1
00:01:10,789 --> 00:00:54,150
[Music]

2
00:01:15,910 --> 00:01:12,789
welcome to nasa's jet propulsion

3
00:01:18,469 --> 00:01:15,920
laboratory in southern california days

4
00:01:21,749 --> 00:01:18,479
ago nasa's most sophisticated and

5
00:01:23,670 --> 00:01:21,759
capable rover to date landed on mars the

6
00:01:27,270 --> 00:01:23,680
perseverance rover

7
00:01:30,390 --> 00:01:27,280
today we'll see mars like never before

8
00:01:32,550 --> 00:01:30,400
with new photos and videos

9
00:01:34,789 --> 00:01:32,560
our panel today will help us understand

10
00:01:37,510 --> 00:01:34,799
how perseverance captured what it's like

11
00:01:39,030 --> 00:01:37,520
to land on mars and what the landing

12
00:01:42,069 --> 00:01:39,040
site looks like

13
00:01:43,590 --> 00:01:42,079

i'm your host raquel villanueva and

14
00:01:46,310 --> 00:01:43,600
joining us is

15
00:01:47,749 --> 00:01:46,320
matt wallace perseverance deputy project

16
00:01:50,469 --> 00:01:47,759
manager

17
00:01:53,109 --> 00:01:50,479
dave gruel perseverance entry descent

18
00:01:56,230 --> 00:01:53,119
and landing camera suite lead

19
00:01:57,749 --> 00:01:56,240
al chen perseverance entry descent and

20
00:02:00,469 --> 00:01:57,759
landing lead

21
00:02:03,109 --> 00:02:00,479
justin mackey perseverance imaging

22
00:02:04,469 --> 00:02:03,119
scientist and instrument operations team

23
00:02:07,190 --> 00:02:04,479
chief

24
00:02:08,869 --> 00:02:07,200
jessica samuels perseverance surface

25
00:02:11,670 --> 00:02:08,879
mission manager

26
00:02:13,510 --> 00:02:11,680
ken williford perseverance deputy

27
00:02:16,150 --> 00:02:13,520
project scientist

28
00:02:18,390 --> 00:02:16,160
and to tell us what this all means for

29
00:02:21,270 --> 00:02:18,400
nasa and exploration

30
00:02:24,869 --> 00:02:21,280
thomas zurbukin associate administrator

31
00:02:26,390 --> 00:02:24,879
for nasa's science mission directorate

32
00:02:29,030 --> 00:02:26,400
we will take questions during this

33
00:02:31,670 --> 00:02:29,040
briefing if you're a member of the media

34
00:02:33,830 --> 00:02:31,680
on the phone lines press star one to be

35
00:02:37,830 --> 00:02:33,840
put in the queue if you're on social

36
00:02:41,110 --> 00:02:37,840
media use the hashtag countdown to mars

37
00:02:43,910 --> 00:02:41,120
now to get us started is jpl director

38
00:02:54,390 --> 00:02:43,920

mike watkins now i will step aside for

39
00:02:58,149 --> 00:02:55,350
thank you

40
00:02:59,910 --> 00:02:58,159
welcome back to jpl we have a jam-packed

41
00:03:01,509 --> 00:02:59,920
press conference today and i was just

42
00:03:02,790 --> 00:03:01,519
looking at uh at the team here i think

43
00:03:05,030 --> 00:03:02,800
we're trying to add it up maybe a

44
00:03:07,990 --> 00:03:05,040
hundred years of combined experience

45
00:03:10,470 --> 00:03:08,000
with mars rovers on the panel today

46
00:03:12,309 --> 00:03:10,480
now we have been working very hard

47
00:03:13,910 --> 00:03:12,319
since we landed the surface team has

48
00:03:15,509 --> 00:03:13,920
been getting the rover set up for the

49
00:03:17,589 --> 00:03:15,519
surface mission they've been working

50
00:03:19,509 --> 00:03:17,599
mars time over the weekend

51
00:03:21,110 --> 00:03:19,519
making fantastic progress and you'll

52
00:03:22,550 --> 00:03:21,120
hear about that today

53
00:03:24,229 --> 00:03:22,560
you'll also see some brand new images

54
00:03:25,190 --> 00:03:24,239
and videos that we acquired over the

55
00:03:29,030 --> 00:03:25,200
weekend

56
00:03:30,710 --> 00:03:29,040
and these are really fantastic images of

57
00:03:32,789 --> 00:03:30,720
the surface of mars

58
00:03:37,350 --> 00:03:32,799
and the rest of the descent imagery that

59
00:03:38,630 --> 00:03:37,360
um that we got a preview of uh on friday

60
00:03:39,990 --> 00:03:38,640
these images

61
00:03:43,589 --> 00:03:40,000
have always been part of the history of

62
00:03:45,430 --> 00:03:43,599
jpl uh we have taken everyone along with

63
00:03:47,350 --> 00:03:45,440

us on our journeys across the solar

64
00:03:49,270 --> 00:03:47,360
system through the rings of saturn

65
00:03:51,030 --> 00:03:49,280
looking back at the pale blue dot and

66
00:03:52,070 --> 00:03:51,040
incredible panoramas on the surface of

67
00:03:54,070 --> 00:03:52,080
mars

68
00:03:55,509 --> 00:03:54,080
this is the first time we've been able

69
00:03:57,350 --> 00:03:55,519
to actually capture

70
00:03:58,949 --> 00:03:57,360
an event like the landing of a

71
00:04:01,110 --> 00:03:58,959
spacecraft on mars

72
00:04:03,270 --> 00:04:01,120
and these are pretty cool videos

73
00:04:04,550 --> 00:04:03,280
and we will learn something by looking

74
00:04:06,949 --> 00:04:04,560
at the performance of the vehicle in

75
00:04:09,509 --> 00:04:06,959
these videos but a lot of it is also to

76
00:04:11,509 --> 00:04:09,519
bring you along uh on our journey our

77
00:04:13,190 --> 00:04:11,519
touchdown to mars and of course our

78
00:04:15,910 --> 00:04:13,200
surface mission as well

79
00:04:18,310 --> 00:04:15,920
and these are really amazing videos

80
00:04:20,789 --> 00:04:18,320
uh we all binge watched them over the

81
00:04:22,629 --> 00:04:20,799
weekend if you can call a one-minute

82
00:04:24,230 --> 00:04:22,639
video binge watching but uh

83
00:04:25,749 --> 00:04:24,240
but we watched it many many times and

84
00:04:27,430 --> 00:04:25,759
it's really fantastic

85
00:04:29,350 --> 00:04:27,440
and uh just to show you how far we've

86
00:04:30,710 --> 00:04:29,360
come in history of jpl i want to show

87
00:04:32,710 --> 00:04:30,720
one image

88
00:04:34,870 --> 00:04:32,720

this is from mariner 4

89
00:04:37,749 --> 00:04:34,880
in 1965.

