
PAO

1
00:00:04,470 --> 00:00:02,710
all right so so with that it's a good

2
00:00:07,269 --> 00:00:04,480
way to end our conversation because it

3
00:00:10,070 --> 00:00:07,279
is now time to introduce you to

4
00:00:13,030 --> 00:00:10,080
um our public affairs officer brandy

5
00:00:14,709 --> 00:00:13,040
dean and our special guest dan gazda who

6
00:00:17,430 --> 00:00:14,719
is a chemist here at the johnson space

7
00:00:19,269 --> 00:00:17,440
center so mission control i introduced

8
00:00:20,150 --> 00:00:19,279
you to st peter's preparatory high

9
00:00:22,150 --> 00:00:20,160
school

10
00:00:24,150 --> 00:00:22,160
hi thanks so much and welcome to the

11
00:00:25,990 --> 00:00:24,160
mission control here in houston we're in

12
00:00:27,189 --> 00:00:26,000
the international space station flight

13
00:00:29,189 --> 00:00:27,199

control room

14
00:00:31,509 --> 00:00:29,199
and like you said i have with me dan

15
00:00:33,670 --> 00:00:31,519
gasta who is an environmental scientist

16
00:00:36,069 --> 00:00:33,680
and chemist so hopefully i know y'all

17
00:00:37,990 --> 00:00:36,079
send in a few uh questions ahead of time

18
00:00:39,190 --> 00:00:38,000
a lot uh you're studying chemistry and

19
00:00:41,030 --> 00:00:39,200
hopefully he'll be able to help you with

20
00:00:42,549 --> 00:00:41,040
that but first i'm going to let him tell

21
00:00:44,389 --> 00:00:42,559
you a little bit about who he is and

22
00:00:46,229 --> 00:00:44,399
what he does

23
00:00:48,549 --> 00:00:46,239
yes as you mentioned my name is dan

24
00:00:51,270 --> 00:00:48,559
gazda i work in the human health and

25
00:00:53,590 --> 00:00:51,280
performance directorate here at jsc

26
00:00:55,670 --> 00:00:53,600
i'm an environmental scientist in the

27
00:00:57,430 --> 00:00:55,680
water and food analytical lab and our

28
00:00:58,950 --> 00:00:57,440
primary responsibilities are supporting

29
00:01:00,310 --> 00:00:58,960
the environmental health systems and the

30
00:01:02,069 --> 00:01:00,320
environmental control and life support

31
00:01:03,910 --> 00:01:02,079
systems on iss

32
00:01:05,830 --> 00:01:03,920
all right well thanks so much for

33
00:01:07,590 --> 00:01:05,840
joining us dan we really appreciate it

34
00:01:25,590 --> 00:01:07,600
and i guess if y'all want to start with

35
00:01:31,830 --> 00:01:28,710
oh um the lady that spoke to us uh prior

36
00:01:33,670 --> 00:01:31,840
to you guys um she said that um on space

37
00:01:36,149 --> 00:01:33,680
some medals are made that

38
00:01:38,950 --> 00:01:36,159

wouldn't be able to be made on earth

39
00:01:40,710 --> 00:01:38,960
what happens if you bring those medals

40
00:01:42,149 --> 00:01:40,720
that can only be made

41
00:01:45,030 --> 00:01:42,159
in space

42
00:01:47,190 --> 00:01:45,040
to earth like would they you know

43
00:01:49,270 --> 00:01:47,200
come apart or something like that

44
00:01:53,109 --> 00:01:49,280
or what what would happen or would they

45
00:01:57,510 --> 00:01:55,990
generally speaking once uh

46
00:01:58,709 --> 00:01:57,520
you when you're in the microgravity

47
00:02:00,149 --> 00:01:58,719
environment you're able to do things

48
00:02:01,990 --> 00:02:00,159
that you can't do

49
00:02:03,990 --> 00:02:02,000
in a terrestrial laboratory here on

50
00:02:06,870 --> 00:02:04,000
earth and so

51
00:02:09,270 --> 00:02:06,880
with metals you can alloy metals and mix

52
00:02:10,949 --> 00:02:09,280
them in unique ratios to achieve desired

53
00:02:12,869 --> 00:02:10,959
properties

54
00:02:14,869 --> 00:02:12,879
so you can mix these things in space and

55
00:02:17,030 --> 00:02:14,879
and allow them to form

56
00:02:18,869 --> 00:02:17,040
with uh the specific ratios and the

57
00:02:20,470 --> 00:02:18,879
alloy but once they're formed they

58
00:02:30,150 --> 00:02:20,480
should be locked into place so they can

59
00:02:34,470 --> 00:02:32,710
um i was just wondering uh like how

60
00:02:37,190 --> 00:02:34,480
close are we to

61
00:02:39,270 --> 00:02:37,200
like sustaining a community in space

62
00:02:41,509 --> 00:02:39,280
like in the movie like wally like where

63
00:02:45,750 --> 00:02:41,519

they had a big ship and they can go like

64
00:02:45,760 --> 00:02:49,430
how close

65
00:02:55,030 --> 00:02:53,110
closer uh than we were several years ago

66
00:02:56,790 --> 00:02:55,040
uh one of the exciting things the some

67
00:02:59,830 --> 00:02:56,800
of the exciting progress that we've made

68
00:03:01,830 --> 00:02:59,840
in the past couple of years is really

69
00:03:03,190 --> 00:03:01,840
moving towards a closed-loop life

70
00:03:04,470 --> 00:03:03,200
support system on the space station

71
00:03:06,550 --> 00:03:04,480
where we're now

72
00:03:07,750 --> 00:03:06,560
