1
00:00:07,510 --> 00:00:05,910
nasa's jet propulsion laboratory

2
00:00:10,230 --> 00:00:07,520
presents

3
00:00:12,230 --> 00:00:10,240
the von carmen lecture a series of talks

4
00:00:12,950 --> 00:00:12,240
by scientists and engineers who are

5
00:00:16,070 --> 00:00:12,960
exploring

6
00:00:45,110 --> 00:00:16,080
our planet our solar system and all

7
00:00:45,120 --> 00:00:48,310
can you hear me

8
00:00:52,549 --> 00:00:51,110
and this is why we they see welcome

9
00:00:55,910 --> 00:00:52,559
already talking about

10
00:00:57,510 --> 00:00:55,920
technical issues thank you everybody uh

11
00:00:59,430 --> 00:00:57,520
well put very pleasant good evening to

12
00:01:01,110 --> 00:00:59,440
you wherever you are i'm brian white

13
00:01:01,910 --> 00:01:01,120

from jpl's office of communications and

14
00:01:04,149 --> 00:01:01,920
education

15
00:01:05,910 --> 00:01:04,159
and apparently i don't know how to use a

16
00:01:06,870 --> 00:01:05,920
mute button like the rest of the country

17
00:01:09,510 --> 00:01:06,880
right now

18
00:01:10,950 --> 00:01:09,520
welcome to the von carmen lecture series

19
00:01:12,630 --> 00:01:10,960
we're here to talk about planetary

20
00:01:14,870 --> 00:01:12,640
protection it protects our solar system

21
00:01:16,950 --> 00:01:14,880
from contamination by earth

22
00:01:18,390 --> 00:01:16,960
and protects earth from possible life

23
00:01:19,590 --> 00:01:18,400
forms that may be brought back it's a

24
00:01:21,190 --> 00:01:19,600
vital process

25
00:01:22,950 --> 00:01:21,200
but not one that's talked about too much

26
00:01:23,590 --> 00:01:22,960
and our speaker tonight will be breaking

27
00:01:25,190 --> 00:01:23,600
down

28
00:01:27,350 --> 00:01:25,200
how she protects the earth from the scum

29
00:01:29,270 --> 00:01:27,360
of the universe and the universe

30
00:01:30,630 --> 00:01:29,280
from the scum of earth now if we run

31
00:01:33,109 --> 00:01:30,640
into any technical

32
00:01:34,789 --> 00:01:33,119
technical difficulties like we just did

33
00:01:36,390 --> 00:01:34,799
we ask for your patience and stick with

34
00:01:38,069 --> 00:01:36,400
us as we get them sorted out

35
00:01:40,469 --> 00:01:38,079
as always we like to remind you that

36
00:01:41,830 --> 00:01:40,479
this is your space program

37
00:01:43,510 --> 00:01:41,840
we want you to be involved in the

38
00:01:45,830 --> 00:01:43,520

conversation this evening

39
00:01:47,910 --> 00:01:45,840
please ask questions in the chat and our

40
00:01:48,950 --> 00:01:47,920
amazing social media team will pass them

41
00:01:50,710 --> 00:01:48,960
along to us

42
00:01:52,310 --> 00:01:50,720
and we'll try to get to as many of your

43
00:01:53,590 --> 00:01:52,320
questions as possible throughout our

44
00:01:56,389 --> 00:01:53,600
discussion this evening

45
00:01:57,590 --> 00:01:56,399
but if you do not see the chat please

46
00:01:59,990 --> 00:01:57,600
refresh your page

47
00:02:01,830 --> 00:02:00,000
and it should be right there and joining

48
00:02:03,749 --> 00:02:01,840
us tonight as co-host fielding your

49
00:02:07,190 --> 00:02:03,759
questions this evening is my colleague

50
00:02:08,550 --> 00:02:07,200
nikki weirich hi nikki hi brian

51
00:02:09,990 --> 00:02:08,560
thanks for having me tonight and uh

52
00:02:11,910 --> 00:02:10,000
folks out there make sure you put lots

53
00:02:13,110 --> 00:02:11,920
of questions in tonight i'm very excited

54
00:02:14,630 --> 00:02:13,120
for our speaker and to

55
00:02:17,270 --> 00:02:14,640
ask a lot of those great questions for

56
00:02:20,309 --> 00:02:19,030
thank you very much nikki now our

57
00:02:21,910 --> 00:02:20,319
speaker tonight

58
00:02:24,790 --> 00:02:21,920
received her bachelor's degree in

59
00:02:26,710 --> 00:02:24,800
physics from hampton university in 2006

60
00:02:28,309 --> 00:02:26,720
and a master's in a phd in mechanical

61
00:02:30,390 --> 00:02:28,319
engineering with a concentration in

62
00:02:31,430 --> 00:02:30,400
thermal fluid sciences from drexel

63
00:02:32,949 --> 00:02:31,440

university

64
00:02:35,110 --> 00:02:32,959
she is currently the planetary

65
00:02:36,949 --> 00:02:35,120
protection lead for the europa lander

66
00:02:38,949 --> 00:02:36,959
concept at nasa's jet propulsion

67
00:02:41,350 --> 00:02:38,959
laboratory having recently served

68
00:02:43,270 --> 00:02:41,360
as the planetary protection lead of the

69
00:02:45,270 --> 00:02:43,280
mars 2020 mission

70
00:02:46,470 --> 00:02:45,280
in addition to her work at jpl she also

71
00:02:47,910 --> 00:02:46,480
enjoys public outreach

72
00:02:49,750 --> 00:02:47,920
collaborating with schools lecture

73
00:02:52,070 --> 00:02:49,760
series such as this one and

74
00:02:54,150 --> 00:02:52,080
media organizations to spread the love

75
00:02:57,190 --> 00:02:54,160
of steam please welcome

76
00:02:59,509 --> 00:02:57,200
dr mujigay cooper

77
00:03:01,190 --> 00:02:59,519
hi thanks so much for having me brian

78
00:03:04,229 --> 00:03:01,200
and feel free to call me moo

79
00:03:06,229 --> 00:03:04,239
from now on i will call you move from

80
00:03:07,830 --> 00:03:06,239
now on it's such a wonderful name

81
00:03:09,750 --> 00:03:07,840
um but let's talk about how you got to

82
00:03:10,630 --> 00:03:09,760
jpl and i love asking this of our

83
00:03:12,309 --> 00:03:10,640
speakers

84
00:03:16,390 --> 00:03:12,319
um because it reminds our audience that

85
00:03:18,710 --> 00:03:16,400
there's not just one path to get to jpl

86
00:03:20,630 --> 00:03:18,720
yeah exactly in fact this this little

87
00:03:23,430 --> 00:03:20,640
visual board here that you see

88
00:03:25,030 --> 00:03:23,440

kind of illustrates my journey to jpl

89
00:03:27,190 --> 00:03:25,040
and it started off you see the little

90
00:03:29,750 --> 00:03:27,200
report card icons the little

91
00:03:30,470 --> 00:03:29,760
little cartoons there i actually was not

92
00:03:32,390 --> 00:03:30,480
very good

93
00:03:33,509 --> 00:03:32,400
at at math and science and actually

94
00:03:35,830 --> 00:03:33,519
reading too

95
00:03:36,550 --> 00:03:35,840
um so for those of you out there that

96
00:03:38,470 --> 00:03:36,560
maybe think

97
00:03:39,670 --> 00:03:38,480
oh i'm not a prodigy i could never work

98
00:03:42,390 --> 00:03:39,680
for nasa that does

99
00:03:43,830 --> 00:03:42,400
not the case at all um so yeah i started

100
00:03:46,229 --> 00:03:43,840
off with poor grades

101
00:03:46,949 --> 00:03:46,239
and as soon as i rented carl sagan's the

102
00:03:49,990 --> 00:03:46,959
cosmos

103
00:03:52,470 --> 00:03:50,000
from the local library i thought oh

104
00:03:53,589 --> 00:03:52,480
i want to be an astrophysicist and now i

105
00:03:55,990 --> 00:03:53,599
understood why

106
00:03:58,070 --> 00:03:56,000
i had to really take an interest in math

107
00:03:59,750 --> 00:03:58,080
and sciences and all of my grades turned

108
00:04:01,270 --> 00:03:59,760
completely around because

109
00:04:02,630 --> 00:04:01,280
i was the kid in school that sat through

110
00:04:03,509 --> 00:04:02,640
the class thinking why do i even need

111
00:04:06,070 --> 00:04:03,519
this

112
00:04:06,710 --> 00:04:06,080
so yeah did improve my grades in math

113
00:04:08,710 --> 00:04:06,720

and science

114
00:04:10,470 --> 00:04:08,720
everybody has a nerd origin story that's

115
00:04:14,710 --> 00:04:10,480
me and my younger sister

116
00:04:15,670 --> 00:04:14,720
a diving marching band um after that i

117
00:04:18,310 --> 00:04:15,680
applied to

118
00:04:19,349 --> 00:04:18,320
um to college uh while i was actually

119
00:04:22,550 --> 00:04:19,359
when i was 15

120
00:04:23,030 --> 00:04:22,560
that was my one big lesson in setting a

121
00:04:26,550 --> 00:04:23,040
goal

122
00:04:28,230 --> 00:04:26,560
and failing at it uh and

123
00:04:29,830 --> 00:04:28,240
i'm glad i did because it took me

124
00:04:32,550 --> 00:04:29,840
another year to grow

125
00:04:34,870 --> 00:04:32,560
mature uh and i actually started college

126
00:04:38,150 --> 00:04:34,880
at hampton university at 16

127
00:04:40,870 --> 00:04:38,160
and after that all of my summers i spent

128
00:04:43,510 --> 00:04:40,880
at nasa langley all of the school year

129
00:04:44,790 --> 00:04:43,520
times i spent doing research at

130
00:04:46,870 --> 00:04:44,800
atmospheric sciences center for

131
00:04:49,189 --> 00:04:46,880
atmospheric sciences at hanson

132
00:04:50,390 --> 00:04:49,199
and eventually i was able to go to

133
00:04:53,830 --> 00:04:50,400
graduate school

134
00:04:54,390 --> 00:04:53,840
do an internship um at jpl and thanks to

135
00:04:57,350 --> 00:04:54,400
dr

136
00:04:58,070 --> 00:04:57,360
venkateshwaran at jpl i was hired as a

137
00:05:02,950 --> 00:04:58,080
postdoc

138
00:05:06,710 --> 00:05:04,790

i love hearing you talk about that

139
00:05:08,390 --> 00:05:06,720
because it reminds

140
00:05:10,310 --> 00:05:08,400
me your failure you called it your

141
00:05:11,189 --> 00:05:10,320
failure in this was that you went to

142
