
PAO
POSN 4732

1
00:00:05,090 --> 00:00:02,960
hi welcome to Mission Control Center

2
00:00:06,980 --> 00:00:05,100
here in Houston where we have a Mario

3
00:00:09,860 --> 00:00:06,990
ronca with us one of our astronauts who

4
00:00:11,089 --> 00:00:09,870
also works with a bunch of different

5
00:00:12,470 --> 00:00:11,099
projects here on the ground as well

6
00:00:14,589 --> 00:00:12,480
including he's been really involved

7
00:00:17,060 --> 00:00:14,599
lately with the transit of Venus

8
00:00:18,290 --> 00:00:17,070
experience that just took place earlier

9
00:00:19,880 --> 00:00:18,300
this week and I think y'all learned a

10
00:00:21,200 --> 00:00:19,890
little bit about it before we get

11
00:00:23,120 --> 00:00:21,210
started with your questions and we're

12
00:00:24,859 --> 00:00:23,130
here in the Mission Control Center this

13
00:00:27,470 --> 00:00:24,869

is the International Space Station

14
00:00:29,990 --> 00:00:27,480
flight control room and this is where

15
00:00:32,060 --> 00:00:30,000
all the people who control the space

16
00:00:33,080 --> 00:00:32,070
station from the ground sit and work and

17
00:00:35,150 --> 00:00:33,090
you can probably see in the background

18
00:00:37,310 --> 00:00:35,160
the map that tracks International Space

19
00:00:39,020 --> 00:00:37,320
Station and around the room we've got

20
00:00:41,540 --> 00:00:39,030
all the different positions that

21
00:00:42,799 --> 00:00:41,550
actually control the systems on board so

22
00:00:48,250 --> 00:00:42,809
we look forward to hearing your

23
00:00:51,410 --> 00:00:48,260
questions I'm Marvin uh I was wondering

24
00:00:53,660 --> 00:00:51,420
could you would it be possible to send

25
00:00:59,270 --> 00:00:53,670
her over to fix one of the rover's they

26
00:01:04,070 --> 00:00:59,280
got crashed on I presume Marvin you mean

27
00:01:06,710 --> 00:01:04,080
on Mars and at the current time present

28
00:01:11,060 --> 00:01:06,720
technology would probably not permit

29
00:01:13,520 --> 00:01:11,070
that in terms of being able to to to do

30
00:01:16,280 --> 00:01:13,530
that sort of repair it might not be

31
00:01:20,240 --> 00:01:16,290
cost-effective to do so whereas sending

32
00:01:22,490 --> 00:01:20,250
another Rover to replace it would might

33
00:01:24,980 --> 00:01:22,500
be a better option than to repair one

34
00:01:27,140 --> 00:01:24,990
that is there having said that if the

35
00:01:29,149 --> 00:01:27,150
repair is simple enough and we did send

36
00:01:32,420 --> 00:01:29,159
another Rover for more experimentation

37
00:01:34,010 --> 00:01:32,430
and more exploration it probably would

38
00:01:35,899 --> 00:01:34,020

be in a different area but if it were in

39
00:01:37,850 --> 00:01:35,909
the same area and then the repair were

40
00:01:40,130 --> 00:01:37,860
simple enough something like pulling out

41
00:01:43,249 --> 00:01:40,140
a part and replacing it that might be

42
00:01:45,800 --> 00:01:43,259
plug-in then it then it I would say it

43
00:01:47,600 --> 00:01:45,810
would might be possible maybe y'all

44
00:01:49,670 --> 00:01:47,610
heard about the Curiosity rover that's

45
00:01:51,560 --> 00:01:49,680
going to be landing on Mars in August

46
00:01:52,910 --> 00:01:51,570
and won't be going to get that a rubber

47
00:01:59,120 --> 00:01:52,920
but hopefully we'll find out some cool

48
00:02:00,889 --> 00:01:59,130
new stuff from it do you want us to ask

49
00:02:02,389 --> 00:02:00,899
questions now or do you want to speak

50
00:02:04,010 --> 00:02:02,399
for a little bit and then have us ask

51
00:02:06,560 --> 00:02:04,020
questions please go ahead and ask your

52
00:02:11,900 --> 00:02:06,570
question yeah let's give the students

53
00:02:18,920 --> 00:02:15,880
hi this is Garrett I was wondering if

54
00:02:20,690 --> 00:02:18,930
like if you have plants up there and

55
00:02:25,010 --> 00:02:20,700
like if you can like make them grow

56
00:02:27,650 --> 00:02:25,020
really big well Garrett you have asked a

57
00:02:30,200 --> 00:02:27,660
question that is very basic to science

58
00:02:32,720 --> 00:02:30,210
that is a super question as a matter of

59
00:02:35,600 --> 00:02:32,730
fact we have been experimenting with

60
00:02:37,790 --> 00:02:35,610
plants in space for quite some time we

61
00:02:39,380 --> 00:02:37,800
used to do on the Space Shuttle plant

62
00:02:40,910 --> 00:02:39,390
experiments but the the drawback to

63
00:02:43,760 --> 00:02:40,920

doing them on the Space Shuttle was the

64
00:02:46,280 --> 00:02:43,770
spatial only state in space for about 14

65
00:02:48,920 --> 00:02:46,290
days and as you probably know 14 days is

66
00:02:50,750 --> 00:02:48,930
not a long time to grow a plant however

67
00:02:53,090 --> 00:02:50,760
on the International Space Station we do

68
00:02:56,660 --> 00:02:53,100
have additional experiments with plant

69
00:03:00,080 --> 00:02:56,670
growth and a lot of the curiosity as to

70
00:03:02,630 --> 00:03:00,090
with the plants and how they behave in

71
00:03:04,610 --> 00:03:02,640
microgravity are related to is since

72
00:03:07,400 --> 00:03:04,620
there's no up or down which way will

73
00:03:08,780 --> 00:03:07,410
they grow how do they respond to light

74
00:03:11,780 --> 00:03:08,790
do they respond to the light differently

75
00:03:14,120 --> 00:03:11,790
than on the ground is there a change in

76
00:03:18,020 --> 00:03:14,130
in the plant itself when it is growing

77
00:03:20,600 --> 00:03:18,030
so and I would guess even though we

78
00:03:22,640 --> 00:03:20,610
haven't grown a plant very large because

79
00:03:24,380 --> 00:03:22,650
