1
00:00:09,110 --> 00:00:07,269
hey everybody

2
00:00:11,830 --> 00:00:09,120
welcome to nasa's jet propulsion

3
00:00:13,430 --> 00:00:11,840
laboratory here in southern california

4
00:00:15,110 --> 00:00:13,440
my name is stephanie smith i'm part of

5
00:00:18,390 --> 00:00:15,120
the digital news and media team

6
00:00:21,349 --> 00:00:18,400
the social media team here at jpl and

7
00:00:23,349 --> 00:00:21,359
fewer than 48 hours from now i can't

8
00:00:24,310 --> 00:00:23,359
believe it our countdown to mars is

9
00:00:26,950 --> 00:00:24,320
nearly done

10
00:00:27,910 --> 00:00:26,960
our perseverance mars rover is nearly to

11
00:00:30,310 --> 00:00:27,920
the red planet

12
00:00:32,549 --> 00:00:30,320
with landing this thursday we wanted to

13
00:00:34,950 --> 00:00:32,559

take a time out and bring you all behind

14
00:00:37,190 --> 00:00:34,960
the scenes on a very windy day

15
00:00:39,350 --> 00:00:37,200
here at jpl and give you a chance to

16
00:00:41,030 --> 00:00:39,360
meet some of the fantastic human beings

17
00:00:43,510 --> 00:00:41,040
behind this mission

18
00:00:44,069 --> 00:00:43,520
take your questions live and get them

19
00:00:46,549 --> 00:00:44,079
answered

20
00:00:48,709 --> 00:00:46,559
so if you've got questions about science

21
00:00:51,110 --> 00:00:48,719
about technology particularly the

22
00:00:52,310 --> 00:00:51,120
moxie instrument moxie technology

23
00:00:54,630 --> 00:00:52,320
demonstration

24
00:00:56,709 --> 00:00:54,640
or engineering of landing on mars we're

25
00:00:59,270 --> 00:00:56,719
going to take you inside mission control

26
00:01:00,630 --> 00:00:59,280
so without any further ado just keep

27
00:01:02,470 --> 00:01:00,640
those questions coming

28
00:01:04,789 --> 00:01:02,480
you can use the hashtag countdown to

29
00:01:05,910 --> 00:01:04,799
mars you can also put them right here in

30
00:01:08,230 --> 00:01:05,920
the comments

31
00:01:09,350 --> 00:01:08,240
here to tell us more about the science

32
00:01:12,230 --> 00:01:09,360
of this mission

33
00:01:13,670 --> 00:01:12,240
and its search for ancient life on mars

34
00:01:15,670 --> 00:01:13,680
is dr bethany ellman

35
00:01:18,149 --> 00:01:15,680
hey bethany hi stephanie how are you

36
00:01:19,350 --> 00:01:18,159
doing i'm doing great i'm i've got

37
00:01:22,230 --> 00:01:19,360
butterflies i've got

38
00:01:23,990 --> 00:01:22,240

energy but uh i'm i'm so excited to be

39
00:01:26,870 --> 00:01:24,000
sharing this time with you guys

40
00:01:27,910 --> 00:01:26,880
we've been socially distant for seven

41
00:01:30,069 --> 00:01:27,920
months now right

42
00:01:31,990 --> 00:01:30,079
we're maintaining distance because it

43
00:01:34,310 --> 00:01:32,000
should come as no surprise that safety

44
00:01:36,550 --> 00:01:34,320
is really really important to nasa

45
00:01:37,990 --> 00:01:36,560
both for our flight hardware but more

46
00:01:39,270 --> 00:01:38,000
importantly for our people

47
00:01:40,710 --> 00:01:39,280
and that's why you're going to see us

48
00:01:42,630 --> 00:01:40,720
keep our distance we're going to keep

49
00:01:43,749 --> 00:01:42,640
these masks on at all times

50
00:01:45,830 --> 00:01:43,759
but it doesn't mean we're not going to

51
00:01:46,630 --> 00:01:45,840
have any fun so keep those questions

52
00:01:48,870 --> 00:01:46,640
coming

53
00:01:50,630 --> 00:01:48,880
um to give you some time to think about

54
00:01:51,350 --> 00:01:50,640
them and know what kinds of things you

55
00:01:53,350 --> 00:01:51,360
can ask

56
00:01:54,789 --> 00:01:53,360
i'll be talking to each of our experts a

57
00:01:57,109 --> 00:01:54,799
little bit up top

58
00:01:59,190 --> 00:01:57,119
so bethany you're on the science team

59
00:01:59,749 --> 00:01:59,200
what is your official title and then

60
00:02:02,389 --> 00:01:59,759
what does it

61
00:02:04,630 --> 00:02:02,399
mean in plain english okay well my day

62
00:02:05,830 --> 00:02:04,640
job is i'm a professor of planetary

63
00:02:08,150 --> 00:02:05,840

science at caltech

64
00:02:10,070 --> 00:02:08,160
but for the mars 2020 mission i am

65
00:02:11,830 --> 00:02:10,080
privileged to be a co-investigator on

66
00:02:13,030 --> 00:02:11,840
the science team and i'm a part of two

67
00:02:15,430 --> 00:02:13,040
instruments

68
00:02:16,470 --> 00:02:15,440
mass cam z and sherlock so what does

69
00:02:20,790 --> 00:02:16,480
that mean

70
00:02:23,030 --> 00:02:20,800
participate in looking at the data as it

71
00:02:24,470 --> 00:02:23,040
comes down figuring out what is going on

72
00:02:25,830 --> 00:02:24,480
on mars and then working with the

73
00:02:28,470 --> 00:02:25,840
engineering team to

74
00:02:30,309 --> 00:02:28,480
plan the next steps of the rover over

75
00:02:34,390 --> 00:02:30,319
the coming days weeks months that we'll

76
00:02:37,990 --> 00:02:36,470
all right so we've got this fabulous

77
00:02:40,630 --> 00:02:38,000
model you can't

78
00:02:42,790 --> 00:02:40,640
let this go to waste nope um can you

79
00:02:45,750 --> 00:02:42,800
give us just a little guided tour

80
00:02:46,710 --> 00:02:45,760
of the science payload on this rover

81
00:02:49,910 --> 00:02:46,720
yeah sure so

82
00:02:51,509 --> 00:02:49,920
uh well what we've got up here are the

83
00:02:52,390 --> 00:02:51,519
what we call the remote sensing

84
00:02:54,550 --> 00:02:52,400
instruments

85
00:02:56,790 --> 00:02:54,560
that means we look at things from afar

86
00:02:58,790 --> 00:02:56,800
and take pictures or analyze them

87
00:02:59,990 --> 00:02:58,800
so the two instruments uh so the

88
00:03:03,190 --> 00:03:00,000

instrument that i work on

89
00:03:06,229 --> 00:03:03,200
that's on this mast are the mast cam

