:44,309 --> 00:03:42,959

with the earth again

86

00:03:47,509 --> 00:03:44,319

the

87

00:03:50,470 --> 00:03:47,519

incredible

88

00:03:51,990 --> 00:03:50,480

beauty nuance uh the colors the variants

89

00:03:55,270 --> 00:03:52,000

from country to country and from season

90

00:03:56,630 --> 00:03:55,280

to season is uh is remarkable and it's

91

00:03:58,390 --> 00:03:56,640

impossible to pull you're almost

92

00:03:59,509 --> 00:03:58,400

impossible to pull your eyes away from

93

00:04:02,390 --> 00:03:59,519

it

94

00:04:04,309 --> 00:04:02,400

what strikes every astronaut is that

95

00:04:05,910 --> 00:04:04,319

there are no borders down there and that

96

00:04:07,830 --> 00:04:05,920

with our lives with our international

97

00:04:09,589 --> 00:04:07,840

partners up here

98

00:04:12,470 --> 00:04:09,599

knocks down a lot of the barriers that

99

00:04:14,149 --> 00:04:12,480

we have for for

100

00:04:15,910 --> 00:04:14,159

getting getting through technological

101

00:04:17,990 --> 00:04:15,920

difficulties and language difficulties

102

00:04:19,270 --> 00:04:18,000

and and cultural differences and we

103

00:04:21,509 --> 00:04:19,280

actually share that looking out the

104

00:04:23,189 --> 00:04:21,519

window together so the earth is riveting

105

00:04:25,110 --> 00:04:23,199

it's beautiful uh

106

00:04:27,270 --> 00:04:25,120

our existence on there appears to be

107

00:04:29,430 --> 00:04:27,280

very fragile the atmosphere is very thin

108

00:04:31,189 --> 00:04:29,440

so we try to get pictures to convey that

109

00:04:33,189 --> 00:04:31,199

to everyone on the ground it really

110

00:04:37,749 --> 00:04:33,199

changes the way you see the earth and

111

00:04:42,390 --> 00:04:40,150

tom you look pretty good you look like

112

00:04:45,189 --> 00:04:42,400

you're physically fit

113

00:04:46,790 --> 00:04:45,199

uh we've been concerned that there's

114

00:04:50,230 --> 00:04:46,800

bone loss

115

00:04:51,830 --> 00:04:50,240

in zero g for extended periods of time

116

00:04:54,310 --> 00:04:51,840

tell us about the things that you're

117

00:04:56,790 --> 00:04:54,320

trying to do to keep yourself in shape

118

00:04:59,749 --> 00:04:56,800

which you obviously have

119

00:05:01,189 --> 00:04:59,759

and how do you adjust to the fact that

120

00:05:03,590 --> 00:05:01,199

the fluids

121

00:05:08,230 --> 00:05:03,600

shift into the upper torso outside of

122

00:05:11,510 --> 00:05:09,590

we're exactly right that's one of the

123

00:05:13,670 --> 00:05:11,520

biggest challenges uh another way of

124

00:05:14,950 --> 00:05:13,680

putting that actually the zero gravity

125

00:05:17,110 --> 00:05:14,960

and the atrophy that occurs in the

126

00:05:19,270 --> 00:05:17,120

muscles and the bones and our heart and

127

00:05:21,270 --> 00:05:19,280

blood vessels as well that on top of the

128

00:05:23,110 --> 00:05:21,280

radiation we're getting from the outside

129

00:05:25,430 --> 00:05:23,120

uh high radiation doses up here where

130

00:05:27,749 --> 00:05:25,440

all radiation workers all of that is

131

00:05:30,390 --> 00:05:27,759

accelerates it's it's an analog for

132

00:05:32,310 --> 00:05:30,400

acceleration of the aging process so it

133

00:05:33,510 --> 00:05:32,320

actually offers an opportunity to do a

134

00:05:35,110 --> 00:05:33,520

lot of research

135

00:05:37,110 --> 00:05:35,120

you can do in a few years what you can

136

00:05:40,390 --> 00:05:37,120

only do on the ground in decades through

137

00:05:41,270 --> 00:05:40,400

the final years of someone's life

138

00:05:42,870 --> 00:05:41,280

so

139

00:05:45,029 --> 00:05:42,880

what we've been doing is research on

140

00:05:46,390 --> 00:05:45,039

that area i believe that we're getting

141

00:05:48,390 --> 00:05:46,400

close to solving the problem for the

142

00:05:49,749 --> 00:05:48,400

bone and muscle atrophy that you've

143

00:05:51,909 --> 00:05:49,759

alluded to

144

00:05:53,830 --> 00:05:51,919

we i'll exercise two and a half hours a

145

00:05:56,550 --> 00:05:53,840

day a little bit of cardiovascular a lot

146

00:05:58,710 --> 00:05:56,560

of resistance exercise uh we i'm

147

00:06:00,150 --> 00:05:58,720

participating right now on the subject

148

00:06:02,550 --> 00:06:00,160

in an experiment where we're looking at

149

00:06:05,749 --> 00:06:02,560

dietary changes it's called pro-k

150

00:06:07,270 --> 00:06:05,759

and seeing if we can tweak the diet

151
00:06:09,590 --> 00:06:07,280
with the right protein to potassium

152
00:06:11,430 --> 00:06:09,600
ratio to actually

153
00:06:13,189 --> 00:06:11,440
reduce bone loss

