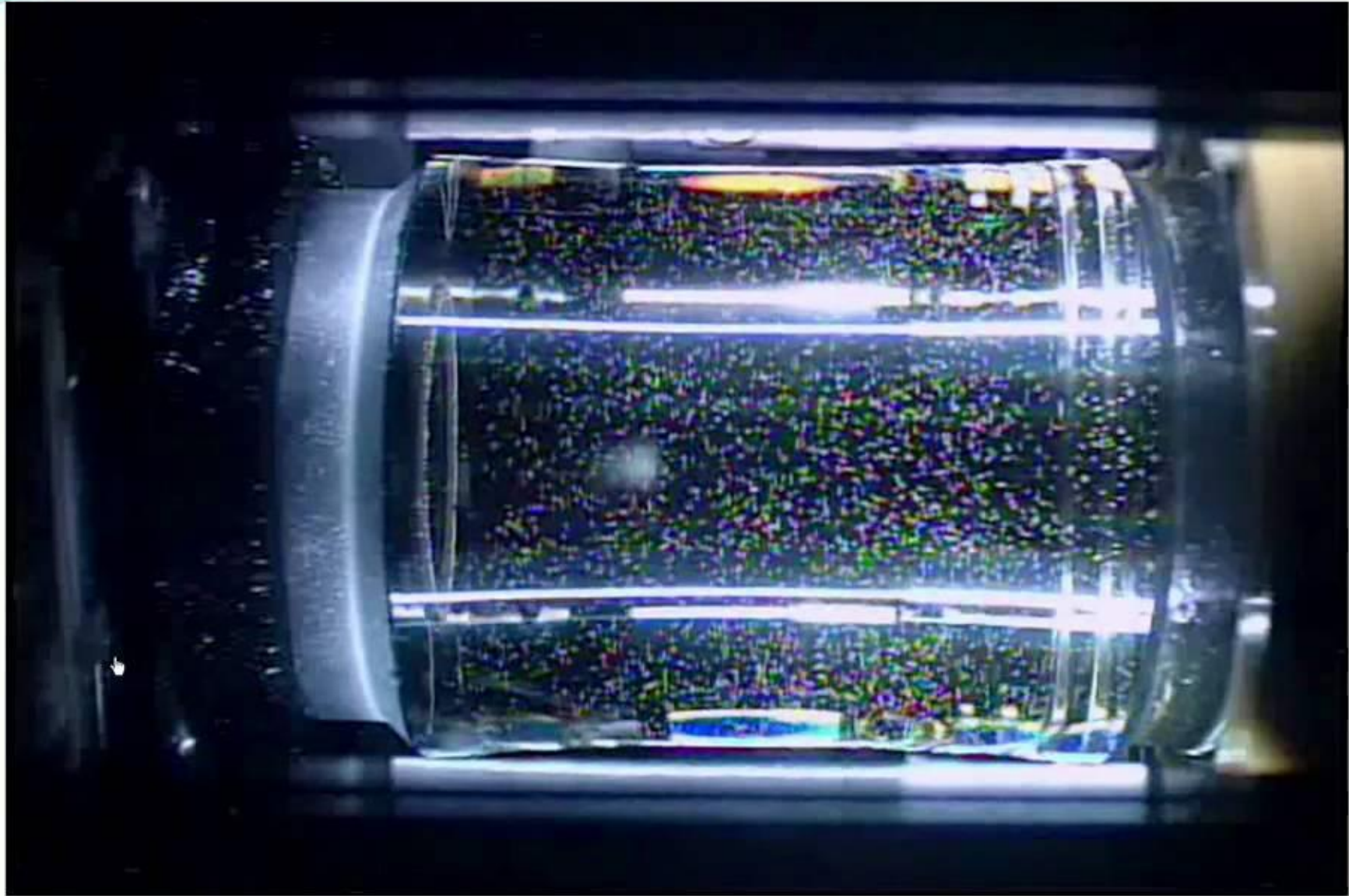


# Marangoni



1  
00:00:08,390 --> 00:00:06,309  
good afternoon everyone i want to

2  
00:00:10,150 --> 00:00:08,400  
welcome all of you uh to the national

3  
00:00:11,350 --> 00:00:10,160  
air and space museum my name is jennifer

4  
00:00:18,470 --> 00:00:11,360  
lavasser

5  
00:00:22,950 --> 00:00:20,470  
it is my honor and pleasure to get to

6  
00:00:24,710 --> 00:00:22,960  
introduce astronaut kevin ford who's

7  
00:00:26,390 --> 00:00:24,720  
here to talk to us about his experience

8  
00:00:29,910 --> 00:00:26,400  
in space

9  
00:00:33,510 --> 00:00:29,920  
kevin is a retired u.s air force colonel

10  
00:00:36,110 --> 00:00:33,520  
and he joined nasa in 2000 he flew he

11  
00:00:38,389 --> 00:00:36,120  
was the pilot of space shuttle flight

12  
00:00:41,030 --> 00:00:38,399  
sts-128 which

13  
00:00:43,030 --> 00:00:41,040

occurred in 2009 happened to be on the

14

00:00:44,790 --> 00:00:43,040

pilot of our own discovery out at the

15

00:00:47,029 --> 00:00:44,800

udvar-hazy center

16

00:00:49,750 --> 00:00:47,039

he also flew to the international space

17

00:00:51,430 --> 00:00:49,760

station in october of 2012 and was

18

00:00:54,950 --> 00:00:51,440

commander of the space station from

19

00:00:56,549 --> 00:00:54,960

november through march of 2013. so he's

20

00:00:58,229 --> 00:00:56,559

only been back on earth for just a few

21

00:01:00,790 --> 00:00:58,239

months

22

00:01:04,630 --> 00:01:00,800

colonel ford has over 4 000 hours of

23

00:01:07,670 --> 00:01:04,640

flying experience and 157 days in space

24

00:01:09,670 --> 00:01:07,680

he's a native of indiana and comes

25

00:01:12,070 --> 00:01:09,680

from the university of notre dame with a

26  
00:01:13,830 --> 00:01:12,080  
bachelor of science degree he has master

27  
00:01:16,149 --> 00:01:13,840  
of science degrees from troy state

28  
00:01:18,230 --> 00:01:16,159  
university and the university of florida

29  
00:01:20,149 --> 00:01:18,240  
and has a phd from the air force

30  
00:01:21,990 --> 00:01:20,159  
institute of technology

31  
00:01:28,310 --> 00:01:22,000  
welcome all to all of you and let's

32  
00:01:32,149 --> 00:01:29,749  
all right

33  
00:01:33,990 --> 00:01:32,159  
thank you jennifer and uh thank you for

34  
00:01:36,390 --> 00:01:34,000  
not saying anything uh negative about

35  
00:01:38,469 --> 00:01:36,400  
notre dame i know you're a michigan grad

36  
00:01:40,550 --> 00:01:38,479  
and that took some restraint i know i

37  
00:01:43,190 --> 00:01:40,560  
appreciate the introduction it's great

38  
00:01:45,590 --> 00:01:43,200

to be here in our nation's air and space

39

00:01:48,469 --> 00:01:45,600

museum and uh my

40

00:01:51,030 --> 00:01:48,479

my uh spaceship discovery is now uh here

41

00:01:52,469 --> 00:01:51,040

at the space uh the space museum as well

42

00:01:54,870 --> 00:01:52,479

and i haven't had a chance to see it

43

00:01:56,630 --> 00:01:54,880

myself yet but i can't wait to get over

44

00:01:58,789 --> 00:01:56,640

and see that

45

00:02:00,149 --> 00:01:58,799

i did have a the great opportunity and

46

00:02:01,910 --> 00:02:00,159

good fortune of flying space shuttle

47

00:02:04,389 --> 00:02:01,920

discovery to the international space

48

00:02:05,670 --> 00:02:04,399

station in late 2009

49

00:02:08,070 --> 00:02:05,680

and then having the opportunity to

50

00:02:11,029 --> 00:02:08,080

return again on a soyuz spacecraft a

51

00:02:12,869 --> 00:02:11,039

russian soyuz to spend uh

52

00:02:15,830 --> 00:02:12,879

five almost five months on the space

53

00:02:17,830 --> 00:02:15,840

station just uh just late last fall uh

54

00:02:19,190 --> 00:02:17,840

through the spring so i did just return

55

00:02:21,510 --> 00:02:19,200

just

56

00:02:23,750 --> 00:02:21,520

two months ago

57

00:02:24,869 --> 00:02:23,760

i see and out here a little bit

58

00:02:26,949 --> 00:02:24,879

just

59

00:02:28,630 --> 00:02:26,959

you know

60

00:02:29,830 --> 00:02:28,640

the mic i think that's cutting out a

61

00:02:33,030 --> 00:02:29,840

little bit

62

00:02:36,229 --> 00:02:33,040

uh and uh how to had a great

63

00:02:38,150 --> 00:02:36,239

living aboard is very different than uh

64

00:02:44,470 --> 00:02:38,160

than visiting on a space shuttle mission

65

00:02:47,030 --> 00:02:45,589

okay i think i'm going to go to the

66

00:02:48,869 --> 00:02:47,040

handheld mics and so it's cutting out

67

00:02:51,430 --> 00:02:48,879

just a little bit there for

68

00:02:53,030 --> 00:02:51,440

our audience outside the building uh the

69

00:02:55,030 --> 00:02:53,040

the living in space is a completely

70

00:02:57,509 --> 00:02:55,040

different thing than visiting on a space

71

00:03:00,550 --> 00:02:57,519

shuttle sortie uh the short the shuttle

72

00:03:02,309 --> 00:03:00,560

sortie of about two weeks is very uh

73

00:03:04,229 --> 00:03:02,319

choreographed orchestrated planned ahead

74

00:03:06,070 --> 00:03:04,239

of time checklists are written out and

75

00:03:07,270 --> 00:03:06,080

we do everything deliver the cargo we

76

00:03:09,589 --> 00:03:07,280

get in and we get out of there and we

77

00:03:11,430 --> 00:03:09,599

try not to disturb the resident crew and

78

00:03:13,990 --> 00:03:11,440

being there as a resident crew doing

79

00:03:15,270 --> 00:03:14,000

science living on board and spending

80

00:03:17,350 --> 00:03:15,280

months and months there is a very

81

00:03:19,589 --> 00:03:17,360

different experience so i'm going to

82

00:03:21,589 --> 00:03:19,599

share today with you uh the information

83

00:03:22,949 --> 00:03:21,599

more about the expedition but at the end

84

00:03:24,070 --> 00:03:22,959

of the session in about a half an hour

85

00:03:26,390 --> 00:03:24,080

we're going to take some questions and

86

00:03:29,030 --> 00:03:26,400

if anybody has any questions about

87

00:03:31,030 --> 00:03:29,040

discovery itself or the soyuz operations

88

00:03:32,949 --> 00:03:31,040

and how they are similar and different

89

00:03:36,550 --> 00:03:32,959

please feel free to ask if we could go

90

00:03:39,910 --> 00:03:36,560

to the first slide i flew up on a soyuz

91

00:03:41,750 --> 00:03:39,920

called soyuz 32s because it was the 32nd

92

00:03:44,229 --> 00:03:41,760

soyuz to visit the international space

93

00:03:46,309 --> 00:03:44,239

station the program history soyuz have

94

00:03:48,869 --> 00:03:46,319

flown many many uh hundreds and hundreds

95

00:03:50,390 --> 00:03:48,879

of sorties safely but this was the 32nd

96

00:03:51,750 --> 00:03:50,400

one to the the space station the

97

00:03:54,550 --> 00:03:51,760

international space station they also

98

00:03:56,949 --> 00:03:54,560

flew to mir and uh before that to solute

99

00:03:58,309 --> 00:03:56,959

and so forth so um there's a there's our

100

00:04:01,110 --> 00:03:58,319

international space station on the

101  
00:04:03,350 --> 00:04:01,120  
screen and also uh the rocket that i

102  
00:04:05,030 --> 00:04:03,360  
flew up on that rocket the soyuz rocket

103  
00:04:07,350 --> 00:04:05,040  
is about the size of a space shuttle

104  
00:04:09,350 --> 00:04:07,360  
solid rocket booster so quite a bit

105  
00:04:10,949 --> 00:04:09,360  
smaller than the space shuttle is itself

106  
00:04:12,949 --> 00:04:10,959  
its sole purpose is just to carry the

107  
00:04:14,550 --> 00:04:12,959  
three people up there deliver them and

108  
00:04:16,390 --> 00:04:14,560  
then serve as a lifeboat while you're on

109  
00:04:18,550 --> 00:04:16,400  
board the space station and come home

110  
00:04:21,030 --> 00:04:18,560  
again there's a beautiful model in this

111  
00:04:22,469 --> 00:04:21,040  
uh in this uh area right here that you

112  
00:04:24,310 --> 00:04:22,479  
can have a look at before you leave too

113  
00:04:26,950 --> 00:04:24,320

i'm gonna spend some time admiring it

114

00:04:28,390 --> 00:04:26,960

it's uh it really gives you a nice feel

115

00:04:29,909 --> 00:04:28,400

of the three-dimensional nature of the

116

00:04:30,790 --> 00:04:29,919

space station if you'll give me the next

117

00:04:32,790 --> 00:04:30,800

slide

118

00:04:35,430 --> 00:04:32,800

i put this this photo in to show you it

119

00:04:37,430 --> 00:04:35,440

was taken at the end of sts-132 as the

120

00:04:39,749 --> 00:04:37,440

space shuttle was departing and it's

121

00:04:41,990 --> 00:04:39,759

almost completely in its glory there you

122

00:04:43,270 --> 00:04:42,000

can see a soyuz dock to the top port

123

00:04:45,030 --> 00:04:43,280

there with those little bitty solar

124

00:04:47,830 --> 00:04:45,040

arrays up in the middle and that is

125

00:04:50,150 --> 00:04:47,840

where when i arrived back in october we

126  
00:04:52,150 --> 00:04:50,160  
parked our soyuz on a module called

127  
00:04:53,670 --> 00:04:52,160  
poisk which means

128  
00:04:55,270 --> 00:04:53,680  
search kind of is in search for

129  
00:04:57,350 --> 00:04:55,280  
knowledge that's where we parked and we

130  
00:04:59,189 --> 00:04:57,360  
left our soyuz there for the for the

131  
00:05:01,029 --> 00:04:59,199  
five months we were on board next slide

132  
00:05:02,870 --> 00:05:01,039  
please this just gives you a feel for

133  
00:05:04,390 --> 00:05:02,880  
the size it's really hard for people to

134  
00:05:06,230 --> 00:05:04,400  
imagine how big the international space

135  
00:05:07,590 --> 00:05:06,240  
station is i can tell you when you see

136  
00:05:09,350 --> 00:05:07,600  
it out the windows as you're approaching

137  
00:05:11,270 --> 00:05:09,360  
it looks absolutely huge there's a

138  
00:05:14,390 --> 00:05:11,280

football field underneath it where the

139

00:05:16,469 --> 00:05:14,400

nasa football team plays and you can see

140

00:05:18,790 --> 00:05:16,479

how how big and how much acreage it

141

00:05:21,670 --> 00:05:18,800

covers the interior volume is about the

142

00:05:23,430 --> 00:05:21,680

interior of what would be a 747 aircraft

143

00:05:26,710 --> 00:05:23,440

if you emptied out this gives us a lot

144

00:05:28,550 --> 00:05:26,720

of room to live and to do science and

145

00:05:30,469 --> 00:05:28,560

maintenance and stow things that you

146

00:05:33,590 --> 00:05:30,479

might need during the course of the

147

00:05:35,670 --> 00:05:33,600

expedition next slide please

148

00:05:38,629 --> 00:05:35,680

we leave now to and from the space

149

00:05:40,950 --> 00:05:38,639

station at the current time on a soyuz

150

00:05:42,870 --> 00:05:40,960

rocket that again just carries three

151

00:05:45,350 --> 00:05:42,880

crew members the spacecraft itself is

152

00:05:46,710 --> 00:05:45,360

tiny and fits underneath the nose of the

153

00:05:49,029 --> 00:05:46,720

fairing on the front of the rocket and

154

00:05:51,430 --> 00:05:49,039

that rocket booster takes us to space in

155

00:05:53,029 --> 00:05:51,440

about nine minutes and this is what it

156

00:05:55,430 --> 00:05:53,039

looks like in kazakhstan you can see we

157

00:05:58,790 --> 00:05:55,440

don't have quite the crowd in kazakhstan

158

00:06:01,430 --> 00:05:58,800

that we would have in florida next slide

159

00:06:03,110 --> 00:06:01,440

there's a after you get into space and

160

00:06:05,350 --> 00:06:03,120

the rocket has done its job and

161

00:06:06,950 --> 00:06:05,360

delivered you there the solar arrays pop

162

00:06:09,350 --> 00:06:06,960

out and you'll see uh you'll get to see

163

00:06:10,790 --> 00:06:09,360

a little uh video in the in the movie

164

00:06:13,029 --> 00:06:10,800

i'm going to show in a second where you

165

00:06:14,550 --> 00:06:13,039

can see those arrays extending and this

166

00:06:16,710 --> 00:06:14,560

is what the spacecraft looks like that

167

00:06:18,710 --> 00:06:16,720

spacecraft is actually made up of that

168

00:06:20,790 --> 00:06:18,720

bulb on the front that's the habitation

169

00:06:23,510 --> 00:06:20,800

module if you can see that

170

00:06:25,749 --> 00:06:23,520

that's not accessible during launch

171

00:06:27,510 --> 00:06:25,759

it's closed off and that's where we live

172

00:06:28,870 --> 00:06:27,520

during the two-day transit to the

173

00:06:31,270 --> 00:06:28,880

international space station because it

174

00:06:33,590 --> 00:06:31,280

takes us as a routine about 50 hours to

175

00:06:34,950 --> 00:06:33,600

get there the middle section of that

176

00:06:37,670 --> 00:06:34,960

piece right there looks like a little

177

00:06:39,670 --> 00:06:37,680

gumdrop shape and that is the descent

178

00:06:41,430 --> 00:06:39,680

module and that's the piece that we end

179

00:06:43,189 --> 00:06:41,440

up coming all the way to the ground in

180

00:06:45,510 --> 00:06:43,199

that's the only part of the spacecraft

181

00:06:46,950 --> 00:06:45,520

that survives re-entry all the way to

182

00:06:48,870 --> 00:06:46,960

the ground and it's got the parachutes

183

00:06:51,270 --> 00:06:48,880

in it it's got a main and a spare and

184

00:06:53,189 --> 00:06:51,280

that's how we get home safely and then

185

00:06:56,070 --> 00:06:53,199

the bottom section is the electrical you

186

00:06:57,670 --> 00:06:56,080

can see the arrays and the solar well

187

00:06:59,589 --> 00:06:57,680

the solar arrays and the propulsion

188

00:07:01,670 --> 00:06:59,599

system on the back and lots of antennas

189

00:07:03,830 --> 00:07:01,680

and this is where the main engine is as

190

00:07:05,510 --> 00:07:03,840

well that allows us to increase our

191

00:07:07,430 --> 00:07:05,520

altitude and do our rendezvous with the

192

00:07:09,110 --> 00:07:07,440

space station and then when it's time to

193

00:07:12,150 --> 00:07:09,120

come home to fly away from the space

194

00:07:13,670 --> 00:07:12,160

station safely and then do our slow down

195

00:07:16,070 --> 00:07:13,680

burn we have to burn

196

00:07:18,629 --> 00:07:16,080

an engine for about almost five minutes

197

00:07:21,430 --> 00:07:18,639

now from the 250 miles of altitude and

198

00:07:23,510 --> 00:07:21,440

that slowing down is what allows us to

199

00:07:25,270 --> 00:07:23,520

fall back to the earth and out of orbit

200

00:07:26,629 --> 00:07:25,280

we now if once we've slowed down we

201  
00:07:28,710 --> 00:07:26,639  
don't have the speed to stay in orbit

202  
00:07:31,510 --> 00:07:28,720  
anymore we fall back we catch the

203  
00:07:33,510 --> 00:07:31,520  
atmosphere and we essentially re-enter

204  
00:07:34,950 --> 00:07:33,520  
just like a meteor would so

205  
00:07:36,629 --> 00:07:34,960  
that's the way we come home and then a

206  
00:07:41,029 --> 00:07:36,639  
parachute to a hard landing on the

207  
00:07:43,670 --> 00:07:41,039  
ground in kazakhstan next slide please

208  
00:07:46,070 --> 00:07:43,680  
this is just a really cool space shot of

209  
00:07:48,469 --> 00:07:46,080  
my buddies that joined me in the middle

210  
00:07:50,230 --> 00:07:48,479  
of the the expedition and my time on

211  
00:07:52,230 --> 00:07:50,240  
board coming in the moon in the

212  
00:07:55,029 --> 00:07:52,240  
background and the soyuz pointing at us

213  
00:07:57,749 --> 00:07:55,039

in the black of space it's really

214

00:07:59,110 --> 00:07:57,759

it's really an amazing set of machines

215

00:08:01,270 --> 00:07:59,120

but when you get into space and you look

216

00:08:03,430 --> 00:08:01,280

at the beauty of it it seems uh so

217

00:08:06,150 --> 00:08:03,440

simple against the blackness of the

218

00:08:07,589 --> 00:08:06,160

cosmos next slide

219

00:08:10,869 --> 00:08:07,599

these are the crews i was there as part

220

00:08:13,270 --> 00:08:10,879

of expedition 33 and then expedition 34.

