
PAO

1
00:00:09,260 --> 00:00:07,099
hi welcome to Mission Control Center

2
00:00:11,150 --> 00:00:09,270
here in Houston where we have a Mario

3
00:00:13,850 --> 00:00:11,160
runco with us one of our astronauts who

4
00:00:15,260 --> 00:00:13,860
also works with a bunch of different

5
00:00:16,519 --> 00:00:15,270
projects here on the ground as well

6
00:00:18,730 --> 00:00:16,529
including he's been really involved

7
00:00:21,230 --> 00:00:18,740
lately with the transit of Venus

8
00:00:22,429 --> 00:00:21,240
experience that just took place earlier

9
00:00:24,019 --> 00:00:22,439
this week and I think y'all learned a

10
00:00:25,339 --> 00:00:24,029
little bit about it before we get

11
00:00:27,259 --> 00:00:25,349
started with your questions and we're

12
00:00:29,029 --> 00:00:27,269
here in the Mission Control Center this

13
00:00:31,609 --> 00:00:29,039

is the International Space Station

14
00:00:34,160 --> 00:00:31,619
flight control room and this is where

15
00:00:36,350 --> 00:00:34,170
all the people who control the space

16
00:00:37,730 --> 00:00:36,360
station from the ground sit and work you

17
00:00:39,320 --> 00:00:37,740
can probably see in the background the

18
00:00:41,450 --> 00:00:39,330
map that tracks International Space

19
00:00:43,160 --> 00:00:41,460
Station and around the room we've got

20
00:00:45,710 --> 00:00:43,170
all the different positions that

21
00:00:46,940 --> 00:00:45,720
actually control the systems on board so

22
00:00:52,390 --> 00:00:46,950
we look forward to hearing your

23
00:00:55,550 --> 00:00:52,400
questions I'm Marvin uh I was wondering

24
00:00:57,830 --> 00:00:55,560
could you would it be possible to send

25
00:01:03,440 --> 00:00:57,840
her over to fix one of the rover's they

26
00:01:08,209 --> 00:01:03,450
got crashed on I presume Marvin you mean

27
00:01:10,849 --> 00:01:08,219
on Mars and at current time present

28
00:01:15,200 --> 00:01:10,859
technology would probably not permit

29
00:01:17,690 --> 00:01:15,210
that in terms of being able to to to do

30
00:01:20,450 --> 00:01:17,700
that sort of repair it might not be

31
00:01:24,380 --> 00:01:20,460
cost-effective to do so whereas sending

32
00:01:26,630 --> 00:01:24,390
another Rover to replace it would might

33
00:01:29,120 --> 00:01:26,640
be a better option than to repair one

34
00:01:31,309 --> 00:01:29,130
that is there having said that if the

35
00:01:33,289 --> 00:01:31,319
repair is simple enough and we did send

36
00:01:36,590 --> 00:01:33,299
another Rover for more experimentation

37
00:01:38,179 --> 00:01:36,600
and more exploration it probably would

38
00:01:39,919 --> 00:01:38,189

be in a different area but if it were in

39
00:01:41,450 --> 00:01:39,929
the same area and the stand the repair

40
00:01:43,879 --> 00:01:41,460
were simple enough something like

41
00:01:47,120 --> 00:01:43,889
pulling out a part and replacing it that

42
00:01:49,789 --> 00:01:47,130
might be plug-in then it then it I would

43
00:01:51,139 --> 00:01:49,799
say it would might be possible maybe

44
00:01:53,270 --> 00:01:51,149
y'all heard about the Curiosity rover

45
00:01:55,429 --> 00:01:53,280
that's going to be landing on Mars in

46
00:01:56,629 --> 00:01:55,439
August and won't be going to get that

47
00:02:02,840 --> 00:01:56,639
are over but hopefully we'll find out

48
00:02:04,580 --> 00:02:02,850
some cool new stuff from it do you want

49
00:02:06,230 --> 00:02:04,590
us to ask questions now or do you want

50
00:02:07,969 --> 00:02:06,240
to speak for a little bit and then have

51
00:02:10,309 --> 00:02:07,979
us ask questions please go ahead ask

52
00:02:15,900 --> 00:02:10,319
your question yeah let's give the

53
00:02:23,100 --> 00:02:20,030
hi this is Garrett I was wondering if

54
00:02:24,840 --> 00:02:23,110
like if you have plants up there and

55
00:02:29,160 --> 00:02:24,850
like if you can like make them grow

56
00:02:31,800 --> 00:02:29,170
really big well Garrett you have asked a

57
00:02:34,350 --> 00:02:31,810
question that is very basic to science

58
00:02:36,870 --> 00:02:34,360
that is a super question as a matter of

59
00:02:39,750 --> 00:02:36,880
fact we have been experimenting with

60
00:02:41,940 --> 00:02:39,760
plants in space for quite some time we

61
00:02:43,530 --> 00:02:41,950
used to do on the Space Shuttle plant

62
00:02:45,090 --> 00:02:43,540
experiments but the the drawback to

63
00:02:47,910 --> 00:02:45,100

doing them on the Space Shuttle was the

64
00:02:50,430 --> 00:02:47,920
spatial only state in space for about 14

65
00:02:53,070 --> 00:02:50,440
days and as you probably know 14 days is

66
00:02:54,930 --> 00:02:53,080
not a long time to grow a plant however

67
00:02:57,240 --> 00:02:54,940
on the International Space Station we do

68
00:03:00,810 --> 00:02:57,250
have additional experiments with plant

69
00:03:04,230 --> 00:03:00,820
growth and a lot of the curiosity as to

70
00:03:06,780 --> 00:03:04,240
with the plants and how they behave in

71
00:03:08,760 --> 00:03:06,790
microgravity are related to is since

72
00:03:11,580 --> 00:03:08,770
there's no up or down which way will

73
00:03:12,930 --> 00:03:11,590
they grow how do they respond to light

74
00:03:15,930 --> 00:03:12,940
do they respond to the light differently

75
00:03:18,270 --> 00:03:15,940
than on the ground is there a change in

76
00:03:22,170 --> 00:03:18,280
in the plant itself when it is growing

77
00:03:24,750 --> 00:03:22,180
so and I would guess even though we

78
00:03:26,790 --> 00:03:24,760
haven't grown a plant very large because

79
00:03:28,530 --> 00:03:26,800