154
00:06:15,350 --> 00:06:13,199
our food group has also worked very hard

155
00:06:16,550 --> 00:06:15,360
on changing our food reducing the salt

156
00:06:18,150 --> 00:06:16,560
in the food

157
00:06:19,830 --> 00:06:18,160
and has actually been invited to a lot

158
00:06:21,830 --> 00:06:19,840
of conferences around the country

159
00:06:23,510 --> 00:06:21,840
because the food is great it's wonderful

160
00:06:25,909 --> 00:06:23,520
it's great tasting and it's relatively

161
00:06:28,390 --> 00:06:25,919
low in salt so again we don't leech the

162
00:06:31,029 --> 00:06:28,400
the bone out of our bodies so these are

163
00:06:31,830 --> 00:06:31,039

all avenues that we're working on

164

00:06:36,550 --> 00:06:31,840

to

165

00:06:38,469 --> 00:06:36,560

heart and our blood vessel status

166

00:06:39,909 --> 00:06:38,479

feel great i think i'm going to

167

00:06:41,909 --> 00:06:39,919

certainly be ready to stand up and walk

168

00:06:46,150 --> 00:06:41,919

around when i get back to the earth but

169

00:06:50,629 --> 00:06:47,909

so you've been there four and a half

170

00:06:52,790 --> 00:06:50,639

months uh do you think when you first

171

00:06:57,350 --> 00:06:52,800

stand up back on earth you'll be able to

172

00:07:00,870 --> 00:06:59,589

i think so i was able to after my

173

00:07:03,110 --> 00:07:00,880

shuttle flight

174

00:07:05,350 --> 00:07:03,120

i didn't exercise as much on the shuttle

175

00:07:06,870 --> 00:07:05,360

flight as i have here i've been very

176

00:07:08,150 --> 00:07:06,880

diligent about it

177

00:07:09,990 --> 00:07:08,160

there will be people around if there's

178

00:07:12,150 --> 00:07:10,000

any problems there's a lot of variants

179

00:07:14,070 --> 00:07:12,160

amongst astronauts about how they adapt

180

00:07:15,830 --> 00:07:14,080

when they arrive and when they

181

00:07:17,430 --> 00:07:15,840

when they come back so we don't know

182

00:07:20,230 --> 00:07:17,440

everything about it but i certainly hope

183

00:07:21,830 --> 00:07:20,240

so i intend on trying to stand up uh i'm

184

00:07:23,430 --> 00:07:21,840

going to take some fluids into my body

185

00:07:25,029 --> 00:07:23,440

either through an iv or drinking some

186

00:07:27,189 --> 00:07:25,039

water because you may know that we lose

187

00:07:28,309 --> 00:07:27,199

body fluids up here as well our body

188

00:07:30,150 --> 00:07:28,319

interprets

189

00:07:32,309 --> 00:07:30,160

zero gravity by saying hey there's too

190

00:07:35,589 --> 00:07:32,319

much fluid on board and it gets rid of

191

00:07:37,270 --> 00:07:35,599

it it adapts very well to space and so

192

00:07:39,110 --> 00:07:37,280

it takes some time to adapt again to the

193

00:07:41,430 --> 00:07:39,120

ground when you get back so all of that

194

00:07:42,710 --> 00:07:41,440

together i think we're prepared

195

00:07:43,990 --> 00:07:42,720

there's a lot of interesting research in

196

00:07:47,990 --> 00:07:44,000

that area as well but i think we're

197

00:07:52,390 --> 00:07:49,909

well when you get back i want you to

198

00:07:53,670 --> 00:07:52,400

tell me if you were able to stand

199

00:07:57,589 --> 00:07:53,680

immediately

200

00:08:00,070 --> 00:07:57,599

i tried and i fell right over

201
00:08:02,390 --> 00:08:00,080
i want to introduce

202
00:08:05,670 --> 00:08:02,400
senator ted cruz

203
00:08:07,510 --> 00:08:05,680
my co-leader of the

204
00:08:09,830 --> 00:08:07,520
science and space subcommittee of the

205
00:08:10,869 --> 00:08:09,840
commerce committee senator cruz is from

206
00:08:12,790 --> 00:08:10,879
texas

207
00:08:15,909 --> 00:08:12,800
his hometown as a matter of fact is

208
00:08:18,230 --> 00:08:15,919
houston but he's on the opposite side uh

209
00:08:21,029 --> 00:08:18,240
clear lake you're on the

210
00:08:22,230 --> 00:08:21,039
southeast side he's over a little bit to

211
00:08:24,390 --> 00:08:22,240
the west

212
00:08:26,390 --> 00:08:24,400
senator cruz

213
00:08:28,629 --> 00:08:26,400

thank you senator nelson i want to thank

214

00:08:32,230 --> 00:08:28,639

you dr marshburn for your service and

215

00:08:34,709 --> 00:08:32,240

and i'd love to just ask a question uh

216

00:08:36,070 --> 00:08:34,719

what surprised you the most about your

217

00:08:37,909 --> 00:08:36,080

time on the space station is there

218

00:08:40,070 --> 00:08:37,919

something you didn't expect that now

219

00:08:44,630 --> 00:08:40,080

four and a half months into it has

220

00:08:50,790 --> 00:08:46,550

yes what surprised me

221

00:08:53,110 --> 00:08:50,800

uh was that how busy and vibrant life

222

00:08:55,430 --> 00:08:53,120