we have to stay inside so essentially

80
00:03:28,820 --> 00:03:24,390
any plants we do grow our house plans

81
00:03:32,510 --> 00:03:28,830
and and the house is only so much size

82
00:03:35,390 --> 00:03:32,520
is if I would think because of the lack

83
00:03:39,320 --> 00:03:35,400
of gravity the plants potentially could

84
00:03:41,960 --> 00:03:39,330
grow very large maybe y'all have heard

85
00:03:43,190 --> 00:03:41,970
about the blog that one of the

86
00:03:45,260 --> 00:03:43,200
astronauts on the space station is

87
00:03:47,090 --> 00:03:45,270
writing right now Don Pettit it's a he's

88
00:03:48,740 --> 00:03:47,100

written one called the diary of a

89
00:03:52,100 --> 00:03:48,750
zucchini and you can find that online at

90
00:03:53,630 --> 00:03:52,110
blog our blogs nasa gov so you might

91
00:03:54,949 --> 00:03:53,640
check into that and see what he has to

92
00:04:01,670 --> 00:03:54,959
say about the plants he's been growing

93
00:04:05,840 --> 00:04:01,680
in space my name is red my name is ren

94
00:04:09,470 --> 00:04:05,850
and um home how big are those solar

95
00:04:11,720 --> 00:04:09,480
panels that's a good question i don't

96
00:04:14,180 --> 00:04:11,730
know exact dimensions on the solar

97
00:04:17,030 --> 00:04:14,190
panels but i would say that the length

98
00:04:20,180 --> 00:04:17,040
of them are probably about half a

99
00:04:23,590 --> 00:04:20,190
football field long and they are

100
00:04:30,100 --> 00:04:23,600
probably i would guess each and win

101
00:04:35,560 --> 00:04:30,110
about 20-30 feet sounds about right mmm

102
00:04:39,280 --> 00:04:35,570
this is taye in and has has opportunity

103
00:04:42,760 --> 00:04:39,290
picked up a new information actually

104
00:04:46,590 --> 00:04:42,770
opportunity is let's see now help me out

105
00:04:49,360 --> 00:04:46,600
here because we've got opportunity and

106
00:04:51,100 --> 00:04:49,370
spirit and one of those is not

107
00:04:52,770 --> 00:04:51,110
functional at this point I'm I believe

108
00:04:54,990 --> 00:04:52,780
its spirit I think you're right not

109
00:04:58,660 --> 00:04:55,000
operational so the twin Rovers on Mars

110
00:05:02,380 --> 00:04:58,670
have been there for many many years now

111
00:05:03,670 --> 00:05:02,390
and they have performed better than we

112
00:05:06,310 --> 00:05:03,680
have expected because i think the

113
00:05:09,460 --> 00:05:06,320

original mission was only like 45 50

114
00:05:11,980 --> 00:05:09,470
days they have picked up new information

115
00:05:13,060 --> 00:05:11,990
both Rovers have opportunity

116
00:05:15,160 --> 00:05:13,070
particularly because it's still

117
00:05:17,590 --> 00:05:15,170
operational and that is why we have the

118
00:05:19,480 --> 00:05:17,600
Mars Science Laboratory the Curiosity

119
00:05:22,840 --> 00:05:19,490
rover on its way to Mars now in August

120
00:05:25,750 --> 00:05:22,850
because of the discoveries that made us

121
00:05:26,890 --> 00:05:25,760
even more curious about some of the

122
00:05:29,110 --> 00:05:26,900
things we were observing with

123
00:05:32,290 --> 00:05:29,120
opportunity on Mars and we're trying to

124
00:05:36,430 --> 00:05:32,300
go and discover those we found water we

125
00:05:39,250 --> 00:05:36,440
found minerals that are somewhat related

126
00:05:44,110 --> 00:05:39,260
to biologics and so that that is a

127
00:05:45,850 --> 00:05:44,120
tantalizing elevation of the information

128
00:05:47,830 --> 00:05:45,860
that makes us believe that there might

129
00:05:49,990 --> 00:05:47,840
have been life on Mars at one point in

130
00:05:52,330 --> 00:05:50,000
its history so to be able to go there

131
00:06:00,700 --> 00:05:52,340
and actually discover that would be a

132
00:06:03,220 --> 00:06:00,710
fantastic discovery my name is Trey and

133
00:06:06,820 --> 00:06:03,230
what do they make the space shoots at

134
00:06:08,590 --> 00:06:06,830
spacesuits out of you mean the space

135
00:06:10,300 --> 00:06:08,600
suits or the space shoots as in

136
00:06:15,610 --> 00:06:10,310
parachute I didn't quite understand your

137
00:06:17,920 --> 00:06:15,620
question suits suits okay the spacesuits

138
00:06:22,380 --> 00:06:17,930

are made of several layers okay the

139
00:06:25,990 --> 00:06:22,390
outer layer is basically a plastic shell

140
00:06:28,030 --> 00:06:26,000
on the upper torso and around the the

141
00:06:30,820 --> 00:06:28,040
waist and there is their metal parts to

142
00:06:33,550 --> 00:06:30,830
it as well and that helps contain the

143
00:06:36,159 --> 00:06:33,560
pressure net outside of that there's a

144
00:06:37,720 --> 00:06:36,169
a rubber bladder that contains the air

145
00:06:39,640 --> 00:06:37,730
excuse me inside of that there's a

146
00:06:43,900 --> 00:06:39,650
rubber bladder that contains the air and

147
00:06:47,220 --> 00:06:43,910
outside of that there's a nomex material

148
00:06:50,530 --> 00:06:47,230
that acts as a micrometeoroid or

149
00:06:52,720 --> 00:06:50,540
essentially a protection against the

150
00:06:55,050 --> 00:06:52,730
small particles in space so that doesn't

151
00:06:57,580 --> 00:06:55,060
puncture the suit and it also has

152
00:06:59,350 --> 00:06:57,590
thermal protection on the outside in

153
00:07:02,980 --> 00:06:59,360
that same material there's a blanket uh

154
00:07:05,230 --> 00:07:02,990
like a Lumina meeeeee colored kind of

155
00:07:07,300 --> 00:07:05,240
blanket underneath the the Nomex that

156
00:07:09,159 --> 00:07:07,310
that is a sort of like a radiative

157
00:07:11,290 --> 00:07:09,169
barrier that now what you might put in