recovering water from urine

73
00:03:09,830 --> 00:03:07,760
and

74
00:03:12,470 --> 00:03:09,840
scrubbing the atmosphere

75
00:03:14,710 --> 00:03:12,480
recovering some water through a sabati a

76
00:03:16,470 --> 00:03:14,720
process and what this does this

77
00:03:18,470 --> 00:03:16,480
dramatically reduces our reliance on

78
00:03:21,830 --> 00:03:18,480
ground supplied resources

79
00:03:25,190 --> 00:03:21,840
and does move us closer to

80
00:03:27,430 --> 00:03:25,200
having the ability to sustain

81
00:03:29,190 --> 00:03:27,440
a population of folks out in space on a

82
00:03:31,110 --> 00:03:29,200
long duration mission

83
00:03:32,630 --> 00:03:31,120
without having to constantly resupply

84
00:03:34,710 --> 00:03:32,640
things from the ground

85
00:03:36,149 --> 00:03:34,720
and i think i don't know necessarily

86
00:03:38,229 --> 00:03:36,159
about wally but although it's a great

87
00:03:39,910 --> 00:03:38,239
movie we do get a lot of inspiration

88
00:03:42,470 --> 00:03:39,920

from science fiction and occasionally

89
00:03:45,430 --> 00:03:42,480
movies right there are a lot of folks

90
00:03:47,430 --> 00:03:45,440
working at nasa who definitely

91
00:03:49,750 --> 00:03:47,440
watched a lot of science fiction

92
00:03:51,509 --> 00:03:49,760
definitely and there are certain aspects

93
00:03:54,229 --> 00:03:51,519
of science fiction that

94
00:04:00,309 --> 00:03:54,239
are more realistic than others

95
00:04:04,949 --> 00:04:02,869
um what materials were used in the

96
00:04:05,750 --> 00:04:04,959
astronaut suits to ensure their safety

97
00:04:07,589 --> 00:04:05,760
like

98
00:04:09,270 --> 00:04:07,599
i'm guessing they have some pretty high

99
00:04:10,390 --> 00:04:09,280
end insulation because our hair space is

100
00:04:13,589 --> 00:04:10,400
pretty cold

101
00:04:15,750 --> 00:04:13,599
and like also what material is used to

102
00:04:19,110 --> 00:04:15,760
block radiation because that could be

103
00:04:22,629 --> 00:04:21,189
yes i'm not

104
00:04:25,350 --> 00:04:22,639
i'm not familiar with the exact

105
00:04:28,469 --> 00:04:25,360
materials that go into

106
00:04:30,629 --> 00:04:28,479
the outer shell of the extra vehicular

107
00:04:32,070 --> 00:04:30,639
mobility units the emu's those are the

108
00:04:35,030 --> 00:04:32,080
suits that the the astronauts wear

109
00:04:37,189 --> 00:04:35,040
during during spacewalks or evas the

110
00:04:38,230 --> 00:04:37,199
extra vehicular activities

111
00:04:40,790 --> 00:04:38,240
they are

112
00:04:42,550 --> 00:04:40,800
multi-layer materials so what you have

113
00:04:44,870 --> 00:04:42,560

is a unique combination of many

114
00:04:47,189 --> 00:04:44,880
materials stacked on top of each other

115
00:04:50,710 --> 00:04:47,199
to provide the desired characteristics

116
00:04:51,909 --> 00:04:50,720
and ensure crew safety during spacewalks

117
00:04:55,189 --> 00:04:51,919
they do

118
00:04:57,510 --> 00:04:55,199
have certain materials in the suit that

119
00:04:59,110 --> 00:04:57,520
reduce the radiation exposure but when

120
00:05:00,550 --> 00:04:59,120
you're in space the radiation exposure

121
00:05:01,510 --> 00:05:00,560
is going to be higher than it is on the

122
00:05:03,510 --> 00:05:01,520
ground

123
00:05:05,430 --> 00:05:03,520
and i think they also have uh at least

124
00:05:07,670 --> 00:05:05,440
in their their gloves heaters that help

125
00:05:09,029 --> 00:05:07,680
them keep formulas about insulation um

126
00:05:10,550 --> 00:05:09,039
it definitely does get very cold in

127
00:05:12,070 --> 00:05:10,560
space and you especially want your hands

128
00:05:14,310 --> 00:05:12,080
to be warm because you work a lot with

129
00:05:15,830 --> 00:05:14,320
your hands so to help them keep from

130
00:05:17,189 --> 00:05:15,840
getting stiff fingers they they have

131
00:05:18,629 --> 00:05:17,199
heaters inside their gloves yeah they

132
00:05:20,790 --> 00:05:18,639
actually have some some very unique

133
00:05:22,790 --> 00:05:20,800
undergarments for the spacesuits called

134
00:05:23,590 --> 00:05:22,800
liquid cooling and ventilation garments

135
00:05:25,189 --> 00:05:23,600
that

136
00:05:27,110 --> 00:05:25,199
look a lot like thermal underwear but

137
00:05:29,189 --> 00:05:27,120
they have very small diameter tubing

138
00:05:31,110 --> 00:05:29,199

that liquid circulates through and

139
00:05:32,469 --> 00:05:31,120
passes through a heat exchanger that

140
00:05:34,070 --> 00:05:32,479
helps regulate the temperature inside

141
00:05:35,909 --> 00:05:34,080
the suits because you also get hot in

142
00:05:38,310 --> 00:05:35,919
space when the sun is on you so you have

143
00:05:39,510 --> 00:05:38,320
to be ready for both really really cold

144