we have to stay inside so essentially

80
00:03:32,970 --> 00:03:28,540
any plants we do grow our house plans

81
00:03:36,660 --> 00:03:32,980
and and the house is only so much size

82
00:03:39,570 --> 00:03:36,670
is if I would think because of the lack

83
00:03:43,470 --> 00:03:39,580
of gravity the plants potentially could

84
00:03:46,110 --> 00:03:43,480
grow very large maybe y'all have heard

85
00:03:47,340 --> 00:03:46,120
about the blog that one of the

86
00:03:49,410 --> 00:03:47,350
astronauts on the space station is

87
00:03:51,240 --> 00:03:49,420
riding right now Don Pettit it's a he's

88
00:03:52,890 --> 00:03:51,250

written one called the diary of a

89
00:03:56,250 --> 00:03:52,900
zucchini and you can find that online at

90
00:03:57,810 --> 00:03:56,260
blog our blogs nasa gov so you might

91
00:03:59,100 --> 00:03:57,820
check into that and see what he has to

92
00:04:05,850 --> 00:03:59,110
say about the plants he's been growing

93
00:04:09,990 --> 00:04:05,860
in space my name is Ren my name is Ren

94
00:04:13,620 --> 00:04:10,000
and um home how big are those solar

95
00:04:15,870 --> 00:04:13,630
panels that's a good question i don't

96
00:04:18,360 --> 00:04:15,880
know exact dimensions on the solar

97
00:04:21,180 --> 00:04:18,370
panels but i would say that the length

98
00:04:24,330 --> 00:04:21,190
of them are probably about half a

99
00:04:26,000 --> 00:04:24,340
football field long and they are

100
00:04:31,070 --> 00:04:26,010
probably i would

101
00:04:37,330 --> 00:04:31,080
us each in with about 20-30 feet sounds

102
00:04:40,970 --> 00:04:37,340
about right mm this is taye in and has

103
00:04:45,140 --> 00:04:40,980
has opportunity picked up a new

104
00:04:47,270 --> 00:04:45,150
information actually opportunity is

105
00:04:52,850 --> 00:04:47,280
let's see now help me out here because

106
00:04:54,680 --> 00:04:52,860
we've got opportunity and spirit and one

107
00:04:56,300 --> 00:04:54,690
of those is not functional at this point

108
00:04:58,460 --> 00:04:56,310
in time I believe its spirit I think

109
00:05:01,160 --> 00:04:58,470
you're right not operational so the twin

110
00:05:05,720 --> 00:05:01,170
Rovers on Mars have been there for many

111
00:05:07,520 --> 00:05:05,730
many years now and they have performed

112
00:05:09,440 --> 00:05:07,530
better than we have expected because i

113
00:05:13,400 --> 00:05:09,450

think the original mission was only like

114
00:05:16,130 --> 00:05:13,410
45 50 days they have picked up new

115
00:05:17,210 --> 00:05:16,140
information both Rovers have opportunity

116
00:05:19,310 --> 00:05:17,220
particularly because it's still

117
00:05:21,740 --> 00:05:19,320
operational and that is why we have the

118
00:05:23,630 --> 00:05:21,750
Mars Science Laboratory the Curiosity

119
00:05:26,990 --> 00:05:23,640
rover on its way to Mars now in August

120
00:05:29,900 --> 00:05:27,000
because of the discoveries that made us

121
00:05:31,010 --> 00:05:29,910
even more curious about some of the

122
00:05:32,750 --> 00:05:31,020
things we were observing with

123
00:05:35,090 --> 00:05:32,760
opportunity on Mars and we're going

124
00:05:39,350 --> 00:05:35,100
trying to go and discover those we found

125
00:05:42,380 --> 00:05:39,360
water we found minerals that are

126
00:05:46,880 --> 00:05:42,390
somewhat related to biologics and so

127
00:05:49,310 --> 00:05:46,890
that that is a tantalizing elevation of

128
00:05:51,170 --> 00:05:49,320
the information that makes us believe

129
00:05:53,450 --> 00:05:51,180
that there might have been life on Mars

130
00:05:55,130 --> 00:05:53,460
at one point in its history so to be

131
00:06:02,570 --> 00:05:55,140
able to go there and actually discover

132
00:06:10,279 --> 00:06:06,350
my name is Trey and what do they make a

133
00:06:12,320 --> 00:06:10,289
space shoots at space suits out of you

134
00:06:13,820 --> 00:06:12,330
mean the space suits or the space shoots

135
00:06:17,990 --> 00:06:13,830
as in parachute I didn't quite

136
00:06:20,809 --> 00:06:18,000
understand your question suits suits

137
00:06:25,070 --> 00:06:20,819
okay the space suits are made of several

138
00:06:28,999 --> 00:06:25,080

layers okay the outer layer is basically

139
00:06:31,399 --> 00:06:29,009
a plastic shell on the upper torso and

140
00:06:34,040 --> 00:06:31,409
around the the waist and there is their

141
00:06:36,529 --> 00:06:34,050
metal parts to it as well and that helps

142
00:06:39,890 --> 00:06:36,539
contain the pressure net outside of that

143
00:06:41,540 --> 00:06:39,900
there's a rubber bladder that contains

144
00:06:43,070 --> 00:06:41,550
the air or excuse me inside of that

145
00:06:45,640 --> 00:06:43,080
there's a rubber bladder that contains

146
00:06:49,610 --> 00:06:45,650
the air and outside of that there's a

147
00:06:53,240 --> 00:06:49,620
nomex material that acts as a

148
00:06:56,420 --> 00:06:53,250
micrometeoroid or essentially protection

149
00:06:58,339 --> 00:06:56,430
against the small particles in space so

150
00:07:00,980 --> 00:06:58,349
that doesn't puncture the suit and then

151
00:07:02,899 --> 00:07:00,990
it also has thermal protection on the

152
00:07:06,320 --> 00:07:02,909
outside in that same material there's a

153
00:07:08,990 --> 00:07:06,330
blanket uh like a Lumina meeeeee colored

154
00:07:11,450 --> 00:07:09,000
kind of blanket underneath the the Nomex

155
00:07:13,309 --> 00:07:11,460
that that is a sort of like a radiative

156
00:07:15,469 --> 00:07:13,319
barrier that know what you might put in

157
00:07:17,809 --> 00:07:15,479
