1
00:00:00,000 --> 00:00:05,990
that you can make it real

2
00:00:10,870 --> 00:00:08,870
and here we are with mars perseverance

3
00:00:13,749 --> 00:00:10,880
51 years later getting ready to do the

4
00:00:15,669 --> 00:00:13,759
first ever mars return mission

5
00:00:17,670 --> 00:00:15,679
eventually we can bring those samples

6
00:00:18,950 --> 00:00:17,680
back to earth and determine for the very

7
00:00:20,400 --> 00:00:18,960
first time

8
00:00:28,950 --> 00:00:20,410
did life exist on mars

9
00:00:35,190 --> 00:00:32,389
in less than an hour nasa's 300 million

10
00:00:37,670 --> 00:00:35,200
mile journey from america's shore to

11
00:00:41,110 --> 00:00:37,680
jezreel crater on mars will begin with

12
00:00:43,830 --> 00:00:41,120
the launch of this atlas v rocket into

13
00:00:46,229 --> 00:00:43,840

space and at the top of that rocket with

14
00:00:49,029 --> 00:00:46,239
a beautiful sunrise and shrouded by that

15
00:00:51,910 --> 00:00:49,039
protective fairing is the perseverance

16
00:00:54,950 --> 00:00:51,920
rover headed to mars ready to ride a

17
00:00:57,670 --> 00:00:54,960
column of fire and smoke on its way to

18
00:00:59,910 --> 00:00:57,680
the red planet what a beautiful morning

19
00:01:02,630 --> 00:00:59,920
here on the space coast

20
00:01:03,750 --> 00:01:02,640
welcome everyone behind us the star of

21
00:01:06,390 --> 00:01:03,760
the show

22
00:01:09,030 --> 00:01:06,400
this is a life-size mock-up of the

23
00:01:12,310 --> 00:01:09,040
perseverance rover which is just like

24
00:01:14,550 --> 00:01:12,320
the one we are launching to space hi

25
00:01:16,789 --> 00:01:14,560
everyone i'm daryl nail and i'm mooji

26
00:01:18,789 --> 00:01:16,799
cooper in the 50 minutes leading up to

27
00:01:20,390 --> 00:01:18,799
launch we will show you how this mission

28
00:01:22,789 --> 00:01:20,400
will reach and search for ancient

29
00:01:24,390 --> 00:01:22,799
microscopic life on mars and test new

30
00:01:26,789 --> 00:01:24,400
technologies critical to the ultimate

31
00:01:28,469 --> 00:01:26,799
goal future human missions to mars

32
00:01:30,310 --> 00:01:28,479
that's right and we've got the rocket on

33
00:01:33,590 --> 00:01:30,320
the pad and it is ready to go a

34
00:01:36,630 --> 00:01:33,600
beautiful day outside we're l minus 47

35
00:01:39,670 --> 00:01:36,640
minutes and counting until launch and so

36
00:01:41,749 --> 00:01:39,680
far the countdown to mars is on track

37
00:01:44,149 --> 00:01:41,759
we've got great weather the rocket's

38
00:01:47,910 --> 00:01:44,159

looking good and it puts us on track for

39
00:01:50,870 --> 00:01:47,920
a launch at 7 50 a.m eastern time the

40
00:01:52,630 --> 00:01:50,880
beginning of a two-hour window

41
00:01:54,950 --> 00:01:52,640
in today's coverage we will hear grammy

42
00:01:56,550 --> 00:01:54,960
award winner gregory porter we'll talk

43
00:01:58,550 --> 00:01:56,560
live with derek muller of the youtube

44
00:02:01,109 --> 00:01:58,560
channel veritasium along with the

45
00:02:02,709 --> 00:02:01,119
aerospace engineers scientist and a nasa

46
00:02:05,429 --> 00:02:02,719
astronaut oh it's going to be a great

47
00:02:07,670 --> 00:02:05,439
show i love it i love it and we have

48
00:02:09,990 --> 00:02:07,680
teams from coast to coast folks helping

49
00:02:12,229 --> 00:02:10,000
us count down to mars we will go live to

50
00:02:14,309 --> 00:02:12,239
the atlas space flight operations center

51
00:02:16,630 --> 00:02:14,319
just a few miles away from us and we'll

52
00:02:18,470 --> 00:02:16,640
go live to california to jets the jet

53
00:02:20,229 --> 00:02:18,480
propulsion laboratory where the mars

54
00:02:21,830 --> 00:02:20,239
2020 mission team is standing by to

55
00:02:24,070 --> 00:02:21,840
communicate with perseverance after it

56
00:02:25,910 --> 00:02:24,080
gets to space and of course we are here

57
00:02:28,790 --> 00:02:25,920
to tell you what the perseverance

58
00:02:30,869 --> 00:02:28,800
mission is all about it's an exciting

59
00:02:32,710 --> 00:02:30,879
day for all of us here so we want to

60
00:02:34,630 --> 00:02:32,720
walk you through what you will see next

61
00:02:36,949 --> 00:02:34,640
during the countdown and the rocket

62
00:02:39,430 --> 00:02:36,959
launch so let's send it over to joshua

63
00:02:42,070 --> 00:02:39,440

santora and mick woltman who are with

64
00:02:44,390 --> 00:02:42,080
the ula and launch services program

65
00:02:45,990 --> 00:02:44,400
teams gentlemen hey good morning daryl

66
00:02:48,710 --> 00:02:46,000
i'm joshua santora and i am here at

67
00:02:50,150 --> 00:02:48,720
atlas space flight operations center

68
00:02:52,309 --> 00:02:50,160
joined by mick waltman from nasa's

69
00:02:54,070 --> 00:02:52,319
launch services program mick you excited

70
00:02:56,070 --> 00:02:54,080
to go to mars i am excited to go to mars

71
00:02:58,390 --> 00:02:56,080
this morning josh this is a great day

72
00:03:00,630 --> 00:02:58,400
the sunrise out there looks awesome on

73
00:03:01,990 --> 00:03:00,640
this rocket and ready for a great launch

74
00:03:03,589 --> 00:03:02,000
today thanks for having me on the show

75
00:03:05,589 --> 00:03:03,599
man happy to have you along providing a

76
00:03:06,869 --> 00:03:05,599
ton of good context as we go through

77
00:03:08,229 --> 00:03:06,879
before we dive into the story of

78
00:03:10,470 --> 00:03:08,239
perseverance we want to give you a

79
00:03:12,550 --> 00:03:10,480
preview of what's ahead today in the

80
00:03:14,390 --> 00:03:12,560
countdown things really got going this

81
00:03:16,710 --> 00:03:14,400
morning just after midnight actually and

82
00:03:17,750 --> 00:03:16,720
atlas 5 is just about ready to fly

83
00:03:19,750 --> 00:03:17,760
in a few more minutes we're going to get

84
00:03:21,190 --> 00:03:19,760
the final check of the weather and that

85
00:03:23,270 --> 00:03:21,200
weather report should be coming back

86
00:03:25,190 --> 00:03:23,280
really positive it's been great um all

87
00:03:26,309 --> 00:03:25,200
morning we have the terminal count ahead

88
00:03:28,390 --> 00:03:26,319

after that

89
00:03:30,070 --> 00:03:28,400
we will be proceeding through uh the

90
00:03:32,070 --> 00:03:30,080
last few minutes of the countdown and

91
00:03:34,149 --> 00:03:32,080
then the the drama will be at its peak

92
00:03:35,750 --> 00:03:34,159
at launch when the clock strikes zero

93
00:03:37,990 --> 00:03:35,760
the engines ignite and the spacecraft

94
00:03:39,910 --> 00:03:38,000
and rocket take flight

95
00:03:42,309 --> 00:03:39,920
after successfully passing through max q

96
00:03:43,910 --> 00:03:42,319
just shy of two minutes into flight the

97
00:03:45,990 --> 00:03:43,920
solid rocket boosters will be expended

98
00:03:47,270 --> 00:03:46,000
and will be jettisoned nearly two more

99
00:03:48,789 --> 00:03:47,280
minutes and the payload fairing which

100
00:03:49,750 --> 00:03:48,799
you might call the nose cone of the

101
00:03:51,350 --> 00:03:49,760
rocket

102
00:03:53,110 --> 00:03:51,360
that has been protecting perseverance

103
00:03:54,710 --> 00:03:53,120
will no longer be needed it will split

104
00:03:56,550 --> 00:03:54,720
in two halves and fall away from the

105
00:03:58,070 --> 00:03:56,560
accelerating vehicle

106
00:03:59,509 --> 00:03:58,080
one minute later the atlas booster will

107
00:04:01,509 --> 00:03:59,519
have finished its task of lifting

108
00:04:03,350 --> 00:04:01,519
perseverance above earth's atmosphere

109
00:04:05,030 --> 00:04:03,360
and being on the way to orbit

110
00:04:07,190 --> 00:04:05,040
it too will separate exposing the

111
00:04:08,949 --> 00:04:07,200
centaur rl10

112
00:04:11,190 --> 00:04:08,959
upper stage engine that will almost

113
00:04:13,350 --> 00:04:11,200

immediately begin its first burn that

114
00:04:14,949 --> 00:04:13,360
lasts approximately seven minutes

115
00:04:16,629 --> 00:04:14,959
after coasting for more than 30 minutes

116
00:04:18,150 --> 00:04:16,639
the second burn lasting around eight

117
00:04:19,909 --> 00:04:18,160
minutes will take perseverance out of

118
00:04:21,349 --> 00:04:19,919
earth orbit and into solar orbit on its

119
00:04:22,950 --> 00:04:21,359
way to mars

120
00:04:24,710 --> 00:04:22,960
that sets up spacecraft separation and

121
00:04:26,790 --> 00:04:24,720
the final milestone we're hoping to hear

122
00:04:28,629 --> 00:04:26,800
this morning the acquisition of signal

123
00:04:29,909 --> 00:04:28,639
and i say hoping to intentionally

124
00:04:31,189 --> 00:04:29,919
because it's quite possible that

125
00:04:33,189 --> 00:04:31,199
perseverance will be in perfect

126
00:04:35,189 --> 00:04:33,199
condition but we won't make contact

127
00:04:36,950 --> 00:04:35,199
during the broadcast so

128
00:04:37,830 --> 00:04:36,960
lots more to come lots ahead but daryl

129
00:04:39,270 --> 00:04:37,840
we're going to throw it back over to you

130
00:04:41,110 --> 00:04:39,280
now to tell us more about this amazing

131
00:04:43,030 --> 00:04:41,120
mission all right thank you joshua and

132
00:04:44,629 --> 00:04:43,040
mick we've got a lot of really smart

133
00:04:46,469 --> 00:04:44,639
people and talented people that we're

134
00:04:47,430 --> 00:04:46,479
going to be talking to today but let's

135
00:04:49,510 --> 00:04:47,440
begin

136
00:04:51,990 --> 00:04:49,520
with uh a scientist who's coming up in

137
00:04:52,870 --> 00:04:52,000
just a bit i want to talk a little bit

138
00:04:55,749 --> 00:04:52,880

about

139
00:04:57,990 --> 00:04:55,759
mujiga cooper who's here she is a

140
00:04:59,830 --> 00:04:58,000
planetary protection lead for this

141
00:05:01,830 --> 00:04:59,840
mission uh thank you so much you've been

142
00:05:03,590 --> 00:05:01,840
working on this for a while now yes this

143
00:05:05,430 --> 00:05:03,600
has been seven years in the making and

144
00:05:07,270 --> 00:05:05,440
i'm so excited to share this moment with

145
00:05:10,070 --> 00:05:07,280
you and with those that are viewing

146
00:05:11,909 --> 00:05:10,080
today i'm just ecstatic it's fantastic

147
00:05:12,870 --> 00:05:11,919
and we're in a launch period people

148
00:05:14,310 --> 00:05:12,880
probably want to know why are we

149
00:05:16,870 --> 00:05:14,320
launching today why are we launching

150
00:05:18,870 --> 00:05:16,880
right now um we're in a period that only

151
00:05:20,550 --> 00:05:18,880
comes around once every two years yeah

152
00:05:22,310 --> 00:05:20,560
explain that the orbits of earth and

153
00:05:24,550 --> 00:05:22,320
mars are on the same side of the sun so

154
00:05:26,950 --> 00:05:24,560
that we can reach that destination with

155
00:05:29,110 --> 00:05:26,960
less fuel so it's the best time short

156
00:05:30,950 --> 00:05:29,120
journey less power we like that and

157
00:05:33,670 --> 00:05:30,960
we're studying the climate the geology

158
00:05:35,110 --> 00:05:33,680
and searching for ancient life but who

159
00:05:36,390 --> 00:05:35,120
what kind of life are we talking about

160
00:05:38,469 --> 00:05:36,400
here well when we search we're not going

161
00:05:39,670 --> 00:05:38,479
to find dinosaur fossils right we're

162
00:05:41,590 --> 00:05:39,680
like

163
00:05:42,790 --> 00:05:41,600

unfortunately

164
00:05:46,150 --> 00:05:42,800
likely we're going to find it in the

165
00:05:47,830 --> 00:05:46,160
form of microscopic life we're hoping

166
00:05:49,670 --> 00:05:47,840
we're hoping we don't know if it's there

167
00:05:51,670 --> 00:05:49,680
right yeah i don't know okay well that's

168
00:05:54,310 --> 00:05:51,680
why we're going yes thank you very much

169
00:05:56,710 --> 00:05:54,320
moo and back here on earth our friends

170
00:05:58,950 --> 00:05:56,720
at twitter are celebrating mars 2020 in

171
00:06:01,510 --> 00:05:58,960
a very special way we want to let you

172
00:06:04,150 --> 00:06:01,520
know about check this out if you type if

173
00:06:07,110 --> 00:06:04,160
you tap the like icon on any tweet

174
00:06:09,830 --> 00:06:07,120
containing the hashtag countdown to mars

175
00:06:11,990 --> 00:06:09,840
you'll see an animation brighten up your

176
00:06:14,230 --> 00:06:12,000
screen you can check it out also the

177
00:06:16,150 --> 00:06:14,240
like button itself has a special little

178
00:06:17,990 --> 00:06:16,160
animation that you can see oh right

179
00:06:22,790 --> 00:06:18,000
there in the corner see that did you see

180
00:06:27,510 --> 00:06:25,029
it will also work in any language from

181
00:06:31,270 --> 00:06:27,520
our partner countries including spanish

182
00:06:33,909 --> 00:06:31,280
french norwegian and italian wow that is

183
00:06:36,070 --> 00:06:33,919
pretty incredible yeah and despite the

184
00:06:37,830 --> 00:06:36,080
daunting challenges nasa has a long

185
00:06:40,309 --> 00:06:37,840
history of missions to mars going all

186
00:06:42,230 --> 00:06:40,319
the way back to 1965 with the mariner 4

187
00:06:44,550 --> 00:06:42,240
spacecraft yeah we've covered a lot of

188
00:06:47,350 --> 00:06:44,560

ground on mars since then so let's head

189
00:06:49,670 --> 00:06:47,360
out to california and join jpl's raquel

190
00:06:54,469 --> 00:06:49,680
villanueva raquel what can you share

191
00:06:59,430 --> 00:06:57,029
well daryl in the past we explored the

192
00:07:01,589 --> 00:06:59,440
red planet with orbiters and landers but

193
00:07:04,390 --> 00:07:01,599
it was the ability to move around mars

194
00:07:07,270 --> 00:07:04,400
with rovers that truly helped unlock its

195
00:07:10,070 --> 00:07:07,280
secrets today i'm joined by perseverance

196
00:07:12,469 --> 00:07:10,080
deputy project manager jennifer trosper

197
00:07:15,990 --> 00:07:12,479
she has worked on every single mars

198
00:07:18,150 --> 00:07:16,000
rover mission for the past three decades

199
00:07:21,189 --> 00:07:18,160
now jennifer how does today's launch fit

200
00:07:23,510 --> 00:07:21,199
into the history of exploring mars

201
00:07:24,950 --> 00:07:23,520
well we have always been interested in

202
00:07:27,029 --> 00:07:24,960
mars because

203
00:07:28,950 --> 00:07:27,039
it's the thing that's most like earth

204
00:07:30,870 --> 00:07:28,960
that we know of and it's a little bit

205
00:07:32,790 --> 00:07:30,880
different today and so understanding

206
00:07:34,870 --> 00:07:32,800
what happened to mars will help us

207
00:07:37,830 --> 00:07:34,880
understand more about our solar system

208
00:07:40,150 --> 00:07:37,840
and also more about earth now as

209
00:07:42,790 --> 00:07:40,160
as we said mars exploration started in

210
00:07:46,309 --> 00:07:42,800
1965 with the mariner spacecraft flying

211
00:07:48,950 --> 00:07:46,319
by mars and in 1975 we actually landed

212
00:07:49,990 --> 00:07:48,960
the viking one lander on the surface of

213
00:07:51,589 --> 00:07:50,000

mars

214
00:07:54,150 --> 00:07:51,599
and then after that

215
00:07:56,230 --> 00:07:54,160
we started sending orbiters with more

216
00:07:58,629 --> 00:07:56,240
sophisticated instruments those

217
00:08:00,869 --> 00:07:58,639
instruments would do global mapping

218
00:08:03,270 --> 00:08:00,879
they'd find the minerals they'd find the

219
00:08:05,990 --> 00:08:03,280
topography of mars they'd actually study

220
00:08:08,629 --> 00:08:06,000
the weather of mars but we found out

221
00:08:10,390 --> 00:08:08,639
that those orbiters needed partners they

222
00:08:12,070 --> 00:08:10,400
needed partners to go down to the

223
00:08:14,950 --> 00:08:12,080
surface of mars and explore like a

224
00:08:17,589 --> 00:08:14,960
geologist on earthwood we walks around

225
00:08:19,510 --> 00:08:17,599
and takes pictures and maybe she takes

226
00:08:21,110 --> 00:08:19,520
some measurements that's what these

227
00:08:23,189 --> 00:08:21,120
rovers needed to do and that's really

228
00:08:23,909 --> 00:08:23,199
what started the mars rover program for

229
00:08:26,790 --> 00:08:23,919
us

230
00:08:29,189 --> 00:08:26,800
our very first rover we sent in 1997 it

231
00:08:31,909 --> 00:08:29,199
was a sojourner rover sojourner weighed

232
00:08:35,350 --> 00:08:31,919
about 25 pounds and drove all of about

233
00:08:38,149 --> 00:08:35,360
400 feet but she really showed us what

234
00:08:40,310 --> 00:08:38,159
value a rover on mars could have

235
00:08:42,310 --> 00:08:40,320
and so then the mars program started the

236
00:08:44,790 --> 00:08:42,320
follow the water theme to try to

237
00:08:46,870 --> 00:08:44,800
understand mars better and the first two

238
00:08:49,750 --> 00:08:46,880

rovers that were sent to mars to follow

239
00:08:51,990 --> 00:08:49,760
the rover were spirit and opportunity

240
00:08:56,150 --> 00:08:52,000
they landed on opposite sides of mars in

241
00:08:58,150 --> 00:08:56,160
2004 and they drove 30 miles combined

242
00:09:01,190 --> 00:08:58,160
and they both found evidence that there

243
00:09:03,670 --> 00:09:01,200
had been water on mars in the past but

244
00:09:05,590 --> 00:09:03,680
we still weren't sure whether that water

245
00:09:06,630 --> 00:09:05,600
fostered an environment that was good

246
00:09:09,509 --> 00:09:06,640
for life

247
00:09:11,910 --> 00:09:09,519
and so then we sent curiosity in 2012.

248
00:09:14,070 --> 00:09:11,920
the curiosity rover was big it had a big

249
00:09:16,949 --> 00:09:14,080
robotic arm it had a drill it had a

250
00:09:18,470 --> 00:09:16,959
science lab in the front and curiosity

251
00:09:21,190 --> 00:09:18,480
was trying to understand the

252
00:09:24,070 --> 00:09:21,200
habitability of mars could mars have

253
00:09:26,230 --> 00:09:24,080
ever fostered life could life have ever

254
00:09:28,870 --> 00:09:26,240
grown on mars

255
00:09:30,070 --> 00:09:28,880
and within months of curiosity landing

256
00:09:32,790 --> 00:09:30,080
on the surface

257
00:09:35,590 --> 00:09:32,800
she actually found an ancient habitable

258
00:09:38,150 --> 00:09:35,600
environment on mars but we still don't

259
00:09:39,910 --> 00:09:38,160
know if life ever did form on mars and

260
00:09:41,670 --> 00:09:39,920
that's the goal of the perseverance

261
00:09:44,870 --> 00:09:41,680
mission

262
00:09:47,030 --> 00:09:44,880
wow thanks jennifer and now that we

263
00:09:48,310 --> 00:09:47,040

understand how each rover mission helps

264
00:09:52,630 --> 00:09:48,320
shape the other

265
00:09:57,509 --> 00:09:55,350
you know mars is the closest place that

266
00:09:59,269 --> 00:09:57,519
we can reach with robotic exploration

267
00:10:00,870 --> 00:09:59,279
that we think had a really good chance

268
00:10:03,030 --> 00:10:00,880
of having ancient life

269
00:10:05,110 --> 00:10:03,040
the perseverance rover will land at a

270
00:10:07,190 --> 00:10:05,120
location called jezreel crater

271
00:10:09,670 --> 00:10:07,200
jezreel crater is a very interesting

272
00:10:10,470 --> 00:10:09,680
place it's a crater that once held a

273
00:10:12,069 --> 00:10:10,480
lake

274
00:10:13,829 --> 00:10:12,079
there are a lot of craters on the

275
00:10:16,150 --> 00:10:13,839
surface of mars that could have once

276
00:10:18,310 --> 00:10:16,160
hosted ancient lakes but not every

277
00:10:20,230 --> 00:10:18,320
crater that we think had a lake actually

278
00:10:22,389 --> 00:10:20,240
preserves evidence that that lake was

279
00:10:24,470 --> 00:10:22,399
there it had an inflow channel and it

280
00:10:27,030 --> 00:10:24,480
had an outflow channel that means it was

281
00:10:29,190 --> 00:10:27,040
filled the crater was filled with water

282
00:10:31,110 --> 00:10:29,200
in jezra we have probably one of the

283
00:10:35,030 --> 00:10:31,120
most beautifully preserved delta

284
00:10:37,269 --> 00:10:35,040
deposits on mars in that crater

285
00:10:39,030 --> 00:10:37,279
the major goal of the perseverance

286
00:10:41,590 --> 00:10:39,040
mission is to

287
00:10:43,590 --> 00:10:41,600
investigate astrobiology on mars in

288
00:10:46,870 --> 00:10:43,600

particular to address the question of

289
00:10:48,630 --> 00:10:46,880
whether life ever existed on mars

290
00:10:50,470 --> 00:10:48,640
the perseverance rover starts with a

291
00:10:52,550 --> 00:10:50,480
design that's very similar to curiosity

292
00:10:54,550 --> 00:10:52,560
but we've added to it a whole new set of

293
00:10:57,110 --> 00:10:54,560
science instruments and these science

294
00:10:58,949 --> 00:10:57,120
instruments were purposefully selected

295
00:11:00,710 --> 00:10:58,959
to help us in the search for

296
00:11:02,230 --> 00:11:00,720
biosignatures

297
00:11:05,190 --> 00:11:02,240
we're going to be taking

298
00:11:06,630 --> 00:11:05,200
microphones with us for the first time

299
00:11:10,310 --> 00:11:06,640
we're going to have

300
00:11:12,389 --> 00:11:10,320
that human sense on another planet

301
00:11:15,990 --> 00:11:12,399
perseverance carries with her a grand

302
00:11:18,790 --> 00:11:16,000
experiment in space fairing technology a

303
00:11:21,509 --> 00:11:18,800
helicopter the name of which is now

304
00:11:24,230 --> 00:11:21,519
ingenuity one of the major upgrades that

305
00:11:26,870 --> 00:11:24,240
perseverance has from curiosity is that

306
00:11:30,389 --> 00:11:26,880
it's able to self-drive for a distance

307
00:11:32,630 --> 00:11:30,399
of up to 200 meters per day as the rover

308
00:11:36,470 --> 00:11:32,640
is driving it's literally building the

309
00:11:38,470 --> 00:11:36,480
map of the road it's driving on on mars

310
00:11:40,630 --> 00:11:38,480
scientists for years have told us that

311
00:11:42,389 --> 00:11:40,640
to really unlock

312
00:11:44,870 --> 00:11:42,399
the secrets of mars we have to bring

313
00:11:48,310 --> 00:11:44,880

samples from mars back to earth so what

314
00:11:49,670 --> 00:11:48,320
marsh 2020 is going to do is to

315
00:11:52,150 --> 00:11:49,680
drill samples

316
00:11:54,790 --> 00:11:52,160
put them in small tubes we're going to

317
00:11:56,629 --> 00:11:54,800
seal it in its own individual tube we

318
00:11:59,190 --> 00:11:56,639
set them on the surface to provide a

319
00:12:01,110 --> 00:11:59,200
target for the second two missions

320
00:12:02,470 --> 00:12:01,120
which hopefully will get in development

321
00:12:04,389 --> 00:12:02,480
in the next several years and could

322
00:12:06,949 --> 00:12:04,399
potentially get the samples back to

323
00:12:10,069 --> 00:12:06,959
earth by 2031.