00:05:13,430 --> 00:05:11,199
college

143
00:05:16,310 --> 00:05:13,440
only a little early out of high school

144
00:05:19,350 --> 00:05:16,320
not as early as you wanted to go

145
00:05:21,189 --> 00:05:19,360
um but talk about that i mean that that

146
00:05:23,029 --> 00:05:21,199
turn around between

147
00:05:25,510 --> 00:05:23,039
not really being into it and suddenly

148
00:05:28,390 --> 00:05:25,520
you that spark that moment hits you

149
00:05:30,230 --> 00:05:28,400
yeah it's that light bulb moment is what

150
00:05:32,150 --> 00:05:30,240
what i call it and i feel like

151
00:05:33,909 --> 00:05:32,160
everybody has a light bulb moment

152
00:05:36,390 --> 00:05:33,919
everyone has a passion

153
00:05:36,950 --> 00:05:36,400
and one day it'll turn on for you and

154
00:05:39,029 --> 00:05:36,960
you don't

155
00:05:40,870 --> 00:05:39,039
even know why that would happen right

156
00:05:42,550 --> 00:05:40,880
but it'll turn on and i just wish

157
00:05:43,350 --> 00:05:42,560
everybody has their light bulb moment no

158
00:05:46,469 --> 00:05:43,360
matter

159
00:05:48,230 --> 00:05:46,479
what field you decide to go into

160
00:05:49,830 --> 00:05:48,240
very cool i'm a big fan of those light

161
00:05:50,550 --> 00:05:49,840
bulb moments but let's get into your

162
00:05:53,029 --> 00:05:50,560
topic

163
00:05:54,230 --> 00:05:53,039

let's talk about planetary protection if

164
00:05:55,270 --> 00:05:54,240
you're watching this and you have no

165
00:05:56,469 --> 00:05:55,280
idea what it is

166
00:05:57,749 --> 00:05:56,479
when i first started working here i

167
00:05:59,670 --> 00:05:57,759
didn't know what it was what is

168
00:06:03,670 --> 00:05:59,680
planetary protection

169
00:06:05,749 --> 00:06:03,680
to bring it back to the basics

170
00:06:07,350 --> 00:06:05,759
it's kind of like the same rules as when

171
00:06:08,870 --> 00:06:07,360
you go to a national park the whole

172
00:06:11,430 --> 00:06:08,880
leave no trace

173
00:06:13,430 --> 00:06:11,440
when you explore other planets you want

174
00:06:13,990 --> 00:06:13,440
to make sure that you preserve the

175
00:06:16,390 --> 00:06:14,000
natural

176
00:06:17,390 --> 00:06:16,400
environment that is there especially if

177
00:06:20,070 --> 00:06:17,400
there's this high

178
00:06:20,550 --> 00:06:20,080
astrobiological interest in possibly

179
00:06:23,350 --> 00:06:20,560
finding

180
00:06:25,029 --> 00:06:23,360
ancient life you want to make sure you

181
00:06:26,790 --> 00:06:25,039
don't contaminate that environment

182
00:06:28,790 --> 00:06:26,800
and the same thing when we bring samples

183
00:06:29,830 --> 00:06:28,800
back one day we want to make sure that

184
00:06:31,590 --> 00:06:29,840
our biosphere

185
00:06:32,950 --> 00:06:31,600
is protected from any inadvertent

186
00:06:35,830 --> 00:06:32,960
contamination

187
00:06:37,270 --> 00:06:35,840
so it's just the right thing to do it's

188
00:06:38,870 --> 00:06:37,280

the right thing to do

189
00:06:40,710 --> 00:06:38,880
um so let's go to our next image and

190
00:06:41,590 --> 00:06:40,720
let's see you doing the right thing to

191
00:06:47,189 --> 00:06:41,600
do

192
00:06:48,870 --> 00:06:47,199
among many things we take a ton of

193
00:06:51,189 --> 00:06:48,880
samples of the spacecraft

194
00:06:53,189 --> 00:06:51,199
and this is one uh one illustration of

195
00:06:55,430 --> 00:06:53,199
me taking a sample there

196
00:06:56,390 --> 00:06:55,440
and if you go to the next slide actually

197
00:06:59,830 --> 00:06:56,400
you can see

198
00:07:03,589 --> 00:06:59,840
a picture of how we take

199
00:07:06,710 --> 00:07:03,599
if you go to slide number three

200
00:07:08,469 --> 00:07:06,720
you can see also we bake sample

201
00:07:10,150 --> 00:07:08,479
bake our spacecraft out too in small

202
00:07:11,029 --> 00:07:10,160
pieces not the entire spacecraft like

203
00:07:13,189 --> 00:07:11,039
viking

204
00:07:14,070 --> 00:07:13,199
but we we take parts of the sample or

205
00:07:16,070 --> 00:07:14,080
the spacecraft

206
00:07:17,830 --> 00:07:16,080
and this actually is the most critical

207
00:07:21,110 --> 00:07:17,840
part of the spacecraft

208
00:07:22,469 --> 00:07:21,120
it is the tube assemblies and the volume

209
00:07:25,029 --> 00:07:22,479
assessment probes

210
00:07:26,070 --> 00:07:25,039
uh and also the seals that's called the

211
00:07:29,270 --> 00:07:26,080
dvt

212
00:07:31,270 --> 00:07:29,280
and that is in its little case there

213
00:07:32,550 --> 00:07:31,280

um after it was baked out right before

214
00:07:33,110 --> 00:07:32,560
it was integrated at the cape for the

215
00:07:36,150 --> 00:07:33,120
very

216
00:07:37,589 --> 00:07:36,160
last time and that was baked out at 150

217
00:07:40,629 --> 00:07:37,599
degrees celsius for

218
00:07:41,270 --> 00:07:40,639
26 hours so that's some of the ways that

219
00:07:54,629 --> 00:07:41,280
we

220
00:07:56,950 --> 00:07:54,639
getting it out there

221
00:07:58,710 --> 00:07:56,960
how important is this this seems like it

222
00:07:59,430 --> 00:07:58,720
would be a big deal uh with mission

223
00:08:02,710 --> 00:07:59,440
development

224
00:08:05,189 --> 00:08:02,720
at the early stages of it too yeah

225
00:08:06,629 --> 00:08:05,199
that's a really really great point um in

226
00:08:08,710 --> 00:08:06,639
fact if you go to the

227
00:08:11,830 --> 00:08:08,720
the next visual aid we have so many

228
00:08:14,230 --> 00:08:11,840
visual aids we put together for you all

229
00:08:15,749 --> 00:08:14,240
so planetary protection would not work

230
00:08:17,670 --> 00:08:15,759
if we didn't have

231
00:08:18,790 --> 00:08:17,680
everybody involved kind of on the same

232
00:08:20,390 --> 00:08:18,800
page and

233
00:08:21,909 --> 00:08:20,400
all the way from the beginning at the

234
00:08:23,749 --> 00:08:21,919
design phase the

235
00:08:25,189 --> 00:08:23,759
engineers who designed these wonderful

236
00:08:28,230 --> 00:08:25,199
parts you see here

237
00:08:30,070 --> 00:08:28,240
the seal dispenser on that left side the

238
00:08:31,430 --> 00:08:30,080

sample tube in the storage which i

239
00:08:34,230 --> 00:08:31,440
actually have a fun

240
00:08:35,110 --> 00:08:34,240
3d printed visual aid here the same

241
00:08:36,870 --> 00:08:35,120
thing

242
00:08:39,350 --> 00:08:36,880
and the volume assessment station all of

243
00:08:41,589 --> 00:08:39,360
those parts are going to directly touch

244
00:08:43,269 --> 00:08:41,599
the martian sample and there was a

245
00:08:45,190 --> 00:08:43,279
special part that was designed by the

246
00:08:46,150 --> 00:08:45,200
engineers to meet planetary protection

247
00:08:49,190 --> 00:08:46,160
needs to keep

248
00:08:52,389 --> 00:08:49,200
those critical pieces extremely clean

249
00:08:55,269 --> 00:08:52,399
so if you imagine my finger is the arm

250
00:08:57,350 --> 00:08:55,279
inside of the belly of the rover the way

251
00:08:57,750 --> 00:08:57,360
we manipulate the tubes is we take it

252
00:09:00,949 --> 00:08:57,760
out

253
00:09:02,550 --> 00:09:00,959
of the sheath and then this represents

254
00:09:04,070 --> 00:09:02,560
the tube that you're going to acquire

255
00:09:07,190 --> 00:09:04,080
the sample and

256
00:09:09,750 --> 00:09:07,200
this glove we call it a glove protects

257
00:09:10,710 --> 00:09:09,760
the arm from directly touching the tube

258
00:09:12,710 --> 00:09:10,720
so it keeps

259
00:09:14,870 --> 00:09:12,720
the really critical areas extremely

260
00:09:17,670 --> 00:09:14,880
clean so this was engineered

261
00:09:19,829 --> 00:09:17,680
by um by our really amazing engineers

262
00:09:22,630 --> 00:09:19,839
early on so that we make sure we meet

263
00:09:24,310 --> 00:09:22,640

the planetary protection needs

264
00:09:25,829 --> 00:09:24,320
that's so cool and i love that you've

265
00:09:26,710 --> 00:09:25,839
got a prop it's always great to have

266
00:09:30,150 --> 00:09:26,720
props with this

267
00:09:32,630 --> 00:09:30,160
um because it also demonstrates really

268
00:09:34,790 --> 00:09:32,640
it it's not a theory it's it's in

269
00:09:36,630 --> 00:09:34,800
practicality and if we go to our next

270
00:09:38,630 --> 00:09:36,640
image we can see you taking a look at

271
00:09:42,230 --> 00:09:38,640
those from underneath

272
00:09:44,550 --> 00:09:42,240
exactly yeah yeah and

273
00:09:45,590 --> 00:09:44,560
and it's really i mean we all had to

274
00:09:48,949 --> 00:09:45,600
pinch ourselves

275
00:09:50,710 --> 00:09:48,959
seeing it in real life um it's not just

276
00:09:51,509 --> 00:09:50,720
a cad drawing anymore it's not in piece

277
00:09:53,990 --> 00:09:51,519
parts uh

278
00:09:56,389 --> 00:09:54,000
being assembled that that was the final

279
00:09:59,030 --> 00:09:56,399
deal and that sample was taken

280
00:10:01,030 --> 00:09:59,040
just moments before the belly pan was

281
00:10:03,670 --> 00:10:01,040
put on the bottom of the rover

282
00:10:04,870 --> 00:10:03,680
so that's yeah and that sample really

