1
00:03:08,149 --> 00:03:06,070
on lab

2
00:03:10,229 --> 00:03:08,159
like christina we'll get a closer look

3
00:03:13,190 --> 00:03:10,239
behind the scenes at the facility she's

4
00:03:14,149 --> 00:03:13,200
in in a moment but first let's go to you

5
00:03:19,030 --> 00:03:14,159
jessica

6
00:03:23,030 --> 00:03:19,040
let's start with that let's unpack that

7
00:03:25,830 --> 00:03:23,040
a little bit what is fault protection

8
00:03:26,949 --> 00:03:25,840
yeah thank you stephanie um so fault

9
00:03:30,309 --> 00:03:26,959
protection

10
00:03:33,190 --> 00:03:30,319
is a kind of a unique field at jpl

11
00:03:34,229 --> 00:03:33,200
and the metaphor that i sometimes hear

12
00:03:36,949 --> 00:03:34,239
people use is that

13
00:03:37,990 --> 00:03:36,959

we're kind of like the doctors for the

14
00:03:41,030 --> 00:03:38,000
rover so

15
00:03:44,070 --> 00:03:41,040
um we because there there's nobody

16
00:03:45,670 --> 00:03:44,080
to take care of the rover on mars or

17
00:03:48,789 --> 00:03:45,680
in route to mars if it encounters an

18
00:03:50,789 --> 00:03:48,799
issue we actually have to equip

19
00:03:52,229 --> 00:03:50,799
perseverance with the ability to

20
00:03:55,750 --> 00:03:52,239
diagnose

21
00:03:57,030 --> 00:03:55,760
problems on itself so we build in all of

22
00:04:00,149 --> 00:03:57,040
this software

23
00:04:01,429 --> 00:04:00,159
to help perseverance detect if something

24
00:04:04,390 --> 00:04:01,439
has gone wrong

25
00:04:05,830 --> 00:04:04,400
and then there actually are several

26
00:04:09,110 --> 00:04:05,840
spare

27
00:04:12,070 --> 00:04:09,120
components that she can use

28
00:04:13,509 --> 00:04:12,080
and swap to if she encounters an issue

29
00:04:16,310 --> 00:04:13,519
so

30
00:04:17,749 --> 00:04:16,320
in addition to that we uh we kind of

31
00:04:20,229 --> 00:04:17,759
operate like the doctors

32
00:04:21,430 --> 00:04:20,239
in operations once she's on her way to

33
00:04:24,230 --> 00:04:21,440
mars because

34
00:04:26,230 --> 00:04:24,240
we um if there is a problem uh

35
00:04:26,710 --> 00:04:26,240
perseverance notifies the team on the

36
00:04:28,950 --> 00:04:26,720
ground

37
00:04:29,909 --> 00:04:28,960
and then we work to try to diagnose

38
00:04:32,310 --> 00:04:29,919

what's going on

39
00:04:34,390 --> 00:04:32,320
and try to get her back to full

40
00:04:36,629 --> 00:04:34,400
operations

41
00:04:37,830 --> 00:04:36,639
now you're at home right now you'll be

42
00:04:42,790 --> 00:04:37,840
on console

43
00:04:46,070 --> 00:04:42,800
at jpl tomorrow what will you be doing

44
00:04:48,629 --> 00:04:46,080
um hopefully not getting too nervous but

45
00:04:51,030 --> 00:04:48,639
really just getting excited and we're

46
00:04:53,189 --> 00:04:51,040
going our team is going to

47
00:04:54,390 --> 00:04:53,199
be looking at the data coming from

48
00:04:56,070 --> 00:04:54,400
perseverance

49
00:04:57,670 --> 00:04:56,080
and assessing whether everything looks

50
00:05:00,469 --> 00:04:57,680
nominal um

51
00:05:01,830 --> 00:05:00,479
both before the launch and then um after

52
00:05:05,350 --> 00:05:01,840
we launch

53
00:05:07,430 --> 00:05:05,360
about 45

54
00:05:08,870 --> 00:05:07,440
minutes or so before we we go into

55
00:05:11,510 --> 00:05:08,880
what's called an eclipse

56
00:05:11,909 --> 00:05:11,520
so we'll go behind the earth and the sun

57
00:05:14,550 --> 00:05:11,919
will

58
00:05:15,430 --> 00:05:14,560
be blocked out and during that time we

59
00:05:18,710 --> 00:05:15,440
will separate

60
00:05:20,230 --> 00:05:18,720
from the the rocket and um

61
00:05:21,749 --> 00:05:20,240
so that period of time we'll actually

62
00:05:24,950 --> 00:05:21,759
lose data

63
00:05:26,790 --> 00:05:24,960

lose visibility and then we um when we

64
00:05:29,749 --> 00:05:26,800
come out of that eclipse we will

65
00:05:30,469 --> 00:05:29,759
begin receiving data from perseverance's

66
00:05:33,510 --> 00:05:30,479
own radio

67
00:05:35,749 --> 00:05:33,520
so that'll be a huge event where we're

68
00:05:37,029 --> 00:05:35,759
looking forward to seeing

69
00:05:39,110 --> 00:05:37,039
data for the first time being

70
00:05:42,230 --> 00:05:39,120
transmitted by perseverance on

71
00:05:44,150 --> 00:05:42,240
on its own radio

72
00:05:46,390 --> 00:05:44,160
i can't wait to see what the uh what the

73
00:05:48,230 --> 00:05:46,400
shot looks like out of mission control

74
00:05:50,230 --> 00:05:48,240
although you'll all be social distancing

75
00:05:51,590 --> 00:05:50,240
so maybe not quite as many high fives

76
00:05:53,909 --> 00:05:51,600
right

77
00:05:54,950 --> 00:05:53,919
correct yeah we actually had to do a lot

78
00:05:56,469 --> 00:05:54,960
to um

79
00:05:58,309 --> 00:05:56,479
kind of work in this new realm with

80
00:06:00,550 --> 00:05:58,319
covid so we have very

81
00:06:01,830 --> 00:06:00,560
strict cleaning um guidelines when we

82
00:06:03,270 --> 00:06:01,840
come into our console

83
00:06:05,749 --> 00:06:03,280
we're all gonna be wearing masks so you

84
00:06:09,029 --> 00:06:05,759
won't really be able to see us

85
00:06:09,590 --> 00:06:09,039
smiling ear to ear and then you know our

86
00:06:11,830 --> 00:06:09,600
typical

87
00:06:14,309 --> 00:06:11,840
jumping up and down and high fives you

88
00:06:16,950 --> 00:06:14,319

probably won't see us doing that

89
00:06:17,670 --> 00:06:16,960
and we are going to try to eat peanuts

90
00:06:20,070 --> 00:06:17,680
which is

91
00:06:20,870 --> 00:06:20,080
a good luck tradition but we will be

92
00:06:24,150 --> 00:06:20,880
doing it

93
00:06:25,590 --> 00:06:24,160
in a very discreet and safer way um

94
00:06:28,070 --> 00:06:25,600
but still want to try to carry that

95
00:06:30,629 --> 00:06:28,080
tradition through

96
00:06:31,670 --> 00:06:30,639
fantastic all right so i've got a

97
00:06:33,670 --> 00:06:31,680
million questions

98
00:06:34,950 --> 00:06:33,680
but that pales in comparison to the

99
00:06:36,150 --> 00:06:34,960
number of questions who are coming in

100
00:06:37,590 --> 00:06:36,160
from people online

101
00:06:39,510 --> 00:06:37,600
and i want to make sure we get as many

102
00:06:42,469 --> 00:06:39,520
as possible so um

103
00:06:44,390 --> 00:06:42,479
over on twitter fragile fern uh has a

104
00:06:46,230 --> 00:06:44,400
software question for you

105
00:06:48,469 --> 00:06:46,240
so speaking as a software developer

106
00:06:49,990 --> 00:06:48,479
she's curious what programming language

107
00:06:54,309 --> 00:06:50,000
