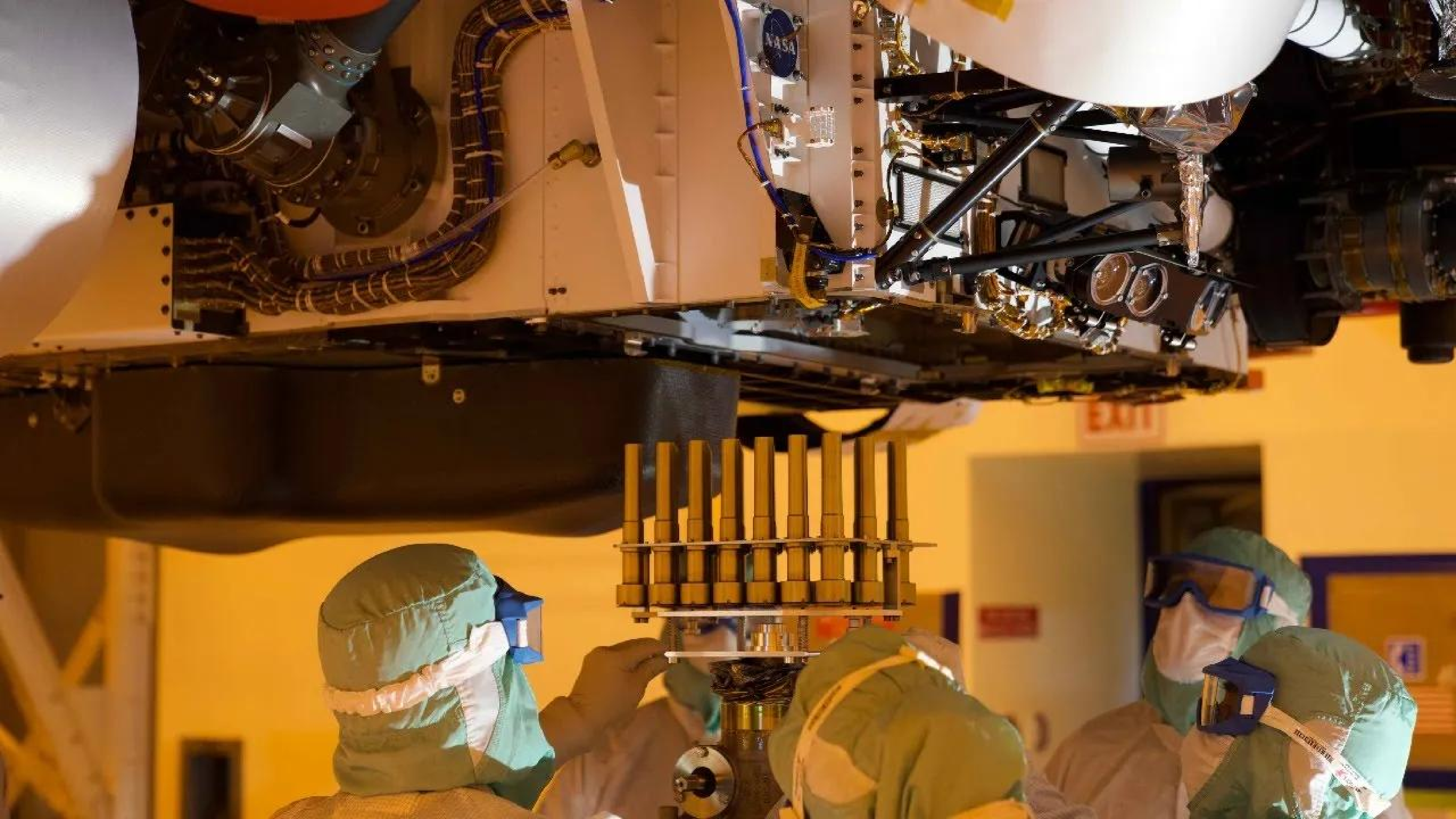
NASA
EXIT

1
00:00:20,300 --> 00:00:17,930
[Music]

2
00:00:58,590 --> 00:00:20,310
[Applause]

3
00:03:59,920 --> 00:01:15,270
[Music]

4
00:04:38,210 --> 00:03:59,930
[Applause]

5
00:04:42,170 --> 00:04:40,830
[Music]

6
00:04:55,280 --> 00:04:42,180
so

7
00:05:45,909 --> 00:05:15,660
[Music]