283
00:10:07,269 --> 00:10:04,880
illustrates how

284
00:10:07,910 --> 00:10:07,279
we need help from all kinds of people

285
00:10:11,590 --> 00:10:07,920
you know

286
00:10:15,590 --> 00:10:11,600
to make this happen that's very cool

287
00:10:17,190 --> 00:10:15,600
um yeah it's just it's i love your joy

288
00:10:18,870 --> 00:10:17,200

and your excitement that you you just

289
00:10:21,190 --> 00:10:18,880
talking about it's

290
00:10:23,030 --> 00:10:21,200
as the spacecraft and once again folks

291
00:10:25,110 --> 00:10:23,040
mars 2020 is heading

292
00:10:26,870 --> 00:10:25,120
to mars scheduled to land on february

293
00:10:27,990 --> 00:10:26,880
18th we'll keep saying that but the

294
00:10:30,870 --> 00:10:28,000
mission that

295
00:10:32,230 --> 00:10:30,880
that moo is working on um but this can't

296
00:10:35,269 --> 00:10:32,240
be done in a vacuum right

297
00:10:36,470 --> 00:10:35,279
planetary protection has to be

298
00:10:38,870 --> 00:10:36,480
you're not just looking over somebody's

299
00:10:41,030 --> 00:10:38,880
shoulder like hey don't do that are you

300
00:10:42,230 --> 00:10:41,040
yeah no in fact what you see in this

301
00:10:44,710 --> 00:10:42,240
picture here

302
00:10:46,550 --> 00:10:44,720
it took the agreement of a lot of people

303
00:10:48,710 --> 00:10:46,560
i mean first of all we have to make sure

304
00:10:50,069 --> 00:10:48,720
nasa headquarters is on board because

305
00:10:51,990 --> 00:10:50,079
they have to make sure

306
00:10:53,110 --> 00:10:52,000
that the planetary protection policies

307
00:10:55,509 --> 00:10:53,120
and procedures are

308
00:10:57,509 --> 00:10:55,519
equally applied across the board so we

309
00:11:00,150 --> 00:10:57,519
have headquarters that we're

310
00:11:01,110 --> 00:11:00,160
always constantly communicating with um

311
00:11:03,350 --> 00:11:01,120
there's also

312
00:11:05,590 --> 00:11:03,360
a processes that we have where for

313
00:11:06,550 --> 00:11:05,600

example independent reviewers come in

314
00:11:08,630 --> 00:11:06,560
and they see

315
00:11:10,550 --> 00:11:08,640
exactly what we're doing and they make

316
00:11:11,990 --> 00:11:10,560
sure that all of our processes are sound

317
00:11:13,829 --> 00:11:12,000
so i know there's even a couple of

318
00:11:16,310 --> 00:11:13,839
independent reviewers uh listening to

319
00:11:18,389 --> 00:11:16,320
the swan carmen lecture today

320
00:11:19,670 --> 00:11:18,399
um but yeah we need just a group of

321
00:11:22,389 --> 00:11:19,680
people to include

322
00:11:23,670 --> 00:11:22,399
also our own team members that swab if i

323
00:11:26,150 --> 00:11:23,680
swab the wrong place

324
00:11:26,949 --> 00:11:26,160
that's bad for the contamination control

325
00:11:28,310 --> 00:11:26,959
engineers

326
00:11:30,550 --> 00:11:28,320
so we have to make sure we're all in

327
00:11:33,350 --> 00:11:30,560
agreement and all on the same page

328
00:11:34,069 --> 00:11:33,360
about where i sample and when in the

329
00:11:36,710 --> 00:11:34,079
process

330
00:11:40,630 --> 00:11:36,720
myself and my team member sample so yeah

331
00:11:44,470 --> 00:11:43,590
well let's talk about um specifically

332
00:11:46,150 --> 00:11:44,480
like

333
00:11:47,910 --> 00:11:46,160
mars is one thing right you're going to

334
00:11:49,190 --> 00:11:47,920
mars there's a very specific idea of

335
00:11:53,030 --> 00:11:49,200
what we have there

336
00:11:55,030 --> 00:11:53,040
um let's say you're going someplace

337
00:11:58,470 --> 00:11:55,040
a little further out let's say you're

338
00:12:00,470 --> 00:11:58,480

going to some place like europa

339
00:12:02,150 --> 00:12:00,480
how do you leverage these models how do

340
00:12:05,509 --> 00:12:02,160
you kind of assess

341
00:12:08,150 --> 00:12:05,519
what is okay and what isn't yeah

342
00:12:09,990 --> 00:12:08,160
so there are a lot of tried and true

343
00:12:12,230 --> 00:12:10,000
policies and procedures that

344
00:12:14,150 --> 00:12:12,240
we use to make sure that we're doing the

345
00:12:16,550 --> 00:12:14,160
right thing that the spacecraft is clean

346
00:12:17,269 --> 00:12:16,560
but we also bridge and infuse a lot of

347
00:12:19,350 --> 00:12:17,279
new

348
00:12:21,030 --> 00:12:19,360
and cutting edge technologies for

349
00:12:23,430 --> 00:12:21,040
example we're looking at

350
00:12:24,310 --> 00:12:23,440
metagenomics so looking at the genetic

351
00:12:26,470 --> 00:12:24,320
material

352
00:12:27,750 --> 00:12:26,480
of everything that might be present on

353
00:12:29,509 --> 00:12:27,760
that spacecraft

354
00:12:31,590 --> 00:12:29,519
and understanding specifically what's

355
00:12:34,870 --> 00:12:31,600
there and what could possibly

356
00:12:36,389 --> 00:12:34,880
uh survive or thrive in that kind of

357
00:12:38,710 --> 00:12:36,399
high radiation environment

358
00:12:40,870 --> 00:12:38,720
on europa so we can really have an even

359
00:12:42,949 --> 00:12:40,880
more tailored and targeted approach

360
00:12:45,269 --> 00:12:42,959
to get rid of for example microbes that

361
00:12:47,269 --> 00:12:45,279
have a higher resistance to radiation

362
00:12:48,949 --> 00:12:47,279
like tinococcus radiodurans

363
00:12:51,110 --> 00:12:48,959

that's one of the most radiation

364
00:12:52,230 --> 00:12:51,120
resistant microbes that we can find on

365
00:12:54,230 --> 00:12:52,240
earth so

366
00:12:56,069 --> 00:12:54,240
we we use a lot of new techniques and

367
00:12:57,110 --> 00:12:56,079
try to infuse that as we continue to

368
00:12:58,949 --> 00:12:57,120
build upon

369
00:13:00,790 --> 00:12:58,959
the the strong foundation of planetary

370
00:13:02,790 --> 00:13:00,800
protection

371
00:13:05,269 --> 00:13:02,800
that's wonderful um into something we

372
00:13:06,389 --> 00:13:05,279
were talking about before we talked

373
00:13:08,790 --> 00:13:06,399
there are different levels for each

374
00:13:10,069 --> 00:13:08,800
mission um

375
00:13:11,430 --> 00:13:10,079
earlier you didn't take the bait when i

376
00:13:11,829 --> 00:13:11,440
said you're not just pointing looking at

377
00:13:13,110 --> 00:13:11,839
people

378
00:13:14,949 --> 00:13:13,120
over their shoulders and pointing out

379
00:13:17,829 --> 00:13:14,959
things that are going wrong um

380
00:13:19,430 --> 00:13:17,839
if we go to image six i mean you have to

381
00:13:23,030 --> 00:13:19,440
be a part of this team

382
00:13:24,949 --> 00:13:23,040
right yeah i love this picture

383
00:13:26,550 --> 00:13:24,959
uh when it comes to talking about

384
00:13:28,550 --> 00:13:26,560
teamwork so we're not

385
00:13:30,069 --> 00:13:28,560
you know over someone's shoulder saying

386
00:13:31,590 --> 00:13:30,079
you know this is wrong you should do

387
00:13:33,829 --> 00:13:31,600
that in a cleaner way

388
00:13:35,350 --> 00:13:33,839

we're all a team so we're shoulder to

389
00:13:36,629 --> 00:13:35,360
shoulder pointing out that there's

390
00:13:37,829 --> 00:13:36,639
something wrong and you need to improve

391
00:13:40,470 --> 00:13:37,839
it now

392
00:13:41,269 --> 00:13:40,480
we're together we're as one um and there

393
00:13:43,430 --> 00:13:41,279
are times

394
00:13:45,030 --> 00:13:43,440
we call each other out because we're all

395
00:13:45,829 --> 00:13:45,040
trying to make sure we do the right

396
00:13:48,710 --> 00:13:45,839
thing

397
00:13:50,710 --> 00:13:48,720
uh and and yeah and this is one great

398
00:13:53,750 --> 00:13:50,720
example so this is a picture

399
00:13:56,629 --> 00:13:53,760
of us unboxing the descent stage at

400
00:13:57,430 --> 00:13:56,639
at the cape at kennedy space center and

401
00:14:00,629 --> 00:13:57,440
in order to

402
00:14:02,550 --> 00:14:00,639
unbox it in a clean way and lift it we

403
00:14:04,870 --> 00:14:02,560
had to make sure that it had a layer of

404
00:14:05,910 --> 00:14:04,880
covering that amerstat layer there that

405
00:14:08,470 --> 00:14:05,920
you see

406
00:14:09,189 --> 00:14:08,480
um in order to because we found out that

407
00:14:10,870 --> 00:14:09,199
the crane

408
00:14:13,110 --> 00:14:10,880
that they're using doesn't have an

409
00:14:15,509 --> 00:14:13,120
umbrella so we had to make sure that

410
00:14:17,670 --> 00:14:15,519
as the crane operated it didn't drop any

411
00:14:19,509 --> 00:14:17,680
new particulates and microbes

412
00:14:21,030 --> 00:14:19,519
on that descent stage that we knew was

413
00:14:24,550 --> 00:14:21,040

already clean before it left

414
00:14:25,189 --> 00:14:24,560
jpl so we came together and they said

415
00:14:28,230 --> 00:14:25,199
all right

416
00:14:30,470 --> 00:14:28,240
we can lift it and we can cut the

417
00:14:32,150 --> 00:14:30,480
the covering so that it still covers the

418
00:14:33,030 --> 00:14:32,160
top of the descent stage so we're able

419
00:14:34,790 --> 00:14:33,040
to

420
00:14:36,870 --> 00:14:34,800
get the cleanliness requirements

421
00:14:39,269 --> 00:14:36,880
achieved and move the spacecraft because

422
00:14:41,829 --> 00:14:39,279