221

00:08:15,110 --> 00:08:13,280

so you usually split your time you're a

222

00:08:16,629 --> 00:08:15,120

three-person crew that goes up and you

223

00:08:18,150 --> 00:08:16,639

join a three-person crew that's already

224

00:08:20,070 --> 00:08:18,160

been there so they're the senior crew if

225

00:08:21,749 --> 00:08:20,080

you will and then we're the junior crew

226

00:08:24,629 --> 00:08:21,759

for a while they teach us all about the

227

00:08:27,029 --> 00:08:24,639

station space station get us all set up

228

00:08:29,270 --> 00:08:27,039

hand it over and then they leave and a

229

00:08:31,749 --> 00:08:29,280

new crew comes up so that's my first uh

230

00:08:34,070 --> 00:08:31,759

six six-person expedition the top left

231

00:08:35,909 --> 00:08:34,080

and the final compliment we had on board

232

00:08:37,670 --> 00:08:35,919

on the bottom right three members of the

233

00:08:40,310 --> 00:08:37,680

crew on the bottom right picture there

234

00:08:43,350 --> 00:08:40,320

are uh in the dark blue seats uh

235

00:08:46,150 --> 00:08:43,360

romanenko hadfield marshburn just landed

236

00:08:47,990 --> 00:08:46,160

last night in kazakhstan and are on

237

00:08:49,750 --> 00:08:48,000

their way back to their homes as we

238

00:08:51,590 --> 00:08:49,760

speaking i know hadfield and marshburn are

239

00:08:53,509 --> 00:08:51,600

in an airplane somewhere over the

240

00:08:56,710 --> 00:08:53,519

atlantic headed to houston at this very

241

00:08:58,070 --> 00:08:56,720

second next slide

242

00:08:59,350 --> 00:08:58,080

this is the last slide i'm going to show

243

00:09:01,190 --> 00:08:59,360

before i start a little bit of a crew

244

00:09:02,550 --> 00:09:01,200

movie and i wanted to show you this one

245

00:09:04,710 --> 00:09:02,560

because in the movie you're going to see

246

00:09:07,110 --> 00:09:04,720

these two guys flying these two little

247

00:09:09,590 --> 00:09:07,120

bowling ball sized satellites are called

248

00:09:11,670 --> 00:09:09,600

spheres it's just one of the

249

00:09:13,350 --> 00:09:11,680

engineering test bed things that we do

250

00:09:15,190 --> 00:09:13,360

on space station if you will and these

251  
00:09:16,470 --> 00:09:15,200  
two these satellites can fly around they

252  
00:09:18,230 --> 00:09:16,480  
have their own propulsion system and

253  
00:09:19,910 --> 00:09:18,240  
their own brains and i wanted to show

254  
00:09:21,030 --> 00:09:19,920  
you this because in the movie you can't

255  
00:09:23,030 --> 00:09:21,040  
tell it very well but the one on the

256  
00:09:24,710 --> 00:09:23,040  
left there the red guy actually has his

257  
00:09:27,110 --> 00:09:24,720  
own brains and his own eyes you can see

258  
00:09:29,829 --> 00:09:27,120  
the the lens caps there on the glasses

259  
00:09:31,829 --> 00:09:29,839  
and he can find the blue satellite fly

260  
00:09:33,750 --> 00:09:31,839  
over to it fly in look at it from a

261  
00:09:35,590 --> 00:09:33,760  
certain angle which is all very useful

262  
00:09:37,269 --> 00:09:35,600  
someday in space if you want to send

263  
00:09:39,030 --> 00:09:37,279

your robot out to go look for pneumonia

264

00:09:40,550 --> 00:09:39,040

leak you could just put it out the hatch

265

00:09:42,070 --> 00:09:40,560

you could go out go find the leak take

266

00:09:43,670 --> 00:09:42,080

pictures of it and send it back inside

267

00:09:45,670 --> 00:09:43,680

to you we wouldn't have to go out and do

268

00:09:47,990 --> 00:09:45,680

a spacewalk and invest all those

269

00:09:50,470 --> 00:09:48,000

resources a few three or four days of

270

00:09:53,110 --> 00:09:50,480

resources to go find problems like that

271

00:09:55,030 --> 00:09:53,120

so if you could now we'll take it to the

272

00:09:56,790 --> 00:09:55,040

to the movie and i'll be uh just

273

00:10:00,070 --> 00:09:56,800

narrating most of the movie there is

274

00:10:01,269 --> 00:10:00,080

some sound uh as well so i'll i'll quiet

275

00:10:03,269 --> 00:10:01,279

down a little bit when there's something

276

00:10:05,590 --> 00:10:03,279

to be heard

277

00:10:08,710 --> 00:10:05,600

so these are clips uh really both of uh

278

00:10:10,870 --> 00:10:08,720

expedition 33 and 34. again we launched

279

00:10:12,150 --> 00:10:10,880

uh on the 23rd of october out of

280

00:10:15,350 --> 00:10:12,160

kazakhstan

281

00:10:17,509 --> 00:10:15,360

and uh on the on the days prior to the

282

00:10:18,870 --> 00:10:17,519

to arriving in kazakhstan they roll the

283

00:10:21,590 --> 00:10:18,880

rocket out they take it out of its

284

00:10:23,590 --> 00:10:21,600

hangar on a train track and early

285

00:10:25,110 --> 00:10:23,600

morning the prime crew doesn't ever get

286

00:10:27,190 --> 00:10:25,120

to see the rocket before launch but the

287

00:10:29,030 --> 00:10:27,200

backup crew gets to go see you can see

288

00:10:30,870 --> 00:10:29,040

it's got strap-on boosters on the back

289

00:10:32,710 --> 00:10:30,880

and a middle section it's got kerosene

290

00:10:34,310 --> 00:10:32,720

and liquid oxygen is propellant and then

291

00:10:36,150 --> 00:10:34,320

the spacecraft is underneath the white

292

00:10:37,990 --> 00:10:36,160

section on the front which you'll see in

293

00:10:39,509 --> 00:10:38,000

just a minute it never hurts to get a

294

00:10:41,509 --> 00:10:39,519

little blessing before you go fly in

295

00:10:43,350 --> 00:10:41,519

space we are very happy to get that

296

00:10:45,190 --> 00:10:43,360

nobody ever turns that down as far as i

297

00:10:47,750 --> 00:10:45,200

know we'll take all the luck we can get

298

00:10:49,269 --> 00:10:47,760

and all the help we can get so walk out

299

00:10:52,470 --> 00:10:49,279

to the bus usually some of the family

300

00:10:54,710 --> 00:10:52,480

members get to come and join us and and

301  
00:10:56,389 --> 00:10:54,720  
see us off real briefly we are

302  
00:10:58,069 --> 00:10:56,399  
quarantined so it's very carefully

303  
00:10:59,990 --> 00:10:58,079  
controlled those are doctors walking

304  
00:11:01,509 --> 00:11:00,000  
behind us to make sure we don't touch

305  
00:11:02,949 --> 00:11:01,519  
any of the wrong people we're allowed to

306  
00:11:04,470 --> 00:11:02,959  
touch the big shots but we're not

307  
00:11:07,190 --> 00:11:04,480  
allowed to touch any of the wrong people

308  
00:11:10,310 --> 00:11:07,200  
so we get suited up we do wear pressure

309  
00:11:11,910 --> 00:11:10,320  
suits on ascent and entry as well and

310  
00:11:13,030 --> 00:11:11,920  
you climb in through that opening right

311  
00:11:15,590 --> 00:11:13,040  
there and then they tie it up with

312  
00:11:17,350 --> 00:11:15,600  
rubber bands twice they fold it over and

313  
00:11:19,190 --> 00:11:17,360

they stick it in and you zip it up tight

314

00:11:21,829 --> 00:11:19,200

and it actually holds pressure just fine

315

00:11:23,990 --> 00:11:21,839

so we do we do get the suits put on by

316

00:11:25,509 --> 00:11:24,000

professionals we do everything way too

317

00:11:26,630 --> 00:11:25,519

early so there's a lot of sitting around

318

00:11:29,190 --> 00:11:26,640

and waiting

319

00:11:30,710 --> 00:11:29,200

a lot of times before launch time

320

00:11:32,790 --> 00:11:30,720

this is a chance to get in the

321

00:11:34,870 --> 00:11:32,800

specialists make sure the suit is get

322

00:11:37,030 --> 00:11:34,880

them a teaching that's actually air

323

00:11:39,030 --> 00:11:37,040

tight and it can hold pressure and we

324

00:11:41,190 --> 00:11:39,040

make sure that if for some reason on

325

00:11:43,110 --> 00:11:41,200

ascent the spacecraft depressurizes

326

00:11:45,190 --> 00:11:43,120

because of some kind of problem or we

327

00:11:47,190 --> 00:11:45,200

have to re-enter immediately and we have

328

00:11:49,430 --> 00:11:47,200

some kind of depressurization

329

00:11:51,750 --> 00:11:49,440

then we will be safe inside these suits

330

00:11:53,829 --> 00:11:51,760

all pressured up it is like being inside

331

00:11:55,829 --> 00:11:53,839

a really really tight beach ball though

332

00:11:57,350 --> 00:11:55,839

it doesn't give you much mobility it's a

333

00:11:59,829 --> 00:11:57,360

little tight and uncomfortable to work

334

00:12:02,629 --> 00:11:59,839

in but it's better than the alternative

335

00:12:04,710 --> 00:12:02,639

if you were to depressurize to vacuum

336

00:12:06,710 --> 00:12:04,720

so all the formalities a lot of nasa

337

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

management came to join us and see us

338

00:12:10,389 --> 00:12:08,959

off which is very heartwarming to see a

339

00:12:12,550 --> 00:12:10,399

lot of your friends

340

00:12:14,310 --> 00:12:12,560

there all the way in kazakhstan much

341

00:12:17,190 --> 00:12:14,320

appreciated the chiefer ross cosmo is

342

00:12:19,670 --> 00:12:17,200

here saying final goodbyes and telling

343

00:12:21,910 --> 00:12:19,680

us not to mess up up the ladder we go we

344

00:12:23,829 --> 00:12:21,920

get into a very small elevator and crawl

345

00:12:25,750 --> 00:12:23,839

up and then spend about oh 45 minutes

346

00:12:27,269 --> 00:12:25,760

getting into our seats uh the first time

347

00:12:29,030 --> 00:12:27,279

you ever actually make the entry into

348

00:12:32,069 --> 00:12:29,040

the spacecraft and take your perch

349

00:12:33,430 --> 00:12:32,079

inside the soyuz is launch day you get

350

00:12:35,430 --> 00:12:33,440

in there once that one other time but

351  
00:12:37,190 --> 00:12:35,440  
not in the same way you do this day

352  
00:12:38,710 --> 00:12:37,200  
so here's a little launch sequence i'll

353  
00:12:40,389 --> 00:12:38,720  
just kind of let the video or the audio

354  
00:12:43,829 --> 00:12:40,399  
play on this one

355  
00:12:46,550 --> 00:12:43,839  
lift off liftoff of kevin ford evgeny

356  
00:12:48,470 --> 00:12:46,560  
tarakin and oleg novitskiy as they head

357  
00:13:00,949 --> 00:12:48,480  
on a two-day trip to the international

358  
00:13:04,949 --> 00:13:02,949  
a little bit of high clouds but uh

359  
00:13:07,430 --> 00:13:04,959  
didn't really get in our way as we punch

360  
00:13:10,069 --> 00:13:07,440  
up through the rocket launch is just a

361  
00:13:11,670 --> 00:13:10,079  
big push in the back lots of vibration

362  
00:13:14,069 --> 00:13:11,680  
lots of stirring left and right and up

363  
00:13:16,230 --> 00:13:14,079

and down as the rocket steers itself and

364

00:13:18,470 --> 00:13:16,240

then big booms and bangs is like you can

365

00:13:19,430 --> 00:13:18,480

see the strap-on boosters coming up off

366

00:13:21,110 --> 00:13:19,440

right

367

00:13:22,629 --> 00:13:21,120

they last about two minutes then they

368

00:13:24,550 --> 00:13:22,639

separate and fly off and every time one

369

00:13:26,389 --> 00:13:24,560

of these pyrotechnic events happens

370

00:13:27,910 --> 00:13:26,399

there's a big bang inside and you kind

371

00:13:29,750 --> 00:13:27,920

of okay that was supposed to be there

372

00:13:31,990 --> 00:13:29,760

right yeah that was supposed to be there

373

00:13:33,670 --> 00:13:32,000

and then you're happy we have usually

374

00:13:35,750 --> 00:13:33,680

have a little toy hanging inside so that

375

00:13:37,750 --> 00:13:35,760

we can see when we're in zero g and kind

376

00:13:39,269 --> 00:13:37,760

of what the g level is you can see that

377

00:13:41,509 --> 00:13:39,279

thing swinging at kind of a high

378

00:13:42,949 --> 00:13:41,519

frequency doesn't quite look normal like

379

00:13:44,629 --> 00:13:42,959

it would swing if you had it hanging at

380

00:13:46,310 --> 00:13:44,639

home and that's because and under the

381

00:13:49,030 --> 00:13:46,320

high g's it swings in a little bit of a

382

00:13:50,949 --> 00:13:49,040

stiffer fashion

383

00:13:52,790 --> 00:13:50,959

we've at this point just shut down the

384

00:13:54,470 --> 00:13:52,800

engines uh this thing's happened fast

385

00:13:56,230 --> 00:13:54,480

here if you look in the window in the

386

00:13:57,990 --> 00:13:56,240

top top of the screen you can see the

387

00:13:59,509 --> 00:13:58,000

solar array through the glass there

388

00:14:01,829 --> 00:13:59,519

that's deployed it's all deployed

389

00:14:03,509 --> 00:14:01,839

automatically and after we get off the

390

00:14:05,829 --> 00:14:03,519

rocket we're kicked off again with like

391

00:14:07,990 --> 00:14:05,839

a pyro explosion and then for the next

392

00:14:10,230 --> 00:14:08,000

orbit we just tumble we just tumble

393

00:14:11,829 --> 00:14:10,240

outside and you can see our toy is

394

00:14:13,110 --> 00:14:11,839

telling us it's floating and if we

395

00:14:14,389 --> 00:14:13,120

weren't strapped in our seats we'd be

396

00:14:16,310 --> 00:14:14,399

doing the same thing but we stayed

397

00:14:18,470 --> 00:14:16,320

strapped in nice and tight for quite a

398

00:14:20,870 --> 00:14:18,480

while because after we get off we fire

399

00:14:23,030 --> 00:14:20,880

up all the spacecraft systems and turn

400

00:14:25,030 --> 00:14:23,040

on the jets and we do some maneuvering

401  
00:14:26,470 --> 00:14:25,040  
and we do some burns we actually call

402  
00:14:29,269 --> 00:14:26,480  
them burns when we light our rocket

403  
00:14:31,670 --> 00:14:29,279  
engine and add some altitude to our

404  
00:14:33,990 --> 00:14:31,680  
orbit at just the right times so that

405  
00:14:35,509 --> 00:14:34,000  
two days further down the line we'll be

406  
00:14:36,870 --> 00:14:35,519  
in a position to fly up to the

407  
00:14:38,870 --> 00:14:36,880  
international space station and

408  
00:14:40,629 --> 00:14:38,880  
rendezvous with it

409  
00:14:42,389 --> 00:14:40,639  
so this is oleg my soyuz commander and

410  
00:14:44,949 --> 00:14:42,399  
you have guinea there's out my window a

411  
00:14:47,670 --> 00:14:44,959  
little bit of jets firing and so forth

412  
00:14:50,310 --> 00:14:47,680  
and this is uh taken uh

413  
00:14:52,550 --> 00:14:50,320

out out my my right window that's the

414

00:14:54,389 --> 00:14:52,560

nile river valley right there during our

415

00:14:57,269 --> 00:14:54,399

orbits during the first couple days

416

00:14:59,350 --> 00:14:57,279

really spectacular uh to be up there the

417

00:15:01,269 --> 00:14:59,360

two cosmonauts i flew with were both

418

00:15:02,550 --> 00:15:01,279

first-time soyuz flyers i don't call

419

00:15:04,150 --> 00:15:02,560

them rookies because they're super

420

00:15:05,670 --> 00:15:04,160

experienced but they

421

00:15:07,590 --> 00:15:05,680

they are first time flyers and of course

422

00:15:09,590 --> 00:15:07,600

it was my my first time in the soyuz as

423

00:15:11,590 --> 00:15:09,600

well so this is a new experience to most

424

00:15:13,590 --> 00:15:11,600

of us that little spin right there on

425

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

that toy that's a toy soyuz inside a

426

00:15:17,829 --> 00:15:15,760

real soyuz and that's the kind of spin

427

00:15:19,590 --> 00:15:17,839

we do for a couple days as we're waiting

428

00:15:21,430 --> 00:15:19,600

to catch up and phase up to the

429

00:15:23,350 --> 00:15:21,440

international space station we do that

430

00:15:25,430 --> 00:15:23,360

to stabilize our attitude so that we can

431

00:15:27,430 --> 00:15:25,440

keep our solar rays pointed at the sun

432

00:15:30,470 --> 00:15:27,440

and this is what it looks like out the

433

00:15:31,829 --> 00:15:30,480

window as we as we make this solar spin

434

00:15:33,910 --> 00:15:31,839