00:05:50,070 --> 00:05:39,520
temperatures and really really hot

145
00:05:55,270 --> 00:05:52,870
hi i'm just curious uh with

146
00:05:57,830 --> 00:05:55,280
for instance the space station

147
00:05:59,909 --> 00:05:57,840
uh using propulsion systems in space

148
00:06:05,590 --> 00:05:59,919
since there's not a lot to push off of

149
00:06:11,189 --> 00:06:07,510
uh that one is probably going to be

150
00:06:14,790 --> 00:06:11,199
pretty far outside my area of expertise

151
00:06:16,950 --> 00:06:14,800
uh in general you do have

152
00:06:18,550 --> 00:06:16,960
you have an inertial mass from the

153
00:06:21,510 --> 00:06:18,560
vehicle itself

154
00:06:23,830 --> 00:06:21,520
that you push against

155
00:06:26,469 --> 00:06:23,840
so there there is a mass to overcome

156
00:06:29,670 --> 00:06:26,479
there but uh

157
00:06:31,590 --> 00:06:29,680
how the systems exactly work is is

158
00:06:33,590 --> 00:06:31,600
outside of my area of expertise and i

159
00:06:36,870 --> 00:06:33,600
think we can say though that it takes a

160
00:06:38,230 --> 00:06:36,880
lot less force to move you in space just

161
00:06:39,670 --> 00:06:38,240
uh you you can see it on the

162
00:06:42,390 --> 00:06:39,680
international space station if you watch

163
00:06:44,629 --> 00:06:42,400

nasa tv um the astronauts can push off

164
00:06:46,710 --> 00:06:44,639
with just you know a finger and keep

165
00:06:48,469 --> 00:06:46,720
going for a long time so it takes a lot

166
00:06:50,790 --> 00:06:48,479
less energy to move

167
00:06:52,230 --> 00:06:50,800
at all and so that that at least helps

168
00:06:53,430 --> 00:06:52,240
us getting around in space once we've

169
00:06:54,870 --> 00:06:53,440
gotten out of the earth's atmosphere

170
00:06:55,830 --> 00:06:54,880
which certainly does take a lot of

171
00:06:57,749 --> 00:06:55,840
thrust

172
00:06:59,749 --> 00:06:57,759
yeah once you don't have to overcome the

173
00:07:02,309 --> 00:06:59,759
gravitational vector you can expend a

174
00:07:03,510 --> 00:07:02,319
lot less energy moving and translating

175
00:07:05,350 --> 00:07:03,520
hopefully that helps answer your

176
00:07:09,430 --> 00:07:05,360
question

177
00:07:13,270 --> 00:07:11,270
i just gotta ask because i know that

178
00:07:15,430 --> 00:07:13,280
they wear suits and but with the systems

179
00:07:16,390 --> 00:07:15,440
itself on the station how do you defend

180
00:07:19,110 --> 00:07:16,400
against

181
00:07:21,510 --> 00:07:19,120
solar flares that could also hurt the

182
00:07:24,710 --> 00:07:21,520
magnetics within the systems or the

183
00:07:28,950 --> 00:07:25,589
the

184
00:07:31,510 --> 00:07:28,960
space station are

185
00:07:33,909 --> 00:07:31,520
tested extensively and there are

186
00:07:36,070 --> 00:07:33,919
specific precautions that are taken uh

187
00:07:39,430 --> 00:07:36,080
to protect against ionizing radiation

188
00:07:41,749 --> 00:07:39,440

events uh with the the crew themselves

189
00:07:42,710 --> 00:07:41,759
there are certain instances where

190
00:07:44,469 --> 00:07:42,720
um

191
00:07:46,629 --> 00:07:44,479
you know they they locate in certain

192
00:07:48,790 --> 00:07:46,639
areas of the station uh occasionally

193
00:07:50,230 --> 00:07:48,800
they they locate in the water the water

194
00:07:52,309 --> 00:07:50,240
storage area because water ends up being

195
00:07:53,830 --> 00:07:52,319
a great shield for radiation

196
00:07:55,830 --> 00:07:53,840
uh so we have large bags of water that

197
00:07:57,510 --> 00:07:55,840
we use to to maintain a contingency

198
00:07:59,350 --> 00:07:57,520
reserve and sometimes the crew will will

199
00:08:01,510 --> 00:07:59,360
sleep in the proximity of those

200
00:08:02,950 --> 00:08:01,520
and we basically have space weathermen

201
00:08:04,390 --> 00:08:02,960
who let us know when there's going to be

202
00:08:05,909 --> 00:08:04,400
a lot of activity that we want to

203
00:08:08,309 --> 00:08:05,919
protect the astronauts from so that

204
00:08:09,990 --> 00:08:08,319
helps us know when we need to maybe get

205
00:08:11,589 --> 00:08:10,000
them into an area like

206
00:08:20,469 --> 00:08:11,599
dan said that has a little bit more

207
00:08:25,670 --> 00:08:22,230
um

208
00:08:27,350 --> 00:08:25,680
as an event an environmental scientist

209
00:08:29,990 --> 00:08:27,360
what is what is one of the most

210
00:08:33,269 --> 00:08:30,000
interesting side effects of being in

211
00:08:36,790 --> 00:08:35,190
i would say that probably the most

212
00:08:38,469 --> 00:08:36,800
interesting

213
00:08:40,070 --> 00:08:38,479

aspect of

214
00:08:41,670 --> 00:08:40,080
maintaining environmental control

215
00:08:43,909 --> 00:08:41,680
systems in space

216
00:08:46,870 --> 00:08:43,919