your attic Maria what do you need the

158
00:07:20,240 --> 00:07:17,819
thermal protection one is my suit a good

159
00:07:22,579 --> 00:07:20,250
question the thermal protection is such

160
00:07:26,930 --> 00:07:22,589
that when you're in orbit around the

161
00:07:28,760 --> 00:07:26,940
earth most of the time you go behind the

162
00:07:31,820 --> 00:07:28,770
earth away from the Sun in the shadow of

163
00:07:34,329 --> 00:07:31,830

the earth so that would be an eclipse to

164
00:07:36,740 --> 00:07:34,339
the person who's doing the spacewalk

165
00:07:39,589 --> 00:07:36,750
because this the earth blocks the Sun

166
00:07:41,360 --> 00:07:39,599
and when you're on the backside of the

167
00:07:43,939 --> 00:07:41,370
earth you don't have any of the sunlight

168
00:07:46,399 --> 00:07:43,949
and it gets very very cold down to minus

169
00:07:48,769 --> 00:07:46,409
250 degrees Fahrenheit or thereabouts--

170
00:07:51,829 --> 00:07:48,779
and then when you're in the Sun the

171
00:07:54,499 --> 00:07:51,839
temperature rises to about that much to

172
00:07:56,029 --> 00:07:54,509
plus 250 so you got a four to five

173
00:07:58,159 --> 00:07:56,039
hundred degree temperature range with

174
00:08:00,559 --> 00:07:58,169
which you're dealing and the human

175
00:08:03,860 --> 00:08:00,569
beings and creatures on earth like to

176
00:08:06,290 --> 00:08:03,870
stay around 70 degrees Fahrenheit so to

177
00:08:10,330 --> 00:08:06,300
keep us comfortable and alive you need

178
00:08:15,470 --> 00:08:13,580
okay my name is Courtney and what kind

179
00:08:18,320 --> 00:08:15,480
of food do you guys eat on the space

180
00:08:19,700 --> 00:08:18,330
station and how do you eat it okay what

181
00:08:23,180 --> 00:08:19,710
kind of food there's a variety of

182
00:08:25,970 --> 00:08:23,190
different kinds of foods there's there's

183
00:08:27,860 --> 00:08:25,980
a limited variety of fresh foods when a

184
00:08:29,600 --> 00:08:27,870
spacecraft first gets up and docks with

185
00:08:31,160 --> 00:08:29,610
the space station there's there's treats

186
00:08:33,529 --> 00:08:31,170
on board if you will there might be some

187
00:08:35,810 --> 00:08:33,539
fresh fruit some some fresh cookies

188
00:08:39,110 --> 00:08:35,820

things like that so that you're familiar

189
00:08:41,719 --> 00:08:39,120
with the the other food as it comes in a

190
00:08:44,570 --> 00:08:41,729
kind of varieties there's rehydrate able

191
00:08:46,400 --> 00:08:44,580
foods you might know them as free stride

192
00:08:48,560 --> 00:08:46,410
they're not exactly freeze-dried but the

193
00:08:51,170 --> 00:08:48,570
water is removed from them and then we

194
00:08:53,420 --> 00:08:51,180
have to add the water back in heat them

195
00:08:58,580 --> 00:08:53,430
up and and they come in lots of

196
00:09:00,950 --> 00:08:58,590
varieties turkey Tetrazzini there's

197
00:09:02,510 --> 00:09:00,960
chicken soups there's burgers and stuff

198
00:09:06,530 --> 00:09:02,520
like that so and then there's another

199
00:09:07,880 --> 00:09:06,540
variety that comes from the military if

200
00:09:11,110 --> 00:09:07,890
you will there the meals ready to eat

201
00:09:14,600 --> 00:09:11,120
the same food that the the troops and

202
00:09:17,300 --> 00:09:14,610
would use in the field when they are on

203
00:09:18,740 --> 00:09:17,310
bivouac if you will and those foods are

204
00:09:21,530 --> 00:09:18,750
thermal stabilizers they're put in

205
00:09:23,330 --> 00:09:21,540
pouches and they come in a variety of

206
00:09:26,150 --> 00:09:23,340
different flavors now the thing about

207
00:09:28,040 --> 00:09:26,160
the foods is each astronaut generally

208
00:09:30,380 --> 00:09:28,050
samples the menu they pick what they

209
00:09:32,630 --> 00:09:30,390
like and of course you're not gonna eat

210
00:09:36,020 --> 00:09:32,640
things you don't like except there's a

211
00:09:38,330 --> 00:09:36,030
little part of the story here and you

212
00:09:40,430 --> 00:09:38,340
know you prepare your menus and you plan

213
00:09:41,960 --> 00:09:40,440

your menus ahead for the time you're

214
00:09:44,720 --> 00:09:41,970
going to be on board so generally the

215
00:09:48,020 --> 00:09:44,730
food is are things that you generally

216
00:09:51,020 --> 00:09:48,030
like however because of nutritional

217
00:09:52,040 --> 00:09:51,030
factors they'll look at your menu and

218
00:09:53,660 --> 00:09:52,050
what you've picked and if you're

219
00:09:57,980 --> 00:09:53,670
deficient in something over the long

220
00:09:59,900 --> 00:09:57,990
term potassium or vitamin E or whatever

221
00:10:02,510 --> 00:09:59,910
it might be they will recommend and add

222
00:10:05,570 --> 00:10:02,520
to your diet things that will contain

223
00:10:07,700 --> 00:10:05,580
those those nutrients for you and of

224
00:10:10,579 --> 00:10:07,710
course you'll pick the ones that you

225
00:10:13,400 --> 00:10:10,589
prefer the most for that contain those

226
00:10:14,900 --> 00:10:13,410
those nutrients I heard that you can't

227
00:10:16,850 --> 00:10:14,910
or you don't get to eat a whole of bread

228
00:10:19,579 --> 00:10:16,860
on in space is that right well bred and

229
00:10:21,140 --> 00:10:19,589
space is problematic first of all who

230
00:10:24,440 --> 00:10:21,150
bread has a short

231
00:10:26,000 --> 00:10:24,450
shelf life and it gets very dry for some

232
00:10:29,060 --> 00:10:26,010
reason or other it doesn't last even as

233
00:10:31,250 --> 00:10:29,070
long as it does down here if you just

234
00:10:35,450 --> 00:10:31,260
left it on the counter or in the