and the work here on the space station

223

00:08:56,710 --> 00:08:55,440

is the space station is a hard place to

224

00:08:58,630 --> 00:08:56,720

go to sleep

225

00:09:01,430 --> 00:08:58,640

because if it's not looking out the

226

00:09:03,910 --> 00:09:01,440

window it is every moment enjoying the

227

00:09:06,790 --> 00:09:03,920

effects of zero gravity and especially

228

00:09:09,190 --> 00:09:06,800

the work during the day we are busy as

229

00:09:10,870 --> 00:09:09,200

can be and in a wonderful way

230

00:09:11,910 --> 00:09:10,880

we've just you may know we've just uh

231

00:09:14,070 --> 00:09:11,920

added

232

00:09:15,590 --> 00:09:14,080

up to four comm loops we can talk to

233

00:09:17,190 --> 00:09:15,600

scientists all around the world and if

234

00:09:19,190 --> 00:09:17,200

for a few days we've had every loop

235

00:09:21,350 --> 00:09:19,200

socked in with conversation with

236

00:09:23,590 --> 00:09:21,360

scientists as we do experiments there's

237

00:09:25,829 --> 00:09:23,600

so much going on up here it's it's just

238

00:09:28,230 --> 00:09:25,839

hard to stop quite frankly it's it's

239

00:09:29,030 --> 00:09:28,240

hard to stop and go to sleep and

240

00:09:31,590 --> 00:09:29,040

and

241

00:09:33,509 --> 00:09:31,600

leave it alone for a while so that's

242

00:09:37,829 --> 00:09:33,519

very honestly that is what shocked me

243

00:09:41,750 --> 00:09:39,750

is there particular research that you're

244

00:09:44,790 --> 00:09:41,760

working on now that you're able to

245

00:09:49,269 --> 00:09:44,800

discuss that you think is is exciting or

246

00:09:52,310 --> 00:09:51,509

i actually i don't know where to start

247

00:09:54,870 --> 00:09:52,320

um

248

00:09:57,509 --> 00:09:54,880

being a doctor i'll be uh preferential

249

00:09:59,590 --> 00:09:57,519

to to those experiments just yesterday i

250

00:10:01,430 --> 00:09:59,600

was finalizing our uh

251

00:10:03,190 --> 00:10:01,440

i was the first subject along with my

252

00:10:04,470 --> 00:10:03,200

colleagues first subjects in the spinal

253

00:10:06,069 --> 00:10:04,480

ultrasound study

254

00:10:08,230 --> 00:10:06,079

using ultrasound as we all know it on

255

00:10:10,069 --> 00:10:08,240

the ground but in a very novel way

256

00:10:11,590 --> 00:10:10,079

looking at our spines doing something

257

00:10:14,310 --> 00:10:11,600

that's good for human space flight that

258

00:10:15,750 --> 00:10:14,320

is figuring out what is the cause of

259

00:10:17,269 --> 00:10:15,760

back pain which is something that occurs

260

00:10:19,110 --> 00:10:17,279

in some astronauts

261

00:10:21,269 --> 00:10:19,120

particularly maybe even back injury when

262

00:10:23,269 --> 00:10:21,279

we get back to the earth and we put our

263

00:10:24,870 --> 00:10:23,279

spine under compression again

264

00:10:27,910 --> 00:10:24,880

and comparing these ultrasound images to

265

00:10:29,509 --> 00:10:27,920

mri now we have ultrasound

266

00:10:31,590 --> 00:10:29,519

on the ground obviously they don't

267

00:10:32,870 --> 00:10:31,600

usually use it for the back

268

00:10:35,590 --> 00:10:32,880

but what's

269

00:10:38,069 --> 00:10:35,600

very exciting about this is that we are

270

00:10:40,949 --> 00:10:38,079

finding ways to use ultrasound even

271

00:10:43,509 --> 00:10:40,959

being able to visualize the spinal cord

272

00:10:45,910 --> 00:10:43,519

in ways that are completely unexpected

273

00:10:47,269 --> 00:10:45,920

there are countries and obviously places

274

00:10:50,230 --> 00:10:47,279

even in the united states where there

275

00:10:52,550 --> 00:10:50,240

are no mris are no cat scanners even in

276
00:10:55,030 --> 00:10:52,560
emergency rooms where the wait is eight

277
00:10:57,590 --> 00:10:55,040
to ten hours in the middle of a city

278
00:10:59,350 --> 00:10:57,600
this is one example a small example but

279
00:11:01,670 --> 00:10:59,360
one example of how

280
00:11:03,990 --> 00:11:01,680
nasa is using a current technology

281
00:11:05,269 --> 00:11:04,000
applying it to a very difficult problem

282
00:11:06,710 --> 00:11:05,279
that is bringing medical care to

283
00:11:08,310 --> 00:11:06,720
astronauts where we don't have a

284
00:11:10,069 --> 00:11:08,320
hospital up here

285
00:11:12,630 --> 00:11:10,079
and that has developed techniques and

286
00:11:14,150 --> 00:11:12,640
processes that can be used on the earth

287
00:11:17,110 --> 00:11:14,160
that's been done many times as a matter

288
00:11:19,269 --> 00:11:17,120

of fact i'll just have to say

289

00:11:20,949 --> 00:11:19,279

training for every surgical resident in

