
MISSION CONTROL CENTER
PAO

1
00:00:04,950 --> 00:00:02,710
welcome to mission control houston i'm

2
00:00:06,869 --> 00:00:04,960
dan hewitt joining me here is one of our

3
00:00:07,990 --> 00:00:06,879
fantastic spacesuit engineers heather

4
00:00:09,669 --> 00:00:08,000
paul

5
00:00:11,990 --> 00:00:09,679
again you're inside the international

6
00:00:13,350 --> 00:00:12,000
space station flight control room now so

7
00:00:15,030 --> 00:00:13,360
all the people in this room are

8
00:00:18,230 --> 00:00:15,040
monitoring systems on an orbiting

9
00:00:21,910 --> 00:00:18,240
laboratory traveling at 17 500 miles an

10
00:00:23,830 --> 00:00:21,920
hour over 260 miles over our heads so

11
00:00:26,470 --> 00:00:23,840
pretty ex

12
00:00:27,830 --> 00:00:26,480
excuse me incredible stuff going on

13
00:00:29,509 --> 00:00:27,840

some of the stuff going on on board the

14
00:00:30,550 --> 00:00:29,519
station today a lot of science work

15
00:00:33,190 --> 00:00:30,560
they're getting ready there's a

16
00:00:35,190 --> 00:00:33,200
spaceship about to dock with it tomorrow

17
00:00:37,270 --> 00:00:35,200
and all the guys and girls in this room

18
00:00:39,990 --> 00:00:37,280
are helping them get ready uh they're

19
00:00:41,510 --> 00:00:40,000
currently six astronauts on board and i

20
00:00:43,110 --> 00:00:41,520
know you guys have a lot of questions

21
00:00:45,270 --> 00:00:43,120
about just what happens to you when you

22
00:00:46,709 --> 00:00:45,280
go to space and things like that so why

23
00:00:53,590 --> 00:00:46,719
don't we go ahead and jump right in and

24
00:00:58,950 --> 00:00:56,069
we've discussed how muscle contracts in

25
00:01:01,670 --> 00:00:58,960
depth what is the physiology of muscle

26
00:01:04,950 --> 00:01:01,680
atrophy knowing that is what happens to

27
00:01:06,950 --> 00:01:04,960
astronauts on the iss

28
00:01:07,990 --> 00:01:06,960
this is a really great question dan and

29
00:01:09,510 --> 00:01:08,000
it shows

30
00:01:11,350 --> 00:01:09,520
you know that they've been talking a lot

31
00:01:13,270 --> 00:01:11,360
about physiology in their class and

32
00:01:15,910 --> 00:01:13,280
that's really cool um

33
00:01:17,590 --> 00:01:15,920
you know muscles contract and expand and

34
00:01:19,749 --> 00:01:17,600
that's how we move around and when

35
00:01:21,990 --> 00:01:19,759
you're in microgravity because we don't

36
00:01:23,350 --> 00:01:22,000
have gravity acting upon our bodies our

37
00:01:24,950 --> 00:01:23,360
muscles tend to be a little bit more

38
00:01:27,109 --> 00:01:24,960

relaxed because they don't have to work

39
00:01:29,350 --> 00:01:27,119
as hard and that's why they atrophy or

40
00:01:31,350 --> 00:01:29,360
they degrade because they're really not

41
00:01:33,749 --> 00:01:31,360
having to work as hard to contract and

42
00:01:35,990 --> 00:01:33,759
relax contract and relax like we do here

43
00:01:38,310 --> 00:01:36,000
on earth and that's primarily what

44
00:01:40,710 --> 00:01:38,320
causes that atrophy or degradation of

45
00:01:42,630 --> 00:01:40,720
the muscle

46
00:01:47,270 --> 00:01:42,640
all right very cool okay next question

47
00:01:52,630 --> 00:01:50,630
how quickly does the mud

48
00:01:55,910 --> 00:01:52,640
how quickly does the muscle atrophy

49
00:01:57,990 --> 00:01:55,920
begin to occur once on the iss how

50
00:01:59,510 --> 00:01:58,000
quickly it's pretty fast actually you

51
00:02:02,230 --> 00:01:59,520
know in the early shuttle days we

52
00:02:03,510 --> 00:02:02,240
realized how important exercise was on

53
00:02:04,709 --> 00:02:03,520
when you're in microgravity whether

54
00:02:06,709 --> 00:02:04,719
you're on the space shuttle or the

55
00:02:09,109 --> 00:02:06,719
international space station and some of

56
00:02:11,430 --> 00:02:09,119
our early studies indicated that within

57
00:02:13,430 --> 00:02:11,440
just five even up to 11 days our

58
00:02:15,750 --> 00:02:13,440
astronauts were getting about 20 percent

59
00:02:17,350 --> 00:02:15,760
of muscle loss that's a lot of your

60
00:02:19,350 --> 00:02:17,360
muscle and i mean our muscles are really

61
00:02:21,030 --> 00:02:19,360
important to keep our body functioning

62
00:02:22,710 --> 00:02:21,040
and moving so while they don't have to

63
00:02:24,550 --> 00:02:22,720

work as hard in microgravity it's a

64
00:02:26,790 --> 00:02:24,560
concern when our astronauts come back

65
00:02:28,550 --> 00:02:26,800
down to earth that if they've lost all

66
00:02:30,790 --> 00:02:28,560
of that muscle they won't be as strong

67
00:02:32,630 --> 00:02:30,800
and capable of moving around so that's

68
00:02:34,309 --> 00:02:32,640
why the astronauts actually exercise for

69
00:02:37,270 --> 00:02:34,319
anywhere from you know two to three

70
00:02:38,869 --> 00:02:37,280
hours a day using our different exercise

71
00:02:40,869 --> 00:02:38,879
machines up there it's important that we

72
00:02:43,589 --> 00:02:40,879
don't lose that 20 muscle mass

73
00:02:45,270 --> 00:02:43,599
especially when five to 11 days is far

74
00:02:47,830 --> 00:02:45,280
shorter than our current mission

75
00:02:48,790 --> 00:02:47,840
duration of six months and even up to a

76
00:02:50,309 --> 00:02:48,800
year

77
00:02:52,229 --> 00:02:50,319
yeah i mean i've heard from a number of

78
00:02:55,110 --> 00:02:52,239
scientists it's amazing how quick the

79
00:02:57,509 --> 00:02:55,120
human body can adapt to very foreign i

80
00:02:59,190 --> 00:02:57,519
mean microgravity is something that your

81
00:03:01,190 --> 00:02:59,200
body will never experience basically

82
00:03:02,630 --> 00:03:01,200
throughout your entire life within five

83
00:03:04,710 --> 00:03:02,640
days it already starts

84
00:03:05,830 --> 00:03:04,720