235
00:10:36,710 --> 00:10:35,460
breadbox what we prefer in space is the

236
00:10:39,380 --> 00:10:36,720
alternative to bread or tortillas

237
00:10:41,840 --> 00:10:39,390
because two reasons one is they seem to

238
00:10:43,550 --> 00:10:41,850

keep longer and they're not as flaky

239
00:10:45,920 --> 00:10:43,560
when you have bread it tends to crumble

240
00:10:48,890 --> 00:10:45,930
and it flies all over the place and it

241
00:10:50,330 --> 00:10:48,900
gets pretty messy or as for example if I

242
00:10:52,850 --> 00:10:50,340
wanted to make a peanut butter and jelly

243
00:10:55,400 --> 00:10:52,860
sandwich I could spread the peanut

244
00:10:56,930 --> 00:10:55,410
butter on a tortilla and the tortillas

245
00:10:59,180 --> 00:10:56,940
much tougher it holds together better

246
00:11:02,030 --> 00:10:59,190
and will contain and hold the jelly and

247
00:11:03,920 --> 00:11:02,040
the peanut butter so we know I'm

248
00:11:05,390 --> 00:11:03,930
floating around in space on right and

249
00:11:07,250 --> 00:11:05,400
then we have to be like fish and start

250
00:11:11,290 --> 00:11:07,260
eating the crumbs like a fish in a tank

251
00:11:16,520 --> 00:11:14,960
I'm Marvin and watch a short video and

252
00:11:18,920 --> 00:11:16,530
it showed it didn't show where they

253
00:11:22,340 --> 00:11:18,930
slept do they I sleep in beds are just

254
00:11:25,250 --> 00:11:22,350
like strapped down in flow haha good

255
00:11:28,610 --> 00:11:25,260
question actually on the I'll talk about

256
00:11:31,010 --> 00:11:28,620
how they sleep on the ISS and then you

257
00:11:32,960 --> 00:11:31,020
could extrapolate to other vehicles like

258
00:11:35,330 --> 00:11:32,970
the space shuttle or smaller vehicles

259
00:11:38,540 --> 00:11:35,340
like the Soyuz or even some of the

260
00:11:41,720 --> 00:11:38,550
future vehicles like a riot each crew

261
00:11:44,240 --> 00:11:41,730
member has a sleep station think of the

262
00:11:46,160 --> 00:11:44,250
sleep station as a phone booth a large

263
00:11:47,900 --> 00:11:46,170

phone booth a little bit shorter than a

264
00:11:49,660 --> 00:11:47,910
phone booth because we're not as tall as

265
00:11:52,370 --> 00:11:49,670
the phone booth and a little bit wider

266
00:11:56,000 --> 00:11:52,380
to give more room to turn around in and

267
00:11:57,950 --> 00:11:56,010
each crew member has his personal items

268
00:12:00,620 --> 00:11:57,960
in their pictures of his family the

269
00:12:02,150 --> 00:12:00,630
books he might want to read his laptop

270
00:12:04,730 --> 00:12:02,160
the videos he might want to launch an

271
00:12:07,490 --> 00:12:04,740
asst laptop and things like that and

272
00:12:11,090 --> 00:12:07,500
inside that compartment they usually

273
00:12:13,250 --> 00:12:11,100
have for lack of a better term it's it's

274
00:12:15,290 --> 00:12:13,260
a sleep restraint or a sleeping bag and

275
00:12:17,660 --> 00:12:15,300
the purpose of the sleeping bag so that

276
00:12:19,760 --> 00:12:17,670
you're not you you restrain someone and

277
00:12:21,440 --> 00:12:19,770
you're not floating around in this case

278
00:12:23,570 --> 00:12:21,450
within the compartment within the phone

279
00:12:24,890 --> 00:12:23,580
booth and if you're sleeping and you're

280
00:12:26,270 --> 00:12:24,900
floating and you actually floating

281
00:12:27,560 --> 00:12:26,280
around and you bump into something that

282
00:12:30,020 --> 00:12:27,570
will wake you up and you don't want that

283
00:12:32,090 --> 00:12:30,030
to happen so generally speaking most

284
00:12:34,480 --> 00:12:32,100
crewmembers crawl inside the sleep

285
00:12:36,190 --> 00:12:34,490
restraint zip it up

286
00:12:39,460 --> 00:12:36,200
like I said it's not unlike a sleeping

287
00:12:42,460 --> 00:12:39,470
bag and that sleeping bag is attached to

288
00:12:44,139 --> 00:12:42,470

one wall or the other of the of the

289
00:12:50,530 --> 00:12:44,149
sleeping compartment of the phone booth

290
00:12:54,519 --> 00:12:50,540
and that's how they sleep I this is

291
00:12:56,949 --> 00:12:54,529
griffin uh what happens if some goes

292
00:13:00,579 --> 00:12:56,959
wrong while astronaut is out in space

293
00:13:02,500 --> 00:13:00,589
working on the space station okay that's

294
00:13:06,040 --> 00:13:02,510
a that's a good question and I'm gonna

295
00:13:07,600 --> 00:13:06,050
I'm gonna ask you when you say something

296
00:13:10,720 --> 00:13:07,610
goes wrong because many things can go

297
00:13:12,220 --> 00:13:10,730
wrong so what it what are you thinking

298
00:13:14,290 --> 00:13:12,230
right now in terms of something going

299
00:13:15,940 --> 00:13:14,300
wrong a problem with the suit a problem

300
00:13:17,860 --> 00:13:15,950
with the space station a problem with

301
00:13:19,780 --> 00:13:17,870
communications I mean there's a lot of

302
00:13:21,750 --> 00:13:19,790
things I can answer but I want to tailor

303
00:13:25,630 --> 00:13:21,760
the question to what you're thinking

304
00:13:27,280 --> 00:13:25,640
well like like something goes wrong with

305
00:13:31,150 --> 00:13:27,290
the Sioux like they can't breathe or

306
00:13:34,360 --> 00:13:31,160
some more they are they drift too far

307
00:13:38,350 --> 00:13:34,370
away from the space station okay fair

308
00:13:42,340 --> 00:13:38,360
enough the suit is designed at least the

309
00:13:45,069 --> 00:13:42,350
u.s. made extra vehicular mobility units

310
00:13:48,370 --> 00:13:45,079
that we call them am use to go EV a

311
00:13:51,250 --> 00:13:48,380
that's a mouthful of letters but the

312