8
00:05:50,469 --> 00:05:48,629
hello everyone and welcome to nasa's jet

9
00:05:51,590 --> 00:05:50,479
propulsion laboratory in southern

10
00:05:54,390 --> 00:05:51,600
california

11
00:05:55,990 --> 00:05:54,400
nasa's perseverance rover landed on mars

12
00:05:57,830 --> 00:05:56,000
on february 18th

13
00:05:59,590 --> 00:05:57,840

and it's been really busy since then

14
00:06:01,590 --> 00:05:59,600
completing initial checkouts and

15
00:06:04,070 --> 00:06:01,600
starting its science mission

16
00:06:04,950 --> 00:06:04,080
i'm jari cook of jpl's digital news and

17
00:06:06,790 --> 00:06:04,960
media office

18
00:06:08,790 --> 00:06:06,800
and i'll be your host today as we talk

19
00:06:10,870 --> 00:06:08,800
about early science findings

20
00:06:12,790 --> 00:06:10,880
and preparations for the next major

21
00:06:15,029 --> 00:06:12,800
mission milestone collecting

22
00:06:16,870 --> 00:06:15,039
the first ever martian samples for

23
00:06:19,029 --> 00:06:16,880
planned return to earth

24
00:06:20,710 --> 00:06:19,039
so those of us here at jpl have our

25
00:06:23,189 --> 00:06:20,720
masks on because there's been a recent

26
00:06:23,990 --> 00:06:23,199
increase in coronavirus cases here in la

27
00:06:25,510 --> 00:06:24,000
county

28
00:06:27,189 --> 00:06:25,520
but i'm going to introduce you now to

29
00:06:28,710 --> 00:06:27,199
our speakers we're going to start off at

30
00:06:31,029 --> 00:06:28,720
nasa headquarters

31
00:06:34,710 --> 00:06:31,039
thomas erbukin associate administrator

32
00:06:37,430 --> 00:06:34,720
for nasa's science mission directorate

33
00:06:40,629 --> 00:06:37,440
and then here at jpl jennifer trosper

34
00:06:42,790 --> 00:06:40,639
perseverance project manager

35
00:06:44,550 --> 00:06:42,800
ken farley perseverance project

36
00:06:47,430 --> 00:06:44,560
scientist

37
00:06:48,870 --> 00:06:47,440
vivian sun perseverance science campaign

38
00:06:52,309 --> 00:06:48,880

co-lead

39
00:06:54,710 --> 00:06:52,319
and olivier toupee perseverance enhanced

40
00:06:55,430 --> 00:06:54,720
navigation lead we will be taking

41
00:06:56,950 --> 00:06:55,440
questions

42
00:06:58,309 --> 00:06:56,960
during this briefing so if you're a

43
00:07:00,390 --> 00:06:58,319
member of the media and you're on the

44
00:07:01,350 --> 00:07:00,400
phone lines press star one to get into

45
00:07:03,270 --> 00:07:01,360
the queue

46
00:07:05,909 --> 00:07:03,280
and if you're on social media use the

47
00:07:09,909 --> 00:07:05,919
hashtag asknasa

48
00:07:12,390 --> 00:07:09,919
so now i'll turn it over to thomas

49
00:07:13,029 --> 00:07:12,400
well thank you so much uh i just cannot

50
00:07:15,589 --> 00:07:13,039
tell you how

51
00:07:16,790 --> 00:07:15,599
excited i am to be here today and be

52
00:07:19,110 --> 00:07:16,800
part of this

53
00:07:21,110 --> 00:07:19,120
moment of course we're starting to

54
00:07:22,150 --> 00:07:21,120
conduct the observations that i've been

55
00:07:24,790 --> 00:07:22,160
planning for

56
00:07:27,430 --> 00:07:24,800
years or even decades and continue to

57
00:07:30,550 --> 00:07:27,440
learn about this beautiful planet

58
00:07:32,629 --> 00:07:30,560
the planet that has so many answers to

59
00:07:33,990 --> 00:07:32,639
questions that we have on our mind such

60
00:07:36,309 --> 00:07:34,000
as

61
00:07:37,589 --> 00:07:36,319
how does it look like it does so dry and

62
00:07:41,270 --> 00:07:37,599
desolate even and

63
00:07:42,550 --> 00:07:41,280

did it ever harbor life and uh we're now

64
00:07:46,070 --> 00:07:42,560
ready

65
00:07:47,830 --> 00:07:46,080
for years and decades of discovery

66
00:07:49,270 --> 00:07:47,840
missions like that of course are planned

67
00:07:52,309 --> 00:07:49,280
and contemplated

68
00:07:54,309 --> 00:07:52,319
to the best of our ability not only

69
00:07:57,270 --> 00:07:54,319
how we execute these observations but

70
00:08:00,629 --> 00:07:57,280
also how it fits into our plans not only

71
00:08:01,670 --> 00:08:00,639
of exploring mars but all the solar

72
00:08:05,350 --> 00:08:01,680
system and even

73
00:08:08,309 --> 00:08:05,360
learning about our earth our home itself

74
00:08:09,749 --> 00:08:08,319
and let's start at the planning that

75
00:08:11,909 --> 00:08:09,759
goes into the rover

76
00:08:13,029 --> 00:08:11,919
itself and also the journey to jezreel

77
00:08:15,029 --> 00:08:13,039
crater

78
00:08:16,230 --> 00:08:15,039
it's an incredible team that got us

79
00:08:18,950 --> 00:08:16,240
there frankly i'm just

80
00:08:19,670 --> 00:08:18,960
so such an awe still about this team and

81
00:08:22,869 --> 00:08:19,680
i can't

82
00:08:24,790 --> 00:08:22,879
forget the amazing movies that were

83
00:08:27,430 --> 00:08:24,800
played back to earth both of cameras

84
00:08:29,029 --> 00:08:27,440
looking down into the dust whirling up

85
00:08:32,310 --> 00:08:29,039
as we were landing and cameras

86
00:08:33,110 --> 00:08:32,320
up looking at the parachute going up

87
00:08:35,190 --> 00:08:33,120
there

88
00:08:38,230 --> 00:08:35,200

and of course that inspired me inspired

89
00:08:41,430 --> 00:08:38,240
all of us and we believe inspires future

90
00:08:42,389 --> 00:08:41,440
generations of explorers all that

91
00:08:45,750 --> 00:08:42,399
preparation

92
00:08:46,150 --> 00:08:45,760
now turns into the wonderful fails that

93
00:08:49,670 --> 00:08:46,160
we're

94
00:08:50,470 --> 00:08:49,680
in now the time that we really get a

95
00:08:52,829 --> 00:08:50,480
chance

96
00:08:55,509 --> 00:08:52,839
to observe the surrounding and learn the

97
00:08:56,070 --> 00:08:55,519
time where surprises are starting to

98
00:08:59,430 --> 00:08:56,080
come in

99
00:09:03,350 --> 00:08:59,440
at the time where we learn things about

100
00:09:05,990 --> 00:09:03,360
our new new kind of environment

101
00:09:07,269 --> 00:09:06,000
of this planetary neighbor please could

102
00:09:11,350 --> 00:09:07,279
you pull up the

103
00:09:12,150 --> 00:09:11,360
slide this of course used a vast martian

104
00:09:14,470 --> 00:09:12,160
fleet of

105
00:09:15,670 --> 00:09:14,480
spacecraft to learn about whether water

106
00:09:18,550 --> 00:09:15,680
existed

107
00:09:21,110 --> 00:09:18,560
on mars and inform us about the complex

108
00:09:23,030 --> 00:09:21,120
chemical composition the geology

109
00:09:24,150 --> 00:09:23,040
and we're studying the planetary crust

110
00:09:26,470 --> 00:09:24,160
and mantle of the core

111
00:09:28,310 --> 00:09:26,480
right now on inside and i just want to

112
00:09:29,110 --> 00:09:28,320
give you a heads up that even later this

113
00:09:31,750 --> 00:09:29,120

week

114
00:09:33,829 --> 00:09:31,760
we actually have another news conference

115
00:09:35,670 --> 00:09:33,839
and kind of news are coming out of this

116
00:09:37,590 --> 00:09:35,680
inside spacecraft about the very

117
00:09:39,990 --> 00:09:37,600
questions i just outdressed

118
00:09:41,509 --> 00:09:40,000
but today now we're here talking about

119
00:09:44,070 --> 00:09:41,519
perseverance

120
00:09:46,550 --> 00:09:44,080
going right to the exact place that can

121
00:09:49,750 --> 00:09:46,560
help us gather the next set of answers

122
00:09:51,269 --> 00:09:49,760
to key questions then generate even more

123
00:09:53,750 --> 00:09:51,279
we didn't just parachute in

124
00:09:55,350 --> 00:09:53,760
of course uh and try to figure out when

125
00:09:58,070 --> 00:09:55,360
we're on the ground we landed

126
00:09:59,910 --> 00:09:58,080
in the most promising place to answer

127
00:10:01,430 --> 00:09:59,920
the very questions i just outlined

128
00:10:05,110 --> 00:10:01,440
jezreel crater

129
00:10:07,750 --> 00:10:05,120
it used to be a lake and really the home

130
00:10:10,069 --> 00:10:07,760
of the most important site of mars

131
00:10:12,630 --> 00:10:10,079
discovery today

132
00:10:15,269 --> 00:10:12,640
we will see and discuss evidence that

133
00:10:16,470 --> 00:10:15,279
the lake had multiple cycles of dryness

134
00:10:18,870 --> 00:10:16,480
and filling back

135
00:10:20,870 --> 00:10:18,880
up and ken farley of course is going to

136
00:10:21,829 --> 00:10:20,880
talk to us about this and also about the

137
00:10:24,710 --> 00:10:21,839
instruments

138
00:10:26,470 --> 00:10:24,720

that are kind of really on you know

139
00:10:28,550 --> 00:10:26,480
showing us new things about the

140
00:10:31,269 --> 00:10:28,560
mars environment unprecedented

141
00:10:34,230 --> 00:10:31,279
instruments that we've never had there

142
00:10:35,910 --> 00:10:34,240
could you pull up the next visual please

143
00:10:37,910 --> 00:10:35,920
we recognize of course that

144
00:10:39,110 --> 00:10:37,920
exploration is not a sprint it's a

145
00:10:41,110 --> 00:10:39,120
marathon

146
00:10:43,350 --> 00:10:41,120
perseverance is one step of a long

147
00:10:44,949 --> 00:10:43,360
legacy of carefully planned mars

148
00:10:52,150 --> 00:10:44,959
exploration

149
00:10:54,230 --> 00:10:52,160
for the time to come our minds are

150
00:10:56,310 --> 00:10:54,240
already there with the human explorers

151
00:10:59,269 --> 00:10:56,320
on the surface of mars just like

152
00:11:01,910 --> 00:10:59,279
perseverance is right now

153
00:11:04,630 --> 00:11:01,920
it's also laying the groundwork for one

154
00:11:06,389 --> 00:11:04,640
of the most ambitious campaigns yet

155
00:11:08,230 --> 00:11:06,399
and of course that's a campaign of

156
00:11:10,790 --> 00:11:08,240
international collaboration with the

157
00:11:13,269 --> 00:11:10,800
european space agency and nasa

158
00:11:13,990 --> 00:11:13,279
bringing back samples that are collected

159
00:11:16,710 --> 00:11:14,000
on the surface

160
00:11:19,190 --> 00:11:16,720
of mars bring them back to the best labs

161
00:11:21,190 --> 00:11:19,200
that are available to all of humanity

162
00:11:22,949 --> 00:11:21,200
for the analysis of the very questions

163
00:11:25,350 --> 00:11:22,959

already outlined

164
00:11:28,069 --> 00:11:25,360
we're just so excited to get to that

165
00:11:31,590 --> 00:11:28,079
face every yard on the surface

166
00:11:33,990 --> 00:11:31,600
of mars is a mars of sample return

167
00:11:35,350 --> 00:11:34,000
and uh but back to the present of course

168
00:11:37,910 --> 00:11:35,360
i just can tell you

169
00:11:39,030 --> 00:11:37,920
how excited i am to with you learn about

170
00:11:41,590 --> 00:11:39,040
these uh

171
00:11:42,069 --> 00:11:41,600
discoveries and uh and really what we've

172
00:11:45,430 --> 00:11:42,079
achieved

173
00:11:47,430 --> 00:11:45,440
so far uh time and time again this

174
00:11:48,550 --> 00:11:47,440
team that is really at the heart of this

175
00:11:51,590 --> 00:11:48,560
has exemplified

176
00:11:54,470 --> 00:11:51,600
immeasurable dedication and shall i say

177
00:11:55,430 --> 00:11:54,480
perseverance i just can't wait to see

178
00:11:58,629 --> 00:11:55,440
what we all

179
00:12:01,030 --> 00:11:58,639
cover next i'm really excited jennifer

180
00:12:01,829 --> 00:12:01,040
uh jennifer trosper to turn it over to

181
00:12:04,230 --> 00:12:01,839
you the

182
00:12:05,430 --> 00:12:04,240
perseverance project manager jennifer go

183
00:12:08,230 --> 00:12:05,440
ahead

184
00:12:09,269 --> 00:12:08,240
thanks thomas well it's great to be here

185
00:12:12,310 --> 00:12:09,279
to talk about

186
00:12:14,310 --> 00:12:12,320
perseverance and ingenuity and what the

187
00:12:15,269 --> 00:12:14,320
operations team has been up to this

188
00:12:17,509 --> 00:12:15,279

summer

189
00:12:19,750 --> 00:12:17,519
and perhaps like a lot of you folks

190
00:12:21,829 --> 00:12:19,760
we've actually been on a road trip

191
00:12:24,470 --> 00:12:21,839
this road trip is associated with our

192
00:12:26,790 --> 00:12:24,480
very first science campaign and during

193
00:12:28,790 --> 00:12:26,800
it we will take our very first sample

194
00:12:30,550 --> 00:12:28,800
from the surface of mars go ahead and

195
00:12:31,670 --> 00:12:30,560
bring up my first graphic so i can give

196
00:12:34,150 --> 00:12:31,680
you a little bit

197
00:12:34,949 --> 00:12:34,160
of orientation about where we are in

198
00:12:36,470 --> 00:12:34,959
this graphic

199
00:12:38,069 --> 00:12:36,480
you can see the landing location which

200
00:12:40,629 --> 00:12:38,079
is at the very top in the middle

201
00:12:42,790 --> 00:12:40,639
where the beginning of the white line is

202
00:12:45,430 --> 00:12:42,800
you can see the rover's current location

203
00:12:47,110 --> 00:12:45,440
which is the blue dot and you can see

204
00:12:48,150 --> 00:12:47,120
where we've been driving this summer on

205
00:12:50,470 --> 00:12:48,160
our road trip

206
00:12:52,069 --> 00:12:50,480
we've been driving mostly south you can

207
00:12:54,470 --> 00:12:52,079
see the there's a

208
00:12:56,230 --> 00:12:54,480
an area in the middle we call sata which

209
00:12:58,470 --> 00:12:56,240
is a lot of sand dunes and we've been

210
00:13:00,790 --> 00:12:58,480
skirting the edge of those sand dunes

211
00:13:02,230 --> 00:13:00,800
if you recall at landing our terrain

212
00:13:04,310 --> 00:13:02,240
relative navigation system

213
00:13:05,990 --> 00:13:04,320

also diverted us away from those same

214
00:13:07,430 --> 00:13:06,000
sand dunes because they are dangerous

215
00:13:09,110 --> 00:13:07,440
we don't want to drive the rover in

216
00:13:10,949 --> 00:13:09,120
those or we could get stuck

217
00:13:12,629 --> 00:13:10,959
so we've been skirting the edge you can

218
00:13:15,750 --> 00:13:12,639
see where the rover is currently

219
00:13:17,910 --> 00:13:15,760
in that blue dot then you also see a red

220
00:13:19,590 --> 00:13:17,920
dot that's where ingenuity is

221
00:13:21,590 --> 00:13:19,600
we've been continuing the ingenuity

222
00:13:24,310 --> 00:13:21,600
mission and engineering just recently

223
00:13:25,110 --> 00:13:24,320
flew across that sada region to the

224
00:13:26,790 --> 00:13:25,120
south

225
00:13:28,949 --> 00:13:26,800
it's in a location where the rover will

226
00:13:31,670 --> 00:13:28,959
eventually get to after it does sampling

227
00:13:33,430 --> 00:13:31,680
at the location we're currently in

228
00:13:36,310 --> 00:13:33,440
so we've been doing a lot of driving if

229
00:13:38,790 --> 00:13:36,320
you bring up my next graphic please

230
00:13:40,310 --> 00:13:38,800
this image was taken during a new kind

231
00:13:41,110 --> 00:13:40,320
of driving that we've been doing on the

232
00:13:43,189 --> 00:13:41,120
rover we've been

233
00:13:45,350 --> 00:13:43,199
we've been upgrading our driving to an

234
00:13:47,269 --> 00:13:45,360
autonomous navigation capability

235
00:13:48,870 --> 00:13:47,279
so this is taken from the navigation

236
00:13:51,990 --> 00:13:48,880
camera looking back

237
00:13:52,710 --> 00:13:52,000
over the rover after it did it's one of

238
00:13:55,670 --> 00:13:52,720

its first

239
00:13:57,350 --> 00:13:55,680
and longest self-directed drives so

240
00:14:00,069 --> 00:13:57,360
those wheel tracks that you see in that

241
00:14:01,829 --> 00:14:00,079
image are all directed by the rover

242
00:14:03,750 --> 00:14:01,839
in its autonomous navigation you'll hear

243
00:14:04,150 --> 00:14:03,760
a little bit more about that from olivia

244
00:14:09,189 --> 00:14:04,160
to

245
00:14:10,870 --> 00:14:09,199
so we haven't just been driving we've

246
00:14:12,069 --> 00:14:10,880
actually been continuing some of our

247
00:14:15,189 --> 00:14:12,079
tech demos

248
00:14:19,829 --> 00:14:15,199
moxie

249
00:14:21,590 --> 00:14:19,839
future missions the ability to extract

250
00:14:22,710 --> 00:14:21,600
oxygen from the carbon dioxide

251
00:14:24,629 --> 00:14:22,720
atmosphere

252
00:14:26,710 --> 00:14:24,639
we've done three runs to date and those

253
00:14:29,509 --> 00:14:26,720
have all been very successful each one

254
00:14:31,670 --> 00:14:29,519
got about six grams of oxygen

255
00:14:33,509 --> 00:14:31,680
we will continue to do those runs

256
00:14:35,750 --> 00:14:33,519
throughout the seasons

257
00:14:37,269 --> 00:14:35,760
on mars the atmospheric density varies

258
00:14:38,710 --> 00:14:37,279
so we want to make sure that we get

259
00:14:41,430 --> 00:14:38,720
experiments at the

260
00:14:42,310 --> 00:14:41,440
lowest and highest atmospheric density

261
00:14:44,470 --> 00:14:42,320
and this mission

262
00:14:45,990 --> 00:14:44,480
is in this experiment is feeding forward

263
00:14:48,310 --> 00:14:46,000

to these future missions that would

264
00:14:50,230 --> 00:14:48,320
would want to extract oxygen to use for

265
00:14:52,069 --> 00:14:50,240
human astronauts to breathe

266
00:14:53,509 --> 00:14:52,079
and even launch vehicles so

267
00:14:55,189 --> 00:14:53,519
congratulations to

268
00:14:57,189 --> 00:14:55,199
mike hecht and his whole team for a

269
00:14:59,269 --> 00:14:57,199
great experiment so far and will

270
00:15:01,110 --> 00:14:59,279
continue to be doing the moxie tech demo

271
00:15:03,350 --> 00:15:01,120
throughout our mission

272
00:15:05,509 --> 00:15:03,360
another demo that we've been continuing

273
00:15:06,629 --> 00:15:05,519
is the operations demo for the ingenuity

274
00:15:08,150 --> 00:15:06,639
helicopter

275
00:15:09,910 --> 00:15:08,160
you recall that we continued the

276
00:15:11,509 --> 00:15:09,920
helicopter mission to

277
00:15:12,949 --> 00:15:11,519
feed forward information to future

278
00:15:15,030 --> 00:15:12,959
missions about how

279
00:15:16,790 --> 00:15:15,040
an aerial reconnaissance vehicle might

280
00:15:18,150 --> 00:15:16,800
help the science investigations for

281
00:15:20,230 --> 00:15:18,160
future missions

282
00:15:21,269 --> 00:15:20,240
we just completed flight nine flight

283
00:15:23,990 --> 00:15:21,279
nine broke

284
00:15:26,150 --> 00:15:24,000
all of our records the duration was two

285
00:15:28,550 --> 00:15:26,160
minutes and 46 seconds

286
00:15:30,629 --> 00:15:28,560
the velocity was five meters per second

287
00:15:32,509 --> 00:15:30,639
and we flew we quadrupled the distance

288
00:15:35,110 --> 00:15:32,519

that we had ever flown and we flew about

289
00:15:37,189 --> 00:15:35,120
625 meters and that's the flight

290
00:15:38,550 --> 00:15:37,199
that took us over to the south end of

291
00:15:39,829 --> 00:15:38,560
seda i have to say when we were all

292
00:15:41,509 --> 00:15:39,839
sitting there waiting for the data to

293
00:15:43,430 --> 00:15:41,519
come down we were very relieved

294
00:15:45,269 --> 00:15:43,440
that the helicopter succeeded on that

295
00:15:47,269 --> 00:15:45,279
very ambitious flight

296
00:15:49,990 --> 00:15:47,279
our next flight is planned for no

297
00:15:51,990 --> 00:15:50,000
earlier than 7 24 july 24th

298
00:15:53,670 --> 00:15:52,000
and we'll be going to an area called the

299
00:15:53,990 --> 00:15:53,680
raised ridges which you'll hear about

300
00:15:57,350 --> 00:15:54,000
from

301
00:15:59,110 --> 00:15:57,360
little bit it's an

302
00:16:00,550 --> 00:15:59,120
area where we may choose to do some

303
00:16:02,870 --> 00:16:00,560
sampling

304
00:16:04,710 --> 00:16:02,880
the next thing that we've really been

305
00:16:07,189 --> 00:16:04,720
working on probably the most

306
00:16:08,230 --> 00:16:07,199
since we last talked is preparing for

307
00:16:10,230 --> 00:16:08,240
sampling

308
00:16:11,430 --> 00:16:10,240
so i'd like to show this next video

309
00:16:14,150 --> 00:16:11,440
which reminds you

310
00:16:16,230 --> 00:16:14,160
of our sample caching system the purpose

311
00:16:17,829 --> 00:16:16,240
of our sample caching system is to