324
00:12:11,350 --> 00:12:10,079
perseverance is a very very profound

325
00:12:13,910 --> 00:12:11,360
first step

326
00:12:15,430 --> 00:12:13,920
in both our understanding

327
00:12:16,710 --> 00:12:15,440
of our place

328
00:12:17,509 --> 00:12:16,720
in the universe

329
00:12:19,110 --> 00:12:17,519
and

330
00:12:26,790 --> 00:12:19,120
a stepping stone towards human

331
00:12:30,389 --> 00:12:28,710
and a great breakdown of the rover there

332
00:12:32,790 --> 00:12:30,399
welcome back to the kennedy space center

333
00:12:35,509 --> 00:12:32,800
in florida where our next mars rover

334
00:12:37,509 --> 00:12:35,519
will be propelled into space by an atlas

335
00:12:39,190 --> 00:12:37,519
v rocket and the man who leads the

336
00:12:42,069 --> 00:12:39,200
company tasked with safely getting

337
00:12:44,389 --> 00:12:42,079
perseverance off this planet is tory

338
00:12:46,389 --> 00:12:44,399

bruno he is the ceo and president of

339
00:12:48,870 --> 00:12:46,399
united launch alliance we appreciate you

340
00:12:51,110 --> 00:12:48,880
being here tony this morning oh happy to

341
00:12:53,190 --> 00:12:51,120
be here howard the launch team how was

342
00:12:55,030 --> 00:12:53,200
the launch team doing how are you doing

343
00:12:56,870 --> 00:12:55,040
well the launch team is doing great

344
00:12:58,790 --> 00:12:56,880
they've been on station for hours

345
00:13:00,710 --> 00:12:58,800
they're calm they're confident they're

346
00:13:02,870 --> 00:13:00,720
going through the script i'm a little

347
00:13:05,590 --> 00:13:02,880
nervous but i always get nervous before

348
00:13:07,509 --> 00:13:05,600
all of my 400 launches so

349
00:13:09,910 --> 00:13:07,519
why do you get nervous well you know a

350
00:13:12,790 --> 00:13:09,920
rocket is such an incredibly powerful

351
00:13:16,470 --> 00:13:12,800
and complex machine everything has to go

352
00:13:18,470 --> 00:13:16,480
right nothing can go wrong and

353
00:13:20,550 --> 00:13:18,480
it's just it never gets old it's always

354
00:13:22,550 --> 00:13:20,560
the same it's always exciting yes and

355
00:13:24,230 --> 00:13:22,560
this is a particularly exciting mission

356
00:13:26,870 --> 00:13:24,240
talk a little bit about that this is the

357
00:13:29,269 --> 00:13:26,880
largest and heaviest rover

358
00:13:31,670 --> 00:13:29,279
that we've ever sent to the red planet

359
00:13:33,670 --> 00:13:31,680
so how did you configure your rocket to

360
00:13:37,430 --> 00:13:33,680
do this launch effectively yeah this is

361
00:13:40,150 --> 00:13:37,440
our second most powerful atlas the 541

362
00:13:44,150 --> 00:13:40,160
we call it the dominator it's got four

363
00:13:46,310 --> 00:13:44,160

giant srbs each putting out 350 000

364
00:13:47,189 --> 00:13:46,320
pounds of thrust to augment the center

365
00:13:49,509 --> 00:13:47,199
core

366
00:13:52,069 --> 00:13:49,519
and so it has got the power to get out

367
00:13:53,829 --> 00:13:52,079
there to mars as well as the precision

368
00:13:56,470 --> 00:13:53,839
it's the most accurate rocket in the

369
00:13:59,509 --> 00:13:56,480
world because when we let it go it's got

370
00:14:02,150 --> 00:13:59,519
about 200 million miles to travel on

371
00:14:04,870 --> 00:14:02,160
that transfer orbit and precision is key

372
00:14:06,550 --> 00:14:04,880
that is right yes so the power source

373
00:14:08,230 --> 00:14:06,560
for the mars rover is a contained

374
00:14:10,150 --> 00:14:08,240
radioactive battery i've seen it up

375
00:14:12,389 --> 00:14:10,160
close and we had to alter the way we

376
00:14:14,710 --> 00:14:12,399
behaved around that how has that changed

377
00:14:16,710 --> 00:14:14,720
your team's efforts oh yes the

378
00:14:18,310 --> 00:14:16,720
operations around that are completely

379
00:14:20,310 --> 00:14:18,320
different now we have a lot of

380
00:14:22,470 --> 00:14:20,320
experience with these we've flown all of

381
00:14:24,470 --> 00:14:22,480
america's rtgs and we're the only

382
00:14:27,189 --> 00:14:24,480
provider that is certified to handle

383
00:14:29,430 --> 00:14:27,199
them but you know it is still 11 pounds

384
00:14:31,509 --> 00:14:29,440
of plutonium as you saw

385
00:14:34,389 --> 00:14:31,519
and in this particular case the one very

386
00:14:36,949 --> 00:14:34,399
special thing was to install it in the

387
00:14:38,949 --> 00:14:36,959
vif where we would normally never breach

388
00:14:41,670 --> 00:14:38,959

the containment around the spacecraft it

389
00:14:44,069 --> 00:14:41,680
has to be clean and biological free but

390
00:14:46,389 --> 00:14:44,079
we created a portable clean room and

391
00:14:48,310 --> 00:14:46,399
brought this nuclear battery out and

392
00:14:50,790 --> 00:14:48,320
installed it in the machine while

393
00:14:52,550 --> 00:14:50,800
keeping everything perfect awesome can

394
00:14:54,230 --> 00:14:52,560
you explain what the vip is actually

395
00:14:56,629 --> 00:14:54,240
before i let that go this is the

396
00:14:59,670 --> 00:14:56,639
vertical integration facility so these

397
00:15:01,509 --> 00:14:59,680
rockets are so gigantic we build them in

398
00:15:03,829 --> 00:15:01,519
a factory but we can't assemble them

399
00:15:06,389 --> 00:15:03,839
there yeah atlas and perseverance are

400
00:15:09,030 --> 00:15:06,399
standing 20 stories proud right now in

401
00:15:11,910 --> 00:15:09,040
the pad so they come to here on they

402
00:15:14,470 --> 00:15:11,920
come to canaveral in pieces on our

403
00:15:16,949 --> 00:15:14,480
rocket ship and then we assemble them in

404
00:15:18,629 --> 00:15:16,959
the vertical integration facility and

405
00:15:21,509 --> 00:15:18,639
normally the last thing would be to

406
00:15:23,670 --> 00:15:21,519
bring an encapsulated under the fairing

407
00:15:26,389 --> 00:15:23,680
perfectly clean and prepared spacecraft

408
00:15:29,670 --> 00:15:26,399
and put it on top which we did but then

409
00:15:30,710 --> 00:15:29,680
we opened it to install the mm rtg

410
00:15:32,470 --> 00:15:30,720
battery

411
00:15:34,550 --> 00:15:32,480
now that came late in the process and

412
00:15:36,150 --> 00:15:34,560
that was intentional yeah

413
00:15:39,030 --> 00:15:36,160

you mentioned there's a certification

414
00:15:41,189 --> 00:15:39,040
for who certifies the rocket so nasa

415
00:15:43,269 --> 00:15:41,199
certifies the rocket and then nasa and

416
00:15:45,910 --> 00:15:43,279
the department of energy certify a

417
00:15:48,069 --> 00:15:45,920
provider like us to handle a nuclear

418
00:15:50,150 --> 00:15:48,079
payload because of all these special

419
00:15:52,069 --> 00:15:50,160
requirements very good you know when you

420
00:15:54,230 --> 00:15:52,079
were preparing for this mission you

421
00:15:56,310 --> 00:15:54,240
couldn't have imagined uh you know a

422
00:15:58,949 --> 00:15:56,320
year ago that you would have

423
00:16:00,710 --> 00:15:58,959
a coronavirus pandemic oh yes wreaking

424
00:16:02,629 --> 00:16:00,720
havoc on this state

425
00:16:04,710 --> 00:16:02,639
how did you uh

426
00:16:06,470 --> 00:16:04,720
handle that and how'd you overcome it

427
00:16:09,110 --> 00:16:06,480
yes well you know the one big lesson

428
00:16:11,749 --> 00:16:09,120
learned here is you can't buy back time

429
00:16:13,749 --> 00:16:11,759
so when this broke out our response was

430
00:16:16,230 --> 00:16:13,759
early it was aggressive

431
00:16:18,150 --> 00:16:16,240
and fortunately it was effective so we

432
00:16:20,069 --> 00:16:18,160
did all the things you might be familiar

433
00:16:22,470 --> 00:16:20,079
with you know we wipe down every surface

434
00:16:25,110 --> 00:16:22,480
every hour we deep clean every evening

435
00:16:27,509 --> 00:16:25,120
we are wearing ppe we have our teams

436
00:16:29,990 --> 00:16:27,519
spread out we actually change the flow

437
00:16:32,069 --> 00:16:30,000
of the work to keep our people safe but

438
00:16:34,710 --> 00:16:32,079

to also keep these vitally important

439
00:16:36,949 --> 00:16:34,720
missions going and of course i can't say

440
00:16:39,030 --> 00:16:36,959
enough about our team they're so

441
00:16:40,550 --> 00:16:39,040
disciplined and so courageous to

442
00:16:42,230 --> 00:16:40,560
persevere

443
00:16:44,629 --> 00:16:42,240
through all of this

444
00:16:46,870 --> 00:16:44,639
and now to make our third launch under

445
00:16:47,990 --> 00:16:46,880
all of these mitigations i'm just so

446
00:16:50,470 --> 00:16:48,000
proud of them

447
00:16:52,230 --> 00:16:50,480
well tory bruno ceo of united launch

448
00:16:54,150 --> 00:16:52,240
alliance we appreciate you being here

449
00:16:55,829 --> 00:16:54,160
sharing your knowledge with us good luck

450
00:16:56,550 --> 00:16:55,839
with the rocket launch today and enjoy

451
00:16:58,470 --> 00:16:56,560
it

452
00:17:00,389 --> 00:16:58,480
thank you very much go atlas go

453
00:17:02,550 --> 00:17:00,399
perseverance all right

454
00:17:04,470 --> 00:17:02,560
the countdown to mars is well underway

455
00:17:06,150 --> 00:17:04,480
let's go to our launch commentator team

456
00:17:08,470 --> 00:17:06,160
for an update on the pre-launch efforts

457
00:17:10,230 --> 00:17:08,480
and a weather forecast joshua

458
00:17:12,549 --> 00:17:10,240
hey thanks moo operations this morning

459
00:17:13,990 --> 00:17:12,559
have been really pretty quiet uh can you

460
00:17:15,429 --> 00:17:14,000
tell us what's transpired to get the

461
00:17:17,189 --> 00:17:15,439
rocket to the point that it is today

462
00:17:18,710 --> 00:17:17,199
right at this moment yeah actually josh

463
00:17:19,909 --> 00:17:18,720

it's great to be have a quiet countdown

464
00:17:22,309 --> 00:17:19,919
this morning that means really good

465
00:17:24,230 --> 00:17:22,319
things for us here in the asoc but the

466
00:17:26,390 --> 00:17:24,240
teams did come on station today about

467
00:17:28,069 --> 00:17:26,400
midnight they got on station started

468
00:17:29,750 --> 00:17:28,079
configuring the launch vehicle getting

469
00:17:31,990 --> 00:17:29,760
it ready for fueling as we've been

470
00:17:34,470 --> 00:17:32,000
listening to them fuel the first stage

471
00:17:36,789 --> 00:17:34,480
atlas with locks and the second stage

472
00:17:38,070 --> 00:17:36,799
centaur upper stage with cryogenics the

473
00:17:39,590 --> 00:17:38,080
team continues to do that they've

474
00:17:41,750 --> 00:17:39,600
checked out the avionics electrical

475
00:17:43,510 --> 00:17:41,760
systems they've also done a

476
00:17:45,830 --> 00:17:43,520
flight termination system check with the

477
00:17:47,190 --> 00:17:45,840
range so all systems are looking nominal

478
00:17:49,270 --> 00:17:47,200
and the team is now currently in their

479
00:17:51,110 --> 00:17:49,280
t-minus four and holding and just

480
00:17:53,430 --> 00:17:51,120
assessing the telemetry and the launch

481
00:17:55,990 --> 00:17:53,440
vehicle as we get ready to lift off this

482
00:17:57,510 --> 00:17:56,000
morning yeah and it is a programmed hold

483
00:17:59,430 --> 00:17:57,520
um so this is part of the plan this is

484
00:18:01,190 --> 00:17:59,440
not anything going wrong we do have a

485
00:18:03,029 --> 00:18:01,200
two hour window today but everything is

486
00:18:04,950 --> 00:18:03,039
charging ahead towards that 7 50 a.m

487
00:18:06,630 --> 00:18:04,960
eastern liftoff time we want to

488
00:18:08,150 --> 00:18:06,640

introduce you to a few of the teams

489
00:18:10,950 --> 00:18:08,160
involved this morning we want to start

490
00:18:12,470 --> 00:18:10,960
with the u.s space force

491
00:18:15,110 --> 00:18:12,480
they're responsible for the range

492
00:18:16,070 --> 00:18:15,120
operations and weather activities um so

493
00:18:17,270 --> 00:18:16,080
tell me about the range really fast

494
00:18:18,950 --> 00:18:17,280
before we get this weather briefing in

495
00:18:20,789 --> 00:18:18,960
just a few seconds yes the united states

496
00:18:22,310 --> 00:18:20,799
space force is responsible for public

497
00:18:23,830 --> 00:18:22,320
and personnel safety here at cape

498
00:18:25,590 --> 00:18:23,840
canaveral air force station and kennedy

499
00:18:27,110 --> 00:18:25,600
space center where we're launching from

500
00:18:28,630 --> 00:18:27,120
so very important part of the mission

501
00:18:30,070 --> 00:18:28,640
today they are one of five teams that

502
00:18:31,990 --> 00:18:30,080
are working with us

503
00:18:34,070 --> 00:18:32,000
to launch mars perseverance on its way

504
00:18:36,390 --> 00:18:34,080
this morning and an important part of

505
00:18:38,549 --> 00:18:36,400
that not only public safety but is they

506
00:18:39,909 --> 00:18:38,559
also do weather for us to make sure that

507
00:18:41,669 --> 00:18:39,919
everything looks good as we saw that

508
00:18:42,630 --> 00:18:41,679
sunrise this morning come up right

509
00:18:47,830 --> 00:18:42,640
behind

510
00:19:00,390 --> 00:18:51,110
conduct by the briefing on channel 8

511
00:19:13,190 --> 00:19:10,310
so

512
00:19:15,590 --> 00:19:13,200
that for you live and apparently the

513
00:19:17,110 --> 00:19:15,600

audio is on another channel forgive us

514
00:19:19,510 --> 00:19:17,120
we should be looking at a visible

515
00:19:20,630 --> 00:19:19,520
satellite image we have now mostly clear

516
00:19:22,789 --> 00:19:20,640
skies

517
00:19:25,750 --> 00:19:22,799
a few clouds off to the east over the

518
00:19:28,070 --> 00:19:25,760
water we were monitoring one cell on the

519
00:19:29,750 --> 00:19:28,080
radar 10 miles to our southeast which

520
00:19:32,470 --> 00:19:29,760
has dissipated so things are looking

521
00:19:34,789 --> 00:19:32,480
great for launch

522
00:19:36,870 --> 00:19:34,799
we are go on all lccs and expected to

523
00:19:39,190 --> 00:19:36,880
remain go through the count

524
00:19:41,029 --> 00:19:39,200
our temperature is currently 80 degrees

525
00:19:43,510 --> 00:19:41,039
could climb to 82 by the end of the

526
00:19:45,510 --> 00:19:43,520
window winds are currently from two to

527
00:19:47,909 --> 00:19:45,520
zero eight not sustained with peaks to

528
00:19:50,150 --> 00:19:47,919
ten knots ten percent pov for the

529
00:19:51,750 --> 00:19:50,160
cumulus cloud rule

530
00:19:53,270 --> 00:19:51,760
proton flux is at normal background

531
00:19:54,710 --> 00:19:53,280
levels and expected to remain sowed

532
00:19:55,830 --> 00:19:54,720
through the count this concludes the

533
00:20:00,789 --> 00:19:55,840
weather brief unless there are any

534
00:20:05,110 --> 00:20:02,950
all right so i think we're in good shape

535
00:20:08,630 --> 00:20:05,120
uh we heard a great report there again

536
00:20:11,350 --> 00:20:08,640
hearing the go on all lcc's launch uh

537
00:20:13,029 --> 00:20:11,360
absolutely lcc launch community

538
00:20:15,430 --> 00:20:13,039

commitment criteria i can never remember

539
00:20:17,350 --> 00:20:15,440
the second c i appreciate that so uh

540
00:20:18,789 --> 00:20:17,360
tell us about the t clock because

541
00:20:20,549 --> 00:20:18,799
obviously we mentioned we're at t minus

542
00:20:21,750 --> 00:20:20,559
four minutes and holding so we have a

543
00:20:23,190 --> 00:20:21,760
difference here in these two clocks

544
00:20:24,789 --> 00:20:23,200
today yeah so the teams actually are

545
00:20:26,789 --> 00:20:24,799
working to two different clocks the l

546
00:20:29,029 --> 00:20:26,799
clock or what we call the launch time or

547
00:20:30,710 --> 00:20:29,039
l minus time is the real time clock

548
00:20:33,190 --> 00:20:30,720
which continues to count down towards

549
00:20:35,430 --> 00:20:33,200
liftoff t time that's the clock that the

550
00:20:38,070 --> 00:20:35,440
team uses for operational sequences of

551
00:20:40,070 --> 00:20:38,080
events in the procedure this time has

552
00:20:42,070 --> 00:20:40,080
built-in holds in it one of which we're

553
00:20:44,470 --> 00:20:42,080
in right now 30-minute hold which allows

554
00:20:47,110 --> 00:20:44,480
the team to adjust things that they need

555
00:20:48,870 --> 00:20:47,120
to do throughout the countdown tonight

556
00:20:50,630 --> 00:20:48,880
so the l clock will continue counting

557
00:20:52,870 --> 00:20:50,640
down and what's unique about this is

558
00:20:54,789 --> 00:20:52,880
that l minus four or t minus four as we

559
00:20:56,789 --> 00:20:54,799
pick up the count these two clocks will

560
00:20:58,070 --> 00:20:56,799
sync up and we will count down to lift

561
00:20:59,590 --> 00:20:58,080
off this morning

562
00:21:00,950 --> 00:20:59,600
one of the things we want to kind of

563
00:21:02,549 --> 00:21:00,960

piggyback off of the weather briefing

564
00:21:04,149 --> 00:21:02,559
for us to talk about the power source

565
00:21:06,149 --> 00:21:04,159
for perseverance

566
00:21:08,470 --> 00:21:06,159
perseverance actually has a nuclear

567
00:21:09,909 --> 00:21:08,480
battery which that might be a little bit

568
00:21:11,669 --> 00:21:09,919
alarming for people to hear that it's

569
00:21:13,750 --> 00:21:11,679
not a nuclear reactor it's a nuclear

570
00:21:15,590 --> 00:21:13,760
battery and it's actually something that

571
00:21:17,590 --> 00:21:15,600
has been developed by the department of

572
00:21:19,669 --> 00:21:17,600
energy for this kind of a purpose it's a

573
00:21:21,590 --> 00:21:19,679
multi-mission radio isotope

574
00:21:24,149 --> 00:21:21,600
thermoelectric generator which is a

575
00:21:26,310 --> 00:21:24,159
mouthful but it's an mm-rtg it's roughly

576
00:21:28,950 --> 00:21:26,320
the size of a five-gallon bucket

577
00:21:30,549 --> 00:21:28,960
and it is designed to actually make how

578
00:21:32,789 --> 00:21:30,559
does this actually produce power for the

579
00:21:34,470 --> 00:21:32,799
robot so it's using a

580
00:21:36,630 --> 00:21:34,480
nuclear material inside right to

581
00:21:38,149 --> 00:21:36,640
generate the electricity that's there

582
00:21:40,230 --> 00:21:38,159
starting off the mission today it'll be

583
00:21:42,230 --> 00:21:40,240
about 110 watts of power that provides

584
00:21:44,230 --> 00:21:42,240
the spacecraft as we lift off and it'll

585
00:21:45,990 --> 00:21:44,240
provide power for mars perseverance

586
00:21:47,350 --> 00:21:46,000
throughout its whole mission life so

587
00:21:49,590 --> 00:21:47,360
that's the unique thing about this

588
00:21:51,510 --> 00:21:49,600

battery source that's it's pretty neat

589
00:21:53,909 --> 00:21:51,520
is uh that it will continue for the

590
00:21:56,549 --> 00:21:53,919
whole time yeah the atlas 5 has a

591
00:21:58,070 --> 00:21:56,559
perfect launch record um so it's in good

592
00:21:59,510 --> 00:21:58,080
shape so we're not expecting any

593
00:22:01,430 --> 00:21:59,520
problems but if there were a contingency

594
00:22:02,549 --> 00:22:01,440
today we'd want you to stay with us to

595
00:22:04,070 --> 00:22:02,559
talk through some of the details and

596
00:22:05,430 --> 00:22:04,080
we'd be providing advisories we have

597
00:22:06,950 --> 00:22:05,440
teams that have been focused on this

598
00:22:09,029 --> 00:22:06,960
specifically and they're working towards

599
00:22:10,710 --> 00:22:09,039
making sure that everybody is safe and

600
00:22:12,870 --> 00:22:10,720
our robotic explorers are safe as well

601
00:22:14,149 --> 00:22:12,880
so that's going to do it for now a great

602
00:22:15,909 --> 00:22:14,159
weather briefing we'll send it back over

603
00:22:18,070 --> 00:22:15,919
to you to daryl and moo

604
00:22:20,310 --> 00:22:18,080
thanks joshua with the countdown to mars

605
00:22:21,830 --> 00:22:20,320
well underway we want to take a moment

606
00:22:24,149 --> 00:22:21,840
to honor our country with the singing of

607
00:22:26,549 --> 00:22:24,159
america the beautiful we are proud to

608
00:22:31,010 --> 00:22:26,559
present to you now two-time grammy

609
00:22:41,830 --> 00:22:37,909
[Music]

610
00:22:43,700 --> 00:22:41,840
lori glaze come on down

611
00:23:04,310 --> 00:22:43,710
good morning

612
00:23:07,920 --> 00:23:05,400
majesty

613
00:23:09,990 --> 00:23:07,930

[Music]

614
00:23:11,070 --> 00:23:10,000
[Applause]

615
00:23:16,789 --> 00:23:11,080
the

616
00:23:22,630 --> 00:23:18,570
americans

617
00:23:27,029 --> 00:23:22,640
[Music]

618
00:23:32,790 --> 00:23:28,630
god

619
00:23:46,149 --> 00:23:44,230
[Music]

620
00:23:49,010 --> 00:23:46,159
from sea

621
00:23:56,510 --> 00:23:49,020
to shining

622
00:23:57,230 --> 00:23:56,520
[Music]

623
00:24:03,350 --> 00:23:57,240
[Applause]

624
00:24:07,850 --> 00:24:04,630
god

625
00:24:30,149 --> 00:24:07,860
sent his grace

626
00:24:43,750 --> 00:24:32,020
see

627
00:24:49,510 --> 00:24:46,710
the beautiful baritone voice of grammy

628
00:24:53,269 --> 00:24:49,520
award-winning singer gregory porter that

629
00:24:55,190 --> 00:24:53,279
was outstanding it was so emotional ah

630
00:24:57,110 --> 00:24:55,200
if i could launch the rocket right now

631
00:24:58,149 --> 00:24:57,120
after that see some rockets red red

632
00:24:59,350 --> 00:24:58,159
glare

633
00:25:00,789 --> 00:24:59,360
perfect

634
00:25:01,990 --> 00:25:00,799
thank you very much mr porter we

635
00:25:04,630 --> 00:25:02,000
appreciate that

636
00:25:06,789 --> 00:25:04,640
so perseverance will seek to unlock many

637
00:25:09,029 --> 00:25:06,799
mysteries about mars but remote

638
00:25:11,029 --> 00:25:09,039

scientific instruments can only go so

639
00:25:13,269 --> 00:25:11,039
far joining us now to talk about

640
00:25:15,590 --> 00:25:13,279
returning mars samples back to earth is

641
00:25:17,590 --> 00:25:15,600
dr lori glaze director of nasa's

642
00:25:19,110 --> 00:25:17,600
planetary science division thank you so

643
00:25:21,590 --> 00:25:19,120
much for joining us today it's my

644
00:25:23,350 --> 00:25:21,600
pleasure happy to be here yeah first can

645
00:25:26,149 --> 00:25:23,360
you talk to us about the value of

646
00:25:28,390 --> 00:25:26,159
studying mars samples here on earth

647
00:25:29,750 --> 00:25:28,400
you bet so one of the most exciting

648
00:25:31,430 --> 00:25:29,760
parts of this mission of course is that

649
00:25:33,510 --> 00:25:31,440
we're going to drill samples that we're

650
00:25:35,350 --> 00:25:33,520
going to go back to mars and pick up and

651
00:25:37,830 --> 00:25:35,360
bring back to earth and part of the

652
00:25:39,510 --> 00:25:37,840
reason for that is the main reason is

653
00:25:41,190 --> 00:25:39,520
that we can only go so far with the

654
00:25:43,510 --> 00:25:41,200
instruments that we have on the rover

655
00:25:45,750 --> 00:25:43,520
they're wonderful it's a great suite but

656
00:25:47,669 --> 00:25:45,760
nothing compared to the state-of-the-art

657
00:25:49,669 --> 00:25:47,679
instruments in the laboratories around

658
00:25:51,510 --> 00:25:49,679
the world so we really want to get those

659
00:25:54,549 --> 00:25:51,520
precious samples back here so that we

660
00:25:57,510 --> 00:25:54,559
can do that really in-depth analysis of

661
00:25:59,830 --> 00:25:57,520
the samples here in addition to that not

662
00:26:01,590 --> 00:25:59,840
only do we want to study them now today

663
00:26:04,149 --> 00:26:01,600

with those state-of-the-art instruments

664
00:26:06,950 --> 00:26:04,159
and facilities we can preserve actually

665
00:26:08,549 --> 00:26:06,960
most of the sample for decades and that

666
00:26:09,430 --> 00:26:08,559
will allow us to

667
00:26:10,630 --> 00:26:09,440
use

668
00:26:12,710 --> 00:26:10,640
future instruments that haven't even

669
00:26:14,230 --> 00:26:12,720
been invented yet or

670
00:26:15,909 --> 00:26:14,240
you know answer questions we haven't

671
00:26:17,350 --> 00:26:15,919
even thought of yet so that's it's

672
00:26:18,870 --> 00:26:17,360
really important to get those samples

673
00:26:21,430 --> 00:26:18,880
back here and

674
00:26:23,510 --> 00:26:21,440
could we confirm life if it if it is

675
00:26:24,870 --> 00:26:23,520
there with the instruments we have on

676
00:26:26,710 --> 00:26:24,880
the rover or would that actually

677
00:26:28,470 --> 00:26:26,720
actually happen back on earth i fully

678
00:26:29,990 --> 00:26:28,480
expect we won't be able to make that

679
00:26:31,590 --> 00:26:30,000
real determination until they're back

680
00:26:33,430 --> 00:26:31,600
here on earth we expect with the

681
00:26:35,830 --> 00:26:33,440
instruments we have on board to be able

682
00:26:37,510 --> 00:26:35,840
to detect bio signatures and the types

683
00:26:40,789 --> 00:26:37,520
of things that say yes this is a sample

684
00:26:42,630 --> 00:26:40,799
that may contain evidence of past life

685
00:26:44,390 --> 00:26:42,640
in the sample but i think it would be

686
00:26:45,909 --> 00:26:44,400
very difficult to confirm that until we

687
00:26:47,750 --> 00:26:45,919
actually get the samples back here on

688
00:26:48,710 --> 00:26:47,760

earth speaking of getting them back here

689
00:26:50,789 --> 00:26:48,720
to earth

690
00:26:53,029 --> 00:26:50,799
the key part of this how will you do

691
00:26:55,110 --> 00:26:53,039
that that's a great question we're

692
00:26:57,350 --> 00:26:55,120
already starting work on that next

693
00:26:58,390 --> 00:26:57,360
mission called marsh sample return we

694
00:27:01,269 --> 00:26:58,400
think it's going to launch we're

695
00:27:03,190 --> 00:27:01,279
planning for a launch in 2026 this is a

696
00:27:05,750 --> 00:27:03,200
really complex submission it's going to

697
00:27:07,430 --> 00:27:05,760
require two launches from earth and one

698
00:27:09,350 --> 00:27:07,440
launch from mars in order to get those

699
00:27:11,430 --> 00:27:09,360
samples back here we're working really

700
00:27:13,590 --> 00:27:11,440
closely with the european space agency

701
00:27:15,750 --> 00:27:13,600
our core partners on this mission so

702
00:27:16,470 --> 00:27:15,760
we'll have a launch from the us which

703
00:27:20,310 --> 00:27:16,480
will

704
00:27:22,149 --> 00:27:20,320
land on the surface carrying a fetch

705
00:27:24,870 --> 00:27:22,159
rover that will go out and pick up the

706
00:27:26,789 --> 00:27:24,880
samples bring them back load them into a

707
00:27:29,110 --> 00:27:26,799
rocket the mars ascent vehicle and

708
00:27:30,630 --> 00:27:29,120
launch them into orbit around mars at

709
00:27:32,870 --> 00:27:30,640
the same time when we launched from

710
00:27:35,110 --> 00:27:32,880
earth the europeans are also launching

711
00:27:36,789 --> 00:27:35,120
an orbiter from earth that will be in

712
00:27:38,549 --> 00:27:36,799
orbit around mars

713
00:27:40,630 --> 00:27:38,559

and it will capture

714
00:27:42,630 --> 00:27:40,640
those samples with that orbiter we're

715
00:27:45,510 --> 00:27:42,640
going to capture them and then it will

716
00:27:47,350 --> 00:27:45,520
make its return trip back to earth

717
00:27:49,190 --> 00:27:47,360
release them and they'll come down and

718
00:27:51,430 --> 00:27:49,200
land in the utah desert where we will

719
00:27:53,830 --> 00:27:51,440
then safely carry them and put them in

720
00:27:55,909 --> 00:27:53,840
the curation facility wow what a process

721
00:27:57,430 --> 00:27:55,919
awesome that is so amazing thank you so

722
00:28:00,630 --> 00:27:57,440
much lori for joining us today we

723
00:28:02,950 --> 00:28:00,640
appreciate your time enjoy the launch

724
00:28:03,990 --> 00:28:02,960
go perseverance go ingenuity thank you

725
00:28:06,470 --> 00:28:04,000
lori

726
00:28:08,470 --> 00:28:06,480
well in the early 1900s the wright

727
00:28:11,430 --> 00:28:08,480
brothers proved powered flight was

728
00:28:13,909 --> 00:28:11,440
possible on earth now nasa plans to test

729
00:28:16,310 --> 00:28:13,919
a powered flight on mars with an

730
00:28:18,630 --> 00:28:16,320
ingenious helicopter so let's get back

731
00:28:21,269 --> 00:28:18,640
out to california now and raquel the

732
00:28:23,669 --> 00:28:21,279
martian atmosphere is 99

733
00:28:29,029 --> 00:28:23,679
less dense than here on earth so this is

734
00:28:33,750 --> 00:28:31,750
it is sterile now hitching a ride on the

735
00:28:35,830 --> 00:28:33,760
perseverance rover is an exciting

736
00:28:38,630 --> 00:28:35,840
technology demonstration the mars

737
00:28:41,029 --> 00:28:38,640
ingenuity helicopter now if successful

738
00:28:43,590 --> 00:28:41,039

it would mark the first time humans have

739
00:28:45,990 --> 00:28:43,600
taken powered flight on another planet

740
00:28:48,230 --> 00:28:46,000
ingenuity's project manager mimi ong

741
00:28:50,630 --> 00:28:48,240
joins us now to talk about the set of

742
00:28:53,430 --> 00:28:50,640
milestones ingenuity needs to hit in

743
00:28:55,269 --> 00:28:53,440
order to take flight on mars

744
00:28:58,470 --> 00:28:55,279
hi by the way we just had an earthquake

745
00:29:01,590 --> 00:28:58,480
in this room but anyway with that um

746
00:29:03,430 --> 00:29:01,600
mars helicopter tech demo is motivated

747
00:29:05,830 --> 00:29:03,440
by the potential of adding the aerial

748
00:29:08,870 --> 00:29:05,840
dimension to space exploration in the

749
00:29:11,430 --> 00:29:08,880
future a helicopter can serve as a scout

750
00:29:13,430 --> 00:29:11,440
for rovers and astronauts a helicopter

751
00:29:15,669 --> 00:29:13,440
can get us to places of high scientific

752
00:29:17,990 --> 00:29:15,679
interest that cannot be reached today

753
00:29:20,149 --> 00:29:18,000
it's not easy to build a rotograph for

754
00:29:22,149 --> 00:29:20,159
flight at mars the atmosphere there is

755
00:29:24,789 --> 00:29:22,159
very thin about one percent compared to

756
00:29:26,789 --> 00:29:24,799
that at earth so a helicopter for mars

757
00:29:30,710 --> 00:29:26,799
has to be very light and have a rotor

758
00:29:32,470 --> 00:29:30,720
system that can spin very fast behind me

759
00:29:35,669 --> 00:29:32,480
is the full-scale model of mars

760
00:29:38,710 --> 00:29:35,679
helicopter ingenuity it's very light 1.8

761
00:29:40,389 --> 00:29:38,720
kilograms about 4 pounds it's capable of

762
00:29:41,350 --> 00:29:40,399
flying through the thin atmosphere of

763
00:29:43,430 --> 00:29:41,360

mars

764
00:29:45,990 --> 00:29:43,440
and is capable of surviving and

765
00:29:48,789 --> 00:29:46,000
operating autonomously

766
00:29:51,350 --> 00:29:48,799
there is a set of milestones between now

767
00:29:53,190 --> 00:29:51,360
and ingenuity's first flight

768
00:29:55,029 --> 00:29:53,200
the very first one is when we turn on

769
00:29:56,389 --> 00:29:55,039
the helicopter and the base station to

770
00:29:58,149 --> 00:29:56,399
check their health

771
00:29:59,430 --> 00:29:58,159
first time operating in true space

772
00:30:02,549 --> 00:29:59,440
environment

773
00:30:05,750 --> 00:30:02,559
the next major milestone will be when

774
00:30:08,710 --> 00:30:05,760
perseverance rover deploys ingenuity

775
00:30:11,590 --> 00:30:08,720
helicopter to the surface the deployment

776
00:30:14,710 --> 00:30:11,600
will also mark the first moment the

777
00:30:16,630 --> 00:30:14,720
helicopter starts to work on its own in

778
00:30:19,269 --> 00:30:16,640
a stand-alone manner it will never

779
00:30:21,909 --> 00:30:19,279
return to the rover and the first major

780
00:30:24,070 --> 00:30:21,919
stone milestone then will be the

781
00:30:26,789 --> 00:30:24,080
helicopter surviving the first cold

782
00:30:29,029 --> 00:30:26,799
martian night about minus degree minus

783
00:30:31,909 --> 00:30:29,039
90 degrees celsius and we've designed

784
00:30:34,470 --> 00:30:31,919
the helicopter to keep itself warm

785
00:30:36,070 --> 00:30:34,480
so we've planned for up to five flights

786
00:30:38,310 --> 00:30:36,080
in the 30 martian days that have been

787
00:30:40,710 --> 00:30:38,320
set aside for our flight experiments the

788
00:30:42,789 --> 00:30:40,720

fly data we get from the helicopter will

789
00:30:44,070 --> 00:30:42,799
inform our team the health of the

790
00:30:47,430 --> 00:30:44,080
helicopter

791
00:30:50,310 --> 00:30:47,440
and performance of each flight

792
00:30:51,510 --> 00:30:50,320
the data could also include a few color

793
00:30:56,310 --> 00:30:51,520
photos

794
00:30:59,990 --> 00:30:56,320
taken from aerovantage that would be

795
00:31:03,669 --> 00:31:01,669
cake mimi thank you and you're right we

796
00:31:05,909 --> 00:31:03,679
did have a little bit of a shake up but

797
00:31:07,990 --> 00:31:05,919
everything seems to be okay right here

798
00:31:10,310 --> 00:31:08,000
so far and we look forward to

799
00:31:12,870 --> 00:31:10,320
ingenuity's first flight and with that

800
00:31:14,950 --> 00:31:12,880
let's head back to ksc as we continue

801
00:31:16,789 --> 00:31:14,960
the countdown to mars

802
00:31:18,630 --> 00:31:16,799
all right thank you raquel

803
00:31:20,470 --> 00:31:18,640
when the name perseverance was chosen

804
00:31:23,430 --> 00:31:20,480
for the rover our country was in the

805
00:31:25,269 --> 00:31:23,440
early stages of the covid 19 pandemic

806
00:31:27,269 --> 00:31:25,279
now the name is also a fitting

807
00:31:30,470 --> 00:31:27,279
description of what nasa teams needed to

808
00:31:33,350 --> 00:31:30,480
get this rover to the pad on time

809
00:31:34,870 --> 00:31:33,360
joining us now is nasa administrator jim

810
00:31:37,509 --> 00:31:34,880
breidenstein thank you very much for

811
00:31:39,110 --> 00:31:37,519
being here jim uh perseverance is

812
00:31:41,350 --> 00:31:39,120
meaning a lot and that includes a

813
00:31:43,590 --> 00:31:41,360

recently a 3.9 earthquake that we have

814
00:31:45,350 --> 00:31:43,600
reports of in california we just saw our

815
00:31:46,389 --> 00:31:45,360
own minions she said things were

816
00:31:48,389 --> 00:31:46,399
rattling there

817
00:31:49,909 --> 00:31:48,399
so we are persevering a lot good thing

818
00:31:52,070 --> 00:31:49,919
we're not launching from vandenberg

819
00:31:53,509 --> 00:31:52,080
today you're absolutely right about that

820
00:31:56,070 --> 00:31:53,519
things looking good here in florida i

821
00:31:58,389 --> 00:31:56,080
want to ask you why did we choose why

822
00:32:00,149 --> 00:31:58,399
did you choose to move nasa forward on

823
00:32:02,070 --> 00:32:00,159
this launch in the midst of a global

824
00:32:04,230 --> 00:32:02,080
pandemic oh well there's a number of

825
00:32:06,149 --> 00:32:04,240
reasons but i think the biggest thing is

826
00:32:08,070 --> 00:32:06,159
uh you know the public wants to see the

827
00:32:10,389 --> 00:32:08,080
united states of america and our

828
00:32:12,549 --> 00:32:10,399
international partners do stunning

829
00:32:14,470 --> 00:32:12,559
things and we we have a history of doing

830
00:32:17,190 --> 00:32:14,480
amazing things in the most challenging

831
00:32:19,190 --> 00:32:17,200
times and this is this is no different

832
00:32:20,950 --> 00:32:19,200
um so so look here's the here's the

833
00:32:23,190 --> 00:32:20,960
other challenging thing with mars in

834
00:32:25,509 --> 00:32:23,200
general you know we can only go to mars

835
00:32:27,590 --> 00:32:25,519
once every 26 months when

836
00:32:30,070 --> 00:32:27,600
when literally the planets are aligned

837
00:32:32,389 --> 00:32:30,080
and um and if we missed this launch

838
00:32:34,389 --> 00:32:32,399

window you know it would cost us half a

839
00:32:37,430 --> 00:32:34,399
billion dollars to store this vehicle

840
00:32:39,669 --> 00:32:37,440
for the next two years um and so there's

841
00:32:41,830 --> 00:32:39,679
a lot of reasons to go forward some of

842
00:32:44,230 --> 00:32:41,840
it is you know financial you know the

843
00:32:46,230 --> 00:32:44,240
nasa budget um you know and then the

844
00:32:47,990 --> 00:32:46,240
other the other big reason is americans

845
00:32:49,750 --> 00:32:48,000
want to see us continue to do big things

846
00:32:51,750 --> 00:32:49,760
i want to be really clear though

847
00:32:53,590 --> 00:32:51,760
we have made sure that all along this

848
00:32:55,350 --> 00:32:53,600
process if somebody didn't feel

849
00:32:57,110 --> 00:32:55,360
comfortable working on this project they

850
00:32:58,310 --> 00:32:57,120
had the option to not work on this

851
00:32:59,990 --> 00:32:58,320
project

852
00:33:02,470 --> 00:33:00,000
and and and i will tell you we didn't

853
00:33:04,789 --> 00:33:02,480
find that very often if at all

854
00:33:06,230 --> 00:33:04,799
i will i will also say that our our

855
00:33:08,230 --> 00:33:06,240
highest priority

856
00:33:09,830 --> 00:33:08,240
was the safety of our people and we

857
00:33:11,350 --> 00:33:09,840
wanted them to know that if they come to

858
00:33:12,710 --> 00:33:11,360
work they're going to be safer at work

859
00:33:15,909 --> 00:33:12,720
than they would be if they stayed at

860
00:33:18,310 --> 00:33:15,919
home um and and of course the the the

861
00:33:20,470 --> 00:33:18,320
personal protective equipment the social

862
00:33:22,470 --> 00:33:20,480
distancing the changing of schedules in

863
00:33:24,470 --> 00:33:22,480

order to minimize people working on the

864
00:33:25,909 --> 00:33:24,480
vehicle at one time all of these things

865
00:33:27,669 --> 00:33:25,919
were put into place as protective

866
00:33:30,070 --> 00:33:27,679
measures but it is true

867
00:33:33,190 --> 00:33:30,080
the name perseverance which was given to

868
00:33:35,509 --> 00:33:33,200
this robot by alex mather who's a

869
00:33:37,350 --> 00:33:35,519
seventh grader in virginia

870
00:33:39,430 --> 00:33:37,360
this is all about perseverance and going

871
00:33:41,509 --> 00:33:39,440
to mars as you said

872
00:33:43,830 --> 00:33:41,519
going to mars is all about persevering

873
00:33:46,149 --> 00:33:43,840
in general doing it now is more

874
00:33:47,590 --> 00:33:46,159
persevering than ever before real quick

875
00:33:49,830 --> 00:33:47,600
we've got to launch of course counting

876
00:33:51,830 --> 00:33:49,840
down how are you feeling uh well nervous

877
00:33:53,590 --> 00:33:51,840
as always this is a lot of money at the

878
00:33:56,470 --> 00:33:53,600
top of a rocket and of course not just

879
00:33:58,549 --> 00:33:56,480
the money but uh the the entire life's

880
00:34:01,430 --> 00:33:58,559
work of so many you know thousands of

881
00:34:03,509 --> 00:34:01,440
people so um look it's uh it's gonna be

882
00:34:05,029 --> 00:34:03,519
a good day we're knocking on wood

883
00:34:06,630 --> 00:34:05,039
but it's but it's gonna be a good day

884
00:34:07,669 --> 00:34:06,640
for nasa thank you very much for being

885
00:34:09,349 --> 00:34:07,679
here jim

886
00:34:13,430 --> 00:34:09,359
thank you you've been all right thank

887
00:34:15,829 --> 00:34:13,440
you so much we are now at l minus 14

888
00:34:17,589 --> 00:34:15,839

minutes and counting let's check back in

889
00:34:20,710 --> 00:34:17,599
with joshua and mick get an update on

890
00:34:22,230 --> 00:34:20,720
preparations to launch the rocket joshua

891
00:34:24,149 --> 00:34:22,240
there's an important poll by the launch

892
00:34:26,550 --> 00:34:24,159
services program happening soon right

893
00:34:28,950 --> 00:34:26,560
yes absolutely so the the countdown is

894
00:34:30,069 --> 00:34:28,960
continuing um obviously a status report

895
00:34:31,990 --> 00:34:30,079
we heard them talking about the

896
00:34:33,270 --> 00:34:32,000
earthquake and everything is still good

897
00:34:35,349 --> 00:34:33,280
um we're hearing that on the back end

898
00:34:37,589 --> 00:34:35,359
that things are proceeding well no no

899
00:34:39,349 --> 00:34:37,599
major issues or hiccups because of that

900
00:34:41,109 --> 00:34:39,359
um other everything going well the savvy

901
00:34:42,869 --> 00:34:41,119
viewers out there will notice the clocks

902
00:34:44,230 --> 00:34:42,879
in motion two clocks actually the

903
00:34:46,310 --> 00:34:44,240
countdown clock there behind daryl and

904
00:34:47,750 --> 00:34:46,320
mu is is at four minus and holding

905
00:34:49,349 --> 00:34:47,760
excuse me at t minus four minutes

906
00:34:51,109 --> 00:34:49,359
unholding uh but the clock on your

907
00:34:52,790 --> 00:34:51,119
screen now is the l clock and that is

908
00:34:55,109 --> 00:34:52,800
continuing to count down towards that 7

909
00:34:56,710 --> 00:34:55,119
50 am liftoff time

910
00:34:58,230 --> 00:34:56,720
yeah that's exactly right josh as we

911
00:34:59,990 --> 00:34:58,240
talked earlier the l time is the real

912
00:35:02,310 --> 00:35:00,000
time clock that continues to count down

913
00:35:03,990 --> 00:35:02,320

to zero at t minus four and counting the

914
00:35:06,150 --> 00:35:04,000
two clocks the t clock and the l clock

915
00:35:07,829 --> 00:35:06,160
will sync up as the team continues to

916
00:35:10,069 --> 00:35:07,839
work their operational sequence events

917
00:35:12,310 --> 00:35:10,079
in the procedure so team is very focused

918
00:35:14,069 --> 00:35:12,320
this morning as you already mentioned

919
00:35:15,349 --> 00:35:14,079
the earthquake that was brought up the

920
00:35:17,030 --> 00:35:15,359
team has assessed that and looked at it

921
00:35:18,950 --> 00:35:17,040
and they're doing a great job and

922
00:35:21,190 --> 00:35:18,960
getting us to zero this morning so we

923
00:35:23,270 --> 00:35:21,200
mentioned the us space force as one of

924
00:35:25,190 --> 00:35:23,280
the five teams earlier and next up we

925
00:35:27,349 --> 00:35:25,200
have the nasa launch services program

926
00:35:28,550 --> 00:35:27,359
team responsible for managing the launch

927
00:35:30,950 --> 00:35:28,560
and we're going to hear a poll here from

928
00:35:32,550 --> 00:35:30,960
the nasa launch manager himself omar

929
00:35:34,150 --> 00:35:32,560
baez he's going to pull his team for

930
00:35:35,750 --> 00:35:34,160
their readiness to be able to report out

931
00:35:37,750 --> 00:35:35,760
in just a few minutes so he's very

932
00:35:39,190 --> 00:35:37,760
punctual so this should be coming right

933
00:35:43,510 --> 00:35:39,200
on time here in just a few seconds let's

934
00:35:48,230 --> 00:35:46,069
this is the nlm on the nlm net

935
00:35:50,630 --> 00:35:48,240
currently working uh no issues on the

936
00:35:54,390 --> 00:35:50,640
range or the launch vehicle

937
00:35:56,150 --> 00:35:54,400
whether it's uh green 10 chance of

938
00:35:56,950 --> 00:35:56,160

violation

939
00:35:58,710 --> 00:35:56,960
and

940
00:36:01,270 --> 00:35:58,720
wins aloft looked good for the entire

941
00:36:04,230 --> 00:36:01,280
window um

942
00:36:06,310 --> 00:36:04,240
the spacecraft did experience some

943
00:36:08,470 --> 00:36:06,320
earthquake activity at their control

944
00:36:10,069 --> 00:36:08,480
center in pasadena but here's be ready

945
00:36:12,310 --> 00:36:10,079
to proceed

946
00:36:13,430 --> 00:36:12,320
and with that i would like to pull the

947
00:36:16,069 --> 00:36:13,440
team

948
00:36:19,670 --> 00:36:16,079
for final launch poll and spacecraft

949
00:36:21,109 --> 00:36:19,680
community configuration nasa ce nasa

950
00:36:22,470 --> 00:36:21,119
cesco

951
00:36:25,589 --> 00:36:22,480
sma

952
00:36:27,670 --> 00:36:25,599
smp

953
00:36:29,670 --> 00:36:27,680
smd is go

954
00:36:31,589 --> 00:36:29,680
nasa mission manager

955
00:36:32,870 --> 00:36:31,599
yes the mission manager is go

956
00:36:38,630 --> 00:36:32,880
lsp

957
00:36:39,990 --> 00:36:38,640
nest team is ready to proceed

958
00:36:42,150 --> 00:36:40,000
all right so we heard nasa team is ready

959
00:36:43,349 --> 00:36:42,160
to proceed um he even mentioned the

960
00:36:45,109 --> 00:36:43,359
weather in there which is great only at

961
00:36:46,950 --> 00:36:45,119
ten percent chance of violation again a

962
00:36:49,430 --> 00:36:46,960
big thank you to jessica williams of the

963
00:36:50,950 --> 00:36:49,440

u.s space force 45th space wing i like

964
00:36:52,550 --> 00:36:50,960
the fact that we're working no issues

965
00:36:54,470 --> 00:36:52,560
this morning into this count that's an

966
00:36:56,470 --> 00:36:54,480
important part that omar brought up

967
00:36:57,910 --> 00:36:56,480
and uh the team you know one one thing

968
00:37:00,069 --> 00:36:57,920
you need to understand about the nlm is

969
00:37:02,150 --> 00:37:00,079
it's a combined nasa team of spacecraft

970
00:37:03,750 --> 00:37:02,160
and engineering so hearing all those

971
00:37:04,710 --> 00:37:03,760
goes is good this morning yep and we're

972
00:37:06,069 --> 00:37:04,720
going to keep moving because we got a

973
00:37:07,670 --> 00:37:06,079
lot to do still we're going to throw

974
00:37:10,069 --> 00:37:07,680
back out to you daryl all right thank

975
00:37:12,630 --> 00:37:10,079
you very much joshua our nasa teams

976
00:37:14,630 --> 00:37:12,640
across the country overcame challenges

977
00:37:16,870 --> 00:37:14,640
caused by the covid 19 outbreak as

978
00:37:19,670 --> 00:37:16,880
you've heard so far to get this mars

979
00:37:21,750 --> 00:37:19,680
rover to the launch pad on time we are

980
00:37:23,829 --> 00:37:21,760
about to hear from workers at centers in

981
00:37:26,069 --> 00:37:23,839
california and florida who took every

982
00:37:34,230 --> 00:37:26,079
imaginable precaution while managing to

983
00:37:37,750 --> 00:37:35,510
when i saw

984
00:37:39,430 --> 00:37:37,760
the country shutting down

985
00:37:41,670 --> 00:37:39,440
i thought for sure

986
00:37:43,750 --> 00:37:41,680
there is no way we're going to be able

987
00:37:45,750 --> 00:37:43,760
to continue this

988
00:37:47,829 --> 00:37:45,760

it's something that nobody expected it's

989
00:37:49,829 --> 00:37:47,839
something nobody could plan for rather

990
00:37:51,670 --> 00:37:49,839
than your first priority being mission

991
00:37:53,829 --> 00:37:51,680
success and

992
00:37:55,910 --> 00:37:53,839
and getting to the launch pad your first

993
00:37:58,550 --> 00:37:55,920
priority immediately gets displaced and

994
00:38:00,790 --> 00:37:58,560
it's now the safety of the people i was

995
00:38:03,430 --> 00:38:00,800
seriously thinking mars would be march

996
00:38:04,950 --> 00:38:03,440
2022.

