
PAO

1
00:00:08,580 --> 00:00:05,539
it is now time to introduce you to our

2
00:00:11,220 --> 00:00:08,590
public affairs officer brandy dean and

3
00:00:12,689 --> 00:00:11,230
our special guest dan gozde who is a

4
00:00:15,629 --> 00:00:12,699
chemist here at the Johnson Space Center

5
00:00:17,419 --> 00:00:15,639
so Mission Control I am introduced you

6
00:00:20,189 --> 00:00:17,429
to st. peter's preparatory high school

7
00:00:22,230 --> 00:00:20,199
hi thanks so much and welcome to the

8
00:00:23,759 --> 00:00:22,240
Mission Control here in Houston were in

9
00:00:26,279 --> 00:00:23,769
the International Space Station flight

10
00:00:28,439 --> 00:00:26,289
control room and like you said I have

11
00:00:30,269 --> 00:00:28,449
with me den gazda who is an

12
00:00:32,370 --> 00:00:30,279
environmental scientist and chemist so

13
00:00:34,550 --> 00:00:32,380

hopefully I know y'all sent in a few

14
00:00:36,600 --> 00:00:34,560
questions ahead of time a lot of

15
00:00:37,980 --> 00:00:36,610
studying chemistry and hopefully he'll

16
00:00:39,630 --> 00:00:37,990
be able to help you with that but first

17
00:00:42,930 --> 00:00:39,640
I'm gonna let him tell you a little bit

18
00:00:44,880 --> 00:00:42,940
about who he is and what he does yes as

19
00:00:46,740 --> 00:00:44,890
you mentioned my name is Dan gosder I

20
00:00:50,190 --> 00:00:46,750
work in the human health and performance

21
00:00:52,110 --> 00:00:50,200
Directorate here at JSC I'm an

22
00:00:53,970 --> 00:00:52,120
environmental scientist in the water and

23
00:00:55,650 --> 00:00:53,980
food analytical lab our primary

24
00:00:57,120 --> 00:00:55,660
responsibilities are supporting the

25
00:00:58,170 --> 00:00:57,130
environmental health systems and the

26
00:01:01,140 --> 00:00:58,180
environmental control and life support

27
00:01:02,940 --> 00:01:01,150
systems on ISS all right well thanks so

28
00:01:05,130 --> 00:01:02,950
much for joining this team we really

29
00:01:06,630 --> 00:01:05,140
appreciate it and I guess if y'all want

30
00:01:15,020 --> 00:01:06,640
to start with your questions now that

31
00:01:25,999 --> 00:01:22,820
oh um the lady that spoke to us prior to

32
00:01:28,249 --> 00:01:26,009
you guys she said that on space some

33
00:01:31,130 --> 00:01:28,259
medals are made that wouldn't be able to

34
00:01:34,010 --> 00:01:31,140
be made on earth what happens if you

35
00:01:37,700 --> 00:01:34,020
bring those metals that can only be made

36
00:01:40,340 --> 00:01:37,710
in space to earth like will they you

37
00:01:43,580 --> 00:01:40,350
know come apart or something like that

38
00:01:47,510 --> 00:01:43,590

or what would happen or worthy or with

39
00:01:50,870 --> 00:01:47,520
nothing happened at all generally

40
00:01:52,310 --> 00:01:50,880
speaking once you when you're in the

41
00:01:54,350 --> 00:01:52,320
microgravity environment you're able to

42
00:01:56,359 --> 00:01:54,360
do things that you can't do in a

43
00:02:00,169 --> 00:01:56,369
terrestrial laboratory here on earth and

44
00:02:02,630 --> 00:02:00,179
so with metals you can alloy metals and

45
00:02:05,600 --> 00:02:02,640
mix them in unique ratios to achieve

46
00:02:07,960 --> 00:02:05,610
desired properties so you can mix these

47
00:02:11,300 --> 00:02:07,970
things in space and allow them to form

48
00:02:13,040 --> 00:02:11,310
with the specific ratios and the alloy

49
00:02:14,509 --> 00:02:13,050
but once they're formed they should be

50
00:02:20,470 --> 00:02:14,519
locked into place so they can be

51
00:02:27,590 --> 00:02:24,320
I was just wondering like how close are

52
00:02:30,140 --> 00:02:27,600
we to like to sending a community in

53
00:02:32,030 --> 00:02:30,150
space like in the movie like wall-e like

54
00:02:38,360 --> 00:02:32,040
where they had a big ship and then go

55
00:02:42,380 --> 00:02:38,370
like wherever they want how close closer

56
00:02:43,850 --> 00:02:42,390
than we were several years ago one of

57
00:02:45,710 --> 00:02:43,860
the exciting things the some of the

58
00:02:49,250 --> 00:02:45,720
exciting progress we've made in the past

59
00:02:51,350 --> 00:02:49,260
couple of years is really moving towards

60
00:02:53,630 --> 00:02:51,360
a closed-loop life support system on the

61
00:02:56,960 --> 00:02:53,640
space station where we're now recovering

62
00:02:59,840 --> 00:02:56,970
water from urine and scrubbing the

63
00:03:02,630 --> 00:02:59,850

atmosphere recovering some water through

64
00:03:04,850 --> 00:03:02,640
a sub body a process and what this does