do you use to control

108
00:06:57,270 --> 00:06:54,319
various functions um on the rover

109
00:06:59,749 --> 00:06:57,280
that is a really good question so i

110
00:07:01,830 --> 00:06:59,759
actually don't write the software but we

111
00:07:03,110 --> 00:07:01,840
we do what we call specify it for our

112
00:07:05,589 --> 00:07:03,120
software engineers

113
00:07:06,390 --> 00:07:05,599

to go and write the code and it's all in

114
00:07:09,350 --> 00:07:06,400
c

115
00:07:09,909 --> 00:07:09,360
so um you might be familiar with that

116
00:07:13,830 --> 00:07:09,919
and

117
00:07:17,990 --> 00:07:13,840
um yeah it's uh there's no special jpl

118
00:07:21,270 --> 00:07:19,430
excellent excellent now i'm just

119
00:07:24,150 --> 00:07:21,280
scanning through here

120
00:07:27,350 --> 00:07:24,160
let's see um cameras may i ask you a

121
00:07:31,589 --> 00:07:27,360
question about the cameras

122
00:07:33,430 --> 00:07:31,599
sure all right so um

123
00:07:35,270 --> 00:07:33,440
here we go a mall on twitter wants to

124
00:07:35,909 --> 00:07:35,280
know how will perseverance clean its

125
00:07:39,990 --> 00:07:35,919
cameras

126
00:07:42,469 --> 00:07:40,000
um what if dust particles cover it

127
00:07:44,150 --> 00:07:42,479
that's a really good question um so i'm

128
00:07:45,270 --> 00:07:44,160
not quite as familiar with the cameras

129
00:07:47,350 --> 00:07:45,280
but i do know we

130
00:07:48,710 --> 00:07:47,360
when we land we're worried about dust

131
00:07:52,469 --> 00:07:48,720
accumulation

132
00:07:53,510 --> 00:07:52,479
from landing itself so um the cameras

133
00:07:56,469 --> 00:07:53,520
are equipped with dust

134
00:07:57,830 --> 00:07:56,479
covers that then once all that dust has

135
00:08:00,869 --> 00:07:57,840
settled and we've been on the surface

136
00:08:03,670 --> 00:08:00,879
safely we pop them off

137
00:08:04,950 --> 00:08:03,680
if after that fact there is some dust

138
00:08:06,230 --> 00:08:04,960

accumulation

139
00:08:08,309 --> 00:08:06,240
i don't think there's that much we can

140
00:08:11,670 --> 00:08:08,319
do other than kind of rely on

141
00:08:14,710 --> 00:08:11,680
the ambient winds to clean them off um

142
00:08:16,309 --> 00:08:14,720
but i know on msl uh you know which has

143
00:08:17,749 --> 00:08:16,319
been on the surface of mars for years

144
00:08:20,790 --> 00:08:17,759
now we haven't had any

145
00:08:22,790 --> 00:08:20,800
major issues with dust accumulations so

146
00:08:25,589 --> 00:08:22,800
i think we're kind of hoping for the

147
00:08:28,790 --> 00:08:28,070
all right and um you know a lot of folks

148
00:08:30,790 --> 00:08:28,800
want to know

149
00:08:33,509 --> 00:08:30,800
you know how do you even get a job like

150
00:08:36,790 --> 00:08:33,519
this uh what was the path that you took

151
00:08:39,269 --> 00:08:36,800
to get to jpl yeah

152
00:08:40,469 --> 00:08:39,279
it's kind of a winding and seemingly

153
00:08:42,709 --> 00:08:40,479
random path

154
00:08:44,070 --> 00:08:42,719
uh there's a you can't major in fault

155
00:08:47,110 --> 00:08:44,080
protection engineering

156
00:08:50,070 --> 00:08:47,120
um in college so um

157
00:08:50,790 --> 00:08:50,080
i uh you know realized i wanted to be an

158
00:08:53,110 --> 00:08:50,800
engineer

159
00:08:54,550 --> 00:08:53,120
around when i was a senior in high

160
00:08:58,070 --> 00:08:54,560
school

161
00:09:00,150 --> 00:08:58,080
and i applied to georgia tech i

162
00:09:01,829 --> 00:09:00,160
switched majors two times i went from

163
00:09:03,910 --> 00:09:01,839

undecided to biomedical

164
00:09:06,470 --> 00:09:03,920
i thought i wanted to be a real doctor

165
00:09:10,070 --> 00:09:06,480
then realize that wasn't for me

166
00:09:11,990 --> 00:09:10,080
so i uh went into aerospace engineering

167
00:09:13,110 --> 00:09:12,000
and just happened to kind of fall in

168
00:09:16,310 --> 00:09:13,120
love with it

169
00:09:17,509 --> 00:09:16,320
and um through that i got internships at

170
00:09:20,630 --> 00:09:17,519
jpl

171
00:09:22,630 --> 00:09:20,640
and that was a great way to um kind of

172
00:09:26,230 --> 00:09:22,640
get a

173
00:09:29,590 --> 00:09:26,240
acquainted with jpl and how nasa works

174
00:09:31,750 --> 00:09:29,600
so um through that i got hired at jpl

175
00:09:33,590 --> 00:09:31,760
um and then fault protection again was

176
00:09:36,790 --> 00:09:33,600
something i had never

177
00:09:39,750 --> 00:09:36,800
um had prior experience in but i

178
00:09:41,269 --> 00:09:39,760
um i actually completely love doing fall

179
00:09:43,030 --> 00:09:41,279
protection engineering and i

180
00:09:45,910 --> 00:09:43,040
and i don't know if i'll ever kind of

181
00:09:50,070 --> 00:09:48,710
fantastic okay so i want to make sure

182
00:09:52,630 --> 00:09:50,080
that we get

183
00:09:54,070 --> 00:09:52,640
to all of our panelists here so jessica

184
00:09:54,870 --> 00:09:54,080
hang on we're going to switch things

185
00:09:57,590 --> 00:09:54,880
over

186
00:09:59,030 --> 00:09:57,600
to the jet propulsion laboratory where

187
00:10:02,389 --> 00:09:59,040
christina hernandez

188
00:10:04,710 --> 00:10:02,399

is in a very very special place one of

189
00:10:05,110 --> 00:10:04,720
our indoor mars yards christina tell us

190
00:10:07,110 --> 00:10:05,120
more

191
00:10:08,870 --> 00:10:07,120
about the lab you're in and what's going

192
00:10:11,430 --> 00:10:08,880
on there

193
00:10:13,190 --> 00:10:11,440
yeah uh so thanks for having me um so

194
00:10:14,150 --> 00:10:13,200
right now i'm in the flight software

195
00:10:17,030 --> 00:10:14,160
test bed

196
00:10:19,269 --> 00:10:17,040
so it's basically an indoor mars yard

197
00:10:21,590 --> 00:10:19,279
and um we do have kobit protocol

198
00:10:22,790 --> 00:10:21,600
but i took my mask off my mars 2020

199
00:10:24,949 --> 00:10:22,800
issued mask

200
00:10:26,870 --> 00:10:24,959
since nobody else is around right now

201
00:10:29,509 --> 00:10:26,880
but basically behind me what you have

202
00:10:30,470 --> 00:10:29,519
is the start of the twin that will

203
00:10:33,110 --> 00:10:30,480
eventually become

204
00:10:34,949 --> 00:10:33,120
mars perseverance's twin and what we do

205
00:10:36,870 --> 00:10:34,959
in here is we test the higher level

206
00:10:39,990 --> 00:10:36,880
behaviors of this robotic

207
00:10:41,829 --> 00:10:40,000
geologist and astrobiologists so behind

208
00:10:43,430 --> 00:10:41,839
me we've got the robotic arm in the

209
00:10:46,150 --> 00:10:43,440
stowed configuration

210