90
00:04:39,670 --> 00:04:37,759
so this was actually the first data

91
00:04:42,150 --> 00:04:39,680
first images sent back from mars by

92
00:04:43,909 --> 00:04:42,160
mariner 4 and that was hand colored by

93
00:04:46,870 --> 00:04:43,919
the engineers according to a code kind

94
00:04:48,390 --> 00:04:46,880
of like a paint by numbers uh painting

95
00:04:50,950 --> 00:04:48,400
and that's there it is the first color

96
00:04:53,270 --> 00:04:50,960
color image hand painted and so when you

97
00:04:54,790 --> 00:04:53,280
see these videos later uh i think dave

98
00:04:56,710 --> 00:04:54,800
gruel and justin mackey will be

99
00:04:58,629 --> 00:04:56,720
overjoyed that they didn't have to hand

100
00:05:00,070 --> 00:04:58,639
color each one of these

101
00:05:01,749 --> 00:05:00,080
one of these images

102
00:05:03,510 --> 00:05:01,759
so my hat is off it's a great press

103
00:05:05,590 --> 00:05:03,520
conference today my head is off to the

104
00:05:07,590 --> 00:05:05,600
team you know for getting the rover to

105
00:05:09,670 --> 00:05:07,600
where we are and these fantastic images

106
00:05:11,749 --> 00:05:09,680
down and to learn more about that team

107
00:05:13,189 --> 00:05:11,759
let me introduce matt wallace

108
00:05:16,310 --> 00:05:13,199
thanks very much mike and thanks for the

109
00:05:17,590 --> 00:05:16,320
nice words about the uh the the team

110
00:05:19,670 --> 00:05:17,600
i'll try to be brief because i want to

111
00:05:21,189 --> 00:05:19,680
get to this video and i know you do too

112
00:05:22,710 --> 00:05:21,199
um i just want to give you a little bit

113
00:05:24,550 --> 00:05:22,720

of background on how this whole thing

114
00:05:27,909 --> 00:05:24,560
started

115
00:05:29,749 --> 00:05:27,919
my daughter is a gymnast she's been a

116
00:05:31,189 --> 00:05:29,759
gymnast since she was

117
00:05:33,189 --> 00:05:31,199
a little kid

118
00:05:35,749 --> 00:05:33,199
and when she was about

119
00:05:37,749 --> 00:05:35,759
i guess 11 years old and the project was

120
00:05:41,110 --> 00:05:37,759
still in formulation she asked me for

121
00:05:43,590 --> 00:05:41,120
one of those little sports cameras

122
00:05:45,830 --> 00:05:43,600
and being the indulgent parent i am i i

123
00:05:48,070 --> 00:05:45,840
got her the sports camera and she put it

124
00:05:50,310 --> 00:05:48,080
in the harness that it came with

125
00:05:52,790 --> 00:05:50,320
and she put the harness on

126
00:05:55,590 --> 00:05:52,800
and she did a backflip

127
00:05:59,270 --> 00:05:55,600
and uh i i don't know about you

128
00:06:00,309 --> 00:05:59,280
but uh i cannot do a backflip

129
00:06:02,469 --> 00:06:00,319
but when

130
00:06:04,710 --> 00:06:02,479
she showed me the video

131
00:06:07,830 --> 00:06:04,720
and i watched that camera

132
00:06:10,710 --> 00:06:07,840
pan up to the ceiling and then

133
00:06:13,830 --> 00:06:10,720
the room go upside down and then somehow

134
00:06:17,590 --> 00:06:13,840
write itself as she landed on her feet

135
00:06:19,590 --> 00:06:17,600
um you know i felt for a moment

136
00:06:22,790 --> 00:06:19,600
that i had a glimpse into what it would

137
00:06:23,670 --> 00:06:22,800
be like if i could do a backflip

138
00:06:25,909 --> 00:06:23,680

and

139
00:06:28,550 --> 00:06:25,919
that was the moment that inspired a

140
00:06:30,870 --> 00:06:28,560
phone call to my friend dave gruel over

141
00:06:36,950 --> 00:06:34,550
and that's what led to this system this

142
00:06:39,909 --> 00:06:36,960
entry descent and landing camera system

143
00:06:41,670 --> 00:06:39,919
we call them the edl cams

144
00:06:44,150 --> 00:06:41,680
that you're about to see

145
00:06:46,469 --> 00:06:44,160
the product of here just just in a

146
00:06:49,029 --> 00:06:46,479
moment

147
00:06:52,469 --> 00:06:49,039
now i don't know about you

148
00:06:54,390 --> 00:06:52,479
but uh it is unlikely at this point my

149
00:06:56,629 --> 00:06:54,400
career that i will

150
00:07:00,150 --> 00:06:56,639
pilot a spacecraft down to the surface

151
00:07:04,150 --> 00:07:03,270
but when you see this imagery

152
00:07:05,990 --> 00:07:04,160
uh

153
00:07:08,309 --> 00:07:06,000
i think you will feel like you are

154
00:07:09,270 --> 00:07:08,319
getting a glimpse into what it would be

155
00:07:12,390 --> 00:07:09,280
like

156
00:07:14,870 --> 00:07:12,400
to land successfully in jezreel cradle

157
00:07:17,830 --> 00:07:14,880
crater with perseverance

158
00:07:19,189 --> 00:07:17,840
and so without any further delay i'm

159
00:07:20,950 --> 00:07:19,199
going to turn it over to dave who'll

160
00:07:23,110 --> 00:07:20,960
describe the system and we'll get to the

161
00:07:25,270 --> 00:07:23,120
video thanks great

162
00:07:27,670 --> 00:07:25,280
thanks matt um

163
00:07:30,790 --> 00:07:27,680

the idea of adding a ruggedized

164
00:07:33,510 --> 00:07:30,800
commercial off the shelf hardware onto a

165
00:07:34,550 --> 00:07:33,520
flagship spacecraft to do a nice to have

166
00:07:36,230 --> 00:07:34,560
function

167
00:07:39,110 --> 00:07:36,240
proved to be quite an interesting

168
00:07:41,189 --> 00:07:39,120
challenge that matt handed over to us

169
00:07:43,270 --> 00:07:41,199
along the way we encountered one

170
00:07:45,270 --> 00:07:43,280
maybe two people who

171
00:07:46,629 --> 00:07:45,280
were a little bit skeptical of what we

172
00:07:48,390 --> 00:07:46,639
were trying to do

173
00:07:51,189 --> 00:07:48,400
but thankfully we had the full support

174
00:07:53,830 --> 00:07:51,199
of project leadership um all the

175
00:07:54,869 --> 00:07:53,840
individuals directly supporting the 2020

176
00:07:56,710 --> 00:07:54,879
mission

177
00:07:58,550 --> 00:07:56,720
were super excited to help and in the

178
00:08:00,710 --> 00:07:58,560
end we were able to actually make it

179
00:08:02,390 --> 00:08:00,720
happen

180
00:08:05,110 --> 00:08:02,400
our edl cam team

181
00:08:06,150 --> 00:08:05,120
were guided by uh two two requirements

182
00:08:08,070 --> 00:08:06,160
if you will

183
00:08:10,469 --> 00:08:08,080
um the first one was that the entry

184
00:08:14,230 --> 00:08:10,479
descent and landing system camera system

185
00:08:15,670 --> 00:08:14,240
must do no harm to the flight vehicle

186
00:08:16,869 --> 00:08:15,680
and that's especially important during

187
00:08:19,029 --> 00:08:16,879
edl

188
00:08:21,510 --> 00:08:19,039

this was our one critical requirement

189
00:08:23,670 --> 00:08:21,520
and as you all saw last thursday

190
00:08:25,670 --> 00:08:23,680
that requirement was met

191
00:08:28,070 --> 00:08:25,680
the second item is not so much as of a

192
00:08:30,950 --> 00:08:28,080
requirement as it is a mantra if you

193
00:08:32,310 --> 00:08:30,960
will we get what we get and we don't get

194
00:08:34,709 --> 00:08:32,320
upset

195
00:08:36,949 --> 00:08:34,719
we wanted our edl cam system to get onto

196
00:08:40,230 --> 00:08:36,959
the vehicle and return amazing imagery

197
00:08:42,630 --> 00:08:40,240
of the vehicle landing in uh jezreel

198
00:08:44,630 --> 00:08:42,640
crater on mars

199
00:08:47,670 --> 00:08:44,640
like every other element on the mars

200
00:08:49,509 --> 00:08:47,680
2020 spacecraft individuals worked

201
00:08:51,269 --> 00:08:49,519
really hard and went above and beyond to

202
00:08:53,269 --> 00:08:51,279
make sure that their piece of the

203
00:08:55,670 --> 00:08:53,279
spacecraft did what it was supposed to

204
00:08:57,910 --> 00:08:55,680
do and would be successful

205
00:09:00,870 --> 00:08:57,920
but in the end we knew that our entry

206
00:09:02,630 --> 00:09:00,880
descent and landing camera system

207
00:09:04,949 --> 00:09:02,640
the mission could still be 100

208
00:09:05,750 --> 00:09:04,959
successful if our camera system didn't

209
00:09:07,829 --> 00:09:05,760
work

210
00:09:10,389 --> 00:09:07,839
and if we could even get just one image

211
00:09:11,430 --> 00:09:10,399
or one piece of information back during

212
00:09:12,630 --> 00:09:11,440
edl

213
00:09:14,710 --> 00:09:12,640

that we shouldn't get upset and we

214
00:09:17,030 --> 00:09:14,720
should be excited

215
00:09:19,750 --> 00:09:17,040
so as you probably realize after last

216
00:09:21,430 --> 00:09:19,760
friday's press conference

217
00:09:23,829 --> 00:09:21,440
the ddo cam system

218
00:09:25,590 --> 00:09:23,839
successfully captured some amazing

219
00:09:27,990 --> 00:09:25,600
imagery of the vehicle's descent and

220
00:09:30,790 --> 00:09:28,000
landing on the surface of mars

221
00:09:32,630 --> 00:09:30,800
we collected a little over 30 gigabytes

222
00:09:36,790 --> 00:09:32,640
of information

223
00:09:40,710 --> 00:09:36,800
and over 23 000 images of the vehicle

224
00:09:42,470 --> 00:09:40,720
descending down to the surface of mars

225
00:09:44,230 --> 00:09:42,480
as a quick introduction if i could have

226
00:09:46,949 --> 00:09:44,240
the first graphic a reminder for some of

227
00:09:48,949 --> 00:09:46,959
you exactly what are the sensors that we

228
00:09:50,630 --> 00:09:48,959
included in the entry descent and

229
00:09:52,470 --> 00:09:50,640
landing camera system

230
00:09:54,550 --> 00:09:52,480
uh there are three cameras that are

231
00:09:55,829 --> 00:09:54,560
located on the top of the vehicle on the

232
00:09:58,070 --> 00:09:55,839
back shell

233
00:09:58,870 --> 00:09:58,080
uh those cameras actually capture a high

234
00:10:01,430 --> 00:09:58,880
rate

235
00:10:03,030 --> 00:10:01,440
75 frames a second imagery of the

236
00:10:04,470 --> 00:10:03,040
parachute inflating in the martian

237
00:10:06,710 --> 00:10:04,480
atmosphere

238
00:10:08,710 --> 00:10:06,720

now one of the cameras stopped operating

239
00:10:10,710 --> 00:10:08,720
coincident with the mortar fire when the

240
00:10:11,829 --> 00:10:10,720
parachute was deployed and that's to be

241
00:10:14,630 --> 00:10:11,839
expected

242
00:10:16,069 --> 00:10:14,640
it is a very high dynamic environment

243
00:10:17,829 --> 00:10:16,079
but luckily the other two cameras

244
00:10:20,069 --> 00:10:17,839
continue to operate as expected and

245
00:10:21,750 --> 00:10:20,079
captured some amazing footage of the

246
00:10:23,030 --> 00:10:21,760
parachutes inflating in that martian

247
00:10:24,790 --> 00:10:23,040
atmosphere

248
00:10:26,230 --> 00:10:24,800
we put one camera on the bottom of the

249
00:10:28,550 --> 00:10:26,240
descent stage

250
00:10:31,829 --> 00:10:28,560
that camera looked down on the rover

251
00:10:33,670 --> 00:10:31,839
as we lowered the rover on the bridles

252
00:10:34,870 --> 00:10:33,680
the mobility system latched into

253
00:10:36,790 --> 00:10:34,880
position

254
00:10:38,310 --> 00:10:36,800
and then the vehicle touched down onto

255
00:10:40,550 --> 00:10:38,320
the surface of mars

256
00:10:42,790 --> 00:10:40,560
we also installed two cameras onto the

257
00:10:44,630 --> 00:10:42,800
rover one on the top of the vehicle

258
00:10:46,630 --> 00:10:44,640
looking up on the descent stage so the

259
00:10:47,509 --> 00:10:46,640
rover could actually see the descent

260
00:10:49,829 --> 00:10:47,519
stage

261
00:10:52,630 --> 00:10:49,839
lower it down to the surface and then

262
00:10:54,230 --> 00:10:52,640
ideally fly off into the distance after

263
00:10:56,310 --> 00:10:54,240

it had delivered perseverance safely

264
00:10:58,550 --> 00:10:56,320
under the surface and then we also put a

265
00:11:00,150 --> 00:10:58,560
camera on the bottom of the rover which

266
00:11:02,069 --> 00:11:00,160
actually looked down on the surface of

267
00:11:04,069 --> 00:11:02,079
mars once the heat shield was dropped

268
00:11:05,910 --> 00:11:04,079
away and that camera continued to

269
00:11:08,389 --> 00:11:05,920
capture imagery until the vehicle

270
00:11:10,470 --> 00:11:08,399
touched down on the surface of mars

271
00:11:12,069 --> 00:11:10,480
and then we also put a microphone on the

272
00:11:14,949 --> 00:11:12,079
port side of

273
00:11:17,430 --> 00:11:14,959
the rover now unfortunately i do have to

274
00:11:19,190 --> 00:11:17,440
say that we did not collect any audio

275
00:11:21,430 --> 00:11:19,200
during edl

276
00:11:23,190 --> 00:11:21,440
but uh please stay tuned a little bit

277
00:11:24,710 --> 00:11:23,200
later in this press conference because

278
00:11:28,550 --> 00:11:24,720
we do have some exciting information

279
00:11:31,030 --> 00:11:28,560
about uh the edl cam microphone

280
00:11:33,110 --> 00:11:31,040
so now the reaction to the edl cam

281
00:11:36,069 --> 00:11:33,120
videos has been absolutely amazing

282
00:11:38,389 --> 00:11:36,079
around jpl and

283
00:11:40,630 --> 00:11:38,399
we are super excited to actually share

284
00:11:42,550 --> 00:11:40,640
with all of you video imagery of

285
00:11:44,069 --> 00:11:42,560
perseverance landing on the surface of

286
00:11:46,230 --> 00:11:44,079
mars

287
00:11:48,069 --> 00:11:46,240
please roll the video

288
00:11:49,750 --> 00:11:48,079

starting the straighten up and fly right

289
00:11:52,069 --> 00:11:49,760
maneuver where the spacecraft will

290
00:11:54,230 --> 00:11:52,079
jettison the entry balance masses in

291
00:11:55,910 --> 00:11:54,240
preparation for parachute deploy and to

292
00:11:59,670 --> 00:11:55,920
roll over to give the radar a better

293
00:12:05,190 --> 00:12:02,949
applicator indicate shoot deploy

294
00:12:06,949 --> 00:12:05,200
the navigation has confirmed that the

295
00:12:09,110 --> 00:12:06,959
parachute has deployed and we are seeing

296
00:12:11,190 --> 00:12:09,120
significant deceleration

297
00:12:14,069 --> 00:12:11,200
in the velocity our current velocity is

298
00:12:15,910 --> 00:12:14,079
450 meters per second at an altitude of

299
00:12:18,710 --> 00:12:15,920
about 12 kilometers from the surface of

300
00:12:22,710 --> 00:12:20,310
heat shields up

301
00:12:24,069 --> 00:12:22,720
press advance has now slowed to subsonic

302
00:12:27,030 --> 00:12:24,079
speeds and the heat shield has been

303
00:12:29,190 --> 00:12:27,040
separated this allows both the radar and

304
00:12:32,150 --> 00:12:29,200
the cameras to get their first look at

305
00:12:33,750 --> 00:12:32,160
the surface current velocity is 145

306
00:12:36,310 --> 00:12:33,760
meters per second and an altitude of

307
00:12:53,269 --> 00:12:36,320
about 10 km nine and a half kilometers

308
00:12:59,030 --> 00:12:55,590
now filter converge velocity solution

309
00:13:01,030 --> 00:12:59,040
3.3 meters per second altitude 7.4

310
00:13:03,269 --> 00:13:01,040
kilometers now has radar lock on the

311
00:13:05,590 --> 00:13:03,279
ground current velocity is about 100

312
00:13:11,590 --> 00:13:05,600
meters per second

313
00:13:16,790 --> 00:13:13,509

perseverance is continuing to descend on

314
00:13:18,710 --> 00:13:16,800
the parachute we are coming up on

315
00:13:21,430 --> 00:13:18,720
the initialization of terrain relative

316
00:13:22,790 --> 00:13:21,440
navigation and subsequently the priming

317
00:13:25,910 --> 00:13:22,800
of the landing engines our current

318
00:13:32,870 --> 00:13:25,920
velocity is about 90 meters per second

319
00:13:36,870 --> 00:13:35,269
ovf salad we have confirmation that the

320
00:13:39,110 --> 00:13:36,880
land of vision system has produced a

321
00:13:41,590 --> 00:13:39,120
valid solution and part of touring

322
00:13:43,670 --> 00:13:41,600
relative navigation priming

323
00:13:51,509 --> 00:13:43,680
pba is nominal

324
00:13:57,509 --> 00:13:54,629
back shelf current velocity is 83 meters

325
00:13:59,670 --> 00:13:57,519
per second at about 2.6 kilometers from

326
00:14:02,230 --> 00:13:59,680
the surface to mars we have confirmation

327
00:14:04,470 --> 00:14:02,240
that the back shell has separated we are

328
00:14:06,550 --> 00:14:04,480
currently performing the divert maneuver

329
00:14:08,790 --> 00:14:06,560
current velocity is about 75 meters per

330
00:14:11,509 --> 00:14:08,800
second and an altitude of about a

331
00:14:14,470 --> 00:14:11,519
kilometer off the surface of mars

332
00:14:16,629 --> 00:14:14,480
here in safety bravo

333
00:14:17,990 --> 00:14:16,639
we have completed our terrain relative

334
00:14:19,590 --> 00:14:18,000
navigation

335
00:14:21,590 --> 00:14:19,600
current speed is about

336
00:14:27,030 --> 00:14:21,600
30 meters per second altitude of about

337
00:14:31,269 --> 00:14:29,350
we have started our constant velocity

338
00:14:33,189 --> 00:14:31,279

accordion which means we are conducting

339
00:14:34,389 --> 00:14:33,199
the sky crane

340
00:14:37,910 --> 00:14:34,399
about to conduct the flight crane

341
00:14:37,920 --> 00:14:41,590
skyteam maneuver has started

342
00:14:41,600 --> 00:14:49,750
about 20 meters off the surface

343
00:14:54,949 --> 00:14:52,790
we're getting signals from mro

344
00:14:57,990 --> 00:14:54,959
tango delta

345
00:14:59,590 --> 00:14:58,000
confirmed perseverance carefully on the

346
00:15:01,670 --> 00:14:59,600
surface of mars

347
00:15:03,070 --> 00:15:01,680
ready to begin seeking the stands of

348
00:15:13,030 --> 00:15:03,080
past life

349
00:15:17,189 --> 00:15:15,189
it gives me goof bumps every time i i

350
00:15:19,670 --> 00:15:17,199
see it just just amazing i hope

351
00:15:21,269 --> 00:15:19,680
everybody kept their uh hands and arms

352
00:15:22,870 --> 00:15:21,279
inside the vehicle at all times while i

353
00:15:25,350 --> 00:15:22,880
was in motion

354
00:15:26,790 --> 00:15:25,360
um so i do need to say uh i wouldn't be

355
00:15:30,310 --> 00:15:26,800
sitting at this podium and you wouldn't

356
00:15:32,790 --> 00:15:30,320
have all seen that uh amazing imagery

357
00:15:34,870 --> 00:15:32,800
uh without a a a lot of support from an

358
00:15:37,030 --> 00:15:34,880
amazing team and both those who work

359
00:15:39,189 --> 00:15:37,040
directly on the edl cam task as well as

360
00:15:41,269 --> 00:15:39,199
those who supported us uh across the

361
00:15:43,110 --> 00:15:41,279
project i thank you for everything

362
00:15:45,670 --> 00:15:43,120
you've done to get us here today uh just

363
00:15:48,629 --> 00:15:45,680

an amazing amazing accomplishment so

364
00:15:50,310 --> 00:15:48,639
um i'm gonna turn over to al al is gonna

365
00:15:51,749 --> 00:15:50,320
be our color analyst doesn't have a

366
00:15:52,949 --> 00:15:51,759
telestrator but he's gonna actually walk

367
00:15:55,430 --> 00:15:52,959
through some of those videos in even

368
00:15:56,870 --> 00:15:55,440
more detail and actually show you some

369
00:15:58,230 --> 00:15:56,880
just incredible things that you can

370
00:16:00,230 --> 00:15:58,240
actually see once you look at those

371
00:16:01,990 --> 00:16:00,240
videos over and over

372
00:16:03,509 --> 00:16:02,000
i'm not sure the color commentator is

373
00:16:04,949 --> 00:16:03,519
supposed to have as many chills as i do

374
00:16:06,870 --> 00:16:04,959
right now and every time i see these

375
00:16:09,430 --> 00:16:06,880
videos but i wanted to add my thanks to

376
00:16:10,949 --> 00:16:09,440
the el camera team i mean these videos

377
00:16:12,710 --> 00:16:10,959
and these images are the stuff of our

378
00:16:15,189 --> 00:16:12,720
dreams it's been the what we've been

379
00:16:17,030 --> 00:16:15,199
dreaming about for years so thank you so

380
00:16:18,870 --> 00:16:17,040
much

381
00:16:20,629 --> 00:16:18,880
um let's see uh

382
00:16:22,470 --> 00:16:20,639
as uh as dave mentioned we'll try to

383
00:16:24,710 --> 00:16:22,480
walk through what we see a little bit we

384
00:16:26,150 --> 00:16:24,720
won't take that much time because uh we

385
00:16:28,230 --> 00:16:26,160
could spend literally all day looking at

386
00:16:29,670 --> 00:16:28,240
these videos and some of us have

387
00:16:31,189 --> 00:16:29,680
spent all the weekend looking at these

388
00:16:32,629 --> 00:16:31,199

videos but we'll just try to show you

389
00:16:34,790 --> 00:16:32,639
some highlights of what we've been

390
00:16:36,550 --> 00:16:34,800
seeing and invite you all to continue to

391
00:16:37,829 --> 00:16:36,560
look for more things as we kind of see

392
00:16:39,189 --> 00:16:37,839
new things every time we look at these

393
00:16:40,870 --> 00:16:39,199
videos

394
00:16:42,470 --> 00:16:40,880
so let's start with the parachute upload

395
00:16:44,150 --> 00:16:42,480
camera and let me give you a quick

396
00:16:47,110 --> 00:16:44,160
warning to not blink

397
00:16:48,629 --> 00:16:47,120
because things go really fast here

398
00:16:50,150 --> 00:16:48,639
you can see that you can get a sense

399
00:16:52,470 --> 00:16:50,160
really of how violent that parachute

400
00:16:54,710 --> 00:16:52,480
deploy and inflation are the parachute

401
00:16:56,710 --> 00:16:54,720
pack it's the parachute is packed so

402
00:16:58,550 --> 00:16:56,720
densely that the pack is basically the

403
00:17:00,870 --> 00:16:58,560
same density as oak

404
00:17:02,629 --> 00:17:00,880
and it's about 150 pounds

405
00:17:03,990 --> 00:17:02,639
it gets launched out of the spacecraft

406
00:17:05,990 --> 00:17:04,000
with a mortar which is basically a

407
00:17:08,069 --> 00:17:06,000
cannon with a muzzle velocity of around

408
00:17:09,590 --> 00:17:08,079
100 miles an hour and the spacecraft

409
00:17:11,029 --> 00:17:09,600
itself was going about a thousand miles

410
00:17:13,590 --> 00:17:11,039
an hour at this point uh going about

411
00:17:15,029 --> 00:17:13,600
1.75 times the speed of sound

412
00:17:17,029 --> 00:17:15,039
so just in case you blink let's show you

413
00:17:19,350 --> 00:17:17,039

that one more time you kind of see that

414
00:17:21,510 --> 00:17:19,360
in uh in high speed and then or real

415
00:17:24,069 --> 00:17:21,520
time and then we'll slow it down

416
00:17:25,829 --> 00:17:24,079
and take a look at the details

417
00:17:27,750 --> 00:17:25,839
okay so let's try to walk through this a

418
00:17:29,350 --> 00:17:27,760
bit slower uh this time at about quarter

419
00:17:31,029 --> 00:17:29,360
speed and we'll pause at times to point

420
00:17:33,590 --> 00:17:31,039
out things we see

421
00:17:35,110 --> 00:17:33,600
so let's start that rolling

422
00:17:36,789 --> 00:17:35,120
okay here you can see the pack getting

423
00:17:38,470 --> 00:17:36,799
pushed out of there you can kind of see

424
00:17:40,870 --> 00:17:38,480
the pack right in the middle uh as it's

425
00:17:42,549 --> 00:17:40,880
being pushed uh and the uh

426
00:17:43,990 --> 00:17:42,559
the parachute lid which is right on top

427
00:17:45,430 --> 00:17:44,000
of it it's kind of that circle to the

428
00:17:47,830 --> 00:17:45,440
left of the pack

429
00:17:49,750 --> 00:17:47,840
was on top of the pack and it was there

430
00:17:51,110 --> 00:17:49,760
to protect the parachute during entry

431
00:17:53,029 --> 00:17:51,120
it's got some thermal protection system

432
00:17:55,110 --> 00:17:53,039
material on it to keep the parachute

433
00:17:56,710 --> 00:17:55,120
nice and cool and protected and the pack

434
00:17:59,110 --> 00:17:56,720
is used to push that lid right off the

435
00:18:00,710 --> 00:17:59,120
vehicle given that cannon force you can

436
00:18:02,549 --> 00:18:00,720
also see some of the other things that

437
00:18:04,470 --> 00:18:02,559
have popped off of that lid which is

438
00:18:06,870 --> 00:18:04,480

kind of expected given how violent this

439
00:18:09,990 --> 00:18:06,880
uh this launch really is

440
00:18:11,270 --> 00:18:10,000
so let's move on from here

441
00:18:13,110 --> 00:18:11,280
so we keep going out here you can see

442
00:18:14,310 --> 00:18:13,120
the pack reach what we call line stretch

443
00:18:15,510 --> 00:18:14,320
so that's as far as it's going to go

444
00:18:16,789 --> 00:18:15,520
it's where the parachute is going to

445
00:18:18,549 --> 00:18:16,799
start inflating

446
00:18:20,150 --> 00:18:18,559
that's about 150 feet behind the

447
00:18:21,990 --> 00:18:20,160
spacecraft and it got there in just

448
00:18:23,750 --> 00:18:22,000
under one second so this pack is really

449
00:18:25,190 --> 00:18:23,760
moving

450
00:18:26,390 --> 00:18:25,200
that's pretty much as the parachute

451
00:18:28,230 --> 00:18:26,400
starts to come out you can see the pack

452
00:18:30,549 --> 00:18:28,240
is rotated about 90 degrees that's

453
00:18:31,990 --> 00:18:30,559
pretty common we've seen that in some of

454
00:18:33,750 --> 00:18:32,000
our testing here on earth at high

455
00:18:34,950 --> 00:18:33,760
altitude as well

456
00:18:37,430 --> 00:18:34,960
so let's keep going and take a look at

457
00:18:39,190 --> 00:18:37,440
the inflation

458
00:18:40,789 --> 00:18:39,200
side inflation really looks textbook

459
00:18:42,310 --> 00:18:40,799
it's nice and symmetric

460
00:18:44,950 --> 00:18:42,320
the parachute opens in only about seven

461
00:18:46,310 --> 00:18:44,960
tenths of a second again really fast

462
00:18:47,669 --> 00:18:46,320
there's no evidence of tangling of the

463
00:18:49,830 --> 00:18:47,679

lines which is great

464
00:18:51,990 --> 00:18:49,840
that's uh there's about two miles of

465
00:18:53,270 --> 00:18:52,000
lines in the parachute system so the

466
00:18:54,470 --> 00:18:53,280
fact that we don't see any evidence of

467
00:18:55,669 --> 00:18:54,480
tangling or any kind of other

468
00:18:57,430 --> 00:18:55,679
misbehavior

469
00:18:59,669 --> 00:18:57,440
is great news and i'm sure we'll be

470
00:19:01,909 --> 00:18:59,679
studying this video for many many years

471
00:19:03,430 --> 00:19:01,919
and picking it apart frame by frame and

472
00:19:05,990 --> 00:19:03,440
of course we have a second camera on

473
00:19:08,950 --> 00:19:06,000
board as well that recorded this this

474
00:19:10,630 --> 00:19:08,960
launch and inflation of the parachute

475
00:19:12,630 --> 00:19:10,640
um you might notice the pattern that's

476
00:19:13,909 --> 00:19:12,640
on the the parachute here the sync

477
00:19:15,590 --> 00:19:13,919
patterns are useful in helping us

478
00:19:17,590 --> 00:19:15,600
determine the clocking or orientation of

479
00:19:19,350 --> 00:19:17,600
the parachute also the contrasting

480
00:19:21,190 --> 00:19:19,360
sections can be useful in tracking

481
00:19:22,390 --> 00:19:21,200
different positions of the parachute

482
00:19:23,750 --> 00:19:22,400
different portions of the parachute as

483
00:19:25,750 --> 00:19:23,760
it inflates

484
00:19:27,110 --> 00:19:25,760