is the lack of phase separation that you

217
00:08:48,070 --> 00:08:46,880
have when you're outside of the

218
00:08:49,110 --> 00:08:48,080
or when you're in a microgravity

219
00:08:51,590 --> 00:08:49,120
environment

220
00:08:53,829 --> 00:08:51,600
so for a water system for example which

221
00:08:55,350 --> 00:08:53,839
is one of the things that i'm the most

222
00:08:56,630 --> 00:08:55,360
familiar with

223
00:08:58,949 --> 00:08:56,640
on the ground you don't get too

224
00:09:00,949 --> 00:08:58,959
concerned about air bubbles being

225
00:09:02,870 --> 00:09:00,959
entrapped in the water supply because

226
00:09:04,389 --> 00:09:02,880
they always rise to the surface well the

227
00:09:06,550 --> 00:09:04,399
reason the bubbles rise to the surface

228
00:09:08,550 --> 00:09:06,560
is because the gas is less dense than

229
00:09:10,470 --> 00:09:08,560
the liquid and in a gravitational field

230
00:09:11,829 --> 00:09:10,480
it moves to the top

231
00:09:13,590 --> 00:09:11,839
in the absence of that gravitational

232
00:09:15,910 --> 00:09:13,600
field all the air bubbles stay entrained

233
00:09:18,070 --> 00:09:15,920
in the body of the liquid and that can

234
00:09:30,790 --> 00:09:18,080
pose a lot of problems for fluid

235
00:09:35,509 --> 00:09:33,430
um i was watching something and i read

236
00:09:38,150 --> 00:09:35,519
an article that there is uh

237
00:09:40,070 --> 00:09:38,160
over the last 60 or 50 years or so there

238
00:09:42,550 --> 00:09:40,080

have been a lot of satellites

239
00:09:43,910 --> 00:09:42,560
uh put up in that are just floating down

240
00:09:45,910 --> 00:09:43,920
earth orbit i think the number was like

241
00:09:47,829 --> 00:09:45,920
there's about 50 000

242
00:09:49,990 --> 00:09:47,839
of them and only about 1 000 are

243
00:09:52,389 --> 00:09:50,000
actually functioning so they deem those

244
00:09:54,150 --> 00:09:52,399
you know dead satellites space junk is

245
00:09:56,070 --> 00:09:54,160
there any like efforts being used to

246
00:09:57,430 --> 00:09:56,080
clean that up because they do pose a

247
00:10:00,870 --> 00:09:57,440
problem especially for the international

248
00:10:04,230 --> 00:10:02,790
again i'm not aware of efforts i know

249
00:10:06,630 --> 00:10:04,240
it's definitely something that is

250
00:10:08,069 --> 00:10:06,640
tracked very closely uh because folks

251
00:10:10,550 --> 00:10:08,079
always want to know if any of the the

252
00:10:13,430 --> 00:10:10,560
orbital debris is going to pose a risk

253
00:10:14,710 --> 00:10:13,440
to the station right and we have a team

254
00:10:16,710 --> 00:10:14,720
here on the ground that lets us know if

255
00:10:17,829 --> 00:10:16,720
there's any uh debris which is what we

256
00:10:18,949 --> 00:10:17,839
call it um

257
00:10:20,550 --> 00:10:18,959
it's going to get anywhere near the

258
00:10:22,389 --> 00:10:20,560
space station and if we need to we move

259
00:10:24,550 --> 00:10:22,399
the space station around to avoid it um

260
00:10:26,389 --> 00:10:24,560
but as far as cleaning up i know we're

261
00:10:27,430 --> 00:10:26,399
looking into different ideas and and

262
00:10:29,110 --> 00:10:27,440
hopefully are going to come up with an

263
00:10:30,550 --> 00:10:29,120

effort just because like you said

264
00:10:32,150 --> 00:10:30,560
there's there's it's getting to the

265
00:10:34,069 --> 00:10:32,160
point where there's so much of it in

266
00:10:36,870 --> 00:10:34,079
space but a lot of it takes care of

267
00:10:38,949 --> 00:10:36,880
itself it all eventually continues to

268
00:10:40,389 --> 00:10:38,959
lower in orbit and then usually burns up

269
00:10:41,990 --> 00:10:40,399
in the earth's atmosphere before it

270
00:10:44,069 --> 00:10:42,000
falls down so

271
00:10:45,829 --> 00:10:44,079
given enough time it'll it'll take care

272
00:10:47,990 --> 00:10:45,839
of itself but there's so much of it like

273
00:10:50,310 --> 00:10:48,000
you said that we do want to try and find

274
00:10:57,110 --> 00:10:50,320
some other way to help out with the

275
00:11:02,870 --> 00:10:58,710
what new chemical discoveries have been

276
00:11:08,389 --> 00:11:05,509
new chemical discoveries um

277
00:11:11,430 --> 00:11:08,399
there there's a lot of interesting

278
00:11:14,310 --> 00:11:11,440
phenomenon that have been observed

279
00:11:16,550 --> 00:11:14,320
in space a lot of them relating to the

280
00:11:18,389 --> 00:11:16,560
the behavior of materials outside of uh

281
00:11:19,750 --> 00:11:18,399
or in the absence of gravity there's

282
00:11:21,430 --> 00:11:19,760
been a lot of studies done on protein

283
00:11:22,949 --> 00:11:21,440
crystallization that they've seen some

284
00:11:23,990 --> 00:11:22,959
very novel

285
00:11:25,910 --> 00:11:24,000