65
00:03:08,090 --> 00:03:04,860
this dramatically reduces our reliance

66
00:03:11,900 --> 00:03:08,100
on ground supplied resources and does

67
00:03:15,050 --> 00:03:11,910
move us closer to having the ability to

68
00:03:18,080 --> 00:03:15,060
sustain a population of folks out in

69
00:03:20,000 --> 00:03:18,090
space on a long-duration mission without

70
00:03:22,640 --> 00:03:20,010
having to constantly resupply things

71
00:03:24,350 --> 00:03:22,650
from the ground and I think I don't know

72
00:03:26,210 --> 00:03:24,360
necessarily about Wally with all of

73
00:03:28,100 --> 00:03:26,220
those in great movie we do get a lot of

74
00:03:30,320 --> 00:03:28,110
inspiration from science fiction and

75
00:03:32,240 --> 00:03:30,330
occasionally movies right there are a

76
00:03:35,030 --> 00:03:32,250
lot of folks working at NASA who

77
00:03:37,970 --> 00:03:35,040
definitely watched a lot of science

78
00:03:41,090 --> 00:03:37,980
fiction definitely and there are certain

79
00:03:45,800 --> 00:03:41,100
aspects of science fiction that are more

80
00:03:47,780 --> 00:03:45,810
realistic than others what materials

81
00:03:50,150 --> 00:03:47,790
were used in the astronaut suits to

82
00:03:51,500 --> 00:03:50,160
ensure their safety like I'm guessing

83
00:03:53,060 --> 00:03:51,510
they have some pretty high end

84
00:03:55,699 --> 00:03:53,070
insulation because I hear space is

85
00:03:59,300 --> 00:03:55,709
pretty cold and like also what material

86
00:04:00,410 --> 00:03:59,310
is used to block radiation because that

87
00:04:05,780 --> 00:04:00,420
could be pretty dangerous for them out

88
00:04:09,259 --> 00:04:05,790

there yes I'm not I'm not familiar with

89
00:04:11,740 --> 00:04:09,269
the exact materials that go into the

90
00:04:14,390 --> 00:04:11,750
outer shell of the extra vehicular

91
00:04:16,039 --> 00:04:14,400
mobility units the e/m use those are the

92
00:04:19,070 --> 00:04:16,049
suits that the astronauts wear during

93
00:04:21,610 --> 00:04:19,080
during spacewalks or EV a's the extra

94
00:04:23,780 --> 00:04:21,620
vehicular activities they are

95
00:04:26,240 --> 00:04:23,790
multi-layer materials so what you have

96
00:04:27,980 --> 00:04:26,250
is a unique combination of many

97
00:04:30,529 --> 00:04:27,990
materials stacked on top of each other

98
00:04:33,620 --> 00:04:30,539
to provide the desired characteristics

99
00:04:37,439 --> 00:04:33,630
and ensure crew safety during space

100
00:04:40,379 --> 00:04:37,449
they do have certain materials in the

101
00:04:42,420 --> 00:04:40,389
suit that reduce the radiation exposure

102
00:04:44,010 --> 00:04:42,430
but when you're in space the radiation

103
00:04:46,439 --> 00:04:44,020
exposure is going to be higher than it

104
00:04:48,810 --> 00:04:46,449
is on the ground I think they also have

105
00:04:50,129 --> 00:04:48,820
at least in their their gloves heaters

106
00:04:52,050 --> 00:04:50,139
that helped me keep form you'd asked

107
00:04:53,340 --> 00:04:52,060
about insulation and it definitely does

108
00:04:54,780 --> 00:04:53,350
get very cold in space and you

109
00:04:56,280 --> 00:04:54,790
especially want your hands to be warm

110
00:04:58,590 --> 00:04:56,290
because you work a lot with your hands

111
00:05:00,180 --> 00:04:58,600
so to help them keep from getting stiff

112
00:05:01,350 --> 00:05:00,190
fingers they they have heaters inside

113
00:05:03,750 --> 00:05:01,360

their gloves yeah they actually have

114
00:05:05,460 --> 00:05:03,760
some very unique undergarments for the

115
00:05:07,770 --> 00:05:05,470
spacesuits called liquid cooling and

116
00:05:09,180 --> 00:05:07,780
ventilation garments that look a lot

117
00:05:11,580 --> 00:05:09,190
like thermal underwear but they have

118
00:05:13,620 --> 00:05:11,590
very small diameter tubing that liquid

119
00:05:15,629 --> 00:05:13,630
circulates through and passes through a

120
00:05:17,040 --> 00:05:15,639
heat exchanger that helps regulate the

121
00:05:18,960 --> 00:05:17,050
temperature inside the suits because you

122
00:05:20,700 --> 00:05:18,970
also get hot in space when the Sun is on

123
00:05:22,650 --> 00:05:20,710
you so you have to be ready for both

124
00:05:26,879 --> 00:05:22,660
really really cold temperatures and

125
00:05:30,210 --> 00:05:26,889
really really hot temperatures hi I'm

126
00:05:33,390 --> 00:05:30,220
just curious with for instance the space

127
00:05:35,760 --> 00:05:33,400
station using propulsion systems in

128
00:05:40,080 --> 00:05:35,770
space since there's not a lot to push