90
00:03:09,270 --> 00:03:06,239
z cameras so these are twin

91
00:03:11,830 --> 00:03:09,280
stereo color infrared cameras

92
00:03:13,110 --> 00:03:11,840
that take the best science images of the

93
00:03:15,350 --> 00:03:13,120
surface for our

94
00:03:16,949 --> 00:03:15,360
exploration and you know what's really

95
00:03:17,990 --> 00:03:16,959
special about these is not only do they

96
00:03:19,830 --> 00:03:18,000
have like crazy

97
00:03:22,070 --> 00:03:19,840
powerful zoom lenses to look get a

98
00:03:23,589 --> 00:03:22,080
microscopic view from far away

99
00:03:25,830 --> 00:03:23,599
but we're also getting that view in the

100
00:03:26,149 --> 00:03:25,840
infrared and so that means we can tell

101
00:03:33,910 --> 00:03:26,159
the

102
00:03:35,430 --> 00:03:33,920
are made of so that's super exciting

103
00:03:36,710 --> 00:03:35,440
these cameras here you might see you

104
00:03:38,630 --> 00:03:36,720
might ask what are those well those are

105
00:03:40,630 --> 00:03:38,640
navigational cameras that take color

106
00:03:43,030 --> 00:03:40,640
pictures to help the rover drive

107
00:03:44,229 --> 00:03:43,040
the giant cyclops eye that you see here

108
00:03:46,470 --> 00:03:44,239
is super cam

109
00:03:48,070 --> 00:03:46,480
it has a microscopic imager it has a

110
00:03:50,390 --> 00:03:48,080
couple of spectrometers

111
00:03:51,430 --> 00:03:50,400
one of the spectrometers even fires

112
00:03:53,670 --> 00:03:51,440
laser beams

113
00:03:54,550 --> 00:03:53,680

at rocks and soils yes it has a laser in

114
00:03:57,670 --> 00:03:54,560
its head

115
00:03:59,830 --> 00:03:57,680
and it is geared toward understanding

116
00:04:00,550 --> 00:03:59,840
the chemistry and the mineralogy of the

117
00:04:01,990 --> 00:04:00,560
surface

118
00:04:03,830 --> 00:04:02,000
moving on you know that's not all

119
00:04:04,630 --> 00:04:03,840
because once we use our remote sensing

120
00:04:07,670 --> 00:04:04,640
suite to like

121
00:04:09,190 --> 00:04:07,680
zero in on where we're going then once

122
00:04:10,949 --> 00:04:09,200
we get to the destination drive to the

123
00:04:11,910 --> 00:04:10,959
destination then we can pull out this

124
00:04:14,710 --> 00:04:11,920
beefy arm

125
00:04:16,550 --> 00:04:14,720
here and get up and close and personal

126
00:04:18,550 --> 00:04:16,560
to the rocks to investigate them

127
00:04:21,509 --> 00:04:18,560
so what you're seeing right here is the

128
00:04:24,710 --> 00:04:21,519
core assembly now mars 2020 is really

129
00:04:26,150 --> 00:04:24,720
special because it has it will host a

130
00:04:27,590 --> 00:04:26,160
drill bit here it's not really shown on

131
00:04:29,670 --> 00:04:27,600
the model but it hosts it actually it's

132
00:04:33,430 --> 00:04:29,680
shown retracted inside the model

133
00:04:35,830 --> 00:04:33,440
but it has a bit that allows a core

134
00:04:37,830 --> 00:04:35,840
about the size of a piece of chalk to be

135
00:04:39,590 --> 00:04:37,840
pulled into a sample tube and then that

136
00:04:41,270 --> 00:04:39,600
sample tube is then put under the belly

137
00:04:43,030 --> 00:04:41,280
of the rover tucked in

138
00:04:45,030 --> 00:04:43,040

for safe keeping an eventual return to

139
00:04:45,830 --> 00:04:45,040
earth but how do we pick the best

140
00:04:48,150 --> 00:04:45,840
samples

141
00:04:49,670 --> 00:04:48,160
right that's a key question that's where

142
00:04:51,670 --> 00:04:49,680
these other two bits on the arm that you

143
00:04:53,510 --> 00:04:51,680
see here this is the pixel instrument

144
00:04:54,870 --> 00:04:53,520
that measures chemistry and the

145
00:04:56,230 --> 00:04:54,880
instrument over here is the other one i

146
00:04:58,390 --> 00:04:56,240
work on called sherlock

147
00:04:59,590 --> 00:04:58,400
and sherlock takes microscopic images of

148
00:05:03,029 --> 00:04:59,600
the surface

149
00:05:05,909 --> 00:05:03,039
but in addition to a pic a picture

150
00:05:08,070 --> 00:05:05,919
it uses uv fluorescence spectroscopy so

151
00:05:10,710 --> 00:05:08,080
ultraviolet radiation

152
00:05:12,629 --> 00:05:10,720
to get a sense of what the minerals and

153
00:05:14,230 --> 00:05:12,639
the organics are also within that

154
00:05:14,950 --> 00:05:14,240
microscopic image so you can actually

155
00:05:16,790 --> 00:05:14,960
trace

156
00:05:19,110 --> 00:05:16,800
you know things like potential fossils

157
00:05:20,950 --> 00:05:19,120
right if you see a line of organics and

158
00:05:22,950 --> 00:05:20,960
sediment so so this is the this is the

159
00:05:26,710 --> 00:05:22,960
business end that lets us really select

160
00:05:29,749 --> 00:05:28,550
okay so we're getting some questions in

161
00:05:30,550 --> 00:05:29,759
and i want to make sure that we work

162
00:05:33,830 --> 00:05:30,560
them into the show

163
00:05:34,870 --> 00:05:33,840

first up from nathan baker um what will

164
00:05:38,230 --> 00:05:34,880
our approach be

165
00:05:39,749 --> 00:05:38,240
if we find very ancient fossils if we

166
00:05:41,590 --> 00:05:39,759
find ancient fossils it will be an

167
00:05:43,909 --> 00:05:41,600
amazing day on mars because we will have

168
00:05:46,070 --> 00:05:43,919
hit the scientific jackpot

169
00:05:48,150 --> 00:05:46,080
i mean that's one of the reasons that we

170
00:05:49,590 --> 00:05:48,160
explore right we're all interested

171
00:05:51,029 --> 00:05:49,600
we're many of us are driven and

172
00:05:52,390 --> 00:05:51,039
interested by the question like are we

173
00:05:54,310 --> 00:05:52,400
alone right is there

174
00:05:56,150 --> 00:05:54,320
is there other life elsewhere in the

175
00:05:58,309 --> 00:05:56,160
universe one way to do that is by