so it's especially useful when we have

485
00:19:28,310 --> 00:19:27,120
multiple cameras as we do here and

486
00:19:30,150 --> 00:19:28,320
they're trying to track features in the

487
00:19:31,830 --> 00:19:30,160
parachute inflating

488
00:19:33,510 --> 00:19:31,840

in addition to enabling incredible

489
00:19:35,590 --> 00:19:33,520
science we hope our efforts and our

490
00:19:37,110 --> 00:19:35,600
engineering can inspire others

491
00:19:39,430 --> 00:19:37,120
sometimes we leave messages in our work

492
00:19:41,270 --> 00:19:39,440
for others to find for that purpose

493
00:19:43,750 --> 00:19:41,280
so we invite you all to give it a shot

494
00:19:45,029 --> 00:19:43,760
and show your work

495
00:19:46,310 --> 00:19:45,039
let's move on to the rover download

496
00:19:47,990 --> 00:19:46,320
camera and take a look at that a little

497
00:19:49,350 --> 00:19:48,000
bit more detail

498
00:19:51,190 --> 00:19:49,360
so if we start that up you can see the

499
00:19:52,390 --> 00:19:51,200
heat shield falling away very nicely and

500
00:19:53,750 --> 00:19:52,400
symmetrically

501
00:19:55,830 --> 00:19:53,760
pausing here we can take a look at what

502
00:19:57,669 --> 00:19:55,840
we see on the on the heat shield

503
00:19:58,630 --> 00:19:57,679
first we see the medley components on

504
00:20:00,549 --> 00:19:58,640
the heat shield you can see the

505
00:20:02,310 --> 00:20:00,559
electronics box and the gold wires that

506
00:20:03,909 --> 00:20:02,320
lead to all the various

507
00:20:06,470 --> 00:20:03,919
to all the various sensors that measure

508
00:20:08,549 --> 00:20:06,480
the aerodynamics and heating during

509
00:20:10,310 --> 00:20:08,559
entry during the entry portion of flight

510
00:20:11,750 --> 00:20:10,320
we can also see some white flecks in

511
00:20:14,070 --> 00:20:11,760
different places both on the heat shield

512
00:20:16,070 --> 00:20:14,080
and free flying which are likely frost

513
00:20:17,750 --> 00:20:16,080

that accumulated on the heat shield that

514
00:20:19,430 --> 00:20:17,760
heat shield is really really cold during

515
00:20:20,950 --> 00:20:19,440
cruise so it's not at all unexpected to

516
00:20:23,510 --> 00:20:20,960
see some of that frost appearing on the

517
00:20:24,710 --> 00:20:23,520
heat shield on the inside

518
00:20:26,710 --> 00:20:24,720
you can also see something we didn't

519
00:20:28,230 --> 00:20:26,720
expect to see if you kind of look at the

520
00:20:30,789 --> 00:20:28,240
four o'clock position

521
00:20:32,070 --> 00:20:30,799
on the heat shield or so towards the

522
00:20:33,669 --> 00:20:32,080
middle somewhere somewhere between the

523
00:20:35,029 --> 00:20:33,679
middle and the edge

524
00:20:37,270 --> 00:20:35,039
one of the springs that helped push the

525
00:20:39,110 --> 00:20:37,280
heat shield off seems to come loose

526
00:20:41,029 --> 00:20:39,120
uh it doesn't you know it's not much of

527
00:20:43,029 --> 00:20:41,039
a big deal but it's definitely

528
00:20:45,350 --> 00:20:43,039
not not what we expected if you look at

529
00:20:46,549 --> 00:20:45,360
the other eight uh springs they actually

530
00:20:47,990 --> 00:20:46,559
are where they're supposed to be all

531
00:20:50,230 --> 00:20:48,000
around the edge of the heat shield

532
00:20:51,909 --> 00:20:50,240
there's no danger to the spacecraft here

533
00:20:53,510 --> 00:20:51,919
but it's something we

534
00:20:54,870 --> 00:20:53,520
expect and i think we wouldn't have seen

535
00:20:56,950 --> 00:20:54,880
if we didn't have the camera system to

536
00:20:58,870 --> 00:20:56,960
show us what was going on

537
00:20:59,909 --> 00:20:58,880
so let's keep rolling here

538
00:21:01,510 --> 00:20:59,919

we can see that the heat shield

539
00:21:03,110 --> 00:21:01,520
basically stays in the same orientation

540
00:21:04,950 --> 00:21:03,120
as it flies away from us they'll come

541
00:21:06,230 --> 00:21:04,960
back into view in a little bit

542
00:21:07,590 --> 00:21:06,240
but this is uh this is great this is

543
00:21:08,950 --> 00:21:07,600
kind of what we expected in terms of the

544
00:21:11,750 --> 00:21:08,960
aerodynamics of that heat shield it

545
00:21:13,750 --> 00:21:11,760
doesn't tumble or do something weird uh

546
00:21:15,430 --> 00:21:13,760
that was unexpected in flight so that's

547
00:21:17,190 --> 00:21:15,440
very useful to have this video to show

548
00:21:19,029 --> 00:21:17,200
us that

549
00:21:20,710 --> 00:21:19,039
so in interest time let's skip ahead to

550
00:21:23,110 --> 00:21:20,720
about 15 seconds before backshell

551
00:21:24,390 --> 00:21:23,120
separation

552
00:21:25,909 --> 00:21:24,400
so starting this video here you can see

553
00:21:28,230 --> 00:21:25,919
that the spacecraft is rocking back and

554
00:21:29,510 --> 00:21:28,240
forth while hanging under the parachute

555
00:21:30,789 --> 00:21:29,520
this this rocket is less than it was

556
00:21:32,390 --> 00:21:30,799
earlier in flight but pretty much what

557
00:21:34,149 --> 00:21:32,400
we expect there that white flash was

558
00:21:35,750 --> 00:21:34,159
backshell separation and you can see us

559
00:21:37,110 --> 00:21:35,760
throttle up and begin our divert

560
00:21:38,870 --> 00:21:37,120
maneuver you see the vehicle's turned

561
00:21:39,830 --> 00:21:38,880
over so we're actually beginning to fly

562
00:21:41,669 --> 00:21:39,840
east

563
00:21:43,029 --> 00:21:41,679

and that's why you can see the the delta

564
00:21:45,029 --> 00:21:43,039
over there

565
00:21:46,549 --> 00:21:45,039
as it as it maneuvers eastward to the

566
00:21:47,830 --> 00:21:46,559
eventual landing site it actually passes

567
00:21:48,870 --> 00:21:47,840
over the field of view will pass over

568
00:21:50,390 --> 00:21:48,880
the landing site and then kind of

569
00:21:52,070 --> 00:21:50,400
overshoot it a little bit because it's

570
00:21:54,149 --> 00:21:52,080
got to stop that horizontal divert that

571
00:21:55,270 --> 00:21:54,159
we did

572
00:21:56,950 --> 00:21:55,280
you can see everything's nice and smooth

573
00:22:00,549 --> 00:21:56,960
now that the engines are under control

574
00:22:02,470 --> 00:22:00,559
that ongeed parachute rocking is gone

575
00:22:03,909 --> 00:22:02,480
so here we are slowing down and stopping

576
00:22:05,669 --> 00:22:03,919
and we're coming straight down on our

577
00:22:07,590 --> 00:22:05,679
eventual landing site here

578
00:22:08,710 --> 00:22:07,600
uh you can see that as we as we're

579
00:22:11,190 --> 00:22:08,720
really going to slow down here you can

580
00:22:12,549 --> 00:22:11,200
see the engines as we get lower

581
00:22:13,669 --> 00:22:12,559
throttle up there and

582
00:22:15,190 --> 00:22:13,679
stop us here and you can see it

583
00:22:17,270 --> 00:22:15,200
beginning to push all that dust around

584
00:22:18,950 --> 00:22:17,280
on the ground on the two sides that

585
00:22:20,870 --> 00:22:18,960
shaking there is the rover deploying and

586
00:22:22,870 --> 00:22:20,880
the mobility during skycrane

587
00:22:25,190 --> 00:22:22,880
and here we are coming down and that

588
00:22:26,789 --> 00:22:25,200

that rocking motion of the of the rover

589
00:22:28,149 --> 00:22:26,799
we'll see in other videos but that

590
00:22:30,549 --> 00:22:28,159
settles down right before we hit the

591
00:22:32,149 --> 00:22:30,559
ground in a nice safe flat spot there

592
00:22:34,789 --> 00:22:32,159
doesn't appear to be too much of concern

593
00:22:36,230 --> 00:22:34,799
that's right below us

594
00:22:37,990 --> 00:22:36,240
so that was the rover's view looking

595
00:22:40,549 --> 00:22:38,000
down let's take a look at the descent

596
00:22:43,590 --> 00:22:40,559
stage view looking down as well uh

597
00:22:45,350 --> 00:22:43,600
during that skycrane portion of flight

598
00:22:46,630 --> 00:22:45,360
so here we go the rover begins to drop

599
00:22:48,470 --> 00:22:46,640
away from the descent stage and that's

600
00:22:50,070 --> 00:22:48,480
the first the first part of the mobility

601
00:22:51,990 --> 00:22:50,080
deployed you kind of see here right

602
00:22:53,590 --> 00:22:52,000
before we pause that the

603
00:22:55,830 --> 00:22:53,600
mobility kind of shook a little bit in

604
00:22:58,149 --> 00:22:55,840
that in that first deployment

605
00:22:59,350 --> 00:22:58,159
uh here you can see the uh the bridles

606
00:23:00,710 --> 00:22:59,360
that are hanging down from the top of

607
00:23:01,990 --> 00:23:00,720
the picture those are what supporting

608
00:23:03,830 --> 00:23:02,000
the weight of the rover below the

609
00:23:05,750 --> 00:23:03,840
descent stage and if you look down

610
00:23:07,430 --> 00:23:05,760
toward the left the bottom part of the

611
00:23:09,830 --> 00:23:07,440
image and toward the left you can see

612
00:23:11,430 --> 00:23:09,840
that gold umbilical that's uh what's

613
00:23:12,950 --> 00:23:11,440

transferring all the information between

614
00:23:14,789 --> 00:23:12,960
the rover and the descent stage

615
00:23:16,630 --> 00:23:14,799
including this video this picture is

616
00:23:18,230 --> 00:23:16,640
coming down from the camera up on the

617
00:23:19,270 --> 00:23:18,240
descent stage down to the rover through

618
00:23:20,630 --> 00:23:19,280
that cord

619
00:23:23,430 --> 00:23:20,640
in addition to other information that's

620
00:23:25,350 --> 00:23:23,440
going back and forth

621
00:23:27,750 --> 00:23:25,360
so as we keep going here

622
00:23:29,430 --> 00:23:27,760
you can see the bogey that's on both

623
00:23:30,789 --> 00:23:29,440
sides of the mobility back you see those

624
00:23:32,630 --> 00:23:30,799
wheels the back two wheels on either

625
00:23:34,230 --> 00:23:32,640
side swing down that caused a little bit

626
00:23:35,510 --> 00:23:34,240
of rocking of the rover as expected but

627
00:23:36,710 --> 00:23:35,520
you can kind of see that kind of settles

628
00:23:39,029 --> 00:23:36,720
out a little bit

629
00:23:41,190 --> 00:23:39,039
right as we enter that that uh that

630
00:23:42,789 --> 00:23:41,200
plume and dust cloud as we get down and

631
00:23:44,310 --> 00:23:42,799
touch down and the video ends a

632
00:23:46,070 --> 00:23:44,320
touchdown of course because the camera

633
00:23:48,390 --> 00:23:46,080
that's taking this video

634
00:23:50,549 --> 00:23:48,400
is about to leave this area in a hurry

635
00:23:52,549 --> 00:23:50,559
on that descent stage after we uh we cut

636
00:23:54,710 --> 00:23:52,559
it loose from the rover

637
00:23:56,470 --> 00:23:54,720
um so now let's take a look at the rover

638
00:24:00,630 --> 00:23:56,480

upload camera so now staring up at the

639
00:24:03,590 --> 00:24:02,230
so here we go we got a really close up

640
00:24:04,950 --> 00:24:03,600
look at the descent stage and we can

641
00:24:05,990 --> 00:24:04,960
start rolling that

642
00:24:08,070 --> 00:24:06,000
you can see the descent stage as the

643
00:24:09,669 --> 00:24:08,080
rover begins to fall away from it and

644
00:24:11,269 --> 00:24:09,679
see the effect of that rover wobble from

645
00:24:12,789 --> 00:24:11,279
the mobility deploy

646
00:24:14,390 --> 00:24:12,799
so pausing here the first thing that

647
00:24:16,950 --> 00:24:14,400
most people will probably notice is that

648
00:24:18,070 --> 00:24:16,960
there's no no plumes or no visible smoke

649
00:24:19,669 --> 00:24:18,080
or anything else coming out of the

650
00:24:22,230 --> 00:24:19,679
rockets at the corner of the descent

651
00:24:24,549 --> 00:24:22,240
stage that's expected hydrazine doesn't

652
00:24:26,390 --> 00:24:24,559
really isn't isn't a combustion reaction

653
00:24:28,470 --> 00:24:26,400
when we when we burn it the exhaust

654
00:24:30,710 --> 00:24:28,480
products are nitrogen and hydrogen which

655
00:24:32,149 --> 00:24:30,720
are clear so we expect the the plumes to

656
00:24:34,310 --> 00:24:32,159
be clear that's what we see in tests

657
00:24:35,750 --> 00:24:34,320
here on earth as well uh so i can

658
00:24:37,510 --> 00:24:35,760
promise you those engines are on though

659
00:24:39,590 --> 00:24:37,520
uh one thing you can see in this in the

660
00:24:41,269 --> 00:24:39,600
earth testing we do is that the chambers

661
00:24:43,669 --> 00:24:41,279
the thrust chambers of those engines get

662
00:24:45,350 --> 00:24:43,679
kind of hot and glow pink and you can

663
00:24:47,510 --> 00:24:45,360

kind of see that in here especially if

664
00:24:49,750 --> 00:24:47,520
you look at the the the engine at the

665
00:24:51,990 --> 00:24:49,760
very top right of this image if you look

666
00:24:53,909 --> 00:24:52,000
closely right above the uh the engine

667
00:24:55,909 --> 00:24:53,919
bell there on the truss chamber you can

668
00:24:57,110 --> 00:24:55,919
see little streaks of pink on there and

669
00:24:58,789 --> 00:24:57,120
that's what's happening

670
00:25:00,710 --> 00:24:58,799
as the engines have been on for a long

671
00:25:02,630 --> 00:25:00,720
time they get really hot

672
00:25:04,470 --> 00:25:02,640
and that heat shows up there in those

673
00:25:05,830 --> 00:25:04,480
pink stripes that we see

674
00:25:07,590 --> 00:25:05,840
so take a look at that closely when you

675
00:25:09,350 --> 00:25:07,600
get a chance to to look at the image in

676
00:25:11,029 --> 00:25:09,360
some detail

677
00:25:12,789 --> 00:25:11,039
as with the previous videos you can see

678
00:25:14,070 --> 00:25:12,799
the bridles that are supporting the

679
00:25:15,990 --> 00:25:14,080
weight of the rover there at the bottom

680
00:25:17,990 --> 00:25:16,000
now of this image and that umbilical

681
00:25:20,230 --> 00:25:18,000
again transferring uh transferring data

682
00:25:21,510 --> 00:25:20,240
back and forth between the stage and the

683
00:25:23,750 --> 00:25:21,520
rover

684
00:25:24,950 --> 00:25:23,760
so let's keep going a little bit more

685
00:25:26,630 --> 00:25:24,960
you'll see the image begin to wobble a

686
00:25:27,990 --> 00:25:26,640
little bit here i can promise not the

687
00:25:29,510 --> 00:25:28,000
descent stage wobbling it's actually

688
00:25:31,350 --> 00:25:29,520

that rover tipping back and forth a

689
00:25:33,190 --> 00:25:31,360
little bit as we saw as the mobility

690
00:25:35,430 --> 00:25:33,200
deploys both the first initial mobility

691
00:25:38,149 --> 00:25:35,440
deploy and then the the

692
00:25:39,590 --> 00:25:38,159
the bogeys deploying

693
00:25:42,549 --> 00:25:39,600
as we near touchdown let's slow it down

694
00:25:43,909 --> 00:25:42,559
a bit and proceed in slow-mo here

695
00:25:45,269 --> 00:25:43,919
um so now we're watching about quarter

696
00:25:46,710 --> 00:25:45,279
speed things are getting pretty dusty

697
00:25:48,870 --> 00:25:46,720
here as we get down down toward the

698
00:25:50,390 --> 00:25:48,880
bottom uh take a look here at the bottom

699
00:25:51,830 --> 00:25:50,400
left of this picture um you'll see

700
00:25:53,750 --> 00:25:51,840
actually the instance that we cut the

701
00:25:55,350 --> 00:25:53,760
descent stage away

702
00:25:57,190 --> 00:25:55,360
and you'll see the models begin to get

703
00:25:58,630 --> 00:25:57,200
retracted up toward that descent stage

704
00:25:59,750 --> 00:25:58,640
as they're pulled up and this is as

705
00:26:01,990 --> 00:25:59,760
planned

706
00:26:03,590 --> 00:26:02,000
see as they got yanked up there

707
00:26:05,590 --> 00:26:03,600
right before and then we'll see the

708
00:26:06,789 --> 00:26:05,600
descent stage begin to turn and ascend

709
00:26:08,950 --> 00:26:06,799
and head out

710
00:26:11,510 --> 00:26:08,960
toward the northwest with the umbilical

711
00:26:13,110 --> 00:26:11,520
dangling behind it

712
00:26:14,710 --> 00:26:13,120
since the rover was pointed almost

713
00:26:17,029 --> 00:26:14,720

directly to southeast the descent stage

714
00:26:18,470 --> 00:26:17,039
chose to go toward the back now that's

715
00:26:20,390 --> 00:26:18,480
also to make sure of course that the uh

716
00:26:22,870 --> 00:26:20,400
the engines don't plume the rover that

717
00:26:24,950 --> 00:26:22,880
we don't damage the rover uh with those

718
00:26:26,950 --> 00:26:24,960
that engine thrust uh so we sent that

719
00:26:28,789 --> 00:26:26,960
descent stage uh off to the northwest

720
00:26:29,909 --> 00:26:28,799
which jessica will show you about in a

721
00:26:32,310 --> 00:26:29,919
little bit

722
00:26:33,909 --> 00:26:32,320
um so i can and have watched those

723
00:26:36,149 --> 00:26:33,919
videos for hours and keep seeing new

724
00:26:37,430 --> 00:26:36,159
stuff every time um so i invite you all

725
00:26:39,110 --> 00:26:37,440
to do that too

726
00:26:40,310 --> 00:26:39,120
so now i'll turn it over to justin who

727
00:26:42,870 --> 00:26:40,320
will talk to you a little bit about the

728
00:26:44,390 --> 00:26:42,880
images we've been taking on the ground

729
00:26:47,669 --> 00:26:44,400
all right thank you al

730
00:26:50,390 --> 00:26:47,679
i'm justin mackey i'm the mars 2020

731
00:26:53,029 --> 00:26:50,400
perseverance uh imaging scientist here

732
00:26:55,269 --> 00:26:53,039
and i developed imaging systems at jpl

733
00:26:57,590 --> 00:26:55,279
and when when dave asked me to help out

734
00:26:59,269 --> 00:26:57,600
with the edl cam development about

735
00:27:00,630 --> 00:26:59,279
six years ago

736
00:27:02,070 --> 00:27:00,640
we were

737
00:27:04,230 --> 00:27:02,080
i was really excited about it and it

738
00:27:06,710 --> 00:27:04,240

would be challenging and interesting

739
00:27:08,230 --> 00:27:06,720
and even possibly spectacular but i had

740
00:27:10,230 --> 00:27:08,240
no idea that it would be this amazing

741
00:27:12,149 --> 00:27:10,240
and we are so happy

742
00:27:14,070 --> 00:27:12,159
and proud and i just want to thank dave

743
00:27:15,510 --> 00:27:14,080
and matt for just giving us the

744
00:27:18,070 --> 00:27:15,520
leadership and

745
00:27:20,149 --> 00:27:18,080
giving us the chance to do this um

746
00:27:21,590 --> 00:27:20,159
like matt and jennifer and rick and

747
00:27:22,789 --> 00:27:21,600
others on the project i've i've actually

748
00:27:25,269 --> 00:27:22,799
worked on all five of the nasa

749
00:27:27,669 --> 00:27:25,279
revolutions and as part of my job i

750
00:27:28,870 --> 00:27:27,679
review images from mars like every day

751
00:27:31,029 --> 00:27:28,880
that's what i do

752
00:27:35,190 --> 00:27:31,039
and when i saw these uh images come down

753
00:27:36,870 --> 00:27:35,200
um i have to say i was truly amazed

754
00:27:38,549 --> 00:27:36,880
i know it's been a tough year for

755
00:27:40,149 --> 00:27:38,559
everybody and we're hoping that maybe

756
00:27:42,950 --> 00:27:40,159
these images will you know help brighten

757
00:27:45,110 --> 00:27:42,960
people's day um you know your

758
00:27:46,950 --> 00:27:45,120
smartphones and make them your your

759
00:27:50,149 --> 00:27:46,960
screen backgrounds and things just

760
00:27:52,549 --> 00:27:50,159
really happy that it all worked out so

761
00:27:53,510 --> 00:27:52,559
so now we're on mars and um

762
00:27:56,710 --> 00:27:53,520
i'm going to talk a little bit about

763
00:27:58,789 --> 00:27:56,720

what we've been doing over the weekend

764
00:28:00,710 --> 00:27:58,799
over the weekend we deployed the rsm if

765
00:28:02,870 --> 00:28:00,720
you go to the first picture there's a

766
00:28:04,149 --> 00:28:02,880
picture of the remote sensing mask the

767
00:28:05,590 --> 00:28:04,159
rsm

768
00:28:06,789 --> 00:28:05,600
which is that mast on the rover and you

769
00:28:08,549 --> 00:28:06,799
can see the

770
00:28:10,470 --> 00:28:08,559
the navigation cameras up there the left

771
00:28:11,669 --> 00:28:10,480
and right navigation cameras or nav cams

772
00:28:13,830 --> 00:28:11,679
as we call them

773
00:28:15,110 --> 00:28:13,840
um this is another new imaging system

774
00:28:17,269 --> 00:28:15,120
that we've

775
00:28:18,710 --> 00:28:17,279
developed here specifically for the 2020

776
00:28:20,470 --> 00:28:18,720
mission

777
00:28:22,389 --> 00:28:20,480
these cameras represent a pretty

778
00:28:23,830 --> 00:28:22,399
significant advancement over

779
00:28:26,549 --> 00:28:23,840
previous imaging systems that we've

780
00:28:27,669 --> 00:28:26,559
flown these are 20 megapixel color

781
00:28:30,149 --> 00:28:27,679
cameras

782
00:28:31,510 --> 00:28:30,159
with very high resolution and wide angle

783
00:28:33,750 --> 00:28:31,520
lenses

784
00:28:35,430 --> 00:28:33,760
that we use to basically map out the

785
00:28:36,710 --> 00:28:35,440
surface as the river drives and then we

786
00:28:37,510 --> 00:28:36,720
use these images to do planning and

787
00:28:39,110 --> 00:28:37,520
things

788
00:28:40,549 --> 00:28:39,120

and so we um the first thing we did

789
00:28:42,470 --> 00:28:40,559
after we deployed the mass is we started

790
00:28:44,630 --> 00:28:42,480
imaging the surface so the next slide

791
00:28:45,830 --> 00:28:44,640
shows one of our first images from the

792
00:28:48,230 --> 00:28:45,840
cameras

793
00:28:49,350 --> 00:28:48,240
this image is actually in low resolution

794
00:28:50,789 --> 00:28:49,360
mode

795
00:28:52,630 --> 00:28:50,799
so it's one quarter of the full

796
00:28:54,310 --> 00:28:52,640
resolution of the of the camera so it's

797
00:28:55,830 --> 00:28:54,320
been it's been shrunk down

798
00:28:57,430 --> 00:28:55,840
but you can see right there the vista

799
00:28:59,190 --> 00:28:57,440
that we're seeing this is the rover

800
00:29:01,669 --> 00:28:59,200
obviously on mars and you can see some

801
00:29:03,430 --> 00:29:01,679
of the material that landed on the deck

802
00:29:05,669 --> 00:29:03,440
but everything looks in good shape and

803
00:29:07,430 --> 00:29:05,679
so we're using these images to inspect

804
00:29:09,669 --> 00:29:07,440
not only the vehicle but the surface

805
00:29:11,510 --> 00:29:09,679
around us the next slide shows the view

806
00:29:13,510 --> 00:29:11,520
down towards the surface

807
00:29:15,510 --> 00:29:13,520
you can see the wheels there this is the

808
00:29:17,830 --> 00:29:15,520
same surface we just saw in the edl cam

809
00:29:18,870 --> 00:29:17,840
videos you can see some of the scouring

810
00:29:20,710 --> 00:29:18,880
that the

811
00:29:21,990 --> 00:29:20,720
rocket plumes did for us clean it off

812
00:29:24,870 --> 00:29:22,000
make it nice and clean so we can take

813
00:29:27,190 --> 00:29:24,880

pictures of it and dust it off for us

814
00:29:30,470 --> 00:29:27,200
the next slide shows a view

815
00:29:32,870 --> 00:29:30,480
looking out towards the south um and

816
00:29:35,110 --> 00:29:32,880
this just an amazing scene here uh this

817
00:29:36,070 --> 00:29:35,120
is it this is mars where we're here in

818
00:29:38,070 --> 00:29:36,080
our place that we're going to be

819
00:29:39,430 --> 00:29:38,080
exploring over the next months and

820
00:29:41,909 --> 00:29:39,440
coming years

821
00:29:43,830 --> 00:29:41,919
and it's just really exciting to see um

822
00:29:45,510 --> 00:29:43,840
you know these scenes look familiar to

823
00:29:47,110 --> 00:29:45,520
us you know they look earth-like in a

824
00:29:48,789 --> 00:29:47,120
sense you know you see them

825
00:29:50,310 --> 00:29:48,799
the mountains back there and the rocks

826
00:29:52,310 --> 00:29:50,320
and things it just

827
00:29:54,470 --> 00:29:52,320
really is the surface of an alien world

828
00:29:55,830 --> 00:29:54,480
and we just arrived you can also see

829
00:29:56,950 --> 00:29:55,840
some more scouring there over on the

830
00:29:58,870 --> 00:29:56,960
right

831
00:30:01,269 --> 00:29:58,880
the next image looks over towards the

832
00:30:02,549 --> 00:30:01,279
west you can see the delta out there in

833
00:30:05,110 --> 00:30:02,559
the horizon

834
00:30:06,950 --> 00:30:05,120
and again more scouring from the

835
00:30:08,870 --> 00:30:06,960
rocket plumes

836
00:30:10,789 --> 00:30:08,880
and then we take all of these images and

837
00:30:13,029 --> 00:30:10,799
we uh stitch them together into

838
00:30:13,990 --> 00:30:13,039

panoramas and so that next the next

839
00:30:16,950 --> 00:30:14,000
frame

840
00:30:19,110 --> 00:30:16,960
shows the full panorama from the navcam

841
00:30:20,870 --> 00:30:19,120
uh stitched together we're still working

842
00:30:23,029 --> 00:30:20,880
out the calibration of things so this is

843
00:30:24,950 --> 00:30:23,039
uh you know approximate color but it

844
00:30:27,430 --> 00:30:24,960
just gives you a feel for

845
00:30:28,710 --> 00:30:27,440
the vista here that we we're

846
00:30:31,590 --> 00:30:28,720
our new environment that we're going to

847
00:30:34,789 --> 00:30:31,600
explore uh and we're hoping uh everyone

848
00:30:36,389 --> 00:30:34,799
will join us in

849
00:30:38,470 --> 00:30:36,399
seeing these images we're

850
00:30:40,789 --> 00:30:38,480
today we're going to be releasing a

851
00:30:42,710 --> 00:30:40,799
whole slew of raw images it's been a

852
00:30:44,630 --> 00:30:42,720
fire hose of data basically we have

853
00:30:47,190 --> 00:30:44,640
thousands of images already from the edl

854
00:30:49,430 --> 00:30:47,200
cameras nav cams uh you've seen the haz

855
00:30:51,190 --> 00:30:49,440
cams and so we will be putting those uh

856
00:30:53,750 --> 00:30:51,200
out on the website today uh for people

857
00:30:55,510 --> 00:30:53,760
to download and uh process yourself or

858
00:30:57,669 --> 00:30:55,520
just look at the great picture

859
00:30:59,750 --> 00:30:57,679
find your favorite picture and uh make

860
00:31:01,669 --> 00:30:59,760
it make it your screen background and

861
00:31:03,509 --> 00:31:01,679
then the last image that i just wanted

862
00:31:05,110 --> 00:31:03,519
to point out is the

863
00:31:07,750 --> 00:31:05,120

first image one of the first images from

864
00:31:09,430 --> 00:31:07,760
the mastcam z camera this is another

865
00:31:11,110 --> 00:31:09,440
next generation imaging system on the

866
00:31:13,909 --> 00:31:11,120
rover um

867
00:31:15,909 --> 00:31:13,919
jim bell is the the pi i'm the deputy pi

868
00:31:18,870 --> 00:31:15,919
for this uh working with our industry

869
00:31:20,950 --> 00:31:18,880
partners ms cubed down in san diego

870
00:31:23,190 --> 00:31:20,960
this is just a fantastic imaging system

871
00:31:24,789 --> 00:31:23,200
this is a preview of things to come this

872
00:31:26,230 --> 00:31:24,799