290

00:11:23,829 --> 00:11:20,959

the united states right now

291

00:11:25,990 --> 00:11:23,839

uses a technique that was developed by

292

00:11:28,389 --> 00:11:26,000

people that were solving a problem for

293

00:11:30,710 --> 00:11:28,399

nasa onboard the space station

294

00:11:32,310 --> 00:11:30,720

that is very essential for trauma care

295

00:11:34,470 --> 00:11:32,320

in the first hour

296

00:11:35,750 --> 00:11:34,480

it's saving lives right now this is a

297

00:11:38,150 --> 00:11:35,760

part of training for every resident

298

00:11:39,829 --> 00:11:38,160

surgical resident and surgeon in the u.s

299

00:11:41,670 --> 00:11:39,839

right now it's been adopted it came

300

00:11:43,990 --> 00:11:41,680

completely from the desire to provide

301
00:11:46,069 --> 00:11:44,000
medical care for astronauts

302
00:11:48,470 --> 00:11:46,079
so and that was an ultrasound technique

303
00:11:49,829 --> 00:11:48,480
as well so i'm very excited about it as

304
00:11:52,790 --> 00:11:49,839
a doctor but i think it's a great

305
00:11:54,870 --> 00:11:52,800
example of what happens when you ask

306
00:11:57,269 --> 00:11:54,880
very smart people to do a very hard

307
00:11:59,030 --> 00:11:57,279
thing and tell them also you're helping

308
00:12:00,629 --> 00:11:59,040
the exploration of the universe

309
00:12:04,790 --> 00:12:00,639
it's a great combination and wonderful

310
00:12:04,800 --> 00:12:07,750
terrific thank you

311
00:12:14,230 --> 00:12:10,790
tell us about are you still doing

312
00:12:16,949 --> 00:12:14,240
crystal growth in zero g

313
00:12:19,509 --> 00:12:16,959

and if not

314

00:12:21,990 --> 00:12:19,519

what are some of the promising

315

00:12:23,350 --> 00:12:22,000

medical research

316

00:12:26,230 --> 00:12:23,360

experiments

317

00:12:33,269 --> 00:12:26,240

for example in the development of drugs

318

00:12:37,110 --> 00:12:35,269

there is crystallography and crystal

319

00:12:38,870 --> 00:12:37,120

research going on right now particularly

320

00:12:40,389 --> 00:12:38,880

in this module in the japanese

321

00:12:43,509 --> 00:12:40,399

experiment module

322

00:12:45,509 --> 00:12:43,519

that is one experiment we we are

323

00:12:47,590 --> 00:12:45,519

astronauts are subjects as well as

324

00:12:49,829 --> 00:12:47,600

surrogate scientists but we're also lab

325

00:12:52,389 --> 00:12:49,839

technicians we get things going and let

326

00:12:53,670 --> 00:12:52,399

them run and the crystal growth

327

00:12:56,150 --> 00:12:53,680

experiments there's several of them

328

00:12:57,990 --> 00:12:56,160

actually and we stock them we let get

329

00:12:59,430 --> 00:12:58,000

them going and then we resupply them to

330

00:13:01,269 --> 00:12:59,440

the ground

331

00:13:02,790 --> 00:13:01,279

so that's going on all the time

332

00:13:04,069 --> 00:13:02,800

in my opinion one of the greatest

333

00:13:05,990 --> 00:13:04,079

achievements recently on the space

334

00:13:08,389 --> 00:13:06,000

station is the ability to turn that into

335

00:13:10,870 --> 00:13:08,399

a an assembly line a process whereby we

336

00:13:13,430 --> 00:13:10,880

can bring up lots of samples of crystals

337

00:13:14,790 --> 00:13:13,440

lots of samples of proteins

338

00:13:16,550 --> 00:13:14,800

and then

339

00:13:18,310 --> 00:13:16,560

put them up in these laboratories return

340

00:13:19,910 --> 00:13:18,320

them to the earth and then companies and

341

00:13:21,509 --> 00:13:19,920

scientists universities can go back and

342

00:13:23,670 --> 00:13:21,519

look at them and

343

00:13:25,590 --> 00:13:23,680

really define proteins to a level

344

00:13:27,670 --> 00:13:25,600

they've never been able to before uh

345

00:13:29,190 --> 00:13:27,680

you're probably familiar with uh

346

00:13:31,509 --> 00:13:29,200

better description of the genes that

347

00:13:33,990 --> 00:13:31,519

cause duchene's muscular dystrophy

348

00:13:35,750 --> 00:13:34,000

there's a

349

00:13:38,230 --> 00:13:35,760

any number of drugs that have been uh

350

00:13:40,310 --> 00:13:38,240

coming through it's fairly rare that a

351

00:13:42,310 --> 00:13:40,320

useful um

352

00:13:44,310 --> 00:13:42,320

application is discovered but now with

353

00:13:46,389 --> 00:13:44,320

the accelerated numbers that we're able

354

00:13:50,310 --> 00:13:46,399

to process up here on the space station

355

00:13:51,509 --> 00:13:50,320

i feel that the the uh the findings and

356

00:13:52,949 --> 00:13:51,519

the discoveries are going to be

357

00:13:55,910 --> 00:13:52,959

accelerating coming out much more

358

00:13:58,470 --> 00:13:55,920

