
PAO

1
00:00:05,349 --> 00:00:02,950
hi guys welcome to mission control

2
00:00:07,990 --> 00:00:05,359
houston i'm kelly humphries and this is

3
00:00:10,150 --> 00:00:08,000
veteran astronaut mario renko we are

4
00:00:11,589 --> 00:00:10,160
ready for your questions

5
00:00:14,070 --> 00:00:11,599
all right do you want the students to be

6
00:00:15,030 --> 00:00:14,080
hi this is mrs sukumar from bedford high

7
00:00:17,430 --> 00:00:15,040
school

8
00:00:18,870 --> 00:00:17,440
do you want me to um ask the questions

9
00:00:20,870 --> 00:00:18,880
one at a time or do you want the

10
00:00:22,470 --> 00:00:20,880
students to be asking a question

11
00:00:24,390 --> 00:00:22,480
uh we'd love to hear directly from the

12
00:00:26,150 --> 00:00:24,400
students but they do need to speak up so

13
00:00:28,390 --> 00:00:26,160

we can hear the voices and i want to

14
00:00:30,870 --> 00:00:28,400
make sure they know that mario knows new

15
00:00:32,870 --> 00:00:30,880
jersey he went to rutgers university and

16
00:00:34,709 --> 00:00:32,880
uh is originally from new york so he

17
00:00:37,270 --> 00:00:34,719
knows your area

18
00:00:39,590 --> 00:00:37,280
very nice so let's uh start with brandt

19
00:00:41,750 --> 00:00:39,600
wilson he's a great 11 student he's a

20
00:00:52,549 --> 00:00:41,760
junior at our school

21
00:01:00,709 --> 00:00:55,189
how long have you been

22
00:01:06,390 --> 00:01:03,510
how long have i been in space uh i i had

23
00:01:09,510 --> 00:01:06,400
done three missions uh the first one was

24
00:01:12,070 --> 00:01:09,520
1991 on sts-44 that was with the space

25
00:01:16,230 --> 00:01:12,080
shuttle and then i did two more space

26
00:01:19,190 --> 00:01:16,240
shuttle missions uh in 93 and in 96 and

27
00:01:23,749 --> 00:01:19,200
the total time among all missions

28
00:01:24,469 --> 00:01:23,759
uh is was about 21 days total which now

29
00:01:26,550 --> 00:01:24,479
it

30
00:01:30,710 --> 00:01:26,560
days compared to what the guys spend on

31
00:01:34,630 --> 00:01:32,550
okay that's that's a great question and

32
00:01:36,630 --> 00:01:34,640
just a reminder be please get to the

33
00:01:39,030 --> 00:01:36,640
microphone and speak up so we can hear

34
00:01:41,910 --> 00:01:39,040
you it's a little hard

35
00:01:44,710 --> 00:01:41,920
sure um the next question is from brian

36
00:01:46,230 --> 00:01:44,720
mclachlan he's a great um night student

37
00:01:47,429 --> 00:01:46,240
he's a

38
00:01:51,030 --> 00:01:47,439

freshman

39
00:01:55,429 --> 00:01:52,710
all right brian's not here but i'm gonna

40
00:01:58,550 --> 00:01:55,439
ask the question that brian had asked on

41
00:02:00,709 --> 00:01:58,560
his behalf his question is how is space

42
00:02:04,310 --> 00:02:00,719
always expanding and where does it

43
00:02:09,190 --> 00:02:07,109
how and why is space expanding and what

44
00:02:11,350 --> 00:02:09,200
is it expanding into that is a great

45
00:02:14,710 --> 00:02:11,360
question that i don't think we know the

46
00:02:17,589 --> 00:02:14,720
answer to at this point uh space is is

47
00:02:19,670 --> 00:02:17,599
as far as we have sensed with our uh

48
00:02:21,190 --> 00:02:19,680
hubble space telescope and other uh

49
00:02:23,030 --> 00:02:21,200
orbiting observatories like the

50
00:02:25,270 --> 00:02:23,040
gamma-ray observatory

51
00:02:26,309 --> 00:02:25,280
we know that there are objects that we

52
00:02:29,830 --> 00:02:26,319
can see

53
00:02:30,790 --> 00:02:29,840
uh and sense uh out 13 billion light

54
00:02:33,030 --> 00:02:30,800
years

55
00:02:36,470 --> 00:02:33,040
from earth so and that's really the

56
00:02:39,190 --> 00:02:36,480
extent of of the known universe the

57
00:02:41,589 --> 00:02:39,200
objects in within that space that the

58
00:02:43,589 --> 00:02:41,599
known universe are expanding away from

59
00:02:46,869 --> 00:02:43,599
each other into

60
00:02:49,190 --> 00:02:46,879