we need a spacecraft too

423
00:14:43,990 --> 00:14:41,839
so yeah teamwork makes the dream work

424
00:14:48,550 --> 00:14:44,000
and teamwork makes the dream work

425
00:14:54,710 --> 00:14:52,389
uh evolution is there in techniques

426
00:14:55,990 --> 00:14:54,720
um i mean is what you're doing on this

427
00:14:58,710 --> 00:14:56,000
mission different than what

428
00:14:59,350 --> 00:14:58,720
has done been done on earlier missions

429
00:15:01,430 --> 00:14:59,360
yeah

430
00:15:03,110 --> 00:15:01,440
there are some things that stay the same

431
00:15:05,150 --> 00:15:03,120
uh and a lot of the

432
00:15:06,310 --> 00:15:05,160
swabbing that we're doing i mean

433
00:15:09,509 --> 00:15:06,320
microbiology

434
00:15:12,150 --> 00:15:09,519
is a very old and uh

435
00:15:13,030 --> 00:15:12,160
and also very much evolving uh

436
00:15:15,750 --> 00:15:13,040
discipline

437
00:15:18,389 --> 00:15:15,760
but a lot of what used to was invented

438
00:15:21,430 --> 00:15:18,399

you know 30 40 50 60 years ago is still

439
00:15:22,470 --> 00:15:21,440
pretty reliable uh so we still take

440
00:15:24,470 --> 00:15:22,480
swabs

441
00:15:25,829 --> 00:15:24,480
of the spacecraft or wipes depending on

442
00:15:27,189 --> 00:15:25,839
the surface area that we're taking

443
00:15:28,550 --> 00:15:27,199
samples from

444
00:15:30,949 --> 00:15:28,560
and we grow them up and we look for

445
00:15:32,470 --> 00:15:30,959
bacterial endospores and these are

446
00:15:34,790 --> 00:15:32,480
seed like microbes that can make these

447
00:15:37,910 --> 00:15:34,800
seed like structures that could possibly

448
00:15:40,550 --> 00:15:37,920
survive that harsh environment of space

449
00:15:42,470 --> 00:15:40,560
so we use old tech but then they're

450
00:15:43,590 --> 00:15:42,480
still like we're talking about earlier a

451
00:15:45,430 --> 00:15:43,600
lot of new tech

452
00:15:48,310 --> 00:15:45,440
that we're that we're using so we're

453
00:15:49,910 --> 00:15:48,320
trying to bridge the gap

454
00:15:51,990 --> 00:15:49,920
bridging the gap is great let's go to

455
00:15:56,150 --> 00:15:52,000
actually uh

456
00:15:58,389 --> 00:15:56,160
image seven um and there's some good ah

457
00:15:59,590 --> 00:15:58,399
yeah yes i your eyes lit up you nerd it

458
00:16:02,710 --> 00:15:59,600
out when you saw it

459
00:16:05,749 --> 00:16:02,720
um i love numbers

460
00:16:07,910 --> 00:16:05,759
yeah so this really illustrates uh

461
00:16:09,590 --> 00:16:07,920
the the hard work of every single person

462
00:16:11,590 --> 00:16:09,600
on the planetary protection team

463
00:16:13,430 --> 00:16:11,600

this is not a one-person effort there

464
00:16:15,350 --> 00:16:13,440
were 11 to

465
00:16:17,590 --> 00:16:15,360
depending on the time of you know when

466
00:16:18,629 --> 00:16:17,600
you picked the time point 11 to 15

467
00:16:21,030 --> 00:16:18,639
people

468
00:16:22,949 --> 00:16:21,040
physically working on this mission and

469
00:16:24,310 --> 00:16:22,959
over the course of the entire

470
00:16:28,590 --> 00:16:24,320
seven years we've been collecting

471
00:16:31,590 --> 00:16:28,600
samples we've taken 13 042 swabs

472
00:16:33,509 --> 00:16:31,600
3521 wipes 318

473
00:16:35,430 --> 00:16:33,519
air samples and the reason why we take

474
00:16:36,949 --> 00:16:35,440
air samples is you can imagine when

475
00:16:38,230 --> 00:16:36,959
you're assembling in a clean environment

476
00:16:39,030 --> 00:16:38,240
you have to make sure that the air

477
00:16:41,670 --> 00:16:39,040
around you

478
00:16:43,350 --> 00:16:41,680
is still clean it is a clean room that's

479
00:16:47,110 --> 00:16:43,360
usually clean

480
00:16:48,790 --> 00:16:47,120
and then also we took a 1122

481
00:16:50,310 --> 00:16:48,800
genetic samples remember i was telling

482
00:16:51,749 --> 00:16:50,320
you about looking at the genetic

483
00:16:53,030 --> 00:16:51,759
material and kind of getting an

484
00:16:55,430 --> 00:16:53,040
understanding of what's there

485
00:16:58,710 --> 00:16:55,440
independent of what can be cultured

486
00:16:59,509 --> 00:16:58,720
in the laboratory so we took a lot of

487
00:17:01,189 --> 00:16:59,519
samples

488
00:17:03,749 --> 00:17:01,199

all across the board not only the

489
00:17:04,789 --> 00:17:03,759
spacecraft but the tables that are by

490
00:17:06,549 --> 00:17:04,799
the spacecraft

491
00:17:07,990 --> 00:17:06,559
the tools that you use to hold

492
00:17:08,949 --> 00:17:08,000
particular components because you want

493
00:17:10,230 --> 00:17:08,959
to make sure

494
00:17:12,470 --> 00:17:10,240
that even the tools that touch the

495
00:17:15,429 --> 00:17:12,480
spacecraft are extremely clean

496
00:17:16,870 --> 00:17:15,439
so we took we took a lot of samples we

497
00:17:18,230 --> 00:17:16,880
have to make sure we do it right

498
00:17:20,789 --> 00:17:18,240
because we're bringing these samples

499
00:17:23,429 --> 00:17:20,799
back one day and we have to ensure that

500
00:17:25,350 --> 00:17:23,439
it is clean enough

501
00:17:26,470 --> 00:17:25,360
so if our spacecraft is on mars and it

502
00:17:28,870 --> 00:17:26,480
sends back and it

503
00:17:30,549 --> 00:17:28,880
turns out it was you we found samples of

504
00:17:32,630 --> 00:17:30,559
mu on mars

505
00:17:34,310 --> 00:17:32,640
you would have the sample of that to

506
00:17:36,549 --> 00:17:34,320
match that with

507
00:17:37,510 --> 00:17:36,559
yeah well we really focus on the

508
00:17:40,789 --> 00:17:37,520
microbial

509
00:17:42,230 --> 00:17:40,799
uh dna the the human side we we dump

510
00:17:46,310 --> 00:17:42,240
that data

511
00:17:49,669 --> 00:17:46,320
no human dna no human dna very cool

512
00:17:51,590 --> 00:17:49,679
um i want to talk about

513
00:17:53,590 --> 00:17:51,600

these you mentioned it a little earlier

514
00:17:56,390 --> 00:17:53,600
but um

515
00:17:58,830 --> 00:17:56,400
owing to the changing pp context i mean

516
00:18:01,990 --> 00:17:58,840
these part of your requirements

517
00:18:04,150 --> 00:18:02,000
um we uh if we bring up the image of

518
00:18:05,909 --> 00:18:04,160
europa i think it's number nine

519
00:18:07,190 --> 00:18:05,919
um sending something there and you

520
00:18:09,669 --> 00:18:07,200
talked about

521
00:18:10,310 --> 00:18:09,679
development i mean everything kind of

522
00:18:13,350 --> 00:18:10,320
evolves

523
00:18:14,070 --> 00:18:13,360
in in these different ways um yeah how

524
00:18:17,990 --> 00:18:14,080
do you reassess

525
00:18:21,110 --> 00:18:18,000
these guidelines yeah i mean it takes

526
00:18:23,990 --> 00:18:21,120
a lot of communication and a lot of

527
00:18:25,669 --> 00:18:24,000
uh meetings right by people far far

528
00:18:28,470 --> 00:18:25,679
above my head right

529
00:18:29,990 --> 00:18:28,480
but it takes the the minds of many many

530
00:18:32,470 --> 00:18:30,000
bright scientists

531
00:18:34,870 --> 00:18:32,480
to come together and make sure that the

532
00:18:36,950 --> 00:18:34,880
needs of you know going to europa

533
00:18:37,909 --> 00:18:36,960
are not only satisfied but really well

534
00:18:39,750 --> 00:18:37,919
understood

535
00:18:41,270 --> 00:18:39,760
and one of the ways for example that

536
00:18:44,549 --> 00:18:41,280
we're trying to implement that

537
00:18:46,549 --> 00:18:44,559
on the europa lander mission is making a

538
00:18:48,230 --> 00:18:46,559

probability model to understand the

539
00:18:49,669 --> 00:18:48,240
probability of contamination

540
00:18:51,590 --> 00:18:49,679
there are so many factors that you need

541
00:18:53,350 --> 00:18:51,600
to understand uh

542
00:18:54,630 --> 00:18:53,360
number one are there these special

543
00:18:57,510 --> 00:18:54,640
microbes on there that can

544
00:18:58,950 --> 00:18:57,520
resist um a rad high radiation

545
00:19:03,669 --> 00:18:58,960
environment

546
00:19:05,830 --> 00:19:03,679
and how much can we rely on that to

547
00:19:08,870 --> 00:19:05,840
really kill off the microbes as we

548
00:19:09,990 --> 00:19:08,880
make our way to to europa so there's a

549
00:19:12,789 --> 00:19:10,000
lot of new things that we're

550
00:19:15,430 --> 00:19:12,799
trying to to incorporate to really

551
00:19:16,950 --> 00:19:15,440
understand this picture better

552
00:19:18,710 --> 00:19:16,960
well i think that's something that's

553
00:19:21,750 --> 00:19:18,720
neglected or not thought of is

554
00:19:24,950 --> 00:19:21,760
all the things that you don't know yet

555
00:19:28,070 --> 00:19:24,960
um how do you predict to how do you

556
00:19:30,150 --> 00:19:28,080
protect what you can't predict

557
00:19:32,230 --> 00:19:30,160
yeah that's a really great question and

558
00:19:33,029 --> 00:19:32,240
a lot of times when we have uh these

559
00:19:35,510 --> 00:19:33,039
peer reviews

560
00:19:37,110 --> 00:19:35,520
or i was mentioning one of the ways that

561
00:19:37,590 --> 00:19:37,120
we make sure we're doing the right thing

562
00:19:39,909 --> 00:19:37,600
is

563