129
00:05:41,520 --> 00:05:40,090
off of per se how do they work that one

130
00:05:45,719 --> 00:05:41,530
is probably going to be pretty far

131
00:05:49,440 --> 00:05:45,729
outside my area of expertise in general

132
00:05:52,680 --> 00:05:49,450
you do have you have an inertial mass

133
00:05:56,760 --> 00:05:52,690
from the vehicle itself that you push

134
00:06:00,870 --> 00:05:56,770
against so there there is a mass to

135
00:06:04,050 --> 00:06:00,880
overcome there but how the systems

136
00:06:06,719 --> 00:06:04,060
exactly work is is outside of my area of

137
00:06:09,570 --> 00:06:06,729
expertise i think we can say that it

138
00:06:11,730 --> 00:06:09,580

takes a lot less force to move you in

139
00:06:13,080 --> 00:06:11,740
space just you can see it on the

140
00:06:16,050 --> 00:06:13,090
International Space Station if you watch

141
00:06:18,300 --> 00:06:16,060
NASA TV the astronauts can push off with

142
00:06:20,370 --> 00:06:18,310
just you know a finger and keep going

143
00:06:23,850 --> 00:06:20,380
for a long time so it takes a lot less

144
00:06:25,170 --> 00:06:23,860
energy to move at all and so that at

145
00:06:26,490 --> 00:06:25,180
least helps us getting around in space

146
00:06:27,810 --> 00:06:26,500
once we've gotten out of the Earth's

147
00:06:30,210 --> 00:06:27,820
atmosphere which certainly does take a

148
00:06:32,730 --> 00:06:30,220
lot of thrust yeah once you don't have

149
00:06:34,320 --> 00:06:32,740
to overcome the gravitational vector you

150
00:06:36,750 --> 00:06:34,330
can expend a lot less energy moving and

151
00:06:40,119 --> 00:06:36,760
translating hopefully that helps answer

152
00:06:44,829 --> 00:06:40,129
your question yeah thanks

153
00:06:46,329 --> 00:06:44,839
I just got to act because I know that

154
00:06:48,399 --> 00:06:46,339
they were suits and but with the

155
00:06:50,829 --> 00:06:48,409
system's itself on the station how do

156
00:06:53,439 --> 00:06:50,839
you defend against solar flares that

157
00:06:55,479 --> 00:06:53,449
could also hurt the magnetics within

158
00:07:00,040 --> 00:06:55,489
those systems or the astronauts

159
00:07:02,859 --> 00:07:00,050
themselves the all of the systems that

160
00:07:05,559 --> 00:07:02,869
go up on the space station are tested

161
00:07:07,749 --> 00:07:05,569
extensively and there are specific

162
00:07:11,109 --> 00:07:07,759
precautions that are taken to protect

163
00:07:13,239 --> 00:07:11,119

against ionizing radiation events with

164
00:07:16,600 --> 00:07:13,249
the the crew themselves there are

165
00:07:18,429 --> 00:07:16,610
certain instances where you know they

166
00:07:21,159 --> 00:07:18,439
they locate in certain areas of the

167
00:07:23,019 --> 00:07:21,169
station occasionally they they locate in

168
00:07:24,669 --> 00:07:23,029
the water the water storage area because

169
00:07:27,129 --> 00:07:24,679
water ends up being a great shield for

170
00:07:29,199 --> 00:07:27,139
radiation so we have large bags of water

171
00:07:30,519 --> 00:07:29,209
that we use to maintain a contingency

172
00:07:33,129 --> 00:07:30,529
reserve and sometimes the crew will

173
00:07:35,319 --> 00:07:33,139
sleep in the proximity of those and we

174
00:07:36,639 --> 00:07:35,329
basically have space weathermen who let

175
00:07:38,319 --> 00:07:36,649
us know when there's going to be a lot

176
00:07:39,999 --> 00:07:38,329
of activity that we want to protect the

177
00:07:42,339 --> 00:07:40,009
astronauts from so that helps us know

178
00:07:44,769 --> 00:07:42,349
when we need to maybe get them into an

179
00:07:48,519 --> 00:07:44,779
area like Dan said that has a little bit

180
00:07:53,859 --> 00:07:51,819
as intervent environmental scientists

181
00:07:56,649 --> 00:07:53,869
what is what is one of the most

182
00:08:01,569 --> 00:07:56,659
interesting side effects of being in

183
00:08:04,739 --> 00:08:01,579
space i would say that they're probably

184
00:08:06,789 --> 00:08:04,749
the most interesting aspect of

185
00:08:09,459 --> 00:08:06,799
maintaining environmental control

186
00:08:11,799 --> 00:08:09,469
systems in space is the lack of phase

187
00:08:14,229 --> 00:08:11,809
separation that you have when you're

188
00:08:16,809 --> 00:08:14,239

outside of the or when you're in a

189
00:08:19,299 --> 00:08:16,819
microgravity environment so for a water

190
00:08:21,009 --> 00:08:19,309
system for example which is one of the

191
00:08:23,349 --> 00:08:21,019
things that I'm the most familiar with

192
00:08:25,629 --> 00:08:23,359