frequent much quicker much more quickly

359

00:14:00,629 --> 00:13:58,480

uh other things outside crystallography

360

00:14:03,030 --> 00:14:00,639

uh you're probably familiar with the

361

00:14:04,790 --> 00:14:03,040

salmonella vaccine which came out of

362

00:14:07,910 --> 00:14:04,800

being able to bring up is something no

363

00:14:09,829 --> 00:14:07,920

one ever expected but bring up bacteria

364

00:14:10,870 --> 00:14:09,839

microorganisms up here and they actually

365

00:14:13,110 --> 00:14:10,880

change

366

00:14:15,269 --> 00:14:13,120

probably due to microgravity and become

367

00:14:17,269 --> 00:14:15,279

more virulent and therefore there are

368

00:14:19,590 --> 00:14:17,279

much better test cases for producing

369

00:14:21,670 --> 00:14:19,600

vaccines we can get to the answer of the

370

00:14:24,230 --> 00:14:21,680

proper vaccine much faster because of

371

00:14:27,350 --> 00:14:24,240

these super microorganisms that that

372

00:14:29,509 --> 00:14:27,360

occur up here that can grow up here

373

00:14:31,590 --> 00:14:29,519

along the medical field

374

00:14:33,829 --> 00:14:31,600

another thing so much of this is

375

00:14:35,269 --> 00:14:33,839

unexpected there's a capillary flow

376

00:14:36,069 --> 00:14:35,279

experimental just working on the other

377

00:14:38,790 --> 00:14:36,079

day

378

00:14:40,710 --> 00:14:38,800

the intent is to provide

379

00:14:42,550 --> 00:14:40,720

fuel tanks for spacecraft that don't

380

00:14:44,470 --> 00:14:42,560

have to have pumps just use capillary

381

00:14:46,790 --> 00:14:44,480

flow well it turns out

382

00:14:49,350 --> 00:14:46,800

micro flow the flow of micro liters of

383

00:14:51,750 --> 00:14:49,360

fluid can use this technology as well

384

00:14:53,750 --> 00:14:51,760

and they've been working on producing

385

00:14:55,350 --> 00:14:53,760

better lab on a chip technology so you

386

00:14:58,150 --> 00:14:55,360

can have a greater

387

00:14:59,430 --> 00:14:58,160

suite of laboratory analysis you can do

388

00:15:01,509 --> 00:14:59,440

on blood

389

00:15:03,670 --> 00:15:01,519

just on a chip so put a cd and a little

390

00:15:05,030 --> 00:15:03,680

disc and uh get a blood analysis

391

00:15:07,110 --> 00:15:05,040

accomplished

392

00:15:09,829 --> 00:15:07,120

the list goes on i hope i'm not talking

393

00:15:11,350 --> 00:15:09,839

too much but it's it's very hard to say

394

00:15:12,790 --> 00:15:11,360

in just a few minutes everything that's

395

00:15:15,670 --> 00:15:12,800

going on particularly in the medical

396

00:15:20,790 --> 00:15:18,790

tom what is it about zero g

397

00:15:23,430 --> 00:15:20,800

that is causing

398

00:15:30,150 --> 00:15:26,470

differences in the production of a

399

00:15:32,150 --> 00:15:30,160

vaccine for mrsa and i also for for

400

00:15:36,949 --> 00:15:32,160

salmonella and i also understand for

401
00:15:41,749 --> 00:15:39,670
yes sir for mrsa as well

402
00:15:43,430 --> 00:15:41,759
that's a great question

403
00:15:44,949 --> 00:15:43,440
and i'm sure that there are scientists

404
00:15:45,910 --> 00:15:44,959
that can answer it much better than i

405
00:15:47,110 --> 00:15:45,920
could

406
00:15:49,590 --> 00:15:47,120
if just

407
00:15:51,030 --> 00:15:49,600
on my somewhat layman's

408
00:15:52,829 --> 00:15:51,040
knowledge on it

409
00:15:55,110 --> 00:15:52,839
every cell has a

410
00:15:57,910 --> 00:15:55,120
cytoskeleton there are changes to that

411
00:16:00,550 --> 00:15:57,920
cytoskeleton because of zero gravity how

412
00:16:03,030 --> 00:16:00,560
that changes gene expression within the

413
00:16:04,550 --> 00:16:03,040

cell within the microorganism i don't

414

00:16:06,870 --> 00:16:04,560

know the answer to that

415

00:16:08,790 --> 00:16:06,880

maybe it's not microgravity maybe it's

416

00:16:09,749 --> 00:16:08,800

potentially the the radiation

417

00:16:11,670 --> 00:16:09,759

environment

418

00:16:14,230 --> 00:16:11,680

although they're somewhat protected here

419

00:16:16,150 --> 00:16:14,240

i think it is microgravity but it's a

420

00:16:18,629 --> 00:16:16,160

great example of

421

00:16:20,870 --> 00:16:18,639

of we're we're in our infancy here and

422

00:16:23,189 --> 00:16:20,880

seeing what the benefits of doing

423

00:16:23,990 --> 00:16:23,199

research in microgravity are

424

00:16:25,910 --> 00:16:24,000

and

425

00:16:27,670 --> 00:16:25,920

so i i can't answer your question but i

426
00:16:29,269 --> 00:16:27,680
would love to know the answer i would

427
00:16:30,710 --> 00:16:29,279
love to talk to the experts that maybe

428
00:16:34,389 --> 00:16:30,720