00:10:46,949 --> 00:10:46,160
at the very top we have the turret and

211
00:10:48,870 --> 00:10:46,959
on the turret

212
00:10:49,990 --> 00:10:48,880
um we'll have sherlock we have sherlock

213
00:10:52,550 --> 00:10:50,000

on the other side

214
00:10:54,069 --> 00:10:52,560
and on tuesday the pixel em sensor

215
00:10:55,829 --> 00:10:54,079
assembly one of our other science

216
00:10:58,069 --> 00:10:55,839
instruments will be getting installed

217
00:10:59,910 --> 00:10:58,079
for some robotic arm testing and so we

218
00:11:00,230 --> 00:10:59,920
test you know all kinds of things we

219
00:11:02,790 --> 00:11:00,240
take

220
00:11:05,430 --> 00:11:02,800
images with the instruments we look at

221
00:11:06,550 --> 00:11:05,440
rocks we drill rocks and we try and test

222
00:11:08,470 --> 00:11:06,560
the end-to-end

223
00:11:10,069 --> 00:11:08,480
behavior that we're going to see once we

224
00:11:12,230 --> 00:11:10,079
get to mars

225
00:11:15,430 --> 00:11:12,240
fantastic now i know that you are an

226
00:11:17,750 --> 00:11:15,440
instrument engineer currently working on

227
00:11:20,069 --> 00:11:17,760
pixel what does an instrument engineer

228
00:11:23,670 --> 00:11:22,069
it's a fun job uh sometimes it's a

229
00:11:24,389 --> 00:11:23,680
little chaotic but i think that's why we

230
00:11:27,190 --> 00:11:24,399
all became

231
00:11:28,310 --> 00:11:27,200
engineers to solve tough problems so

232
00:11:31,350 --> 00:11:28,320
instrument engineers

233
00:11:33,190 --> 00:11:31,360
their job is to understand the rover and

234
00:11:35,350 --> 00:11:33,200
how it interacts with the instruments

235
00:11:37,829 --> 00:11:35,360
but at the same time understand all the

236
00:11:38,949 --> 00:11:37,839
nuts and bolts in behaviors and quirks

237
00:11:40,710 --> 00:11:38,959
as we call them

238
00:11:42,470 --> 00:11:40,720

of the seven different science

239
00:11:43,910 --> 00:11:42,480
instruments so we have a team of

240
00:11:45,990 --> 00:11:43,920
instrument engineers

241
00:11:47,750 --> 00:11:46,000
who have been apart from the early

242
00:11:49,430 --> 00:11:47,760
design and accommodation of the

243
00:11:51,430 --> 00:11:49,440
instruments on the rover

244
00:11:53,110 --> 00:11:51,440
through assembly tests and launch

245
00:11:54,150 --> 00:11:53,120
operations where we were testing with

246
00:11:55,990 --> 00:11:54,160
the flight vehicle

247
00:11:58,230 --> 00:11:56,000
and with engineers like jessica on

248
00:12:00,230 --> 00:11:58,240
console and then now we're getting ready

249
00:12:02,069 --> 00:12:00,240
to prepare for our operations and

250
00:12:03,910 --> 00:12:02,079
understanding what are the tools

251
00:12:05,990 --> 00:12:03,920
um that scientists like joby that you'll

252
00:12:09,430 --> 00:12:06,000
hear from uh later are gonna need

253
00:12:12,389 --> 00:12:09,440
to do cool science on mars okay

254
00:12:13,430 --> 00:12:12,399
so question from our youtube chat uh

255
00:12:17,590 --> 00:12:13,440
laxmi pandit

256
00:12:21,910 --> 00:12:17,600
wants to know how was the rover built

257
00:12:24,150 --> 00:12:21,920
so you've got you've please

258
00:12:25,670 --> 00:12:24,160
it's just an exciting question because

259
00:12:28,069 --> 00:12:25,680
this is not the effort of

260
00:12:29,750 --> 00:12:28,079
a few engineers it's the effort um of

261
00:12:31,350 --> 00:12:29,760
not just the united states also but our

262
00:12:33,910 --> 00:12:31,360
global collaborators in

263
00:12:35,110 --> 00:12:33,920

france norway and spain and many other

264
00:12:36,710 --> 00:12:35,120
places so

265
00:12:39,030 --> 00:12:36,720
basically we had different groups of

266
00:12:40,949 --> 00:12:39,040
teams build the boxes the instruments

267
00:12:43,990 --> 00:12:40,959
the different subsystems

268
00:12:44,629 --> 00:12:44,000
most of it was built here at jpl and at

269
00:12:46,629 --> 00:12:44,639
jpl

270
00:12:48,710 --> 00:12:46,639
is where we integrated and assembled it

271
00:12:49,750 --> 00:12:48,720
all together and so it started from a

272
00:12:51,590 --> 00:12:49,760
paper design

273
00:12:53,110 --> 00:12:51,600
about 10 years ago and now it's

274
00:12:54,870 --> 00:12:53,120
manifested to a one ton

275
00:12:56,629 --> 00:12:54,880
beast of a thing that's on a launch pad

276
00:12:59,590 --> 00:12:56,639
today

277
00:12:59,990 --> 00:12:59,600
fantastic oh my goodness we're getting

278
00:13:02,470 --> 00:13:00,000
so

279
00:13:03,910 --> 00:13:02,480
many questions here from all over the

280
00:13:07,269 --> 00:13:03,920
world

281
00:13:08,069 --> 00:13:07,279
ah fantastic all right i'm seeing

282
00:13:09,829 --> 00:13:08,079
several here

283
00:13:12,150 --> 00:13:09,839
where multiple of you are gonna be able

284
00:13:14,069 --> 00:13:12,160
to weigh in and so i'm gonna wait and

285
00:13:14,629 --> 00:13:14,079
hold those for a few minutes in the show

286
00:13:17,030 --> 00:13:14,639
here

287
00:13:18,710 --> 00:13:17,040
and switch things over to uh joby thank

288
00:13:20,150 --> 00:13:18,720

you christina we'll be back with you in

289
00:13:22,430 --> 00:13:20,160
just a moment

290
00:13:24,790 --> 00:13:22,440
now joby joby brazil hollis

291
00:13:25,350 --> 00:13:24,800
astrobiologist postdoctoral scholar

292
00:13:28,550 --> 00:13:25,360
working

293
00:13:30,790 --> 00:13:28,560
on the sherlock instrument let's uh

294
00:13:32,829 --> 00:13:30,800
let's talk about what all of that means

295
00:13:35,269 --> 00:13:32,839
what is

296
00:13:41,910 --> 00:13:35,279
astrobiology

297
00:13:42,870 --> 00:13:41,920
the study mostly theoretical at the

298
00:13:46,150 --> 00:13:42,880
moment

299
00:13:49,590 --> 00:13:46,160
of what life could be beyond earth

300
00:13:52,310 --> 00:13:49,600
so the question of like if life existed

301
00:13:53,030 --> 00:13:52,320
on a world like mars what did it look

302
00:13:54,949 --> 00:13:53,040
like

303
00:13:57,269 --> 00:13:54,959
uh you know was it made from the same

304
00:13:59,030 --> 00:13:57,279
molecules of like dna

305
00:14:01,030 --> 00:13:59,040
that we are or was it made from

306
00:14:02,470 --> 00:14:01,040
something completely different

307
00:14:04,550 --> 00:14:02,480
so a lot of this is kind of like

308
00:14:06,949 --> 00:14:04,560
investigating the kinds of

309
00:14:07,829 --> 00:14:06,959
molecules that might be available on

310
00:14:09,269 --> 00:14:07,839
other worlds

311
00:14:10,710 --> 00:14:09,279
and trying to work out how would they

312
00:14:11,990 --> 00:14:10,720