completely changing that's absolutely

85
00:03:08,630 --> 00:03:05,840
insane

86
00:03:10,309 --> 00:03:08,640
all right next question guys

87
00:03:14,149 --> 00:03:10,319
thank you

88
00:03:18,790 --> 00:03:16,550

i should not take supplements to help

89
00:03:22,309 --> 00:03:18,800
neglect the bone marks that the

90
00:03:25,830 --> 00:03:23,750
yes i think they asked the question

91
00:03:27,270 --> 00:03:25,840
about supplements okay you know and and

92
00:03:29,110 --> 00:03:27,280
this is important i bet we all take

93
00:03:31,110 --> 00:03:29,120
vitamins here on earth right well we

94
00:03:33,030 --> 00:03:31,120
have these really important people

95
00:03:35,270 --> 00:03:33,040
called food scientists that work with us

96
00:03:37,110 --> 00:03:35,280
here as part of our nasa team and their

97
00:03:39,589 --> 00:03:37,120
job is to make sure that the food that

98
00:03:40,949 --> 00:03:39,599
the astronauts eat contain all of the

99
00:03:42,869 --> 00:03:40,959
vitamins and supplements that the

100
00:03:44,470 --> 00:03:42,879
astronauts would need so they don't

101
00:03:46,789 --> 00:03:44,480
really take vitamins like what we do

102
00:03:48,309 --> 00:03:46,799
here on earth we make sure that the food

103
00:03:49,830 --> 00:03:48,319
contains all of the nutrients that they

104
00:03:51,509 --> 00:03:49,840
need but you know i've heard that they

105
00:03:53,750 --> 00:03:51,519
actually do have to take vitamin d

106
00:03:55,589 --> 00:03:53,760
supplements to help because here on

107
00:03:57,110 --> 00:03:55,599
earth we can go step outside in just a

108
00:03:59,750 --> 00:03:57,120
few minutes in the sun we get some

109
00:04:01,509 --> 00:03:59,760
vitamin d well they can't step outside

110
00:04:03,030 --> 00:04:01,519
the international space station so

111
00:04:04,869 --> 00:04:03,040
easily and the vitamin d they would get

112
00:04:06,149 --> 00:04:04,879
is it a little bit higher exposure than

113
00:04:08,390 --> 00:04:06,159

what we want that's why they wear the

114
00:04:10,710 --> 00:04:08,400
spacesuit so we do provide them with

115
00:04:12,869 --> 00:04:10,720
with some supplements for vitamin d okay

116
00:04:22,550 --> 00:04:12,879
i did not know that there you go

117
00:04:25,030 --> 00:04:24,150
what

118
00:04:27,670 --> 00:04:25,040
your

119
00:04:30,230 --> 00:04:27,680
physiology makes the iss

120
00:04:36,310 --> 00:04:30,240
astronauts knowledge is

121
00:04:40,150 --> 00:04:37,909
this is an important thing and when i

122
00:04:41,749 --> 00:04:40,160
first got my job here at nasa i was a

123
00:04:43,990 --> 00:04:41,759
student still studying engineering at

124
00:04:46,070 --> 00:04:44,000
the university and i got to work with

125
00:04:48,230 --> 00:04:46,080
our life science team and one of the

126
00:04:50,070 --> 00:04:48,240
things we were studying was space

127
00:04:51,749 --> 00:04:50,080
adaptation sickness a lot of our

128
00:04:53,749 --> 00:04:51,759
astronauts within the first two to three

129
00:04:55,430 --> 00:04:53,759
days of being in space

130
00:04:57,430 --> 00:04:55,440
whether they've flown before or not

131
00:04:58,469 --> 00:04:57,440
sometimes their stomachs can get upset

132
00:05:00,950 --> 00:04:58,479
and they get a little dizzy and

133
00:05:03,430 --> 00:05:00,960
definitely nauseous and a lot of that is

134
00:05:05,990 --> 00:05:03,440
attributed to the fact that your body

135
00:05:07,430 --> 00:05:06,000
has all these senses sensory organism

136
00:05:09,430 --> 00:05:07,440
and everything that's communicating back

137
00:05:11,510 --> 00:05:09,440
and forth with your eyes and your brain

138
00:05:13,670 --> 00:05:11,520

and it's really just confusing for all

139
00:05:15,909 --> 00:05:13,680
of these sensors in your body when

140
00:05:17,510 --> 00:05:15,919
suddenly here on earth we have a ceiling

141
00:05:19,830 --> 00:05:17,520
and we have a floor and we have walls

142
00:05:21,270 --> 00:05:19,840
and everything's upright and normal once

143
00:05:23,590 --> 00:05:21,280
you get in space

144
00:05:25,510 --> 00:05:23,600
there is really no up or down

145
00:05:26,950 --> 00:05:25,520
and so your eyes are looking at

146
00:05:29,590 --> 00:05:26,960
something and your brain is trying to

147
00:05:31,270 --> 00:05:29,600
understand it and your neuro vestibular

148
00:05:33,510 --> 00:05:31,280
system that's working to keep you

149
00:05:35,029 --> 00:05:33,520
balanced all of these different sensors

150
00:05:37,189 --> 00:05:35,039
are talking to each other and the

151
00:05:38,710 --> 00:05:37,199
information isn't matching up

152
00:05:40,230 --> 00:05:38,720
and that causes you to feel maybe a

153
00:05:41,990 --> 00:05:40,240
little dizzy you might start to get a

154
00:05:44,310 --> 00:05:42,000
headache and sometimes our astronauts do

155
00:05:46,150 --> 00:05:44,320
feel nauseous but typically after a few

156
00:05:49,590 --> 00:05:46,160
days you get used to it because as dan

157
00:05:51,270 --> 00:05:49,600
said our bodies are so amazing we adapt

158
00:05:53,029 --> 00:05:51,280
nearly immediately so sometimes that

159
00:05:55,670 --> 00:05:53,039
adaptation process takes a little bit

160
00:05:57,830 --> 00:05:55,680
longer for some of our astronauts but

161
00:06:01,990 --> 00:05:57,840
they get better very quickly

162
00:06:05,110 --> 00:06:03,430
um

163
00:06:06,710 --> 00:06:05,120

is there anything different about the

164
00:06:11,749 --> 00:06:06,720
air pressure

165
00:06:14,309 --> 00:06:11,759
pressurization on the iss in relation to

166
00:06:16,950 --> 00:06:14,319
that of the sea level on earth if so

167
00:06:18,309 --> 00:06:16,960
does this have implications on the human

168
00:06:20,309 --> 00:06:18,319
body

169
00:06:22,150 --> 00:06:20,319