are coming close to an answer to that

429
00:16:39,910 --> 00:16:36,790
let me ask a a lighter question on on a

430
00:16:42,310 --> 00:16:39,920
more personal side which is

431
00:16:43,590 --> 00:16:42,320
what do you do for recreation up there

432
00:16:47,910 --> 00:16:43,600
are there

433
00:16:52,790 --> 00:16:47,920
games you play nerf golf in zero g or

434
00:16:56,310 --> 00:16:54,629
you know actually

435
00:16:58,550 --> 00:16:56,320
for me

436
00:16:59,990 --> 00:16:58,560
just moving around the space station is

437
00:17:01,590 --> 00:17:00,000
a lot of fun

438
00:17:02,870 --> 00:17:01,600

we can have some competitions as to who

439

00:17:04,390 --> 00:17:02,880

can get through a module without

440

00:17:05,829 --> 00:17:04,400

touching a wall or

441

00:17:08,630 --> 00:17:05,839

who can stay free floating for the

442

00:17:10,390 --> 00:17:08,640

longest time without touching a wall but

443

00:17:12,789 --> 00:17:10,400

just the day-to-day work

444

00:17:15,350 --> 00:17:12,799

i love the efficiencies that we build up

445

00:17:17,029 --> 00:17:15,360

as we've been here for a while learn how

446

00:17:19,909 --> 00:17:17,039

to not put anything anywhere but just

447

00:17:21,110 --> 00:17:19,919

kind of it's like uh static juggling you

448

00:17:22,630 --> 00:17:21,120

just put everything up there that just

449

00:17:24,069 --> 00:17:22,640

sits there once you get good enough at

450

00:17:26,150 --> 00:17:24,079

it and you can do a lot of work without

451
00:17:27,270 --> 00:17:26,160
having to put anything down or restrain

452
00:17:28,470 --> 00:17:27,280
it

453
00:17:30,870 --> 00:17:28,480
looking out the window is a great

454
00:17:33,830 --> 00:17:30,880
pastime we have a guitar up here we play

455
00:17:36,150 --> 00:17:33,840
guitar uh usually just by ourselves off

456
00:17:38,950 --> 00:17:36,160
into a module somewhere

457
00:17:40,230 --> 00:17:38,960
we do have some books as well but it's

458
00:17:45,350 --> 00:17:40,240
it's hard to tear yourself away from

459
00:17:50,789 --> 00:17:48,470
uh you know uh the people on earth

460
00:17:53,590 --> 00:17:50,799
don't really know a lot about what's

461
00:17:56,310 --> 00:17:53,600
going on we have uh a contraption up

462
00:17:58,150 --> 00:17:56,320
there that's as long as from one goal

463
00:18:00,789 --> 00:17:58,160

post to the other goal posts on a

464

00:18:03,190 --> 00:18:00,799

football field and all of this

465

00:18:05,190 --> 00:18:03,200

scientific experiment is going on with

466

00:18:08,390 --> 00:18:05,200

six human beings

467

00:18:10,390 --> 00:18:08,400

uh what could you tell us earthlings

468

00:18:12,230 --> 00:18:10,400

that we can do better

469

00:18:13,830 --> 00:18:12,240

to get them to understand this

470

00:18:16,070 --> 00:18:13,840

extraordinarily

471

00:18:21,190 --> 00:18:16,080

this extraordinary flying machine that

472

00:18:25,430 --> 00:18:23,270

that's a great question i i believe

473

00:18:28,230 --> 00:18:25,440

we're making inroads as we go one of my

474

00:18:30,789 --> 00:18:28,240

colleagues chris hadfield has been using

475

00:18:32,230 --> 00:18:30,799

music to tell the story of of not just

476

00:18:34,789 --> 00:18:32,240

the personal experience of living on

477

00:18:36,470 --> 00:18:34,799

space station but just a glimpse of what

478

00:18:37,750 --> 00:18:36,480

it means in terms of the science return

479

00:18:39,510 --> 00:18:37,760

as well

480

00:18:40,789 --> 00:18:39,520

social media we've been trying to use

481

00:18:41,590 --> 00:18:40,799

quite a bit

482

00:18:51,029 --> 00:18:41,600

it

483

00:18:53,029 --> 00:18:51,039

that they really do want to know what's

484

00:18:53,990 --> 00:18:53,039

going on up here they are fascinated

485

00:18:56,070 --> 00:18:54,000

with it

486

00:18:57,750 --> 00:18:56,080

they like the direct access that some of

487

00:18:59,190 --> 00:18:57,760

the social media provides so they can

488

00:19:02,230 --> 00:18:59,200

ask directly a question and get a

489

00:19:05,190 --> 00:19:02,240

response directly back from an astronaut

490

00:19:06,470 --> 00:19:05,200

so we've been exploring that a good bit

491

00:19:07,830 --> 00:19:06,480

and

492

00:19:09,750 --> 00:19:07,840

that with the events that we're having

493

00:19:11,190 --> 00:19:09,760

right now we obviously are talking to a

494

00:19:13,590 --> 00:19:11,200

lot of schools do a lot of pre-flight

495

00:19:15,750 --> 00:19:13,600

and post flight work as well

496

00:19:18,150 --> 00:19:15,760

but uh that's a great question i think

497

00:19:19,830 --> 00:19:18,160

we're getting better at it

498