176
00:05:59,990 --> 00:05:58,319
looking at the sediments of mars so

177
00:06:02,070 --> 00:06:00,000
the rocks the rocks and the sediments of

178
00:06:03,749 --> 00:06:02,080
mars so what we'll do

179
00:06:05,430 --> 00:06:03,759
is first of all we won't just yell

180
00:06:07,510 --> 00:06:05,440
fossil

181
00:06:09,029 --> 00:06:07,520
because we're scientists we take a

182
00:06:10,550 --> 00:06:09,039
cautious approach right so we're gonna

183
00:06:11,029 --> 00:06:10,560
we're gonna look very carefully and

184
00:06:12,870 --> 00:06:11,039
measure

185
00:06:15,110 --> 00:06:12,880
if we see something that like looks like

186
00:06:16,790 --> 00:06:15,120
a fossil like to our eyeballs

187
00:06:18,550 --> 00:06:16,800
then the next thing we check is there

188
00:06:21,430 --> 00:06:18,560

anything about it that's unusual

189
00:06:21,830 --> 00:06:21,440
uh in the chemistry or in the minerals

190
00:06:23,430 --> 00:06:21,840
right

191
00:06:25,670 --> 00:06:23,440
so that would point to maybe it is

192
00:06:27,990 --> 00:06:25,680
special maybe it got fossilized

193
00:06:29,430 --> 00:06:28,000
we would also look to see is there

194
00:06:31,510 --> 00:06:29,440
organic matter in there

195
00:06:33,510 --> 00:06:31,520
carbon the stuff of which we are built

196
00:06:34,309 --> 00:06:33,520
can we see any of that associated with

197
00:06:36,950 --> 00:06:34,319
the fossil

198
00:06:37,590 --> 00:06:36,960
because really you know extraordinary

199
00:06:40,550 --> 00:06:37,600
claims

200
00:06:41,830 --> 00:06:40,560
require extraordinary evidence so said

201
00:06:43,189 --> 00:06:41,840
carl sagan

202
00:06:45,189 --> 00:06:43,199
and if we're going to make some sort of

203
00:06:47,110 --> 00:06:45,199
a life claim we need a few lines of

204
00:06:49,110 --> 00:06:47,120
evidence so what we would probably do

205
00:06:50,790 --> 00:06:49,120
is pick the best spot on the rock with

206
00:06:52,550 --> 00:06:50,800
the most lines of evidence that

207
00:06:54,230 --> 00:06:52,560
suggested fossil life

208
00:06:55,909 --> 00:06:54,240
then what we'd do is we'd take a sample

209
00:06:57,749 --> 00:06:55,919
of it with this core

210
00:07:01,430 --> 00:06:57,759
and bring that tube back to earth for

211
00:07:04,550 --> 00:07:03,830
so this rover looks an awful lot like

212
00:07:07,270 --> 00:07:04,560
curiosity

213
00:07:08,870 --> 00:07:07,280

it does but it is very different in a

214
00:07:10,870 --> 00:07:08,880
lot of the ways that you have mentioned

215
00:07:13,589 --> 00:07:10,880
like that coring drill that is going to

216
00:07:17,029 --> 00:07:13,599
cash those samples for a future mission

217
00:07:18,710 --> 00:07:17,039
to return um what are some of the other

218
00:07:21,189 --> 00:07:18,720
key differences between

219
00:07:22,710 --> 00:07:21,199
this and uh other mars rovers over the

220
00:07:24,309 --> 00:07:22,720
years that's uh sid haines

221
00:07:26,230 --> 00:07:24,319
question yeah yeah good question i'm

222
00:07:28,230 --> 00:07:26,240
just i just have time to name a few

223
00:07:29,990 --> 00:07:28,240
uh but one of the differences from the

224
00:07:31,830 --> 00:07:30,000
the previous iteration of the rover the

225
00:07:33,990 --> 00:07:31,840
the curiosity rover that's now at gale

226
00:07:36,790 --> 00:07:34,000
crater uh is the wheels

227
00:07:38,150 --> 00:07:36,800
so these guys we learned that pointy

228
00:07:41,749 --> 00:07:38,160
rocks on mars

229
00:07:42,710 --> 00:07:41,759
destroy wheels and so wising up to this

230
00:07:45,270 --> 00:07:42,720
advice

231
00:07:47,350 --> 00:07:45,280
we have beefed up the wheels on this

232
00:07:48,150 --> 00:07:47,360
rover to give them an extended lifetime

233
00:07:49,990 --> 00:07:48,160
even if we

234
00:07:51,830 --> 00:07:50,000
encounter you know really sharp pointy

235
00:07:53,830 --> 00:07:51,840
rocks there's no

236
00:07:55,510 --> 00:07:53,840
aaa on mars if you bust your tire

237
00:07:56,710 --> 00:07:55,520
there's there's no tow truck right so

238
00:07:58,790 --> 00:07:56,720

we've got to make sure

239
00:07:59,909 --> 00:07:58,800
that our wheels endure the entire

240
00:08:00,950 --> 00:07:59,919
mission

241
00:08:03,189 --> 00:08:00,960
another key difference you're going to

242
00:08:06,390 --> 00:08:03,199
hear about shortly and that's we have an

243
00:08:08,950 --> 00:08:06,400
in-situ resource utilization experi

244
00:08:09,430 --> 00:08:08,960
experiment called moxie that you'll hear

245
00:08:11,749 --> 00:08:09,440
about

246
00:08:13,430 --> 00:08:11,759
that turns that takes carbon dioxide and

247
00:08:15,510 --> 00:08:13,440
turns it into oxygen but more on that in

248
00:08:17,350 --> 00:08:15,520
the next segment

249
00:08:19,189 --> 00:08:17,360
all right well i know that you are a

250
00:08:21,749 --> 00:08:19,199
very very busy person

251
00:08:23,430 --> 00:08:21,759
who's got uh big plans ahead if we have

252
00:08:25,189 --> 00:08:23,440
a good day on thursday

253
00:08:26,629 --> 00:08:25,199
you'll just be clearing your schedule

254
00:08:29,270 --> 00:08:26,639
for what the the next

255
00:08:30,629 --> 00:08:29,280
science on mars the next two earth years

256
00:08:33,509 --> 00:08:30,639
one motion year

257
00:08:33,909 --> 00:08:33,519
at least um bethany thank you so much

258
00:08:36,070 --> 00:08:33,919
pleasure

259
00:08:37,509 --> 00:08:36,080
uh for your time today and with that

260
00:08:40,550 --> 00:08:37,519
we'll let you go

261
00:08:43,029 --> 00:08:40,560
and keep those questions coming folks we

262
00:08:44,210 --> 00:08:43,039
want to hear from you

263
00:08:49,350 --> 00:08:44,220

up next

264
00:08:51,910 --> 00:08:49,360
[Music]