997
00:38:07,670 --> 00:38:04,960
it took a lot of work to put stuff

998
00:38:09,750 --> 00:38:07,680
together in order to keep momentum going

999
00:38:12,069 --> 00:38:09,760
to keep people working safely keep them

1000
00:38:16,230 --> 00:38:12,079
healthy and to keep the project uh on

1001
00:38:20,069 --> 00:38:16,240
schedule there's no doubt that working

1002
00:38:20,950 --> 00:38:20,079
in isolation not virtual isolation but

1003
00:38:23,190 --> 00:38:20,960
in

1004
00:38:25,349 --> 00:38:23,200
physical isolation from everyone else

1005
00:38:28,230 --> 00:38:25,359
is a challenge it's hard for me i have

1006
00:38:30,550 --> 00:38:28,240
two young kids sometimes i'm not able to

1007
00:38:32,390 --> 00:38:30,560
focus or listen probably as well as i

1008
00:38:34,390 --> 00:38:32,400
would want to a lot of our work was

1009
00:38:36,310 --> 00:38:34,400
occurring in a clean room anyways but

1010
00:38:39,510 --> 00:38:36,320
that meant that even before we entered

1011
00:38:41,430 --> 00:38:39,520
the clean room we had to find ways of

1012
00:38:43,109 --> 00:38:41,440
ensuring that

1013
00:38:45,510 --> 00:38:43,119

we were not putting ourselves or others

1014
00:38:47,670 --> 00:38:45,520
at risk

1015
00:38:50,310 --> 00:38:47,680
most of the time for these missions our

1016
00:38:51,910 --> 00:38:50,320
relation with the spacecraft customer is

1017
00:38:53,990 --> 00:38:51,920
incredibly important so usually we're

1018
00:38:56,150 --> 00:38:54,000
able to be here working beside them on

1019
00:38:57,430 --> 00:38:56,160
their equipment and making sure that all

1020
00:38:59,910 --> 00:38:57,440
of their needs are covered even before

1021
00:39:01,270 --> 00:38:59,920
they ask for it it is a challenge but

1022
00:39:03,190 --> 00:39:01,280
we're used to meeting unique

1023
00:39:05,270 --> 00:39:03,200
requirements here at the hangar and we

1024
00:39:07,349 --> 00:39:05,280
pride ourselves in our flexibility

1025
00:39:09,349 --> 00:39:07,359
this is just another mission just with

1026
00:39:11,430 --> 00:39:09,359
different set of obstacles that we have

1027
00:39:14,470 --> 00:39:11,440
to overcome might not be you know like a

1028
00:39:16,550 --> 00:39:14,480
broken rocket but it's

1029
00:39:20,310 --> 00:39:16,560
it's got its own challenges

1030
00:39:23,109 --> 00:39:20,320
our job is to go into the unknown and

1031
00:39:24,550 --> 00:39:23,119
this is just another example of

1032
00:39:26,550 --> 00:39:24,560
the unknown

1033
00:39:28,550 --> 00:39:26,560
how to make this job happen

1034
00:39:31,030 --> 00:39:28,560
when you're doing it largely through a

1035
00:39:32,950 --> 00:39:31,040
computer screen

1036
00:39:35,190 --> 00:39:32,960
i asked the team a couple months ago if

1037
00:39:37,109 --> 00:39:35,200
they would like to do something to kind

1038
00:39:39,270 --> 00:39:37,119

of symbolize and mark these challenges

1039
00:39:41,910 --> 00:39:39,280
that we faced and they designed

1040
00:39:44,470 --> 00:39:41,920
something that we called a covid19

1041
00:39:47,589 --> 00:39:44,480
perseverance plate it's now fixed to the

1042
00:39:49,829 --> 00:39:47,599
port side of the rover it has a globe

1043
00:39:51,829 --> 00:39:49,839
representing all of us that face this

1044
00:39:54,710 --> 00:39:51,839
challenge together the spacecraft

1045
00:39:56,310 --> 00:39:54,720
leaving the earth on its way to mars and

1046
00:39:58,550 --> 00:39:56,320
all of this supported by the now

1047
00:40:00,790 --> 00:39:58,560
familiar staff and servant of the

1048
00:40:03,190 --> 00:40:00,800
medical community and we hope that this

1049
00:40:06,790 --> 00:40:03,200
mission in some small way can inspire

1050
00:40:10,710 --> 00:40:08,309
pretty much everybody that i've talked

1051
00:40:13,349 --> 00:40:10,720
to that's associated with the mission

1052
00:40:14,710 --> 00:40:13,359
has has said the same thing which you

1053
00:40:16,710 --> 00:40:14,720
could not have come up with a better

1054
00:40:19,510 --> 00:40:16,720
name than perseverance we have

1055
00:40:21,829 --> 00:40:19,520
persevered food if nobody's given up we

1056
00:40:24,390 --> 00:40:21,839
will get this mission done we will get

1057
00:40:26,790 --> 00:40:24,400
it done through the pandemic i think it

1058
00:40:29,589 --> 00:40:26,800
now is it's a really important symbol of

1059
00:40:31,349 --> 00:40:29,599
humanity hopefully persevering through

1060
00:40:35,510 --> 00:40:31,359
this great challenging time that we have

1061
00:40:39,109 --> 00:40:37,270
we appreciate that team as well as the

1062
00:40:40,950 --> 00:40:39,119
medical community that really stepped up

1063
00:40:42,790 --> 00:40:40,960

and helped and it's ironic you know move

1064
00:40:44,710 --> 00:40:42,800
because the name perseverance was chosen

1065
00:40:47,030 --> 00:40:44,720
by a seventh grader who at the time he

1066
00:40:49,109 --> 00:40:47,040
submitted that name he didn't know that

1067
00:40:49,829 --> 00:40:49,119
we would be faced with a global pandemic

1068
00:40:51,910 --> 00:40:49,839
so

1069
00:40:53,430 --> 00:40:51,920
we are glad to have him and his family

1070
00:40:56,069 --> 00:40:53,440
here along with the student who named

1071
00:40:58,710 --> 00:40:56,079
the helicopter to watch the launch in

1072
00:41:00,790 --> 00:40:58,720
person their names are alexander mather

1073
00:41:02,390 --> 00:41:00,800
and veneza rupani and they are watching

1074
00:41:04,309 --> 00:41:02,400
from the fifth floor balcony of our

1075
00:41:06,230 --> 00:41:04,319
engineering building just a stone's

1076
00:41:09,270 --> 00:41:06,240
throw away from the countdown clock look

1077
00:41:11,030 --> 00:41:09,280
at that there they are looking cool

1078
00:41:12,630 --> 00:41:11,040
alexander mather who goes to lake

1079
00:41:14,309 --> 00:41:12,640
braddock element secondary school in

1080
00:41:16,550 --> 00:41:14,319
burke virginia submitted the winning

1081
00:41:18,390 --> 00:41:16,560
essay to name our rover perseverance

1082
00:41:20,630 --> 00:41:18,400
yeah they've got a great view i've seen

1083
00:41:22,390 --> 00:41:20,640
it from up there they've got the vab in

1084
00:41:24,390 --> 00:41:22,400
the background as you can see there so

1085
00:41:26,550 --> 00:41:24,400
it's such a beautiful setup for this

1086
00:41:28,069 --> 00:41:26,560
awesome launch and venisa you can see

1087
00:41:30,150 --> 00:41:28,079
here

1088
00:41:32,470 --> 00:41:30,160

hey guys appreciate ya

1089
00:41:35,190 --> 00:41:32,480
she's a junior at tuscaloosa county high

1090
00:41:36,950 --> 00:41:35,200
school in northport alabama she entered

1091
00:41:39,750 --> 00:41:36,960
the contest as well and came up with the

1092
00:41:42,309 --> 00:41:39,760
name ingenuity for our helicopter that

1093
00:41:44,550 --> 00:41:42,319
will accompany our rover to mars thank

1094
00:41:46,550 --> 00:41:44,560
you both for being here what a neat view

1095
00:41:47,990 --> 00:41:46,560
that is yes

1096
00:41:49,589 --> 00:41:48,000
all right folks with the coast phase

1097
00:41:51,910 --> 00:41:49,599
coming up we want to let you know that

1098
00:41:54,309 --> 00:41:51,920
after the launch it will be about an

1099
00:41:56,630 --> 00:41:54,319
hour before mars perseverance separates

1100
00:41:59,109 --> 00:41:56,640
from the second stage when that and when

1101
00:42:01,190 --> 00:41:59,119
that happens the rover will then be on

1102
00:42:02,950 --> 00:42:01,200
its way to mars so hang in there yeah

1103
00:42:04,950 --> 00:42:02,960
don't go away as we will walk you

1104
00:42:06,950 --> 00:42:04,960
through the flight around the earth and

1105
00:42:08,950 --> 00:42:06,960
we'll talk live with the astronaut xena

1106
00:42:10,790 --> 00:42:08,960
cardman about our human exploration

1107
00:42:12,870 --> 00:42:10,800
ambitions and nasa's associate

1108
00:42:14,630 --> 00:42:12,880
administrator of science dr thomas

1109
00:42:17,910 --> 00:42:14,640
zurbuchen it's going to be great folks

1110
00:42:20,710 --> 00:42:17,920
so stick around it's l minus six minutes

1111
00:42:22,550 --> 00:42:20,720
and 26 seconds now and time to focus our

1112
00:42:25,030 --> 00:42:22,560
attention on the launch operation the

1113
00:42:27,510 --> 00:42:25,040

rest of the way to liftoff so let's send

1114
00:42:28,829 --> 00:42:27,520
it back out to mick woltman and joshua

1115
00:42:30,630 --> 00:42:28,839
santorum

1116
00:42:31,990 --> 00:42:30,640
gentlemen thank you i want to let you

1117
00:42:34,950 --> 00:42:32,000
listen into the to the remainder of this

1118
00:42:36,390 --> 00:42:34,960
poll in motion let's go to that now

1119
00:42:37,750 --> 00:42:36,400
range coordinator

1120
00:42:39,430 --> 00:42:37,760
clear proceed

1121
00:42:41,510 --> 00:42:39,440
launch director

1122
00:42:42,710 --> 00:42:41,520
ld is go and you have permission to

1123
00:42:44,870 --> 00:42:42,720
launch

1124
00:42:54,470 --> 00:42:44,880
proceeding with account

1125
00:43:00,630 --> 00:42:57,270
so 1150 zulu

1126
00:43:02,950 --> 00:43:00,640
that is 7 50 a.m eastern time uh so that

1127
00:43:05,270 --> 00:43:02,960
time is correct as i'm watching josh do

1128
00:43:06,710 --> 00:43:05,280
the calculations on his finger

1129
00:43:08,790 --> 00:43:06,720
get my advocates out

1130
00:43:11,349 --> 00:43:08,800
so there's a lot to come ahead uh one of

1131
00:43:13,589 --> 00:43:11,359
the things coming up um in just a few

1132
00:43:15,430 --> 00:43:13,599
seconds five minutes thirty seconds

1133
00:43:16,630 --> 00:43:15,440
oh yes nfc

1134
00:43:18,630 --> 00:43:16,640
go nsc

1135
00:43:22,069 --> 00:43:18,640
spacecraft on internal power and time

1136
00:43:24,829 --> 00:43:22,079
are set for t0 of 1150

1137
00:43:27,750 --> 00:43:24,839
roger os start list data capture

1138
00:43:31,349 --> 00:43:27,760

roger fantastic complete prior to

1139
00:43:32,790 --> 00:43:31,359
terminal count lc switch is ready

1140
00:43:33,990 --> 00:43:32,800
awesome so things are really starting to

1141
00:43:35,670 --> 00:43:34,000
pick up here you're going to hear more

1142
00:43:37,589 --> 00:43:35,680
and more chatter on those nets there

1143
00:43:39,430 --> 00:43:37,599
that call was to say that perseverance

1144
00:43:41,109 --> 00:43:39,440
is powered and ready to go which is a

1145
00:43:42,630 --> 00:43:41,119
phenomenal call yeah a couple things

1146
00:43:44,230 --> 00:43:42,640
happened during that time right is a

1147
00:43:46,309 --> 00:43:44,240
launch conductor ula's launch conductor

1148
00:43:48,069 --> 00:43:46,319
scott barney pulled the whole ula team

1149
00:43:49,589 --> 00:43:48,079
they were all go we got the third of our

1150
00:43:50,950 --> 00:43:49,599
five teams the third of our five teams

1151
00:43:54,150 --> 00:43:50,960
we got to hear the end of that where the

1152
00:43:55,990 --> 00:43:54,160
range was clear to proceed and ula's

1153
00:43:57,990 --> 00:43:56,000
launch director bill collin gave the

1154
00:43:59,589 --> 00:43:58,000
authority to go for launch this morning

1155
00:44:01,589 --> 00:43:59,599
at 7 50 a.m

1156
00:44:03,270 --> 00:44:01,599
then we got to hear from the the jpl

1157
00:44:04,950 --> 00:44:03,280
spacecraft team that they are the fourth

1158
00:44:07,910 --> 00:44:04,960
team the fourth team that they are on

1159
00:44:10,150 --> 00:44:07,920
internal power and uh timers are set uh

1160
00:44:12,470 --> 00:44:10,160
they are targeting a lift off of 7 50

1161
00:44:14,390 --> 00:44:12,480
a.m this morning so all things are

1162
00:44:16,150 --> 00:44:14,400
looking good for us joshua this morning

1163
00:44:17,910 --> 00:44:16,160

it's so you know we talk about being

1164
00:44:20,150 --> 00:44:17,920
nervous and excited this is right here

1165
00:44:21,430 --> 00:44:20,160
where we're nervous and excited yes

1166
00:44:24,470 --> 00:44:21,440
there are a lot of things happening as

1167
00:44:26,390 --> 00:44:24,480
we get ready to count down uh to uh the

1168
00:44:28,069 --> 00:44:26,400
liftoff this morning we have about 15

1169
00:44:29,670 --> 00:44:28,079
seconds left in this hole before we pick

1170
00:44:31,270 --> 00:44:29,680
up the count yeah we're gonna listen

1171
00:44:32,470 --> 00:44:31,280
into that uh the fifth team the one we

1172
00:44:34,710 --> 00:44:32,480
haven't mentioned yet is the department

1173
00:44:43,190 --> 00:44:34,720
of energy who is responsible for the

1174
00:44:46,470 --> 00:44:44,630
awesome so this is now the terminal

1175
00:44:47,829 --> 00:44:46,480
countdown this is that time when things

1176
00:44:50,069 --> 00:44:47,839
become more and more automated over the

1177
00:44:51,589 --> 00:44:50,079
next couple minutes few minutes and the

1178
00:44:53,750 --> 00:44:51,599
the energy's building but the focus is

1179
00:44:55,349 --> 00:44:53,760
increasing exponentially yes torrey said

1180
00:44:57,510 --> 00:44:55,359
during his interview you know the teams

1181
00:44:59,109 --> 00:44:57,520
are very disciplined very focused on

1182
00:45:00,390 --> 00:44:59,119
what they're doing the operational

1183
00:45:01,910 --> 00:45:00,400
sequence of events that they're

1184
00:45:03,349 --> 00:45:01,920
following they are making sure

1185
00:45:05,589 --> 00:45:03,359
everything happens especially in this

1186
00:45:06,870 --> 00:45:05,599
t-minus four and counting period because

1187
00:45:09,349 --> 00:45:06,880
there's a lot of things they have to do

1188
00:45:11,430 --> 00:45:09,359

they have to finish topping the vehicle

1189
00:45:13,589 --> 00:45:11,440
make sure that all the tanks first stage

1190
00:45:15,990 --> 00:45:13,599
second stage on centaur are at flight

1191
00:45:17,349 --> 00:45:16,000
pressures and full fuel ready to go for

1192
00:45:20,309 --> 00:45:17,359
this morning they have to make sure the

1193
00:45:22,470 --> 00:45:20,319
fds system is armed and ready for

1194
00:45:24,470 --> 00:45:22,480
personnel safety just in case uh so the

1195
00:45:26,470 --> 00:45:24,480
range can do that they have to check the

1196
00:45:28,309 --> 00:45:26,480
electrical and avionics systems they

1197
00:45:30,230 --> 00:45:28,319
have to make sure that the flight

1198
00:45:32,630 --> 00:45:30,240
computer has all the information it

1199
00:45:35,270 --> 00:45:32,640
needs to place mars 2020 into the orbit

1200
00:45:38,550 --> 00:45:35,280
it has to so a lot of things going on

1201
00:45:40,630 --> 00:45:38,560
exciting time for the team right now but

1202
00:45:42,710 --> 00:45:40,640
again staying focused and following that

1203
00:45:45,270 --> 00:45:42,720
procedure they've got three minutes

1204
00:45:46,309 --> 00:45:45,280
as we look ahead to post liftoff want to

1205
00:45:47,349 --> 00:45:46,319
kind of preview for you what's going to

1206
00:45:48,390 --> 00:45:47,359
happen because there's going to be a lot

1207
00:45:49,910 --> 00:45:48,400
going on you're not going to hear much

1208
00:45:51,829 --> 00:45:49,920
from us you'll actually be hearing from

1209
00:45:53,750 --> 00:45:51,839
the ula flight commentator jesse

1210
00:45:55,910 --> 00:45:53,760
gonzalez he'll be kind of giving those

1211
00:45:58,309 --> 00:45:55,920
calls past liftoff that will walk us

1212
00:46:01,270 --> 00:45:58,319
through maximum dynamic pressure and

1213
00:46:04,150 --> 00:46:01,280

into srb separation and then into

1214
00:46:05,829 --> 00:46:04,160
fairing separation booster separation

1215
00:46:08,550 --> 00:46:05,839
and then the

1216
00:46:09,670 --> 00:46:08,560
first main engine ignition of the

1217
00:46:11,510 --> 00:46:09,680
centaur

1218
00:46:13,190 --> 00:46:11,520
rl10 and so then you'll kind of hear us

1219
00:46:14,950 --> 00:46:13,200
jump back in and help provide some more

1220
00:46:15,910 --> 00:46:14,960
context to what's going on we encourage

1221
00:46:17,910 --> 00:46:15,920
you to stay with us for the rest of the

1222
00:46:19,589 --> 00:46:17,920
show there's a ton more content we have

1223
00:46:21,030 --> 00:46:19,599
to bring you and we are far from over

1224
00:46:23,430 --> 00:46:21,040
want to emphasize that the countdown to

1225
00:46:25,910 --> 00:46:23,440
mars is not done at zero today the

1226
00:46:28,150 --> 00:46:25,920
countdown to mars ends in february when

1227
00:46:29,990 --> 00:46:28,160
march 2020 safely delivers perseverance

1228
00:46:31,589 --> 00:46:30,000
and ingenuity to the surface of the red

1229
00:46:32,710 --> 00:46:31,599
planet so we're going to let you listen

1230
00:46:35,349 --> 00:46:32,720
in now and enjoy the last couple of

1231
00:46:42,470 --> 00:46:35,359
minutes of the the process of launching

1232
00:46:48,230 --> 00:46:45,430
one minute 59

1233
00:46:51,349 --> 00:46:48,240
vehicle internal one minute 55 launch

1234
00:46:54,550 --> 00:46:53,510
one minute 50. the carrying centauri

1235
00:46:59,829 --> 00:46:54,560
leaks too

1236
00:47:03,270 --> 00:47:01,349
so there we heard the fueling is is

1237
00:47:05,430 --> 00:47:03,280
wrapping up 40. yep fueling is wrapping

1238
00:47:07,589 --> 00:47:05,440

up the team is gone launch naval's done

1239
00:47:08,630 --> 00:47:07,599
launch conductor sequence is ready to go

1240
00:47:11,030 --> 00:47:08,640
they're getting ready to turn the

1241
00:47:14,069 --> 00:47:11,040
vehicle over to automatically armed at t

1242
00:47:15,750 --> 00:47:14,079
minus 31 seconds um so that's a

1243
00:47:18,150 --> 00:47:15,760
big thing that they're getting done here

1244
00:47:20,230 --> 00:47:18,160
at t minus 25 seconds we will hear the

1245
00:47:22,069 --> 00:47:20,240
team give their final goes that

1246
00:47:23,030 --> 00:47:22,079
everything is ready and the launch

1247
00:47:25,910 --> 00:47:23,040
vehicle

1248
00:47:28,950 --> 00:47:25,920
is uh ready to lift you on this mission

1249
00:47:31,270 --> 00:47:28,960
scf count start minute 15 produce ecs

1250
00:47:34,230 --> 00:47:31,280
for launch roger

1251
00:47:34,240 --> 00:47:41,430
denver

1252
00:47:45,910 --> 00:47:42,549
one minute

1253
00:47:47,589 --> 00:47:45,920
rock report range status range green

1254
00:47:49,109 --> 00:47:47,599
that's good to hear joshua right there

1255
00:47:51,109 --> 00:47:49,119
public safety there's accounting for the

1256
00:47:53,829 --> 00:47:51,119
fts system there you see on your screen

1257
00:47:55,829 --> 00:47:53,839
a beautiful shot uh the skies look great

1258
00:47:57,750 --> 00:47:55,839
there is little wind um happening you'd

1259
00:47:59,270 --> 00:47:57,760
be able to see more of the the venting

1260
00:48:01,190 --> 00:47:59,280
um if there were wind the trail that of

1261
00:48:02,230 --> 00:48:01,200
that venting so we're ready to go and

1262
00:48:03,750 --> 00:48:02,240
actually that's our important point the

1263
00:48:05,430 --> 00:48:03,760

reason we don't see that is that the

1264
00:48:07,349 --> 00:48:05,440
event valves have been locked up to put

1265
00:48:09,190 --> 00:48:07,359
flight pressure into the tanks and as we

1266
00:48:11,349 --> 00:48:09,200
just heard they're stable at step three

1267
00:48:13,589 --> 00:48:11,359
which means the tanks are ready to go

1268
00:48:15,430 --> 00:48:13,599
and uh here at about five seconds we

1269
00:48:23,670 --> 00:48:15,440
will hear the team eps reduced for

1270
00:48:33,349 --> 00:48:25,829
there we go we're ready to go lift off

1271
00:48:36,069 --> 00:48:35,270
eight seven

1272
00:48:37,910 --> 00:48:36,079
six

1273
00:48:39,910 --> 00:48:37,920
five five four

1274
00:48:40,790 --> 00:48:39,920
engine ignition two

1275
00:48:42,950 --> 00:48:40,800
one

1276
00:48:45,589 --> 00:48:42,960
zero

1277
00:48:47,990 --> 00:48:45,599
related and liftoff

1278
00:48:49,829 --> 00:48:48,000
as the countdown to mars continues the

1279
00:48:51,990 --> 00:48:49,839
perseverance of humanity launching the

1280
00:48:58,309 --> 00:48:52,000
next generation of robotic explorers to

1281
00:49:05,680 --> 00:49:00,150
and atlas tu has gone to close loop

1282
00:49:11,190 --> 00:49:09,430
[Music]

1283
00:49:13,349 --> 00:49:11,200
coming up on 30 seconds into flight the

1284
00:49:17,190 --> 00:49:13,359
rd-180 is throttling down as expected

1285
00:49:28,069 --> 00:49:17,200
engine response looks good

1286
00:49:31,910 --> 00:49:30,230
and passing 45 seconds into flight

1287
00:49:47,910 --> 00:49:31,920
vehicle is now passing through max q

1288
00:49:52,390 --> 00:49:49,829

and passing one minute into flight the

1289
00:49:54,230 --> 00:49:52,400
rd-180 is throttling back up as expected

1290
00:49:56,230 --> 00:49:54,240
engine response looks good

1291
00:49:58,790 --> 00:49:56,240
at this time in flight the srv chamber

1292
00:50:00,549 --> 00:49:58,800
pressures remain nominal the rd-180 pump

1293
00:50:03,430 --> 00:50:00,559
speed and fuel injector pressures are

1294
00:50:13,829 --> 00:50:03,440
responding well to demands on the engine

1295
00:50:17,589 --> 00:50:15,910
and we have burnout on all four srbs

1296
00:50:35,829 --> 00:50:17,599
burnout pressure signatures look good

1297
00:50:41,030 --> 00:50:38,309
and we have a good indication of srb

1298
00:50:42,790 --> 00:50:41,040
jettison of all four srbs

1299
00:50:47,109 --> 00:50:42,800
and the vehicle has gone to closed loop

1300
00:51:04,950 --> 00:50:48,630
vehicle body rates are responding

1301
00:51:09,190 --> 00:51:06,470
and coming up on two and a half minutes

1302
00:51:11,270 --> 00:51:09,200
for the flight

1303
00:51:13,190 --> 00:51:11,280
the rd-180 is throttled down slightly as

1304
00:51:15,030 --> 00:51:13,200
expected engine response continues to

1305
00:51:17,430 --> 00:51:15,040
look good

1306
00:51:18,549 --> 00:51:17,440
at this time the vehicle is 50 miles in

1307
00:51:21,589 --> 00:51:18,559
altitude

1308
00:51:30,390 --> 00:51:21,599
85 miles downrange traveling at 6000

1309
00:51:49,349 --> 00:51:32,150
and the centaur reaction control system

1310
00:51:53,190 --> 00:51:51,030
and just past three minutes into flight

1311
00:51:55,270 --> 00:51:53,200
the rd-180 is now throttling to maintain

1312
00:51:57,349 --> 00:51:55,280
a constant two and a half g acceleration

1313
00:51:59,190 --> 00:51:57,359

limit for payload fairing jettison

1314
00:52:13,430 --> 00:51:59,200
engine response and vehicle acceleration

1315
00:52:17,270 --> 00:52:15,109
and we have good indication of payload

1316
00:52:26,150 --> 00:52:17,280
fairing jettison and centaur ford

1317
00:52:30,829 --> 00:52:28,309
and the rd180 is throttled back is

1318
00:52:32,390 --> 00:52:30,839
throttling back up to attain a 4.6 g

1319
00:52:42,470 --> 00:52:32,400
acceleration

1320
00:52:45,670 --> 00:52:44,309
and centaur has begun the boost phase

1321
00:52:51,430 --> 00:52:45,680
chill down sequence to thermally

1322
00:52:51,440 --> 00:53:01,030
standing by for beco shortly

1323
00:53:01,040 --> 00:53:04,150
biko is the

1324
00:53:08,630 --> 00:53:06,630
because the call for booster engine and

1325
00:53:15,910 --> 00:53:08,640
we have bco booster engine cutoff

1326
00:53:23,030 --> 00:53:17,589
and we have good indication of atlas

1327
00:53:26,309 --> 00:53:24,390
so they're using live footage and we

1328
00:53:30,710 --> 00:53:26,319
have one

1329
00:53:30,720 --> 00:53:39,750
chamber pressures are stable

1330
00:53:43,670 --> 00:53:41,750
this will be the first of two burns for

1331
00:53:45,670 --> 00:53:43,680
today's mission this first burn will

1332
00:53:53,589 --> 00:53:45,680
prob be approximately seven minutes in

1333
00:53:56,870 --> 00:53:54,950
so make this pretty exceptional footage

1334
00:53:58,710 --> 00:53:56,880
there that's live video uh we will see

1335
00:54:00,870 --> 00:53:58,720
that switch over shortly into an

1336
00:54:02,230 --> 00:54:00,880
animation that kind of helps

1337
00:54:04,150 --> 00:54:02,240
let us know what's happening with the

1338
00:54:06,230 --> 00:54:04,160

rocket but right there uh a beautiful

1339
00:54:08,950 --> 00:54:06,240
liftoff fun to feel that rumble in the

1340
00:54:11,829 --> 00:54:08,960
building here as we proceed towards uh

1341
00:54:13,990 --> 00:54:11,839
orbit and then towards mars destination

1342
00:54:16,069 --> 00:54:14,000
yeah absolutely it was great watching an

1343
00:54:18,549 --> 00:54:16,079
on time lift off of the atlas 5 with

1344
00:54:19,670 --> 00:54:18,559
that a little over 2 million pounds of

1345
00:54:23,030 --> 00:54:19,680
thrust

1346
00:54:24,710 --> 00:54:23,040
cleared the tower in roughly 5 seconds

1347
00:54:26,230 --> 00:54:24,720
josh you and i worked the insight

1348
00:54:28,309 --> 00:54:26,240
mission and if you recall that mission

1349
00:54:30,390 --> 00:54:28,319
on the west coast took about 17 seconds

1350
00:54:32,150 --> 00:54:30,400
to get pest tower so with those four

1351
00:54:33,589 --> 00:54:32,160
solids today this thing really got out

1352
00:54:35,910 --> 00:54:33,599
of here and on its way

1353
00:54:36,710 --> 00:54:35,920
it's uh as we hear from jesse chamber

1354
00:54:39,190 --> 00:54:36,720
pressure

1355
00:54:41,430 --> 00:54:39,200
everything's looking nominal and all uh

1356
00:54:43,190 --> 00:54:41,440
vehicle parameters are within the design

1357
00:54:45,030 --> 00:54:43,200
limits and and we're getting ready to

1358
00:54:47,349 --> 00:54:45,040
come up on a main engine start for that

1359
00:54:50,630 --> 00:54:47,359
first burn that jesse was talking about

1360
00:54:51,750 --> 00:54:50,640
yeah so recapping this countdown to mars

1361
00:54:53,589 --> 00:54:51,760
stations began to be filled up this

1362
00:54:56,069 --> 00:54:53,599
morning just after midnight uh

1363
00:54:57,829 --> 00:54:56,079

preparations fuelings powering up uh all

1364
00:55:00,150 --> 00:54:57,839
the way through that that liftoff that

1365
00:55:01,430 --> 00:55:00,160
happened uh i think uh it wasn't

1366
00:55:03,750 --> 00:55:01,440
precisely on time i think you said it

1367
00:55:05,510 --> 00:55:03,760
was like 10 milliseconds early um so

1368
00:55:07,109 --> 00:55:05,520
it's pretty much dead on yeah dead on

1369
00:55:09,589 --> 00:55:07,119
this team does a great job as i said

1370
00:55:11,910 --> 00:55:09,599
they're very focused very disciplined as

1371
00:55:13,510 --> 00:55:11,920
torrey also said courageous they have

1372
00:55:15,829 --> 00:55:13,520
done a lot of work to get us to this

1373
00:55:18,309 --> 00:55:15,839
point today through this pandemic

1374
00:55:20,950 --> 00:55:18,319
changed how they did some of their work

1375
00:55:22,549 --> 00:55:20,960
you know made adjustments as needed a

1376
00:55:25,030 --> 00:55:22,559
lot of cleaning a lot of things a lot of

1377
00:55:26,789 --> 00:55:25,040
wearing their face masks doing all kinds

1378
00:55:28,950 --> 00:55:26,799
of things and so this is an exciting

1379
00:55:30,870 --> 00:55:28,960
time not only for the jpl team in mars

1380
00:55:32,549 --> 00:55:30,880
2020 but everybody that's worked this

1381
00:55:34,549 --> 00:55:32,559
mission and for the country in the

1382
00:55:36,390 --> 00:55:34,559
agency so this is exciting to see we

1383
00:55:38,309 --> 00:55:36,400
still have a long way to go joshua

1384
00:55:39,910 --> 00:55:38,319
before spacecraft separation yeah we had

1385
00:55:41,910 --> 00:55:39,920
a really quiet countdown today which is

1386
00:55:43,670 --> 00:55:41,920
phenomenal that we got off the ground on

1387
00:55:45,829 --> 00:55:43,680
time and we are proceeding now that we

1388
00:55:47,670 --> 00:55:45,839

are in the middle of the first burn it's

1389
00:55:49,510 --> 00:55:47,680
tough to make out but that engine is lit

1390
00:55:50,710 --> 00:55:49,520
and it's firing um so we are in motion

1391
00:55:52,710 --> 00:55:50,720
there you go there's the animation we

1392
00:55:55,990 --> 00:55:52,720
talked about the telemetry there as we

1393
00:55:58,549 --> 00:55:56,000
switch to a tdrs compatible data format

1394
00:56:00,950 --> 00:55:58,559
uh tdrs overall telemetry quality is uh

1395
00:56:02,789 --> 00:56:00,960
very good the space tracking system um

1396
00:56:04,870 --> 00:56:02,799
so there you go this is not an actual

1397
00:56:07,109 --> 00:56:04,880
video but this is an animation that's

1398
00:56:08,630 --> 00:56:07,119
driven by real data so although we're

1399
00:56:10,470 --> 00:56:08,640
not actually seeing the engine on screen

1400
00:56:12,230 --> 00:56:10,480
right now we can see that the engine is

1401
00:56:13,829 --> 00:56:12,240
lit and that is driven by the data that

1402
00:56:15,030 --> 00:56:13,839
says that the engine is truly lit and

1403
00:56:16,710 --> 00:56:15,040
we're in this burn yeah the launch

1404
00:56:19,109 --> 00:56:16,720
vehicle continues to send telemetry to

1405
00:56:20,230 --> 00:56:19,119
the launch team via the tdrs network as

1406
00:56:21,829 --> 00:56:20,240
you mentioned

1407
00:56:23,190 --> 00:56:21,839
and that allows them to continue to

1408
00:56:24,870 --> 00:56:23,200
watch what's going on and make sure all

1409
00:56:27,270 --> 00:56:24,880
their sequence of events meet their

1410
00:56:28,950 --> 00:56:27,280
timeline that we continue on a nominal

1411
00:56:30,950 --> 00:56:28,960
flight this morning

1412
00:56:32,470 --> 00:56:30,960
this uh this first burn as we heard

1413
00:56:35,109 --> 00:56:32,480

earlier will be about six minutes this

1414
00:56:38,549 --> 00:56:35,119
will get us into that park orbit around

1415
00:56:40,390 --> 00:56:38,559
earth allow us to get uh on our way and

1416
00:56:42,150 --> 00:56:40,400
then get into that approximately 30

1417
00:56:44,710 --> 00:56:42,160
minute coast period that we're gonna

1418
00:56:48,230 --> 00:56:44,720
have eight minutes into flight beginning

1419
00:56:50,230 --> 00:56:48,240
to see the centaur pu system balance out

1420
00:56:52,230 --> 00:56:50,240
mass errors

1421
00:56:54,280 --> 00:56:52,240
seeing very stable body rates in the

1422
00:56:55,750 --> 00:56:54,290
centaur

1423
00:56:57,510 --> 00:56:55,760
[Music]

