



MARS
PERSEVERANCE

1
00:01:15,590 --> 00:01:13,109
and liftoff as the countdown to mars

2
00:01:17,510 --> 00:01:15,600
continues the perseverance of humanity

3
00:01:32,789 --> 00:01:17,520
launching the next generation of robotic

4
00:01:32,799 --> 00:02:01,109
so

5
00:02:06,630 --> 00:02:03,749
nasa's mars perseverance rover left

6
00:02:08,790 --> 00:02:06,640
earth six months ago now we are gearing

7
00:02:10,790 --> 00:02:08,800
up for touchdown on the red planet in

8
00:02:12,550 --> 00:02:10,800
just a few weeks

9
00:02:15,350 --> 00:02:12,560
the rover will attempt to land in

10
00:02:17,589 --> 00:02:15,360
jezreel crater on february 18th it's the

11
00:02:20,309 --> 00:02:17,599
most difficult landing site on mars ever

12
00:02:23,190 --> 00:02:20,319
attempted but the perseverance rover and

13
00:02:24,869 --> 00:02:23,200

the team are ready welcome to nasa's jet

14

00:02:27,990 --> 00:02:24,879

propulsion laboratory in southern

15

00:02:29,510 --> 00:02:28,000

california i'm required

16

00:02:31,910 --> 00:02:29,520

today we are here to talk about

17

00:02:34,070 --> 00:02:31,920

perseverance's mission we will go over

18

00:02:36,470 --> 00:02:34,080

the challenges the team has faced and

19

00:02:38,150 --> 00:02:36,480

the challenging landing ahead we will

20

00:02:40,550 --> 00:02:38,160

also talk about the mission science

21

00:02:43,110 --> 00:02:40,560

goals and how perseverance fits into

22

00:02:44,630 --> 00:02:43,120

nasa's future plans for mars sample

23

00:02:46,949 --> 00:02:44,640

return

24

00:02:49,509 --> 00:02:46,959

on our panel today are

25

00:02:51,350 --> 00:02:49,519

nasa associate administrator thomas

26
00:02:54,390 --> 00:02:51,360
zurbukin

27
00:02:56,630 --> 00:02:54,400
nasa planetary science division director

28
00:02:59,750 --> 00:02:56,640
lori glaze

29
00:03:01,589 --> 00:02:59,760
perseverance deputy project manager matt

30
00:03:04,149 --> 00:03:01,599
wallace

31
00:03:05,509 --> 00:03:04,159
entry descent and landing phase lead al

32
00:03:07,990 --> 00:03:05,519
chen

33
00:03:09,430 --> 00:03:08,000
perseverance project scientist ken

34
00:03:11,990 --> 00:03:09,440
farley

35
00:03:13,350 --> 00:03:12,000
perseverance science team member briny

36
00:03:15,110 --> 00:03:13,360
horgan

37
00:03:17,750 --> 00:03:15,120
for anyone watching who'd like to submit

38
00:03:20,229 --> 00:03:17,760

a question you can do so by using the

39

00:03:21,910 --> 00:03:20,239

countdown to mars hashtag

40

00:03:24,630 --> 00:03:21,920

our phone lines are now open to the

41

00:03:26,550 --> 00:03:24,640

media you can ask a question by pressing

42

00:03:28,789 --> 00:03:26,560

star one

43

00:03:33,750 --> 00:03:28,799

i'd like to start by welcoming thomas

44

00:03:38,309 --> 00:03:35,670

hey thanks so much

45

00:03:40,470 --> 00:03:38,319

i'm so pleased to be here today as the

46

00:03:43,509 --> 00:03:40,480

perseverance rover makes the final

47

00:03:46,390 --> 00:03:43,519

kilometers on its long journey to mars

48

00:03:48,630 --> 00:03:46,400

and the landing on february 18th

49

00:03:51,190 --> 00:03:48,640

i want to note for a moment the place

50

00:03:53,509 --> 00:03:51,200

where we find ourselves

51
00:03:55,429 --> 00:03:53,519
a place where a mission to mars

52
00:03:57,990 --> 00:03:55,439
and what all of us do in science and

53
00:03:59,830 --> 00:03:58,000
exploration provide hope

54
00:04:02,470 --> 00:03:59,840
and unity

55
00:04:04,869 --> 00:04:02,480
vice president harris said

56
00:04:07,910 --> 00:04:04,879
even in dark times

57
00:04:11,190 --> 00:04:07,920
we not only dream we do

58
00:04:13,350 --> 00:04:11,200
we don't only see what has been

59
00:04:15,509 --> 00:04:13,360
we see what can be

60
00:04:17,349 --> 00:04:15,519
we shoot for the moon and then we plant

61
00:04:18,789 --> 00:04:17,359
our flag on it

62
00:04:22,150 --> 00:04:18,799
we are bold

63
00:04:24,070 --> 00:04:22,160

fearless and ambitious end of quote

64

00:04:26,629 --> 00:04:24,080

at the request of the new administration

65

00:04:29,510 --> 00:04:26,639

our rock from the apollo 17 mission was

66

00:04:30,710 --> 00:04:29,520

delivered to the white house on loan on

67

00:04:31,749 --> 00:04:30,720

display in the

68

00:04:33,749 --> 00:04:31,759

office

69

00:04:35,990 --> 00:04:33,759

a recognition of the bold fearless

70

00:04:38,710 --> 00:04:36,000

ambitions and accomplishments of earlier

71

00:04:41,030 --> 00:04:38,720

generations and the symbol

72

00:04:42,870 --> 00:04:41,040

of the new administration's support from

73

00:04:44,710 --> 00:04:42,880

america's current moon to mars

74

00:04:46,950 --> 00:04:44,720

exploration approach

75

00:04:48,629 --> 00:04:46,960

and perseverance is at the forefront of

76

00:04:50,790 --> 00:04:48,639

that work

77

00:04:53,430 --> 00:04:50,800

as our cosmic neighbor and as a

78

00:04:55,510 --> 00:04:53,440

destination mars continues to captivate

79

00:04:58,230 --> 00:04:55,520

our imagination both

80

00:05:00,550 --> 00:04:58,240

scientists and as explorers and it seems

81

00:05:03,830 --> 00:05:00,560

every time we learn something new

82

00:05:06,790 --> 00:05:03,840

we uncover more questions

83

00:05:08,790 --> 00:05:06,800

we know that mars had a bad past

84

00:05:11,590 --> 00:05:08,800

and we used our spirit and opportunity

85

00:05:12,629 --> 00:05:11,600

rovers to follow the water in search of

86

00:05:15,749 --> 00:05:12,639

answers

87

00:05:18,469 --> 00:05:15,759

as to why this once ocean world is now

88

00:05:20,230 --> 00:05:18,479

dry and desolate

89

00:05:23,350 --> 00:05:20,240

following those missions came our

90

00:05:26,550 --> 00:05:23,360

curiosity rover which landed on mars in

91

00:05:29,189 --> 00:05:26,560

2012 and is still operating today and

92

00:05:32,790 --> 00:05:29,199

constantly sending back data about the

93

00:05:34,390 --> 00:05:32,800

complex chemical composition and history

94

00:05:35,670 --> 00:05:34,400

of mars

95

00:05:38,150 --> 00:05:35,680

we have additional missions in

96

00:05:41,749 --> 00:05:38,160

development and formulation but the mars

97

00:05:44,550 --> 00:05:41,759

2020 perseverance rover is the next step

98

00:05:46,390 --> 00:05:44,560

in a logical progression that nasa has

99

00:05:49,270 --> 00:05:46,400

strategically pursued with mars

100

00:05:50,550 --> 00:05:49,280

exploration and it builds upon decades

101
00:05:54,310 --> 00:05:50,560
of knowledge

102
00:05:56,350 --> 00:05:54,320
experience and unique expertise

103
00:05:57,909 --> 00:05:56,360
perseverance is our robotic

104
00:05:59,990 --> 00:05:57,919
astrobiologist

105
00:06:02,710 --> 00:06:00,000
and it will be the first rover nasa has

106
00:06:06,309 --> 00:06:02,720
sent to mars with the explicit goal of

107
00:06:07,670 --> 00:06:06,319
searching for signs of ancient life it

108
00:06:10,150 --> 00:06:07,680
will build upon

109
00:06:12,629 --> 00:06:10,160
what we currently know from our previous

110
00:06:15,430 --> 00:06:12,639
rovers orbiters and landers and it will

111
00:06:17,189 --> 00:06:15,440
attempt to answer an age-old question

112
00:06:19,110 --> 00:06:17,199
that has eluded humanities for

113
00:06:22,070 --> 00:06:19,120

generation

114

00:06:25,270 --> 00:06:22,080

whether life has ever existed

115

00:06:27,270 --> 00:06:25,280

elsewhere beyond our own planet

116

00:06:29,909 --> 00:06:27,280

our earth

117

00:06:31,909 --> 00:06:29,919

perseverance also will help enable human

118

00:06:34,309 --> 00:06:31,919

exploration of the planet in the coming

119

00:06:36,230 --> 00:06:34,319

years as it demonstrates new and more

120

00:06:37,510 --> 00:06:36,240

precise entry descendant landing

121

00:06:40,550 --> 00:06:37,520

technologies

122

00:06:43,029 --> 00:06:40,560

the moxie instrument will show us how to

123

00:06:45,350 --> 00:06:43,039

produce oxygen on the martian surface

124

00:06:47,270 --> 00:06:45,360

from the atmosphere and many other

125

00:06:48,390 --> 00:06:47,280

aspects of our science instruments will

126
00:06:51,510 --> 00:06:48,400
inform the

127
00:06:53,830 --> 00:06:51,520
future journey of astronauts there

128
00:06:56,230 --> 00:06:53,840
our rover also carries the ingenuity

129
00:06:58,950 --> 00:06:56,240
helicopter which will be the first

130
00:07:01,990 --> 00:06:58,960
aircraft to attempt controlled flight on

131
00:07:04,070 --> 00:07:02,000
another planet a true extraterrestrial

132
00:07:06,469 --> 00:07:04,080
wright brothers moment

133
00:07:08,629 --> 00:07:06,479
the rover exemplifies the spirit of

134
00:07:11,110 --> 00:07:08,639
exploration as it pulls on science

135
00:07:14,469 --> 00:07:11,120
technology and human exploration to work

136
00:07:17,430 --> 00:07:14,479
to advance our goals in many areas

137
00:07:19,909 --> 00:07:17,440
and perseverance by its very name

138
00:07:21,189 --> 00:07:19,919

describes the human spirit that gets us

139

00:07:23,430 --> 00:07:21,199

there

140

00:07:25,670 --> 00:07:23,440

landing on mars is hard enough

141

00:07:27,029 --> 00:07:25,680

and while we are all eagerly awaiting

142

00:07:29,350 --> 00:07:27,039

the next

143

00:07:32,070 --> 00:07:29,360

the today next months when perseverance

144

00:07:33,909 --> 00:07:32,080

safely lands on the red planet it is not

145

00:07:36,710 --> 00:07:33,919

guaranteed that we will be

146

00:07:38,870 --> 00:07:36,720

successful it's very hard

147

00:07:41,270 --> 00:07:38,880

while we hope that the situation on our

148

00:07:44,469 --> 00:07:41,280

world with respect to chloe would have

149

00:07:46,230 --> 00:07:44,479

improved since launch it has not and

150

00:07:48,390 --> 00:07:46,240

that has meant that we've needed to be

151
00:07:50,550 --> 00:07:48,400
flexible and adapt to keep working

152
00:07:52,550 --> 00:07:50,560
safely and effectively

153
00:07:55,189 --> 00:07:52,560
regardless of everything that has

154
00:07:59,270 --> 00:07:55,199
happened due to cloed it is the constant

155
00:08:01,670 --> 00:07:59,280
innovation dedication above else unity

156
00:08:03,909 --> 00:08:01,680
of this team that has allowed work on

157
00:08:06,230 --> 00:08:03,919
the perseverance rover to continue in a

158
00:08:08,390 --> 00:08:06,240
safe manner

159
00:08:09,990 --> 00:08:08,400
and now the world can join us once again

160
00:08:11,990 --> 00:08:10,000
as we attempt to do

161
00:08:15,430 --> 00:08:12,000
one of the hardest things ever done by

162
00:08:18,070 --> 00:08:15,440
humanity and certainly in space science

163
00:08:20,710 --> 00:08:18,080

success does not come easily and it's

164

00:08:22,710 --> 00:08:20,720

only due to the efforts of this team

165

00:08:24,550 --> 00:08:22,720

that we are here today to talk about

166

00:08:26,950 --> 00:08:24,560

this next step in mars exploration

167

00:08:28,710 --> 00:08:26,960

planetary science you'll hear my

168

00:08:31,189 --> 00:08:28,720

colleagues on this panel talk about the

169

00:08:34,149 --> 00:08:31,199

difficulties of landing the technologies

170

00:08:36,070 --> 00:08:34,159

that make it possible and the hope a

171

00:08:39,670 --> 00:08:36,080

successful landing brings for finally

172

00:08:41,670 --> 00:08:39,680

bringing a sample of mars home to earth

173

00:08:44,470 --> 00:08:41,680

but the journey of perseverance also

174

00:08:46,790 --> 00:08:44,480

begins with a successful touchdown it

175

00:08:49,430 --> 00:08:46,800

only begins that way in fact then the

176

00:08:51,430 --> 00:08:49,440

hard work and the long-term perseverance

177

00:08:54,470 --> 00:08:51,440

really starts that's because

178

00:08:56,790 --> 00:08:54,480

perseverance is also the first step

179

00:08:58,389 --> 00:08:56,800

in our round trip mission to mars

180

00:09:00,949 --> 00:08:58,399

our roar begins an ambitious

181

00:09:04,070 --> 00:09:00,959

international campaign with european

182

00:09:07,190 --> 00:09:04,080

space agency to bring pristine samples

183

00:09:09,670 --> 00:09:07,200

from mars safely back to earth

184

00:09:11,670 --> 00:09:09,680

through our mars sample return campaign

185

00:09:15,030 --> 00:09:11,680

which you'll hear my colleague dr laurie

186

00:09:17,750 --> 00:09:15,040

glace speak about in more detail

187

00:09:19,990 --> 00:09:17,760

at nasa we are dedicated to the peaceful

188

00:09:22,230 --> 00:09:20,000

exploration of space for the benefit of

189

00:09:23,990 --> 00:09:22,240

humanity and we are dedicated to

190

00:09:25,350 --> 00:09:24,000

inspiring the next generation of

191

00:09:27,750 --> 00:09:25,360

explorers

192

00:09:29,910 --> 00:09:27,760

science has the power to unite us

193

00:09:32,389 --> 00:09:29,920

as it transcends language

194

00:09:33,910 --> 00:09:32,399

borders and many boundaries of many

195

00:09:36,550 --> 00:09:33,920

types

196

00:09:38,949 --> 00:09:36,560

this mission could not have a better

197

00:09:40,710 --> 00:09:38,959

name perseverance

198

00:09:43,190 --> 00:09:40,720

and it is my sincere hope that this

199

00:09:46,389 --> 00:09:43,200

mission will inspire all of us all of

200

00:09:48,310 --> 00:09:46,399

you to persevere together in hopes of a

201
00:09:50,630 --> 00:09:48,320
better tomorrow

202
00:09:52,150 --> 00:09:50,640
now i'll turn it over to dr laurie glaze

203
00:09:53,910 --> 00:09:52,160
director of the planetary science

204
00:09:57,110 --> 00:09:53,920
division to tell you more

205
00:10:00,230 --> 00:09:57,120
about why we want a sample of mars and

206
00:10:01,670 --> 00:10:00,240
how we'll get it done lori

207
00:10:04,710 --> 00:10:01,680
thank you thomas

208
00:10:08,310 --> 00:10:04,720
i am thrilled to be here today as our

209
00:10:10,230 --> 00:10:08,320
countdown to mars winds down from months

210
00:10:12,790 --> 00:10:10,240
to just weeks

211
00:10:15,030 --> 00:10:12,800
perseverance is closing in on the red

212
00:10:17,509 --> 00:10:15,040
planet and our team is preparing for her

213
00:10:19,750 --> 00:10:17,519

to touch down at jezreel crater

214

00:10:22,069 --> 00:10:19,760

after an incredibly challenging year

215

00:10:23,430 --> 00:10:22,079

filled with high stakes on a world stage

216

00:10:25,829 --> 00:10:23,440

of uncertainty

217

00:10:27,829 --> 00:10:25,839

i am so proud of the men and women

218

00:10:31,110 --> 00:10:27,839

across all of nasa

219

00:10:32,790 --> 00:10:31,120

their focus dedication and resolve never

220

00:10:35,190 --> 00:10:32,800

once wavered

221

00:10:38,710 --> 00:10:35,200

they are the epitome of perseverance and

222

00:10:41,269 --> 00:10:38,720

they are the heart of perseverance

223

00:10:43,829 --> 00:10:41,279

this epic mission that exemplifies

224

00:10:46,069 --> 00:10:43,839

nasa's vision for science to lead a

225

00:10:47,350 --> 00:10:46,079

globally interconnected program of

226

00:10:49,910 --> 00:10:47,360

discovery

227

00:10:52,630 --> 00:10:49,920

that encourages innovation positively

228

00:10:54,710 --> 00:10:52,640

impacts people's lives and is a source

229

00:10:56,710 --> 00:10:54,720

of inspiration

230

00:10:59,030 --> 00:10:56,720

as the next bold step in our mars

231

00:11:01,430 --> 00:10:59,040

exploration program perseverance is the

232

00:11:03,910 --> 00:11:01,440

most advanced mission humans have ever

233

00:11:06,230 --> 00:11:03,920

sent to the red planet's surface

234

00:11:08,949 --> 00:11:06,240

to say we're pumped about it well that

235

00:11:11,590 --> 00:11:08,959

would be a huge understatement

236

00:11:14,389 --> 00:11:11,600

one of perseverance's primary objectives

237

00:11:16,550 --> 00:11:14,399

supports the field of astrobiology

238

00:11:18,710 --> 00:11:16,560

which is the study of how life comes to

239

00:11:20,389 --> 00:11:18,720

be the environments that can support

240

00:11:23,350 --> 00:11:20,399

life and the search to see if life

241

00:11:25,670 --> 00:11:23,360

exists anywhere else beyond earth

242

00:11:29,430 --> 00:11:25,680

perseverance is the very first rover

243

00:11:33,269 --> 00:11:29,440

designed to seek signs of past microbial

244

00:11:35,269 --> 00:11:33,279

life by collecting and caching rock and

245

00:11:38,150 --> 00:11:35,279

soil samples that will be returned to

246

00:11:40,630 --> 00:11:38,160

earth by future missions

247

00:11:42,470 --> 00:11:40,640

her robust set of advanced instruments

248

00:11:44,710 --> 00:11:42,480

will also look for evidence of ancient

249

00:11:47,030 --> 00:11:44,720

habitable environments and monitor

250

00:11:48,470 --> 00:11:47,040

environmental conditions all of which

251
00:11:50,550 --> 00:11:48,480
are paramount to increasing our

252
00:11:53,829 --> 00:11:50,560
understanding of how to protect

253
00:11:55,910 --> 00:11:53,839
future human explorers

254
00:11:58,949 --> 00:11:55,920
mars is a keeper of deep scientific

255
00:12:01,430 --> 00:11:58,959
secrets which the rover will help unlock

256
00:12:03,509 --> 00:12:01,440
by studying the ancient record preserved

257
00:12:04,790 --> 00:12:03,519
in the layers of rock on the planet's

258
00:12:06,470 --> 00:12:04,800
surface

259
00:12:08,629 --> 00:12:06,480
scientists will be looking for rocks

260
00:12:10,150 --> 00:12:08,639
that may have formed in water possibly

261
00:12:12,790 --> 00:12:10,160
preserving evidence of the chemical

262
00:12:15,190 --> 00:12:12,800
building blocks of life

263
00:12:17,269 --> 00:12:15,200

for generations scientists have wanted a

264

00:12:19,110 --> 00:12:17,279

sample of mars to study

265

00:12:21,030 --> 00:12:19,120

while we do have martian meteorites here

266

00:12:23,670 --> 00:12:21,040

on earth it's much different than having

267

00:12:26,470 --> 00:12:23,680

samples of mars rocks and soil that are

268

00:12:28,230 --> 00:12:26,480

pristine and that we know exactly where

269

00:12:30,069 --> 00:12:28,240

they came from

270

00:12:32,230 --> 00:12:30,079

samples from mars had the potential to

271

00:12:34,470 --> 00:12:32,240

profoundly change our understanding of

272

00:12:36,870 --> 00:12:34,480

the origin evolution and distribution of

273

00:12:40,150 --> 00:12:36,880

life on earth and elsewhere in the solar

274

00:12:41,990 --> 00:12:40,160

system even now nasa continues to study

275

00:12:44,790 --> 00:12:42,000

moon samples returned by the apollo

276

00:12:47,030 --> 00:12:44,800

program more than 50 years ago

277

00:12:49,030 --> 00:12:47,040

we expect samples of mars to provide new

278

00:12:50,389 --> 00:12:49,040

knowledge for decades to come as we

279

00:12:52,550 --> 00:12:50,399

study them with state-of-the-art

280

00:12:54,870 --> 00:12:52,560

laboratory tools we couldn't possibly

281

00:12:56,389 --> 00:12:54,880

carry to mars right now

282

00:12:58,389 --> 00:12:56,399

we may even see a sample of mars

283

00:13:00,470 --> 00:12:58,399

displayed in the oval office one day but

284

00:13:01,910 --> 00:13:00,480

first we need to bring the samples back

285

00:13:04,389 --> 00:13:01,920

to earth

286

00:13:07,350 --> 00:13:04,399

the plans for mars sample return are

287

00:13:09,110 --> 00:13:07,360

multi-faceted and complex but it's

288

00:13:11,509 --> 00:13:09,120

exciting how our technologies have

289

00:13:15,269 --> 00:13:11,519

matured bringing us to this point where

290

00:13:17,269 --> 00:13:15,279

we can now attempt this amazing feat

291

00:13:19,829 --> 00:13:17,279

to be certain we are ready nasa

292

00:13:21,910 --> 00:13:19,839

initiated an independent review board to

293

00:13:24,150 --> 00:13:21,920

determine if this long-awaited mission

294

00:13:26,870 --> 00:13:24,160

is positioned for success

295

00:13:28,790 --> 00:13:26,880

the board concluded that nasa is indeed

296

00:13:30,710 --> 00:13:28,800

prepared for the campaign

297

00:13:33,190 --> 00:13:30,720

building on decades of scientific

298

00:13:35,350 --> 00:13:33,200

advancements and technical progress in

299

00:13:38,389 --> 00:13:35,360

mars exploration

300

00:13:39,750 --> 00:13:38,399

this historic endeavor demands multiple

301
00:13:41,189 --> 00:13:39,760
spacecraft

302
00:13:44,230 --> 00:13:41,199
and our partnership with the european

303
00:13:47,030 --> 00:13:44,240
space agency working together with a

304
00:13:49,590 --> 00:13:47,040
carefully orchestrated approach

305
00:13:50,550 --> 00:13:49,600
let me show you how

306
00:13:53,269 --> 00:13:50,560
first

307
00:13:55,829 --> 00:13:53,279
perseverance will drill and prepare

308
00:13:57,430 --> 00:13:55,839
samples for return and cash them on the

309
00:14:00,550 --> 00:13:57,440
surface of mars

310
00:14:02,389 --> 00:14:00,560
in 2026 a fetch rover will be launched

311
00:14:05,189 --> 00:14:02,399
to collect those samples and bring them

312
00:14:07,430 --> 00:14:05,199
to a rocket that will launch them into

313
00:14:09,750 --> 00:14:07,440