312
00:16:20,150 --> 00:16:17,839
acquire samples

313
00:16:22,310 --> 00:16:20,160

and then to transit transfer those

314
00:16:24,230 --> 00:16:22,320
through our bit carousel to the adaptive

315
00:16:26,870 --> 00:16:24,240
caching assembly which is in the front

316
00:16:28,870 --> 00:16:26,880
of the rover the front of the rover then

317
00:16:31,350 --> 00:16:28,880
has another sample handling arm

318
00:16:33,110 --> 00:16:31,360
which manages those tubes and the

319
00:16:36,150 --> 00:16:33,120
samples inside of them

320
00:16:38,150 --> 00:16:36,160
to do imaging and measure the volume and

321
00:16:38,629 --> 00:16:38,160
then we will seal those and store those

322
00:16:41,509 --> 00:16:38,639
for

323
00:16:43,189 --> 00:16:41,519
planned future return to earth so a lot

324
00:16:45,110 --> 00:16:43,199
of what we've been doing recently both

325
00:16:46,870 --> 00:16:45,120
on earth as well as on the vehicle is

326
00:16:48,949 --> 00:16:46,880
preparing for that first sample

327
00:16:50,870 --> 00:16:48,959
so we've been checking out the adaptive

328
00:16:51,670 --> 00:16:50,880
caching assembly which is there in the

329
00:16:53,829 --> 00:16:51,680
front

330
00:16:54,870 --> 00:16:53,839
of the rover one of the things that we

331
00:16:57,990 --> 00:16:54,880
did is we

332
00:17:01,110 --> 00:16:58,000
actually processed a witness tube so

333
00:17:02,629 --> 00:17:01,120
we have 43 sample tubes on the rover

334
00:17:05,429 --> 00:17:02,639
they're inside of the front of the rover

335
00:17:07,750 --> 00:17:05,439
here in this adaptive caching assembly

336
00:17:09,429 --> 00:17:07,760
and five of those are witness tubes the

337
00:17:11,429 --> 00:17:09,439
purpose of the witness tubes is

338
00:17:13,510 --> 00:17:11,439

exactly as their name they're to witness

339
00:17:14,549 --> 00:17:13,520
any contamination that might be present

340
00:17:16,309 --> 00:17:14,559
so that we can

341
00:17:17,990 --> 00:17:16,319
correlate that with the samples taken at

342
00:17:19,669 --> 00:17:18,000
the time the specific

343
00:17:21,990 --> 00:17:19,679
witness tube that we actually just

344
00:17:25,110 --> 00:17:22,000
processed was in the big carousel

345
00:17:26,069 --> 00:17:25,120
here measuring any sort of contaminants

346
00:17:28,710 --> 00:17:26,079
that we have seen

347
00:17:30,710 --> 00:17:28,720
in the big carousel since launch so we

348
00:17:31,990 --> 00:17:30,720
extracted that with our sample handling

349
00:17:35,270 --> 00:17:32,000
arm and you can go ahead and play

350
00:17:37,430 --> 00:17:35,280
the next video we processed it by

351
00:17:39,669 --> 00:17:37,440
imaging it so this is actually taken

352
00:17:41,510 --> 00:17:39,679
with a cache cam it's a camera inside

353
00:17:42,549 --> 00:17:41,520
the adaptive caching assembly it's

354
00:17:44,950 --> 00:17:42,559
imaging

355
00:17:46,390 --> 00:17:44,960
the inside of that witness tube so

356
00:17:47,909 --> 00:17:46,400
inside there you see a witness tube

357
00:17:49,270 --> 00:17:47,919
assembly which is what collects the

358
00:17:51,669 --> 00:17:49,280
contaminants

359
00:17:52,630 --> 00:17:51,679
and then after we image it we actually

360
00:17:54,390 --> 00:17:52,640
seal it

361
00:17:56,870 --> 00:17:54,400
and activate the seal and that's what

362
00:17:59,750 --> 00:17:56,880
you see at the end of this video

363
00:18:00,710 --> 00:17:59,760

so the great news is that all worked

364
00:18:03,750 --> 00:18:00,720
perfectly

365
00:18:06,470 --> 00:18:03,760
and so we are ready to sample i

366
00:18:08,310 --> 00:18:06,480
am very excited about getting our first

367
00:18:11,190 --> 00:18:08,320
sample on mars i think the team

368
00:18:12,789 --> 00:18:11,200
has done a tremendous work i joked about

369
00:18:14,630 --> 00:18:12,799
it being a road trip and summer vacation

370
00:18:16,710 --> 00:18:14,640
they've been working very very hard it

371
00:18:18,950 --> 00:18:16,720
hasn't really been a vacation for them

372
00:18:20,870 --> 00:18:18,960
we're still working seven days a week

373
00:18:21,270 --> 00:18:20,880
but they've done the job we're ready to

374
00:18:23,190 --> 00:18:21,280
go

375
00:18:24,870 --> 00:18:23,200
and we expect to get that first sample

376
00:18:27,190 --> 00:18:24,880
within the first few weeks of

377
00:18:29,270 --> 00:18:27,200
august and with that i'd like to hand it

378
00:18:30,230 --> 00:18:29,280
off to ken farley to talk more about the

379
00:18:33,110 --> 00:18:30,240
rationale

380
00:18:34,310 --> 00:18:33,120
scientifically behind what we're doing

381
00:18:36,390 --> 00:18:34,320
thanks jennifer

382
00:18:38,310 --> 00:18:36,400
indeed it has been an extremely busy

383
00:18:39,190 --> 00:18:38,320
five months for perseverance and for the

384
00:18:41,510 --> 00:18:39,200
team

385
00:18:43,110 --> 00:18:41,520
not only have we done the technology

386
00:18:44,230 --> 00:18:43,120
demonstrations that jennifer described

387
00:18:46,789 --> 00:18:44,240
but but also

388
00:18:47,270 --> 00:18:46,799

testing out a lot of our capabilities

389
00:18:49,190 --> 00:18:47,280
and

390
00:18:50,549 --> 00:18:49,200
acquiring an enormous amount of

391
00:18:51,830 --> 00:18:50,559
scientific data

392
00:18:54,470 --> 00:18:51,840
and i want to tell you a little bit

393
00:18:56,070 --> 00:18:54,480
about the highlights of that data

394
00:18:57,750 --> 00:18:56,080
tell you about some of our discoveries

395
00:18:59,510 --> 00:18:57,760
and also to tell you about some of the

396
00:19:01,750 --> 00:18:59,520
things we are going to be doing

397
00:19:03,110 --> 00:19:01,760
in the days ahead i'll start off by

398
00:19:05,430 --> 00:19:03,120
talking about

399
00:19:06,789 --> 00:19:05,440
the current environmental conditions

400
00:19:08,870 --> 00:19:06,799
within jezreel crater

401
00:19:09,990 --> 00:19:08,880
perseverance has a very sophisticated

402
00:19:12,710 --> 00:19:10,000
set of sensors on

403
00:19:14,549 --> 00:19:12,720
board to try to understand the

404
00:19:15,350 --> 00:19:14,559
atmospheric conditions and the climatic

405
00:19:16,870 --> 00:19:15,360
conditions

406
00:19:18,870 --> 00:19:16,880
and to relate them to the broader

407
00:19:20,789 --> 00:19:18,880
conditions around mars

408
00:19:22,789 --> 00:19:20,799
and we have been acquiring some really

409
00:19:25,510 --> 00:19:22,799
fascinating images

410
00:19:27,590 --> 00:19:25,520
of dust devils dust devils are just like

411
00:19:28,950 --> 00:19:27,600
on earth they're vortices that lift dust

412
00:19:31,909 --> 00:19:28,960
into the air

413
00:19:33,110 --> 00:19:31,919

and we see them very commonly in images

414
00:19:35,110 --> 00:19:33,120
sometimes we see them

415
00:19:36,470 --> 00:19:35,120
when we have set out to do so we point

416
00:19:38,789 --> 00:19:36,480
the camera in a region at

417
00:19:40,549 --> 00:19:38,799
a time when we think we might see them

418
00:19:42,390 --> 00:19:40,559
and occasionally they just appear in

419
00:19:43,430 --> 00:19:42,400
images that are taken for navigation

420
00:19:44,950 --> 00:19:43,440
purposes or for

421
00:19:46,789 --> 00:19:44,960
understanding the geology or getting

422
00:19:49,430 --> 00:19:46,799
photobombed by

423
00:19:51,110 --> 00:19:49,440
dust devils we've also acquired images

424
00:19:53,669 --> 00:19:51,120
like this one here

425
00:19:54,710 --> 00:19:53,679
which shows a wind gust sweeping across

426
00:19:56,549 --> 00:19:54,720
the landscape

427
00:19:57,830 --> 00:19:56,559
lifting dust and blowing it along this

428
00:20:00,310 --> 00:19:57,840
is a very visceral

429
00:20:01,510 --> 00:20:00,320
kind of image makes it feel very

430
00:20:03,190 --> 00:20:01,520
earth-like

431
00:20:04,549 --> 00:20:03,200
we have this sophisticated set of

432
00:20:06,789 --> 00:20:04,559
instruments on the rover that we hope to

433
00:20:09,750 --> 00:20:06,799
better understand why this is happening

434
00:20:11,909 --> 00:20:09,760
and what it means for the big picture

435
00:20:13,110 --> 00:20:11,919
also within the the last several months

436
00:20:15,110 --> 00:20:13,120
jennifer mentioned we're on the

437
00:20:17,110 --> 00:20:15,120
on a road trip we've driven about one

438
00:20:19,350 --> 00:20:17,120

kilometer to the south

439
00:20:20,789 --> 00:20:19,360
investigating rocks of the crater floor

440
00:20:21,350 --> 00:20:20,799
so now we're looking at environments

441
00:20:23,270 --> 00:20:21,360
that are

442
00:20:25,190 --> 00:20:23,280
much further in the past billions of

443
00:20:28,310 --> 00:20:25,200
years in the past

444
00:20:28,950 --> 00:20:28,320
if i could have this first uh movie this

445
00:20:32,390 --> 00:20:28,960
shows

446
00:20:34,630 --> 00:20:32,400
a panorama that we took

447
00:20:35,750 --> 00:20:34,640
of these rocks of the crater floor these

448
00:20:38,390 --> 00:20:35,760
rocks are important

449
00:20:40,230 --> 00:20:38,400
because we believe they are the lowest

450
00:20:41,430 --> 00:20:40,240
down rocks in the sequence of rocks that

451
00:20:42,549 --> 00:20:41,440
we have and therefore they are very

452
00:20:45,350 --> 00:20:42,559
likely to be

453
00:20:47,029 --> 00:20:45,360
the oldest and one of the hypotheses

454
00:20:49,430 --> 00:20:47,039
that we are trying to test

455
00:20:51,029 --> 00:20:49,440
is that the lake that once filled jezero

456
00:20:52,789 --> 00:20:51,039
wasn't there just once

457
00:20:54,789 --> 00:20:52,799
but that it went through multiple

458
00:20:57,830 --> 00:20:54,799
episodes of filling up

459
00:21:00,470 --> 00:20:57,840
drying down and filling up again

460
00:21:01,430 --> 00:21:00,480
this is very important because it means

461
00:21:03,669 --> 00:21:01,440
that we will have

462
00:21:05,510 --> 00:21:03,679
multiple time periods in which we could

463
00:21:06,630 --> 00:21:05,520

potentially learn about environmental

464
00:21:08,630 --> 00:21:06,640
conditions

465
00:21:10,070 --> 00:21:08,640
on mars and we also have multiple time

466
00:21:10,950 --> 00:21:10,080
periods when we might be able to look

467
00:21:12,870 --> 00:21:10,960
for evidence

468
00:21:15,190 --> 00:21:12,880
of ancient life that might have existed

469
00:21:17,430 --> 00:21:15,200
on the planet this is a hypothesis

470
00:21:19,750 --> 00:21:17,440
but we've started to acquire information

471
00:21:20,390 --> 00:21:19,760
that bears directly on it and if i could

472
00:21:23,350 --> 00:21:20,400
have the next

473
00:21:24,070 --> 00:21:23,360
image this is an image taken with the

474
00:21:25,830 --> 00:21:24,080
supercam

475
00:21:27,830 --> 00:21:25,840
rmi camera this is essentially a

476
00:21:30,950 --> 00:21:27,840
telescope mounted on the rover

477
00:21:31,430 --> 00:21:30,960
and it's of a region that we call r2b it

478
00:21:34,630 --> 00:21:31,440
shows

479
00:21:37,350 --> 00:21:34,640
a small hill or a small cliff

480
00:21:37,990 --> 00:21:37,360
several meters across a very finely

481
00:21:41,510 --> 00:21:38,000
layered

482
00:21:43,590 --> 00:21:41,520
rock this is exciting to us because the

483
00:21:44,870 --> 00:21:43,600
simplest interpretation of these rocks

484
00:21:46,870 --> 00:21:44,880
is that they represent

485
00:21:47,909 --> 00:21:46,880
fine-grained rock deposited on the

486
00:21:49,590 --> 00:21:47,919
bottom of a lake

487
00:21:51,750 --> 00:21:49,600
in other words mud that might have been

488
00:21:53,590 --> 00:21:51,760

deposited and turned into rock

489
00:21:55,590 --> 00:21:53,600
this is exactly the kind of rock that we

490
00:21:58,470 --> 00:21:55,600
are most interested investigating

491
00:21:58,950 --> 00:21:58,480
for looking for potential bio signatures

492
00:22:03,669 --> 00:21:58,960
in this

493
00:22:05,669 --> 00:22:03,679
have the next image

494
00:22:07,350 --> 00:22:05,679
now we have driven to this locality that

495
00:22:09,430 --> 00:22:07,360
you see in front of you

496
00:22:10,630 --> 00:22:09,440
this is the area where we are really

497
00:22:13,270 --> 00:22:10,640
going to be digging in

498
00:22:14,950 --> 00:22:13,280
both figuratively and literally to

499
00:22:15,350 --> 00:22:14,960
understand the rocks that we have been

500
00:22:19,669 --> 00:22:15,360
on

501
00:22:21,029 --> 00:22:19,679
ever since we landed

502
00:22:23,270 --> 00:22:21,039
we have been on rocks that we call the

503
00:22:24,630 --> 00:22:23,280
paver stones and those are the whitish

504
00:22:26,310 --> 00:22:24,640
rocks that you see

505
00:22:27,990 --> 00:22:26,320
in this image we've been studying these

506
00:22:31,029 --> 00:22:28,000
in detail for some time

507
00:22:32,149 --> 00:22:31,039
trying to ask and answer this this most

508
00:22:33,909 --> 00:22:32,159
simple question

509
00:22:35,750 --> 00:22:33,919
are these rocks volcanic or are they

510
00:22:36,870 --> 00:22:35,760
sedimentary we've been talking about

511
00:22:38,149 --> 00:22:36,880
that for a while

512
00:22:39,909 --> 00:22:38,159
and i'll tell you we still don't have

513
00:22:41,510 --> 00:22:39,919

the answer but i want to tell you why we

514
00:22:44,549 --> 00:22:41,520
don't have the answer

515
00:22:46,549 --> 00:22:44,559
if i could have the the next image

516
00:22:47,750 --> 00:22:46,559
this this shows you what we are up

517
00:22:50,390 --> 00:22:47,760
against this is an

518
00:22:52,390 --> 00:22:50,400
image that is taken with the watson

519
00:22:53,029 --> 00:22:52,400
camera which is mounted on the robotic

520
00:22:55,909 --> 00:22:53,039
arm

521
00:22:58,310 --> 00:22:55,919
this camera extends out to a few

522
00:23:01,270 --> 00:22:58,320
centimeters off the surface of the rock

523
00:23:02,310 --> 00:23:01,280
and takes close-up pictures so this is a

524
00:23:05,909 --> 00:23:02,320
few centimeters

525
00:23:09,029 --> 00:23:05,919
on a side what you are looking at here

526
00:23:10,710 --> 00:23:09,039
has an exquisite detail

527
00:23:12,710 --> 00:23:10,720
but what we are seeing still doesn't

528
00:23:13,590 --> 00:23:12,720
answer the question volcanic or

529
00:23:15,830 --> 00:23:13,600
sedimentary

530
00:23:16,950 --> 00:23:15,840
because there are confounding factors so

531
00:23:18,549 --> 00:23:16,960
one of the things that you can see in

532
00:23:20,870 --> 00:23:18,559
this image is dust

533
00:23:22,070 --> 00:23:20,880
dust coats essentially all of the rocks

534
00:23:23,909 --> 00:23:22,080
in our study area

535
00:23:25,750 --> 00:23:23,919
it's what gives this image its reddish

536
00:23:28,149 --> 00:23:25,760
tint you can also see

537
00:23:30,070 --> 00:23:28,159
little sand grains and pebbles these are

538
00:23:32,070 --> 00:23:30,080

presumably brought in from

539
00:23:33,590 --> 00:23:32,080
somewhere nearby but don't have

540
00:23:34,710 --> 00:23:33,600
necessarily anything to do with the rock

541
00:23:36,789 --> 00:23:34,720
below

542
00:23:38,470 --> 00:23:36,799
and perhaps less obvious but of of

543
00:23:40,149 --> 00:23:38,480
considerable interest is what appears to

544
00:23:43,029 --> 00:23:40,159
be a purplish coating

545
00:23:44,230 --> 00:23:43,039
on the smoother surfaces of this rock so

546
00:23:47,190 --> 00:23:44,240
all of these factors

547
00:23:48,149 --> 00:23:47,200
conspire to prevent us from peering into

548
00:23:50,310 --> 00:23:48,159
the rock

549
00:23:51,269 --> 00:23:50,320
and actually seeing what it is made out

550
00:23:53,029 --> 00:23:51,279
of

551
00:23:54,789 --> 00:23:53,039
so this is a reason we have not been

552
00:23:56,070 --> 00:23:54,799
able to answer this question igneous or

553
00:23:58,470 --> 00:23:56,080
sedimentary

554
00:24:00,230 --> 00:23:58,480
but we have a potential solution we're

555
00:24:00,950 --> 00:24:00,240
very excited to deploy for the first

556
00:24:03,029 --> 00:24:00,960
time

557
00:24:04,310 --> 00:24:03,039
our abrasion tool so much like a

558
00:24:05,830 --> 00:24:04,320
geologist when they go out into the

559
00:24:07,510 --> 00:24:05,840
field they take a hammer

560
00:24:09,110 --> 00:24:07,520
they will break open every rock that

561
00:24:09,750 --> 00:24:09,120
they want to study and they will look

562
00:24:11,510 --> 00:24:09,760
into it

563
00:24:12,870 --> 00:24:11,520

but we don't have a hammer but we have

564
00:24:15,750 --> 00:24:12,880
an abrasion tool

565
00:24:16,789 --> 00:24:15,760
and if i could have the final movie this

566
00:24:19,669 --> 00:24:16,799
is a movie taken

567
00:24:20,470 --> 00:24:19,679
from the test bed prior to launch and

568
00:24:23,029 --> 00:24:20,480
what you see

569
00:24:23,990 --> 00:24:23,039
is mounted on the robotic arm an

570
00:24:26,149 --> 00:24:24,000
abrading bit

571
00:24:28,230 --> 00:24:26,159
that is grinding into the surface of the

572
00:24:31,430 --> 00:24:28,240
rock and it's producing a

573
00:24:32,149 --> 00:24:31,440
smooth patch that is of about a

574
00:24:35,110 --> 00:24:32,159
centimeter

575
00:24:36,070 --> 00:24:35,120
into the rock then we will pull the

576
00:24:39,110 --> 00:24:36,080
abrading bit

577
00:24:42,950 --> 00:24:39,120
out and we will blow compressed air

578
00:24:45,190 --> 00:24:42,960
to blow the dust away to yield a

579
00:24:45,990 --> 00:24:45,200
smooth dust free surface that we can

580
00:24:48,149 --> 00:24:46,000
then deploy

581
00:24:49,830 --> 00:24:48,159
our instruments on this will allow us to

582
00:24:52,390 --> 00:24:49,840
see through all of these con

583
00:24:53,029 --> 00:24:52,400
confounding factors and to really uh i'm

584
00:24:54,630 --> 00:24:53,039
i'm

585
00:24:56,950 --> 00:24:54,640
pretty confident that we will be able to

586
00:24:59,750 --> 00:24:56,960
anal answer this question

587
00:25:01,590 --> 00:24:59,760
volcanic or sedimentary we actually

588
00:25:02,630 --> 00:25:01,600

commissioned this capability just within

589
00:25:04,710 --> 00:25:02,640
the last few days

590
00:25:06,549 --> 00:25:04,720
and we will deploy it for the first time

591
00:25:07,430 --> 00:25:06,559
and get our instruments out onto those

592
00:25:09,269 --> 00:25:07,440
surfaces

593
00:25:10,870 --> 00:25:09,279
in the coming weeks so it's a very

594
00:25:11,350 --> 00:25:10,880
exciting time because we will now

595
00:25:14,630 --> 00:25:11,360
actually

596
00:25:16,710 --> 00:25:14,640
get into these paver stone rocks

597
00:25:18,070 --> 00:25:16,720
both with the abrasion tool and with our

598
00:25:19,750 --> 00:25:18,080
scientific instruments

599
00:25:22,149 --> 00:25:19,760
and then we will also take our first

600
00:25:23,990 --> 00:25:22,159
sample this really important step

601
00:25:25,750 --> 00:25:24,000
uh in meeting the missions goals of

602
00:25:26,390 --> 00:25:25,760
collecting a suite of samples that are

603
00:25:28,870 --> 00:25:26,400
worthy

604
00:25:29,750 --> 00:25:28,880
of return to earth and to tell you more

605
00:25:31,510 --> 00:25:29,760
about the

606
00:25:33,190 --> 00:25:31,520
the science campaign that we are doing

607
00:25:35,190 --> 00:25:33,200
and our sampling i turn it over to

608
00:25:37,510 --> 00:25:35,200
vivian's son

609
00:25:39,110 --> 00:25:37,520
great thank you ken uh so yeah i'll be

610
00:25:40,710 --> 00:25:39,120
uh talking in a little bit more detail

611
00:25:41,990 --> 00:25:40,720
about our first science campaign and

612
00:25:45,350 --> 00:25:42,000
what we're doing to prepare

613
00:25:47,669 --> 00:25:45,360

for getting our first sample um so as

614
00:25:49,430 --> 00:25:47,679
tom as dr zurbukin mentioned at the

615
00:25:50,630 --> 00:25:49,440
beginning the sampling process is

616
00:25:53,350 --> 00:25:50,640
actually one that began

617