fit together you know what would you

313
00:14:15,030 --> 00:14:12,000

expect to see

314
00:14:17,189 --> 00:14:15,040
billions of years later um how would

315
00:14:19,269 --> 00:14:17,199
life survive in such an extremely

316
00:14:19,670 --> 00:14:19,279
different environment like that of mars

317
00:14:26,389 --> 00:14:19,680
or

318
00:14:27,990 --> 00:14:26,399
now obviously we have only discovered

319
00:14:30,790 --> 00:14:28,000
life on one planet so far

320
00:14:32,069 --> 00:14:30,800
earth so a lot of this is quite like

321
00:14:33,750 --> 00:14:32,079
investigative like

322
00:14:35,110 --> 00:14:33,760
we're still not sure what we're looking

323
00:14:39,269 --> 00:14:35,120
for but we're pretty certain that when

324
00:14:44,150 --> 00:14:42,389
so um eduardo over on facebook has a

325
00:14:46,790 --> 00:14:44,160
question for you you mentioned looking

326
00:14:48,470 --> 00:14:46,800
for molecules and possibly new molecules

327
00:14:50,230 --> 00:14:48,480
there on mars

328
00:14:52,550 --> 00:14:50,240
he wants to know is it possible to find

329
00:14:55,350 --> 00:14:52,560
a new chemical element on mars

330
00:14:58,389 --> 00:14:55,360
or another compound that might not exist

331
00:15:00,550 --> 00:14:58,399
on earth uh

332
00:15:02,470 --> 00:15:00,560
so in terms of elements uh those are

333
00:15:04,870 --> 00:15:02,480
pretty well established you know we've

334
00:15:06,949 --> 00:15:04,880
uh discovered all pretty much all of the

335
00:15:07,269 --> 00:15:06,959
sort of naturally occurring elements

336
00:15:09,910 --> 00:15:07,279
that

337
00:15:11,590 --> 00:15:09,920
form through stellar fusion or

338
00:15:13,670 --> 00:15:11,600

supernovae that sort of thing

339
00:15:14,870 --> 00:15:13,680
so that's kind of everything up to iron

340
00:15:16,790 --> 00:15:14,880
and beyond

341
00:15:17,910 --> 00:15:16,800
uh the super heavy elements that are

342
00:15:19,590 --> 00:15:17,920
still being discovered

343
00:15:21,350 --> 00:15:19,600
these days are being made in particle

344
00:15:22,870 --> 00:15:21,360
accelerators so they're not really

345
00:15:24,310 --> 00:15:22,880
something we would expect to find like

346
00:15:26,310 --> 00:15:24,320
naturally occurring

347
00:15:28,150 --> 00:15:26,320
on the surface of a planet like mars

348
00:15:31,189 --> 00:15:28,160
when it comes to chemicals and

349
00:15:33,269 --> 00:15:31,199
molecules there's a huge number like

350
00:15:34,710 --> 00:15:33,279
almost infinite number of possible

351
00:15:37,670 --> 00:15:34,720
combinations atoms

352
00:15:37,910 --> 00:15:37,680
that can make molecules now some of them

353
00:15:39,829 --> 00:15:37,920
are

354
00:15:41,430 --> 00:15:39,839
unstable and we would not expect to find

355
00:15:43,670 --> 00:15:41,440
them the ones that make up

356
00:15:44,629 --> 00:15:43,680
us you know so we we comprise a dna

357
00:15:47,430 --> 00:15:44,639
that's com that

358
00:15:48,069 --> 00:15:47,440
has four distinct nucleobases in it so

359
00:15:50,550 --> 00:15:48,079
those are a

360
00:15:52,150 --> 00:15:50,560
c g and t that you might remember from

361
00:15:53,749 --> 00:15:52,160
biology classes at school

362
00:15:55,910 --> 00:15:53,759
now it's quite possible that alien life

363
00:15:57,829 --> 00:15:55,920

might have something similar to dna

364
00:15:59,829 --> 00:15:57,839
that just uses slightly different set of

365
00:16:01,829 --> 00:15:59,839
molecules so you know you add a methyl

366
00:16:03,030 --> 00:16:01,839
group there you put a nitrogen somewhere

367
00:16:03,829 --> 00:16:03,040
else and suddenly it's a slightly

368
00:16:05,430 --> 00:16:03,839
different molecule

369
00:16:07,269 --> 00:16:05,440
which means it may not be compatible

370
00:16:08,870 --> 00:16:07,279
with us but it could still be a valid

371
00:16:10,629 --> 00:16:08,880
way of building

372
00:16:12,550 --> 00:16:10,639
like an information storage system like

373
00:16:16,069 --> 00:16:12,560
dna something that could be passed on

374
00:16:18,389 --> 00:16:16,079
and um from one organism to the next

375
00:16:19,269 --> 00:16:18,399
so we don't really know what to expect

376
00:16:21,590 --> 00:16:19,279
we're sort of built

377
00:16:22,629 --> 00:16:21,600
working from our what we know on earth

378
00:16:24,710 --> 00:16:22,639
so we're looking for

379
00:16:26,069 --> 00:16:24,720
stuff like dna first we have certain

380
00:16:28,069 --> 00:16:26,079
ideas about like you know

381
00:16:29,350 --> 00:16:28,079
life needs to be somewhat complicated to

382
00:16:30,710 --> 00:16:29,360
be able to do clever things like

383
00:16:32,790 --> 00:16:30,720
metabolize and

384
00:16:34,310 --> 00:16:32,800
uh reproduce you know that involves a

385
00:16:37,430 --> 00:16:34,320
lot of like quite clever

386
00:16:39,030 --> 00:16:37,440
chemical machinery um that

387
00:16:40,949 --> 00:16:39,040
needs requiring that so that requires a

388
00:16:41,910 --> 00:16:40,959

certain minimum amount of complexity so

389
00:16:43,430 --> 00:16:41,920
we're looking at lots of different

390
00:16:45,110 --> 00:16:43,440
molecules put together

391
00:16:47,350 --> 00:16:45,120
um in a way that we have not yet

392
00:16:47,749 --> 00:16:47,360
observed in any of the studies we've

393
00:16:50,069 --> 00:16:47,759
done

394
00:16:50,949 --> 00:16:50,079
of organic molecules from things like

395
00:16:53,509 --> 00:16:50,959
meteorites

396
00:16:54,949 --> 00:16:53,519
samples of mars have crashed on earth

397
00:16:56,389 --> 00:16:54,959
from hundreds of millions of years ago

398
00:16:58,790 --> 00:16:56,399
we found organic molecules

399
00:17:00,230 --> 00:16:58,800
but they're all extremely simple stuff

400
00:17:02,550 --> 00:17:00,240
that could have just formed

401
00:17:04,150 --> 00:17:02,560
through like natural geochemistry so

402
00:17:05,669 --> 00:17:04,160
like the chemistry of rocks

403
00:17:08,630 --> 00:17:05,679
so they could be the building blocks of

404
00:17:11,750 --> 00:17:08,640
life but they are not proof of life

405
00:17:14,390 --> 00:17:11,760
now on that note uh kasia over

406
00:17:16,829 --> 00:17:14,400
on facebook wants to know how do you

407
00:17:20,390 --> 00:17:16,839
define

408
00:17:22,949 --> 00:17:20,400
life okay that is a very big question

409
00:17:24,870 --> 00:17:22,959
i do not feel like i am qualified to

410
00:17:28,309 --> 00:17:24,880
answer that i'm not sure if anyone

411
00:17:31,590 --> 00:17:28,319
really is qualified to answer that uh

412
00:17:34,710 --> 00:17:31,600
but certainly in terms of the life