265
00:08:52,870 --> 00:08:51,920
technology on this rover to help future

266
00:08:56,070 --> 00:08:52,880
life on mars

267
00:08:56,470 --> 00:08:56,080
in the form of astronauts so one of the

268
00:09:00,150 --> 00:08:56,480
key

269
00:09:02,630 --> 00:09:00,160
pieces of uh engineering on this rover

270
00:09:03,269 --> 00:09:02,640
is called moxie and here to tell us more

271
00:09:06,389 --> 00:09:03,279
about it

272
00:09:08,630 --> 00:09:06,399
dr assad abu baker hey assange hi there

273
00:09:10,070 --> 00:09:08,640
all right so i will start with the same

274
00:09:12,470 --> 00:09:10,080
question that i asked bethany can you

275
00:09:14,630 --> 00:09:12,480
tell us what your formal title is

276
00:09:16,310 --> 00:09:14,640
um with the project and what does it

277
00:09:18,470 --> 00:09:16,320
mean in plain english

278
00:09:19,910 --> 00:09:18,480
um you know that's a hard question

279
00:09:21,509 --> 00:09:19,920
actually because my title has changed so

280
00:09:23,030 --> 00:09:21,519
many times as a part of moxie

281
00:09:24,790 --> 00:09:23,040
right now i just call myself a systems

282
00:09:27,110 --> 00:09:24,800
engineer all right all right

283
00:09:27,829 --> 00:09:27,120
you're like the producers of engineering

284
00:09:30,630 --> 00:09:27,839
something like that

285
00:09:31,829 --> 00:09:30,640
okay all right but moxie you can tell us

286
00:09:33,509 --> 00:09:31,839
about moxie

287
00:09:36,070 --> 00:09:33,519
what does it stand for what does it do

288
00:09:39,829 --> 00:09:36,080

and why do we care moxie stands for the

289
00:09:41,430 --> 00:09:39,839
mars oxygen isru experiment so isru is

290
00:09:43,829 --> 00:09:41,440
that acronym that bethany mentioned

291
00:09:44,630 --> 00:09:43,839
that's in-situ resource utilization

292
00:09:46,389 --> 00:09:44,640
which is

293
00:09:47,990 --> 00:09:46,399
going somewhere and using the materials

294
00:09:49,030 --> 00:09:48,000
you have available there and doing

295
00:09:50,870 --> 00:09:49,040
something useful with them

296
00:09:52,870 --> 00:09:50,880
instead of carrying everything with you

297
00:09:54,949 --> 00:09:52,880
excellent okay and so

298
00:09:56,790 --> 00:09:54,959
moxie in particular is going to be

299
00:09:58,949 --> 00:09:56,800
extracting oxygen from that

300
00:10:00,949 --> 00:09:58,959
thin martian atmosphere i think i would

301
00:10:03,670 --> 00:10:00,959
be remiss you guys can probably

302
00:10:06,150 --> 00:10:03,680
hear us with our lavalier microphones it

303
00:10:08,870 --> 00:10:06,160
is extremely windy here

304
00:10:10,550 --> 00:10:08,880
today and the the wind the good news is

305
00:10:11,509 --> 00:10:10,560
that the wind on earth imparts a lot

306
00:10:14,550 --> 00:10:11,519
more force

307
00:10:16,790 --> 00:10:14,560
than the wind does on mars

308
00:10:17,990 --> 00:10:16,800
right but um since we have the model do

309
00:10:21,190 --> 00:10:18,000
you want to point out where

310
00:10:22,230 --> 00:10:21,200
moxie is so you can't see moxie because

311
00:10:24,870 --> 00:10:22,240
moxie is buried

312
00:10:26,470 --> 00:10:24,880
inside the rover it's basically kind of

313
00:10:27,350 --> 00:10:26,480

inside the belly mounted somewhere in

314
00:10:28,710 --> 00:10:27,360
here but

315
00:10:30,550 --> 00:10:28,720
buried in there the only thing that's on

316
00:10:32,470 --> 00:10:30,560
the outside uh

317
00:10:33,750 --> 00:10:32,480
that's part of moxie is a little box

318
00:10:35,990 --> 00:10:33,760
here that has a filter

319
00:10:36,870 --> 00:10:36,000
where we draw in the martian atmosphere

320
00:10:38,710 --> 00:10:36,880
and it goes

321
00:10:40,150 --> 00:10:38,720
in through the filter and then through a

322
00:10:41,030 --> 00:10:40,160
tube that connects to the box that's

323
00:10:44,150 --> 00:10:41,040
inside that

324
00:10:44,470 --> 00:10:44,160
that has all the guts of moxie so how

325
00:10:47,350 --> 00:10:44,480
long

326
00:10:49,350 --> 00:10:47,360
after landing will you get to start

327
00:10:51,030 --> 00:10:49,360
turning moxie on and see if it works

328
00:10:52,790 --> 00:10:51,040
we'll be doing a few checks probably

329
00:10:54,310 --> 00:10:52,800
within the first few weeks and then

330
00:10:56,230 --> 00:10:54,320
the first time we produce oxygen

331
00:10:59,110 --> 00:10:56,240
probably around a month in

332
00:11:00,870 --> 00:10:59,120
you know we are only one of many

333
00:11:02,389 --> 00:11:00,880
instruments and payloads on the mission

334
00:11:04,230 --> 00:11:02,399
obviously the helicopter has to do its

335
00:11:05,590 --> 00:11:04,240
thing uh there's a bunch of science

336
00:11:06,069 --> 00:11:05,600
instruments that need to be checked out

337
00:11:07,350 --> 00:11:06,079
so

338
00:11:09,670 --> 00:11:07,360

you know we're good citizens and we're

339
00:11:12,069 --> 00:11:09,680
going to wait our turn

340
00:11:13,350 --> 00:11:12,079
that's all teamwork makes the driver man

341
00:11:16,310 --> 00:11:13,360
so astro

342
00:11:18,230 --> 00:11:16,320
i'm going to butcher this astromomium

343
00:11:19,829 --> 00:11:18,240
estramium i am sorry

344
00:11:22,870 --> 00:11:19,839
uh but we're going to get your question

345
00:11:26,710 --> 00:11:22,880
in um what are the next steps

346
00:11:29,670 --> 00:11:26,720
after it is working well moxie itself

347
00:11:30,310 --> 00:11:29,680
is going to be run numerous times over

348
00:11:32,310 --> 00:11:30,320
the course

349
00:11:33,350 --> 00:11:32,320
of the mission for mars 2020

350
00:11:35,269 --> 00:11:33,360
perseverance

351
00:11:37,509 --> 00:11:35,279
so the idea is that we want to use moxie

352
00:11:40,150 --> 00:11:37,519
to understand how the technologies

353
00:11:41,509 --> 00:11:40,160
uh behave over various environmental

354
00:11:43,030 --> 00:11:41,519
conditions on mars so

355
00:11:44,949 --> 00:11:43,040
we've got winter and summer night and

356
00:11:46,150 --> 00:11:44,959
day and then dust storm season which is

357
00:11:47,590 --> 00:11:46,160
something that any

358
00:11:48,870 --> 00:11:47,600
mars mission in the future that's going

359
00:11:49,269 --> 00:11:48,880
to be operating for a long period of

360
00:11:50,870 --> 00:11:49,279
time

361
00:11:52,550 --> 00:11:50,880
will have to deal with dust because it's

362
00:11:53,670 --> 00:11:52,560
prevalent it's always there and you have

363
00:11:54,790 --> 00:11:53,680

to be able to deal with it so

364
00:11:57,350 --> 00:11:54,800
these are the kinds of things we want to

365
00:11:57,829 --> 00:11:57,360
learn over the the two years that we're

366
00:12:00,389 --> 00:11:57,839
going to be

367
00:12:01,829 --> 00:12:00,399
spending operating moxie so susan wants

368
00:12:03,910 --> 00:12:01,839
to know what are you going to do with

369
00:12:05,509 --> 00:12:03,920
the oxygen that you produce

370
00:12:07,110 --> 00:12:05,519
nothing well that's not that's not

371
00:12:10,710 --> 00:12:07,120
entirely true and that sounds so

372
00:12:12,470 --> 00:12:10,720
easy yeah no well um we are basically

373
00:12:13,910 --> 00:12:12,480
we don't produce enough oxygen to do

374
00:12:15,590 --> 00:12:13,920
anything really useful so this is a

375
00:12:17,590 --> 00:12:15,600
technology demonstration so

376
00:12:19,430 --> 00:12:17,600
we produce a little bit of oxygen we run

377
00:12:22,069 --> 00:12:19,440
it through a set of sensors that that

378
00:12:23,590 --> 00:12:22,079
measure the gas that we produce how pure

379
00:12:24,790 --> 00:12:23,600