uh

286
00:11:28,550 --> 00:11:25,920
crystallographic patterns that form in

287
00:11:30,230 --> 00:11:28,560
the absence of gravity

288
00:11:31,590 --> 00:11:30,240

and there's uh probably some of the

289
00:11:33,350 --> 00:11:31,600
other things that that have come about

290
00:11:35,030 --> 00:11:33,360
would really be material compatibility

291
00:11:37,590 --> 00:11:35,040
issues and

292
00:11:38,550 --> 00:11:37,600
exposure issues that things designed for

293
00:11:40,870 --> 00:11:38,560
space to

294
00:11:43,509 --> 00:11:40,880
to to tolerate the harsh environment of

295
00:11:45,110 --> 00:11:43,519
space then come back and find

296
00:11:56,470 --> 00:11:45,120
applications in extreme environments on

297
00:12:02,150 --> 00:11:57,670
hi

298
00:12:04,230 --> 00:12:02,160
than a science question

299
00:12:05,509 --> 00:12:04,240
with um with our government 16 trillion

300
00:12:07,829 --> 00:12:05,519
dollars in debt

301
00:12:10,069 --> 00:12:07,839
we the government funds

302
00:12:12,870 --> 00:12:10,079
nasa and you know spends billions of

303
00:12:18,230 --> 00:12:12,880
dollars a year on it why do you think

304
00:12:23,269 --> 00:12:20,069
that's a great question

305
00:12:25,110 --> 00:12:23,279
overall when you look at the

306
00:12:27,910 --> 00:12:25,120
the federal budget nasa is a very small

307
00:12:29,910 --> 00:12:27,920
line item in the big picture and

308
00:12:32,389 --> 00:12:29,920
the the work that is done here is work

309
00:12:33,509 --> 00:12:32,399
that isn't done anywhere else and does

310
00:12:35,269 --> 00:12:33,519
have

311
00:12:36,870 --> 00:12:35,279
direct applications not to the ground

312
00:12:38,470 --> 00:12:36,880
you know it's it's fundamental science

313
00:12:40,629 --> 00:12:38,480

that benefits

314
00:12:41,590 --> 00:12:40,639
benefits everybody so

315
00:12:44,310 --> 00:12:41,600
myself

316
00:12:45,750 --> 00:12:44,320
i work in the the aerospace industry i'm

317
00:12:48,150 --> 00:12:45,760
an advocate for the aerospace industry

318
00:12:49,829 --> 00:12:48,160
and i think it's money well spent

319
00:12:52,550 --> 00:12:49,839
i definitely agree

320
00:12:54,949 --> 00:12:52,560
you're right it certainly is a lot of

321
00:12:56,949 --> 00:12:54,959
money to an individual like us but like

322
00:12:59,430 --> 00:12:56,959
dan said in the big picture you really

323
00:13:01,509 --> 00:12:59,440
don't spend a lot on nasa itself less

324
00:13:03,190 --> 00:13:01,519
than one percent of the national budget

325
00:13:13,670 --> 00:13:03,200
and i think we get a lot of bang for the

326
00:13:18,949 --> 00:13:15,910
hi um i was wondering like in the event

327
00:13:21,350 --> 00:13:18,959
of emergency on the space station like

328
00:13:23,670 --> 00:13:21,360
uh like running out of food or not being

329
00:13:25,509 --> 00:13:23,680
able to get back to earth does nasa have

330
00:13:28,470 --> 00:13:25,519
any like plans

331
00:13:30,629 --> 00:13:28,480
in the case of emergency like that

332
00:13:32,870 --> 00:13:30,639
uh there there are contingencies there

333
00:13:35,350 --> 00:13:32,880
are plans in place to cover for just

334
00:13:37,350 --> 00:13:35,360
about every conceivable contingency that

335
00:13:40,629 --> 00:13:37,360
the crew would encounter

336
00:13:42,310 --> 00:13:40,639
with regard to to critical uh consumable

337
00:13:44,069 --> 00:13:42,320
items like food and water

338
00:13:46,470 --> 00:13:44,079

there is a reserve that's maintained it

339
00:13:48,470 --> 00:13:46,480
usually varies between 45 and 90 days

340
00:13:51,189 --> 00:13:48,480
that if the crew were cut off or if

341
00:13:53,590 --> 00:13:51,199
there was a resupply slip there are

342
00:13:56,310 --> 00:13:53,600
spares pre-positioned to sustain the

343
00:13:58,790 --> 00:13:56,320
crew during that that

344
00:14:01,110 --> 00:13:58,800
that launch delay um and there are

345
00:14:03,350 --> 00:14:01,120
evacuation plans that that are in place

346
00:14:05,110 --> 00:14:03,360
that if a critical life support system

347
00:14:06,710 --> 00:14:05,120
were to be compromised

348
00:14:19,030 --> 00:14:06,720
there there are plans to get the crew

349
00:14:24,949 --> 00:14:21,590
the woman previously talked to us said

350
00:14:27,670 --> 00:14:24,959
that occasionally uh or not occasionally

351
00:14:28,550 --> 00:14:27,680
but astronauts are astronauts in

352
00:14:31,750 --> 00:14:28,560
training

353
00:14:33,829 --> 00:14:31,760
have to train for evacuation plans if

354
00:14:35,350 --> 00:14:33,839
they actually had to evacuate the space

355
00:14:37,829 --> 00:14:35,360
station

356
00:14:40,069 --> 00:14:37,839
uh just for something

357
00:14:44,629 --> 00:14:40,079
then they couldn't get to the right

358