on the ground you don't get too

193
00:08:27,879 --> 00:08:25,639
concerned about air bubbles being and

194
00:08:29,679 --> 00:08:27,889
trapped in the water supply because they

195
00:08:30,849 --> 00:08:29,689
always rise to the surface well the

196
00:08:33,189 --> 00:08:30,859
reason the bubbles rise to the surface

197
00:08:35,469 --> 00:08:33,199
is because the gas is less dense than

198
00:08:38,049 --> 00:08:35,479
liquid and in a gravitational field it

199
00:08:39,610 --> 00:08:38,059
moves to the top in the absence of that

200
00:08:41,019 --> 00:08:39,620
gravitational field all the air bubbles

201
00:08:43,480 --> 00:08:41,029
stay and trained in the body of the

202
00:08:47,889 --> 00:08:43,490
liquid and that can pose a lot of

203
00:08:50,230 --> 00:08:47,899
problems for fluid handling systems I

204
00:08:53,679 --> 00:08:50,240
was watching something and I read an

205
00:08:55,420 --> 00:08:53,689
article that there is over the last 60

206
00:08:58,720 --> 00:08:55,430
or 50 years or so they've been a lot of

207
00:09:00,189 --> 00:08:58,730
satellites put up in that are just

208
00:09:02,230 --> 00:09:00,199
floating now in Earth orbit I think the

209
00:09:04,809 --> 00:09:02,240
number was like this valve 50,000 of

210
00:09:06,879 --> 00:09:04,819
them and only about 1,000 are actually

211
00:09:09,280 --> 00:09:06,889
functioning so they deemed those you

212
00:09:11,199 --> 00:09:09,290
know dead satellites space junk is there

213
00:09:13,090 --> 00:09:11,209

any like efforts being used to clean it

214
00:09:14,379 --> 00:09:13,100
up because they do pros a problem

215
00:09:19,360 --> 00:09:14,389
especially for the International Space

216
00:09:20,889 --> 00:09:19,370
Station again I'm not aware of efforts I

217
00:09:23,290 --> 00:09:20,899
know it's definitely something that is

218
00:09:24,790 --> 00:09:23,300
tracked very closely because folks

219
00:09:27,220 --> 00:09:24,800
always want to know if any of the the

220
00:09:30,129 --> 00:09:27,230
orbital debris is going to pose a risk

221
00:09:31,360 --> 00:09:30,139
to the station right and we have a team

222
00:09:33,579 --> 00:09:31,370
here on the ground that lets us know if

223
00:09:35,499 --> 00:09:33,589
there's any debris which is what we call

224
00:09:36,999 --> 00:09:35,509
it and it's going to get anywhere near

225
00:09:38,559 --> 00:09:37,009
the space station and if we need to we

226
00:09:40,660 --> 00:09:38,569
move the space station around to avoid

227
00:09:42,639 --> 00:09:40,670
it but as far as cleaning up I know

228
00:09:43,990 --> 00:09:42,649
we're looking into different ideas and

229
00:09:45,819 --> 00:09:44,000
hopefully you're going to come up with

230
00:09:47,290 --> 00:09:45,829
an effort just because like you said

231
00:09:48,819 --> 00:09:47,300
there's there's good it's getting to the

232
00:09:50,679 --> 00:09:48,829
point where there's so much of it in

233
00:09:53,499 --> 00:09:50,689
space but a lot of it takes care of

234
00:09:55,720 --> 00:09:53,509
itself um it all eventually continues to

235
00:09:57,069 --> 00:09:55,730
lower in orbit and then usually burns up

236
00:10:00,069 --> 00:09:57,079
in the Earth's atmosphere before it

237
00:10:02,019 --> 00:10:00,079
falls down so given enough time it'll

238
00:10:02,230 --> 00:10:02,029

it'll take care of itself but there's so

239
00:10:04,060 --> 00:10:02,240
much

240
00:10:06,400 --> 00:10:04,070
of it like you said that we do I want to

241
00:10:09,310 --> 00:10:06,410
try and find some other way to help out

242
00:10:10,720 --> 00:10:09,320
with the cleanup effort what new

243
00:10:15,070 --> 00:10:10,730
chemical discoveries have been made in

244
00:10:18,400 --> 00:10:15,080
space new chemical discoveries there

245
00:10:22,120 --> 00:10:18,410
there's a lot of interesting phenomenon

246
00:10:24,370 --> 00:10:22,130
that have been observed in space a lot

247
00:10:26,620 --> 00:10:24,380
of them relating to the behavior of

248
00:10:28,449 --> 00:10:26,630
materials outside of our in the absence

249
00:10:30,100 --> 00:10:28,459
of gravity there's been a lot of studies

250
00:10:32,880 --> 00:10:30,110
done on protein crystallization that

251
00:10:35,320 --> 00:10:32,890
they've seen some very novel

252
00:10:38,320 --> 00:10:35,330
crystallographic patterns that form in

253
00:10:40,120 --> 00:10:38,330
the absence of gravity and there's

254
00:10:41,949 --> 00:10:40,130
probably some of the other things that

255
00:10:45,340 --> 00:10:41,959
have come about would really be material