413
00:17:35,909 --> 00:17:34,720

we see on earth uh the

414
00:17:37,830 --> 00:17:35,919
i mean there's some disagreement about

415
00:17:39,110 --> 00:17:37,840
whether it's stuff like a virus is a

416
00:17:41,590 --> 00:17:39,120
living thing because it

417
00:17:43,510 --> 00:17:41,600
can it usually co-opts the chemical

418
00:17:44,549 --> 00:17:43,520
machinery of another organism to be able

419
00:17:47,510 --> 00:17:44,559
to reproduce

420
00:17:49,270 --> 00:17:47,520
but generally life as we know it

421
00:17:51,350 --> 00:17:49,280
consumes energy

422
00:17:53,510 --> 00:17:51,360
it creates complex structures that

423
00:17:56,310 --> 00:17:53,520
wouldn't occur spontaneously

424
00:17:58,230 --> 00:17:56,320
um and basically reproduce so kind of

425
00:18:00,310 --> 00:17:58,240
makes copies of itself

426
00:18:02,070 --> 00:18:00,320
so right now the molecules we found on

427
00:18:03,990 --> 00:18:02,080
mars through previous investigations so

428
00:18:06,950 --> 00:18:04,000
for example the viking landers

429
00:18:08,549 --> 00:18:06,960
uh the curiosity rover they've found

430
00:18:10,230 --> 00:18:08,559
very very simple molecules

431
00:18:11,990 --> 00:18:10,240
but they're all stuff that can occur

432
00:18:14,470 --> 00:18:12,000
through just natural chemistry

433
00:18:15,270 --> 00:18:14,480
they are not proof of life because they

434
00:18:16,950 --> 00:18:15,280
are they

435
00:18:18,630 --> 00:18:16,960
they're just not complicated enough that

436
00:18:23,029 --> 00:18:18,640
we we cannot

437
00:18:25,270 --> 00:18:23,039
uh ignore any other possible explanation

438
00:18:26,230 --> 00:18:25,280

well okay now that you've tackled one of

439
00:18:28,710 --> 00:18:26,240
the the biggest

440
00:18:30,310 --> 00:18:28,720
questions out there thank you it's all

441
00:18:31,430 --> 00:18:30,320
just going to be so much easier from

442
00:18:34,789 --> 00:18:31,440
here on out

443
00:18:36,470 --> 00:18:34,799
and and not one of us can do this

444
00:18:38,390 --> 00:18:36,480
mission by themselves

445
00:18:40,630 --> 00:18:38,400
so at this point let's bring everybody

446
00:18:40,950 --> 00:18:40,640
back and start to get some perspectives

447
00:18:43,669 --> 00:18:40,960
from

448
00:18:44,870 --> 00:18:43,679
everybody because the work that the free

449
00:18:46,710 --> 00:18:44,880
of you do

450
00:18:47,909 --> 00:18:46,720
as part of this mission team with

451
00:18:50,630 --> 00:18:47,919
thousands of people

452
00:18:52,789 --> 00:18:50,640
on it is all interconnected we've got

453
00:18:54,950 --> 00:18:52,799
scientists asking the big questions

454
00:18:57,270 --> 00:18:54,960
and we've got engineers figuring out how

455
00:18:57,990 --> 00:18:57,280
do we make and use the tools that we

456
00:19:00,470 --> 00:18:58,000
have

457
00:19:01,990 --> 00:19:00,480
to answer those questions so i'd like to

458
00:19:03,510 --> 00:19:02,000
start off this group

459
00:19:05,510 --> 00:19:03,520
discussion or group portion of the

460
00:19:09,110 --> 00:19:05,520
discussion uh with

461
00:19:10,070 --> 00:19:09,120
looking at how how is this rover how are

462
00:19:14,070 --> 00:19:10,080
the instruments on this

463
00:19:17,270 --> 00:19:14,080

rover going to help us specifically

464
00:19:21,430 --> 00:19:17,280
try to fulfill that mission goal of

465
00:19:25,350 --> 00:19:21,440
finding evidence of life agent life

466
00:19:26,789 --> 00:19:25,360
on mars do we want to start with the

467
00:19:28,310 --> 00:19:26,799
okay you can rochambeau do you want to

468
00:19:31,029 --> 00:19:28,320
start with the hardware or with the

469
00:19:35,190 --> 00:19:33,990
i was going to start with the hardware

470
00:19:37,750 --> 00:19:35,200
it seems simplest

471
00:19:39,270 --> 00:19:37,760
let's start there yeah then we'll get

472
00:19:42,630 --> 00:19:39,280
we'll have joby finish it up

473
00:19:44,470 --> 00:19:42,640
and polish it off so we have seven

474
00:19:46,230 --> 00:19:44,480
instruments on the rover and when they

475
00:19:47,430 --> 00:19:46,240
were selected they were selected with

476
00:19:48,870 --> 00:19:47,440
the intent that they should all

477
00:19:50,870 --> 00:19:48,880
complement each other

478
00:19:52,630 --> 00:19:50,880
to meet one of our that science

479
00:19:53,669 --> 00:19:52,640
objective of looking for signs of

480
00:19:56,470 --> 00:19:53,679
ancient life

481
00:19:57,990 --> 00:19:56,480
and so we have um three spectrometers on

482
00:20:00,789 --> 00:19:58,000
the rover uh supercam

483
00:20:01,909 --> 00:20:00,799
sherlock uh and pixel and they're gonna

484
00:20:04,870 --> 00:20:01,919
be using um

485
00:20:05,990 --> 00:20:04,880
chemistry um and astrobiology processes

486
00:20:08,710 --> 00:20:06,000
to try and understand

487
00:20:10,789 --> 00:20:08,720
you know what chemicals and uh organics

488
00:20:12,310 --> 00:20:10,799

are present on the samples that will uh

489
00:20:14,470 --> 00:20:12,320
drill up with the rover

490
00:20:16,230 --> 00:20:14,480
at the same time though we need context

491
00:20:17,669 --> 00:20:16,240
and that's one thing that i appreciated

492
00:20:19,590 --> 00:20:17,679
being an engineer is

493
00:20:22,070 --> 00:20:19,600
if you have a piece of data you need the

494
00:20:24,070 --> 00:20:22,080
context of where that data came from

495
00:20:26,630 --> 00:20:24,080
and so all of our other instruments like

496
00:20:28,870 --> 00:20:26,640
rimfacts are ground penetrating radar

497
00:20:30,630 --> 00:20:28,880
meta our weather station that's going to

498
00:20:32,710 --> 00:20:30,640
understand humidity and pressure and

499
00:20:34,630 --> 00:20:32,720
that sort of thing

500
00:20:36,789 --> 00:20:34,640
masscam z that's kind of like the eyes

501
00:20:39,350 --> 00:20:36,799
of the rover all of these instruments

502
00:20:41,430 --> 00:20:39,360
are really contributing to understand

503
00:20:42,950 --> 00:20:41,440
the context of the samples um that we

504
00:20:45,190 --> 00:20:42,960
take and i don't want to forget moxie

505
00:20:47,029 --> 00:20:45,200
because i didn't mention moxie but moxie

506
00:20:49,029 --> 00:20:47,039
is going to help us with a with a

507
00:20:54,549 --> 00:20:49,039
separate big goal but i'll let joby

508
00:20:58,630 --> 00:20:56,870
so the yeah these instruments have been

509
00:21:01,110 --> 00:20:58,640
selected to try to catch

510
00:21:03,110 --> 00:21:01,120
as wide a range of data as possible so

511
00:21:04,710 --> 00:21:03,120
for example pixel and sherlock on the