orbit around mars

314

00:14:12,310 --> 00:14:09,760

another orbiter will rendezvous and

315

00:14:13,829 --> 00:14:12,320

capture those samples for safe delivery

316

00:14:16,629 --> 00:14:13,839

to earth

317

00:14:19,430 --> 00:14:16,639

if it sounds complicated it is

318

00:14:20,150 --> 00:14:19,440

if it sounds extreme it most certainly

319

00:14:25,189 --> 00:14:20,160

is

320

00:14:26,790 --> 00:14:25,199

help us prepare for human exploration

321

00:14:28,870 --> 00:14:26,800

things like the precision landing

322

00:14:31,030 --> 00:14:28,880

technology capability to launch the

323

00:14:32,550 --> 00:14:31,040

first rocket from the martian surface

324

00:14:35,110 --> 00:14:32,560

and being able to assess soil

325

00:14:37,189 --> 00:14:35,120

characteristics and toxicity are all

326

00:14:40,389 --> 00:14:37,199

essential to paving the way for the

327

00:14:42,470 --> 00:14:40,399

health and safety of our human explorers

328

00:14:44,790 --> 00:14:42,480

the technology to return the samples

329

00:14:46,710 --> 00:14:44,800

that perseverance collects is maturing

330

00:14:48,710 --> 00:14:46,720

but nasa's investments in developing

331

00:14:50,790 --> 00:14:48,720

autonomous robots and landing large

332

00:14:52,870 --> 00:14:50,800

payloads on mars have laid the

333

00:14:54,870 --> 00:14:52,880

groundwork for a successful sample

334

00:14:56,870 --> 00:14:54,880

return campaign

335

00:14:58,949 --> 00:14:56,880

we are so thrilled to be working with

336

00:15:01,750 --> 00:14:58,959

esa on mars sample return and with

337

00:15:03,910 --> 00:15:01,760

partners from spain norway and france on

338

00:15:07,590 --> 00:15:03,920

perseverance science as we take our next

339

00:15:09,590 --> 00:15:07,600

steps in exploring the solar system

340

00:15:11,750 --> 00:15:09,600

it's taken a lot of work and there is

341

00:15:13,430 --> 00:15:11,760

much more work to do but if there's one

342

00:15:15,189 --> 00:15:13,440

thing the perseverance engineers and

343

00:15:18,230 --> 00:15:15,199

scientists have proven is

344

00:15:20,230 --> 00:15:18,240

there's just no i in team

345

00:15:21,990 --> 00:15:20,240

i'll throw things back over to jpl where

346

00:15:25,269 --> 00:15:22,000

matt wallace will talk about his team

347

00:15:27,430 --> 00:15:25,279

and give a project overview

348

00:15:29,430 --> 00:15:27,440

thank you very much lori uh thank both

349

00:15:31,990 --> 00:15:29,440

you and and thomas for your kind words

350

00:15:35,110 --> 00:15:32,000

about the team first of all i've worked

351
00:15:36,710 --> 00:15:35,120
on every mars rover mission this is my

352
00:15:38,870 --> 00:15:36,720
fifth one

353
00:15:40,710 --> 00:15:38,880
and uh perseverance is different in many

354
00:15:43,430 --> 00:15:40,720
important ways i want to touch on some

355
00:15:45,509 --> 00:15:43,440
of those for you to start this off

356
00:15:47,910 --> 00:15:45,519
first of all this is the biggest vehicle

357
00:15:50,790 --> 00:15:47,920
we've ever attempted to land on mars it

358
00:15:52,870 --> 00:15:50,800
weighs in at over a metric ton

359
00:15:55,269 --> 00:15:52,880
and it is carrying

360
00:15:58,790 --> 00:15:55,279
50 percent more science and technology

361
00:16:02,790 --> 00:15:58,800
payload than uh curiosity its closest

362
00:16:04,230 --> 00:16:02,800
relative which landed in 2012.

363
00:16:07,670 --> 00:16:04,240

there are a number of new landing

364

00:16:09,590 --> 00:16:07,680

technologies on this vehicle which uh al

365

00:16:10,629 --> 00:16:09,600

then my teammate here will talk about

366

00:16:12,310 --> 00:16:10,639

shortly

367

00:16:14,389 --> 00:16:12,320

but these technologies have been

368

00:16:16,629 --> 00:16:14,399

critical in allowing us to send this

369

00:16:19,030 --> 00:16:16,639

vehicle in the jezreel crater

370

00:16:21,910 --> 00:16:19,040

a scientifically important location but

371

00:16:23,430 --> 00:16:21,920

also a difficult place to land on mars

372

00:16:25,910 --> 00:16:23,440

and a site that was considered on

373

00:16:30,310 --> 00:16:25,920

previous missions but rejected we can

374

00:16:35,269 --> 00:16:32,629

we're carrying really an exquisitely

375

00:16:37,189 --> 00:16:35,279

complex and sophisticated set of new

376

00:16:39,030 --> 00:16:37,199

instruments to the surface of mars for

377

00:16:40,710 --> 00:16:39,040

the first time

378

00:16:42,629 --> 00:16:40,720

these are the instruments which our

379

00:16:44,310 --> 00:16:42,639

project scientist ken farley will tell

380

00:16:46,069 --> 00:16:44,320

you more about

381

00:16:48,790 --> 00:16:46,079

but they're going to allow us to do the

382

00:16:50,550 --> 00:16:48,800

best job we can to understand that

383

00:16:52,949 --> 00:16:50,560

environment we land on

384

00:16:55,030 --> 00:16:52,959

and to pick the best samples very

385

00:16:55,829 --> 00:16:55,040

limited number of samples that can come

386

00:16:56,710 --> 00:16:55,839

back

387

00:16:58,949 --> 00:16:56,720

on that

388

00:17:03,509 --> 00:16:58,959

mars sample return mission which laurie

389

00:17:08,069 --> 00:17:05,510

we've also built uh

390

00:17:10,390 --> 00:17:08,079

probably the most complex complex

391

00:17:12,309 --> 00:17:10,400

mechanized system that we've ever done

392

00:17:14,150 --> 00:17:12,319

in the mars program and that's that's

393

00:17:15,750 --> 00:17:14,160

probably saying something because we've

394

00:17:17,029 --> 00:17:15,760

we've taken on some big challenges

395

00:17:20,069 --> 00:17:17,039

before

396

00:17:22,630 --> 00:17:20,079

but our sampling and caching system

397

00:17:25,510 --> 00:17:22,640

is uh the the the hardware that we'll

398

00:17:28,549 --> 00:17:25,520

use to collect those samples

399

00:17:30,630 --> 00:17:28,559

it's also extremely clean to ensure that

400

00:17:32,950 --> 00:17:30,640

we don't have any terrestrial

401
00:17:34,630 --> 00:17:32,960
contamination riding along with us when

402
00:17:39,029 --> 00:17:34,640
we collect those samples and we bring

403
00:17:45,750 --> 00:17:42,630
we've added a lot of surface autonomy

404
00:17:47,750 --> 00:17:45,760
a lot of new ai if you will

405
00:17:50,710 --> 00:17:47,760
to this vehicle so that we can complete

406
00:17:53,510 --> 00:17:50,720
this mission on the surface

407
00:17:56,230 --> 00:17:53,520
all of our mars rovers are kind of

408
00:17:58,150 --> 00:17:56,240
self-driving cars to some degree

409
00:17:59,830 --> 00:17:58,160
but perseverance is going to drive three

410
00:18:02,950 --> 00:17:59,840
times faster

411
00:18:05,110 --> 00:18:02,960
than any previous mars rover so that it

412
00:18:05,990 --> 00:18:05,120
can get that job done that we talked

413
00:18:08,950 --> 00:18:06,000

about

414

00:18:12,390 --> 00:18:08,960

in an expeditious and efficient fashion

415

00:18:16,870 --> 00:18:15,190

finally perseverance is really leaning

416

00:18:19,190 --> 00:18:16,880

forward uh

417

00:18:22,070 --> 00:18:19,200

in my mind more than any of these other

418

00:18:24,390 --> 00:18:22,080

vehicles which we've sent to mars

419

00:18:26,710 --> 00:18:24,400

you know in the 1960s right here at this

420

00:18:28,710 --> 00:18:26,720

facility at jpl in fact in the same

421

00:18:30,789 --> 00:18:28,720

clean room

422

00:18:32,630 --> 00:18:30,799

that were where we assembled and tested

423

00:18:34,870 --> 00:18:32,640

perseverance which you just saw in that

424

00:18:37,190 --> 00:18:34,880

clip

425

00:18:39,430 --> 00:18:37,200

we built missions called ranger and

426

00:18:41,270 --> 00:18:39,440

surveyor they were the precursor

427

00:18:43,270 --> 00:18:41,280

missions to the moon

428

00:18:45,350 --> 00:18:43,280

there are human precursor missions for

429

00:18:47,590 --> 00:18:45,360

the apollo astronauts

430

00:18:49,909 --> 00:18:47,600

and in many ways

431

00:18:51,510 --> 00:18:49,919

perseverance serves that purpose for

432

00:18:53,029 --> 00:18:51,520

mars

433

00:18:55,029 --> 00:18:53,039

as i mentioned we're carrying a lot of

434

00:18:58,070 --> 00:18:55,039

new landing technology which will feed

435

00:19:01,190 --> 00:18:58,080

forward into that activity we have more

436

00:19:04,789 --> 00:19:01,200

surface intelligence again more autonomy

437

00:19:06,870 --> 00:19:04,799

that's a feed forward technology as well

438

00:19:09,110 --> 00:19:06,880

we're carrying a suite of ruggedized

439

00:19:10,150 --> 00:19:09,120

commercial high definition video cameras

440

00:19:11,350 --> 00:19:10,160

we're going to be able to watch

441

00:19:13,110 --> 00:19:11,360

ourselves

442

00:19:14,150 --> 00:19:13,120

for the first time land on another

443

00:19:15,830 --> 00:19:14,160

planet

444

00:19:17,590 --> 00:19:15,840

we're carrying microphones to the

445

00:19:19,669 --> 00:19:17,600

surface of mars this will be the first

446

00:19:22,070 --> 00:19:19,679

time we've been able to put that human

447

00:19:24,870 --> 00:19:22,080

sensory capability

448

00:19:26,230 --> 00:19:24,880

on the surface and and uh and see what

449

00:19:27,909 --> 00:19:26,240

we get

450

00:19:29,750 --> 00:19:27,919

well those are very exciting we have a

451
00:19:30,789 --> 00:19:29,760
weather station which will tell us a lot

452
00:19:32,789 --> 00:19:30,799
about

453
00:19:35,190 --> 00:19:32,799
the dust and the radiation and the

454
00:19:38,470 --> 00:19:35,200
weather environment that astronauts

455
00:19:41,350 --> 00:19:38,480
would need to understand and survive for

456
00:19:42,470 --> 00:19:41,360
future for future human exploration as

457
00:19:44,549 --> 00:19:42,480
well

458
00:19:46,950 --> 00:19:44,559
and so this is a mission that's

459
00:19:48,390 --> 00:19:46,960
certainly leaning forward and i want to

460
00:19:50,950 --> 00:19:48,400
show you one of those technology

461
00:19:52,549 --> 00:19:50,960
experiments if you want to run the clip

462
00:19:55,270 --> 00:19:52,559
this is a

463
00:19:58,470 --> 00:19:55,280

a picture of the

464

00:20:01,110 --> 00:19:58,480

moxie experiment getting integrated into

465

00:20:03,830 --> 00:20:01,120

the rover the rover's upside down

466

00:20:05,909 --> 00:20:03,840

and as you can see the moxie

467

00:20:07,750 --> 00:20:05,919

experiment is getting craned into the

468

00:20:09,750 --> 00:20:07,760

belly of the vehicle

469

00:20:11,190 --> 00:20:09,760

now what is moxie moxie is something

470

00:20:13,990 --> 00:20:11,200

called

471

00:20:16,230 --> 00:20:14,000

an in-situ resource utilization

472

00:20:17,190 --> 00:20:16,240

experiment which is kind of a fancy way

473

00:20:21,110 --> 00:20:17,200

of

474

00:20:24,230 --> 00:20:21,120

experiment that will actually create

475

00:20:26,549 --> 00:20:24,240

oxygen on the surface of mars

476
00:20:29,590 --> 00:20:26,559
by ingesting the martian atmosphere the

477
00:20:31,830 --> 00:20:29,600
carbon dioxide dissociating it using a

478
00:20:34,390 --> 00:20:31,840
process called electrolysis

479
00:20:36,310 --> 00:20:34,400
and creating pure oxygen now this is a

480
00:20:38,630 --> 00:20:36,320
scaled experiment

481
00:20:41,669 --> 00:20:38,640
to demonstrate this technology for

482
00:20:42,470 --> 00:20:41,679
future human exploration

483
00:20:45,270 --> 00:20:42,480
both

484
00:20:47,909 --> 00:20:45,280
obviously for life support purposes

485
00:20:50,070 --> 00:20:47,919
but the oxygen is also important as an

486
00:20:52,070 --> 00:20:50,080
oxidizer for fuel

487
00:20:53,990 --> 00:20:52,080
to bring those human missions back to

488
00:20:55,750 --> 00:20:54,000

the earth

489

00:20:58,470 --> 00:20:55,760

and so all of that

490

00:21:00,390 --> 00:20:58,480

is really an exciting and new aspect to

491

00:21:04,310 --> 00:21:00,400

the mission

492

00:21:05,750 --> 00:21:04,320

uh now uh none of these uh things really

493

00:21:08,470 --> 00:21:05,760

happen

494

00:21:10,230 --> 00:21:08,480

uh and one more clip please on the next

495

00:21:12,549 --> 00:21:10,240

clip i want to take you through uh one

496

00:21:14,149 --> 00:21:12,559

of our stars actually here before i go

497

00:21:16,390 --> 00:21:14,159

to the next piece here

498

00:21:18,149 --> 00:21:16,400

this is the ingenuity helicopter

499

00:21:19,750 --> 00:21:18,159

thank you

500

00:21:22,070 --> 00:21:19,760

as most of you know

501
00:21:24,390 --> 00:21:22,080
ingenuity is being carried on the belly

502
00:21:27,510 --> 00:21:24,400
of the vehicle we'll find a good place

503
00:21:29,669 --> 00:21:27,520
to deploy it on the surface of mars

504
00:21:31,430 --> 00:21:29,679
we'll drive off to a standoff distance

505
00:21:32,950 --> 00:21:31,440
and then we will become the official

506
00:21:34,789 --> 00:21:32,960
photographer

507
00:21:35,909 --> 00:21:34,799
for ingenuity as it attempts to do

508
00:21:38,070 --> 00:21:35,919
something

509
00:21:39,590 --> 00:21:38,080
that's never been done before which is

510
00:21:41,510 --> 00:21:39,600
powered flight

511
00:21:43,190 --> 00:21:41,520
on another planet

512
00:21:45,190 --> 00:21:43,200
you know this is a technology that's

513
00:21:48,470 --> 00:21:45,200

really going to open up a new

514

00:21:49,990 --> 00:21:48,480

exploration modality for us

515

00:21:52,470 --> 00:21:50,000

very much like

516

00:21:58,070 --> 00:21:52,480

the rovers did 20 years ago when we flew

517

00:22:04,230 --> 00:22:00,549

none of these things uh actually happen

518

00:22:05,270 --> 00:22:04,240

um without a lot of help and uh i just

519

00:22:06,870 --> 00:22:05,280

want to

520

00:22:08,630 --> 00:22:06,880

acknowledge

521

00:22:10,390 --> 00:22:08,640

the many industry partners that we've

522

00:22:13,110 --> 00:22:10,400

had along the way there are over a

523

00:22:15,750 --> 00:22:13,120

thousand suppliers that have provided

524

00:22:18,230 --> 00:22:15,760

hardware for this mission

525

00:22:21,430 --> 00:22:18,240

they're located in over 500 different

526

00:22:23,350 --> 00:22:21,440

cities 44 different states

527

00:22:26,070 --> 00:22:23,360

pretty much every nasa center has

528

00:22:27,430 --> 00:22:26,080

contributed in one fashion or another to

529

00:22:31,190 --> 00:22:27,440

this mission

530

00:22:32,710 --> 00:22:31,200

and in fact internationally we have

531

00:22:35,590 --> 00:22:32,720

educational

532

00:22:37,430 --> 00:22:35,600

facilities and universities

533

00:22:39,350 --> 00:22:37,440

as well as additional suppliers that

534

00:22:42,149 --> 00:22:39,360

provide both engineering and science

535

00:22:45,270 --> 00:22:42,159

hardware for this mission so this is

536

00:22:48,950 --> 00:22:45,280

this is certainly a a team effort

537

00:22:51,029 --> 00:22:48,960

and every every mission inquires

538

00:22:52,789 --> 00:22:51,039

deals with challenges at one point or

539

00:22:55,510 --> 00:22:52,799

another and frankly

540

00:22:57,110 --> 00:22:55,520

after having been doing this for three

541

00:22:58,870 --> 00:22:57,120

decades or so

542

00:23:00,710 --> 00:22:58,880

i thought i had seen just about

543

00:23:02,950 --> 00:23:00,720

everything

544

00:23:05,510 --> 00:23:02,960

until about a year ago

545

00:23:06,710 --> 00:23:05,520

when i was proven wrong and uh and we

546

00:23:07,909 --> 00:23:06,720

all had to

547

00:23:10,630 --> 00:23:07,919

face

548

00:23:12,390 --> 00:23:10,640

the global pandemic

549

00:23:13,830 --> 00:23:12,400

now this is something that happened

550

00:23:15,510 --> 00:23:13,840

right

551
00:23:18,070 --> 00:23:15,520
during the final processing for the

552
00:23:20,950 --> 00:23:18,080
spacecraft down at kennedy space center

553
00:23:23,510 --> 00:23:20,960
we had to react quickly the teams

554
00:23:25,590 --> 00:23:23,520
had to figure out how to both keep uh

555
00:23:27,270 --> 00:23:25,600
the teams and their families safe as

556
00:23:30,310 --> 00:23:27,280
well as continue to make progress for

557
00:23:32,310 --> 00:23:30,320
the launch as thomas indicated

558
00:23:34,470 --> 00:23:32,320
uh it was really the first time during

559
00:23:37,909 --> 00:23:34,480
the entire development where i felt that

560
00:23:41,029 --> 00:23:37,919
the launch was in actually some jeopardy

561
00:23:42,789 --> 00:23:41,039
it was just so comprehensive and and so

562
00:23:45,110 --> 00:23:42,799
so new

563
00:23:47,510 --> 00:23:45,120

and so many teams came together to help

564

00:23:48,630 --> 00:23:47,520

us across the agency other nasa centers

565

00:23:51,029 --> 00:23:48,640

helped get us

566

00:23:52,950 --> 00:23:51,039

hardware and people down to the to

567

00:23:55,590 --> 00:23:52,960

kennedy space center

568

00:23:58,230 --> 00:23:55,600

uh the headquarters team stepped in both

569

00:24:00,070 --> 00:23:58,240

lori and thomas specifically and others

570

00:24:02,950 --> 00:24:00,080

to help us get through that period and

571

00:24:06,149 --> 00:24:02,960

of course the team rose to the challenge

572

00:24:08,390 --> 00:24:06,159

and got us and got us to the launch pad

573

00:24:09,990 --> 00:24:08,400

and we've managed to fly the spacecraft

574

00:24:13,029 --> 00:24:10,000

to a point here where we're just a few

575

00:24:14,870 --> 00:24:13,039

weeks away now from from landing

576

00:24:17,830 --> 00:24:14,880

i asked the team in the spring of last

577

00:24:19,909 --> 00:24:17,840

year uh to come up with

578

00:24:22,470 --> 00:24:19,919

something that would symbolize to mark

579

00:24:25,750 --> 00:24:22,480

this this challenge and to thank

580

00:24:27,990 --> 00:24:25,760

in particular the front line workers

581

00:24:30,549 --> 00:24:28,000

the medical community that were out

582

00:24:32,549 --> 00:24:30,559

there doing their job

583

00:24:34,390 --> 00:24:32,559

and the team designed this

584

00:24:36,310 --> 00:24:34,400

we called our covet plate

585

00:24:38,310 --> 00:24:36,320

as you can see

586

00:24:41,029 --> 00:24:38,320

it's got a representation of the earth

587

00:24:43,350 --> 00:24:41,039

the globe uh all of us facing this

588

00:24:45,909 --> 00:24:43,360

challenge together

589

00:24:48,630 --> 00:24:45,919

it's got a symbol of the spacecraft

590

00:24:49,669 --> 00:24:48,640

leaving the earth heading to mars and of

591

00:24:52,630 --> 00:24:49,679

course

592

00:24:54,549 --> 00:24:52,640

all of this supported by the familiar

593

00:24:56,549 --> 00:24:54,559

staff and serpent of the medical

594

00:24:58,950 --> 00:24:56,559

community

595

00:25:00,390 --> 00:24:58,960

we're proudly carrying this plate to

596

00:25:02,630 --> 00:25:00,400

mars

597

00:25:04,310 --> 00:25:02,640

so that

598

00:25:07,190 --> 00:25:04,320

we'll remember

599

00:25:09,190 --> 00:25:07,200

back here on the earth in the year 2020

600

00:25:10,870 --> 00:25:09,200

and 21

601
00:25:13,350 --> 00:25:10,880
that there was a community that stepped

602
00:25:17,669 --> 00:25:13,360
up and bravely did their jobs so that we

603
00:25:21,830 --> 00:25:19,110
i want to

604
00:25:23,909 --> 00:25:21,840
pass the baton at this point

605
00:25:27,510 --> 00:25:23,919
over to al chen

606
00:25:28,789 --> 00:25:27,520
he is our entry descent and landing lead

607
00:25:31,510 --> 00:25:28,799
he's going to tell you a little bit

608
00:25:33,110 --> 00:25:31,520
about this activity that we're going to

609
00:25:35,909 --> 00:25:33,120
go through here in just a few weeks it's

610
00:25:38,549 --> 00:25:35,919
one of the most difficult maneuvers

611
00:25:40,149 --> 00:25:38,559
in our business and he

612
00:25:42,230 --> 00:25:40,159
will take you through

613
00:25:45,510 --> 00:25:42,240

the steps and the challenges that we

614

00:25:47,430 --> 00:25:45,520

have coming up in just a few weeks now

615

00:25:49,190 --> 00:25:47,440

thanks man

616

00:25:50,230 --> 00:25:49,200

i don't think i'm exaggerating when i

617

00:25:51,590 --> 00:25:50,240

say that

618

00:25:53,350 --> 00:25:51,600

entry descent landing is the most

619

00:25:55,750 --> 00:25:53,360

critical and most dangerous part of the

620

00:25:57,110 --> 00:25:55,760

mission success is never assured and

621

00:25:59,350 --> 00:25:57,120

that's especially true when we're trying

622

00:26:01,590 --> 00:25:59,360

to land the biggest heaviest and most

623

00:26:03,110 --> 00:26:01,600

complicated rover we've ever built to

624

00:26:05,110 --> 00:26:03,120

the most dangerous site we've ever

625

00:26:06,789 --> 00:26:05,120

attempted to land at

626

00:26:08,630 --> 00:26:06,799

if you take a look at this next little

627

00:26:10,230 --> 00:26:08,640

video here you'll get a little taste of

628

00:26:12,230 --> 00:26:10,240

what those seven minutes of enter

629

00:26:38,110 --> 00:26:12,240

descent landing will look like in just

630

00:26:38,120 --> 00:26:59,269

[Music]