it's about two and a half degrees per

435

00:15:36,790 --> 00:15:33,920

second and it just keeps us in a nice

436

00:15:39,269 --> 00:15:36,800

inertial orientation with the sun always

437

00:15:42,470 --> 00:15:39,279

perpendicular to our solar rays

438

00:15:44,389 --> 00:15:42,480

so we rendezvous again after 50 hours so

439

00:15:46,069 --> 00:15:44,399

it's uh it's an amazing time to be in a

440

00:15:47,829 --> 00:15:46,079

tiny little spacecraft the spacecraft

441

00:15:49,430 --> 00:15:47,839

would fit on this stage and flying

442

00:15:51,990 --> 00:15:49,440

through space but then ultimately the

443

00:15:55,430 --> 00:15:52,000

job is to get up to the space station

444

00:15:57,110 --> 00:15:55,440

and get to work that's why uh nasa

445

00:15:58,550 --> 00:15:57,120

takes care of getting our seats for us

446

00:16:00,389 --> 00:15:58,560

with the russians and gets us up there

447

00:16:01,990 --> 00:16:00,399

to do the research this is uh right

448

00:16:04,470 --> 00:16:02,000

after we arrived on board we popped

449

00:16:05,829 --> 00:16:04,480

inside said hello to our new crew five

450

00:16:08,150 --> 00:16:05,839

days after i got there there was a

451  
00:16:10,310 --> 00:16:08,160  
spacewalk to do so i suited sunny

452  
00:16:11,910 --> 00:16:10,320  
williams and ocuside up and they went

453  
00:16:13,189 --> 00:16:11,920  
outside to fix a little problem with an

454  
00:16:15,590 --> 00:16:13,199  
ammonia leak

455  
00:16:16,949 --> 00:16:15,600  
outside on the space station

456  
00:16:18,470 --> 00:16:16,959  
they did take care of the problem then

457  
00:16:20,470 --> 00:16:18,480  
that problem has recurred a little bit

458  
00:16:22,310 --> 00:16:20,480  
since and we just had another spacewalk

459  
00:16:23,910 --> 00:16:22,320  
about four or five days ago in which

460  
00:16:25,829 --> 00:16:23,920  
those guys went out and did a little bit

461  
00:16:27,670 --> 00:16:25,839  
more work out there

462  
00:16:29,990 --> 00:16:27,680  
they were only with us for about three

463  
00:16:31,350 --> 00:16:30,000

weeks just a little bit irregular but we

464

00:16:32,710 --> 00:16:31,360

didn't have too much hand over time with

465

00:16:34,310 --> 00:16:32,720

sonny and aki

466

00:16:36,389 --> 00:16:34,320

there i am alone looking out through the

467

00:16:38,230 --> 00:16:36,399

cupola windows and

468

00:16:39,509 --> 00:16:38,240

taking taken some opportunities when i

469

00:16:41,509 --> 00:16:39,519

was there on weekends to get some

470

00:16:43,189 --> 00:16:41,519

photography of the ground and getting

471

00:16:45,189 --> 00:16:43,199

familiar with the earth outside it's

472

00:16:47,350 --> 00:16:45,199

really spectacular when i flew on the

473

00:16:49,269 --> 00:16:47,360

shuttle i had very little time for that

474

00:16:51,350 --> 00:16:49,279

but when i flew on the on the space

475

00:16:53,350 --> 00:16:51,360

station for 144 days i had a lot more

476  
00:16:55,189 --> 00:16:53,360  
time this is actually the ground in this

477  
00:16:56,629 --> 00:16:55,199  
area right here if you watch just

478  
00:16:59,269 --> 00:16:56,639  
shortly on the left side that's patuxent

479  
00:17:01,110 --> 00:16:59,279  
river maryland right there that base and

480  
00:17:02,470 --> 00:17:01,120  
i'm showing this because this is if you

481  
00:17:03,990 --> 00:17:02,480  
look at the ground this is how fast

482  
00:17:06,069 --> 00:17:04,000  
we're moving we're doing five miles

483  
00:17:07,909 --> 00:17:06,079  
every single second in the space station

484  
00:17:09,590 --> 00:17:07,919  
going around the earth every 90 minutes

485  
00:17:11,110 --> 00:17:09,600  
and i always thought it'd really be neat

486  
00:17:13,189 --> 00:17:11,120  
to have a space station right down at

487  
00:17:15,270 --> 00:17:13,199  
ground level flying by and you could

488  
00:17:17,750 --> 00:17:15,280

watch it fly by can you imagine 10 miles

489

00:17:19,829 --> 00:17:17,760

away five miles away over you five miles

490

00:17:22,309 --> 00:17:19,839

away and 10 miles away i mean it's just

491

00:17:23,750 --> 00:17:22,319

an incredible rate of speed uh but

492

00:17:24,630 --> 00:17:23,760

because we're up out of the atmosphere

493

00:17:27,429 --> 00:17:24,640

we don't have to worry about

494

00:17:29,029 --> 00:17:27,439

aerodynamics and all is uh safe

495

00:17:30,710 --> 00:17:29,039

so we get in the windows when we can

496

00:17:32,230 --> 00:17:30,720

when we go away we close them up make

497

00:17:33,990 --> 00:17:32,240

sure they don't get struck by any micro

498

00:17:35,270 --> 00:17:34,000

meteorites or anything

499

00:17:37,669 --> 00:17:35,280

while we're up there some interesting

500

00:17:39,590 --> 00:17:37,679

things happen one of them is we had this

501  
00:17:41,669 --> 00:17:39,600  
really high beta period where the sun is

502  
00:17:44,070 --> 00:17:41,679  
out to the perpendicular to our orbit

503  
00:17:45,830 --> 00:17:44,080  
plane so as we fly around the earth we

504  
00:17:47,750 --> 00:17:45,840  
always are in the sunlight it just stays

505  
00:17:49,830 --> 00:17:47,760  
over to the side and goes around in

506  
00:17:51,750 --> 00:17:49,840  
circles for days on end and then slowly

507  
00:17:53,510 --> 00:17:51,760  
it comes back around and starts to be in

508  
00:17:55,270 --> 00:17:53,520  
your plane again and goes around you

509  
00:17:56,710 --> 00:17:55,280  
over your head and back into the earth

510  
00:17:58,390 --> 00:17:56,720  
and then you get night time again and

511  
00:18:00,150 --> 00:17:58,400  
daytime again but in the high beta

512  
00:18:02,150 --> 00:18:00,160  
periods it's always out to the side so

513  
00:18:05,110 --> 00:18:02,160

that's really difficult thing for the

514

00:18:07,510 --> 00:18:05,120

thermal guys to deal with during that

515

00:18:09,430 --> 00:18:07,520

just before christmas time we got a new

516

00:18:12,470 --> 00:18:09,440

crew this is the the crew of what we

517

00:18:14,310 --> 00:18:12,480

call 33s the guys who just came home

518

00:18:15,990 --> 00:18:14,320

last night as a matter of fact and this

519

00:18:18,070 --> 00:18:16,000

is a video i took of them docking on

520

00:18:19,350 --> 00:18:18,080

docking day just before christmas some a

521

00:18:21,190 --> 00:18:19,360

little if you watch closely at the end

522

00:18:23,430 --> 00:18:21,200

you'll see thrusters firing on the soyuz

523

00:18:24,870 --> 00:18:23,440

as it comes and it bumps into the proper

524

00:18:26,870 --> 00:18:24,880

place you're allowed to bump into the

525

00:18:28,470 --> 00:18:26,880

space station but only in the place that

526

00:18:31,350 --> 00:18:28,480

the engineers have decided it's okay to

527

00:18:35,669 --> 00:18:31,360

bump into it and it catches on to you

528

00:18:38,710 --> 00:18:36,390

so

529

00:18:40,070 --> 00:18:38,720

we had christmas day off and we called

530

00:18:42,150 --> 00:18:40,080

the ground and sang some christmas

531

00:18:43,990 --> 00:18:42,160

carols to them had a little bit of fun

532

00:18:46,549 --> 00:18:44,000

and merriment usually it's very hard

533

00:18:47,830 --> 00:18:46,559

work up there but some days in space or

534

00:18:50,230 --> 00:18:47,840

just made to be

535

00:18:52,870 --> 00:18:50,240

made to be leisure and we had a lot of

536

00:18:53,990 --> 00:18:52,880

fun that day had some santa came to see

537

00:18:56,310 --> 00:18:54,000

us and

538

00:19:05,029 --> 00:18:56,320

it was a day of playing just like

539

00:19:09,990 --> 00:19:07,510

i had to cry uncle finally say no no

540

00:19:11,750 --> 00:19:10,000

more so christmas day this is how we

541

00:19:13,270 --> 00:19:11,760

weigh ourselves so of course after

542

00:19:15,510 --> 00:19:13,280

christmas feast day you have to get

543

00:19:18,070 --> 00:19:15,520

weighed and this works on an engineering

544

00:19:19,909 --> 00:19:18,080

principle where the frequency uh

545

00:19:21,510 --> 00:19:19,919

the the frequency you have depends on

546

00:19:23,669 --> 00:19:21,520

your mass so you can tell exactly what

547

00:19:25,270 --> 00:19:23,679

your mass is we do a lot of science we

548

00:19:26,549 --> 00:19:25,280

drop a lot of things things go flying

549

00:19:29,029 --> 00:19:26,559

away in space

550

00:19:31,990 --> 00:19:29,039

this is me getting to a freezer that's a

551  
00:19:34,310 --> 00:19:32,000  
minus 95 degrees celsius so it keeps

552  
00:19:36,950 --> 00:19:34,320  
things frozen very cold that's some

553  
00:19:38,470 --> 00:19:36,960  
urine samples that i've taken

554  
00:19:39,590 --> 00:19:38,480  
earlier in the day and i'm putting them

555  
00:19:41,270 --> 00:19:39,600  
away in the freezer and they'll come

556  
00:19:43,430 --> 00:19:41,280  
home for science they can tell by

557  
00:19:45,590 --> 00:19:43,440  
looking at that urine samples and blood

558  
00:19:47,110 --> 00:19:45,600  
samples how much bone we are losing and

559  
00:19:48,789 --> 00:19:47,120  
how much gain we're how much we're

560  
00:19:49,590 --> 00:19:48,799  
gaining back by the types of food we're

561  
00:19:51,190 --> 00:19:49,600  
eating

562  
00:19:52,870 --> 00:19:51,200  
i showed you that slide of these two

563  
00:19:54,470 --> 00:19:52,880

satellites and that one then my right

564

00:19:55,750 --> 00:19:54,480

hand there is the one that has the

565

00:19:57,350 --> 00:19:55,760

goggles

566

00:19:58,789 --> 00:19:57,360

and it's actually looking at the other

567

00:20:00,230 --> 00:19:58,799

one and we turn them loose and then

568

00:20:01,990 --> 00:20:00,240

these guys can fly relative to each

569

00:20:04,390 --> 00:20:02,000

other for 15 minutes and the engineers

570

00:20:06,230 --> 00:20:04,400

on the ground can work on the algorithms

571

00:20:07,510 --> 00:20:06,240

they need to to figure out how to

572

00:20:09,750 --> 00:20:07,520

maneuver these things to make them

573

00:20:12,070 --> 00:20:09,760

autonomous how to program them up to go

574

00:20:14,470 --> 00:20:12,080

out and do a job this is running a

575

00:20:16,549 --> 00:20:14,480

little bit faster than real time but you

576

00:20:18,230 --> 00:20:16,559

can see that the blue guy there the

577

00:20:19,510 --> 00:20:18,240

close one to us is doing a little work

578

00:20:21,430 --> 00:20:19,520

on the other guy doing a little

579

00:20:23,029 --> 00:20:21,440

inspection

580

00:20:25,909 --> 00:20:23,039

and this ad this experiment is called

581

00:20:29,590 --> 00:20:28,070

very fun to do on board to set these up

582

00:20:30,789 --> 00:20:29,600

and watch them fly around i might just

583

00:20:32,310 --> 00:20:30,799

something you might do for three hours

584

00:20:34,390 --> 00:20:32,320

on an afternoon

585

00:20:35,669 --> 00:20:34,400

this is a picture of uh some fish that

586

00:20:37,909 --> 00:20:35,679

we had on board while we were up there

587

00:20:39,990 --> 00:20:37,919

called medaka they have bones that are

588

00:20:42,390 --> 00:20:40,000

just like mammals and we can look at how

589

00:20:43,990 --> 00:20:42,400

their bone is created and destroyed and

590

00:20:47,110 --> 00:20:44,000

look at the what they call the

591

00:20:49,750 --> 00:20:47,120

osteoclasts and the osteoblast formation

592

00:20:51,029 --> 00:20:49,760

and japanese investigators think that

593

00:20:52,549 --> 00:20:51,039

there's some really good chance that

594

00:20:55,270 --> 00:20:52,559

they'll make a very big impact someday

595

00:20:56,630 --> 00:20:55,280

on osteoporosis and what a legacy just

596

00:20:59,270 --> 00:20:56,640

that alone would be for the space

597

00:21:01,510 --> 00:20:59,280

station if the world's population

598

00:21:04,149 --> 00:21:01,520

someday had some kind of

599

00:21:06,470 --> 00:21:04,159

cure or prevention for osteoporosis so

600

00:21:07,909 --> 00:21:06,480

it makes such a big difference

601  
00:21:09,590 --> 00:21:07,919  
this is just a piece of equipment that

602  
00:21:11,190 --> 00:21:09,600  
tom and i worked on for three days there

603  
00:21:12,710 --> 00:21:11,200  
that's tom marshburn and i and we're

604  
00:21:14,710 --> 00:21:12,720  
just getting ready to put it back and

605  
00:21:16,710 --> 00:21:14,720  
and reassemble it it's a carbon dioxide

606  
00:21:19,270 --> 00:21:16,720  
scrubber but it kind of shows you how

607  
00:21:22,149 --> 00:21:19,280  
massive things just flowed in space and

608  
00:21:24,870 --> 00:21:22,159  
and how interesting it is to work there

609  
00:21:26,470 --> 00:21:24,880  
some science is uh is more for

610  
00:21:28,230 --> 00:21:26,480  
spacecraft this is something they're

611  
00:21:30,310 --> 00:21:28,240  
looking at how to control fluids and

612  
00:21:31,590 --> 00:21:30,320  
fuel tanks if you think about your car

613  
00:21:33,510 --> 00:21:31,600

at home you never have to worry about

614

00:21:34,789 --> 00:21:33,520

where the gasoline is you know it's on

615

00:21:36,630 --> 00:21:34,799

the bottom of the tank and right where

616

00:21:38,549 --> 00:21:36,640

the engineers designed the outlet but in

617

00:21:40,950 --> 00:21:38,559

a rocket that fuel could be anywhere it

618

00:21:42,230 --> 00:21:40,960

migrates to in zero gravity so they're

619

00:21:44,070 --> 00:21:42,240

looking at how to control where the

620

00:21:45,669 --> 00:21:44,080

fluids go where the bubbles go and

621

00:21:47,990 --> 00:21:45,679

that's applicable to pumps on the ground

622

00:21:49,750 --> 00:21:48,000

also and things like syringes i'm sure

623

00:21:50,789 --> 00:21:49,760

some of you have seen maybe with the

624

00:21:52,310 --> 00:21:50,799

nurse or something when you're going to

625

00:21:54,149 --> 00:21:52,320

get a shot there's bubbles in the end

626

00:21:55,590 --> 00:21:54,159

and they're they're using gravity and

627

00:21:57,830 --> 00:21:55,600

flicking them to try to get the bubbles

628

00:21:59,750 --> 00:21:57,840

away from the end and someday we'll

629

00:22:02,230 --> 00:21:59,760

understand how to do that by building

630

00:22:03,669 --> 00:22:02,240

the mechanism perfectly and not have to

631

00:22:05,430 --> 00:22:03,679

worry about flicking it or getting a

632

00:22:07,750 --> 00:22:05,440

bubble into you

633

00:22:09,510 --> 00:22:07,760

one weekend i did some stuff for some

634

00:22:11,590 --> 00:22:09,520

kids that had

635

00:22:12,789 --> 00:22:11,600

legos involved and this is a lego device

636

00:22:14,549 --> 00:22:12,799

here built

637

00:22:16,310 --> 00:22:14,559

built just to demonstrate some things

638

00:22:18,149 --> 00:22:16,320

that kids were interested in

639

00:22:20,470 --> 00:22:18,159

investigating so we do a lot of projects

640

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

for kids too the kids actually can come

641

00:22:24,230 --> 00:22:22,640

up with some fantastic ideas for space

642

00:22:26,470 --> 00:22:24,240

exploration and we'll do some

643

00:22:28,390 --> 00:22:26,480

demonstrations for them and show show

644

00:22:30,549 --> 00:22:28,400

how things work because it's really hard

645

00:22:32,789 --> 00:22:30,559

to get there and we're happy to be the

646

00:22:33,909 --> 00:22:32,799

hands in orbit for any kinds of ideas

647

00:22:36,070 --> 00:22:33,919

that you might have so there are

648

00:22:38,070 --> 00:22:36,080

programs to do that this is actually

649

00:22:39,669 --> 00:22:38,080

just a blob of water i squeezed out of a

650

00:22:42,470 --> 00:22:39,679

water bag and i threw some orange tic

651  
00:22:44,230 --> 00:22:42,480  
tacs into and it just made a nice orange