158
00:07:13,659 --> 00:07:11,300
your attic Maria what do you need the

159
00:07:16,090 --> 00:07:13,669
thermal protection one is my suit a good

160
00:07:18,430 --> 00:07:16,100
question the thermal protection is such

161
00:07:22,780 --> 00:07:18,440
that when you're in orbit around the

162
00:07:24,610 --> 00:07:22,790
earth most of the time you go behind the

163
00:07:27,670 --> 00:07:24,620

earth away from the Sun in the shadow of

164
00:07:30,180 --> 00:07:27,680
the earth so that would be an eclipse to

165
00:07:32,590 --> 00:07:30,190
the person who's doing the spacewalk

166
00:07:35,440 --> 00:07:32,600
because this the earth blocks the Sun

167
00:07:37,210 --> 00:07:35,450
and when you're on the backside of the

168
00:07:39,790 --> 00:07:37,220
earth you don't have any of the sunlight

169
00:07:42,250 --> 00:07:39,800
and it gets very very cold down to minus

170
00:07:44,620 --> 00:07:42,260
250 degrees Fahrenheit or thereabouts--

171
00:07:47,680 --> 00:07:44,630
and then when you're in the Sun the

172
00:07:50,350 --> 00:07:47,690
temperature rises to about that much to

173
00:07:51,880 --> 00:07:50,360
plus 250 so you got a four to five

174
00:07:54,370 --> 00:07:51,890
hundred degree temperature range with

175
00:07:56,740 --> 00:07:54,380
which you're dealing and human beings

176
00:07:59,950 --> 00:07:56,750
and creatures on earth like to stay

177
00:08:02,260 --> 00:07:59,960
around 70 degrees Fahrenheit so to keep

178
00:08:06,220 --> 00:08:02,270
us comfortable and alive you need to

179
00:08:11,320 --> 00:08:09,430
okay my name is Courtney and what kind

180
00:08:14,170 --> 00:08:11,330
of food do you guys eat on the space

181
00:08:15,550 --> 00:08:14,180
station and how do you eat it okay what

182
00:08:19,000 --> 00:08:15,560
kind of food there's a variety of

183
00:08:21,820 --> 00:08:19,010
different kinds of foods there's there's

184
00:08:23,680 --> 00:08:21,830
a limited variety of fresh foods when a

185
00:08:25,450 --> 00:08:23,690
spacecraft first gets up in doc's with

186
00:08:27,010 --> 00:08:25,460
the space station there's there's treats

187
00:08:29,380 --> 00:08:27,020
on board if you will there might be some

188
00:08:31,660 --> 00:08:29,390

fresh fruit some some fresh cookies

189
00:08:34,960 --> 00:08:31,670
things like that so that you're familiar

190
00:08:37,540 --> 00:08:34,970
with the the other food as it comes in a

191
00:08:40,420 --> 00:08:37,550
kind of varieties there's rehydrate able

192
00:08:42,250 --> 00:08:40,430
foods you might know them as free stride

193
00:08:44,410 --> 00:08:42,260
they're not exactly freeze-dried but the

194
00:08:47,020 --> 00:08:44,420
water is removed from them and then we

195
00:08:49,270 --> 00:08:47,030
have to add the water back in heat them

196
00:08:54,430 --> 00:08:49,280
up and and they come in lots of

197
00:08:56,770 --> 00:08:54,440
varieties turkey Tetrazzini there's

198
00:08:58,390 --> 00:08:56,780
chicken soups there's burgers and stuff

199
00:09:02,380 --> 00:08:58,400
like that so and then there's another

200
00:09:03,340 --> 00:09:02,390
variety that comes from the military if

201
00:09:06,960 --> 00:09:03,350
you will there the meals-ready-to-eat

202
00:09:10,450 --> 00:09:06,970
the same food that the the troops and

203
00:09:13,150 --> 00:09:10,460
would use in the field when they are on

204
00:09:14,830 --> 00:09:13,160
bivouac if you will and those foods are

205
00:09:17,650 --> 00:09:14,840
thermal stabilize their put in pouches

206
00:09:19,960 --> 00:09:17,660
and they come in a variety of different

207
00:09:22,720 --> 00:09:19,970
flavors now the thing about the foods is

208
00:09:25,570 --> 00:09:22,730
each astronaut generally samples the

209
00:09:26,650 --> 00:09:25,580
menu they pick what they like and of

210
00:09:29,350 --> 00:09:26,660
course you're not gonna eat things you

211
00:09:32,320 --> 00:09:29,360
don't like except there's a little part

212
00:09:34,210 --> 00:09:32,330
of the story here and you know you

213
00:09:36,460 --> 00:09:34,220

prepare your menus and you plan your

214
00:09:39,370 --> 00:09:36,470
menus ahead for the time you're going to

215
00:09:42,150 --> 00:09:39,380
be on board so generally the food is are

216
00:09:45,850 --> 00:09:42,160
things that you generally like however

217
00:09:47,410 --> 00:09:45,860
because of nutritional factors they'll

218
00:09:48,760 --> 00:09:47,420
look at your menu and what you've picked

219
00:09:53,200 --> 00:09:48,770
and if you're deficient in something

220
00:09:54,790 --> 00:09:53,210
over the long term potassium or vitamin

221
00:09:57,610 --> 00:09:54,800
E or whatever it might be they will

222
00:09:59,680 --> 00:09:57,620
recommend and add to your diet things

223
00:10:02,740 --> 00:09:59,690
that will contain those those nutrients

224
00:10:05,920 --> 00:10:02,750
for you and of course you'll pick the

225
00:10:08,740 --> 00:10:05,930
ones that you prefer the most for that

226
00:10:10,210 --> 00:10:08,750
contain those those nutrients I heard

227
00:10:11,950 --> 00:10:10,220
that you can't or you don't get to eat a

228
00:10:14,620 --> 00:10:11,960
whole of bread on in space is that right

229
00:10:17,800 --> 00:10:14,630
well bred and space is problematic first

230
00:10:19,900 --> 00:10:17,810
of all the bread has a short shelf life

231
00:10:21,340 --> 00:10:19,910
and it gets very draw

232
00:10:24,670 --> 00:10:21,350
for some reason or other it doesn't last

233
00:10:27,100 --> 00:10:24,680
even as long as it does down here if you

234
00:10:31,300 --> 00:10:27,110
just left it on the counter or in the