631

00:26:59,279 --> 00:27:11,029

so

632

00:27:14,149 --> 00:27:12,789

just looking at and thinking about the

633

00:27:15,669 --> 00:27:14,159

landing really gets the blood flowing

634

00:27:17,110 --> 00:27:15,679

for me

635

00:27:19,350 --> 00:27:17,120

landing on mars is really all about

636

00:27:20,870 --> 00:27:19,360

finding a place a way to stop and stop

637

00:27:22,789 --> 00:27:20,880

in a safe place

638

00:27:24,470 --> 00:27:22,799

perseverance first hits the atmosphere

639

00:27:26,149 --> 00:27:24,480

uh going almost twelve thousand over

640

00:27:28,149 --> 00:27:26,159

twelve thousand miles per hour and

641

00:27:30,389 --> 00:27:28,159

streaks across the sky like a meteor

642

00:27:32,549 --> 00:27:30,399

using that atmosphere to slow down

643

00:27:33,990 --> 00:27:32,559

during that entry it's gotta survive the

644

00:27:36,149 --> 00:27:34,000

intense heating and deceleration that

645

00:27:37,990 --> 00:27:36,159

period while also using thrusters to

646

00:27:40,710 --> 00:27:38,000

steer toward the landing target to make

647

00:27:42,630 --> 00:27:40,720

sure we go to the right place

648

00:27:44,870 --> 00:27:42,640

after slowing down to supersonic speeds

649

00:27:46,870 --> 00:27:44,880

perseverance will deploy a large 70 foot

650

00:27:48,950 --> 00:27:46,880

diameter parachute while still traveling

651
00:27:50,389 --> 00:27:48,960
almost twice the speed of sound

652
00:27:51,830 --> 00:27:50,399
that'll slow the spacecraft down even

653
00:27:53,190 --> 00:27:51,840
further

654
00:27:54,710 --> 00:27:53,200
while coming down on the parachute

655
00:27:55,669 --> 00:27:54,720
perseverance needs to figure out where

656
00:27:56,950 --> 00:27:55,679
it is

657
00:27:59,190 --> 00:27:56,960
through that it'll jettison the heat

658
00:28:00,950 --> 00:27:59,200
shield that protected us during entry

659
00:28:03,110 --> 00:28:00,960
and it'll use a radar and a new system

660
00:28:05,909 --> 00:28:03,120
we call terrain relative navigation

661
00:28:07,350 --> 00:28:05,919
to help figure out where it is

662
00:28:09,430 --> 00:28:07,360
but the parachute alone isn't enough to

663
00:28:11,190 --> 00:28:09,440

slow down perseverance for landing in

664

00:28:13,269 --> 00:28:11,200

fact the spacecraft is still going more

665

00:28:15,750 --> 00:28:13,279

than 150 miles per hour when the

666

00:28:17,430 --> 00:28:15,760

parachute is done slowing it down that's

667

00:28:19,029 --> 00:28:17,440

about as fast as a skydiver would be

668

00:28:20,389 --> 00:28:19,039

going if he jumped out of a plane here

669

00:28:23,269 --> 00:28:20,399

on earth and headed straight to the

670

00:28:24,789 --> 00:28:23,279

ground head down without a parachute

671

00:28:27,110 --> 00:28:24,799

so at an altitude of a little over a

672

00:28:29,350 --> 00:28:27,120

mile or so perseverance will fire up its

673

00:28:31,190 --> 00:28:29,360

engines fly to a safe spot identified by

674

00:28:32,870 --> 00:28:31,200

that terrain relative navigation system

675

00:28:34,789 --> 00:28:32,880

and slow down to about a mile and a half

676

00:28:36,870 --> 00:28:34,799

per hour right above it and then it's

677

00:28:38,549 --> 00:28:36,880

ready for sky crane

678

00:28:40,630 --> 00:28:38,559

perseverance will lower itself much like

679

00:28:42,549 --> 00:28:40,640

curiosity did from that rocket powered

680

00:28:43,990 --> 00:28:42,559

jetpack descent stage and maneuver in

681

00:28:46,070 --> 00:28:44,000

for a gentle touchdown right on its

682

00:28:47,830 --> 00:28:46,080

wheels at a speed at a speed slower than

683

00:28:49,909 --> 00:28:47,840

i walk

684

00:28:51,830 --> 00:28:49,919

and because of how long it takes for

685

00:28:53,990 --> 00:28:51,840

radio signals to get back from mars all

686

00:28:55,830 --> 00:28:54,000

the way to earth perseverance has to do

687

00:28:58,710 --> 00:28:55,840

this all on our own we can't help it

688

00:29:00,549 --> 00:28:58,720

during this period

689

00:29:01,990 --> 00:29:00,559

so as you'll hear from ken and briney

690

00:29:04,149 --> 00:29:02,000

jezreel crater is a great place a

691

00:29:06,230 --> 00:29:04,159

magnificent place for science but when i

692

00:29:09,350 --> 00:29:06,240

look at it from a landing perspective

693

00:29:10,710 --> 00:29:09,360

i see danger it's a formidable challenge

694

00:29:12,310 --> 00:29:10,720

the site is replete with steep

695

00:29:13,830 --> 00:29:12,320

cliffsides that happen to run right

696

00:29:15,909 --> 00:29:13,840

through the middle of the landing site

697

00:29:18,230 --> 00:29:15,919

there's sand there's boulders there's

698

00:29:20,230 --> 00:29:18,240

impact craters all these would be a bad

699

00:29:22,470 --> 00:29:20,240

day if we touch down on them

700

00:29:24,950 --> 00:29:22,480

so two two new technologies that we've

701
00:29:26,710 --> 00:29:24,960
added for perseverance since curiosity

702
00:29:27,750 --> 00:29:26,720
make it possible for us to go to jezreel

703
00:29:29,110 --> 00:29:27,760
safely

704
00:29:30,310 --> 00:29:29,120
the first is something we call a range

705
00:29:33,269 --> 00:29:30,320
trigger

706
00:29:35,590 --> 00:29:33,279
perseverance the ability to decide for

707
00:29:37,350 --> 00:29:35,600
herself when to deploy the parachute

708
00:29:39,029 --> 00:29:37,360
based on where she is

709
00:29:41,029 --> 00:29:39,039
that helps to shrink the landing error

710
00:29:42,710 --> 00:29:41,039
ellipse or the all the areas that we can

711
00:29:45,750 --> 00:29:42,720
come down in as you can kind of see in

712
00:29:48,549 --> 00:29:47,029
when coupled with the guided entry

713
00:29:50,470 --> 00:29:48,559

system we had on curiosity giving

714

00:29:52,389 --> 00:29:50,480

perseverance the ability to choose where

715

00:29:54,789 --> 00:29:52,399

to deploy that parachute really shrinks

716

00:29:56,549 --> 00:29:54,799

the area that we might come down in and

717

00:29:59,190 --> 00:29:56,559

lets us land in a tight space like

718

00:30:00,710 --> 00:29:59,200

jezreel crater

719

00:30:02,870 --> 00:30:00,720

the second major technology we've added

720

00:30:05,190 --> 00:30:02,880

is terrain relative navigation

721

00:30:08,070 --> 00:30:05,200

with trn which reynolds navigation we've

722

00:30:09,750 --> 00:30:08,080

given perseverance eyes and a map i'm

723

00:30:11,510 --> 00:30:09,760

not sure most people do this anymore but

724

00:30:13,669 --> 00:30:11,520

at least you used to be able to drive

725

00:30:16,149 --> 00:30:13,679

around in your car and look at a map and

726

00:30:17,830 --> 00:30:16,159

look out the window and see what you saw

727

00:30:19,590 --> 00:30:17,840

out from the window and match it up to

728

00:30:21,190 --> 00:30:19,600

what you have on your map and figure out

729

00:30:22,149 --> 00:30:21,200

where you are based on that

730

00:30:23,590 --> 00:30:22,159

that's kind of what we're asking

731

00:30:25,110 --> 00:30:23,600

perseverance to do too with trained

732

00:30:26,389 --> 00:30:25,120

relative navigation

733

00:30:28,710 --> 00:30:26,399

she's got an extra brain in there to

734

00:30:30,230 --> 00:30:28,720

help figure out where she's going and an

735

00:30:32,149 --> 00:30:30,240

extra camera in there to give her eyes

736

00:30:34,149 --> 00:30:32,159

to see what's out there and match it up

737

00:30:35,510 --> 00:30:34,159

with that onboard map

738

00:30:37,909 --> 00:30:35,520

once she's figured out where she is she

739

00:30:39,430 --> 00:30:37,919

can fly to a safe spot nearby

740

00:30:41,669 --> 00:30:39,440

we've actually tested out this system

741

00:30:43,190 --> 00:30:41,679

out here in california out over places

742

00:30:45,269 --> 00:30:43,200

like death valley as this next clipper

743

00:30:46,870 --> 00:30:45,279

show

744

00:30:48,310 --> 00:30:46,880

here in this clip you can see us uh put

745

00:30:50,070 --> 00:30:48,320

that mount that train with the

746

00:30:51,909 --> 00:30:50,080

navigation system on the front of a

747

00:30:53,750 --> 00:30:51,919

helicopter so we could fly it over all

748

00:30:55,269 --> 00:30:53,760

sorts of different kinds of terrain that

749

00:30:56,630 --> 00:30:55,279

it might see terrain that like that's

750

00:30:58,470 --> 00:30:56,640

similar to mars

751

00:30:59,990 --> 00:30:58,480

so here we are in death valley

752

00:31:01,909 --> 00:31:00,000

out there it's on the on this gimbal in

753

00:31:04,149 --> 00:31:01,919

front of the helicopter trying to mimic

754

00:31:08,389 --> 00:31:04,159

the kinds of rates and altitudes that

755

00:31:12,070 --> 00:31:10,389

here you'll see the the system actually

756

00:31:14,470 --> 00:31:12,080

comparing what it sees from the camera

757

00:31:16,070 --> 00:31:14,480

that's looking down with an onboard map

758

00:31:18,310 --> 00:31:16,080

that's derived from satellite imagery

759

00:31:20,950 --> 00:31:18,320

much like we hope to do on mars it

760

00:31:23,110 --> 00:31:20,960

matches up landmarks that it sees uh

761

00:31:24,950 --> 00:31:23,120

with its camera with its eye with those

762

00:31:28,310 --> 00:31:24,960

uh onboard maps and what it sees from

763

00:31:29,669 --> 00:31:28,320

those maps to figure out where she is

764

00:31:31,830 --> 00:31:29,679

that helps us get down get our

765

00:31:33,909 --> 00:31:31,840

uncertainty in where we're at down to a

766

00:31:35,509 --> 00:31:33,919

couple of tens of meters

767

00:31:37,590 --> 00:31:35,519

when we have that information we can use

768

00:31:39,029 --> 00:31:37,600

that to help us fly to a safe spot

769

00:31:40,630 --> 00:31:39,039

nearby once we are done with the

770

00:31:41,830 --> 00:31:40,640

parachute that are flying on those

771

00:31:43,590 --> 00:31:41,840

engines

772

00:31:44,950 --> 00:31:43,600

that way we can always make sure that we

773

00:31:46,950 --> 00:31:44,960

land in a safe spot for the rover to

774

00:31:48,149 --> 00:31:46,960

touch down

775

00:31:49,909 --> 00:31:48,159

if it wasn't for rain trigger or train

776
00:31:53,190 --> 00:31:49,919
wealth and navigation we just could not

777
00:31:54,630 --> 00:31:53,200
go to jezreel as matt mentioned earlier

778
00:31:55,990 --> 00:31:54,640
finally we have one more system that i'm

779
00:31:57,909 --> 00:31:56,000
really excited about to try to give

780
00:31:59,190 --> 00:31:57,919
people a sense of what it's like to land

781
00:32:00,549 --> 00:31:59,200
on mars

782
00:32:02,070 --> 00:32:00,559
we have the system that's called the el

783
00:32:03,190 --> 00:32:02,080
camera system which includes a slew of

784
00:32:05,590 --> 00:32:03,200
cameras as you'll see in the next

785
00:32:06,950 --> 00:32:05,600
picture and a microphone

786
00:32:08,230 --> 00:32:06,960
we've got cameras that are looking up at

787
00:32:10,389 --> 00:32:08,240
the parachute so we'll see that

788
00:32:11,590 --> 00:32:10,399

supersonic parachute inflate

789

00:32:13,990 --> 00:32:11,600

this will be really the first time we've

790

00:32:16,070 --> 00:32:14,000

ever seen that occur on another planet

791

00:32:17,269 --> 00:32:16,080

we've got a rover download camera

792

00:32:19,110 --> 00:32:17,279

that'll allow us to see the ground

793

00:32:20,310 --> 00:32:19,120

rushing up at us as we go hurtling

794

00:32:21,830 --> 00:32:20,320

toward the ground

795

00:32:24,389 --> 00:32:21,840

and then we also have cameras on the

796

00:32:26,149 --> 00:32:24,399

descent stage that rocket power jet pack

797

00:32:27,990 --> 00:32:26,159

looking down at the rover and then at

798

00:32:29,669 --> 00:32:28,000

the rover looking back up at the descent

799

00:32:31,750 --> 00:32:29,679

stage so we'll be able to really see

800

00:32:33,830 --> 00:32:31,760

what sky crane is like uh during that

801
00:32:35,750 --> 00:32:33,840
period and see that rover descend from

802
00:32:37,509 --> 00:32:35,760
the descent stage and be craned right

803
00:32:38,870 --> 00:32:37,519
down to the surface

804
00:32:40,149 --> 00:32:38,880
additionally with that microphone system

805
00:32:42,230 --> 00:32:40,159
we'll be able to hear what it's like

806
00:32:43,990 --> 00:32:42,240
this and what it sounds like when we're

807
00:32:46,870 --> 00:32:44,000
coming through those seven minutes of

808
00:32:48,870 --> 00:32:46,880
entry to set and landing

809
00:32:50,070 --> 00:32:48,880
so the entry cent landing team is really

810
00:32:51,830 --> 00:32:50,080
excited for the challenge that we have

811
00:32:52,870 --> 00:32:51,840
in a few weeks and we're really looking

812
00:32:54,389 --> 00:32:52,880
forward to bringing everyone for the

813
00:32:56,310 --> 00:32:54,399

ride

814

00:32:57,830 --> 00:32:56,320

but while uh that'll be the end of uh

815

00:33:00,149 --> 00:32:57,840

our journey with perseverance the entry

816

00:33:01,590 --> 00:33:00,159

december manning's team's uh journey

817

00:33:03,350 --> 00:33:01,600

that's really just the beginning of the

818

00:33:05,750 --> 00:33:03,360

adventure on the surface and

819

00:33:07,190 --> 00:33:05,760

perseverance's adventure and its mission

820

00:33:11,029 --> 00:33:07,200

so to talk about some more

821

00:33:12,389 --> 00:33:11,039

i'll i'll hand that over to ken here

822

00:33:14,389 --> 00:33:12,399

thanks al

823

00:33:16,630 --> 00:33:14,399

three and a half billion years ago

824

00:33:18,549 --> 00:33:16,640

mars was very similar to earth in

825

00:33:21,269 --> 00:33:18,559

several important ways

826

00:33:23,990 --> 00:33:21,279

it had a substantial atmosphere it had

827

00:33:26,230 --> 00:33:24,000

lakes and rivers on its surface and it

828

00:33:27,990 --> 00:33:26,240

had habitable environments places where

829

00:33:28,870 --> 00:33:28,000

organisms that we know about on earth

830

00:33:30,789 --> 00:33:28,880

today

831

00:33:32,310 --> 00:33:30,799

could have thrived

832

00:33:34,870 --> 00:33:32,320

these are the only habitable

833

00:33:36,630 --> 00:33:34,880

environments that are known beyond the

834

00:33:38,710 --> 00:33:36,640

earth

835

00:33:41,269 --> 00:33:38,720

central focus of the mars 2020 mission

836

00:33:43,430 --> 00:33:41,279

is to explore one such environment and

837

00:33:45,509 --> 00:33:43,440

to see if it hosted

838

00:33:47,190 --> 00:33:45,519

martian life

839

00:33:48,549 --> 00:33:47,200

we're going to jezreel crater i much

840

00:33:49,909 --> 00:33:48,559

appreciate the efforts of the

841

00:33:51,669 --> 00:33:49,919

engineering team to get us to a

842

00:33:55,350 --> 00:33:51,679

dangerous landing site it is a

843

00:33:56,389 --> 00:33:55,360

spectacular landing site it once held a

844

00:33:57,509 --> 00:33:56,399

lake

845

00:33:58,549 --> 00:33:57,519

and what we're going to do as soon as we

846

00:34:00,149 --> 00:33:58,559

get there

847

00:34:03,029 --> 00:34:00,159

is to explore the rocks that were

848

00:34:04,470 --> 00:34:03,039

deposited in that lake for biosignatures

849

00:34:06,549 --> 00:34:04,480

for evidence

850

00:34:09,030 --> 00:34:06,559

of ancient life

851
00:34:10,950 --> 00:34:09,040
the best and most promising samples will

852
00:34:13,510 --> 00:34:10,960
be collected into

853
00:34:15,750 --> 00:34:13,520
sample tubes that look like this

854
00:34:18,069 --> 00:34:15,760
and i'm i'm really happy i can show this

855
00:34:20,470 --> 00:34:18,079
this is a truly elegant piece of

856
00:34:22,790 --> 00:34:20,480
hardware and it's also beautiful

857
00:34:25,430 --> 00:34:22,800
we will collect the samples directly

858
00:34:27,430 --> 00:34:25,440
into tubes like this

859
00:34:29,750 --> 00:34:27,440
and they can be brought back to earth

860
00:34:31,750 --> 00:34:29,760
by a future mission which will allow

861
00:34:32,470 --> 00:34:31,760
scientists to analyze the samples in

862
00:34:35,270 --> 00:34:32,480
them

863
00:34:38,149 --> 00:34:35,280

using the full arsenal of capabilities

864

00:34:41,349 --> 00:34:38,159

that exist in terrestrial laboratories

865

00:34:43,990 --> 00:34:41,359

march 2020 is the first mission

866

00:34:45,430 --> 00:34:44,000

which explicitly is seeking the signs of

867

00:34:48,470 --> 00:34:45,440

ancient life

868

00:34:52,069 --> 00:34:48,480

and the first mission in which

869

00:34:54,710 --> 00:34:52,079

samples will be located and packaged for

870

00:34:57,270 --> 00:34:54,720

return to earth from another planet

871

00:34:59,670 --> 00:34:57,280

it's also the first mission in which a

872

00:35:01,910 --> 00:34:59,680

significant part of the science team

873

00:35:04,150 --> 00:35:01,920

was selected specifically to represent

874

00:35:06,390 --> 00:35:04,160

the interests of the future

875

00:35:09,190 --> 00:35:06,400

and that's because the samples will

876

00:35:11,829 --> 00:35:09,200

return to earth sometime in the 2030s

877

00:35:14,390 --> 00:35:11,839

and as laurie said they will be analyzed

878

00:35:15,510 --> 00:35:14,400

for decades after that

879

00:35:16,950 --> 00:35:15,520

and what that means is that the

880

00:35:18,950 --> 00:35:16,960

scientists that are presently on the

881

00:35:20,870 --> 00:35:18,960

mars 2020 science team

882

00:35:22,630 --> 00:35:20,880

are unlikely to be the ones that analyze

883

00:35:24,550 --> 00:35:22,640

the samples the scientists who will

884

00:35:26,550 --> 00:35:24,560

analyze these samples

885

00:35:28,310 --> 00:35:26,560

are in school today they might not even

886

00:35:30,150 --> 00:35:28,320

be born yet

887

00:35:32,310 --> 00:35:30,160

and so it's important to understand that

888

00:35:33,990 --> 00:35:32,320

mars 2020 is going to be doing its

889

00:35:34,790 --> 00:35:34,000

mission over the course of the next few

890

00:35:37,030 --> 00:35:34,800

years

891

00:35:39,750 --> 00:35:37,040

but it is also a serious investment in

892

00:35:42,310 --> 00:35:39,760

the future of our science

893

00:35:43,670 --> 00:35:42,320

i had the first graphic um

894

00:35:44,390 --> 00:35:43,680

mars today

895

00:35:49,589 --> 00:35:44,400

is

896

00:35:51,270 --> 00:35:49,599

completely inhospitable on its surface

897

00:35:54,069 --> 00:35:51,280

to life as we know it

898

00:35:56,390 --> 00:35:54,079

the lake that once existed in jezreel is

899

00:35:57,430 --> 00:35:56,400

long gone and here's what it looks like

900

00:36:00,150 --> 00:35:57,440

now

901
00:36:02,069 --> 00:36:00,160
i i love this image because it is so

902
00:36:04,710 --> 00:36:02,079
easy to see what's going on if you look

903
00:36:07,349 --> 00:36:04,720
closely what you see in this image

904
00:36:09,270 --> 00:36:07,359
in the background the hills that's the

905
00:36:11,430 --> 00:36:09,280
rim of jezreel crater

906
00:36:13,910 --> 00:36:11,440
and i hope you can see the canyon that

907
00:36:16,310 --> 00:36:13,920
is cut through that rim

908
00:36:19,349 --> 00:36:16,320
that canyon was cut by a river that

909
00:36:21,910 --> 00:36:19,359
flowed onto the floor of jezreel crater

910
00:36:24,550 --> 00:36:21,920
and deposited that large delta when it

911
00:36:27,349 --> 00:36:24,560
hit the slack water of a lake that delta

912
00:36:28,870 --> 00:36:27,359
tells us absolutely clearly there was a

913
00:36:31,109 --> 00:36:28,880

lake here

914

00:36:33,109 --> 00:36:31,119

this was a very large lake

915

00:36:35,510 --> 00:36:33,119

it was about 30 miles across which is

916