00:13:54,880 --> 00:13:51,260
suit is designed it has about eight

313
00:13:56,380 --> 00:13:54,890

hours more or less depending upon how to

314
00:14:00,040 --> 00:13:56,390
heavily breathe and how much work

315
00:14:01,870 --> 00:14:00,050
activity you're doing of oxygen and

316
00:14:03,670 --> 00:14:01,880
water and remember we talked about the

317
00:14:05,949 --> 00:14:03,680
cooling so the water is there to cool

318
00:14:07,930 --> 00:14:05,959
you and the suit and how that's done let

319
00:14:10,150 --> 00:14:07,940
me get to that for a minute we wear a

320
00:14:12,940 --> 00:14:10,160
set of long full-length long johns if

321
00:14:14,380 --> 00:14:12,950
you will that cover the entire play with

322
00:14:16,600 --> 00:14:14,390
the skin and you might have seen this in

323
00:14:19,900 --> 00:14:16,610
the race car industry where this this

324
00:14:21,400 --> 00:14:19,910
garment is has tubes running through it

325
00:14:23,650 --> 00:14:21,410
all over the body and through those

326
00:14:26,019 --> 00:14:23,660
tubes the water is circulated and so

327
00:14:28,720 --> 00:14:26,029
it's actually cooler water to help

328
00:14:31,210 --> 00:14:28,730
remove the heat from the body okay so

329
00:14:33,880 --> 00:14:31,220
that's how we stay cool and and the

330
00:14:36,699 --> 00:14:33,890
oxygen and then and we use pure oxygen

331
00:14:39,220 --> 00:14:36,709
in the suit and the oxygen is is

332
00:14:41,199 --> 00:14:39,230
designed to last eight hours now if

333
00:14:42,939 --> 00:14:41,209
there's a hole in the suit depending

334
00:14:45,370 --> 00:14:42,949
upon the size of the hole the hole gets

335
00:14:47,590 --> 00:14:45,380
too big then I would say all bets are

336
00:14:48,350 --> 00:14:47,600
off but generally speaking that's a very

337
00:14:51,560 --> 00:14:48,360
very very

338
00:14:53,180 --> 00:14:51,570

a low probability chances are you might

339
00:14:55,490 --> 00:14:53,190
get a hole in the su to slit in your

340
00:14:57,970 --> 00:14:55,500
glove a micrometeoroid puncture that

341
00:15:01,250 --> 00:14:57,980
would be like a pinhole or or even a

342
00:15:04,069 --> 00:15:01,260
pencil hole into the suit if that

343
00:15:07,190 --> 00:15:04,079
happens the the oxygen system the the

344
00:15:09,130 --> 00:15:07,200
breathing system can supply the oxygen

345
00:15:12,259 --> 00:15:09,140
to the suit to keep it pressurized

346
00:15:14,449 --> 00:15:12,269
sufficiently to keep you alive and give

347
00:15:17,329 --> 00:15:14,459
you enough time to get back inside if

348
00:15:19,040 --> 00:15:17,339
this happens at the end of the EV a

349
00:15:21,710 --> 00:15:19,050
where you're low on oxygen there's a

350
00:15:23,269 --> 00:15:21,720
secondary emergency oxygen pack that you

351
00:15:25,519 --> 00:15:23,279
can either manually or it will

352
00:15:27,380 --> 00:15:25,529
automatically kick in and give you an

353
00:15:30,500 --> 00:15:27,390
additional 30 minutes to get back inside

354
00:15:34,250 --> 00:15:30,510
with relation to the tether we are

355
00:15:36,370 --> 00:15:34,260
tethered to the space station so and

356
00:15:39,079 --> 00:15:36,380
that that tether is a very very strong

357
00:15:40,819 --> 00:15:39,089
fishing line if you will that could

358
00:15:42,440 --> 00:15:40,829
bring in quite a big fish so it will

359
00:15:46,069 --> 00:15:42,450
hold us to the station even if we tug on

360
00:15:49,040 --> 00:15:46,079
the line but if it does break we do have

361
00:15:52,160 --> 00:15:49,050
a if you will a jet pack it's called

362
00:15:55,250 --> 00:15:52,170
safer that we could fly ourselves back

363
00:15:56,930 --> 00:15:55,260

to the space station NASA likes to have

364
00:15:58,819 --> 00:15:56,940
lots of backup plans for just in case

365
00:16:00,980 --> 00:15:58,829
something goes wrong it wouldn't be fun

366
00:16:02,750 --> 00:16:00,990
to float away from the space station or

367
00:16:07,819 --> 00:16:02,760
whatever vehicle outside your you're

368
00:16:09,560 --> 00:16:07,829
outside up my this is Kirsten I was

369
00:16:11,410 --> 00:16:09,570
wondering how many hours of exercise

370
00:16:14,990 --> 00:16:11,420
today after day to keep their muscle

371
00:16:17,120 --> 00:16:15,000
muscles and stuff like that cuz well I

372
00:16:18,740 --> 00:16:17,130
think and I'm not a hundred percent sure

373
00:16:21,350 --> 00:16:18,750
because I was a Space Shuttle astronaut

374
00:16:22,790 --> 00:16:21,360
and and the requirements for exercise

375
00:16:26,000 --> 00:16:22,800
for us were a little different than the

376
00:16:27,560 --> 00:16:26,010
exercises for the space station crew

377
00:16:30,860 --> 00:16:27,570
members they are of course long term

378
00:16:34,009 --> 00:16:30,870
long-duration space flier stay fly about

379
00:16:37,759 --> 00:16:34,019
six months at a time in space as opposed

380
00:16:40,250 --> 00:16:37,769
to two weeks or so so their exercise

381
00:16:42,829 --> 00:16:40,260
protocol I I think and correct me if I'm

382
00:16:46,160 --> 00:16:42,839
wrong that they're exercising for an

383
00:16:48,769 --> 00:16:46,170
hour or two every day and it's up to the

384
00:16:50,449 --> 00:16:48,779
crew member sometimes if they're not

385
00:16:52,880 --> 00:16:50,459
feeling well they may not feel like

386
00:16:54,889 --> 00:16:52,890
exercising that day it's it's okay to

387
00:16:56,510 --> 00:16:54,899
skip a day or two now and then but you

388
00:16:59,480 --> 00:16:56,520

really want to get the exercise in

389
00:17:01,480 --> 00:16:59,490
pretty regularly and and not miss it

390
00:17:04,809 --> 00:17:01,490