00:14:49,350 --> 00:14:47,189
well so they're actually they're um

359
00:14:51,670 --> 00:14:49,360
basically their lifeboats um are the

360
00:14:53,670 --> 00:14:51,680
soyuz vehicles that they came to earth

361
00:14:56,150 --> 00:14:53,680
in or came to the space station in so

362
00:14:57,910 --> 00:14:56,160
they would just get back to those um and

363
00:14:59,990 --> 00:14:57,920

get out of the space station and undock

364
00:15:02,389 --> 00:15:00,000
from the space station and use those to

365
00:15:05,750 --> 00:15:02,399
land in where they actually land in

366
00:15:07,829 --> 00:15:05,760
kazakhstan so it's a big

367
00:15:09,829 --> 00:15:07,839
desert area there's plenty of room for

368
00:15:11,110 --> 00:15:09,839
them to land and they would have time

369
00:15:12,710 --> 00:15:11,120
once they got away from the space

370
00:15:13,910 --> 00:15:12,720
station to kind of plan their landing

371
00:15:25,030 --> 00:15:13,920
and make sure they ended up in the right

372
00:15:29,430 --> 00:15:27,269
specifically how did you choose your

373
00:15:33,509 --> 00:15:29,440
career and uh what steps did you have to

374
00:15:35,189 --> 00:15:33,519
take to become part of nasa

375
00:15:36,389 --> 00:15:35,199
uh

376
00:15:39,509 --> 00:15:36,399
it's an interesting question because i

377
00:15:41,350 --> 00:15:39,519
didn't really choose my career it

378
00:15:42,710 --> 00:15:41,360
chose me

379
00:15:45,670 --> 00:15:42,720
to some extent

380
00:15:47,430 --> 00:15:45,680
when i started off in college i actually

381
00:15:48,949 --> 00:15:47,440
wanted to be a physical therapist and

382
00:15:50,470 --> 00:15:48,959
was taking

383
00:15:51,910 --> 00:15:50,480
a lot of biology courses or trying to

384
00:15:53,910 --> 00:15:51,920
take a lot of biology courses that i got

385
00:15:55,430 --> 00:15:53,920
blocked out of and my advisor at the

386
00:15:56,870 --> 00:15:55,440
time told me that i might as well take

387
00:15:58,629 --> 00:15:56,880
chemistry because that was going to be a

388
00:16:00,550 --> 00:15:58,639

requirement as well

389
00:16:03,189 --> 00:16:00,560
i started taking my chemistry sequences

390
00:16:05,189 --> 00:16:03,199
through college and ended up taking an

391
00:16:07,430 --> 00:16:05,199
instrumental analysis and quantitati

392
00:16:09,030 --> 00:16:07,440
quantitative analysis class my freshman

393
00:16:10,790 --> 00:16:09,040
year which

394
00:16:13,269 --> 00:16:10,800
really exposed me for the first time to

395
00:16:15,269 --> 00:16:13,279
using instrumentation to make chemical

396
00:16:16,389 --> 00:16:15,279
measurements and characterize different

397
00:16:17,670 --> 00:16:16,399
materials

398
00:16:19,030 --> 00:16:17,680
and that just really intrigued me and i

399
00:16:21,189 --> 00:16:19,040
stuck with it from there

400
00:16:22,949 --> 00:16:21,199
once i got my undergraduate degree

401
00:16:25,189 --> 00:16:22,959
i went on to

402
00:16:27,430 --> 00:16:25,199
get a phd at iowa state

403
00:16:29,110 --> 00:16:27,440
up in ames and the professor that i

404
00:16:31,189 --> 00:16:29,120
worked for at iowa state

405
00:16:32,949 --> 00:16:31,199
was working on a nasa research grant to

406
00:16:35,030 --> 00:16:32,959
develop water quality monitoring systems

407
00:16:36,710 --> 00:16:35,040
for the space station so while i was in

408
00:16:38,389 --> 00:16:36,720
grad school i

409
00:16:40,310 --> 00:16:38,399
started working on that project and was

410
00:16:42,150 --> 00:16:40,320
able to directly transition that to my

411
00:16:43,590 --> 00:16:42,160
job down here at jsc

412
00:16:45,590 --> 00:16:43,600
i think you hear that from a lot of the

413
00:16:47,350 --> 00:16:45,600

engineers and scientists who work at

414
00:16:49,350 --> 00:16:47,360
nasa and i've also you know talked with

415
00:16:51,430 --> 00:16:49,360
astronauts about that before as well

416
00:16:53,110 --> 00:16:51,440
they all say that what you should do is

417
00:16:54,949 --> 00:16:53,120
find something that you love doing so

418
00:16:56,629 --> 00:16:54,959
that you will be

419
00:16:58,230 --> 00:16:56,639
inspired to be good at it and then that

420
00:17:01,269 --> 00:16:58,240
will help you end up where you want to

421
00:17:02,949 --> 00:17:01,279
go which hopefully could be nasa and for

422
00:17:04,630 --> 00:17:02,959
myself you know i

423
00:17:06,949 --> 00:17:04,640
i work in the public affairs office at

424
00:17:09,189 --> 00:17:06,959
nasa and uh started out as a

425
00:17:11,429 --> 00:17:09,199
newspaper reporter and uh

426
00:17:13,590 --> 00:17:11,439
and finding um even though i never

427
00:17:15,270 --> 00:17:13,600
intended to use it the science classes

428
00:17:17,350 --> 00:17:15,280
that i took when i was in high school