235
00:10:32,560 --> 00:10:31,310
breadbox what we prefer in space is the

236
00:10:35,230 --> 00:10:32,570
alternative to bread or tortillas

237
00:10:37,690 --> 00:10:35,240
because two reasons one is they seem to

238
00:10:39,400 --> 00:10:37,700

keep longer and they're not as flaky

239
00:10:41,770 --> 00:10:39,410
when you have bread it tends to crumble

240
00:10:44,170 --> 00:10:41,780
and it flies all over the place and it

241
00:10:46,030 --> 00:10:44,180
gets pretty messy or as if for example

242
00:10:48,700 --> 00:10:46,040
if I wanted to make a peanut butter and

243
00:10:51,250 --> 00:10:48,710
jelly sandwich I could spread the peanut

244
00:10:52,780 --> 00:10:51,260
butter on a tortilla and the tortillas

245
00:10:55,030 --> 00:10:52,790
much tougher it holds together better

246
00:10:57,880 --> 00:10:55,040
and will contain and hold the jelly and

247
00:11:00,010 --> 00:10:57,890
the peanut butter so we don't I'm

248
00:11:01,510 --> 00:11:00,020
floating around on right and then we

249
00:11:03,520 --> 00:11:01,520
have to be like fish and start eating

250
00:11:08,140 --> 00:11:03,530
the crumbs like a fish in a tank eating

251
00:11:10,990 --> 00:11:08,150
its food that sounds fun enough I'm

252
00:11:12,730 --> 00:11:11,000
Marvin and watch a short video and it

253
00:11:14,950 --> 00:11:12,740
showed it didn't show where they slept

254
00:11:18,700 --> 00:11:14,960
do they like sleep in beds are just like

255
00:11:21,580 --> 00:11:18,710
strapped down in flow good question

256
00:11:24,580 --> 00:11:21,590
actually on the I'll talk about how they

257
00:11:27,040 --> 00:11:24,590
sleep on the ISS and then you could

258
00:11:28,990 --> 00:11:27,050
extrapolate to other vehicles like the

259
00:11:31,480 --> 00:11:29,000
space shuttle or smaller vehicles like

260
00:11:34,420 --> 00:11:31,490
the Soyuz or even some of the future

261
00:11:37,840 --> 00:11:34,430
vehicles like a riot each crew member

262
00:11:40,390 --> 00:11:37,850
has a sleep station think of the sleep

263
00:11:42,250 --> 00:11:40,400

station as a phone booth a large phone

264
00:11:43,780 --> 00:11:42,260
booth a little bit shorter than a phone

265
00:11:46,510 --> 00:11:43,790
booth because we're not as tall as the

266
00:11:48,340 --> 00:11:46,520
phone booth and a little bit wider to

267
00:11:51,850 --> 00:11:48,350
give more room to turn around in and

268
00:11:53,800 --> 00:11:51,860
each crew member has his personal items

269
00:11:56,470 --> 00:11:53,810
in their pictures of his family the

270
00:11:58,000 --> 00:11:56,480
books he might want to read his laptop

271
00:12:00,550 --> 00:11:58,010
the videos he might want to launch an

272
00:12:03,340 --> 00:12:00,560
asst laptop and things like that and

273
00:12:06,940 --> 00:12:03,350
inside that compartment they usually

274
00:12:09,040 --> 00:12:06,950
have for lack of a better term it's it's

275
00:12:11,140 --> 00:12:09,050
a sleep restraint or a sleeping bag and

276
00:12:13,510 --> 00:12:11,150
the purpose of the sleeping bag so that

277
00:12:15,610 --> 00:12:13,520
you're not you you restrain someone and

278
00:12:17,260 --> 00:12:15,620
you're not floating around in this case

279
00:12:19,420 --> 00:12:17,270
within the compartment within the phone

280
00:12:20,740 --> 00:12:19,430
booth and if you're sleeping and you're

281
00:12:22,120 --> 00:12:20,750
floating and you actually floating

282
00:12:23,410 --> 00:12:22,130
around and you bump into something that

283
00:12:25,870 --> 00:12:23,420
will wake you up and you don't want that

284
00:12:27,910 --> 00:12:25,880
to happen so generally speaking most

285
00:12:30,910 --> 00:12:27,920
crewmembers crawl inside the sleep

286
00:12:32,740 --> 00:12:30,920
restraint zip it up like I said it's not

287
00:12:35,560 --> 00:12:32,750
unlike a sleeping bag

288
00:12:38,740 --> 00:12:35,570

and that sleeping bag is attached to one

289
00:12:40,180 --> 00:12:38,750
wall or the other of the of the sleeping

290
00:12:46,750 --> 00:12:40,190
compartment of the phone booth and

291
00:12:50,500 --> 00:12:46,760
that's how they sleep hi this is griffin

292
00:12:53,260 --> 00:12:50,510
uh what happens if something goes wrong

293
00:12:56,590 --> 00:12:53,270
while astronaut is out in space working

294
00:12:58,540 --> 00:12:56,600
on the space station okay that's a

295
00:13:02,080 --> 00:12:58,550
that's a good question and I'm gonna I'm

296
00:13:03,430 --> 00:13:02,090
gonna ask you when you say something

297
00:13:06,550 --> 00:13:03,440
goes wrong because many things can go

298
00:13:08,080 --> 00:13:06,560
wrong so what it what are you thinking

299
00:13:09,730 --> 00:13:08,090
right now in terms of something going

300
00:13:11,680 --> 00:13:09,740
wrong the problem with the suit a

301
00:13:13,660 --> 00:13:11,690
problem with the space station a problem

302
00:13:15,040 --> 00:13:13,670
with communications I mean there's a lot

303
00:13:16,600 --> 00:13:15,050
of things I can answer but I want to

304
00:13:21,070 --> 00:13:16,610
tailor the question to what you're

305
00:13:22,540 --> 00:13:21,080
thinking well like like something goes

306
00:13:26,620 --> 00:13:22,550
wrong with the suit like they can't

307
00:13:29,500 --> 00:13:26,630
breathe or some more they are they drift

308
00:13:33,790 --> 00:13:29,510
too far away from the space station okay

309
00:13:37,050 --> 00:13:33,800
fair enough the suit is designed at

310
00:13:39,430 --> 00:13:37,060
least the u.s. made extra vehicular

311
00:13:42,220 --> 00:13:39,440
mobility units that we call them am use

312
00:13:46,270 --> 00:13:42,230