512
00:21:07,510 --> 00:21:04,720
rover's robotic arm

513
00:21:09,190 --> 00:21:07,520

they were both designed to scan some uh

514
00:21:10,710 --> 00:21:09,200
the surface of a rock

515
00:21:13,110 --> 00:21:10,720
yep christine's pointing to them which

516
00:21:14,870 --> 00:21:13,120
is awesome um

517
00:21:16,789 --> 00:21:14,880
they scan the surface of a rock they're

518
00:21:18,710 --> 00:21:16,799
looking for slightly different things so

519
00:21:21,990 --> 00:21:18,720
sherlock is particularly sensitive to

520
00:21:23,430 --> 00:21:22,000
organics and the aromatic organics which

521
00:21:24,870 --> 00:21:23,440
are kind of made by

522
00:21:27,510 --> 00:21:24,880
like that can be made by living things

523
00:21:30,310 --> 00:21:27,520
so for example the nucleobases of dna

524
00:21:31,830 --> 00:21:30,320
are aromatic organic molecules so

525
00:21:33,430 --> 00:21:31,840
sherlock is particularly sensitive to

526
00:21:34,549 --> 00:21:33,440
those it can detect them down to one

527
00:21:36,630 --> 00:21:34,559
part per million

528
00:21:38,549 --> 00:21:36,640
so if there's even a trace left behind

529
00:21:39,110 --> 00:21:38,559
in the rock then we should be able to

530
00:21:41,110 --> 00:21:39,120
find it

531
00:21:42,230 --> 00:21:41,120
pixel will tell us about the elemental

532
00:21:43,750 --> 00:21:42,240
composition

533
00:21:45,750 --> 00:21:43,760
let's let's it through for a second when

534
00:21:47,750 --> 00:21:45,760
you say aromatic when i you know

535
00:21:49,029 --> 00:21:47,760
as a as a non-specialist when i hear

536
00:21:51,190 --> 00:21:49,039
that i think

537
00:21:53,029 --> 00:21:51,200
something that smells very good is

538
00:21:56,549 --> 00:21:53,039

sherlock literally going to

539
00:21:58,950 --> 00:21:56,559
sniff out these chemicals on mars

540
00:22:00,470 --> 00:21:58,960
not exactly no uh so we're using we're

541
00:22:02,230 --> 00:22:00,480
using a laser to

542
00:22:03,590 --> 00:22:02,240
scan the sample and we look at the light

543
00:22:05,350 --> 00:22:03,600
that comes back from

544
00:22:08,070 --> 00:22:05,360
the rock and some of that light has been

545
00:22:08,549 --> 00:22:08,080
scattered or re-emitted by the molecules

546
00:22:10,710 --> 00:22:08,559
in it

547
00:22:12,230 --> 00:22:10,720
the reason why those molecules we're

548
00:22:14,070 --> 00:22:12,240
interested in are called aromatics is

549
00:22:16,950 --> 00:22:14,080
because when they were first discovered

550
00:22:18,710 --> 00:22:16,960
you know 100 200 years ago uh they were

551
00:22:20,789 --> 00:22:18,720
generally associated with like things

552
00:22:23,029 --> 00:22:20,799
particularly like rich smells

553
00:22:24,950 --> 00:22:23,039
right so a lot of these uh molecules

554
00:22:26,149 --> 00:22:24,960
have very very distinctive smells uh

555
00:22:27,590 --> 00:22:26,159
unfortunately some of them if you open a

556
00:22:28,710 --> 00:22:27,600
bottle in the lab everyone can

557
00:22:31,830 --> 00:22:28,720
immediately tell because

558
00:22:33,750 --> 00:22:31,840
some of them stink but they happen to be

559
00:22:35,990 --> 00:22:33,760
very energy rich molecules

560
00:22:36,950 --> 00:22:36,000
they're very good at self-organizing

561
00:22:38,310 --> 00:22:36,960
they can be

562
00:22:40,549 --> 00:22:38,320
used to create interesting kind of

563
00:22:42,070 --> 00:22:40,559

chemical reactions so they are often the

564
00:22:45,430 --> 00:22:42,080
building blocks of

565
00:22:48,310 --> 00:22:45,440
molecules like dna also proteins so

566
00:22:49,590 --> 00:22:48,320
three out of the 22 amino acids that

567
00:22:52,549 --> 00:22:49,600
make up all proteins

568
00:22:53,029 --> 00:22:52,559
in living things are aromatic so if we

569
00:22:54,390 --> 00:22:53,039
find

570
00:22:56,310 --> 00:22:54,400
a collection of these different

571
00:22:56,870 --> 00:22:56,320
aromatics all localized in the same

572
00:22:58,870 --> 00:22:56,880
place

573
00:23:00,070 --> 00:22:58,880
and they're all sufficiently chemically

574
00:23:02,070 --> 00:23:00,080
complex

575
00:23:04,870 --> 00:23:02,080
uh that they cannot be explained by like

576
00:23:06,230 --> 00:23:04,880
a sim like a simple geochemical process

577
00:23:08,230 --> 00:23:06,240
then we have to start considering the

578
00:23:10,070 --> 00:23:08,240
possibility that they may be

579
00:23:12,070 --> 00:23:10,080
what's left over from a biological

580
00:23:13,590 --> 00:23:12,080
process and if we did find something

581
00:23:14,230 --> 00:23:13,600
like that the first thing we would be

582
00:23:16,710 --> 00:23:14,240
doing

583
00:23:17,430 --> 00:23:16,720
would be taking a sample storing it in a

584
00:23:19,990 --> 00:23:17,440
tube

585
00:23:21,750 --> 00:23:20,000
and bringing it back to earth in i

586
00:23:24,630 --> 00:23:21,760
believe 11 years time

587
00:23:26,549 --> 00:23:24,640
because we want to do more studies so

588
00:23:28,310 --> 00:23:26,559

perseverance is like it has these

589
00:23:30,470 --> 00:23:28,320
amazing instruments that are going to

590
00:23:31,350 --> 00:23:30,480
give us a fantastic amount of contextual

591
00:23:34,390 --> 00:23:31,360
information

592
00:23:35,110 --> 00:23:34,400
but it's not it compels in comparison to

593
00:23:36,870 --> 00:23:35,120
what we can do

594
00:23:38,789 --> 00:23:36,880
on earth with all of the labs we have at

595
00:23:41,029 --> 00:23:38,799
our disposal here so the

596
00:23:42,950 --> 00:23:41,039
main priority is if we find something

597
00:23:44,470 --> 00:23:42,960
really cool or really interesting or

598
00:23:47,590 --> 00:23:44,480
just really strange

599
00:23:49,830 --> 00:23:47,600
we're going to try and bring it back

600
00:23:50,870 --> 00:23:49,840
excellent so you touched on uh the

601
00:23:52,710 --> 00:23:50,880
sampling system

602
00:23:54,390 --> 00:23:52,720
of the rover the fact that this rover

603
00:23:56,710 --> 00:23:54,400
will be the first one

604
00:23:58,549 --> 00:23:56,720
uh to cash samples of the red planet for

605
00:24:01,350 --> 00:23:58,559
eventual return to earth

606
00:24:03,590 --> 00:24:01,360
um whether that's in the the 2030s nasa

607
00:24:04,549 --> 00:24:03,600
and esa are still working out the plans

608
00:24:09,029 --> 00:24:04,559
for that

609
00:24:11,269 --> 00:24:09,039
and obazi over on youtube

610
00:24:13,190 --> 00:24:11,279
wants to know let's see is there any

611
00:24:16,310 --> 00:24:13,200
possibility

612
00:24:20,310 --> 00:24:16,320
for perseverance or any other