429
00:17:18,949 --> 00:17:17,360
and college are really helpful for me

430
00:17:20,390 --> 00:17:18,959
now and kind of knowing what the

431
00:17:37,350 --> 00:17:20,400
scientists and engineers are talking

432
00:17:43,029 --> 00:17:38,950
would you be able to explain how the the

433
00:17:46,470 --> 00:17:45,750
which moisture system or do you mean the

434
00:17:58,470 --> 00:17:46,480
the

435
00:18:00,870 --> 00:17:58,480
astronauts water

436
00:18:02,710 --> 00:18:00,880
yeah so what we have um there's two

437
00:18:03,590 --> 00:18:02,720
components to the water recovery you do

438
00:18:06,390 --> 00:18:03,600

have

439
00:18:07,590 --> 00:18:06,400
condensing heat exchangers so these are

440
00:18:09,510 --> 00:18:07,600
actually very similar to what you have

441
00:18:11,590 --> 00:18:09,520
in commercial and residential air

442
00:18:15,909 --> 00:18:11,600
conditioning units on the ground

443
00:18:17,750 --> 00:18:15,919
where water condenses on the surface of

444
00:18:20,630 --> 00:18:17,760
these heat exchangers it's then drawn

445
00:18:22,470 --> 00:18:20,640
into the water processor assembly

446
00:18:24,470 --> 00:18:22,480
that atmospheric condensate that's

447
00:18:26,830 --> 00:18:24,480
collected is combined with distillate

448
00:18:29,350 --> 00:18:26,840
from the urine processor assembly

449
00:18:31,510 --> 00:18:29,360
to provide the feedstock for the water

450
00:18:33,750 --> 00:18:31,520
processor the water processor itself

451
00:18:35,029 --> 00:18:33,760
uses a combination of processes to to

452
00:18:37,990 --> 00:18:35,039
polish that

453
00:18:40,470 --> 00:18:38,000
combination of distillate and

454
00:18:42,789 --> 00:18:40,480
condensate back into potable water

455
00:18:45,430 --> 00:18:42,799
it uses high temperature oxidation

456
00:18:47,430 --> 00:18:45,440
uh ion exchange uh there's some some

457
00:18:49,830 --> 00:18:47,440
carbon sorbent beds and then the final

458
00:18:52,310 --> 00:18:49,840
step uh before the the water goes into

459
00:18:55,029 --> 00:18:52,320
the storage tank uh for to supply the

460
00:18:57,029 --> 00:18:55,039
crew is addition of uh of a biocide

461
00:18:58,470 --> 00:18:57,039
which we use molecular iodine in the u.s

462
00:19:00,710 --> 00:18:58,480
segment of the states of the space

463
00:19:01,830 --> 00:19:00,720

station and what that does is inhibits

464
00:19:07,830 --> 00:19:01,840
bacterial growth while the water is

465
00:19:11,350 --> 00:19:09,669
on the space station how are we is it

466
00:19:14,549 --> 00:19:11,360
simpler on earth for people in third

467
00:19:17,909 --> 00:19:15,990
is it similar to what people in third

468
00:19:21,990 --> 00:19:17,919
world countries could use is that what

469
00:19:28,310 --> 00:19:22,870
the

470
00:19:29,830 --> 00:19:28,320
water

471
00:19:32,789 --> 00:19:29,840
yes are the same processes that you

472
00:19:35,669 --> 00:19:32,799
would use on the ground to take

473
00:19:37,750 --> 00:19:35,679
water or any contaminated water support

474
00:19:39,590 --> 00:19:37,760
water source and bring it back to it to

475
00:19:42,310 --> 00:19:39,600
a state that could be safe for uh for

476
00:19:45,110 --> 00:19:42,320
human consumption of course with nasa

477
00:19:46,470 --> 00:19:45,120
the specific systems that we employ

478
00:19:48,710 --> 00:19:46,480
are

479
00:19:50,390 --> 00:19:48,720
purpose built to operate in space so

480
00:19:51,350 --> 00:19:50,400
there wouldn't necessarily be the best

481
00:19:53,110 --> 00:19:51,360
answer

482
00:19:54,870 --> 00:19:53,120
for a third world country

483
00:19:57,430 --> 00:19:54,880
the they're also

484
00:19:59,350 --> 00:19:57,440
built to sustain six crew at a time not

485
00:20:01,270 --> 00:19:59,360
a village of hundreds of people but the

486
00:20:02,630 --> 00:20:01,280
basic principles behind water recovery

487
00:20:04,789 --> 00:20:02,640
are exactly the same

488
00:20:06,310 --> 00:20:04,799

and we have engineers who work on the

489
00:20:08,149 --> 00:20:06,320
the water recovery systems that we use

490
00:20:10,070 --> 00:20:08,159
in space who also volunteer their time

491
00:20:12,070 --> 00:20:10,080
to build systems that can work in third

492
00:20:13,909 --> 00:20:12,080
world countries and go out and help

493
00:20:15,750 --> 00:20:13,919
build them in the third world countries

494
00:20:20,149 --> 00:20:15,760
on in some occasions and

495
00:20:24,470 --> 00:20:21,669
during ventilation process with the

496
00:20:26,870 --> 00:20:24,480
water when you you only take out the h2o

497
00:20:29,029 --> 00:20:26,880
and take out everything else or you

498
00:20:30,950 --> 00:20:29,039
separate h2o and the nutrients needed

499
00:20:33,190 --> 00:20:30,960