to go e VA that's a mouthful of letters

313
00:13:50,350 --> 00:13:46,280

but the suit is designed it has about

314
00:13:52,240 --> 00:13:50,360
eight hours more or less depending upon

315
00:13:55,900 --> 00:13:52,250
how to heavily breathe and how much work

316
00:13:57,730 --> 00:13:55,910
activity you're doing of oxygen and

317
00:13:59,470 --> 00:13:57,740
water and remember we talked about the

318
00:14:01,810 --> 00:13:59,480
cooling so the water is there to cool

319
00:14:03,790 --> 00:14:01,820
you and the suit and how that's done let

320
00:14:06,010 --> 00:14:03,800
me get to that for a minute we wear a

321
00:14:08,770 --> 00:14:06,020
set of long full-length long johns if

322
00:14:10,240 --> 00:14:08,780
you will that cover the entire play with

323
00:14:12,460 --> 00:14:10,250
the skin and you might have seen this in

324
00:14:15,730 --> 00:14:12,470
the race car industry where this this

325
00:14:17,260 --> 00:14:15,740
garment is has tubes running through it

326
00:14:19,510 --> 00:14:17,270
all over the body and through those

327
00:14:21,790 --> 00:14:19,520
tubes the water is circulated and so

328
00:14:24,579 --> 00:14:21,800
it's actually cooler water to help

329
00:14:27,070 --> 00:14:24,589
remove the heat from the body okay so

330
00:14:29,710 --> 00:14:27,080
that's how we stay cool and and the

331
00:14:32,560 --> 00:14:29,720
oxygen and then and we use pure oxygen

332
00:14:35,230 --> 00:14:32,570
in the suit and the oxygen is is

333
00:14:37,060 --> 00:14:35,240
designed to last eight hours now if

334
00:14:38,560 --> 00:14:37,070
there's a hole in the suit depending

335
00:14:41,110 --> 00:14:38,570
upon the size of the hole of the hole

336
00:14:43,000 --> 00:14:41,120
gets too big then I would say all bets

337
00:14:46,950 --> 00:14:43,010
are off but generally speaking that's a

338
00:14:48,840 --> 00:14:46,960

very very very low probability chances

339
00:14:51,090 --> 00:14:48,850
you might get a hole in the su to slit

340
00:14:53,580 --> 00:14:51,100
in your glove a micrometeoroid puncture

341
00:14:57,090 --> 00:14:53,590
that would be like a pinhole or or even

342
00:14:59,430 --> 00:14:57,100
a pencil hole into the suit if that

343
00:15:03,030 --> 00:14:59,440
happens the the oxygen system the

344
00:15:04,970 --> 00:15:03,040
breathing system can supply the oxygen

345
00:15:08,100 --> 00:15:04,980
to the suit to keep it pressurized

346
00:15:10,290 --> 00:15:08,110
sufficiently to keep you alive and give

347
00:15:13,560 --> 00:15:10,300
you enough time to get back inside if

348
00:15:15,510 --> 00:15:13,570
this happens at the end of the EBA where

349
00:15:17,760 --> 00:15:15,520
you're low on oxygen there's a secondary

350
00:15:19,710 --> 00:15:17,770
emergency oxygen pack that you can

351
00:15:22,080 --> 00:15:19,720
either manually or it will automatically

352
00:15:24,810 --> 00:15:22,090
kick in and give you an additional 30

353
00:15:27,180 --> 00:15:24,820
minutes to get back inside with relation

354
00:15:31,140 --> 00:15:27,190
to the tether we are tethered to the

355
00:15:33,720 --> 00:15:31,150
space station so and that that tether is

356
00:15:36,000 --> 00:15:33,730
a very very strong fishing line if you

357
00:15:37,440 --> 00:15:36,010
will that could bring in quite a big

358
00:15:39,870 --> 00:15:37,450
fish so it will hold us to the station

359
00:15:43,800 --> 00:15:39,880
even if we tug on the line but if it

360
00:15:46,980 --> 00:15:43,810
does break we do have a if you will a

361
00:15:49,580 --> 00:15:46,990
jet pack it's called safer that we could

362
00:15:52,110 --> 00:15:49,590
fly ourselves back to the space station

363
00:15:54,000 --> 00:15:52,120

NASA likes to have lots of backup plans

364
00:15:55,800 --> 00:15:54,010
for just in case something goes wrong it

365
00:15:57,600 --> 00:15:55,810
wouldn't be fun to float away from the

366
00:16:03,000 --> 00:15:57,610
space station or whatever vehicle

367
00:16:04,710 --> 00:16:03,010
outside you you're outside of my this is

368
00:16:06,540 --> 00:16:04,720
Kirsten I was wondering how many hours

369
00:16:08,700 --> 00:16:06,550
of exercise today after day to keep

370
00:16:12,300 --> 00:16:08,710
their muscle muscles and stuff like that

371
00:16:13,860 --> 00:16:12,310
cuz well I think and I'm not a hundred

372
00:16:15,330 --> 00:16:13,870
percent sure because I was a Space

373
00:16:17,820 --> 00:16:15,340
Shuttle astronaut and and the

374
00:16:20,400 --> 00:16:17,830
requirements for exercise for us were a

375
00:16:22,560 --> 00:16:20,410
little different than the exercises for

376
00:16:25,260 --> 00:16:22,570
the space station crew members they are

377
00:16:28,170 --> 00:16:25,270
of course long term long duration space

378
00:16:30,870 --> 00:16:28,180
flier stay fly about six months at a

379
00:16:35,400 --> 00:16:30,880
time in space as opposed to two weeks or

380
00:16:36,690 --> 00:16:35,410
so so their exercise protocol I think

381
00:16:40,460 --> 00:16:36,700
and correct me if I'm wrong that they're

382
00:16:43,980 --> 00:16:40,470
exercising for an hour or two every day

383
00:16:45,630 --> 00:16:43,990
and it's up to the crew member sometimes

384
00:16:48,120 --> 00:16:45,640
if they're not feeling well they may not

385
00:16:50,460 --> 00:16:48,130
feel like exercising that day it's it's

386
00:16:52,050 --> 00:16:50,470
okay to skip a day or two now and then

387
00:16:55,320 --> 00:16:52,060
but you really want to get the exercise

388
00:16:58,590 --> 00:16:55,330

in pretty regularly and not miss it

389
00:17:00,809 --> 00:16:58,600