uh distances farther than uh the 13

61
00:02:52,309 --> 00:02:49,200
billion light years now remember a light

62
00:02:55,270 --> 00:02:52,319
year is about 6 trillion miles so i said

63
00:02:57,589 --> 00:02:55,280

13 billion times 6 trillion so that's

64
00:03:00,869 --> 00:02:57,599
the distance to the farthest known

65
00:03:03,190 --> 00:03:00,879
extent of the universe at least today

66
00:03:06,710 --> 00:03:03,200
and that's a darn good question and

67
00:03:08,949 --> 00:03:06,720
maybe brian will be able to to become

68
00:03:10,869 --> 00:03:08,959
the scientist that figures that out

69
00:03:13,670 --> 00:03:10,879
you know the other part of that is what

70
00:03:15,190 --> 00:03:13,680
exactly is in all of that space and one

71
00:03:16,949 --> 00:03:15,200
of the experiments on the international

72
00:03:20,149 --> 00:03:16,959
space station the alpha magnetic

73
00:03:22,630 --> 00:03:20,159
spectrometer is doing sifting through

74
00:03:23,910 --> 00:03:22,640
the various cosmic rays and particles

75
00:03:26,309 --> 00:03:23,920
that come

76
00:03:29,030 --> 00:03:26,319
to earth to try to identify a little bit

77
00:03:31,589 --> 00:03:29,040
more about things like matter antimatter

78
00:03:35,350 --> 00:03:31,599
and this theoretical dark matter

79
00:03:37,270 --> 00:03:35,360
that we believe exists because we can

80
00:03:39,350 --> 00:03:37,280
indirectly sense it but we don't have

81
00:03:40,869 --> 00:03:39,360
any direct measurements of that

82
00:03:42,630 --> 00:03:40,879
and so it's a really interesting

83
00:03:44,149 --> 00:03:42,640
experiment and having the space station

84
00:03:46,149 --> 00:03:44,159
orbiting the earth

85
00:03:47,830 --> 00:03:46,159
provides us the power to operate that

86
00:03:50,390 --> 00:03:47,840
outside the earth's atmosphere and look

87
00:04:03,190 --> 00:03:50,400
more at what is in between the matter

88
00:04:03,200 --> 00:04:17,030

and we're ready for your next question

89
00:04:31,590 --> 00:04:18,390
and i'm sorry we're not able to hear

90
00:04:35,670 --> 00:04:33,430
i'm sorry you may want to check your

91
00:04:39,430 --> 00:04:35,680
microphone and verify that it's in a

92
00:04:44,070 --> 00:04:42,790
and why you're doing

93
00:04:46,310 --> 00:04:44,080
and while you're doing that let me

94
00:04:48,950 --> 00:04:46,320
comment about what uh kelly had just

95
00:04:49,909 --> 00:04:48,960
said and that is with uh the dark matter

96
00:04:55,590 --> 00:04:49,919
uh

97
00:04:56,950 --> 00:04:55,600
construct a a thing called dark matter

98
00:04:59,189 --> 00:04:56,960
and that's because

99
00:05:01,590 --> 00:04:59,199
uh for example the milky way galaxy our

100
00:05:04,310 --> 00:05:01,600
own galaxy has matter in it and it is

101
00:05:06,230 --> 00:05:04,320
spinning around in a disc like fashion

102
00:05:08,070 --> 00:05:06,240
but the rate of spin

103
00:05:10,710 --> 00:05:08,080
is is such that the centripetal

104
00:05:13,990 --> 00:05:10,720
acceleration outward that would throw

105
00:05:15,909 --> 00:05:14,000
uh the the objects within the galaxy

106
00:05:17,270 --> 00:05:15,919
like the ball at the end of a string

107
00:05:19,830 --> 00:05:17,280
when you let go of the string they would

108
00:05:22,390 --> 00:05:19,840
fly outward and not stay as part of the

109
00:05:24,790 --> 00:05:22,400
galaxy but there's enough gravity within

110
00:05:27,430 --> 00:05:24,800
that uh galaxy to hold everything

111
00:05:29,909 --> 00:05:27,440
together but the the matter and the mass

112
00:05:32,070 --> 00:05:29,919
that we know of in the objects that we

113
00:05:34,230 --> 00:05:32,080

can see is not enough to do that so

114
00:05:35,670 --> 00:05:34,240
they've invented dark matter

115
00:05:37,670 --> 00:05:35,680
to try and

116
00:05:39,430 --> 00:05:37,680
solve the equation so it makes sense so

117
00:05:42,870 --> 00:05:39,440
there's something there we just can't

118
00:05:45,189 --> 00:05:42,880