1424
00:56:59,030 --> 00:56:57,520
so we've mentioned five teams at play

1425
00:57:00,150 --> 00:56:59,040
and although if you were watching

1426
00:57:02,630 --> 00:57:00,160
hopefully you got a chance to see this

1427
00:57:04,549 --> 00:57:02,640
in person if not on camera it's easy to

1428
00:57:06,309 --> 00:57:04,559
kind of say oh it's over like job done

1429
00:57:08,150 --> 00:57:06,319
but all five of these teams still very

1430
00:57:09,990 --> 00:57:08,160
much engaged still very much focused

1431
00:57:11,829 --> 00:57:10,000
because there's a lot of work ahead as

1432
00:57:13,430 --> 00:57:11,839
we proceed through this first burn and

1433
00:57:15,430 --> 00:57:13,440
then a coast phase like you mentioned mc

1434
00:57:16,789 --> 00:57:15,440
and then a second burn and then

1435
00:57:19,990 --> 00:57:16,799
spacecraft separation and the

1436
00:57:21,910 --> 00:57:20,000
acquisition of signal from mars 2020 um

1437
00:57:23,589 --> 00:57:21,920
so a lot more coming up here mick i know

1438
00:57:25,589 --> 00:57:23,599

for launch services program you guys

1439
00:57:26,950 --> 00:57:25,599
manage the launch uh so what does that

1440
00:57:28,390 --> 00:57:26,960
mean i mean this is this is you guys

1441
00:57:30,069 --> 00:57:28,400
work in action right now by the way

1442
00:57:31,750 --> 00:57:30,079
that's the fifth team that we didn't get

1443
00:57:34,069 --> 00:57:31,760
to mention we talked about jpl we talked

1444
00:57:36,549 --> 00:57:34,079
about doe we talked about united space

1445
00:57:39,349 --> 00:57:36,559
force uh united states space force and

1446
00:57:41,349 --> 00:57:39,359
united launch alliance uh lsp we are we

1447
00:57:43,109 --> 00:57:41,359
are like the brokers uh to select this

1448
00:57:45,109 --> 00:57:43,119
launch vehicle and help with manage this

1449
00:57:47,349 --> 00:57:45,119
mission so we we get our spacecraft

1450
00:57:48,950 --> 00:57:47,359
customer the jpl folks they come to us

1451
00:57:50,950 --> 00:57:48,960
they have some certain requirements that

1452
00:57:53,109 --> 00:57:50,960
they need for this mission the launch

1453
00:57:55,750 --> 00:57:53,119
services program made up of engineers

1454
00:57:57,349 --> 00:57:55,760
and flight analysis folks and

1455
00:57:59,750 --> 00:57:57,359
they look at everything they help to

1456
00:58:01,750 --> 00:57:59,760
find those uh requirements and then we

1457
00:58:03,589 --> 00:58:01,760
go out and procure a vehicle from a

1458
00:58:06,230 --> 00:58:03,599
commercial partner in this case it was

1459
00:58:07,990 --> 00:58:06,240
the atlas 541 for the mars 20

1460
00:58:10,549 --> 00:58:08,000
20 mission that was needed for

1461
00:58:12,309 --> 00:58:10,559
performance right uh as you and i have

1462
00:58:13,589 --> 00:58:12,319
talked over the last several days josh

1463
00:58:15,910 --> 00:58:13,599

one of the things that was important for

1464
00:58:17,270 --> 00:58:15,920
us to look at was that performance to be

1465
00:58:19,990 --> 00:58:17,280
able to get

1466
00:58:23,510 --> 00:58:20,000
mars 2020 onto that transfer orbit into

1467
00:58:25,750 --> 00:58:23,520
solar orbit to intercept mars in

1468
00:58:28,390 --> 00:58:25,760
seven months it's kind of analogous to a

1469
00:58:30,549 --> 00:58:28,400
football game right with a quarterback

1470
00:58:31,750 --> 00:58:30,559
trying to throw a pass downfield you

1471
00:58:34,069 --> 00:58:31,760
need a quarterback with a lot of

1472
00:58:36,870 --> 00:58:34,079
performance who can get that ball down

1473
00:58:39,190 --> 00:58:36,880
there where it needs to be uh and and so

1474
00:58:41,190 --> 00:58:39,200
the receiver can intercept that in our

1475
00:58:43,510 --> 00:58:41,200
case seven months later there you go

1476
00:58:45,990 --> 00:58:43,520
yeah it's the longest football pass ever

1477
00:58:48,309 --> 00:58:46,000
the earth is the quarterback the atlas

1478
00:58:50,309 --> 00:58:48,319
is the quarterback's arm perseverance is

1479
00:58:51,990 --> 00:58:50,319
the football and mars is the receiver

1480
00:58:53,829 --> 00:58:52,000
that's a good guy exactly right and what

1481
00:58:55,829 --> 00:58:53,839
we also talked about is that

1482
00:58:57,270 --> 00:58:55,839
technically you could launch to mars at

1483
00:58:59,270 --> 00:58:57,280
any time if you had a rocket that was

1484
00:59:01,430 --> 00:58:59,280
powerful enough but this is the launch

1485
00:59:03,270 --> 00:59:01,440
period every 26 months or so as we've

1486
00:59:05,270 --> 00:59:03,280
talked about that makes the most sense

1487
00:59:07,589 --> 00:59:05,280
because you require the least amount of

1488
00:59:09,109 --> 00:59:07,599

energy to get to mars because it takes a

1489
00:59:13,030 --> 00:59:09,119
lot to get there obviously like the

1490
00:59:15,190 --> 00:59:13,040
atlas 541 is is a workhorse yes torrey

1491
00:59:17,270 --> 00:59:15,200
said it's their dominator

1492
00:59:19,829 --> 00:59:17,280
i love that name for the atlas v

1493
00:59:21,670 --> 00:59:19,839
541 but we heard uh jim bridenstine our

1494
00:59:23,430 --> 00:59:21,680
nasa administrator tell us that if we

1495
00:59:26,230 --> 00:59:23,440
didn't make this launch period we would

1496
00:59:28,789 --> 00:59:26,240
be down for roughly 26 months right so

1497
00:59:31,910 --> 00:59:28,799
the period started july 17th and went

1498
00:59:33,990 --> 00:59:31,920
and goes to august 15th today july 30th

1499
00:59:35,990 --> 00:59:34,000
was one of those launch opportunities

1500
00:59:37,750 --> 00:59:36,000
that we had we had a two-hour window and

1501
00:59:40,309 --> 00:59:37,760
within that window we had several

1502
00:59:41,430 --> 00:59:40,319
opportunities 25 actually 25

1503
00:59:43,030 --> 00:59:41,440
opportunities and we launched at the

1504
00:59:44,230 --> 00:59:43,040
beginning of the window on our first

1505
00:59:47,349 --> 00:59:44,240
opportunity

1506
00:59:49,510 --> 00:59:47,359
to get mars 2020 uh going on its way and

1507
00:59:51,510 --> 00:59:49,520
and that you know that sounds like a a

1508
00:59:55,270 --> 00:59:51,520
lot and it is the flight analysis group

1509
00:59:57,589 --> 00:59:55,280
both at jpl lsp and ula did a lot of

1510
00:59:58,789 --> 00:59:57,599
work to pick out those target sets and

1511
01:00:00,069 --> 00:59:58,799
figure out where we needed to be so

1512
01:00:02,069 --> 01:00:00,079
they've done a great job we'll see how

1513
01:00:03,670 --> 01:00:02,079

this mission continues so mig tell us

1514
01:00:04,710 --> 01:00:03,680
about the two burns required here and

1515
01:00:06,870 --> 01:00:04,720
we're actually coming up on the end of

1516
01:00:08,549 --> 01:00:06,880
the first one

1517
01:00:10,630 --> 01:00:08,559
ultimately a lot of people probably and

1518
01:00:12,309 --> 01:00:10,640
myself included at some point just like

1519
01:00:14,470 --> 01:00:12,319
why wouldn't you just keep firing the

1520
01:00:17,510 --> 01:00:14,480
engines just fire all the way through

1521
01:00:19,589 --> 01:00:17,520
and get to mars in one shot so the first

1522
01:00:21,510 --> 01:00:19,599
burn gets us into that park orbit we

1523
01:00:23,430 --> 01:00:21,520
talked about we've lifted off we've left

1524
01:00:25,829 --> 01:00:23,440
earth we've got into a park orbit around

1525
01:00:28,230 --> 01:00:25,839
earth right now and while we're in that

1526
01:00:30,309 --> 01:00:28,240
park orbit we will perform some

1527
01:00:32,150 --> 01:00:30,319
maneuvers to kind of roll uh mars

1528
01:00:35,030 --> 01:00:32,160
perspirants and the centaur

1529
01:00:36,230 --> 01:00:35,040
and uh coast during that time

1530
01:00:38,309 --> 01:00:36,240
basically

1531
01:00:40,069 --> 01:00:38,319
setting itself up looking at the sun and

1532
01:00:42,630 --> 01:00:40,079
away from the sun to control the thermal

1533
01:00:44,470 --> 01:00:42,640
environments that are on mars 2020

1534
01:00:46,950 --> 01:00:44,480
during this coast period that coast

1535
01:00:49,030 --> 01:00:46,960
period will allow us to coast around uh

1536
01:00:51,430 --> 01:00:49,040
into the position that we need so that

1537
01:00:53,109 --> 01:00:51,440
we can have that second firing to get

1538
01:00:56,150 --> 01:00:53,119

the velocity needed

1539
01:00:58,150 --> 01:00:56,160
to head off into mars yes and we will be

1540
01:01:00,150 --> 01:00:58,160
back for that second burn in just under

1541
01:01:01,910 --> 01:01:00,160
30 minutes now but for now there's more

1542
01:01:03,910 --> 01:01:01,920
to learn about this mission and all the

1543
01:01:12,309 --> 01:01:03,920
amazing science that's involved daryl

1544
01:01:16,789 --> 01:01:14,390
all right thank you very much great

1545
01:01:19,589 --> 01:01:16,799
launch and great job guys back outside

1546
01:01:22,470 --> 01:01:19,599
now to recap an atlas 5 rocket carrying

1547
01:01:23,910 --> 01:01:22,480
mars perseverance rover launched on time

1548
01:01:27,030 --> 01:01:23,920
from the cape canaveral air force

1549
01:01:29,270 --> 01:01:27,040
station at 7 50 a.m eastern daylight

1550
01:01:31,109 --> 01:01:29,280
time incredible after the rocket took

1551
01:01:32,789 --> 01:01:31,119
flight it separated from the first stage

1552
01:01:35,190 --> 01:01:32,799
and was then boosted into orbit by the

1553
01:01:36,870 --> 01:01:35,200
centaur's second stage perseverance is

1554
01:01:39,349 --> 01:01:36,880
now preparing for a second burn that

1555
01:01:40,710 --> 01:01:39,359
will put it on a trajectory toward mars

1556
01:01:42,789 --> 01:01:40,720
that's just incredible to say it gives

1557
01:01:45,109 --> 01:01:42,799
me goosebumps it really is and we're so

1558
01:01:46,789 --> 01:01:45,119
excited about that as well and while we

1559
01:01:48,309 --> 01:01:46,799
wait for that second burn hang in there

1560
01:01:50,549 --> 01:01:48,319
with us because we got a lot of exciting

1561
01:01:52,710 --> 01:01:50,559
coverage to go we're gonna welcome in

1562
01:01:55,910 --> 01:01:52,720
our one of our launch guests dr derek

1563
01:01:58,150 --> 01:01:55,920

muller he is the creator and host of the

1564
01:02:01,349 --> 01:01:58,160
popular science education channel on

1565
01:02:04,309 --> 01:02:01,359
youtube called veritasium he also holds

1566
01:02:06,309 --> 01:02:04,319
a doctorate in physics education so he's

1567
01:02:07,750 --> 01:02:06,319
really smart and that's why you saw us

1568
01:02:09,589 --> 01:02:07,760
kind of having some fun because derek

1569
01:02:11,990 --> 01:02:09,599
was here on set we're just having a good

1570
01:02:13,910 --> 01:02:12,000
time talking about this launch which i

1571
01:02:15,990 --> 01:02:13,920
got to start off with that derek your

1572
01:02:17,589 --> 01:02:16,000
first time seeing a launch in person

1573
01:02:18,950 --> 01:02:17,599
what do you think i mean

1574
01:02:20,630 --> 01:02:18,960
what can you say that i have nothing to

1575
01:02:21,990 --> 01:02:20,640
compare it to but it was awesome

1576
01:02:23,990 --> 01:02:22,000
something i will never forget and i

1577
01:02:25,589 --> 01:02:24,000
definitely want to be invited back so if

1578
01:02:27,430 --> 01:02:25,599
you guys could make that happen i mean

1579
01:02:29,589 --> 01:02:27,440
just so amazing you did a great job

1580
01:02:30,789 --> 01:02:29,599
explaining physics what did it feel like

1581
01:02:34,390 --> 01:02:30,799
kind of walk me through as you were

1582
01:02:35,829 --> 01:02:34,400
watching and experiencing it well

1583
01:02:37,990 --> 01:02:35,839
it's like all the physics goes out the

1584
01:02:39,829 --> 01:02:38,000
window a little bit it's a very visceral

1585
01:02:42,470 --> 01:02:39,839
moment between you and this very

1586
01:02:44,150 --> 01:02:42,480
powerful craft i think it's just amazing

1587
01:02:45,829 --> 01:02:44,160
all the you know the engineering that

1588
01:02:47,670 --> 01:02:45,839

goes into making something that's that

1589
01:02:49,670 --> 01:02:47,680
powerful and yet that controlled you

1590
01:02:51,670 --> 01:02:49,680
know and to witness that is phenomenal

1591
01:02:54,069 --> 01:02:51,680
and then to feel the rumble of all that

1592
01:02:56,309 --> 01:02:54,079
sound as it hits you i found it an

1593
01:02:58,630 --> 01:02:56,319
incredibly emotional experience it's

1594
01:03:00,710 --> 01:02:58,640
it's almost unbelievable to you know see

1595
01:03:02,710 --> 01:03:00,720
it taking off it's it's very surreal

1596
01:03:04,069 --> 01:03:02,720
that's for sure nice

1597
01:03:06,230 --> 01:03:04,079
what excites you the most about the

1598
01:03:07,510 --> 01:03:06,240
perseverance rover well the perseverance

1599
01:03:09,349 --> 01:03:07,520
rover is going to do a lot of great

1600
01:03:10,470 --> 01:03:09,359
science so i'm excited for example that

1601
01:03:11,990 --> 01:03:10,480
it's going to cache samples that we're

1602
01:03:13,750 --> 01:03:12,000
going to bring back you know super

1603
01:03:15,589 --> 01:03:13,760
excited that we're actually going to

1604
01:03:17,670 --> 01:03:15,599
have samples from mars in our hands and

1605
01:03:19,670 --> 01:03:17,680
i think that may clinch whether we can

1606
01:03:21,910 --> 01:03:19,680
see that life is actually there but i'm

1607
01:03:23,190 --> 01:03:21,920
also super excited about uh ingenuity

1608
01:03:25,270 --> 01:03:23,200
about the helicopter which i got to

1609
01:03:27,190 --> 01:03:25,280
visit out at jpl before it was strapped

1610
01:03:30,150 --> 01:03:27,200
to the underbelly of the rover and to

1611
01:03:32,789 --> 01:03:30,160
think about flying a rotorcraft in uh

1612
01:03:34,789 --> 01:03:32,799
you know another world essentially in a

1613
01:03:37,270 --> 01:03:34,799

place that only has one one hundredth of

1614
01:03:40,150 --> 01:03:37,280
the earth's atmosphere it seems

1615
01:03:42,150 --> 01:03:40,160
audacious and i am impressed and amazed

1616
01:03:44,630 --> 01:03:42,160
and i can't wait to see if it works you

1617
01:03:46,789 --> 01:03:44,640
know i am i'm cautiously optimistic i

1618
01:03:49,109 --> 01:03:46,799
think the team is phenomenal and you did

1619
01:03:50,870 --> 01:03:49,119
a in fact a youtube story on it a piece

1620
01:03:53,190 --> 01:03:50,880
on your channel and did a fantastic job

1621
01:03:55,589 --> 01:03:53,200
going to jpl i did yeah and i was just

1622
01:03:57,029 --> 01:03:55,599
so lucky that it was like there you know

1623
01:03:59,190 --> 01:03:57,039
a meter or two away from me on the other

1624
01:04:01,270 --> 01:03:59,200
side of a door in a clean room and uh

1625
01:04:02,870 --> 01:04:01,280
that was yeah one of the great moments

1626
01:04:05,510 --> 01:04:02,880
of my life yeah that thing's going to

1627
01:04:07,430 --> 01:04:05,520
mars exactly yeah and it weighs like

1628
01:04:09,349 --> 01:04:07,440
about as much as my laptop yeah and you

1629
01:04:11,029 --> 01:04:09,359
think about you know it's you know

1630
01:04:12,789 --> 01:04:11,039
substantial in its size and it's going

1631
01:04:13,910 --> 01:04:12,799
to go there and take off and fly all by

1632
01:04:15,670 --> 01:04:13,920
itself because of course we can't

1633
01:04:17,029 --> 01:04:15,680
control it given the time delay and

1634
01:04:18,549 --> 01:04:17,039
everything i like

1635
01:04:20,870 --> 01:04:18,559
that is i just think one of the

1636
01:04:22,549 --> 01:04:20,880
pinnacles of human engineering yes

1637
01:04:24,069 --> 01:04:22,559
absolutely now this is going to do some

1638
01:04:26,309 --> 01:04:24,079

big science as well what are your

1639
01:04:29,349 --> 01:04:26,319
thoughts on the search for ancient

1640
01:04:31,910 --> 01:04:29,359
microbial life on another planet mars

1641
01:04:34,069 --> 01:04:31,920
well you know i think chances are good

1642
01:04:35,829 --> 01:04:34,079
that mars once harbored life it was so

1643
01:04:37,109 --> 01:04:35,839
similar to earth in the past one can

1644
01:04:38,950 --> 01:04:37,119
only expect

1645
01:04:42,710 --> 01:04:38,960
you know life probably sprung up there

1646
01:04:44,230 --> 01:04:42,720
as well but i'm i'm really excited to

1647
01:04:46,230 --> 01:04:44,240
for us to get that confirmation because

1648
01:04:48,789 --> 01:04:46,240
i think it really transforms our ideas

1649
01:04:50,309 --> 01:04:48,799
about life and you know how frequent it

1650
01:04:53,589 --> 01:04:50,319
is right now all we have is this sample

1651
01:04:56,309 --> 01:04:53,599
size of one one earth with life you know

1652
01:04:57,750 --> 01:04:56,319
we find another one that's 100 more

1653
01:04:59,750 --> 01:04:57,760
information and data and i think it's

1654
01:05:01,990 --> 01:04:59,760
likely that that life will not be

1655
01:05:03,829 --> 01:05:02,000
exactly like ours and and i think it'll

1656
01:05:05,750 --> 01:05:03,839
be fascinating everything we can learn

1657
01:05:07,990 --> 01:05:05,760
about you know other potential forms of

1658
01:05:09,510 --> 01:05:08,000
life just by finding you know life on

1659
01:05:12,150 --> 01:05:09,520
another planet you seem to suggest that

1660
01:05:14,390 --> 01:05:12,160
you think there is life i i do i mean

1661
01:05:15,750 --> 01:05:14,400
you you have liquid water for i don't

1662
01:05:17,990 --> 01:05:15,760
know how many you know half a billion or

1663
01:05:20,150 --> 01:05:18,000

a billion years on earth that was enough

1664
01:05:21,589 --> 01:05:20,160
to create life so

1665
01:05:24,069 --> 01:05:21,599
you know

1666
01:05:25,670 --> 01:05:24,079
the guess is that's not a unique thing

1667
01:05:27,349 --> 01:05:25,680
you know right i mean the scientific

1668
01:05:29,750 --> 01:05:27,359
hypothesis is you you run that enough

1669
01:05:32,069 --> 01:05:29,760
times it's bound to lead to life again

1670
01:05:33,670 --> 01:05:32,079
in other circumstances dr derek muller

1671
01:05:35,349 --> 01:05:33,680
we really appreciate you being here

1672
01:05:37,510 --> 01:05:35,359
youtube creator with the channel

1673
01:05:39,990 --> 01:05:37,520
veritasium you we know you have a two

1674
01:05:41,270 --> 01:05:40,000
and a half week old child uh your wife

1675
01:05:42,870 --> 01:05:41,280
is holding out

1676
01:05:45,349 --> 01:05:42,880
there are very few things that i could

1677
01:05:46,950 --> 01:05:45,359
leave for but this lunch that is one of

1678
01:05:48,390 --> 01:05:46,960
them thank you so much for doing so get

1679
01:05:50,630 --> 01:05:48,400
a selfie with our full-size rover back

1680
01:05:52,150 --> 01:05:50,640
here you see lee definitely very good

1681
01:05:54,150 --> 01:05:52,160
thank you so much

1682
01:05:56,390 --> 01:05:54,160
there has been a lot of anticipation by

1683
01:05:58,150 --> 01:05:56,400
nasa teams leading up to this launch but

1684
01:05:59,829 --> 01:05:58,160
some won't be able to fully celebrate

1685
01:06:02,309 --> 01:05:59,839
until the rover has safely landed on

1686
01:06:03,829 --> 01:06:02,319
mars seven months from now raquel you

1687
01:06:06,150 --> 01:06:03,839
are there with the mars mission team at

1688
01:06:10,390 --> 01:06:06,160

jpl in california how are they reacting

1689
01:06:15,109 --> 01:06:13,109
well it's been quite an eventful morning

1690
01:06:16,950 --> 01:06:15,119
with the earthquake but you could feel

1691
01:06:19,670 --> 01:06:16,960
the energy building in the room in the

1692
01:06:22,150 --> 01:06:19,680
run-up to launch and now i'm with bobby

1693
01:06:25,029 --> 01:06:22,160
braun the director for planetary science

1694
01:06:27,270 --> 01:06:25,039
at jpl bobby now that we've started our

1695
01:06:28,390 --> 01:06:27,280
journey to mars can you tell me how you

1696
01:06:30,950 --> 01:06:28,400
are feeling

1697
01:06:33,510 --> 01:06:30,960
wow it's just it's a great day it's uh

1698
01:06:36,470 --> 01:06:33,520
we're all so excited um and to get

1699
01:06:38,549 --> 01:06:36,480
started in this way and to be on our way

1700
01:06:39,670 --> 01:06:38,559
uh after all this work that the team has

1701
01:06:42,549 --> 01:06:39,680
gone through

1702
01:06:43,910 --> 01:06:42,559
uh it's really really just fantastic

1703
01:06:45,990 --> 01:06:43,920
that's great now

1704
01:06:49,029 --> 01:06:46,000
what's now the perseverance is off the

1705
01:06:51,510 --> 01:06:49,039
launch pad what are its next steps

1706
01:06:53,510 --> 01:06:51,520
yeah well we're almost on the path to

1707
01:06:55,589 --> 01:06:53,520
mars if you will the launch vehicle has

1708
01:06:57,829 --> 01:06:55,599
done great so far our partners at ula

1709
01:06:59,670 --> 01:06:57,839
are just fantastic and we're very happy

1710
01:07:02,150 --> 01:06:59,680
to be working with them and for them to

1711
01:07:04,950 --> 01:07:02,160
give us this boost so far but we still

1712
01:07:07,270 --> 01:07:04,960
have to have another burn of our upper

1713
01:07:09,750 --> 01:07:07,280

stage we have to pass through the night

1714
01:07:12,230 --> 01:07:09,760
side or the shadow of the earth come out

1715
01:07:15,109 --> 01:07:12,240
on the other side and find the sun and

1716
01:07:17,670 --> 01:07:15,119
power up and then uh establish contact

1717
01:07:20,710 --> 01:07:17,680
with the spacecraft and once we do we'll

1718
01:07:23,510 --> 01:07:20,720
truly be on our way to mars we'll have a

1719
01:07:25,349 --> 01:07:23,520
a spacecraft that's power safe that we

1720
01:07:27,109 --> 01:07:25,359
can communicate with and our journey

1721
01:07:30,150 --> 01:07:27,119
will really begin

1722
01:07:31,910 --> 01:07:30,160
we look forward to that thanks bobby now

1723
01:07:33,990 --> 01:07:31,920
daryl as bobby mentioned there's an

1724
01:07:36,710 --> 01:07:34,000
excitement here in the room as the team

1725
01:07:38,710 --> 01:07:36,720
looks ahead to the second centaur burn

1726
01:07:40,710 --> 01:07:38,720
but before we get to that let's learn

1727
01:07:45,109 --> 01:07:40,720
more about the science on board this

1728
01:07:48,710 --> 01:07:46,789
all right thanks raquel and as you

1729
01:07:51,109 --> 01:07:48,720
mentioned there are numerous scientific

1730
01:07:53,430 --> 01:07:51,119
studies and technology demonstrations on

1731
01:07:55,910 --> 01:07:53,440
perseverance some of these are directly

1732
01:07:59,829 --> 01:07:55,920
preparing us to one day send humans to

1733
01:08:01,430 --> 01:07:59,839
mars one in particular is called moxie

1734
01:08:03,190 --> 01:08:01,440
jeff shihai from the science and

1735
01:08:05,670 --> 01:08:03,200
technology mission directorate is

1736
01:08:07,670 --> 01:08:05,680
joining us now to explain and he is here

1737
01:08:16,709 --> 01:08:07,680
with us you know well you know you know

1738
01:08:20,789 --> 01:08:18,470

yeah thanks for making the adjustment

1739
01:08:23,110 --> 01:08:20,799
there so jeff this is an incredible

1740
01:08:25,669 --> 01:08:23,120
piece of technology here this moxie

1741
01:08:29,189 --> 01:08:25,679
right so tell us what is it and why is

1742
01:08:32,070 --> 01:08:29,199
it important well moxie stands for mars

1743
01:08:34,070 --> 01:08:32,080
oxygen institute resource utilization

1744
01:08:35,430 --> 01:08:34,080
experiment that's kind of a mouthful so

1745
01:08:37,910 --> 01:08:35,440
we grab a few letters out of there and

1746
01:08:40,070 --> 01:08:37,920
just call it moxie and i i think the

1747
01:08:42,309 --> 01:08:40,080
name moxie has a certain kind of

1748
01:08:44,470 --> 01:08:42,319
attitude that's appropriate for this

1749
01:08:47,910 --> 01:08:44,480
ambitious mission to mars but

1750
01:08:50,070 --> 01:08:47,920
what in-situ resource utilization is is

1751
01:08:52,070 --> 01:08:50,080
utilizing the resources that we find at

1752
01:08:55,189 --> 01:08:52,080
a destination to produce useful

1753
01:08:58,149 --> 01:08:55,199
commodities and so what moxie's going to

1754
01:09:01,269 --> 01:08:58,159
do is suck in the mars atmosphere which

1755
01:09:03,990 --> 01:09:01,279
is mostly carbon dioxide and produce

1756
01:09:06,149 --> 01:09:04,000
pure oxygen oxygen is a commodity that

1757
01:09:07,030 --> 01:09:06,159
we can use in our exploration endeavors

1758
01:09:07,990 --> 01:09:07,040
and so

1759
01:09:10,070 --> 01:09:08,000
um

1760
01:09:13,189 --> 01:09:10,080
moxie is the first

1761
01:09:15,110 --> 01:09:13,199
in-situ resource utilization experiment

1762
01:09:18,149 --> 01:09:15,120
on another planet how about that that's

1763
01:09:20,390 --> 01:09:18,159

why it's so important if we can produce

1764
01:09:21,829 --> 01:09:20,400
things we need at the destination

1765
01:09:22,789 --> 01:09:21,839
we don't have to load them in a launch

1766
01:09:24,550 --> 01:09:22,799
vehicle

1767
01:09:26,229 --> 01:09:24,560
launch it from the surface to earth push

1768
01:09:29,269 --> 01:09:26,239
them all the way the destination and

1769
01:09:32,630 --> 01:09:29,279
land them on mars or or the moon saving

1770
01:09:33,749 --> 01:09:32,640
incredible weight fuel resources to use

1771
01:09:35,269 --> 01:09:33,759
them the ones that are there and in

1772
01:09:37,430 --> 01:09:35,279
place that's right it took a lot of

1773
01:09:39,269 --> 01:09:37,440
moxie

1774
01:09:41,030 --> 01:09:39,279
what were some of the biggest challenges

1775
01:09:43,430 --> 01:09:41,040
in developing the technology designing

1776
01:09:46,470 --> 01:09:43,440
it developing building it well the the

1777
01:09:48,709 --> 01:09:46,480
team that produced the hardware that we

1778
01:09:49,829 --> 01:09:48,719
just saw the being launched on its way

1779
01:09:51,430 --> 01:09:49,839
to mars

1780
01:09:53,669 --> 01:09:51,440
they certainly had moxie because they

1781
01:09:55,910 --> 01:09:53,679
had overcome a lot of challenges along

1782
01:09:57,669 --> 01:09:55,920