613
00:24:23,669 --> 00:24:20,320

nasa missions to return to earth

614
00:24:26,070 --> 00:24:23,679
hmm this is a this is a really great

615
00:24:32,310 --> 00:24:29,110
for this rover right jessica correct

616
00:24:35,430 --> 00:24:32,320
unfortunately um it takes a lot of

617
00:24:37,590 --> 00:24:35,440
energy just to get the something the

618
00:24:38,310 --> 00:24:37,600
size of perseverance to the surface of

619
00:24:41,350 --> 00:24:38,320
mars

620
00:24:42,789 --> 00:24:41,360
so to return it or even the tubes back

621
00:24:45,990 --> 00:24:42,799
to earth requires

622
00:24:47,909 --> 00:24:46,000
a lot of propellant so for this

623
00:24:49,350 --> 00:24:47,919
particular mission it's a one-way trip

624
00:24:51,110 --> 00:24:49,360
to mars but

625
00:24:53,430 --> 00:24:51,120
um as we were kind of insinuating

626
00:24:55,029 --> 00:24:53,440
earlier there's a longer term vision of

627
00:24:57,830 --> 00:24:55,039
a marsh sample return

628
00:24:58,789 --> 00:24:57,840
that would um go and retrieve those

629
00:25:02,470 --> 00:24:58,799
sample tubes and

630
00:25:04,470 --> 00:25:02,480
bring them back to earth so

631
00:25:06,549 --> 00:25:04,480
yes it may take us a long time to get

632
00:25:08,870 --> 00:25:06,559
those physical samples back but we're

633
00:25:09,830 --> 00:25:08,880
going to get data a lot more quickly

634
00:25:13,430 --> 00:25:09,840
than that

635
00:25:16,470 --> 00:25:13,440
fey over on facebook wants to know

636
00:25:17,750 --> 00:25:16,480
how long between launch arrival on the

637
00:25:21,590 --> 00:25:17,760
surface

638
00:25:23,909 --> 00:25:21,600

to transmission of photos when can we

639
00:25:26,230 --> 00:25:23,919
reasonably expect those first images

640
00:25:29,110 --> 00:25:26,240
jessica

641
00:25:29,750 --> 00:25:29,120
that's a good question i actually am not

642
00:25:33,830 --> 00:25:29,760
sure

643
00:25:35,990 --> 00:25:33,840
um i could imagine it uh

644
00:25:38,310 --> 00:25:36,000
happening relatively quickly though uh

645
00:25:40,549 --> 00:25:38,320
we do have communications

646
00:25:42,230 --> 00:25:40,559
um you know during landing and then

647
00:25:45,909 --> 00:25:42,240
subsequently following that

648
00:25:48,070 --> 00:25:45,919
landing so we have good coverage um

649
00:25:49,510 --> 00:25:48,080
we have a you know a kind of slower data

650
00:25:52,390 --> 00:25:49,520
rate at um

651
00:25:53,830 --> 00:25:52,400
uplinking data once we're on the surface

652
00:25:55,590 --> 00:25:53,840
of mars so it might take us a little

653
00:25:57,269 --> 00:25:55,600
while but i would say

654
00:25:59,110 --> 00:25:57,279
it shouldn't be too too long that we're

655
00:26:02,149 --> 00:25:59,120
waiting to get those images

656
00:26:04,950 --> 00:26:02,159
at least thumbnails like so smaller size

657
00:26:07,269 --> 00:26:04,960
images right after we land back with the

658
00:26:09,269 --> 00:26:07,279
curiosity landing back in 2012

659
00:26:10,789 --> 00:26:09,279
i think all of us were just cautiously

660
00:26:12,870 --> 00:26:10,799
optimistic that we were going to get

661
00:26:14,149 --> 00:26:12,880
photos and the thumbnails came almost

662
00:26:16,549 --> 00:26:14,159
immediately so i hope

663
00:26:18,230 --> 00:26:16,559

curiosity has not set too high of a

664
00:26:19,909 --> 00:26:18,240
unreasonable bar

665
00:26:22,470 --> 00:26:19,919
for what we're going to see on landing

666
00:26:23,990 --> 00:26:22,480
day but i'm skipping a few steps we've

667
00:26:28,310 --> 00:26:24,000
got to get this rover

668
00:26:32,149 --> 00:26:28,320
launched and to mars first um

669
00:26:35,430 --> 00:26:32,159
and then and then over to jezreel crater

670
00:26:36,310 --> 00:26:35,440
so um here's a question from charlie on

671
00:26:38,310 --> 00:26:36,320
twitter

672
00:26:41,110 --> 00:26:38,320
for you joby how did you pick the

673
00:26:45,750 --> 00:26:44,070
i wasn't involved in the decision at all

674
00:26:48,710 --> 00:26:45,760
it happened just before my

675
00:26:50,870 --> 00:26:48,720
before i arrived at jpl no unfortunate

676
00:26:53,029 --> 00:26:50,880
but it was a collective decision made by

677
00:26:54,870 --> 00:26:53,039
hundreds of scientists who are obviously

678
00:26:57,269 --> 00:26:54,880
like mild scientists interested in

679
00:26:58,310 --> 00:26:57,279
invested in the mission and the general

680
00:26:59,990 --> 00:26:58,320
exploration of

681
00:27:02,230 --> 00:27:00,000
mars so they had a number of sites to

682
00:27:04,789 --> 00:27:02,240
choose from jezreel crater was

683
00:27:06,149 --> 00:27:04,799
was selected because uh we can see from

684
00:27:09,110 --> 00:27:06,159
orbital imagery

685
00:27:10,390 --> 00:27:09,120
that uh there it appears to appears to

686
00:27:12,390 --> 00:27:10,400
have been a lake

687
00:27:13,990 --> 00:27:12,400
a roughly three three and a half billion

688
00:27:16,549 --> 00:27:14,000

years ago it looks like there were it

689
00:27:18,389 --> 00:27:16,559
was a lake roughly 250 meters deep

690
00:27:19,990 --> 00:27:18,399
so there was liquid water on the surface

691
00:27:23,029 --> 00:27:20,000
of mars at one point and what's more

692
00:27:24,630 --> 00:27:23,039
we can see a river channel that traveled

693
00:27:26,789 --> 00:27:24,640
into the lake and you can see

694
00:27:28,230 --> 00:27:26,799
a delta a river delta that'd be left

695
00:27:30,630 --> 00:27:28,240
behind so that's kind of like a big

696
00:27:32,310 --> 00:27:30,640
fan of deposits of like minerals like

697
00:27:35,669 --> 00:27:32,320
clays and carbonates that were

698
00:27:37,909 --> 00:27:35,679
carried by that water and dropped um as

699
00:27:39,990 --> 00:27:37,919
the river entered the lake so obviously

700
00:27:40,470 --> 00:27:40,000
there's we can't see any liquid water

701
00:27:42,789 --> 00:27:40,480
now

702
00:27:45,430 --> 00:27:42,799
but we can see these kind of remnants of

703
00:27:47,350 --> 00:27:45,440
what used to be a flowing water on mars

704
00:27:48,470 --> 00:27:47,360
and those deposits those clays those

705
00:27:49,909 --> 00:27:48,480
carbonates we

706
00:27:51,750 --> 00:27:49,919
you know based on what we've seen on

707
00:27:53,269 --> 00:27:51,760
earth they tend to be very very rich in

708
00:27:55,750 --> 00:27:53,279
organic material so anything that was

709
00:27:57,990 --> 00:27:55,760
living in that water could be preserved

710
00:27:59,830 --> 00:27:58,000
over billions of years in those deposits

711
00:28:01,430 --> 00:27:59,840