652  
00:22:46,870 --> 00:22:44,240  
color there and i'm just spinning around

653  
00:22:48,950 --> 00:22:46,880  
playing using a piece of dental floss to

654  
00:22:51,590 --> 00:22:48,960  
make that water spin around so a lot of

655  
00:22:53,990 --> 00:22:51,600  
fun hey derek

656  
00:22:56,630 --> 00:22:54,000  
this is our dragon spacecraft came up to

657  
00:22:58,310 --> 00:22:56,640  
see us and uh this is the birthing

658  
00:22:59,990 --> 00:22:58,320  
process actually

659  
00:23:02,710 --> 00:23:00,000  
you can tell it's running fast a little

660  
00:23:04,390 --> 00:23:02,720  
orbit uh an orbit and a half here ground

661  
00:23:05,990 --> 00:23:04,400  
actually did this birthing for us after

662  
00:23:07,830 --> 00:23:06,000  
we captured it with the arm i'll talk

663  
00:23:09,830 --> 00:23:07,840

about that more in just a second and put

664

00:23:11,669 --> 00:23:09,840

it on the spacecraft that freed us up so

665

00:23:13,510 --> 00:23:11,679

that we could actually do some work

666

00:23:15,350 --> 00:23:13,520

inside while the ground controllers did

667

00:23:18,149 --> 00:23:15,360

that birthing so it's a it's a

668

00:23:20,070 --> 00:23:18,159

development again over the last six or

669

00:23:22,310 --> 00:23:20,080

seven years they've perfected that and

670

00:23:24,390 --> 00:23:22,320

now uh it's just an advancement in space

671

00:23:26,070 --> 00:23:24,400

exploration that uh that frees up the

672

00:23:28,230 --> 00:23:26,080

crew

673

00:23:29,830 --> 00:23:28,240

this is uh time to say goodbye and this

674

00:23:31,990 --> 00:23:29,840

this movie is just about to come to an

675

00:23:33,750 --> 00:23:32,000

end here this is what it looks like on

676  
00:23:35,510 --> 00:23:33,760  
our screen as we're undocking and flying

677  
00:23:39,430 --> 00:23:35,520  
away and then this is what a landing

678  
00:23:42,630 --> 00:23:41,269  
and it's on it's on the plane in

679  
00:23:45,590 --> 00:23:42,640  
kazakhstan there's not supposed to be

680  
00:23:47,269 --> 00:23:45,600  
any trees or big rocks around or any

681  
00:23:48,310 --> 00:23:47,279  
lakes or anything like that and we land

682  
00:23:50,149 --> 00:23:48,320  
out there

683  
00:23:51,669 --> 00:23:50,159  
that wasn't my landing you saw this is

684  
00:23:53,430 --> 00:23:51,679  
my landing we went into a bunch of

685  
00:23:55,269 --> 00:23:53,440  
clouds and we were never seen again

686  
00:23:57,510 --> 00:23:55,279  
until they finally stumbled onto us out

687  
00:23:59,430 --> 00:23:57,520  
there it was really foggy and snowy on

688  
00:24:01,190 --> 00:23:59,440

the ground and it took them a while to

689

00:24:02,630 --> 00:24:01,200

get to us so uh they don't have any

690

00:24:04,390 --> 00:24:02,640

great video of us hitting the ground

691

00:24:06,549 --> 00:24:04,400

unfortunately but i'm i'm here to

692

00:24:07,909 --> 00:24:06,559

testify that we did hit the ground i

693

00:24:10,310 --> 00:24:07,919

remember it well

694

00:24:12,149 --> 00:24:10,320

uh crawling out then with a little help

695

00:24:14,470 --> 00:24:12,159

from the crew after being in zero

696

00:24:16,630 --> 00:24:14,480

gravity it's very difficult to really

697

00:24:18,470 --> 00:24:16,640

pull yourself out of that capsule you

698

00:24:20,710 --> 00:24:18,480

you just even though you're strong you

699

00:24:22,789 --> 00:24:20,720

still feel like you weigh a ton and it's

700

00:24:24,950 --> 00:24:22,799

really really hard to get to get moving

701  
00:24:27,510 --> 00:24:24,960  
they carry you away it's all it's all

702  
00:24:29,830 --> 00:24:27,520  
really fun and pleasant to be honest

703  
00:24:31,909 --> 00:24:29,840  
i took a little bit of

704  
00:24:34,470 --> 00:24:31,919  
of a drug just to help me out no side

705  
00:24:36,549 --> 00:24:34,480  
effects just made me happy and they were

706  
00:24:38,789 --> 00:24:36,559  
able to uh to get me to the helicopter

707  
00:24:41,830 --> 00:24:38,799  
and get me back to the nasa plane so

708  
00:24:44,310 --> 00:24:41,840  
nasa could fly me home again so a lot of

709  
00:24:46,070 --> 00:24:44,320  
russians there we are very familiar and

710  
00:24:48,470 --> 00:24:46,080  
friendly with these people by the time

711  
00:24:50,710 --> 00:24:48,480  
we end up coming back to earth and uh

712  
00:24:52,549 --> 00:24:50,720  
they also take a helicopter pick up our

713  
00:24:54,230 --> 00:24:52,559

spacecraft that's all that's left of

714

00:24:56,149 --> 00:24:54,240

that whole rocket that we launched at

715

00:24:58,870 --> 00:24:56,159

the beginning just that little capsule

716

00:25:01,029 --> 00:24:58,880

that little gumdrop at the at the uh

717

00:25:04,470 --> 00:25:01,039

at the end there and this is uh getting

718

00:25:07,430 --> 00:25:04,480

off the plane back in houston after um

719

00:25:09,669 --> 00:25:07,440

being really gone from houston for about

720

00:25:11,590 --> 00:25:09,679

uh almost like uh six and a half or

721

00:25:13,269 --> 00:25:11,600

seven months total because the flight

722

00:25:14,630 --> 00:25:13,279

the flight itself was about five and

723

00:25:16,789 --> 00:25:14,640

there's a lot of training at the at the

724

00:25:19,110 --> 00:25:16,799

beginning in other locations so

725

00:25:20,149 --> 00:25:19,120

that's uh that's some video coverage of

726

00:25:21,669 --> 00:25:20,159

the flight

727

00:25:23,590 --> 00:25:21,679

i got a few more slides i want to talk

728

00:25:25,830 --> 00:25:23,600

to you about a couple more things uh

729

00:25:27,990 --> 00:25:25,840

that are so the science on board that

730

00:25:29,029 --> 00:25:28,000

isn't in the video and one of them is i

731

00:25:30,230 --> 00:25:29,039

understand they have the original

732

00:25:32,149 --> 00:25:30,240

robonaut here in the air and space

733

00:25:34,870 --> 00:25:32,159

museum so i hope you get a chance to to

734

00:25:37,190 --> 00:25:34,880

see that uh robonaut was delivered up by

735

00:25:39,909 --> 00:25:37,200

a space shuttle and we got this guy out

736

00:25:41,269 --> 00:25:39,919

of his uh out of his uh bunk if you will

737

00:25:43,190 --> 00:25:41,279

pulled him out set him up and he

738

00:25:45,590 --> 00:25:43,200

operated maybe six or seven times during

739

00:25:47,430 --> 00:25:45,600

my expedition up there and he can he's

740

00:25:50,070 --> 00:25:47,440

learning to work switches and grab

741

00:25:51,990 --> 00:25:50,080

handles he can pick up a 70-pound bar

742

00:25:53,830 --> 00:25:52,000

and hold it up over his head for an hour

743

00:25:55,510 --> 00:25:53,840

and i can't do that i don't think most

744

00:25:57,430 --> 00:25:55,520

of you could either but that's what you

745

00:25:58,870 --> 00:25:57,440

can do with somebody that's robotic and

746

00:26:00,950 --> 00:25:58,880

the reason it's nice that they're in

747

00:26:02,870 --> 00:26:00,960

human form is because so many of the

748

00:26:05,590 --> 00:26:02,880

things we interface are made to be

749

00:26:07,190 --> 00:26:05,600

interfaced with um with our hands and

750

00:26:08,549 --> 00:26:07,200

with our eyes above our hands and all

751  
00:26:11,110 --> 00:26:08,559  
that so

752  
00:26:13,029 --> 00:26:11,120  
this last crew actually wore a device a

753  
00:26:15,430 --> 00:26:13,039  
helmet so that they could see what

754  
00:26:18,230 --> 00:26:15,440  
robonaut is seeing through his visor and

755  
00:26:19,750 --> 00:26:18,240  
also um they could move his hands so

756  
00:26:21,350 --> 00:26:19,760  
it's when you're wearing it it's just

757  
00:26:22,549 --> 00:26:21,360  
like you can look out and see robonaut's

758  
00:26:23,669 --> 00:26:22,559  
hands in front of you and you can move

759  
00:26:25,830 --> 00:26:23,679  
your hand like this and reach out and

760  
00:26:27,350 --> 00:26:25,840  
grab something in fact you can reach out

761  
00:26:29,430 --> 00:26:27,360  
toward yourself if you want to it's

762  
00:26:31,350 --> 00:26:29,440  
really kind of a strange strange thing

763  
00:26:33,430 --> 00:26:31,360

but it's really fun to do and next

764

00:26:35,430 --> 00:26:33,440

slides if you show i've got one here

765

00:26:37,269 --> 00:26:35,440

there's there's me just setting robonaut

766

00:26:39,830 --> 00:26:37,279

up in the visor and if you would the

767

00:26:41,430 --> 00:26:39,840

next two in a row will show robonaut

768

00:26:43,110 --> 00:26:41,440

flipping that switch and turning it off

769

00:26:45,590 --> 00:26:43,120

if you saw that he can just reach out

770

00:26:47,830 --> 00:26:45,600

there with his binocular vision and turn

771

00:26:49,590 --> 00:26:47,840

that off so it's going to be a fantastic

772

00:26:50,950 --> 00:26:49,600

capability for getting

773

00:26:52,870 --> 00:26:50,960

lots of different kinds of chores done

774

00:26:55,029 --> 00:26:52,880

on board someday and even maybe outside

775

00:26:56,870 --> 00:26:55,039

the space station so a great a great

776

00:26:59,830 --> 00:26:56,880

development and a great

777

00:27:03,669 --> 00:26:59,840

kind of if you technology test bed for

778

00:27:06,789 --> 00:27:04,950

in just a second i'm going to run this

779

00:27:09,110 --> 00:27:06,799

this is a little video as well the

780

00:27:11,350 --> 00:27:09,120

sphere in the middle is fuel that's been

781

00:27:13,350 --> 00:27:11,360

introduced by those two little needles

782

00:27:15,029 --> 00:27:13,360

that come in from the top and the bottom

783

00:27:15,990 --> 00:27:15,039

so they inject some fuel in there that

784

00:27:17,750 --> 00:27:16,000

can burn

785

00:27:19,750 --> 00:27:17,760

and then the two little loops in the top

786

00:27:21,350 --> 00:27:19,760

left and bottom right are actually

787

00:27:23,430 --> 00:27:21,360

igniters they don't have to touch the

788

00:27:25,750 --> 00:27:23,440

fuel to ignite it they just glow red hot

789

00:27:27,750 --> 00:27:25,760

and it'll light this ball of fuel this

790

00:27:30,070 --> 00:27:27,760

is all done inside the space station and

791

00:27:31,669 --> 00:27:30,080

a shelf on a rack that we can't see at

792

00:27:33,430 --> 00:27:31,679

the time but we do get in there and

793

00:27:34,950 --> 00:27:33,440

change these needles and work with these

794

00:27:36,789 --> 00:27:34,960

igniters i changed the igniters out

795

00:27:39,750 --> 00:27:36,799

while i was there and

796

00:27:41,590 --> 00:27:39,760

that and we just maintain it as well so

797

00:27:43,830 --> 00:27:41,600

what happens here in this video is as

798

00:27:45,190 --> 00:27:43,840

soon as it start the lights go out so

799

00:27:46,789 --> 00:27:45,200

you can see the fuel burning better

800

00:27:48,950 --> 00:27:46,799

you'll see the igniters ignite the ball

801  
00:27:51,750 --> 00:27:48,960  
the needles pull away and then the ball

802  
00:27:54,389 --> 00:27:51,760  
burns in free space and so burning in

803  
00:27:56,549 --> 00:27:54,399  
zero g is very different than burning in

804  
00:27:58,070 --> 00:27:56,559  
in one g if you light a candle on earth

805  
00:27:59,510 --> 00:27:58,080  
you can see it burning and the air comes

806  
00:28:01,510 --> 00:27:59,520  
in from the bottom because of gravity

807  
00:28:03,269 --> 00:28:01,520  
and convection but that can't happen in

808  
00:28:06,310 --> 00:28:03,279  
space so it's very interesting for the

809  
00:28:09,269 --> 00:28:06,320  
scientists next slide

810  
00:28:11,750 --> 00:28:09,279  
this is a a column of water that looks

811  
00:28:13,510 --> 00:28:11,760  
like a jar of glass but it's just really

812  
00:28:15,669 --> 00:28:13,520  
it's water between two plates with some

813  
00:28:17,590 --> 00:28:15,679

particles inside and scientists are

814

00:28:19,350 --> 00:28:17,600

studying a phenomenon called marangoni

815

00:28:21,110 --> 00:28:19,360

flow if you'll go ahead and

816

00:28:22,389 --> 00:28:21,120

start the little video there you can

817

00:28:24,470 --> 00:28:22,399

tell it's water because of the way it's

818

00:28:25,750 --> 00:28:24,480

oscillating this is real time again if

819

00:28:26,789 --> 00:28:25,760

you were to go up and walk up to that

820

00:28:28,149 --> 00:28:26,799

and push it with your hand you would

821

00:28:29,590 --> 00:28:28,159

just be able to knock that water right

822

00:28:32,789 --> 00:28:29,600

away or if you shook it enough that

823

00:28:34,470 --> 00:28:32,799

water would fly away but uh we we are

824

00:28:36,070 --> 00:28:34,480

very careful not to disturb it on board

825

00:28:37,830 --> 00:28:36,080

it can only work this thing can only

826  
00:28:39,590 --> 00:28:37,840  
work in zero gravity you could never do

827  
00:28:41,669 --> 00:28:39,600  
this on the earth and they can study

828  
00:28:43,269 --> 00:28:41,679  
them the flow of these particles inside

829  
00:28:45,510 --> 00:28:43,279  
if they heat and cool the plates on both

830  
00:28:48,710 --> 00:28:45,520  
ends so marin going marangoni flow it's

831  
00:28:50,549 --> 00:28:48,720  
called in the experiment too next slide

832  
00:28:52,789 --> 00:28:50,559  
and we're just about to questions so

833  
00:28:54,549 --> 00:28:52,799  
those of you have the questions go ahead

834  
00:28:56,230 --> 00:28:54,559  
and be thinking about them and be ready

835  
00:28:57,990 --> 00:28:56,240  
to ask me and we'll keep the show going

836  
00:28:59,510 --> 00:28:58,000  
this way

837  
00:29:01,830 --> 00:28:59,520  
one new phenomenon that we're seeing a

838  
00:29:04,710 --> 00:29:01,840

lot more in space is called noctilucent

839

00:29:06,470 --> 00:29:04,720

clouds and they they seem to be

840

00:29:07,830 --> 00:29:06,480

more prominent than they used to be and

841

00:29:09,669 --> 00:29:07,840

if you go through these slides that's

842

00:29:11,669 --> 00:29:09,679

the typical atmosphere there if you go

843

00:29:13,430 --> 00:29:11,679

through to the next slide you'll see up

844

00:29:15,669 --> 00:29:13,440

high some clouds start to appear as we

845

00:29:17,510 --> 00:29:15,679

fly around the earth these clouds are

846

00:29:20,789 --> 00:29:17,520

about 80 kilometers high so like 50

847

00:29:22,710 --> 00:29:20,799

miles well up out of the air so way out

848

00:29:23,990 --> 00:29:22,720

in the atmosphere and it's it's still

849

00:29:25,510 --> 00:29:24,000

very interesting

850

00:29:28,310 --> 00:29:25,520

to earth scientists and stuff what

851

00:29:30,789 --> 00:29:28,320

causes them and uh and what their impact

852

00:29:32,230 --> 00:29:30,799

might be on on earth so very interesting

853

00:29:33,830 --> 00:29:32,240

next slide please

854

00:29:35,750 --> 00:29:33,840

you can see how how thick they can

855

00:29:37,430 --> 00:29:35,760

become and that's that's

856

00:29:39,269 --> 00:29:37,440

just below the altitude where we

857

00:29:41,830 --> 00:29:39,279

normally fly the shuttle in the first

858

00:29:44,070 --> 00:29:41,840

couple of orbits so it's uh it's really

859

00:29:46,149 --> 00:29:44,080

pretty pretty uh high altitude for

860

00:29:48,389 --> 00:29:46,159

clouds next slide

861

00:29:49,830 --> 00:29:48,399

and next slide

862

00:29:51,669 --> 00:29:49,840

one of the things we did while we were

863

00:29:54,710 --> 00:29:51,679

up there this uh a new thing on space

864

00:29:57,350 --> 00:29:54,720

station is delivery of cargo and perhaps

865

00:29:59,750 --> 00:29:57,360

crew in uh three four five years by

866

00:30:01,029 --> 00:29:59,760

commercial companies this uh spacecraft

867

00:30:02,630 --> 00:30:01,039

right here was built by spacex