00:25:54,630 --> 00:25:53,360
many many years ago when the science

618
00:25:57,269 --> 00:25:54,640
community got together

619
00:25:59,269 --> 00:25:57,279
and discussed if there were samples from

620
00:26:00,950 --> 00:25:59,279
mars that we could return

621
00:26:03,350 --> 00:26:00,960
and study in our laboratories here on

622
00:26:05,029 --> 00:26:03,360
earth what are the best types

623
00:26:07,269 --> 00:26:05,039
of samples that we could get that would

624
00:26:10,149 --> 00:26:07,279
really give us the best understanding

625
00:26:11,430 --> 00:26:10,159
possible of mars and its history and so

626
00:26:14,230 --> 00:26:11,440
those early discussions

627
00:26:16,149 --> 00:26:14,240
were of course uh really influential in

628
00:26:17,190 --> 00:26:16,159
our decision to even go to jezreel in

629
00:26:18,870 --> 00:26:17,200
the first place

630
00:26:21,269 --> 00:26:18,880
but also those discussions were really

631
00:26:23,510 --> 00:26:21,279
helpful for guiding our planning

632
00:26:25,510 --> 00:26:23,520
once we landed and even before we landed

633
00:26:27,510 --> 00:26:25,520
and so as jennifer mentioned uh

634
00:26:29,430 --> 00:26:27,520
planning the science campaign in this

635
00:26:29,990 --> 00:26:29,440
mission is really like planning a road

636
00:26:31,110 --> 00:26:30,000
trip

637
00:26:34,070 --> 00:26:31,120
as you would here on earth except that

638
00:26:36,310 --> 00:26:34,080

we're on mars for example we have

639
00:26:37,909 --> 00:26:36,320
a destination we have a set amount of

640
00:26:39,269 --> 00:26:37,919
time in which we want to do this

641
00:26:40,630 --> 00:26:39,279
campaign

642
00:26:42,549 --> 00:26:40,640
and we also have a lot of points of

643
00:26:43,110 --> 00:26:42,559
interest that are nearby or along the

644
00:26:44,870 --> 00:26:43,120
way

645
00:26:46,549 --> 00:26:44,880
to our destination that we really want

646
00:26:49,110 --> 00:26:46,559
to go and see

647
00:26:51,830 --> 00:26:49,120
and the challenge as always is figuring

648
00:26:53,029 --> 00:26:51,840
out you know exactly where we want to go

649
00:26:54,310 --> 00:26:53,039
and how we're going to fit everything

650
00:26:55,750 --> 00:26:54,320
into our schedule

651
00:26:57,909 --> 00:26:55,760
and then once we're on the road as we

652
00:26:59,110 --> 00:26:57,919
are now we're continuously adapting and

653
00:27:02,230 --> 00:26:59,120
adjusting our plan

654
00:27:03,669 --> 00:27:02,240
based on new information that we get and

655
00:27:05,430 --> 00:27:03,679
so this is kind of the process that the

656
00:27:07,190 --> 00:27:05,440
perseverance team has been

657
00:27:08,630 --> 00:27:07,200
going through for the past months and

658
00:27:10,789 --> 00:27:08,640
years and

659
00:27:12,470 --> 00:27:10,799
if we pull up the first graphic now you

660
00:27:14,230 --> 00:27:12,480
can see that we

661
00:27:15,590 --> 00:27:14,240
ever since landing at the octavia e

662
00:27:18,549 --> 00:27:15,600
butler landing site

663
00:27:20,230 --> 00:27:18,559

shown here in the green text we have a

664
00:27:22,230 --> 00:27:20,240
destination for this first

665
00:27:23,269 --> 00:27:22,240
science campaign which is to get to the

666
00:27:25,110 --> 00:27:23,279
delta

667
00:27:26,310 --> 00:27:25,120
and that's indicated in this image here

668
00:27:27,990 --> 00:27:26,320
by that point labeled

669
00:27:29,669 --> 00:27:28,000
three forks and you can see the delta in

670
00:27:32,389 --> 00:27:29,679
the top left corner

671
00:27:34,310 --> 00:27:32,399
um along the way in in our campaign of

672
00:27:36,070 --> 00:27:34,320
course we also have these different

673
00:27:37,990 --> 00:27:36,080
areas of interest that we're going to

674
00:27:39,750 --> 00:27:38,000
and those are the three areas labeled at

675
00:27:40,549 --> 00:27:39,760
the bottom the crater floor fractured

676
00:27:43,669 --> 00:27:40,559
rough

677
00:27:45,029 --> 00:27:43,679
sita south and the raised ridges

678
00:27:46,950 --> 00:27:45,039
and these are the regions where we're

679
00:27:49,110 --> 00:27:46,960
really going to go and do a very

680
00:27:53,430 --> 00:27:49,120
thorough exploration of those rocks

681
00:27:56,230 --> 00:27:53,440
and acquire samples from those locations

682
00:27:56,870 --> 00:27:56,240
so how did we pick our very first

683
00:27:59,510 --> 00:27:56,880
sampling

684
00:27:59,909 --> 00:27:59,520
location well where we currently are is

685
00:28:01,590 --> 00:27:59,919
by

686
00:28:04,549 --> 00:28:01,600
that point that was labeled crater floor

687
00:28:06,870 --> 00:28:04,559
fractured rough about 3000 feet

688
00:28:07,590 --> 00:28:06,880

south of our landing site and as ken

689
00:28:09,430 --> 00:28:07,600
mentioned

690
00:28:11,750 --> 00:28:09,440
our first campaign is really focused on

691
00:28:13,909 --> 00:28:11,760
studying the crater floor of jezero

692
00:28:15,430 --> 00:28:13,919
which is the majority of that image

693
00:28:16,389 --> 00:28:15,440
basically everything that wasn't the

694
00:28:21,750 --> 00:28:16,399
delta

695
00:28:24,070 --> 00:28:21,760
major units that we're interested in

696
00:28:26,070 --> 00:28:24,080
studying in this crater floor area and

697
00:28:28,710 --> 00:28:26,080
so if we look at that image again

698
00:28:30,230 --> 00:28:28,720
on the right side of the image this is

699
00:28:32,070 --> 00:28:30,240
what we have been calling the crater

700
00:28:34,549 --> 00:28:32,080
floor fractured rough which is again

701
00:28:36,789 --> 00:28:34,559
going to be our first sample

702
00:28:38,389 --> 00:28:36,799
and this is the cratered terrain uh very

703
00:28:38,870 --> 00:28:38,399
kind of similar to the terrain that you

704
00:28:40,870 --> 00:28:38,880
see

705
00:28:42,070 --> 00:28:40,880
on the moon with all of its craters and

706
00:28:43,510 --> 00:28:42,080
then in the middle

707
00:28:45,190 --> 00:28:43,520
as we've mentioned this is the region

708
00:28:46,710 --> 00:28:45,200
that we're calling sita which is this

709
00:28:48,549 --> 00:28:46,720
lighter toned rock that's covered by a

710
00:28:50,630 --> 00:28:48,559
lot of sand and dunes

711
00:28:52,789 --> 00:28:50,640
and so these are the two major rock

712
00:28:55,510 --> 00:28:52,799
types that we're really investigating in

713
00:28:56,149 --> 00:28:55,520

this first science campaign and as ken

714
00:28:58,470 --> 00:28:56,159
mentioned

715
00:29:00,230 --> 00:28:58,480
this crater floor fractured rough unit

716
00:29:01,510 --> 00:29:00,240
um is a mystery to us because even

717
00:29:03,750 --> 00:29:01,520
though we have been on this

718
00:29:05,909 --> 00:29:03,760
uh this unit since landing we still

719
00:29:08,070 --> 00:29:05,919
don't know if it's an igneous

720
00:29:09,909 --> 00:29:08,080
rock like a volcanic flow or if it's a

721
00:29:12,950 --> 00:29:09,919
sedimentary rock that was deposited

722
00:29:14,789 --> 00:29:12,960
uh by air or in water and of course

723
00:29:16,149 --> 00:29:14,799
understanding the origin of this crater

724
00:29:18,549 --> 00:29:16,159
floor fractured rough

725
00:29:21,990 --> 00:29:18,559
unit is going to be critical to not only

726
00:29:24,389 --> 00:29:22,000
reconstructing the history of this lake

727
00:29:26,389 --> 00:29:24,399
that used to be here but also it's

728
00:29:29,350 --> 00:29:26,399
important for understanding just the geo

729
00:29:29,830 --> 00:29:29,360
the geologic history of of jezro as well

730
00:29:31,669 --> 00:29:29,840
as the

731
00:29:33,669 --> 00:29:31,679
area around jezreel in this region of

732
00:29:35,750 --> 00:29:33,679
mars

733
00:29:37,669 --> 00:29:35,760
and so what are we going to do once we

734
00:29:40,389 --> 00:29:37,679
get to our first sampling site

735
00:29:41,990 --> 00:29:40,399
and again we're currently at that crater

736
00:29:45,269 --> 00:29:42,000
floor fractured rough point

737
00:29:47,430 --> 00:29:45,279
on that map and this is roughly an area

738
00:29:49,110 --> 00:29:47,440

in which we anticipate our first sample

739
00:29:51,190 --> 00:29:49,120
and so now if we pull up the second

740
00:29:53,190 --> 00:29:51,200
image you can see a picture of actually

741
00:29:55,269 --> 00:29:53,200
where perseverance is currently sitting

742
00:29:57,750 --> 00:29:55,279
right now on mars

743
00:29:58,789 --> 00:29:57,760
in the foreground here you can see those

744
00:30:01,029 --> 00:29:58,799
lighter colored

745
00:30:01,830 --> 00:30:01,039
paver stones and then in the background

746
00:30:04,470 --> 00:30:01,840
you can see these

747
00:30:06,230 --> 00:30:04,480
kind of higher standing more rubbly

748
00:30:08,149 --> 00:30:06,240
parts of the crater floor and again both

749
00:30:10,070 --> 00:30:08,159
of these different types of rocks are

750
00:30:11,990 --> 00:30:10,080
part of that crater floor fractured

751
00:30:16,070 --> 00:30:12,000
rough unit that we're

752
00:30:18,389 --> 00:30:16,080
that we're studying and so

753
00:30:20,070 --> 00:30:18,399
once we get to our first sampling site

754
00:30:20,870 --> 00:30:20,080
the very first thing that we're going to

755
00:30:22,230 --> 00:30:20,880
want to do

756
00:30:23,830 --> 00:30:22,240
and you can expect that it'll probably

757
00:30:24,710 --> 00:30:23,840
look similar to that image that we just

758
00:30:25,909 --> 00:30:24,720
showed

759
00:30:27,990 --> 00:30:25,919
but the first thing that we'll want to

760
00:30:30,070 --> 00:30:28,000
do is identify the exact

761
00:30:31,350 --> 00:30:30,080
rock in our workspace that we want to

762
00:30:32,710 --> 00:30:31,360
sample

763
00:30:35,190 --> 00:30:32,720

and for the purposes of this first

764
00:30:37,590 --> 00:30:35,200
sample what we're really looking for

765
00:30:38,630 --> 00:30:37,600
in this crater floor fractured rough

766
00:30:40,789 --> 00:30:38,640
sample

767
00:30:42,070 --> 00:30:40,799
is really a rock that is kind of

768
00:30:43,990 --> 00:30:42,080
prototypical

769
00:30:46,070 --> 00:30:44,000
crater floor fractured rough and what we

770
00:30:48,870 --> 00:30:46,080
mean by that is

771
00:30:50,230 --> 00:30:48,880
we want this sample to really kind of

772
00:30:53,029 --> 00:30:50,240
summarize

773
00:30:53,510 --> 00:30:53,039
and record the history of this entire

774
00:30:55,029 --> 00:30:53,520
unit

775
00:30:57,190 --> 00:30:55,039
as much as possible we want it to be

776
00:30:58,870 --> 00:30:57,200
representative of this unit

777
00:31:00,549 --> 00:30:58,880
and so that means that we're going to be

778
00:31:02,830 --> 00:31:00,559
looking for things

779
00:31:05,190 --> 00:31:02,840
like texture and chemistry and

780
00:31:06,470 --> 00:31:05,200
mineralogy and will want our ultimate

781
00:31:08,870 --> 00:31:06,480
sampling

782
00:31:09,909 --> 00:31:08,880
our sample rock to have kind of the

783
00:31:12,070 --> 00:31:09,919
typical

784
00:31:13,430 --> 00:31:12,080
texture chemistry and mineralogy as all

785
00:31:15,430 --> 00:31:13,440
the other crater floor fractured rough

786
00:31:15,990 --> 00:31:15,440
rocks that we have explored and seen so

787
00:31:19,430 --> 00:31:16,000
far

788
00:31:21,269 --> 00:31:19,440

on our trip um so after we pick

789
00:31:24,389 --> 00:31:21,279
the exact spot in our workspace that we

790
00:31:26,950 --> 00:31:24,399
want to sample that exact rock

791
00:31:28,470 --> 00:31:26,960
one of the first things that we'll do is

792
00:31:31,750 --> 00:31:28,480
actually kick off a

793
00:31:33,909 --> 00:31:31,760
series of very choreographed and

794
00:31:34,950 --> 00:31:33,919
events and this the series of events is

795
00:31:36,470 --> 00:31:34,960
going to be the same

796
00:31:38,549 --> 00:31:36,480
as for every sample that we're going to

797
00:31:39,190 --> 00:31:38,559
acquire um so one of the first things

798
00:31:41,909 --> 00:31:39,200
that we'll do

799
00:31:43,830 --> 00:31:41,919
is a braid and as you saw in ken's video

800
00:31:45,590 --> 00:31:43,840
that abrasion is really helpful for

801
00:31:48,149 --> 00:31:45,600
removing the surfacial dust

802
00:31:49,909 --> 00:31:48,159
and any surface coatings on these rocks

803
00:31:51,269 --> 00:31:49,919
and hopefully by seeing these finer

804
00:31:54,070 --> 00:31:51,279
scale details

805
00:31:54,710 --> 00:31:54,080
like grains and crystals in the abrasion

806
00:31:56,149 --> 00:31:54,720
patch

807
00:31:57,750 --> 00:31:56,159
hopefully that will give us an answer to

808
00:32:01,029 --> 00:31:57,760
whether these rocks are

809
00:32:02,389 --> 00:32:01,039
igneous or sedimentary but so after

810
00:32:04,789 --> 00:32:02,399
doing that abrasion

811
00:32:06,230 --> 00:32:04,799
will then proceed to core a different

812
00:32:08,630 --> 00:32:06,240
part of that rock

813
00:32:10,389 --> 00:32:08,640

and the core itself is going to be about

814
00:32:13,430 --> 00:32:10,399
the size of your finger

815
00:32:16,549 --> 00:32:13,440
and the rover will acquire the core

816
00:32:18,310 --> 00:32:16,559
and then it will process that sample um

817
00:32:20,149 --> 00:32:18,320
in the tube it will seal the tube and

818
00:32:20,950 --> 00:32:20,159
then it will store that tube inside the

819
00:32:23,669 --> 00:32:20,960
rover belly

820
00:32:25,590 --> 00:32:23,679
uh until it is time to drop off that

821
00:32:27,029 --> 00:32:25,600
sample on the surface of mars

822
00:32:29,990 --> 00:32:27,039
for the sample cache that will

823
00:32:31,029 --> 00:32:30,000
eventually be returned back to earth

824
00:32:32,630 --> 00:32:31,039
and so that was just a really quick

825
00:32:33,990 --> 00:32:32,640
summary of what we've been up to in our

826
00:32:35,990 --> 00:32:34,000
first science campaign

827
00:32:38,630 --> 00:32:36,000
and i think it's safe to say that we're

828
00:32:41,190 --> 00:32:38,640
all just incredibly excited

829
00:32:42,549 --> 00:32:41,200
to be you know on the cusp of getting

830
00:32:45,509 --> 00:32:42,559
this first sample

831
00:32:47,029 --> 00:32:45,519
from mars from another planet so we're

832
00:32:50,389 --> 00:32:47,039
just incredibly excited and

833
00:32:52,230 --> 00:32:50,399
we can't wait for it to finally happen

834
00:32:54,389 --> 00:32:52,240
so uh with that i'll hand it off to

835
00:32:55,110 --> 00:32:54,399
olivier toupee who's going to talk to us

836
00:32:56,789 --> 00:32:55,120
about

837
00:32:58,470 --> 00:32:56,799
the perseverance rover's autonomous

838
00:33:00,149 --> 00:32:58,480

driving capabilities

839
00:33:01,990 --> 00:33:00,159
which is really what is enabling us to

840
00:33:03,509 --> 00:33:02,000
do all this fantastic science and

841
00:33:06,070 --> 00:33:03,519
sampling

842
00:33:08,149 --> 00:33:06,080
thanks vivian i'm now going to talk

843
00:33:11,029 --> 00:33:08,159
about an exciting new technology

844
00:33:12,870 --> 00:33:11,039
which has recently come online on mars

845
00:33:14,549 --> 00:33:12,880
on perseverance this month

846
00:33:15,990 --> 00:33:14,559
and which has already enabled us to make

847
00:33:16,710 --> 00:33:16,000
a lot of progress on our science

848
00:33:19,269 --> 00:33:16,720
campaign

849
00:33:20,870 --> 00:33:19,279
as vivienne explained and that's

850
00:33:22,470 --> 00:33:20,880
something that we call autonomous

851
00:33:24,070 --> 00:33:22,480
navigation

852
00:33:26,230 --> 00:33:24,080
now you may be familiar with the

853
00:33:28,789 --> 00:33:26,240
self-driving cars on earth

854
00:33:31,110 --> 00:33:28,799
those are relatively new and quickly

855
00:33:33,830 --> 00:33:31,120
gaining popularity

856
00:33:34,950 --> 00:33:33,840
but we at jpl have been using autonomous

857
00:33:38,149 --> 00:33:34,960
driving on mars

858
00:33:38,950 --> 00:33:38,159
for over two decades now it all started

859
00:33:42,389 --> 00:33:38,960
with

860
00:33:43,269 --> 00:33:42,399
the sojourner rover in 1997 which had

861
00:33:46,310 --> 00:33:43,279
basic

862
00:33:48,389 --> 00:33:46,320
autonomous driving capabilities and then

863
00:33:50,789 --> 00:33:48,399

those capabilities evolved

864
00:33:52,950 --> 00:33:50,799
with a mass exploration rovers spirit

865
00:33:55,750 --> 00:33:52,960
and opportunity

866
00:33:57,110 --> 00:33:55,760
in 2006 and then with the cursity rover

867
00:33:59,430 --> 00:33:57,120
in 2011

868
00:34:01,750 --> 00:33:59,440
and now finally as of this month that

869
00:34:04,789 --> 00:34:01,760
capability is active on our latest march

870
00:34:08,310 --> 00:34:04,799
over perseverance

871
00:34:10,310 --> 00:34:08,320
while self driving on mars is new

872
00:34:12,069 --> 00:34:10,320
we completely redesigned the artificial

873
00:34:14,790 --> 00:34:12,079
intelligence or ai

874
00:34:16,950 --> 00:34:14,800
software to make it much more capable

875
00:34:19,030 --> 00:34:16,960
for perseverance

876
00:34:21,270 --> 00:34:19,040
in particular the rover is now able to

877
00:34:23,430 --> 00:34:21,280
straddle large rocks

878
00:34:25,349 --> 00:34:23,440
something that no over could do before

879
00:34:27,589 --> 00:34:25,359
and all the complex

880
00:34:28,389 --> 00:34:27,599
on-board decision making and path

881
00:34:31,030 --> 00:34:28,399
planning

882
00:34:33,190 --> 00:34:31,040
is now happening as the rover is driving

883
00:34:35,909 --> 00:34:33,200
which means that perseverance is able to

884
00:34:36,550 --> 00:34:35,919
drive much faster than the other rovers

885
00:34:39,349 --> 00:34:36,560
those

886
00:34:40,389 --> 00:34:39,359
other rovers had to stop take multiple

887
00:34:46,149 --> 00:34:40,399
images

888
00:34:47,829 --> 00:34:46,159

find a safe path forward and only drive

889
00:34:49,430 --> 00:34:47,839
about three to four feet of that path

890
00:34:51,349 --> 00:34:49,440
before having to stop again and repeat

891
00:34:53,349 --> 00:34:51,359
that process

892
00:34:55,030 --> 00:34:53,359
so that meant that those rovers were

893
00:34:57,510 --> 00:34:55,040
spending actually more time stop

894
00:34:59,270 --> 00:34:57,520
than driving which means a much slower

895
00:35:00,829 --> 00:34:59,280
traverse in autonomous mode

896
00:35:03,430 --> 00:35:00,839
this is no longer the case with the

897
00:35:04,790 --> 00:35:03,440
perseverance autonomous driving is now

898
00:35:07,510 --> 00:35:04,800
just about as fast

899
00:35:09,349 --> 00:35:07,520
as human directed driving so let's show

900
00:35:11,510 --> 00:35:09,359
our first video

901
00:35:13,270 --> 00:35:11,520
there you can see the perseverance rover

902
00:35:16,470 --> 00:35:13,280
driving itself

903
00:35:18,550 --> 00:35:16,480
in our mast yard here at jpl through

904
00:35:19,910 --> 00:35:18,560
a pretty challenging terrain filled with

905
00:35:22,470 --> 00:35:19,920
large rocks

906
00:35:24,550 --> 00:35:22,480
and this is one of the many many tests

907
00:35:26,470 --> 00:35:24,560
we conducted over the past five years

908
00:35:29,589 --> 00:35:26,480
that we spent developing this new

909
00:35:35,829 --> 00:35:33,030
so how does autonav work at a high level

910
00:35:37,829 --> 00:35:35,839
the ai software builds a 3d map of the

911
00:35:40,950 --> 00:35:37,839
environment around the rover

912
00:35:42,790 --> 00:35:40,960
using images taken by the

913
00:35:44,310 --> 00:35:42,800

stereo cameras of the rovers of the

914
00:35:46,790 --> 00:35:44,320
rover you can think of those as

915
00:35:49,829 --> 00:35:46,800
the eyes of the rover and then smart

916
00:35:54,630 --> 00:35:53,030
generate a path that is optimized to

917
00:35:57,349 --> 00:35:54,640
bring the rover to the goal as quickly

918
00:35:58,230 --> 00:35:57,359
as possible while avoiding any obstacle

919
00:36:01,430 --> 00:35:58,240