00:36:37,670 --> 00:36:35,520

about the size of lake tahoe

917

00:36:39,430 --> 00:36:37,680

and it was hundreds of feet deep and i

918

00:36:41,349 --> 00:36:39,440

should point out for scale in this image

919

00:36:42,870 --> 00:36:41,359

the crater in the about in the middle of

920

00:36:44,710 --> 00:36:42,880

the image

921

00:36:49,190 --> 00:36:44,720

that is about one kilometer across it's

922

00:36:52,069 --> 00:36:50,710

so we will land

923

00:36:53,589 --> 00:36:52,079

and

924

00:36:56,470 --> 00:36:53,599

we will have to check out the rover

925

00:36:59,990 --> 00:36:56,480

it'll take some time to establish that

926

00:37:01,670 --> 00:37:00,000

the rover has arrived uh after its long

927

00:37:03,190 --> 00:37:01,680

and dangerous journey with everything

928

00:37:04,630 --> 00:37:03,200

functioning properly

929

00:37:06,470 --> 00:37:04,640

so the first thing we have to do is we

930

00:37:07,670 --> 00:37:06,480

have to check out the rover make sure

931

00:37:09,349 --> 00:37:07,680

everything works

932

00:37:11,430 --> 00:37:09,359

check out the science instruments

933

00:37:14,230 --> 00:37:11,440

calibrate the science instruments

934

00:37:16,230 --> 00:37:14,240

and fly the ingenuity helicopter all

935

00:37:18,150 --> 00:37:16,240

that's going to take several months

936

00:37:20,069 --> 00:37:18,160

during which science is not the primary

937

00:37:22,470 --> 00:37:20,079

focus of the mission

938

00:37:24,550 --> 00:37:22,480

as soon as we're done with that phase

939

00:37:27,589 --> 00:37:24,560

we are ready to go

940

00:37:29,829 --> 00:37:27,599

and what we will do then is explore the

941

00:37:31,510 --> 00:37:29,839

geology which means we will look at the

942

00:37:33,910 --> 00:37:31,520

rocks

943

00:37:36,150 --> 00:37:33,920

that were deposited uh in this lake and

944

00:37:38,310 --> 00:37:36,160

its surroundings to understand what they

945

00:37:41,030 --> 00:37:38,320

tell us about the history of the planet

946

00:37:43,030 --> 00:37:41,040

and especially about the history of this

947

00:37:45,109 --> 00:37:43,040

habitable environment

948

00:37:47,109 --> 00:37:45,119

and then we will use the very powerful

949

00:37:49,270 --> 00:37:47,119

instruments on the rover to look for

950

00:37:51,270 --> 00:37:49,280

biosignatures to look for these leavings

951
00:37:53,349 --> 00:37:51,280
of ancient life

952
00:37:55,190 --> 00:37:53,359
and we will collect about 40 samples

953
00:37:57,349 --> 00:37:55,200
into the into the tubes that i just

954
00:37:59,510 --> 00:37:57,359
showed and ultimately these will be

955
00:38:01,670 --> 00:37:59,520
transferred to the follow-on mission

956
00:38:04,150 --> 00:38:01,680
that can bring them back

957
00:38:05,750 --> 00:38:04,160
the team has been studying this site for

958
00:38:07,270 --> 00:38:05,760
quite a few years now

959
00:38:10,069 --> 00:38:07,280
and what we've come up with as a

960
00:38:10,870 --> 00:38:10,079
possible traverse is shown in this image

961
00:38:12,150 --> 00:38:10,880
here

962
00:38:13,990 --> 00:38:12,160
and as i said we don't know exactly

963
00:38:16,950 --> 00:38:14,000

where we're going to land but it is

964

00:38:19,190 --> 00:38:16,960

likely that we will relatively quickly

965

00:38:20,390 --> 00:38:19,200

move on to the green line that you see

966

00:38:21,910 --> 00:38:20,400

here

967

00:38:25,349 --> 00:38:21,920

this is a a

968

00:38:26,870 --> 00:38:25,359

pathway that connects together

969

00:38:30,470 --> 00:38:26,880

all of the different habitable

970

00:38:32,310 --> 00:38:30,480

environments that we uh think exist

971

00:38:33,670 --> 00:38:32,320

existed within this lake and in its

972

00:38:35,430 --> 00:38:33,680

surroundings

973

00:38:37,430 --> 00:38:35,440

uh you can see that we will drive up

974

00:38:38,630 --> 00:38:37,440

onto the delta and explore the features

975

00:38:40,710 --> 00:38:38,640

in the delta

976
00:38:42,150 --> 00:38:40,720
and then move up to possible shoreline

977
00:38:44,710 --> 00:38:42,160
environments and you'll hear more about

978
00:38:47,109 --> 00:38:44,720
those from bryony in just a minute

979
00:38:49,030 --> 00:38:47,119
and then we will climb up the crater rim

980
00:38:51,750 --> 00:38:49,040
and uh just for reference that crater

981
00:38:53,030 --> 00:38:51,760
rim is several thousand feet high so

982
00:38:55,750 --> 00:38:53,040
it's important for me to point out this

983
00:38:58,390 --> 00:38:55,760
is a very ambitious undertaking

984
00:39:01,190 --> 00:38:58,400
i sometimes call it an epic journey

985
00:39:03,109 --> 00:39:01,200
it is about 15 miles long so this is a

986
00:39:04,630 --> 00:39:03,119
long traverse it'll take many years for

987
00:39:07,030 --> 00:39:04,640
us to do this

988
00:39:09,349 --> 00:39:07,040

and the reason we do this though is that

989

00:39:11,670 --> 00:39:09,359

this will allow us to come up with the

990

00:39:13,190 --> 00:39:11,680

best possible set of samples to be

991

00:39:15,510 --> 00:39:13,200

brought back to earth to answer the

992

00:39:19,829 --> 00:39:15,520

major questions that we have about mars

993

00:39:24,230 --> 00:39:23,270

what would a martian biosignature look

994

00:39:29,190 --> 00:39:24,240

like

995

00:39:32,230 --> 00:39:29,200

this is a stromatolite it is a

996

00:39:33,750 --> 00:39:32,240

biosignature of microbial life

997

00:39:36,230 --> 00:39:33,760

uh and

998

00:39:39,270 --> 00:39:36,240

such biosignatures are the oldest

999

00:39:40,710 --> 00:39:39,280

undisputed evidence of life on earth

1000

00:39:42,069 --> 00:39:40,720

rocks that are three and a half billion

1001
00:39:44,790 --> 00:39:42,079
years old that occur in western

1002
00:39:47,670 --> 00:39:44,800
australia and several other places

1003
00:39:49,910 --> 00:39:47,680
tell us that life was abundant on earth

1004
00:39:51,910 --> 00:39:49,920
three and a half billion years ago

1005
00:39:54,950 --> 00:39:51,920
and they tell us that life at that time

1006
00:39:57,030 --> 00:39:54,960
was only microbial there was no complex

1007
00:39:59,030 --> 00:39:57,040
life at that time

1008
00:40:01,670 --> 00:39:59,040
and that's important because if we use

1009
00:40:02,790 --> 00:40:01,680
earth as an analogy to what to look for

1010
00:40:05,430 --> 00:40:02,800
on mars

1011
00:40:07,750 --> 00:40:05,440
we should not be looking for things like

1012
00:40:08,710 --> 00:40:07,760
fossil teeth or fossil bones or fossil

1013
00:40:10,710 --> 00:40:08,720

leaves

1014

00:40:13,109 --> 00:40:10,720

because life took too long to develop

1015

00:40:15,349 --> 00:40:13,119

those kind of capabilities to be present

1016

00:40:17,589 --> 00:40:15,359

in the rocks at jezreel crater

1017

00:40:19,750 --> 00:40:17,599

so we will look for stromatolites and i

1018

00:40:21,270 --> 00:40:19,760

particularly like stromatolites because

1019

00:40:23,430 --> 00:40:21,280

they can be large enough that you know

1020

00:40:25,109 --> 00:40:23,440

you can see with your eyes we can see

1021

00:40:26,550 --> 00:40:25,119

with the cameras on the rover that will

1022

00:40:28,630 --> 00:40:26,560

allow us to

1023

00:40:30,950 --> 00:40:28,640

to locate them in this in this very

1024

00:40:33,270 --> 00:40:30,960

large study environment

1025

00:40:35,910 --> 00:40:33,280

we also have capabilities on the rover

1026
00:40:37,510 --> 00:40:35,920
to study the rocks microscopically in a

1027
00:40:40,230 --> 00:40:37,520
very small patch

1028
00:40:41,750 --> 00:40:40,240
to look for structures at a much smaller

1029
00:40:44,390 --> 00:40:41,760
scale that could have been produced

1030
00:40:46,309 --> 00:40:44,400
microbial by microbial life

1031
00:40:48,309 --> 00:40:46,319
and we have the ability to detect and

1032
00:40:49,750 --> 00:40:48,319
map organic matter

1033
00:40:52,550 --> 00:40:49,760
and of course organic matter is

1034
00:40:55,670 --> 00:40:52,560
important because all life as we know it

1035
00:40:57,349 --> 00:40:55,680
is made out of organic matter

1036
00:40:59,030 --> 00:40:57,359
so those are the kinds of ways that we

1037
00:41:00,630 --> 00:40:59,040
will try to identify ancient

1038
00:41:02,069 --> 00:41:00,640

biosignatures

1039

00:41:05,190 --> 00:41:02,079

on mars

1040

00:41:07,190 --> 00:41:05,200

people often ask

1041

00:41:09,190 --> 00:41:07,200

what is

1042

00:41:10,870 --> 00:41:09,200

the likelihood that we will find

1043

00:41:12,390 --> 00:41:10,880

evidence of ancient life what is the

1044

00:41:13,510 --> 00:41:12,400

likelihood of life existed on mars and

1045

00:41:14,550 --> 00:41:13,520

of course we don't know the answer to

1046

00:41:19,589 --> 00:41:14,560

that

1047

00:41:21,670 --> 00:41:19,599

billion years old

1048

00:41:22,790 --> 00:41:21,680

on earth that have

1049

00:41:24,230 --> 00:41:22,800

biosignatures in them that have

1050

00:41:26,390 --> 00:41:24,240

stromatolites in them

1051
00:41:27,190 --> 00:41:26,400
were deposited by microbes in the bottom

1052
00:41:29,990 --> 00:41:27,200
of

1053
00:41:32,950 --> 00:41:30,000
shallow lakes and seas

1054
00:41:34,390 --> 00:41:32,960
perseverance rover is about to land

1055
00:41:36,390 --> 00:41:34,400
in a former lake

1056
00:41:39,910 --> 00:41:36,400
three and a half billion years old this

1057
00:41:42,470 --> 00:41:39,920
is a tantalizing similarity

1058
00:41:45,190 --> 00:41:42,480
it would of course be a fabulous

1059
00:41:47,750 --> 00:41:45,200
scientific discovery to find that life

1060
00:41:50,069 --> 00:41:47,760
exists existed beyond earth

1061
00:41:53,109 --> 00:41:50,079
it would also be a very important

1062
00:41:54,550 --> 00:41:53,119
discovery for humanity in general we all

1063
00:41:55,750 --> 00:41:54,560

know that this is one of those questions

1064

00:41:58,150 --> 00:41:55,760

that people have

1065

00:42:00,150 --> 00:41:58,160

pondered for a long time

1066

00:42:03,030 --> 00:42:00,160

it's also important to understand that

1067

00:42:04,790 --> 00:42:03,040

even if we don't find evidence of life

1068

00:42:06,950 --> 00:42:04,800

that's important too

1069

00:42:08,390 --> 00:42:06,960

it's important because it seems that all

1070

00:42:10,069 --> 00:42:08,400

habitable environments that have been

1071

00:42:11,910 --> 00:42:10,079

studied in detail

1072

00:42:14,950 --> 00:42:11,920

are inhabited

1073

00:42:16,630 --> 00:42:14,960

if we do a deep exploration of jezreel

1074

00:42:18,550 --> 00:42:16,640

crater with the rover and its

1075

00:42:19,990 --> 00:42:18,560

instruments and with the samples when

1076

00:42:22,550 --> 00:42:20,000

they come back to earth

1077

00:42:24,150 --> 00:42:22,560

and we find no evidence of life

1078

00:42:25,109 --> 00:42:24,160

we will have shown that at least one

1079

00:42:27,109 --> 00:42:25,119

place

1080

00:42:30,069 --> 00:42:27,119

there is a habitable environment

1081

00:42:31,750 --> 00:42:30,079

that is not inhabited that would be a

1082

00:42:33,990 --> 00:42:31,760

unique and important scientific

1083

00:42:36,069 --> 00:42:34,000

discovery if that's what we find it

1084

00:42:39,030 --> 00:42:36,079

would tell us something important that

1085

00:42:41,030 --> 00:42:39,040

habitability alone is not sufficient

1086

00:42:43,349 --> 00:42:41,040

that something else has to be present

1087

00:42:45,349 --> 00:42:43,359

some perhaps magic spark that causes

1088

00:42:46,870 --> 00:42:45,359

life to occur

1089

00:42:47,910 --> 00:42:46,880

and we'll need to think about that as we

1090

00:42:50,309 --> 00:42:47,920

consider

1091

00:42:53,510 --> 00:42:50,319

other potentially habitable environments

1092

00:42:55,349 --> 00:42:53,520

in our solar system and also in the

1093

00:42:59,270 --> 00:42:55,359

very large number of extrasolar planets

1094

00:43:00,790 --> 00:42:59,280

that likely exist in the habitable zone

1095

00:43:02,630 --> 00:43:00,800

so now i'd like to turn it over to

1096

00:43:04,470 --> 00:43:02,640

briony horgan who is a member of our

1097

00:43:08,870 --> 00:43:04,480

science team she's going to tell us more

1098

00:43:12,630 --> 00:43:11,109

great thanks ken yeah so this first

1099

00:43:14,150 --> 00:43:12,640

image you're seeing on the screen this

1100

00:43:15,829 --> 00:43:14,160

is an image that you would see of

1101
00:43:17,349 --> 00:43:15,839
jezreel if you were flying over an

1102
00:43:19,109 --> 00:43:17,359
airplane or landing on it in a

1103
00:43:21,030 --> 00:43:19,119
spacecraft this is the kind of view that

1104
00:43:23,030 --> 00:43:21,040
perseverance will see with its cameras

1105
00:43:24,470 --> 00:43:23,040
during descent and i think it's a really

1106
00:43:26,470 --> 00:43:24,480
nice illustration of what ken was

1107
00:43:28,870 --> 00:43:26,480
talking about that mars today is this

1108
00:43:31,589 --> 00:43:28,880
cold dry and inhospitable place but that

1109
00:43:32,950 --> 00:43:31,599
there's really clear evidence on the

1110
00:43:35,349 --> 00:43:32,960
surface that i did and that's the the

1111
00:43:36,870 --> 00:43:35,359
delta in jezreel so you can very clearly

1112
00:43:38,470 --> 00:43:36,880
see the river cutting through the crater

1113
00:43:39,670 --> 00:43:38,480

rim and depositing this delta on the

1114

00:43:41,430 --> 00:43:39,680

crater floor

1115

00:43:42,870 --> 00:43:41,440

and you know one of the things i love

1116

00:43:44,950 --> 00:43:42,880

about being a geologist at least

1117

00:43:47,109 --> 00:43:44,960

pre-coveted was the ability to get in a

1118

00:43:49,829 --> 00:43:47,119

plane and fly over the united states and

1119

00:43:51,430 --> 00:43:49,839

look down and imagine what surface looks

1120

00:43:53,430 --> 00:43:51,440

like millions of years ago based on what

1121

00:43:54,470 --> 00:43:53,440

i could see and in this image i mean you

1122

00:43:56,069 --> 00:43:54,480

can do that right you can start to

1123

00:43:58,230 --> 00:43:56,079

imagine what jezreel used to look like

1124

00:44:00,630 --> 00:43:58,240

but billions of years ago three to four

1125

00:44:01,910 --> 00:44:00,640

billion years ago and the reason we do

1126

00:44:03,589 --> 00:44:01,920

that and the reason we're hoping to do

1127

00:44:05,510 --> 00:44:03,599

that even better on the ground with

1128

00:44:07,670 --> 00:44:05,520

perseverance is because the geology and

1129

00:44:09,030 --> 00:44:07,680

jezreel crater is so exceptionally well

1130

00:44:10,950 --> 00:44:09,040

preserved

1131

00:44:13,190 --> 00:44:10,960

you know it's very clear that the delta

1132

00:44:14,470 --> 00:44:13,200

was formed time so long ago when mars

1133

00:44:17,030 --> 00:44:14,480

was warmer and wetter and more

1134

00:44:19,190 --> 00:44:17,040

hospitable to life and in fact the delta

1135

00:44:20,870 --> 00:44:19,200

itself is one of our first targets in

1136

00:44:22,950 --> 00:44:20,880

our search of life

1137

00:44:24,950 --> 00:44:22,960

and that's because as delta's deltas

1138

00:44:26,870 --> 00:44:24,960

form and rivers uh travel across the

1139

00:44:29,030 --> 00:44:26,880

surrounding landscape you build this you

1140

00:44:30,790 --> 00:44:29,040

know green and the rivers transporting

1141

00:44:33,030 --> 00:44:30,800

any kind of organic or biological

1142

00:44:34,950 --> 00:44:33,040

material into the lake and those organic

1143

00:44:36,870 --> 00:44:34,960

materials concentrated in the bottom of

1144

00:44:39,030 --> 00:44:36,880

the lake in the muds and we think based

1145

00:44:41,349 --> 00:44:39,040

on looking at orbital data of the delta

1146

00:44:43,589 --> 00:44:41,359

that those muds that could contain signs

1147

00:44:45,270 --> 00:44:43,599

of organic materials and life are

1148

00:44:46,870 --> 00:44:45,280

actually preserved at the base of the

1149

00:44:48,870 --> 00:44:46,880

delta at the cliffs in the front of the

1150

00:44:50,470 --> 00:44:48,880

delta and jezebel crater

1151
00:44:51,750 --> 00:44:50,480
but there's more to jezera than just the

1152
00:44:53,589 --> 00:44:51,760
delta itself and you can see that in

1153
00:44:55,190 --> 00:44:53,599
this image it's shown now with all these

1154
00:44:56,470 --> 00:44:55,200
beautiful colors and so these colors are

1155
00:44:58,550 --> 00:44:56,480
not what you would see with your naked

1156
00:45:00,710 --> 00:44:58,560
eye looking at jezera in fact here we've

1157
00:45:02,630 --> 00:45:00,720
taken colors we've used colors here to

1158
00:45:04,550 --> 00:45:02,640
indicate what kind of minerals we see on

1159
00:45:06,950 --> 00:45:04,560
the surface using spectrometers and

1160
00:45:08,790 --> 00:45:06,960
orbit on our satellites at mars and here

1161
00:45:10,309 --> 00:45:08,800
you know it is telling us that jezreel

1162
00:45:11,829 --> 00:45:10,319
is a very different place has lots of

1163
00:45:13,190 --> 00:45:11,839

really

1164

00:45:14,950 --> 00:45:13,200

great geology different dip over the

1165

00:45:16,870 --> 00:45:14,960

place however what's really important

1166

00:45:18,790 --> 00:45:16,880

here are is the green and the green here

1167

00:45:20,630 --> 00:45:18,800

indicates carbonate minerals now

1168

00:45:22,150 --> 00:45:20,640

carbonate minerals are important on mars

1169

00:45:24,150 --> 00:45:22,160

or on earth because they're they form

1170

00:45:26,150 --> 00:45:24,160

when carbon dioxide in the atmosphere

1171

00:45:28,230 --> 00:45:26,160

interacts with water and rocks and

1172

00:45:29,589 --> 00:45:28,240

precipitates out these minerals on earth

1173

00:45:31,430 --> 00:45:29,599

we see them all over the place they're

1174

00:45:33,270 --> 00:45:31,440

one of the most common deposits you get

1175

00:45:34,790 --> 00:45:33,280

out of lakes and oceans and so we're

1176

00:45:36,309 --> 00:45:34,800

excited to find them on mars they tell

1177

00:45:38,550 --> 00:45:36,319

us that water was once present at the

1178

00:45:40,230 --> 00:45:38,560

surface but in gezero in particular

1179

00:45:41,430 --> 00:45:40,240

we're very excited about the carbonates

1180

00:45:43,430 --> 00:45:41,440

you can see there's kind of green

1181

00:45:45,430 --> 00:45:43,440

everywhere here but in particular

1182

00:45:47,589 --> 00:45:45,440

there's this kind of bathtub ring

1183

00:45:49,990 --> 00:45:47,599

looking zone of carbonates just between

1184

00:45:51,910 --> 00:45:50,000

the delta and the crater rim and we

1185

00:45:54,309 --> 00:45:51,920

think that might correspond to the

1186

00:45:56,710 --> 00:45:54,319

ancient shorelines of ancient lake

1187

00:45:58,230 --> 00:45:56,720

jezreel so places ancient beaches you

1188

00:46:00,150 --> 00:45:58,240

could have sat on along the shore of

1189

00:46:01,349 --> 00:46:00,160

lake jezreel and so that's really

1190

00:46:03,270 --> 00:46:01,359

interesting that the carbonates are in

1191

00:46:05,030 --> 00:46:03,280

that location because that could mean

1192

00:46:07,030 --> 00:46:05,040

that they formed along the ancient

1193

00:46:08,069 --> 00:46:07,040

beaches in the lake itself

1194

00:46:09,910 --> 00:46:08,079

and that's really great because

1195

00:46:11,670 --> 00:46:09,920

carbonates when they form in the lake

1196

00:46:13,270 --> 00:46:11,680

when they precipitate as a mineral out

1197

00:46:15,109 --> 00:46:13,280

of the water can actually trap

1198

00:46:16,630 --> 00:46:15,119