00:19:23,430 --> 00:19:19,840

and we'll continue to look for better

499

00:19:29,990 --> 00:19:26,070

well you are clearly a part of that

500

00:19:32,150 --> 00:19:30,000

uh and uh we thank you uh i you know

501
00:19:34,150 --> 00:19:32,160
we're going to mars

502
00:19:37,669 --> 00:19:34,160
and uh

503
00:19:40,070 --> 00:19:37,679
and we may go back to that

504
00:19:42,150 --> 00:19:40,080
retrograde orbit where we're going to

505
00:19:45,350 --> 00:19:42,160
nudge

506
00:19:48,230 --> 00:19:45,360
a piece of space into an orbit there a

507
00:19:50,870 --> 00:19:48,240
stable orbit we may go back to the moon

508
00:19:53,669 --> 00:19:50,880
in preparation to go to mars

509
00:19:55,909 --> 00:19:53,679
what do you think on the station that

510
00:20:00,710 --> 00:19:55,919
you're doing in preparation for us to go

511
00:20:05,510 --> 00:20:03,750
well virtually everything to keep humans

512
00:20:07,669 --> 00:20:05,520
alive and productive up here on the

513
00:20:09,830 --> 00:20:07,679

space station that that is no small

514

00:20:11,909 --> 00:20:09,840

matter it's something that we get better

515

00:20:14,230 --> 00:20:11,919

at every day

516

00:20:15,510 --> 00:20:14,240

you know we we live inside of a power

517

00:20:17,909 --> 00:20:15,520

station

518

00:20:19,350 --> 00:20:17,919

that's uh the biggest one in orbit

519

00:20:20,390 --> 00:20:19,360

that's why we're able to run so many

520

00:20:22,710 --> 00:20:20,400

experiments

521

00:20:25,430 --> 00:20:22,720

we have a water system where we we

522

00:20:26,870 --> 00:20:25,440

reclaim almost 100 of our water these

523

00:20:28,950 --> 00:20:26,880

are all things that we have to be able

524

00:20:30,310 --> 00:20:28,960

to do to leave earth orbit not be able

525

00:20:31,350 --> 00:20:30,320

to resupply

526

00:20:33,190 --> 00:20:31,360

so

527

00:20:35,350 --> 00:20:33,200

i believe i'm i'm living and working in

528

00:20:37,029 --> 00:20:35,360

the first mars vehicle

529

00:20:38,390 --> 00:20:37,039

uh the the next generation is going to

530

00:20:41,270 --> 00:20:38,400

learn from everything that we have

531

00:20:43,190 --> 00:20:41,280

learned the engineers uh astronauts the

532

00:20:44,950 --> 00:20:43,200

people that build spacecraft

533

00:20:47,029 --> 00:20:44,960

everything that we've learned here

534

00:20:48,789 --> 00:20:47,039

is going to be used and needs to be used

535

00:20:49,909 --> 00:20:48,799

for the for the next generation of

536

00:20:52,310 --> 00:20:49,919

vehicle

537

00:20:54,149 --> 00:20:52,320

so i think we're doing it right now and

538

00:20:55,830 --> 00:20:54,159

we need it's not easy we have to keep

539

00:20:57,430 --> 00:20:55,840

doing it it's not a switch you can turn

540

00:20:58,789 --> 00:20:57,440

off and turn back on again and think you

541

00:21:01,510 --> 00:20:58,799

have the answer

542

00:21:05,750 --> 00:21:01,520

right away it's a process that's very

543

00:21:10,470 --> 00:21:08,149

we have four minutes left in the window

544

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

let's give somebody in the audience a

545

00:21:14,470 --> 00:21:11,520

chance

546

00:21:16,549 --> 00:21:14,480

step up and identify yourself for tom hi

547

00:21:18,630 --> 00:21:16,559

i'm jason hopkins i work in senator bill

548

00:21:19,750 --> 00:21:18,640

nelson's office um

549

00:21:20,549 --> 00:21:19,760

uh

550

00:21:22,310 --> 00:21:20,559

so

551
00:21:24,630 --> 00:21:22,320
can you explain uh how

552
00:21:27,029 --> 00:21:24,640
you know u.s private space companies

553
00:21:31,350 --> 00:21:27,039
uh are using the iss as a technology

554
00:21:36,070 --> 00:21:33,510
well primarily uh first of all it's a

555
00:21:38,789 --> 00:21:36,080
destination uh this is a product they

556
00:21:40,789 --> 00:21:38,799
can provide and a place to go in space

557
00:21:42,549 --> 00:21:40,799
we need it we need the uh need the

558
00:21:45,029 --> 00:21:42,559
supply we need to be able to return

559
00:21:46,230 --> 00:21:45,039
results to the ground

560
00:21:48,470 --> 00:21:46,240
so

561
00:21:50,390 --> 00:21:48,480
if they can do it that is

562
00:21:52,390 --> 00:21:50,400
an incredibly impressive technology

563
00:21:55,270 --> 00:21:52,400

demonstration going into space is not

564

00:21:57,590 --> 00:21:55,280

easy we can still just barely do it

565

00:21:59,510 --> 00:21:57,600

we've had companies with some problems

566

00:22:01,430 --> 00:21:59,520

with launches that's completely expected

567

00:22:03,190 --> 00:22:01,440

because this is still a very hard thing

568

00:22:05,510 --> 00:22:03,200