868

00:30:04,710 --> 00:30:02,640

corporation out in hawthorne california

869

00:30:06,870 --> 00:30:04,720

and it's called the dragon and in early

870

00:30:09,750 --> 00:30:06,880

march one of these was launched by the

871

00:30:12,149 --> 00:30:09,760

company and flew up to us flew up

872

00:30:13,830 --> 00:30:12,159

underneath the space station in a at a

873

00:30:16,549 --> 00:30:13,840

place close enough so that we could take

874

00:30:18,310 --> 00:30:16,559

our robotic arm and reach out and put

875

00:30:20,070 --> 00:30:18,320

the the end effector what we call the

876

00:30:23,029 --> 00:30:20,080

end effector it's the hand if you will

877

00:30:24,870 --> 00:30:23,039

above it and grab it and put it pull it

878

00:30:27,029 --> 00:30:24,880

in and birth it to our space station and

879

00:30:28,549 --> 00:30:27,039

get all the cargo out of it so a very

880

00:30:30,789 --> 00:30:28,559

exciting thing to see it's a beautiful

881

00:30:33,669 --> 00:30:30,799

thing in space to see another spacecraft

882

00:30:35,590 --> 00:30:33,679

come up and approach you and uh and and

883

00:30:37,510 --> 00:30:35,600

just watch the whole dance and watch all

884

00:30:39,430 --> 00:30:37,520

the spacecraft and of course see the

885

00:30:41,110 --> 00:30:39,440

earth below you next slide so that's

886

00:30:43,110 --> 00:30:41,120

what it looks like flying up this is

887

00:30:45,909 --> 00:30:43,120

what it looks like after after the

888

00:30:47,750 --> 00:30:45,919

grapple out my window and we just again

889

00:30:50,470 --> 00:30:47,760

we were able with hand controllers to

890

00:30:53,110 --> 00:30:50,480

fly that big long arm out there and grab

891

00:30:53,990 --> 00:30:53,120

a hold of it next slide

892

00:30:56,549 --> 00:30:54,000

and

893

00:30:58,470 --> 00:30:56,559

that's after a happy job we have it

894

00:31:00,310 --> 00:30:58,480

grappled we can turn the arm off inside

895

00:31:01,990 --> 00:31:00,320

the space station and as i mentioned we

896

00:31:03,830 --> 00:31:02,000

handed it off to ground control we went

897

00:31:05,669 --> 00:31:03,840

and did other work on the space station

898

00:31:07,509 --> 00:31:05,679

while they birthed it some place where

899

00:31:10,310 --> 00:31:07,519

we could open hatches and get the the

900

00:31:12,070 --> 00:31:10,320

car go out next one please

901  
00:31:13,430 --> 00:31:12,080  
one little story here and a couple

902  
00:31:16,070 --> 00:31:13,440  
minutes over

903  
00:31:17,830 --> 00:31:16,080  
this is uh one one day in space just a

904  
00:31:19,029 --> 00:31:17,840  
human human factor story when you're

905  
00:31:20,870 --> 00:31:19,039  
living up there all kinds of strange

906  
00:31:23,029 --> 00:31:20,880  
things happen this is a bottle a bottle

907  
00:31:25,269 --> 00:31:23,039  
of shampoo that's just about empty and

908  
00:31:26,549 --> 00:31:25,279  
you can see that the the shampoo is not

909  
00:31:27,909 --> 00:31:26,559  
just in the bottom of the bottle but

910  
00:31:30,710 --> 00:31:27,919  
it's on the sides of the bottle and in

911  
00:31:32,470 --> 00:31:30,720  
the top of the bottle and i hadn't used

912  
00:31:34,470 --> 00:31:32,480  
this russian shampoo before

913  
00:31:35,509 --> 00:31:34,480

on on orbit so i i went over and i

914

00:31:36,310 --> 00:31:35,519

thought well you know what i'll do is

915

00:31:37,750 --> 00:31:36,320

i'll just

916

00:31:39,190 --> 00:31:37,760

i've been using the american shampoo

917

00:31:40,870 --> 00:31:39,200

maybe i'd like a little change i'll pop

918

00:31:42,389 --> 00:31:40,880

this bottle open and i'll i'll see what

919

00:31:43,669 --> 00:31:42,399

this smells like see if i want to use it

920

00:31:45,750 --> 00:31:43,679

and i put it under my nose popped the

921

00:31:47,590 --> 00:31:45,760

cap and gave a little squeeze and

922

00:31:49,909 --> 00:31:47,600

underneath that cap was hiding a nice

923

00:31:51,190 --> 00:31:49,919

big glob of shampoo and zero gravity it

924

00:31:53,350 --> 00:31:51,200

wasn't all in the bottom like it would

925

00:31:54,310 --> 00:31:53,360

be on earth and i learned a lesson there

926  
00:31:55,830 --> 00:31:54,320  
about

927  
00:31:57,509 --> 00:31:55,840  
making sure you shake that shampoo out

928  
00:31:58,789 --> 00:31:57,519  
of the cap before you before you squeeze

929  
00:32:00,149 --> 00:31:58,799  
it in your nose

930  
00:32:03,830 --> 00:32:00,159  
good recommendation for when you go to

931  
00:32:07,350 --> 00:32:05,909  
also one of the things that was really

932  
00:32:09,430 --> 00:32:07,360  
really touched me while i was up there

933  
00:32:11,190 --> 00:32:09,440  
was a chance to talk to children

934  
00:32:14,630 --> 00:32:11,200  
we used the ham radio and some other

935  
00:32:16,470 --> 00:32:14,640  
means too to do outreach to school kids

936  
00:32:19,110 --> 00:32:16,480  
and to adults and and all kinds of

937  
00:32:21,830 --> 00:32:19,120  
venues really but uh these this is a

938  
00:32:23,509 --> 00:32:21,840

chance for um kids of all ages to get to

939

00:32:25,350 --> 00:32:23,519

talk directly to us on the space station

940

00:32:27,269 --> 00:32:25,360

and we use the ham radio to do that and

941

00:32:29,110 --> 00:32:27,279

and here's here's one day when i was

942

00:32:31,350 --> 00:32:29,120

really enjoying doing that from columbus

943

00:32:33,110 --> 00:32:31,360

next slide

944

00:32:35,590 --> 00:32:33,120

some photography too i thought i'd bring

945

00:32:37,990 --> 00:32:35,600

a little picture along of washington you

946

00:32:39,509 --> 00:32:38,000

guys probably recommend uh or recognize

947

00:32:42,149 --> 00:32:39,519

that if you've been walking the mall

948

00:32:44,389 --> 00:32:42,159

around here lately so that was taken on

949

00:32:45,590 --> 00:32:44,399

the sunday uh before inauguration day

950

00:32:47,269 --> 00:32:45,600

and next

951  
00:32:49,350 --> 00:32:47,279  
and since it's so hard to tell cities

952  
00:32:51,190 --> 00:32:49,360  
apart from 250 miles away i was just

953  
00:32:53,190 --> 00:32:51,200  
snapping whatever cities i could find

954  
00:32:54,230 --> 00:32:53,200  
and i also happened to get baltimore so

955  
00:32:55,830 --> 00:32:54,240  
for those of you who are from the

956  
00:32:57,590 --> 00:32:55,840  
baltimore area you're going to recognize

957  
00:32:58,950 --> 00:32:57,600  
that one too and that wasn't too long

958  
00:33:01,029 --> 00:32:58,960  
before the super bowl i think about a

959  
00:33:02,950 --> 00:33:01,039  
week before so

960  
00:33:06,230 --> 00:33:02,960  
a lot of a lot of fun to shoot shoot

961  
00:33:08,950 --> 00:33:07,909  
once in a while ground will call us and

962  
00:33:11,909 --> 00:33:08,960  
say hey you're going to have an

963  
00:33:13,029 --> 00:33:11,919

excellent pass over a volcano perhaps

964

00:33:15,669 --> 00:33:13,039

over

965

00:33:17,750 --> 00:33:15,679

so maybe maybe some icebergs have broken

966

00:33:19,430 --> 00:33:17,760

off or maybe you have a storm and this

967

00:33:21,430 --> 00:33:19,440

was typhoon bofa

968

00:33:23,110 --> 00:33:21,440

back in november and a great pass by

969

00:33:24,789 --> 00:33:23,120

typhoon bofa boy when you look out the

970

00:33:26,789 --> 00:33:24,799

window and you get there with the camera

971

00:33:28,310 --> 00:33:26,799

there's no question about what's a

972

00:33:29,990 --> 00:33:28,320

typhoon and what's just a bunch of

973

00:33:31,750 --> 00:33:30,000

clouds and i looked at that and i

974

00:33:33,909 --> 00:33:31,760

thought there's no way i'd ever stay you

975

00:33:35,350 --> 00:33:33,919

know stay someplace where a typhoon or a

976

00:33:37,350 --> 00:33:35,360

hurricane is heading my way if i could

977

00:33:40,470 --> 00:33:37,360

help it because it just really looks

978

00:33:43,750 --> 00:33:40,480

powerful and awesome uh from the space

979

00:33:45,750 --> 00:33:43,760

perspective next slide

980

00:33:48,310 --> 00:33:45,760

when you come home you do come home and

981

00:33:50,789 --> 00:33:48,320

the spacecraft most of it burns up you

982

00:33:52,630 --> 00:33:50,799

burn but you don't burn up let's let's

983

00:33:54,470 --> 00:33:52,640

put it that way so there is a lot of

984

00:33:56,149 --> 00:33:54,480

heat associated with entry and as you

985

00:33:58,070 --> 00:33:56,159

look out the window

986

00:33:59,590 --> 00:33:58,080

it's un it's uncanny because you're just

987

00:34:01,990 --> 00:33:59,600

looking at a lot of fire out there and a

988

00:34:04,070 --> 00:34:02,000

lot of stuff around you but this uh the

989

00:34:05,590 --> 00:34:04,080

engineering that has taken us to a place

990

00:34:08,950 --> 00:34:05,600

where we know how to safely get home in

991

00:34:10,950 --> 00:34:08,960

our spacecraft and the very bottom uh

992

00:34:12,950 --> 00:34:10,960

color the very bottom flame on that

993

00:34:14,470 --> 00:34:12,960

picture is uh the crew that was the crew

994

00:34:15,909 --> 00:34:14,480

of actually the before me and i took

995

00:34:17,430 --> 00:34:15,919

this photo as they were coming home and

996

00:34:19,270 --> 00:34:17,440

they're surviving inside that little

997

00:34:21,909 --> 00:34:19,280

fireball the rest of their spacecraft

998

00:34:23,190 --> 00:34:21,919

breaking into pieces and uh and will

999

00:34:25,190 --> 00:34:23,200

will burn up before getting to the

1000

00:34:27,750 --> 00:34:25,200

surface next slide

1001  
00:34:30,950 --> 00:34:27,760  
and uh back on the planet earth and

1002  
00:34:32,550 --> 00:34:30,960  
that's why i'm back here safely and

1003  
00:34:34,629 --> 00:34:32,560  
eight weeks ago that's what i was doing

1004  
00:34:37,270 --> 00:34:34,639  
but now i'm here to answer questions

1005  
00:34:40,069 --> 00:34:37,280  
i love the flight i love telling about

1006  
00:34:42,470 --> 00:34:40,079  
the flight obviously space flight is my

1007  
00:34:44,470 --> 00:34:42,480  
life and i'm just as passionate about it

1008  
00:34:46,230 --> 00:34:44,480  
now as i was before i got into the

1009  
00:34:48,710 --> 00:34:46,240  
business and

1010  
00:34:50,869 --> 00:34:48,720  
i'd like to educate as many people as i

1011  
00:34:53,829 --> 00:34:50,879  
can about all the aspects of what we're

1012  
00:34:56,069 --> 00:34:53,839  
doing out there and uh and bring you

1013  
00:34:58,470 --> 00:34:56,079

bring you all on board i think space is

1014

00:35:00,390 --> 00:34:58,480

definitely in our future it's it's here

1015

00:35:02,630 --> 00:35:00,400

to stay and you're going to see a lot of

1016

00:35:04,310 --> 00:35:02,640

cool things happen in the next decade

1017

00:35:06,230 --> 00:35:04,320

so for anybody who's got questions i

1018

00:35:07,510 --> 00:35:06,240

think that's my cue to start taking a

1019

00:35:09,829 --> 00:35:07,520

few

1020

00:35:12,550 --> 00:35:09,839

and we got a mic over here

1021

00:35:17,990 --> 00:35:13,750

it's not as much fun when you have to

1022

00:35:18,000 --> 00:35:23,109

any questions

1023

00:35:26,069 --> 00:35:23,990

yep

1024

00:35:28,150 --> 00:35:26,079

so what are the common pathways to

1025

00:35:30,630 --> 00:35:28,160

actually become an astronaut

1026

00:35:32,470 --> 00:35:30,640

great question uh we have astronauts who

1027

00:35:35,990 --> 00:35:32,480

are medical doctors

1028

00:35:38,230 --> 00:35:36,000

engineers scientists uh pilots is pretty

1029

00:35:40,550 --> 00:35:38,240

common in my class we had a submarine

1030

00:35:43,670 --> 00:35:40,560

officer an oceanographer

1031

00:35:46,630 --> 00:35:43,680

um just all kinds of a geophysicist in

1032

00:35:49,990 --> 00:35:46,640

my my astronaut class

1033

00:35:52,470 --> 00:35:50,000

really any kind of science is

1034

00:35:53,750 --> 00:35:52,480

is qualifying to be an astronaut you

1035

00:35:55,910 --> 00:35:53,760

have to have at least a bachelor's

1036

00:35:57,190 --> 00:35:55,920

degree to apply of course more advanced

1037

00:36:00,150 --> 00:35:57,200

degrees and the more you know about

1038

00:36:02,230 --> 00:36:00,160

different subjects is really great they

1039

00:36:03,430 --> 00:36:02,240

really like to see of course you know

1040

00:36:05,910 --> 00:36:03,440

you're not always doing science when

1041

00:36:08,390 --> 00:36:05,920

you're strapping into a tiny spacecraft

1042

00:36:09,750 --> 00:36:08,400

and and you know zipping up your your

1043

00:36:11,829 --> 00:36:09,760

spacesuit and that sort of thing a lot

1044

00:36:13,030 --> 00:36:11,839

of it's really operationally intensive

1045

00:36:14,470 --> 00:36:13,040

and they you know they like to think

1046

00:36:16,069 --> 00:36:14,480

that you're going to love the operations

1047

00:36:19,190 --> 00:36:16,079

too because of course that's a that's a

1048

00:36:21,270 --> 00:36:19,200

big part of the job so qualifications of

1049

00:36:22,550 --> 00:36:21,280

a really great science background plus

1050

00:36:24,230 --> 00:36:22,560

some really broad operational

1051  
00:36:25,349 --> 00:36:24,240  
experiences what they're looking for the

1052  
00:36:27,349 --> 00:36:25,359  
most

1053  
00:36:29,430 --> 00:36:27,359  
and what kind of uh battery of like

1054  
00:36:30,710 --> 00:36:29,440  
mental testing and group testing you go

1055  
00:36:32,790 --> 00:36:30,720  
through

1056  
00:36:36,069 --> 00:36:32,800  
it's not too extensive you take as you

1057  
00:36:38,870 --> 00:36:36,079  
apply you take some some tests uh

1058  
00:36:41,270 --> 00:36:38,880  
just just just kind of things maybe

1059  
00:36:42,069 --> 00:36:41,280  
maybe like an sat or something like that

1060  
00:36:43,829 --> 00:36:42,079  
but

1061  
00:36:45,349 --> 00:36:43,839  
for the most part let me just tell you

1062  
00:36:47,750 --> 00:36:45,359  
you know the astronauts are are

1063  
00:36:49,910 --> 00:36:47,760

accomplished people but not necessarily

1064

00:36:51,750 --> 00:36:49,920

uh they're not getting 800s on the sats

1065

00:36:53,510 --> 00:36:51,760

necessarily it's just they're just

1066

00:36:55,270 --> 00:36:53,520

looking for some some good general

1067

00:36:56,790 --> 00:36:55,280

knowledge and the ability to learn i

1068

00:36:58,550 --> 00:36:56,800

would say is is the big thing that

1069

00:37:05,670 --> 00:36:58,560

they're looking for thank you yeah thank

1070

00:37:13,829 --> 00:37:09,430

my name is julianne and i'm from

1071

00:37:14,710 --> 00:37:13,839

and i'm from maryland maryland

1072

00:37:16,790 --> 00:37:14,720

um

1073

00:37:19,109 --> 00:37:16,800

what does it feel like to be in zero

1074

00:37:21,109 --> 00:37:19,119

gravity what does it feel like to be in

1075

00:37:23,109 --> 00:37:21,119

zero gravity that's a that's a fantastic

1076  
00:37:25,430 --> 00:37:23,119  
question and about the the best thing i

1077  
00:37:26,630 --> 00:37:25,440  
can tell you is imagine when you go

1078  
00:37:29,109 --> 00:37:26,640  
swimming

1079  
00:37:30,950 --> 00:37:29,119  
if you could float anywhere you wanted

1080  
00:37:33,030 --> 00:37:30,960  
close your eyes not have to worry about

1081  
00:37:35,190 --> 00:37:33,040  
breathing in water and you could just

1082  
00:37:37,030 --> 00:37:35,200  
breathe the air and you were in kind of

1083  
00:37:39,430 --> 00:37:37,040  
warm water so you didn't really feel

1084  
00:37:41,750 --> 00:37:39,440  
cold or anything then that's that's what

1085  
00:37:43,190 --> 00:37:41,760  
it feels like nothing touching you and

1086  
00:37:44,950 --> 00:37:43,200  
just floating very light touch