for our body and dispose of the acids

500
00:20:35,830 --> 00:20:33,200
and chemicals from our uh from our

501
00:20:37,590 --> 00:20:35,840
systems

502
00:20:41,270 --> 00:20:37,600
with the

503
00:20:44,230 --> 00:20:41,280
condensing heat exchangers you actually

504
00:20:46,390 --> 00:20:44,240
condense water along with any volatile

505
00:20:48,070 --> 00:20:46,400
organic compounds that could be present

506
00:20:49,830 --> 00:20:48,080
along with some dissolved minerals that

507
00:20:51,830 --> 00:20:49,840
may be present in tiny micro droplets of

508
00:20:53,430 --> 00:20:51,840
water that exist

509
00:20:54,470 --> 00:20:53,440
and there's there are metabolic

510
00:20:56,470 --> 00:20:54,480
components that come from the crew

511
00:20:58,789 --> 00:20:56,480
living and exercising in space that you

512
00:21:01,350 --> 00:20:58,799
condense in that

513
00:21:03,909 --> 00:21:01,360

in that moisture when you go through the

514
00:21:05,350 --> 00:21:03,919
the water recovery process

515
00:21:09,270 --> 00:21:05,360
a lot of those contaminants are either

516
00:21:12,149 --> 00:21:10,630
in the catalytic reactor which is the

517
00:21:14,310 --> 00:21:12,159
oxidation unit they're actually broken

518
00:21:16,470 --> 00:21:14,320
down to co2 and bicarbonate and then

519
00:21:18,789 --> 00:21:16,480
scrubbed out using ion exchange beds

520
00:21:19,669 --> 00:21:18,799
in the urine processor assembly when

521
00:21:21,350 --> 00:21:19,679
we're

522
00:21:24,310 --> 00:21:21,360
distilling the urine and bringing over

523
00:21:27,190 --> 00:21:24,320
the distillate there's actually a brine

524
00:21:29,990 --> 00:21:27,200
left that's a concentrated high ionic

525
00:21:31,590 --> 00:21:30,000
strength solution that's discarded uh in

526
00:21:33,669 --> 00:21:31,600
the uh the progress vehicles and burned

527
00:21:35,909 --> 00:21:33,679
up

528
00:21:37,669 --> 00:21:35,919
oh so so makes because they said it's

529
00:21:40,870 --> 00:21:37,679
purer than the water that we have today

530
00:21:42,310 --> 00:21:40,880
and we use just like similar uh

531
00:21:44,549 --> 00:21:42,320
nutrients to make sure our water is

532
00:21:46,149 --> 00:21:44,559
cleaner so you use more uh concentrated

533
00:21:48,070 --> 00:21:46,159
ones you're saying then

534
00:21:49,830 --> 00:21:48,080
no the the water that the the water

535
00:21:52,149 --> 00:21:49,840
that's produced on the space station is

536
00:21:54,230 --> 00:21:52,159
ultra pure water it is

537
00:21:56,149 --> 00:21:54,240
much much cleaner than than the water

538
00:21:59,190 --> 00:21:56,159

that most of us have have access to in

539
00:22:00,310 --> 00:21:59,200
the taps in our house

540
00:22:03,110 --> 00:22:00,320
the

541
00:22:06,390 --> 00:22:03,120
what you need to remember is that in a

542
00:22:09,669 --> 00:22:06,400
on earth the water supply contains a lot

543
00:22:11,510 --> 00:22:09,679
of runoff from agriculture and industry

544
00:22:13,590 --> 00:22:11,520
that adds contaminants into the water

545
00:22:15,750 --> 00:22:13,600
that have to be removed with much more

546
00:22:17,909 --> 00:22:15,760
difficult processes on the space station

547
00:22:19,909 --> 00:22:17,919
we're fortunate in that the number of

548
00:22:21,510 --> 00:22:19,919
contaminants that we have to deal with

549
00:22:23,430 --> 00:22:21,520
are fairly limited because it's a

550
00:22:25,430 --> 00:22:23,440
closed-loop environment we're not using

551
00:22:27,110 --> 00:22:25,440
fertilizers we don't have large

552
00:22:29,430 --> 00:22:27,120
industrial or large industrial

553
00:22:31,830 --> 00:22:29,440
operations or agricultural operations so

554
00:22:33,669 --> 00:22:31,840
we're really dealing with

555
00:22:35,590 --> 00:22:33,679
the metabolic load from the from the

556
00:22:36,870 --> 00:22:35,600
astronauts and then some of the

557
00:22:38,149 --> 00:22:36,880
off-gassing components from the

558
00:22:39,990 --> 00:22:38,159
materials and the products that they use

559
00:22:41,990 --> 00:22:40,000
in space another good reason to be an

560
00:22:44,230 --> 00:22:42,000
astronaut right you get cleaner water

561
00:22:51,110 --> 00:22:44,240
absolutely

562
00:22:54,230 --> 00:22:52,630
i think that's about all the questions

563
00:22:56,630 --> 00:22:54,240

we have time for at this time thank you

564
00:22:58,070 --> 00:22:56,640
so much dan for joining us we really

565
00:22:59,430 --> 00:22:58,080
appreciate you taking the time to answer

566
00:23:00,870 --> 00:22:59,440
some of these questions with us and

567
00:23:02,870 --> 00:23:00,880
thanks so much to the students we

568
00:23:04,390 --> 00:23:02,880
enjoyed talking with you hope we

569
00:23:06,310 --> 00:23:04,400
were helpful and we're able to answer a