256
00:10:48,360 --> 00:10:45,350
compatibility issues and exposure issues

257
00:10:50,519 --> 00:10:48,370
that thing's designed for space to an to

258
00:10:53,650 --> 00:10:50,529
tolerate the harsh environment of space

259
00:10:56,730 --> 00:10:53,660
then come back and find applications and

260
00:10:58,840 --> 00:10:56,740
extreme environments on the ground hi

261
00:11:02,650 --> 00:10:58,850
this is more of a political question

262
00:11:04,329 --> 00:11:02,660
than a science question with um with our

263
00:11:08,139 --> 00:11:04,339

government sixteen trillion dollars in

264
00:11:10,030 --> 00:11:08,149
debt we the government funds NASA and

265
00:11:13,240 --> 00:11:10,040
you know spends billions of dollars a

266
00:11:18,220 --> 00:11:13,250
year on it why do you think that on they

267
00:11:21,010 --> 00:11:18,230
should continue to do that that's a

268
00:11:24,400 --> 00:11:21,020
great question overall when you look at

269
00:11:26,670 --> 00:11:24,410
the the federal budget nasa's a very

270
00:11:29,440 --> 00:11:26,680
small line item in the big picture and

271
00:11:31,900 --> 00:11:29,450
the the work that is done here is work

272
00:11:34,569 --> 00:11:31,910
that isn't done anywhere else and does

273
00:11:36,100 --> 00:11:34,579
have direct applications not to the

274
00:11:38,829 --> 00:11:36,110
ground you know it's it's fundamental

275
00:11:43,090 --> 00:11:38,839
science that benefits benefits everybody

276
00:11:44,650 --> 00:11:43,100
so myself i work in the the aerospace

277
00:11:45,819 --> 00:11:44,660
industry i'm an advocate for the

278
00:11:48,630 --> 00:11:45,829
aerospace industry and I think it's

279
00:11:52,150 --> 00:11:48,640
money well spent I definitely agree

280
00:11:53,980 --> 00:11:52,160
you're right it certainly is a lot of

281
00:11:56,319 --> 00:11:53,990
money to an individual like us but in

282
00:11:58,480 --> 00:11:56,329
like Dan said in the big picture you

283
00:12:00,519 --> 00:11:58,490
really don't spend a lot on NASA itself

284
00:12:02,530 --> 00:12:00,529
less than one percent of the national

285
00:12:05,740 --> 00:12:02,540
budget and I think we get a lot of bang

286
00:12:07,210 --> 00:12:05,750
for the buck out of it hi I was

287
00:12:10,720 --> 00:12:07,220
wondering like in the event of emergency

288
00:12:12,850 --> 00:12:10,730

on the space station like like running

289
00:12:15,610 --> 00:12:12,860
out of food or not being a lyga backs

290
00:12:19,590 --> 00:12:15,620
earth does NASA have any like fly

291
00:12:22,300 --> 00:12:19,600
ends in the case of emergency like that

292
00:12:24,610 --> 00:12:22,310
there are contingent there are plans and

293
00:12:26,710 --> 00:12:24,620
place the cover for just about every

294
00:12:29,740 --> 00:12:26,720
conceivable contingency that the crew

295
00:12:32,470 --> 00:12:29,750
would encounter with regard to two

296
00:12:34,450 --> 00:12:32,480
critical consumable items like food and

297
00:12:36,430 --> 00:12:34,460
water there is a reserve that's

298
00:12:38,950 --> 00:12:36,440
maintained it usually varies between 45

299
00:12:41,170 --> 00:12:38,960
and 90 days that if the crew were cut

300
00:12:44,140 --> 00:12:41,180
off or if there was a resupply slip

301
00:12:47,530 --> 00:12:44,150
there are spares pre-positioned to

302
00:12:50,560 --> 00:12:47,540
sustain the crew during that that that

303
00:12:52,780 --> 00:12:50,570
launch delay and there are evacuation

304
00:12:54,760 --> 00:12:52,790
plans that are in place that if a

305
00:12:57,460 --> 00:12:54,770
critical life-support system were to be

306
00:13:00,820 --> 00:12:57,470
compromised there there are plans to get

307
00:13:03,400 --> 00:13:00,830
the crew safely back to the ground the

308
00:13:06,700 --> 00:13:03,410
woman previously talked to us said that

309
00:13:09,579 --> 00:13:06,710
occasionally or occasionally but

310
00:13:13,000 --> 00:13:09,589
astronauts are astronauts and training

311
00:13:15,400 --> 00:13:13,010
have to train for evacuation plans if

312
00:13:19,990 --> 00:13:15,410
they actually had to evacuate the space

313
00:13:22,360 --> 00:13:20,000

station of just for something then they

314
00:13:27,760 --> 00:13:22,370
couldn't get to the right landing area

315
00:13:30,430 --> 00:13:27,770
where they land well they're actually

316
00:13:32,949 --> 00:13:30,440
they're basically their lifeboats are

317
00:13:35,110 --> 00:13:32,959
the Soyuz vehicles that they came to

318
00:13:37,420 --> 00:13:35,120
earth in or came to the space station in