because the with the lack of

391
00:17:07,299 --> 00:17:04,819
cavity up there your body isn't loaded

392
00:17:08,949 --> 00:17:07,309
and and just sitting here and you guys

393
00:17:11,740 --> 00:17:08,959
sitting in your classroom there if

394
00:17:13,990 --> 00:17:11,750
that's where you are your heart is

395
00:17:16,030 --> 00:17:14,000
working against gravity to pump blood up

396
00:17:17,410 --> 00:17:16,040
to your head and otherwise all the

397
00:17:19,270 --> 00:17:17,420
liquid in your body would go to your

398
00:17:21,189 --> 00:17:19,280
feet and that that wouldn't be a good

399
00:17:23,679 --> 00:17:21,199
thing and you pass out and all of that

400
00:17:27,220 --> 00:17:23,689
but in the long term you know your heart

401
00:17:29,860 --> 00:17:27,230
muscle gets weak because it doesn't have

402
00:17:33,310 --> 00:17:29,870
to push against that force of gravity so

403
00:17:35,440 --> 00:17:33,320
it's doing less work your your bones are

404
00:17:38,049 --> 00:17:35,450
not being loaded by the weight of your

405
00:17:40,360 --> 00:17:38,059
body and so therefore there's something

406
00:17:43,960 --> 00:17:40,370
in our bodies that tells our system that

407
00:17:48,010 --> 00:17:43,970
to hold calcium in our bones and that

408
00:17:49,570 --> 00:17:48,020
keeps them strong and and very very able

409
00:17:52,090 --> 00:17:49,580
to hold the weight of your body up

410
00:17:53,620 --> 00:17:52,100
however if that goes away the gravity

411
00:17:55,600 --> 00:17:53,630
goes away and there's no load on your

412
00:17:58,840 --> 00:17:55,610
body there's something inside us that

413
00:18:00,490 --> 00:17:58,850

says the body shed that calcium and the

414
00:18:03,580 --> 00:18:00,500
bones start to get brittle like somebody

415
00:18:05,770 --> 00:18:03,590
who's elderly and has osteoporosis so in

416
00:18:07,299 --> 00:18:05,780
order to counteract that we do the

417
00:18:09,820 --> 00:18:07,309
exercises and several different

418
00:18:12,580 --> 00:18:09,830
protocols to ensure that when we do come

419
00:18:13,990 --> 00:18:12,590
back to earth we retain our health and

420
00:18:16,570 --> 00:18:14,000
are able to function there's an initial

421
00:18:18,940 --> 00:18:16,580
period of time after we come down that

422
00:18:21,820 --> 00:18:18,950
there's an adaptive period to readjust

423
00:18:23,620 --> 00:18:21,830
to the sudden onset of gravity but that

424
00:18:25,360 --> 00:18:23,630
passes and it takes a little longer than

425
00:18:28,720 --> 00:18:25,370
to get fully adjusted to life back on

426
00:18:30,400 --> 00:18:28,730
earth but you really need to exercise to

427
00:18:31,750 --> 00:18:30,410
be able to do that we have some cool

428
00:18:33,280 --> 00:18:31,760
equipment that they can use to do the

429
00:18:34,600 --> 00:18:33,290
exercising too I don't know if y'all

430
00:18:35,860 --> 00:18:34,610
thought about it but how do you like

431
00:18:37,180 --> 00:18:35,870
lift way it's like you do you're here on

432
00:18:39,669 --> 00:18:37,190
the ground when there's no weight in

433
00:18:42,010 --> 00:18:39,679
microgravity so they have some machines

434
00:18:43,740 --> 00:18:42,020
that let them lift weights and run even

435
00:18:49,180 --> 00:18:43,750
though they're really floating and

436
00:18:52,080 --> 00:18:49,190
exercise back as well my name is Jay and

437
00:18:55,240 --> 00:18:52,090
how many times have you been up in space

438
00:18:58,480 --> 00:18:55,250

that's easiest question today Thank You

439
00:19:02,410 --> 00:18:58,490
Jay I've been in space three times I

440
00:19:05,470 --> 00:19:02,420
first flew on mission sts-48 lantus

441
00:19:06,730 --> 00:19:05,480
which by the way will be now its

442
00:19:11,030 --> 00:19:06,740
permanent homes in the Kennedy Space

443
00:19:14,240 --> 00:19:11,040
Center for at the visitors center there

444
00:19:16,370 --> 00:19:14,250
that was in 1991 my second flight was on

445
00:19:19,340 --> 00:19:16,380
the space shuttle Endeavour who will

446
00:19:20,690 --> 00:19:19,350
which will be in California and it's not

447
00:19:23,090 --> 00:19:20,700
quite there yet there will be shipping

448
00:19:27,020 --> 00:19:23,100
it to California soon and that was on

449
00:19:29,510 --> 00:19:27,030
mission st s 54 in 1993 and my last

450
00:19:33,620 --> 00:19:29,520
mission was also on endeavour I was STS

451
00:19:40,280 --> 00:19:33,630
77 in 1996 so I was long ago I guess

452
00:19:42,920 --> 00:19:40,290
from your perspective um hi my name is

453
00:19:46,040 --> 00:19:42,930
John and I wanted to know how many

454
00:19:48,350 --> 00:19:46,050
robots are overs do you guys have on the

455
00:19:52,010 --> 00:19:48,360
International Space Station other than

456
00:19:55,340 --> 00:19:52,020
our two okay other than our two there's

457
00:19:58,300 --> 00:19:55,350
some robots called spheres they're not

458
00:20:01,070 --> 00:19:58,310
exactly autonomous robots but they're

459
00:20:04,880 --> 00:20:01,080
actually let me describe it this way

460
00:20:07,640 --> 00:20:04,890
you've seen Luke Skywalker in Star Wars

461
00:20:09,830 --> 00:20:07,650
when he was training to be a Jedi Knight

462
00:20:12,200 --> 00:20:09,840
with his lightsaber and there was the

463
00:20:14,750 --> 00:20:12,210

little ball floating around and he was

464
00:20:16,550 --> 00:20:14,760
trying to hit the ball and was not

465
00:20:18,380 --> 00:20:16,560
successful initially until lead up the

466
00:20:20,660 --> 00:20:18,390
training from Yoda having said that

467
00:20:26,270 --> 00:20:20,670