is it how much are we making

380
00:12:25,910 --> 00:12:24,800
and then we just dump it out the side

381
00:12:26,629 --> 00:12:25,920
because we don't have a way to store it

382
00:12:28,389 --> 00:12:26,639
or do anything

383
00:12:30,150 --> 00:12:28,399
other anything else that's useful okay

384
00:12:33,430 --> 00:12:30,160
so you measure how much you got and just

385
00:12:36,310 --> 00:12:33,440
let it go it's just like elsa on mars

386
00:12:37,670 --> 00:12:36,320
exactly okay john henderson asks since

387
00:12:40,870 --> 00:12:37,680
mars dust is so

388
00:12:43,829 --> 00:12:40,880

fine how do you clean moxie's filter

389
00:12:44,389 --> 00:12:43,839
we don't actually um we have sized it

390
00:12:47,269 --> 00:12:44,399
we've done

391
00:12:47,590 --> 00:12:47,279
wind tunnel testing at low pressures to

392
00:12:52,069 --> 00:12:47,600
see

393
00:12:54,069 --> 00:12:52,079
quickly the filter will clog

394
00:12:55,750 --> 00:12:54,079
and it's been sized so that over the

395
00:12:57,269 --> 00:12:55,760
course of the mission the the amount of

396
00:12:58,230 --> 00:12:57,279
accumulation in the filter is actually

397
00:13:02,069 --> 00:12:58,240
pretty low

398
00:13:05,509 --> 00:13:02,079
fantastic so what's next for you

399
00:13:07,030 --> 00:13:05,519
if moxie is successful well for me

400
00:13:08,870 --> 00:13:07,040
i'm working on other missions that are

401
00:13:12,230 --> 00:13:08,880
not mars related but for

402
00:13:13,990 --> 00:13:12,240
uh moxie-like technology it's um

403
00:13:16,069 --> 00:13:14,000
basically trying to understand how to

404
00:13:18,949 --> 00:13:16,079
scale it up and prepare for

405
00:13:20,069 --> 00:13:18,959
actual human exploration so we talk a

406
00:13:22,150 --> 00:13:20,079
lot about

407
00:13:23,910 --> 00:13:22,160
having oxygen for astronauts to be able

408
00:13:25,110 --> 00:13:23,920
to breathe kind of like what we saw in

409
00:13:28,069 --> 00:13:25,120
the martian right

410
00:13:29,190 --> 00:13:28,079
um but oxygen is useful for other things

411
00:13:31,910 --> 00:13:29,200
too

412
00:13:33,990 --> 00:13:31,920
so you'd be making rocket fuel that's

413
00:13:36,150 --> 00:13:34,000

really the the main goal actually is

414
00:13:37,030 --> 00:13:36,160
to produce enough oxygen that you can

415
00:13:39,509 --> 00:13:37,040
then fuel

416
00:13:40,710 --> 00:13:39,519
a rocket and use it as the oxidizer for

417
00:13:42,389 --> 00:13:40,720
a rocket that would be used to get

418
00:13:44,150 --> 00:13:42,399
humans off the surface of mars and get

419
00:13:44,790 --> 00:13:44,160
them back on their journey back home to

420
00:13:47,990 --> 00:13:44,800
earth

421
00:13:50,150 --> 00:13:48,000
that is super cool and super key

422
00:13:52,069 --> 00:13:50,160
we always send the robots first right

423
00:13:54,629 --> 00:13:52,079
figure out all the tough stuff before we

424
00:13:55,110 --> 00:13:54,639
put human lives on the line and we have

425
00:13:57,590 --> 00:13:55,120
put

426
00:13:58,550 --> 00:13:57,600
your human life on the line long enough

427
00:14:00,790 --> 00:13:58,560
we're going to let you

428
00:14:02,550 --> 00:14:00,800
get back to your preparations for

429
00:14:03,829 --> 00:14:02,560
landing where will you be on landing day

430
00:14:05,670 --> 00:14:03,839
i will be comfortably at home with my

431
00:14:07,269 --> 00:14:05,680
cat on my lap and with a video call with

432
00:14:08,150 --> 00:14:07,279
all of my colleagues this sounds very

433
00:14:10,550 --> 00:14:08,160
relatable

434
00:14:11,910 --> 00:14:10,560
yes much of the world everyone out there

435
00:14:15,110 --> 00:14:11,920
everyone in the internet can

436
00:14:17,590 --> 00:14:15,120
can relate okay thanks so much assad

437
00:14:19,269 --> 00:14:17,600
thank you okay but we're not done we are

438
00:14:20,629 --> 00:14:19,279

not done we're staying behind the scenes

439
00:14:21,990 --> 00:14:20,639
here at jpl

440
00:14:23,750 --> 00:14:22,000
and we're going to go up to mission

441
00:14:25,829 --> 00:14:23,760
control and learn a little bit more

442
00:14:28,230 --> 00:14:25,839
about the engineering of this mission

443
00:14:29,350 --> 00:14:28,240
and uh how do you land on mars what do

444
00:14:31,350 --> 00:14:29,360
you do with it

445
00:14:32,870 --> 00:14:31,360
how do you run that rover once it's on

446
00:14:35,110 --> 00:14:32,880
the surface so i'm going to go ahead

447
00:14:36,870 --> 00:14:35,120
and let you move ahead we're going to

448
00:14:40,470 --> 00:14:36,880
meet up with one of my friends and

449
00:14:43,030 --> 00:14:40,480
colleagues diana trujillo hey diana

450
00:14:45,030 --> 00:14:43,040
good you look awfully relaxed for being

451
00:14:46,710 --> 00:14:45,040
this close to landing

452
00:14:48,310 --> 00:14:46,720
well you know we work so hard that at

453
00:14:49,829 --> 00:14:48,320
some point you just need to just

454
00:14:51,990 --> 00:14:49,839
enjoy the ride it's gonna happen

455
00:14:53,110 --> 00:14:52,000
regardless so and we're comfortable with

456
00:14:55,750 --> 00:14:53,120
what we have done so

457
00:14:56,310 --> 00:14:55,760
we got it we got this we got we're ready

458
00:14:58,230 --> 00:14:56,320
okay

459
00:15:00,710 --> 00:14:58,240
all right let's uh let you go ahead

460
00:15:02,629 --> 00:15:00,720
gabby um we're headed up the steps of

461
00:15:05,350 --> 00:15:02,639
building 180 this is our

462
00:15:07,110 --> 00:15:05,360
main administration building here at jpl

463
00:15:09,110 --> 00:15:07,120

so all of our top brass

464
00:15:10,310 --> 00:15:09,120
usually lives in non-covered times but

465
00:15:13,430 --> 00:15:10,320
we've

466
00:15:15,590 --> 00:15:13,440
months now

467
00:15:17,670 --> 00:15:15,600
it doesn't but this is it's still march

468
00:15:19,509 --> 00:15:17,680
of 2020 right

469
00:15:21,910 --> 00:15:19,519
how could it possibly be february of

470
00:15:24,069 --> 00:15:21,920
2021

471
00:15:25,269 --> 00:15:24,079
if you uh you folks out there watching

472
00:15:27,269 --> 00:15:25,279
on the internet

473
00:15:28,310 --> 00:15:27,279
in the after times know that you can

474
00:15:31,110 --> 00:15:28,320
come and take a

475
00:15:31,590 --> 00:15:31,120
tour of the appeal and you'd walk up

476
00:15:38,230 --> 00:15:31,600
through

477
00:15:40,069 --> 00:15:38,240
everybody is always having a good time

478
00:15:43,829 --> 00:15:40,079
we're always doing exciting things

479
00:15:46,150 --> 00:15:43,839
and other people are going live too

480
00:15:48,150 --> 00:15:46,160
lyle from our education group who may be

481
00:15:50,949 --> 00:15:48,160
live with a team right now

482
00:15:52,829 --> 00:15:50,959
so anyway another perseverance rover

483
00:16:01,269 --> 00:15:52,839
let's go ahead and go up to mission

484
00:16:05,430 --> 00:16:03,829
well yes stephanie i was hearing that

485
00:16:06,829 --> 00:16:05,440
bethany was talking about all the fun

486
00:16:09,350 --> 00:16:06,839
things that we're going to do with the

487
00:16:13,350 --> 00:16:09,360
sample

488
00:16:14,790 --> 00:16:13,360

yes yes i mean the science team can't

489
00:16:16,069 --> 00:16:14,800
wait to get their paws on this and they

490
00:16:18,870 --> 00:16:16,079
want to take this rover to

491
00:16:20,629 --> 00:16:18,880
the most dangerous places they can

492
00:16:22,710 --> 00:16:20,639
what's the push-pull like between the

493
00:16:24,629 --> 00:16:22,720
engineering team and the science team

494
00:16:26,870 --> 00:16:24,639