whatever's living in there and so this

1199

00:46:18,230 --> 00:46:16,640

next image you can see an image of you

1200

00:46:19,510 --> 00:46:18,240

know what we think ancient lake jezreel

1201
00:46:21,030 --> 00:46:19,520
might have looked like of course this is

1202
00:46:23,510 --> 00:46:21,040
back on earth this is a place called

1203
00:46:24,950 --> 00:46:23,520
lake salda in southwestern turkey and

1204
00:46:26,870 --> 00:46:24,960
here this is a lake that we think is

1205
00:46:28,790 --> 00:46:26,880
chemically very similar to what ancient

1206
00:46:30,309 --> 00:46:28,800
lake jezreel might have been like and

1207
00:46:31,109 --> 00:46:30,319
you can see it's this beautiful blue

1208
00:46:32,309 --> 00:46:31,119
lake

1209
00:46:33,829 --> 00:46:32,319
but what's really interesting are all

1210
00:46:35,270 --> 00:46:33,839
these weird looking boulders at the very

1211
00:46:36,870 --> 00:46:35,280
front of the image

1212
00:46:38,950 --> 00:46:36,880
these sort of novel looking boulders are

1213
00:46:40,670 --> 00:46:38,960

actually covered in microbial mats these

1214

00:46:42,470 --> 00:46:40,680

are actually modern uh stromatolite

1215

00:46:44,069 --> 00:46:42,480

stromatolite-like boulders that are

1216

00:46:45,990 --> 00:46:44,079

forming today due to interactions

1217

00:46:47,829 --> 00:46:46,000

between microbial mats your microbes

1218

00:46:48,950 --> 00:46:47,839

living in the lake and the minerals the

1219

00:46:51,910 --> 00:46:48,960

carbonate minerals that are

1220

00:46:53,430 --> 00:46:51,920

precipitating out of this lake

1221

00:46:56,150 --> 00:46:53,440

this is the kind of thing we hope to be

1222

00:46:57,510 --> 00:46:56,160

able to find in jezreel crater so in the

1223

00:46:59,109 --> 00:46:57,520

next image you'll see a view you know

1224

00:47:00,790 --> 00:46:59,119

just turning to the right looking away

1225

00:47:02,630 --> 00:47:00,800

from those uh those stromatolite-like

1226
00:47:04,069 --> 00:47:02,640
forms looking down the shoreline of lake

1227
00:47:06,069 --> 00:47:04,079
saldá you can see all these beautiful

1228
00:47:07,750 --> 00:47:06,079
white carbonate minerals and again this

1229
00:47:09,990 --> 00:47:07,760
is what we hope will find in that kind

1230
00:47:12,309 --> 00:47:10,000
of green ring you saw just uh by the

1231
00:47:14,309 --> 00:47:12,319
crate just by the rim of jezreel crater

1232
00:47:16,630 --> 00:47:14,319
we hope we'll find preserved ancient

1233
00:47:17,910 --> 00:47:16,640
beach deposits and in fact in this image

1234
00:47:20,790 --> 00:47:17,920
in the upper right you can see all these

1235
00:47:22,470 --> 00:47:20,800
big white cliffs those are lithified

1236
00:47:23,990 --> 00:47:22,480
beach deposits from when the lake level

1237
00:47:26,150 --> 00:47:24,000
was a little higher and we hope we'll

1238
00:47:27,589 --> 00:47:26,160

find those exact same things in jezreel

1239

00:47:29,510 --> 00:47:27,599

crater and that perseverance can

1240

00:47:31,510 --> 00:47:29,520

actually rove along these ancient beach

1241

00:47:36,309 --> 00:47:31,520

deposits looking for signs of ancient

1242

00:47:39,910 --> 00:47:38,309

okay so that's why we're so excited

1243

00:47:41,109 --> 00:47:39,920

about jezreel crater because it has so

1244

00:47:43,030 --> 00:47:41,119

many different ways that it could

1245

00:47:44,630 --> 00:47:43,040

preserve signs of life so what will we

1246

00:47:46,309 --> 00:47:44,640

actually see once we land well here's a

1247

00:47:47,829 --> 00:47:46,319

great video showing the kind of

1248

00:47:49,750 --> 00:47:47,839

perspective view we might get from the

1249

00:47:51,030 --> 00:47:49,760

rover this is say imagine if we landed

1250

00:47:52,630 --> 00:47:51,040

on the crater floor in front of the

1251

00:47:54,710 --> 00:47:52,640

delta and so the cliffs you can see in

1252

00:47:56,549 --> 00:47:54,720

this video are actually the front of the

1253

00:47:58,710 --> 00:47:56,559

delta and that again will be one of our

1254

00:48:00,549 --> 00:47:58,720

first targets to look for signs of

1255

00:48:03,030 --> 00:48:00,559

organic material and other signs of life

1256

00:48:04,390 --> 00:48:03,040

in the lake bottom muds preserved at the

1257

00:48:05,990 --> 00:48:04,400

front of the delta

1258

00:48:07,430 --> 00:48:06,000

and you know we might land on the delta

1259

00:48:09,109 --> 00:48:07,440

that's also a possibility but then we'll

1260

00:48:11,030 --> 00:48:09,119

end up with a fantastic view looking out

1261

00:48:13,030 --> 00:48:11,040

over the crater floor now either way

1262

00:48:14,710 --> 00:48:13,040

we're going to have we'll be landing on

1263

00:48:16,470 --> 00:48:14,720

just amazing rocks and be able to do

1264

00:48:18,549 --> 00:48:16,480

fantastic science right away so on the

1265

00:48:19,990 --> 00:48:18,559

science team we are incredibly excited

1266

00:48:21,910 --> 00:48:20,000

to actually get on the ground to start

1267

00:48:23,270 --> 00:48:21,920

doing fantastic geology

1268

00:48:25,589 --> 00:48:23,280

all right thanks and i'll send it back

1269

00:48:27,910 --> 00:48:25,599

to you jpl

1270

00:48:29,990 --> 00:48:27,920

thanks brian we are now ready to take

1271

00:48:32,470 --> 00:48:30,000

media questions remember to press star

1272

00:48:33,990 --> 00:48:32,480

one to get put in the queue and please

1273

00:48:36,150 --> 00:48:34,000

direct your questions to one of the

1274

00:48:39,109 --> 00:48:36,160

panelists we're also taking questions

1275

00:48:52,390 --> 00:48:39,119

through the countdown to mars hashtag to

1276

00:49:00,390 --> 00:48:54,390

all right bill bill harwood from cbs

1277

00:49:05,510 --> 00:49:02,470

all right we're going to move on to

1278

00:49:07,510 --> 00:49:05,520

marina corn from the atlantic marina are

1279

00:49:10,950 --> 00:49:07,520

you there

1280

00:49:13,030 --> 00:49:10,960

hi am can you hear me yes we can

1281

00:49:15,990 --> 00:49:13,040

hi um this is a question to whoever

1282

00:49:18,390 --> 00:49:16,000

wants to talk about ingenuity um what

1283

00:49:21,430 --> 00:49:18,400

lessons are you taking away from the

1284

00:49:23,270 --> 00:49:21,440

failure of the mole on insight uh the

1285

00:49:24,950 --> 00:49:23,280

mole and the helicopter are obviously

1286

00:49:26,710 --> 00:49:24,960

very different instruments but they are

1287

00:49:28,470 --> 00:49:26,720

a little similar in that they are more

1288

00:49:30,309 --> 00:49:28,480

on the experimental side and doing

1289

00:49:32,309 --> 00:49:30,319

things that haven't been done on mars

1290

00:49:37,990 --> 00:49:32,319

before so what have you learned from

1291

00:49:40,870 --> 00:49:38,710

well

1292

00:49:43,030 --> 00:49:40,880

let's see i can talk certainly about

1293

00:49:44,549 --> 00:49:43,040

ingenuity and and uh how we're

1294

00:49:47,030 --> 00:49:44,559

approaching it as a technology

1295

00:49:49,990 --> 00:49:47,040

experiment i'm i'm not the right person

1296

00:49:52,950 --> 00:49:50,000

to talk about uh the insight mission

1297

00:49:54,549 --> 00:49:52,960

uh frankly but i will say as i said i

1298

00:49:56,549 --> 00:49:54,559

think during the initial opening

1299

00:49:57,990 --> 00:49:56,559

comments that

1300

00:50:00,470 --> 00:49:58,000

you know when we take on these new

1301
00:50:02,069 --> 00:50:00,480
technologies um that's why we're taking

1302
00:50:03,589 --> 00:50:02,079
them on because they're new because

1303
00:50:05,349 --> 00:50:03,599
they're difficult because we haven't

1304
00:50:07,670 --> 00:50:05,359
done them before

1305
00:50:09,430 --> 00:50:07,680
the helicopter ingenuity is it's a high

1306
00:50:11,910 --> 00:50:09,440
risk high reward

1307
00:50:13,270 --> 00:50:11,920
endeavor it's something we have not

1308
00:50:15,349 --> 00:50:13,280
tried

1309
00:50:17,230 --> 00:50:15,359
um and there's and there's always going

1310
00:50:19,510 --> 00:50:17,240
to be some probability

1311
00:50:20,790 --> 00:50:19,520
of an issue

1312
00:50:23,030 --> 00:50:20,800
but that's why we're doing it we'll

1313
00:50:25,030 --> 00:50:23,040

learn from the issue if it occurs i

1314

00:50:28,950 --> 00:50:25,040

think

1315

00:50:31,270 --> 00:50:28,960

these systems

1316

00:50:33,349 --> 00:50:31,280

we put a lot of thought into what we

1317

00:50:34,710 --> 00:50:33,359

need to do to test them here on the

1318

00:50:36,790 --> 00:50:34,720

earth and

1319

00:50:39,190 --> 00:50:36,800

uh ingenuity is a great example of that

1320

00:50:41,270 --> 00:50:39,200

we flew this helicopter in mars-like

1321

00:50:43,430 --> 00:50:41,280

atmospheric conditions

1322

00:50:45,349 --> 00:50:43,440

in our chamber many times during the

1323

00:50:47,510 --> 00:50:45,359

initial development and during the final

1324

00:50:48,630 --> 00:50:47,520

activities trying to get it ready

1325

00:50:50,870 --> 00:50:48,640

to fly

1326

00:50:52,950 --> 00:50:50,880

we did a lot of work to verify that this

1327

00:50:55,829 --> 00:50:52,960

hardware was going to

1328

00:50:57,670 --> 00:50:55,839

survive that very difficult martian

1329

00:51:02,069 --> 00:50:57,680

environment

1330

00:51:02,950 --> 00:51:02,079

it's the thermal cycles are are

1331

00:51:05,510 --> 00:51:02,960

very

1332

00:51:07,349 --> 00:51:05,520

punishing on electronics and hardware

1333

00:51:09,910 --> 00:51:07,359

and so we test those that hardware

1334

00:51:12,230 --> 00:51:09,920

before we send it to mars

1335

00:51:14,470 --> 00:51:12,240

um you know we we look at things like

1336

00:51:17,030 --> 00:51:14,480

dust the dust on mars is

1337

00:51:18,950 --> 00:51:17,040

very fines like talcum powder and it can

1338

00:51:20,390 --> 00:51:18,960

get into our mechanisms including the

1339

00:51:21,750 --> 00:51:20,400

things that uh

1340

00:51:23,990 --> 00:51:21,760

you know type of mechanisms that

1341

00:51:26,470 --> 00:51:24,000

ingenuity needs to fly

1342

00:51:27,910 --> 00:51:26,480

so we work hard to test uh and look at

1343

00:51:29,829 --> 00:51:27,920

all those environments and all those

1344

00:51:31,910 --> 00:51:29,839

risk factors

1345

00:51:34,230 --> 00:51:31,920

we had there and if we did it again we

1346

00:51:35,990 --> 00:51:34,240

would do it exactly the way we did it

1347

00:51:38,390 --> 00:51:36,000

and i think for the very reason that

1348

00:51:40,710 --> 00:51:38,400

match is talked about and that is

1349

00:51:42,630 --> 00:51:40,720

that it's a perfectly good question i

1350

00:51:45,990 --> 00:51:42,640

was asked with all the information that

1351
00:51:48,470 --> 00:51:46,000
was uh you know known at this time

1352
00:51:50,950 --> 00:51:48,480
with all the testing that was there and

1353
00:51:52,950 --> 00:51:50,960
once we landed successfully with the

1354
00:51:54,710 --> 00:51:52,960
full commitment of the entire team

1355
00:51:56,470 --> 00:51:54,720
trying to make it work and in fact in

1356
00:51:58,549 --> 00:51:56,480
this case finding

1357
00:52:00,470 --> 00:51:58,559
that the physical properties of that

1358
00:52:02,630 --> 00:52:00,480
soil right there where we're trying to

1359
00:52:03,589 --> 00:52:02,640
uh but a mole is trying to hammer itself

1360
00:52:06,790 --> 00:52:03,599
down

1361
00:52:08,309 --> 00:52:06,800
were not the same as we've seen before

1362
00:52:10,710 --> 00:52:08,319
in other cases

1363
00:52:13,589 --> 00:52:10,720

and in other places on mars and so we

1364

00:52:15,750 --> 00:52:13,599

tried everything we could and after

1365

00:52:18,390 --> 00:52:15,760

trying everything we could think of we

1366

00:52:20,790 --> 00:52:18,400

said the experiment is over we learned a

1367

00:52:22,390 --> 00:52:20,800

lot and trust me the next way the next

1368

00:52:24,230 --> 00:52:22,400

time i want to go back with a similar

1369

00:52:26,870 --> 00:52:24,240

type of experiment of course we want to

1370

00:52:29,829 --> 00:52:26,880

try again and we're really excited uh

1371

00:52:31,589 --> 00:52:29,839

once the european rover launches in a

1372

00:52:33,829 --> 00:52:31,599

couple in a year or so

1373

00:52:35,990 --> 00:52:33,839

they will also have kind of a way to get

1374

00:52:37,430 --> 00:52:36,000

below the ground so we look forward to

1375

00:52:39,589 --> 00:52:37,440

what they're learning from that we'll

1376
00:52:41,190 --> 00:52:39,599
learn from these experiences and just

1377
00:52:42,309 --> 00:52:41,200
like matt said

1378
00:52:44,390 --> 00:52:42,319
this is

1379
00:52:46,390 --> 00:52:44,400
exploration that those are the

1380
00:52:48,230 --> 00:52:46,400
characteristics of exploration

1381
00:52:50,230 --> 00:52:48,240
what will we learn about ingenuity

1382
00:52:52,150 --> 00:52:50,240
there's some environmental factors we

1383
00:52:53,589 --> 00:52:52,160
don't fully know we've never

1384
00:52:55,829 --> 00:52:53,599
really

1385
00:52:58,549 --> 00:52:55,839
you know experienced that at the level

1386
00:53:01,430 --> 00:52:58,559
of a flying system but the point is we

1387
00:53:04,549 --> 00:53:01,440
have all the data uh from the surface of

1388
00:53:07,430 --> 00:53:04,559

mars in our uh that is known to humanity

1389

00:53:09,750 --> 00:53:07,440

in our databases and uh you know from

1390

00:53:12,390 --> 00:53:09,760

from various missions and i just like

1391

00:53:14,069 --> 00:53:12,400

matt said or everything that

1392

00:53:16,390 --> 00:53:14,079

could be done was done with this

1393

00:53:18,950 --> 00:53:16,400

particular vehicle to make it successful

1394

00:53:20,630 --> 00:53:18,960

so we look forward to it

1395

00:53:22,950 --> 00:53:20,640

thank you and it appears that bill

1396

00:53:25,430 --> 00:53:22,960

harwood from cbs news is back on the

1397

00:53:27,190 --> 00:53:25,440

line bill can you hear us

1398

00:53:29,190 --> 00:53:27,200

thank you very much that was a mistake

1399

00:53:30,790 --> 00:53:29,200

on my end um just i just wanted to

1400

00:53:33,109 --> 00:53:30,800

follow up something with ken farley if i

1401

00:53:34,549 --> 00:53:33,119

can uh really briefly um you know you

1402

00:53:35,670 --> 00:53:34,559

were talking about the possibility of

1403

00:53:37,990 --> 00:53:35,680

negative results you don't know if

1404

00:53:40,069 --> 00:53:38,000

you'll find any bio signatures but are

1405

00:53:41,990 --> 00:53:40,079

there any practical implications to that

1406

00:53:43,510 --> 00:53:42,000

and what i mean is would you i mean

1407

00:53:45,349 --> 00:53:43,520

you'd still send the landing craft i

1408

00:53:47,270 --> 00:53:45,359

assume to pick up cash samples even if

1409

00:53:50,150 --> 00:53:47,280

you didn't see any obvious bio

1410

00:53:51,349 --> 00:53:50,160

signatures but would a negative result

1411

00:53:53,349 --> 00:53:51,359

in any way

1412

00:53:55,510 --> 00:53:53,359

while it has scientific value

1413

00:53:57,510 --> 00:53:55,520

would you worry that that might impact

1414

00:53:59,829 --> 00:53:57,520

political support ongoing support for

1415

00:54:01,829 --> 00:53:59,839

additional missions down the road given

1416

00:54:03,750 --> 00:54:01,839

the high cost and other targets in the

1417

00:54:05,270 --> 00:54:03,760

solar system that some might want to

1418

00:54:07,670 --> 00:54:05,280

explore thanks

1419

00:54:09,910 --> 00:54:07,680

yeah i don't think we should expect a

1420

00:54:10,950 --> 00:54:09,920

definitive answer of the type that i was

1421

00:54:12,950 --> 00:54:10,960

offering

1422

00:54:14,150 --> 00:54:12,960

from the instruments that are on board

1423

00:54:16,710 --> 00:54:14,160

the rover

1424

00:54:19,510 --> 00:54:16,720

the the kinds of capabilities that are

1425

00:54:21,670 --> 00:54:19,520

required to make a definitive assessment

1426

00:54:23,910 --> 00:54:21,680

was this habitable environment

1427

00:54:25,190 --> 00:54:23,920

not inhabited the kinds of instruments

1428

00:54:26,870 --> 00:54:25,200

that are required to do that are the

1429

00:54:29,510 --> 00:54:26,880

kinds of instruments we have on earth

1430

00:54:32,309 --> 00:54:29,520

that's why sample return is necessary

1431

00:54:34,390 --> 00:54:32,319

so we we generally uh suggest that we

1432

00:54:36,230 --> 00:54:34,400

have the capability to detect potential

1433

00:54:38,309 --> 00:54:36,240

biosignatures things that might be

1434

00:54:39,510 --> 00:54:38,319

biogenic but it'll be very hard for us

1435

00:54:42,230 --> 00:54:39,520

to prove that

1436

00:54:43,589 --> 00:54:42,240

so i don't think uh the the absence of

1437

00:54:45,510 --> 00:54:43,599

something that we can wave in our hands

1438

00:54:47,270 --> 00:54:45,520

and say we have found evidence of life i

1439

00:54:52,630 --> 00:54:47,280

don't think that should be considered at

1440

00:54:59,990 --> 00:54:55,430

thanks ken up next we have mike wahl

1441

00:55:03,109 --> 00:55:01,829

thank you all um

1442

00:55:05,349 --> 00:55:03,119

yeah i think this one's probably for

1443

00:55:07,430 --> 00:55:05,359

matt um could you just give us like an

1444

00:55:09,109 --> 00:55:07,440

idea of what the next three weeks are

1445

00:55:11,990 --> 00:55:09,119

actually gonna be like for you guys as

1446

00:55:14,150 --> 00:55:12,000

you prepare for for the edl um

1447

00:55:14,870 --> 00:55:14,160

like is everything pretty much set now

1448

00:55:17,109 --> 00:55:14,880

and

1449

00:55:18,710 --> 00:55:17,119

or are there lots of of sort of prep

1450

00:55:20,549 --> 00:55:18,720

tests that you need to do lots lots of

1451
00:55:21,750 --> 00:55:20,559
checkups that you need to do to sort of

1452
00:55:23,910 --> 00:55:21,760
get ready for that

1453
00:55:27,109 --> 00:55:23,920
thanks

1454
00:55:28,470 --> 00:55:27,119
yeah i can say a few words um and i

1455
00:55:31,510 --> 00:55:28,480
think what i'll do is i'll turn it over

1456
00:55:32,950 --> 00:55:31,520
to al chen to to say a few words for me

1457
00:55:34,710 --> 00:55:32,960
personally

1458
00:55:36,150 --> 00:55:34,720
i'm gonna get a haircut because we

1459
00:55:39,109 --> 00:55:36,160
haven't been able to get a haircut for a

1460
00:55:40,950 --> 00:55:39,119
long time in los angeles uh so that's

1461
00:55:41,990 --> 00:55:40,960
one thing i'm going to do

1462
00:55:45,190 --> 00:55:42,000
i think

1463
00:55:46,470 --> 00:55:45,200

you know the team has a a number of well

1464

00:55:48,390 --> 00:55:46,480

understood

1465

00:55:50,870 --> 00:55:48,400

sets of activities that they need to

1466

00:55:53,109 --> 00:55:50,880

to uh get through on the vehicle

1467

00:55:54,230 --> 00:55:53,119

um and uh i think al is the best person

1468

00:55:54,950 --> 00:55:54,240

to go ahead and talk us through some of

1469

00:55:57,030 --> 00:55:54,960

that

1470

00:55:59,750 --> 00:55:57,040

sure matt um right now we're finishing

1471

00:56:01,190 --> 00:55:59,760

uh the last test really of all the edl

1472

00:56:02,950 --> 00:56:01,200

hardware the last checkouts we have

1473

00:56:04,710 --> 00:56:02,960

before landing so we're finishing up

1474

00:56:06,549 --> 00:56:04,720

that this week next week we're going to

1475

00:56:08,789 --> 00:56:06,559

do what's called a cold boot we're kind

1476

00:56:11,270 --> 00:56:08,799

of basically in some sense erasing the

1477

00:56:13,270 --> 00:56:11,280

memory of the past uh six months on the