the way when you start to develop new

1783
01:09:59,750 --> 01:09:57,679
technologies you're working in a

1784
01:10:01,990 --> 01:09:59,760
laboratory and you've got all the room

1785
01:10:03,030 --> 01:10:02,000
you need usually you can build it big

1786
01:10:04,229 --> 01:10:03,040
and heavy because you're not trying to

1787
01:10:05,990 --> 01:10:04,239
make it look pretty you're just trying

1788
01:10:08,550 --> 01:10:06,000

to make it work and you've got all the

1789
01:10:10,790 --> 01:10:08,560
power you need and you can control the

1790
01:10:12,630 --> 01:10:10,800
thermal environment and you can have

1791
01:10:13,990 --> 01:10:12,640
people teams of people come in and take

1792
01:10:15,430 --> 01:10:14,000
her with it and fix it when it breaks

1793
01:10:16,950 --> 01:10:15,440
and all that so

1794
01:10:19,430 --> 01:10:16,960
but then you can probably see where i'm

1795
01:10:21,110 --> 01:10:19,440
going with this when when you get to the

1796
01:10:23,430 --> 01:10:21,120
point where it's time to fly that

1797
01:10:26,630 --> 01:10:23,440
hardware to prove it out in the space

1798
01:10:28,310 --> 01:10:26,640
environment or on the planetary surface

1799
01:10:29,590 --> 01:10:28,320
then the rubber really hits the road in

1800
01:10:30,470 --> 01:10:29,600
terms of the engineering and that's

1801
01:10:32,229 --> 01:10:30,480
where the

1802
01:10:34,630 --> 01:10:32,239
teams of engineers

1803
01:10:37,510 --> 01:10:34,640
come into play and and they develop

1804
01:10:39,830 --> 01:10:37,520
clever solutions to implement the the

1805
01:10:42,550 --> 01:10:39,840
process that's been developed in the lab

1806
01:10:44,229 --> 01:10:42,560
and package it for space flight so moxie

1807
01:10:45,830 --> 01:10:44,239
faced a lot of challenges you know what

1808
01:10:46,950 --> 01:10:45,840
once you once you have to put it on the

1809
01:10:50,149 --> 01:10:46,960
rover

1810
01:10:52,630 --> 01:10:50,159
um the the size becomes important it has

1811
01:10:54,870 --> 01:10:52,640
to fit in a certain volume on the rover

1812
01:10:57,750 --> 01:10:54,880
the uh amount of weight or the mass

1813
01:11:00,149 --> 01:10:57,760

becomes really important every ounce you

1814
01:11:01,669 --> 01:11:00,159
uh launch into space takes propellant to

1815
01:11:03,270 --> 01:11:01,679
to move it so

1816
01:11:04,630 --> 01:11:03,280
we want to make moxie as light as

1817
01:11:06,310 --> 01:11:04,640
possible had it fit within a certain

1818
01:11:07,430 --> 01:11:06,320
mass budget or they would have kicked it

1819
01:11:08,950 --> 01:11:07,440
off the rover

1820
01:11:10,950 --> 01:11:08,960
and we're glad you made it on the rover

1821
01:11:12,390 --> 01:11:10,960
yeah and just real quick and without

1822
01:11:14,229 --> 01:11:12,400
getting too deep into the technical

1823
01:11:17,270 --> 01:11:14,239
details how does it convert carbon

1824
01:11:20,149 --> 01:11:17,280
dioxide to oxygen so moxie uses a

1825
01:11:22,709 --> 01:11:20,159
thermal and electrochemical process

1826
01:11:24,310 --> 01:11:22,719
there's a compressor that was built by a

1827
01:11:26,709 --> 01:11:24,320
company called air squared some of that

1828
01:11:29,430 --> 01:11:26,719
was funded under the nasa small business

1829
01:11:30,870 --> 01:11:29,440
innovative research program actually and

1830
01:11:33,189 --> 01:11:30,880
they built the compressor what it does

1831
01:11:35,750 --> 01:11:33,199
is acquire the oxygen or the carbon

1832
01:11:37,990 --> 01:11:35,760
dioxide from the mars atmosphere and

1833
01:11:40,229 --> 01:11:38,000
push it into the electrolysis system a

1834
01:11:42,310 --> 01:11:40,239
company called ceramatech a team led by

1835
01:11:44,950 --> 01:11:42,320
a guy named joe harvickson uh they're

1836
01:11:47,430 --> 01:11:44,960
now called oxyon energy i think but they

1837
01:11:50,470 --> 01:11:47,440
they uh built the guts of moxie which is

1838
01:11:53,590 --> 01:11:50,480

the solid oxide electrolysis system that

1839
01:11:56,310 --> 01:11:53,600
takes the carbon dioxide co2

1840
01:11:59,350 --> 01:11:56,320
actually pulls an atom of oxygen off the

1841
01:12:01,590 --> 01:11:59,360
co2 leaving co oh wow and then those

1842
01:12:05,270 --> 01:12:01,600
atoms migrate through the electrolysis

1843
01:12:07,590 --> 01:12:05,280
system and those oxygen ions are

1844
01:12:10,630 --> 01:12:07,600
neutralized and then they recombined an

1845
01:12:12,470 --> 01:12:10,640
o and an o becomes o2 and so we get pure

1846
01:12:14,950 --> 01:12:12,480
oxygen out of the system that's

1847
01:12:17,510 --> 01:12:14,960
fantastic and so in order for you to get

1848
01:12:19,189 --> 01:12:17,520
moxie on board the rover actually you

1849
01:12:21,590 --> 01:12:19,199
had to kind of clear through the very

1850
01:12:23,669 --> 01:12:21,600
smart lady to my left she's with

1851
01:12:26,070 --> 01:12:23,679
planetary protection so she actually had

1852
01:12:27,830 --> 01:12:26,080
to clean off part of it right yeah yeah

1853
01:12:29,510 --> 01:12:27,840
you had to heat it and then clean the

1854
01:12:31,270 --> 01:12:29,520
that's right yeah the socks part was

1855
01:12:33,030 --> 01:12:31,280
actually self sterilizing it was hot

1856
01:12:35,750 --> 01:12:33,040
enough so it cleaned itself but there's

1857
01:12:37,510 --> 01:12:35,760
a part the o2 sensors that needed vapor

1858
01:12:39,590 --> 01:12:37,520
hydrogen peroxide sterilization so it's

1859
01:12:41,350 --> 01:12:39,600
the first time we used hydrogen peroxide

1860
01:12:43,510 --> 01:12:41,360
on flight hardware oh that's awesome

1861
01:12:44,950 --> 01:12:43,520
yeah yeah so you can say thank you thank

1862
01:12:46,070 --> 01:12:44,960
you thank you

1863
01:12:47,830 --> 01:12:46,080

thank you

1864
01:12:50,709 --> 01:12:47,840
thanks for letting us do that well you

1865
01:12:52,790 --> 01:12:50,719
know in speaking about the rover moo

1866
01:12:54,149 --> 01:12:52,800
what is it you know curiosity told us

1867
01:12:57,510 --> 01:12:54,159
that we have

1868
01:13:00,070 --> 01:12:57,520
or had at one time on mars moving water

1869
01:13:02,709 --> 01:13:00,080
so so what is perseverance going to do

1870
01:13:04,790 --> 01:13:02,719
in terms of uh confirming whether life

1871
01:13:06,709 --> 01:13:04,800
could have been there yeah exactly so

1872
01:13:08,870 --> 01:13:06,719
the the past mission set up the stage as

1873
01:13:10,709 --> 01:13:08,880
far as understanding what could sustain

1874
01:13:13,110 --> 01:13:10,719
life and now we're actually looking for

1875
01:13:14,630 --> 01:13:13,120
signatures of that life

1876
01:13:15,910 --> 01:13:14,640
and so some of the answers that you're

1877
01:13:18,310 --> 01:13:15,920
looking for

1878
01:13:20,630 --> 01:13:18,320
which one are you personally looking

1879
01:13:22,870 --> 01:13:20,640
most forward to yeah i'm personally

1880
01:13:24,149 --> 01:13:22,880
looking forward to seeing

1881
01:13:25,830 --> 01:13:24,159
non-uh

1882
01:13:28,149 --> 01:13:25,840
signs of life where no one will argue

1883
01:13:30,229 --> 01:13:28,159
that it has a biotic source

1884
01:13:32,790 --> 01:13:30,239
it's very easy to say oh this chemistry

1885
01:13:34,709 --> 01:13:32,800
could have happened from natural reasons

1886
01:13:36,790 --> 01:13:34,719
but i want to see a smoking gun it would

1887
01:13:39,510 --> 01:13:36,800
be awesome to see that now that's not

1888
01:13:41,830 --> 01:13:39,520

exactly easy right no not at all and so

1889
01:13:44,229 --> 01:13:41,840
explain that explain that to us yeah so

1890
01:13:45,430 --> 01:13:44,239
in order to get that definitive signal

1891
01:13:46,790 --> 01:13:45,440
one of the main things you have to do is

1892
01:13:48,470 --> 01:13:46,800
make sure you have a clean instrument

1893
01:13:50,870 --> 01:13:48,480
that you're sampling with and so that's

1894
01:13:52,790 --> 01:13:50,880
why we spent a lot of time cleaning

1895
01:13:54,709 --> 01:13:52,800
baking out hardware to such a high

1896
01:13:56,550 --> 01:13:54,719
degree 150 degrees celsius for some of

1897
01:13:58,550 --> 01:13:56,560
these parts to make sure it was clean

1898
01:14:00,229 --> 01:13:58,560
enough and so those parts have to be

1899
01:14:02,149 --> 01:14:00,239
specially made to be able to handle that

1900
01:14:03,669 --> 01:14:02,159
heat that's right yeah in order to get

1901
01:14:05,430 --> 01:14:03,679
it past you yeah all the material

1902
01:14:07,669 --> 01:14:05,440
selection everything was done

1903
01:14:09,750 --> 01:14:07,679
specifically for that purpose where else

1904
01:14:12,149 --> 01:14:09,760
in the universe moo do you think we

1905
01:14:15,910 --> 01:14:12,159
should explore for life yeah i'm really

1906
01:14:16,950 --> 01:14:15,920
excited about europa europa has an ocean

1907
01:14:19,510 --> 01:14:16,960
underneath

1908
01:14:21,510 --> 01:14:19,520
a thick layer of ice it has vents

1909
01:14:23,350 --> 01:14:21,520
underneath that have a heat source so

1910
01:14:26,390 --> 01:14:23,360
there's a source of energy for possible

1911
01:14:27,990 --> 01:14:26,400
life europa a moon yes the moon yeah icy

1912
01:14:29,110 --> 01:14:28,000
moons that's the next place to go it's

1913
01:14:31,590 --> 01:14:29,120

interesting that you picked that i mean

1914
01:14:33,430 --> 01:14:31,600
it's a very very cold cold place yeah

1915
01:14:35,750 --> 01:14:33,440
you've got a rover in front of you that

1916
01:14:38,310 --> 01:14:35,760
is miniaturized we have one that is

1917
01:14:39,750 --> 01:14:38,320
behind us yeah right and as part of this

1918
01:14:42,550 --> 01:14:39,760
you also had to make sure that that

1919
01:14:44,550 --> 01:14:42,560
nuclear battery was installed exactly

1920
01:14:46,790 --> 01:14:44,560
yeah this this bit back here tell me

1921
01:14:49,270 --> 01:14:46,800
about how that worked when you did it

1922
01:14:51,669 --> 01:14:49,280
and how that process was yeah it was

1923
01:14:53,350 --> 01:14:51,679
only a few days before this launch day i

1924
01:14:55,110 --> 01:14:53,360
mean we we just finished counting our

1925
01:14:56,950 --> 01:14:55,120
samples just a couple of days ago how

1926
01:14:58,709 --> 01:14:56,960
about that yes so we had to actually

1927
01:15:00,470 --> 01:14:58,719
alter the way we sample we take wipes

1928
01:15:01,990 --> 01:15:00,480
and swabs of every surface of the rover

1929
01:15:04,310 --> 01:15:02,000
but for this we had to make sure our

1930
01:15:07,110 --> 01:15:04,320
head was far back and we had as minimal

1931
01:15:09,189 --> 01:15:07,120
radiation uh impact as possible but we

1932
01:15:10,870 --> 01:15:09,199
got it it was super clean inl did a

1933
01:15:12,630 --> 01:15:10,880
great job everyone has done a fantastic

1934
01:15:14,070 --> 01:15:12,640
job making sure this was as clean as

1935
01:15:15,669 --> 01:15:14,080
possible it's ready to go what do you

1936
01:15:17,270 --> 01:15:15,679
think about that full-size rover behind

1937
01:15:19,669 --> 01:15:17,280
it it's incredible it's like hey you

1938
01:15:21,750 --> 01:15:19,679

should be up there

1939
01:15:23,510 --> 01:15:21,760
and apparently it is it is right to

1940
01:15:25,430 --> 01:15:23,520
scale as you take a shot of it there

1941
01:15:27,270 --> 01:15:25,440
that's a beautiful rover well

1942
01:15:29,110 --> 01:15:27,280
thanks for describing all that to us we

1943
01:15:31,110 --> 01:15:29,120
really appreciate the time to you for

1944
01:15:33,350 --> 01:15:31,120
you uh describing that

1945
01:15:35,510 --> 01:15:33,360
all right back into the show now we go

1946
01:15:37,350 --> 01:15:35,520
moving forward of course this is the

1947
01:15:39,590 --> 01:15:37,360
countdown as we go up you can see the

1948
01:15:42,149 --> 01:15:39,600
centaur there and the graphics is uh we

1949
01:15:45,189 --> 01:15:42,159
are tracking and continuing to track

1950
01:15:48,149 --> 01:15:45,199
mars 2020 on its way and when searching

1951
01:15:50,709 --> 01:15:48,159
for the possibility of life on mars it's

1952
01:15:52,709 --> 01:15:50,719
all about location location location and

1953
01:15:55,590 --> 01:15:52,719
perseverance perseverance's destination

1954
01:15:58,149 --> 01:15:55,600
is a place called jezreel crater let's

1955
01:15:59,669 --> 01:15:58,159
go back out to jpl now and raquel you've

1956
01:16:01,430 --> 01:15:59,679
got a scientist there that believes

1957
01:16:04,149 --> 01:16:01,440
jezreel crater gives them the best

1958
01:16:08,310 --> 01:16:04,159
chance of finding any evidence of past

1959
01:16:12,630 --> 01:16:10,630
that's right daryl knowing where to look

1960
01:16:15,750 --> 01:16:12,640
for signs of ancient life on mars can be

1961
01:16:18,149 --> 01:16:15,760
a daunting task it took five years to

1962
01:16:20,790 --> 01:16:18,159
select a perfect landing site and with

1963
01:16:23,030 --> 01:16:20,800

us now is katie stack morgan one of the

1964
01:16:25,830 --> 01:16:23,040
project scientists who helped pick that

1965
01:16:28,070 --> 01:16:25,840
location katie can you tell us why we're

1966
01:16:30,790 --> 01:16:28,080
heading to jezreel crater

1967
01:16:32,950 --> 01:16:30,800
thanks raquel there are many reasons why

1968
01:16:35,350 --> 01:16:32,960
scientists are so excited to send

1969
01:16:37,750 --> 01:16:35,360
perseverance to jezreel crater and why

1970
01:16:39,669 --> 01:16:37,760
we think that jezreel crater is an ideal

1971
01:16:42,149 --> 01:16:39,679
place to begin a mars sample return

1972
01:16:44,790 --> 01:16:42,159
campaign at jezro we think that

1973
01:16:47,270 --> 01:16:44,800
perseverance can assemble a diverse set

1974
01:16:49,110 --> 01:16:47,280
of samples that will help us resolve

1975
01:16:51,189 --> 01:16:49,120
some of the most important questions

1976
01:16:54,149 --> 01:16:51,199
about life beyond earth and the

1977
01:16:56,229 --> 01:16:54,159
evolution of planets over time

1978
01:16:58,070 --> 01:16:56,239
at jezreel we know without a doubt that

1979
01:16:59,110 --> 01:16:58,080
there was an ancient lake and river

1980
01:17:00,070 --> 01:16:59,120
delta

1981
01:17:01,830 --> 01:17:00,080
and

1982
01:17:03,669 --> 01:17:01,840
at jezreel we have river valleys that

1983
01:17:05,990 --> 01:17:03,679
flow into and out of the crater and we

1984
01:17:08,229 --> 01:17:06,000
know that that lake filled up with water

1985
01:17:10,149 --> 01:17:08,239
and then overflowed water life as we

1986
01:17:12,310 --> 01:17:10,159
know it requires water to survive and

1987
01:17:15,830 --> 01:17:12,320
thrive and we think that jezreel has all

1988
01:17:18,149 --> 01:17:15,840

the building blocks to support past life

1989
01:17:19,990 --> 01:17:18,159
at jezreel we also have one of the best

1990
01:17:22,070 --> 01:17:20,000
preserved deltas

1991
01:17:24,070 --> 01:17:22,080
on the surface of mars and deltas in

1992
01:17:26,070 --> 01:17:24,080
lake settings are ideal for supporting

1993
01:17:28,470 --> 01:17:26,080
life and the rocks that perseverance

1994
01:17:31,669 --> 01:17:28,480
will explore can tell us more about the

1995
01:17:33,430 --> 01:17:31,679
the possibility for past life on mars

1996
01:17:35,189 --> 01:17:33,440
the rocks at jezreel crater are also

1997
01:17:37,030 --> 01:17:35,199
some of the oldest on mars between three

1998
01:17:38,950 --> 01:17:37,040
and a half and four billion years old

1999
01:17:41,030 --> 01:17:38,960
and that's the same interval of time

2000
01:17:42,950 --> 01:17:41,040
when life was developing here on earth

2001
01:17:45,270 --> 01:17:42,960
so by exploring the rocks and jezer with

2002
01:17:47,830 --> 01:17:45,280
perseverance we have the opportunity to

2003
01:17:49,590 --> 01:17:47,840
explore more about the development of

2004
01:17:51,669 --> 01:17:49,600
life in the solar system and can answer

2005
01:17:53,910 --> 01:17:51,679
some of the major questions we have

2006
01:17:55,189 --> 01:17:53,920
about that fundamental question back to

2007
01:17:58,310 --> 01:17:55,199
you raquel

2008
01:18:00,149 --> 01:17:58,320
great thank you so much katie and with

2009
01:18:02,950 --> 01:18:00,159
that let's head back to kennedy space

2010
01:18:05,350 --> 01:18:02,960
center darryl

2011
01:18:07,669 --> 01:18:05,360
much raquel we are back here at the

2012
01:18:10,149 --> 01:18:07,679
kennedy space center with our most

2013
01:18:12,229 --> 01:18:10,159

special guest moo and

2014
01:18:14,870 --> 01:18:12,239
the perseverance rover here it is a full

2015
01:18:18,470 --> 01:18:14,880
scot full-scale mock-up of the actual

2016
01:18:20,630 --> 01:18:18,480
rover itself well mo here it is and so

2017
01:18:21,910 --> 01:18:20,640
we've learned a lot about this rover so

2018
01:18:24,229 --> 01:18:21,920
far so tell me

2019
01:18:25,910 --> 01:18:24,239
kind of describe from top to bottom what

2020
01:18:27,910 --> 01:18:25,920
we're working here at the top you've got

2021
01:18:29,270 --> 01:18:27,920
the mast cam which is pretty tall right

2022
01:18:31,830 --> 01:18:29,280
it's always towering over your head it

2023
01:18:34,630 --> 01:18:31,840
is on a stage but what does it do yeah

2024
01:18:37,110 --> 01:18:34,640
so it has some a lot of fun components

2025
01:18:39,270 --> 01:18:37,120
some of them are the bass cam z z sams

2026
01:18:41,510 --> 01:18:39,280
for zoom so you see those two stereo

2027
01:18:43,350 --> 01:18:41,520
cameras and there's also that eyeball

2028
01:18:45,830 --> 01:18:43,360
what looks like an eye is actually a

2029
01:18:48,229 --> 01:18:45,840
laser it shoots at the rocks laser a

2030
01:18:49,669 --> 01:18:48,239
laser lasers uh and then depending on

2031
01:18:51,830 --> 01:18:49,679
the signature that comes back the

2032
01:18:53,990 --> 01:18:51,840
spectrometer reads it and tells you what

2033
01:18:56,630 --> 01:18:54,000
the geology is and that's fantastic and

2034
01:18:58,870 --> 01:18:56,640
some of the real exciting science though

2035
01:19:01,110 --> 01:18:58,880
is happening right here on this part

2036
01:19:03,270 --> 01:19:01,120
this is the articulating arm that comes

2037
01:19:05,590 --> 01:19:03,280
out right and then goes down onto the

2038
01:19:07,510 --> 01:19:05,600

planet and starts drilling exactly what

2039
01:19:09,189 --> 01:19:07,520
all is here that's going to help us

2040
01:19:10,950 --> 01:19:09,199
understand more about the geology of

2041
01:19:12,630 --> 01:19:10,960
mars the climate and whether or not

2042
01:19:14,390 --> 01:19:12,640
there was life yeah there's of course

2043
01:19:15,590 --> 01:19:14,400
pixel and sherlock the really amazing

2044
01:19:17,270 --> 01:19:15,600
instruments that are going to tell us

2045
01:19:20,630 --> 01:19:17,280
about the bio signatures but in the

2046
01:19:22,709 --> 01:19:20,640
middle there is the coring drill

2047
01:19:24,630 --> 01:19:22,719
the real drill will have a drill bit a

2048
01:19:26,070 --> 01:19:24,640
coring bit which is hollow in the middle

2049
01:19:28,709 --> 01:19:26,080
and there's going to be a tube inside

2050
01:19:30,470 --> 01:19:28,719
this is just a 3d printed version and as

2051
01:19:32,470 --> 01:19:30,480
it's collecting samples it's going to

2052
01:19:36,470 --> 01:19:32,480
have samples that go directly into the

2053
01:19:38,229 --> 01:19:36,480
tube i've got a tube there yeah

2054
01:19:40,709 --> 01:19:38,239
and it's going to go down the middle of

2055
01:19:43,030 --> 01:19:40,719
the tube as it's acquiring the sample

2056
01:19:44,790 --> 01:19:43,040
once it's done it's going to dock with

2057
01:19:46,709 --> 01:19:44,800
the bit carousel here

2058
01:19:48,790 --> 01:19:46,719
it's going to ingest the entire bit with

2059
01:19:51,750 --> 01:19:48,800
the tube inside in the sample it's going

2060
01:19:53,350 --> 01:19:51,760
to rotate down to the belly and there's

2061
01:19:55,270 --> 01:19:53,360
going to be a little arm on the inside

2062
01:19:58,229 --> 01:19:55,280
called the shaw the sample handling arm

2063
01:19:59,990 --> 01:19:58,239

to manipulate it take pictures uh assess

2064
01:20:01,910 --> 01:20:00,000
the volume and then feel it that's

2065
01:20:04,950 --> 01:20:01,920
fantastic and so there's quite a bit of

2066
01:20:06,709 --> 01:20:04,960
robotics happening between this part the

2067
01:20:09,030 --> 01:20:06,719
big carousel and getting it underneath

2068
01:20:10,790 --> 01:20:09,040
as we know it's now underneath but

2069
01:20:11,830 --> 01:20:10,800
here's a special guest we're going to

2070
01:20:14,390 --> 01:20:11,840
duck down

2071
01:20:16,870 --> 01:20:14,400
this is the this is the mars helicopter

2072
01:20:19,110 --> 01:20:16,880
ingenuity moo this thing is going to be

2073
01:20:21,110 --> 01:20:19,120
actually tucked up underneath the rover

2074
01:20:22,709 --> 01:20:21,120
it was a late addition to this project

2075
01:20:24,149 --> 01:20:22,719
but it's probably the neat one of the

2076
01:20:27,189 --> 01:20:24,159
neatest things on it it is pretty

2077
01:20:28,470 --> 01:20:27,199
amazing 2400 rpm that these blades are

2078
01:20:30,149 --> 01:20:28,480
going to spin

2079
01:20:32,070 --> 01:20:30,159
counter directions

2080
01:20:35,030 --> 01:20:32,080
it's a little bit under four pounds it's

2081
01:20:36,550 --> 01:20:35,040
super light and yeah it's going to

2082
01:20:37,830 --> 01:20:36,560
to be the first roto craft flight on the

2083
01:20:39,830 --> 01:20:37,840
surface of mars

2084
01:20:42,629 --> 01:20:39,840
spectacular and you know what's amazing

2085
01:20:43,990 --> 01:20:42,639
it will be taking pictures as well right

2086
01:20:46,709 --> 01:20:44,000
these plates

2087
01:20:48,310 --> 01:20:46,719
and they turn in opposite directions

2088
01:20:50,790 --> 01:20:48,320

it will have a camera on it it'll shoot

2089
01:20:52,950 --> 01:20:50,800
live or shoot video that we will then

2090
01:20:54,390 --> 01:20:52,960
get back it'll shoot video of the rover

2091
01:20:55,910 --> 01:20:54,400
as it's doing its work right yeah it's

2092
01:20:58,310 --> 01:20:55,920
spectacular and look at the clearance i

2093
01:21:00,070 --> 01:20:58,320
mean it this rover needs to clear this

2094
01:21:01,669 --> 01:21:00,080
helicopter after it's deployed all right

2095
01:21:03,750 --> 01:21:01,679
well thank you so much for giving us the

2096
01:21:05,830 --> 01:21:03,760
tour of the mock-up it's just like the

2097
01:21:07,110 --> 01:21:05,840
real one except for it's not going to

2098
01:21:09,270 --> 01:21:07,120
mars

2099
01:21:10,790 --> 01:21:09,280
well thank you so much and so by now you

2100
01:21:13,669 --> 01:21:10,800
may have heard that this perseverance

2101
01:21:15,350 --> 01:21:13,679
rover was named by a seventh grader

2102
01:21:18,070 --> 01:21:15,360
and it was given that name which is very

2103
01:21:21,189 --> 01:21:18,080
special to us and so we asked hidden

2104
01:21:24,390 --> 01:21:21,199
figures actress octavius spencer to tell

2105
01:21:28,470 --> 01:21:24,400
you why the perseverance name is more

2106
01:21:32,229 --> 01:21:28,480
than just a name to us here at nasa

2107
01:21:34,950 --> 01:21:32,239
we are a species of explorers

2108
01:21:37,350 --> 01:21:34,960
believers we choose to go to the moon in

2109
01:21:39,830 --> 01:21:37,360
this decade and do the other things

2110
01:21:42,310 --> 01:21:39,840
not because they are easy but because

2111
01:21:44,550 --> 01:21:42,320
they are hard we are willing to do the

2112
01:21:46,070 --> 01:21:44,560
hard things to overcome the many

2113
01:21:48,300 --> 01:21:46,080

challenges

2114
01:21:50,629 --> 01:21:48,310
this is what brings out the best in us

2115
01:21:53,350 --> 01:21:50,639
[Music]

2116
01:21:55,510 --> 01:21:53,360
our path has led to success

2117
01:21:57,990 --> 01:21:55,520
and to bitter losses we come together

2118
01:21:59,510 --> 01:21:58,000
today to mourn the loss of seven brave

2119
01:22:00,310 --> 01:21:59,520
americans

2120
01:22:03,669 --> 01:22:00,320
yet

2121
01:22:05,590 --> 01:22:03,679
even when faced with tragedy

2122
01:22:06,810 --> 01:22:05,600
and setbacks

2123
01:22:07,910 --> 01:22:06,820
we persevere

2124
01:22:08,830 --> 01:22:07,920
[Music]

2125
01:22:16,550 --> 01:22:08,840
we keep

2126
01:22:18,950 --> 01:22:16,560
from space we see our planet as a whole

2127
01:22:21,590 --> 01:22:18,960
we see the challenges facing

2128
01:22:23,110 --> 01:22:21,600
and we face those challenges

2129
01:22:24,390 --> 01:22:23,120
together

2130
01:22:25,669 --> 01:22:24,400
we will not

2131
01:22:27,669 --> 01:22:25,679
give up

2132
01:22:30,550 --> 01:22:27,679
we challenge convention

2133
01:22:33,510 --> 01:22:30,560
we refuse to accept the status quo

2134
01:22:35,990 --> 01:22:33,520
the time at hand is hard

2135
01:22:38,390 --> 01:22:36,000
but we will persevere

2136
01:22:40,070 --> 01:22:38,400
we can still draw hope from the moon and

2137
01:22:42,870 --> 01:22:40,080
the stars

2138
01:22:44,709 --> 01:22:42,880

from space

2139
01:22:47,270 --> 01:22:44,719
from exploration

2140
01:22:48,950 --> 01:22:47,280
there is a new day beyond the challenges

2141
01:22:50,070 --> 01:22:48,960
we face now

2142
01:22:53,270 --> 01:22:50,080
curiosity

2143
01:22:54,629 --> 01:22:53,280
insight spirit opportunity

2144
01:22:56,870 --> 01:22:54,639
if you think about it

2145
01:23:01,270 --> 01:22:56,880
all of these names of past mars rovers

2146
01:23:07,510 --> 01:23:03,790
we have ignition sequence

2147
01:23:09,990 --> 01:23:07,520
stars of us as a race

2148
01:23:16,890 --> 01:23:10,000
he missed the most important thing three

2149
01:23:16,900 --> 01:23:19,590
[Music]

2150
01:23:19,600 --> 01:23:22,830
of persons

2151
01:23:27,830 --> 01:23:26,470
[Music]