00:19:41,510 --> 00:19:39,919

if you're in a group all alone if you're

564
00:19:42,710 --> 00:19:41,520
in a room with just a team of people you

565
00:19:44,070 --> 00:19:42,720
usually work with

566
00:19:45,830 --> 00:19:44,080
you're going to have a lot of innovative

567
00:19:47,350 --> 00:19:45,840
ideas but there might be something that

568
00:19:49,590 --> 00:19:47,360
could have fallen through the cracks

569
00:19:50,870 --> 00:19:49,600
so you want to make sure that you invite

570
00:19:53,510 --> 00:19:50,880
all the right people

571
00:19:54,630 --> 00:19:53,520
the right stakeholders to make sure that

572
00:19:56,150 --> 00:19:54,640
things weren't missed

573
00:19:58,070 --> 00:19:56,160
and they usually bring something new to

574
00:19:59,750 --> 00:19:58,080
the table so that we can get a

575
00:20:01,190 --> 00:19:59,760
comprehensive picture of what we have to

576
00:20:04,710 --> 00:20:01,200
do

577
00:20:06,230 --> 00:20:04,720
cool i want to go back to the polo that

578
00:20:09,510 --> 00:20:06,240
you're wearing right now

579
00:20:12,549 --> 00:20:09,520
you've got your atlo mars 2020 um

580
00:20:16,230 --> 00:20:12,559
from the launch a story that you

581
00:20:18,230 --> 00:20:16,240
you told me was about um

582
00:20:20,070 --> 00:20:18,240
and this kind of leads into

583
00:20:21,510 --> 00:20:20,080
communicating with headquarters but

584
00:20:25,350 --> 00:20:21,520
when's the last time that you

585
00:20:29,990 --> 00:20:28,710
uh yeah i love this question because

586
00:20:32,149 --> 00:20:30,000
there are there are pictures that we're

587
00:20:33,510 --> 00:20:32,159
not allowed to share right

588
00:20:35,270 --> 00:20:33,520

while we're on the launch pad but we

589
00:20:38,630 --> 00:20:35,280
sample all the way

590
00:20:40,149 --> 00:20:38,640
until the very very end um myself

591
00:20:41,990 --> 00:20:40,159
and one of my colleagues guyana

592
00:20:45,270 --> 00:20:42,000
kazarians we were

593
00:20:47,430 --> 00:20:45,280
in the vertical integration facility

594
00:20:49,669 --> 00:20:47,440
before they put the aeroshell door on we

595
00:20:52,470 --> 00:20:49,679
had to sample the aeroshell door

596
00:20:54,070 --> 00:20:52,480
they placed that on a few days later we

597
00:20:55,909 --> 00:20:54,080
were ready to close up the

598
00:20:57,430 --> 00:20:55,919
entire vehicle so right before the

599
00:20:58,230 --> 00:20:57,440
fairing door and the fairing is that

600
00:21:00,789 --> 00:20:58,240
part that you see

601
00:21:01,750 --> 00:21:00,799
during the launch that launches into

602
00:21:02,870 --> 00:21:01,760
into space

603
00:21:04,710 --> 00:21:02,880
well actually it doesn't go all the way

604
00:21:05,669 --> 00:21:04,720
to space but it launches and then it

605
00:21:07,830 --> 00:21:05,679
separates

606
00:21:08,950 --> 00:21:07,840
we took the last sample before that

607
00:21:12,230 --> 00:21:08,960
fairing door went

608
00:21:15,750 --> 00:21:12,240
on so just days before launch

609
00:21:19,990 --> 00:21:15,760
we were up there taking samples it it's

610
00:21:25,350 --> 00:21:23,909
um so we you mentioned this earlier in

611
00:21:25,909 --> 00:21:25,360
this kind of last question before i want

612
00:21:27,990 --> 00:21:25,919
to

613
00:21:29,190 --> 00:21:28,000

talk about one final so two final things

614
00:21:30,230 --> 00:21:29,200
um

615
00:21:31,990 --> 00:21:30,240
talk about communicating with

616
00:21:34,710 --> 00:21:32,000
headquarters how big of a deal is that

617
00:21:37,430 --> 00:21:34,720
with each individual mission

618
00:21:39,110 --> 00:21:37,440
yeah it's a huge deal headquarters uh

619
00:21:41,110 --> 00:21:39,120
headquarters is the group that signs

620
00:21:42,470 --> 00:21:41,120
off so for example the planetary

621
00:21:45,590 --> 00:21:42,480
protection officer

622
00:21:46,149 --> 00:21:45,600
at nasa headquarters she signs off elisa

623
00:21:48,870 --> 00:21:46,159
pratt

624
00:21:49,510 --> 00:21:48,880
signs off to make sure that yes i indeed

625
00:21:51,190 --> 00:21:49,520
agree

626
00:21:53,190 --> 00:21:51,200
with everything that was done everything

627
00:21:54,789 --> 00:21:53,200
that was presented um

628
00:21:56,710 --> 00:21:54,799
by that time where she's supposed to

629
00:21:57,909 --> 00:21:56,720
sign off she was led through the entire

630
00:21:59,510 --> 00:21:57,919
journey right she doesn't get the

631
00:22:02,549 --> 00:21:59,520
information at the end

632
00:22:04,470 --> 00:22:02,559
um but it's up to her to really certify

633
00:22:06,630 --> 00:22:04,480
that this mission is good to go from a

634
00:22:08,390 --> 00:22:06,640
planetary protection perspective

635
00:22:09,830 --> 00:22:08,400
um and it's not only her but also

636
00:22:10,830 --> 00:22:09,840
everyone else at headquarters i mean

637
00:22:13,190 --> 00:22:10,840
there are a lot of

638
00:22:14,950 --> 00:22:13,200

stakeholders people who are interested

639
00:22:16,630 --> 00:22:14,960
in the science

640
00:22:18,230 --> 00:22:16,640
the science overlaps of what we do for

641
00:22:21,430 --> 00:22:18,240
planetary protection and how

642
00:22:22,870 --> 00:22:21,440
it enables us to do better science

643
00:22:24,950 --> 00:22:22,880
so there's a lot of stakeholders and

644
00:22:27,590 --> 00:22:24,960
they all have to agree

645
00:22:28,950 --> 00:22:27,600
that we've done a great job they all

646
00:22:29,430 --> 00:22:28,960
have to agree that you've done a great

647
00:22:32,789 --> 00:22:29,440
job

648
00:22:34,549 --> 00:22:32,799
um yeah and then

649
00:22:35,669 --> 00:22:34,559
i love your excitement i've said it

650
00:22:36,390 --> 00:22:35,679
before i'm going to keep saying it

651
00:22:37,909 --> 00:22:36,400
because

652
00:22:41,270 --> 00:22:37,919
it makes me excited about planetary

653
00:22:44,870 --> 00:22:41,280
protection um

654
00:22:46,470 --> 00:22:44,880
yeah talk to me about because i know

655
00:22:48,630 --> 00:22:46,480
this is not the only talk you're you're

656
00:22:51,669 --> 00:22:48,640
doing right like i know you go out

657
00:22:53,270 --> 00:22:51,679
all the time and and reach out to people

658
00:22:55,029 --> 00:22:53,280
and kind of a bookend from where we

659
00:22:57,990 --> 00:22:55,039
started um

660
00:22:58,549 --> 00:22:58,000
talk to me about spreading the message

661
00:23:01,590 --> 00:22:58,559
yeah

662
00:23:02,070 --> 00:23:01,600
i mean we were talking a little offline

663
00:23:05,350 --> 00:23:02,080

right

664
00:23:08,230 --> 00:23:05,360
earlier about how just every time i walk

665
00:23:08,549 --> 00:23:08,240
on campus at jpl i pinch myself and my

666
00:23:10,710 --> 00:23:08,559
my

667
00:23:11,669 --> 00:23:10,720
inner middle schooler is just super

668
00:23:13,270 --> 00:23:11,679
excited that

669
00:23:15,830 --> 00:23:13,280
that little kid that got the light bulb

670
00:23:17,190 --> 00:23:15,840
moment and that's why i feel so

671
00:23:19,909 --> 00:23:17,200
passionate about

672
00:23:21,830 --> 00:23:19,919
science uh outreach steam outreach

673
00:23:22,230 --> 00:23:21,840
because we need the artists too to make

674
00:23:23,909 --> 00:23:22,240
these

675
00:23:25,190 --> 00:23:23,919
beautiful graphics that you see today i

676
00:23:26,549 --> 00:23:25,200
mean you should have seen what i gave

677
00:23:27,990 --> 00:23:26,559
them and what they did with these

678
00:23:31,350 --> 00:23:28,000
graphics

679
00:23:32,549 --> 00:23:31,360
so education and outreach is extremely

680
00:23:35,350 --> 00:23:32,559
important to me and i feel

681
00:23:37,110 --> 00:23:35,360
a duty to pay it forward and turn on a

682
00:23:39,990 --> 00:23:37,120
few more light bulbs for others

683
00:23:40,870 --> 00:23:40,000
so yeah the the only contagion that i

684
00:23:43,190 --> 00:23:40,880
agree with is

685
00:23:45,750 --> 00:23:43,200
spreading the love for science and

686
00:23:47,590 --> 00:23:45,760
engineering

687
00:23:49,590 --> 00:23:47,600
very cool now i know there have been

688
00:23:50,710 --> 00:23:49,600

some questions already in the chat

689
00:23:52,310 --> 00:23:50,720
there were questions before we even

690
00:23:53,510 --> 00:23:52,320
started talking tonight people are very

691
00:23:56,950 --> 00:23:53,520
interested in this

692
00:23:58,310 --> 00:23:56,960
so what's going on with our chat nikki

693
00:24:00,710 --> 00:23:58,320
well i have to tell you people are

694
00:24:02,390 --> 00:24:00,720
incredibly as brian said excited about

695
00:24:04,230 --> 00:24:02,400
having you with us tonight

696
00:24:05,510 --> 00:24:04,240
um i want to start with a question from

697
00:24:08,149 --> 00:24:05,520
daniel on twitter

698
00:24:09,830 --> 00:24:08,159
who asks us why are we so worried about

699
00:24:10,950 --> 00:24:09,840
spreading microbes maybe that's how life

700
00:24:13,029 --> 00:24:10,960
got started here

701
00:24:15,040 --> 00:24:13,039
we've got plenty to share so why not

702
00:24:16,310 --> 00:24:15,050
spread the love

703
00:24:18,070 --> 00:24:16,320
[Laughter]