on the way

920
00:36:03,190 --> 00:36:01,440
and keeping the rover safe so why do we

921
00:36:05,829 --> 00:36:03,200
use autonomous driving on mars

922
00:36:07,670 --> 00:36:05,839
so let's show the next image here you

923
00:36:10,550 --> 00:36:07,680
can see all the driving perseverance has

924
00:36:12,310 --> 00:36:10,560
done on mars since landing in february

925
00:36:14,230 --> 00:36:12,320
and the autonomous drives really stand

926
00:36:17,030 --> 00:36:14,240
out in the bottom part of the image

927
00:36:18,390 --> 00:36:17,040
because they are much uh much longer

928
00:36:21,430 --> 00:36:18,400
than the drives

929
00:36:22,310 --> 00:36:21,440
conducted by human drivers and so why is

930
00:36:24,790 --> 00:36:22,320
that

931
00:36:26,710 --> 00:36:24,800
well human drivers are limited to

932
00:36:29,910 --> 00:36:26,720
driving only on terrain

933
00:36:32,950 --> 00:36:29,920
that is visible on the images

934
00:36:35,030 --> 00:36:32,960
that the rovers send back to earth we

935
00:36:37,589 --> 00:36:35,040
can't drive on terrain that we can see

936
00:36:40,069 --> 00:36:37,599
that would be too dangerous and we also

937
00:36:42,150 --> 00:36:40,079
don't drive the rover in real time

938
00:36:43,190 --> 00:36:42,160

so to explain that a little bit the way

939
00:36:46,630 --> 00:36:43,200
this works is that

940
00:36:48,710 --> 00:36:46,640
the surface ops team meets everyday gpr

941
00:36:50,069 --> 00:36:48,720
writes all the comments for the rover

942
00:36:50,870 --> 00:36:50,079
then at the end of the day we send all

943
00:36:53,190 --> 00:36:50,880
those comments

944
00:36:54,870 --> 00:36:53,200
at once to mars the rover receives them

945
00:36:57,109 --> 00:36:54,880
and then executes them all

946
00:36:58,069 --> 00:36:57,119
overnight where we all sleep and then

947
00:36:59,510 --> 00:36:58,079
sends the data back

948
00:37:01,829 --> 00:36:59,520
the next morning and then we start a new

949
00:37:03,109 --> 00:37:01,839
planning cycle and so that means that

950
00:37:07,750 --> 00:37:03,119
the human pilots

951
00:37:09,750 --> 00:37:07,760
can only drive at most 100 to 150 feet

952
00:37:11,990 --> 00:37:09,760
every immersion day depending on the

953
00:37:13,109 --> 00:37:12,000
local geometry of the terrain

954
00:37:14,790 --> 00:37:13,119
because of course if you have large

955
00:37:16,550 --> 00:37:14,800
boulders and hills those crates

956
00:37:18,230 --> 00:37:16,560
occlusions you can see behind them

957
00:37:19,750 --> 00:37:18,240
and that further restricts how far you

958
00:37:21,750 --> 00:37:19,760
can go

959
00:37:23,589 --> 00:37:21,760
however with autonomous driving the

960
00:37:24,630 --> 00:37:23,599
rover is able to take new images that it

961
00:37:27,990 --> 00:37:24,640
drives

962
00:37:29,670 --> 00:37:28,000
and generate new paths to avoid the

963
00:37:31,829 --> 00:37:29,680

newly detected obstacles so it can

964
00:37:33,910 --> 00:37:31,839
really drive itself

965
00:37:35,030 --> 00:37:33,920
for however long we allow the drive to

966
00:37:37,109 --> 00:37:35,040
last

967
00:37:39,349 --> 00:37:37,119
and as i explained our autonomous

968
00:37:41,430 --> 00:37:39,359
driving is also much faster than before

969
00:37:42,390 --> 00:37:41,440
and so that resulted in perseverance

970
00:37:45,109 --> 00:37:42,400
accomplishing

971
00:37:46,470 --> 00:37:45,119
the longest ever autonomous drive on

972
00:37:48,310 --> 00:37:46,480
mars

973
00:37:49,829 --> 00:37:48,320
and that was just the second on the

974
00:37:50,710 --> 00:37:49,839
second day that perseverance drove

975
00:37:52,470 --> 00:37:50,720
itself

976
00:37:54,950 --> 00:37:52,480
so let's show the video of that

977
00:37:57,030 --> 00:37:54,960
record-breaking drive

978
00:37:59,030 --> 00:37:57,040
and you can see there images that we

979
00:38:02,150 --> 00:37:59,040
collected

980
00:38:03,510 --> 00:38:02,160
every five meters so i apologize if it

981
00:38:04,710 --> 00:38:03,520
jumps a little

982
00:38:08,310 --> 00:38:04,720
although i'm not i'm not seeing the

983
00:38:12,950 --> 00:38:11,030
okay there we go so something that's

984
00:38:15,829 --> 00:38:12,960
pretty cool

985
00:38:16,790 --> 00:38:15,839
i guess we have technical problems well

986
00:38:17,990 --> 00:38:16,800
i was going to say something that is

987
00:38:20,470 --> 00:38:18,000
pretty cool in that video maybe

988
00:38:21,430 --> 00:38:20,480

it will be posted on the website is that

989
00:38:23,270 --> 00:38:21,440
you can see

990
00:38:24,710 --> 00:38:23,280
at the beginning of the video the

991
00:38:28,790 --> 00:38:24,720
perseverance rover

992
00:38:31,589 --> 00:38:28,800
driving by the ingenuity helicopter

993
00:38:32,550 --> 00:38:31,599
during its autonomous drive illustrating

994
00:38:35,510 --> 00:38:32,560
how

995
00:38:36,870 --> 00:38:35,520
our ai software is able to not only

996
00:38:39,430 --> 00:38:36,880
avoid obstacles

997
00:38:40,790 --> 00:38:39,440
in the natural mastering but also

998
00:38:43,990 --> 00:38:40,800
man-made

999
00:38:46,310 --> 00:38:44,000
helicopters from earth but

1000
00:38:47,030 --> 00:38:46,320
the the important takeaway message here

1001
00:38:49,910 --> 00:38:47,040
is that

1002
00:38:50,950 --> 00:38:49,920
um with autonomous driving we're able to

1003
00:38:53,349 --> 00:38:50,960
cover a lot more

1004
00:38:54,310 --> 00:38:53,359
ground and that means making a lot more

1005
00:38:56,310 --> 00:38:54,320
progress

1006
00:38:58,310 --> 00:38:56,320
towards the science campaign desired

1007
00:39:01,030 --> 00:38:58,320
destinations

1008
00:39:01,910 --> 00:39:01,040
so i want to show one last image which

1009
00:39:04,230 --> 00:39:01,920
is a nice

1010
00:39:06,790 --> 00:39:04,240
mosaic taken by the perseverance rover

1011
00:39:09,270 --> 00:39:06,800
at the end of an autonomous drive

1012
00:39:11,030 --> 00:39:09,280
and you can see there in that image the

1013
00:39:13,270 --> 00:39:11,040

tracks of the rover

1014
00:39:15,270 --> 00:39:13,280
which show the path that was picked by

1015
00:39:18,310 --> 00:39:15,280
the ai brain

1016
00:39:19,510 --> 00:39:18,320
of the rover during the autumn's drive

1017
00:39:21,510 --> 00:39:19,520
and that's something i found really

1018
00:39:23,829 --> 00:39:21,520
exciting about every autonomous drive

1019
00:39:24,630 --> 00:39:23,839
is that you never know what path the

1020
00:39:27,910 --> 00:39:24,640
rover

1021
00:39:31,270 --> 00:39:27,920
is going to end up driving on mars

1022
00:39:32,630 --> 00:39:31,280
and as a rover driver myself i can

1023
00:39:34,710 --> 00:39:32,640
talk a little bit about that the way

1024
00:39:37,190 --> 00:39:34,720
this works is that we

1025
00:39:38,150 --> 00:39:37,200
pick waypoints um that are pretty far

1026
00:39:39,829 --> 00:39:38,160
apart

1027
00:39:42,710 --> 00:39:39,839
and then we just send a go command to

1028
00:39:44,950 --> 00:39:42,720
the rover say go ai

1029
00:39:46,550 --> 00:39:44,960
and then we patiently wait for the rover

1030
00:39:49,270 --> 00:39:46,560
to call back home

1031
00:39:51,510 --> 00:39:49,280
and tell us how the drive went so it's a

1032
00:39:52,870 --> 00:39:51,520
really thrilling experience you can

1033
00:39:55,589 --> 00:39:52,880
picture me waking up early in the

1034
00:39:57,829 --> 00:39:55,599
morning and waiting anxiously for

1035
00:39:59,990 --> 00:39:57,839
the data to arrive on earth and discover

1036
00:40:03,349 --> 00:40:00,000
how the drive went where the rover

1037
00:40:05,109 --> 00:40:03,359
uh drove um and so

1038
00:40:06,390 --> 00:40:05,119

uh it's also a little bit nerve-wracking

1039
00:40:09,109 --> 00:40:06,400
if i'm being honest

1040
00:40:10,630 --> 00:40:09,119
but so far the ai software has performed

1041
00:40:12,150 --> 00:40:10,640
extremely well

1042
00:40:14,470 --> 00:40:12,160
and i look forward to seeing

1043
00:40:15,990 --> 00:40:14,480
perseverance continue to drive itself

1044
00:40:18,790 --> 00:40:16,000
successfully on mars

1045
00:40:21,270 --> 00:40:18,800
push the limits of how far it can go and

1046
00:40:23,190 --> 00:40:21,280
how difficult of a terrain can traverse

1047
00:40:24,710 --> 00:40:23,200
thanks to our new autonomous driving

1048
00:40:26,470 --> 00:40:24,720
software

1049
00:40:28,630 --> 00:40:26,480
and with that i will hand it back to

1050
00:40:31,030 --> 00:40:28,640
jerry for the q and a session

1051
00:40:33,589 --> 00:40:31,040
okay thanks olivier so i know we had a

1052
00:40:34,950 --> 00:40:33,599
little bit of a technical issue there

1053
00:40:36,950 --> 00:40:34,960
just know that we are going to put all

1054
00:40:38,630 --> 00:40:36,960
the images on our website so you can go

1055
00:40:41,109 --> 00:40:38,640
to mars.nasa.gov

1056
00:40:41,829 --> 00:40:41,119
perseverance and the websites will be

1057
00:40:43,910 --> 00:40:41,839
played again

1058
00:40:45,670 --> 00:40:43,920
at the end of this briefing okay so now

1059
00:40:47,750 --> 00:40:45,680
we're gonna head into q a

1060
00:40:49,750 --> 00:40:47,760
just a reminder for members of the media

1061
00:40:51,750 --> 00:40:49,760
on the phone lines press star one

1062
00:40:53,990 --> 00:40:51,760
if you'd like to ask a question and if

1063
00:40:54,710 --> 00:40:54,000

you're on social media the hashtag is

1064
00:40:56,870 --> 00:40:54,720
ask

1065
00:40:57,829 --> 00:40:56,880
nasa okay we're going to head first to

1066
00:41:00,390 --> 00:40:57,839
the phone lines

1067
00:41:01,510 --> 00:41:00,400
and our first caller is robin andrews

1068
00:41:06,390 --> 00:41:01,520
from the new york times

1069
00:41:08,230 --> 00:41:06,400
go ahead

1070
00:41:09,430 --> 00:41:08,240
covering the rocks up at the moment but

1071
00:41:11,190 --> 00:41:09,440
has there been any

1072
00:41:13,109 --> 00:41:11,200
anything geologically speaking that has

1073
00:41:16,630 --> 00:41:13,119
either confounded or

1074
00:41:18,710 --> 00:41:16,640
just surprised the science team

1075
00:41:20,470 --> 00:41:18,720
ken would you like to take that yeah

1076
00:41:22,710 --> 00:41:20,480
i'll i'll i'll start

1077
00:41:24,470 --> 00:41:22,720
the uh probably the most surprising

1078
00:41:27,109 --> 00:41:24,480
thing that we have seen so far

1079
00:41:28,630 --> 00:41:27,119
is when we look at images of the delta

1080
00:41:29,030 --> 00:41:28,640
that this feature that brought us to

1081
00:41:31,670 --> 00:41:29,040
this

1082
00:41:32,550 --> 00:41:31,680
location indicative of a lake we see

1083
00:41:34,550 --> 00:41:32,560
clear evidence

1084
00:41:36,150 --> 00:41:34,560
that there was indeed a lake there was a

1085
00:41:36,950 --> 00:41:36,160
period when the water level was quite

1086
00:41:39,270 --> 00:41:36,960
high

1087
00:41:39,990 --> 00:41:39,280
and the lake was uh the delta was

1088
00:41:42,390 --> 00:41:40,000

expanding

1089
00:41:43,510 --> 00:41:42,400
out into the lake a relatively quiescent

1090
00:41:46,069 --> 00:41:43,520
period

1091
00:41:47,510 --> 00:41:46,079
but we also see higher up and this you

1092
00:41:48,870 --> 00:41:47,520
can only see from the ground you can't

1093
00:41:51,190 --> 00:41:48,880
see it from orbit

1094
00:41:52,230 --> 00:41:51,200
is that higher up and therefore younger

1095
00:41:55,349 --> 00:41:52,240
there was a period

1096
00:41:57,430 --> 00:41:55,359
of lower lake level

1097
00:41:58,550 --> 00:41:57,440
and flooding what might have been flash

1098
00:42:01,670 --> 00:41:58,560
flooding moving

1099
00:42:02,630 --> 00:42:01,680
large boulders across the top of the

1100
00:42:04,630 --> 00:42:02,640
delta

1101
00:42:06,069 --> 00:42:04,640
and this is suggesting uh as as part of

1102
00:42:07,750 --> 00:42:06,079
what i indicated earlier

1103
00:42:09,589 --> 00:42:07,760
that there are multiple phases in which

1104
00:42:12,069 --> 00:42:09,599
this lake was active so that's an

1105
00:42:12,870 --> 00:42:12,079
especially interesting aspect to this

1106
00:42:14,710 --> 00:42:12,880
environment

1107
00:42:17,270 --> 00:42:14,720
that it might record multiple events

1108
00:42:20,790 --> 00:42:17,280
that were not obvious at all before

1109
00:42:27,829 --> 00:42:23,510
great okay next in the queue is bill

1110
00:42:31,990 --> 00:42:30,710
yeah hi uh yeah a quick question for ken

1111
00:42:33,910 --> 00:42:32,000
if i can just follow up a minute i'm a

1112
00:42:36,150 --> 00:42:33,920
little confused about the nature of the

1113
00:42:38,390 --> 00:42:36,160

crater floor where you have

1114
00:42:39,510 --> 00:42:38,400
uh rocks that you can't really tell are

1115
00:42:41,510 --> 00:42:39,520
sedimentary or

1116
00:42:43,349 --> 00:42:41,520
or possibly volcanic i would have

1117
00:42:43,990 --> 00:42:43,359
assumed that the floor of a lake bottom

1118
00:42:46,790 --> 00:42:44,000
would feature

1119
00:42:48,309 --> 00:42:46,800
sedimentary deposits by definition so i

1120
00:42:50,630 --> 00:42:48,319
mean can you talk a little bit about

1121
00:42:52,470 --> 00:42:50,640
what it would mean if you if they are

1122
00:42:54,630 --> 00:42:52,480
volcanic rock there i mean i don't

1123
00:42:57,910 --> 00:42:54,640
understand the history of

1124
00:42:59,750 --> 00:42:57,920
of the presumed lake and volcanic

1125
00:43:01,349 --> 00:42:59,760
possibility thanks

1126
00:43:03,109 --> 00:43:01,359
yeah this is a great question and i

1127
00:43:05,190 --> 00:43:03,119
would say the the null hypothesis the

1128
00:43:06,790 --> 00:43:05,200
thing you start off with is

1129
00:43:08,470 --> 00:43:06,800
we are in a setting that we know once

1130
00:43:09,750 --> 00:43:08,480
had a lake in it therefore the first

1131
00:43:10,950 --> 00:43:09,760
thing you should be thinking is these

1132
00:43:13,910 --> 00:43:10,960
are sedimentary rocks that's

1133
00:43:15,030 --> 00:43:13,920
that is a good idea uh but it needs to

1134
00:43:17,190 --> 00:43:15,040
be tested

1135
00:43:19,190 --> 00:43:17,200
and as i indicated we have been

1136
00:43:21,190 --> 00:43:19,200
struggling to apply those tests in a way

1137
00:43:24,230 --> 00:43:21,200
that is definitive about whether they

1138
00:43:26,230 --> 00:43:24,240

uh are lava flows this this um

1139
00:43:27,670 --> 00:43:26,240
crater floor fractured rough that vivian

1140
00:43:28,550 --> 00:43:27,680
referred to or what i called paver

1141
00:43:31,829 --> 00:43:28,560
stones

1142
00:43:33,990 --> 00:43:31,839
uh nevertheless either one

1143
00:43:35,430 --> 00:43:34,000
is a very interesting result and and let

1144
00:43:37,829 --> 00:43:35,440
me explain why

1145
00:43:39,990 --> 00:43:37,839
if the if the crater floor fractured

1146
00:43:41,829 --> 00:43:40,000
rough unit is in fact a lava flow

1147
00:43:43,030 --> 00:43:41,839
sourced from a vent that we have not yet

1148
00:43:45,030 --> 00:43:43,040
identified

1149
00:43:46,710 --> 00:43:45,040
that's really important for our

1150
00:43:47,349 --> 00:43:46,720
understanding and especially for sample

1151
00:43:48,710 --> 00:43:47,359
return

1152
00:43:51,349 --> 00:43:48,720
because one of the special things about

1153
00:43:53,829 --> 00:43:51,359
volcanic rocks is they can be dated

1154
00:43:54,870 --> 00:43:53,839
back on earth with very high precision

1155
00:43:55,990 --> 00:43:54,880
and accuracy

1156
00:43:57,589 --> 00:43:56,000
so one of the things we would be

1157
00:43:59,030 --> 00:43:57,599
particularly excited about if we found

1158
00:44:02,069 --> 00:43:59,040
it was a volcanic rock

1159
00:44:04,069 --> 00:44:02,079
is to get a radiometric date that really

1160
00:44:05,190 --> 00:44:04,079
pins the timing of many of the things

1161
00:44:07,589 --> 00:44:05,200
that we are looking at

1162
00:44:11,670 --> 00:44:07,599
on mars so either way it's interesting

1163
00:44:17,990 --> 00:44:14,230

great okay next reporter on the phone

1164
00:44:20,470 --> 00:44:18,000
line is alexandra whitsey from nature

1165
00:44:22,309 --> 00:44:20,480
hi thanks for taking my call my question

1166
00:44:24,230 --> 00:44:22,319
is for vivian's son

1167
00:44:25,510 --> 00:44:24,240
again just staying on this crater for

1168
00:44:26,950 --> 00:44:25,520
fractured rough

1169
00:44:28,950 --> 00:44:26,960
if this is likely to be where we're

1170
00:44:30,470 --> 00:44:28,960
going to see our first core can you talk

1171
00:44:32,950 --> 00:44:30,480
a little bit more about

1172
00:44:34,870 --> 00:44:32,960
you know what is its texture like does

1173
00:44:36,710 --> 00:44:34,880
it remind you of any particular rock

1174
00:44:39,990 --> 00:44:36,720
units on earth

1175
00:44:42,309 --> 00:44:40,000
does the nature of the cffr unit change

1176
00:44:44,230 --> 00:44:42,319
as you've driven over it for a kilometer

1177
00:44:47,190 --> 00:44:44,240
or more

1178
00:44:48,470 --> 00:44:47,200
oh thank you that's a great question so

1179
00:44:49,750 --> 00:44:48,480
yeah there's a lot there's a lot to

1180
00:44:51,589 --> 00:44:49,760
unpack there

1181
00:44:53,510 --> 00:44:51,599
so this crater floor fractured rough

1182
00:44:54,630 --> 00:44:53,520
unit in terms of the the different

1183
00:44:57,349 --> 00:44:54,640
textures as ken

1184
00:44:58,710 --> 00:44:57,359
mentioned one of the one of the things

1185
00:44:59,910 --> 00:44:58,720
that our science team has been

1186
00:45:01,750 --> 00:44:59,920
discussing in a lot of

1187
00:45:03,109 --> 00:45:01,760
in a lot of detail is determining

1188
00:45:05,349 --> 00:45:03,119

whether these are

1189
00:45:06,550 --> 00:45:05,359
igneous or sedimentary rocks and so i

1190
00:45:09,109 --> 00:45:06,560
think yeah

1191
00:45:10,230 --> 00:45:09,119
comparisons can be drawn um you know

1192
00:45:12,309 --> 00:45:10,240
from what we can see

1193
00:45:13,589 --> 00:45:12,319
uh currently on these crater floor

1194
00:45:15,589 --> 00:45:13,599
fractured rough rocks

1195
00:45:16,630 --> 00:45:15,599
they can be drawn to various rocks on

1196
00:45:19,349 --> 00:45:16,640
earth kind of in

1197
00:45:20,710 --> 00:45:19,359
in both settings so it's it's it's a

1198
00:45:22,790 --> 00:45:20,720
little bit difficult to say

1199
00:45:24,069 --> 00:45:22,800
um exactly you know what the nature of

1200
00:45:25,990 --> 00:45:24,079
these rocks are

1201
00:45:27,190 --> 00:45:26,000
hopefully by doing the first abrasion

1202
00:45:29,510 --> 00:45:27,200
we'll be able to get a

1203
00:45:31,109 --> 00:45:29,520
closer look at the interiors of these

1204
00:45:33,589 --> 00:45:31,119
rocks and hopefully that will be

1205
00:45:34,550 --> 00:45:33,599
less ambiguous but in terms of the

1206
00:45:36,790 --> 00:45:34,560
different textures

1207
00:45:38,550 --> 00:45:36,800
of the rocks i alluded to this a little

1208
00:45:41,109 --> 00:45:38,560
bit but you can see

1209
00:45:43,510 --> 00:45:41,119
in that second graphic that i had we

1210
00:45:45,990 --> 00:45:43,520
have these flatter kind of paver stone

1211
00:45:46,950 --> 00:45:46,000
rocks in in front of us where we

1212
00:45:48,309 --> 00:45:46,960
currently are

1213
00:45:49,750 --> 00:45:48,319

and then in the background you can see

1214
00:45:50,950 --> 00:45:49,760
that there are these kind of higher

1215
00:45:53,750 --> 00:45:50,960
standing parts

1216
00:45:54,790 --> 00:45:53,760
um of the of the crater floor fractured

1217
00:45:57,030 --> 00:45:54,800
rough unit

1218
00:45:58,829 --> 00:45:57,040
um and so this is something that we're

1219
00:46:01,910 --> 00:45:58,839
still continuing to investigate

1220
00:46:04,630 --> 00:46:01,920
on uh with with the mission is

1221
00:46:06,150 --> 00:46:04,640