to do now having said that they're

569

00:22:07,270 --> 00:22:05,520

coming up with great efficiencies great

570

00:22:09,190 --> 00:22:07,280

new technologies built on what nasa's

571

00:22:10,870 --> 00:22:09,200

already done so that they can get

572

00:22:13,270 --> 00:22:10,880

probably cheaper better faster get

573

00:22:15,190 --> 00:22:13,280

things up to the space station

574

00:22:17,669 --> 00:22:15,200

so besides everything we've learned

575

00:22:24,830 --> 00:22:17,679

about spacecraft we're also providing

576

00:22:29,510 --> 00:22:27,430

well thank you doctor for your important

577

00:22:31,750 --> 00:22:29,520

work my name is ben bradley and i just

578

00:22:34,070 --> 00:22:31,760

wanted to ask something about your daily

579

00:22:36,549 --> 00:22:34,080

routine uh what you go through

580

00:22:38,549 --> 00:22:36,559

and uh and and how that helps you

581

00:22:39,669 --> 00:22:38,559

throughout the day developing a routine

582

00:22:45,190 --> 00:22:39,679

i know you've been up there for four

583

00:22:48,630 --> 00:22:46,549

well the ground certainly helps with

584

00:22:50,789 --> 00:22:48,640

that a lot every five minutes is blocked

585

00:22:53,270 --> 00:22:50,799

out but there's some variability there

586

00:22:54,950 --> 00:22:53,280

we wake up and typically we'll read

587

00:22:57,270 --> 00:22:54,960

summaries from the ground we do we do

588

00:22:58,950 --> 00:22:57,280

our homework uh ground sends itself the

589

00:23:01,110 --> 00:22:58,960

plan for the day and why the rationale

590

00:23:02,549 --> 00:23:01,120

for the plan uh things to look out for

591

00:23:04,710 --> 00:23:02,559

we read about the experiments we might

592

00:23:05,990 --> 00:23:04,720

even start looking into the procedures

593

00:23:07,830 --> 00:23:06,000

see if there's any hiccups that might

594

00:23:09,590 --> 00:23:07,840

come up but then we just implement the

595

00:23:11,990 --> 00:23:09,600

plan that we've been given if we find

596

00:23:14,149 --> 00:23:12,000

efficiencies we try to fill fill in more

597

00:23:15,669 --> 00:23:14,159

work during that time

598

00:23:17,350 --> 00:23:15,679

you know obviously we have a little

599

00:23:19,029 --> 00:23:17,360

break for uh for a meal in the middle of

600

00:23:21,190 --> 00:23:19,039

the day we do have our two and a half

601
00:23:23,350 --> 00:23:21,200
hour block of exercise that can occur

602
00:23:25,270 --> 00:23:23,360
just about any time during the day

603
00:23:27,669 --> 00:23:25,280
so that's very much into our routine as

604
00:23:30,630 --> 00:23:27,679
well and then uh after a meal which we

605
00:23:31,909 --> 00:23:30,640
often share with our russian colleagues

606
00:23:33,350 --> 00:23:31,919
it's great to be able to get together

607
00:23:36,310 --> 00:23:33,360
and just talk about the day talk about

608
00:23:38,390 --> 00:23:36,320
the work just amongst uh colleagues we

609
00:23:39,110 --> 00:23:38,400
also have a planning conference both at

610
00:23:42,789 --> 00:23:39,120
the

611
00:23:44,710 --> 00:23:42,799
it's kind of bookended that way

612
00:23:46,950 --> 00:23:44,720
and then it's time off we do kind of

613
00:23:48,789 --> 00:23:46,960

what i described before i'm i'm partial

614

00:23:50,390 --> 00:23:48,799

to doing a little bit of homework

615

00:23:52,070 --> 00:23:50,400

at night to get ready for the following

616

00:23:53,830 --> 00:23:52,080

day as well and usually at the end of

617

00:23:56,310 --> 00:23:53,840

the day we call uh home we have an

618

00:23:59,350 --> 00:23:56,320

opportunity uh to either email or call

619

00:24:03,029 --> 00:24:00,950

all right they're telling us we've got

620

00:24:05,909 --> 00:24:03,039

to wrap so we want to thank you we want

621

00:24:08,789 --> 00:24:05,919

to wish you and two of your crewmates

622

00:24:10,870 --> 00:24:08,799

a safe journey home and as we close out

623

00:24:11,669 --> 00:24:10,880

why don't you do a back flip for us show

624

00:24:16,830 --> 00:24:11,679

us

625

00:24:29,590 --> 00:24:18,950

are i don't know about that but let me

626

00:24:29,600 --> 00:24:35,909

all right thank you so much

627

00:24:39,750 --> 00:24:37,909

it has been a real privilege to talk to

628

00:24:43,590 --> 00:24:39,760

you thank you it's been an honor and a

629

00:24:50,710 --> 00:24:45,269

thank you very much

630

00:24:57,830 --> 00:24:52,549

the station this is houston acr that

631

00:25:01,590 --> 00:24:59,510

senator nelson members of the senate and

632

00:25:03,990 --> 00:25:01,600

staff station we are now resuming

633

00:25:06,070 --> 00:25:04,000

operational audio communication down