1087  
00:37:46,470 --> 00:37:44,960  
everywhere so it's really really a

1088  
00:37:48,950 --> 00:37:46,480

unique experience

1089

00:37:51,030 --> 00:37:48,960

what uh what makes it extra fun is that

1090

00:37:52,950 --> 00:37:51,040

you can just turn upside down though or

1091

00:37:54,710 --> 00:37:52,960

turn sideways anytime you want to and

1092

00:37:56,630 --> 00:37:54,720

float in any orientation you don't have

1093

00:37:58,550 --> 00:37:56,640

to worry about the ceiling or the floor

1094

00:38:00,069 --> 00:37:58,560

and if you wanted to you could just fly

1095

00:38:02,150 --> 00:38:00,079

up to that corner of the room up there

1096

00:38:03,670 --> 00:38:02,160

just give a little push and fly but

1097

00:38:05,589 --> 00:38:03,680

don't go too fast because when you get

1098

00:38:08,390 --> 00:38:05,599

there you have to stop

1099

00:38:09,910 --> 00:38:08,400

how do you how do you how do you stop

1100

00:38:11,270 --> 00:38:09,920

how do you stop there better be

1101

00:38:12,790 --> 00:38:11,280

something to grab hold of and it

1102

00:38:14,310 --> 00:38:12,800

shouldn't be a light or something like

1103

00:38:15,589 --> 00:38:14,320

that because you might rip it off you

1104

00:38:16,710 --> 00:38:15,599

have to be really careful with the

1105

00:38:18,790 --> 00:38:16,720

equipment

1106

00:38:21,030 --> 00:38:18,800

and uh and make sure you have it kind of

1107

00:38:23,430 --> 00:38:21,040

under control we do practice flying

1108

00:38:25,030 --> 00:38:23,440

faster and faster and there are some

1109

00:38:26,390 --> 00:38:25,040

hand rails that you can always grab a

1110

00:38:27,829 --> 00:38:26,400

hold of so you always kind of shoot for

1111

00:38:29,190 --> 00:38:27,839

a handrail so that you know you can get

1112

00:38:43,430 --> 00:38:29,200

yourself stopped

1113

00:38:47,829 --> 00:38:46,069

my name is brianna i'm from nashville my

1114

00:38:50,790 --> 00:38:47,839

question is what majors do you have to

1115

00:38:53,190 --> 00:38:50,800

do to become an astronaut what majors

1116

00:38:54,310 --> 00:38:53,200

you can major it really just needs to be

1117

00:38:57,109 --> 00:38:54,320

something where you can get some

1118

00:38:59,030 --> 00:38:57,119

technical education but we have teachers

1119

00:39:00,790 --> 00:38:59,040

people who are education majors but have

1120

00:39:03,510 --> 00:39:00,800

a lot of also science

1121

00:39:07,349 --> 00:39:03,520

science in their education too

1122

00:39:08,630 --> 00:39:07,359

and medical doctors engineers scientists

1123

00:39:10,790 --> 00:39:08,640

physicists

1124

00:39:13,190 --> 00:39:10,800

chemists any of those kinds of things

1125

00:39:14,790 --> 00:39:13,200

they the the mathematics is is kind of

1126  
00:39:16,950 --> 00:39:14,800  
important so the more mathematics you

1127  
00:39:18,710 --> 00:39:16,960  
can learn the better off and the and the

1128  
00:39:20,870 --> 00:39:18,720  
technical disciplines you kind of really

1129  
00:39:22,390 --> 00:39:20,880  
need to to know those to understand a

1130  
00:39:24,150 --> 00:39:22,400  
lot of the science and a lot of the

1131  
00:39:26,150 --> 00:39:24,160  
operations we have to do

1132  
00:39:27,750 --> 00:39:26,160  
so those are those are the best majors

1133  
00:39:29,430 --> 00:39:27,760  
and if if you're interested for people

1134  
00:39:30,710 --> 00:39:29,440  
who are interested in knowing because it

1135  
00:39:31,829 --> 00:39:30,720  
looks like it's about time for you to

1136  
00:39:34,069 --> 00:39:31,839  
apply

1137  
00:39:35,510 --> 00:39:34,079  
you uh you can look on the nasa website

1138  
00:39:37,910 --> 00:39:35,520

and they'll tell you what the qualifying

1139

00:39:39,430 --> 00:39:37,920

majors are so that's that's a great

1140

00:39:41,109 --> 00:39:39,440

question to know if you're interested in

1141

00:39:42,950 --> 00:39:41,119

the career field before you before you

1142

00:39:44,710 --> 00:39:42,960

head off and pick a major and what

1143

00:39:46,950 --> 00:39:44,720

college did you go to

1144

00:39:49,589 --> 00:39:46,960

i went to notre dame uh we have a lot of

1145

00:39:51,829 --> 00:39:49,599

people that went to really all schools

1146

00:39:53,910 --> 00:39:51,839

that that can offer technical educations

1147

00:39:56,390 --> 00:39:53,920

a lot of academy graduates too that are

1148

00:39:59,109 --> 00:39:56,400

astronauts and certainly all the

1149

00:40:01,589 --> 00:39:59,119

universities uh across the nation

1150

00:40:03,349 --> 00:40:01,599

are qualifying universities

1151

00:40:05,430 --> 00:40:03,359

yeah thank you

1152

00:40:07,990 --> 00:40:05,440

my name is jaron i'm from nashville and

1153

00:40:09,349 --> 00:40:08,000

how do y'all fall asleep on the

1154

00:40:12,150 --> 00:40:09,359

when you're in space how do you fall

1155

00:40:13,829 --> 00:40:12,160

asleep yeah oh that's a great question

1156

00:40:15,910 --> 00:40:13,839

because one of the worries astronauts

1157

00:40:17,430 --> 00:40:15,920

have before they go up there is am i

1158

00:40:20,550 --> 00:40:17,440

gonna be able to get any sleep and

1159

00:40:22,790 --> 00:40:20,560

what's it gonna feel like and uh i was

1160

00:40:24,870 --> 00:40:22,800

i'm very lucky because i did sleep very

1161

00:40:26,710 --> 00:40:24,880

well on space station some people have

1162

00:40:28,550 --> 00:40:26,720

to change body positions and that sort

1163

00:40:30,550 --> 00:40:28,560

of thing at night some people like a

1164

00:40:33,030 --> 00:40:30,560

little support that we have a small

1165

00:40:34,550 --> 00:40:33,040

cabin that's a it's maybe about the size

1166

00:40:36,710 --> 00:40:34,560

of a big refrigerator or something we

1167

00:40:38,390 --> 00:40:36,720

sleep in but it's well lit and padded

1168

00:40:40,230 --> 00:40:38,400

it's got really good ventilation and

1169

00:40:42,309 --> 00:40:40,240

lighting and some people will put their

1170

00:40:44,069 --> 00:40:42,319

feet on the wall with their back against

1171

00:40:45,589 --> 00:40:44,079

the other wall and that gives them a

1172

00:40:46,950 --> 00:40:45,599

little bit of a feeling of being on

1173

00:40:49,589 --> 00:40:46,960

earth so it helps them to sleep a little

1174

00:40:50,870 --> 00:40:49,599

bit better but we have sleeping bags and

1175

00:40:52,390 --> 00:40:50,880

you tie them to the wall so you don't

1176  
00:40:54,069 --> 00:40:52,400  
have to worry about floating away

1177  
00:40:56,470 --> 00:40:54,079  
and they're very nice you can just kind

1178  
00:40:58,630 --> 00:40:56,480  
of slow yourself into them zip yourself

1179  
00:41:00,309 --> 00:40:58,640  
up and then put your arms inside if

1180  
00:41:02,550 --> 00:41:00,319  
you'd like to and if you can sleep

1181  
00:41:04,390 --> 00:41:02,560  
floating then you can just easily fall

1182  
00:41:06,150 --> 00:41:04,400  
asleep it's not too hard i would like

1183  
00:41:08,309 --> 00:41:06,160  
put my feet up on a little hand rail

1184  
00:41:09,910 --> 00:41:08,319  
that i had put it mounted on the floor

1185  
00:41:11,829 --> 00:41:09,920  
that was just a little rail across the

1186  
00:41:13,990 --> 00:41:11,839  
floor and bend myself a little bit put

1187  
00:41:15,430 --> 00:41:14,000  
my arms inside and no problem falling

1188  
00:41:18,309 --> 00:41:15,440

asleep

1189

00:41:20,470 --> 00:41:18,319

that's a great question thank you

1190

00:41:22,150 --> 00:41:20,480

hi my name is lemay and i'm from

1191

00:41:25,430 --> 00:41:22,160

nashville tennessee

1192

00:41:27,670 --> 00:41:25,440

uh how do you like work out at the space

1193

00:41:29,190 --> 00:41:27,680

station that i'm thank you for asking

1194

00:41:31,270 --> 00:41:29,200

that question work out like as an

1195

00:41:34,069 --> 00:41:31,280

exercise right how do we work out we

1196

00:41:36,150 --> 00:41:34,079

have three excellent exercise machines

1197

00:41:37,750 --> 00:41:36,160

on the space station now

1198

00:41:39,910 --> 00:41:37,760

one of them has been there for a long

1199

00:41:41,990 --> 00:41:39,920

time as an exercise bicycle

1200

00:41:43,750 --> 00:41:42,000

that the ground the ground team can

1201  
00:41:46,470 --> 00:41:43,760  
program with various loads and you can

1202  
00:41:48,470 --> 00:41:46,480  
get on it you just wear shoes with clips

1203  
00:41:51,109 --> 00:41:48,480  
on them you put your feet on the pedals

1204  
00:41:53,109 --> 00:41:51,119  
and you just can pedal for 45 minutes of

1205  
00:41:55,030 --> 00:41:53,119  
various loads and really work up a nice

1206  
00:41:56,309 --> 00:41:55,040  
sweat and you can always see your heart

1207  
00:41:59,109 --> 00:41:56,319  
rate so you know you're getting a good

1208  
00:42:00,870 --> 00:41:59,119  
aerobic workout we also have a

1209  
00:42:03,030 --> 00:42:00,880  
treadmill that we can run on the

1210  
00:42:06,309 --> 00:42:03,040  
treadmill itself is

1211  
00:42:09,030 --> 00:42:06,319  
requires special bungee cords and a

1212  
00:42:11,349 --> 00:42:09,040  
special harness on the space station to

1213  
00:42:13,030 --> 00:42:11,359

hold you down against it so otherwise

1214

00:42:14,390 --> 00:42:13,040

when you took a step and ran it would

1215

00:42:16,309 --> 00:42:14,400

just push you away from it you wouldn't

1216

00:42:18,390 --> 00:42:16,319

be able to keep your feet on the track

1217

00:42:21,430 --> 00:42:18,400

so you wear this special harness

1218

00:42:23,750 --> 00:42:21,440

developed by nasa and you can adjust it

1219

00:42:26,470 --> 00:42:23,760

to different different weights and then

1220

00:42:28,870 --> 00:42:26,480

you can run for hours on end with that

1221

00:42:30,390 --> 00:42:28,880

with that bungee system on you

1222

00:42:32,230 --> 00:42:30,400

and then we have one more thing that's

1223

00:42:33,910 --> 00:42:32,240

kind of an aerobic exercise as well but

1224

00:42:36,309 --> 00:42:33,920

i really like that one the other thing

1225

00:42:38,550 --> 00:42:36,319

we have for anaerobic exercise to make

1226  
00:42:39,750 --> 00:42:38,560  
sure our bones and muscles stay strong

1227  
00:42:41,589 --> 00:42:39,760  
is called

1228  
00:42:44,790 --> 00:42:41,599  
the a-red it's a resistive advanced

1229  
00:42:46,470 --> 00:42:44,800  
resistive exercise device and we can't

1230  
00:42:49,270 --> 00:42:46,480  
lift weights up there because everything

1231  
00:42:50,710 --> 00:42:49,280  
is weightless as you know but we can

1232  
00:42:53,030 --> 00:42:50,720  
with this machine

1233  
00:42:54,790 --> 00:42:53,040  
dial in a certain kind of

1234  
00:42:56,710 --> 00:42:54,800  
resistance in the bar and there's a

1235  
00:42:58,950 --> 00:42:56,720  
platform we stand on and we can pick up

1236  
00:43:00,550 --> 00:42:58,960  
this bar we can lay on a bench and push

1237  
00:43:02,710 --> 00:43:00,560  
this bar up like we're doing a bench

1238  
00:43:04,390 --> 00:43:02,720

press and shoulder presses over our

1239

00:43:06,309 --> 00:43:04,400

heads and we can really work our legs

1240

00:43:08,710 --> 00:43:06,319

out all the way up to 600 pounds of load

1241

00:43:11,670 --> 00:43:08,720

if we want to and it's all based on a

1242

00:43:13,670 --> 00:43:11,680

couple big tubes that are vacuumed

1243

00:43:15,990 --> 00:43:13,680

and you're really pushing against the

1244

00:43:17,990 --> 00:43:16,000

pressure of the air in the cabin with a

1245

00:43:19,589 --> 00:43:18,000

lever arm that makes it all work out so

1246

00:43:21,349 --> 00:43:19,599

that you can get a really good workout

1247

00:43:22,630 --> 00:43:21,359

and we exercise two and a half hours

1248

00:43:24,069 --> 00:43:22,640

every day

1249

00:43:25,589 --> 00:43:24,079

the whole time you're up there and

1250

00:43:28,069 --> 00:43:25,599

that's important to keep your bones in

1251  
00:43:30,150 --> 00:43:28,079  
good shape and to keep your muscle

1252  
00:43:32,069 --> 00:43:30,160  
muscle tone

1253  
00:43:35,030 --> 00:43:32,079  
fantastic question thank you

1254  
00:43:37,750 --> 00:43:35,040  
yes my name is rosalind ellis hyde i'm

1255  
00:43:39,750 --> 00:43:37,760  
from baltimore maryland i'm extremely

1256  
00:43:42,950 --> 00:43:39,760  
interested in the psychological and

1257  
00:43:45,270 --> 00:43:42,960  
artistic aspects of space travel i write

1258  
00:43:47,270 --> 00:43:45,280  
poetry about space travel

1259  
00:43:49,030 --> 00:43:47,280  
and i know that some of the astronauts

1260  
00:43:50,150 --> 00:43:49,040  
in the apollo program were very

1261  
00:43:53,589 --> 00:43:50,160  
interested

1262  
00:43:55,349 --> 00:43:53,599  
in this particular subject jim irwin

1263  
00:43:58,069 --> 00:43:55,359

being one of them and the other i

1264

00:44:00,390 --> 00:43:58,079

believe his name was charles duke

1265

00:44:02,470 --> 00:44:00,400

and they did a number of psychological

1266

00:44:05,190 --> 00:44:02,480

experiments and i was wondering if this

1267

00:44:06,470 --> 00:44:05,200

has ever factored into your flight plans

1268

00:44:09,510 --> 00:44:06,480

well we do

1269

00:44:10,630 --> 00:44:09,520

we as well we look at a lot of different

1270

00:44:12,309 --> 00:44:10,640

things

1271

00:44:14,390 --> 00:44:12,319

with the way our brain behaves we take

1272

00:44:16,710 --> 00:44:14,400

some tests regularly called winscat to

1273

00:44:19,030 --> 00:44:16,720

make sure our cognitive processing

1274

00:44:21,349 --> 00:44:19,040

to see how that's changing with time a

1275

00:44:23,829 --> 00:44:21,359

lot of the the scientific

1276

00:44:26,309 --> 00:44:23,839

individual human science we do

1277

00:44:28,550 --> 00:44:26,319

might be looking and interpreting images

1278

00:44:30,950 --> 00:44:28,560

and stuff on on a display while we're

1279

00:44:32,630 --> 00:44:30,960

free floating and comparing the way we

1280

00:44:34,870 --> 00:44:32,640

interpreted them on the ground to what

1281

00:44:36,309 --> 00:44:34,880

we see in space and then there are there

1282

00:44:38,470 --> 00:44:36,319

are some other things where we'll

1283

00:44:41,670 --> 00:44:38,480

they'll they'll ask us to do some things

1284

00:44:43,670 --> 00:44:41,680

maybe maybe um listen to at some tones

1285

00:44:45,670 --> 00:44:43,680

or something like that and then make

1286

00:44:47,510 --> 00:44:45,680

estimates on how we're feeling so you

1287

00:44:49,910 --> 00:44:47,520

know as a as a pilot i kind of don't

1288

00:44:52,069 --> 00:44:49,920

understand that whole thing but i do

1289

00:44:55,510 --> 00:44:52,079

feel it and i felt some things in space

1290

00:44:57,349 --> 00:44:55,520

that surprised me and um just just the

1291

00:44:59,349 --> 00:44:57,359

kind of the way i felt about looking at

1292

00:45:00,870 --> 00:44:59,359

the earth i i found that after i'd been

1293

00:45:03,030 --> 00:45:00,880

there for a few months i i had a

1294

00:45:04,790 --> 00:45:03,040

different feeling about it there was it

1295

00:45:06,230 --> 00:45:04,800

was kind of emotional and so some of

1296

00:45:08,150 --> 00:45:06,240

those things are very interesting to me

1297

00:45:10,630 --> 00:45:08,160

and i wrote them down and and may you

1298

00:45:11,910 --> 00:45:10,640

know may when i when the pace slows down

1299

00:45:14,230 --> 00:45:11,920

a little bit think a little bit more

1300

00:45:16,870 --> 00:45:14,240

about those things please read the book

1301

00:45:19,510 --> 00:45:16,880

uh called to rule the night by jim irwin

1302

00:45:20,950 --> 00:45:19,520

to rule the night yes he was apollo 15.