sense it and we don't know uh what it is

119
00:05:48,070 --> 00:05:45,199
now there is some uh there are things

120
00:05:51,029 --> 00:05:48,080
out there called rogue planets that are

121
00:05:53,350 --> 00:05:51,039
like the earth or jupiter that do not

122
00:05:55,749 --> 00:05:53,360
revolve around the star so they would be

123
00:05:57,430 --> 00:05:55,759
dark planets that we can't see so maybe

124
00:05:59,749 --> 00:05:57,440
there's that's one maybe that's one

125
00:06:02,710 --> 00:05:59,759
possibility that's not so exotic that

126
00:06:04,629 --> 00:06:02,720
that would account for that extra mass

127
00:06:06,150 --> 00:06:04,639
okay i'm hearing that we may have gotten

128
00:06:09,270 --> 00:06:06,160
the audio connection fixed you want to

129
00:06:11,029 --> 00:06:09,280
try another question guys yes we do

130
00:06:13,350 --> 00:06:11,039
that's about we can hear you now

131
00:06:15,510 --> 00:06:13,360
yeah how do you feel in space do you

132
00:06:17,189 --> 00:06:15,520
feel more inspired and at ease or do you

133
00:06:20,309 --> 00:06:17,199
become cynical

134
00:06:23,029 --> 00:06:20,319
uh good question i i actually it's the

135
00:06:26,230 --> 00:06:23,039
it's the former i i feel very inspired

136
00:06:28,390 --> 00:06:26,240
and and uplifted and uh and the reason

137
00:06:30,550 --> 00:06:28,400
for that is when you're in orbit around

138
00:06:32,469 --> 00:06:30,560

the earth you can see most of the earth

139
00:06:34,150 --> 00:06:32,479
and indeed some of the earlier

140
00:06:35,510 --> 00:06:34,160
astronauts who traveled farther away

141
00:06:37,590 --> 00:06:35,520
from the earth like those that went to

142
00:06:40,070 --> 00:06:37,600
the moon could see the entire earth at

143
00:06:43,270 --> 00:06:40,080
one time and it is so spectacularly

144
00:06:44,950 --> 00:06:43,280
beautiful and majestic and and likewise

145
00:06:47,029 --> 00:06:44,960
when you look out into the universe you

146
00:06:50,309 --> 00:06:47,039
see the stars and

147
00:06:52,629 --> 00:06:50,319
and the celestial sky in in much more in

148
00:06:55,350 --> 00:06:52,639
a much more vivid fashion and and and

149
00:06:58,070 --> 00:06:55,360
your being among them uh that in that

150
00:07:00,710 --> 00:06:58,080
setting just is is very exhilarating and

151
00:07:02,710 --> 00:07:00,720
and inspirational and and and actually

152
00:07:05,029 --> 00:07:02,720
we had talked earlier kelly and i about

153
00:07:07,270 --> 00:07:05,039
uh some of the work we were doing uh

154
00:07:10,070 --> 00:07:07,280
here at nasa that that is related to

155
00:07:13,909 --> 00:07:10,080
that in terms of uh taking images of the

156
00:07:19,189 --> 00:07:17,110
all right next question um next question

157
00:07:22,390 --> 00:07:19,199
is from michael holmes uh he's a

158
00:07:25,189 --> 00:07:22,400
freshman and his question is

159
00:07:27,909 --> 00:07:25,199
what do you use to work out in space

160
00:07:30,469 --> 00:07:27,919
oh good question and you really need to

161
00:07:32,629 --> 00:07:30,479
work out in space uh

162
00:07:34,390 --> 00:07:32,639
i'll answer the the question let me just

163
00:07:36,870 --> 00:07:34,400

say firstly that

164
00:07:39,029 --> 00:07:36,880
on earth gravity is working on us all

165
00:07:41,110 --> 00:07:39,039
the time and for example like my heart

166
00:07:43,589 --> 00:07:41,120
is pumping blood right now

167
00:07:45,189 --> 00:07:43,599
up against gravity to my head to keep me

168
00:07:46,070 --> 00:07:45,199
conscious so i don't keel over in the

169
00:07:49,029 --> 00:07:46,080
chair

170
00:07:51,110 --> 00:07:49,039
and when gravity is removed the heart

171
00:07:53,189 --> 00:07:51,120
doesn't have to work so hard yet when i

172
00:07:55,270 --> 00:07:53,199
come return to earth it has to go back

173
00:07:56,950 --> 00:07:55,280
into that environment so we need to stay

174
00:07:59,430 --> 00:07:56,960