1478

00:56:15,109 --> 00:56:13,280

vehicle so that we get a system that's

1479

00:56:17,030 --> 00:56:15,119

very much like we bring up our testing

1480

00:56:18,870 --> 00:56:17,040

systems here our test beds in which we

1481

00:56:20,230 --> 00:56:18,880

bring them up from power off

1482

00:56:22,470 --> 00:56:20,240

so we want to make sure that we fly the

1483

00:56:23,990 --> 00:56:22,480

vehicle just like we tested so that's

1484

00:56:26,069 --> 00:56:24,000

really what the purpose of next week is

1485

00:56:29,030 --> 00:56:26,079

is to try to configure the spacecraft as

1486

00:56:30,950 --> 00:56:29,040

close to the way we test it as possible

1487

00:56:32,309 --> 00:56:30,960

past that we have a few more maneuvers

1488

00:56:34,470 --> 00:56:32,319

that we can do to make sure we're right

1489

00:56:36,230 --> 00:56:34,480

in the right place to start edl uh the

1490

00:56:37,270 --> 00:56:36,240

entry descent and landing at the right

1491

00:56:39,829 --> 00:56:37,280

time

1492

00:56:42,069 --> 00:56:39,839

additionally we have the ability to uh

1493

00:56:44,390 --> 00:56:42,079

to give the spacecraft more information

1494

00:56:46,470 --> 00:56:44,400

about where it is that it'll use when

1495

00:56:47,430 --> 00:56:46,480

it's in the atmosphere i spoke earlier

1496

00:56:49,589 --> 00:56:47,440

the fact that we're allowing

1497

00:56:51,589 --> 00:56:49,599

perseverance to figure out uh when to

1498

00:56:53,910 --> 00:56:51,599

deploy her own parachute we need to see

1499

00:56:56,789 --> 00:56:53,920

her with that with the best information

1500

00:56:58,710 --> 00:56:56,799

of where she is to begin edl so she can

1501
00:56:59,910 --> 00:56:58,720
make that decision well so those are

1502
00:57:02,069 --> 00:56:59,920
kind of the big activities that are

1503
00:57:03,670 --> 00:57:02,079
going on basically in that last week

1504
00:57:05,430 --> 00:57:03,680
it's all about making sure that we're

1505
00:57:07,829 --> 00:57:05,440
all primed and in the best efficient

1506
00:57:09,910 --> 00:57:07,839
position to succeed almost literally for

1507
00:57:12,710 --> 00:57:09,920
edl

1508
00:57:15,670 --> 00:57:12,720
thanks al and up next is steve gregory

1509
00:57:17,589 --> 00:57:15,680
from kfi

1510
00:57:19,270 --> 00:57:17,599
thank you very much um this might be for

1511
00:57:21,190 --> 00:57:19,280
ken i'm really curious about the

1512
00:57:23,109 --> 00:57:21,200
microphones on board whose idea was it

1513
00:57:25,270 --> 00:57:23,119

to install microphone

1514

00:57:28,710 --> 00:57:25,280

and what exactly is it you hope to learn

1515

00:57:30,470 --> 00:57:28,720

from microphones thank you very much

1516

00:57:32,710 --> 00:57:30,480

yeah let me just point out there there

1517

00:57:33,829 --> 00:57:32,720

are two microphones that are on border

1518

00:57:36,150 --> 00:57:33,839

rover

1519

00:57:38,630 --> 00:57:36,160

one of them is associated with the the

1520

00:57:41,750 --> 00:57:38,640

package of uh

1521

00:57:44,150 --> 00:57:41,760

sensors uh that will record edl

1522

00:57:46,309 --> 00:57:44,160

uh and and i will turn it to matt to to

1523

00:57:48,309 --> 00:57:46,319

comment on that but there's a second

1524

00:57:49,349 --> 00:57:48,319

microphone that is part of the super cam

1525

00:57:51,510 --> 00:57:49,359

instrument

1526

00:57:55,109 --> 00:57:51,520

and we don't really know what it will be

1527

00:57:57,030 --> 00:57:55,119

able to record but one of the

1528

00:57:59,349 --> 00:57:57,040

rationales for doing it is

1529

00:58:01,510 --> 00:57:59,359

there's a there's a laser on super cam

1530

00:58:02,470 --> 00:58:01,520

that will interact with rock at a

1531

00:58:03,430 --> 00:58:02,480

distance

1532

00:58:05,510 --> 00:58:03,440

and

1533

00:58:07,430 --> 00:58:05,520

it is likely that that interaction will

1534

00:58:08,470 --> 00:58:07,440

make noise that we can record with the

1535

00:58:10,390 --> 00:58:08,480

microphone

1536

00:58:12,309 --> 00:58:10,400

and we can for example potentially learn

1537

00:58:13,670 --> 00:58:12,319

about surface coatings and other

1538

00:58:17,510 --> 00:58:13,680

characteristics of those rocks that we

1539

00:58:21,349 --> 00:58:19,349

yeah so as ken said there's there are

1540

00:58:23,030 --> 00:58:21,359

two microphones the one you mentioned on

1541

00:58:25,589 --> 00:58:23,040

super cam and then there is one

1542

00:58:27,990 --> 00:58:25,599

associated with uh the cameras that al

1543

00:58:29,670 --> 00:58:28,000

talked about the what we call the edl

1544

00:58:32,230 --> 00:58:29,680

cameras these are

1545

00:58:33,510 --> 00:58:32,240

uh commercial uh ruggedized cameras and

1546

00:58:35,589 --> 00:58:33,520

they came with

1547

00:58:38,870 --> 00:58:35,599

or they gave us the capability

1548

00:58:40,710 --> 00:58:38,880

essentially to almost for free plug in a

1549

00:58:41,829 --> 00:58:40,720

microphone

1550

00:58:43,910 --> 00:58:41,839

sensor

1551
00:58:45,750 --> 00:58:43,920
to that system

1552
00:58:47,829 --> 00:58:45,760
and so we took it you know we thought it

1553
00:58:50,870 --> 00:58:47,839
would be exciting to have as i said

1554
00:58:53,030 --> 00:58:50,880
before that that new human sense along

1555
00:58:55,109 --> 00:58:53,040
with us for the ride

1556
00:58:57,109 --> 00:58:55,119
we expect to have that microphone well

1557
00:58:59,829 --> 00:58:57,119
we'll be active during entry descent and

1558
00:59:02,069 --> 00:58:59,839
landing so we're hoping to hear

1559
00:59:05,510 --> 00:59:02,079
a lot of pyrotechnics being fired a lot

1560
00:59:07,510 --> 00:59:05,520
of separations and deployments happening

1561
00:59:09,910 --> 00:59:07,520
maybe some wind you know after the heat

1562
00:59:11,670 --> 00:59:09,920
shield comes off

1563
00:59:14,789 --> 00:59:11,680

so we're hoping to hear essentially the

1564

00:59:16,630 --> 00:59:14,799

sounds of edl and we believe engines

1565

00:59:19,270 --> 00:59:16,640

firing maybe

1566

00:59:20,870 --> 00:59:19,280

we'll see we'll see what we hear um

1567

00:59:22,549 --> 00:59:20,880

that's part of the reason we're taking

1568

00:59:24,390 --> 00:59:22,559

it because it's new and we haven't done

1569

00:59:25,990 --> 00:59:24,400

it before and we want to understand what

1570

00:59:27,990 --> 00:59:26,000

we get from it

1571

00:59:30,630 --> 00:59:28,000

uh and there will probably be some

1572

00:59:33,030 --> 00:59:30,640

engineering aspects um

1573

00:59:34,390 --> 00:59:33,040

you know uh that that will derive from

1574

00:59:36,150 --> 00:59:34,400

from that data

1575

00:59:38,630 --> 00:59:36,160

if that microphone survives on the

1576

00:59:39,589 --> 00:59:38,640

surface and i suspect it it probably

1577

00:59:41,270 --> 00:59:39,599

will

1578

00:59:42,870 --> 00:59:41,280

then we'll also use that microphone just

1579

00:59:45,430 --> 00:59:42,880

to listen to the sounds of the vehicle

1580

00:59:47,349 --> 00:59:45,440

we have for instance a pump that that

1581

00:59:49,589 --> 00:59:47,359

pumps fluid around the vehicle freon

1582

00:59:51,589 --> 00:59:49,599

around the vehicle to keep it warm

1583

00:59:53,670 --> 00:59:51,599

and so we'll listen to see how that pump

1584

00:59:55,990 --> 00:59:53,680

sounds just like anybody would

1585

00:59:57,750 --> 00:59:56,000

you know from a health perspective on a

1586

00:59:59,430 --> 00:59:57,760

you know on an industrial pump for

1587

01:00:00,549 --> 00:59:59,440

instance we should be able to hear the

1588

01:00:04,069 --> 01:00:00,559

wheels

1589

01:00:05,829 --> 01:00:04,079

crunching over the surface as we drive

1590

01:00:07,990 --> 01:00:05,839

and i think we're going to hear that big

1591

01:00:09,670 --> 01:00:08,000

rotary percussive drill the big

1592

01:00:11,430 --> 01:00:09,680

jackhammer drill out on the end of the

1593

01:00:12,870 --> 01:00:11,440

robot arm

1594

01:00:15,589 --> 01:00:12,880

i think we'll hear that as well with

1595

01:00:17,349 --> 01:00:15,599

that with that microphone so uh

1596

01:00:19,829 --> 01:00:17,359

so those are some of the things where we

1597

01:00:22,390 --> 01:00:19,839

hope to to get with the mic

1598

01:00:24,069 --> 01:00:22,400

modern cells we could likely detect them

1599

01:00:26,069 --> 01:00:24,079

with the instruments that we have but we

1600

01:00:28,950 --> 01:00:26,079

would not be able to tell that they were

1601

01:00:30,710 --> 01:00:28,960

alive so it is possible that if life

1602

01:00:34,870 --> 01:00:30,720

existed there we could see it but we

1603

01:00:44,150 --> 01:00:37,349

thanks ken we now have the phone lines

1604

01:00:44,160 --> 01:00:51,430

paul can you hear us

1605

01:00:56,630 --> 01:00:52,630

all right we're going to move on to

1606

01:00:58,309 --> 01:00:56,640

irene klotz from aviation week

1607

01:00:59,990 --> 01:00:58,319

hi thanks very much i have an

1608

01:01:01,990 --> 01:01:00,000

engineering question and a science

1609

01:01:03,589 --> 01:01:02,000

question um the engineering question for

1610

01:01:05,910 --> 01:01:03,599

alan is um

1611

01:01:09,349 --> 01:01:05,920

with the range trigger and the trn how

1612

01:01:11,270 --> 01:01:09,359

much fly time does that buy for the

1613

01:01:13,030 --> 01:01:11,280

for perseverance um

1614

01:01:15,670 --> 01:01:13,040

what sort of

1615

01:01:16,710 --> 01:01:15,680

like time frame could the landing occur

1616

01:01:17,910 --> 01:01:16,720

in

1617

01:01:19,589 --> 01:01:17,920

and i'm gonna go ahead and ask the

1618

01:01:20,309 --> 01:01:19,599

science questions that's all right it's

1619

01:01:21,829 --> 01:01:20,319

um

1620

01:01:24,630 --> 01:01:21,839

kind of follows a little bit what bill i

1621

01:01:26,870 --> 01:01:24,640

think was trying to get at is uh after

1622

01:01:29,990 --> 01:01:26,880

viking there were no mars missions for

1623

01:01:32,630 --> 01:01:30,000

for 20 years or so um when that proved

1624

01:01:34,230 --> 01:01:32,640

to not find life or most people feel it

1625

01:01:36,950 --> 01:01:34,240

didn't find life

1626
01:01:38,549 --> 01:01:36,960
maybe can or anyone else can you put

1627
01:01:39,270 --> 01:01:38,559
into context

1628
01:01:41,109 --> 01:01:39,280
the

1629
01:01:43,829 --> 01:01:41,119
experiments that are going to be done

1630
01:01:46,230 --> 01:01:43,839
with perseverance and light of what was

1631
01:01:47,109 --> 01:01:46,240
done with not only viking but also all

1632
01:01:53,670 --> 01:01:47,119
the

1633
01:01:55,589 --> 01:01:53,680
8401 meteorite thanks

1634
01:01:57,190 --> 01:01:55,599
i think the first question was about uh

1635
01:01:59,510 --> 01:01:57,200
how much uncertainty there is and how

1636
01:02:01,990 --> 01:01:59,520
long it takes to land i got that right

1637
01:02:02,870 --> 01:02:02,000
um right so how much time would you have

1638
01:02:03,589 --> 01:02:02,880

to

1639

01:02:05,430 --> 01:02:03,599

like

1640

01:02:08,870 --> 01:02:05,440

it could land between this time and this

1641

01:02:11,990 --> 01:02:08,880

time based on the ability of the

1642

01:02:13,670 --> 01:02:12,000

rover to fly itself gotcha um we land

1643

01:02:14,789 --> 01:02:13,680

you know typically normally about in

1644

01:02:16,630 --> 01:02:14,799

seven minutes from the top of the

1645

01:02:18,390 --> 01:02:16,640

atmosphere to the bottom the uncertainty

1646

01:02:20,710 --> 01:02:18,400

in that timing can vary about half a

1647

01:02:22,390 --> 01:02:20,720

minute to a minute or so depending on

1648

01:02:23,349 --> 01:02:22,400

what the conditions are

1649

01:02:24,549 --> 01:02:23,359

as you mentioned right there there are

1650

01:02:26,470 --> 01:02:24,559

lots of things that drive that

1651

01:02:27,589 --> 01:02:26,480

uncertainty in particular it's the

1652

01:02:30,390 --> 01:02:27,599

atmosphere

1653

01:02:32,870 --> 01:02:30,400

that day what the weather really happens

1654

01:02:34,870 --> 01:02:32,880

to be like that day can affect how uh

1655

01:02:36,150 --> 01:02:34,880

how fast we come down that's typically

1656

01:02:38,789 --> 01:02:36,160

between a half minute and a minute of

1657

01:02:42,309 --> 01:02:40,390

i know you had a science question

1658

01:02:47,190 --> 01:02:42,319

perhaps lori glaze could answer it for

1659

01:02:52,390 --> 01:02:49,589

i can certainly try to answer that

1660

01:02:55,349 --> 01:02:52,400

question um

1661

01:02:57,349 --> 01:02:55,359

so you know we've we've really since the

1662

01:03:00,789 --> 01:02:57,359

viking days really tried to take a very

1663

01:03:03,190 --> 01:03:00,799

methodical approach to how we go about

1664

01:03:05,190 --> 01:03:03,200

trying to ask the questions

1665

01:03:08,069 --> 01:03:05,200

about whether or not life might exist

1666

01:03:10,230 --> 01:03:08,079

someplace on another planet or another

1667

01:03:12,549 --> 01:03:10,240

location besides earth

1668

01:03:14,230 --> 01:03:12,559

we've taken a very very uh

1669

01:03:16,390 --> 01:03:14,240

as i said methodical approach first

1670

01:03:18,549 --> 01:03:16,400

starting with trying to follow the water

1671

01:03:20,390 --> 01:03:18,559

on mars trying to understand

1672

01:03:22,549 --> 01:03:20,400

just what the environments were like on

1673

01:03:24,950 --> 01:03:22,559

mars in the past and today and that

1674

01:03:25,750 --> 01:03:24,960

evolution over time trying to understand

1675

01:03:27,670 --> 01:03:25,760

just

1676

01:03:29,589 --> 01:03:27,680

when the water was present in what

1677

01:03:30,630 --> 01:03:29,599

quantities whether it was liquid on the

1678

01:03:32,710 --> 01:03:30,640

surface

1679

01:03:33,750 --> 01:03:32,720

uh was it acidic was it a

1680

01:03:37,430 --> 01:03:33,760

more

1681

01:03:38,630 --> 01:03:37,440

conductive or similar to the types of

1682

01:03:40,230 --> 01:03:38,640

water we have on earth that were

1683

01:03:41,670 --> 01:03:40,240

conductive to life

1684

01:03:43,349 --> 01:03:41,680

and we've done this we've taken these

1685

01:03:45,910 --> 01:03:43,359

steps we were able to identify that

1686

01:03:47,589 --> 01:03:45,920

water was present on on mars and then we

1687

01:03:49,750 --> 01:03:47,599

took the next steps and says well let's

1688

01:03:51,349 --> 01:03:49,760

uh go to some places where

1689

01:03:53,589 --> 01:03:51,359

we believe water was present in the past

1690

01:03:54,549 --> 01:03:53,599

such as you know curiosity in gale

1691

01:03:57,270 --> 01:03:54,559

crater

1692

01:03:59,349 --> 01:03:57,280

able to identify looked for and identify

1693

01:04:01,190 --> 01:03:59,359

organic molecules that were present

1694

01:04:03,270 --> 01:04:01,200

looked for complex organic molecules

1695

01:04:05,109 --> 01:04:03,280

that could be the early building blocks

1696

01:04:07,190 --> 01:04:05,119

potentially of life

1697

01:04:09,910 --> 01:04:07,200

so again kind of a stepwise approach to

1698

01:04:12,710 --> 01:04:09,920

trying to best position ourselves

1699

01:04:15,109 --> 01:04:12,720

to to be prepared to look in the in the

1700

01:04:17,270 --> 01:04:15,119

best places we can uh

1701

01:04:18,789 --> 01:04:17,280

to try and uh find or look for those

1702

01:04:21,109 --> 01:04:18,799

signatures of where life might have

1703

01:04:23,670 --> 01:04:21,119

existed and all of those steps have

1704

01:04:26,069 --> 01:04:23,680

driven us and and uh had taken us to

1705

01:04:28,470 --> 01:04:26,079

this point that ken described which was

1706

01:04:29,270 --> 01:04:28,480

to identify jezreel crater as a place

1707

01:04:31,510 --> 01:04:29,280

where

1708

01:04:33,910 --> 01:04:31,520

we believe there was standing water in

1709

01:04:35,270 --> 01:04:33,920

the creature within the jezreel crater

1710

01:04:36,630 --> 01:04:35,280

and that there was actually river

1711

01:04:38,549 --> 01:04:36,640

flowing into that crater that would have

1712

01:04:41,430 --> 01:04:38,559

been depositing its sediments from a

1713

01:04:43,190 --> 01:04:41,440

large catchment area and that if life

1714

01:04:45,190 --> 01:04:43,200

had started to form three and a half

1715

01:04:47,670 --> 01:04:45,200

billion years ago as it was beginning to

1716

01:04:49,670 --> 01:04:47,680

form on earth same time frame

1717

01:04:51,670 --> 01:04:49,680

if it was happening at that time there's

1718

01:04:54,069 --> 01:04:51,680

a very high probability that if it were

1719

01:04:55,750 --> 01:04:54,079

there it should have been contained in

1720

01:04:58,470 --> 01:04:55,760

those sediments and could potentially

1721

01:05:00,789 --> 01:04:58,480

have been deposited in the deposit there

1722

01:05:02,309 --> 01:05:00,799

uh in the river delta that's inside

1723

01:05:04,390 --> 01:05:02,319

jezreel crater

1724

01:05:07,270 --> 01:05:04,400

and so we feel like we've positioned

1725

01:05:08,789 --> 01:05:07,280

ourselves in a as best

1726

01:05:10,069 --> 01:05:08,799

place as we can with the information

1727

01:05:11,190 --> 01:05:10,079

that we have

1728

01:05:12,870 --> 01:05:11,200

to look

1729

01:05:13,910 --> 01:05:12,880

in the best spot that we know is

1730

01:05:16,069 --> 01:05:13,920

available

1731

01:05:18,470 --> 01:05:16,079

and again as ken says

1732

01:05:19,430 --> 01:05:18,480

there's a a chance that we may not find

1733

01:05:21,349 --> 01:05:19,440

it there

1734

01:05:23,430 --> 01:05:21,359

but that's an important science

1735

01:05:25,349 --> 01:05:23,440

discovery in and of itself and there's

1736

01:05:27,109 --> 01:05:25,359

certainly many many other

1737

01:05:29,430 --> 01:05:27,119

incredibly important science questions

1738

01:05:31,910 --> 01:05:29,440

to answer at mars beyond

1739

01:05:34,390 --> 01:05:31,920

just uh just the astrobiology questions

1740

01:05:36,470 --> 01:05:34,400

just trying to understand how planets

1741

01:05:38,710 --> 01:05:36,480

form how they evolve over time

1742

01:05:40,309 --> 01:05:38,720

how their climates change over time and

1743

01:05:43,029 --> 01:05:40,319

so i think you know mars is an

1744

01:05:45,349 --> 01:05:43,039

incredibly compelling destination uh

1745

01:05:47,349 --> 01:05:45,359

for for many many reasons and i fully

1746

01:05:51,190 --> 01:05:47,359

expect uh us to continue that

1747

01:05:54,549 --> 01:05:51,200

exploration uh well into the future

1748

01:05:57,029 --> 01:05:54,559

thank you lori up next is keith cohen

1749

01:05:58,390 --> 01:05:57,039

from nasa watch

1750

01:05:59,829 --> 01:05:58,400

hi can you hear me

1751

01:06:01,589 --> 01:05:59,839

yes we can

1752

01:06:02,950 --> 01:06:01,599

uh okay my question should be addressed

1753

01:06:04,870 --> 01:06:02,960

to some people who are not present on

1754

01:06:07,109 --> 01:06:04,880

this panel so i'm going to uh direct it

1755

01:06:09,190 --> 01:06:07,119

to doctors of broken instead

1756

01:06:11,430 --> 01:06:09,200

the mars 2020 mission involves the

1757

01:06:13,270 --> 01:06:11,440

flight of the ingenuity helicopter drone

1758

01:06:14,870 --> 01:06:13,280

which is a joint effort by the science

1759

01:06:16,710 --> 01:06:14,880

mission director the aeronautics

1760

01:06:18,870 --> 01:06:16,720

research mission directorate and the

1761

01:06:20,230 --> 01:06:18,880

space technology mission directorate we