there are spheres like that on board

468
00:20:28,480 --> 00:20:26,280
that are used to for robotic purposes to

469
00:20:30,680 --> 00:20:28,490
hold positions to carry things around

470
00:20:32,150 --> 00:20:30,690
they are experimental and they're

471
00:20:34,040 --> 00:20:32,160
they're really not used for anything

472
00:20:35,570 --> 00:20:34,050
practical right now but the hope is that

473
00:20:37,310 --> 00:20:35,580
we will be able to do so in the future

474
00:20:39,320 --> 00:20:37,320
now if there's other robots besides

475
00:20:40,430 --> 00:20:39,330
Robonaut I'm not exactly sure there

476
00:20:42,170 --> 00:20:40,440
might be probably not what you're

477
00:20:44,390 --> 00:20:42,180
thinking of as robots but we have the

478
00:20:46,280 --> 00:20:44,400
robotic arms on the outside of the space

479
00:20:47,900 --> 00:20:46,290
station that we used to carry big pieces

480
00:20:49,670 --> 00:20:47,910
of equipment from one place to another

481
00:20:52,730 --> 00:20:49,680
as we're installing things on the space

482
00:20:55,370 --> 00:20:52,740
station and there's actually three of

483
00:20:57,890 --> 00:20:55,380
those there's our big one that we call

484
00:21:02,200 --> 00:20:57,900
Canada arm to is the main one and then

485
00:21:06,620 --> 00:21:02,210
there's a robotic arm for the Japanese

486
00:21:09,170 --> 00:21:06,630
laboratory kibo and there's also an

487
00:21:12,440 --> 00:21:09,180
attachment for the candidate arm too

488
00:21:15,770 --> 00:21:12,450

right Dexter that is used to change out

489
00:21:17,360 --> 00:21:15,780
spare parts and just to clarify those or

490
00:21:20,540 --> 00:21:17,370
robotic arms but they are controlled by

491
00:21:22,400 --> 00:21:20,550
someone inside its it would be like my

492
00:21:23,690 --> 00:21:22,410
being in this room here and I would be

493
00:21:26,480 --> 00:21:23,700
controlling

494
00:21:29,330 --> 00:21:26,490
the arm on a backhoe if you will that

495
00:21:31,190 --> 00:21:29,340
might be outside the room and so that's

496
00:21:38,389 --> 00:21:31,200
why they call it robotics because it's

497
00:21:42,350 --> 00:21:38,399
remotely controlled this is T and I was

498
00:21:46,730 --> 00:21:42,360
wondering how cold does it doesn't get

499
00:21:48,259 --> 00:21:46,740
at night in space okay how cold it gets

500
00:21:52,399 --> 00:21:48,269
at night in space let's talk about

501
00:21:54,769 --> 00:21:52,409
inside for the moment inside the the ISS

502
00:21:56,450 --> 00:21:54,779
and spacecraft in general is temperature

503
00:21:58,190 --> 00:21:56,460
controlled we have a thermostat just

504
00:21:59,750 --> 00:21:58,200
like you have in your house and you set

505
00:22:01,759 --> 00:21:59,760
the temperature and hopefully the

506
00:22:04,310 --> 00:22:01,769
systems control that now when the system

507
00:22:05,840 --> 00:22:04,320
breaks you call the repairman we have to

508
00:22:08,240 --> 00:22:05,850
repair it ourselves in order to maintain

509
00:22:11,570 --> 00:22:08,250
the temperature automatically we like to

510
00:22:12,950 --> 00:22:11,580
keep it at around 75 degrees at fifty

511
00:22:14,480 --> 00:22:12,960
percent relative humidity that's

512
00:22:18,769 --> 00:22:14,490
generally a comfortable thing might be

513
00:22:20,539 --> 00:22:18,779

like 72 degrees Fahrenheit so and we try

514
00:22:22,430 --> 00:22:20,549
to can the systems on board or designed

515
00:22:24,830 --> 00:22:22,440
to be able to do that against the

516
00:22:27,230 --> 00:22:24,840
temperature extremes outside which again

517
00:22:29,149 --> 00:22:27,240
range like on the dark side of the earth

518
00:22:31,610 --> 00:22:29,159
if you're in orbit from Earth it can get

519
00:22:34,639 --> 00:22:31,620
as low as 250 maybe even more I don't

520
00:22:36,919 --> 00:22:34,649
know the exact number minus 250 degrees

521
00:22:38,240 --> 00:22:36,929
Fahrenheit as n as high in the Sun on

522
00:22:40,610 --> 00:22:38,250
when you come around the Sun side as

523
00:22:43,759 --> 00:22:40,620
high as 250 so there's quite a wide

524
00:22:46,129 --> 00:22:43,769
temperature range now for probes that go

525
00:22:47,360 --> 00:22:46,139
out into the solar system they are in

526
00:22:50,049 --> 00:22:47,370
the Sun all the time so there's a

527
00:22:52,669 --> 00:22:50,059
problem with those at least initially

528
00:22:54,080 --> 00:22:52,679
for keeping them cool but as they get

529
00:22:56,480 --> 00:22:54,090
farther and farther away from the Sun

530
00:22:59,210 --> 00:22:56,490
the effects of the Sun are much less and

531
00:23:03,200 --> 00:22:59,220
they can get very cold you get to Mars

532
00:23:05,029 --> 00:23:03,210
Mars still is relatively a in inner area

533
00:23:07,149 --> 00:23:05,039
away from the Sun and a distance away

534
00:23:11,330 --> 00:23:07,159
from the Sun that's that's relatively

535
00:23:15,649 --> 00:23:11,340
comfortable it's cold on Mars but it can

536
00:23:17,539 --> 00:23:15,659
get up to as high as as as maybe even 15

537
00:23:21,409 --> 00:23:17,549
degrees on the surface and the summer

538
00:23:23,960 --> 00:23:21,419

and the tropics on Mars so it can get

539
00:23:26,180 --> 00:23:23,970
comfortable for you and I to be on Mars

540
00:23:29,149 --> 00:23:26,190
on the surface however you go farther

541
00:23:31,930 --> 00:23:29,159
past Mars we haven't spacecraft on its

542
00:23:33,460 --> 00:23:31,940
way to Pluto as a matter of fact

543
00:23:36,730 --> 00:23:33,470
it's called the new horizon spacecraft

544
00:23:38,980 --> 00:23:36,740
and that spacecraft is already past