2152
01:23:31,830 --> 01:23:27,840
we will meet

2153
01:23:33,750 --> 01:23:31,840
many obstacles on our way to mars

2154
01:23:34,629 --> 01:23:33,760
but as humans

2155
01:23:35,430 --> 01:23:34,639
will

2156
01:23:38,709 --> 01:23:35,440
not

2157
01:23:50,070 --> 01:23:41,030
we will always

2158
01:23:54,390 --> 01:23:51,990
our collective perseverance is what has

2159
01:23:56,229 --> 01:23:54,400
gotten us to this day and now mars 2020

2160
01:23:58,070 --> 01:23:56,239
is on its seven month journey to mars

2161
01:24:00,830 --> 01:23:58,080
with an anticipated landing date of

2162
01:24:03,350 --> 01:24:00,840
perseverance on february 18

2163
01:24:05,189 --> 01:24:03,360

2021 now we are joined by dr thomas

2164
01:24:08,229 --> 01:24:05,199
sirvilkin associate administrator for

2165
01:24:10,950 --> 01:24:08,239
science at nasa dr z thank you so much

2166
01:24:13,189 --> 01:24:10,960
for coming over here god i'm so glad i'm

2167
01:24:15,350 --> 01:24:13,199
here and i'm so relieved you know we

2168
01:24:17,430 --> 01:24:15,360
have a space mission

2169
01:24:19,270 --> 01:24:17,440
we're in touch with the spacecraft you

2170
01:24:21,910 --> 01:24:19,280
know and everything is nominal waiting

2171
01:24:23,430 --> 01:24:21,920
of course for the for the second burn

2172
01:24:25,910 --> 01:24:23,440
but it's not quite there but we're

2173
01:24:28,310 --> 01:24:25,920
really close yes so can you tell us what

2174
01:24:29,910 --> 01:24:28,320
makes going to mars incredibly hard so

2175
01:24:31,430 --> 01:24:29,920
there's really two pieces that make it

2176
01:24:33,030 --> 01:24:31,440
hard the first one is what we're doing

2177
01:24:35,750 --> 01:24:33,040
today which is

2178
01:24:38,470 --> 01:24:35,760
you really need to hit head in the right

2179
01:24:40,390 --> 01:24:38,480
direction so take it off the earth and

2180
01:24:41,510 --> 01:24:40,400
have a lot of energy and head exactly in

2181
01:24:42,629 --> 01:24:41,520
the right direction because what you

2182
01:24:45,030 --> 01:24:42,639
want to make sure

2183
01:24:46,390 --> 01:24:45,040
is in february when

2184
01:24:48,070 --> 01:24:46,400
marth comes

2185
01:24:50,790 --> 01:24:48,080
you want to be right there so you can

2186
01:24:52,229 --> 01:24:50,800
get captured the second one which is the

2187
01:24:55,510 --> 01:24:52,239
one that going to make us nervous in

2188
01:24:57,270 --> 01:24:55,520

february is to entry descent and land

2189
01:24:59,270 --> 01:24:57,280
you know so so the mars atmosphere is

2190
01:25:01,110 --> 01:24:59,280
almost the worst of all worlds if it was

2191
01:25:03,030 --> 01:25:01,120
really thick you could do what we're

2192
01:25:05,189 --> 01:25:03,040
doing on earth we just go in and with

2193
01:25:06,870 --> 01:25:05,199
parachutes if there was none of them

2194
01:25:08,629 --> 01:25:06,880
there you could do you know what we do

2195
01:25:11,510 --> 01:25:08,639
at the moon when in mars you have to do

2196
01:25:13,669 --> 01:25:11,520
both on top of each other which makes it

2197
01:25:15,590 --> 01:25:13,679
ten times harder than any of the other

2198
01:25:17,830 --> 01:25:15,600
two and so that's what makes it so hard

2199
01:25:19,830 --> 01:25:17,840
wow you've devoted much of your life to

2200
01:25:21,669 --> 01:25:19,840
science and i know you were asked uh the

2201
01:25:23,910 --> 01:25:21,679
other day during a news conference you

2202
01:25:26,149 --> 01:25:23,920
know why another rover and you gave a

2203
01:25:29,430 --> 01:25:26,159
pretty impassioned response why is this

2204
01:25:31,830 --> 01:25:29,440
rover important in your mind to the work

2205
01:25:33,350 --> 01:25:31,840
that so many people are doing in science

2206
01:25:34,629 --> 01:25:33,360
so it's

2207
01:25:36,709 --> 01:25:34,639
really

2208
01:25:37,669 --> 01:25:36,719
kind of a key

2209
01:25:42,229 --> 01:25:37,679
of

2210
01:25:43,910 --> 01:25:42,239
doing that is focused on a question that

2211
01:25:45,750 --> 01:25:43,920
for thousands of years philosophers

2212
01:25:47,430 --> 01:25:45,760
philosophers have asked scientists have

2213
01:25:49,110 --> 01:25:47,440

asked and we're ready to answer with the

2214
01:25:51,750 --> 01:25:49,120
tools of science which is the way to get

2215
01:25:53,270 --> 01:25:51,760
reliable answers and that is is there

2216
01:25:55,270 --> 01:25:53,280
life out there

2217
01:25:56,950 --> 01:25:55,280
we have for 20 years we've learned about

2218
01:25:59,270 --> 01:25:56,960
the environment at mars and we're ready

2219
01:26:01,430 --> 01:25:59,280
to ask that now and and the way we're

2220
01:26:02,310 --> 01:26:01,440
doing it is with this rover so it's

2221
01:26:04,510 --> 01:26:02,320
really

2222
01:26:07,189 --> 01:26:04,520
for the first time in decades the first

2223
01:26:09,350 --> 01:26:07,199
astrobiology mission we're ready for it

2224
01:26:11,030 --> 01:26:09,360
where it's the next step and and of

2225
01:26:13,350 --> 01:26:11,040
course there's others coming you know uh

2226
01:26:15,910 --> 01:26:13,360
dragonfly yeah we're already thinking

2227
01:26:17,750 --> 01:26:15,920
about and you know other uh missions we

2228
01:26:20,310 --> 01:26:17,760
want to of course go to enceladus in

2229
01:26:23,990 --> 01:26:20,320
europa you know and really learn about

2230
01:26:25,990 --> 01:26:24,000
life there also uh so so it's an amazing

2231
01:26:27,590 --> 01:26:26,000
first in that respect and whether

2232
01:26:29,110 --> 01:26:27,600
there's life there or not that that's

2233
01:26:31,669 --> 01:26:29,120
going to be the answer that we're

2234
01:26:33,830 --> 01:26:31,679
looking for in these places

2235
01:26:35,750 --> 01:26:33,840
yeah exactly yeah and so we want to do a

2236
01:26:37,189 --> 01:26:35,760
social media question yeah if that's all

2237
01:26:39,430 --> 01:26:37,199
right with you absolutely all right we

2238
01:26:41,830 --> 01:26:39,440

have a question from twitter what is the

2239
01:26:44,629 --> 01:26:41,840
key difference between previous nasa

2240
01:26:47,030 --> 01:26:44,639
missions rover missions um from to mars

2241
01:26:49,189 --> 01:26:47,040
like spirit opportunity curiosity and

2242
01:26:51,110 --> 01:26:49,199
perseverance rover in what way is

2243
01:26:51,990 --> 01:26:51,120
perseverance unique from the previous

2244
01:26:53,750 --> 01:26:52,000
ones

2245
01:26:55,110 --> 01:26:53,760
so there's a fundamental difference in

2246
01:26:57,189 --> 01:26:55,120
the approach

2247
01:26:57,990 --> 01:26:57,199
and the fundamental difference is

2248
01:26:59,750 --> 01:26:58,000
that

2249
01:27:02,790 --> 01:26:59,760
we decided

2250
01:27:05,750 --> 01:27:02,800
to put the instruments on perseverance

2251
01:27:08,950 --> 01:27:05,760
the best geology instruments on this

2252
01:27:12,229 --> 01:27:08,960
so we can find the right samples and we

2253
01:27:15,430 --> 01:27:12,239
decided not to put a chemistry lab on it

2254
01:27:17,189 --> 01:27:15,440
that's why we don't know which one yet

2255
01:27:19,830 --> 01:27:17,199
and so what we're doing is we're

2256
01:27:21,270 --> 01:27:19,840
actually crea collecting the samples

2257
01:27:22,950 --> 01:27:21,280
that we're going to bring to the best

2258
01:27:25,030 --> 01:27:22,960
labs that are available to humanity

2259
01:27:26,870 --> 01:27:25,040
which are the labs all over the world

2260
01:27:28,790 --> 01:27:26,880
and that's the choice here and that's of

2261
01:27:30,709 --> 01:27:28,800
course to do that we need to do another

2262
01:27:32,390 --> 01:27:30,719
first which is humanity's first round

2263
01:27:34,070 --> 01:27:32,400

trip to another planet and that's what

2264
01:27:35,750 --> 01:27:34,080
makes it different we've got more with

2265
01:27:37,910 --> 01:27:35,760
the launch operation to go but real

2266
01:27:40,149 --> 01:27:37,920
quick how did you feel about that launch

2267
01:27:42,629 --> 01:27:40,159
oh i loved it it's like punching a hole

2268
01:27:45,910 --> 01:27:42,639
in the sky right it's really getting off

2269
01:27:48,310 --> 01:27:45,920
the cosmic shore our earth into into

2270
01:27:50,790 --> 01:27:48,320
waiting out there into the cosmic ocean

2271
01:27:53,110 --> 01:27:50,800
i just i just love it every time it gets

2272
01:27:55,189 --> 01:27:53,120
me all right very good dr thomas

2273
01:27:56,709 --> 01:27:55,199
zurbukin thank you for joining us we

2274
01:27:58,070 --> 01:27:56,719
appreciate you being here to explain all

2275
01:28:00,310 --> 01:27:58,080
the science and the excitement that's

2276
01:28:01,590 --> 01:28:00,320
coming up thank you so much appreciate

2277
01:28:03,110 --> 01:28:01,600
it

2278
01:28:05,110 --> 01:28:03,120
now we've talked to scientists and

2279
01:28:06,950 --> 01:28:05,120
engineers and we have shared highlights

2280
01:28:09,189 --> 01:28:06,960
of the mission and tech demonstrations

2281
01:28:11,510 --> 01:28:09,199
that are central to the perseverance

2282
01:28:13,350 --> 01:28:11,520
rover and folks we have a lot more to

2283
01:28:15,510 --> 01:28:13,360
share

2284
01:28:18,390 --> 01:28:15,520
mars perseverance has been flying in

2285
01:28:20,310 --> 01:28:18,400
space for more than a half hour now

2286
01:28:22,070 --> 01:28:20,320
let's check back in with joshua and mick

2287
01:28:24,070 --> 01:28:22,080
to recap the flight so far and tell us

2288
01:28:25,430 --> 01:28:24,080

what's coming up next

2289
01:28:27,350 --> 01:28:25,440
hey thanks mu yeah as you're seeing on

2290
01:28:29,830 --> 01:28:27,360
screen there that is again the animation

2291
01:28:31,510 --> 01:28:29,840
of the the centaur in motion around

2292
01:28:33,030 --> 01:28:31,520
earth in orbit around earth and you can

2293
01:28:35,510 --> 01:28:33,040
see there like i mentioned the animation

2294
01:28:37,510 --> 01:28:35,520
being driven by real telemetry data um

2295
01:28:39,350 --> 01:28:37,520
mick how was how was the report coming

2296
01:28:40,709 --> 01:28:39,360
back from the first burn and then

2297
01:28:42,390 --> 01:28:40,719
currently our coast phase so we're

2298
01:28:43,990 --> 01:28:42,400
hearing from jesse gonzalez and the

2299
01:28:46,070 --> 01:28:44,000
engineering team is that everything so

2300
01:28:48,070 --> 01:28:46,080
far has been nominal uh centaur's been

2301
01:28:49,990 --> 01:28:48,080
performing well all the settling firings

2302
01:28:51,750 --> 01:28:50,000
have been going great which is keeping

2303
01:28:53,270 --> 01:28:51,760
the fuel that's still in the tank where

2304
01:28:55,030 --> 01:28:53,280
it needs to be as we get ready to come

2305
01:28:57,110 --> 01:28:55,040
up on main engine start two for that

2306
01:28:59,110 --> 01:28:57,120
second burn which is very important to

2307
01:29:00,950 --> 01:28:59,120
get us our velocity and into that

2308
01:29:02,229 --> 01:29:00,960
transfer orbit to mars

2309
01:29:03,910 --> 01:29:02,239
yeah so that will be up in just a few

2310
01:29:05,510 --> 01:29:03,920
minutes uh but i think we're going to

2311
01:29:09,189 --> 01:29:05,520
actually send you back out to our main

2312
01:29:11,030 --> 01:29:09,199
desk to hear oh so sorry i'm being held

2313
01:29:13,510 --> 01:29:11,040

uh we're gonna hang out here uh so so

2314
01:29:14,950 --> 01:29:13,520
coming up so talk about uh c3 meg this

2315
01:29:16,709 --> 01:29:14,960
is something that we talked about has

2316
01:29:18,709 --> 01:29:16,719
having to do with the the energy to

2317
01:29:20,229 --> 01:29:18,719
leave earth and go somewhere else we're

2318
01:29:22,709 --> 01:29:20,239
talking about having to get to speeds

2319
01:29:24,629 --> 01:29:22,719
over 25 000 miles per hour that's

2320
01:29:26,390 --> 01:29:24,639
earth's escape velocity

2321
01:29:28,070 --> 01:29:26,400
yeah so c3 is basically just the

2322
01:29:29,990 --> 01:29:28,080
technical term that we use in the

2323
01:29:32,709 --> 01:29:30,000
aerospace industry to refer to the

2324
01:29:34,310 --> 01:29:32,719
velocity that we need to get uh the

2325
01:29:36,229 --> 01:29:34,320
vehicle where it needs to be so as you

2326
01:29:38,070 --> 01:29:36,239
said we got that little over two million

2327
01:29:40,149 --> 01:29:38,080
pounds of thrust that we left earth this

2328
01:29:42,149 --> 01:29:40,159
morning with with those mighty four

2329
01:29:44,390 --> 01:29:42,159
solids on the dominator i still like

2330
01:29:46,709 --> 01:29:44,400
that from tory bruno i'm gonna i'm gonna

2331
01:29:48,709 --> 01:29:46,719
take that one from tory but uh we got

2332
01:29:50,629 --> 01:29:48,719
off here and into the park orbit uh with

2333
01:29:52,709 --> 01:29:50,639
the proper velocity we needed and then

2334
01:29:53,910 --> 01:29:52,719
of course this second burn is so

2335
01:29:55,669 --> 01:29:53,920
important for the velocity we need to

2336
01:29:57,830 --> 01:29:55,679
get in transfer orbit awesome so the

2337
01:30:00,070 --> 01:29:57,840
dominator punching a hole in the sky as

2338
01:30:01,189 --> 01:30:00,080

dr zurbukin said uh so we will send it

2339
01:30:02,390 --> 01:30:01,199
back out now to the main desk and be

2340
01:30:04,550 --> 01:30:02,400
back with you in just a minute to catch

2341
01:30:06,709 --> 01:30:04,560
that second burn daryl all right thank

2342
01:30:08,470 --> 01:30:06,719
you very much thanks so much joshua

2343
01:30:09,830 --> 01:30:08,480
joining us now to talk about how special

2344
01:30:12,310 --> 01:30:09,840
these missions are

2345
01:30:13,590 --> 01:30:12,320
is dr michael watkins he's the director

2346
01:30:15,430 --> 01:30:13,600
of the jet propulsion laboratory in

2347
01:30:17,990 --> 01:30:15,440
california which planned perseverance's

2348
01:30:21,990 --> 01:30:18,000
mission to mars that is my home center

2349
01:30:27,510 --> 01:30:23,990
so we have so many great questions for

2350
01:30:28,950 --> 01:30:27,520
you why are missions to mars unique

2351
01:30:30,870 --> 01:30:28,960
well you know i think they're unique for

2352
01:30:31,990 --> 01:30:30,880
two ways and one is just it's just mars

2353
01:30:34,149 --> 01:30:32,000
you know it's it's been in our

2354
01:30:35,430 --> 01:30:34,159
imagination for for centuries you know

2355
01:30:36,629 --> 01:30:35,440
we it's a place that looks like the

2356
01:30:38,709 --> 01:30:36,639
earth it looks like it could be home to

2357
01:30:40,790 --> 01:30:38,719
us it looked like it was once home to

2358
01:30:42,229 --> 01:30:40,800
you know to to what could have been life

2359
01:30:43,590 --> 01:30:42,239
and and the fact that we can get there

2360
01:30:45,350 --> 01:30:43,600
we can get there every couple years and

2361
01:30:46,550 --> 01:30:45,360
we can send missions and we can build on

2362
01:30:47,910 --> 01:30:46,560
those missions

2363
01:30:49,110 --> 01:30:47,920

and uh you know we you can learn from

2364
01:30:51,830 --> 01:30:49,120
your mistakes you can learn from your

2365
01:30:53,350 --> 01:30:51,840
successes one of the things i i like to

2366
01:30:55,830 --> 01:30:53,360
joke about is you know we we say

2367
01:30:57,669 --> 01:30:55,840
perseverance looks like curiosity but

2368
01:30:59,510 --> 01:30:57,679
the people who built them are the same

2369
01:31:01,430 --> 01:30:59,520
they look even more like a child and so

2370
01:31:02,950 --> 01:31:01,440
they uh you know so a lot of our folks

2371
01:31:05,270 --> 01:31:02,960
worked on mars pathfinder worked on

2372
01:31:07,750 --> 01:31:05,280
spirit opportunity um they worked on

2373
01:31:09,830 --> 01:31:07,760
curiosity and now perseverance and that

2374
01:31:11,590 --> 01:31:09,840
you know that that history that that

2375
01:31:13,350 --> 01:31:11,600
that group of folks they're just they're

2376
01:31:15,430 --> 01:31:13,360
just world leaders and uh it's why we're

2377
01:31:18,070 --> 01:31:15,440
successful so you oversee the jet

2378
01:31:21,189 --> 01:31:18,080
propulsion laboratory in california and

2379
01:31:24,470 --> 01:31:21,199
doing incredibly complex work why are

2380
01:31:26,790 --> 01:31:24,480
these robotic missions so hard

2381
01:31:28,470 --> 01:31:26,800
you know they're hard because you you

2382
01:31:31,189 --> 01:31:28,480
can't really see what's going on you

2383
01:31:32,629 --> 01:31:31,199
can't use your human responses right you

2384
01:31:34,629 --> 01:31:32,639
know you're used to driving your car and

2385
01:31:36,390 --> 01:31:34,639
see what's happening and and you know

2386
01:31:38,310 --> 01:31:36,400
you turn the wheel in this case you know

2387
01:31:39,830 --> 01:31:38,320
we've got to tilde rover

2388
01:31:41,669 --> 01:31:39,840

but we've got to prepare the rover to do

2389
01:31:43,350 --> 01:31:41,679
a lot of that stuff on its own right and

2390
01:31:45,270 --> 01:31:43,360
so we've got to understand mars we've

2391
01:31:46,870 --> 01:31:45,280
got to understand how the rover works

2392
01:31:48,470 --> 01:31:46,880
and we've got to put all that together

2393
01:31:50,629 --> 01:31:48,480
into a machine that can function more or

2394
01:31:52,310 --> 01:31:50,639
less without us so we talk to it once a

2395
01:31:54,149 --> 01:31:52,320
day and we say how are we doing and go

2396
01:31:55,990 --> 01:31:54,159
over there and do these experiments and

2397
01:31:58,310 --> 01:31:56,000
then it's got to do that so you know we

2398
01:31:59,990 --> 01:31:58,320
kind of give it its intention but then

2399
01:32:01,830 --> 01:32:00,000
it's got to do all those activities by

2400
01:32:02,950 --> 01:32:01,840
itself and and that's a challenge and

2401
01:32:04,629 --> 01:32:02,960
the further away from the earth you get

2402
01:32:06,390 --> 01:32:04,639
the harder it is so you get out to

2403
01:32:08,070 --> 01:32:06,400
saturn you get to europa you get beyond

2404
01:32:09,750 --> 01:32:08,080
and it becomes harder and harder real

2405
01:32:12,229 --> 01:32:09,760
quick one question to wrap up you've

2406
01:32:14,310 --> 01:32:12,239
been in touch with the folks out at jpl

2407
01:32:16,790 --> 01:32:14,320
on air there was an earthquake that

2408
01:32:18,550 --> 01:32:16,800
played out it was a 3.9 magnitude how is

2409
01:32:20,070 --> 01:32:18,560
everybody doing how's your team

2410
01:32:21,669 --> 01:32:20,080
they're doing great uh you know our view

2411
01:32:23,669 --> 01:32:21,679
was just just pasadena it's just the

2412
01:32:25,510 --> 01:32:23,679
earth being excited about going to mars

2413
01:32:27,590 --> 01:32:25,520

so it was a very minor earthquake we

2414
01:32:28,950 --> 01:32:27,600
have them a lot in california okay um

2415
01:32:30,870 --> 01:32:28,960
you know maybe it's like hurricanes here

2416
01:32:33,030 --> 01:32:30,880
or something but uh tropical storms here

2417
01:32:34,709 --> 01:32:33,040
but uh it was a it was a very uh very

2418
01:32:36,629 --> 01:32:34,719
minor event and everything's fine and uh

2419
01:32:38,149 --> 01:32:36,639
we were we're on our way to mars okay so

2420
01:32:40,550 --> 01:32:38,159
a little rumble here in florida some

2421
01:32:42,070 --> 01:32:40,560
rumble in california it works out great

2422
01:32:43,110 --> 01:32:42,080
mike watkins thank you so much we

2423
01:32:45,189 --> 01:32:43,120
appreciate you joining us on the

2424
01:32:46,629 --> 01:32:45,199
broadcast my pleasure thank you sir

2425
01:32:48,870 --> 01:32:46,639
awesome

2426
01:32:50,629 --> 01:32:48,880
we will have that conversation a

2427
01:32:52,229 --> 01:32:50,639
conversation with zena carmen coming up

2428
01:32:53,590 --> 01:32:52,239
yeah yeah she's really excited about

2429
01:32:55,910 --> 01:32:53,600
that's right yeah

2430
01:32:58,310 --> 01:32:55,920
on the other side of the centaur burn

2431
01:33:00,070 --> 01:32:58,320
and spacecraft separation we'll also

2432
01:33:01,750 --> 01:33:00,080
highlight six major technologies that

2433
01:33:03,430 --> 01:33:01,760
nasa is focusing on over the next decade

2434
01:33:06,149 --> 01:33:03,440
including the critical energy needs for

2435
01:33:07,669 --> 01:33:06,159
such missions but with that let's turn

2436
01:33:10,550 --> 01:33:07,679
our attention to the next operational

2437
01:33:13,189 --> 01:33:10,560
steps joshua are you there yeah we're

2438
01:33:15,510 --> 01:33:13,199

here and we're excited uh we have a fuel

2439
01:33:17,990 --> 01:33:15,520
pre-start call just coming in we are

2440
01:33:21,189 --> 01:33:18,000
getting ready to hear the call for this

2441
01:33:24,310 --> 01:33:21,199
second burn of that centaur rl10 engine

2442
01:33:26,310 --> 01:33:24,320
again make explain what this second burn

2443
01:33:27,990 --> 01:33:26,320
is for so as we talked earlier the

2444
01:33:29,910 --> 01:33:28,000
second burn is really to get us that

2445
01:33:32,470 --> 01:33:29,920
velocity as we head into that transfer

2446
01:33:34,790 --> 01:33:32,480
orbit right centaur in mars 2020 we'll

2447
01:33:36,390 --> 01:33:34,800
head into that solar orbit on its way

2448
01:33:39,750 --> 01:33:36,400
with the proper velocity

2449
01:33:42,149 --> 01:33:39,760
we will then uh get ready to uh separate

2450
01:33:44,149 --> 01:33:42,159
march 2020 on its way

2451
01:33:46,070 --> 01:33:44,159
and i'm hearing that uh

2452
01:33:47,590 --> 01:33:46,080
settling is done and we have maintenance

2453
01:33:48,790 --> 01:33:47,600
main engine start

2454
01:33:50,950 --> 01:33:48,800
there we go awesome and again that

2455
01:33:52,629 --> 01:33:50,960
animation there being driven by uh

2456
01:33:56,709 --> 01:33:52,639
actual telemetry data coming from that

2457
01:33:58,310 --> 01:33:56,719
rocket so that's a phenomenal sign

2458
01:34:00,950 --> 01:33:58,320
again i think that it's it's tough with

2459
01:34:03,750 --> 01:34:00,960
these images uh perspective and scale

2460
01:34:05,590 --> 01:34:03,760
are so important this vehicle is in

2461
01:34:07,910 --> 01:34:05,600
earth orbit it's not near anything so

2462
01:34:09,110 --> 01:34:07,920
you can't see the acceleration of what's

2463
01:34:10,709 --> 01:34:09,120

happening right now but for eight

2464
01:34:12,390 --> 01:34:10,719
minutes it's gonna be picking up speed

2465
01:34:14,629 --> 01:34:12,400
yeah this is this is the burn that gets

2466
01:34:16,629 --> 01:34:14,639
us really moving in the direction we

2467
01:34:18,870 --> 01:34:16,639
need to go that fast velocity that we

2468
01:34:21,270 --> 01:34:18,880
need to get out of our park orbit and

2469
01:34:24,790 --> 01:34:21,280
head our head on our way to uh mars of

2470
01:34:26,709 --> 01:34:24,800
course centaur and march 2020 are still

2471
01:34:28,229 --> 01:34:26,719
together with them and

2472
01:34:30,470 --> 01:34:28,239
so we're hearing everything is looking

2473
01:34:33,270 --> 01:34:30,480
nominal on this fire so far the main

2474
01:34:35,830 --> 01:34:33,280
engine start was good and the

2475
01:34:37,350 --> 01:34:35,840
firing is going well nominal as we see

2476
01:34:39,669 --> 01:34:37,360
in the animation there

2477
01:34:41,590 --> 01:34:39,679
fantastic uh so this is rocket science

2478
01:34:43,189 --> 01:34:41,600
and it's not easy we actually want to

2479
01:34:46,070 --> 01:34:43,199
bring in now we have a special guest

2480
01:34:49,109 --> 01:34:46,080
this is denton dr denton gibson excuse

2481
01:34:51,590 --> 01:34:49,119
me uh he is a rocket scientist his

2482
01:34:54,149 --> 01:34:51,600
official title is senior senior vehicle

2483
01:34:55,270 --> 01:34:54,159
systems engineer uh denton how are you

2484
01:34:58,310 --> 01:34:55,280
doing

2485
01:35:00,229 --> 01:34:58,320
did you enjoy that obviously you got to

2486
01:35:01,590 --> 01:35:00,239
kind of spectate a lot of days you guys

2487
01:35:03,189 --> 01:35:01,600
sitting on console you have to kind of

2488
01:35:04,950 --> 01:35:03,199

focus on your computer but you got to

2489
01:35:06,950 --> 01:35:04,960
see this one today oh yes and it was a

2490
01:35:09,109 --> 01:35:06,960
beautiful launch today yeah nice sunrise

2491
01:35:11,109 --> 01:35:09,119
hey tell us about your role with lsp i

2492
01:35:12,310 --> 01:35:11,119
was not um making up things when i said

2493
01:35:15,430 --> 01:35:12,320
you're a rocket scientist but what

2494
01:35:16,950 --> 01:35:15,440
exactly do you do so as our role in lsp

2495
01:35:19,189 --> 01:35:16,960
as a vehicle system engineer we are the

2496
01:35:20,709 --> 01:35:19,199
engineering team lead for a lot of

2497
01:35:22,790 --> 01:35:20,719
rockets that we launch our science

2498
01:35:24,149 --> 01:35:22,800
missions on and we are responsible for

2499
01:35:27,030 --> 01:35:24,159
the oversight and insight into these

2500
01:35:28,870 --> 01:35:27,040
launch vehicles from for the nasa

2501
01:35:30,149 --> 01:35:28,880
that's awesome and i know in the past

2502
01:35:31,189 --> 01:35:30,159
you've supported a variety of vehicles

2503
01:35:33,430 --> 01:35:31,199
tell us a little bit about the vehicles

2504
01:35:35,590 --> 01:35:33,440
that you have supported and the ones uh

2505
01:35:36,870 --> 01:35:35,600
the ones you're focused on today yeah so

2506
01:35:39,109 --> 01:35:36,880
some of the vehicles i supported in the

2507
01:35:42,149 --> 01:35:39,119
past is the delta ii which was a long

2508
01:35:45,030 --> 01:35:42,159
time workforce for our science missions

2509
01:35:47,270 --> 01:35:45,040
as well as the pegasus and taurus slash

2510
01:35:49,270 --> 01:35:47,280
minnesota minotaur c and right now i've

2511
01:35:50,229 --> 01:35:49,280
been focused mainly on falcon 9 fog and

2512
01:35:52,070 --> 01:35:50,239
heavy

2513
01:35:53,830 --> 01:35:52,080

yeah awesome um so obviously not focused

2514
01:35:55,910 --> 01:35:53,840
on the atlas v but a lot of that

2515
01:35:57,270 --> 01:35:55,920
experience and the process is the same i

2516
01:35:59,030 --> 01:35:57,280
want to take a moment to pause and say

2517
01:36:00,550 --> 01:35:59,040
denton's there at hangar ae that's the

2518
01:36:02,149 --> 01:36:00,560
nasa launch services programs hangar

2519
01:36:03,590 --> 01:36:02,159
they're very proud of that we call it

2520
01:36:05,669 --> 01:36:03,600
the telemetry center of the universe

2521
01:36:06,870 --> 01:36:05,679
that's where the data for today is

2522
01:36:09,270 --> 01:36:06,880
flowing

2523
01:36:11,109 --> 01:36:09,280
but i wanted to also ask you is the

2524
01:36:12,709 --> 01:36:11,119
process the same for all these vehicles

2525
01:36:14,950 --> 01:36:12,719
when we talk about the telemetry and

2526
01:36:17,510 --> 01:36:14,960
these sort of uh processes of getting

2527
01:36:19,030 --> 01:36:17,520
from earth to mars uh does does falcon 9

2528
01:36:21,750 --> 01:36:19,040
experience translate to atlas or are

2529
01:36:23,030 --> 01:36:21,760
they completely separate so the process

2530
01:36:25,030 --> 01:36:23,040
for many of these launch vehicles are

2531
01:36:26,390 --> 01:36:25,040
the same whereas you you

2532
01:36:29,669 --> 01:36:26,400
ship stages to the launch site and

2533
01:36:31,270 --> 01:36:29,679
assemble the launch vehicles by stages

2534
01:36:32,950 --> 01:36:31,280
so in that sense they're they're saying

2535
01:36:35,510 --> 01:36:32,960
but there's a lot of differences between

2536
01:36:37,430 --> 01:36:35,520
the launch vehicles that may change that

2537
01:36:39,350 --> 01:36:37,440
process a little bit but in general the

2538
01:36:40,790 --> 01:36:39,360

processes are the same yeah and joshua i

2539
01:36:42,950 --> 01:36:40,800
was going to say denton i work with

2540
01:36:44,310 --> 01:36:42,960
denton quite a bit over the years and he

2541
01:36:46,390 --> 01:36:44,320
you know he talks about the different

2542
01:36:47,669 --> 01:36:46,400
vehicles he's worked on but denton is

2543
01:36:50,310 --> 01:36:47,679
one of my senior

2544
01:36:52,070 --> 01:36:50,320
vehicle engineers in lsp and so although

2545
01:36:53,510 --> 01:36:52,080
he's not totally supporting atlas 5

2546
01:36:55,669 --> 01:36:53,520
today he does have experience with atlas

2547
01:36:57,830 --> 01:36:55,679
5 and as he said things are very similar

2548
01:36:58,709 --> 01:36:57,840
so using his experience we're able to

2549
01:37:01,350 --> 01:36:58,719
train

2550
01:37:03,910 --> 01:37:01,360
and bring on new generation of engineers

2551
01:37:06,550 --> 01:37:03,920
and denton's been a huge part of that to

2552
01:37:08,149 --> 01:37:06,560
allow us to grow our uh bench if you

2553
01:37:10,310 --> 01:37:08,159
will to start working commercial

2554
01:37:11,990 --> 01:37:10,320
partners yeah awesome so den tell us a

2555
01:37:13,270 --> 01:37:12,000
little bit about kind of what's involved

2556
01:37:14,950 --> 01:37:13,280
what goes in behind the scenes what's

2557
01:37:18,149 --> 01:37:14,960
the rocket science of going from earth

2558
01:37:20,149 --> 01:37:18,159
to mars this this maneuver to go uh into

2559
01:37:21,990 --> 01:37:20,159
solar orbit yeah so a lot of the things

2560
01:37:23,990 --> 01:37:22,000
that happen behind the scenes are it's a

2561
01:37:25,910 --> 01:37:24,000
lot of analysis work done by our

2562
01:37:27,669 --> 01:37:25,920
analysis teams i mean it's months and

2563
01:37:31,030 --> 01:37:27,679

months of analyses that are performed

2564
01:37:32,550 --> 01:37:31,040
based on the orbit insertion um the the

2565
01:37:35,350 --> 01:37:32,560
performance of the launch vehicle a lot

2566
01:37:37,669 --> 01:37:35,360
of modeling and simulations was done to

2567
01:37:39,990 --> 01:37:37,679
be able to get to this point to where

2568
01:37:42,950 --> 01:37:40,000
where we can transfer from

2569
01:37:44,870 --> 01:37:42,960
earth orbit into solar orbit

2570
01:37:45,910 --> 01:37:44,880
awesome and obviously you're a rocket

2571
01:37:47,189 --> 01:37:45,920
scientist

2572
01:37:48,470 --> 01:37:47,199
that's for a lot of people that's like

2573
01:37:50,550 --> 01:37:48,480
the pinnacle that's like hey i want to

2574
01:37:51,830 --> 01:37:50,560
be a rocket scientist uh so where do you

2575
01:37:53,430 --> 01:37:51,840
go from here in your career because

2576
01:37:54,310 --> 01:37:53,440
obviously like i'm sure there's lots of

2577
01:37:55,350 --> 01:37:54,320
things that you'd like to go and

2578
01:37:57,430 --> 01:37:55,360
accomplish

2579
01:37:59,430 --> 01:37:57,440
so you know going from here one of the

2580
01:38:00,870 --> 01:37:59,440
coolest things about this job working in

2581
01:38:02,950 --> 01:38:00,880
the lawn services program is working the

2582
01:38:04,310 --> 01:38:02,960
launch right i mean who doesn't love the

2583
01:38:06,149 --> 01:38:04,320
launch and who doesn't

2584
01:38:07,669 --> 01:38:06,159
work in launches yeah we love them and

2585
01:38:09,270 --> 01:38:07,679
we love them excitement this morning

2586
01:38:10,629 --> 01:38:09,280
right didn't we got to see that's that's

2587
01:38:12,310 --> 01:38:10,639
what it's all about of course so you

2588
01:38:13,510 --> 01:38:12,320

know one of the ideal jobs to be a

2589
01:38:16,070 --> 01:38:13,520
launch director because you get to work

2590
01:38:17,910 --> 01:38:16,080
all the lunches i mean very cool is that

2591
01:38:19,990 --> 01:38:17,920
no yeah that's true and i guess you get

2592
01:38:21,350 --> 01:38:20,000
to uh on some is it right to say you

2593
01:38:22,709 --> 01:38:21,360
call the shots or is it that the buck

2594
01:38:24,070 --> 01:38:22,719
stops with you or how would you say that

2595
01:38:26,070 --> 01:38:24,080
i'd say the buck stops with the launch

2596
01:38:27,590 --> 01:38:26,080
manager as a as today we talked right

2597
01:38:29,990 --> 01:38:27,600
omar baez is our launch manager for

2598
01:38:31,830 --> 01:38:30,000
march 2020 and and he had to pull the

2599
01:38:33,430 --> 01:38:31,840
team and make sure everything's ready to

2600
01:38:35,590 --> 01:38:33,440
go so the buck does stop with him right

2601
01:38:36,790 --> 01:38:35,600
there on today's launch and as denton

2602
01:38:38,470 --> 01:38:36,800
says i think there's a lot of people

2603
01:38:39,830 --> 01:38:38,480
that would love that job and denton's

2604
01:38:41,910 --> 01:38:39,840
denton's definitely looking at that next

2605
01:38:43,910 --> 01:38:41,920
step so i guess we need to give omar and

2606
01:38:46,470 --> 01:38:43,920
his assistant launch manager tim dunn a

2607
01:38:47,910 --> 01:38:46,480
heads up yeah there you go dr gibson dr

2608
01:38:51,910 --> 01:38:47,920
gibson

2609
01:38:53,030 --> 01:38:51,920
you go give us a real quick snapshot i

2610
01:38:55,270 --> 01:38:53,040
know you have a mission coming up later

2611
01:38:56,709 --> 01:38:55,280
this year what are you working on so um

2612
01:38:59,189 --> 01:38:56,719
so we're

2613
01:39:00,550 --> 01:38:59,199

supporting the crew one launch coming up

2614
01:39:02,790 --> 01:39:00,560
so we're helping commercial crew out

2615
01:39:04,149 --> 01:39:02,800
with that one as well as 10 06 as far as

2616
01:39:06,149 --> 01:39:04,159
lsp missions

2617
01:39:07,830 --> 01:39:06,159
um that's coming up um later on this

2618
01:39:09,350 --> 01:39:07,840
year and so we're excited about that one

2619
01:39:10,870 --> 01:39:09,360
yeah ton going on dr gibson appreciate

2620
01:39:12,550 --> 01:39:10,880
you thanks uh and i want to take a

2621
01:39:15,669 --> 01:39:12,560
special moment on the commercial crew

2622
01:39:17,590 --> 01:39:15,679
note yeah to comment we've got a big day

2623
01:39:18,950 --> 01:39:17,600
coming up yes um pending weather um

2624
01:39:20,790 --> 01:39:18,960
there's a tropical system that might

2625
01:39:22,229 --> 01:39:20,800
kind of get in the mix here um but we

2626
01:39:23,910 --> 01:39:22,239
have a tropical system that could create

2627
01:39:25,910 --> 01:39:23,920
some problems otherwise we've got bob

2628
01:39:27,510 --> 01:39:25,920
and doug from demo2 they're coming home

2629
01:39:29,030 --> 01:39:27,520
on august 2nd yes i was going to say

2630
01:39:29,990 --> 01:39:29,040
joshua that's important for us also in

2631
01:39:32,790 --> 01:39:30,000
lsp

2632
01:39:33,990 --> 01:39:32,800
denton was my lead uh vsc along with a

2633
01:39:36,229 --> 01:39:34,000
few others

2634
01:39:38,070 --> 01:39:36,239
that are in the group that worked that

2635
01:39:39,590 --> 01:39:38,080
mission with the commercial crew program

2636
01:39:41,189 --> 01:39:39,600
and so it's really important for us to

2637
01:39:43,270 --> 01:39:41,199
be able to support other programs within

2638
01:39:45,189 --> 01:39:43,280

the agency to to make these things

2639
01:39:47,669 --> 01:39:45,199
happen as we as we launch march 2020

2640
01:39:50,310 --> 01:39:47,679
today uh which is another step for us

2641
01:39:52,070 --> 01:39:50,320
getting humans to mars right is uh

2642
01:39:54,870 --> 01:39:52,080
getting humans launched off of earth

2643
01:39:57,430 --> 01:39:54,880
soil was a huge step for off of american

2644
01:39:58,550 --> 01:39:57,440
soil yes was uh was a huge step for us

2645
01:40:01,109 --> 01:39:58,560
yeah and so talk about that really

2646
01:40:03,350 --> 01:40:01,119
briefly with lsp obviously denton there

2647
01:40:05,030 --> 01:40:03,360
appreciate him and his contribution uh

2648
01:40:07,350 --> 01:40:05,040
and you working towards commercial crew

2649
01:40:09,350 --> 01:40:07,360
but also supporting artemis

2650
01:40:10,870 --> 01:40:09,360
which is a nut which is also part of

2651
01:40:12,870 --> 01:40:10,880
that path of getting humans to mars

2652
01:40:14,149 --> 01:40:12,880
someday artemis is about learning to

2653
01:40:15,830 --> 01:40:14,159
live on the moon to sustain a presence

2654
01:40:17,590 --> 01:40:15,840
there with the eyes on mars so how is

2655
01:40:19,189 --> 01:40:17,600
lsp supporting even artemis yeah one of

2656
01:40:21,830 --> 01:40:19,199
the things there is the gateway program

2657
01:40:24,470 --> 01:40:21,840
right deep space logistics that uh is uh

2658
01:40:26,870 --> 01:40:24,480
working a lot of that and so lsp is in

2659
01:40:28,629 --> 01:40:26,880
the works of of supporting gateway and

2660
01:40:30,229 --> 01:40:28,639
helping them work with the commercial

2661
01:40:32,149 --> 01:40:30,239
partners that are providing the rockets

2662
01:40:34,390 --> 01:40:32,159
for those kind of missions that are out

2663
01:40:35,669 --> 01:40:34,400

there and future things one of the cool

2664
01:40:37,109 --> 01:40:35,679
things about working with launch

2665
01:40:38,950 --> 01:40:37,119
services program

2666
01:40:41,270 --> 01:40:38,960
is that we work with all of our

2667
01:40:43,510 --> 01:40:41,280
commercial partners spacex united launch

2668
01:40:44,870 --> 01:40:43,520
alliance uh northrop grumman space

2669
01:40:46,470 --> 01:40:44,880
systems and of course some up and

2670
01:40:48,550 --> 01:40:46,480
comings you may have heard some right

2671
01:40:49,910 --> 01:40:48,560
it's a growing origin yeah it's

2672
01:40:52,070 --> 01:40:49,920
definitely a growing field in the

2673
01:40:53,669 --> 01:40:52,080
aerospace industry and and lsp takes

2674
01:40:55,109 --> 01:40:53,679
pride in working with those commercial

2675
01:40:57,350 --> 01:40:55,119
partners to figure out what we can do

2676
01:40:59,189 --> 01:40:57,360
for nasa and the country awesome yeah it

2677
01:41:00,390 --> 01:40:59,199
is a it is an exciting time for space

2678
01:41:02,629 --> 01:41:00,400
flight the commercial space flight

2679
01:41:03,990 --> 01:41:02,639
industry is booming uh there's always

2680
01:41:05,830 --> 01:41:04,000
new things happening if you keep an eye

2681
01:41:07,669 --> 01:41:05,840
on the news you will see new things

2682
01:41:09,430 --> 01:41:07,679
we're getting word now that the the

2683
01:41:11,430 --> 01:41:09,440
engine cut off here should be happening

2684
01:41:13,270 --> 01:41:11,440
momentarily once we see that happen

2685
01:41:15,270 --> 01:41:13,280
we'll have roughly i believe it's five

2686
01:41:16,870 --> 01:41:15,280
minutes until we actually see the

2687
01:41:18,310 --> 01:41:16,880
spacecraft separation occur so we're

2688
01:41:19,750 --> 01:41:18,320

going to stay with you through that but

2689
01:41:21,350 --> 01:41:19,760
want to kind of just preview that for

2690
01:41:22,790 --> 01:41:21,360
you that hopefully on screen here you

2691
01:41:24,470 --> 01:41:22,800
should be seeing that engine cut off and

2692
01:41:26,390 --> 01:41:24,480
that's completely expected that's that's

2693
01:41:28,229 --> 01:41:26,400
a nominal operation

2694
01:41:29,510 --> 01:41:28,239
operation we'll hear from jesse gonzalez