very good question i i'm excited about

170
00:06:24,390 --> 00:06:22,160
this one because what you're asking is

171
00:06:26,469 --> 00:06:24,400
something that i've actually worked with

172
00:06:28,629 --> 00:06:26,479
on our team of life support engineers

173
00:06:30,950 --> 00:06:28,639
and more specifically i've worked with

174
00:06:32,790 --> 00:06:30,960
your atmosphere within your space suit

175
00:06:34,550 --> 00:06:32,800
but our team that works on the

176
00:06:36,070 --> 00:06:34,560
atmosphere for the international space

177
00:06:37,749 --> 00:06:36,080
station does something similar and

178
00:06:39,670 --> 00:06:37,759
maintaining that environment is very

179
00:06:41,749 --> 00:06:39,680
important now the international space

180
00:06:43,990 --> 00:06:41,759
station is at the same atmospheric

181
00:06:47,189 --> 00:06:44,000
pressure as sea level so that's 14.7

182
00:06:49,110 --> 00:06:47,199
pounds per square inch absolute and the

183
00:06:50,629 --> 00:06:49,120
composition of gases is the same just

184
00:06:52,469 --> 00:06:50,639
like what we're breathing here on earth

185
00:06:54,790 --> 00:06:52,479
we have the same up there now the

186
00:06:56,550 --> 00:06:54,800
spacesuit on the other hand because

187
00:06:58,070 --> 00:06:56,560
you're inflated in the suit that's

188
00:07:00,469 --> 00:06:58,080

protecting you from those extreme

189
00:07:02,950 --> 00:07:00,479
environments we have that at a reduced

190
00:07:05,749 --> 00:07:02,960
pressure of 4.3 pounds per square inch

191
00:07:07,589 --> 00:07:05,759
but it's 100 pure oxygen so the

192
00:07:09,510 --> 00:07:07,599
spacesuit is slightly different but it's

193
00:07:11,430 --> 00:07:09,520
sea level and regular atmospheric

194
00:07:13,670 --> 00:07:11,440
composition on the space station so what

195
00:07:15,189 --> 00:07:13,680
would happen if the spacesuit was at an

196
00:07:17,510 --> 00:07:15,199
atmospheric

197
00:07:19,029 --> 00:07:17,520
like would they not be able to move

198
00:07:20,309 --> 00:07:19,039
exactly because

199
00:07:22,390 --> 00:07:20,319
when when you're inflating it's

200
00:07:24,150 --> 00:07:22,400
basically like a human shaped balloon

201
00:07:25,830 --> 00:07:24,160
and the more you pressurize or inflate

202
00:07:27,589 --> 00:07:25,840
that balloon the harder it's going to be

203
00:07:29,589 --> 00:07:27,599
for the human being inside to move

204
00:07:32,150 --> 00:07:29,599
against those materials that's why we

205
00:07:34,469 --> 00:07:32,160
wouldn't want a suit that's made out of

206
00:07:35,990 --> 00:07:34,479
fabrics kind of like we have now

207
00:07:37,510 --> 00:07:36,000
and pressurize it to atmospheric

208
00:07:40,230 --> 00:07:37,520
pressure because it would just be really

209
00:07:42,070 --> 00:07:40,240
hard to move for astronaut and let's

210
00:07:43,990 --> 00:07:42,080
face it when they're out on a spacewalk

211
00:07:46,150 --> 00:07:44,000
hard enough already exactly we don't we

212
00:07:53,510 --> 00:07:46,160
want to make it as easy as possible all

213
00:07:57,990 --> 00:07:55,749

okay is there anything different about

214
00:07:59,029 --> 00:07:58,000
the air pressurization on the iss in

215
00:08:00,710 --> 00:07:59,039
relation

216
00:08:02,869 --> 00:08:00,720
okay sorry is there anything different

217
00:08:05,909 --> 00:08:02,879
about the proportions of different gases

218
00:08:08,309 --> 00:08:05,919
that make up the air aboard the iss

219
00:08:10,550 --> 00:08:08,319
nothing different at all nothing at all

220
00:08:13,589 --> 00:08:10,560
now sometimes when we're getting ready

221
00:08:15,909 --> 00:08:13,599
to do a walk the astronauts will go into

222
00:08:17,749 --> 00:08:15,919
the airlock and we might decrease the

223
00:08:19,909 --> 00:08:17,759
atmospheric pressure a little bit and we

224
00:08:22,469 --> 00:08:19,919
might ask them to put on masks to

225
00:08:24,230 --> 00:08:22,479
breathe pure oxygen and the intent there

226
00:08:26,710 --> 00:08:24,240
is when you're going from an atmospheric

227
00:08:28,710 --> 00:08:26,720
pressure of regular air composition to a

228
00:08:30,550 --> 00:08:28,720
space suit pressure that's a lot lower

229
00:08:32,870 --> 00:08:30,560
100 oxygen

230
00:08:35,589 --> 00:08:32,880
we want to get out all of those extra

231
00:08:37,509 --> 00:08:35,599
gases like nitrogen that stay in our

232
00:08:39,589 --> 00:08:37,519
blood and our tissues if you've ever

233
00:08:41,269 --> 00:08:39,599
heard about scuba diving you know that

234
00:08:43,589 --> 00:08:41,279
the astronauts if they spend too much

235
00:08:45,910 --> 00:08:43,599
time under water at depth they have to

236
00:08:48,070 --> 00:08:45,920
take their time coming back up to sea

237
00:08:50,389 --> 00:08:48,080
level because they've saturated their

238
00:08:52,630 --> 00:08:50,399

tissues with nitrogen and those nitrogen

239
00:08:54,310 --> 00:08:52,640
bubbles want to expand as you reduce the

240
00:08:56,550 --> 00:08:54,320
pressure around them well we're doing

241
00:08:59,190 --> 00:08:56,560
the same thing when we go from a high

242
00:09:00,470 --> 00:08:59,200
pressure sea level atmosphere down to a

243
00:09:02,230 --> 00:09:00,480
low pressure spacesuit you don't want

244
00:09:03,910 --> 00:09:02,240
those nitrogen bubbles to expand because

245
00:09:05,430 --> 00:09:03,920
that could be pretty dangerous to our

246
00:09:07,590 --> 00:09:05,440
astronauts health

247
00:09:09,350 --> 00:09:07,600
so that's why sometimes they do what we

248
00:09:11,110 --> 00:09:09,360
call a campout in the airlock and they

249
00:09:12,870 --> 00:09:11,120
get to overnight with their space

250
00:09:15,110 --> 00:09:12,880
walking buddy have a little slumber

251
00:09:17,509 --> 00:09:15,120