system has a zoom lens on it that's what

873
00:31:28,230 --> 00:31:26,240
the z stands for

874
00:31:30,789 --> 00:31:28,240
uh and we're going to get incredibly

875
00:31:32,149 --> 00:31:30,799
high resolution photos from this imaging

876
00:31:33,509 --> 00:31:32,159
system i just wanted to point out a few

877
00:31:35,430 --> 00:31:33,519
things in this picture

878
00:31:36,710 --> 00:31:35,440
on the far right you can see those

879
00:31:38,630 --> 00:31:36,720
cables

880
00:31:39,830 --> 00:31:38,640
where they had been cut uh in the video

881
00:31:41,430 --> 00:31:39,840
that you just saw so there's kind of a

882
00:31:43,190 --> 00:31:41,440
close-up of that

883
00:31:45,350 --> 00:31:43,200
and then just in the middle to the left

884
00:31:47,029 --> 00:31:45,360
of that that black

885
00:31:48,230 --> 00:31:47,039
instrument that's uh the rover upload

886
00:31:50,149 --> 00:31:48,240
camera that's the camera that actually

887
00:31:52,230 --> 00:31:50,159
took the video of the sky crane

888
00:31:53,750 --> 00:31:52,240

as as we were coming down and then in

889
00:31:55,750 --> 00:31:53,760
the bottom of the frame is the mass cam

890
00:31:57,029 --> 00:31:55,760
z calibration target set there's two of

891
00:31:58,950 --> 00:31:57,039
them there's the circular one with the

892
00:32:00,870 --> 00:31:58,960
the shadow post and then the color chips

893
00:32:02,870 --> 00:32:00,880
down the bottom there's another cal

894
00:32:04,789 --> 00:32:02,880
target in the back that's the super cam

895
00:32:06,630 --> 00:32:04,799
instrument with our partners from los

896
00:32:07,909 --> 00:32:06,640
alamos and in france

897
00:32:09,750 --> 00:32:07,919
we're going to be commissioning super

898
00:32:11,110 --> 00:32:09,760
cam over the next few days

899
00:32:12,710 --> 00:32:11,120
and then finally just as a teaser i'll

900
00:32:15,029 --> 00:32:12,720
point out that there is a little antenna

901
00:32:17,029 --> 00:32:15,039
there to the right on that uh box on the

902
00:32:18,549 --> 00:32:17,039
center right that is the helicopter

903
00:32:19,669 --> 00:32:18,559
antenna that's a helicopter base station

904
00:32:21,750 --> 00:32:19,679
location

905
00:32:23,990 --> 00:32:21,760
and a preview of things to come we're

906
00:32:25,430 --> 00:32:24,000
excited about that as well so with that

907
00:32:27,830 --> 00:32:25,440
i'm going to turn it over to jessica to

908
00:32:30,070 --> 00:32:27,840
talk about latest status all right thank

909
00:32:32,230 --> 00:32:30,080
you justin i know you can uh test

910
00:32:33,909 --> 00:32:32,240
firsthand to being in the control room

911
00:32:36,470 --> 00:32:33,919
and the excitement that

912
00:32:39,110 --> 00:32:36,480
everybody has been experiencing seeing

913
00:32:40,830 --> 00:32:39,120

all these images from the surface and uh

914
00:32:43,269 --> 00:32:40,840
as they come down you know we're

915
00:32:46,789 --> 00:32:43,279
immediately sharing them and and

916
00:32:49,190 --> 00:32:46,799
everybody clapping and smiles all around

917
00:32:52,470 --> 00:32:49,200
great camera suite so i am happy to

918
00:32:55,669 --> 00:32:52,480
report that uh perseverance is healthy

919
00:32:58,310 --> 00:32:55,679
and uh continuing with activities as we

920
00:33:01,269 --> 00:32:58,320
have been uh planning them over the

921
00:33:03,750 --> 00:33:01,279
first few sols on the surface

922
00:33:05,909 --> 00:33:03,760
to date which is really only just you

923
00:33:09,190 --> 00:33:05,919
know three solves of activities and one

924
00:33:12,230 --> 00:33:09,200
more and coming up later this afternoon

925
00:33:15,269 --> 00:33:12,240
we've commanded 5 we've executed 5 000

926
00:33:17,269 --> 00:33:15,279
commands so lots of uh instructions to

927
00:33:20,070 --> 00:33:17,279
the vehicle for

928
00:33:22,789 --> 00:33:20,080
for her to perform and uh having

929
00:33:25,110 --> 00:33:22,799
everything come back exactly how we've

930
00:33:28,389 --> 00:33:25,120
been wanting it to with respect to our

931
00:33:30,230 --> 00:33:28,399
health checkouts and our instrument uh

932
00:33:32,549 --> 00:33:30,240
checkout so that's been things have been

933
00:33:34,950 --> 00:33:32,559
going well a couple of

934
00:33:37,590 --> 00:33:34,960
key highlights so we have fired and

935
00:33:40,950 --> 00:33:37,600
replete and released um our launch lock

936
00:33:44,310 --> 00:33:40,960
restraints to allow our mechanisms to be

937
00:33:46,389 --> 00:33:44,320
deployed we saw the remote sensing mast

938
00:33:49,029 --> 00:33:46,399

but one of those also being the high

939
00:33:50,710 --> 00:33:49,039
gain antenna now this is

940
00:33:53,029 --> 00:33:50,720
important for the high gain antenna to

941
00:33:54,310 --> 00:33:53,039
be deployed because it increases our

942
00:33:57,350 --> 00:33:54,320
uplink rate

943
00:33:59,430 --> 00:33:57,360
to the rover and so it will allow us to

944
00:34:01,350 --> 00:33:59,440
send a higher

945
00:34:04,149 --> 00:34:01,360
volume of instructions

946
00:34:06,070 --> 00:34:04,159
to perseverance and allow her to perform

947
00:34:07,830 --> 00:34:06,080
more involved activities over the days

948
00:34:09,349 --> 00:34:07,840
to come

949
00:34:12,470 --> 00:34:09,359
additionally with respect to our

950
00:34:15,349 --> 00:34:12,480
communication uh we have

951
00:34:18,710 --> 00:34:15,359
established a strong communication link

952
00:34:20,069 --> 00:34:18,720
with all of our relay orbiters and our

953
00:34:22,149 --> 00:34:20,079
partners

954
00:34:26,470 --> 00:34:22,159
the mars reconnaissance orbiter the

955
00:34:29,829 --> 00:34:26,480
maven orbiter trace gas observer the tgo

956
00:34:31,750 --> 00:34:29,839
and odyssey spacecraft and so we thank

957
00:34:34,310 --> 00:34:31,760
those teams and

958
00:34:37,270 --> 00:34:34,320
are happy to be able to use those assets

959
00:34:38,950 --> 00:34:37,280
to relay all of the information that we

960
00:34:41,510 --> 00:34:38,960
all these beautiful images that we are

961
00:34:44,550 --> 00:34:41,520
looking at today

962
00:34:47,750 --> 00:34:44,560
the remote sensing mash remote sensing

963
00:34:49,829 --> 00:34:47,760

mast motion checks were nominal and as

964
00:34:51,750 --> 00:34:49,839
expected and

965
00:34:54,389 --> 00:34:51,760
all of our instruments have gone through

966
00:34:56,950 --> 00:34:54,399
their initial checkouts and are happy to

967
00:34:59,349 --> 00:34:56,960
report that they are all performing

968
00:35:01,910 --> 00:34:59,359
nominally and as expected now when i say

969
00:35:02,870 --> 00:35:01,920
nominal it really means fantastic

970
00:35:06,550 --> 00:35:02,880
because

971
00:35:08,310 --> 00:35:06,560
we can't wait to continue to use this

972
00:35:10,550 --> 00:35:08,320
payload suite

973
00:35:11,670 --> 00:35:10,560
our backup computer was turned on

974
00:35:12,470 --> 00:35:11,680
yesterday

975
00:35:15,430 --> 00:35:12,480
and

976
00:35:18,470 --> 00:35:15,440
that was in preparation for our upcoming

977
00:35:20,390 --> 00:35:18,480
flight software uh transition which we

978
00:35:21,510 --> 00:35:20,400
will be performing over the next few

979
00:35:24,950 --> 00:35:21,520
days

980
00:35:25,829 --> 00:35:24,960
and the ingenuity helicopter has also

981
00:35:27,829 --> 00:35:25,839
been

982
00:35:29,990 --> 00:35:27,839
checked out we have performed a battery

983
00:35:31,990 --> 00:35:30,000
charging event which we will continue to

984
00:35:33,589 --> 00:35:32,000
perform over the weeks to come in

985
00:35:35,109 --> 00:35:33,599
preparation for that aspect of the

986
00:35:36,790 --> 00:35:35,119
mission

987
00:35:40,310 --> 00:35:36,800
but looking ahead

988
00:35:42,950 --> 00:35:40,320

we are excited to be part or to be on

989
00:35:45,829 --> 00:35:42,960
our surface flight software

990
00:35:47,510 --> 00:35:45,839
this is a much more uh surface capable a

991
00:35:49,109 --> 00:35:47,520
lot more capabilities for the surface

992
00:35:51,430 --> 00:35:49,119
mission as part of this flight software

993
00:35:53,750 --> 00:35:51,440
load it will take us a few days

994
00:35:55,829 --> 00:35:53,760
to transition but once we're on that

995
00:35:58,470 --> 00:35:55,839
load it will allow us to do further

996
00:35:59,990 --> 00:35:58,480
in-depth checkouts of the instrument as

997
00:36:03,030 --> 00:36:00,000
well as

998
00:36:04,790 --> 00:36:03,040
deploy the robotic arm and exercise some

999
00:36:07,030 --> 00:36:04,800
of the turret

1000
00:36:09,190 --> 00:36:07,040
items that you see in this image so you

1001
00:36:11,510 --> 00:36:09,200
can see that we have our coring drill in

1002
00:36:13,829 --> 00:36:11,520
the center our pixel and sherlock

1003
00:36:17,430 --> 00:36:13,839
instruments mounted to the side and that

1004
00:36:20,710 --> 00:36:17,440
black tank is to support the gut the gas

1005
00:36:23,270 --> 00:36:20,720
dust removal tool which will uh remove

1006
00:36:25,109 --> 00:36:23,280
uh dust from the surfaces that we will

1007
00:36:28,550 --> 00:36:25,119
be inspecting later

1008
00:36:31,109 --> 00:36:28,560
so uh coming up here the uh the wheels

1009
00:36:33,030 --> 00:36:31,119
uh if you noticed in the image now are

1010
00:36:35,190 --> 00:36:33,040
off to the side we will be performing a

1011
00:36:36,790 --> 00:36:35,200
wiggle we'll straighten those up we'll

1012
00:36:39,430 --> 00:36:36,800
do a short drive

1013
00:36:40,630 --> 00:36:39,440

uh and as i mentioned deploy the robotic

1014
00:36:43,030 --> 00:36:40,640
arm

1015
00:36:44,630 --> 00:36:43,040
and then continue with further in-depth

1016
00:36:48,230 --> 00:36:44,640
checkouts

1017
00:36:50,550 --> 00:36:48,240
so we are very excited to be happily on

1018
00:36:53,670 --> 00:36:50,560
the surface and

1019
00:36:55,589 --> 00:36:53,680
and exercising our system and

1020
00:36:57,589 --> 00:36:55,599
looking for what's ahead

1021
00:37:00,230 --> 00:36:57,599
so going back to

1022
00:37:02,150 --> 00:37:00,240
our partnership with the larger mars

1023
00:37:05,750 --> 00:37:02,160
spacecraft and science teams and

1024
00:37:07,750 --> 00:37:05,760
community we're really excited that the

1025
00:37:09,990 --> 00:37:07,760
mro spacecraft mars reconnaissance

1026
00:37:13,109 --> 00:37:10,000
orbiter and the high rise

1027
00:37:15,270 --> 00:37:13,119
team was able to find our hardware on

1028
00:37:18,230 --> 00:37:15,280
the surface of mars so if you see in

1029
00:37:20,550 --> 00:37:18,240
this image if the next pop-up you can

1030
00:37:24,230 --> 00:37:20,560
see that we have the descent stage the

1031
00:37:27,190 --> 00:37:24,240
parachute and the heat shield all here

1032
00:37:29,349 --> 00:37:27,200
um in this image with a few

1033
00:37:31,430 --> 00:37:29,359
stats here the descent stage is about

1034
00:37:32,550 --> 00:37:31,440
700 meters away

1035
00:37:35,030 --> 00:37:32,560
from

1036
00:37:37,430 --> 00:37:35,040
where perseverance is on the surface

1037
00:37:40,470 --> 00:37:37,440
parachute is about 1.2 kilometers and

1038
00:37:41,829 --> 00:37:40,480

the heat shield about 1.5 kilometers

1039
00:37:44,069 --> 00:37:41,839
and so it's a

1040
00:37:45,670 --> 00:37:44,079
very exciting that we can see all these

1041
00:37:47,829 --> 00:37:45,680
different components

1042
00:37:48,630 --> 00:37:47,839
now that we've landed on the surface

1043
00:37:51,990 --> 00:37:48,640
and

1044
00:37:54,950 --> 00:37:52,000
as a special treat the high-rise image

1045
00:37:56,630 --> 00:37:54,960
was able to actually acquire um the

1046
00:37:59,270 --> 00:37:56,640
entry descent landing

1047
00:38:01,430 --> 00:37:59,280
event from their perspective and uh we

1048
00:38:03,589 --> 00:38:01,440
can never

1049
00:38:06,310 --> 00:38:03,599
have enough images of this activity and

1050
00:38:08,630 --> 00:38:06,320
so this is a fantastic view

1051
00:38:09,990 --> 00:38:08,640
but i'm going to send it back to dave

1052
00:38:11,990 --> 00:38:10,000
here he

1053
00:38:14,069 --> 00:38:12,000
is part of this suite we have one more

1054
00:38:16,870 --> 00:38:14,079
surprise or one more

1055
00:38:18,950 --> 00:38:16,880
uh gift i'll say

1056
00:38:20,790 --> 00:38:18,960
that uh that we've been able to um

1057
00:38:23,270 --> 00:38:20,800
receive from this package

1058
00:38:24,950 --> 00:38:23,280
over here dave thanks jessica so

1059
00:38:26,390 --> 00:38:24,960
i think we probably have overloaded your

1060
00:38:27,589 --> 00:38:26,400
visual sense for a little bit we're

1061
00:38:29,349 --> 00:38:27,599
gonna do something a little bit

1062
00:38:30,710 --> 00:38:29,359
different and i'm gonna have some fun

1063
00:38:37,030 --> 00:38:30,720

here for a second too so i'm gonna get

1064
00:38:39,990 --> 00:38:38,870
and i'm going to talk to you now with

1065
00:38:45,430 --> 00:38:40,000
this

1066
00:38:47,109 --> 00:38:45,440
the edl camera system

1067
00:38:49,109 --> 00:38:47,119
when the edl cam system was first

1068
00:38:51,750 --> 00:38:49,119
envisioned it was set up as

1069
00:38:53,270 --> 00:38:51,760
just a bunch of cameras um to capture

1070
00:38:54,150 --> 00:38:53,280
some amazing imagery on the surface of

1071
00:38:55,670 --> 00:38:54,160
mars

1072
00:38:57,270 --> 00:38:55,680
and about a year or so after it was

1073
00:38:58,870 --> 00:38:57,280
first conceived i got a phone call

1074
00:39:00,710 --> 00:38:58,880
another call from matt

1075
00:39:01,750 --> 00:39:00,720
after talking to headquarters ask the

1076
00:39:03,990 --> 00:39:01,760
question

1077
00:39:06,630 --> 00:39:04,000
could we possibly put a microphone as

1078
00:39:08,550 --> 00:39:06,640
part of our edl camera system

1079
00:39:09,510 --> 00:39:08,560
so we work with the team we took a look

1080
00:39:12,150 --> 00:39:09,520
and

1081
00:39:13,109 --> 00:39:12,160
sure enough it was something that we

1082
00:39:15,349 --> 00:39:13,119
could do

1083
00:39:17,190 --> 00:39:15,359
and so we started off that detail design

1084
00:39:19,190 --> 00:39:17,200
and uh identifying a microphone that

1085
00:39:20,470 --> 00:39:19,200
would work for us and uh getting it onto

1086
00:39:23,589 --> 00:39:20,480
the vehicle

1087
00:39:25,430 --> 00:39:23,599
about a year after uh this first started

1088
00:39:26,950 --> 00:39:25,440

i'm giving a tour

1089
00:39:28,710 --> 00:39:26,960
at gpl

1090
00:39:30,550 --> 00:39:28,720
and i happened to mention to the group

1091
00:39:32,470 --> 00:39:30,560
that i was giving the tour to

1092
00:39:34,550 --> 00:39:32,480
that the decision had come down we're

1093
00:39:37,030 --> 00:39:34,560
working to actually include a microphone

1094
00:39:39,030 --> 00:39:37,040
onto onto the vehicle

1095
00:39:40,790 --> 00:39:39,040
and after the tour was done a gal came

1096
00:39:42,870 --> 00:39:40,800
up to me and she said some things to me

1097
00:39:45,109 --> 00:39:42,880
that i won't forget anytime soon

1098
00:39:47,030 --> 00:39:45,119
she said i'm super excited that you guys

1099
00:39:48,790 --> 00:39:47,040
are going to try to put a microphone

1100
00:39:50,630 --> 00:39:48,800
onto the rover and get it to the surface

1101
00:39:52,630 --> 00:39:50,640
of mars and and i was very appreciative

1102
00:39:54,310 --> 00:39:52,640
and i asked her afterwards i said i'm

1103
00:39:57,109 --> 00:39:54,320
curious why is it that this relates to

1104
00:39:59,990 --> 00:39:57,119
you so much and her response was that

1105
00:40:02,470 --> 00:40:00,000
her sister was visually impaired

1106
00:40:05,349 --> 00:40:02,480
she was not able to see these images

1107
00:40:07,510 --> 00:40:05,359
that that we saw earlier or that we sent

1108
00:40:09,990 --> 00:40:07,520
down in the past and while she tries to

1109
00:40:12,230 --> 00:40:10,000
describe them to her she felt that she

1110
00:40:14,069 --> 00:40:12,240
just can't quite capture

1111
00:40:16,069 --> 00:40:14,079
that same sense of amazement that she

1112
00:40:17,990 --> 00:40:16,079
gets when she gets in visually and that

1113
00:40:19,990 --> 00:40:18,000

by actually getting a microphone at the

1114
00:40:22,550 --> 00:40:20,000
surface of mars the hope was that she'd

1115
00:40:24,630 --> 00:40:22,560
be able to experience things on mars the

1116
00:40:26,630 --> 00:40:24,640
same way that uh that she was when she

1117
00:40:28,550 --> 00:40:26,640
actually looked at them

1118
00:40:30,069 --> 00:40:28,560
and that stuck with me we continued to

1119
00:40:31,910 --> 00:40:30,079
work super hard to make sure that this

1120
00:40:33,430 --> 00:40:31,920
microphone would work and that's part of

1121
00:40:35,030 --> 00:40:33,440
the reason we were disappointed why it

1122
00:40:35,829 --> 00:40:35,040
didn't work when we actually went and

1123
00:40:38,710 --> 00:40:35,839
did

1124
00:40:40,950 --> 00:40:38,720
our entry descent lending sequence um i

1125
00:40:42,630 --> 00:40:40,960
wish i had actually captured that

1126
00:40:44,630 --> 00:40:42,640
individual's name i would love to reach

1127
00:40:46,309 --> 00:40:44,640
out to her now and say

1128
00:40:47,430 --> 00:40:46,319
we've done it i hope your sister is

1129
00:40:48,550 --> 00:40:47,440
enjoying it

1130
00:40:49,750 --> 00:40:48,560
because what i'm going to show you in a

1131
00:40:51,349 --> 00:40:49,760
second or what i'm going to you're going

1132
00:40:53,349 --> 00:40:51,359
to hear in a second is actually the

1133
00:40:55,190 --> 00:40:53,359
first sounds being recorded from the

1134
00:40:57,750 --> 00:40:55,200
surface of mars so there are two

1135
00:40:59,750 --> 00:40:57,760
microphones on the perseverance vehicle

1136
00:41:01,109 --> 00:40:59,760
there's this microphone here part of the

1137
00:41:02,630 --> 00:41:01,119
entry descent and landing system and

1138
00:41:04,230 --> 00:41:02,640

there's a second microphone that is on

1139
00:41:05,910 --> 00:41:04,240
the supercam instrument

1140
00:41:07,670 --> 00:41:05,920
and we're we're counting on both of

1141
00:41:09,349 --> 00:41:07,680
these instruments recording some

1142
00:41:12,630 --> 00:41:09,359
absolutely amazing

1143
00:41:15,030 --> 00:41:12,640
uh sounds from the surface of mars so

1144
00:41:16,790 --> 00:41:15,040
with that um i invite you now to if you

1145
00:41:19,030 --> 00:41:16,800
would like to close your eyes and just

1146
00:41:20,790 --> 00:41:19,040
imagine yourself sitting on the surface

1147
00:41:22,069 --> 00:41:20,800
of mars and listening to to the

1148
00:41:43,829 --> 00:41:22,079
surroundings

1149
00:41:47,349 --> 00:41:45,589
so that gentle world that happens in the

1150
00:41:49,829 --> 00:41:47,359
background that is a noise made by the

1151
00:41:52,069 --> 00:41:49,839
rover but yes what you did here 10

1152
00:41:53,910 --> 00:41:52,079
seconds in was an actual wind gust on

1153
00:41:56,710 --> 00:41:53,920
the surface of mars picked up by the

1154
00:41:58,870 --> 00:41:56,720
microphone sent back to us here on earth

1155
00:42:01,750 --> 00:41:58,880
the nexus indicates that was around a 5

1156
00:42:03,670 --> 00:42:01,760
meter per second type of wind gust

1157
00:42:05,270 --> 00:42:03,680
so we have actually we can sit here now

1158
00:42:08,390 --> 00:42:05,280
and actually tell you that we have

1159
00:42:10,630 --> 00:42:08,400
recorded sound from the surface of mars

1160
00:42:12,390 --> 00:42:10,640
so we have a second one which basically

1161
00:42:14,790 --> 00:42:12,400
further reduces

1162
00:42:16,790 --> 00:42:14,800
the noise of the rover so you can just

1163
00:42:18,470 --> 00:42:16,800

hear uh what the wind would sound like

1164
00:42:20,790 --> 00:42:18,480
on mars and once again

1165
00:42:22,230 --> 00:42:20,800
i invite you to sit back and have a

1166
00:42:42,390 --> 00:42:22,240
listen to what it would sound like to be

1167
00:42:48,790 --> 00:42:45,109
that's just it's cool it's

1168
00:42:49,990 --> 00:42:48,800
really neat overwhelming if you will um

1169
00:42:51,990 --> 00:42:50,000
i can't remember what i was going to go

1170
00:42:53,910 --> 00:42:52,000
and say next

1171
00:42:55,190 --> 00:42:53,920
um so looking forward to doing some

1172
00:42:56,309 --> 00:42:55,200
amazing things with the microphones

1173
00:42:57,910 --> 00:42:56,319
going forward we need to work with the

1174
00:42:59,190 --> 00:42:57,920
ops team there's some great science that

1175
00:43:00,710 --> 00:42:59,200
they're they're looking to do we're

1176
00:43:02,150 --> 00:43:00,720
hopeful that we continue to use these

1177
00:43:04,710 --> 00:43:02,160
microphones both the super cam

1178
00:43:06,470 --> 00:43:04,720
microphone and the edl cam microphone to

1179
00:43:08,309 --> 00:43:06,480
capture sounds perhaps the rocks

1180
00:43:09,750 --> 00:43:08,319
interacting with the surface

1181
00:43:12,950 --> 00:43:09,760
supercam is going to use theirs to get

1182
00:43:14,630 --> 00:43:12,960
some great data of them zapping rocks

1183
00:43:16,710 --> 00:43:14,640
so as you've heard and we'll continue

1184
00:43:18,790 --> 00:43:16,720
here we're just beginning to do amazing

1185
00:43:19,990 --> 00:43:18,800
things on the surface of mars and now

1186
00:43:21,190 --> 00:43:20,000
ken is going to talk to you a little bit

1187
00:43:22,710 --> 00:43:21,200
about the science that we've done to

1188
00:43:27,430 --> 00:43:22,720

date and what they're looking forward to

1189
00:43:31,829 --> 00:43:29,589
thanks dave

1190
00:43:34,470 --> 00:43:31,839
and i'll start by just taking this

1191
00:43:37,270 --> 00:43:34,480
opportunity to say to matt dave al and

1192
00:43:40,230 --> 00:43:37,280
everybody else on this fantastic team

1193
00:43:42,470 --> 00:43:40,240
thank you for the ride of a lifetime

1194
00:43:44,630 --> 00:43:42,480
that is just incredible what we've seen

1195
00:43:46,470 --> 00:43:44,640
today and and what i'm sure

1196
00:43:47,990 --> 00:43:46,480
we'll continue to see as the mission

1197
00:43:49,670 --> 00:43:48,000
unfolds

1198
00:43:52,390 --> 00:43:49,680
so with all the focus on these uh

1199
00:43:54,230 --> 00:43:52,400
spectacular videos and audio

1200
00:43:56,470 --> 00:43:54,240
uh we wanted to make sure to remind you

1201
00:43:58,550 --> 00:43:56,480
that there is plenty of science going on

1202
00:44:01,430 --> 00:43:58,560
already with hundreds of team members

1203
00:44:03,510 --> 00:44:01,440
poring over every new image

1204
00:44:05,430 --> 00:44:03,520
so if we can get the first of those

1205
00:44:08,390 --> 00:44:05,440
uh images

1206
00:44:11,190 --> 00:44:08,400
as you'll see in this navcam frame we

1207
00:44:15,030 --> 00:44:11,200
start with what may seem like very basic

1208
00:44:17,670 --> 00:44:15,040
observations light rocks dark rocks holy

1209
00:44:20,069 --> 00:44:17,680
rocks that's holy with an e

1210
00:44:22,470 --> 00:44:20,079
we use these very generic terms at this

1211
00:44:25,109 --> 00:44:22,480
early stage until we have more data that

1212
00:44:28,470 --> 00:44:25,119
allow us to test our hypotheses

1213
00:44:30,630 --> 00:44:28,480

and make more confident interpretations

1214
00:44:32,390 --> 00:44:30,640
follow along with the mission and you'll

1215
00:44:34,069 --> 00:44:32,400
see that it's a theme

1216
00:44:36,550 --> 00:44:34,079
as we get closer

1217
00:44:39,589 --> 00:44:36,560
our view of mars continues to resolve

1218
00:44:42,790 --> 00:44:39,599
and a coherent story emerges

1219
00:44:47,430 --> 00:44:44,950
finally i just want to briefly point out

1220
00:44:50,069 --> 00:44:47,440
that we are finding real science value

1221
00:44:51,589 --> 00:44:50,079
in these edl cam videos here you can see

1222
00:44:53,430 --> 00:44:51,599
a beautiful new perspective on the

1223
00:44:58,550 --> 00:44:53,440
jezero delta

1224
00:45:02,950 --> 00:45:00,630
also a new perspective on some of the

1225
00:45:06,150 --> 00:45:02,960
beautiful stratigraphy around our

1226
00:45:08,710 --> 00:45:06,160
landing site which is is up near uh uh

1227
00:45:11,190 --> 00:45:08,720
on the far right side of this image

1228
00:45:13,750 --> 00:45:11,200
uh so now to put all of this in context

1229
00:45:16,950 --> 00:45:13,760
for us i'll hand it over to dr thomas

1230
00:45:22,309 --> 00:45:19,270
well what we've seen here today is

1231
00:45:23,109 --> 00:45:22,319
really nothing short of amazing you know

1232
00:45:24,710 --> 00:45:23,119
and i

1233
00:45:26,309 --> 00:45:24,720
perhaps you've had moments like this

1234
00:45:28,550 --> 00:45:26,319
before some of

1235
00:45:30,390 --> 00:45:28,560
you have told me that i was

1236
00:45:32,150 --> 00:45:30,400
too young to remember but they had a

1237
00:45:34,790 --> 00:45:32,160
moment like that for example when they

1238
00:45:37,030 --> 00:45:34,800

observed the first landing

1239
00:45:38,390 --> 00:45:37,040
on the phone they had moments like that

1240
00:45:40,230 --> 00:45:38,400
where it felt

1241
00:45:43,030 --> 00:45:40,240
that we took a big leap

1242
00:45:43,990 --> 00:45:43,040
a big leap not just in this case because

1243
00:45:47,430 --> 00:45:44,000
of

1244
00:45:48,790 --> 00:45:47,440
at jpl or at nasa but a big loop as

1245
00:45:50,950 --> 00:45:48,800
humanity

1246
00:45:52,790 --> 00:45:50,960
uh of course it's a leap that was

1247
00:45:55,030 --> 00:45:52,800
enabled by work

1248
00:45:57,109 --> 00:45:55,040
over decades and on this mission for

1249
00:45:59,030 --> 00:45:57,119
close to a decade

1250
00:46:01,109 --> 00:45:59,040
so what's possible today or feels

1251
00:46:03,349 --> 00:46:01,119
possible is different

1252
00:46:05,910 --> 00:46:03,359
even yesterday

1253
00:46:07,829 --> 00:46:05,920
it's how it feels to make history and i

1254
00:46:09,829 --> 00:46:07,839
just that's how i feel today i'm so

1255
00:46:12,309 --> 00:46:09,839
moved by this wow

1256
00:46:14,790 --> 00:46:12,319
the video of perseverance to sand and

1257
00:46:17,349 --> 00:46:14,800
landing and the amazing panorama and the

1258
00:46:18,230 --> 00:46:17,359
first white landscape shot of jesus

1259
00:46:19,990 --> 00:46:18,240
christ

1260
00:46:22,550 --> 00:46:20,000
seen with human eyes and the first

1261
00:46:23,750 --> 00:46:22,560
martian sounds are the closest you can

1262
00:46:25,750 --> 00:46:23,760
get

1263
00:46:27,430 --> 00:46:25,760

the landing on mars without putting on a

1264
00:46:29,829 --> 00:46:27,440
pressure suit

1265
00:46:32,710 --> 00:46:29,839
that video i believe should

1266