2695
01:41:32,070 --> 01:41:29,520
who's looking at the launch vehicle

2696
01:41:34,870 --> 01:41:32,080
telemetry and and watching the animation

2697
01:41:36,790 --> 01:41:34,880
there so uh let's listen in for uh jesse

2698
01:41:38,709 --> 01:41:36,800
here and there's the call and there's

2699
01:41:40,550 --> 01:41:38,719
the animation again uh modified based on

2700
01:41:42,629 --> 01:41:40,560
zero shutdown parameters let's talk

2701
01:41:45,510 --> 01:41:42,639
about communication for a minute because

2702
01:41:48,790 --> 01:41:45,520
it is not an automatic thing to just

2703
01:41:51,350 --> 01:41:48,800
shoot information at earth and have that

2704
01:41:53,669 --> 01:41:51,360
be usable so how do we go about

2705
01:41:54,950 --> 01:41:53,679
communicating not only through launch

2706
01:41:56,470 --> 01:41:54,960
but on the way to mars and then once

2707
01:41:58,149 --> 01:41:56,480
we're at mars

2708
01:42:00,149 --> 01:41:58,159
yeah so the important thing this morning

2709
01:42:02,149 --> 01:42:00,159
is when we lift it off from from complex

2710
01:42:03,590 --> 01:42:02,159
41 here cape canaveral air force station

2711
01:42:04,870 --> 01:42:03,600
we had ground stations that were looking

2712
01:42:07,030 --> 01:42:04,880
at the launch vehicle and tracked it all

2713
01:42:09,590 --> 01:42:07,040

the way to provide to uh provide data

2714
01:42:11,990 --> 01:42:09,600
once we got onto orbit after uh stage

2715
01:42:14,390 --> 01:42:12,000
separation you heard a callout for tdrs

2716
01:42:16,550 --> 01:42:14,400
uh the telemetry network that that nasa

2717
01:42:18,310 --> 01:42:16,560
owns uh which by the way is also used

2718
01:42:20,070 --> 01:42:18,320
for the iss and

2719
01:42:22,709 --> 01:42:20,080
will be used uh hopefully for the

2720
01:42:24,310 --> 01:42:22,719
landing with doug and yes um so getting

2721
01:42:25,990 --> 01:42:24,320
off the ground today was great because

2722
01:42:27,430 --> 01:42:26,000
we could deconflict some of that tdrs

2723
01:42:29,750 --> 01:42:27,440
usage right

2724
01:42:31,350 --> 01:42:29,760
but tdrs is very important for us to to

2725
01:42:33,430 --> 01:42:31,360
be able to get the telemetry from the

2726
01:42:35,510 --> 01:42:33,440
launch vehicle back down to earth here

2727
01:42:37,990 --> 01:42:35,520
and then of course when mars 2020

2728
01:42:40,310 --> 01:42:38,000
separates and it gets on its way to mars

2729
01:42:42,790 --> 01:42:40,320
then the jpl team will take advantage of

2730
01:42:44,709 --> 01:42:42,800
nasa's deep space network which has been

2731
01:42:47,189 --> 01:42:44,719
around for a long time to be able to

2732
01:42:49,990 --> 01:42:47,199
transmit commands and data back and

2733
01:42:52,310 --> 01:42:50,000
forth to the mars 2020 so it takes a lot

2734
01:42:53,669 --> 01:42:52,320
of folks to work those and and that tdrs

2735
01:42:55,590 --> 01:42:53,679
and deep space network are very

2736
01:42:57,510 --> 01:42:55,600
important to not only the science

2737
01:42:58,950 --> 01:42:57,520
missions but human space flight also

2738
01:43:00,310 --> 01:42:58,960

yeah and i think the coordination of

2739
01:43:02,310 --> 01:43:00,320
that is something that people don't get

2740
01:43:04,790 --> 01:43:02,320
a chance to understand much because as

2741
01:43:07,350 --> 01:43:04,800
you said we're using tdrs for crew

2742
01:43:09,510 --> 01:43:07,360
return we use tdrs for space station and

2743
01:43:11,750 --> 01:43:09,520
tdrs is not an unlimited resource we

2744
01:43:13,510 --> 01:43:11,760
have a good number of tdrs satellites in

2745
01:43:14,950 --> 01:43:13,520
orbit that help us do these things but

2746
01:43:15,990 --> 01:43:14,960
it is a coordinating effort across the

2747
01:43:17,990 --> 01:43:16,000
globe

2748
01:43:19,669 --> 01:43:18,000
because we even have ground stations in

2749
01:43:21,669 --> 01:43:19,679
australia i think where are all of our

2750
01:43:23,430 --> 01:43:21,679
ground stations even we have ground

2751
01:43:25,830 --> 01:43:23,440
stations everywhere not only here in

2752
01:43:28,790 --> 01:43:25,840
america on the west coast and east coast

2753
01:43:29,669 --> 01:43:28,800
but then you get into the south africa

2754
01:43:32,390 --> 01:43:29,679
area

2755
01:43:34,310 --> 01:43:32,400
australia you said we have several

2756
01:43:37,030 --> 01:43:34,320
ground stations that catch up different

2757
01:43:39,030 --> 01:43:37,040
things for missions but of course in

2758
01:43:40,390 --> 01:43:39,040
orbit tdrs and the deep space network

2759
01:43:41,350 --> 01:43:40,400
are very important and as you said

2760
01:43:44,950 --> 01:43:41,360
there's not

2761
01:43:46,229 --> 01:43:44,960
resources there in the tdrs network so

2762
01:43:47,990 --> 01:43:46,239
we have to coordinate those things

2763
01:43:50,550 --> 01:43:48,000

within the nasa agency and with our

2764
01:43:52,550 --> 01:43:50,560
commercial partners when they're used uh

2765
01:43:55,910 --> 01:43:52,560
for our launches and again that's

2766
01:43:58,310 --> 01:43:55,920
another part of what nasa does as as an

2767
01:43:59,830 --> 01:43:58,320
agency yeah so um

2768
01:44:01,910 --> 01:43:59,840
just on that note kind of thinking about

2769
01:44:03,590 --> 01:44:01,920
around the world currently uh this

2770
01:44:05,430 --> 01:44:03,600
spacecraft is roughly over the south

2771
01:44:07,910 --> 01:44:05,440
indian ocean so that's just thinking

2772
01:44:10,149 --> 01:44:07,920
about how fast we're moving uh just

2773
01:44:11,510 --> 01:44:10,159
just the amazing

2774
01:44:13,109 --> 01:44:11,520
world of space flight it's just hard to

2775
01:44:14,390 --> 01:44:13,119
put into a word sometimes like we're

2776
01:44:16,629 --> 01:44:14,400
literally flying around the earth and

2777
01:44:18,629 --> 01:44:16,639
we're already halfway around it

2778
01:44:20,390 --> 01:44:18,639
and so i want to talk actually about

2779
01:44:22,470 --> 01:44:20,400
planetary protection some more i know we

2780
01:44:24,709 --> 01:44:22,480
heard about that a little bit from

2781
01:44:25,910 --> 01:44:24,719
uh about how they're working to protect

2782
01:44:27,830 --> 01:44:25,920
mars from

2783
01:44:29,430 --> 01:44:27,840
contamination so to speak just putting

2784
01:44:31,030 --> 01:44:29,440
things there we don't want and we have

2785
01:44:32,629 --> 01:44:31,040
to consider that or ula has to consider

2786
01:44:34,070 --> 01:44:32,639
that when they're flying to mars and

2787
01:44:36,790 --> 01:44:34,080
delivering the spacecraft yeah it's a

2788
01:44:38,950 --> 01:44:36,800

combined team ula jpl lsp had to look at

2789
01:44:40,229 --> 01:44:38,960
that uh for uh when we get ready for

2790
01:44:42,070 --> 01:44:40,239
spacecraft separation here in about a

2791
01:44:45,030 --> 01:44:42,080
minute right one of the things we talked

2792
01:44:47,030 --> 01:44:45,040
earlier is that centaur and march 2020

2793
01:44:49,350 --> 01:44:47,040
are on the same path towards mars right

2794
01:44:50,870 --> 01:44:49,360
now so once we separate centaur will do

2795
01:44:52,470 --> 01:44:50,880
a sea can maneuver what we call

2796
01:44:54,870 --> 01:44:52,480
contamination and control avoidance

2797
01:44:57,350 --> 01:44:54,880
maneuver and then blow down what's left

2798
01:44:59,669 --> 01:44:57,360
of propellants in its tank and by doing

2799
01:45:01,830 --> 01:44:59,679
that we have now put centaur on a

2800
01:45:04,470 --> 01:45:01,840
different track so that it will not

2801
01:45:06,550 --> 01:45:04,480
intercept mars or interfere with mars

2802
01:45:08,790 --> 01:45:06,560
2020 at all for approximately the next

2803
01:45:11,109 --> 01:45:08,800
50 years yeah and that would that took a

2804
01:45:12,310 --> 01:45:11,119
lot of work by the jpl team and and the

2805
01:45:14,310 --> 01:45:12,320
launch team to make sure that would

2806
01:45:17,270 --> 01:45:14,320
happen so again another planetary

2807
01:45:19,109 --> 01:45:17,280
protection maneuver that had to be done

2808
01:45:21,750 --> 01:45:19,119
yeah and i understand from the telemetry

2809
01:45:23,990 --> 01:45:21,760
experts in lsp that this rocket actually

2810
01:45:25,510 --> 01:45:24,000
after the second burn is not actually

2811
01:45:27,270 --> 01:45:25,520
aimed straight at mars for that reason

2812
01:45:29,669 --> 01:45:27,280
it's actually slightly off of mars and

2813
01:45:31,189 --> 01:45:29,679

so perseverance march 2020 will redirect

2814
01:45:32,229 --> 01:45:31,199
itself just slightly we're not talking

2815
01:45:33,669 --> 01:45:32,239
about

2816
01:45:34,629 --> 01:45:33,679
over seven months a little bit of

2817
01:45:37,189 --> 01:45:34,639
difference here makes a lot of

2818
01:45:39,590 --> 01:45:37,199
difference later absolutely and josh we

2819
01:45:42,229 --> 01:45:39,600
we hear jesse telling us that centaur is

2820
01:45:44,709 --> 01:45:42,239
uh spinning up uh this is the maneuver

2821
01:45:47,750 --> 01:45:44,719
right prior to uh spacecraft separation

2822
01:45:49,030 --> 01:45:47,760
where we get into a slight role

2823
01:45:51,350 --> 01:45:49,040
model

2824
01:45:53,350 --> 01:45:51,360
stable frontal tank pressure stability

2825
01:45:54,550 --> 01:45:53,360
uh very good performance from the rcs

2826
01:45:56,390 --> 01:45:54,560
system

2827
01:45:59,350 --> 01:45:56,400
um and stable indications from the

2828
01:46:01,270 --> 01:45:59,360
avionics systems as well

2829
01:46:03,350 --> 01:46:01,280
so rcs there the reaction control system

2830
01:46:04,790 --> 01:46:03,360
that's those small and the the series of

2831
01:46:06,790 --> 01:46:04,800
those small engines that you see firing

2832
01:46:08,709 --> 01:46:06,800
around the spacecraft those are used for

2833
01:46:10,790 --> 01:46:08,719
that in flight operations they need the

2834
01:46:12,070 --> 01:46:10,800
rolling activities as mixing is

2835
01:46:14,070 --> 01:46:12,080
basically providing stability to the

2836
01:46:15,350 --> 01:46:14,080
flight of mars 2020 as we go forward

2837
01:46:17,590 --> 01:46:15,360
tell us about actually and we have

2838
01:46:19,990 --> 01:46:17,600

separate successful separation of mars

2839
01:46:21,590 --> 01:46:20,000
2020 with the perseverance rover there

2840
01:46:23,270 --> 01:46:21,600
we go awesome we got some nice applause

2841
01:46:25,590 --> 01:46:23,280
there that is a big moment we are hoping

2842
01:46:27,109 --> 01:46:25,600
to get some live video back from that um

2843
01:46:28,790 --> 01:46:27,119
because of the time delays with

2844
01:46:29,910 --> 01:46:28,800
communicating with things in space we

2845
01:46:31,030 --> 01:46:29,920
don't have it at this instant we're

2846
01:46:32,709 --> 01:46:31,040
hoping we'll get to see that here in a

2847
01:46:34,870 --> 01:46:32,719
few minutes um and we'll bring that to

2848
01:46:36,550 --> 01:46:34,880
you if we do uh but tell us about the

2849
01:46:38,550 --> 01:46:36,560
separation maneuver because the the

2850
01:46:40,390 --> 01:46:38,560
apparatus the actual

2851
01:46:41,830 --> 01:46:40,400
it's really simple it's a separation

2852
01:46:43,109 --> 01:46:41,840
clamp we'll talk about a minute but as

2853
01:46:45,109 --> 01:46:43,119
you see on your screen right now you see

2854
01:46:47,030 --> 01:46:45,119
the mission director center where omar

2855
01:46:49,270 --> 01:46:47,040
baez and the team are and josh you and i

2856
01:46:50,870 --> 01:46:49,280
joked about this a little bit earlier um

2857
01:46:52,310 --> 01:46:50,880
but with the with the pandemic and

2858
01:46:54,310 --> 01:46:52,320
everything going on the teams have done

2859
01:46:56,310 --> 01:46:54,320
a great job normally spacecraft

2860
01:46:58,149 --> 01:46:56,320
separation c20 with the perseverance

2861
01:46:59,990 --> 01:46:58,159
rover the centaur will now perform its

2862
01:47:01,669 --> 01:47:00,000
standard propellant blowdown sequence to

2863
01:47:02,629 --> 01:47:01,679

inert the vehicle and complete today's

2864
01:47:04,550 --> 01:47:02,639
flight

2865
01:47:06,950 --> 01:47:04,560
after completing its uh

2866
01:47:08,790 --> 01:47:06,960
c-cam avoidance maneuver

2867
01:47:10,950 --> 01:47:08,800
this will conclude today's commentary of

2868
01:47:13,030 --> 01:47:10,960
the mars 2020 mission this is atlas

2869
01:47:15,109 --> 01:47:13,040
light commentary signing off so that's

2870
01:47:16,870 --> 01:47:15,119
the end of ula's job for jesse jesse

2871
01:47:18,390 --> 01:47:16,880
gonzalez did a great job with ula

2872
01:47:19,910 --> 01:47:18,400
commentary sworn but what i was saying

2873
01:47:21,350 --> 01:47:19,920
about the mission director center is

2874
01:47:22,629 --> 01:47:21,360
normally we would see a lot of clapping

2875
01:47:24,390 --> 01:47:22,639
a lot of who paul and a lot of high

2876
01:47:25,910 --> 01:47:24,400
fives handshakes yeah but with the

2877
01:47:27,750 --> 01:47:25,920
pandemic and everything people are

2878
01:47:30,070 --> 01:47:27,760
staying their distance taking the

2879
01:47:32,310 --> 01:47:30,080
guidelines seriously wearing mess with

2880
01:47:34,870 --> 01:47:32,320
this so we saw a lot of air high five

2881
01:47:37,109 --> 01:47:34,880
yes absolutely that does not take away

2882
01:47:39,270 --> 01:47:37,119
from what the team is how excited they

2883
01:47:41,430 --> 01:47:39,280
are um they have done a lot of work to

2884
01:47:44,070 --> 01:47:41,440
get to this point and that seeing

2885
01:47:46,709 --> 01:47:44,080
spacecraft separation is is awesome so

2886
01:47:48,390 --> 01:47:46,719
yeah but again and throw all of on top

2887
01:47:51,109 --> 01:47:48,400
of all that 2020 was like here have an

2888
01:47:51,990 --> 01:47:51,119

earthquake right so it's just we did it

2889
01:47:53,430 --> 01:47:52,000
like

2890
01:47:55,030 --> 01:47:53,440
we're we're most of the way they're not

2891
01:47:57,750 --> 01:47:55,040
not there yet yeah as you heard omar

2892
01:47:59,910 --> 01:47:57,760
earlier in the broadcast say a lot of us

2893
01:48:02,870 --> 01:47:59,920
when we started this when the pandemic

2894
01:48:04,870 --> 01:48:02,880
started we kind of thought mars 2020

2895
01:48:05,750 --> 01:48:04,880
might be mars 2022

2896
01:48:08,070 --> 01:48:05,760
but

2897
01:48:10,310 --> 01:48:08,080
mr bridenstine the nasa agency decided

2898
01:48:11,270 --> 01:48:10,320
to move forward the teams found ways to

2899
01:48:12,709 --> 01:48:11,280
do this

2900
01:48:15,590 --> 01:48:12,719
as we heard they were disciplined they

2901
01:48:17,030 --> 01:48:15,600
were focused they were courageous and

2902
01:48:19,510 --> 01:48:17,040
all that played off today with a

2903
01:48:21,750 --> 01:48:19,520
successful launch at 750 and now

2904
01:48:24,070 --> 01:48:21,760
spacecraft separation mars 2020

2905
01:48:26,310 --> 01:48:24,080
perseverance and ingenuity on their way

2906
01:48:28,149 --> 01:48:26,320
to the railway hey uh we're gonna wait

2907
01:48:29,750 --> 01:48:28,159
for acquisition to signal stay with us

2908
01:48:31,669 --> 01:48:29,760
but really fast nick tell us very very

2909
01:48:33,510 --> 01:48:31,679
quickly about this this mechanism

2910
01:48:34,950 --> 01:48:33,520
because we teased it we teased it yeah

2911
01:48:37,510 --> 01:48:34,960
how did these things separate so the

2912
01:48:39,990 --> 01:48:37,520
separation uh system is is called a

2913
01:48:41,669 --> 01:48:40,000

marmon clamp band actually designed um

2914
01:48:44,310 --> 01:48:41,679
earlier by karl marx one of mark's

2915
01:48:45,030 --> 01:48:44,320
brothers very simple uh design but it

2916
01:48:47,030 --> 01:48:45,040
has

2917
01:48:49,590 --> 01:48:47,040
some spring systems in it that once the

2918
01:48:52,310 --> 01:48:49,600
signal is sent and the bolts release the

2919
01:48:54,070 --> 01:48:52,320
clamp band the springs basically just

2920
01:48:56,229 --> 01:48:54,080
give just enough force to push the

2921
01:48:57,830 --> 01:48:56,239
spacecraft off the front of the vehicle

2922
01:49:00,149 --> 01:48:57,840
awesome and again hopefully we'll see

2923
01:49:01,109 --> 01:49:00,159
that video here momentarily but for now

2924
01:49:03,189 --> 01:49:01,119
we're going to send it back to you and

2925
01:49:06,310 --> 01:49:03,199
check in for one final time in a little

2926
01:49:08,390 --> 01:49:06,320
bit with the folks here at asoc uh but

2927
01:49:10,310 --> 01:49:08,400
daryl back to you all right thank you

2928
01:49:11,669 --> 01:49:10,320
and great job both of you joshua and

2929
01:49:14,229 --> 01:49:11,679
mick it's always great to see mick

2930
01:49:15,589 --> 01:49:14,239
explain that springs are what's getting

2931
01:49:17,350 --> 01:49:15,599
us to mars

2932
01:49:19,030 --> 01:49:17,360
all right so we've got our second burn

2933
01:49:21,830 --> 01:49:19,040
underway we've been flying for right

2934
01:49:24,709 --> 01:49:21,840
about an hour and as you just saw

2935
01:49:27,589 --> 01:49:24,719
spacecraft separation went well and so

2936
01:49:29,830 --> 01:49:27,599
that's fantastic we can now say that

2937
01:49:31,430 --> 01:49:29,840
perseverance is officially

2938
01:49:33,750 --> 01:49:31,440

on its way to mars

2939
01:49:35,189 --> 01:49:33,760
what a beautiful thought that is and

2940
01:49:37,270 --> 01:49:35,199
while nasa has been tracking the

2941
01:49:39,189 --> 01:49:37,280
spacecraft since launch with its

2942
01:49:41,109 --> 01:49:39,199
tracking and data relay satellite system

2943
01:49:42,629 --> 01:49:41,119
i know the mission control team at jpl

2944
01:49:44,709 --> 01:49:42,639
is turning their attention to the next

2945
01:49:46,550 --> 01:49:44,719
milestone and that is ensuring that the

2946
01:49:49,510 --> 01:49:46,560
array of communication antennas known as

2947
01:49:51,109 --> 01:49:49,520
the deep space network or dsn begin to

2948
01:49:53,510 --> 01:49:51,119
receive a signal from the spacecraft

2949
01:49:55,030 --> 01:49:53,520
flying the perseverance rover to mars we

2950
01:49:58,390 --> 01:49:55,040
expect to see the teams acquire the

2951
01:50:00,390 --> 01:49:58,400
signal close to 9 14 eastern time though

2952
01:50:02,550 --> 01:50:00,400
as you saw the spacecraft separation has

2953
01:50:04,149 --> 01:50:02,560
occurred in the shadow of the earth and

2954
01:50:05,510 --> 01:50:04,159
out of line of sight of the system so

2955
01:50:07,589 --> 01:50:05,520
this could take a bit longer than

2956
01:50:09,830 --> 01:50:07,599
estimated

2957
01:50:12,149 --> 01:50:09,840
all right and so finding life on mars

2958
01:50:14,229 --> 01:50:12,159
won't be as easy as you might think and

2959
01:50:16,950 --> 01:50:14,239
we talked a little bit about that here

2960
01:50:20,149 --> 01:50:16,960
to talk about that and more is nasa

2961
01:50:21,750 --> 01:50:20,159
astronaut xena cardman xena is here to

2962
01:50:24,149 --> 01:50:21,760
join us and we're so glad that you're

2963
01:50:27,669 --> 01:50:24,159

here thanks for taking the time first of

2964
01:50:30,390 --> 01:50:27,679
all your reaction to that launch wow

2965
01:50:32,070 --> 01:50:30,400
every time it takes my breath away i had

2966
01:50:34,229 --> 01:50:32,080
actually never seen a launch before

2967
01:50:36,709 --> 01:50:34,239
until i got this job as an astronaut and

2968
01:50:39,030 --> 01:50:36,719
now i'm very lucky to have seen three

2969
01:50:40,870 --> 01:50:39,040
and every single time it just makes me

2970
01:50:42,470 --> 01:50:40,880
feel so much emotion and kind of talk us

2971
01:50:43,910 --> 01:50:42,480
through i mean it got up quick right so

2972
01:50:46,149 --> 01:50:43,920
as you were watching it did you feel the

2973
01:50:47,990 --> 01:50:46,159
rumble it did yeah first you see it go

2974
01:50:50,070 --> 01:50:48,000
up and then you feel the rumble as the

2975
01:50:51,990 --> 01:50:50,080
sound travels to you and you can really

2976
01:50:53,430 --> 01:50:52,000
feel it in your chest it's amazing very

2977
01:50:56,390 --> 01:50:53,440
good very good talking about

2978
01:50:58,390 --> 01:50:56,400
astrobiology now you're um you have an

2979
01:51:00,390 --> 01:50:58,400
amazing uh background

2980
01:51:02,870 --> 01:51:00,400
you've searched for signs of life in

2981
01:51:06,149 --> 01:51:02,880
some of the most extreme environments on

2982
01:51:07,589 --> 01:51:06,159
earth the antarctic the arctic um so

2983
01:51:09,589 --> 01:51:07,599
you're used to looking for these bio

2984
01:51:11,030 --> 01:51:09,599
signatures what are your thoughts about

2985
01:51:12,950 --> 01:51:11,040
this rover

2986
01:51:15,589 --> 01:51:12,960
searching for signs of life yeah you

2987
01:51:17,350 --> 01:51:15,599
know we have a lot of experience looking

2988
01:51:19,350 --> 01:51:17,360

for signs of life in unusual

2989
01:51:21,750 --> 01:51:19,360
environments here on earth so

2990
01:51:24,390 --> 01:51:21,760
if you take a look at mars today it's

2991
01:51:25,910 --> 01:51:24,400
very cold and very dry and we have some

2992
01:51:28,470 --> 01:51:25,920
places on earth that are actually a lot

2993
01:51:29,589 --> 01:51:28,480
like that so places like antarctica or

2994
01:51:31,669 --> 01:51:29,599
deserts

2995
01:51:34,149 --> 01:51:31,679
but if you want to look for signs of

2996
01:51:35,990 --> 01:51:34,159
ancient life life that existed billions

2997
01:51:38,070 --> 01:51:36,000
of years ago perhaps when mars looked

2998
01:51:40,070 --> 01:51:38,080
maybe a lot more like earth does today

2999
01:51:42,390 --> 01:51:40,080
you have to know what those signs of

3000
01:51:44,790 --> 01:51:42,400
life left behind in the rock record

3001
01:51:46,790 --> 01:51:44,800
because microorganisms are very tiny and

3002
01:51:48,470 --> 01:51:46,800
very soft so they don't leave a fossil

3003
01:51:50,629 --> 01:51:48,480
the same way a dinosaur would leave a

3004
01:51:52,629 --> 01:51:50,639
bone or a footprint so instead we use

3005
01:51:54,790 --> 01:51:52,639
these chemical signatures

3006
01:51:56,070 --> 01:51:54,800
daryl's dreams shattered again we told

3007
01:51:57,830 --> 01:51:56,080
him there's going to be no dinosaur

3008
01:52:00,709 --> 01:51:57,840
bones on there

3009
01:52:02,629 --> 01:52:00,719
wiggling around but yeah

3010
01:52:04,709 --> 01:52:02,639
so why do we need to go to the moon

3011
01:52:06,310 --> 01:52:04,719
before we go to mars that's such a good

3012
01:52:08,629 --> 01:52:06,320
question because we've been to the moon

3013
01:52:11,270 --> 01:52:08,639

right but we haven't been to the moon to

3014
01:52:14,149 --> 01:52:11,280
stay we really don't know how to live

3015
01:52:17,270 --> 01:52:14,159
off of earth on another planetary body

3016
01:52:20,149 --> 01:52:17,280
and we really need to figure out how to

3017
01:52:22,950 --> 01:52:20,159
use resources use tools especially if we

3018
01:52:24,550 --> 01:52:22,960
want to do geology on mars the tools

3019
01:52:26,390 --> 01:52:24,560
that we use here on earth are going to

3020
01:52:28,950 --> 01:52:26,400
look pretty similar but they might not

3021
01:52:31,109 --> 01:52:28,960
work quite the same way and because the

3022
01:52:32,709 --> 01:52:31,119
round trip to mars is so much longer

3023
01:52:35,109 --> 01:52:32,719
than the round trip to the moon when we

3024
01:52:36,550 --> 01:52:35,119
go we want to do it right very good and

3025
01:52:39,589 --> 01:52:36,560
uh how do you like that rover behind you

3026
01:52:41,350 --> 01:52:39,599
oh my gosh i love it yeah it's great hey

3027
01:52:43,189 --> 01:52:41,360
i want to ask you some social uh

3028
01:52:44,870 --> 01:52:43,199
questions now these are some from our

3029
01:52:46,870 --> 01:52:44,880
audience who have been watching so great

3030
01:52:48,310 --> 01:52:46,880
we appreciate you uh doing that our

3031
01:52:51,430 --> 01:52:48,320
first question comes to us through

3032
01:52:53,830 --> 01:52:51,440
facebook thomas asks will perseverance

3033
01:52:55,830 --> 01:52:53,840
land to investigate the landing site for

3034
01:52:57,830 --> 01:52:55,840
a future manned mission in the same

3035
01:52:59,750 --> 01:52:57,840
location yeah you know that's a really

3036
01:53:01,430 --> 01:52:59,760
good question i think one of the most

3037
01:53:03,109 --> 01:53:01,440
interesting things about doing a mission

3038
01:53:04,070 --> 01:53:03,119

to mars is choosing where you're going

3039
01:53:05,750 --> 01:53:04,080
to go

3040
01:53:07,109 --> 01:53:05,760
because you know you can imagine

3041
01:53:08,870 --> 01:53:07,119
planning a

3042
01:53:11,669 --> 01:53:08,880
mission from mars to the earth and if

3043
01:53:13,589 --> 01:53:11,679
something landed in utah versus landed

3044
01:53:16,950 --> 01:53:13,599
in the ocean your your vision of earth

3045
01:53:19,669 --> 01:53:16,960
might be quite different so one possible

3046
01:53:21,270 --> 01:53:19,679
approach is taking a human mission and

3047
01:53:23,350 --> 01:53:21,280
going back to somewhere where these

3048
01:53:25,350 --> 01:53:23,360
rovers have been already or maybe we'll

3049
01:53:27,510 --> 01:53:25,360
decide to explore somewhere new i have

3050
01:53:29,430 --> 01:53:27,520
no idea yet but i can't wait to find out

3051
01:53:31,510 --> 01:53:29,440
awesome looks like we have another

3052
01:53:32,470 --> 01:53:31,520
social media question from twitter from

3053
01:53:34,229 --> 01:53:32,480
huda

3054
01:53:36,229 --> 01:53:34,239
do you think that in a few years we'll

3055
01:53:38,149 --> 01:53:36,239
be able to send astronauts to mars in a

3056
01:53:39,910 --> 01:53:38,159
safe way if we are able to send a

3057
01:53:42,149 --> 01:53:39,920
rover-like perseverance to mars in a

3058
01:53:44,550 --> 01:53:42,159
safe and amazingly planned way

3059
01:53:46,310 --> 01:53:44,560
i hope so we won't go until it's safe

3060
01:53:48,229 --> 01:53:46,320
for humans for sure and we're not going

3061
01:53:49,830 --> 01:53:48,239
until it's a round trip but actually

3062
01:53:52,470 --> 01:53:49,840
part of this mission of course is a

3063
01:53:55,350 --> 01:53:52,480

round trip and so we will eventually

3064
01:53:57,270 --> 01:53:55,360
learn how to send a rocket to mars and

3065
01:53:58,870 --> 01:53:57,280
then have something lift off of mars and

3066
01:54:00,870 --> 01:53:58,880
come back

3067
01:54:03,109 --> 01:54:00,880
well xena cardman thank you so much for

3068
01:54:04,950 --> 01:54:03,119
being here you did a fantastic job

3069
01:54:06,790 --> 01:54:04,960
you're a great guest and uh i'm glad you

3070
01:54:09,589 --> 01:54:06,800
enjoyed the launch oh my goodness it's

3071
01:54:11,189 --> 01:54:09,599
impossible not to no doubt all right

3072
01:54:13,350 --> 01:54:11,199
thank you

3073
01:54:15,589 --> 01:54:13,360
now as you can imagine there are a lot

3074
01:54:18,390 --> 01:54:15,599
of systems to develop and prove out as

3075
01:54:19,750 --> 01:54:18,400
we prepare for sending humans to mars as

3076
01:54:22,229 --> 01:54:19,760
you just heard

3077
01:54:24,470 --> 01:54:22,239
here now are six technology disciplines

3078
01:54:27,350 --> 01:54:24,480
that are critical to the success of our

3079
01:55:38,310 --> 01:54:27,360
future explorations

3080
01:56:29,109 --> 01:55:40,330
so

3081
01:56:34,229 --> 01:56:32,229
nasa's first mars rover were powered by

3082
01:56:36,790 --> 01:56:34,239
solar energy but dust storms caused

3083
01:56:39,589 --> 01:56:36,800
issues by blocking much needed sunlight

3084
01:56:42,149 --> 01:56:39,599
so nasa upgraded to nuclear batteries

3085
01:56:44,070 --> 01:56:42,159
provided by the department of energy and

3086
01:56:46,149 --> 01:56:44,080
joining us now is the assistant

3087
01:56:49,030 --> 01:56:46,159
secretary for the office of nuclear

3088
01:56:50,550 --> 01:56:49,040

energy dr rita barnwall thank you so

3089
01:56:52,229 --> 01:56:50,560
much for being here great thank you for

3090
01:56:54,070 --> 01:56:52,239
having me pleasure to be here how did

3091
01:56:56,709 --> 01:56:54,080
you enjoy the launch it was amazing

3092
01:56:58,629 --> 01:56:56,719
absolutely amazing so so fortunate to be

3093
01:56:59,589 --> 01:56:58,639
able to be here and be invited to watch

3094
01:57:01,830 --> 01:56:59,599
it i

3095
01:57:03,589 --> 01:57:01,840
i'm just giddy

3096
01:57:05,030 --> 01:57:03,599
no i hadn't it was my first one and what

3097
01:57:07,750 --> 01:57:05,040
did you feel as you were it was you

3098
01:57:09,910 --> 01:57:07,760
could literally feel yeah the the launch

3099
01:57:12,070 --> 01:57:09,920
so it was um it was very exciting very

3100
01:57:13,910 --> 01:57:12,080
good so it's really interesting when i

3101
01:57:15,830 --> 01:57:13,920
saw this segment i was just fascinated

3102
01:57:17,589 --> 01:57:15,840
by the whole nuclear part of this this

3103
01:57:19,510 --> 01:57:17,599
is right in your wheelhouse so explain

3104
01:57:21,270 --> 01:57:19,520
to me how did the department of energy

3105
01:57:23,669 --> 01:57:21,280
get into the the business of making

3106
01:57:26,709 --> 01:57:23,679
nuclear batteries for space exploration

3107
01:57:29,589 --> 01:57:26,719
so space exploration requires uh power

3108
01:57:31,430 --> 01:57:29,599
sources for uh the long-lived missions

3109
01:57:34,070 --> 01:57:31,440
that we need for for this type of

3110
01:57:36,310 --> 01:57:34,080
activity for heat and electricity uh to

3111
01:57:38,709 --> 01:57:36,320
be provided to the spacecraft and the

3112
01:57:41,830 --> 01:57:38,719
scientific instruments and nuclear

3113
01:57:44,390 --> 01:57:41,840

energy can certainly provide that power

3114
01:57:46,629 --> 01:57:44,400
one source is the radio isotope power

3115
01:57:49,030 --> 01:57:46,639
system rps

3116
01:57:51,589 --> 01:57:49,040
part of that rps is the radio isotope

3117
01:57:53,589 --> 01:57:51,599
thermoelectric generator and rtg i know

3118
01:57:55,350 --> 01:57:53,599
that's a lot of powerful but um you've

3119
01:57:57,750 --> 01:57:55,360
got a decoder ring so i hope you're good

3120
01:57:59,910 --> 01:57:57,760
there uh a space nuclear but it's an a

3121
01:58:02,629 --> 01:57:59,920
space nuclear power system that converts

3122
01:58:03,830 --> 01:58:02,639
heat into electricity without any moving

3123
01:58:06,870 --> 01:58:03,840
parts

3124
01:58:09,350 --> 01:58:06,880
rps's work by converting heat from the

3125
01:58:11,510 --> 01:58:09,360
natural decay of radioisotope materials

3126
01:58:14,470 --> 01:58:11,520
into electricity and that's what we have

3127
01:58:16,629 --> 01:58:14,480
up on the on the rover that just got

3128
01:58:18,790 --> 01:58:16,639
launched this morning it consists of two

3129
01:58:21,350 --> 01:58:18,800
major elements a heat source that

3130
01:58:22,350 --> 01:58:21,360
contains a radioisotope fuel

3131
01:58:23,990 --> 01:58:22,360
mostly

3132
01:58:25,430 --> 01:58:24,000
plutonium-238

3133
01:58:27,750 --> 01:58:25,440
and solid-state thermocouples that

3134
01:58:29,910 --> 01:58:27,760
convert the plutonium's decay heat

3135
01:58:33,350 --> 01:58:29,920
energy to electricity

3136
01:58:35,030 --> 01:58:33,360
doe developed several generations of

3137
01:58:37,510 --> 01:58:35,040
nuclear space power systems that can be

3138
01:58:39,510 --> 01:58:37,520

used to supply electricity and use the

3139
01:58:41,030 --> 01:58:39,520
excess heat for a variety of other space

3140
01:58:42,629 --> 01:58:41,040
applications

3141
01:58:44,149 --> 01:58:42,639
this one that was launched is called the

3142
01:58:45,270 --> 01:58:44,159
multi-mission

3143
01:58:47,430 --> 01:58:45,280
rtg

3144
01:58:50,070 --> 01:58:47,440
and it was designed with the flexibility

3145
01:58:52,070 --> 01:58:50,080
to be able to be operated on planetary

3146
01:58:54,070 --> 01:58:52,080
bodies with atmospheres just like mars

3147
01:58:55,990 --> 01:58:54,080
as well as in the vacuum of space it's

3148
01:58:57,589 --> 01:58:56,000
amazing the longevity of that battery

3149
01:59:00,709 --> 01:58:57,599
yeah i heard it could last up to up to

3150
01:59:02,709 --> 01:59:00,719
14 years right will it actually last

3151
01:59:05,030 --> 01:59:02,719
longer than that duration

3152
01:59:07,830 --> 01:59:05,040
it can and actually right now it was 17

3153
01:59:10,390 --> 01:59:07,840
years three years here

3154
01:59:13,270 --> 01:59:10,400
and then 14 years out in in the mission

3155
01:59:14,870 --> 01:59:13,280
itself so we're very excited about that

3156
01:59:17,510 --> 01:59:14,880
that's one of the benefits of powering

3157
01:59:19,270 --> 01:59:17,520
this mission with nuclear energy

3158
01:59:22,470 --> 01:59:19,280
the rps's that are currently powering

3159
01:59:24,950 --> 01:59:22,480
voyager 1 and 2 um that are exploring

3160
01:59:27,109 --> 01:59:24,960
the extremes of our solar system also

3161
01:59:29,189 --> 01:59:27,119
are being powered by an rps that has

3162
01:59:31,830 --> 01:59:29,199
lasted for 43 years

3163
01:59:34,629 --> 01:59:31,840

and yeah yeah so a long time that's

3164
01:59:36,870 --> 01:59:34,639
that's a great great extent of time

3165
01:59:38,870 --> 01:59:36,880
the mm rtg is essentially it's a nuclear

3166
01:59:41,669 --> 01:59:38,880
battery like you said and it contains

3167
01:59:42,870 --> 01:59:41,679
only 10.6 pounds of plutonium dioxide

3168
01:59:45,669 --> 01:59:42,880
fuel

3169
01:59:47,910 --> 01:59:45,679
and it provides 2000 watts of thermal

3170
01:59:49,430 --> 01:59:47,920
power um it's similar the material

3171
01:59:52,229 --> 01:59:49,440
that's used in this is similar to what

3172
01:59:55,510 --> 01:59:52,239
was used in the two viking spacecraft

3173
01:59:57,589 --> 01:59:55,520
that landed on mars in 1976 wow so this

3174
02:00:00,149 --> 01:59:57,599
technology has been around a long time

3175
02:00:02,070 --> 02:00:00,159
and it's well proven yes dr rita

3176
02:00:04,229 --> 02:00:02,080
berenwald we thank you very much the

3177
02:00:05,990 --> 02:00:04,239
secretary assistant secretary for the

3178
02:00:07,510 --> 02:00:06,000
office of nuclear energy thanks for

3179
02:00:09,030 --> 02:00:07,520
coming out we're so glad you enjoyed the

3180
02:00:11,270 --> 02:00:09,040
launch too thank you for having me

3181
02:00:13,030 --> 02:00:11,280
you're welcome

3182
02:00:15,910 --> 02:00:13,040
all right here's a statistic you might

3183
02:00:17,030 --> 02:00:15,920
not know about missions to mars roughly

3184
02:00:19,910 --> 02:00:17,040
half of them

3185
02:00:22,149 --> 02:00:19,920
actually make it there imagine that but

3186
02:00:24,790 --> 02:00:22,159
right now we know the health of the mars

3187
02:00:27,030 --> 02:00:24,800
2020 rocket is good because it's sending

3188
02:00:29,270 --> 02:00:27,040

back a stream of data to our telemetry

3189
02:00:31,830 --> 02:00:29,280
nerve center here at the cape let's go

3190
02:00:34,070 --> 02:00:31,840
back now to joshua santora to learn more

3191
02:00:35,990 --> 02:00:34,080
about that joshua yeah thanks daryl so

3192
02:00:38,070 --> 02:00:36,000
we talked to dr denton gibson who is one

3193
02:00:39,750 --> 02:00:38,080
of the guys that works behind the scenes

3194
02:00:42,149 --> 02:00:39,760
but there is a group of folks that work

3195
02:00:43,750 --> 02:00:42,159
behind the people behind the scenes uh

3196
02:00:45,189 --> 02:00:43,760
and jessica connor is one of those she's

3197
02:00:47,910 --> 02:00:45,199
coming to us now from the same hangar a

3198
02:00:49,430 --> 02:00:47,920
loca hanger ae location jessica thanks

3199
02:00:51,030 --> 02:00:49,440
for joining us

3200
02:00:53,350 --> 02:00:51,040
hey it's a pleasure to be here thanks so

3201
02:00:55,990 --> 02:00:53,360
much for having me on yeah uh so tell us

3202
02:00:57,669 --> 02:00:56,000
about what you do uh to help make all of

3203
02:00:59,430 --> 02:00:57,679
these activities and as darryl mentioned

3204
02:01:02,950 --> 02:00:59,440
the telemetry happen what do you do for

3205
02:01:07,109 --> 02:01:04,870
so i work as a mission communications

3206
02:01:09,030 --> 02:01:07,119
engineer for lsp that means that i'm

3207
02:01:10,470 --> 02:01:09,040
getting the video data and voice

3208
02:01:11,990 --> 02:01:10,480
requirements from the spacecraft and

3209
02:01:14,709 --> 02:01:12,000
then ensuring that they're able to go

3210
02:01:17,830 --> 02:01:14,719
ahead and uh perform these operations

3211
02:01:19,270 --> 02:01:17,840
once they actually get to uh pad phase

3212
02:01:21,109 --> 02:01:19,280
ed joshua i was just going to say

3213
02:01:22,950 --> 02:01:21,119

jessica is one of our wizards you said

3214
02:01:25,109 --> 02:01:22,960
behind scene within the launch services

3215
02:01:27,109 --> 02:01:25,119
program as engineers we depend on our

3216
02:01:29,189 --> 02:01:27,119
folks at ae to make sure that we get

3217
02:01:31,109 --> 02:01:29,199
everything we need to do our assessments

3218
02:01:32,790 --> 02:01:31,119
as engineers so they make everything

3219
02:01:34,709 --> 02:01:32,800
possible there yeah absolutely so

3220
02:01:35,990 --> 02:01:34,719
jessica tell us a little bit about how

3221
02:01:40,229 --> 02:01:36,000
you get the data back and then how it's

3222
02:01:43,189 --> 02:01:41,750
so while it's on the pad we go ahead and

3223
02:01:45,189 --> 02:01:43,199
get that data through the umbilical

3224
02:01:47,109 --> 02:01:45,199
lines and then that go

3225
02:01:48,629 --> 02:01:47,119
that goes ahead and gets back to the

3226
02:01:51,350 --> 02:01:48,639
engineers and they're able to provide

3227
02:01:53,589 --> 02:01:51,360
fleet insight based on the debate that

3228
02:01:54,709 --> 02:01:53,599
they get from the consoles

3229
02:01:55,830 --> 02:01:54,719
and can you tell us about how long

3230
02:01:57,830 --> 02:01:55,840
you've been working this mission people

3231
02:02:00,070 --> 02:01:57,840
probably don't understand how much time

3232
02:02:03,030 --> 02:02:00,080
goes in ahead of time behind the scenes

3233
02:02:04,709 --> 02:02:03,040
to make these missions happen

3234
02:02:06,550 --> 02:02:04,719
so i've been working for about two and a

3235
02:02:08,390 --> 02:02:06,560
half years on this mission about two

3236
02:02:10,229 --> 02:02:08,400
years out we start working with jpl to

3237
02:02:11,830 --> 02:02:10,239
go ahead and get those requirements and

3238
02:02:13,910 --> 02:02:11,840

then we've been working with them since

3239
02:02:16,870 --> 02:02:13,920
to go ahead and get a

3240
02:02:19,189 --> 02:02:16,880
processing video and also