party in the airlock at a lower pressure

252
00:09:19,269 --> 00:09:17,519
to get them ready for that lower even

253
00:09:21,670 --> 00:09:19,279
lower pressure of the spacesuit but the

254
00:09:24,470 --> 00:09:21,680
regular cabin environment is just like

255
00:09:26,389 --> 00:09:24,480
breathing air here at sea level

256
00:09:28,870 --> 00:09:26,399
all right very cool stuff nice question

257
00:09:32,470 --> 00:09:31,110
and and the kids were dying to have us

258
00:09:34,550 --> 00:09:32,480
let you know that we just went scuba

259
00:09:35,670 --> 00:09:34,560
diving we learned all about that so

260
00:09:37,829 --> 00:09:35,680
well

261
00:09:39,509 --> 00:09:37,839
there you go so see now it's kind of the

262
00:09:40,710 --> 00:09:39,519
opposite when you think about it scuba

263
00:09:42,790 --> 00:09:40,720

diving you go

264
00:09:44,389 --> 00:09:42,800
down in depth and the pressure increases

265
00:09:46,230 --> 00:09:44,399
and then you come up to sea level well

266
00:09:48,550 --> 00:09:46,240
in space we're floating

267
00:09:50,470 --> 00:09:48,560
and we're at sea level and we go down to

268
00:09:52,550 --> 00:09:50,480
space suit pressure so it's a little bit

269
00:09:54,150 --> 00:09:52,560
different but we do the same kinds of

270
00:09:55,350 --> 00:09:54,160
things to prepare

271
00:09:57,110 --> 00:09:55,360
just like you would if you're a scuba

272
00:09:59,670 --> 00:09:57,120
diver coming up to sea level taking it

273
00:10:01,750 --> 00:09:59,680
slow we take them slow from 14.7 down to

274
00:10:04,790 --> 00:10:01,760
4.3

275
00:10:07,350 --> 00:10:04,800
alright cool next question

276
00:10:09,110 --> 00:10:07,360
okay what is the most common noticeable

277
00:10:10,949 --> 00:10:09,120
effect that astronauts still have when

278
00:10:12,870 --> 00:10:10,959
they return to earth from a spin on the

279
00:10:14,630 --> 00:10:12,880
iss

280
00:10:17,750 --> 00:10:14,640
that's a really good question and it's a

281
00:10:19,509 --> 00:10:17,760
very personal response so each astronaut

282
00:10:21,829 --> 00:10:19,519
reacts a little bit different we've had

283
00:10:23,350 --> 00:10:21,839
some astronauts that come back and they

284
00:10:25,030 --> 00:10:23,360
hop out of their seats walk out of the

285
00:10:27,030 --> 00:10:25,040
space shuttle they're waving and feeling

286
00:10:29,670 --> 00:10:27,040
great there are some astronauts that

287
00:10:31,670 --> 00:10:29,680
come back and maybe they feel a little

288
00:10:33,430 --> 00:10:31,680

bit dizzy or even nauseous sometimes

289
00:10:34,870 --> 00:10:33,440
it's a little harder to feel all of a

290
00:10:36,470 --> 00:10:34,880
sudden your arms are really heavy you

291
00:10:38,949 --> 00:10:36,480
know just to pick yourself up out of the

292
00:10:41,190 --> 00:10:38,959
seat could be exhausting and really the

293
00:10:43,190 --> 00:10:41,200
response depends on how long you've been

294
00:10:45,030 --> 00:10:43,200
up in space so the space shuttle

295
00:10:46,949 --> 00:10:45,040
astronauts who were up there for maybe a

296
00:10:49,269 --> 00:10:46,959
couple of days to two weeks at a time at

297
00:10:51,269 --> 00:10:49,279
a time it was much easier for them to

298
00:10:52,630 --> 00:10:51,279
adapt when they got back to earth than

299
00:10:54,630 --> 00:10:52,640
some of our astronauts that live on

300
00:10:55,829 --> 00:10:54,640
these increment missions for six months

301
00:10:57,750 --> 00:10:55,839
at a time

302
00:11:00,230 --> 00:10:57,760
so it's really very different for each

303
00:11:01,910 --> 00:11:00,240
astronaut but one of the most common

304
00:11:03,990 --> 00:11:01,920
things that i've heard happens is they

305
00:11:05,910 --> 00:11:04,000
feel a little bit light-headed and

306
00:11:07,350 --> 00:11:05,920
that's because in space we get what we

307
00:11:09,750 --> 00:11:07,360
call a fluid shift due to the

308
00:11:11,750 --> 00:11:09,760
microgravity environment our fluids

309
00:11:13,509 --> 00:11:11,760
which on earth tend to pull down in the

310
00:11:15,829 --> 00:11:13,519
lower half of our body because gravity

311
00:11:17,509 --> 00:11:15,839
is pulling down well all of those fluids

312
00:11:19,590 --> 00:11:17,519
redistribute in the body and they tend

313
00:11:21,750 --> 00:11:19,600

to kind of creep up into the upper half

314
00:11:23,190 --> 00:11:21,760
of the body which is why our astronauts

315
00:11:25,190 --> 00:11:23,200
sometimes when you see a picture of them

316
00:11:26,870 --> 00:11:25,200
on earth versus in space in space they

317
00:11:28,310 --> 00:11:26,880
look like they've gained weight well

318
00:11:29,910 --> 00:11:28,320
they haven't gained weight at all

319
00:11:32,069 --> 00:11:29,920
they've just got a little bit more fluid

320
00:11:33,750 --> 00:11:32,079
in their upper body and their faces puff

321
00:11:35,750 --> 00:11:33,760
out just a bit more

322
00:11:37,430 --> 00:11:35,760
now your heart

323
00:11:39,430 --> 00:11:37,440
gets used to that and it thinks that's

324
00:11:41,509 --> 00:11:39,440
cool i don't have to worry about making

325
00:11:43,350 --> 00:11:41,519
so much blood and pumping so much blood

326
00:11:45,030 --> 00:11:43,360
and so when you get back to earth and

327
00:11:47,190 --> 00:11:45,040
our astronauts land and gravity pulls

328
00:11:48,389 --> 00:11:47,200
the fluids back down into the lower body

329
00:11:49,750 --> 00:11:48,399
sometimes our astronauts get a little

330
00:11:51,509 --> 00:11:49,760
bit dizzy

331
00:11:53,990 --> 00:11:51,519
you know they feel a little disoriented

332
00:11:56,630 --> 00:11:54,000
but again they they adapt pretty quickly

333
00:11:58,310 --> 00:11:56,640
to their back home environment one of my

334
00:12:00,389 --> 00:11:58,320