319
00:13:39,490 --> 00:13:37,430
so they would just get back to those and

320
00:13:41,560 --> 00:13:39,500
get out of the space station and undock

321
00:13:43,930 --> 00:13:41,570
from the space station and use those to

322
00:13:48,130 --> 00:13:43,940
land in where they actually land in

323
00:13:49,900 --> 00:13:48,140
Kazakhstan so it's a big desert area

324
00:13:51,910 --> 00:13:49,910
there's plenty of room for them to land

325
00:13:53,500 --> 00:13:51,920
and they would have time once they got

326
00:13:54,850 --> 00:13:53,510
away from the space station to kind of

327
00:13:58,060 --> 00:13:54,860
plan their landing and make sure they

328
00:14:01,030 --> 00:13:58,070
ended up in the right place specifically

329
00:14:02,829 --> 00:14:01,040
how did you choose your career and what

330
00:14:08,560 --> 00:14:02,839
steps did you have to take to become

331
00:14:10,660 --> 00:14:08,570
part of NASA uh interesting question

332
00:14:15,400 --> 00:14:10,670
because I didn't really choose my career

333
00:14:18,430 --> 00:14:15,410
it chose me to some extent when I

334
00:14:20,079 --> 00:14:18,440
started off in college I actually wanted

335
00:14:22,690 --> 00:14:20,089
to be a physical therapist and was

336
00:14:23,949 --> 00:14:22,700
taking a lot of biology courses are

337
00:14:26,020 --> 00:14:23,959
trying to take a lot of biology courses

338
00:14:27,699 --> 00:14:26,030

that I got blocked out of and my advisor

339
00:14:29,170 --> 00:14:27,709
at the time told me that I might as well

340
00:14:29,319 --> 00:14:29,180
take chemistry because that was going to

341
00:14:32,139 --> 00:14:29,329
be

342
00:14:33,789 --> 00:14:32,149
requirement as well I started taking my

343
00:14:36,639 --> 00:14:33,799
chemistry sequences through college and

344
00:14:38,619 --> 00:14:36,649
ended up taking an instrumental analysis

345
00:14:41,710 --> 00:14:38,629
and quantitative quantitative analysis

346
00:14:43,650 --> 00:14:41,720
class my freshman year which really

347
00:14:45,699 --> 00:14:43,660
exposed me for the first time to using

348
00:14:47,769 --> 00:14:45,709
instrumentation to make kind of chemical

349
00:14:49,900 --> 00:14:47,779
measurements and character as different

350
00:14:51,850 --> 00:14:49,910
materials and that just really intrigued

351
00:14:54,600 --> 00:14:51,860
me and I stuck with it from there once I

352
00:14:58,629 --> 00:14:54,610
got my undergraduate degree I went on to

353
00:15:00,699 --> 00:14:58,639
get a PhD at Iowa State up in ames and

354
00:15:03,069 --> 00:15:00,709
the professor that I worked for at Iowa

355
00:15:04,389 --> 00:15:03,079
State was working on a NASA research

356
00:15:06,220 --> 00:15:04,399
grant to develop water quality

357
00:15:09,309 --> 00:15:06,230
monitoring systems for the space station

358
00:15:11,109 --> 00:15:09,319
so while I was in grad school I started

359
00:15:13,119 --> 00:15:11,119
working on that project and was able to

360
00:15:15,549 --> 00:15:13,129
directly transition that to my job down

361
00:15:17,679 --> 00:15:15,559
here Jesse I think you hear that from a

362
00:15:19,299 --> 00:15:17,689
lot of the engineers and scientists who

363
00:15:20,949 --> 00:15:19,309

work at NASA and I've also you know

364
00:15:23,259 --> 00:15:20,959
talked with astronauts about that before

365
00:15:24,639 --> 00:15:23,269
as well they all say that what you

366
00:15:27,669 --> 00:15:24,649
should do is find something that you

367
00:15:29,439 --> 00:15:27,679
love doing so that you will be inspired

368
00:15:31,059 --> 00:15:29,449
to be good at it and then that will help

369
00:15:33,909 --> 00:15:31,069
you end up where you want to go which

370
00:15:36,609 --> 00:15:33,919
hopefully could be NASA and for myself

371
00:15:38,699 --> 00:15:36,619
you know I I work in the public affairs

372
00:15:42,579 --> 00:15:38,709
office at NASA and started out as a

373
00:15:44,739 --> 00:15:42,589
newspaper reporter and and and finding

374
00:15:46,929 --> 00:15:44,749
even though I never intended to use it

375
00:15:48,909 --> 00:15:46,939
the science classes that I took when I

376
00:15:50,979 --> 00:15:48,919
was in high school in college are really

377
00:15:52,479 --> 00:15:50,989
helpful for me now and kind of knowing

378
00:15:55,539 --> 00:15:52,489
what the scientists and engineers are

379
00:15:57,579 --> 00:15:55,549
talking about would you be able to

380
00:16:01,929 --> 00:15:57,589
explain how the moisture system works in

381
00:16:05,379 --> 00:16:01,939
the system which moisture system aren't