704
00:24:19,510 --> 00:24:18,080
i love how you're so giving with your

705
00:24:22,149 --> 00:24:19,520
microbes um

706
00:24:23,190 --> 00:24:22,159
yeah i mean in a certain context right

707
00:24:26,630 --> 00:24:23,200
you can spread

708
00:24:27,830 --> 00:24:26,640
spread the love uh maybe on in the earth

709
00:24:30,390 --> 00:24:27,840
environment but

710
00:24:32,789 --> 00:24:30,400
when it comes to interplanetary and

711
00:24:34,549 --> 00:24:32,799
exploration and looking at other moons

712
00:24:36,070 --> 00:24:34,559
the goal is to not spread our own

713
00:24:38,149 --> 00:24:36,080

contaminants

714
00:24:39,990 --> 00:24:38,159
in inadvertently right you don't want it

715
00:24:41,350 --> 00:24:40,000
you want to make sure that we are doing

716
00:24:42,390 --> 00:24:41,360
good science and it's just the right

717
00:24:44,870 --> 00:24:42,400
thing to do

718
00:24:45,990 --> 00:24:44,880
and yes that may have been the original

719
00:24:48,710 --> 00:24:46,000
mechanism for

720
00:24:49,789 --> 00:24:48,720
seeding planets you know panspermia is a

721
00:24:53,110 --> 00:24:49,799
a prevalent

722
00:24:53,990 --> 00:24:53,120
astrobiological theory but when we send

723
00:24:55,190 --> 00:24:54,000
spacecraft out

724
00:24:57,029 --> 00:24:55,200
we just want to make sure it's not

725
00:24:58,950 --> 00:24:57,039
because of us

726
00:25:00,549 --> 00:24:58,960
it can happen naturally it can happen by

727
00:25:02,950 --> 00:25:00,559
any other means but

728
00:25:05,269 --> 00:25:02,960
we just don't want to be the the one

729
00:25:08,310 --> 00:25:05,279
spreading based on spacecraft

730
00:25:10,070 --> 00:25:08,320
uh spacecraft transfer

731
00:25:11,350 --> 00:25:10,080
well thanks for uh clearing that up so

732
00:25:12,789 --> 00:25:11,360
now that we know for sure we want to

733
00:25:15,190 --> 00:25:12,799
watch out for that

734
00:25:16,950 --> 00:25:15,200
johnny asks on facebook how do we detect

735
00:25:17,590 --> 00:25:16,960
contaminants that we've never seen

736
00:25:19,830 --> 00:25:17,600
before

737
00:25:21,510 --> 00:25:19,840
that maybe don't look like what we know

738
00:25:23,669 --> 00:25:21,520

on earth or maybe are from earth that we

739
00:25:25,350 --> 00:25:23,679
don't recognize

740
00:25:27,190 --> 00:25:25,360
that's yeah that's a really cool

741
00:25:29,430 --> 00:25:27,200
question and so far

742
00:25:30,870 --> 00:25:29,440
the model that we have in our brains and

743
00:25:33,909 --> 00:25:30,880
that we work to is

744
00:25:34,310 --> 00:25:33,919
life as we know it and there are a lot

745
00:25:36,390 --> 00:25:34,320
of

746
00:25:38,310 --> 00:25:36,400
really brilliant people who discover

747
00:25:39,750 --> 00:25:38,320
things accidentally

748
00:25:41,909 --> 00:25:39,760
and there are people working on

749
00:25:43,110 --> 00:25:41,919
theoretical forms of life that may have

750
00:25:44,870 --> 00:25:43,120
ways that we can

751
00:25:47,029 --> 00:25:44,880
enhance our detection capabilities so

752
00:25:48,710 --> 00:25:47,039
that we can see those kind of things

753
00:25:50,789 --> 00:25:48,720
but for now that's why we're trying to

754
00:25:53,110 --> 00:25:50,799
improve not only growing things in the

755
00:25:54,870 --> 00:25:53,120
lab but also looking at the dna

756
00:25:56,470 --> 00:25:54,880
just in case there's some something that

757
00:25:58,310 --> 00:25:56,480
we're doing that work some way that

758
00:25:59,669 --> 00:25:58,320
we're culturing this in the lab where we

759
00:26:02,070 --> 00:25:59,679
can't see everything

760
00:26:03,269 --> 00:26:02,080
on the dna level that really helps us to

761
00:26:05,430 --> 00:26:03,279
see much more

762
00:26:06,710 --> 00:26:05,440
and if you can find invent a new way to

763
00:26:09,510 --> 00:26:06,720

find a new form of life

764
00:26:09,990 --> 00:26:09,520
we would love to hear that but we're

765
00:26:13,830 --> 00:26:10,000
always

766
00:26:15,750 --> 00:26:13,840
question

767
00:26:17,750 --> 00:26:15,760
so i've got another one here similar

768
00:26:19,350 --> 00:26:17,760
topic from kristin on facebook

769
00:26:21,590 --> 00:26:19,360
who's asking what are some of the

770
00:26:22,149 --> 00:26:21,600
strangest particles you've ever had to

771
00:26:24,789 --> 00:26:22,159
clean

772
00:26:26,070 --> 00:26:24,799
off of a spacecraft and found from

773
00:26:29,669 --> 00:26:26,080
objects

774
00:26:31,350 --> 00:26:29,679
going to space or coming from space

775
00:26:33,350 --> 00:26:31,360
the strangest particles that i would

776
00:26:37,350 --> 00:26:33,360
have to clean off of spacecraft

777
00:26:40,310 --> 00:26:37,360
um none of them have been too strange

778
00:26:40,630 --> 00:26:40,320
uh usually the particulates that we find

779
00:26:42,950 --> 00:26:40,640
are

780
00:26:43,990 --> 00:26:42,960
common in the clean room environment and

781
00:26:45,909 --> 00:26:44,000
just to double check

782
00:26:47,110 --> 00:26:45,919
we have these instruments where we can

783
00:26:49,830 --> 00:26:47,120
look at it uh

784
00:26:51,350 --> 00:26:49,840
in an sem a scanning electron microscope

785
00:26:54,390 --> 00:26:51,360
and then we also use

786
00:26:57,110 --> 00:26:54,400
what we call x-ray diffraction so it it

787
00:26:58,710 --> 00:26:57,120
hits it with x-rays and based on what

788
00:27:00,870 --> 00:26:58,720

comes out of it the signature that comes

789
00:27:03,110 --> 00:27:00,880
out of it we can identify what it is

790
00:27:04,870 --> 00:27:03,120
so a lot of it is just things that you

791
00:27:07,750 --> 00:27:04,880
would find typically um

792
00:27:10,390 --> 00:27:07,760
the the fibers of maybe the mop that is

793
00:27:15,750 --> 00:27:10,400
used to clean the clean room environment

794
00:27:18,389 --> 00:27:17,029
so we've gotten a chance to talk a

795
00:27:19,990 --> 00:27:18,399
little bit about you know different

796
00:27:22,310 --> 00:27:20,000
things you might find

797
00:27:23,350 --> 00:27:22,320
but uh timothy has a different question

798
00:27:25,830 --> 00:27:23,360
for us from linkedin

799
00:27:26,710 --> 00:27:25,840
do you believe that earlier mars

800
00:27:29,110 --> 00:27:26,720
missions

801
00:27:30,549 --> 00:27:29,120
may have contaminated their landing site

802
00:27:34,310 --> 00:27:30,559
and i think you've got a little uh

803
00:27:35,990 --> 00:27:34,320
video for us as well i do yeah i get

804
00:27:38,070 --> 00:27:36,000
this question here and there so that's

805
00:27:39,909 --> 00:27:38,080
why we put a backup video in here just

806
00:27:43,510 --> 00:27:39,919
in case we get this question

807
00:27:46,549 --> 00:27:43,520
so yeah i i think that my opinion

808
00:27:47,590 --> 00:27:46,559
is that likely we did not contaminate it

809
00:27:50,710 --> 00:27:47,600
i mean

810
00:27:52,149 --> 00:27:50,720
mars is such a heavily bombarded uv

811
00:27:54,389 --> 00:27:52,159
environment

812
00:27:55,510 --> 00:27:54,399
and if you look at this really beautiful

813
00:27:58,230 --> 00:27:55,520

animation here

814
00:27:59,990 --> 00:27:58,240
um you can see all of the landing sites

815
00:28:01,990 --> 00:28:00,000
on the surface of mars

816
00:28:03,110 --> 00:28:02,000
including where perseverance is going to

817
00:28:05,430 --> 00:28:03,120
land and it's

818
00:28:06,950 --> 00:28:05,440
extremely far away from all of the other

819
00:28:09,669 --> 00:28:06,960
landing sites so

820
00:28:10,630 --> 00:28:09,679
likely with the landing of all the prior

821
00:28:12,630 --> 00:28:10,640
missions right

822
00:28:13,669 --> 00:28:12,640
likely it is not did not contaminate the

823
00:28:17,269 --> 00:28:13,679
surface of mars

824
00:28:18,950 --> 00:28:17,279
but if big if it did it's

825
00:28:20,710 --> 00:28:18,960
it's pretty pretty far away so the

826
00:28:22,470 --> 00:28:20,720
likelihood that anything that came from

827
00:28:25,590 --> 00:28:22,480
another spacecraft would get into

828
00:28:29,029 --> 00:28:25,600
our sample um is very

829
00:28:32,470 --> 00:28:31,269
it's great to hear that for all of us

830
00:28:33,750 --> 00:28:32,480
that are looking forward to this

831
00:28:36,870 --> 00:28:33,760
wonderful landing

832
00:28:38,710 --> 00:28:36,880
coming up of the mars 2020 rover

833
00:28:39,990 --> 00:28:38,720
uh aaron has a little bit of a different

834
00:28:41,430 --> 00:28:40,000
question for you so

835
00:28:43,029 --> 00:28:41,440
obviously you're working in the realm of

836
00:28:44,310 --> 00:28:43,039
working with nasa headquarters and here

837
00:28:45,990 --> 00:28:44,320
at jpl

838
00:28:47,430 --> 00:28:46,000

and some of our missions but aaron on

839
00:28:49,750 --> 00:28:47,440
linkedin wants to know what

840
00:28:51,029 --> 00:28:49,760
is the science community doing to ensure

841
00:28:53,990 --> 00:28:51,039
that space

842
00:28:55,430 --> 00:28:54,000
industries are also following protocols

843
00:28:57,510 --> 00:28:55,440
to protect the solar system

844
00:28:59,269 --> 00:28:57,520
from earth and the earth from the solar

845
00:29:01,029 --> 00:28:59,279
system

846
00:29:02,870 --> 00:29:01,039
yeah that that's a really really great

847
00:29:04,630 --> 00:29:02,880
question especially in light of