1762

01:06:21,750 --> 01:06:20,240

just heard a quote from the new vice

1763

01:06:23,349 --> 01:06:21,760

president and you know i'm wondering at

1764

01:06:25,510 --> 01:06:23,359

a time when this new administration

1765

01:06:27,270 --> 01:06:25,520

talks about a quote whole government

1766

01:06:29,670 --> 01:06:27,280

approach one would think that the whole

1767

01:06:31,190 --> 01:06:29,680

of nasa would be using their various

1768

01:06:33,349 --> 01:06:31,200

outreach tools to talk about this

1769

01:06:34,309 --> 01:06:33,359

helicopter and the overall mission yet

1770

01:06:35,829 --> 01:06:34,319

you don't hear anything from the

1771

01:06:38,789 --> 01:06:35,839

aeronautics or technology mission

1772

01:06:40,309 --> 01:06:38,799

directorates uh and and their audiences

1773

01:06:41,910 --> 01:06:40,319

aren't hearing about this this is a

1774

01:06:43,829 --> 01:06:41,920

little odd since this rover and its

1775

01:06:46,309 --> 01:06:43,839

helicopter have relevance to virtually

1776

01:06:47,670 --> 01:06:46,319

everything nasa does and applicabilities

1777

01:06:50,150 --> 01:06:47,680

of things in many people's everyday

1778

01:06:51,990 --> 01:06:50,160

lives so why isn't the whole of nasa

1779

01:06:58,870 --> 01:06:52,000

doing their best to highlight the

1780

01:07:02,950 --> 01:07:00,309

hey thanks so much keith for the

1781

01:07:04,950 --> 01:07:02,960

question uh as always you're one of the

1782

01:07:07,990 --> 01:07:04,960

best experts at looking at how we

1783

01:07:10,230 --> 01:07:08,000

communicate and uh also uh helping us

1784

01:07:12,470 --> 01:07:10,240

kind of identify places where in fact we

1785

01:07:14,950 --> 01:07:12,480

can get better but let me just uh talk

1786

01:07:17,750 --> 01:07:14,960

about this experiment this is a whole of

1787

01:07:19,270 --> 01:07:17,760

nasa hall of government kind of approach

1788

01:07:21,589 --> 01:07:19,280

there's never been

1789

01:07:23,990 --> 01:07:21,599

uh you know a rover that was developed

1790

01:07:25,829 --> 01:07:24,000

with all the parts of nasa really being

1791

01:07:28,870 --> 01:07:25,839

involved i think matt already told us

1792

01:07:30,630 --> 01:07:28,880

that uh experts from all these domains

1793

01:07:33,750 --> 01:07:30,640

were actively present and that includes

1794

01:07:35,589 --> 01:07:33,760

aeronautics uh the space tech uh people

1795

01:07:37,270 --> 01:07:35,599

you know uh you know looking at medley

1796

01:07:39,349 --> 01:07:37,280

also an experiment on the way down

1797

01:07:42,230 --> 01:07:39,359

looking at anti-descendant landing and

1798

01:07:43,589 --> 01:07:42,240

discovering science uh there and then of

1799

01:07:45,349 --> 01:07:43,599

course on human exploration with

1800

01:07:48,230 --> 01:07:45,359

democracy experiment that was being

1801
01:07:50,390 --> 01:07:48,240
talked about and of course uh signed so

1802
01:07:52,230 --> 01:07:50,400
it is really has the characteristics

1803
01:07:54,390 --> 01:07:52,240
that you just talked about

1804
01:07:56,230 --> 01:07:54,400
and it's also true i met with both

1805
01:07:57,990 --> 01:07:56,240
associate administrators both the one

1806
01:08:00,069 --> 01:07:58,000
from space tech and

1807
01:08:02,069 --> 01:08:00,079
from uh aeronautics this morning

1808
01:08:03,750 --> 01:08:02,079
precisely on this point because i just

1809
01:08:05,750 --> 01:08:03,760
really believe it's just a huge

1810
01:08:07,990 --> 01:08:05,760
opportunity for us and uh there's

1811
01:08:10,390 --> 01:08:08,000
tremendous excitement on all of these

1812
01:08:12,150 --> 01:08:10,400
and and this will not stop with this one

1813
01:08:14,950 --> 01:08:12,160

uh look at dragonfly that we're

1814

01:08:17,829 --> 01:08:14,960

developing going to titan another flying

1815

01:08:20,950 --> 01:08:17,839

object look at other destinations that

1816

01:08:22,709 --> 01:08:20,960

are under consideration and uh as we go

1817

01:08:24,550 --> 01:08:22,719

forward you know there's kind of whole

1818

01:08:26,470 --> 01:08:24,560

of nasa a whole of government approach

1819

01:08:28,229 --> 01:08:26,480

just like we are modeling here in this

1820

01:08:30,229 --> 01:08:28,239

particular vehicle it's really an

1821

01:08:33,189 --> 01:08:30,239

overarching theme of what you're going

1822

01:08:35,990 --> 01:08:33,199

to see in communications across and yes

1823

01:08:38,309 --> 01:08:36,000

as we go forward kind of uh we'll going

1824

01:08:40,390 --> 01:08:38,319

to be uh excited to kind of learn from

1825

01:08:42,630 --> 01:08:40,400

each other and you know i do the same as

1826

01:08:44,630 --> 01:08:42,640

i look at our breakthroughs and space

1827

01:08:47,110 --> 01:08:44,640

tech trying to really cheer from our

1828

01:08:49,430 --> 01:08:47,120

accounts in science the same way because

1829

01:08:51,030 --> 01:08:49,440

we are really on the same team so thanks

1830

01:08:53,829 --> 01:08:51,040

for that uh yes

1831

01:08:55,590 --> 01:08:53,839

it's truly like you said uh hall of naza

1832

01:08:59,349 --> 01:08:55,600

hall of government mission like there

1833

01:09:01,269 --> 01:08:59,359

has never really been uh before

1834

01:09:03,829 --> 01:09:01,279

thank you and now we have a social media

1835

01:09:06,390 --> 01:09:03,839

question tammy on twitter asks

1836

01:09:09,349 --> 01:09:06,400

how do you land perseverance on a 45

1837

01:09:11,110 --> 01:09:09,359

kilometer spot when mars is rotating how

1838

01:09:13,510 --> 01:09:11,120

do you get it to the right side of mars

1839

01:09:15,829 --> 01:09:13,520

facing you to land

1840

01:09:17,269 --> 01:09:15,839

i guess i should take that one um yeah

1841

01:09:18,950 --> 01:09:17,279

it's a little tricky right i mean it's

1842

01:09:20,149 --> 01:09:18,960

uh we have to go a long way and then put

1843

01:09:21,349 --> 01:09:20,159

the spacecraft in the position to

1844

01:09:23,590 --> 01:09:21,359

succeed

1845

01:09:24,870 --> 01:09:23,600

um not quite sure what the best way to

1846

01:09:26,630 --> 01:09:24,880

answer your particular question is

1847

01:09:28,149 --> 01:09:26,640

except to say that there's a we're

1848

01:09:30,550 --> 01:09:28,159

essentially targeting a particular

1849

01:09:32,229 --> 01:09:30,560

position for mars to kind of hit us

1850

01:09:34,229 --> 01:09:32,239

we're really throwing our vehicle up in

1851

01:09:36,709 --> 01:09:34,239

front of mars and letting mars run into

1852

01:09:37,990 --> 01:09:36,719

us and that's how we uh we target the

1853

01:09:39,510 --> 01:09:38,000

the position that we're trying to come

1854

01:09:41,430 --> 01:09:39,520

and enter in from

1855

01:09:43,030 --> 01:09:41,440

once from that position on really the

1856

01:09:44,309 --> 01:09:43,040

spacecraft's on our own to fly out where

1857

01:09:45,749 --> 01:09:44,319

we're trying to go

1858

01:09:47,669 --> 01:09:45,759

and that's where we use its initial

1859

01:09:49,030 --> 01:09:47,679

guess of where we were when we came in

1860

01:09:50,070 --> 01:09:49,040

those parameter updates i talked about

1861

01:09:51,590 --> 01:09:50,080

earlier

1862

01:09:53,510 --> 01:09:51,600

and then it'll fly its way based on that

1863

01:09:55,830 --> 01:09:53,520

information until it determines where it

1864

01:09:57,590 --> 01:09:55,840

is relative to the ground using train

1865

01:09:59,669 --> 01:09:57,600

melted navigation and radar while on

1866

01:10:01,830 --> 01:09:59,679

parachute that's how i can really figure

1867

01:10:03,990 --> 01:10:01,840

out where exactly it is and then target

1868

01:10:06,630 --> 01:10:04,000

a nearby safe spot to fly to with the

1869

01:10:08,630 --> 01:10:06,640

rockets during powered flight

1870

01:10:11,110 --> 01:10:08,640

thanks for answering al and up next on

1871

01:10:13,510 --> 01:10:11,120

the phone lines is robert holtz from

1872

01:10:15,270 --> 01:10:13,520

wall street journal

1873

01:10:16,790 --> 01:10:15,280

thank you can you hear me all right yes

1874

01:10:19,270 --> 01:10:16,800

we can

1875

01:10:22,630 --> 01:10:19,280

super uh this i guess is a question for

1876

01:10:25,350 --> 01:10:22,640

uh thomas and laurie i would like uh for

1877

01:10:28,390 --> 01:10:25,360

you to step back for a moment your bit

1878

01:10:30,709 --> 01:10:28,400

you this is of course the astrobiology

1879

01:10:31,910 --> 01:10:30,719

mission i'd like you to help my readers

1880

01:10:34,790 --> 01:10:31,920

understand

1881

01:10:37,030 --> 01:10:34,800

how this sits in the broader context of

1882

01:10:39,270 --> 01:10:37,040

the question of astrobiology

1883

01:10:42,149 --> 01:10:39,280

in our solar system and the other

1884

01:10:46,470 --> 01:10:42,159

potentials clouds of venus frozen oceans

1885

01:10:51,830 --> 01:10:46,480

of europa titan what what is the

1886

01:10:56,229 --> 01:10:53,750

i'm going to start and then i really

1887

01:10:58,630 --> 01:10:56,239

want lori to talk about this

1888

01:11:00,310 --> 01:10:58,640

and that is that i really do believe and

1889

01:11:02,470 --> 01:11:00,320

i think we're totally in agreement in

1890

01:11:05,270 --> 01:11:02,480

all of science that astrobiology is one

1891

01:11:07,350 --> 01:11:05,280

of the key topics in all of science that

1892

01:11:09,669 --> 01:11:07,360

is currently at the heart of what we're

1893

01:11:11,350 --> 01:11:09,679

doing it's a it's a field where the

1894

01:11:14,070 --> 01:11:11,360

progress is occurring at the speed

1895

01:11:16,790 --> 01:11:14,080

that's frankly breathtaking uh it is

1896

01:11:18,790 --> 01:11:16,800

uh what we know today and compared to 20

1897

01:11:20,149 --> 01:11:18,800

years ago is just incredible what we've

1898

01:11:21,350 --> 01:11:20,159

learned we talked about some of these

1899

01:11:22,950 --> 01:11:21,360

things on

1900

01:11:25,350 --> 01:11:22,960

mars we could have similar discussions

1901

01:11:27,590 --> 01:11:25,360

about enceladus about europa we could

1902

01:11:29,189 --> 01:11:27,600

have discussions about asteroids we

1903

01:11:31,590 --> 01:11:29,199

could just have discussions about

1904

01:11:33,990 --> 01:11:31,600

exoplanets and we could have discussions

1905

01:11:35,590 --> 01:11:34,000

about biology where breakthroughs have

1906

01:11:37,189 --> 01:11:35,600

occurred in the meantime

1907

01:11:39,350 --> 01:11:37,199

so for us

1908

01:11:41,430 --> 01:11:39,360

the benefit we have with nasa is we

1909

01:11:43,350 --> 01:11:41,440

actually have the ability using various

1910

01:11:45,910 --> 01:11:43,360

tools to do some of these experiments in

1911

01:11:48,070 --> 01:11:45,920

parallel and therefore not blame against

1912

01:11:50,630 --> 01:11:48,080

each other and so i'm just excited that

1913

01:11:53,030 --> 01:11:50,640

we're of course developing a mission to

1914

01:11:55,270 --> 01:11:53,040

europa and many other

1915

01:11:57,750 --> 01:11:55,280

approaches that we're looking at in

1916

01:11:59,590 --> 01:11:57,760

parallel including also

1917

01:12:01,590 --> 01:11:59,600

researchers from heliophysics for

1918

01:12:03,910 --> 01:12:01,600

example looking at the effects of

1919

01:12:06,390 --> 01:12:03,920

magnetic fields on the stability of

1920

01:12:10,310 --> 01:12:06,400

atmospheres and so forth but lori please

1921

01:12:12,390 --> 01:12:10,320

take it from here sure um so i actually

1922

01:12:14,470 --> 01:12:12,400

really love this question because you

1923

01:12:16,470 --> 01:12:14,480

know as thomas says we are uh looking

1924

01:12:18,470 --> 01:12:16,480

across the solar system and even beyond

1925

01:12:20,830 --> 01:12:18,480

into the exoplanets trying to think

1926

01:12:22,630 --> 01:12:20,840

about astrobiology from a much broader

1927

01:12:24,149 --> 01:12:22,640

perspective of

1928

01:12:25,669 --> 01:12:24,159

what are all the different potential

1929

01:12:27,830 --> 01:12:25,679

places where we should and could be

1930

01:12:30,390 --> 01:12:27,840

looking for potentially

1931

01:12:32,709 --> 01:12:30,400

signs of past life or current life

1932

01:12:35,030 --> 01:12:32,719

and of course mars fits nicely into that

1933

01:12:37,430 --> 01:12:35,040

context as a place that is

1934

01:12:39,510 --> 01:12:37,440

fairly quick to get to it's a it's an

1935

01:12:41,110 --> 01:12:39,520

easy round you know easy place to get to

1936

01:12:43,110 --> 01:12:41,120

uh we've we've got lots of practice

1937

01:12:44,709 --> 01:12:43,120

getting there not to say that it's easy

1938

01:12:45,750 --> 01:12:44,719

but just that we've got lots of practice

1939

01:12:47,669 --> 01:12:45,760

getting there

1940

01:12:50,149 --> 01:12:47,679

and we've done a lot of work over the

1941

01:12:52,310 --> 01:12:50,159

last uh 20 years in uh in the mars

1942

01:12:54,709 --> 01:12:52,320

exploration program of really uh setting

1943

01:12:56,550 --> 01:12:54,719

the groundwork for for knowing exactly

1944

01:12:58,790 --> 01:12:56,560

where we want to go and at the kinds of

1945

01:13:00,310 --> 01:12:58,800

questions we want to ask but as thomas

1946

01:13:02,390 --> 01:13:00,320

just said there's there's many other

1947

01:13:05,430 --> 01:13:02,400

places that we're exploring in parallel

1948

01:13:07,189 --> 01:13:05,440

that also have a lot of potential for

1949

01:13:08,950 --> 01:13:07,199

for maybe also feeding into those

1950

01:13:11,510 --> 01:13:08,960

questions of what types of habitable

1951

01:13:14,310 --> 01:13:11,520

environments could uh maybe even still

1952

01:13:15,750 --> 01:13:14,320

host life today thomas mentioned europa

1953

01:13:18,149 --> 01:13:15,760

you know we have a mission that's being

1954

01:13:19,590 --> 01:13:18,159

planned now to launch to europa in in

1955

01:13:21,110 --> 01:13:19,600

2024

1956

01:13:23,189 --> 01:13:21,120

that's going to map out the surface of

1957

01:13:25,430 --> 01:13:23,199

europa and help us better understand how

1958

01:13:27,110 --> 01:13:25,440

thick is the ice shell and and is there

1959

01:13:29,110 --> 01:13:27,120

potentially uh

1960

01:13:31,030 --> 01:13:29,120

the ocean beneath that might sustain a

1961

01:13:32,630 --> 01:13:31,040

life and other destinations like titan

1962

01:13:34,790 --> 01:13:32,640

which the dragonfly mission we talked

1963

01:13:37,910 --> 01:13:34,800

about uh just a little bit ago is going

1964

01:13:40,790 --> 01:13:37,920

to fly a rotorcraft to the moon of

1965

01:13:43,430 --> 01:13:40,800

saturn titan also looking for organic

1966

01:13:44,470 --> 01:13:43,440

molecules and and potentially

1967

01:13:46,790 --> 01:13:44,480

environments that could have been

1968

01:13:48,550 --> 01:13:46,800

habitable at some point in time

1969

01:13:50,870 --> 01:13:48,560

and so all of these efforts are going on

1970

01:13:53,110 --> 01:13:50,880

in parallel really each one different

1971

01:13:55,270 --> 01:13:53,120

types of environments all trying to

1972

01:13:56,870 --> 01:13:55,280

answer those important questions about

1973

01:13:59,030 --> 01:13:56,880

what types of environments could host

1974

01:14:02,550 --> 01:13:59,040

life and what environments may even

1975

01:14:08,390 --> 01:14:05,270

thank you we now have jonathan amos from

1976

01:14:11,110 --> 01:14:08,400

bbc london on the phone

1977

01:14:13,189 --> 01:14:11,120

hi thanks uh for doing uh this i was

1978

01:14:14,870 --> 01:14:13,199

just looking back at my reports from the

1979

01:14:16,470 --> 01:14:14,880

curiosity landing

1980

01:14:18,790 --> 01:14:16,480

and i think the post landing analysis

1981

01:14:21,030 --> 01:14:18,800

showed the rover came down about a mile

1982

01:14:23,110 --> 01:14:21,040

from the notional bullseye and i'm

1983

01:14:25,350 --> 01:14:23,120

wondering if you'd had range trigger and

1984

01:14:27,189 --> 01:14:25,360

terrain relative navigation back then

1985

01:14:28,630 --> 01:14:27,199

how much of that error could have been

1986

01:14:31,030 --> 01:14:28,640

reduced i'm just trying to get a sense

1987

01:14:33,430 --> 01:14:31,040

of how much more accurate perseverance

1988

01:14:35,430 --> 01:14:33,440

will be and also for curiosity's landing

1989

01:14:38,310 --> 01:14:35,440

you drew up a grid system for gale

1990

01:14:40,229 --> 01:14:38,320

crater and named each square in the grid

1991

01:14:42,070 --> 01:14:40,239

now wondering what the name is that

1992

01:14:45,189 --> 01:14:42,080

you've given to the notional bullseye

1993

01:14:46,550 --> 01:14:45,199

square in the perseverance grid

1994

01:14:47,830 --> 01:14:46,560

i guess i'll take the first part of that

1995

01:14:49,350 --> 01:14:47,840

uh it sounded like you were talking

1996

01:14:51,189 --> 01:14:49,360

about the uh the fact that we actually

1997

01:14:53,110 --> 01:14:51,199

overshot just a little bit i'm still

1998

01:14:55,750 --> 01:14:53,120

well within our lips but uh overshot a

1999

01:14:57,669 --> 01:14:55,760

little bit on curiosity in fact uh

2000

01:14:59,990 --> 01:14:57,679

curiosity actually knew at parachute

2001

01:15:01,910 --> 01:15:00,000

deploy that it was a little bit past the

2002

01:15:03,350 --> 01:15:01,920

intended parachute deployed target but

2003

01:15:05,510 --> 01:15:03,360

it was programmed to just deploy the

2004

01:15:06,709 --> 01:15:05,520

parachute when it hit a certain velocity

2005

01:15:08,310 --> 01:15:06,719

that's what's different this time with

2006

01:15:10,149 --> 01:15:08,320

range trigger is that once we're in a

2007

01:15:12,550 --> 01:15:10,159

safe velocity range to deploy the

2008

01:15:14,709 --> 01:15:12,560

parachute it'll look at where it is the

2009

01:15:15,830 --> 01:15:14,719

range and decide whether it needs to

2010

01:15:17,830 --> 01:15:15,840

wait a little bit longer to play the

2011

01:15:20,470 --> 01:15:17,840

parachute or it's hit the right place

2012

01:15:22,310 --> 01:15:20,480

so if we had range trigger on on

2013

01:15:24,390 --> 01:15:22,320

curiosity we would have flown we would

2014

01:15:27,990 --> 01:15:24,400

have been able to eliminate a large part

2015

01:15:29,430 --> 01:15:28,000

of that error that we saw at touchdown

2016

01:15:31,750 --> 01:15:29,440

so i guess the next question was the

2017

01:15:33,669 --> 01:15:31,760

what's the bullseye named these days

2018

01:15:35,270 --> 01:15:33,679

i'll toss it over to ken yeah let me

2019

01:15:37,669 --> 01:15:35,280

help if you're not familiar with this

2020

01:15:39,590 --> 01:15:37,679

the scientists uh choose names for all

2021

01:15:41,669 --> 01:15:39,600

of their targets

2022

01:15:43,189 --> 01:15:41,679

that we study from the rover

2023

01:15:45,189 --> 01:15:43,199

we have a list of names and they are

2024

01:15:47,030 --> 01:15:45,199

actually pulled off of existing

2025

01:15:49,270 --> 01:15:47,040

terrestrial maps

2026

01:15:51,270 --> 01:15:49,280

and we are following a protocol where

2027

01:15:53,270 --> 01:15:51,280

our names will come from national parks

2028

01:15:55,830 --> 01:15:53,280

and preserves around the world

2029

01:15:59,669 --> 01:15:55,840

and i believe the most likely place we

2030

01:16:01,270 --> 01:15:59,679

will land is called tamanfaya which is a

2031

01:16:04,390 --> 01:16:01,280