conditioned because muscles that you

175
00:08:01,350 --> 00:07:59,440
don't use as everyone knows tend to grow

176
00:08:03,029 --> 00:08:01,360
weaker so we need to maintain at least

177
00:08:06,390 --> 00:08:03,039
the level of strength that we had when

178
00:08:09,670 --> 00:08:06,400
we left the earth and we use

179
00:08:12,629 --> 00:08:09,680
devices such as ergometers and

180
00:08:16,790 --> 00:08:12,639
treadmills and and cycling machines and

181
00:08:19,990 --> 00:08:16,800
bungees uh in a fashion that are all uh

182
00:08:23,029 --> 00:08:20,000
designed using uh springs and and the

183
00:08:25,029 --> 00:08:23,039
like to mimic uh gravity for example if

184
00:08:27,589 --> 00:08:25,039
i'm running on a treadmill uh there are

185
00:08:29,270 --> 00:08:27,599
bungee cords holding me to the treadmill

186
00:08:32,870 --> 00:08:29,280
such that i can actually run on the

187
00:08:34,389 --> 00:08:32,880
treadmill and and and it works and and

188
00:08:36,790 --> 00:08:34,399

then uh

189
00:08:38,709 --> 00:08:36,800
we use uh bungees and stuff and spring

190
00:08:40,709 --> 00:08:38,719
like things to to mimic weight lifting

191
00:08:42,389 --> 00:08:40,719
and the like so we try to do and there

192
00:08:45,829 --> 00:08:42,399
are many devices that have been

193
00:08:47,670 --> 00:08:45,839
developed to to help and facilitate that

194
00:08:49,750 --> 00:08:47,680
exercise protocol

195
00:08:51,430 --> 00:08:49,760
and just to add on to that

196
00:08:53,829 --> 00:08:51,440
there are

197
00:08:55,269 --> 00:08:53,839
bone density loss is another important

198
00:08:57,750 --> 00:08:55,279
thing when you do the long duration

199
00:09:00,310 --> 00:08:57,760
stays in space and so doing this kind of

200
00:09:02,470 --> 00:09:00,320
exercise puts

201
00:09:04,710 --> 00:09:02,480
force onto your bones in the same way

202
00:09:06,870 --> 00:09:04,720
that you would put force on your heels

203
00:09:09,030 --> 00:09:06,880
when you walk and that helps keep the

204
00:09:10,870 --> 00:09:09,040
bones strong which is a really important

205
00:09:12,710 --> 00:09:10,880
thing and research into that is also

206
00:09:15,430 --> 00:09:12,720
helping us solve problems that people

207
00:09:17,430 --> 00:09:15,440
have on earth like osteoporosis

208
00:09:19,670 --> 00:09:17,440
some of your grandparents may have

209
00:09:21,509 --> 00:09:19,680
experienced that and have it's too easy

210
00:09:23,430 --> 00:09:21,519
to break a hip or whatnot because of

211
00:09:25,509 --> 00:09:23,440
that and some of the research in space

212
00:09:28,389 --> 00:09:25,519
is helping us apply what we're learning

213
00:09:30,070 --> 00:09:28,399

there uh two diseases we have here on

214
00:09:31,910 --> 00:09:30,080
earth and so that's another part of

215
00:09:33,670 --> 00:09:31,920
exercise on orbit because these folks

216
00:09:35,110 --> 00:09:33,680
all come stay up there for about six

217
00:09:37,110 --> 00:09:35,120
months and then they've got to re-adapt

218
00:09:39,030 --> 00:09:37,120
to being on gravity when they get home

219
00:09:41,590 --> 00:09:39,040
and in the case of osteoporosis it

220
00:09:43,990 --> 00:09:41,600
happens if we don't exercise we tend to

221
00:09:45,829 --> 00:09:44,000
develop those symptoms in the very short

222
00:09:47,670 --> 00:09:45,839
period of time in a matter of weeks and

223
00:09:49,829 --> 00:09:47,680
months so we can study that

224
00:09:51,350 --> 00:09:49,839
whereas normally on a person on earth it

225
00:09:53,750 --> 00:09:51,360
would take a lifetime before they

226
00:09:55,509 --> 00:09:53,760
develop any symptoms so we have a very

227
00:09:58,310 --> 00:09:55,519
accelerated laboratory in which to

228
00:09:59,910 --> 00:09:58,320
develop drugs and protocols to to maybe

229
00:10:01,990 --> 00:09:59,920
address that and that's what kelly was

230
00:10:03,350 --> 00:10:02,000
talking about and nutrition too because

231