that's a great question because we have

495
00:16:28,470 --> 00:16:26,880
to figure out a way of working together

496
00:16:30,710 --> 00:16:28,480
at the end of the day the science team

497
00:16:33,110 --> 00:16:30,720
is the one that knows how we should be

498
00:16:35,189 --> 00:16:33,120
or where we should be going and then we

499
00:16:36,150 --> 00:16:35,199
are the ones that can enable that by

500
00:16:38,470 --> 00:16:36,160
helping

501
00:16:39,509 --> 00:16:38,480
get their own the fastest way or in a

502
00:16:42,870 --> 00:16:39,519
way that is safe

503
00:16:43,189 --> 00:16:42,880
so yeah it's a it's a happy family in a

504
00:16:45,670 --> 00:16:43,199
way

505
00:16:48,230 --> 00:16:45,680
where you disagree and you have to find

506
00:16:50,069 --> 00:16:48,240
a way also to agree

507
00:16:51,590 --> 00:16:50,079
well right now we are walking up the

508
00:16:54,710 --> 00:16:51,600
ramp to the space

509
00:16:58,069 --> 00:16:54,720
flight operations facility aka

510
00:17:02,310 --> 00:16:58,079
s-both aka the dark room aka

511
00:17:03,509 --> 00:17:02,320
mission control and uh this is the room

512
00:17:06,150 --> 00:17:03,519
where it happens folks

513
00:17:07,669 --> 00:17:06,160

this is the center of the universe and

514
00:17:10,309 --> 00:17:07,679
it's got some new flare

515
00:17:11,189 --> 00:17:10,319
there's our old flare and then up on the

516
00:17:13,990 --> 00:17:11,199
ceiling here

517
00:17:14,789 --> 00:17:14,000
we just installed the worm i know there

518
00:17:17,029 --> 00:17:14,799
are a lot of

519
00:17:19,189 --> 00:17:17,039
graphic design fans out there who

520
00:17:21,270 --> 00:17:19,199
absolutely love the nasa worm

521
00:17:22,309 --> 00:17:21,280
so we put it in it's subtle it's very

522
00:17:24,470 --> 00:17:22,319
nice

523
00:17:25,829 --> 00:17:24,480
most jblers haven't seen this yet

524
00:17:27,750 --> 00:17:25,839
because it was installed after we

525
00:17:36,230 --> 00:17:27,760
started working off lab

526
00:17:41,430 --> 00:17:39,270
so here we are in the newly designed

527
00:17:44,630 --> 00:17:41,440
lobby

528
00:17:45,669 --> 00:17:44,640
of space flight operations facility but

529
00:17:49,270 --> 00:17:45,679
let's go inside

530
00:17:53,909 --> 00:17:51,510
as you come up these stairs into the

531
00:17:56,710 --> 00:17:53,919
viewing gallery

532
00:17:57,830 --> 00:17:56,720
this is a space where in normal times we

533
00:18:01,510 --> 00:17:57,840
would have

534
00:18:04,950 --> 00:18:01,520
lots of vips for a major mission event

535
00:18:06,390 --> 00:18:04,960
back when mars exploration rovers landed

536
00:18:09,190 --> 00:18:06,400
then california governor arnold

537
00:18:12,390 --> 00:18:09,200
schwarzenegger was up here

538
00:18:15,830 --> 00:18:12,400

all kinds of folks so

539
00:18:18,710 --> 00:18:15,840
i realized anna i was so breathless and

540
00:18:20,070 --> 00:18:18,720
excited to see you that i didn't ask you

541
00:18:21,190 --> 00:18:20,080
about the work that you have been doing

542
00:18:22,870 --> 00:18:21,200
to this point

543
00:18:24,710 --> 00:18:22,880
you want to tell everybody what it is

544
00:18:26,470 --> 00:18:24,720
that you do what you've done

545
00:18:27,750 --> 00:18:26,480
and then what you will be doing sure

546
00:18:30,390 --> 00:18:27,760
absolutely so

547
00:18:31,190 --> 00:18:30,400
in the past i will say past meeting up

548
00:18:33,909 --> 00:18:31,200
to maybe

549
00:18:34,310 --> 00:18:33,919
april of this year i was working with

550
00:18:40,789 --> 00:18:34,320
the

551
00:18:42,150 --> 00:18:40,799
bethany went over

552
00:18:43,669 --> 00:18:42,160
that will be doing the scan on the

553
00:18:44,390 --> 00:18:43,679
surface so i had the pleasure to

554
00:18:45,990 --> 00:18:44,400
actually be on

555
00:18:47,590 --> 00:18:46,000
on the clean room testing all of that

556
00:18:49,830 --> 00:18:47,600
thing ship it to the cape

557
00:18:51,830 --> 00:18:49,840
and then see it get on the rocket but

558
00:18:53,350 --> 00:18:51,840
now my current job is i'm one of the

559
00:18:54,150 --> 00:18:53,360
four flight directors for surface

560
00:18:57,029 --> 00:18:54,160
operations

561
00:18:57,510 --> 00:18:57,039
so i will be there uh actually on day

562
00:19:02,390 --> 00:18:57,520
two

563
00:19:05,909 --> 00:19:02,400

uh already landed and see it all

564
00:19:08,310 --> 00:19:05,919
unfold excellent well all right

565
00:19:10,390 --> 00:19:08,320
we've got some beautiful visuals here i

566
00:19:11,909 --> 00:19:10,400
think people are probably very curious

567
00:19:14,150 --> 00:19:11,919
can you give us a little tour of what

568
00:19:15,590 --> 00:19:14,160
we're looking at absolutely so i love

569
00:19:16,710 --> 00:19:15,600
this room because the fact that it looks

570
00:19:19,750 --> 00:19:16,720
super cool

571
00:19:21,190 --> 00:19:19,760
it's actually a very cool room so

572
00:19:23,909 --> 00:19:21,200
a few things that you can see here so

573
00:19:24,470 --> 00:19:23,919
right on behind us you'll see curiosity

574
00:19:25,990 --> 00:19:24,480
ace

575
00:19:27,750 --> 00:19:26,000
that's the station where all the

576
00:19:29,430 --> 00:19:27,760
commands that go to the curiosity

577
00:19:30,789 --> 00:19:29,440
mission go so the person sits there

578
00:19:32,390 --> 00:19:30,799
sends them from here

579
00:19:34,630 --> 00:19:32,400
uh on the front row you will see the

580
00:19:36,150 --> 00:19:34,640
data controllers and the com chief

581
00:19:38,150 --> 00:19:36,160
and the d space network right on the

582
00:19:39,750 --> 00:19:38,160
middle this is where all the information

583
00:19:43,029 --> 00:19:39,760
from multiple missions that

584
00:19:45,029 --> 00:19:43,039
nasa jpl is actually uh flying

585
00:19:47,190 --> 00:19:45,039
gets to this room all that information

586
00:19:48,390 --> 00:19:47,200
that gets routed to the right teams on

587
00:19:50,230 --> 00:19:48,400
their mission control

588
00:19:52,230 --> 00:19:50,240

and one of the things that is super cool

589
00:19:54,710 --> 00:19:52,240
also about this room is that it's

590
00:19:55,909 --> 00:19:54,720
it's an international room i see it like

591
00:19:58,310 --> 00:19:55,919
that because you can see

592
00:20:00,150 --> 00:19:58,320
from the displays on the front you got

593
00:20:01,669 --> 00:20:00,160
the antennas that are in madrid

594
00:20:03,830 --> 00:20:01,679
the antennas that are on ghosting which

595
00:20:04,549 --> 00:20:03,840
is the us and then the antennas on

596
00:20:06,549 --> 00:20:04,559
cambera

597
00:20:07,990 --> 00:20:06,559
in australia those are the three big

598
00:20:10,070 --> 00:20:08,000
sites around the world

599
00:20:11,510 --> 00:20:10,080
where you can see any spacecraft that is

600
00:20:13,430 --> 00:20:11,520
in a planetary mission

601
00:20:14,789 --> 00:20:13,440
so all of those are the ones that track

602
00:20:16,789 --> 00:20:14,799
uh those missions right

603
00:20:18,870 --> 00:20:16,799
because we need those three stations you

604
00:20:19,669 --> 00:20:18,880
have to have line of sight to be able to

605
00:20:20,950 --> 00:20:19,679
talk

606
00:20:23,029 --> 00:20:20,960
to things out in space you've got to

607
00:20:24,710 --> 00:20:23,039
have an unobstructed view of them

608
00:20:27,029 --> 00:20:24,720
to get those radio signals either

609
00:20:30,230 --> 00:20:27,039
commands up or data back

610
00:20:32,310 --> 00:20:30,240
so as the globe turns as one station

611