848
00:29:06,230 --> 00:29:04,640
all of the work that's happening you

849
00:29:07,750 --> 00:29:06,240
know with all of our our brother and

850
00:29:09,669 --> 00:29:07,760
sister institutions

851
00:29:11,510 --> 00:29:09,679
um and at least one thing that i can

852
00:29:12,549 --> 00:29:11,520
speak to is one of the things that we're

853
00:29:13,430 --> 00:29:12,559
trying to do with in planetary

854
00:29:16,710 --> 00:29:13,440
protection

855
00:29:19,590 --> 00:29:16,720
is make the policies and the rules more

856
00:29:20,710 --> 00:29:19,600
accessible at least implementing it we

857
00:29:22,789 --> 00:29:20,720
were talking about

858
00:29:24,630 --> 00:29:22,799
doing metagenomics and taking samples

859
00:29:26,470 --> 00:29:24,640
and really looking at the dna

860
00:29:27,669 --> 00:29:26,480
and just doing things and evolving it so

861
00:29:30,549 --> 00:29:27,679
that it's not

862
00:29:32,389 --> 00:29:30,559
extremely expensive uh to implement

863
00:29:34,630 --> 00:29:32,399

planetary protection so it's more

864
00:29:35,990 --> 00:29:34,640
it gives other companies more of an

865
00:29:38,710 --> 00:29:36,000
advantage to like hey

866
00:29:39,990 --> 00:29:38,720
we can do this it's it's achievable and

867
00:29:44,310 --> 00:29:40,000
it makes it more accessible

868
00:29:46,389 --> 00:29:44,320
to others well we like accessibility

869
00:29:48,950 --> 00:29:46,399
i'm glad to hear that uh things are

870
00:29:51,190 --> 00:29:48,960
being taken seriously by the community

871
00:29:52,149 --> 00:29:51,200
uh we've got a question here a little

872
00:29:53,590 --> 00:29:52,159
bit about

873
00:29:54,950 --> 00:29:53,600
that teamwork you were talking about

874
00:29:56,470 --> 00:29:54,960
earlier and how important it is that

875
00:29:58,310 --> 00:29:56,480
everyone works together

876
00:30:00,070 --> 00:29:58,320
uh tom on linkedin wants to know have

877
00:30:03,350 --> 00:30:00,080
any designs sort of been

878
00:30:06,870 --> 00:30:03,360
changed or had to be thrown away due to

879
00:30:09,830 --> 00:30:06,880
violating contamination constraints

880
00:30:10,630 --> 00:30:09,840
ah uh well it's interesting that you say

881
00:30:13,029 --> 00:30:10,640
that

882
00:30:14,389 --> 00:30:13,039
let me answer a slightly different

883
00:30:16,870 --> 00:30:14,399
rendition of your question

884
00:30:17,750 --> 00:30:16,880
as far as designs being thrown away

885
00:30:21,110 --> 00:30:17,760
early on

886
00:30:23,990 --> 00:30:21,120
i remember when the first design of the

887
00:30:25,029 --> 00:30:24,000
drill bit there used to be and what we

888
00:30:28,149 --> 00:30:25,039

called obok

889
00:30:29,590 --> 00:30:28,159
one bit one core and we were just so

890
00:30:31,590 --> 00:30:29,600
concerned about

891
00:30:33,830 --> 00:30:31,600
planetary protection and sample

892
00:30:35,350 --> 00:30:33,840
integrity biological sample integrity

893
00:30:37,590 --> 00:30:35,360
that we thought you know we have to

894
00:30:40,630 --> 00:30:37,600
clean everything to the degree that we

895
00:30:41,669 --> 00:30:40,640
have cleaned our current um sample tubes

896
00:30:44,389 --> 00:30:41,679
and drills

897
00:30:46,230 --> 00:30:44,399
but for each core there has to be one

898
00:30:47,909 --> 00:30:46,240
sample that we acquire and then it's

899
00:30:49,669 --> 00:30:47,919
automatically too dirty

900
00:30:51,909 --> 00:30:49,679
and that design had to be thrown away

901
00:30:55,590 --> 00:30:51,919
because now you're imagining we

902
00:30:58,630 --> 00:30:55,600
have to send 40 drill bits and and 42s

903
00:30:58,950 --> 00:30:58,640
you know 43 tubes 43 drill bits that is

904
00:31:04,230 --> 00:30:58,960
just

905
00:31:05,990 --> 00:31:04,240
um so that design had to be thrown away

906
00:31:07,269 --> 00:31:06,000
and it was updated to the design that we

907
00:31:09,430 --> 00:31:07,279
have today

908
00:31:10,710 --> 00:31:09,440
uh so yeah there there's definitely been

909
00:31:13,750 --> 00:31:10,720
a lot of evolution of

910
00:31:15,350 --> 00:31:13,760
of designs early on so that we can meet

911
00:31:16,950 --> 00:31:15,360
the planetary protection and science

912
00:31:20,470 --> 00:31:16,960
needs and

913
00:31:24,789 --> 00:31:23,110

well that's important too um we've got a

914
00:31:27,029 --> 00:31:24,799
question a little different about what's

915
00:31:30,389 --> 00:31:27,039
kind of going on in our world today from

916
00:31:31,110 --> 00:31:30,399
joshua uh joshua asks us how has covered

917
00:31:33,269 --> 00:31:31,120
19

918
00:31:36,870 --> 00:31:33,279
affected your work with regard to

919
00:31:39,269 --> 00:31:36,880
cleaning and microbes in the clean room

920
00:31:40,549 --> 00:31:39,279
yeah so i i get this question often i

921
00:31:42,789 --> 00:31:40,559
love answering this question

922
00:31:44,470 --> 00:31:42,799
because when i see what everyone is

923
00:31:47,830 --> 00:31:44,480
doing just out when i go

924
00:31:49,350 --> 00:31:47,840
outside i think well everybody is now

925
00:31:51,590 --> 00:31:49,360
their own version of a planetary

926
00:31:53,590 --> 00:31:51,600
protection engineer i mean what you're

927
00:31:55,190 --> 00:31:53,600
doing when you wear a mask

928
00:31:57,350 --> 00:31:55,200
is you're protecting other people from

929
00:31:59,909 --> 00:31:57,360
your biosphere and vice versa

930
00:32:01,190 --> 00:31:59,919
so i'm actually quite proud of of the

931
00:32:03,350 --> 00:32:01,200
world

932
00:32:05,029 --> 00:32:03,360
for being their own mini version of

933
00:32:07,509 --> 00:32:05,039
planetary protection engineers

934
00:32:08,470 --> 00:32:07,519
but as far as our processes that we've

935
00:32:11,110 --> 00:32:08,480
done at jpl

936
00:32:12,710 --> 00:32:11,120
and that we carried on to ksc to get us

937
00:32:15,190 --> 00:32:12,720
to the launch pad

938
00:32:15,990 --> 00:32:15,200

fortunately a lot of what we decided to

939
00:32:18,950 --> 00:32:16,000
do

940
00:32:20,070 --> 00:32:18,960
is completely robust against covet 19

941
00:32:22,149 --> 00:32:20,080
and all of the

942
00:32:23,669 --> 00:32:22,159
the changes that had to happen you know

943
00:32:25,990 --> 00:32:23,679
due to this pandemic

944
00:32:27,990 --> 00:32:26,000
for example when we're assembling these

945
00:32:30,310 --> 00:32:28,000
you know sampling the tubes the critical

946
00:32:31,350 --> 00:32:30,320
tubes and seals and all the hardware

947
00:32:34,230 --> 00:32:31,360
that's going to touch

948
00:32:35,909 --> 00:32:34,240
the surface of mars we had to not only

949
00:32:36,710 --> 00:32:35,919
wear full bunny suits that you see in

950
00:32:38,950 --> 00:32:36,720
the clean room

951
00:32:40,149 --> 00:32:38,960
but we also had to wear sterile goggles

952
00:32:43,269 --> 00:32:40,159
a sterile smock

953
00:32:45,590 --> 00:32:43,279
and sterile gloves and that just kept

954
00:32:48,310 --> 00:32:45,600
everybody protected the entire time from

955
00:32:50,950 --> 00:32:48,320
from from transferring contaminants from

956
00:32:51,990 --> 00:32:50,960
the environment to the critical samples

957
00:32:54,870 --> 00:32:52,000
so whether or not

958
00:32:55,669 --> 00:32:54,880
covet 19 was a thing we still had the

959
00:32:58,789 --> 00:32:55,679
best

960
00:33:01,750 --> 00:32:58,799
policies and procedures in place so that

961
00:33:03,190 --> 00:33:01,760
that didn't change a thing

962
00:33:04,950 --> 00:33:03,200
well it's good to hear that uh you've

963
00:33:07,909 --> 00:33:04,960

been able to keep moving forward despite

964
00:33:09,830 --> 00:33:07,919
what's going on and truly persevere

965
00:33:12,070 --> 00:33:09,840
with the mars 2020 rover and our other

966
00:33:14,149 --> 00:33:12,080
missions at jpl

967
00:33:16,230 --> 00:33:14,159
um tim has an additional question for us

968
00:33:18,310 --> 00:33:16,240
from facebook and he wants to know isn't

969
00:33:20,789 --> 00:33:18,320
planetary protection sort of

970
00:33:25,110 --> 00:33:20,799
incompatible with human exploration

971
00:33:27,750 --> 00:33:25,120
in general oh this question is very deep

972
00:33:29,110 --> 00:33:27,760
um so it's not that it's incompatible

973
00:33:31,190 --> 00:33:29,120
but you're right

974
00:33:33,669 --> 00:33:31,200
that the whole landscape would change

975
00:33:35,990 --> 00:33:33,679
for example if we focus on mars right

976
00:33:36,789 --> 00:33:36,000
and we are really doing our best to make

977
00:33:39,430 --> 00:33:36,799
sure that

978
00:33:41,110 --> 00:33:39,440
any earth microbes don't get onto mars

979
00:33:43,669 --> 00:33:41,120
and humans we know

980
00:33:44,149 --> 00:33:43,679
humans are a cesspool of microorganisms

981
00:33:46,149 --> 00:33:44,159
and that's

982
00:33:47,190 --> 00:33:46,159
that's a good thing we need all of these

983
00:33:50,230 --> 00:33:47,200
microbes

984
00:33:53,110 --> 00:33:50,240
in and on our body to regulate

985
00:33:54,149 --> 00:33:53,120
our our uh in fact if you count the

986
00:33:56,789 --> 00:33:54,159
amount of uh

987
00:33:57,990 --> 00:33:56,799
bacteria and microorganisms on and in

988
00:34:01,590 --> 00:33:58,000

our body we're actually

989
00:34:04,950 --> 00:34:01,600