1303

00:45:22,069 --> 00:45:20,960

he was the uh

1304

00:45:23,670 --> 00:45:22,079

um

1305

00:45:25,750 --> 00:45:23,680

i don't know not the commander but the

1306

00:45:28,790 --> 00:45:25,760

second in command and he had some

1307

00:45:30,790 --> 00:45:28,800

absolutely amazing experiences

1308

00:45:32,390 --> 00:45:30,800

and it's called to rule the night and

1309

00:45:34,870 --> 00:45:32,400

i'm sure you can get it in the nasa

1310

00:45:38,309 --> 00:45:34,880

library thank you fantastic okay thank

1311

00:45:40,069 --> 00:45:38,319

you very much this is a great question

1312

00:45:42,150 --> 00:45:40,079

thank you so much colonel for coming to

1313

00:45:43,750 --> 00:45:42,160

1313  
speak with us today happy to be here i'm

1314  
00:45:45,109 --> 00:45:43,760  
lynn fairley i'm from santa barbara

1315  
00:45:46,950 --> 00:45:45,119  
california

1316  
00:45:49,510 --> 00:45:46,960  
you said you weigh a ton when you get

1317  
00:45:51,109 --> 00:45:49,520  
down on the ground

1318  
00:45:53,109 --> 00:45:51,119  
that was an interesting statement the

1319  
00:45:55,510 --> 00:45:53,119  
longer you're in space do you feel

1320  
00:45:57,270 --> 00:45:55,520  
heavier when you arrive back on earth

1321  
00:45:59,430 --> 00:45:57,280  
how long does it take to recover a

1322  
00:46:01,430 --> 00:45:59,440  
feeling of just normalcy in your human

1323  
00:46:02,630 --> 00:46:01,440  
body here on earth what do you do to get

1324  
00:46:05,030 --> 00:46:02,640  
that feeling

1325  
00:46:07,430 --> 00:46:05,040  
that's um that's a fantastic question

1326

00:46:09,109 --> 00:46:07,440

and one of the things that i found the

1327

00:46:10,309 --> 00:46:09,119

most confusing when i came back from my

1328

00:46:11,910 --> 00:46:10,319

shuttle flight

1329

00:46:14,870 --> 00:46:11,920

was how

1330

00:46:17,430 --> 00:46:14,880

how weak i felt but how strong i was on

1331

00:46:19,030 --> 00:46:17,440

the other hand normally normally we when

1332

00:46:21,109 --> 00:46:19,040

we pull on something

1333

00:46:21,910 --> 00:46:21,119

if you were to do a pull-up for example

1334

00:46:23,109 --> 00:46:21,920

uh

1335

00:46:25,270 --> 00:46:23,119

on earth

1336

00:46:27,190 --> 00:46:25,280

you might you might feel like it's very

1337

00:46:29,510 --> 00:46:27,200

hard but you might be strong enough to

1338

00:46:31,910 --> 00:46:29,520

do more than than you thought

1339

00:46:33,910 --> 00:46:31,920

there's a sensory perception as well as

1340

00:46:35,510 --> 00:46:33,920

the real strength that you have

1341

00:46:36,950 --> 00:46:35,520

when i came back from

1342

00:46:38,950 --> 00:46:36,960

space station

1343

00:46:40,630 --> 00:46:38,960

because of this advanced resistive

1344

00:46:44,150 --> 00:46:40,640

exercise device this weight lifting

1345

00:46:46,790 --> 00:46:44,160

machine we had i was actually stronger

1346

00:46:49,910 --> 00:46:46,800

about 20 stronger in my upper body than

1347

00:46:51,349 --> 00:46:49,920

before when i left and if you would ask

1348

00:46:53,270 --> 00:46:51,359

me when you when you hung me from the

1349

00:46:55,030 --> 00:46:53,280

bar and they said see how many pull-ups

1350

00:46:57,589 --> 00:46:55,040

you can do i would have said i can't

1351  
00:46:59,910 --> 00:46:57,599  
even do one but in truth i could do even

1352  
00:47:01,430 --> 00:46:59,920  
more than before i left so that's a very

1353  
00:47:03,349 --> 00:47:01,440  
interesting phenomenon i think that

1354  
00:47:06,069 --> 00:47:03,359  
sensory perception it's the same thing

1355  
00:47:09,270 --> 00:47:06,079  
with with picking things up because

1356  
00:47:11,270 --> 00:47:09,280  
because for 144 days in space i never

1357  
00:47:13,829 --> 00:47:11,280  
used any kind of hand pressure on

1358  
00:47:15,990 --> 00:47:13,839  
anything even that really big device you

1359  
00:47:18,150 --> 00:47:16,000  
saw us moving through the laboratory

1360  
00:47:19,109 --> 00:47:18,160  
even though it might be 300 pounds of

1361  
00:47:21,750 --> 00:47:19,119  
mass

1362  
00:47:23,750 --> 00:47:21,760  
it um it just you just touch it gently

1363  
00:47:26,150 --> 00:47:23,760

and you move everything so gently that

1364

00:47:28,390 --> 00:47:26,160

in a hut for a hundred and some days a

1365

00:47:29,510 --> 00:47:28,400

long time you just don't put any kind of

1366

00:47:31,030 --> 00:47:29,520

pressure on anything and you've probably

1367

00:47:32,710 --> 00:47:31,040

heard stories about astronauts dropping

1368

00:47:34,870 --> 00:47:32,720

things when they come home because

1369

00:47:37,030 --> 00:47:34,880

you'll pick up a cup and you what you've

1370

00:47:38,950 --> 00:47:37,040

done before is you just you just feather

1371

00:47:40,549 --> 00:47:38,960

touch it to keep it in position but now

1372

00:47:42,150 --> 00:47:40,559

with gravity it's going to be pulled

1373

00:47:44,470 --> 00:47:42,160

free from your hands crashed to the

1374

00:47:45,910 --> 00:47:44,480

floor and we all learned that lesson i

1375

00:47:47,670 --> 00:47:45,920

did it again after this flight even

1376

00:47:49,750 --> 00:47:47,680

though i said i wasn't going to

1377

00:47:52,150 --> 00:47:49,760

right on my kitchen floor so

1378

00:47:54,390 --> 00:47:52,160

anyway those those things are really

1379

00:47:56,309 --> 00:47:54,400

interesting and uh and unique and

1380

00:47:58,150 --> 00:47:56,319

there's a lot of study going on about

1381

00:48:00,470 --> 00:47:58,160

getting past those one of the things we

1382

00:48:02,870 --> 00:48:00,480

do is we work with rehabilitation guys

1383

00:48:04,470 --> 00:48:02,880

directly i mean the day we get home we

1384

00:48:05,510 --> 00:48:04,480

start doing stuff

1385

00:48:07,829 --> 00:48:05,520

you know

1386

00:48:09,670 --> 00:48:07,839

walking standing on one leg for a while

1387

00:48:11,270 --> 00:48:09,680

and and hiking across the gym floor and

1388

00:48:12,549 --> 00:48:11,280

back and that sort of thing and they're

1389

00:48:14,870 --> 00:48:12,559

they're really building us back to

1390

00:48:16,309 --> 00:48:14,880

normalcy and it takes it takes about six

1391

00:48:18,470 --> 00:48:16,319

weeks before you're close to a hundred

1392

00:48:20,790 --> 00:48:18,480

percent and about three weeks two and a

1393

00:48:23,190 --> 00:48:20,800

half weeks before you're not dangerous

1394

00:48:25,270 --> 00:48:23,200

dangerous that's funny and no more

1395

00:48:27,829 --> 00:48:25,280

snorting russian shampoo

1396

00:48:29,430 --> 00:48:27,839

that's exactly right so it's a sensory

1397

00:48:31,670 --> 00:48:29,440

perception

1398

00:48:32,829 --> 00:48:31,680

yes that you're weaker than you really

1399

00:48:35,670 --> 00:48:32,839

are

1400

00:48:37,109 --> 00:48:35,680

yes second question i noticed in one of

1401

00:48:39,670 --> 00:48:37,119

the last shots you had a really

1402

00:48:42,069 --> 00:48:39,680

hilarious piece of astro turf that

1403

00:48:43,589 --> 00:48:42,079

looked like grass underneath your seats

1404

00:48:44,870 --> 00:48:43,599

why did you put asteroid turf in

1405

00:48:46,790 --> 00:48:44,880

kazakhstan

1406

00:48:48,470 --> 00:48:46,800

well of course we get pulled out of the

1407

00:48:50,230 --> 00:48:48,480

capsule and we're pretty much

1408

00:48:52,470 --> 00:48:50,240

all we're doing is looking at sky and

1409

00:48:54,710 --> 00:48:52,480

you know breathing the fresh air

1410

00:48:56,390 --> 00:48:54,720

i guess they put it out there so that we

1411

00:48:58,230 --> 00:48:56,400

people could stand there and not slip

1412

00:48:59,750 --> 00:48:58,240

around that's all i'm guessing

1413

00:49:01,030 --> 00:48:59,760

i did see it when i came out of the

1414

00:49:02,470 --> 00:49:01,040

capsule and of course it was

1415

00:49:04,390 --> 00:49:02,480

snow-covered

1416

00:49:06,870 --> 00:49:04,400

kazakhstan at that point it was actually

1417

00:49:08,470 --> 00:49:06,880

about that deep with a big crust on top

1418

00:49:10,630 --> 00:49:08,480

so they had a hard time carrying us

1419

00:49:12,790 --> 00:49:10,640

around and i guess they they mashed an

1420

00:49:14,630 --> 00:49:12,800

area down and put that grass down

1421

00:49:16,630 --> 00:49:14,640

just just so they wouldn't slip around

1422

00:49:18,309 --> 00:49:16,640

perhaps very funny thanks again it's

1423

00:49:21,510 --> 00:49:18,319

been fascinating nice you noticed that

1424

00:49:25,829 --> 00:49:23,990

hi my name is eric front i'm from

1425

00:49:28,390 --> 00:49:25,839

jacksonville north carolina

1426

00:49:30,710 --> 00:49:28,400

first of all i had the honor of making

1427

00:49:33,349 --> 00:49:30,720

the clevis joints and the uh

1428

00:49:36,069 --> 00:49:33,359

radiators uh for the space shuttle oh

1429

00:49:37,510 --> 00:49:36,079

man and uh congratulations you know

1430

00:49:40,230 --> 00:49:37,520

it feels good for me

1431

00:49:42,069 --> 00:49:40,240

but um are you guys training for you

1432

00:49:43,670 --> 00:49:42,079

they got the dragon

1433

00:49:46,390 --> 00:49:43,680

they're gonna have a man thing are you

1434

00:49:48,790 --> 00:49:46,400

guys training already for that

1435

00:49:51,349 --> 00:49:48,800

particular space no correct not training

1436

00:49:52,870 --> 00:49:51,359

not training for it yet in a manned role

1437

00:49:54,470 --> 00:49:52,880

i think the development we have some

1438

00:49:56,309 --> 00:49:54,480

astronauts in the office

1439

00:49:58,150 --> 00:49:56,319

that are part of the development and

1440

00:49:59,270 --> 00:49:58,160

they actually can't even tell us stuff

1441

00:50:00,470 --> 00:49:59,280

uh one of the pro you know with the

1442

00:50:02,470 --> 00:50:00,480

commercial thing one of the things they

1443

00:50:04,710 --> 00:50:02,480

have to be care careful about in

1444

00:50:06,150 --> 00:50:04,720

development is this proprietary uh

1445

00:50:07,670 --> 00:50:06,160

rights and that sort of thing but we do

1446

00:50:09,109 --> 00:50:07,680

have astronauts that are out there and

1447

00:50:11,589 --> 00:50:09,119

in tune with the people who are making

1448

00:50:13,750 --> 00:50:11,599

the designs to make sure that you know

1449

00:50:15,510 --> 00:50:13,760

our concerns are satisfied at the same

1450

00:50:17,430 --> 00:50:15,520

time when we finally have a man-rated

1451  
00:50:18,870 --> 00:50:17,440  
dragon we don't want to say you have to

1452  
00:50:20,870 --> 00:50:18,880  