national park in spain i think it's in

2032

01:16:08,229 --> 01:16:06,229

thank you alan ken up next we have a

2033

01:16:10,709 --> 01:16:08,239

social media question briny i think this

2034

01:16:12,149 --> 01:16:10,719

could be for you an average american on

2035

01:16:13,910 --> 01:16:12,159

youtube asks

2036

01:16:16,310 --> 01:16:13,920

are you going to study the surface of

2037

01:16:18,390 --> 01:16:16,320

mars i heard there might be water down

2038

01:16:20,950 --> 01:16:18,400

there

2039

01:16:23,270 --> 01:16:20,960

that's a great question yeah so you know

2040

01:16:24,950 --> 01:16:23,280

we're looking for signs of ancient water

2041

01:16:27,030 --> 01:16:24,960

mostly on mars you know whether or not

2042

01:16:28,470 --> 01:16:27,040

there's lots of water liquid water on

2043

01:16:30,390 --> 01:16:28,480

the surface today is still an open

2044

01:16:31,510 --> 01:16:30,400

question when we're trying to understand

2045

01:16:33,270 --> 01:16:31,520

you know in terms of

2046

01:16:35,270 --> 01:16:33,280

understanding modern habitability but as

2047

01:16:36,630 --> 01:16:35,280

you know ken talked about earlier this

2048

01:16:39,110 --> 01:16:36,640

mission is really about looking for

2049

01:16:40,390 --> 01:16:39,120

signs of ancient water and we know from

2050

01:16:41,830 --> 01:16:40,400

all the missions that have come before

2051

01:16:44,070 --> 01:16:41,840

this that there was lots and lots of

2052

01:16:45,189 --> 01:16:44,080

water on ancient mars billions of years

2053

01:16:46,870 --> 01:16:45,199

ago and so that's really what we're

2054

01:16:49,030 --> 01:16:46,880

targeting is things that could have

2055

01:16:51,590 --> 01:16:49,040

lived in this those ancient watery

2056

01:16:53,110 --> 01:16:51,600

environments

2057

01:16:57,669 --> 01:16:53,120

thank you now we have the phone lines

2058

01:16:59,590 --> 01:16:57,679

open again to jeff faust from space news

2059

01:17:01,750 --> 01:16:59,600

uh good afternoon a question i think

2060

01:17:05,030 --> 01:17:01,760

probably for al chen i'm curious what

2061

01:17:07,510 --> 01:17:05,040

sort of telemetry you're getting back in

2062

01:17:09,590 --> 01:17:07,520

real time effectively during

2063

01:17:11,110 --> 01:17:09,600

entry descent and landing itself

2064

01:17:13,189 --> 01:17:11,120

you talked about having a lot of these

2065

01:17:14,870 --> 01:17:13,199

cameras on various parts of the

2066

01:17:17,189 --> 01:17:14,880

spacecraft during reentry i'm curious how

2067

01:17:20,630 --> 01:17:17,199

much of that you'll be getting be able

2068

01:17:23,430 --> 01:17:20,640

to see live in effect as it lands and a

2069

01:17:24,790 --> 01:17:23,440

related question is

2070

01:17:26,870 --> 01:17:24,800

during previous landings some of the

2071

01:17:29,510 --> 01:17:26,880

most iconic scenes were in mission

2072

01:17:31,830 --> 01:17:29,520

control the celebrations during

2073

01:17:33,590 --> 01:17:31,840

successful landings i suspect with kobe

2074

01:17:35,189 --> 01:17:33,600

that's going to be a different uh scene

2075

01:17:37,350 --> 01:17:35,199

there i'm curious uh

2076

01:17:39,189 --> 01:17:37,360

how different mission control will look

2077

01:17:41,270 --> 01:17:39,199

for perseverance's landing versus

2078

01:17:43,110 --> 01:17:41,280

previous landing thanks

2079

01:17:44,390 --> 01:17:43,120

okay i think i could take those now

2080

01:17:46,229 --> 01:17:44,400

let's see uh the first question was

2081

01:17:47,750 --> 01:17:46,239

about edl communications and what we'll

2082

01:17:49,510 --> 01:17:47,760

have in real time

2083

01:17:51,430 --> 01:17:49,520

much like curiosity we are sending some

2084

01:17:53,750 --> 01:17:51,440

signals directly back to earth

2085

01:17:55,830 --> 01:17:53,760

those are what we call x-band tones you

2086

01:17:58,390 --> 01:17:55,840

can think of it like a piano with 256

2087

01:17:59,910 --> 01:17:58,400

keys and we use each of those keys to

2088

01:18:01,590 --> 01:17:59,920

mean something different

2089

01:18:03,910 --> 01:18:01,600

so we'll be have we'll have those uh

2090

01:18:05,910 --> 01:18:03,920

pretty much throughout edl until about a

2091

01:18:07,750 --> 01:18:05,920

minute before touchdown about uh time

2092

01:18:09,990 --> 01:18:07,760

right before or right after back shell

2093

01:18:12,229 --> 01:18:10,000

separation unfortunately then uh based

2094

01:18:14,550 --> 01:18:12,239

on the geometry earth will likely set

2095

01:18:17,350 --> 01:18:14,560

below the horizon of what the spacecraft

2096

01:18:19,350 --> 01:18:17,360

can see from mars so we'll have toned

2097

01:18:21,189 --> 01:18:19,360

those tones up to about a minute before

2098

01:18:23,110 --> 01:18:21,199

touchdown or so

2099

01:18:25,750 --> 01:18:23,120

second we have a telemetry coming

2100

01:18:27,669 --> 01:18:25,760

through the mars reconnaissance orbiter

2101
01:18:29,910 --> 01:18:27,679
that team has actually managed to update

2102
01:18:32,070 --> 01:18:29,920
their software so that they can support

2103
01:18:34,229 --> 01:18:32,080
what we call bent pipe communications so

2104
01:18:35,110 --> 01:18:34,239
we can send telemetry back from

2105
01:18:38,070 --> 01:18:35,120
uh

2106
01:18:39,430 --> 01:18:38,080
from perseverance through mro to earth

2107
01:18:41,669 --> 01:18:39,440
in real time there's a little bit of

2108
01:18:43,669 --> 01:18:41,679
latency but not a lot of latency

2109
01:18:45,030 --> 01:18:43,679
unfortunately that the rate that we can

2110
01:18:46,550 --> 01:18:45,040
support there is only about eight

2111
01:18:49,110 --> 01:18:46,560
kilobits per second

2112
01:18:50,950 --> 01:18:49,120
um which uh if you had dial up like me

2113
01:18:52,630 --> 01:18:50,960

i'm dating myself a little bit but uh

2114

01:18:55,270 --> 01:18:52,640

it's really slow it's pretty it's slower

2115

01:18:56,950 --> 01:18:55,280

than most style that folks had so we

2116

01:18:59,350 --> 01:18:56,960

will not be able to send things like

2117

01:19:01,350 --> 01:18:59,360

camera data or microphone data in real

2118

01:19:03,270 --> 01:19:01,360

time we'll have to send that all after

2119

01:19:04,709 --> 01:19:03,280

we land

2120

01:19:06,550 --> 01:19:04,719

i think the next part of your question

2121

01:19:08,550 --> 01:19:06,560

was uh what what mission control will

2122

01:19:10,149 --> 01:19:08,560

look like at landing

2123

01:19:11,990 --> 01:19:10,159

as you surprised right the uh the

2124

01:19:13,510 --> 01:19:12,000

coveted considerations of course make

2125

01:19:15,030 --> 01:19:13,520

sure uh mean that we have to follow

2126
01:19:16,790 --> 01:19:15,040
various protocols as well to make sure

2127
01:19:17,990 --> 01:19:16,800
that we keep ourselves safe and keep

2128
01:19:20,070 --> 01:19:18,000
each other safe

2129
01:19:22,149 --> 01:19:20,080
um so the mission control area will

2130
01:19:24,550 --> 01:19:22,159
definitely be less densely packed than

2131
01:19:26,790 --> 01:19:24,560
it was for curiosity and certainly

2132
01:19:28,950 --> 01:19:26,800
you'll see us wearing all the productive

2133
01:19:30,149 --> 01:19:28,960
equipment and other

2134
01:19:32,149 --> 01:19:30,159
other pieces of equipment like these

2135
01:19:35,270 --> 01:19:32,159
dividers that will help us keep each

2136
01:19:38,870 --> 01:19:37,990
sorry i'll just uh i'll just add that

2137
01:19:41,189 --> 01:19:38,880
uh

2138
01:19:44,229 --> 01:19:41,199

you know like every workplace as al

2139

01:19:46,070 --> 01:19:44,239

mentioned we have to instigate uh those

2140

01:19:48,470 --> 01:19:46,080

those protective

2141

01:19:49,590 --> 01:19:48,480

uh protocols to keep keep each other

2142

01:19:51,030 --> 01:19:49,600

safe

2143

01:19:53,110 --> 01:19:51,040

but assuming

2144

01:19:55,750 --> 01:19:53,120

we do have confirmation you know of

2145

01:19:57,590 --> 01:19:55,760

landing i don't think kobut's going to

2146

01:19:59,669 --> 01:19:57,600

be able to stop us from jumping up and

2147

01:20:00,950 --> 01:19:59,679

down and fist pumping so you're going to

2148

01:20:03,990 --> 01:20:00,960

see a lot of

2149

01:20:08,070 --> 01:20:04,000

happy people no matter what uh once we

2150

01:20:13,030 --> 01:20:10,790

thank you up next is leonard david from

2151

01:20:15,350 --> 01:20:13,040

scientific american

2152

01:20:17,189 --> 01:20:15,360

yes can you hear me we can hear you

2153

01:20:18,550 --> 01:20:17,199

well great uh thanks so much for doing

2154

01:20:19,990 --> 01:20:18,560

this and uh

2155

01:20:22,550 --> 01:20:20,000

quite a team

2156

01:20:25,189 --> 01:20:22,560

right right team for the red planet

2157

01:20:28,229 --> 01:20:25,199

uh i'd like to jump ahead a bit

2158

01:20:33,350 --> 01:20:28,239

and talk about the samples coming back

2159

01:20:35,510 --> 01:20:33,360

perhaps 30 31 or i think 31

2160

01:20:38,070 --> 01:20:35,520

are we still talking about a containment

2161

01:20:45,189 --> 01:20:38,080

facility for all the

2162

01:20:49,669 --> 01:20:46,550

lori would you like to try to answer

2163

01:20:51,430 --> 01:20:49,679

that so i can i can take that one

2164

01:20:52,629 --> 01:20:51,440

yes i would yeah

2165

01:20:53,750 --> 01:20:52,639

thank you

2166

01:20:59,590 --> 01:20:53,760

um

2167

01:21:02,149 --> 01:20:59,600

in in bringing the samples back from

2168

01:21:04,470 --> 01:21:02,159

mars when we think about making sure

2169

01:21:06,709 --> 01:21:04,480

that we protect ourselves back here on

2170

01:21:08,629 --> 01:21:06,719

earth in the event that potentially

2171

01:21:10,070 --> 01:21:08,639

there might be something

2172

01:21:12,070 --> 01:21:10,080

contained in those samples that we'd

2173

01:21:14,229 --> 01:21:12,080

want to protect ourselves from

2174

01:21:15,350 --> 01:21:14,239

we are thinking about that in uh

2175

01:21:16,950 --> 01:21:15,360

we've been thinking about it for quite a

2176
01:21:18,310 --> 01:21:16,960
while we're all now creating a very

2177
01:21:20,790 --> 01:21:18,320
serious thought as we're really starting

2178
01:21:22,070 --> 01:21:20,800
to begin our endeavor for uh mars sample

2179
01:21:24,149 --> 01:21:22,080
return

2180
01:21:25,669 --> 01:21:24,159
and we are in fact in the process of

2181
01:21:27,669 --> 01:21:25,679
really evaluating and thinking about

2182
01:21:29,590 --> 01:21:27,679
exactly what type of facility would be

2183
01:21:32,470 --> 01:21:29,600
the best for containing those samples

2184
01:21:33,830 --> 01:21:32,480
when they when they come back to earth

2185
01:21:35,750 --> 01:21:33,840
there's still a lot of work to be done

2186
01:21:36,470 --> 01:21:35,760
on exactly what that looks like but we

2187
01:21:38,790 --> 01:21:36,480
are

2188
01:21:41,590 --> 01:21:38,800

you know there's a broad uh agency-wide

2189

01:21:43,270 --> 01:21:41,600

uh work effort going on there and we're

2190

01:21:45,189 --> 01:21:43,280

actually bringing in expertise from

2191

01:21:46,709 --> 01:21:45,199

other agencies as well to it to

2192

01:21:49,270 --> 01:21:46,719

understand exactly what type of

2193

01:21:50,790 --> 01:21:49,280

facilities uh would be best uh

2194

01:21:52,310 --> 01:21:50,800

for that purpose

2195

01:21:55,350 --> 01:21:52,320

but yes we are we're taking that very

2196

01:22:01,270 --> 01:21:56,470

thank you

2197

01:22:03,590 --> 01:22:01,280

from irish television

2198

01:22:06,470 --> 01:22:03,600

you would be completed

2199

01:22:07,750 --> 01:22:06,480

hello leo can you hear us

2200

01:22:17,030 --> 01:22:07,760

yup

2201

01:22:17,040 --> 01:22:21,430

all right leo

2202

01:22:27,189 --> 01:22:24,950

leo enright can you hear us yes i hear

2203

01:22:29,350 --> 01:22:27,199

you fine can you hear me yes it's your

2204

01:22:32,629 --> 01:22:29,360

turn for the question

2205

01:22:34,950 --> 01:22:32,639

thanks very much uh rockwell um this is

2206

01:22:37,830 --> 01:22:34,960

for al chen uh just following up on a

2207

01:22:40,950 --> 01:22:37,840

couple of questions are is there some

2208

01:22:44,390 --> 01:22:40,960

sort of hover time uh if the vehicle

2209

01:22:46,950 --> 01:22:44,400

arrives at a certain place after release

2210

01:22:49,750 --> 01:22:46,960

uh from the back shell can it do a neil

2211

01:22:52,550 --> 01:22:49,760

armstrong can it zip across the surface

2212

01:22:55,750 --> 01:22:52,560

for a few meters if it doesn't like what

2213

01:22:58,950 --> 01:22:55,760

it's seeing uh and i also have another

2214

01:23:02,470 --> 01:22:58,960

question uh for al if i made uh as a tv

2215

01:23:05,510 --> 01:23:02,480

guy could you tell us what can we expect

2216

01:23:08,550 --> 01:23:05,520

in terms of early pictures can you

2217

01:23:10,229 --> 01:23:08,560

please try in best case scenario what

2218

01:23:14,149 --> 01:23:10,239

what are you expecting in terms of

2219

01:23:16,070 --> 01:23:14,159

pictures uh in the moments after landing

2220

01:23:18,070 --> 01:23:16,080

okay so let me try those uh i think the

2221

01:23:19,189 --> 01:23:18,080

first question was about divert

2222

01:23:20,870 --> 01:23:19,199

as part of that terrain relative

2223

01:23:22,629 --> 01:23:20,880

navigation system we've added to the

2224

01:23:23,990 --> 01:23:22,639

system uh right after back shell

2225

01:23:25,990 --> 01:23:24,000

separation we do what's called safe

2226

01:23:27,910 --> 01:23:26,000

target selection so the vehicle will

2227

01:23:29,910 --> 01:23:27,920

actually try to figure out where is the

2228

01:23:32,229 --> 01:23:29,920

nearest reachable safest landing spot

2229

01:23:33,750 --> 01:23:32,239

that it can go to and then fly there so

2230

01:23:35,270 --> 01:23:33,760

that kind of is your neil armstrong

2231

01:23:37,350 --> 01:23:35,280

moment right there right after battle

2232

01:23:39,590 --> 01:23:37,360

separation it'll use its engines to fly

2233

01:23:41,910 --> 01:23:39,600

up to about 700 meters or so

2234

01:23:44,229 --> 01:23:41,920

to in search of the best possible place

2235

01:23:46,470 --> 01:23:44,239

that it can reach at that point

2236

01:23:48,149 --> 01:23:46,480

so that is uh your divert there now the

2237

01:23:50,870 --> 01:23:48,159

next question i think was about what we

2238

01:23:52,470 --> 01:23:50,880

expect to get back camera wise um after

2239

01:23:54,870 --> 01:23:52,480

touchdown much like we saw with

2240

01:23:55,910 --> 01:23:54,880

curiosity we are taking pictures after

2241

01:23:57,350 --> 01:23:55,920

touchdown

2242

01:23:59,189 --> 01:23:57,360

assuming we are still in communication

2243

01:24:01,350 --> 01:23:59,199

with mro at that time and our vent type

2244

01:24:03,669 --> 01:24:01,360

system is working we expect to get back

2245

01:24:05,750 --> 01:24:03,679

at least low resolution images uh from

2246

01:24:07,750 --> 01:24:05,760

the front and back taking a look at both

2247

01:24:09,669 --> 01:24:07,760

the front and back of the rover um out

2248

01:24:11,350 --> 01:24:09,679

from the front and back of the rover and

2249

01:24:13,430 --> 01:24:11,360

if we have enough time depending on

2250

01:24:14,709 --> 01:24:13,440

exactly what time we landed

2251
01:24:17,590 --> 01:24:14,719
and how much additional coverage we have

2252
01:24:19,669 --> 01:24:17,600
before mro sets below the horizon we

2253
01:24:21,669 --> 01:24:19,679
expect to get some of that data

2254
01:24:23,510 --> 01:24:21,679
some higher resolution versions of those

2255
01:24:25,830 --> 01:24:23,520
pictures as well

2256
01:24:27,510 --> 01:24:25,840
past that we are we have a data return

2257
01:24:29,110 --> 01:24:27,520
plan for getting back some of the data

2258
01:24:31,189 --> 01:24:29,120
from the entry descent landing camera

2259
01:24:32,470 --> 01:24:31,199
system that's the city all those cameras

2260
01:24:33,750 --> 01:24:32,480
that are taking pictures of all sorts of

2261
01:24:36,229 --> 01:24:33,760
stuff

2262
01:24:39,110 --> 01:24:36,239
we may in the best case scenario get a

2263
01:24:41,030 --> 01:24:39,120

little bit of a taste uh the next day uh

2264

01:24:43,750 --> 01:24:41,040

but more likely over the weekend since

2265

01:24:46,550 --> 01:24:43,760

we land on thursday we'll get a decent

2266

01:24:48,229 --> 01:24:46,560

chunk of those images not quite at the

2267

01:24:50,149 --> 01:24:48,239

full resolution not the full length by

2268

01:24:52,470 --> 01:24:50,159

any means since that's a lot of data but

2269

01:24:56,310 --> 01:24:52,480

at least a good uh a good first bite at

2270

01:25:00,149 --> 01:24:58,229

great thank you al we unfortunately

2271

01:25:02,149 --> 01:25:00,159

can't answer all of the media questions

2272

01:25:04,870 --> 01:25:02,159

on air for those of you with additional

2273

01:25:07,430 --> 01:25:04,880

questions please call jpl's digital news

2274

01:25:09,830 --> 01:25:07,440

and media office we'll also continue to

2275

01:25:11,750 --> 01:25:09,840

answer social media questions online

2276

01:25:13,669 --> 01:25:11,760

thank you for your questions and thank

2277

01:25:16,070 --> 01:25:13,679

you to our panelists for joining us

2278

01:25:18,790 --> 01:25:16,080

today perseverance is set to land on

2279

01:25:22,310 --> 01:25:18,800

mars on february 18th with commentary

2280

01:25:23,110 --> 01:25:22,320

beginning at 11 15 a.m pacific standard

2281

01:25:25,189 --> 01:25:23,120

time

2282

01:25:27,590 --> 01:25:25,199

and we are offering lots of ways to ride

2283

01:25:30,310 --> 01:25:27,600

along with us to join the virtual nasa

2284

01:25:31,830 --> 01:25:30,320

social and virtual guest events register

2285

01:25:33,990 --> 01:25:31,840

for the mission to mars student

2286

01:25:36,110 --> 01:25:34,000

challenge and live stream the mars

2287

01:25:37,830 --> 01:25:36,120

landing visit

2288

01:25:40,229 --> 01:25:37,840

go.nasa.gov

2289

01:25:42,070 --> 01:25:40,239

mars 2020 tool kit

2290

01:25:44,390 --> 01:25:42,080

for those of you interested in a deeper

2291

01:25:47,189 --> 01:25:44,400

dive we have a new press kit available

2292

01:25:49,110 --> 01:25:47,199

online too with lots of information and

2293

01:25:50,070 --> 01:25:49,120

graphics describing the rover and its

2294

01:25:51,910 --> 01:25:50,080

mission

2295

01:25:54,390 --> 01:25:51,920

there you'll also have a chance to sign

2296

01:25:56,870 --> 01:25:54,400

up to send your name to mars on nasa's

2297

01:25:59,830 --> 01:25:56,880

next flight to the red planet

2298

01:26:02,550 --> 01:25:59,840

and put yourself right into the action

2299

01:26:04,629 --> 01:26:02,560

with our perseverance photo booth you

2300

01:26:07,030 --> 01:26:04,639

can pose next to the rover place

2301

01:26:08,629 --> 01:26:07,040

yourself on our mission control and even

2302

01:26:10,310 --> 01:26:08,639

see what you might look like taking a

2303

01:26:14,870 --> 01:26:10,320

selfie on the red planet

2304

01:26:17,669 --> 01:26:14,880

again it's all available at go.nasa.gov

2305

01:26:19,830 --> 01:26:17,679

mars 2020 toolkit

2306

01:26:22,229 --> 01:26:19,840

if you're on social media join the

2307

01:26:23,750 --> 01:26:22,239

conversation with the mission on

2308

01:26:26,550 --> 01:26:23,760

facebook and twitter

2309

01:26:29,910 --> 01:26:26,560

follow at nasa persevere and use the