545
00:23:40,930 --> 00:23:38,990
Jupiter and is on and I think it's a

546
00:23:42,369 --> 00:23:40,940
scheduled arrival at Pluto to take

547
00:23:48,129 --> 00:23:42,379
pictures of Pluto for the first time

548
00:23:50,649 --> 00:23:48,139
directly I think it's 2015 and it out

549
00:23:52,930 --> 00:23:50,659
that far it's very very cold I can't

550
00:23:55,539 --> 00:23:52,940
tell you the exact number but it's it's

551
00:23:57,009 --> 00:23:55,549
in that minus 250 or lower range than

552
00:24:00,789 --> 00:23:57,019
what I just described so keeping that

553
00:24:04,210 --> 00:24:00,799
spacecraft warm enough for it to

554
00:24:06,310 --> 00:24:04,220
function is is quite a challenge you

555
00:24:08,019 --> 00:24:06,320
guys live in South Dakota gets very cold

556
00:24:09,879 --> 00:24:08,029
there in the winter it's even a

557
00:24:11,769 --> 00:24:09,889
challenge to get your car started in the

558
00:24:13,450 --> 00:24:11,779
morning and that's just right here on

559
00:24:15,820 --> 00:24:13,460
earth so you can imagine the challenge

560
00:24:17,680 --> 00:24:15,830
for sending a spacecraft out that far in

561
00:24:23,049 --> 00:24:17,690
that extreme of the regime of

562
00:24:26,139 --> 00:24:23,059
temperature hi this is Joe Koda um what

563
00:24:28,840 --> 00:24:26,149

kind of schooling the you used to be an

564
00:24:31,779 --> 00:24:28,850
astronaut okay what kind of schooling

565
00:24:33,610 --> 00:24:31,789
okay well I started out the same way you

566
00:24:38,110 --> 00:24:33,620
guys are I was in classrooms much like

567
00:24:40,419 --> 00:24:38,120
yourself and and I was for myself I was

568
00:24:42,430 --> 00:24:40,429
always very inquest was much as I could

569
00:24:44,889 --> 00:24:42,440
about everything and you just can't do

570
00:24:48,970 --> 00:24:44,899
that so you have to focus on something

571
00:24:51,940 --> 00:24:48,980
to narrow the field a little bit so I

572
00:24:53,889 --> 00:24:51,950
decided after high school and well I

573
00:24:55,509 --> 00:24:53,899
decided before high school that I wanted

574
00:24:57,700 --> 00:24:55,519
to do something in science and

575
00:25:00,159 --> 00:24:57,710
engineering and when I got to college I

576
00:25:03,970 --> 00:25:00,169
studied in my case earth science

577
00:25:05,889 --> 00:25:03,980
physical oceanography and meteorology so

578
00:25:09,940 --> 00:25:05,899
that's my particular background but

579
00:25:12,009 --> 00:25:09,950
generically astronauts mainly have

580
00:25:14,379 --> 00:25:12,019
technical scientific engineering

581
00:25:16,690 --> 00:25:14,389
backgrounds medical backgrounds because

582
00:25:19,210 --> 00:25:16,700
of the problems with keeping people

583
00:25:20,560 --> 00:25:19,220
alive and potential medical problems if

584
00:25:23,590 --> 00:25:20,570
we go too far away from space and

585
00:25:26,169 --> 00:25:23,600
something happens medically so mostly

586
00:25:28,629 --> 00:25:26,179
backgrounds like that they prefer to

587
00:25:30,669 --> 00:25:28,639
have advanced degrees not required so

588
00:25:33,279 --> 00:25:30,679

that means you can you can become an

589
00:25:36,249 --> 00:25:33,289
astronaut with a bachelor's degree but a

590
00:25:40,389 --> 00:25:36,259
master's degree is is desired and even a

591
00:25:42,310 --> 00:25:40,399
doctorate PhD is even better of course

592
00:25:47,649 --> 00:25:42,320
all of the education

593
00:25:50,080 --> 00:25:47,659
is not the final bottom line is they

594
00:25:52,299 --> 00:25:50,090
also prefer to have people who have some

595
00:25:56,019 --> 00:25:52,309
experience of course in their fields and

596
00:25:59,499 --> 00:25:56,029
who are good or premier in the fields

597
00:26:02,590 --> 00:25:59,509
that they've chosen to be so and then

598
00:26:04,600 --> 00:26:02,600
that is that is generally speaking the

599
00:26:06,669 --> 00:26:04,610
the science engineering astronauts there

600
00:26:08,399 --> 00:26:06,679
is also the other side of the coin where

601
00:26:11,769 --> 00:26:08,409
you have pilot astronauts who generally

602
00:26:13,480 --> 00:26:11,779
for example fly the spacecraft and just

603
00:26:15,700 --> 00:26:13,490
recently retired Space Shuttle that

604
00:26:18,310 --> 00:26:15,710
would actually fly the shuttle to the

605
00:26:20,499 --> 00:26:18,320
landing that or would fly the capsule

606
00:26:22,330 --> 00:26:20,509
down to the ground or take over

607
00:26:23,860 --> 00:26:22,340
automatic control in the event of a

608
00:26:26,769 --> 00:26:23,870
malfunction on a computer that were

609
00:26:29,710 --> 00:26:26,779
where the was on autopilot so you do

610
00:26:32,110 --> 00:26:29,720
need to have the pilot end of things in

611
00:26:34,090 --> 00:26:32,120
here and the pilots are generally from

612
00:26:35,740 --> 00:26:34,100
military backgrounds not always Neil

613
00:26:37,419 --> 00:26:35,750

Armstrong was not a military pilot he

614
00:26:38,799 --> 00:26:37,429
was a test pilot but not a military test

615
00:26:40,810 --> 00:26:38,809
pilot but generally speaking where you

616
00:26:42,190 --> 00:26:40,820
get that kind of flying experiences in

617
00:26:44,409 --> 00:26:42,200
the military in high-performance

618
00:26:48,870 --> 00:26:44,419
aircraft and you have to have thousands

619
00:26:52,500 --> 00:26:51,000
ok I think that's actually all the

620
00:26:54,150 --> 00:26:52,510
questions were going to have time for

621
00:26:55,530 --> 00:26:54,160
this time around but we really enjoyed

622
00:26:57,060 --> 00:26:55,540
talking with you and I hope you had fun