uh figuring out you know is there um is

1222
00:46:07,670 --> 00:46:06,160
there any difference between these two

1223
00:46:09,910 --> 00:46:07,680
different types of rocks that are both

1224
00:46:12,150 --> 00:46:09,920
in the crater floor fractured rough unit

1225
00:46:15,910 --> 00:46:12,160
um and uh and if so what might those

1226
00:46:18,950 --> 00:46:18,470
okay all right next caller on the line

1227
00:46:29,430 --> 00:46:18,960
is

1228
00:46:31,349 --> 00:46:29,440
vivina i suppose um

1229
00:46:33,430 --> 00:46:31,359
you've spoken about um the sort of

1230
00:46:34,550 --> 00:46:33,440
searching for these bio signatures and i

1231
00:46:36,390 --> 00:46:34,560
understand that you know

1232
00:46:37,589 --> 00:46:36,400
none of nothing will ever be confirmed

1233
00:46:40,790 --> 00:46:37,599
until we have the

1234
00:46:42,470 --> 00:46:40,800
sample return mission but when do you

1235
00:46:42,710 --> 00:46:42,480
think you might get some at least sort

1236
00:46:45,750 --> 00:46:42,720
of

1237
00:46:48,390 --> 00:46:45,760
sense or idea that if something uh

1238
00:46:51,589 --> 00:46:48,400

looks promising amongst samples for

1239
00:46:54,950 --> 00:46:51,599
having biosignatures

1240
00:46:56,390 --> 00:46:54,960
yeah i'll take that one the potential

1241
00:46:59,910 --> 00:46:56,400
biosignatures that we can see

1242
00:47:02,150 --> 00:46:59,920
with the rover uh are primarily with the

1243
00:47:04,069 --> 00:47:02,160
instruments that are on the robotic arm

1244
00:47:05,910 --> 00:47:04,079
pixel and sherlock which measure

1245
00:47:07,030 --> 00:47:05,920
elemental composition so the chemistry

1246
00:47:11,510 --> 00:47:07,040
of the rock

1247
00:47:14,309 --> 00:47:11,520
mapping of organic matter

1248
00:47:16,150 --> 00:47:14,319
and the first opportunity where we could

1249
00:47:17,750 --> 00:47:16,160
see potential biosignatures

1250
00:47:19,430 --> 00:47:17,760
in a in a way that i think could be

1251
00:47:22,390 --> 00:47:19,440
compelling will be

1252
00:47:24,470 --> 00:47:22,400
when we expose the interior of the rock

1253
00:47:26,549 --> 00:47:24,480
through abrasion and our first

1254
00:47:28,870 --> 00:47:26,559
opportunity to do that is in association

1255
00:47:32,870 --> 00:47:28,880
with the collection of this first sample

1256
00:47:34,470 --> 00:47:32,880
in the next few weeks

1257
00:47:37,190 --> 00:47:34,480
the rock that we are looking at as you

1258
00:47:38,710 --> 00:47:37,200
have gathered we are still puzzling over

1259
00:47:40,230 --> 00:47:38,720
but some of the rocks that we see in the

1260
00:47:41,030 --> 00:47:40,240
area that jennifer referred to called

1261
00:47:42,790 --> 00:47:41,040
sita

1262
00:47:45,430 --> 00:47:42,800
and i showed you images of a rock that

1263
00:47:48,710 --> 00:47:45,440

may be similar with those fine layers

1264
00:47:50,150 --> 00:47:48,720
if those in fact are lake muds that have

1265
00:47:52,390 --> 00:47:50,160
been turned into rock

1266
00:47:53,670 --> 00:47:52,400
those are a very prospective place those

1267
00:47:56,150 --> 00:47:53,680
are a very good place

1268
00:47:57,990 --> 00:47:56,160
to look for biosignatures and uh yeah

1269
00:48:00,069 --> 00:47:58,000
that image there is showing you the

1270
00:48:01,430 --> 00:48:00,079
the area that we that we might imagine

1271
00:48:04,309 --> 00:48:01,440
to be lake

1272
00:48:05,349 --> 00:48:04,319
muds and so i think that area is in the

1273
00:48:07,349 --> 00:48:05,359
in the near term

1274
00:48:08,790 --> 00:48:07,359
this is at least a few months out before

1275
00:48:10,549 --> 00:48:08,800
we get to this outcrop

1276
00:48:13,910 --> 00:48:10,559
uh is an area that we will be looking

1277
00:48:16,470 --> 00:48:13,920
very closely for potential biosignatures

1278
00:48:18,549 --> 00:48:16,480
thank you okay we're going to go to

1279
00:48:21,670 --> 00:48:18,559
social media for a couple questions

1280
00:48:23,030 --> 00:48:21,680
um first one will be for thomas zerbukin

1281
00:48:25,910 --> 00:48:23,040
there's been a couple of questions on

1282
00:48:27,829 --> 00:48:25,920
social media so pervez on facebook and

1283
00:48:29,990 --> 00:48:27,839
david on linkedin are asking

1284
00:48:32,630 --> 00:48:30,000
when can we get the samples back to

1285
00:48:36,549 --> 00:48:34,630
as soon as possible that's the answer

1286
00:48:38,150 --> 00:48:36,559
right and how long does that take

1287
00:48:40,309 --> 00:48:38,160
and of course the most important part is

1288
00:48:41,910 --> 00:48:40,319

that we let ken and the entire team do

1289
00:48:42,710 --> 00:48:41,920
the work that they're doing right now

1290
00:48:45,750 --> 00:48:42,720
which is

1291
00:48:46,150 --> 00:48:45,760
just select the samples get them ready

1292
00:48:47,829 --> 00:48:46,160
and

1293
00:48:50,390 --> 00:48:47,839
either deposit them or bring them

1294
00:48:53,190 --> 00:48:50,400
forward um the earliest we could go

1295
00:48:54,710 --> 00:48:53,200
and pick them up is later this decade uh

1296
00:48:57,589 --> 00:48:54,720
26 or 28

1297
00:48:58,150 --> 00:48:57,599
which brings the sample back the samples

1298
00:49:01,030 --> 00:48:58,160
back

1299
00:49:01,510 --> 00:49:01,040
the earliest uh in the early 30s so

1300
00:49:06,390 --> 00:49:01,520
that's

1301
00:49:08,150 --> 00:49:06,400
samples back on earth

1302
00:49:09,829 --> 00:49:08,160
great thank you thomas uh another

1303
00:49:11,510 --> 00:49:09,839
question on facebook and

1304
00:49:14,069 --> 00:49:11,520
maybe we'll start with jennifer on this

1305
00:49:14,790 --> 00:49:14,079
one niels nielsen on facebook wants to

1306
00:49:17,349 --> 00:49:14,800
know

1307
00:49:19,109 --> 00:49:17,359
how has your path plans for perseverance

1308
00:49:22,230 --> 00:49:19,119
changed as a result of what you've

1309
00:49:25,270 --> 00:49:22,240
discovered since landing

1310
00:49:27,510 --> 00:49:25,280
well i think the obvious one

1311
00:49:29,109 --> 00:49:27,520
is that we thought we were going to land

1312
00:49:30,870 --> 00:49:29,119
right at the delta there's a little

1313
00:49:32,870 --> 00:49:30,880

airstrip there we thought that was where

1314
00:49:35,270 --> 00:49:32,880
we were going to be and we were going to

1315
00:49:37,030 --> 00:49:35,280
start investigation of the delta because

1316
00:49:38,790 --> 00:49:37,040
of the sita region and the terrain

1317
00:49:40,309 --> 00:49:38,800
relative navigation putting us on the

1318
00:49:42,309 --> 00:49:40,319
other side of that

1319
00:49:44,230 --> 00:49:42,319
we've decided that there's a very

1320
00:49:45,349 --> 00:49:44,240
interesting unit that you've heard about

1321
00:49:46,870 --> 00:49:45,359
this um

1322
00:49:48,470 --> 00:49:46,880
unit that we're on right now where we

1323
00:49:50,309 --> 00:49:48,480
want to actually drive the opposite

1324
00:49:52,630 --> 00:49:50,319
direction we're going south

1325
00:49:53,750 --> 00:49:52,640
to investigate this area in this first

1326
00:49:56,549 --> 00:49:53,760
science campaign

1327
00:49:57,510 --> 00:49:56,559
and get some of these very old samples

1328
00:50:00,230 --> 00:49:57,520
from this

1329
00:50:02,309 --> 00:50:00,240
crater floor unit and then we will

1330
00:50:03,990 --> 00:50:02,319
transition and go back over to the delta

1331
00:50:06,630 --> 00:50:04,000
we'll still take you saw from

1332
00:50:08,630 --> 00:50:06,640
you can bring up vivian's slide here you

1333
00:50:11,030 --> 00:50:08,640
can see we're going to drive

1334
00:50:11,990 --> 00:50:11,040
down south and we'll probably go all the

1335
00:50:14,710 --> 00:50:12,000
way to south

1336
00:50:16,150 --> 00:50:14,720
sita you can see that location there

1337
00:50:19,030 --> 00:50:16,160
we'll collect samples we'll go

1338
00:50:20,069 --> 00:50:19,040

back to the original landing site and

1339
00:50:21,829 --> 00:50:20,079
then we will

1340
00:50:23,270 --> 00:50:21,839
put the pedal to the metal with our auto

1341
00:50:25,589 --> 00:50:23,280
navigation that you heard about from

1342
00:50:27,510 --> 00:50:25,599
olivier and we will you can see the path

1343
00:50:28,309 --> 00:50:27,520
that will take to get back over to the

1344
00:50:29,750 --> 00:50:28,319
delta so

1345
00:50:32,150 --> 00:50:29,760
that's very different than we thought

1346
00:50:33,910 --> 00:50:32,160
but um it's it's a great opportunity to

1347
00:50:37,430 --> 00:50:33,920
get some samples from this region

1348
00:50:39,430 --> 00:50:37,440
of the lake bed great thank you we're

1349
00:50:40,470 --> 00:50:39,440
going to go back to the media telecon

1350
00:50:43,349 --> 00:50:40,480
line

1351
00:50:45,349 --> 00:50:43,359
so we have chelsea god from space.com go

1352
00:50:47,990 --> 00:50:45,359
ahead

1353
00:50:50,230 --> 00:50:48,000
hi thanks so much um so with these

1354
00:50:50,870 --> 00:50:50,240
months of observation and all of these

1355
00:50:53,030 --> 00:50:50,880
new

1356
00:50:54,790 --> 00:50:53,040
science findings uh you know i'm sure

1357
00:50:55,670 --> 00:50:54,800
that mission teams have learned so much

1358
00:50:58,710 --> 00:50:55,680
about the

1359
00:51:01,190 --> 00:50:58,720
this area on mars that they did not

1360
00:51:01,829 --> 00:51:01,200
know concretely previously i'm curious

1361
00:51:04,710 --> 00:51:01,839
how

1362
00:51:07,190 --> 00:51:04,720
this new information post landing has

1363
00:51:10,470 --> 00:51:07,200

influenced you know the planned uh

1364
00:51:12,390 --> 00:51:10,480
sample capture sites as you narrow down

1365
00:51:13,750 --> 00:51:12,400
more general sites into exactly where

1366
00:51:15,349 --> 00:51:13,760
you're going to be collecting and

1367
00:51:19,510 --> 00:51:15,359
caching these samples in the coming

1368
00:51:19,520 --> 00:51:24,150
who wants to take that one

1369
00:51:28,470 --> 00:51:26,710
well the i i'll answer with respect to

1370
00:51:30,710 --> 00:51:28,480
the to the sample collection one of the

1371
00:51:32,950 --> 00:51:30,720
things that uh actually vivian has been

1372
00:51:34,470 --> 00:51:32,960
leading is an effort to come up with a

1373
00:51:37,670 --> 00:51:34,480
plan for

1374
00:51:38,470 --> 00:51:37,680
uh many months ahead perhaps until the

1375
00:51:41,190 --> 00:51:38,480
spring of

1376
00:51:42,069 --> 00:51:41,200
of next year and what you see in the

1377
00:51:43,910 --> 00:51:42,079
image if i can

1378
00:51:45,190 --> 00:51:43,920
show the image that uh that we've been

1379
00:51:48,470 --> 00:51:45,200
showing from vivian showing

1380
00:51:48,870 --> 00:51:48,480
our traverse route you see that there

1381
00:51:53,190 --> 00:51:48,880
are

1382
00:51:55,990 --> 00:51:53,200
very likely to collect samples

1383
00:51:56,390 --> 00:51:56,000
so we are discovery driven but the way

1384
00:51:58,309 --> 00:51:56,400
we

1385
00:52:00,710 --> 00:51:58,319
navigate around to make discoveries is

1386
00:52:02,630 --> 00:52:00,720
to follow the path that you see there

1387
00:52:05,270 --> 00:52:02,640
and the expectation is here on the

1388
00:52:05,910 --> 00:52:05,280

crater floor over the about the coming

1389
00:52:08,710 --> 00:52:05,920
year

1390
00:52:10,710 --> 00:52:08,720
we will collect four unique samples and

1391
00:52:13,670 --> 00:52:10,720
we will keep them on board

1392
00:52:14,950 --> 00:52:13,680
we will carry them to a site which is

1393
00:52:16,870 --> 00:52:14,960
not yet determined

1394
00:52:18,870 --> 00:52:16,880
where we will cash them for future

1395
00:52:20,790 --> 00:52:18,880
pickup it's my expectation that this

1396
00:52:22,150 --> 00:52:20,800
caching will not happen within the next

1397
00:52:23,750 --> 00:52:22,160
year and therefore we don't feel

1398
00:52:24,950 --> 00:52:23,760
enormous urgency right now to think

1399
00:52:29,190 --> 00:52:24,960
about where it's going to happen because

1400
00:52:32,630 --> 00:52:32,069
okay next on the phone lines is passant

1401
00:52:36,390 --> 00:52:32,640
ravi

1402
00:52:39,990 --> 00:52:39,430
uh hi uh i wanted to know uh given the

1403
00:52:42,390 --> 00:52:40,000
additional

1404
00:52:43,349 --> 00:52:42,400
observations of general crater could you

1405
00:52:45,270 --> 00:52:43,359
compare them to

1406
00:52:47,510 --> 00:52:45,280
the observations made by curiosity when

1407
00:52:49,109 --> 00:52:47,520
it first got to gale crater and how that

1408
00:52:52,790 --> 00:52:49,119
speaks to the differences between the

1409
00:52:55,910 --> 00:52:54,150
do you want to take that one ken or

1410
00:52:58,870 --> 00:52:55,920
vivian

1411
00:53:00,630 --> 00:52:58,880
yeah i can give that a shot all right um

1412
00:53:01,910 --> 00:53:00,640
so yeah so it's a very that's a really

1413
00:53:03,990 --> 00:53:01,920

good question because that's a really

1414
00:53:07,030 --> 00:53:04,000
interesting comparison where we have

1415
00:53:09,510 --> 00:53:07,040
both jezreel and gale crater uh both

1416
00:53:10,230 --> 00:53:09,520
uh we really believe uh used to host

1417
00:53:12,710 --> 00:53:10,240
these ancient

1418
00:53:13,990 --> 00:53:12,720
lake systems um but i think you know

1419
00:53:16,309 --> 00:53:14,000
what we've been seeing so far from

1420
00:53:18,390 --> 00:53:16,319
jezreel is in some ways similar what we

1421
00:53:20,790 --> 00:53:18,400
see at gale and in some ways it's not

1422
00:53:22,710 --> 00:53:20,800
um so for example uh thinking back to

1423
00:53:23,510 --> 00:53:22,720
gale crater and what curiosity has been

1424
00:53:26,870 --> 00:53:23,520
seeing

1425
00:53:30,309 --> 00:53:26,880
curiosity has seen you know just

1426
00:53:34,549 --> 00:53:30,319
many many feet in in terms of uh

1427
00:53:37,030 --> 00:53:34,559
elevation many many um you know feet of

1428
00:53:39,190 --> 00:53:37,040
these layered rocks that are kind of the

1429
00:53:41,910 --> 00:53:39,200
hallmark of being in a lake

1430
00:53:43,109 --> 00:53:41,920
system a lake and river system and so we

1431
00:53:45,990 --> 00:53:43,119
see these you know very

1432
00:53:47,510 --> 00:53:46,000
uh finely layered um layered rocks and

1433
00:53:48,950 --> 00:53:47,520
there's variations in the layering that

1434
00:53:51,829 --> 00:53:48,960
tells you about the

1435
00:53:53,430 --> 00:53:51,839
uh depositional environment um and the

1436
00:53:56,470 --> 00:53:53,440
the pace of the water

1437
00:53:58,069 --> 00:53:56,480
that deposited those rocks and when we

1438
00:53:59,349 --> 00:53:58,079

think about that in the context of

1439
00:54:00,790 --> 00:53:59,359
jezreel though

1440
00:54:02,549 --> 00:54:00,800
you can see from a lot of the images

1441
00:54:04,630 --> 00:54:02,559
that we've seen so far

1442
00:54:06,230 --> 00:54:04,640
of the crater floor fractured rough you

1443
00:54:08,630 --> 00:54:06,240
know there's not a lot of layering

1444
00:54:09,829 --> 00:54:08,640
in these crater floor fractured rough

1445
00:54:12,470 --> 00:54:09,839
rocks

1446
00:54:12,950 --> 00:54:12,480
there are some kind of on the boundary

1447
00:54:14,630 --> 00:54:12,960
between

1448
00:54:16,950 --> 00:54:14,640
the crater full fractured rough and the

1449
00:54:19,750 --> 00:54:16,960
sita unit as shown in ken's

1450
00:54:20,710 --> 00:54:19,760
images showing that layering that are

1451
00:54:22,470 --> 00:54:20,720
kind of

1452
00:54:24,150 --> 00:54:22,480
new data and that we're still um you

1453
00:54:25,750 --> 00:54:24,160
know digesting but

1454
00:54:27,270 --> 00:54:25,760
for the majority of our traverse you

1455
00:54:29,349 --> 00:54:27,280
know uh these layered rocks and the

1456
00:54:31,030 --> 00:54:29,359
crater floor fractured rough have been

1457
00:54:32,790 --> 00:54:31,040
um have been kind of hard to come by so

1458
00:54:35,430 --> 00:54:32,800
that's an interesting contrast between

1459
00:54:36,549 --> 00:54:35,440
what we've seen at gale with those many

1460
00:54:38,150 --> 00:54:36,559
layered rocks

1461
00:54:40,230 --> 00:54:38,160
and and the lack of layering in a crater

1462
00:54:42,150 --> 00:54:40,240
floor fractured rough

1463
00:54:44,150 --> 00:54:42,160

but one surprising thing i think that

1464
00:54:46,470 --> 00:54:44,160
we've seen um since we landed

1465
00:54:48,309 --> 00:54:46,480
is uh getting a closer look at that sita

1466
00:54:49,589 --> 00:54:48,319
unit um that's kind of in the

1467
00:54:52,309 --> 00:54:49,599
that we're kind of skirting around the

1468
00:54:54,309 --> 00:54:52,319
edge of and you know from orbit

1469
00:54:56,150 --> 00:54:54,319
when we look at this unit it's we can't

1470
00:54:57,910 --> 00:54:56,160
really see at the scale of the orbital

1471
00:55:00,950 --> 00:54:57,920
data we can't see any of the

1472
00:55:03,750 --> 00:55:00,960
of the layering uh in this rock and so

1473
00:55:05,510 --> 00:55:03,760
when we did land and we did put our

1474
00:55:07,430 --> 00:55:05,520
cameras out to the sita region to really

1475
00:55:10,710 --> 00:55:07,440
see it up close for the first time

1476
00:55:12,309 --> 00:55:10,720
i think we all were very uh happily

1477
00:55:13,109 --> 00:55:12,319
surprised to see you know there are

1478
00:55:15,430 --> 00:55:13,119
layers

1479
00:55:16,230 --> 00:55:15,440
in that unit and so of course that might

1480
00:55:19,030 --> 00:55:16,240
spark some

1481
00:55:20,710 --> 00:55:19,040
more comparison with curiosity and what

1482
00:55:22,390 --> 00:55:20,720
it's been seeing at gale crater

1483
00:55:23,910 --> 00:55:22,400
um so hopefully we'll be able to get

1484
00:55:25,829 --> 00:55:23,920
more up close and personal

1485
00:55:28,789 --> 00:55:25,839
with these rocks to really make that

1486
00:55:32,069 --> 00:55:30,789
great okay we're gonna go back to social

1487
00:55:34,069 --> 00:55:32,079
media um and

1488
00:55:35,670 --> 00:55:34,079

a reminder for the folks on the media on

1489
00:55:36,230 --> 00:55:35,680
the phone again if you want to get into

1490
00:55:38,549 --> 00:55:36,240
the queue

1491
00:55:39,990 --> 00:55:38,559
you press star one and the hashtag is

1492
00:55:41,829 --> 00:55:40,000
ask nasa

1493
00:55:44,630 --> 00:55:41,839
so this is a question for uh dr

1494
00:55:46,870 --> 00:55:44,640
zerbouken darin on youtube asks

1495
00:55:50,870 --> 00:55:46,880
how would this science help future

1496
00:55:53,990 --> 00:55:52,390
so we already heard about some of the

1497
00:55:55,349 --> 00:55:54,000
technologies that are being developed

1498
00:55:58,150 --> 00:55:55,359
and especially

1499
00:55:59,349 --> 00:55:58,160
you talked to us about a moxie

1500
00:56:01,829 --> 00:55:59,359
experiment right

1501
00:56:03,190 --> 00:56:01,839
earlier which is all about making

1502
00:56:06,230 --> 00:56:03,200
breathable oxygen

1503
00:56:07,990 --> 00:56:06,240
that is there so there's tangible actual

1504
00:56:09,990 --> 00:56:08,000
technologies that really help

1505
00:56:12,390 --> 00:56:10,000
support life once we're there with

1506
00:56:13,910 --> 00:56:12,400
humans that are being proven right now

1507
00:56:15,750 --> 00:56:13,920
both on the landing site on the

1508
00:56:17,829 --> 00:56:15,760
navigation side but also

1509
00:56:19,109 --> 00:56:17,839
that particular experiment i think

1510
00:56:21,270 --> 00:56:19,119
secondarily the

1511
00:56:22,309 --> 00:56:21,280
uh what we're really doing with this uh

1512
00:56:25,510 --> 00:56:22,319
particular

1513
00:56:26,309 --> 00:56:25,520

uh you know explorer is really look at

1514
00:56:28,230 --> 00:56:26,319
the entire

1515
00:56:29,990 --> 00:56:28,240
environment uh both uh remember there's

1516
00:56:30,870 --> 00:56:30,000
a weather station that it's carting

1517