go back to the drawing board we want to

1453  
00:50:22,309 --> 00:50:20,880  
say hey we're happy with it when it

1454  
00:50:24,069 --> 00:50:22,319  
finally arrives at our doorstep and of

1455  
00:50:26,470 --> 00:50:24,079  
course it will happen

1456  
00:50:29,349 --> 00:50:26,480  
sometime down the road dragon is was a

1457  
00:50:32,309 --> 00:50:29,359  
beautiful vehicle on board and uh right

1458  
00:50:34,150 --> 00:50:32,319  
now it it needs a lot of enhancements

1459  
00:50:37,589 --> 00:50:34,160  
obviously to fly people including you

1460  
00:50:39,270 --> 00:50:37,599  
know emergency escape provisions and uh

1461  
00:50:40,870 --> 00:50:39,280  
environmental control systems and that

1462  
00:50:42,710 --> 00:50:40,880  
sort of thing so

1463  
00:50:44,309 --> 00:50:42,720

it's got a it's got a ways to go but i

1464

00:50:46,710 --> 00:50:44,319

think it's capable the only reason why i

1465

00:50:48,309 --> 00:50:46,720

asked that question is is because

1466

00:50:50,630 --> 00:50:48,319

to me

1467

00:50:51,589 --> 00:50:50,640

helped building that beautiful machine

1468

00:50:53,670 --> 00:50:51,599

over there

1469

00:50:55,829 --> 00:50:53,680

they retired it too early you know

1470

00:50:56,790 --> 00:50:55,839

because we went from

1471

00:50:58,470 --> 00:50:56,800

100

1472

00:51:00,549 --> 00:50:58,480

almost to zero percent and now we're

1473

00:51:02,950 --> 00:51:00,559

dependent on somebody else and the space

1474

00:51:05,190 --> 00:51:02,960

shuttle also lifted up the uh

1475

00:51:06,549 --> 00:51:05,200

space station to um

1476

00:51:07,510 --> 00:51:06,559

because it's falling

1477

00:51:09,750 --> 00:51:07,520

yeah

1478

00:51:11,910 --> 00:51:09,760

what lifts it up now well we can we can

1479

00:51:14,309 --> 00:51:11,920

still use uh propellant from the space

1480

00:51:16,710 --> 00:51:14,319

station we can take propellant up one

1481

00:51:18,390 --> 00:51:16,720

progress and also the the atv the

1482

00:51:21,750 --> 00:51:18,400

automated transfer vehicle the esa

1483

00:51:23,510 --> 00:51:21,760

vehicle and uh take propellant up and

1484

00:51:25,030 --> 00:51:23,520

they can use the propellant from the

1485

00:51:26,549 --> 00:51:25,040

back end of the space station or they

1486

00:51:28,470 --> 00:51:26,559

can use the vehicle while it's docked

1487

00:51:31,750 --> 00:51:28,480

there itself to give it a little bit of

1488

00:51:33,510 --> 00:51:31,760

extra boost and that's done regularly

1489

00:51:35,430 --> 00:51:33,520

more often than once a month almost to

1490

00:51:37,190 --> 00:51:35,440

go ahead and add a little bit of of

1491

00:51:38,790 --> 00:51:37,200

energy to the space station to keep its

1492

00:51:40,630 --> 00:51:38,800

orbit up where where it needs to be so

1493

00:51:42,309 --> 00:51:40,640

that's what we do and that's of course

1494

00:51:44,950 --> 00:51:42,319

we did do that with uh with the space

1495

00:51:46,390 --> 00:51:44,960

shuttle so and we did we absolutely did

1496

00:51:48,470 --> 00:51:46,400

hate to say goodbye to our space

1497

00:51:49,910 --> 00:51:48,480

shuttles i agree with you i thank you

1498

00:51:54,390 --> 00:51:49,920

for your time yeah thank you for your

1499

00:51:58,470 --> 00:51:56,710

all right a few more i'm shania from

1500

00:52:00,630 --> 00:51:58,480

nashville uh-huh

1501  
00:52:02,790 --> 00:52:00,640  
i wanted to know what's a benefit for

1502  
00:52:06,069 --> 00:52:02,800  
you to go to school longer than what's

1503  
00:52:08,870 --> 00:52:06,079  
required i'm sorry more time

1504  
00:52:10,710 --> 00:52:08,880  
i said i wanted to know what's a benefit

1505  
00:52:12,549 --> 00:52:10,720  
for you to go to school longer than

1506  
00:52:14,790 --> 00:52:12,559  
what's required

1507  
00:52:18,390 --> 00:52:14,800  
what's the benefit for me to

1508  
00:52:19,589 --> 00:52:18,400  
go to school longer go to school longer

1509  
00:52:20,870 --> 00:52:19,599  
is that what you said go to school

1510  
00:52:23,190 --> 00:52:20,880  
longer

1511  
00:52:25,990 --> 00:52:23,200  
well um you know i've kind of been like

1512  
00:52:27,750 --> 00:52:26,000  
a student my whole life

1513  
00:52:30,390 --> 00:52:27,760

even even when you're all done with

1514

00:52:31,349 --> 00:52:30,400

school and you're done with university

1515

00:52:38,710 --> 00:52:31,359

and

1516

00:52:40,230 --> 00:52:38,720

take uh

1517

00:52:42,069 --> 00:52:40,240

all kinds of uh

1518

00:52:44,150 --> 00:52:42,079

tests sometimes before committees and

1519

00:52:46,630 --> 00:52:44,160

that sort of thing and of course the

1520

00:52:49,430 --> 00:52:46,640

ultimate test is can we can we do the

1521

00:52:51,030 --> 00:52:49,440

job on the space station so school yeah

1522

00:52:53,270 --> 00:52:51,040

school is kind of learned teaching you

1523

00:52:54,790 --> 00:52:53,280

how to learn i always looked at school

1524

00:52:56,549 --> 00:52:54,800

most as

1525

00:52:58,309 --> 00:52:56,559

well maybe i won't use this material

1526

00:53:00,630 --> 00:52:58,319

directly but learning how to assimilate

1527

00:53:03,190 --> 00:53:00,640

this material in case i do need it as

1528

00:53:04,710 --> 00:53:03,200

kind of the most important thing so a

1529

00:53:06,549 --> 00:53:04,720

lot a lot of school and learning to

1530

00:53:08,390 --> 00:53:06,559

become a good student is really is

1531

00:53:10,230 --> 00:53:08,400

really good for any career field i think

1532

00:53:11,829 --> 00:53:10,240

you should always study and keep up with

1533

00:53:15,349 --> 00:53:11,839

your career field regardless of what it

1534

00:53:17,190 --> 00:53:15,359

is and in my business we we even keep

1535

00:53:19,190 --> 00:53:17,200

having exams right up until the launch

1536

00:53:21,910 --> 00:53:19,200

pad and if you if you think about it the

1537

00:53:24,069 --> 00:53:21,920

the launch itself is an exam of sorts

1538

00:53:25,750 --> 00:53:24,079

so just getting it just getting in tune

1539

00:53:28,230 --> 00:53:25,760

with uh staying with that education is

1540

00:53:31,109 --> 00:53:28,240

important thing

1541

00:53:35,190 --> 00:53:33,430

hi my name is aziza kevil

1542

00:53:36,710 --> 00:53:35,200

i was a flight surgeon in the united

1543

00:53:37,510 --> 00:53:36,720

states air force

1544

00:53:39,109 --> 00:53:37,520

so

1545

00:53:40,870 --> 00:53:39,119

i'm very much interested in the space

1546

00:53:42,230 --> 00:53:40,880

flight i was

1547

00:53:44,230 --> 00:53:42,240

stationed that bill where there the

1548

00:53:46,630 --> 00:53:44,240

sr-71

1549

00:53:48,549 --> 00:53:46,640

so we were always interested in what

1550

00:53:50,870 --> 00:53:48,559

blood changes happen in your body when

1551  
00:53:51,670 --> 00:53:50,880  
you're in space what changes well yeah

1552  
00:53:53,670 --> 00:53:51,680  
like

1553  
00:53:54,630 --> 00:53:53,680  
do you lose a lot of calcium and vitamin

1554  
00:53:59,109 --> 00:53:54,640  
d

1555  
00:54:00,710 --> 00:53:59,119  
recover well uh you're right they have

1556  
00:54:02,309 --> 00:54:00,720  
recognized that that's a problem up

1557  
00:54:04,549 --> 00:54:02,319  
there certainly uh during the mere

1558  
00:54:07,109 --> 00:54:04,559  
program uh long duration flights people

1559  
00:54:09,510 --> 00:54:07,119  
were losing a lot of bone mass and also

1560  
00:54:10,790 --> 00:54:09,520  
structure and you can rebuild it back on

1561  
00:54:12,069 --> 00:54:10,800  
the ground but sometimes it's a very

1562  
00:54:14,150 --> 00:54:12,079  
different structure on the ground when

1563  
00:54:16,630 --> 00:54:14,160

you rebuild it back so we are really

1564

00:54:18,549 --> 00:54:16,640

trying hard to maintain our bone our

1565

00:54:20,950 --> 00:54:18,559

bone mass and we take vitamin d

1566

00:54:23,349 --> 00:54:20,960

supplements every day on board

1567

00:54:24,549 --> 00:54:23,359

to help with that and then the nutrition

1568

00:54:26,549 --> 00:54:24,559

experts

1569

00:54:28,710 --> 00:54:26,559

are can continue to refine what they

1570

00:54:30,630 --> 00:54:28,720

what they feed us and what we eat the

1571

00:54:32,710 --> 00:54:30,640

changes in our body are kind of

1572

00:54:34,230 --> 00:54:32,720

remarkable one of the things

1573

00:54:35,589 --> 00:54:34,240

that seems to be true for space flight

1574

00:54:37,270 --> 00:54:35,599

is that you can eat as much as you want

1575

00:54:39,349 --> 00:54:37,280

to and you won't gain weight i don't

1576  
00:54:41,430 --> 00:54:39,359  
really know why but your metabolism and

1577  
00:54:43,750 --> 00:54:41,440  
zero gravity is just confused enough

1578  
00:54:44,789 --> 00:54:43,760  
that there's some subtle changes to it

1579  
00:54:46,390 --> 00:54:44,799  
so

1580  
00:54:48,069 --> 00:54:46,400  
we we

1581  
00:54:50,789 --> 00:54:48,079  
we see a lot of things up there very

1582  
00:54:52,710 --> 00:54:50,799  
interesting and those those flight docs

1583  
00:54:54,470 --> 00:54:52,720  
they look at us once a week they talk to

1584  
00:54:56,630 --> 00:54:54,480  
us and they look at everything we're

1585  
00:54:58,549 --> 00:54:56,640  
doing and they've they found a way to

1586  
00:55:00,230 --> 00:54:58,559  
keep us in shape and now nowadays keep

1587  
00:55:02,390 --> 00:55:00,240  
our bones uh where they're supposed to

1588  
00:55:04,390 --> 00:55:02,400

be and our muscle tissues too so one of

1589

00:55:05,670 --> 00:55:04,400

the great benefits of the iss i think

1590

00:55:07,430 --> 00:55:05,680

for the future

1591

00:55:09,270 --> 00:55:07,440

so i'm getting i'm getting the word here

1592

00:55:11,510 --> 00:55:09,280

it's time to wrap it up or do we have

1593

00:55:14,870 --> 00:55:11,520

time for one more thank you okay thank

1594

00:55:18,390 --> 00:55:16,309

you said wrap it up

1595

00:55:21,109 --> 00:55:18,400

all right well thanks again uh

1596

00:55:22,789 --> 00:55:21,119

what a great uh great room to be in uh

1597

00:55:24,390 --> 00:55:22,799

space shuttle main engine back here

1598

00:55:25,829 --> 00:55:24,400

models i'm not going to leave here until

1599

00:55:28,549 --> 00:55:25,839

i have a chance to look over the space

1600

00:55:30,549 --> 00:55:28,559

station model and it's just been a

1601

00:55:33,030 --> 00:55:30,559

fantastic experience with all of you

1602

00:55:34,390 --> 00:55:33,040

today great to be here and

1603

00:55:36,630 --> 00:55:34,400

if you have any questions maybe i can