00:46:34,550 --> 00:46:32,720
become mandatory view for young people

1267
00:46:35,670 --> 00:46:34,560
who not only want to explore other

1268
00:46:37,990 --> 00:46:35,680
worlds

1269
00:46:41,030 --> 00:46:38,000
and build spacecraft to take them there

1270
00:46:43,990 --> 00:46:41,040
but also want to be part of diverse

1271
00:46:46,550 --> 00:46:44,000
teams achieving all the audacious goals

1272
00:46:48,470 --> 00:46:46,560
of our future

1273
00:46:50,309 --> 00:46:48,480
at the center of that is a team and i'll

1274
00:46:52,790 --> 00:46:50,319
ask for the next image

1275
00:46:55,349 --> 00:46:52,800
now you should know i met this team i

1276
00:46:57,349 --> 00:46:55,359
see me there in a dark suit next to dr

1277
00:46:59,510 --> 00:46:57,359
laurie glaze the body division director

1278
00:47:01,750 --> 00:46:59,520
and how he just uh he just talked to you

1279
00:47:03,589 --> 00:47:01,760
is on his knee and there and he entered

1280
00:47:06,870 --> 00:47:03,599
ascendant landing team and we met him

1281
00:47:08,950 --> 00:47:06,880
just hours before that historic landing

1282
00:47:11,270 --> 00:47:08,960
and i love this picture

1283
00:47:14,069 --> 00:47:11,280
because of course the event today

1284
00:47:15,990 --> 00:47:14,079
demonstrates that the human aspect of

1285
00:47:18,150 --> 00:47:16,000
exploration

1286
00:47:21,670 --> 00:47:18,160
and that is of course every reason for

1287
00:47:23,030 --> 00:47:21,680
what we can do at nasa and also why we

1288
00:47:23,990 --> 00:47:23,040

do things

1289
00:47:26,309 --> 00:47:24,000
the video

1290
00:47:29,750 --> 00:47:26,319
images here are

1291
00:47:32,150 --> 00:47:29,760
provided to us are from the surface

1292
00:47:33,349 --> 00:47:32,160
of mars and sometimes we forget if we

1293
00:47:35,990 --> 00:47:33,359
look at that

1294
00:47:38,150 --> 00:47:36,000
well the robot shouldn't get all the fun

1295
00:47:40,950 --> 00:47:38,160
we want to make sure that all of us on

1296
00:47:43,670 --> 00:47:40,960
earth see and feel what it's like to be

1297
00:47:45,510 --> 00:47:43,680
on our mars and explore other worlds

1298
00:47:47,270 --> 00:47:45,520
i'm so excited

1299
00:47:49,910 --> 00:47:47,280
for the more than one million students

1300
00:47:51,829 --> 00:47:49,920
who join the mars student challenge

1301
00:47:54,069 --> 00:47:51,839
and that many more across the world will

1302
00:47:56,790 --> 00:47:54,079
be inspired by these characters

1303
00:47:59,030 --> 00:47:56,800
released today and even yesterday

1304
00:48:01,910 --> 00:47:59,040
their journey is also

1305
00:48:05,109 --> 00:48:01,920
just the beginning just imagine

1306
00:48:08,549 --> 00:48:05,119
imagine perseverance sitting on a hill

1307
00:48:11,510 --> 00:48:08,559
recording the next martian landing

1308
00:48:13,670 --> 00:48:11,520
with a cargo that is basically a rocket

1309
00:48:16,630 --> 00:48:13,680
and then the first

1310
00:48:17,829 --> 00:48:16,640
from another world with samples bound

1311
00:48:19,910 --> 00:48:17,839
for earth

1312
00:48:21,670 --> 00:48:19,920
that are collected by perseverance now

1313
00:48:24,150 --> 00:48:21,680

in the near future

1314
00:48:26,549 --> 00:48:24,160
imagine follow the entry descendant

1315
00:48:28,230 --> 00:48:26,559
of the first human crew on the planetary

1316
00:48:29,670 --> 00:48:28,240
surface sometimes

1317
00:48:32,549 --> 00:48:29,680
in the future

1318
00:48:35,030 --> 00:48:32,559
these hit future historical way

1319
00:48:36,230 --> 00:48:35,040
which i'm confident will happen will be

1320
00:48:38,950 --> 00:48:36,240
enabled

1321
00:48:40,870 --> 00:48:38,960
by women and men working

1322
00:48:42,470 --> 00:48:40,880
in diverse teams

1323
00:48:43,750 --> 00:48:42,480
imagine the goals we can achieve

1324
00:48:45,750 --> 00:48:43,760
together

1325
00:48:47,430 --> 00:48:45,760
so what is possible

1326
00:48:48,950 --> 00:48:47,440
sometimes to address that question it's

1327
00:48:50,790 --> 00:48:48,960
good to look back and think where we've

1328
00:48:52,069 --> 00:48:50,800
come from just like my friend mike did

1329
00:48:53,750 --> 00:48:52,079
earlier

1330
00:48:55,910 --> 00:48:53,760
we've been on a journey

1331
00:48:57,910 --> 00:48:55,920
both as a human race for for quite a

1332
00:49:00,870 --> 00:48:57,920
while now and i don't want to show this

1333
00:49:03,349 --> 00:49:00,880
next image of sojourner of the

1334
00:49:05,750 --> 00:49:03,359
pathfinder mission

1335
00:49:09,109 --> 00:49:05,760
uh which was designed for seven souls or

1336
00:49:12,589 --> 00:49:09,119
martian days or so maybe 30 ultimately

1337
00:49:16,150 --> 00:49:12,599
lasted for 85 earth days in

1338
00:49:18,790 --> 00:49:16,160

1997. i remember that really this thing

1339
00:49:21,190 --> 00:49:18,800
clear through pathfinder instead in

1340
00:49:24,549 --> 00:49:21,200
indeed that you know weighed 23 pounds

1341
00:49:26,549 --> 00:49:24,559
and i returned a surprising amount of

1342
00:49:28,390 --> 00:49:26,559
data back to earth and i'm trying a

1343
00:49:31,270 --> 00:49:28,400
surprising amount of science for many

1344
00:49:32,950 --> 00:49:31,280
scientists i must say some people didn't

1345
00:49:34,790 --> 00:49:32,960
it's back quite that much and that's

1346
00:49:36,950 --> 00:49:34,800
what happened sometimes too

1347
00:49:38,710 --> 00:49:36,960
when you're in a white bait just like uh

1348
00:49:40,390 --> 00:49:38,720
we've seen here

1349
00:49:43,109 --> 00:49:40,400
we've grown from that seat that

1350
00:49:45,589 --> 00:49:43,119
perseverance is the size of a small car

1351
00:49:48,390 --> 00:49:45,599
and it's ready for us for the next shine

1352
00:49:51,030 --> 00:49:48,400
leaves and here's a picture that we're

1353
00:49:53,670 --> 00:49:51,040
putting up that is one of the many

1354
00:49:56,230 --> 00:49:53,680
pictures that we're releasing and of

1355
00:49:58,710 --> 00:49:56,240
course it's a picture one of my absolute

1356
00:50:00,790 --> 00:49:58,720
favorite and that's a picture of the

1357
00:50:03,109 --> 00:50:00,800
sample caching system on there because

1358
00:50:05,190 --> 00:50:03,119
it's that sample caching system that

1359
00:50:07,670 --> 00:50:05,200
will connect this mission

1360
00:50:08,549 --> 00:50:07,680
to the samples that will bring back to

1361
00:50:12,390 --> 00:50:08,559
earth

1362
00:50:14,390 --> 00:50:12,400
and other historic feed we're working on

1363
00:50:16,950 --> 00:50:14,400

this system is on the surface of marsh

1364
00:50:19,270 --> 00:50:16,960
now i remember just by looking at it

1365
00:50:22,309 --> 00:50:19,280
before we packed it up from jpl and

1366
00:50:25,270 --> 00:50:22,319
moved it over then of course uh launched

1367
00:50:27,829 --> 00:50:25,280
it uh from from the top of a rocket

1368
00:50:30,069 --> 00:50:27,839
that's my friends it's one of the

1369
00:50:32,309 --> 00:50:30,079
indelible moments in nasa's history

1370
00:50:33,750 --> 00:50:32,319
where what we can see and what we can

1371
00:50:35,670 --> 00:50:33,760
learn and what we can hope for in the

1372
00:50:37,030 --> 00:50:35,680
future and the extraordinary emotions

1373
00:50:38,549 --> 00:50:37,040
that takes

1374
00:50:41,510 --> 00:50:38,559
makes us feel

1375
00:50:44,950 --> 00:50:41,520
all of us coming together and human

1376
00:50:46,390 --> 00:50:44,960
element will fill our future at mars

1377
00:50:49,030 --> 00:50:46,400
which is bright

1378
00:50:51,589 --> 00:50:49,040
indeed and it will fuel the dreams of a

1379
00:50:54,069 --> 00:50:51,599
new generation and will return to mars

1380
00:50:55,270 --> 00:50:54,079
and also study the samples that we will

1381
00:50:58,150 --> 00:50:55,280
eventually

1382
00:51:00,870 --> 00:50:58,160
bring home i'm so grateful to this team

1383
00:51:03,270 --> 00:51:00,880
and literally the thousands both at jpl

1384
00:51:05,750 --> 00:51:03,280
and within the us and around the world

1385
00:51:07,510 --> 00:51:05,760
to all of you who have engaged in this

1386
00:51:09,750 --> 00:51:07,520
mission

1387
00:51:12,470 --> 00:51:09,760
as has been noted

1388
00:51:14,309 --> 00:51:12,480

the raw image pipeline is opening up

1389
00:51:16,390 --> 00:51:14,319
please go take

1390
00:51:18,150 --> 00:51:16,400
a look at these data and play with them

1391
00:51:20,630 --> 00:51:18,160
especially those of you

1392
00:51:23,109 --> 00:51:20,640
uh the children and the youth that have

1393
00:51:25,750 --> 00:51:23,119
signed up to our educational campaign

1394
00:51:27,510 --> 00:51:25,760
what can you find in these pictures and

1395
00:51:29,750 --> 00:51:27,520
who's going to compose the first piece

1396
00:51:31,109 --> 00:51:29,760
of music with actual mars

1397
00:51:33,270 --> 00:51:31,119
sound

1398
00:51:35,589 --> 00:51:33,280
mike matt jennifer al

1399
00:51:37,829 --> 00:51:35,599
many of you leaders and could not be

1400
00:51:40,069 --> 00:51:37,839
more proud of both you

1401
00:51:42,710 --> 00:51:40,079
and your team on behalf of our entire

1402
00:51:43,829 --> 00:51:42,720
nasa leadership team a heartfelt and a

1403
00:51:45,750 --> 00:51:43,839
proud

1404
00:51:48,230 --> 00:51:45,760
thanks to you

1405
00:51:51,430 --> 00:51:48,240
for the record matt i'm so glad for your

1406
00:51:53,910 --> 00:51:51,440
idea about these cameras we will learn a

1407
00:51:56,630 --> 00:51:53,920
lot from that much more than we ever

1408
00:51:59,510 --> 00:51:56,640
expected and of course this is just

1409
00:52:01,990 --> 00:51:59,520
a start for the surface team

1410
00:52:03,910 --> 00:52:02,000
a real work starts now to evaluate the

1411
00:52:06,870 --> 00:52:03,920
surrounding and start a plan and our

1412
00:52:08,549 --> 00:52:06,880
trajectory across chessroad crater

1413
00:52:09,829 --> 00:52:08,559

it's a big team and there are lots of

1414
00:52:12,950 --> 00:52:09,839
discussions

1415
00:52:14,549 --> 00:52:12,960
but that's science in action

1416
00:52:16,309 --> 00:52:14,559
stay with us

1417
00:52:19,829 --> 00:52:16,319
there is much more

1418
00:52:22,069 --> 00:52:19,839
amazement to come back to your account

1419
00:52:24,790 --> 00:52:22,079
thank you thomas and we'll now move on

1420
00:52:26,390 --> 00:52:24,800
to your questions remember if you are a

1421
00:52:28,790 --> 00:52:26,400
member of the media on the phone line

1422
00:52:29,589 --> 00:52:28,800
you can press star one to get into the

1423
00:52:32,230 --> 00:52:29,599
queue

1424
00:52:34,630 --> 00:52:32,240
if you're on social media you can tag

1425
00:52:36,790 --> 00:52:34,640
questions with the hashtag countdown to

1426
00:52:41,270 --> 00:52:36,800
mars now starting on the phone line is

1427
00:52:44,470 --> 00:52:42,790
yeah hi um

1428
00:52:46,870 --> 00:52:44,480
i guess it's a pharrell or maybe for

1429
00:52:48,549 --> 00:52:46,880
matt i mean other than the the loose

1430
00:52:50,549 --> 00:52:48,559
spring you guys on the heat shield is

1431
00:52:52,630 --> 00:52:50,559
there anything at all in that video that

1432
00:52:54,790 --> 00:52:52,640
looked off nominal i mean

1433
00:52:57,349 --> 00:52:54,800
you know it looked like it was almost

1434
00:52:58,390 --> 00:52:57,359
textbook um and i'm not saying that just

1435
00:53:00,390 --> 00:52:58,400
to

1436
00:53:01,990 --> 00:53:00,400
i don't know give you free praise but i

1437
00:53:03,670 --> 00:53:02,000
didn't see you know i don't see anything

1438
00:53:06,470 --> 00:53:03,680

like that so

1439
00:53:08,390 --> 00:53:06,480
is there anything thanks

1440
00:53:10,069 --> 00:53:08,400
so we've been i think that when uh we've

1441
00:53:11,670 --> 00:53:10,079
been pouring over those videos and

1442
00:53:13,109 --> 00:53:11,680
looking for anything that uh that could

1443
00:53:14,950 --> 00:53:13,119
be wrong and also looking at the rest of

1444
00:53:16,710 --> 00:53:14,960
the data and we did have a pretty clean

1445
00:53:18,549 --> 00:53:16,720
run uh through through entry descent and

1446
00:53:21,190 --> 00:53:18,559
landing uh there are a couple of bits of

1447
00:53:23,190 --> 00:53:21,200
the uh pair of the parachute lid

1448
00:53:24,870 --> 00:53:23,200
that came off some of that was expected

1449
00:53:26,390 --> 00:53:24,880
in fact we knew that there was some risk

1450
00:53:27,829 --> 00:53:26,400
of that as well

1451
00:53:29,349 --> 00:53:27,839
and there was if you look at the video

1452
00:53:32,630 --> 00:53:29,359
you can actually see a chunk uh that's

1453
00:53:34,230 --> 00:53:32,640
the uh the radome it's a uh a cover uh

1454
00:53:36,230 --> 00:53:34,240
for one of the uh pair that one of the

1455
00:53:37,990 --> 00:53:36,240
logan antennas we use during cruise and

1456
00:53:39,670 --> 00:53:38,000
also during part of edl

1457
00:53:40,630 --> 00:53:39,680
that came off we had hoped that it

1458
00:53:42,470 --> 00:53:40,640
wouldn't

1459
00:53:43,910 --> 00:53:42,480
when we tried to restrain it a little

1460
00:53:45,510 --> 00:53:43,920
bit better but we knew that it was a

1461
00:53:47,270 --> 00:53:45,520
risk that it might um so that's

1462
00:53:48,870 --> 00:53:47,280
something we noticed uh that's on there

1463
00:53:50,710 --> 00:53:48,880

as well there's a couple other little

1464
00:53:52,230 --> 00:53:50,720
things that we've been taking a look at

1465
00:53:54,309 --> 00:53:52,240
but i think you're in general right that

1466
00:53:56,390 --> 00:53:54,319
the uh the actual ascent landing system

1467
00:53:57,670 --> 00:53:56,400
behaves as expected and it did what it

1468
00:53:59,829 --> 00:53:57,680
had to do

1469
00:54:01,349 --> 00:53:59,839
especially given uh and a big shout out

1470
00:54:03,030 --> 00:54:01,359
to the terrain relative navigation

1471
00:54:04,710 --> 00:54:03,040
system which put us down

1472
00:54:07,270 --> 00:54:04,720
in the safest spot that was available to

1473
00:54:08,870 --> 00:54:07,280
us the places that we had to choose from

1474
00:54:10,470 --> 00:54:08,880
um weren't great if we didn't have

1475
00:54:11,510 --> 00:54:10,480
something like trey and ulta navigation

1476
00:54:15,030 --> 00:54:11,520
so uh

1477
00:54:17,109 --> 00:54:15,040
yeah the landing system worked great

1478
00:54:20,870 --> 00:54:17,119
great thanks al and up next we have

1479
00:54:24,069 --> 00:54:20,880
marcia dunn from the associated press

1480
00:54:26,870 --> 00:54:24,079
yes hi um wonderful video i'm just

1481
00:54:29,750 --> 00:54:26,880
wondering did the jpl team get to see

1482
00:54:32,150 --> 00:54:29,760
snippets coming down in the video um and

1483
00:54:34,790 --> 00:54:32,160
then or did you have to wait until this

1484
00:54:37,190 --> 00:54:34,800
one minute uh video was put together

1485
00:54:39,750 --> 00:54:37,200
what was the reaction when you saw first

1486
00:54:41,349 --> 00:54:39,760
saw the video and laid eyes on it and

1487
00:54:43,190 --> 00:54:41,359
and for david

1488
00:54:46,230 --> 00:54:43,200

why do you think mike didn't work during

1489
00:54:50,150 --> 00:54:48,150
i could say a couple words about the um

1490
00:54:51,990 --> 00:54:50,160
the first part

1491
00:54:55,030 --> 00:54:52,000
i had trouble leaving this mission

1492
00:54:56,950 --> 00:54:55,040
support area this week just because

1493
00:54:58,870 --> 00:54:56,960
i kept waiting for every little bit of

1494
00:55:00,710 --> 00:54:58,880
information to come back from

1495
00:55:02,470 --> 00:55:00,720
particularly from these cameras but from

1496
00:55:04,710 --> 00:55:02,480
the vehicle in general

1497
00:55:07,510 --> 00:55:04,720
and i can tell you every time we got

1498
00:55:10,950 --> 00:55:07,520
something people were

1499
00:55:12,950 --> 00:55:10,960
overjoyed giddy they were like kids you

1500
00:55:15,030 --> 00:55:12,960
know in a candy store

1501
00:55:16,630 --> 00:55:15,040
uh you know we get a little bit we get a

1502
00:55:19,589 --> 00:55:16,640
thumbnail which literally is just a

1503
00:55:22,549 --> 00:55:19,599
really low res blobby looking thing

1504
00:55:24,870 --> 00:55:22,559
of of one of those videos that came down

1505
00:55:27,190 --> 00:55:24,880
first and we'd just be falling on the

1506
00:55:29,670 --> 00:55:27,200
floor excited with what we were seeing

1507
00:55:31,750 --> 00:55:29,680
and that's before even the high res came

1508
00:55:33,510 --> 00:55:31,760
you know

1509
00:55:35,109 --> 00:55:33,520
there's a lot of people that have

1510
00:55:38,230 --> 00:55:35,119
contributed to

1511
00:55:39,589 --> 00:55:38,240
to this entry descent and landing system

1512
00:55:44,630 --> 00:55:39,599
our

1513
00:55:46,470 --> 00:55:44,640

to be here in the uh the studio

1514
00:55:48,789 --> 00:55:46,480
he was kind of the father of the sky

1515
00:55:49,670 --> 00:55:48,799
crane system this started 15 years ago

1516
00:55:51,910 --> 00:55:49,680
for him

1517
00:55:53,990 --> 00:55:51,920
he and his team have never seen this

1518
00:55:55,750 --> 00:55:54,000
system operate before not even on the

1519
00:55:57,910 --> 00:55:55,760
earth because we can't test it on the

1520
00:55:59,829 --> 00:55:57,920
earth so this is the first time we've

1521
00:56:01,670 --> 00:55:59,839
had a chance as engineers to actually

1522
00:56:04,390 --> 00:56:01,680
see what we designed

1523
00:56:05,510 --> 00:56:04,400
and uh i just can't it's hard for me to

1524
00:56:07,430 --> 00:56:05,520
uh

1525
00:56:09,910 --> 00:56:07,440
express just how emotional it was and

1526
00:56:12,069 --> 00:56:09,920
how exciting it was for everybody as we

1527
00:56:13,510 --> 00:56:12,079
got this information down

1528
00:56:14,710 --> 00:56:13,520
i'll turn it over to dave to say a

1529
00:56:16,309 --> 00:56:14,720
couple words

1530
00:56:19,510 --> 00:56:16,319
before you said that can i just chime in

1531
00:56:21,109 --> 00:56:19,520
on the first image of this justin i will

1532
00:56:23,270 --> 00:56:21,119
say um

1533
00:56:25,750 --> 00:56:23,280
when when we get these first image any

1534
00:56:28,230 --> 00:56:25,760
of these imaging systems

1535
00:56:30,150 --> 00:56:28,240
the test images never look as good as

1536
00:56:32,309 --> 00:56:30,160
the real thing it's not even close in

1537
00:56:34,789 --> 00:56:32,319
fact it's very hard to simulate a lot of

1538
00:56:36,710 --> 00:56:34,799

these things especially these

1539
00:56:38,230 --> 00:56:36,720
you know sky cranes and things and so

1540
00:56:40,470 --> 00:56:38,240
the images that we normally see during

1541
00:56:41,670 --> 00:56:40,480
test programs are

1542
00:56:43,190 --> 00:56:41,680
you know there's always like a ladder in

1543
00:56:45,030 --> 00:56:43,200
the background or the lighting's never

1544
00:56:46,549 --> 00:56:45,040
quite right or there's a car in the case

1545
00:56:48,470 --> 00:56:46,559
of the eo cams where these big targets

1546
00:56:50,069 --> 00:56:48,480
out in parking lots and

1547
00:56:51,349 --> 00:56:50,079
we were dodging cars to try to do our

1548
00:56:53,270 --> 00:56:51,359
tests and things

1549
00:56:55,430 --> 00:56:53,280
and so that moment that you get these

1550
00:56:56,549 --> 00:56:55,440
images from mars it's it's just kind of

1551
00:56:58,230 --> 00:56:56,559
an electric

1552
00:56:59,670 --> 00:56:58,240
feeling where it just all just snaps

1553
00:57:00,950 --> 00:56:59,680
into place and you get these pictures

1554
00:57:02,470 --> 00:57:00,960
that are just like

1555
00:57:03,910 --> 00:57:02,480
perfectly you know they're pictures of

1556
00:57:06,390 --> 00:57:03,920
mars that you can never simulate here on

1557
00:57:08,309 --> 00:57:06,400
earth and i think that we all experience

1558
00:57:10,150 --> 00:57:08,319
that especially after you we go through

1559
00:57:12,230 --> 00:57:10,160
months and months of testing

1560
00:57:13,589 --> 00:57:12,240
and the images don't really look that

1561
00:57:14,950 --> 00:57:13,599
great and you know people get skeptical

1562
00:57:16,549 --> 00:57:14,960
like are these these cameras really that

1563
00:57:18,069 --> 00:57:16,559

great because you know that looks like a

1564
00:57:19,190 --> 00:57:18,079
garage or something

1565
00:57:20,710 --> 00:57:19,200
uh so

1566
00:57:22,470 --> 00:57:20,720
we're it's just amazing to get these

1567
00:57:23,990 --> 00:57:22,480
pictures and i just i think we all feel

1568
00:57:25,190 --> 00:57:24,000
that way because we're all seeing

1569
00:57:26,470 --> 00:57:25,200
pictures of

1570
00:57:27,670 --> 00:57:26,480
insides of

1571
00:57:29,349 --> 00:57:27,680
labs and everything and they're never

1572
00:57:31,430 --> 00:57:29,359
that great that it's amazing to get

1573
00:57:33,430 --> 00:57:31,440
these photos from mars okay

1574
00:57:36,069 --> 00:57:33,440
i'll give you my take so uh

1575
00:57:38,710 --> 00:57:36,079
thursday evening and friday when the

1576
00:57:40,150 --> 00:57:38,720
data started to come down and uh

1577
00:57:41,430 --> 00:57:40,160
we kind of realized what we had i was

1578
00:57:43,430 --> 00:57:41,440
sitting at home

1579
00:57:44,789 --> 00:57:43,440
and my phone started to go off and i was

1580
00:57:46,390 --> 00:57:44,799
getting face times from people who were

1581
00:57:47,750 --> 00:57:46,400
in the msa and what was happening was

1582
00:57:49,190 --> 00:57:47,760
that they were starting to show them on

1583
00:57:50,230 --> 00:57:49,200
the monitors that we have hanging on the

1584
00:57:51,670 --> 00:57:50,240
wall

1585
00:57:53,270 --> 00:57:51,680
and people were turning their phones

1586
00:57:55,430 --> 00:57:53,280
around and saying girl you got to see

1587
00:57:57,030 --> 00:57:55,440
this reaction and people were just

1588
00:57:58,710 --> 00:57:57,040

jumping up and down and giddy and

1589
00:58:00,710 --> 00:57:58,720
ecstatic and it

1590
00:58:02,230 --> 00:58:00,720
it was a great feeling i mean from where

1591
00:58:04,230 --> 00:58:02,240
i was sitting i only was excited to see

1592
00:58:05,670 --> 00:58:04,240
these videos that we had captured it was

1593
00:58:07,190 --> 00:58:05,680
also the fact that a lot of people had

1594
00:58:10,150 --> 00:58:07,200
put a lot of effort in to make this

1595
00:58:13,190 --> 00:58:10,160
system work and to actually reward that

1596
00:58:15,030 --> 00:58:13,200
effort and to to pay it back and and get

1597
00:58:17,349 --> 00:58:15,040
this excitement going

1598
00:58:18,630 --> 00:58:17,359
it made me super happy i was glad to see

1599
00:58:20,390 --> 00:58:18,640
that all the hard work all the

1600
00:58:21,589 --> 00:58:20,400
dedication had come in and that everyone

1601
00:58:23,750 --> 00:58:21,599
was just

1602
00:58:24,950 --> 00:58:23,760
excited about uh not only what we

1603
00:58:27,190 --> 00:58:24,960
captured but

1604
00:58:29,109 --> 00:58:27,200
also what this mission um could do going

1605
00:58:30,470 --> 00:58:29,119
for forwards

1606
00:58:32,069 --> 00:58:30,480
it was a great feeling it was a feeling

1607
00:58:33,109 --> 00:58:32,079
i won't i won't forget for for quite

1608
00:58:34,309 --> 00:58:33,119
some time

1609
00:58:36,390 --> 00:58:34,319
and then regarding the question about

1610
00:58:37,990 --> 00:58:36,400
the microphone we started to look at it

1611
00:58:39,910 --> 00:58:38,000
what we think happened is that there was

1612
00:58:42,630 --> 00:58:39,920
a communication error

1613
00:58:45,349 --> 00:58:42,640

between uh the device that is

1614
00:58:46,870 --> 00:58:45,359
responsible for uh digitizing the analog

1615
00:58:49,109 --> 00:58:46,880
signals that the microphone picked up

1616
00:58:51,190 --> 00:58:49,119
and then passing them back to the

1617
00:58:53,349 --> 00:58:51,200
uh the computer that actually stores all

1618
00:58:55,750 --> 00:58:53,359
the data we're not exactly sure why it

1619
00:58:58,069 --> 00:58:55,760
has been a fact it was just so much data

1620
00:58:59,589 --> 00:58:58,079
coming into the system we tested it but

1621
00:59:01,190 --> 00:58:59,599
you know obviously everything's a little

1622
00:59:03,910 --> 00:59:01,200
bit different on mars than we actually

1623
00:59:05,670 --> 00:59:03,920
have here here on the ground so we were

1624
00:59:07,829 --> 00:59:05,680
pretty quickly able to determine didn't

1625
00:59:09,670 --> 00:59:07,839
think there was a hardware issue

1626
00:59:12,309 --> 00:59:09,680
with the microphone which is why we were

1627
00:59:14,069 --> 00:59:12,319
able to uh uh approach the project

1628
00:59:15,910 --> 00:59:14,079
and get their concurrence to try to turn

1629
00:59:17,109 --> 00:59:15,920
the microphone on then on that saw ii

1630
00:59:18,950 --> 00:59:17,119
boundary

1631
00:59:21,349 --> 00:59:18,960
it's just unfortunate that that error

1632
00:59:22,870 --> 00:59:21,359
happened during the edl and and we just

1633
00:59:25,109 --> 00:59:22,880
weren't able to record any of the data

1634
00:59:27,430 --> 00:59:25,119
that uh that we generated during the

1635
00:59:29,750 --> 00:59:27,440
sequence

1636
00:59:30,789 --> 00:59:29,760
all right thanks and up next we have

1637
00:59:33,750 --> 00:59:30,799
chris

1638
00:59:35,829 --> 00:59:33,760

from the washington post

1639
00:59:38,069 --> 00:59:35,839
hi uh thanks for taking the time and for

1640
00:59:39,190 --> 00:59:38,079
showing this i really appreciate it um i

1641
00:59:40,710 --> 00:59:39,200
wonder if you could talk a little bit

1642
00:59:42,870 --> 00:59:40,720
about the cameras that were used to

1643
00:59:44,710 --> 00:59:42,880
record the video i understand they were

1644
00:59:47,349 --> 00:59:44,720
specially designed maybe

1645
00:59:49,910 --> 00:59:47,359
a commercial company called fl ir

1646
00:59:51,750 --> 00:59:49,920
systems just curious to know like what

1647
00:59:53,829 --> 00:59:51,760
goes into you know designing a camera

1648
00:59:55,910 --> 00:59:53,839
that's sustaining the the g's the blast

1649
00:59:58,309 --> 00:59:55,920
of the thrusters everything that it's

1650
01:00:01,030 --> 00:59:58,319
got to go through to capture that images

1651
01:00:02,950 --> 01:00:01,040
uh thanks okay so

1652
01:00:05,910 --> 01:00:02,960
the cameras were originally purchased

1653
01:00:08,789 --> 01:00:05,920
from a company called uh point grey

1654
01:00:11,349 --> 01:00:08,799
uh which was then bought out by flir

1655
01:00:13,910 --> 01:00:11,359
um and i can tell you that the

1656
01:00:15,750 --> 01:00:13,920
modifications we made to the camera were