00:10:05,670 --> 00:10:03,360
they're learning that nutrition and

232
00:10:07,509 --> 00:10:05,680
exercise and combination have a really

233
00:10:09,509 --> 00:10:07,519
important effect on how well you're able

234
00:10:14,150 --> 00:10:09,519
to keep fit aboard the space station i'm

235
00:10:14,160 --> 00:10:17,990
next question

236
00:10:22,230 --> 00:10:20,470
um i'm john gilbert i'm a senior i

237
00:10:24,710 --> 00:10:22,240
wanted to know how did your navy career

238
00:10:27,990 --> 00:10:24,720

prepare you to be an astronaut ah good

239
00:10:30,230 --> 00:10:28,000
question uh i my my navy career uh i was

240
00:10:34,550 --> 00:10:30,240
a meteorologist oceanographer and i was

241
00:10:38,550 --> 00:10:35,910
watch officer

242
00:10:40,150 --> 00:10:38,560
in the navy and the scientific part of

243
00:10:41,910 --> 00:10:40,160
my background the meteorology

244
00:10:44,630 --> 00:10:41,920
oceanography

245
00:10:47,430 --> 00:10:44,640
helped with my ability to understand all

246
00:10:49,750 --> 00:10:47,440
of the technical parts of

247
00:10:51,509 --> 00:10:49,760
what is needed to operate in space

248
00:10:52,550 --> 00:10:51,519
orbital mechanics and the like so i have

249
00:10:53,590 --> 00:10:52,560
a very

250
00:10:56,069 --> 00:10:53,600
rigorous

251
00:10:59,110 --> 00:10:56,079
engineering scientific background

252
00:11:01,670 --> 00:10:59,120
the navy portion of it is the crew of a

253
00:11:05,350 --> 00:11:01,680
ship uh much uh like the crew of a

254
00:11:07,910 --> 00:11:05,360
spaceship uh is is based in operations

255
00:11:10,550 --> 00:11:07,920
and and it's very similar when you're

256
00:11:12,949 --> 00:11:10,560
operating on board a ship or a submarine

257
00:11:15,910 --> 00:11:12,959
to when you're operating in a spacecraft

258
00:11:18,230 --> 00:11:15,920
as a crew you learn to operate as a team

259
00:11:20,310 --> 00:11:18,240
you learn your systems on the ship and

260
00:11:22,710 --> 00:11:20,320
and indeed many of them uh

261
00:11:23,990 --> 00:11:22,720
actually they're all the same as say

262
00:11:25,590 --> 00:11:24,000
that uh for example there's

263
00:11:27,990 --> 00:11:25,600

environmental systems on the ship as

264
00:11:29,670 --> 00:11:28,000
there are on the spacecraft so uh some

265
00:11:31,269 --> 00:11:29,680
of the hardware is different and how it

266
00:11:34,550 --> 00:11:31,279
is it functions is different but the

267
00:11:36,470 --> 00:11:34,560
principle and and why it's there uh is

268
00:11:38,470 --> 00:11:36,480
basically the same so it's it's a very

269
00:11:40,790 --> 00:11:38,480
very close one-to-one relationship

270
00:11:43,350 --> 00:11:40,800
between operating in a naval environment

271
00:11:44,710 --> 00:11:43,360
as a space environment and interestingly

272
00:11:46,550 --> 00:11:44,720
enough one of the crew members on the

273
00:11:53,190 --> 00:11:46,560
space station right now also is a navy

274
00:11:57,590 --> 00:11:55,110
next question

275
00:11:58,710 --> 00:11:57,600
i'm sean i'm in uh 9th grade and i my

276
00:12:00,949 --> 00:11:58,720
question is what made you want to be an

277
00:12:03,190 --> 00:12:00,959
astronaut

278
00:12:05,990 --> 00:12:03,200
well i've always had a uh

279
00:12:08,870 --> 00:12:06,000
a desire to to learn new things and and

280
00:12:12,230 --> 00:12:08,880
to understand uh the universe uh what's

281
00:12:15,030 --> 00:12:12,240
out there uh but very specifically when

282
00:12:17,110 --> 00:12:15,040
i was very young at age five years old

283
00:12:19,269 --> 00:12:17,120
the first uh satellite went into orbit

284
00:12:21,430 --> 00:12:19,279
sputnik and then uh shortly thereafter a

285
00:12:23,910 --> 00:12:21,440
few years later uh the first human

286
00:12:26,710 --> 00:12:23,920
beings uh yuri gagarin and alan shepard

287
00:12:29,190 --> 00:12:26,720
went into orbit around earth and

288
00:12:31,190 --> 00:12:29,200

uh i knew then that's exactly what i