because the with the lack of gravity up

390
00:17:03,119 --> 00:17:00,819
there your body isn't loaded

391
00:17:04,769 --> 00:17:03,129
and and just sitting here and you guys

392
00:17:07,590 --> 00:17:04,779
sitting in your classroom there if

393
00:17:09,809 --> 00:17:07,600
that's where you are your heart is

394
00:17:11,850 --> 00:17:09,819
working against gravity to pump blood up

395
00:17:13,289 --> 00:17:11,860
to your head and otherwise all the

396
00:17:15,120 --> 00:17:13,299
liquid in your body would go to your

397
00:17:17,039 --> 00:17:15,130
feet and that that wouldn't be a good

398
00:17:19,529 --> 00:17:17,049
thing and you pass out and all of that

399
00:17:23,069 --> 00:17:19,539
but in the long term you know your heart

400
00:17:25,710 --> 00:17:23,079
muscle gets weak because it doesn't have

401
00:17:29,159 --> 00:17:25,720
to push against that force of gravity so

402
00:17:31,379 --> 00:17:29,169
it's doing less work your your bones are

403
00:17:33,899 --> 00:17:31,389
not being loaded by the weight of your

404
00:17:36,210 --> 00:17:33,909
body and so therefore there's something

405
00:17:39,810 --> 00:17:36,220
in our bodies that tells our system that

406
00:17:44,190 --> 00:17:39,820
to hold calcium in our bones and that

407
00:17:45,840 --> 00:17:44,200
keeps them strong and very very able to

408
00:17:48,269 --> 00:17:45,850
hold the weight of your body up however

409
00:17:50,610 --> 00:17:48,279
if that goes away the gravity goes away

410
00:17:53,009 --> 00:17:50,620
and there's no load on your body there's

411
00:17:55,320 --> 00:17:53,019
something inside us that says the body

412
00:17:56,940 --> 00:17:55,330
shed that calcium and the bones start to

413
00:17:59,820 --> 00:17:56,950

get brittle like somebody who's elderly

414
00:18:02,580 --> 00:17:59,830
in has osteoporosis so in order to

415
00:18:04,529 --> 00:18:02,590
counteract that we do the exercises and

416
00:18:07,470 --> 00:18:04,539
several different protocols to ensure

417
00:18:08,820 --> 00:18:07,480
that when we do come back to earth we

418
00:18:10,320 --> 00:18:08,830
retain our health and are able to

419
00:18:13,590 --> 00:18:10,330
function there's an initial period of

420
00:18:15,389 --> 00:18:13,600
time after we come down that there's an

421
00:18:18,240 --> 00:18:15,399
adaptive period to readjust to the

422
00:18:19,799 --> 00:18:18,250
sudden onset of gravity but that passes

423
00:18:22,190 --> 00:18:19,809
and it takes a little longer than to get

424
00:18:24,810 --> 00:18:22,200
fully adjusted to life back on earth but

425
00:18:26,490 --> 00:18:24,820
you really need to exercise to be able

426
00:18:28,200 --> 00:18:26,500
to do that we have some cool equipment

427
00:18:29,519 --> 00:18:28,210
that they can use to do the exercising

428
00:18:31,200 --> 00:18:29,529
too I don't know if y'all thought about

429
00:18:32,340 --> 00:18:31,210
it but how do you like lift weights like

430
00:18:34,529 --> 00:18:32,350
you do you're here on the ground when

431
00:18:36,450 --> 00:18:34,539
there's no weight in microgravity so we

432
00:18:38,009 --> 00:18:36,460
have some machines that let them lift

433
00:18:40,950 --> 00:18:38,019
weights and run even though they're

434
00:18:46,019 --> 00:18:40,960
really floating and exercise back as

435
00:18:49,049 --> 00:18:46,029
well my name is Jay and how many times

436
00:18:51,149 --> 00:18:49,059
have you been up in space that's the

437
00:18:54,330 --> 00:18:51,159
easiest question I had today Thank You

438
00:18:58,259 --> 00:18:54,340

Jay I've been in space three times I

439
00:19:01,320 --> 00:18:58,269
first flew on mission sts-48 lantus

440
00:19:02,580 --> 00:19:01,330
which by the way will be now its

441
00:19:05,519 --> 00:19:02,590
permanent homes in the Kennedy Space

442
00:19:09,659 --> 00:19:05,529
Center for at the visitors center there

443
00:19:11,789 --> 00:19:09,669
and that was in 1991 my second flight

444
00:19:14,200 --> 00:19:11,799
was on the space shuttle endeavour who

445
00:19:16,150 --> 00:19:14,210
will which will be in California

446
00:19:18,070 --> 00:19:16,160
and it's not quite there yet there will

447
00:19:22,030 --> 00:19:18,080
be shipping it to California soon and

448
00:19:24,520 --> 00:19:22,040
that was on mission st s 54 in 1993 and

449
00:19:29,080 --> 00:19:24,530
my last mission was also on endeavor I

450
00:19:35,890 --> 00:19:29,090
was STS 77 in 1996 so I was long ago I

451
00:19:38,710 --> 00:19:35,900
guess from your perspective um hi my

452
00:19:41,410 --> 00:19:38,720
name is John and I wanted to know how

453
00:19:43,870 --> 00:19:41,420
many robots are Rovers do you guys have

454
00:19:47,500 --> 00:19:43,880
on the International Space Station other

455
00:19:50,470 --> 00:19:47,510
than our two okay other than our two

456
00:19:52,840 --> 00:19:50,480
there's some robots called spheres

457
00:19:56,560 --> 00:19:52,850
they're not exactly autonomous robots

458
00:20:00,250 --> 00:19:56,570
but they're actually let me describe it

459
00:20:02,460 --> 00:20:00,260
this way you've seen Luke Skywalker in

460
00:20:04,930 --> 00:20:02,470
Star Wars when he was training to be a

461
00:20:06,700 --> 00:20:04,940
Jedi Knight with his lightsaber and

462
00:20:09,070 --> 00:20:06,710
there was the little ball floating

463
00:20:12,010 --> 00:20:09,080

around and he was trying to hit the ball

464
00:20:13,900 --> 00:20:12,020
and was not successful initially until

465
00:20:16,090 --> 00:20:13,910
lead up the training from Yoda having

466
00:20:21,250 --> 00:20:16,100
said that there are spheres like that on

467