more microbe than we are human

990
00:34:08,310 --> 00:34:04,960
so once you send this bag of

991
00:34:10,230 --> 00:34:08,320
bag of bacteria to a place like mars

992
00:34:11,430 --> 00:34:10,240
it's really difficult i mean you'd have

993
00:34:13,349 --> 00:34:11,440
to think of

994
00:34:15,190 --> 00:34:13,359
natural preserves for example where

995
00:34:17,109 --> 00:34:15,200
humans don't go and maybe keep an

996
00:34:19,270 --> 00:34:17,119
area pristine on mars so there's

997
00:34:20,069 --> 00:34:19,280
definitely an evolution that needs to

998
00:34:22,389 --> 00:34:20,079
occur

999
00:34:23,829 --> 00:34:22,399
as we send humans to other places in our

1000
00:34:26,950 --> 00:34:23,839
solar system

1001
00:34:28,790 --> 00:34:26,960
so totally right

1002
00:34:30,790 --> 00:34:28,800
i mean the work you do has evolved over

1003
00:34:33,109 --> 00:34:30,800
time and it really is incredible

1004
00:34:35,430 --> 00:34:33,119
um you've been inspiring a lot of

1005
00:34:36,230 --> 00:34:35,440
students or aspiring students in our

1006
00:34:37,829 --> 00:34:36,240
chat

1007
00:34:39,510 --> 00:34:37,839
and we've got a lot of questions from

1008
00:34:40,790 --> 00:34:39,520
them they want advice they want to know

1009
00:34:43,190 --> 00:34:40,800
how to network

1010
00:34:44,710 --> 00:34:43,200
but we've also got a question in here

1011
00:34:47,030 --> 00:34:44,720
from jordan on linkedin

1012
00:34:48,230 --> 00:34:47,040
who wants to go back to university as a

1013
00:34:50,230 --> 00:34:48,240

35 year old

1014
00:34:51,990 --> 00:34:50,240
for computer engineering they all want

1015
00:34:52,550 --> 00:34:52,000
some advice they want to know how to get

1016
00:34:56,069 --> 00:34:52,560
where you

1017
00:34:56,710 --> 00:34:56,079
are today yeah one of the biggest

1018
00:35:00,710 --> 00:34:56,720
answers

1019
00:35:03,030 --> 00:35:00,720
when i talk to

1020
00:35:05,270 --> 00:35:03,040
college students especially college

1021
00:35:08,870 --> 00:35:05,280
students who are just starting off fresh

1022
00:35:11,190 --> 00:35:08,880
is make sure you use your summers

1023
00:35:12,230 --> 00:35:11,200
every time for example every time i had

1024
00:35:14,390 --> 00:35:12,240
a summer

1025
00:35:15,910 --> 00:35:14,400
vacation i would spend that time in the

1026
00:35:19,030 --> 00:35:15,920
lab do an internship

1027
00:35:21,750 --> 00:35:19,040
apply and what really helped me

1028
00:35:22,390 --> 00:35:21,760
is it allowed me to get more exposure

1029
00:35:25,109 --> 00:35:22,400
and network

1030
00:35:26,790 --> 00:35:25,119
my first internship at langley so i

1031
00:35:28,310 --> 00:35:26,800
started off with computer programming in

1032
00:35:29,430 --> 00:35:28,320
atmospheric sciences but when i was at

1033
00:35:30,950 --> 00:35:29,440
nasa langley

1034
00:35:32,550 --> 00:35:30,960
i worked in the technical library

1035
00:35:36,550 --> 00:35:32,560
because by then i was

1036
00:35:38,630 --> 00:35:36,560
17 so i shouldn't i wasn't allowed near

1037
00:35:41,670 --> 00:35:38,640
really important things

1038
00:35:43,910 --> 00:35:41,680

but i was able to look up

1039
00:35:45,349 --> 00:35:43,920
scientific publications talk to other

1040
00:35:46,950 --> 00:35:45,359
scientists that came through the

1041
00:35:47,510 --> 00:35:46,960
technical library because they were

1042
00:35:49,829 --> 00:35:47,520
looking

1043
00:35:52,150 --> 00:35:49,839
for for publications to support their

1044
00:35:53,589 --> 00:35:52,160
work and that allowed me to align my

1045
00:35:56,390 --> 00:35:53,599
next rotation

1046
00:35:57,589 --> 00:35:56,400
in plasma physics and it was only

1047
00:36:00,230 --> 00:35:57,599
because of that that i

1048
00:36:02,230 --> 00:36:00,240
turned onto plasma sciences plasma

1049
00:36:03,349 --> 00:36:02,240
engineering and and worked my way into

1050
00:36:06,069 --> 00:36:03,359
my phd

1051
00:36:07,109 --> 00:36:06,079
so put yourself in these situations get

1052
00:36:09,270 --> 00:36:07,119
those internships

1053
00:36:10,870 --> 00:36:09,280
use it as leverage to talk to to new

1054
00:36:11,990 --> 00:36:10,880
people and and line your next

1055
00:36:14,069 --> 00:36:12,000
opportunity up

1056
00:36:16,150 --> 00:36:14,079
because and and keep in mind too when

1057
00:36:17,750 --> 00:36:16,160
we're talking about success and failures

1058
00:36:19,670 --> 00:36:17,760
even if you don't like what you're doing

1059
00:36:20,390 --> 00:36:19,680
at your internship you're that much

1060
00:36:21,750 --> 00:36:20,400
closer

1061
00:36:23,829 --> 00:36:21,760
to doing what you love because you

1062
00:36:27,670 --> 00:36:23,839
figured out what you don't want to do

1063
00:36:29,109 --> 00:36:27,680

so do it internships well i'm glad to

1064
00:36:31,109 --> 00:36:29,119
hear that that has been your path

1065
00:36:33,430 --> 00:36:31,119
forward thank you for inspiring so many

1066
00:36:36,390 --> 00:36:33,440
students and aspiring students tonight

1067
00:36:38,310 --> 00:36:36,400
we've got time for one more question

1068
00:36:40,710 --> 00:36:38,320
rayleigh on on linkedin wants to know

1069
00:36:43,510 --> 00:36:40,720
would you ever want to take the trip to

1070
00:36:46,950 --> 00:36:43,520
mars yourself

1071
00:36:48,950 --> 00:36:46,960
that's a great question i think one day

1072
00:36:50,390 --> 00:36:48,960
uh i would love to take that trip

1073
00:36:53,430 --> 00:36:50,400
although it's quite a long

1074
00:36:53,990 --> 00:36:53,440
journey um i i really i really like it

1075
00:36:56,310 --> 00:36:54,000
here on

1076
00:36:58,230 --> 00:36:56,320
earth and i admire everyone who wants to

1077
00:36:59,190 --> 00:36:58,240
go to mars and i will do my best to

1078
00:37:02,150 --> 00:36:59,200
support you

1079
00:37:03,589 --> 00:37:02,160
and cheer you on from afar maybe i'll go

1080
00:37:05,030 --> 00:37:03,599
to the international space station one

1081
00:37:09,270 --> 00:37:05,040
day but

1082
00:37:11,510 --> 00:37:09,280
i'll support the next generation

1083
00:37:13,430 --> 00:37:11,520
i like thank you very much yeah for

1084
00:37:15,589 --> 00:37:13,440
supporting the next generation

1085
00:37:16,710 --> 00:37:15,599
um that's all the time that we have for

1086
00:37:18,390 --> 00:37:16,720
questions tonight

1087
00:37:21,270 --> 00:37:18,400
thank you nikki for helping us out with

1088
00:37:22,950 --> 00:37:21,280

that um before i thank everyone

1089
00:37:24,790 --> 00:37:22,960
i would like to remind you and they're

1090
00:37:26,150 --> 00:37:24,800
gonna they're gonna bring up the website

1091
00:37:29,190 --> 00:37:26,160
on the screen here in a second

1092
00:37:30,470 --> 00:37:29,200
as we discussed that mars 2020 is on its

1093
00:37:32,150 --> 00:37:30,480
way to the martian surface and is

1094
00:37:32,870 --> 00:37:32,160
scheduled to arrive in two weeks from

1095
00:37:35,829 --> 00:37:32,880
today

1096
00:37:37,550 --> 00:37:35,839
on thursday february 18th so if you go

1097
00:37:39,349 --> 00:37:37,560
to

1098
00:37:42,390 --> 00:37:39,359
go.nasa.gov

1099
00:37:44,310 --> 00:37:42,400
slash mars 2020 toolkit and you'll also

1100
00:37:46,150 --> 00:37:44,320
see it in the chat below

1101
00:37:48,310 --> 00:37:46,160
you will find all sorts of goodies

1102
00:37:50,150 --> 00:37:48,320
landing resources how to participate how

1103
00:37:52,790 --> 00:37:50,160
to watch online and so

1104
00:37:53,990 --> 00:37:52,800
so much more we say it often on these

1105
00:37:56,790 --> 00:37:54,000
talks

1106
00:37:57,829 --> 00:37:56,800
this is your space program we want you

1107
00:37:59,829 --> 00:37:57,839
to be involved we

1108
00:38:01,190 --> 00:37:59,839
want you to share in these moments we

1109
00:38:02,150 --> 00:38:01,200
want you to share them with us because

1110
00:38:05,510 --> 00:38:02,160
they belong to

1111
00:38:07,750 --> 00:38:05,520
all of us so please follow along with

1112
00:38:08,550 --> 00:38:07,760
the aptly named perseverance on february

1113
00:38:11,589 --> 00:38:08,560

18th

1114
00:38:14,950 --> 00:38:11,599
once again at go.nasa.gov

1115
00:38:16,069 --> 00:38:14,960
mars 2020 cool toolkit it is a cool kit

1116
00:38:18,470 --> 00:38:16,079
but it's the toolkit

1117
00:38:20,230 --> 00:38:18,480
our next talk on march 11th will be

1118
00:38:22,870 --> 00:38:20,240
helicopters in space

1119
00:38:25,510 --> 00:38:22,880
about the mars helicopter ingenuity a

1120
00:38:28,390 --> 00:38:25,520
lot of cool things coming our way

1121
00:38:30,069 --> 00:38:28,400
i would like to thank dr mujigay cooper

1122
00:38:32,870 --> 00:38:30,079
for joining us this evening for her

1123
00:38:34,870 --> 00:38:32,880
intelligence her passion her joy thank

1124
00:38:35,910 --> 00:38:34,880
you nikki and everyone behind the scenes

1125
00:38:38,230 --> 00:38:35,920
the social media team

1126
00:38:40,150 --> 00:38:38,240
tv ops everyone who makes this possible

1127
00:38:41,510 --> 00:38:40,160
and finally a big thank you to all of

1128
00:38:44,710 --> 00:38:41,520
you who join us

1129
00:39:00,200 --> 00:38:44,720
each and every single month stay safe

1130
00:39:12,870 --> 00:39:00,210
stay kind and we'll see you next month