00:20:34,950 --> 00:20:32,320
sets the next one comes into view

612
00:20:35,830 --> 00:20:34,960
that's right so uh you folks out there

613
00:20:38,710 --> 00:20:35,840

on the internet

614
00:20:40,149 --> 00:20:38,720
if you are interested in seeing what

615
00:20:42,710 --> 00:20:40,159
dishes are speaking to which

616
00:20:44,070 --> 00:20:42,720
spacecraft now you can go to your

617
00:20:47,750 --> 00:20:44,080
favorite search engine

618
00:20:49,750 --> 00:20:47,760
and type in dsn now and you will get a

619
00:20:50,230 --> 00:20:49,760
visualization tool that is powered by

620
00:20:52,710 --> 00:20:50,240
the

621
00:20:53,909 --> 00:20:52,720
well we're looking at it live uh what we

622
00:20:56,470 --> 00:20:53,919
have is what you have

623
00:20:57,029 --> 00:20:56,480
so you can do this from your phone and

624
00:20:59,029 --> 00:20:57,039
uh

625
00:21:00,310 --> 00:20:59,039
and tell everybody you know these are

626
00:21:00,950 --> 00:21:00,320
the signals that are coming in from

627
00:21:03,750 --> 00:21:00,960
space

628
00:21:04,390 --> 00:21:03,760
right now so you'll be connected with us

629
00:21:07,430 --> 00:21:04,400
we'll be

630
00:21:09,110 --> 00:21:07,440
alone together here on the internet and

631
00:21:11,230 --> 00:21:09,120
i love what you said because even from

632
00:21:14,830 --> 00:21:11,240
the screen you can see the dss

633
00:21:18,789 --> 00:21:14,840
25 from goldstone is actually tracking

634
00:21:21,350 --> 00:21:18,799
m20 meaning us perseverance

635
00:21:22,950 --> 00:21:21,360
very nice very nice right now the

636
00:21:25,270 --> 00:21:22,960
one-way light time between earth and

637
00:21:27,110 --> 00:21:25,280
mars is about 11 minutes it'll be 11

638
00:21:30,549 --> 00:21:27,120

minutes 22 seconds if

639
00:21:32,710 --> 00:21:30,559
i remember my press kit on landing day

640
00:21:33,990 --> 00:21:32,720
so we'll be broadcasting live from this

641
00:21:35,669 --> 00:21:34,000
room and

642
00:21:37,669 --> 00:21:35,679
we'll get to a little bit more about

643
00:21:40,470 --> 00:21:37,679
that at the end of our show how you can

644
00:21:43,750 --> 00:21:40,480
tune in live and be part of that action

645
00:21:44,149 --> 00:21:43,760
but um but before we get to that deanna

646
00:21:47,430 --> 00:21:44,159
the

647
00:21:49,750 --> 00:21:47,440
right

648
00:21:51,430 --> 00:21:49,760
in this room we should call out exactly

649
00:21:52,710 --> 00:21:51,440
so okay so this is really cool but then

650
00:21:54,870 --> 00:21:52,720
to the left

651
00:21:56,390 --> 00:21:54,880
you will see the room where entry

652
00:21:56,789 --> 00:21:56,400
decision and landing will be happening

653
00:21:58,630 --> 00:21:56,799
so

654
00:22:00,070 --> 00:21:58,640
all the team members from operations

655
00:22:01,510 --> 00:22:00,080
that will be sitting on station

656
00:22:03,110 --> 00:22:01,520
is on the left side where you can see

657
00:22:06,149 --> 00:22:03,120
the bottom of the american flag

658
00:22:07,270 --> 00:22:06,159
you can even see the flight director and

659
00:22:09,750 --> 00:22:07,280
the edl

660
00:22:10,470 --> 00:22:09,760
introducing and landing activity lead

661
00:22:12,710 --> 00:22:10,480
signs

662
00:22:16,230 --> 00:22:12,720
so whenever you see the broadcast you're

663
00:22:17,909 --> 00:22:16,240

going to be watching that room live

664
00:22:20,149 --> 00:22:17,919
okay so let's go ahead and go to some

665
00:22:21,110 --> 00:22:20,159
questions from the internet here for

666
00:22:24,390 --> 00:22:21,120
diana

667
00:22:25,669 --> 00:22:24,400
um danielle asks what's the difference

668
00:22:27,270 --> 00:22:25,679
between entry descent and landing on

669
00:22:30,230 --> 00:22:27,280
perseverance compared

670
00:22:31,990 --> 00:22:30,240
to curiosity oh i like that question

671
00:22:33,190 --> 00:22:32,000
okay so one of the differences that is

672
00:22:35,190 --> 00:22:33,200
very important

673
00:22:36,789 --> 00:22:35,200
is the way that curiosity came in you

674
00:22:38,470 --> 00:22:36,799
know we did the whole navigation it

675
00:22:39,990 --> 00:22:38,480
finds where we have to actually land

676
00:22:41,350 --> 00:22:40,000
but the difference with perseverance is

677
00:22:43,190 --> 00:22:41,360
that this go around we're gonna do it

678
00:22:43,830 --> 00:22:43,200
with eyes open that's how we describe it

679
00:22:46,149 --> 00:22:43,840
which is

680
00:22:48,310 --> 00:22:46,159
it's actually taking images as is coming

681
00:22:50,630 --> 00:22:48,320
in and then comparing it with an

682
00:22:51,430 --> 00:22:50,640
onboard map to determine exactly how to

683
00:22:52,870 --> 00:22:51,440
navigate to

684
00:22:54,549 --> 00:22:52,880
safely get to the place that we're gonna

685
00:22:57,510 --> 00:22:54,559
land so uh

686
00:22:58,710 --> 00:22:57,520
yeah that's a key difference all right

687
00:23:01,590 --> 00:22:58,720
so emma harding

688
00:23:03,430 --> 00:23:01,600

um tuning in from the uk uh is there

689
00:23:05,510 --> 00:23:03,440
with her nine-year-old son oliver who is

690
00:23:07,590 --> 00:23:05,520
super excited for the mission

691
00:23:09,510 --> 00:23:07,600
he wants to know how long did it take to

692
00:23:11,430 --> 00:23:09,520
build the perseverance rover and how

693
00:23:13,750 --> 00:23:11,440
many people did it take to build it

694
00:23:14,630 --> 00:23:13,760
oh that's a great question so it takes a

695
00:23:16,470 --> 00:23:14,640
lot of time

696
00:23:18,070 --> 00:23:16,480
it takes approximately from the

697
00:23:19,510 --> 00:23:18,080
beginning of conception of like saying

698
00:23:21,029 --> 00:23:19,520
what's the design looking like

699
00:23:23,750 --> 00:23:21,039
to the point where we actually put it on

700
00:23:25,190 --> 00:23:23,760
the rocket it's approximately 10 years

701
00:23:27,110 --> 00:23:25,200
or something along those lines

702
00:23:29,190 --> 00:23:27,120
and it's a ton of people it's a ton of

703
00:23:30,789 --> 00:23:29,200
people in even not so many people it's

704
00:23:33,110 --> 00:23:30,799
also people from different countries

705
00:23:34,630 --> 00:23:33,120
from different languages it's very great

706
00:23:36,789 --> 00:23:34,640
because you come in together as an

707
00:23:38,630 --> 00:23:36,799
international group and an international

708
00:23:40,630 --> 00:23:38,640
team to build this thing

709
00:23:41,990 --> 00:23:40,640
and once we're on the surface uh daniel

710
00:23:45,029 --> 00:23:42,000
ryan on facebook asked

711
00:23:45,990 --> 00:23:45,039
how long is the mission ah how long is

712
00:23:47,909 --> 00:23:46,000
the mission so

713
00:23:50,149 --> 00:23:47,919

the mission itself has two different

714
00:23:53,430 --> 00:23:50,159
stages the actual primary mission

715
00:23:53,830 --> 00:23:53,440
it will be a two earth year one a marsh

716
00:23:56,390 --> 00:23:53,840
year

717
00:23:57,350 --> 00:23:56,400
on the surface of mars and so we hope

718
00:23:59,029 --> 00:23:57,360
that we can answer

719
00:24:01,110 --> 00:23:59,039
the question and the objective is about

720
00:24:02,630 --> 00:24:01,120
that time but usually the missions then

721
00:24:04,070 --> 00:24:02,640
eventually get extended because we're

722
00:24:04,950 --> 00:24:04,080
still on the surface of mars and in this

723
00:24:06,950 --> 00:24:04,960
specific case

724
00:24:08,070 --> 00:24:06,960
we have nuclear power so we can stay

725
00:24:10,230 --> 00:24:08,080
longer but

726
00:24:11,990 --> 00:24:10,240