00:20:23,530 --> 00:20:21,260
board that are used to for robotic

468
00:20:26,410 --> 00:20:23,540
purposes to hold positions to carry

469
00:20:27,850 --> 00:20:26,420
things around they are experimental and

470
00:20:29,410 --> 00:20:27,860
they're they're really not used for

471
00:20:31,270 --> 00:20:29,420
anything practical right now but the

472
00:20:32,770 --> 00:20:31,280
hope is that we will be able to do so in

473
00:20:34,780 --> 00:20:32,780
the future now if there's other robots

474
00:20:36,280 --> 00:20:34,790
besides Robonaut I'm not exactly sure

475
00:20:38,020 --> 00:20:36,290
there might be probably not what you're

476
00:20:40,240 --> 00:20:38,030
thinking of as robots but we have the

477
00:20:42,130 --> 00:20:40,250
robotic arms on the outside of the space

478
00:20:43,750 --> 00:20:42,140
station that we used to carry big pieces

479
00:20:45,520 --> 00:20:43,760
of equipment from one place to another

480
00:20:48,580 --> 00:20:45,530
as we're installing things on the space

481
00:20:51,190 --> 00:20:48,590
station and there's actually three of

482
00:20:53,740 --> 00:20:51,200
those there's our big one that we call

483
00:20:58,050 --> 00:20:53,750
Canada arm to is the main one and then

484
00:21:02,500 --> 00:20:58,060
there's a robotic arm for the Japanese

485
00:21:05,020 --> 00:21:02,510
laboratory kibo and there's also an

486
00:21:08,290 --> 00:21:05,030
attachment for the candidate arm too

487
00:21:11,620 --> 00:21:08,300
right Dexter that is used to change out

488
00:21:13,180 --> 00:21:11,630

spare parts and just to clarify those or

489
00:21:16,420 --> 00:21:13,190
robotic arms but they are controlled by

490
00:21:18,250 --> 00:21:16,430
someone inside its it would be like my

491
00:21:22,120 --> 00:21:18,260
being in this room here and I would be

492
00:21:23,980 --> 00:21:22,130
controlling the arm on a backhoe if you

493
00:21:26,620 --> 00:21:23,990
will that might be outside the room and

494
00:21:27,270 --> 00:21:26,630
so that's why they call it robotics

495
00:21:34,260 --> 00:21:27,280
because it's

496
00:21:38,190 --> 00:21:34,270
molle controlled this is tea and I was

497
00:21:42,570 --> 00:21:38,200
wondering how cold does it does it get

498
00:21:44,100 --> 00:21:42,580
at night in space okay how cold it gets

499
00:21:48,240 --> 00:21:44,110
at night in space let's talk about

500
00:21:50,610 --> 00:21:48,250
inside for the moment inside the the ISS

501
00:21:52,050 --> 00:21:50,620
and spacecraft in general is temperature

502
00:21:54,030 --> 00:21:52,060
controlled we have a thermostat just

503
00:21:55,590 --> 00:21:54,040
like you have in your house and you set

504
00:21:57,600 --> 00:21:55,600
the temperature and hopefully the

505
00:22:00,150 --> 00:21:57,610
systems control that now when the system

506
00:22:01,680 --> 00:22:00,160
breaks you call the repairman we have to

507
00:22:04,110 --> 00:22:01,690
repair it ourselves in order to maintain

508
00:22:07,440 --> 00:22:04,120
the temperature automatically we like to

509
00:22:08,820 --> 00:22:07,450
keep it at around 75 degrees at fifty

510
00:22:10,350 --> 00:22:08,830
percent relative humidity that's

511
00:22:14,610 --> 00:22:10,360
generally a comfortable thing might be

512
00:22:16,380 --> 00:22:14,620
like 72 degrees Fahrenheit so and we try

513
00:22:18,300 --> 00:22:16,390

to can the systems on board or designed

514
00:22:20,670 --> 00:22:18,310
to be able to do that against the

515
00:22:23,100 --> 00:22:20,680
temperature extremes outside which again

516
00:22:25,020 --> 00:22:23,110
range like on the dark side of the earth

517
00:22:27,390 --> 00:22:25,030
if you're in orbit from Earth it can get

518
00:22:30,480 --> 00:22:27,400
as low as 250 maybe even more I don't

519
00:22:32,760 --> 00:22:30,490
know the exact number minus 250 degrees

520
00:22:34,110 --> 00:22:32,770
Fahrenheit as n is high in the Sun on

521
00:22:36,450 --> 00:22:34,120
when you come around the Sun side as

522
00:22:39,600 --> 00:22:36,460
high as 250 so there's quite a wide

523
00:22:42,000 --> 00:22:39,610
temperature range now for probes that go

524
00:22:43,200 --> 00:22:42,010
out into the solar system they are in

525
00:22:45,890 --> 00:22:43,210
the Sun all the time so there's a

526
00:22:48,510 --> 00:22:45,900
problem with those at least initially

527
00:22:49,920 --> 00:22:48,520
for keeping them cool but as they get

528
00:22:52,350 --> 00:22:49,930
farther and farther away from the Sun

529
00:22:55,080 --> 00:22:52,360
the effects of the Sun are much less and

530
00:22:59,070 --> 00:22:55,090
they can get very cold you get to Mars

531
00:23:00,900 --> 00:22:59,080
Mars still is relatively in inner area

532
00:23:02,990 --> 00:23:00,910
away from the Sun and a distance away

533
00:23:07,170 --> 00:23:03,000
from the Sun that's that's relatively

534
00:23:11,490 --> 00:23:07,180
comfortable it's cold on Mars but it can

535
00:23:13,380 --> 00:23:11,500
get up to as high as as as maybe even 15

536
00:23:17,250 --> 00:23:13,390
degrees on the surface and the summer

537
00:23:19,830 --> 00:23:17,260
and the tropics on Mars so it can get

538
00:23:22,050 --> 00:23:19,840

comfortable for you and I to be on Mars

539
00:23:24,990 --> 00:23:22,060
on the surface however you go farther

540
00:23:28,380 --> 00:23:25,000
past Mars we have a spacecraft on its

541
00:23:30,180 --> 00:23:28,390
way to Pluto as a matter of fact it's

542
00:23:33,390 --> 00:23:30,190
called a new horizon spacecraft and that

543
00:23:35,220 --> 00:23:33,400
spacecraft is already past Jupiter and

544
00:23:37,320 --> 00:23:35,230