favorites that i have heard from a few

335
00:12:02,470 --> 00:12:00,399
astronauts not really a physiological

336
00:12:03,750 --> 00:12:02,480
almost more of a psychological is

337
00:12:06,550 --> 00:12:03,760
they'll forget that they're not in

338
00:12:08,310 --> 00:12:06,560

microgravity so they'll hop out of bed

339
00:12:11,110 --> 00:12:08,320
one morning grab a glass of water and

340
00:12:13,269 --> 00:12:11,120
then go to just let it float away and

341
00:12:15,269 --> 00:12:13,279
plop drops right in the ground so it can

342
00:12:17,269 --> 00:12:15,279
be it can be difficult when you i mean

343
00:12:18,629 --> 00:12:17,279
live a certain way for six months to

344
00:12:20,150 --> 00:12:18,639
suddenly go back to the complete

345
00:12:21,990 --> 00:12:20,160
opposite even if it's where you've lived

346
00:12:23,829 --> 00:12:22,000
for your entire life more your body

347
00:12:25,190 --> 00:12:23,839
adapts very quickly and your mind does

348
00:12:30,310 --> 00:12:25,200
as well

349
00:12:35,590 --> 00:12:32,949
all right so at what point in time were

350
00:12:39,269 --> 00:12:35,600
the exercise machines that are currently

351
00:12:41,110 --> 00:12:39,279
being used on the iss installed

352
00:12:43,110 --> 00:12:41,120
that's a good question now remember

353
00:12:45,110 --> 00:12:43,120
before we built this the space station

354
00:12:47,030 --> 00:12:45,120
we were flying the space shuttle so we'd

355
00:12:49,430 --> 00:12:47,040
already been doing a lot of experiments

356
00:12:51,430 --> 00:12:49,440
to understand to what extent we needed

357
00:12:53,509 --> 00:12:51,440
to exercise if we lived for long

358
00:12:55,829 --> 00:12:53,519
duration in the space station and what

359
00:12:57,829 --> 00:12:55,839
kinds of machines we would need so i

360
00:12:59,990 --> 00:12:57,839
don't know exactly when we first started

361
00:13:02,470 --> 00:13:00,000
bringing up exercise equipment i believe

362
00:13:04,790 --> 00:13:02,480
it was when we first brought humans up

363
00:13:06,629 --> 00:13:04,800

one of the very first pieces of exercise

364
00:13:08,790 --> 00:13:06,639
equipment that was on board the station

365
00:13:11,430 --> 00:13:08,800
actually just left the station it was

366
00:13:12,710 --> 00:13:11,440
the very first treadmill which was on

367
00:13:15,269 --> 00:13:12,720
one of the russian segments that

368
00:13:17,750 --> 00:13:15,279
launched back in night the first russian

369
00:13:19,910 --> 00:13:17,760
segment that launched back in 1998 so

370
00:13:22,310 --> 00:13:19,920
there has been exercise equipment on

371
00:13:24,069 --> 00:13:22,320
board the station you know since

372
00:13:25,670 --> 00:13:24,079
the station's been in existence humans

373
00:13:27,829 --> 00:13:25,680
got there in 2000 there was already

374
00:13:29,269 --> 00:13:27,839
exercise equipment waiting for them one

375
00:13:31,750 --> 00:13:29,279
of the more one of the ones you might

376
00:13:33,829 --> 00:13:31,760
have heard of is known as the colbert

377
00:13:35,430 --> 00:13:33,839
it's one of the

378
00:13:37,509 --> 00:13:35,440
treadmills on board the international

379
00:13:39,030 --> 00:13:37,519
space station this was named after

380
00:13:40,790 --> 00:13:39,040
stephen colbert you may have heard of

381
00:13:42,310 --> 00:13:40,800
him it's the combined operational

382
00:13:45,350 --> 00:13:42,320
load-bearing external resistance

383
00:13:47,750 --> 00:13:45,360
treadmill we love acronyms but that one

384
00:13:49,110 --> 00:13:47,760
launched back in 2009 on one of the

385
00:13:51,030 --> 00:13:49,120
space shuttles and that's one of the

386
00:13:52,949 --> 00:13:51,040
more recent pieces on board the

387
00:13:54,550 --> 00:13:52,959
international space station and we've

388
00:13:56,710 --> 00:13:54,560

definitely been making upgrades to the

389
00:13:58,710 --> 00:13:56,720
equipment as we learn more about what

390
00:14:00,870 --> 00:13:58,720
the astronauts like to do and the

391
00:14:02,230 --> 00:14:00,880
effects of that exercise on their bodies

392
00:14:04,389 --> 00:14:02,240
you know we can't do traditional

393
00:14:06,310 --> 00:14:04,399
weightlifting in space because you're

394
00:14:08,389 --> 00:14:06,320
weightless so so would those big

395
00:14:09,670 --> 00:14:08,399
barbells that you'd be lifting so

396
00:14:11,430 --> 00:14:09,680
learning how to do something like

397
00:14:13,189 --> 00:14:11,440
resistive exercise so it's not just

398
00:14:15,509 --> 00:14:13,199
about the cardiovascular effect of

399
00:14:16,389 --> 00:14:15,519
running on a treadmill or working on a

400
00:14:17,829 --> 00:14:16,399
bicycle

401
00:14:20,790 --> 00:14:17,839
we have to really make sure that we're

402
00:14:21,990 --> 00:14:20,800
doing that resistance exercise as well

403
00:14:24,230 --> 00:14:22,000
to make sure that they're maintaining

404
00:14:27,189 --> 00:14:24,240
their bones and muscles yep

405
00:14:30,230 --> 00:14:27,199
all right next question

406
00:14:32,150 --> 00:14:30,240
um acronym mate was the acronym came

407
00:14:33,590 --> 00:14:32,160
first and then you decided after colbert

408
00:14:35,829 --> 00:14:33,600
or was it first we had to find an

409
00:14:38,310 --> 00:14:35,839
acronym that fits for stephen colbert we

410
00:14:41,110 --> 00:14:38,320
had to find an acronym that fit

411
00:14:42,790 --> 00:14:41,120
we sometimes you'll get a cool name and

412
00:14:44,790 --> 00:14:42,800
we have some very talented people here

413
00:14:46,629 --> 00:14:44,800

coming up with acronyms

414
00:14:48,069 --> 00:14:46,639
yes as an engineer that works on a lot

415
00:14:50,150 --> 00:14:48,079
of different pieces of hardware we're

416
00:14:51,750 --> 00:14:50,160
always really trying to figure out how