289
00:12:33,350 --> 00:12:31,200
wanted to do and i feel very very

290
00:12:35,509 --> 00:12:33,360
fortunate and and privileged to have had

291
00:12:38,230 --> 00:12:35,519
the opportunity to do so and i'm very

292
00:12:42,310 --> 00:12:38,240
lucky to be here sitting uh talking to

293
00:12:46,150 --> 00:12:44,230
go ahead yeah what do you think is your

294
00:12:49,509 --> 00:12:46,160
most significant accomplishment in all

295
00:12:51,509 --> 00:12:49,519
your space missions as an astronaut

296
00:12:54,710 --> 00:12:51,519
my most significant accomplishment the

297
00:12:57,030 --> 00:12:54,720
most memorable one uh was the one on my

298
00:12:58,310 --> 00:12:57,040
second mission was when i uh did uh a

299
00:13:01,670 --> 00:12:58,320
spacewalk

300
00:13:04,069 --> 00:13:01,680
and and honestly i i guess the the

301
00:13:06,949 --> 00:13:04,079
the most significant accomplishment uh

302
00:13:09,110 --> 00:13:06,959
is is in my on my last mission is we had

303
00:13:11,350 --> 00:13:09,120
a number of technology development

304
00:13:14,069 --> 00:13:11,360
experiments on board that spacecraft

305
00:13:16,949 --> 00:13:14,079
both on the uh on the shuttle and others

306
00:13:19,829 --> 00:13:16,959
that we put overboard and we tested uh

307
00:13:20,790 --> 00:13:19,839
in in orbit alongside the space shuttle

308
00:13:24,150 --> 00:13:20,800
and

309
00:13:25,990 --> 00:13:24,160
in that sense is is is those technology

310
00:13:28,150 --> 00:13:26,000
development experiments were pushing the

311
00:13:30,629 --> 00:13:28,160
boundaries of what our capabilities are

312
00:13:33,110 --> 00:13:30,639
to explore space so i guess that

313
00:13:35,990 --> 00:13:33,120

in my mind would be something that that

314
00:13:38,870 --> 00:13:36,000
if we can move to a a an area where we

315
00:13:41,670 --> 00:13:38,880
can uh explore it more efficiently and

316
00:13:43,990 --> 00:13:41,680
and go farther out into space is is

317
00:13:46,150 --> 00:13:44,000
something that i hope uh

318
00:13:47,990 --> 00:13:46,160
continues and i think some of those were

319
00:13:50,310 --> 00:13:48,000
directly applicable to the space station

320
00:13:54,069 --> 00:13:50,320
development weren't they uh actually uh

321
00:13:55,750 --> 00:13:54,079
yes we had uh uh attitude control uh

322
00:13:59,110 --> 00:13:55,760
satellite is called the satellite test

323
00:14:02,230 --> 00:13:59,120
unit it was a device uh that we tried to

324
00:14:03,829 --> 00:14:02,240
use the forces in earth orbit to control

325
00:14:06,150 --> 00:14:03,839
the attitude of this uh of the

326
00:14:07,509 --> 00:14:06,160
spacecraft and and in a sense they do

327
00:14:10,150 --> 00:14:07,519
that a little bit with the with the

328
00:14:11,030 --> 00:14:10,160
space station uh we've got gyros that

329
00:14:13,189 --> 00:14:11,040
move

330
00:14:15,430 --> 00:14:13,199
uh through angular momentum that can

331
00:14:17,030 --> 00:14:15,440
torque the space station around uh we

332
00:14:19,269 --> 00:14:17,040
also have thrusters but we don't use

333
00:14:21,350 --> 00:14:19,279
those that often and we try to keep the

334
00:14:24,310 --> 00:14:21,360
space station in an equilibrium point

335
00:14:25,829 --> 00:14:24,320
where we don't have to use the gyros

336
00:14:28,230 --> 00:14:25,839
even but uh

337
00:14:30,470 --> 00:14:28,240
all three together hold the spacecraft

338
00:14:31,829 --> 00:14:30,480

where it needs to be

339
00:14:33,910 --> 00:14:31,839
great

340
00:14:34,949 --> 00:14:33,920
another question

341
00:14:37,189 --> 00:14:34,959
um

342
00:14:40,230 --> 00:14:37,199
how does your body shift the gravity to

343
00:14:42,389 --> 00:14:40,240
no gravity and how do you feel

344
00:14:45,030 --> 00:14:42,399
well uh the body does a number of

345
00:14:47,189 --> 00:14:45,040
reactions when you get into a

346
00:14:49,990 --> 00:14:47,199
space and you're in orbit and and the