is on and I think it's a scheduled

545
00:23:38,940 --> 00:23:37,330
arrival at Pluto to take pictures of

546
00:23:40,499 --> 00:23:38,950
Pluto for the first time directly I

547
00:23:45,779 --> 00:23:40,509
think it's 2,000

548
00:23:47,669 --> 00:23:45,789
15 and it out that far it's very very

549
00:23:50,669 --> 00:23:47,679
cold I can't tell you the exact number

550
00:23:52,409 --> 00:23:50,679
but it's it's in that minus 250 or lower

551
00:23:56,399 --> 00:23:52,419
range than what I just described so

552
00:23:59,009 --> 00:23:56,409
keeping that spacecraft warm enough for

553
00:24:01,139 --> 00:23:59,019
it to function is is is quite a

554
00:24:02,669 --> 00:24:01,149
challenge you guys live in South Dakota

555
00:24:04,979 --> 00:24:02,679
it gets very cold there in the winter

556
00:24:07,049 --> 00:24:04,989
it's even a challenge to get your car

557
00:24:08,430 --> 00:24:07,059
started in the morning and that's just

558
00:24:10,289 --> 00:24:08,440
right here on earth so you can imagine

559
00:24:12,959 --> 00:24:10,299
the challenge for sending a spacecraft

560
00:24:17,759 --> 00:24:12,969
out that far in that extreme of the

561
00:24:20,789 --> 00:24:17,769
regime of temperature hi this is Joe

562
00:24:24,239 --> 00:24:20,799
Koda um what kind of schooling the you

563
00:24:27,180 --> 00:24:24,249

used to be an astronaut hey what kind of

564
00:24:28,559 --> 00:24:27,190
schooling okay well I started out the

565
00:24:32,309 --> 00:24:28,569
same way you guys are I was in

566
00:24:34,769 --> 00:24:32,319
classrooms much like yourself and and I

567
00:24:36,449 --> 00:24:34,779
was for myself I was always very inquest

568
00:24:38,699 --> 00:24:36,459
wanted to learn as much as I could about

569
00:24:41,989 --> 00:24:38,709
everything and you just can't do that so

570
00:24:45,809 --> 00:24:41,999
you have to focus on something to narrow

571
00:24:48,149 --> 00:24:45,819
the field a little bit so I decided

572
00:24:50,099 --> 00:24:48,159
after high school and and well I decided

573
00:24:52,049 --> 00:24:50,109
before high school that I wanted to do

574
00:24:54,359 --> 00:24:52,059
something in science and engineering and

575
00:24:57,329 --> 00:24:54,369
when I got to college I studied in my

576
00:25:01,019 --> 00:24:57,339
case earth science physical oceanography

577
00:25:04,519 --> 00:25:01,029
and meteorology so that's my particular

578
00:25:07,049 --> 00:25:04,529
background but generically astronauts

579
00:25:09,119 --> 00:25:07,059
mainly have technical scientific

580
00:25:11,430 --> 00:25:09,129
engineering backgrounds medical

581
00:25:13,829 --> 00:25:11,440
backgrounds because of the problems with

582
00:25:15,869 --> 00:25:13,839
keeping people alive and potential

583
00:25:17,159 --> 00:25:15,879
medical problems if we go too far away

584
00:25:20,399 --> 00:25:17,169
from space and something happens

585
00:25:22,889 --> 00:25:20,409
medically so mostly backgrounds like

586
00:25:25,499 --> 00:25:22,899
that they prefer to have advanced

587
00:25:26,999 --> 00:25:25,509
degrees not required so that means you

588
00:25:29,939 --> 00:25:27,009

can you can become an astronaut with a

589
00:25:33,379 --> 00:25:29,949
bachelor's degree but a master's degree

590
00:25:36,869 --> 00:25:33,389
is is desired and even a doctorate PhD

591
00:25:42,149 --> 00:25:36,879
is even better of course all of the

592
00:25:45,539 --> 00:25:42,159
education is not the final bottom line

593
00:25:47,549 --> 00:25:45,549
is they also prefer to have people who

594
00:25:48,870 --> 00:25:47,559
have some experience of course in their

595
00:25:51,870 --> 00:25:48,880
fields and

596
00:25:55,350 --> 00:25:51,880
who are good or premier in the fields

597
00:25:58,440 --> 00:25:55,360
that they've chosen to be so and then

598
00:26:00,450 --> 00:25:58,450
that is that is generally speaking the

599
00:26:02,520 --> 00:26:00,460
the science engineering astronauts there

600
00:26:04,220 --> 00:26:02,530
is also the other side of the coin where

601
00:26:07,020 --> 00:26:04,230
you have pilot astronauts who generally

602
00:26:09,180 --> 00:26:07,030
for example fly the spacecraft in the

603
00:26:11,520 --> 00:26:09,190
end just recently retired space shuttle

604
00:26:13,590 --> 00:26:11,530
that would actually fly the shuttle to

605
00:26:16,350 --> 00:26:13,600
the landing that or would fly the

606
00:26:18,180 --> 00:26:16,360
capsule down to the ground or take over

607
00:26:19,710 --> 00:26:18,190
automatic control in the event of a

608
00:26:22,620 --> 00:26:19,720
malfunction on a computer that were

609
00:26:25,560 --> 00:26:22,630
where the was on autopilot so you do

610
00:26:27,960 --> 00:26:25,570
need to have the pilot end of things in

611
00:26:29,940 --> 00:26:27,970
here and the pilots are generally from

612
00:26:31,590 --> 00:26:29,950
military backgrounds not always Neil

613
00:26:33,210 --> 00:26:31,600

Armstrong was not a military pilot he

614
00:26:34,650 --> 00:26:33,220
was a test pilot but not a military test

615
00:26:36,660 --> 00:26:34,660
pilot but generally speaking where you

616
00:26:38,040 --> 00:26:36,670
get that kind of flying experiences in

617
00:26:40,260 --> 00:26:38,050
the military in high-performance

618
00:26:45,900 --> 00:26:40,270
aircraft and you have to have thousands

619
00:26:47,520 --> 00:26:45,910
of hours doing that as well I think

620
00:26:48,990 --> 00:26:47,530
that's actually all the questions were

621
00:26:50,550 --> 00:26:49,000
going to have time for this time around

622
00:26:52,350 --> 00:26:50,560
but we really enjoyed talking with you