417
00:14:53,990 --> 00:14:51,760
could i make the name heather into an

418
00:14:55,990 --> 00:14:54,000
acronym for that piece of equipment one

419
00:14:58,949 --> 00:14:56,000
of our engineers came very close his

420
00:15:01,430 --> 00:14:58,959
name is hep h iep and we were working on

421
00:15:04,710 --> 00:15:01,440
something that became e-hip so he got

422
00:15:07,350 --> 00:15:04,720
really close he was so excited

423
00:15:09,750 --> 00:15:07,360
all right next question guys

424
00:15:12,230 --> 00:15:09,760
astronauts um always known that they

425
00:15:15,750 --> 00:15:12,240
needed to exercise well in space to

426
00:15:16,790 --> 00:15:15,760
combat muscle asthma astrophy

427
00:15:19,509 --> 00:15:16,800
atrophy

428
00:15:23,990 --> 00:15:19,519
and bone loss since the beginning of iss

429
00:15:28,949 --> 00:15:26,389
yes absolutely you know um it's a big

430
00:15:31,030 --> 00:15:28,959
concern because again microgravity your

431
00:15:32,470 --> 00:15:31,040
bones and muscles your tissues they tend

432
00:15:34,069 --> 00:15:32,480
to relax it's almost like they're on a

433
00:15:36,310 --> 00:15:34,079
vacation because they don't have to work

434
00:15:38,710 --> 00:15:36,320
as hard and that muscle atrophy is

435
00:15:40,389 --> 00:15:38,720
really serious um like like i said

436
00:15:42,230 --> 00:15:40,399
earlier you can lose up to about twenty

437
00:15:44,470 --> 00:15:42,240
percent within the first five to eleven

438
00:15:47,350 --> 00:15:44,480

days if you're not exercising

439
00:15:49,350 --> 00:15:47,360
and it's not as critical up there i mean

440
00:15:50,790 --> 00:15:49,360
unless you're a space walking engineer

441
00:15:52,389 --> 00:15:50,800
astronaut and then you definitely have

442
00:15:54,470 --> 00:15:52,399
to make sure that you are still strong

443
00:15:56,790 --> 00:15:54,480
enough to do the operations but there's

444
00:15:58,949 --> 00:15:56,800
more of a concern here on earth you know

445
00:16:00,629 --> 00:15:58,959
and the other thing is the bone loss

446
00:16:02,310 --> 00:16:00,639
that has been a big source of our

447
00:16:04,550 --> 00:16:02,320
studies because

448
00:16:06,230 --> 00:16:04,560
your bones degrade at a much faster rate

449
00:16:08,389 --> 00:16:06,240
in microgravity compared to here on

450
00:16:11,189 --> 00:16:08,399
earth and in fact they can lose about 10

451
00:16:13,269 --> 00:16:11,199
bone loss in one year in microgravity

452
00:16:15,910 --> 00:16:13,279
that's equivalent 10 bone loss is

453
00:16:18,470 --> 00:16:15,920
equivalent to what someone age 50 or

454
00:16:20,550 --> 00:16:18,480
higher would lose in 10 years here on

455
00:16:23,110 --> 00:16:20,560
earth so really making sure that our

456
00:16:24,629 --> 00:16:23,120
astronauts are eating a good diet that

457
00:16:26,310 --> 00:16:24,639
provides all the supplementation and

458
00:16:28,389 --> 00:16:26,320
nutrients that they need and they're

459
00:16:30,069 --> 00:16:28,399
doing that exercise for about two to

460
00:16:31,430 --> 00:16:30,079
three hours a day

461
00:16:33,509 --> 00:16:31,440
and

462
00:16:35,350 --> 00:16:33,519
also part of your question this is this

463
00:16:36,870 --> 00:16:35,360

is something that we've been aware of

464
00:16:39,430 --> 00:16:36,880
you know we've been doing space flights

465
00:16:41,350 --> 00:16:39,440
since the 60s so it is something

466
00:16:43,910 --> 00:16:41,360
if it only takes five days to appear

467
00:16:46,389 --> 00:16:43,920
then you can have noticeable effects

468
00:16:48,389 --> 00:16:46,399
it's really become a priority you know

469
00:16:50,470 --> 00:16:48,399
since the advent of space stations in

470
00:16:53,110 --> 00:16:50,480
space like the old russian mir

471
00:16:54,550 --> 00:16:53,120
and also the u.s skylab missions but

472
00:16:56,629 --> 00:16:54,560
especially on the international space

473
00:16:59,670 --> 00:16:56,639
station and it's such a huge

474
00:17:01,749 --> 00:16:59,680
part of the iss nowadays because we have

475
00:17:03,910 --> 00:17:01,759
these continuous crews these i mean

476
00:17:05,909 --> 00:17:03,920
we've had people in space since the year

477
00:17:08,069 --> 00:17:05,919
2000 like human beings have been a

478
00:17:09,270 --> 00:17:08,079
space-faring civilization since the year

479
00:17:11,590 --> 00:17:09,280
2000

480
00:17:13,750 --> 00:17:11,600
so we now have the capability to do

481
00:17:15,590 --> 00:17:13,760
constant research and have lots of test

482
00:17:18,230 --> 00:17:15,600
subjects so we can really you know

483
00:17:20,870 --> 00:17:18,240
examine what causes this much muscle

484
00:17:22,390 --> 00:17:20,880
atrophy and bone loss and how can we

485
00:17:23,829 --> 00:17:22,400
really combat it

486
00:17:24,949 --> 00:17:23,839
you know it's really exciting dan

487
00:17:27,590 --> 00:17:24,959
because

488
00:17:29,510 --> 00:17:27,600

we have selected our first astronaut and

489
00:17:32,230 --> 00:17:29,520
cosmonaut to do a one-year stint on the

490
00:17:33,909 --> 00:17:32,240
space station and that astronaut has an

491
00:17:35,590 --> 00:17:33,919
astronaut twin brother who's going to

492
00:17:37,430 --> 00:17:35,600
stay here on earth

493
00:17:40,549 --> 00:17:37,440
and our international space station

494
00:17:42,630 --> 00:17:40,559
program uh science office has set out a

495
00:17:44,789 --> 00:17:42,640
notice to scientists around the world

496
00:17:46,630 --> 00:17:44,799
saying we've got one astronaut brother

497
00:17:48,310 --> 00:17:46,640
up and one astronaut brother down and

498
00:17:49,830 --> 00:17:48,320
they're the first you know set of twins

499
00:17:51,270 --> 00:17:49,840
where one will be in space and one here

500
00:17:52,950 --> 00:17:51,280