1657
01:00:18,230 --> 01:00:15,760
minimal this was not a camera

1658
01:00:20,230 --> 01:00:18,240
specifically designed for use on mars

1659
01:00:22,390 --> 01:00:20,240
you can purchase the same camera off the

1660
01:00:23,670 --> 01:00:22,400
internet for whatever applications you

1661
01:00:26,230 --> 01:00:23,680
might have for it

1662
01:00:27,990 --> 01:00:26,240
the only things we did is we actually uh

1663
01:00:30,710 --> 01:00:28,000

added some bonding material on the

1664
01:00:33,270 --> 01:00:30,720
inside to try to make sure that in the

1665
01:00:34,870 --> 01:00:33,280
dynamic environment of launch and then

1666
01:00:35,670 --> 01:00:34,880
that mortar fire event that they talked

1667
01:00:37,190 --> 01:00:35,680
about

1668
01:00:39,109 --> 01:00:37,200
uh that the camera would continue to

1669
01:00:41,270 --> 01:00:39,119
operate and then we had to swap out a

1670
01:00:43,910 --> 01:00:41,280
couple pieces on the inside because in

1671
01:00:46,870 --> 01:00:43,920
the vacuum of space they had the ability

1672
01:00:48,870 --> 01:00:46,880
to outgas material and if that material

1673
01:00:51,030 --> 01:00:48,880
deposited itself on the detector then we

1674
01:00:52,150 --> 01:00:51,040
wouldn't get the clear images that we

1675
01:00:53,589 --> 01:00:52,160
actually got

1676
01:00:55,190 --> 01:00:53,599
but other than that

1677
01:00:57,190 --> 01:00:55,200
it was not specially designed for use

1678
01:01:00,230 --> 01:00:57,200
for this application it is a commercial

1679
01:01:01,270 --> 01:01:00,240
off the shelf camera

1680
01:01:04,630 --> 01:01:01,280
thank you

1681
01:01:07,990 --> 01:01:04,640
and up next we have michael sheets from

1682
01:01:13,910 --> 01:01:10,710
hi congratulations again on catherine's

1683
01:01:16,390 --> 01:01:13,920
uh stumping footage of this landing i'm

1684
01:01:18,470 --> 01:01:16,400
curious on two aspects i mean one

1685
01:01:20,390 --> 01:01:18,480
adam selter you know you guys had said

1686
01:01:21,829 --> 01:01:20,400
that in 15 years since he really

1687
01:01:23,670 --> 01:01:21,839
engineered the sky crane he never

1688
01:01:25,829 --> 01:01:23,680

actually seen an operation i'm curious

1689
01:01:28,549 --> 01:01:25,839
what adam thinks about

1690
01:01:29,990 --> 01:01:28,559
seeing this uh work on a planet and

1691
01:01:32,309 --> 01:01:30,000
secondarily

1692
01:01:34,950 --> 01:01:32,319
how this informs and how it's being able

1693
01:01:38,150 --> 01:01:34,960
to actually see the landing and forms

1694
01:01:40,309 --> 01:01:38,160
future missions even as nasa looks to

1695
01:01:42,710 --> 01:01:40,319
one day land astronauts you know what

1696
01:01:44,950 --> 01:01:42,720
does this really teach you about

1697
01:01:48,230 --> 01:01:44,960
trying to get people on the surface of

1698
01:01:53,910 --> 01:01:51,430
uh well let's see adam's not up here but

1699
01:01:56,390 --> 01:01:53,920
i can uh i can channel him for for just

1700
01:01:57,270 --> 01:01:56,400
a moment perhaps and and tell you that

1701
01:01:59,430 --> 01:01:57,280
uh

1702
01:02:01,190 --> 01:01:59,440
you know this is a throw of a lifetime i

1703
01:02:03,589 --> 01:02:01,200
think not just for adam but all the

1704
01:02:06,789 --> 01:02:03,599
people that contributed

1705
01:02:10,870 --> 01:02:06,799
uh to to this architecture development

1706
01:02:13,029 --> 01:02:10,880
uh back on curiosity i remember when we

1707
01:02:16,309 --> 01:02:13,039
first briefed this

1708
01:02:18,950 --> 01:02:16,319
uh this this system you know with the

1709
01:02:21,349 --> 01:02:18,960
supersonic parachutes and the

1710
01:02:23,430 --> 01:02:21,359
you know multi-body systems and we're

1711
01:02:25,589 --> 01:02:23,440
gonna lower this thing on a tether and

1712
01:02:26,870 --> 01:02:25,599
people just looked at us like we were

1713
01:02:29,349 --> 01:02:26,880

insane

1714
01:02:32,870 --> 01:02:29,359
you know and uh adam uh

1715
01:02:34,630 --> 01:02:32,880
and his team of which al was part you

1716
01:02:36,470 --> 01:02:34,640
know they kept at it and they explained

1717
01:02:38,789 --> 01:02:36,480
why it made sense they explained why it

1718
01:02:41,029 --> 01:02:38,799
was robust they explained why it would

1719
01:02:43,510 --> 01:02:41,039
work it was not easy to build i will

1720
01:02:45,829 --> 01:02:43,520
tell you that uh as as the flight system

1721
01:02:47,910 --> 01:02:45,839
manager on curiosity but

1722
01:02:49,109 --> 01:02:47,920
once you build it and once you test it

1723
01:02:52,309 --> 01:02:49,119
it's something

1724
01:02:54,470 --> 01:02:52,319
that really is designed inherently to

1725
01:02:57,589 --> 01:02:54,480
interact with the uncertainties that

1726
01:02:58,630 --> 01:02:57,599
throw at you throws at you and

1727
01:03:01,829 --> 01:02:58,640
and so

1728
01:03:03,990 --> 01:03:01,839
i think being able to see his system

1729
01:03:06,789 --> 01:03:04,000
operate like this

1730
01:03:08,549 --> 01:03:06,799
you know in high definition

1731
01:03:10,230 --> 01:03:08,559
landing at jezreel

1732
01:03:12,309 --> 01:03:10,240
you know it doesn't get too much better

1733
01:03:13,510 --> 01:03:12,319
than that i don't think

1734
01:03:15,109 --> 01:03:13,520
so

1735
01:03:16,630 --> 01:03:15,119
i'm going to throw it to al he can maybe

1736
01:03:19,430 --> 01:03:16,640
say a few words about the types of

1737
01:03:21,349 --> 01:03:19,440
technologies and and information

1738
01:03:23,109 --> 01:03:21,359

that we have on the technologies on the

1739
01:03:25,270 --> 01:03:23,119
system and information we got getting

1740
01:03:27,750 --> 01:03:25,280
back from edl and we'll be getting back

1741
01:03:29,109 --> 01:03:27,760
as part of our reconstruction activity

1742
01:03:30,390 --> 01:03:29,119
that feed into

1743
01:03:31,510 --> 01:03:30,400
the future

1744
01:03:33,510 --> 01:03:31,520
yeah i mean i think we can talk about a

1745
01:03:35,029 --> 01:03:33,520
lot of things i mean but as matt

1746
01:03:35,910 --> 01:03:35,039
matt mentioned you know as a fresh-faced

1747
01:03:37,510 --> 01:03:35,920
kid

1748
01:03:39,829 --> 01:03:37,520
when this guy was invented and i was in

1749
01:03:41,349 --> 01:03:39,839
that room and uh it's uh it's amazing to

1750
01:03:42,789 --> 01:03:41,359
see it finally in action even though we

1751
01:03:43,990 --> 01:03:42,799
knew it worked once

1752
01:03:46,309 --> 01:03:44,000
we didn't know for sure it was going to

1753
01:03:49,430 --> 01:03:46,319
work again and then for it to work again

1754
01:03:50,630 --> 01:03:49,440
and then for us to see it is incredible

1755
01:03:51,829 --> 01:03:50,640
and just starting with skycrane there

1756
01:03:53,670 --> 01:03:51,839
you can see some things that i think are

1757
01:03:55,190 --> 01:03:53,680
going to be useful to the future uh one

1758
01:03:56,789 --> 01:03:55,200
thing that's of course of a lot of

1759
01:03:58,630 --> 01:03:56,799
interest especially as we start landing

1760
01:04:00,470 --> 01:03:58,640
bigger things is the plume ground

1761
01:04:01,750 --> 01:04:00,480
interaction the interaction between

1762
01:04:03,029 --> 01:04:01,760
those rockets

1763
01:04:04,870 --> 01:04:03,039

and what they're doing to the ground and

1764
01:04:07,109 --> 01:04:04,880
how they kick things around and we've

1765
01:04:08,630 --> 01:04:07,119
got great video of that here this time

1766
01:04:10,230 --> 01:04:08,640
both from the rover download camera and

1767
01:04:12,069 --> 01:04:10,240
the descent stage down the camera we can

1768
01:04:13,829 --> 01:04:12,079
see how those uh how they create those

1769
01:04:15,990 --> 01:04:13,839
scours and stuff gets pushed together

1770
01:04:17,829 --> 01:04:16,000
and creates a sheet underneath the rover

1771
01:04:20,069 --> 01:04:17,839
we can see that all occurring

1772
01:04:21,670 --> 01:04:20,079
so that's super useful uh the parachute

1773
01:04:23,270 --> 01:04:21,680
stuff too one thing we didn't show uh

1774
01:04:24,789 --> 01:04:23,280
necessarily here is that that the

1775
01:04:27,270 --> 01:04:24,799
parachute upload cameras the two that we

1776
01:04:29,270 --> 01:04:27,280
got are at 75 frames per second

1777
01:04:31,349 --> 01:04:29,280
so we can see that inflation that only

1778
01:04:33,510 --> 01:04:31,359
occurs in you know 0.7 seconds in less

1779
01:04:35,109 --> 01:04:33,520
than a second um you can see that snap

1780
01:04:36,630 --> 01:04:35,119
open and look at all the details of how

1781
01:04:38,549 --> 01:04:36,640
it unfolds and and how it's

1782
01:04:39,990 --> 01:04:38,559
symmetrically inflated and all those

1783
01:04:41,670 --> 01:04:40,000
things are very useful for future

1784
01:04:43,990 --> 01:04:41,680
missions uh both whether they're landing

1785
01:04:46,069 --> 01:04:44,000
more things in people or stuff and then

1786
01:04:47,510 --> 01:04:46,079
people um you know

1787
01:04:48,549 --> 01:04:47,520
other missions are going to use future

1788
01:04:50,230 --> 01:04:48,559

missions like the sample retrieval

1789
01:04:52,470 --> 01:04:50,240
missions are likely going to use things

1790
01:04:54,789 --> 01:04:52,480
like parachutes and rockets of course

1791
01:04:56,549 --> 01:04:54,799
so we're very interested in seeing how

1792
01:04:58,230 --> 01:04:56,559
uh how those those cameras and what we

1793
01:04:59,750 --> 01:04:58,240
see in the in that in those camera

1794
01:05:01,990 --> 01:04:59,760
images can teach us about how those

1795
01:05:05,510 --> 01:05:02,000
systems are actually performing and make

1796
01:05:12,390 --> 01:05:07,910
thanks alan matt up next we have ken

1797
01:05:17,029 --> 01:05:14,710
hi thank you um i was wanting to give me

1798
01:05:18,950 --> 01:05:17,039
a few more details about how the data

1799
01:05:20,710 --> 01:05:18,960
came back there's 30 gigabytes that was

1800
01:05:22,630 --> 01:05:20,720
collected how much has come back and

1801
01:05:25,349 --> 01:05:22,640
what was the data rate that you were

1802
01:05:28,150 --> 01:05:25,359
able to send the information back

1803
01:05:29,750 --> 01:05:28,160
thank you maybe jessica can uh

1804
01:05:32,309 --> 01:05:29,760
so i can say that as part of our

1805
01:05:34,950 --> 01:05:32,319
commission activity we actually walk the

1806
01:05:37,029 --> 01:05:34,960
data rate up uh over the course of our

1807
01:05:42,789 --> 01:05:37,039
different overflights with the orbiters

1808
01:05:46,470 --> 01:05:42,799
and uh so we start um with uh to

1809
01:05:49,109 --> 01:05:46,480
ver a lower rate um 2000 8000 and then

1810
01:05:51,270 --> 01:05:49,119
we mo we increase that into an adaptive

1811
01:05:55,029 --> 01:05:51,280
data rate with the orbiter in which we

1812
01:05:56,870 --> 01:05:55,039
can continue to go many uh megabits i'm

1813
01:06:00,390 --> 01:05:56,880

sorry two meg

1814
01:06:03,430 --> 01:06:00,400
meg and then much further beyond that um

1815
01:06:05,109 --> 01:06:03,440
over the course the total volume that i

1816
01:06:06,710 --> 01:06:05,119
don't have off the top of my head and so

1817
01:06:08,630 --> 01:06:06,720
maybe i don't know if that's something

1818
01:06:10,950 --> 01:06:08,640
that dave or we can provide for you

1819
01:06:12,150 --> 01:06:10,960
later

1820
01:06:14,069 --> 01:06:12,160
justin do you have how many how many

1821
01:06:15,670 --> 01:06:14,079
images we got back yeah

1822
01:06:17,349 --> 01:06:15,680
so uh we counted

1823
01:06:20,309 --> 01:06:17,359
yesterday that we're releasing today

1824
01:06:21,670 --> 01:06:20,319
there's a about 4 500 that we've gotten

1825
01:06:23,510 --> 01:06:21,680
so far that we're pushing out to the web

1826
01:06:25,670 --> 01:06:23,520
today i mean i will mention that when

1827
01:06:28,390 --> 01:06:25,680
the orbiters could fly overhead

1828
01:06:33,190 --> 01:06:28,400
the compasses typically return

1829
01:06:35,190 --> 01:06:33,200
let's say 500 to 900 megabits per pass

1830
01:06:36,870 --> 01:06:35,200
and we've had i don't know

1831
01:06:37,990 --> 01:06:36,880
we've had a lot of them now like five or

1832
01:06:40,069 --> 01:06:38,000
ten of them

1833
01:06:42,470 --> 01:06:40,079
we've typically had about two to three

1834
01:06:43,829 --> 01:06:42,480
over flights per night and it does vary

1835
01:06:45,750 --> 01:06:43,839
the rates i was recording are the

1836
01:06:47,430 --> 01:06:45,760
communication rates from the rover to

1837
01:06:50,150 --> 01:06:47,440
the orbiter and then once that's

1838
01:06:53,990 --> 01:06:50,160

collected then we're anywhere from you

1839
01:06:56,390 --> 01:06:54,000
know some passes smaller 80 uh to 100

1840
01:06:58,549 --> 01:06:56,400
and where we've had other passes

1841
01:07:00,789 --> 01:06:58,559
which have been significant amounts of

1842
01:07:03,430 --> 01:07:00,799
data up at 700

1843
01:07:05,910 --> 01:07:03,440
and so it is variable per orbiter

1844
01:07:07,510 --> 01:07:05,920
and per orientation yeah and i would add

1845
01:07:09,430 --> 01:07:07,520
one more thing i wanted to mention about

1846
01:07:11,029 --> 01:07:09,440
the the camera technology and then this

1847
01:07:12,789 --> 01:07:11,039
data

1848
01:07:14,870 --> 01:07:12,799
we haven't mentioned it but in addition

1849
01:07:17,589 --> 01:07:14,880
to use commercial cameras um we're using

1850
01:07:20,390 --> 01:07:17,599
a commercial computer an intel based

1851
01:07:21,750 --> 01:07:20,400
pc that's running linux open source so

1852
01:07:23,750 --> 01:07:21,760
it's the first open source at least that

1853
01:07:25,349 --> 01:07:23,760
i know of open source linux box running

1854
01:07:27,829 --> 01:07:25,359
on the surface of mars especially inside

1855
01:07:29,270 --> 01:07:27,839
the rover it's quite compact

1856
01:07:30,309 --> 01:07:29,280
and so there's the linux operating

1857
01:07:33,270 --> 01:07:30,319
system

1858
01:07:35,430 --> 01:07:33,280
and we compress the video using ffmpeg

1859
01:07:37,430 --> 01:07:35,440
which is another open source tool so

1860
01:07:39,190 --> 01:07:37,440
thank you to the open source community

1861
01:07:41,510 --> 01:07:39,200
for allowing us to use your amazing

1862
01:07:42,950 --> 01:07:41,520
software appreciate it

1863
01:07:45,430 --> 01:07:42,960

i just uh

1864
01:07:47,750 --> 01:07:45,440
just very briefly i just want to note as

1865
01:07:49,349 --> 01:07:47,760
jessica said um you saw some of the

1866
01:07:50,950 --> 01:07:49,359
terrific imagery from the mars

1867
01:07:52,870 --> 01:07:50,960
reconnaissance orbiter we've been

1868
01:07:54,470 --> 01:07:52,880
getting fantastic support from the

1869
01:07:57,029 --> 01:07:54,480
orbiter community

1870
01:07:58,789 --> 01:07:57,039
not just mro uh for for both that

1871
01:08:01,270 --> 01:07:58,799
imagery and the comms

1872
01:08:03,990 --> 01:08:01,280
uh but also uh from maven which is a

1873
01:08:05,910 --> 01:08:04,000
goddard space spacecraft from odyssey

1874
01:08:09,270 --> 01:08:05,920
one of our older orbiters

1875
01:08:11,670 --> 01:08:09,280
uh if the esa european uh trace gas

1876
01:08:13,990 --> 01:08:11,680
orbiter as well some of the biggest data

1877
01:08:15,829 --> 01:08:14,000
volume passes we've had brought back a

1878
01:08:17,910 --> 01:08:15,839
lot of this imagery came from our

1879
01:08:20,630 --> 01:08:17,920
partners in europe and so thank you all

1880
01:08:28,470 --> 01:08:23,110
okay and up next on the phone lines is

1881
01:08:31,829 --> 01:08:30,229
thank you all for doing this and yeah

1882
01:08:33,349 --> 01:08:31,839
yeah it's really amazing video thanks

1883
01:08:35,669 --> 01:08:33,359
for sharing it um

1884
01:08:38,070 --> 01:08:35,679
just yeah there's a question for for

1885
01:08:40,149 --> 01:08:38,080
dave um what do you anticipate doing

1886
01:08:41,910 --> 01:08:40,159
maybe with with the edl mic now that

1887
01:08:43,829 --> 01:08:41,920
it's up and running do you see it having

1888
01:08:46,550 --> 01:08:43,839

any kind of diagnostic uses during the

1889
01:08:48,470 --> 01:08:46,560
deployments of the robotic arm and sort

1890
01:08:50,950 --> 01:08:48,480
of like like the instrument checkouts

1891
01:08:52,390 --> 01:08:50,960
and so forth um yeah i mean what do you

1892
01:08:54,229 --> 01:08:52,400
see it doing aside from recording

1893
01:08:56,149 --> 01:08:54,239
martian wind and the sound of the dirt

1894
01:08:57,189 --> 01:08:56,159
under the wheels and so on

1895
01:08:59,510 --> 01:08:57,199
thank you

1896
01:09:01,669 --> 01:08:59,520
yes we've had a lot of discussion about

1897
01:09:03,349 --> 01:09:01,679
how we might be able to use

1898
01:09:05,030 --> 01:09:03,359
both the edl cam microphone and the

1899
01:09:06,789 --> 01:09:05,040
super cam microphone to do those type of

1900
01:09:08,630 --> 01:09:06,799
diagnostic stuff i mean

1901
01:09:09,910 --> 01:09:08,640
the ops team right now i don't want to

1902
01:09:12,309 --> 01:09:09,920
jessica but they're focused on getting

1903
01:09:13,829 --> 01:09:12,319
the system deployed and capturing noise

1904
01:09:15,349 --> 01:09:13,839
of that is definitely not the first

1905
01:09:16,709 --> 01:09:15,359
priority they need to focus on getting

1906
01:09:18,070 --> 01:09:16,719
this vehicle ready to perform some

1907
01:09:19,510 --> 01:09:18,080
amazing science

1908
01:09:20,950 --> 01:09:19,520
but that doesn't mean in the future we

1909
01:09:22,870 --> 01:09:20,960
could not sit down and discuss the

1910
01:09:24,870 --> 01:09:22,880
possibility of capturing

1911
01:09:28,149 --> 01:09:24,880
audio files of an actuator as it

1912
01:09:30,309 --> 01:09:28,159
actually uh spins on the surface of mars

1913
01:09:32,229 --> 01:09:30,319

um you know that the noise is an

1914
01:09:35,269 --> 01:09:32,239
incredible thing that engineers can use

1915
01:09:37,189 --> 01:09:35,279
to basically detect the health of moving

1916
01:09:39,990 --> 01:09:37,199
systems gears and actuators and things

1917
01:09:42,229 --> 01:09:40,000
like that and so if we get a snapshot of

1918
01:09:44,229 --> 01:09:42,239
of uh actuator today

1919
01:09:45,910 --> 01:09:44,239
and uh you know you can compare over

1920
01:09:48,470 --> 01:09:45,920
time do another snapshot another audio

1921
01:09:50,390 --> 01:09:48,480
file of that uh of that actuator

1922
01:09:51,669 --> 01:09:50,400
in the future compare the two and see if

1923
01:09:53,189 --> 01:09:51,679
there's anything that can be learned in

1924
01:09:54,149 --> 01:09:53,199
terms of the health of that uh that

1925
01:09:55,990 --> 01:09:54,159
device

1926
01:09:57,590 --> 01:09:56,000
now with that said i do need to remind

1927
01:09:59,430 --> 01:09:57,600
everybody that uh

1928
01:10:01,669 --> 01:09:59,440
the the microphone that's in the edl

1929
01:10:03,270 --> 01:10:01,679
camera system just like all of the the

1930
01:10:05,750 --> 01:10:03,280
cameras and other hardware is off the

1931
01:10:08,390 --> 01:10:05,760
shelf hardware it is not designed

1932
01:10:11,830 --> 01:10:08,400
to live in the hostile environment of

1933
01:10:13,510 --> 01:10:11,840
mars it gets down 120 degrees plus below

1934
01:10:15,510 --> 01:10:13,520
zero at night and then it warms up

1935
01:10:18,149 --> 01:10:15,520
significantly more in the day to what

1936
01:10:19,830 --> 01:10:18,159
-40 or something like that so

1937
01:10:22,550 --> 01:10:19,840
those temperature cycles and that cold

1938
01:10:24,950 --> 01:10:22,560

temperature are going to

1939
01:10:26,950 --> 01:10:24,960
significantly limit the life of of these

1940
01:10:29,110 --> 01:10:26,960
devices they're just not designed to

1941
01:10:30,790 --> 01:10:29,120
last for long periods of time

1942
01:10:32,310 --> 01:10:30,800
the super cam microphone might continue

1943
01:10:33,350 --> 01:10:32,320
to work it actually is designed a little

1944
01:10:34,950 --> 01:10:33,360
bit more

1945
01:10:37,350 --> 01:10:34,960
for this particular environment it can

1946
01:10:38,149 --> 01:10:37,360
last longer so i think

1947
01:10:39,830 --> 01:10:38,159
you know

1948
01:10:41,910 --> 01:10:39,840
as you heard i think dr z mentioned

1949
01:10:43,590 --> 01:10:41,920
earlier we're always surprised by how

1950
01:10:45,350 --> 01:10:43,600
rugged and robust some of our items are

1951
01:10:47,590 --> 01:10:45,360
how long they actually last you know

1952
01:10:49,430 --> 01:10:47,600
they they continue to operate far longer

1953
01:10:50,870 --> 01:10:49,440
than we designed them

1954
01:10:52,310 --> 01:10:50,880
we've gotten pretty lucky over the last

1955
01:10:53,350 --> 01:10:52,320
couple of days perhaps we'll get lucky

1956
01:10:55,189 --> 01:10:53,360
and the hardware will continue to

1957
01:10:56,709 --> 01:10:55,199
operate uh on the surface of mars and

1958
01:10:58,870 --> 01:10:56,719
allow us to do those type of diagnostic

1959
01:11:00,070 --> 01:10:58,880
things in the future well jeff you want

1960
01:11:01,830 --> 01:11:00,080
to add anything more about how you might

1961
01:11:03,590 --> 01:11:01,840
consider using them

1962
01:11:05,110 --> 01:11:03,600
well i can i can say that that

1963
01:11:06,709 --> 01:11:05,120

application was one of the things that

1964
01:11:09,030 --> 01:11:06,719
we had projected

1965
01:11:10,550 --> 01:11:09,040
and tested and wanted to make sure that

1966
01:11:12,229 --> 01:11:10,560
even though this was

1967
01:11:14,310 --> 01:11:12,239
a capability that was part of the cruise

1968
01:11:16,470 --> 01:11:14,320
and entry descent landing software

1969
01:11:18,709 --> 01:11:16,480
package that we're operating right now

1970
01:11:21,430 --> 01:11:18,719
we've also carried that capability

1971
01:11:22,950 --> 01:11:21,440
forward into our surface software and so

1972
01:11:24,790 --> 01:11:22,960
um for

1973
01:11:27,270 --> 01:11:24,800
assuming the hardware is good we uh

1974
01:11:29,030 --> 01:11:27,280
we're open and ready to use it

1975
01:11:30,550 --> 01:11:29,040
yeah and i will mention um to the

1976
01:11:32,630 --> 01:11:30,560
question we we actually have gotten

1977
01:11:35,030 --> 01:11:32,640
requests from instrument teams wanting

1978
01:11:37,030 --> 01:11:35,040
to turn on the microphone to observe

1979
01:11:38,390 --> 01:11:37,040
their instrument functioning moxie is

1980
01:11:40,550 --> 01:11:38,400
one of the instruments that's going to

1981
01:11:42,310 --> 01:11:40,560
be generating oxygen has compressors and

1982
01:11:43,750 --> 01:11:42,320
scroll pumps and things and they

1983
01:11:46,470 --> 01:11:43,760
actually want to want us to use the

1984
01:11:47,510 --> 01:11:46,480
microphones to do diagnostic acoustic

1985
01:11:49,990 --> 01:11:47,520
measurements

1986
01:11:52,149 --> 01:11:50,000
so i actually think that this might

1987
01:11:53,350 --> 01:11:52,159
become something that all rovers might

1988
01:11:54,390 --> 01:11:53,360

want because

1989
01:11:56,229 --> 01:11:54,400
everybody knows that when you hear

1990
01:11:58,070 --> 01:11:56,239
something squeaking it's diagnostic

1991
01:11:59,350 --> 01:11:58,080
maybe you need to check it out and it

1992
01:12:02,070 --> 01:11:59,360
tells you a little bit about how that

1993
01:12:03,350 --> 01:12:02,080
how it works and so we will find out how

1994
01:12:05,030 --> 01:12:03,360
these get used it's actually kind of

1995
01:12:07,030 --> 01:12:05,040
exciting um and we're getting requests

1996
01:12:09,990 --> 01:12:07,040
from the teams so we're gonna and we're

1997
01:12:11,030 --> 01:12:10,000
working to to put those into the plan

1998
01:12:13,590 --> 01:12:11,040
i'll just

1999
01:12:15,510 --> 01:12:13,600
say i hope it does survive long enough

2000
01:12:16,550 --> 01:12:15,520
so that we can hear those wheels crunch

2001
01:12:18,070 --> 01:12:16,560
over

2002
01:12:20,470 --> 01:12:18,080
the surface of the planet because i

2003
01:12:22,310 --> 01:12:20,480
think we would hear it and i think uh

2004
01:12:25,189 --> 01:12:22,320
it'd be great to hear that big rotary

2005
01:12:27,189 --> 01:12:25,199
percussive jackhammer drill

2006
01:12:29,669 --> 01:12:27,199
taking that first sample

2007
01:12:31,750 --> 01:12:29,679
of a rock on on mars

2008
01:12:33,669 --> 01:12:31,760
as well i think we'd hear that also so

2009
01:12:35,350 --> 01:12:33,679
i'm hopeful that that our little

2010
01:12:38,709 --> 01:12:35,360
microphone will hang in there for for

2011
01:12:44,950 --> 01:12:41,750
okay and up next is lisa grossman from

2012
01:12:49,350 --> 01:12:47,430
hi thanks for taking my question um the

2013
01:12:51,510 --> 01:12:49,360

video is amazing and a lot of it looks a

2014
01:12:53,990 --> 01:12:51,520
lot like the um animations that you've

2015
01:12:56,229 --> 01:12:54,000
shown before the landing to to kind of

2016
01:12:57,510 --> 01:12:56,239
advertise this

2017
01:12:59,510 --> 01:12:57,520
excuse me

2018
01:13:01,590 --> 01:12:59,520
going forward how will you distinguish

2019
01:13:03,910 --> 01:13:01,600
the video that is the real video from

2020
01:13:06,070 --> 01:13:03,920
the animation to kind of make it clear

2021
01:13:07,830 --> 01:13:06,080
to people what they're looking at and

2022
01:13:09,510 --> 01:13:07,840
keep them from getting confused or not

2023
01:13:12,149 --> 01:13:09,520
be fuel for conspiracy theorists saying

2024
01:13:13,590 --> 01:13:12,159
we haven't actually done this

2025
01:13:15,590 --> 01:13:13,600
i guess i could try to take that one i

2026
01:13:16,950 --> 01:13:15,600
mean i think we should label very

2027
01:13:19,350 --> 01:13:16,960
clearly which ones

2028
01:13:20,790 --> 01:13:19,360
are from mars and uh and not

2029
01:13:21,990 --> 01:13:20,800
i think it's cleared a lot of us but i

2030
01:13:23,990 --> 01:13:22,000
think you're right right given the way

2031
01:13:26,550 --> 01:13:24,000
that the animation has been pretty good

2032
01:13:27,910 --> 01:13:26,560
uh you getting a good sense for uh for

2033
01:13:29,270 --> 01:13:27,920
how that could be confusing i think we

2034
01:13:31,110 --> 01:13:29,280
should label them going forward now that

2035
01:13:33,990 --> 01:13:31,120
we have this kind of you know we should

2036
01:13:35,590 --> 01:13:34,000
be clear what's uh what's real

2037
01:13:36,660 --> 01:13:35,600
what a great problem to have exactly i

2038
01:13:38,310 --> 01:13:36,670

mean it's an amazing problem

2039
01:13:40,550 --> 01:13:38,320
[Laughter]