00:56:33,910 --> 00:56:30,880
around with

1518
00:56:35,829 --> 00:56:33,920
but also are really looking at

1519
00:56:37,430 --> 00:56:35,839
the best science that of course humans

1520
00:56:40,150 --> 00:56:37,440
could do as we get there so

1521
00:56:41,910 --> 00:56:40,160
really understanding what mars is like

1522
00:56:43,589 --> 00:56:41,920
right there with all dimensions but

1523
00:56:44,630 --> 00:56:43,599
learning also how to take advantage of

1524
00:56:46,789 --> 00:56:44,640
the resources

1525
00:56:49,829 --> 00:56:46,799
are the most important factors of how it

1526
00:56:52,710 --> 00:56:49,839
supports human exploration

1527
00:56:54,630 --> 00:56:52,720
great thank you thomas uh this is a

1528
00:56:54,950 --> 00:56:54,640
question i'll i'll start with ken but if

1529
00:56:56,630 --> 00:56:54,960
ever

1530
00:56:59,589 --> 00:56:56,640
if other people have ideas you can feel

1531
00:57:02,150 --> 00:56:59,599
free to chime in cnc news on youtube

1532
00:57:03,750 --> 00:57:02,160
asks what is the most exciting thing

1533
00:57:08,150 --> 00:57:03,760
found by perseverance

1534
00:57:13,910 --> 00:57:11,190
i would say two things um the the first

1535
00:57:14,470 --> 00:57:13,920
is uh the very compelling demonstration

1536
00:57:17,430 --> 00:57:14,480
of

1537
00:57:18,950 --> 00:57:17,440
the uh helicopter ingenuity and and i'll

1538
00:57:22,390 --> 00:57:18,960

let others speak to that it

1539
00:57:23,990 --> 00:57:22,400
is remarkable what that uh uh

1540
00:57:25,270 --> 00:57:24,000
helicopter can do and i think it's gonna

1541
00:57:26,789 --> 00:57:25,280
be in the future it will be

1542
00:57:30,150 --> 00:57:26,799
transformative to have

1543
00:57:32,549 --> 00:57:30,160
a helicopter element for

1544
00:57:33,430 --> 00:57:32,559
science investigations uh the other

1545
00:57:36,470 --> 00:57:33,440
feature which

1546
00:57:38,150 --> 00:57:36,480
is is a direct scientific observation is

1547
00:57:41,190 --> 00:57:38,160
the one that i alluded to

1548
00:57:43,910 --> 00:57:41,200
that quite different from gale we see

1549
00:57:46,789 --> 00:57:43,920
evidence of

1550
00:57:47,750 --> 00:57:46,799
rapidly flowing water a phase of rapidly

1551
00:57:50,309 --> 00:57:47,760
flowing water

1552
00:57:51,510 --> 00:57:50,319
in this lake late in its history at the

1553
00:57:52,950 --> 00:57:51,520
top of the delta

1554
00:57:55,670 --> 00:57:52,960
after the lake had dried down

1555
00:57:58,150 --> 00:57:55,680
substantially and this fits into

1556
00:57:59,190 --> 00:57:58,160
a larger picture of the way mars may

1557
00:58:02,470 --> 00:57:59,200
have evolved

1558
00:58:03,990 --> 00:58:02,480
from a period when lakes were relatively

1559
00:58:06,390 --> 00:58:04,000
common on the surface

1560
00:58:07,109 --> 00:58:06,400
to a period that is younger when there

1561
00:58:10,630 --> 00:58:07,119
were

1562
00:58:11,270 --> 00:58:10,640
periodic uh outflow events we don't know

1563
00:58:13,670 --> 00:58:11,280

exactly

1564
00:58:14,309 --> 00:58:13,680
how those happened or or why they

1565
00:58:16,150 --> 00:58:14,319
happened

1566
00:58:17,430 --> 00:58:16,160
but we are starting to see evidence and

1567
00:58:19,190 --> 00:58:17,440
and later in the mission

1568
00:58:23,190 --> 00:58:19,200
we will actually be up on those rocks

1569
00:58:26,150 --> 00:58:23,200
and be able to explore them directly

1570
00:58:28,789 --> 00:58:26,160
okay we're going to go to another social

1571
00:58:31,109 --> 00:58:28,799
media question

1572
00:58:32,630 --> 00:58:31,119
this one is about navigation so i'm

1573
00:58:34,230 --> 00:58:32,640
going to alter it a bit because

1574
00:58:35,990 --> 00:58:34,240
olivier was talking about how much we

1575
00:58:38,309 --> 00:58:36,000
can do with the autonomous

1576
00:58:39,349 --> 00:58:38,319
driving there and so let's see where did

1577
00:58:42,150 --> 00:58:39,359
it go uh

1578
00:58:43,190 --> 00:58:42,160
oh no i lost it it's uh okay sorry about

1579
00:58:46,390 --> 00:58:43,200
this there we go okay

1580
00:58:48,870 --> 00:58:46,400
mars hub on facebook asks um is

1581
00:58:51,430 --> 00:58:48,880
perseverance programmed to drive and do

1582
00:58:52,549 --> 00:58:51,440
a lot of things itself or do you control

1583
00:58:54,230 --> 00:58:52,559
it from earth

1584
00:58:56,950 --> 00:58:54,240
how much how much are you guys doing

1585
00:59:01,109 --> 00:58:58,230
that's a good question so there are

1586
00:59:04,230 --> 00:59:01,119
various modes of autonomy

1587
00:59:06,549 --> 00:59:04,240
various ways we can uh drive the rover

1588
00:59:08,150 --> 00:59:06,559

one is to actually give it low level

1589
00:59:10,069 --> 00:59:08,160
commands and and say

1590
00:59:11,190 --> 00:59:10,079
per severance please turn your wheels

1591
00:59:12,789 --> 00:59:11,200
that much

1592
00:59:14,390 --> 00:59:12,799
uh to make forward progress backward

1593
00:59:16,789 --> 00:59:14,400
progress turn in place

1594
00:59:19,030 --> 00:59:16,799
and so we can really control uh the

1595
00:59:21,670 --> 00:59:19,040
exact motion that the rover does

1596
00:59:23,750 --> 00:59:21,680
but as i explained when we control it

1597
00:59:25,510 --> 00:59:23,760
that way we can only drive

1598
00:59:28,470 --> 00:59:25,520
in the terrain that is visible right

1599
00:59:31,750 --> 00:59:28,480
around the rover so we can go very far

1600
00:59:34,390 --> 00:59:31,760
and then there is you know more advanced

1601
00:59:36,470 --> 00:59:34,400
modes of autonomy where we can say uh

1602
00:59:38,309 --> 00:59:36,480
rover please drive to that way point

1603
00:59:39,670 --> 00:59:38,319
and we can choose where to place that

1604
00:59:43,510 --> 00:59:39,680
point on mars

1605
00:59:46,390 --> 00:59:43,520
and um then the rover can either

1606
00:59:48,390 --> 00:59:46,400
drive just the fastest path to the goal

1607
00:59:50,390 --> 00:59:48,400
without imaging

1608
00:59:51,670 --> 00:59:50,400
and so without avoiding obstacles in the

1609
00:59:52,549 --> 00:59:51,680
terrain if we think the terrain is very

1610
00:59:55,589 --> 00:59:52,559
benign

1611
00:59:59,190 --> 00:59:55,599
or it can actually image

1612
00:59:59,990 --> 00:59:59,200
detect obstacles and by itself decide to

1613
01:00:03,030 --> 01:00:00,000

swerve in between

1614
01:00:04,630 --> 01:00:03,040
obstacles to get to the goal

1615
01:00:06,069 --> 01:00:04,640
another autonomous capability i haven't

1616
01:00:06,390 --> 01:00:06,079
mentioned which is part which is new

1617
01:00:08,390 --> 01:00:06,400
with

1618
01:00:11,030 --> 01:00:08,400
perseverance is that at the end of the

1619
01:00:12,630 --> 01:00:11,040
drive once the rover reaches a goal

1620
01:00:14,630 --> 01:00:12,640
in order to be able to talk back to

1621
01:00:18,950 --> 01:00:14,640
earth he needs to

1622
01:00:21,910 --> 01:00:18,960
turn to a heading that enables it

1623
01:00:23,829 --> 01:00:21,920
to talk to the orbiter and in order to

1624
01:00:25,349 --> 01:00:23,839
do that we actually do that autonomously

1625
01:00:27,030 --> 01:00:25,359
because at the end of an autonomous

1626
01:00:29,430 --> 01:00:27,040
drive as i as i hinted

1627
01:00:30,309 --> 01:00:29,440
at uh earlier we really don't know what

1628
01:00:31,589 --> 01:00:30,319
the rover is going to be

1629
01:00:33,430 --> 01:00:31,599
what is going to be the final heading

1630
01:00:36,789 --> 01:00:33,440
what is going to be the final location

1631
01:00:39,109 --> 01:00:36,799
and so the ai software is actually able

1632
01:00:40,549 --> 01:00:39,119
to look at the table that says hey given

1633
01:00:42,470 --> 01:00:40,559
my current tilt

1634
01:00:44,390 --> 01:00:42,480
i need to turn at that heading to be

1635
01:00:46,069 --> 01:00:44,400
able to talk to back to earth

1636
01:00:47,829 --> 01:00:46,079
and if it cannot because there's an

1637
01:00:49,349 --> 01:00:47,839
obstacle then it's going to keep on

1638
01:00:50,950 --> 01:00:49,359

making progress towards the goal until

1639
01:00:55,589 --> 01:00:50,960
it finds a place where it can

1640
01:00:58,870 --> 01:00:55,599
turn forcom is how we call it so

1641
01:01:01,670 --> 01:00:58,880
that's about the extent of the autonomy

1642
01:01:02,789 --> 01:01:01,680
for for the driving side and of course

1643
01:01:04,549 --> 01:01:02,799
there is also

1644
01:01:08,390 --> 01:01:04,559
some autonomy for the robotic arm

1645
01:01:12,470 --> 01:01:09,910
but but that's probably a different

1646
01:01:15,030 --> 01:01:12,480
topic i think we should take

1647
01:01:16,950 --> 01:01:15,040
sorry okay all right so we're uh going

1648
01:01:20,390 --> 01:01:16,960
to go back to the phone lines

1649
01:01:23,990 --> 01:01:20,400
and uh we have john amos from the bbc

1650
01:01:25,670 --> 01:01:24,000
on the line go ahead john hi thanks very

1651
01:01:28,950 --> 01:01:25,680
much uh for doing this

1652
01:01:31,910 --> 01:01:28,960
can i just um just talk about the uh the

1653
01:01:32,309 --> 01:01:31,920
sampling strategy for a moment if i may

1654
01:01:34,470 --> 01:01:32,319
um

1655
01:01:36,309 --> 01:01:34,480
ken mentioned you know maybe four

1656
01:01:37,910 --> 01:01:36,319
samples over the next year

1657
01:01:40,230 --> 01:01:37,920
i mean i i just wonder if you get to

1658
01:01:42,470 --> 01:01:40,240
somewhere like r2b and

1659
01:01:43,990 --> 01:01:42,480
you look at that that stretch of rocks

1660
01:01:45,589 --> 01:01:44,000
which i think is about what is it about

1661
01:01:48,309 --> 01:01:45,599
20 meters across something like that and

1662
01:01:49,910 --> 01:01:48,319
you look at one end and you think wow

1663
01:01:51,349 --> 01:01:49,920

we ought to take a sample from there but

1664
01:01:52,789 --> 01:01:51,359
then you look at the other end of it and

1665
01:01:53,349 --> 01:01:52,799
you think oh i don't know what about the

1666
01:01:55,430 --> 01:01:53,359
other end

1667
01:01:56,549 --> 01:01:55,440
would you conceivably take two samples

1668
01:01:58,630 --> 01:01:56,559
at a location

1669
01:02:00,470 --> 01:01:58,640
or are you restricted by the the number

1670
01:02:02,549 --> 01:02:00,480
of total tubes you have so

1671
01:02:07,589 --> 01:02:02,559
you have to make a choice you know one

1672
01:02:08,870 --> 01:02:07,599
place or another

1673
01:02:10,950 --> 01:02:08,880
yeah that's a really great question

1674
01:02:13,270 --> 01:02:10,960
because uh i think you're hitting on

1675
01:02:15,109 --> 01:02:13,280
uh the um you know some of the

1676
01:02:16,630 --> 01:02:15,119
complexity that we work with when we are

1677
01:02:18,309 --> 01:02:16,640
planning these missions

1678
01:02:19,829 --> 01:02:18,319
and as you mentioned there's a limited

1679
01:02:21,750 --> 01:02:19,839
number of tubes

1680
01:02:23,990 --> 01:02:21,760
so we have to make our choices about

1681
01:02:25,510 --> 01:02:24,000
what rocks to sample

1682
01:02:28,710 --> 01:02:25,520
very very carefully and with as much

1683
01:02:31,270 --> 01:02:28,720
information as we can as we can have

1684
01:02:32,870 --> 01:02:31,280
so i think an important thing to mention

1685
01:02:34,870 --> 01:02:32,880
is as ken mentioned

1686
01:02:37,109 --> 01:02:34,880
you know we are planning uh with this

1687
01:02:39,589 --> 01:02:37,119
first campaign our going in plan is to

1688
01:02:41,829 --> 01:02:39,599

collect four samples four unique samples

1689
01:02:42,950 --> 01:02:41,839
uh from those three areas uh the crater

1690
01:02:45,910 --> 01:02:42,960
for fractured rough

1691
01:02:47,829 --> 01:02:45,920
sita south and the raised ridges um but

1692
01:02:48,789 --> 01:02:47,839
it's also important to keep in mind that

1693
01:02:50,710 --> 01:02:48,799
you know this is our

1694
01:02:51,990 --> 01:02:50,720
this is our plan based on what we know

1695
01:02:54,549 --> 01:02:52,000
and as i mentioned we're always

1696
01:02:56,950 --> 01:02:54,559
continuously adapting and adjusting

1697
01:02:57,750 --> 01:02:56,960
our plans based on new information and

1698
01:02:59,190 --> 01:02:57,760
so i think

1699
01:03:01,029 --> 01:02:59,200
as we progress in this first science

1700
01:03:02,950 --> 01:03:01,039
campaign as we get

1701
01:03:04,789 --> 01:03:02,960
more of a better understanding of what

1702
01:03:06,710 --> 01:03:04,799
these rocks are and what the environment

1703
01:03:09,670 --> 01:03:06,720
at jezreel was like

1704
01:03:12,150 --> 01:03:09,680
we'll always you know keep in mind that

1705
01:03:16,549 --> 01:03:12,160
that plan can be adjusted and adapted

1706
01:03:19,510 --> 01:03:16,559
based on that new information

1707
01:03:20,390 --> 01:03:19,520
okay uh next on the line we have katrina

1708
01:03:23,589 --> 01:03:20,400
miller from

1709
01:03:28,390 --> 01:03:26,309
hi thank you um so it was said that

1710
01:03:30,710 --> 01:03:28,400
perseverance could drive

1711
01:03:31,990 --> 01:03:30,720
about 100 to 100 feet per day with human

1712
01:03:33,670 --> 01:03:32,000
pilots um

1713
01:03:35,829 --> 01:03:33,680

and i'm not sure if i missed this but

1714
01:03:37,029 --> 01:03:35,839
what was the distance of the longest ai

1715
01:03:39,109 --> 01:03:37,039
powered drive so far

1716
01:03:41,510 --> 01:03:39,119
and is there ever a time or situation

1717
01:03:43,750 --> 01:03:41,520
when manual driving would be better

1718
01:03:45,430 --> 01:03:43,760
or more beneficial than the autonomous

1719
01:03:48,950 --> 01:03:45,440
driving

1720
01:03:52,230 --> 01:03:48,960
olivier that's a great question um

1721
01:03:53,750 --> 01:03:52,240
so um in indeed in the terrain that is

1722
01:03:55,510 --> 01:03:53,760
visible around the rover we have the

1723
01:03:57,109 --> 01:03:55,520
choice to either drive manually

1724
01:04:00,309 --> 01:03:57,119
or just turn on at an hour and let the

1725
01:04:02,069 --> 01:04:00,319
driver the rover drive itself

1726
01:04:04,789 --> 01:04:02,079
that's always a little bit of compromise

1727
01:04:06,470 --> 01:04:04,799
and a recent experience has shown

1728
01:04:08,470 --> 01:04:06,480
that actually we've been more successful

1729
01:04:10,710 --> 01:04:08,480
letting the rover drive itself

1730
01:04:12,630 --> 01:04:10,720
then trying to micromanage the path

1731
01:04:14,390 --> 01:04:12,640
because what happens is that

1732
01:04:16,950 --> 01:04:14,400
sometimes the rover is going to sleep

1733
01:04:19,750 --> 01:04:16,960
and deviate from the expected path

1734
01:04:21,430 --> 01:04:19,760
and if it's not autonomous then you know

1735
01:04:24,870 --> 01:04:21,440
it's going to keep on deviating

1736
01:04:26,549 --> 01:04:24,880
and sometimes it may you know drive over

1737
01:04:29,270 --> 01:04:26,559
a large rock or

1738
01:04:30,150 --> 01:04:29,280

uh you know and end up floating the

1739
01:04:32,069 --> 01:04:30,160
drive

1740
01:04:33,589 --> 01:04:32,079
uh because for example the suspension

1741
01:04:35,190 --> 01:04:33,599
angles are not what we expect

1742
01:04:37,270 --> 01:04:35,200
and so we have reactive checks that that

1743
01:04:38,150 --> 01:04:37,280
will say that we safely stop us in that

1744
01:04:41,109 --> 01:04:38,160
case

1745
01:04:42,950 --> 01:04:41,119
um however in autonomous mode the rover

1746
01:04:44,549 --> 01:04:42,960
is about to image he's able to see all

1747
01:04:46,230 --> 01:04:44,559
the rocks uh you know every

1748
01:04:48,150 --> 01:04:46,240
three or four feet it's about to

1749
01:04:49,349 --> 01:04:48,160
reassess the situation and plan a new

1750
01:04:52,390 --> 01:04:49,359
safe path

1751
01:04:55,510 --> 01:04:52,400
so it's actually been doing really well

1752
01:04:57,990 --> 01:04:55,520
that way and so far again we just

1753
01:04:59,750 --> 01:04:58,000
started using autonomous navigation so

1754
01:05:03,670 --> 01:04:59,760
we don't have a lot of miles under the

1755
01:05:08,150 --> 01:05:03,680
wheels but so far we've driven

1756
01:05:11,430 --> 01:05:08,160
about i would say uh three to four times

1757
01:05:15,190 --> 01:05:11,440
uh longer distances uh than uh

1758
01:05:18,230 --> 01:05:15,200
uh when human drivers uh pilot the rover

1759
01:05:20,069 --> 01:05:18,240
um and but we expect those distances to

1760
01:05:23,829 --> 01:05:20,079
grow much more in the future

1761
01:05:27,589 --> 01:05:23,839
uh as uh we uh

1762
01:05:30,710 --> 01:05:27,599
are able to drive for longer on mars um

1763
01:05:34,829 --> 01:05:30,720

and so i think you will see uh probably

1764
01:05:37,349 --> 01:05:34,839
uh drives that are gonna be uh you know

1765
01:05:39,349 --> 01:05:37,359
um three to four times

1766
01:05:42,390 --> 01:05:39,359
uh our longest drive so far which is

1767
01:05:44,390 --> 01:05:42,400
about 350 feet

1768
01:05:45,430 --> 01:05:44,400
in the next in the next few weeks or

1769
01:05:47,349 --> 01:05:45,440
months

1770
01:05:49,589 --> 01:05:47,359
and in fact in the future we'll even be

1771
01:05:52,230 --> 01:05:49,599
able to do what we call multi

1772
01:05:53,829 --> 01:05:52,240
saw otto nav where the rover is able to

1773
01:05:55,589 --> 01:05:53,839
drive itself on mars and stop

1774
01:05:57,910 --> 01:05:55,599
and then the next day resume certainly

1775
01:05:59,510 --> 01:05:57,920
was driving and then stop and and go on

1776
01:06:01,910 --> 01:05:59,520
like that for several days so

1777
01:06:03,190 --> 01:06:01,920
we expect to be able to uh to break a

1778
01:06:06,470 --> 01:06:03,200
few records in terms of

1779
01:06:08,470 --> 01:06:06,480
longest drives longest drive on mars

1780
01:06:10,309 --> 01:06:08,480
in history so i'm very excited about

1781
01:06:13,190 --> 01:06:10,319
that

1782
01:06:14,309 --> 01:06:13,200
great thank you oh thank you all right

1783
01:06:16,789 --> 01:06:14,319
so we have a little

1784
01:06:17,750 --> 01:06:16,799
time so we're going to keep going next

1785
01:06:22,150 --> 01:06:17,760
on the phone lines

1786
01:06:23,990 --> 01:06:22,160
is ken cramer of space up close go ahead

1787
01:06:25,430 --> 01:06:24,000
hi thank you for doing this and a great

1788
01:06:27,589 --> 01:06:25,440

mission so far um

1789
01:06:29,270 --> 01:06:27,599
my question is uh i think for vivian

1790
01:06:30,710 --> 01:06:29,280
please can you talk a little bit more

1791
01:06:32,470 --> 01:06:30,720
about how you're going to use the

1792
01:06:35,589 --> 01:06:32,480
science instruments to

1793
01:06:37,109 --> 01:06:35,599
select the samples which which which

1794
01:06:38,710 --> 01:06:37,119
ones you're going to use how long do you

1795
01:06:41,750 --> 01:06:38,720
need to operate them

1796
01:06:43,990 --> 01:06:41,760
thank you yeah absolutely um so i think

1797
01:06:45,910 --> 01:06:44,000
the short answer is that we're really

1798
01:06:48,309 --> 01:06:45,920
wanting to use all of our science

1799
01:06:50,870 --> 01:06:48,319
instruments and our payload on board to

1800
01:06:52,549 --> 01:06:50,880
get as much data as we can even just in

1801
01:06:54,710 --> 01:06:52,559
the preparation for sampling so

1802
01:06:57,670 --> 01:06:54,720
acquiring as much data as we can

1803
01:06:59,910 --> 01:06:57,680
of these rocks so that we can inform our

1804
01:07:01,109 --> 01:06:59,920
decision about exactly which rock to

1805
01:07:04,309 --> 01:07:01,119
sample

1806
01:07:05,510 --> 01:07:04,319
in terms of in terms of getting into a

1807
01:07:06,470 --> 01:07:05,520
little bit more detail about the

1808
01:07:08,789 --> 01:07:06,480
instruments

1809
01:07:10,309 --> 01:07:08,799
i think we have a fantastic suite of

1810
01:07:12,630 --> 01:07:10,319
instruments that really complement each

1811