382
00:16:07,569 --> 00:16:05,389
you mean the waste collection system on

383
00:16:10,040 --> 00:16:07,579
the space station that that recycles

384
00:16:14,180 --> 00:16:12,829
yeah that the know that takes the

385
00:16:17,139 --> 00:16:14,190
moisture out of the air so it gives the

386
00:16:19,160 --> 00:16:17,149
astronauts water yeah so what we have

387
00:16:21,710 --> 00:16:19,170
there's two components to the water

388
00:16:24,259 --> 00:16:21,720

recovery you do have condensing heat

389
00:16:25,639 --> 00:16:24,269
exchangers so these are actually very

390
00:16:27,650 --> 00:16:25,649
similar to what you have in commercial

391
00:16:31,190 --> 00:16:27,660
and residential air conditioning units

392
00:16:34,340 --> 00:16:31,200
on the ground where water condenses on

393
00:16:36,590 --> 00:16:34,350
the surface of these heat exchangers

394
00:16:38,780 --> 00:16:36,600
it's then drawn into the water processor

395
00:16:41,120 --> 00:16:38,790
assembly that that atmospheric

396
00:16:43,009 --> 00:16:41,130
condensate that's collected is combined

397
00:16:46,280 --> 00:16:43,019
with this lit from the urine processor

398
00:16:48,079 --> 00:16:46,290
assembly to provide the feedstock for

399
00:16:50,630 --> 00:16:48,089
the water processor the water processor

400
00:16:54,470 --> 00:16:50,640
itself uses a combination of processes

401
00:16:57,069 --> 00:16:54,480
to polish that combination of distillate

402
00:17:01,190 --> 00:16:57,079
and common sight back into potable water

403
00:17:03,560 --> 00:17:01,200
it uses high temperature oxidation ion

404
00:17:06,380 --> 00:17:03,570
exchange there's some some carbon sorban

405
00:17:09,020 --> 00:17:06,390
beds and then the final step before the

406
00:17:11,350 --> 00:17:09,030
the water goes into the storage tank for

407
00:17:14,179 --> 00:17:11,360
to supply the crew is addition of a

408
00:17:15,710 --> 00:17:14,189
biocide which we use molecular iodine in

409
00:17:17,630 --> 00:17:15,720
the u.s. segment of the space of the

410
00:17:19,010 --> 00:17:17,640
space station and what that does is

411
00:17:21,949 --> 00:17:19,020
inhibits bacterial growth while the

412
00:17:24,439 --> 00:17:21,959
waters being stored on the space station

413
00:17:25,669 --> 00:17:24,449

how are we is it simpler on earth for

414
00:17:29,510 --> 00:17:25,679
people in third world countries without

415
00:17:31,520 --> 00:17:29,520
water is it similar to what people in

416
00:17:34,940 --> 00:17:31,530
third world countries could use is that

417
00:17:42,200 --> 00:17:39,860
the the overall processes that we use on

418
00:17:43,610 --> 00:17:42,210
the space station to recover water yes

419
00:17:47,660 --> 00:17:43,620
are the same processes that you would

420
00:17:49,880 --> 00:17:47,670
use on the ground to take water or any

421
00:17:51,830 --> 00:17:49,890
contaminated water support water source

422
00:17:53,930 --> 00:17:51,840
and bring it back to it to a state that

423
00:17:57,200 --> 00:17:53,940
could be safe for for human consumption

424
00:18:00,980 --> 00:17:57,210
of course with NASA the specific systems

425
00:18:02,930 --> 00:18:00,990
that we employ are purpose-built to

426
00:18:05,330 --> 00:18:02,940
operate in space so there wouldn't

427
00:18:07,760 --> 00:18:05,340
necessarily be the best answer for a

428
00:18:10,340 --> 00:18:07,770
third world country the they're also

429
00:18:12,800 --> 00:18:10,350
built the sustained six crew at a time

430
00:18:14,420 --> 00:18:12,810
not a village of hundreds of people but

431
00:18:16,820 --> 00:18:14,430
the basic principles behind water

432
00:18:18,860 --> 00:18:16,830
recovery are exactly the same and we

433
00:18:20,330 --> 00:18:18,870
have engineers who work on the the water

434
00:18:22,160 --> 00:18:20,340
recovery systems that we use in space

435
00:18:23,810 --> 00:18:22,170
you also volunteer their time to build

436
00:18:26,240 --> 00:18:23,820
systems that can work in third-world

437
00:18:28,160 --> 00:18:26,250
countries and go out and help build them

438
00:18:30,080 --> 00:18:28,170

in the third world countries on in some

439
00:18:33,080 --> 00:18:30,090
occasions and teach people how to use

440
00:18:35,390 --> 00:18:33,090
them Thorin ventilation process with the

441
00:18:38,120 --> 00:18:35,400
water when you you only take out the h2o

442
00:18:40,700 --> 00:18:38,130
and take out everything else or you

443
00:18:42,530 --> 00:18:40,710
separate hton nutrients needed for our

444
00:18:47,390 --> 00:18:42,540