2040
01:13:43,830 --> 01:13:40,560
justin do you have anything uh anything

2041
01:13:45,590 --> 01:13:43,840
any thoughts here yeah i i can attest to

2042
01:13:47,590 --> 01:13:45,600
it's real it's actually real i know

2043
01:13:49,430 --> 01:13:47,600
because i know the data very well it's

2044
01:13:50,709 --> 01:13:49,440
it's stunning and it's real and that was

2045
01:13:52,870 --> 01:13:50,719
our thought too when we first saw it

2046
01:13:55,910 --> 01:13:52,880
we're like wow this looks

2047
01:13:59,110 --> 01:13:55,920
like doesn't look real um but it is and

2048
01:14:01,030 --> 01:13:59,120
that's what's so amazing about it and um

2049
01:14:02,470 --> 01:14:01,040
you know i i know i've seen some of the

2050
01:14:04,310 --> 01:14:02,480
video games are getting pretty good you

2051
01:14:06,070 --> 01:14:04,320
know second glance you look at a sports

2052
01:14:07,910 --> 01:14:06,080
game and it looks like it's real but

2053
01:14:10,470 --> 01:14:07,920
it's fake but this is actually real

2054
01:14:12,470 --> 01:14:10,480
stuff and that's why it's so exciting um

2055
01:14:13,750 --> 01:14:12,480
and i actually just want to say uh for

2056
01:14:14,790 --> 01:14:13,760
those of you that want to watch the

2057
01:14:16,550 --> 01:14:14,800
videos

2058
01:14:18,390 --> 01:14:16,560
personally i like watching like quarter

2059
01:14:20,870 --> 01:14:18,400
quarter speed or even slower because

2060
01:14:22,550 --> 01:14:20,880
there's so much detail in there

2061
01:14:24,790 --> 01:14:22,560
that anyone who's done animations know

2062
01:14:26,149 --> 01:14:24,800
that knows that that would take a lot of

2063
01:14:27,510 --> 01:14:26,159

time to do

2064
01:14:29,270 --> 01:14:27,520
and it all happened so quickly and the

2065
01:14:31,110 --> 01:14:29,280
camera cut everything and so that's how

2066
01:14:32,390 --> 01:14:31,120
that's how we know it's real because we

2067
01:14:34,870 --> 01:14:32,400
we know so much about these these

2068
01:14:37,590 --> 01:14:34,880
systems but there's just so much detail

2069
01:14:40,229 --> 01:14:37,600
um that that's that's one way that you

2070
01:14:41,350 --> 01:14:40,239
could you could look at um but yeah

2071
01:14:43,270 --> 01:14:41,360
there's one other thing i forgot too i

2072
01:14:44,950 --> 01:14:43,280
remember early on msl when they started

2073
01:14:46,790 --> 01:14:44,960
coming up with animation for uh for

2074
01:14:48,390 --> 01:14:46,800
curiosity's landing uh we had a

2075
01:14:50,390 --> 01:14:48,400
discussion about the uh the plumes

2076
01:14:52,470 --> 01:14:50,400
actually coming out of this end stage uh

2077
01:14:54,149 --> 01:14:52,480
and the fact that uh that they were

2078
01:14:55,430 --> 01:14:54,159
clear and that you wouldn't see them uh

2079
01:14:56,709 --> 01:14:55,440
in real life like you can do if you

2080
01:14:58,790 --> 01:14:56,719
don't see them in the rover upload

2081
01:15:00,470 --> 01:14:58,800
camera um but we thought that it would

2082
01:15:02,310 --> 01:15:00,480
be uh that people would be expecting to

2083
01:15:03,750 --> 01:15:02,320
see them in the in the animation so they

2084
01:15:05,430 --> 01:15:03,760
took some artistic license and putting

2085
01:15:06,790 --> 01:15:05,440
them there so

2086
01:15:09,030 --> 01:15:06,800
here i can tell you now that hopefully

2087
01:15:10,630 --> 01:15:09,040
our future animations will uh will show

2088
01:15:12,310 --> 01:15:10,640

the right thing and show the uh the

2089
01:15:13,270 --> 01:15:12,320
clear plumes like you see in the real

2090
01:15:14,550 --> 01:15:13,280
video

2091
01:15:16,229 --> 01:15:14,560
yeah

2092
01:15:17,990 --> 01:15:16,239
the same comment for

2093
01:15:19,270 --> 01:15:18,000
the exquisite detail on the rover if you

2094
01:15:21,830 --> 01:15:19,280
actually look at you know every cal

2095
01:15:24,070 --> 01:15:21,840
target's in place every little twist in

2096
01:15:25,590 --> 01:15:24,080
every tie cable tie they're all there in

2097
01:15:27,189 --> 01:15:25,600
the animations you don't have that when

2098
01:15:28,550 --> 01:15:27,199
you get down to that level of detail at

2099
01:15:30,470 --> 01:15:28,560
least at least now you you know

2100
01:15:32,470 --> 01:15:30,480
typically don't because a lot of the

2101
01:15:33,990 --> 01:15:32,480
things happen kind of last minute and

2102
01:15:35,110 --> 01:15:34,000
you know as the rover's getting built

2103
01:15:36,550 --> 01:15:35,120
and people slap things on and they're

2104
01:15:38,390 --> 01:15:36,560
not in the drawing so the animators

2105
01:15:39,990 --> 01:15:38,400
don't pick it up and that's another

2106
01:15:42,470 --> 01:15:40,000
thing that's amazing about this video

2107
01:15:43,990 --> 01:15:42,480
every single detail is in there so

2108
01:15:46,390 --> 01:15:44,000
encourage people to look at it

2109
01:15:47,750 --> 01:15:46,400
it's fun

2110
01:15:50,550 --> 01:15:47,760
thanks justin it really is some

2111
01:15:53,110 --> 01:15:50,560
beautiful detail now we have a social

2112
01:15:54,070 --> 01:15:53,120
media question to take jerome on twitter

2113
01:15:56,149 --> 01:15:54,080

asks

2114
01:15:58,149 --> 01:15:56,159
some pictures we can see dirt and small

2115
01:16:01,030 --> 01:15:58,159
rocks inside the real

2116
01:16:03,510 --> 01:16:01,040
wheel rim was this expected and will it

2117
01:16:05,350 --> 01:16:03,520
become an issue if more dust and sand is

2118
01:16:08,630 --> 01:16:05,360
picked up along the way

2119
01:16:11,910 --> 01:16:08,640
yep i can i can speak to that so uh it's

2120
01:16:13,990 --> 01:16:11,920
not uncommon for us to have uh rocks and

2121
01:16:16,390 --> 01:16:14,000
dirt inside the wheels um

2122
01:16:18,790 --> 01:16:16,400
either from the landing event or as

2123
01:16:20,870 --> 01:16:18,800
we're driving across the surface you'll

2124
01:16:23,750 --> 01:16:20,880
also notice on the deck

2125
01:16:26,070 --> 01:16:23,760
we also experienced some of that debris

2126
01:16:27,830 --> 01:16:26,080
coming down on top of the rover and we

2127
01:16:29,189 --> 01:16:27,840
design our mechanisms for these

2128
01:16:32,310 --> 01:16:29,199
conditions

2129
01:16:34,310 --> 01:16:32,320
so we don't expect any issue with the

2130
01:16:36,229 --> 01:16:34,320
material from the landing event or as we

2131
01:16:39,910 --> 01:16:36,239
continue to surf the rove across the

2132
01:16:48,790 --> 01:16:42,550
thanks jessica and right now we have a

2133
01:16:52,550 --> 01:16:50,390
yes hi thank you very much for doing

2134
01:16:55,590 --> 01:16:52,560
this congratulations on such a stunning

2135
01:16:58,070 --> 01:16:55,600
um array of photos and and videos um

2136
01:16:59,430 --> 01:16:58,080
alan chen or al chen mentioned the dust

2137
01:17:01,510 --> 01:16:59,440
earlier and i

2138
01:17:03,110 --> 01:17:01,520

it was striking as the spacecraft got

2139
01:17:03,830 --> 01:17:03,120
close to the surface how much was kicked

2140
01:17:06,149 --> 01:17:03,840
up

2141
01:17:07,750 --> 01:17:06,159
um it's a one ton rover it's pretty

2142
01:17:09,910 --> 01:17:07,760
sizable but you know when you're talking

2143
01:17:12,229 --> 01:17:09,920
about human emissions um it's it's much

2144
01:17:14,070 --> 01:17:12,239
larger and so you know what does you

2145
01:17:15,669 --> 01:17:14,080
know what does being able to see this

2146
01:17:17,590 --> 01:17:15,679
dust tell us about the challenge of

2147
01:17:20,390 --> 01:17:17,600
landing future kind of much larger

2148
01:17:21,990 --> 01:17:20,400
spacecraft on mars is that something

2149
01:17:23,830 --> 01:17:22,000
that you're going to have to account for

2150
01:17:25,270 --> 01:17:23,840
and if you know

2151
01:17:27,430 --> 01:17:25,280
is it going to be a really significant

2152
01:17:28,709 --> 01:17:27,440
issue to deal with thank you

2153
01:17:30,149 --> 01:17:28,719
yeah i think i take that one i mean i

2154
01:17:31,910 --> 01:17:30,159
think you know as most people know right

2155
01:17:34,550 --> 01:17:31,920
there as far as i'm aware there are no

2156
01:17:36,630 --> 01:17:34,560
landing pads on uh on mars or barges

2157
01:17:38,310 --> 01:17:36,640
that we can land on uh prepared places

2158
01:17:39,750 --> 01:17:38,320
so we we're gonna have to deal with

2159
01:17:41,910 --> 01:17:39,760
especially if we use propulsion where we

2160
01:17:43,750 --> 01:17:41,920
have to deal with uh this plume ground

2161
01:17:45,750 --> 01:17:43,760
interaction and it's really difficult

2162
01:17:48,149 --> 01:17:45,760
it's difficult to get right to get the

2163
01:17:49,990 --> 01:17:48,159

modeling right to get uh to understand

2164
01:17:51,590 --> 01:17:50,000
it or even to do a real test that does

2165
01:17:53,270 --> 01:17:51,600
that shows a good impression of what

2166
01:17:54,550 --> 01:17:53,280
you're going to come down on especially

2167
01:17:56,709 --> 01:17:54,560
when you don't know exactly where you're

2168
01:17:58,550 --> 01:17:56,719
going and what the terrain is like

2169
01:18:00,310 --> 01:17:58,560
and what the ground properties are where

2170
01:18:02,790 --> 01:18:00,320
you're coming down so i do think this is

2171
01:18:04,149 --> 01:18:02,800
a big challenge for us going forward and

2172
01:18:06,229 --> 01:18:04,159
that's why collecting this information

2173
01:18:08,070 --> 01:18:06,239
here is useful uh we can certainly begin

2174
01:18:09,669 --> 01:18:08,080
to see

2175
01:18:11,590 --> 01:18:09,679
how it actually behaved in real life and

2176
01:18:13,350 --> 01:18:11,600
see how things began to move and what

2177
01:18:14,790 --> 01:18:13,360
those scours are like and we have a

2178
01:18:16,630 --> 01:18:14,800
vehicle that'll tell us what the ground

2179
01:18:18,709 --> 01:18:16,640
that we happen to land on was like and

2180
01:18:20,390 --> 01:18:18,719
we know how we recommend those uh those

2181
01:18:22,550 --> 01:18:20,400
engines and where they were pointed so

2182
01:18:24,470 --> 01:18:22,560
we have a rich treasure trove here

2183
01:18:26,550 --> 01:18:24,480
that we can use to kind of get at that

2184
01:18:27,990 --> 01:18:26,560
kind of challenge but because i do think

2185
01:18:29,830 --> 01:18:28,000
it's a big one especially as we start to

2186
01:18:33,270 --> 01:18:29,840
land heavier and heavier things

2187
01:18:39,110 --> 01:18:35,750
and up next on the phone lines is joey

2188
01:18:41,510 --> 01:18:39,120

roulette from the verge

2189
01:18:43,669 --> 01:18:41,520
hey uh thanks for doing this um earlier

2190
01:18:46,070 --> 01:18:43,679
it was mentioned that scientists are

2191
01:18:47,990 --> 01:18:46,080
already uh pouring through the thousands

2192
01:18:50,870 --> 01:18:48,000
and thousands of images and i was just

2193
01:18:52,390 --> 01:18:50,880
wondering what about um the surface or

2194
01:18:55,270 --> 01:18:52,400
the rocks that you guys have seen so far

2195
01:18:57,270 --> 01:18:55,280
from these images are standing out uh

2196
01:18:58,470 --> 01:18:57,280
and and kind of what has been

2197
01:19:01,430 --> 01:18:58,480
interesting from a scientific

2198
01:19:06,229 --> 01:19:05,350
ken uh some ken's there yeah okay ken

2199
01:19:07,110 --> 01:19:06,239
sure

2200
01:19:15,830 --> 01:19:07,120
uh

2201
01:19:17,830 --> 01:19:15,840
little bit there but um we're noticing

2202
01:19:20,950 --> 01:19:17,840
basically the different colors that we

2203
01:19:23,110 --> 01:19:20,960
see and and textures and tones and

2204
01:19:24,950 --> 01:19:23,120
and so one thing that's

2205
01:19:27,990 --> 01:19:24,960
striking to me standing out to me some

2206
01:19:30,709 --> 01:19:28,000
of us is that um a lot of the the rocks

2207
01:19:33,430 --> 01:19:30,719
that are labeled as light rocks uh seem

2208
01:19:35,189 --> 01:19:33,440
to have a rough texture uh whereas some

2209
01:19:38,149 --> 01:19:35,199
of the darker rocks further afield that

2210
01:19:39,669 --> 01:19:38,159
that are higher standing more like large

2211
01:19:41,590 --> 01:19:39,679
boulders

2212
01:19:42,470 --> 01:19:41,600
seem to be smoother

2213
01:19:45,270 --> 01:19:42,480

um

2214
01:19:47,830 --> 01:19:45,280
that can mean something about the the

2215
01:19:49,270 --> 01:19:47,840
grain size and the and the potentially

2216
01:19:51,430 --> 01:19:49,280
the composition

2217
01:19:53,750 --> 01:19:51,440
uh of the rocks themselves one of the

2218
01:19:55,669 --> 01:19:53,760
things where we're noting um as the

2219
01:19:58,630 --> 01:19:55,679
resolution gets better

2220
01:20:01,270 --> 01:19:58,640
is that these these light rocks uh

2221
01:20:03,750 --> 01:20:01,280
closer to the foreground may actually be

2222
01:20:06,390 --> 01:20:03,760
kind of dark on the inside and that the

2223
01:20:08,870 --> 01:20:06,400
light tone we see may be largely due to

2224
01:20:10,709 --> 01:20:08,880
dust covering uh and where the rocks

2225
01:20:12,870 --> 01:20:10,719
stand up a bit higher

2226
01:20:14,390 --> 01:20:12,880
and have less dust they tend to appear

2227
01:20:17,189 --> 01:20:14,400
dark so a lot of

2228
01:20:18,470 --> 01:20:17,199
you know new patterns are emerging um

2229
01:20:19,990 --> 01:20:18,480
and then of course one of the most

2230
01:20:22,790 --> 01:20:20,000
exciting and interesting things are

2231
01:20:24,310 --> 01:20:22,800
these what we call the holy rocks uh

2232
01:20:26,149 --> 01:20:24,320
that are you know in some cases right

2233
01:20:28,870 --> 01:20:26,159
under our wheels and these smaller

2234
01:20:30,070 --> 01:20:28,880
cobbles that are right around the rover

2235
01:20:32,470 --> 01:20:30,080
um

2236
01:20:34,550 --> 01:20:32,480
i didn't mention uh but you know one of

2237
01:20:35,910 --> 01:20:34,560
the possibilities for those holes is

2238
01:20:39,189 --> 01:20:35,920

that they are what we would call

2239
01:20:41,669 --> 01:20:39,199
vesicles which would be uh due to gas

2240
01:20:43,430 --> 01:20:41,679
escape from a volcanic rock we're not

2241
01:20:45,270 --> 01:20:43,440
calling them vehicles at this point

2242
01:20:47,430 --> 01:20:45,280
because we it's important for us to stay

2243
01:20:50,310 --> 01:20:47,440
open to the you know different possible

2244
01:20:52,629 --> 01:20:50,320
interpretations and not get locked yet

2245
01:20:53,669 --> 01:20:52,639
on limited data uh but if they are

2246
01:20:56,950 --> 01:20:53,679
volcanic

2247
01:20:58,310 --> 01:20:56,960
that is is enormously important uh to us

2248
01:21:00,550 --> 01:20:58,320
because it potentially provides an

2249
01:21:03,830 --> 01:21:00,560
opportunity to get a a really nice

2250
01:21:05,750 --> 01:21:03,840
radiometric age or an absolute date uh

2251
01:21:06,870 --> 01:21:05,760
if a sample like that comes back to

2252
01:21:09,189 --> 01:21:06,880
earth

2253
01:21:11,990 --> 01:21:09,199
but then again if you go back to

2254
01:21:14,390 --> 01:21:12,000
images from many uh previous uh mars

2255
01:21:15,510 --> 01:21:14,400
missions rovers and otherwise you'll see

2256
01:21:18,229 --> 01:21:15,520
that that

2257
01:21:20,550 --> 01:21:18,239
wind abrasion can cause those those

2258
01:21:21,750 --> 01:21:20,560
sorts of holes in all different types of

2259
01:21:23,510 --> 01:21:21,760
rocks

2260
01:21:24,790 --> 01:21:23,520
so just a few of the thoughts that are

2261
01:21:26,870 --> 01:21:24,800
that are emerging and then of course

2262
01:21:28,550 --> 01:21:26,880
we're starting to get views of the delt

2263
01:21:30,790 --> 01:21:28,560

front now which just

2264
01:21:32,310 --> 01:21:30,800
have us you know on cloud nine uh

2265
01:21:33,910 --> 01:21:32,320
looking at some of the targets further

2266
01:21:36,310 --> 01:21:33,920
afield that that we're excited to

2267
01:21:40,870 --> 01:21:38,550
great thanks ken we have another phone

2268
01:21:43,590 --> 01:21:40,880
line question mark is astro from

2269
01:21:45,510 --> 01:21:43,600
astronomy magazine

2270
01:21:48,149 --> 01:21:45,520
hi thanks for taking my question um i

2271
01:21:49,669 --> 01:21:48,159
guess this is a question for al

2272
01:21:51,110 --> 01:21:49,679
and i was just wondering if you could

2273
01:21:52,950 --> 01:21:51,120
speak to

2274
01:21:54,709 --> 01:21:52,960
the performance of the landing vision

2275
01:21:57,110 --> 01:21:54,719
system if you've gotten a chance to dive

2276
01:21:59,430 --> 01:21:57,120
into that how the range figure and

2277
01:22:01,270 --> 01:21:59,440
terrain relative navigation really

2278
01:22:02,870 --> 01:22:01,280
performed and just sort of

2279
01:22:05,590 --> 01:22:02,880
what it was thinking how it was making

2280
01:22:07,030 --> 01:22:05,600
its decisions as it descended uh and

2281
01:22:09,189 --> 01:22:07,040
then when you look at its performance

2282
01:22:11,270 --> 01:22:09,199
accuracy you know how do you judge it

2283
01:22:13,189 --> 01:22:11,280
and can you see that improvement over

2284
01:22:14,709 --> 01:22:13,199
curiosity

2285
01:22:15,990 --> 01:22:14,719
yeah that'd be great i mean i was really

2286
01:22:17,590 --> 01:22:16,000
hoping for a chance to speak that a

2287
01:22:18,790 --> 01:22:17,600
little bit actually uh the language

2288
01:22:20,870 --> 01:22:18,800

division system as part of the train

2289
01:22:22,709 --> 01:22:20,880
relative navigation system really did

2290
01:22:24,390 --> 01:22:22,719
great um in fact you know here's some

2291
01:22:26,550 --> 01:22:24,400
stats right the uh updates on the

2292
01:22:28,550 --> 01:22:26,560
targeted well we took many images on the

2293
01:22:30,870 --> 01:22:28,560
way down uh we got tons of landmarks

2294
01:22:33,189 --> 01:22:30,880
we're real very able to match up what we

2295
01:22:35,669 --> 01:22:33,199
saw with our onboard map it was almost

2296
01:22:38,149 --> 01:22:35,679
perfect better than many of our field

2297
01:22:41,110 --> 01:22:38,159
tests or even simulations so we got a

2298
01:22:42,629 --> 01:22:41,120
very good uh good lock on where we were

2299
01:22:44,149 --> 01:22:42,639
and in fact when you combined that with

2300
01:22:45,270 --> 01:22:44,159
our safe target selection and where we

2301
01:22:47,990 --> 01:22:45,280
flew to

2302
01:22:49,830 --> 01:22:48,000
we only missed the targeted pixel by by

2303
01:22:51,350 --> 01:22:49,840
about five meters

2304
01:22:52,870 --> 01:22:51,360
so we were aiming for a particular spot

2305
01:22:55,030 --> 01:22:52,880
on the planet once it decided what was

2306
01:22:56,870 --> 01:22:55,040
reachable and what the safest spot was

2307
01:22:58,870 --> 01:22:56,880
and given the uh given how well the

2308
01:23:00,470 --> 01:22:58,880
lander vision system performed and our

2309
01:23:02,550 --> 01:23:00,480
system in flying is there we only missed

2310
01:23:04,390 --> 01:23:02,560
by five meters so that was really great

2311
01:23:06,149 --> 01:23:04,400
i mean i think the uh we've really

2312
01:23:07,910 --> 01:23:06,159
showed that this system can do what we

2313
01:23:09,830 --> 01:23:07,920

what we wanted it to do in helping us

2314
01:23:12,470 --> 01:23:09,840
figure out where to go and go to a safe

2315
01:23:16,229 --> 01:23:14,470
great thanks al we have so many

2316
01:23:17,990 --> 01:23:16,239
questions coming in that we are going to

2317
01:23:21,189 --> 01:23:18,000
keep the phone lines open for a little

2318
01:23:23,430 --> 01:23:21,199
while longer to press start one to get

2319
01:23:25,750 --> 01:23:23,440
in our queue for now i'm going to take a

2320
01:23:28,310 --> 01:23:25,760
social media question from bob on

2321
01:23:30,790 --> 01:23:28,320
twitter who asks how does the processing

2322
01:23:33,590 --> 01:23:30,800
power of the onboard computer compare to

2323
01:23:35,189 --> 01:23:33,600
a great smartphone matt do you want to

2324
01:23:36,950 --> 01:23:35,199
take that one

2325
01:23:40,070 --> 01:23:36,960
yeah sure that's that's a good question

2326
01:23:42,790 --> 01:23:40,080
you know in the space business um

2327
01:23:46,149 --> 01:23:42,800
we have to build things that we know uh

2328
01:23:47,590 --> 01:23:46,159
are gonna are gonna work and space is a

2329
01:23:49,270 --> 01:23:47,600
pretty hostile environment and the

2330
01:23:50,870 --> 01:23:49,280
surface of mars is even worse with the

2331
01:23:51,830 --> 01:23:50,880
temperature swings which we were talking

2332
01:23:53,030 --> 01:23:51,840
about

2333
01:23:55,590 --> 01:23:53,040
you know you need systems that are

2334
01:23:56,550 --> 01:23:55,600
capable of um

2335
01:23:58,709 --> 01:23:56,560
of

2336
01:24:00,950 --> 01:23:58,719
dealing with the radiation and and the

2337
01:24:03,030 --> 01:24:00,960
temperatures and and really perform with

2338
01:24:05,189 --> 01:24:03,040

very high reliability so as a result of

2339
01:24:06,470 --> 01:24:05,199
that we have a tendency to use systems

2340
01:24:09,110 --> 01:24:06,480
that have been around for a while

2341
01:24:10,390 --> 01:24:09,120
they're well shaken out

2342
01:24:12,629 --> 01:24:10,400
and on

2343
01:24:16,149 --> 01:24:12,639
uh on perseverance we're using the same

2344
01:24:18,229 --> 01:24:16,159
computer that we used on on curiosity in

2345
01:24:20,070 --> 01:24:18,239
large part because we know it worked and

2346
01:24:22,470 --> 01:24:20,080
we wanted to have that successful flight

2347
01:24:24,149 --> 01:24:22,480
heritage that we had from

2348
01:24:26,310 --> 01:24:24,159
from the previous mission so this is a

2349
01:24:28,550 --> 01:24:26,320
computer that you know

2350
01:24:32,629 --> 01:24:28,560
you would have found 15 or maybe even 20

2351
01:24:35,430 --> 01:24:32,639
years ago that were flying

2352
01:24:37,030 --> 01:24:35,440
having said that these edl cameras which

2353
01:24:40,070 --> 01:24:37,040
we were just talking about are

2354
01:24:41,990 --> 01:24:40,080
off-the-shelf you know state-of-the-art

2355
01:24:43,590 --> 01:24:42,000
new technology

2356
01:24:45,510 --> 01:24:43,600
and

2357
01:24:47,590 --> 01:24:45,520
it is always a thrill for us when we

2358
01:24:49,590 --> 01:24:47,600
have the opportunity like we did in this

2359
01:24:51,990 --> 01:24:49,600
particular application

2360
01:24:55,910 --> 01:24:52,000
uh to bring that kind of technology into

2361
01:24:59,350 --> 01:24:55,920
our systems uh it's a very powerful way

2362
01:25:01,189 --> 01:24:59,360
to multiply our our uh our functionality

2363
01:25:03,669 --> 01:25:01,199

and our capability

2364
01:25:07,270 --> 01:25:03,679
and uh and so this was a great example

2365
01:25:10,310 --> 01:25:07,280
of being able to use um new technology

2366
01:25:12,950 --> 01:25:10,320
uh so uh so i don't know if that's uh an

2367
01:25:15,030 --> 01:25:12,960
exact answer to the question but uh in

2368
01:25:17,350 --> 01:25:15,040
short that's uh you know

2369
01:25:19,990 --> 01:25:17,360
that's uh that's a summary

2370
01:25:21,270 --> 01:25:20,000
great thank you matt and thomas uh we

2371
01:25:24,229 --> 01:25:21,280
actually have a question for you coming

2372
01:25:25,669 --> 01:25:24,239
in hayden an 11 year old from ireland on

2373
01:25:28,070 --> 01:25:25,679
twitter asks

2374
01:25:30,709 --> 01:25:28,080
what advice would you give to a budding

2375
01:25:32,709 --> 01:25:30,719
planetary scientist in working towards

2376
01:25:35,830 --> 01:25:32,719
maybe being part of the mission that

2377
01:25:38,470 --> 01:25:35,840
will bring back samples to earth in the

2378
01:25:42,470 --> 01:25:40,390
well i'm so glad for that question i

2379
01:25:44,550 --> 01:25:42,480
think about that a lot and the advice

2380
01:25:46,550 --> 01:25:44,560
would i would give is first of all

2381
01:25:50,149 --> 01:25:46,560
that's exactly the right time to get

2382
01:25:52,310 --> 01:25:50,159
into that career braden that that now it

2383
01:25:54,470 --> 01:25:52,320
could not be a better time to join that

2384
01:25:57,189 --> 01:25:54,480
career or even if you started 10 years

2385
01:25:59,270 --> 01:25:57,199
earlier or you know in 10 years now is

2386
01:26:01,910 --> 01:25:59,280
the time to start that the advice i

2387
01:26:02,790 --> 01:26:01,920
would give is uh look uh

2388
01:26:05,350 --> 01:26:02,800

go

2389
01:26:08,709 --> 01:26:05,360
really start playing with data right

2390
01:26:10,310 --> 01:26:08,719
away kind of i mean yes go to school you

2391
01:26:13,189 --> 01:26:10,320
know the teachers that are there are

2392
01:26:15,750 --> 01:26:13,199
your allies going forward you know that

2393
01:26:17,990 --> 01:26:15,760
eventually probably opened me perhaps at

2394
01:26:19,910 --> 01:26:18,000
the university or at an advanced school

2395
01:26:22,310 --> 01:26:19,920
but go to school do that but the other

2396
01:26:23,990 --> 01:26:22,320
thing i want to just give you advice on

2397
01:26:26,229 --> 01:26:24,000
hating this is you know we're putting

2398
01:26:28,790 --> 01:26:26,239
all these data out

2399
01:26:31,430 --> 01:26:28,800
be your own researcher learn how to do

2400
01:26:33,350 --> 01:26:31,440
that kind of go play with it that's what

2401
01:26:36,149 --> 01:26:33,360
research is so much about and find

2402
01:26:38,870 --> 01:26:36,159
others who are just excited as excited

2403
01:26:41,350 --> 01:26:38,880
as you are and i'm sure soon enough

2404
01:26:43,510 --> 01:26:41,360
we'll have you on our teams in uh in the

2405
01:26:45,030 --> 01:26:43,520
future

2406
01:26:47,669 --> 01:26:45,040
that's some great advice thank you

2407
01:26:50,229 --> 01:26:47,679
thomas and up next we have on the phone

2408
01:26:52,629 --> 01:26:50,239
lines alexandra witz from nature

2409
01:26:54,390 --> 01:26:52,639
magazine

2410
01:26:56,470 --> 01:26:54,400
great thanks very much i'm not quite

2411
01:26:58,470 --> 01:26:56,480
sure who to address this too but i

2412
01:27:04,390 --> 01:26:58,480
wanted to ask about insight and whether

2413
01:27:08,870 --> 01:27:07,030

so i'm not sure anybody up here has the

2414
01:27:10,550 --> 01:27:08,880
latest information have do you al have

2415
01:27:11,910 --> 01:27:10,560
you heard anything now just heard from

2416
01:27:13,669 --> 01:27:11,920
other folks on the team i'm not sure

2417
01:27:15,510 --> 01:27:13,679
this is official or not but that they

2418
01:27:16,950 --> 01:27:15,520
hadn't seen much yet i think we'd have

2419
01:27:19,030 --> 01:27:16,960
to check uh

2420
01:27:21,430 --> 01:27:19,040
to be honest to be sure we got the right

2421
01:27:23,350 --> 01:27:21,440
answer so

2422
01:27:25,830 --> 01:27:23,360
great thank you and then another phone

2423
01:27:28,470 --> 01:27:25,840
line question from jackie goddard from

2424
01:27:30,870 --> 01:27:28,480
the times of london

2425
01:27:32,950 --> 01:27:30,880
hello congratulations everyone one of

2426
01:27:34,950 --> 01:27:32,960
the most common questions that i get

2427
01:27:38,229 --> 01:27:34,960
from readers who aren't generally a

2428
01:27:40,470 --> 01:27:38,239
scientific audience but regular folks

2429
01:27:42,470 --> 01:27:40,480
is what is the point of spending all

2430
01:27:44,470 --> 01:27:42,480
this money to go to another planet and

2431
01:27:46,149 --> 01:27:44,480
explore it and sometimes that's not even

2432
01:27:47,750 --> 01:27:46,159
a question it's a statement there are

2433
01:27:51,270 --> 01:27:47,760
cynics out there

2434
01:27:53,669 --> 01:27:51,280
can you say why we explore and how does

2435
01:27:55,510 --> 01:27:53,679
humanity benefit from you finding out

2436
01:28:03,860 --> 01:27:55,520
what you find out

2437
01:28:09,510 --> 01:28:06,390
[Music]