so by landing in jezreel crater we're

712
00:28:03,190 --> 00:28:01,440
getting immediate access

713
00:28:05,350 --> 00:28:03,200

to effectively a geological and

714
00:28:08,230 --> 00:28:05,360
potentially an astrobiological

715
00:28:09,590 --> 00:28:08,240
record of what was going on in that

716
00:28:11,830 --> 00:28:09,600
water system and that's going to be

717
00:28:13,269 --> 00:28:11,840
incredibly invaluable for understanding

718
00:28:15,909 --> 00:28:13,279
the history of mars

719
00:28:17,990 --> 00:28:15,919
and especially things like was mars

720
00:28:20,149 --> 00:28:18,000
habitable three billion years ago

721
00:28:22,149 --> 00:28:20,159
did something ever evolve and live in

722
00:28:24,389 --> 00:28:22,159
that water

723
00:28:26,310 --> 00:28:24,399
three billion years can leave a lot of

724
00:28:29,350 --> 00:28:26,320
sediments behind

725
00:28:30,389 --> 00:28:29,360
and i have a very practical question for

726
00:28:33,430 --> 00:28:30,399
you christina

727
00:28:37,269 --> 00:28:33,440
from edgar on youtube who wants to know

728
00:28:39,269 --> 00:28:37,279
how deep can this rover drill

729
00:28:41,029 --> 00:28:39,279
wow that's actually a good question i

730
00:28:42,149 --> 00:28:41,039
don't know if you know it jessica i do

731
00:28:45,110 --> 00:28:42,159
know though

732
00:28:47,269 --> 00:28:45,120
um that we have the ability to image the

733
00:28:48,230 --> 00:28:47,279
subsurface of mars i kind of alluded to

734
00:28:50,389 --> 00:28:48,240
this earlier

735
00:28:52,470 --> 00:28:50,399
uh with rimfacts and so you can imagine

736
00:28:54,230 --> 00:28:52,480
rimfax giving us some context of what's

737
00:28:56,149 --> 00:28:54,240
underneath the subsurface

738
00:28:58,230 --> 00:28:56,159

and then the coring team coming in and

739
00:28:59,510 --> 00:28:58,240
taking some samples but i don't think

740
00:29:01,590 --> 00:28:59,520
it's quite deep we've sent

741
00:29:03,750 --> 00:29:01,600
other landers like insight for example

742
00:29:05,350 --> 00:29:03,760
that we're able to penetrate much deeper

743
00:29:07,909 --> 00:29:05,360
we're really trying to just get right

744
00:29:09,750 --> 00:29:07,919
below that subsurface

745
00:29:11,029 --> 00:29:09,760
if perseverance is drill is five

746
00:29:14,149 --> 00:29:11,039
centimeters i believe

747
00:29:16,710 --> 00:29:14,159
ah there we go it's both the same on the

748
00:29:18,789 --> 00:29:16,720
same order as the curiosity rover

749
00:29:20,950 --> 00:29:18,799
which is currently up there on mars i

750
00:29:22,149 --> 00:29:20,960
think it's getting a final taste of the

751
00:29:25,590 --> 00:29:22,159
clay unit

752
00:29:27,830 --> 00:29:25,600
right now so um we love all our robots

753
00:29:28,389 --> 00:29:27,840
right it's not just about perseverance

754
00:29:31,990 --> 00:29:28,399
and

755
00:29:34,789 --> 00:29:32,000
um

756
00:29:36,389 --> 00:29:34,799
my goodness uh we've got so many people

757
00:29:39,669 --> 00:29:36,399
around the world working on

758
00:29:43,269 --> 00:29:39,679
this who are so excited and

759
00:29:45,510 --> 00:29:43,279
i just want to make sure that everybody

760
00:29:46,950 --> 00:29:45,520
has really just had a chance to to get

761
00:29:49,909 --> 00:29:46,960
to know all of you today

762
00:29:51,269 --> 00:29:49,919
to see you and before we wrap up this

763
00:29:53,430 --> 00:29:51,279

show i want to ask

764
00:29:54,870 --> 00:29:53,440
um how are you feeling how are you

765
00:29:59,110 --> 00:29:54,880
feeling as we head into

766
00:30:02,870 --> 00:30:00,389
i don't think i'm gonna get much sleep

767
00:30:06,630 --> 00:30:04,870
so not much sleep from joby jessica how

768
00:30:09,350 --> 00:30:06,640
are you doing

769
00:30:11,510 --> 00:30:09,360
i i'm i'm doing okay actually i have a

770
00:30:14,230 --> 00:30:11,520
strange sense of calm even though

771
00:30:15,590 --> 00:30:14,240
uh tomorrow we're going to be on console

772
00:30:17,990 --> 00:30:15,600
and i think the biggest thing is i'm

773
00:30:20,549 --> 00:30:18,000
just trying to shift my sleep hours

774
00:30:21,269 --> 00:30:20,559
so that i when i wake up at you know

775
00:30:23,909 --> 00:30:21,279
midnight

776
00:30:25,510 --> 00:30:23,919
and go into work i won't be completely

777
00:30:28,789 --> 00:30:25,520
dunked

778
00:30:32,149 --> 00:30:28,799
but i'm excited i'm ready

779
00:30:33,990 --> 00:30:32,159
and how about you christina i'm super

780
00:30:34,310 --> 00:30:34,000
excited because with the launch it means

781
00:30:35,909 --> 00:30:34,320
that

782
00:30:38,070 --> 00:30:35,919
it's time to do more testing to get

783
00:30:40,549 --> 00:30:38,080
ready for the surface of mars so

784
00:30:42,920 --> 00:30:40,559
there's a lot of work to do all about

785
00:30:46,389 --> 00:30:42,930
job security for you then right

786
00:30:49,350 --> 00:30:46,399
[Laughter]

787
00:30:49,990 --> 00:30:49,360
fantastic i want to thank you all for

788
00:30:51,830 --> 00:30:50,000

your time

789
00:30:53,269 --> 00:30:51,840
and for everybody watching online thank

790
00:30:55,430 --> 00:30:53,279
you for the fantastic

791
00:30:56,389 --> 00:30:55,440
questions we hope that you will be

792
00:30:59,190 --> 00:30:56,399
watching

793
00:31:00,549 --> 00:30:59,200
live with us as perseverance lifts off

794
00:31:03,830 --> 00:31:00,559
for the red planet

795
00:31:05,029 --> 00:31:03,840
our launch coverage will start at um oh

796
00:31:08,149 --> 00:31:05,039
dark 30 here

797
00:31:10,470 --> 00:31:08,159
and in the pacific time zone uh we'll be

798
00:31:14,230 --> 00:31:10,480
going live at 4 00 a.m pacific

799
00:31:16,950 --> 00:31:14,240
7 a.m eastern 1100 utc

800
00:31:18,789 --> 00:31:16,960
with liftoff expected about 50 minutes

801
00:31:20,549 --> 00:31:18,799
later and we will be streaming live on

802
00:31:23,430 --> 00:31:20,559
nasa television

803
00:31:24,470 --> 00:31:23,440
the nasa website youtube dailymotion

804
00:31:27,509 --> 00:31:24,480
linkedin

805
00:31:29,350 --> 00:31:27,519
facebook twitter and twitch don't forget

806
00:31:31,509 --> 00:31:29,360
that you can follow the rover

807
00:31:34,070 --> 00:31:31,519
at nasa persevere on twitter and

808
00:31:36,389 --> 00:31:34,080
facebook all of us here at jpl

809
00:31:38,310 --> 00:31:36,399
at nasa jpl wherever you get your social

810
00:31:41,190 --> 00:31:38,320
and all of nasa's missions

811
00:31:42,710 --> 00:31:41,200
at nasa don't forget to use the hashtag

812
00:31:44,230 --> 00:31:42,720
countdown to mars to join the