uh the primary mission is one a mars

727
00:24:13,590 --> 00:24:12,000
year all right so we're gonna get all

728
00:24:14,789 --> 00:24:13,600
that seasonal data that the uh the

729
00:24:17,269 --> 00:24:14,799
scientists are so

730
00:24:17,990 --> 00:24:17,279
hungry for and moxie too moxie needs to

731
00:24:20,710 --> 00:24:18,000
see how

732
00:24:22,390 --> 00:24:20,720
it behaves over all the seasons okay

733
00:24:24,390 --> 00:24:22,400
christopher mick on facebook

734
00:24:25,830 --> 00:24:24,400
asks how much of an orbit does

735
00:24:27,830 --> 00:24:25,840
perseverance make of

736
00:24:29,909 --> 00:24:27,840
mars before starting entry descent and

737
00:24:32,549 --> 00:24:29,919
landing oh how much of an orbit

738
00:24:33,510 --> 00:24:32,559

uh that's a good question uh so we're

739
00:24:36,789 --> 00:24:33,520
coming in

740
00:24:38,470 --> 00:24:36,799
straight into uh mars we do tcm's to

741
00:24:39,350 --> 00:24:38,480
correct exactly where we're gonna do the

742
00:24:42,230 --> 00:24:39,360
entry point

743
00:24:43,510 --> 00:24:42,240
just going straight in through the

744
00:24:45,110 --> 00:24:43,520
atmosphere to land so

745
00:24:47,029 --> 00:24:45,120
there's not much time that we're wasting

746
00:24:49,110 --> 00:24:47,039
as soon as we feel the atmosphere just

747
00:24:51,190 --> 00:24:49,120
we're just going in

748
00:24:52,950 --> 00:24:51,200
and uh on the software side of things

749
00:24:55,029 --> 00:24:52,960
nor the door asks how

750
00:24:57,350 --> 00:24:55,039
complicated is the automated landing

751
00:24:59,510 --> 00:24:57,360
sequence and who wrote the code

752
00:25:00,870 --> 00:24:59,520
oh that's a really interesting question

753
00:25:03,750 --> 00:25:00,880
okay so

754
00:25:04,710 --> 00:25:03,760
very complicated i think the way that i

755
00:25:06,630 --> 00:25:04,720
describe it

756
00:25:08,549 --> 00:25:06,640
is we're touching the top of the

757
00:25:11,590 --> 00:25:08,559
atmosphere of mars at

758
00:25:12,950 --> 00:25:11,600
20 000 kilometers per hour which is

759
00:25:14,870 --> 00:25:12,960
insanely fast

760
00:25:16,390 --> 00:25:14,880
and then the complicated aspect of it is

761
00:25:17,990 --> 00:25:16,400
that it has multi parts that come

762
00:25:20,149 --> 00:25:18,000
off at the specific instances while

763
00:25:20,950 --> 00:25:20,159

taking pictures and having retro rockets

764
00:25:22,630 --> 00:25:20,960
and landing

765
00:25:24,870 --> 00:25:22,640
so you can imagine that just my

766
00:25:27,909 --> 00:25:24,880
description is super complicated so

767
00:25:29,990 --> 00:25:27,919
now i will say we tested we tested

768
00:25:32,070 --> 00:25:30,000
constantly we tested multiple times

769
00:25:33,510 --> 00:25:32,080
and the code itself is actually a team

770
00:25:34,470 --> 00:25:33,520
so it's a team of people that write

771
00:25:37,110 --> 00:25:34,480
different pieces

772
00:25:38,070 --> 00:25:37,120
of that uh of that area the devices that

773
00:25:39,350 --> 00:25:38,080
are going to be used

774
00:25:41,430 --> 00:25:39,360
how those devices are going to get

775
00:25:43,590 --> 00:25:41,440
integrated and then the software itself

776
00:25:44,950 --> 00:25:43,600
gets built by lots of different people

777
00:25:46,549 --> 00:25:44,960
that we get to test with lots of

778
00:25:48,470 --> 00:25:46,559
different more people

779
00:25:50,549 --> 00:25:48,480
okay you really you touched on this a

780
00:25:53,269 --> 00:25:50,559
little bit with the um

781
00:25:55,430 --> 00:25:53,279
the needing to see the surface to choose

782
00:25:56,870 --> 00:25:55,440
that landing site so nancy wilkins wants

783
00:25:59,350 --> 00:25:56,880
to know is it the rover

784
00:26:00,149 --> 00:25:59,360
uh perseverance or the descent module

785
00:26:02,630 --> 00:26:00,159
taking

786
00:26:04,390 --> 00:26:02,640
those images to find the safest lane the

787
00:26:05,590 --> 00:26:04,400
safest landing site uh that's a really

788
00:26:08,070 --> 00:26:05,600

good question so

789
00:26:09,669 --> 00:26:08,080
when the back shield of the rover comes

790
00:26:11,110 --> 00:26:09,679
so it has a heat shield and it has a

791
00:26:11,590 --> 00:26:11,120
back shield when the heat shield comes

792
00:26:14,230 --> 00:26:11,600
out

793
00:26:15,990 --> 00:26:14,240
there is a radar that we point down to

794
00:26:18,470 --> 00:26:16,000
find actually that location

795
00:26:20,310 --> 00:26:18,480
of where we're going so it is not per se

796
00:26:22,870 --> 00:26:20,320
the actual rover itself

797
00:26:24,310 --> 00:26:22,880
is actually the decent stage that has

798
00:26:26,230 --> 00:26:24,320
the radar the lighter

799
00:26:27,510 --> 00:26:26,240
that will find the location but there's

800
00:26:29,430 --> 00:26:27,520
one thing that i like about your

801
00:26:32,230 --> 00:26:29,440
question which is the rover itself

802
00:26:34,070 --> 00:26:32,240
on a side also has a camera that will be

803
00:26:34,390 --> 00:26:34,080
taking pictures as is coming down so we

804
00:26:41,830 --> 00:26:34,400
got

805
00:26:43,590 --> 00:26:41,840
all right aveena's uh hj98

806
00:26:45,430 --> 00:26:43,600
can i be a member of this mission how

807
00:26:46,950 --> 00:26:45,440
can i work for nasa

808
00:26:48,310 --> 00:26:46,960
oh my goodness of course you can be a

809
00:26:50,470 --> 00:26:48,320
member of this mission it takes

810
00:26:51,909 --> 00:26:50,480
everybody to get to do this right like

811
00:26:53,510 --> 00:26:51,919
the questions are things that we have

812
00:26:55,110 --> 00:26:53,520
never asked ourselves before things that

813
00:26:57,110 --> 00:26:55,120

we have never tried before

814
00:26:58,950 --> 00:26:57,120
so we kind of need everybody to come up

815
00:26:59,990 --> 00:26:58,960
with their own way of seeing things from

816
00:27:02,789 --> 00:27:00,000
their different angles

817
00:27:05,350 --> 00:27:02,799
so i will say go to nasa.gov check out

818
00:27:07,350 --> 00:27:05,360
jpl for any opening that there is and if

819
00:27:09,669 --> 00:27:07,360
you are not interested in those jobs

820
00:27:11,990 --> 00:27:09,679
you can certainly follow the show and be

821
00:27:13,750 --> 00:27:12,000
part of all of this even with the online

822
00:27:16,549 --> 00:27:13,760
activities that stephanie and her team

823
00:27:18,310 --> 00:27:16,559
have all right that is a perfect segue

824
00:27:19,990 --> 00:27:18,320
if you want to know how to participate

825
00:27:21,669 --> 00:27:20,000
in the mission if you want to join

826
00:27:23,190 --> 00:27:21,679
our mission tomorrow student challenge

827
00:27:25,750 --> 00:27:23,200
if you want to join the conversation

828
00:27:30,310 --> 00:27:25,760
with the rover on twitter and facebook

829
00:27:34,470 --> 00:27:30,320
all of that you can find at go.nasa.gov

830
00:27:36,230 --> 00:27:34,480
mars 2020 toolkit and oh my goodness

831
00:27:39,029 --> 00:27:36,240
here it is it's tuesday afternoon

832
00:27:40,630 --> 00:27:39,039
thursday we're going to be

833
00:27:42,149 --> 00:27:40,640
live streaming from this room we'll be

834
00:27:45,190 --> 00:27:42,159
live streaming in

835
00:27:48,070 --> 00:27:45,200
2d in 360 degrees

836
00:27:49,190 --> 00:27:48,080
and for the first time ever an espanol

837
00:27:53,510 --> 00:27:49,200
en espanol

838
00:28:00,830 --> 00:27:53,520

yes for the first time ever espanol

839
00:28:06,230 --> 00:28:03,190
is

840
00:28:09,269 --> 00:28:06,240
everyone we hope that you