2438
01:28:11,350 --> 01:28:09,520

yeah why don't i why don't i get started

2439
01:28:13,990 --> 01:28:11,360
turn it over to you matt is that okay if

2440
01:28:16,390 --> 01:28:14,000
i start might be good with that yeah so

2441
01:28:18,709 --> 01:28:16,400
well frankly i'm thinking about this

2442
01:28:19,830 --> 01:28:18,719
question all the time uh why do we

2443
01:28:21,990 --> 01:28:19,840
explore

2444
01:28:24,870 --> 01:28:22,000
and of course when we do that at nasa i

2445
01:28:26,310 --> 01:28:24,880
just wanna just let everybody know

2446
01:28:28,390 --> 01:28:26,320
that if you look at

2447
01:28:30,310 --> 01:28:28,400
how much money we're spending on each

2448
01:28:32,310 --> 01:28:30,320
planet and the exploration of each

2449
01:28:34,790 --> 01:28:32,320
planet of course the majority

2450
01:28:36,629 --> 01:28:34,800
uh kind of that the money where the the

2451
01:28:38,870 --> 01:28:36,639
planet we're spending most money on of

2452
01:28:40,629 --> 01:28:38,880
course is the earth the place where we

2453
01:28:43,430 --> 01:28:40,639
live where our friends live for our

2454
01:28:45,350 --> 01:28:43,440
history is and we're so where our future

2455
01:28:47,189 --> 01:28:45,360
is going to be and so we're not confused

2456
01:28:50,070 --> 01:28:47,199
about the importance and

2457
01:28:52,790 --> 01:28:50,080
just as excited about the the amazing

2458
01:28:55,030 --> 01:28:52,800
future of what exploration is uh going

2459
01:28:57,990 --> 01:28:55,040
forward exploration for us though is

2460
01:28:59,830 --> 01:28:58,000
broader than just what is useful right

2461
01:29:01,590 --> 01:28:59,840
now and and the reason we're so

2462
01:29:02,950 --> 01:29:01,600
convinced that that is important is

2463
01:29:05,110 --> 01:29:02,960

first of all

2464
01:29:07,110 --> 01:29:05,120
uh the questions that have driven

2465
01:29:09,910 --> 01:29:07,120
humanity important questions truly

2466
01:29:11,910 --> 01:29:09,920
historic questions in so many ways are

2467
01:29:13,830 --> 01:29:11,920
what we're really about addressing those

2468
01:29:16,470 --> 01:29:13,840
is what we're really about as humans we

2469
01:29:18,790 --> 01:29:16,480
want to be sure you know as we look at

2470
01:29:20,390 --> 01:29:18,800
our contributions of our generations

2471
01:29:22,950 --> 01:29:20,400
that we really

2472
01:29:27,030 --> 01:29:22,960
move forward uh what we know and how

2473
01:29:29,830 --> 01:29:27,040
also uh really affect how we think about

2474
01:29:32,149 --> 01:29:29,840
ourselves and that so often comes

2475
01:29:34,470 --> 01:29:32,159
through our research there's a second

2476
01:29:36,550 --> 01:29:34,480
reason though it's truly secondary but

2477
01:29:39,750 --> 01:29:36,560
i'm going to mention it anyway

2478
01:29:40,550 --> 01:29:39,760
so often and surprisingly

2479
01:29:47,350 --> 01:29:40,560
the

2480
01:29:49,990 --> 01:29:47,360
really driven by fundamental science

2481
01:29:51,669 --> 01:29:50,000
questions are extremely

2482
01:29:54,070 --> 01:29:51,679
useful and i just want to remind you

2483
01:29:55,030 --> 01:29:54,080
that perhaps today whoever asked that

2484
01:29:57,750 --> 01:29:55,040
question

2485
01:29:59,430 --> 01:29:57,760
is driving around in a car with a gps

2486
01:30:00,870 --> 01:29:59,440
system built for an entirely different

2487
01:30:02,950 --> 01:30:00,880
purpose and looked at the weather

2488
01:30:05,590 --> 01:30:02,960

forecast with the both of them

2489
01:30:08,550 --> 01:30:05,600
anticipated when in fact we built the

2490
01:30:10,790 --> 01:30:08,560
first earth satellite so yes we want to

2491
01:30:12,790 --> 01:30:10,800
uh kind of focus on that immediate needs

2492
01:30:15,590 --> 01:30:12,800
today and it's really important but it's

2493
01:30:17,669 --> 01:30:15,600
so critical for us as a species to look

2494
01:30:19,590 --> 01:30:17,679
forward and explore

2495
01:30:21,590 --> 01:30:19,600
matthew

2496
01:30:23,430 --> 01:30:21,600
thanks thomas i i think you said it

2497
01:30:25,189 --> 01:30:23,440
really well you know i've been landing

2498
01:30:27,350 --> 01:30:25,199
things on mars now for

2499
01:30:29,189 --> 01:30:27,360
25 plus years

2500
01:30:30,870 --> 01:30:29,199
and so i've had a chance to go out and

2501
01:30:32,070 --> 01:30:30,880
and talk to a lot of different people

2502
01:30:34,470 --> 01:30:32,080
and it's

2503
01:30:37,189 --> 01:30:34,480
it's not unusual when somebody asks this

2504
01:30:39,590 --> 01:30:37,199
question and and i used to

2505
01:30:40,470 --> 01:30:39,600
you know have a long list of of reasons

2506
01:30:41,830 --> 01:30:40,480
uh

2507
01:30:44,550 --> 01:30:41,840
and there are a good long list of

2508
01:30:46,629 --> 01:30:44,560
reasons um but but fundamentally i've

2509
01:30:48,629 --> 01:30:46,639
come to the conclusion that

2510
01:30:50,629 --> 01:30:48,639
in some ways it's kind of a moot

2511
01:30:52,470 --> 01:30:50,639
question um because

2512
01:30:54,470 --> 01:30:52,480
how can we not explore

2513
01:30:57,350 --> 01:30:54,480

it's just who we are it's what we are

2514
01:31:00,229 --> 01:30:57,360
it's in our dna you know you almost you

2515
01:31:02,149 --> 01:31:00,239
couldn't stop us as a species

2516
01:31:04,070 --> 01:31:02,159
from exploring i don't think i think

2517
01:31:06,070 --> 01:31:04,080
it's part of the reason why we're you

2518
01:31:07,990 --> 01:31:06,080
know at the top of the food chain

2519
01:31:10,149 --> 01:31:08,000
is because we're curious because we want

2520
01:31:11,510 --> 01:31:10,159
to go to places

2521
01:31:13,110 --> 01:31:11,520
we haven't been

2522
01:31:15,189 --> 01:31:13,120
we want to answer questions we don't

2523
01:31:16,790 --> 01:31:15,199
know the answer to

2524
01:31:19,110 --> 01:31:16,800
sometimes we want to find the questions

2525
01:31:21,350 --> 01:31:19,120
we don't even know need to be asked

2526
01:31:24,149 --> 01:31:21,360
you know it's just it's just part of

2527
01:31:27,669 --> 01:31:24,159
part of who we are and uh

2528
01:31:31,590 --> 01:31:27,679
and it opens new horizons uh

2529
01:31:33,350 --> 01:31:31,600
new frontiers it inspires us

2530
01:31:36,310 --> 01:31:33,360
it inspires kids

2531
01:31:39,110 --> 01:31:36,320
you know and as as thomas mentioned all

2532
01:31:41,510 --> 01:31:39,120
the academic programs that

2533
01:31:43,990 --> 01:31:41,520
that are paying attention here uh

2534
01:31:46,470 --> 01:31:44,000
science to technology

2535
01:31:49,990 --> 01:31:46,480
that that we bring to the table that

2536
01:31:51,510 --> 01:31:50,000
that's important for us uh you know and

2537
01:31:53,270 --> 01:31:51,520
i think that's the best i can do to

2538
01:31:56,390 --> 01:31:53,280

answer that question

2539
01:32:02,310 --> 01:31:59,270
all right we can move on now to another

2540
01:32:04,790 --> 01:32:02,320
call from matt kaplan from planetary

2541
01:32:10,950 --> 01:32:07,990
hi everyone congratulations uh from not

2542
01:32:14,470 --> 01:32:10,960
just me but all of the planetary society

2543
01:32:16,550 --> 01:32:14,480
um i've been texting with our boss

2544
01:32:19,189 --> 01:32:16,560
uh bill nye the science guy who has been

2545
01:32:21,510 --> 01:32:19,199
watching uh everything along with us

2546
01:32:24,470 --> 01:32:21,520
and uh here's part of his reaction oh my

2547
01:32:26,470 --> 01:32:24,480
this is astonishing astonishing

2548
01:32:28,950 --> 01:32:26,480
dare mighty things

2549
01:32:32,070 --> 01:32:28,960
but here's my question for ken williford

2550
01:32:35,510 --> 01:32:32,080
uh ken getting these first images

2551
01:32:37,669 --> 01:32:35,520
and video from so much closer to the

2552
01:32:39,910 --> 01:32:37,679
surface of mars

2553
01:32:42,149 --> 01:32:39,920
than we have from the orbiters in spite

2554
01:32:44,229 --> 01:32:42,159
of the great job that they're capable of

2555
01:32:45,510 --> 01:32:44,239
does this start to make you think about

2556
01:32:47,990 --> 01:32:45,520
the potential

2557
01:32:54,390 --> 01:32:48,000
of doing this on a regular basis from

2558
01:32:56,470 --> 01:32:55,750
well sure

2559
01:32:57,990 --> 01:32:56,480
you know

2560
01:33:01,590 --> 01:32:58,000
almost everything i'm thinking about

2561
01:33:04,310 --> 01:33:01,600
right now is potential um i've uh

2562
01:33:05,910 --> 01:33:04,320
i guess i've compared it um you know to

2563
01:33:06,870 --> 01:33:05,920

several people who have asked me how i'm

2564
01:33:09,030 --> 01:33:06,880
feeling

2565
01:33:11,430 --> 01:33:09,040
you know what's it like and and the

2566
01:33:13,189 --> 01:33:11,440
closest thing i can compare it to is i

2567
01:33:15,990 --> 01:33:13,199
would say the birth of my daughter you

2568
01:33:17,830 --> 01:33:16,000
know where uh the the cruise phase

2569
01:33:20,550 --> 01:33:17,840
that's about eight months long you know

2570
01:33:21,750 --> 01:33:20,560
is like that uh that nine month period

2571
01:33:23,270 --> 01:33:21,760
where you're just waiting and you're

2572
01:33:24,070 --> 01:33:23,280
just hoping everything goes right and

2573
01:33:27,990 --> 01:33:24,080
then

2574
01:33:30,990 --> 01:33:28,000
we're on the surface

2575
01:33:34,310 --> 01:33:31,000
and it's real and the potential is

2576
01:33:37,350 --> 01:33:34,320
astounding i mean i was just uh katie

2577
01:33:39,669 --> 01:33:37,360
sack and i were just texting last night

2578
01:33:42,550 --> 01:33:39,679
as we got some new images down and

2579
01:33:44,550 --> 01:33:42,560
and we're just you know we're so excited

2580
01:33:46,790 --> 01:33:44,560
like like kids just looking at every

2581
01:33:48,950 --> 01:33:46,800
picture and and seeing so many new

2582
01:33:51,590 --> 01:33:48,960
things and having so many new ideas and

2583
01:33:53,910 --> 01:33:51,600
new questions are appearing

2584
01:33:55,270 --> 01:33:53,920
and and the potential of it all is is

2585
01:33:57,590 --> 01:33:55,280
what strikes me

2586
01:33:59,990 --> 01:33:57,600
more than anything we have so far to go

2587
01:34:01,990 --> 01:34:00,000
so so much to learn

2588
01:34:03,110 --> 01:34:02,000

uh and i just couldn't be more more

2589
01:34:05,590 --> 01:34:03,120
grateful

2590
01:34:07,830 --> 01:34:05,600
to have made this transition from from

2591
01:34:09,990 --> 01:34:07,840
all the years of hard work and and

2592
01:34:11,189 --> 01:34:10,000
stress and wondering you know is it

2593
01:34:13,910 --> 01:34:11,199
going to work out how is it going to

2594
01:34:17,110 --> 01:34:13,920
work out to now when we actually get to

2595
01:34:20,070 --> 01:34:17,120
do this thing uh it's just it's it's

2596
01:34:26,070 --> 01:34:22,470
thanks ken and up next we have irene

2597
01:34:28,790 --> 01:34:26,080
klotz from aviation week

2598
01:34:31,590 --> 01:34:28,800
thanks uh just looking ahead a bit um

2599
01:34:33,750 --> 01:34:31,600
what's been the probably for jessica

2600
01:34:36,790 --> 01:34:33,760
have you made any progress homing in on

2601
01:34:37,910 --> 01:34:36,800
a site for the helicopter flight demos

2602
01:34:40,470 --> 01:34:37,920
and

2603
01:34:42,709 --> 01:34:40,480
if so about how far from the

2604
01:34:44,390 --> 01:34:42,719
perseverance landing site

2605
01:34:46,950 --> 01:34:44,400
are those

2606
01:34:48,390 --> 01:34:46,960
so the team has started to evaluate um

2607
01:34:50,470 --> 01:34:48,400
and is uh

2608
01:34:52,229 --> 01:34:50,480
using the images that we've received

2609
01:34:55,109 --> 01:34:52,239
from entry descent landing as well as

2610
01:34:57,990 --> 01:34:55,119
now these uh images that we've acquired

2611
01:35:01,189 --> 01:34:58,000
over the last couple saws uh we are

2612
01:35:04,070 --> 01:35:01,199
fortunate to have landed in a potential

2613
01:35:06,149 --> 01:35:04,080

spot for that but the team is still

2614
01:35:07,030 --> 01:35:06,159
evaluating and

2615
01:35:09,270 --> 01:35:07,040
is

2616
01:35:11,910 --> 01:35:09,280
looking forward to additional imaging

2617
01:35:15,350 --> 01:35:11,920
from the 360 degree panorama from the

2618
01:35:17,669 --> 01:35:15,360
nascam z as well as a

2619
01:35:19,590 --> 01:35:17,679
future data that's to come down so we

2620
01:35:20,950 --> 01:35:19,600
have not locked in a site yet and that

2621
01:35:24,070 --> 01:35:20,960
will still be

2622
01:35:26,709 --> 01:35:24,080
work for the team to go looking forward

2623
01:35:30,149 --> 01:35:26,719
whether it's here or a few 100 meters

2624
01:35:33,590 --> 01:35:32,470
and we have a social media question

2625
01:35:37,590 --> 01:35:33,600
coming in

2626
01:35:39,350 --> 01:35:37,600
jake who is 12 years old on youtube asks

2627
01:35:44,390 --> 01:35:39,360
was there one point you thought that

2628
01:35:48,390 --> 01:35:46,550
that that's a that's a great question

2629
01:35:49,830 --> 01:35:48,400
jake um

2630
01:35:51,990 --> 01:35:49,840
there might have been many points when

2631
01:35:54,709 --> 01:35:52,000
it felt a little impossible i'll just

2632
01:35:56,950 --> 01:35:54,719
i'll give you my one moment and then the

2633
01:35:59,750 --> 01:35:56,960
other folks may may want to

2634
01:36:01,109 --> 01:35:59,760
add in and that's uh you know last march

2635
01:36:04,390 --> 01:36:01,119
when

2636
01:36:05,669 --> 01:36:04,400
the uh cove pandemic struck you know we

2637
01:36:09,669 --> 01:36:05,679
just

2638
01:36:11,990 --> 01:36:09,679

spacecraft down to kennedy

2639
01:36:15,270 --> 01:36:12,000
dave gruel who believe it or not this

2640
01:36:17,910 --> 01:36:15,280
whole edl camera gig is is is not what

2641
01:36:20,790 --> 01:36:17,920
he does for a living he was our assembly

2642
01:36:22,390 --> 01:36:20,800
test and launch operations manager

2643
01:36:24,790 --> 01:36:22,400
and he along with his deputy art

2644
01:36:26,470 --> 01:36:24,800
thompson were responsible for assembling

2645
01:36:29,189 --> 01:36:26,480
the flight spacecraft

2646
01:36:31,189 --> 01:36:29,199
testing it and getting it down uh to the

2647
01:36:32,310 --> 01:36:31,199
launch pad for for launch that's

2648
01:36:35,030 --> 01:36:32,320
actually

2649
01:36:36,870 --> 01:36:35,040
what he did for a day job so uh so the

2650
01:36:39,270 --> 01:36:36,880
pandemic struck about a year ago and

2651
01:36:41,030 --> 01:36:39,280
dave and i and art and others

2652
01:36:42,709 --> 01:36:41,040
were just constantly on the phone trying

2653
01:36:45,270 --> 01:36:42,719
to figure out how to react to it and how

2654
01:36:47,350 --> 01:36:45,280
to respond to it you know we

2655
01:36:49,270 --> 01:36:47,360
um i said it before we didn't have a lot

2656
01:36:50,390 --> 01:36:49,280
of margin we didn't have a lot of time

2657
01:36:51,350 --> 01:36:50,400
um

2658
01:36:53,030 --> 01:36:51,360
you know

2659
01:36:55,910 --> 01:36:53,040
we were we were figuring out a lot of

2660
01:36:58,950 --> 01:36:55,920
things as quickly as we could

2661
01:37:00,470 --> 01:36:58,960
and our focus was shifted from

2662
01:37:02,950 --> 01:37:00,480
trying to get the spacecraft built and

2663
01:37:04,149 --> 01:37:02,960

tested correctly and staying on schedule

2664
01:37:05,590 --> 01:37:04,159
for the launch

2665
01:37:07,430 --> 01:37:05,600
because if you miss it you've got to

2666
01:37:09,189 --> 01:37:07,440
wait two years for these planetary

2667
01:37:11,030 --> 01:37:09,199
launches to mars

2668
01:37:13,109 --> 01:37:11,040
um and suddenly our whole focus had to

2669
01:37:14,709 --> 01:37:13,119
change to keeping the people safe and

2670
01:37:16,229 --> 01:37:14,719
keeping their family safe as a number

2671
01:37:18,470 --> 01:37:16,239
one priority

2672
01:37:20,709 --> 01:37:18,480
and i wasn't sure honestly i wasn't sure

2673
01:37:22,550 --> 01:37:20,719
we could do that i knew that if we

2674
01:37:24,470 --> 01:37:22,560
couldn't keep them

2675
01:37:27,270 --> 01:37:24,480
just as safe as they would be at home

2676
01:37:29,109 --> 01:37:27,280
doing other things that you know

2677
01:37:32,149 --> 01:37:29,119
that that could be that could be it for

2678
01:37:34,470 --> 01:37:32,159
us for this for this opportunity we got

2679
01:37:36,149 --> 01:37:34,480
tremendous support across the board from

2680
01:37:39,270 --> 01:37:36,159
the institution

2681
01:37:41,350 --> 01:37:39,280
here at jpl from headquarters thomas and

2682
01:37:43,910 --> 01:37:41,360
and smd

2683
01:37:46,629 --> 01:37:43,920
and we got through it but um that was

2684
01:37:49,270 --> 01:37:46,639
the existential moment for me

2685
01:37:52,310 --> 01:37:49,280
uh that that very uh

2686
01:37:55,590 --> 01:37:52,320
that that time right there the first

2687
01:37:59,030 --> 01:37:55,600
three to six weeks um after after code

2688
01:38:01,669 --> 01:37:59,040

would really hit hard so anybody else

2689
01:38:03,030 --> 01:38:01,679
same answer yeah exactly same answers

2690
01:38:05,109 --> 01:38:03,040
okay

2691
01:38:06,550 --> 01:38:05,119
i'll add to that um

2692
01:38:08,629 --> 01:38:06,560
one of the things about that's

2693
01:38:11,669 --> 01:38:08,639
interesting about this this

2694
01:38:12,870 --> 01:38:11,679
these jobs we have are we spend years i

2695
01:38:14,709 --> 01:38:12,880
mean

2696
01:38:16,709 --> 01:38:14,719
seven or eight years for me and all

2697
01:38:19,590 --> 01:38:16,719
these guys we years and years years of

2698
01:38:20,870 --> 01:38:19,600
work building testing making sure it's

2699
01:38:22,870 --> 01:38:20,880
going to work

2700
01:38:25,510 --> 01:38:22,880
and you know i have to say there's some

2701
01:38:27,109 --> 01:38:25,520
amount of stress um involved when you

2702
01:38:28,709 --> 01:38:27,119
spend seven years of your career doing

2703
01:38:30,149 --> 01:38:28,719
something and then it all comes down to

2704
01:38:31,350 --> 01:38:30,159
like one moment and for me it's

2705
01:38:32,790 --> 01:38:31,360
obviously like those first images that

2706
01:38:35,030 --> 01:38:32,800
come from the cameras

2707
01:38:36,870 --> 01:38:35,040
like you really want that to work like

2708
01:38:38,070 --> 01:38:36,880
really really want it to work and you've

2709
01:38:39,030 --> 01:38:38,080
tried everything you can do to make sure

2710
01:38:42,229 --> 01:38:39,040
to work

2711
01:38:43,910 --> 01:38:42,239
and so um but you know it's definitely

2712
01:38:45,590 --> 01:38:43,920
you know we all we try to be open-minded

2713
01:38:48,149 --> 01:38:45,600

about what could go wrong

2714
01:38:50,550 --> 01:38:48,159
uh we try to cover our cover all our

2715
01:38:52,550 --> 01:38:50,560
bases and um that's what's one of the

2716
01:38:55,109 --> 01:38:52,560
great things about jpl is that there's a

2717
01:38:57,350 --> 01:38:55,119
team of people here really smart people

2718
01:39:00,470 --> 01:38:57,360
uh you go to these reviews uh to review

2719
01:39:02,550 --> 01:39:00,480
your product your your designs

2720
01:39:04,790 --> 01:39:02,560
we call them withering reviews you get

2721
01:39:06,790 --> 01:39:04,800
you get a lot of tough questions

2722
01:39:08,790 --> 01:39:06,800
but that's one of the really you know

2723
01:39:11,590 --> 01:39:08,800
jpl is a real gem of a place because we

2724
01:39:13,510 --> 01:39:11,600
built this culture of always questioning

2725
01:39:14,550 --> 01:39:13,520
um what could go wrong

2726
01:39:16,070 --> 01:39:14,560
um

2727
01:39:17,750 --> 01:39:16,080
but hoping for the best and and it's

2728
01:39:20,229 --> 01:39:17,760
it's a really interesting experience i

2729
01:39:22,390 --> 01:39:20,239
think we all share that

2730
01:39:24,149 --> 01:39:22,400
i will agree i think we invite the

2731
01:39:26,390 --> 01:39:24,159
feedback from each other and our

2732
01:39:27,750 --> 01:39:26,400
reviewers to make sure that we are

2733
01:39:29,430 --> 01:39:27,760
thinking about all the things that we

2734
01:39:31,830 --> 01:39:29,440
need to think about and pushing

2735
01:39:34,550 --> 01:39:31,840
ourselves to

2736
01:39:36,870 --> 01:39:34,560
meet those challenges and uh and of

2737
01:39:37,830 --> 01:39:36,880
course you want it all to work but um

2738
01:39:41,590 --> 01:39:37,840

you know

2739
01:39:43,830 --> 01:39:41,600
worry that you didn't think about

2740
01:39:44,629 --> 01:39:43,840
but as a community and as a collective

2741
01:39:46,790 --> 01:39:44,639
and as

2742
01:39:48,629 --> 01:39:46,800
you know a team you know we use each

2743
01:39:49,750 --> 01:39:48,639
other to help

2744
01:39:52,950 --> 01:39:49,760
make sure that we're covering those

2745
01:39:56,870 --> 01:39:55,189
i mean the team really did persevere and

2746
01:39:59,430 --> 01:39:56,880
we are here today

2747
01:40:01,750 --> 01:39:59,440
uh up next is leo enright from irish

2748
01:40:04,629 --> 01:40:01,760
television

2749
01:40:07,030 --> 01:40:04,639
thanks very much raquel i

2750
01:40:09,830 --> 01:40:07,040
i just realized there's no doubt about a

2751
01:40:11,189 --> 01:40:09,840
12 year olds definitely ask the best

2752
01:40:13,750 --> 01:40:11,199
questions

2753
01:40:15,830 --> 01:40:13,760
but if you forgive me for um

2754
01:40:17,550 --> 01:40:15,840
going geeky on this

2755
01:40:20,709 --> 01:40:17,560
could somebody talk to the

2756
01:40:22,390 --> 01:40:20,719
traversibility of canyon duchess

2757
01:40:23,990 --> 01:40:22,400
now that you've seen these amazing

2758
01:40:27,030 --> 01:40:24,000
pictures

2759
01:40:29,350 --> 01:40:27,040
do you think that you can just simply

2760
01:40:32,950 --> 01:40:29,360
turn around the rover and head directly

2761
01:40:34,629 --> 01:40:32,960
west northwest possibly right past the

2762
01:40:35,390 --> 01:40:34,639
descent stage

2763
01:40:37,910 --> 01:40:35,400

or

2764
01:40:39,669 --> 01:40:37,920
realistically are you going to have to

2765
01:40:42,470 --> 01:40:39,679
go to the northeast

2766
01:40:43,750 --> 01:40:42,480
um around olympic

2767
01:40:46,229 --> 01:40:43,760
uh and then

2768
01:40:48,629 --> 01:40:46,239
to uh chairman foia

2769
01:40:51,750 --> 01:40:48,639
i'm sorry for being geeky but

2770
01:40:53,430 --> 01:40:51,760
it's kind of a serious question can you

2771
01:40:55,750 --> 01:40:53,440
move quickly

2772
01:40:59,510 --> 01:40:55,760
so i can uh i'll comment and all that

2773
01:41:01,189 --> 01:40:59,520
can comment also uh you know we have uh

2774
01:41:02,310 --> 01:41:01,199
spent you know as we do in our

2775
01:41:04,470 --> 01:41:02,320
development program as we were

2776
01:41:06,550 --> 01:41:04,480
mentioning you know a lot of time in

2777
01:41:08,550 --> 01:41:06,560
different conditions to evaluate the

2778
01:41:09,830 --> 01:41:08,560
performance of our system

2779
01:41:11,109 --> 01:41:09,840
and one of the

2780
01:41:13,189 --> 01:41:11,119
things that we did

2781
01:41:14,870 --> 01:41:13,199
on this mission compared to other

2782
01:41:18,070 --> 01:41:14,880
missions was to enhance that

2783
01:41:20,390 --> 01:41:18,080
traversability capability with enhanced

2784
01:41:21,990 --> 01:41:20,400
autonomous navigation and as well as

2785
01:41:24,070 --> 01:41:22,000
processing

2786
01:41:26,149 --> 01:41:24,080
while we're driving so to increase our

2787
01:41:29,910 --> 01:41:26,159
drive rates now

2788
01:41:31,030 --> 01:41:29,920

we have many more images and still to

2789
01:41:32,950 --> 01:41:31,040
assess

2790
01:41:35,030 --> 01:41:32,960
in terms of evaluating

2791
01:41:36,390 --> 01:41:35,040
our path forward

2792
01:41:38,870 --> 01:41:36,400
but i will

2793
01:41:41,430 --> 01:41:38,880
let ken speak to maybe some of the

2794
01:41:42,870 --> 01:41:41,440
areas that we are interested in pursuing

2795
01:41:44,550 --> 01:41:42,880
and what's really great is that we work

2796
01:41:47,910 --> 01:41:44,560
together you know with the science and

2797
01:41:48,790 --> 01:41:47,920
engineering team to evaluate those paths

2798
01:41:50,390 --> 01:41:48,800
and

2799
01:41:55,669 --> 01:41:50,400
what sort of

2800
01:41:59,590 --> 01:41:57,830
yeah so it's a great question and it's

2801
01:42:01,750 --> 01:41:59,600
it's our major focus right now on the

2802
01:42:03,750 --> 01:42:01,760
science team is is answering exactly

2803
01:42:05,510 --> 01:42:03,760
that question uh what are we going to do

2804
01:42:07,109 --> 01:42:05,520
what do we want to do uh where do we

2805
01:42:08,950 --> 01:42:07,119
want to go

2806
01:42:11,430 --> 01:42:08,960
and i'll say first of all we're so

2807
01:42:14,070 --> 01:42:11,440
extraordinarily happy about exactly

2808
01:42:15,189 --> 01:42:14,080
where we've put down

2809
01:42:18,070 --> 01:42:15,199
because

2810
01:42:21,270 --> 01:42:18,080
we ended up right on this major geologic

2811
01:42:22,950 --> 01:42:21,280
feature this contact we call it between

2812
01:42:30,149 --> 01:42:22,960
two

2813
01:42:32,070 --> 01:42:30,159

you see there's this sort of um

2814
01:42:34,470 --> 01:42:32,080
uh undulating

2815
01:42:36,470 --> 01:42:34,480
feature uh that you know this sort of

2816
01:42:39,189 --> 01:42:36,480
obvious line

2817
01:42:41,030 --> 01:42:39,199
um that we're landed right next to and

2818
01:42:43,109 --> 01:42:41,040
that's the big contact one of the major

2819
01:42:46,550 --> 01:42:43,119
features we were hoping to explore

2820
01:42:49,669 --> 01:42:46,560
in this mission and it it uh presents

2821
01:42:51,270 --> 01:42:49,679
for us uh one of the big mysteries uh i

2822
01:42:53,590 --> 01:42:51,280
mentioned the you know the possible

2823
01:42:55,590 --> 01:42:53,600
vesicles uh it gets down to one of the

2824
01:42:57,189 --> 01:42:55,600
big questions for us early on is what is

2825
01:43:00,310 --> 01:42:57,199
that crater floor

2826
01:43:02,629 --> 01:43:00,320
uh made of and are there igneous rocks

2827
01:43:04,149 --> 01:43:02,639
there sedimentary rocks both

2828
01:43:06,709 --> 01:43:04,159
uh you know there's a lot of

2829
01:43:07,669 --> 01:43:06,719
implications for both so so

2830
01:43:09,430 --> 01:43:07,679
what

2831
01:43:11,750 --> 01:43:09,440
i would say we're probably currently

2832
01:43:14,709 --> 01:43:11,760
leaning toward is is exploring that

2833
01:43:16,229 --> 01:43:14,719
contact which would not lead us more i

2834
01:43:18,390 --> 01:43:16,239
think to the second

2835
01:43:21,109 --> 01:43:18,400
um of the two options but we'll see

2836
01:43:23,109 --> 01:43:21,119
we've got a good amount of time while

2837
01:43:24,709 --> 01:43:23,119
the team does the commissioning and

2838
01:43:26,790 --> 01:43:24,719

checks all the systems out and during

2839
01:43:28,950 --> 01:43:26,800
that time we'll be digesting all those

2840
01:43:32,310 --> 01:43:28,960
new images and doing a lot of strategic

2841
01:43:35,030 --> 01:43:32,320
planning evaluating different options um

2842
01:43:37,030 --> 01:43:35,040
arguing amongst ourselves in the team

2843
01:43:38,709 --> 01:43:37,040
right after this this uh press

2844
01:43:39,910 --> 01:43:38,719
conference is over our first science

2845
01:43:41,910 --> 01:43:39,920
team meeting

2846
01:43:44,149 --> 01:43:41,920
post landing starts immediately after

2847
01:43:45,750 --> 01:43:44,159
that so we'll we'll start talking about

2848
01:43:48,229 --> 01:43:45,760
just those things

2849
01:43:50,950 --> 01:43:48,239
so we'll see

2850
01:43:55,270 --> 01:43:50,960
thank you jessica and ken uh up next we

2851
01:43:56,709 --> 01:43:55,280
have stephen gorman from reuters news

2852
01:43:58,709 --> 01:43:56,719
hi thank you very much can you hear me

2853
01:44:00,870 --> 01:43:58,719
okay yes we can

2854
01:44:02,070 --> 01:44:00,880
yeah so my question is i have like a

2855
01:44:04,229 --> 01:44:02,080
question about the superlatives

2856
01:44:05,270 --> 01:44:04,239
regarding the video footage of the edl

2857
01:44:07,109 --> 01:44:05,280
sequence

2858
01:44:08,550 --> 01:44:07,119
and the audio of that gust of wind that

2859
01:44:10,950 --> 01:44:08,560
was picked up on the martian surface by

2860
01:44:13,189 --> 01:44:10,960
the by the microsoft so i believe is it

2861
01:44:13,990 --> 01:44:13,199
correct to say this this video marks the

2862
01:44:16,709 --> 01:44:14,000
first

2863
01:44:19,750 --> 01:44:16,719

sort of moving footage

2864
01:44:22,470 --> 01:44:19,760
of a spacecraft from a spacecraft from

2865
01:44:24,310 --> 01:44:22,480
that thing uh showing it's it's it's uh

2866
01:44:26,390 --> 01:44:24,320
descent and and landing on the surface

2867
01:44:29,189 --> 01:44:26,400
of another world you know mars or any

2868
01:44:30,709 --> 01:44:29,199
world i think right i don't see that

2869
01:44:31,590 --> 01:44:30,719
including the moon or an asteroid or

2870
01:44:33,910 --> 01:44:31,600
anything

2871
01:44:35,990 --> 01:44:33,920
and then secondly is this likewise is

2872
01:44:37,189 --> 01:44:36,000
this the first sound recording ever made

2873
01:44:39,750 --> 01:44:37,199
on mars

2874
01:44:41,270 --> 01:44:39,760
or any celestial object on earth or just

2875
01:44:42,709 --> 01:44:41,280
the first one that was made that's been

2876
01:44:44,229 --> 01:44:42,719
played back on earth i don't know if you

2877
01:44:46,870 --> 01:44:44,239
could just

2878
01:44:50,149 --> 01:44:46,880
uh clarify that

2879
01:44:52,790 --> 01:44:50,159
i can um let's see on your on your first

2880
01:44:54,550 --> 01:44:52,800
question uh putting aside the apollo

2881
01:44:56,070 --> 01:44:54,560
program and the moon and just talking

2882
01:44:57,430 --> 01:44:56,080
about planets

2883
01:44:59,109 --> 01:44:57,440
uh this is

2884
01:45:00,470 --> 01:44:59,119
most certainly

2885
01:45:02,550 --> 01:45:00,480
i'm pretty sure

2886
01:45:04,950 --> 01:45:02,560
as far as i know this is the first time

2887
01:45:06,550 --> 01:45:04,960
we're able to see ourselves see our

2888
01:45:09,510 --> 01:45:06,560

spacecraft

2889
01:45:12,470 --> 01:45:09,520
land on another planet and uh

2890
01:45:14,790 --> 01:45:12,480
and hopefully that that answers uh the

2891
01:45:16,390 --> 01:45:14,800
question that you you asked

2892
01:45:18,709 --> 01:45:16,400
um

2893
01:45:20,470 --> 01:45:18,719
as far as sound

2894
01:45:22,470 --> 01:45:20,480
i'm not sure anybody else has any more

2895
01:45:25,189 --> 01:45:22,480
information but again as to the best of

2896
01:45:26,870 --> 01:45:25,199
my knowledge this is the first

2897
01:45:29,510 --> 01:45:26,880
planetary

2898
01:45:31,030 --> 01:45:29,520
sound that's been recorded

2899
01:45:33,350 --> 01:45:31,040
so

2900
01:45:34,870 --> 01:45:33,360
yeah go ahead justin i can i can i can

2901
01:45:37,109 --> 01:45:34,880
add to that

2902
01:45:39,430 --> 01:45:37,119
in terms of sound the the um the insight

2903
01:45:40,950 --> 01:45:39,440
lander has a seismometer on it and they

2904
01:45:41,750 --> 01:45:40,960
did measure

2905
01:45:43,590 --> 01:45:41,760
uh

2906
01:45:45,270 --> 01:45:43,600
seismic signals that were acoustically

2907
01:45:47,830 --> 01:45:45,280
driven and then rendered that as as

2908
01:45:49,830 --> 01:45:47,840
audio so that that could be potentially

2909
01:45:52,709 --> 01:45:49,840
another another one but um in terms of

2910
01:45:55,430 --> 01:45:52,719
like imaging and doing video

2911
01:45:56,470 --> 01:45:55,440
msl did have a descent imager that did

2912
01:45:57,910 --> 01:45:56,480
video

2913
01:45:59,270 --> 01:45:57,920

three and a half frames per second so it

2914
01:46:02,310 --> 01:45:59,280
was a little slower

2915
01:46:04,470 --> 01:46:02,320
um and that was the marty instrument um

2916
01:46:06,550 --> 01:46:04,480
we've also done time lapse of

2917
01:46:08,149 --> 01:46:06,560
deployments of things on inside you know

2918
01:46:09,590 --> 01:46:08,159
we deployed a seismometer and we do time

2919
01:46:13,830 --> 01:46:09,600
lapse video

2920
01:46:15,030 --> 01:46:13,840
of the rover driving down onto the

2921
01:46:16,790 --> 01:46:15,040
surface

2922
01:46:19,590 --> 01:46:16,800
uh but then again it was it's time lapse

2923
01:46:21,350 --> 01:46:19,600
you know so seconds in between frames

2924
01:46:22,390 --> 01:46:21,360
so it you know it's you you've probably

2925
01:46:25,030 --> 01:46:22,400
seen this they're all out on the

2926
01:46:27,590 --> 01:46:25,040
internet the the rover movies um i

2927
01:46:31,270 --> 01:46:27,600
worked on that as a postdoc actually but

2928
01:46:33,270 --> 01:46:31,280
this is definitely the best video of any

2929
01:46:35,430 --> 01:46:33,280
of them so i think we can at least say

2930
01:46:37,430 --> 01:46:35,440
that pretty definitively it's it's just

2931
01:46:41,990 --> 01:46:37,440
it's a whole nother level of of

2932
01:46:45,910 --> 01:46:43,910
great well that is all the time we have

2933
01:46:48,550 --> 01:46:45,920
for questions today thank you so much to

2934
01:46:50,790 --> 01:46:48,560
our panelists we unfortunately can't

2935
01:46:52,709 --> 01:46:50,800
answer all the media questions on there

2936
01:46:56,070 --> 01:46:52,719
for those with additional questions

2937
01:46:58,629 --> 01:46:56,080
please call jpl's digital news and media

2938
01:47:01,350 --> 01:46:58,639

office our social media team will

2939
01:47:04,550 --> 01:47:01,360
continue to answer questions online and

2940
01:47:07,590 --> 01:47:04,560
we have a reddit ama with perseverance

2941
01:47:09,430 --> 01:47:07,600
team members starting at 1pm pacific

2942
01:47:13,950 --> 01:47:09,440
time today

2943
01:47:15,830 --> 01:47:13,960
now to see the raw images of mars visit

2944
01:47:20,830 --> 01:47:15,840
mars.nasa.gov

2945
01:47:24,229 --> 01:47:20,840
mars2020 slash multimedia slash raw dash

2946
01:47:27,430 --> 01:47:24,239
images for more updates on the mission

2947
01:47:29,910 --> 01:47:27,440
visit nasa.gov perseverance and

2948
01:47:33,189 --> 01:47:29,920
mars.nasa.gov

2949
01:47:37,510 --> 01:47:33,199
perseverance and you can also follow us

2950
01:47:39,350 --> 01:47:37,520
on social media using at nasa persevere

2951
01:47:45,750 --> 01:47:39,360
i'm raquel villanueva

2952
01:47:49,510 --> 01:47:47,590
i'm starting to straighten up and fly

2953
01:47:51,830 --> 01:47:49,520
right maneuver where the spacecraft will

2954
01:47:53,990 --> 01:47:51,840
jettison the entry balance masses in

2955
01:47:55,669 --> 01:47:54,000
preparation for parachute deploy and to

2956
01:47:59,430 --> 01:47:55,679
roll over to give the radar a better

2957
01:48:02,709 --> 01:48:00,709
application

2958
01:48:04,950 --> 01:48:02,719
shoot deploy

2959
01:48:06,709 --> 01:48:04,960
the navigation has confirmed that the

2960
01:48:08,870 --> 01:48:06,719
parachute has deployed and we are seeing

2961
01:48:10,950 --> 01:48:08,880
significant deceleration

2962
01:48:13,830 --> 01:48:10,960
in the velocity our current velocity is

2963
01:48:15,669 --> 01:48:13,840

450 meters per second at an altitude of

2964
01:48:18,470 --> 01:48:15,679
about 12 kilometers from the surface of

2965
01:48:20,070 --> 01:48:18,480
mars

2966
01:48:22,470 --> 01:48:20,080
heat shields up

2967
01:48:23,830 --> 01:48:22,480
press advance has now slowed to subsonic

2968
01:48:26,790 --> 01:48:23,840
speeds and the heat shield has been

2969
01:48:28,950 --> 01:48:26,800
separated this allows both the radar and

2970
01:48:31,910 --> 01:48:28,960
the cameras to get their first look at

2971
01:48:33,510 --> 01:48:31,920
the surface current velocity is 145

2972
01:48:36,070 --> 01:48:33,520
meters per second and an altitude of

2973
01:48:53,030 --> 01:48:36,080
about 10 km nine and a half kilometers

2974
01:48:58,790 --> 01:48:55,350
now filter converge velocity solution

2975
01:49:00,790 --> 01:48:58,800
3.3 meters per second altitude 7.4

2976
01:49:03,030 --> 01:49:00,800
kilometers now has radar lock on the

2977
01:49:04,550 --> 01:49:03,040
ground current velocity is about 100

2978
01:49:11,270 --> 01:49:04,560
meters per second

2979
01:49:16,550 --> 01:49:13,189
first advance is continuing to descend

2980
01:49:18,470 --> 01:49:16,560
on the parachute we are coming up on

2981
01:49:21,189 --> 01:49:18,480
the initialization of terrain relative

2982
01:49:22,550 --> 01:49:21,199
navigation and subsequently the priming

2983
01:49:25,669 --> 01:49:22,560
of the landing engines our current

2984
01:49:32,629 --> 01:49:25,679
velocity is about 90 meters per second

2985
01:49:36,629 --> 01:49:35,030
ovf valid we have confirmation that the

2986
01:49:38,870 --> 01:49:36,639
lander vision system has produced a

2987
01:49:41,750 --> 01:49:38,880
valid solution and part of touring

2988
01:49:43,430 --> 01:49:41,760

relative navigation rhyming

2989
01:49:51,270 --> 01:49:43,440
is nominal

2990
01:49:56,470 --> 01:49:53,990
back shell set current velocity is 83

2991
01:49:58,950 --> 01:49:56,480
meters per second at about 2.6

2992
01:50:00,390 --> 01:49:58,960
kilometers from the surface mars we have

2993
01:50:01,750 --> 01:50:00,400
confirmation that the back shell has

2994
01:50:03,350 --> 01:50:01,760
separated

2995
01:50:05,830 --> 01:50:03,360
we are currently performing the divert

2996
01:50:08,229 --> 01:50:05,840
maneuver current velocity is about 75

2997
01:50:09,990 --> 01:50:08,239
meters per second at an altitude of

2998
01:50:11,270 --> 01:50:10,000
about a kilometer off the surface of

2999
01:50:14,229 --> 01:50:11,280
mars

3000
01:50:16,390 --> 01:50:14,239
here in safety bravo

3001
01:50:17,750 --> 01:50:16,400
we have completed our terrain relative

3002
01:50:19,350 --> 01:50:17,760
navigation

3003
01:50:21,350 --> 01:50:19,360
current speed is about

3004
01:50:26,790 --> 01:50:21,360
30 meters per second altitude of about

3005
01:50:31,030 --> 01:50:29,109
we have started our constant velocity

3006
01:50:32,950 --> 01:50:31,040
accordion which means we are conducting

3007
01:50:37,669 --> 01:50:32,960
the sky crane

3008
01:50:37,679 --> 01:50:41,350
skytrain maneuver has started

3009
01:50:41,360 --> 01:50:49,510
about 20 meters off the surface

3010
01:50:54,229 --> 01:50:52,550
we're getting signals from mro

3011
01:50:56,390 --> 01:50:54,239
tango delta

3012
01:50:59,350 --> 01:50:56,400
touchdown confirmed perseverance

3013
01:51:01,830 --> 01:50:59,360

faithfully on the surface of mars

3014
01:51:02,840 --> 01:51:01,840
ready to begin seeking the sands of past

3015
01:51:04,550 --> 01:51:02,850
life

3016
01:51:17,669 --> 01:51:04,560
[Applause]

3017
01:51:17,679 --> 01:51:27,490
you