for a full year

501
00:17:54,870 --> 00:17:52,960
what can we do to study the effects of

502
00:17:56,870 --> 00:17:54,880
microgravity on one versus the other i

503
00:17:58,390 --> 00:17:56,880
think that's so amazing it's really

504
00:18:00,470 --> 00:17:58,400
exciting stuff coming up in the next

505
00:18:02,150 --> 00:18:00,480
year or two absolutely the research

506
00:18:05,750 --> 00:18:02,160
never stops

507
00:18:11,190 --> 00:18:08,630
okay so

508
00:18:14,789 --> 00:18:11,200
does the lack of restful sleep

509
00:18:17,990 --> 00:18:14,799
and that most astronauts tell us on the

510
00:18:19,909 --> 00:18:18,000
iss contribute to the muscle astrophy

511
00:18:21,430 --> 00:18:19,919
and our bone loss

512
00:18:23,350 --> 00:18:21,440
you know i haven't heard that lack of

513
00:18:25,430 --> 00:18:23,360

sleep really contributes to that i think

514
00:18:27,990 --> 00:18:25,440
it's more the environment around them

515
00:18:29,350 --> 00:18:28,000
but what lack of sleep might do is just

516
00:18:31,190 --> 00:18:29,360
make them a little bit more tired

517
00:18:32,630 --> 00:18:31,200
throughout their day although most of my

518
00:18:34,710 --> 00:18:32,640
astronaut friends that i've talked to

519
00:18:35,990 --> 00:18:34,720
said after that few first few days of

520
00:18:37,830 --> 00:18:36,000
getting used to things they actually

521
00:18:39,590 --> 00:18:37,840
sleep really well

522
00:18:41,029 --> 00:18:39,600
when they're on the space station and i

523
00:18:42,310 --> 00:18:41,039
think one of my favorite things when i

524
00:18:44,150 --> 00:18:42,320
think about how they sleep they're

525
00:18:46,390 --> 00:18:44,160
basically in a sleeping bag

526
00:18:48,310 --> 00:18:46,400
but we had to develop a head strap

527
00:18:49,990 --> 00:18:48,320
because naturally when you're in space

528
00:18:52,390 --> 00:18:50,000
your arms are going to float up and your

529
00:18:54,549 --> 00:18:52,400
head will tilt forward and then that's a

530
00:18:55,750 --> 00:18:54,559
little bit uncomfortable for the neck so

531
00:18:58,470 --> 00:18:55,760
our

532
00:19:00,230 --> 00:18:58,480
engineers who designed their sleepwear

533
00:19:01,909 --> 00:19:00,240
had to design a comfortable head strap

534
00:19:02,710 --> 00:19:01,919
so the astronauts can strap their head

535
00:19:03,510 --> 00:19:02,720
back

536
00:19:05,350 --> 00:19:03,520
and

537
00:19:06,950 --> 00:19:05,360
get that sense of the contact of the

538
00:19:10,390 --> 00:19:06,960

back of their head on the sleeping bag

539
00:19:20,950 --> 00:19:10,400
almost like they're sleeping on a pillow

540
00:19:24,950 --> 00:19:23,110
what is the process for re-entry into

541
00:19:26,710 --> 00:19:24,960
the earth like for astronauts does it

542
00:19:28,710 --> 00:19:26,720
take a while to become accustomed to

543
00:19:31,110 --> 00:19:28,720
gravity again

544
00:19:33,510 --> 00:19:31,120
so i think the question is about reentry

545
00:19:35,029 --> 00:19:33,520
yes so um it takes quite a bit of time

546
00:19:36,549 --> 00:19:35,039
because you know it's basically like

547
00:19:38,230 --> 00:19:36,559
they're packing up after they've been on

548
00:19:41,350 --> 00:19:38,240
a really long trip they want to make

549
00:19:42,549 --> 00:19:41,360
sure everything is packed up and secure

550
00:19:44,310 --> 00:19:42,559
and they want to make sure that their

551
00:19:45,830 --> 00:19:44,320
suits that they're wearing for re-entry

552
00:19:47,590 --> 00:19:45,840
are working well so they do a lot of

553
00:19:49,430 --> 00:19:47,600
different checkouts so it can take

554
00:19:51,270 --> 00:19:49,440
several hours for them to prepare for

555
00:19:53,510 --> 00:19:51,280
re-entry and then really once we're

556
00:19:55,270 --> 00:19:53,520
ready for them to go they strap into

557
00:19:56,390 --> 00:19:55,280
their seats and then we fly them back

558
00:19:58,070 --> 00:19:56,400
home

559
00:20:00,390 --> 00:19:58,080
and once they're down like heather had

560
00:20:02,630 --> 00:20:00,400
said earlier it affects the astronauts

561
00:20:04,630 --> 00:20:02,640
differently we've had some that they

562
00:20:06,549 --> 00:20:04,640
land they hop out they can walk on their

563
00:20:08,230 --> 00:20:06,559

own they're totally fine others might

564
00:20:11,750 --> 00:20:08,240
need a little assistance

565
00:20:27,909 --> 00:20:11,760
it really varies from the individual

566
00:20:31,590 --> 00:20:29,750
activities did the astronauts do on

567
00:20:33,830 --> 00:20:31,600
earth to prepare them for

568
00:20:37,750 --> 00:20:33,840
um for the rigors of

569
00:20:39,590 --> 00:20:37,760
living zero gravity short-term training

570
00:20:41,190 --> 00:20:39,600
well the astronauts do a lot of training

571
00:20:42,950 --> 00:20:41,200
once they get selected for a mission it

572
00:20:44,310 --> 00:20:42,960
can be several years and part of that

573
00:20:45,830 --> 00:20:44,320
training is to

574
00:20:47,029 --> 00:20:45,840
get them used to the different things

575
00:20:49,270 --> 00:20:47,039
they're going to be doing on the space

576
00:20:52,230 --> 00:20:49,280
station so we have a lot of different

577
00:20:53,830 --> 00:20:52,240
trainers here some of which stay gravity

578
00:20:55,990 --> 00:20:53,840
based you know and they just do their

579
00:20:57,350 --> 00:20:56,000
operations in our mock-ups but we have a

580
00:20:59,430 --> 00:20:57,360
really big swimming pool called the

581
00:21:02,470 --> 00:20:59,440
neutral buoyancy laboratory

582
00:21:04,630 --> 00:21:02,480
and it's big enough to sink several of

583
00:21:06,310 --> 00:21:04,640
our modules for the space station when

584
00:21:07,750 --> 00:21:06,320
we were flying the shuttle we we sunk

585
00:21:09,669 --> 00:21:07,760