347
00:14:52,629 --> 00:14:50,000
gravity vector is removed primarily and

348
00:14:55,110 --> 00:14:52,639
and and we had already discussed uh some

349
00:14:58,790 --> 00:14:55,120
of that with the the bone density loss

350
00:15:01,110 --> 00:14:58,800
the muscle uh toning loss but uh the

351
00:15:04,550 --> 00:15:01,120
most immediate reaction that one feels

352
00:15:06,629 --> 00:15:04,560
is a fluid shift and and again i'm

353
00:15:08,710 --> 00:15:06,639
sitting here or if i'm standing up uh

354
00:15:12,949 --> 00:15:08,720
gravity is working to hold my bodily

355
00:15:14,949 --> 00:15:12,959
fluids the bloods and and in in my legs

356
00:15:17,590 --> 00:15:14,959
and and arms if i have my arms at my

357
00:15:19,269 --> 00:15:17,600
side uh when you remove the gravity that

358
00:15:21,269 --> 00:15:19,279
there tends to be a fluid shift out of

359
00:15:23,189 --> 00:15:21,279
the legs into the chest cavity and the

360
00:15:24,470 --> 00:15:23,199
head and if you look very carefully at

361
00:15:27,110 --> 00:15:24,480
some of the pictures of the astronauts

362
00:15:28,710 --> 00:15:27,120
in space they do look a little puffy a

363
00:15:29,910 --> 00:15:28,720

little more full than they do on the

364
00:15:31,590 --> 00:15:29,920
ground

365
00:15:33,509 --> 00:15:31,600
and that is because of that fluid shift

366
00:15:36,150 --> 00:15:33,519
now the a consequence of that fluid

367
00:15:38,069 --> 00:15:36,160
shift is what we call space adaptation

368
00:15:41,829 --> 00:15:38,079
syndrome uh

369
00:15:43,990 --> 00:15:41,839
it's not the same as but it's not very

370
00:15:46,150 --> 00:15:44,000
much different as it's hard to describe

371
00:15:47,829 --> 00:15:46,160
as as when you if if you go aboard a

372
00:15:49,030 --> 00:15:47,839
ship and you have a tendency to be

373
00:15:52,150 --> 00:15:49,040
seasick

374
00:15:54,550 --> 00:15:52,160
it is it is a similar reaction uh but

375
00:15:56,470 --> 00:15:54,560
but not exactly and and you tend not to

376
00:15:58,710 --> 00:15:56,480
feel very comfortable you got this uh

377
00:16:01,829 --> 00:15:58,720
maybe a headache uh you might have some

378
00:16:04,629 --> 00:16:01,839
nausea it depends on the individual uh

379
00:16:07,030 --> 00:16:04,639
and what what's the good news is is that

380
00:16:08,949 --> 00:16:07,040
goes away after a few days the body

381
00:16:09,910 --> 00:16:08,959
adapts you tend to uh

382
00:16:12,389 --> 00:16:09,920
you know

383
00:16:15,110 --> 00:16:12,399
not notice it anymore an analogy i would

384
00:16:16,629 --> 00:16:15,120
draw is if you ever had a tooth filled

385
00:16:18,069 --> 00:16:16,639
you know with cavity and you had a

386
00:16:19,189 --> 00:16:18,079
filling done or you had work done on

387
00:16:21,189 --> 00:16:19,199
your teeth

388
00:16:22,710 --> 00:16:21,199

you know the first day or two that

389
00:16:24,470 --> 00:16:22,720
you've had that filling you tend to

390
00:16:25,829 --> 00:16:24,480
notice it but then after a few days or

391
00:16:27,509 --> 00:16:25,839
three days

392
00:16:29,110 --> 00:16:27,519
you don't notice it anymore

393
00:16:30,310 --> 00:16:29,120
you get used to that feeling and it's

394
00:16:32,069 --> 00:16:30,320
it's sort of the same with space

395
00:16:35,430 --> 00:16:32,079
attitude

396
00:16:35,440 --> 00:16:38,870
okay another question

397
00:16:41,990 --> 00:16:40,150
um

398
00:16:44,069 --> 00:16:42,000
my name is brian brooks i'm in ninth

399
00:16:48,069 --> 00:16:44,079
grade i'm a freshman and i wanted to

400
00:16:50,389 --> 00:16:48,079
know what does open space smell like

401
00:16:52,629 --> 00:16:50,399
did i get that right

402
00:16:55,749 --> 00:16:52,639
smell what does space smell like that's

403
00:16:58,150 --> 00:16:55,759
a darn good question actually uh the the

404
00:17:00,550 --> 00:16:58,160
direct answer is

405
00:17:03,189 --> 00:17:00,560
nobody knows because space would not