01:07:14,470 --> 01:07:12,640
other in terms of their functions and

1812
01:07:15,750 --> 01:07:14,480
they really help us put together you

1813
01:07:19,029 --> 01:07:15,760

know an efficient plan

1814
01:07:21,349 --> 01:07:19,039
for getting to that sampling decision

1815
01:07:22,069 --> 01:07:21,359
so for example we have uh instruments

1816
01:07:23,829 --> 01:07:22,079
like

1817
01:07:25,109 --> 01:07:23,839
supercam and mastcam that are on the

1818
01:07:26,950 --> 01:07:25,119
remote mast

1819
01:07:28,789 --> 01:07:26,960
and we call them our remote sensing

1820
01:07:30,870 --> 01:07:28,799
instruments because

1821
01:07:32,390 --> 01:07:30,880
they we can be at a distance from the

1822
01:07:35,670 --> 01:07:32,400
rocks that we're actually observing

1823
01:07:38,630 --> 01:07:35,680
so uh mass cam z takes these fantastic

1824
01:07:39,910 --> 01:07:38,640
images a very high resolution um that

1825
01:07:42,630 --> 01:07:39,920
helps us really uh

1826
01:07:44,470 --> 01:07:42,640
do a do at the same time a kind of

1827
01:07:46,470 --> 01:07:44,480
survey of the rocks around us

1828
01:07:48,150 --> 01:07:46,480
covering a lot of area while also

1829
01:07:50,870 --> 01:07:48,160
letting us see kind of those fire

1830
01:07:52,710 --> 01:07:50,880
finer level details like um kind of the

1831
01:07:53,829 --> 01:07:52,720
textures of the rock and any layering in

1832
01:07:56,390 --> 01:07:53,839
the rock

1833
01:07:57,190 --> 01:07:56,400
we also have super cam on the most mast

1834
01:08:00,150 --> 01:07:57,200
which is

1835
01:08:01,270 --> 01:08:00,160
helping to get at the composition of

1836
01:08:03,430 --> 01:08:01,280
these rocks so

1837
01:08:05,430 --> 01:08:03,440
things like the chemistry and the

1838
01:08:07,430 --> 01:08:05,440

mineralogy of these rocks

1839
01:08:09,109 --> 01:08:07,440
and similarly we use that in a surveying

1840
01:08:10,549 --> 01:08:09,119
fashion as well

1841
01:08:12,390 --> 01:08:10,559
and we also have our engineering cameras

1842
01:08:13,029 --> 01:08:12,400
of course that we use every single day

1843
01:08:14,549 --> 01:08:13,039
to

1844
01:08:17,269 --> 01:08:14,559
give us the full context of the

1845
01:08:18,709 --> 01:08:17,279
workspace that we're in

1846
01:08:20,470 --> 01:08:18,719
and then all these remote sensing

1847
01:08:23,910 --> 01:08:20,480
instruments are really helpful for

1848
01:08:24,630 --> 01:08:23,920
complementing the proximity science

1849
01:08:26,470 --> 01:08:24,640
instruments

1850
01:08:28,309 --> 01:08:26,480
that we call that are mounted on the arm

1851
01:08:30,390 --> 01:08:28,319
of the of the rover

1852
01:08:31,430 --> 01:08:30,400
um and these are the instruments that uh

1853
01:08:33,669 --> 01:08:31,440
we place

1854
01:08:35,189 --> 01:08:33,679
uh much closer to the rocks and so in

1855
01:08:36,950 --> 01:08:35,199
that second image that i had you could

1856
01:08:39,110 --> 01:08:36,960
actually see the robotic arm

1857
01:08:41,669 --> 01:08:39,120
reaching out and hovering over the rocks

1858
01:08:45,189 --> 01:08:41,679
in front of us in our workspace

1859
01:08:46,229 --> 01:08:45,199
and these instruments because of how

1860
01:08:47,829 --> 01:08:46,239
close and

1861
01:08:49,829 --> 01:08:47,839
proximal they get to those rocks they

1862
01:08:51,030 --> 01:08:49,839
really give us really the highest

1863
01:08:53,430 --> 01:08:51,040

resolution

1864
01:08:56,070 --> 01:08:53,440
data possible and so we're able to see

1865
01:08:59,189 --> 01:08:56,080
really fine scale things like

1866
01:09:01,590 --> 01:08:59,199
grains and crystals you know especially

1867
01:09:04,149 --> 01:09:01,600
once we are able to abrade

1868
01:09:04,950 --> 01:09:04,159
and also at that scale we can get these

1869
01:09:07,749 --> 01:09:04,960
chemistry

1870
01:09:08,390 --> 01:09:07,759
maps as well as these mineralogic maps

1871
01:09:11,749 --> 01:09:08,400
and so

1872
01:09:12,149 --> 01:09:11,759
getting that really high level detailed

1873
01:09:15,110 --> 01:09:12,159
look

1874
01:09:16,709 --> 01:09:15,120
at these rocks up close is is also

1875
01:09:17,749 --> 01:09:16,719
incredibly helpful as you can imagine

1876
01:09:20,470 --> 01:09:17,759
for

1877
01:09:22,309 --> 01:09:20,480
coming to an idea of not only what these

1878
01:09:26,550 --> 01:09:22,319
rocks are but also just what rocks

1879
01:09:31,030 --> 01:09:28,950
thank you great okay we're going to go

1880
01:09:32,709 --> 01:09:31,040
back to social media

1881
01:09:36,229 --> 01:09:32,719
so i think i'm going to throw this one

1882
01:09:39,189 --> 01:09:36,239
to ken stephen tendrick on facebook says

1883
01:09:41,910 --> 01:09:39,199
mazel tov are we expecting evidence of

1884
01:09:45,669 --> 01:09:41,920
ancient sea life

1885
01:09:49,189 --> 01:09:45,679
interesting thing

1886
01:09:50,550 --> 01:09:49,199
about mars is we don't know whether

1887
01:09:52,550 --> 01:09:50,560
there was ever a phase

1888
01:09:53,829 --> 01:09:52,560

when there was an ocean it is a matter

1889
01:09:55,750 --> 01:09:53,839
of debate

1890
01:09:58,310 --> 01:09:55,760
but it is clear that the place we are

1891
01:09:59,590 --> 01:09:58,320
looking at in jezreel crater was not

1892
01:10:02,149 --> 01:09:59,600
part of

1893
01:10:04,709 --> 01:10:02,159
a sea it was a lake and it was a lake

1894
01:10:06,149 --> 01:10:04,719
that was about 40 kilometers across

1895
01:10:07,830 --> 01:10:06,159
so we are not looking for things that

1896
01:10:11,030 --> 01:10:07,840
would have been growing in the sea

1897
01:10:13,270 --> 01:10:11,040
and the other important aspect of this

1898
01:10:16,390 --> 01:10:13,280
is that we are looking very very far

1899
01:10:18,070 --> 01:10:16,400
back in the history of the solar system

1900
01:10:20,070 --> 01:10:18,080
and what that means is that life would

1901
01:10:21,110 --> 01:10:20,080
not have had much of a chance to advance

1902
01:10:22,709 --> 01:10:21,120
very far

1903
01:10:24,470 --> 01:10:22,719
and that's why we always say that we are

1904
01:10:25,910 --> 01:10:24,480
looking for evidence of potential

1905
01:10:28,149 --> 01:10:25,920
microbial life

1906
01:10:30,470 --> 01:10:28,159
because on earth our example of one

1907
01:10:33,189 --> 01:10:30,480
about how long it takes life to evolve

1908
01:10:35,110 --> 01:10:33,199
on earth advanced life which you might

1909
01:10:36,870 --> 01:10:35,120
consider to be sea life like you know

1910
01:10:38,550 --> 01:10:36,880
fish and

1911
01:10:39,990 --> 01:10:38,560
corals and these sort of things they

1912
01:10:42,310 --> 01:10:40,000
didn't appear until

1913
01:10:43,750 --> 01:10:42,320

relatively recently so we are appearing

1914
01:10:45,669 --> 01:10:43,760
very far back

1915
01:10:47,590 --> 01:10:45,679
in the in the history of life and we

1916
01:10:51,189 --> 01:10:47,600
only expect if there is life that it

1917
01:10:54,310 --> 01:10:53,910
did you want to add to that jennifer or

1918
01:10:56,790 --> 01:10:54,320
no

1919
01:10:57,510 --> 01:10:56,800
okay i think ken handled it very well

1920
01:11:00,310 --> 01:10:57,520
yeah

1921
01:11:01,270 --> 01:11:00,320
okay uh next on social media i think

1922
01:11:04,470 --> 01:11:01,280
i'll uh

1923
01:11:05,270 --> 01:11:04,480
toss this over to thomas alimsha on

1924
01:11:07,590 --> 01:11:05,280
linkedin

1925
01:11:10,310 --> 01:11:07,600
asks if samples are tested under

1926
01:11:14,950 --> 01:11:10,320
labrador laboratory conditions on earth

1927
01:11:19,189 --> 01:11:17,350
well that's exactly the question at the

1928
01:11:21,110 --> 01:11:19,199
heart of this right we bring these

1929
01:11:21,990 --> 01:11:21,120
samples back to earth because we can

1930
01:11:24,390 --> 01:11:22,000
make them

1931
01:11:25,990 --> 01:11:24,400
as the measurements as accurately as

1932
01:11:27,590 --> 01:11:26,000
humanly possible here on earth

1933
01:11:29,590 --> 01:11:27,600
you know that every year the

1934
01:11:32,229 --> 01:11:29,600
technologies are getting better

1935
01:11:33,830 --> 01:11:32,239
and the as we bring these samples back

1936
01:11:35,510 --> 01:11:33,840
and we said in the early 30s these

1937
01:11:38,070 --> 01:11:35,520
samples will be here

1938
01:11:39,830 --> 01:11:38,080

we have the best technology available to

1939
01:11:40,229 --> 01:11:39,840
actually make these measurements thereby

1940
01:11:41,830 --> 01:11:40,239
far

1941
01:11:44,310 --> 01:11:41,840
better than the technologies that we

1942
01:11:46,229 --> 01:11:44,320
have today if history is any teacher

1943
01:11:49,030 --> 01:11:46,239
so it will affect it tremendously and in

1944
01:11:51,910 --> 01:11:49,040
a positive fashion

1945
01:11:52,830 --> 01:11:51,920
great thank you thomas uh juggernaut joe

1946
01:11:55,510 --> 01:11:52,840
on youtube

1947
01:11:57,830 --> 01:11:55,520
asks what place has the highest

1948
01:11:59,990 --> 01:11:57,840
probability to have preserved fossils

1949
01:12:05,590 --> 01:12:00,000
that we could find if they exist on mars

1950
01:12:08,870 --> 01:12:07,030
well i'll give i'll give my answer this

1951
01:12:09,750 --> 01:12:08,880
is this would be a matter of opinion at

1952
01:12:12,470 --> 01:12:09,760
this point because

1953
01:12:14,070 --> 01:12:12,480
it depends completely on what the

1954
01:12:16,709 --> 01:12:14,080
environment was

1955
01:12:18,630 --> 01:12:16,719
that is recorded in those rocks and if

1956
01:12:20,870 --> 01:12:18,640
the rocks that are in the crater floor

1957
01:12:22,870 --> 01:12:20,880
and in particular for example in that

1958
01:12:24,310 --> 01:12:22,880
area that i called artubi or in the area

1959
01:12:27,430 --> 01:12:24,320
that we called sita

1960
01:12:31,030 --> 01:12:27,440
if those are former lake muds

1961
01:12:33,830 --> 01:12:31,040
those are a very good place to look for

1962
01:12:34,709 --> 01:12:33,840
fossils for what we call biosignatures

1963
01:12:36,870 --> 01:12:34,719

the delta may

1964
01:12:37,830 --> 01:12:36,880
also have such environments but it's

1965
01:12:40,149 --> 01:12:37,840
also clear that

1966
01:12:41,830 --> 01:12:40,159
some parts of the delta were fast

1967
01:12:45,030 --> 01:12:41,840
flowing water

1968
01:12:46,870 --> 01:12:45,040
and sand sand and rocks and and

1969
01:12:49,430 --> 01:12:46,880
just even intuitively you could imagine

1970
01:12:52,870 --> 01:12:49,440
that the ability of a rock to preserve

1971
01:12:56,630 --> 01:12:52,880
evidence of life if it is mud

1972
01:12:58,950 --> 01:12:56,640
that deposits very smoothly and slowly

1973
01:13:01,430 --> 01:12:58,960
and without much agitation there's a

1974
01:13:03,189 --> 01:13:01,440
good possibility of preservation

1975
01:13:05,110 --> 01:13:03,199
if you're in say a mountain stream with

1976
01:13:06,709 --> 01:13:05,120
boulders rolling along

1977
01:13:08,149 --> 01:13:06,719
not a good place for preservation so

1978
01:13:08,630 --> 01:13:08,159
that's the kind of criteria that we will

1979
01:13:10,550 --> 01:13:08,640
use

1980
01:13:13,510 --> 01:13:10,560
but we can't really apply it all that

1981
01:13:19,270 --> 01:13:16,310
great thank you all right so this is a

1982
01:13:19,910 --> 01:13:19,280
question for jennifer sakshi on linkedin

1983
01:13:21,830 --> 01:13:19,920
asks

1984
01:13:25,270 --> 01:13:21,840
what was the most challenging part of

1985
01:13:28,470 --> 01:13:25,280
building this mars rover

1986
01:13:32,229 --> 01:13:28,480
wow how much time do we have no i think

1987
01:13:34,630 --> 01:13:32,239
i think the key here is that there are

1988
01:13:37,350 --> 01:13:34,640

thousands of people who contributed to

1989
01:13:39,590 --> 01:13:37,360
this and and every person had a

1990
01:13:40,790 --> 01:13:39,600
a depth of knowledge and or a breadth of

1991
01:13:42,550 --> 01:13:40,800
knowledge that

1992
01:13:44,470 --> 01:13:42,560
that brought something unique to the

1993
01:13:46,310 --> 01:13:44,480
team to to be able to build this rover

1994
01:13:47,669 --> 01:13:46,320
this helicopter and developed this

1995
01:13:49,990 --> 01:13:47,679
science mission

1996
01:13:52,070 --> 01:13:50,000
and so there's nothing you know the the

1997
01:13:53,430 --> 01:13:52,080
landing system is always harrowing

1998
01:13:55,590 --> 01:13:53,440
because it's got to work and there's

1999
01:13:57,430 --> 01:13:55,600
only one way to get to the surface so

2000
01:13:59,270 --> 01:13:57,440
obviously that's one of the challenging

2001
01:14:01,510 --> 01:13:59,280
things but i think in terms of

2002
01:14:03,669 --> 01:14:01,520
the upgrades that we've made over time

2003
01:14:05,189 --> 01:14:03,679
i've worked on all of these rovers and

2004
01:14:09,350 --> 01:14:05,199
all of these missions

2005
01:14:11,990 --> 01:14:09,360
and a real um complex and difficult to

2006
01:14:13,590 --> 01:14:12,000
operate and manage system that we are

2007
01:14:13,990 --> 01:14:13,600
that we built on this was the whole

2008
01:14:16,149 --> 01:14:14,000
sample

2009
01:14:18,149 --> 01:14:16,159
caching system and the adaptive caching

2010
01:14:20,550 --> 01:14:18,159
assembly i mean we added

2011
01:14:22,070 --> 01:14:20,560
uh we had three robots we have the big

2012
01:14:24,310 --> 01:14:22,080
robotic arm on the outside which

2013
01:14:26,229 --> 01:14:24,320

curiosity had we have the big carousel

2014
01:14:28,149 --> 01:14:26,239
now that we use to transfer

2015
01:14:30,390 --> 01:14:28,159
samples and tubes back and forth and

2016
01:14:32,470 --> 01:14:30,400
bits and then we have another robotic

2017
01:14:34,470 --> 01:14:32,480
arm on the inside that manipulates these

2018
01:14:37,110 --> 01:14:34,480
tubes and uses force sensors and

2019
01:14:37,590 --> 01:14:37,120
there's just a lot of complexity to that

2020
01:14:44,149 --> 01:14:37,600
and

2021
01:14:46,470 --> 01:14:44,159
a couple first-time activities that we

2022
01:14:48,550 --> 01:14:46,480
we tried once and and we had maybe a

2023
01:14:49,990 --> 01:14:48,560
thermal issue of some modeling we didn't

2024
01:14:52,310 --> 01:14:50,000
quite understand and then we tried it

2025
01:14:54,630 --> 01:14:52,320
again and we had a timing issue with the

2026
01:14:55,990 --> 01:14:54,640
motor controller so so we are learning

2027
01:14:58,229 --> 01:14:56,000
as we go it's a complex

2028
01:14:59,350 --> 01:14:58,239
system and i think that adaptive caching

2029
01:15:01,110 --> 01:14:59,360
assembly is really

2030
01:15:02,390 --> 01:15:01,120
kind of the paramount thing that we've

2031
01:15:06,470 --> 01:15:02,400
done on this mission

2032
01:15:12,310 --> 01:15:09,510
okay and lira on linkedin

2033
01:15:13,990 --> 01:15:12,320
asks a question maybe this is a question

2034
01:15:16,070 --> 01:15:14,000
for ken or vivian

2035
01:15:23,189 --> 01:15:16,080
how will texture of these rocks be

2036
01:15:27,750 --> 01:15:25,110
sorry could you repeat the question how

2037
01:15:29,910 --> 01:15:27,760
will texture of these rocks be analyzed

2038
01:15:30,630 --> 01:15:29,920

if you use the abrasion tool i think you

2039
01:15:32,149 --> 01:15:30,640
know

2040
01:15:33,990 --> 01:15:32,159
how do you analyze it after you've

2041
01:15:37,350 --> 01:15:34,000
rubbed things away from it

2042
01:15:38,550 --> 01:15:37,360
ah okay yeah so we abrade off the

2043
01:15:41,669 --> 01:15:38,560
surface

2044
01:15:43,030 --> 01:15:41,679
we get rid of the sand and the dust and

2045
01:15:45,669 --> 01:15:43,040
the coatings

2046
01:15:47,830 --> 01:15:45,679
and then with compressed gas we blow all

2047
01:15:50,229 --> 01:15:47,840
of the tailings away

2048
01:15:51,990 --> 01:15:50,239
and so this would be it would not be

2049
01:15:53,910 --> 01:15:52,000
quite as polished as your countertop but

2050
01:15:55,350 --> 01:15:53,920
it is the same kind of idea it's a nice

2051
01:15:57,270 --> 01:15:55,360
flat surface

2052
01:15:58,870 --> 01:15:57,280
and it will be recessed below the

2053
01:16:00,149 --> 01:15:58,880
surface of the rock by maybe that much

2054
01:16:01,750 --> 01:16:00,159
so not very far

2055
01:16:03,990 --> 01:16:01,760
and then we bring the instruments in and

2056
01:16:06,390 --> 01:16:04,000
they look directly at this

2057
01:16:07,669 --> 01:16:06,400
new surface and this is exactly the way

2058
01:16:09,189 --> 01:16:07,679
these instruments were designed to

2059
01:16:10,630 --> 01:16:09,199
function it's what it's what we have

2060
01:16:11,350 --> 01:16:10,640
always been assuming that we would need

2061
01:16:15,030 --> 01:16:11,360
to do

2062
01:16:18,149 --> 01:16:15,040
to get rid of this confounding surfacial

2063
01:16:21,590 --> 01:16:19,830

okay we'll take one more question on

2064
01:16:23,270 --> 01:16:21,600
social media uh

2065
01:16:26,310 --> 01:16:23,280
i think that's probably a question for

2066
01:16:29,110 --> 01:16:26,320
jennifer ellazam on linkedin asks

2067
01:16:31,350 --> 01:16:29,120
how deep does the drilling process go

2068
01:16:33,110 --> 01:16:31,360
how many attempts do you have to drill

2069
01:16:36,790 --> 01:16:33,120
before the cutting tools become

2070
01:16:38,950 --> 01:16:36,800
dull great question

2071
01:16:39,990 --> 01:16:38,960
we we go down you know about five

2072
01:16:42,550 --> 01:16:40,000
centimeters and

2073
01:16:44,310 --> 01:16:42,560
in general we like to we have several

2074
01:16:45,669 --> 01:16:44,320
bits that we've take that we've brought

2075
01:16:47,430 --> 01:16:45,679
along with us

2076
01:16:49,350 --> 01:16:47,440
and we will look at the abrading bits

2077
01:16:50,390 --> 01:16:49,360
and we'll inspect them and we'll see it

2078
01:16:52,630 --> 01:16:50,400
really depends

2079
01:16:55,030 --> 01:16:52,640
on the kind of rocks we're up against if

2080
01:16:56,550 --> 01:16:55,040
we have very soft rocks a bit may last a

2081
01:16:58,550 --> 01:16:56,560
very long time

2082
01:17:00,790 --> 01:16:58,560
if we have very hard rocks you know we

2083
01:17:02,950 --> 01:17:00,800
may have have to change out the

2084
01:17:04,709 --> 01:17:02,960
braiding bits more frequently and so

2085
01:17:06,709 --> 01:17:04,719
that's something that we monitor

2086
01:17:08,070 --> 01:17:06,719
the team is very adaptable to those

2087
01:17:10,470 --> 01:17:08,080
types of things we

2088
01:17:11,590 --> 01:17:10,480

we basically have designed the system to

2089
01:17:14,550 --> 01:17:11,600
be able to manage

2090
01:17:16,070 --> 01:17:14,560
around whatever we find relative to the

2091
01:17:19,110 --> 01:17:16,080
bits and so

2092
01:17:21,110 --> 01:17:19,120
it i think time will tell how how we do

2093
01:17:23,510 --> 01:17:21,120
with that

2094
01:17:25,590 --> 01:17:23,520
okay there's much more mission ahead and

2095
01:17:27,430 --> 01:17:25,600
so we're going to wrap this briefing

2096
01:17:29,510 --> 01:17:27,440
if you want more information about the

2097
01:17:30,550 --> 01:17:29,520
perseverance rover we've got plenty of

2098
01:17:34,630 --> 01:17:30,560
it online

2099
01:17:37,990 --> 01:17:34,640
you can go to nasa.gov perseverance

2100
01:17:39,910 --> 01:17:38,000
and mars.nasa.gov perseverance

2101
01:17:41,669 --> 01:17:39,920
the rover is also constantly sending

2102
01:17:43,709 --> 01:17:41,679
down raw images to us

2103
01:17:45,590 --> 01:17:43,719
and you can check that out at

2104
01:17:49,270 --> 01:17:45,600
go.nasa.gov

2105
01:17:50,870 --> 01:17:49,280
perseverance dash raw dash images

2106
01:17:52,790 --> 01:17:50,880
you can also follow our journey on

2107
01:17:55,189 --> 01:17:52,800
social media at

2108
01:17:55,990 --> 01:17:55,199
nasa persevere thanks very much for