the cargo bay of the space shuttle as

586
00:21:11,669 --> 00:21:09,679
well and that's where our astronauts get

587
00:21:13,590 --> 00:21:11,679
the most training for every one hour

588
00:21:15,669 --> 00:21:13,600

that they're on a spacewalk they do

589
00:21:17,510 --> 00:21:15,679
about eight hours underwater now that's

590
00:21:19,430 --> 00:21:17,520
mostly for that's primarily for our

591
00:21:21,909 --> 00:21:19,440
spacewalking astronauts

592
00:21:23,750 --> 00:21:21,919
um with our astronauts that maybe are

593
00:21:25,350 --> 00:21:23,760
early on their selection process or need

594
00:21:27,029 --> 00:21:25,360
to get that feeling of what it's like to

595
00:21:29,029 --> 00:21:27,039
float in microgravity we also have a

596
00:21:31,590 --> 00:21:29,039
very special aircraft

597
00:21:34,470 --> 00:21:31,600
called the vomit comet for reasons that

598
00:21:36,549 --> 00:21:34,480
flies parabolas over the gulf of mexico

599
00:21:38,630 --> 00:21:36,559
and when you're on that downward part of

600
00:21:39,909 --> 00:21:38,640
the parabola everyone's floating inside

601
00:21:41,669 --> 00:21:39,919
because you're not strapped in it's like

602
00:21:43,270 --> 00:21:41,679
a big roller coaster that you fly up and

603
00:21:44,630 --> 00:21:43,280
down multiple times and that's a good

604
00:21:46,310 --> 00:21:44,640
way to get them

605
00:21:49,350 --> 00:21:46,320
kind of a feel for what it's like to be

606
00:21:50,950 --> 00:21:49,360
in microgravity but you're only floating

607
00:21:52,950 --> 00:21:50,960
and free falling on that plane for about

608
00:21:54,789 --> 00:21:52,960
20 to 30 seconds

609
00:21:56,390 --> 00:21:54,799
so other than that

610
00:21:57,830 --> 00:21:56,400
you know it's really hard to tell people

611
00:21:59,750 --> 00:21:57,840
what it's going to be like to float in

612
00:22:01,990 --> 00:21:59,760
space until they get there

613
00:22:04,470 --> 00:22:02,000

and the best simulation we can do is

614
00:22:06,070 --> 00:22:04,480
really to float in water

615
00:22:19,270 --> 00:22:06,080
that's about it though

616
00:22:23,750 --> 00:22:21,909
were they all athletes to begin with if

617
00:22:26,470 --> 00:22:23,760
so what were their favorite sports

618
00:22:28,230 --> 00:22:26,480
activities that kept them in shape

619
00:22:30,789 --> 00:22:28,240
what did some of them have to put

620
00:22:33,909 --> 00:22:30,799
themselves in the shape or in order to

621
00:22:35,669 --> 00:22:33,919
apply to be an astronaut

622
00:22:37,669 --> 00:22:35,679
well you know the health is the health

623
00:22:40,470 --> 00:22:37,679
consideration is a very big part of the

624
00:22:42,950 --> 00:22:40,480
astronaut selection process we do a full

625
00:22:44,149 --> 00:22:42,960
physical we do several psychological

626
00:22:46,070 --> 00:22:44,159
interviews

627
00:22:48,149 --> 00:22:46,080
so the astronauts have to be very

628
00:22:49,990 --> 00:22:48,159
healthy before they even get selected

629
00:22:51,990 --> 00:22:50,000
and then a big part of their training is

630
00:22:53,590 --> 00:22:52,000
to maintain their health we actually

631
00:22:55,510 --> 00:22:53,600
have personal trainers that work with

632
00:22:57,270 --> 00:22:55,520
the astronauts every day

633
00:22:59,510 --> 00:22:57,280
to make sure that they are getting

634
00:23:01,029 --> 00:22:59,520
enough cardiovascular work exercise

635
00:23:03,270 --> 00:23:01,039
they're maintaining their bone and

636
00:23:05,350 --> 00:23:03,280
muscle mass here on earth and even maybe

637
00:23:07,190 --> 00:23:05,360
bulking up a little bit before they go

638
00:23:08,789 --> 00:23:07,200

so that when they lose a little bit of

639
00:23:10,630 --> 00:23:08,799
that bone and muscle even with all the

640
00:23:13,110 --> 00:23:10,640
exercise they're doing they'll still be

641
00:23:15,110 --> 00:23:13,120
strong enough to return home now several

642
00:23:17,029 --> 00:23:15,120
of our astronauts maybe weren't

643
00:23:18,630 --> 00:23:17,039
necessarily athletes like professional

644
00:23:21,669 --> 00:23:18,640
athletes although i do know of one who

645
00:23:23,990 --> 00:23:21,679
was a professional football player

646
00:23:26,950 --> 00:23:24,000
but most definitely our astronauts are

647
00:23:29,430 --> 00:23:26,960
very athletic and a lot of them grew up

648
00:23:31,750 --> 00:23:29,440
on you know football teams basketball

649
00:23:33,350 --> 00:23:31,760
teams volleyball teams growing up

650
00:23:35,029 --> 00:23:33,360
through high school and maybe even in

651
00:23:36,630 --> 00:23:35,039
college so

652
00:23:39,110 --> 00:23:36,640
definitely the astronauts we select

653
00:23:41,270 --> 00:23:39,120
recognize the importance of health and

654
00:23:43,830 --> 00:23:41,280
exercise and a lot of our astronauts

655
00:23:45,669 --> 00:23:43,840
today still do many different athletics

656
00:23:47,270 --> 00:23:45,679
intramurals and they're on clubs and

657
00:23:48,630 --> 00:23:47,280
teams

658
00:23:50,230 --> 00:23:48,640
all right well unfortunately i think

659
00:23:51,830 --> 00:23:50,240
that's all the time that we have today

660
00:23:53,750 --> 00:23:51,840
for questions really want to thank you

661
00:23:55,750 --> 00:23:53,760
guys for you know coming on and asking

662
00:23:57,830 --> 00:23:55,760
us hope we gave you a couple of cool

663
00:24:00,549 --> 00:23:57,840

answers and you enjoyed getting a look

664
00:24:02,549 --> 00:24:00,559
inside of mission control houston here

665
00:24:04,789 --> 00:24:02,559
again it was a real pleasure for us

666
00:24:06,390 --> 00:24:04,799
thanks again

667
00:24:07,909 --> 00:24:06,400
yes thank you so much and i'm excited

668
00:24:10,310 --> 00:24:07,919
that you guys are in durango i've been