406
00:17:05,990 --> 00:17:03,199
have smell if you're outside because

407
00:17:08,150 --> 00:17:06,000
it's a it's basically a vacuum and

408
00:17:10,390 --> 00:17:08,160
there's no way to sense odors because we

409
00:17:13,189 --> 00:17:10,400
need atmosphere and air for to pass over

410
00:17:16,069 --> 00:17:13,199
our nostrils to have a sense of smell

411
00:17:19,110 --> 00:17:16,079
having said that there is a sense of of

412
00:17:20,069 --> 00:17:19,120
of odor in space and and that tends to

413
00:17:23,029 --> 00:17:20,079

be

414
00:17:24,710 --> 00:17:23,039
like uh new car smell if you get into a

415
00:17:27,350 --> 00:17:24,720
new car everybody most people like the

416
00:17:30,070 --> 00:17:27,360
smell uh you take it in and that is from

417
00:17:32,950 --> 00:17:30,080
the outgassing of the materials

418
00:17:34,710 --> 00:17:32,960
of which the car is made and depending

419
00:17:36,150 --> 00:17:34,720
upon the spacecraft in the case of the

420
00:17:37,830 --> 00:17:36,160
space shuttle

421
00:17:39,029 --> 00:17:37,840
i was not aware of that you know you

422
00:17:41,270 --> 00:17:39,039
kind of get used to it because you

423
00:17:42,950 --> 00:17:41,280
operate in in a similar environment in

424
00:17:45,750 --> 00:17:42,960
simulators you actually train in the

425
00:17:47,590 --> 00:17:45,760
space shuttle uh at times before launch

426
00:17:50,150 --> 00:17:47,600
so you're in the real vehicle

427
00:17:51,669 --> 00:17:50,160
and uh you're also in the in inside your

428
00:17:54,630 --> 00:17:51,679
suits at times and

429
00:17:57,270 --> 00:17:54,640
and what i noticed one time after being

430
00:18:00,950 --> 00:17:57,280
removed from the space shuttle after

431
00:18:04,150 --> 00:18:00,960
several years i got back inside of one

432
00:18:07,350 --> 00:18:04,160
and what what struck me was the odor the

433
00:18:10,070 --> 00:18:07,360
the the smell of the the the space

434
00:18:12,630 --> 00:18:10,080
shuttle itself is that the that combined

435
00:18:14,950 --> 00:18:12,640
uh collective of outgassing from the

436
00:18:16,710 --> 00:18:14,960
materials in the space shuttle in at

437
00:18:17,590 --> 00:18:16,720
least in the case of the space shuttle

438
00:18:18,630 --> 00:18:17,600

and

439
00:18:29,990 --> 00:18:18,640
it

440
00:18:33,110 --> 00:18:30,000
actually give us a sense of

441
00:18:35,430 --> 00:18:33,120
of orientation uh for from a sense of

442
00:18:37,190 --> 00:18:35,440
smell perspective now you're a veteran

443
00:18:39,029 --> 00:18:37,200
spacewalker i understand there is a

444
00:18:41,270 --> 00:18:39,039
special smell that comes with coming

445
00:18:43,830 --> 00:18:41,280
back in the airlock after a spacewalk

446
00:18:45,590 --> 00:18:43,840
for some folks yes it it when you come

447
00:18:47,909 --> 00:18:45,600
back in and pop your helmet off again

448
00:18:50,710 --> 00:18:47,919
it's that it's that that

449
00:18:53,830 --> 00:18:50,720
odor of the spacecraft that that that

450
00:18:56,390 --> 00:18:53,840
hits you that that uh it it's it's like

451
00:18:59,750 --> 00:18:56,400
a sense of home i mean if you walk into

452
00:19:01,830 --> 00:18:59,760
various uh retail stores or somebody's

453
00:19:04,070 --> 00:19:01,840
home there's a slightly different

454
00:19:05,830 --> 00:19:04,080
characteristic odor and that and and

455
00:19:07,350 --> 00:19:05,840
that's you know if it's your home and

456
00:19:09,510 --> 00:19:07,360
that's this and if it's something wrong

457
00:19:11,830 --> 00:19:09,520
or different then you'll notice it

458
00:19:13,669 --> 00:19:11,840
okay well i understand that's all the

459
00:19:16,310 --> 00:19:13,679
time we have for today we want to thank

460
00:19:18,150 --> 00:19:16,320
you folks for being with us today uh and

461
00:19:19,669 --> 00:19:18,160
thank you mario for joining us and

462
00:19:20,950 --> 00:19:19,679
answering the students questions we hope