body and dispose of the acids and

445
00:18:51,770 --> 00:18:47,400
chemicals from our from our systems with

446
00:18:53,380 --> 00:18:51,780
the so with the condensing heat

447
00:18:56,060 --> 00:18:53,390
exchangers you actually condensed water

448
00:18:58,100 --> 00:18:56,070
along with any volatile organic

449
00:18:59,750 --> 00:18:58,110
compounds that could be present along

450
00:19:01,280 --> 00:18:59,760
with some dissolved minerals that may be

451
00:19:04,220 --> 00:19:01,290
present in tiny micro droplets of water

452
00:19:05,750 --> 00:19:04,230
that exists and there's there are

453
00:19:07,790 --> 00:19:05,760
metabolic components that come from the

454
00:19:10,670 --> 00:19:07,800
crew living and exercising in space that

455
00:19:13,130 --> 00:19:10,680
you condensed in that in that moisture

456
00:19:15,800 --> 00:19:13,140
when you go through the the water

457
00:19:17,960 --> 00:19:15,810
recovery process a lot of those

458
00:19:21,980 --> 00:19:17,970
contaminants are either broken down in

459
00:19:23,360 --> 00:19:21,990
the in the catalytic reactor which is

460
00:19:25,070 --> 00:19:23,370
the oxidation unit they're actually

461
00:19:27,050 --> 00:19:25,080
broken down to co2 and bicarbonate and

462
00:19:29,480 --> 00:19:27,060
then scrubbed out using ion exchange

463
00:19:32,240 --> 00:19:29,490

beds in the urine processor assembly

464
00:19:34,010 --> 00:19:32,250
when we're distilling the urine and

465
00:19:36,610 --> 00:19:34,020
bringing over the distillate there's

466
00:19:38,900 --> 00:19:36,620
actually a brine left that's a

467
00:19:41,960 --> 00:19:38,910
concentrated high ionic strength

468
00:19:44,430 --> 00:19:41,970
solution that's discarded in the the

469
00:19:47,550 --> 00:19:44,440
progress vehicles and burned up

470
00:19:49,740 --> 00:19:47,560
oh so makes because they said it's pure

471
00:19:53,100 --> 00:19:49,750
than the water that we have today and we

472
00:19:55,070 --> 00:19:53,110
use just like similar nutrients to make

473
00:19:57,720 --> 00:19:55,080
sure our ward is cleaner so you use more

474
00:19:59,640 --> 00:19:57,730
concentrated once you're saying then no

475
00:20:01,590 --> 00:19:59,650
the the water that the the water that's

476
00:20:04,440 --> 00:20:01,600
produced on the space station is ultra

477
00:20:06,630 --> 00:20:04,450
pure water it is much much cleaner than

478
00:20:10,940 --> 00:20:06,640
than the water that most of us have

479
00:20:13,440 --> 00:20:10,950
access to in the taps in our house the

480
00:20:17,820 --> 00:20:13,450
what you need to remember is that in a

481
00:20:20,940 --> 00:20:17,830
on earth the water supply contains a lot

482
00:20:22,920 --> 00:20:20,950
of runoff from agriculture and Industry

483
00:20:25,080 --> 00:20:22,930
that adds contaminants into the water

484
00:20:26,430 --> 00:20:25,090
that have to be removed with much more

485
00:20:29,280 --> 00:20:26,440
difficult processes on the space station

486
00:20:30,690 --> 00:20:29,290
we're fortunate in that the number of

487
00:20:32,940 --> 00:20:30,700
contaminants that we have to deal with

488
00:20:34,740 --> 00:20:32,950

are fairly limited because it's a

489
00:20:36,780 --> 00:20:34,750
closed-loop environment we're not using

490
00:20:38,220 --> 00:20:36,790
fertilizers we don't have large

491
00:20:40,860 --> 00:20:38,230
industrial or large industrial

492
00:20:43,980 --> 00:20:40,870
operations or agricultural operations so

493
00:20:45,840 --> 00:20:43,990
we're really dealing with the metabolic

494
00:20:48,060 --> 00:20:45,850
load from the from the astronauts and

495
00:20:49,320 --> 00:20:48,070
then some of the off-gas and components

496
00:20:51,180 --> 00:20:49,330
from the materials and the products that

497
00:20:52,560 --> 00:20:51,190
they use in space another good reason to

498
00:20:56,640 --> 00:20:52,570
be an astronaut right you get cleaner

499
00:21:01,690 --> 00:20:56,650
water absolutely and you get to drink

500
00:21:05,470 --> 00:21:04,060
I think that's about all the questions

501
00:21:08,080 --> 00:21:05,480
we have time for at this time thank you

502
00:21:09,279 --> 00:21:08,090
so much dan for joining us and we really

503
00:21:10,750 --> 00:21:09,289
appreciate you taking the time to answer

504
00:21:12,549 --> 00:21:10,760
some of these questions with us and

505
00:21:14,769 --> 00:21:12,559
thanks so much to the students we enjoy

506
00:21:16,210 --> 00:21:14,779
talking with you hope we were helpful

507
00:21:18,250 --> 00:21:16,220
and were able to answer a lot of your