3241
02:02:21,350 --> 02:02:19,199
being able to talk back to jpl being

3242
02:02:22,229 --> 02:02:21,360
able to talk to headquarters and stuff

3243
02:02:23,589 --> 02:02:22,239
like that

3244
02:02:25,189 --> 02:02:23,599
awesome and so what's been the biggest

3245
02:02:26,870 --> 02:02:25,199
challenge for this mission i know that

3246
02:02:28,629 --> 02:02:26,880
this mission has presented a lot of

3247
02:02:30,470 --> 02:02:28,639
unique challenges for all of our teams

3248
02:02:32,950 --> 02:02:30,480
but for you uh where has that challenge

3249
02:02:34,950 --> 02:02:32,960
lied

3250
02:02:36,550 --> 02:02:34,960
so we have a ton of experience from

3251
02:02:39,510 --> 02:02:36,560
different mission com engineers from the

3252
02:02:41,270 --> 02:02:39,520
past and so the most unique thing about

3253
02:02:43,589 --> 02:02:41,280
this mission has been our treatment of

3254
02:02:45,510 --> 02:02:43,599
covid and it's amazing what we've done

3255
02:02:48,149 --> 02:02:45,520
to go ahead and keep the control room

3256
02:02:50,149 --> 02:02:48,159
safe for all of the people on console

3257
02:02:52,790 --> 02:02:50,159
and to go ahead and launch this mission

3258
02:02:54,229 --> 02:02:52,800
on time and successfully hey listen and

3259
02:02:55,430 --> 02:02:54,239
we did it uh we have the data coming

3260
02:02:56,709 --> 02:02:55,440
back so that means that yeah i think

3261
02:02:59,350 --> 02:02:56,719
that means you did your job really well

3262
02:03:01,030 --> 02:02:59,360
today i i would say they did their job

3263
02:03:02,790 --> 02:03:01,040

great joshua they

3264
02:03:04,709 --> 02:03:02,800
they found new ways as we talked earlier

3265
02:03:06,470 --> 02:03:04,719
with the launch team uh finding new ways

3266
02:03:09,189 --> 02:03:06,480
to their stuff the folks out at hangar

3267
02:03:10,470 --> 02:03:09,199
ae also found new ways to make sure that

3268
02:03:11,830 --> 02:03:10,480
all the engineering team could perform

3269
02:03:13,750 --> 02:03:11,840
their fleet's insight

3270
02:03:15,510 --> 02:03:13,760
assessments and support today's launch

3271
02:03:18,550 --> 02:03:15,520
so that team out there has done a great

3272
02:03:20,229 --> 02:03:18,560
job they actually make us in engineering

3273
02:03:22,709 --> 02:03:20,239
look good so we appreciate all the work

3274
02:03:25,109 --> 02:03:22,719
you guys do jessica yeah awesome jessica

3275
02:03:26,310 --> 02:03:25,119
congratulations uh job well done thank

3276
02:03:27,189 --> 02:03:26,320
you for joining us for this interview

3277
02:03:30,310 --> 02:03:27,199
today

3278
02:03:32,550 --> 02:03:30,320
thanks all right so mick uh things are

3279
02:03:33,830 --> 02:03:32,560
pretty quiet now um and that's expected

3280
02:03:36,149 --> 02:03:33,840
um because we're just hanging out for

3281
02:03:38,470 --> 02:03:36,159
the signal acquisition uh the time there

3282
02:03:40,790 --> 02:03:38,480
is is the estimate based on the

3283
02:03:43,189 --> 02:03:40,800
pre-launch data yes right now we're

3284
02:03:44,870 --> 02:03:43,199
actually in the shade of this the earth

3285
02:03:46,149 --> 02:03:44,880
uh so we're behind the earth and so

3286
02:03:47,750 --> 02:03:46,159
we'll come out of that at some point

3287
02:03:48,950 --> 02:03:47,760
shortly and then hopefully acquire that

3288
02:03:51,270 --> 02:03:48,960

signal because there's some solar arrays

3289
02:03:53,270 --> 02:03:51,280
that have to play in here um so still

3290
02:03:55,030 --> 02:03:53,280
still kind of some i don't know tense is

3291
02:03:56,950 --> 02:03:55,040
the right right word but it's it's we're

3292
02:03:59,669 --> 02:03:56,960
anxious still yeah i would say we're

3293
02:04:01,270 --> 02:03:59,679
anxious we're focused still as i like

3294
02:04:02,709 --> 02:04:01,280
this i like to refer back to what tori

3295
02:04:04,390 --> 02:04:02,719
said earlier right focused and

3296
02:04:06,069 --> 02:04:04,400
disciplined even though it's pretty

3297
02:04:08,229 --> 02:04:06,079
quiet right now we have had spacecraft

3298
02:04:10,390 --> 02:04:08,239
separation which was a huge milestone

3299
02:04:13,990 --> 02:04:10,400
for the team an exciting time for us at

3300
02:04:17,430 --> 02:04:14,000
nasa ula jpl the doe and our united

3301
02:04:19,669 --> 02:04:17,440
states states space force family but the

3302
02:04:22,310 --> 02:04:19,679
team is still sitting on console they're

3303
02:04:23,910 --> 02:04:22,320
still following their procedures they're

3304
02:04:25,830 --> 02:04:23,920
still performing everything that needs

3305
02:04:27,750 --> 02:04:25,840
to be done as we await the acquisition

3306
02:04:30,709 --> 02:04:27,760
signal uh some of the things are going

3307
02:04:31,990 --> 02:04:30,719
on here behind us is ground securing and

3308
02:04:33,510 --> 02:04:32,000
everything here at the complex to make

3309
02:04:35,350 --> 02:04:33,520
sure we can safely enter and do the work

3310
02:04:36,709 --> 02:04:35,360
so yeah very lot of work still going on

3311
02:04:38,550 --> 02:04:36,719
yes and we're going to send you back to

3312
02:04:39,510 --> 02:04:38,560
darrell because we need to check in and

3313
02:04:41,270 --> 02:04:39,520

talk to the folks who are going to be

3314
02:04:43,430 --> 02:04:41,280
getting that data back so darrell will

3315
02:04:44,950 --> 02:04:43,440
check in for one one last thing uh in

3316
02:04:46,790 --> 02:04:44,960
just a few minutes all right thank you

3317
02:04:48,629 --> 02:04:46,800
very much signals every day on our cell

3318
02:04:50,470 --> 02:04:48,639
phones and you can imagine driving out

3319
02:04:52,229 --> 02:04:50,480
into the countryside and

3320
02:04:53,910 --> 02:04:52,239
you farthest from the nearest cell phone

3321
02:04:56,470 --> 02:04:53,920
tower and you look down at yourself when

3322
02:04:58,470 --> 02:04:56,480
you see one bar a very faint signal

3323
02:05:01,030 --> 02:04:58,480
as you mentioned uh mars is very far

3324
02:05:03,669 --> 02:05:01,040
away so you get a very faint

3325
02:05:05,910 --> 02:05:03,679
signal very much less than one bar and

3326
02:05:07,510 --> 02:05:05,920
so thankfully we have on the ground uh

3327
02:05:10,470 --> 02:05:07,520
from our deep space network managed owl

3328
02:05:12,950 --> 02:05:10,480
jpl very large antenna dishes

3329
02:05:14,149 --> 02:05:12,960
that can detect that very faint signal

3330
02:05:15,669 --> 02:05:14,159
you're talking about a signal that's

3331
02:05:17,750 --> 02:05:15,679
basically like an incandescent light

3332
02:05:20,709 --> 02:05:17,760
bulb and receiving that from millions of

3333
02:05:23,109 --> 02:05:20,719
miles we have 70 meter antennas and 34

3334
02:05:25,109 --> 02:05:23,119
meter antennas a 70 meter antenna is

3335
02:05:27,830 --> 02:05:25,119
about the size give some context about

3336
02:05:30,149 --> 02:05:27,840
the size of a 20 story building so very

3337
02:05:33,109 --> 02:05:30,159
large systems that can detect that very

3338
02:05:37,030 --> 02:05:35,350

great and the deep space network also

3339
02:05:39,350 --> 02:05:37,040
communicates with all of our other

3340
02:05:42,550 --> 02:05:39,360
missions beyond the moon now how far

3341
02:05:44,229 --> 02:05:42,560
have we gone into space

3342
02:05:46,149 --> 02:05:44,239
well our voyager missions are the

3343
02:05:50,069 --> 02:05:46,159
farthest and fastest uh human-made

3344
02:05:52,870 --> 02:05:50,079
objects they exist voyager 1 is nearly

3345
02:05:55,270 --> 02:05:52,880
14 billion miles away from earth it

3346
02:05:57,189 --> 02:05:55,280
takes almost 20 hours one way to

3347
02:05:58,310 --> 02:05:57,199
communicate to it so once again you can

3348
02:06:00,069 --> 02:05:58,320
think about that light bulb could you

3349
02:06:02,229 --> 02:06:00,079
imagine turning on a light bulb or a

3350
02:06:04,229 --> 02:06:02,239
light switch and that light taking 20

3351
02:06:06,790 --> 02:06:04,239
hours to get to your eyes and so

3352
02:06:09,189 --> 02:06:06,800
basically to communicate to voyager we

3353
02:06:10,870 --> 02:06:09,199
we send a command saying hi it takes 20

3354
02:06:13,589 --> 02:06:10,880
hours to get there and every 20 hours to

3355
02:06:16,629 --> 02:06:13,599
receive us a response from voyager so

3356
02:06:18,229 --> 02:06:16,639
very far away thankfully mars is not as

3357
02:06:20,629 --> 02:06:18,239
far as what far away as you mentioned

3358
02:06:22,550 --> 02:06:20,639
several million miles not billions uh so

3359
02:06:24,790 --> 02:06:22,560
it takes not 20 hours but it takes about

3360
02:06:26,790 --> 02:06:24,800
seven minutes so it's a little better

3361
02:06:29,109 --> 02:06:26,800
situation there

3362
02:06:30,950 --> 02:06:29,119
wow so what does it take to add the

3363
02:06:33,030 --> 02:06:30,960

perseverance mission to the deep space

3364
02:06:34,870 --> 02:06:33,040
network

3365
02:06:36,950 --> 02:06:34,880
well it's a lot of pre-work

3366
02:06:38,550 --> 02:06:36,960
before the launch we test with the

3367
02:06:41,669 --> 02:06:38,560
launch vehicle we test with the

3368
02:06:43,910 --> 02:06:41,679
spacecraft we test with the rover

3369
02:06:46,149 --> 02:06:43,920
we we test over and over again to ensure

3370
02:06:48,310 --> 02:06:46,159
that when it launches

3371
02:06:50,550 --> 02:06:48,320
when the spacecraft separates

3372
02:06:52,229 --> 02:06:50,560
when it lands on mars that we can have

3373
02:06:54,629 --> 02:06:52,239
confidence that it will be to establish

3374
02:06:56,390 --> 02:06:54,639
a communication with us back on earth

3375
02:06:58,470 --> 02:06:56,400
that's very important that we instill

3376
02:07:00,149 --> 02:06:58,480
that confidence by testing and making

3377
02:07:01,910 --> 02:07:00,159
sure we have a lot of testing up front

3378
02:07:04,550 --> 02:07:01,920
and the payoff comes when we see those

3379
02:07:06,310 --> 02:07:04,560
great all aspiring images from mars so a

3380
02:07:08,069 --> 02:07:06,320
lot of testing happens out front up

3381
02:07:09,589 --> 02:07:08,079
front and a great team that works on

3382
02:07:12,390 --> 02:07:09,599
that

3383
02:07:15,189 --> 02:07:12,400
great now getting an acquisition of

3384
02:07:17,030 --> 02:07:15,199
signal is a very significant moment can

3385
02:07:20,069 --> 02:07:17,040
you tell us how it works and what we

3386
02:07:22,149 --> 02:07:20,079
should expect to see for this mission

3387
02:07:24,310 --> 02:07:22,159
yes that's a very important important

3388
02:07:26,229 --> 02:07:24,320

moment and sometimes you'll see a a

3389
02:07:28,149 --> 02:07:26,239
spectrum graph that's a couple squiggly

3390
02:07:30,709 --> 02:07:28,159
lines in the bottom and which you expect

3391
02:07:32,550 --> 02:07:30,719
to see is a is a peak in the middle come

3392
02:07:34,870 --> 02:07:32,560
up and that's what you call the carrier

3393
02:07:36,470 --> 02:07:34,880
signal and the carrier signal is

3394
02:07:38,149 --> 02:07:36,480
described as a carrier because what it

3395
02:07:40,550 --> 02:07:38,159
does it brings in

3396
02:07:41,990 --> 02:07:40,560
it brings in the the signal it carries

3397
02:07:44,069 --> 02:07:42,000
the signal to us

3398
02:07:45,830 --> 02:07:44,079
therefore we can see that signal and

3399
02:07:47,990 --> 02:07:45,840
know that we're receiving data and

3400
02:07:49,350 --> 02:07:48,000
basically we see the carrier signal but

3401
02:07:50,790 --> 02:07:49,360
after that we have to decode what the

3402
02:07:52,709 --> 02:07:50,800
signal is saying and hopefully what

3403
02:07:54,870 --> 02:07:52,719
we're seeing is that this spacecraft is

3404
02:07:57,350 --> 02:07:54,880
saying hey i'm doing okay i'm on my way

3405
02:07:59,430 --> 02:07:57,360
to mars and i'll see you there in some

3406
02:08:01,430 --> 02:07:59,440
of the most and so we expect to see that

3407
02:08:02,709 --> 02:08:01,440
signal and then we'll decode it and be

3408
02:08:05,189 --> 02:08:02,719
able to get the health and safety of the

3409
02:08:08,069 --> 02:08:05,199
spacecraft but also what we'll also look

3410
02:08:09,510 --> 02:08:08,079
out for is uh how to track it so once we

3411
02:08:11,990 --> 02:08:09,520
have the signal we'll lock on to it

3412
02:08:14,629 --> 02:08:12,000
we'll move our very large antenna dishes

3413
02:08:17,109 --> 02:08:14,639

and as the earth spins we'll track the

3414
02:08:19,510 --> 02:08:17,119
spacecraft uh around the globe this is a

3415
02:08:22,709 --> 02:08:19,520
global effort we have uh our station in

3416
02:08:24,709 --> 02:08:22,719
canberra uh australia and madrid spain

3417
02:08:27,350 --> 02:08:24,719
and goldstone california who all be part

3418
02:08:29,430 --> 02:08:27,360
of this tracking as a spacecraft uh goes

3419
02:08:30,950 --> 02:08:29,440
to mars so very exciting time and we're

3420
02:08:32,870 --> 02:08:30,960
looking forward to hearing from

3421
02:08:35,109 --> 02:08:32,880
perseverance shortly

3422
02:08:38,390 --> 02:08:35,119
great thank you phillip now

3423
02:08:40,310 --> 02:08:38,400
we are just a couple minutes away from

3424
02:08:41,750 --> 02:08:40,320
the first opportunity we will have to

3425
02:08:44,310 --> 02:08:41,760
see if the perseverance signal on the

3426
02:08:46,950 --> 02:08:44,320
deep space network is up on our screens

3427
02:08:49,510 --> 02:08:46,960
that moment brings us one step closer to

3428
02:08:51,350 --> 02:08:49,520
mars but we have many other milestones

3429
02:08:53,669 --> 02:08:51,360
to hit over the next seven months and

3430
02:08:56,069 --> 02:08:53,679
i'm with perseverance's chief engineer

3431
02:08:58,229 --> 02:08:56,079
adam stelzner who will tell us what's in

3432
02:09:01,350 --> 02:08:58,239
store for the rover adam what should we

3433
02:09:04,470 --> 02:09:03,189
well raquel

3434
02:09:07,510 --> 02:09:04,480
we are

3435
02:09:08,550 --> 02:09:07,520
after we acquire signal we we have left

3436
02:09:10,470 --> 02:09:08,560
the building

3437
02:09:14,310 --> 02:09:10,480
we are on our way to mars

3438
02:09:15,910 --> 02:09:14,320

we're no longer in orbit around earth

3439
02:09:19,350 --> 02:09:15,920
and

3440
02:09:22,470 --> 02:09:19,360
what what will happen next is we will

3441
02:09:24,470 --> 02:09:22,480
start our cruise phase

3442
02:09:27,350 --> 02:09:24,480
it'll be about seven months before we

3443
02:09:29,109 --> 02:09:27,360
make it to the red planet we have a set

3444
02:09:31,589 --> 02:09:29,119
of

3445
02:09:34,950 --> 02:09:31,599
planned trajectory change maneuvers that

3446
02:09:35,830 --> 02:09:34,960
we do during cruise to adjust

3447
02:09:37,990 --> 02:09:35,840
our

3448
02:09:40,149 --> 02:09:38,000
targeting in fact we're targeting to

3449
02:09:42,470 --> 02:09:40,159
miss mars right now we're on the way

3450
02:09:46,149 --> 02:09:42,480
general direction of mars but in order

3451
02:09:47,669 --> 02:09:46,159
to make our atlas centaur which threw us

3452
02:09:49,990 --> 02:09:47,679
in the direction of mars not running to

3453
02:09:52,149 --> 02:09:50,000
mars we're we're on a

3454
02:09:55,990 --> 02:09:52,159
a missing trajectory and i will do tcm

3455
02:09:58,629 --> 02:09:56,000
one which will target our um our impact

3456
02:10:01,830 --> 02:09:58,639
with the with the martian surface

3457
02:10:04,149 --> 02:10:01,840
in a few days so uh we

3458
02:10:07,109 --> 02:10:04,159
start to monitor the spacecraft make

3459
02:10:09,270 --> 02:10:07,119
sure it's healthy and happy and uh tweak

3460
02:10:11,990 --> 02:10:09,280
its trajectory to be right on target by

3461
02:10:14,069 --> 02:10:12,000
the time we make it to mars great thank

3462
02:10:17,510 --> 02:10:14,079
you so much adam and right now we are

3463
02:10:19,750 --> 02:10:17,520

just a minute away from the acquisition

3464
02:10:30,870 --> 02:10:19,760
signal so let's pause for a moment and

3465
02:10:30,880 --> 02:10:51,030
hello

3466
02:11:29,270 --> 02:11:23,350
okay

3467
02:12:07,830 --> 02:11:29,280
acquisition of signal

3468
02:12:07,840 --> 02:12:31,510
[Applause]

3469
02:12:31,520 --> 02:12:44,149
hmm

3470
02:12:44,159 --> 02:12:52,229
initial acquisition

3471
02:12:59,669 --> 02:12:54,870
radio science

3472
02:12:59,679 --> 02:13:15,589
go ahead now

3473
02:13:15,599 --> 02:13:38,470
these copies

3474
02:13:43,910 --> 02:13:41,109
we now have an acquisition of signals

3475
02:13:46,310 --> 02:13:43,920
the rumbles now are of claps and cheers

3476
02:13:47,990 --> 02:13:46,320
and it's an amazing moment and the years

3477
02:13:49,750 --> 02:13:48,000
of blood sweat and tears from every

3478
02:13:53,189 --> 02:13:49,760
person who worked on this mission is now

3479
02:13:55,510 --> 02:13:53,199
realized as perseverance makes its way

3480
02:13:58,310 --> 02:13:55,520
to mars now if we still have adam here

3481
02:14:00,470 --> 02:13:58,320
adam i want to know your reaction to

3482
02:14:02,709 --> 02:14:00,480
getting the acquisition of signal

3483
02:14:05,430 --> 02:14:02,719
well raquel it's very nice to have the

3484
02:14:07,910 --> 02:14:05,440
spacecraft in a uh safe

3485
02:14:10,149 --> 02:14:07,920
separated on its way to mars nav looks

3486
02:14:12,550 --> 02:14:10,159
good we are hearing from the spacecraft

3487
02:14:14,870 --> 02:14:12,560
that was the only question it's not

3488
02:14:17,109 --> 02:14:14,880

really much of a question but it's just

3489
02:14:18,229 --> 02:14:17,119
nice to have that confirmation

3490
02:14:21,270 --> 02:14:18,239
our

3491
02:14:23,669 --> 02:14:21,280
launch process is complete uh the

3492
02:14:26,790 --> 02:14:23,679
vehicle's on its way to mars

3493
02:14:29,830 --> 02:14:26,800
and so the next chapter in

3494
02:14:31,510 --> 02:14:29,840
perseverance's mission can begin

3495
02:14:33,030 --> 02:14:31,520
great and what are you looking forward

3496
02:14:35,750 --> 02:14:33,040
to next

3497
02:14:38,709 --> 02:14:35,760
i'm looking forward to ideally a very

3498
02:14:41,430 --> 02:14:38,719
quiet and boring cruise to mars

3499
02:14:44,550 --> 02:14:41,440
as we prepare for the never boring and

3500
02:14:47,270 --> 02:14:44,560
always just um stressful entry descent

3501
02:14:48,709 --> 02:14:47,280
landing on the 18th of february

3502
02:14:51,830 --> 02:14:48,719
great

3503
02:14:53,910 --> 02:14:51,840
thank you so much adam and we hope you

3504
02:14:57,350 --> 02:14:53,920
tune into our coverage of the landing

3505
02:15:00,229 --> 02:14:57,360
happening on february 18th 2021 joshua

3506
02:15:02,069 --> 02:15:00,239
mick we here at jpl would like to thank

3507
02:15:04,390 --> 02:15:02,079
you and the entire launch service

3508
02:15:06,629 --> 02:15:04,400
program and united launch alliance teams

3509
02:15:09,030 --> 02:15:06,639
for all your amazing work today and all

3510
02:15:11,030 --> 02:15:09,040
the work you do every day to make a

3511
02:15:13,270 --> 02:15:11,040
launch like this possible you know

3512
02:15:14,950 --> 02:15:13,280
joshua back to you at the cape

3513
02:15:17,270 --> 02:15:14,960

raquel uh congratulations to you and the

3514
02:15:18,950 --> 02:15:17,280
team over there obviously jpl uh i think

3515
02:15:21,030 --> 02:15:18,960
adam's response is kind of what you'd

3516
02:15:23,189 --> 02:15:21,040
expect from adam of like hey check that

3517
02:15:24,870 --> 02:15:23,199
box but we got a lot of work to go yes

3518
02:15:27,830 --> 02:15:24,880
yeah i mean the work here for the launch

3519
02:15:29,589 --> 02:15:27,840
team exciting day yes we got this done

3520
02:15:31,510 --> 02:15:29,599
our portion of this is done adam and the

3521
02:15:32,629 --> 02:15:31,520
team now have mars 2020 underway and

3522
02:15:34,390 --> 02:15:32,639
they've got a lot of work in front of

3523
02:15:36,069 --> 02:15:34,400
them too and hopefully it is a quiet

3524
02:15:37,750 --> 02:15:36,079
seven months and they get ready to go

3525
02:15:40,229 --> 02:15:37,760
but we are so excited to be able to

3526
02:15:42,069 --> 02:15:40,239
perform this for them as our jpl

3527
02:15:44,709 --> 02:15:42,079
customer i know tory bruno and the ua

3528
02:15:47,030 --> 02:15:44,719
team are excited as well and uh i just

3529
02:15:48,390 --> 02:15:47,040
can't be i i i'm just i can't be more

3530
02:15:50,069 --> 02:15:48,400
excited about how this went it feels

3531
02:15:51,750 --> 02:15:50,079
good hey before we sign off today we

3532
02:15:53,830 --> 02:15:51,760
want to check in with the nasa launch

3533
02:15:55,669 --> 02:15:53,840
manager omar baez to get some thoughts

3534
02:15:57,589 --> 02:15:55,679
from him omar can i give us your

3535
02:16:05,510 --> 02:15:57,599
response after seeing a successful

3536
02:16:10,149 --> 02:16:06,550
okay

3537
02:16:12,390 --> 02:16:10,159
so um about a minute ago

3538
02:16:14,229 --> 02:16:12,400

we did get acquisition of the spacecraft

3539
02:16:17,350 --> 02:16:14,239
signal

3540
02:16:20,709 --> 02:16:17,360
that signifies that

3541
02:16:22,629 --> 02:16:20,719
jpl's deep space network has

3542
02:16:26,709 --> 02:16:22,639
locked onto the spacecraft

3543
02:16:30,229 --> 02:16:28,870
everything appears to be going nominally

3544
02:16:31,750 --> 02:16:30,239
for them they'll get to check out the

3545
02:16:34,150 --> 02:16:31,760
spacecraft now

3546
02:16:36,309 --> 02:16:34,160
do those checks that they need to do to

3547
02:16:40,230 --> 02:16:36,319
learn how to fly that that vehicle the

3548
02:16:43,429 --> 02:16:40,240
way it wants to fly on its way to mars

3549
02:16:46,950 --> 02:16:43,439
pretty interesting we separated them at

3550
02:16:48,549 --> 02:16:46,960
approximately 25 000 miles an hour

3551
02:16:51,349 --> 02:16:48,559
and

3552
02:16:53,910 --> 02:16:51,359
it's going to take a little bit of a

3553
02:16:55,509 --> 02:16:53,920
couple of months to get to that february

3554
02:16:57,910 --> 02:16:55,519
18th landing date which they're

3555
02:16:59,270 --> 02:16:57,920
targeting so it's an impressive amount

3556
02:17:02,389 --> 02:16:59,280
of

3557
02:17:05,190 --> 02:17:02,399
speed that we imparted to them and and

3558
02:17:07,509 --> 02:17:05,200
that speed is what

3559
02:17:09,429 --> 02:17:07,519
our job as launch services program and

3560
02:17:11,830 --> 02:17:09,439
united launch alliance is to provide

3561
02:17:14,790 --> 02:17:11,840
that spacecraft the

3562
02:17:17,270 --> 02:17:14,800
heavy lifting now is on our partners at

3563
02:17:20,549 --> 02:17:17,280

the jet propulsion lab

3564
02:17:21,509 --> 02:17:20,559
to slow it down when it gets to mars

3565
02:17:23,190 --> 02:17:21,519
up the

3566
02:17:24,549 --> 02:17:23,200
parachutes slow them down in the

3567
02:17:26,070 --> 02:17:24,559
atmosphere

3568
02:17:27,349 --> 02:17:26,080
and

3569
02:17:30,389 --> 02:17:27,359
extend that

3570
02:17:32,549 --> 02:17:30,399
sky crane and land on mars so they've

3571
02:17:34,629 --> 02:17:32,559
got a heck of a lot of work to do

3572
02:17:37,589 --> 02:17:34,639
uh from here on out

3573
02:17:39,910 --> 02:17:37,599
today's count went uh beautiful up until

3574
02:17:41,990 --> 02:17:39,920
the last 20 minutes uh

3575
02:17:45,110 --> 02:17:42,000
started to get exciting with some of the

3576
02:17:45,990 --> 02:17:45,120
assets on the range having dropouts

3577
02:17:49,349 --> 02:17:46,000
and

3578
02:17:50,150 --> 02:17:49,359
then a surprise call from

3579
02:17:52,950 --> 02:17:50,160
the

3580
02:17:56,469 --> 02:17:52,960
spacecraft mission director that

3581
02:17:57,750 --> 02:17:56,479
we had a small earthquake uh in

3582
02:17:59,110 --> 02:17:57,760
california at

3583
02:18:01,830 --> 02:17:59,120
pasadena

3584
02:18:02,790 --> 02:18:01,840
um that the folks in the control room

3585
02:18:04,230 --> 02:18:02,800
felt

3586
02:18:06,709 --> 02:18:04,240
uh but they

3587
02:18:10,070 --> 02:18:06,719
never lost signal

3588
02:18:11,669 --> 02:18:10,080

and they came back to me and

3589
02:18:12,709 --> 02:18:11,679
said they were ready to proceed we were

3590
02:18:15,910 --> 02:18:12,719
able to

3591
02:18:17,750 --> 02:18:15,920
to block down the the time we were after

3592
02:18:19,750 --> 02:18:17,760
launched on time

3593
02:18:22,309 --> 02:18:19,760
perfect launch from what i could see

3594
02:18:25,110 --> 02:18:22,319
visually here in the control room

3595
02:18:26,389 --> 02:18:25,120
um the oracle parameters look

3596
02:18:30,629 --> 02:18:26,399
dead on

3597
02:18:32,950 --> 02:18:30,639
so we're on our way to mars there's no

3598
02:18:34,629 --> 02:18:32,960
way back so

3599
02:18:36,389 --> 02:18:34,639
good luck to the

3600
02:18:38,469 --> 02:18:36,399
mars 2020 team

3601
02:18:41,349 --> 02:18:38,479
it's been a pleasure to be part of this

3602
02:18:43,750 --> 02:18:41,359
i've been with this uh

3603
02:18:47,190 --> 02:18:43,760
roving mars community

3604
02:18:49,990 --> 02:18:47,200
um since sojourner

3605
02:18:52,790 --> 02:18:50,000
and through spirit opportunity and

3606
02:18:53,990 --> 02:18:52,800
curiosity so it's a pleasure to be once

3607
02:18:56,629 --> 02:18:54,000
again

3608
02:18:58,870 --> 02:18:56,639
part of that little bit

3609
02:19:00,070 --> 02:18:58,880
that that becomes that club that auto

3610
02:19:02,549 --> 02:19:00,080
club

3611
02:19:03,990 --> 02:19:02,559
of roving on mars and

3612
02:19:06,469 --> 02:19:04,000
i just want to say

3613
02:19:08,309 --> 02:19:06,479

i'm very proud of this team this team

3614
02:19:12,309 --> 02:19:08,319
has uh

3615
02:19:14,629 --> 02:19:12,319
worked diligently to get here um

3616
02:19:16,870 --> 02:19:14,639
it's hard enough to get the mars throw

3617
02:19:19,270 --> 02:19:16,880
in covet

3618
02:19:21,669 --> 02:19:19,280
today we're dealing with a small

3619
02:19:24,070 --> 02:19:21,679
earthquake the threat of a

3620
02:19:25,910 --> 02:19:24,080
tropical storm heading in our direction

3621
02:19:27,750 --> 02:19:25,920
it's just

3622
02:19:31,830 --> 02:19:27,760
an immense amount of pressure on the

3623
02:19:33,429 --> 02:19:31,840
team and it's so relieving to be able to

3624
02:19:35,429 --> 02:19:33,439
have gotten that mission off today on

3625
02:19:37,030 --> 02:19:35,439
the first attempt

3626
02:19:41,270 --> 02:19:37,040
and with that

3627
02:19:43,669 --> 02:19:41,280
um that closes the show for us

3628
02:19:46,389 --> 02:19:43,679
awesome a big thanks to omar appreciate

3629
02:19:47,910 --> 02:19:46,399
him and his words obviously a phenomenal

3630
02:19:50,630 --> 02:19:47,920
effort from all five of our teams we

3631
02:19:54,150 --> 02:19:50,640
talked about yes um so uh from lsp

3632
02:19:56,150 --> 02:19:54,160
congrats to this team jpl uh congrats to

3633
02:19:57,830 --> 02:19:56,160
the u.s space force congrats to ula

3634
02:19:59,590 --> 02:19:57,840
thank you to ula for hosting us today

3635
02:20:01,590 --> 02:19:59,600
and then the department of energy um and

3636
02:20:03,830 --> 02:20:01,600
a special thanks to a couple groups the

3637
02:20:05,349 --> 02:20:03,840
red cc yep and the jic

3638
02:20:07,429 --> 02:20:05,359

those were two teams that were working

3639
02:20:10,550 --> 02:20:07,439
behind the scenes for over three years

3640
02:20:12,790 --> 02:20:10,560
to prepare for a contingency with the

3641
02:20:14,389 --> 02:20:12,800
the mmrpg that's correct didn't have to

3642
02:20:15,990 --> 02:20:14,399
exercise any of that work which is what

3643
02:20:17,590 --> 02:20:16,000
they wanted like that's kind of what

3644
02:20:19,670 --> 02:20:17,600
they had a great day they had a great

3645
02:20:21,030 --> 02:20:19,680
day yes everybody had a great day so uh

3646
02:20:22,309 --> 02:20:21,040
mick thanks to you as well for joining

3647
02:20:23,910 --> 02:20:22,319
me appreciate it joshua thanks for

3648
02:20:26,150 --> 02:20:23,920
having me again i've always loved doing

3649
02:20:29,590 --> 02:20:26,160
this with you and again excited about

3650
02:20:32,389 --> 02:20:29,600
the mars mission as omar said uh our our

3651
02:20:33,990 --> 02:20:32,399
prayers and and good luck with the jpl

3652
02:20:35,750 --> 02:20:34,000
team they've got a lot of work in front

3653
02:20:38,550 --> 02:20:35,760
of them and we're just so excited to get

3654
02:20:40,309 --> 02:20:38,560
them on their way in a perfect launch in

3655
02:20:42,469 --> 02:20:40,319
orbit today so thanks again for having

3656
02:20:44,070 --> 02:20:42,479
me yeah the countdown to mars continues

3657
02:20:45,510 --> 02:20:44,080
that's gonna do it for us at the asoc

3658
02:20:47,190 --> 02:20:45,520
for the launch of the mars 2020 mission

3659
02:20:49,110 --> 02:20:47,200
with the perseverance rover daryl back

3660
02:20:51,270 --> 02:20:49,120
to you all right mick woltman and joshua

3661
02:20:53,750 --> 02:20:51,280
santora thank you both a great job done

3662
02:20:55,670 --> 02:20:53,760
by you and again congratulations to the

3663
02:20:58,070 --> 02:20:55,680

launch services program team here at

3664
02:21:00,150 --> 02:20:58,080
nasa for the great launch as well as

3665
02:21:02,389 --> 02:21:00,160
united launch alliance getting that off

3666
02:21:04,550 --> 02:21:02,399
and i i gotta congratulate you as well

3667
02:21:06,469 --> 02:21:04,560
dr mu you're with jpl you've been

3668
02:21:08,710 --> 02:21:06,479
working on this for seven years yes

3669
02:21:10,389 --> 02:21:08,720
congratulations how does it feel it's

3670
02:21:13,190 --> 02:21:10,399
amazing to have this phase of the

3671
02:21:14,710 --> 02:21:13,200
mission cemented now in time is amazing

3672
02:21:16,469 --> 02:21:14,720
but like adam said there's so much more

3673
02:21:17,670 --> 02:21:16,479
to go a lot of work to do but you know

3674
02:21:20,389 --> 02:21:17,680
that your baby right there in front of

3675
02:21:22,550 --> 02:21:20,399
you is on its way to mars it is

3676
02:21:24,870 --> 02:21:22,560
very good well engineers and scientists

3677
02:21:27,270 --> 02:21:24,880
at nasa have spent years designing as we

3678
02:21:29,110 --> 02:21:27,280
told you and testing and building the

3679
02:21:31,429 --> 02:21:29,120
mars perseverance rover but we've also

3680
02:21:34,230 --> 02:21:31,439
had help from a number of countries

3681
02:21:36,469 --> 02:21:34,240
around the world norway france and spain

3682
02:21:38,790 --> 02:21:36,479
just to name a few but also the european

3683
02:21:40,389 --> 02:21:38,800
and japanese space agencies here now is

3684
02:21:42,710 --> 02:21:40,399
a toast to all of those who helped us

3685
02:21:45,790 --> 02:21:42,720
get to mars and help that perseverance

3686
02:21:47,990 --> 02:21:45,800
rover get ready to fly

3687
02:21:50,870 --> 02:21:48,000
congratulations for the successful

3688
02:21:52,469 --> 02:21:50,880

launch of this fantastic new mission to

3689
02:21:55,429 --> 02:21:52,479
the planet mars

3690
02:21:58,230 --> 02:21:55,439
congratulations for the great work

3691
02:21:59,990 --> 02:21:58,240
despite all the obstructions said by

3692
02:22:02,790 --> 02:22:00,000
scottish 19.

3693
02:22:05,349 --> 02:22:02,800
i want to congratulate everybody who

3694
02:22:07,510 --> 02:22:05,359
made this mission happen thus far thank

3695
02:22:13,590 --> 02:22:07,520
you all for the passion and the

3696
02:22:18,710 --> 02:22:16,309
which means my heartfelt congratulations

3697
02:22:21,190 --> 02:22:18,720
to all the teams involved in this

3698
02:22:23,349 --> 02:22:21,200
magnificent adventure so you've been

3699
02:22:25,590 --> 02:22:23,359
rewarded with a beautiful launch

3700
02:22:27,110 --> 02:22:25,600
and i hope you'll have a safe cruise to

3701
02:22:29,270 --> 02:22:27,120
mars so

3702
02:22:30,230 --> 02:22:29,280
well done the work so far let's keep

3703
02:22:31,429 --> 02:22:30,240
going

3704
02:22:34,710 --> 02:22:31,439
school

3705
02:22:37,349 --> 02:22:34,720
to all teams for a successful flight our

3706
02:22:39,429 --> 02:22:37,359
international effort to reach mars is is

3707
02:22:42,550 --> 02:22:39,439
more important now than it ever has been

3708
02:22:45,190 --> 02:22:42,560
before this mission confirms that when

3709
02:22:48,469 --> 02:22:45,200
we work together we can overcome

3710
02:22:49,510 --> 02:22:48,479
unbelievable challenges and to build a

3711
02:22:50,389 --> 02:22:49,520
mission

3712
02:22:53,429 --> 02:22:50,399
that

3713
02:22:55,110 --> 02:22:53,439

truly deserves its name perseverance to

3714
02:22:56,309 --> 02:22:55,120
persevere means

3715
02:22:57,590 --> 02:22:56,319
to insist

3716
02:22:59,670 --> 02:22:57,600
to people

3717
02:23:02,070 --> 02:22:59,680
to continue trying

3718
02:23:04,230 --> 02:23:02,080
tirelessly and if we persevere we

3719
02:23:06,309 --> 02:23:04,240
succeed and that's why i think this is

3720
02:23:07,990 --> 02:23:06,319
an appropriate name for this nation

3721
02:23:11,110 --> 02:23:08,000
perseverance

3722
02:23:13,030 --> 02:23:11,120
has just started the journey

3723
02:23:15,910 --> 02:23:13,040
to make history

3724
02:23:17,429 --> 02:23:15,920
in mars exploration it's the start of

3725
02:23:19,990 --> 02:23:17,439
our collaboration

3726
02:23:22,950 --> 02:23:20,000
knowledge to go to mars but bring back

3727
02:23:25,030 --> 02:23:22,960
samples the mars sample return campaign

3728
02:23:26,550 --> 02:23:25,040
and this is going to change our view of

3729
02:23:28,790 --> 02:23:26,560
mars forever

3730
02:23:30,950 --> 02:23:28,800
mars is an amazing place to explore

3731
02:23:34,309 --> 02:23:30,960
because exploration is inside

3732
02:23:37,270 --> 02:23:34,319
the human being very nature mars is

3733
02:23:39,910 --> 02:23:37,280
essential to understand and know about

3734
02:23:42,630 --> 02:23:39,920
our solar system including our earth we

3735
02:23:45,670 --> 02:23:42,640
believe we can contribute to scientific

3736
02:23:48,230 --> 02:23:45,680
research and the future

3737
02:23:51,510 --> 02:23:48,240
exploration of mass this exploration of

3738
02:23:52,950 --> 02:23:51,520

mass is of great global significance as

3739
02:23:54,950 --> 02:23:52,960
it contributes

3740
02:23:58,230 --> 02:23:54,960
to the humanities search

3741
02:24:00,790 --> 02:23:58,240
for a home away from planet earth we

3742
02:24:03,429 --> 02:24:00,800
need robotic precursor missions like

3743
02:24:05,510 --> 02:24:03,439
mars 2020 perseverance to help us

3744
02:24:07,510 --> 02:24:05,520
understand where we need to go and what

3745
02:24:10,630 --> 02:24:07,520
we need to do when we get to mars but

3746
02:24:14,070 --> 02:24:10,640
ultimately our objective as a globe is

3747
02:24:16,550 --> 02:24:14,080
to put humans on the surface of mars

3748
02:24:29,240 --> 02:24:16,560
together we're counting down tomorrow so

3749
02:24:29,250 --> 02:24:35,510
[Music]

3750
02:24:41,750 --> 02:24:38,309
together we are counting down to mars go

3751
02:24:45,429 --> 02:24:43,510
and thank you so much to our

3752
02:24:48,230 --> 02:24:45,439
international partners that you just saw

3753
02:24:49,910 --> 02:24:48,240
there they did a fantastic job now

3754
02:24:53,190 --> 02:24:49,920
before we let you go we want to tell you

3755
02:24:54,870 --> 02:24:53,200
about a little tradition that jpl has

3756
02:24:56,950 --> 02:24:54,880
where they did this i guess after the

3757
02:24:59,190 --> 02:24:56,960
launch or before the launch with with

3758
02:25:01,270 --> 02:24:59,200
some peanuts and moo knows it well yeah

3759
02:25:02,790 --> 02:25:01,280
in fact perseverance a little baby percy

3760
02:25:04,630 --> 02:25:02,800
brought us some peanuts here to divvy

3761
02:25:07,030 --> 02:25:04,640
out so let me give you some look at

3762
02:25:07,910 --> 02:25:07,040
there it actually started with a landing

3763
02:25:10,870 --> 02:25:07,920

event

3764
02:25:13,510 --> 02:25:10,880
so rangers one through six didn't go as

3765
02:25:15,590 --> 02:25:13,520
planned and then with ranger seven it

3766
02:25:17,030 --> 02:25:15,600
landed successfully on the moon and they

3767
02:25:18,630 --> 02:25:17,040
were thinking what was the difference

3768
02:25:21,270 --> 02:25:18,640
between rangers one through six and

3769
02:25:23,670 --> 02:25:21,280
seven and it was these lucky peanuts the

3770
02:25:25,429 --> 02:25:23,680
lucky peanuts and so ever since then i

3771
02:25:26,630 --> 02:25:25,439
guess they've been having peanuts

3772
02:25:28,710 --> 02:25:26,640
exactly

3773
02:25:30,230 --> 02:25:28,720
every landing and now launches well and

3774
02:25:31,670 --> 02:25:30,240
now we've got ours in our hand we're

3775
02:25:33,510 --> 02:25:31,680
gonna hold off because we got a little

3776
02:25:36,070 --> 02:25:33,520
more reading to do but we're ready to go

3777
02:25:37,670 --> 02:25:36,080
with our peanuts yes yes thank you so

3778
02:25:40,230 --> 02:25:37,680
much for watching nasa's launch coverage

3779
02:25:42,150 --> 02:25:40,240
of march 2020 stay tuned to nasa tv and

3780
02:25:43,750 --> 02:25:42,160
our social media channels for updates to

3781
02:25:46,070 --> 02:25:43,760
the mission yeah coming up in just a bit

3782
02:25:48,950 --> 02:25:46,080
at 11 30 eastern daylight time we will

3783
02:25:51,830 --> 02:25:48,960
have a post-launch news conference right

3784
02:25:53,349 --> 02:25:51,840
here on nasa tv so stay tuned for that

3785
02:25:54,870 --> 02:25:53,359
and of course to the next big moment

3786
02:25:57,590 --> 02:25:54,880
that we've been talking about the

3787
02:26:00,389 --> 02:25:57,600
landing of the perseverance rover on the

3788
02:26:03,110 --> 02:26:00,399

surface of mars seven months from now

3789
02:26:06,070 --> 02:26:03,120
that date february 18th

3790
02:26:08,150 --> 02:26:06,080
2021. so for now we leave you with

3791
02:26:10,150 --> 02:26:08,160
highlights from the thrilling liftoff

3792
02:26:12,790 --> 02:26:10,160
earlier this morning take care everyone

3793
02:26:13,990 --> 02:26:12,800
and remember keep looking up cheers

3794
02:26:14,870 --> 02:26:14,000
cheers

3795
02:26:15,750 --> 02:26:14,880
seven

3796
02:26:17,590 --> 02:26:15,760
six

3797
02:26:19,510 --> 02:26:17,600
five five four

3798
02:26:20,389 --> 02:26:19,520
engine ignition two

3799
02:26:22,550 --> 02:26:20,399
one

3800
02:26:25,270 --> 02:26:22,560
zero zero

3801
02:26:27,590 --> 02:26:25,280
relate and liftoff

3802
02:26:29,510 --> 02:26:27,600
as the countdown to mars continues the

3803
02:26:31,670 --> 02:26:29,520
perseverance of humanity launching the

3804
02:26:37,990 --> 02:26:31,680
next generation of robotic explorers to

3805
02:26:49,030 --> 02:26:39,750
and atlas tu has gone to closed loop