1
00:01:24,830 --> 00:00:11,090
[Music]

2
00:01:39,220 --> 00:01:26,630
so

3
00:04:54,830 --> 00:01:51,660
[Music]

4
00:04:54,840 --> 00:05:00,430
one

5
00:05:48,390 --> 00:05:17,050
[Music]

6
00:05:51,510 --> 00:05:50,390
welcome to nasa's jet propulsion

7
00:05:54,469 --> 00:05:51,520
laboratory in

8
00:05:55,909 --> 00:05:54,479
southern california nasa's ingenuity

9
00:05:58,469 --> 00:05:55,919
mars helicopter made

10
00:05:59,029 --> 00:05:58,479
history this month with the first

11
00:06:01,510 --> 00:05:59,039
powered

12
00:06:02,230 --> 00:06:01,520
controlled flight on another planet

13
00:06:04,150 --> 00:06:02,240

today

14
00:06:07,270 --> 00:06:04,160
we will learn what ingenuity's next

15
00:06:10,629 --> 00:06:07,280
steps are after successfully completing

16
00:06:13,110 --> 00:06:10,639
three test flights on mars i'm your host

17
00:06:14,950 --> 00:06:13,120
raquel v nueva to talk about the

18
00:06:19,189 --> 00:06:14,960
helicopter's upcoming plans

19
00:06:23,270 --> 00:06:19,199
are lori glaze director of nasa's

20
00:06:33,749 --> 00:06:28,390
mimi young ingenuity project manager

21
00:06:37,029 --> 00:06:33,759
bob balaram ingenuity chief engineer

22
00:06:40,550 --> 00:06:37,039
jennifer trosper perseverance mars

23
00:06:44,230 --> 00:06:40,560
rover deputy project manager

24
00:06:47,909 --> 00:06:44,240
and ken farley perseverance

25
00:06:49,589 --> 00:06:47,919
project scientist for anyone watching

26
00:06:52,070 --> 00:06:49,599
who would like to submit a question

27
00:06:53,909 --> 00:06:52,080
you can do so by using the mars

28
00:06:55,909 --> 00:06:53,919
helicopter hashtag

29
00:06:59,029 --> 00:06:55,919
our phone lines are now open to the

30
00:07:02,070 --> 00:06:59,039
media you can ask a question by pressing

31
00:07:04,390 --> 00:07:02,080
star 1 and enter the queue to talk

32
00:07:05,510 --> 00:07:04,400
about the goals ingenuity has met i'd

33
00:07:08,710 --> 00:07:05,520
like to welcome

34
00:07:12,390 --> 00:07:11,670
hi thank you so much raquel i want to

35
00:07:15,670 --> 00:07:12,400
start off

36
00:07:18,749 --> 00:07:15,680
by congratulating the amazing

37
00:07:21,670 --> 00:07:18,759
ingenuity team they have achieved the

38
00:07:24,070 --> 00:07:21,680

unbelievable and inspired the next

39
00:07:27,029 --> 00:07:24,080
generation of explorers with their

40
00:07:28,309 --> 00:07:27,039
their wright brothers moment last week i

41
00:07:29,830 --> 00:07:28,319
also really want to thank the

42
00:07:31,909 --> 00:07:29,840
perseverance team

43
00:07:33,670 --> 00:07:31,919
for their incredible support of this

44
00:07:36,870 --> 00:07:33,680
month of ingenuity

45
00:07:38,309 --> 00:07:36,880
the videos of ingenuity flying on mars

46
00:07:40,309 --> 00:07:38,319
that perseverance has

47
00:07:43,189 --> 00:07:40,319
captured and shared with the world are

48
00:07:44,790 --> 00:07:43,199
are truly spectacular

49
00:07:46,950 --> 00:07:44,800
and the ingenuity technology

50
00:07:49,749 --> 00:07:46,960
demonstration demonstration is a huge

51
00:07:50,869 --> 00:07:49,759
success we're they've done an amazing

52
00:07:54,150 --> 00:07:50,879
job and they've met

53
00:07:56,869 --> 00:07:54,160
all three of the goals that nasa set

54
00:07:57,670 --> 00:07:56,879
at the outset the first goal of course

55
00:07:59,749 --> 00:07:57,680
was to

56
00:08:01,350 --> 00:07:59,759
to demonstrate back here on earth before

57
00:08:04,309 --> 00:08:01,360
we ever even launched

58
00:08:04,629 --> 00:08:04,319
to demonstrate that it was possible for

59
00:08:07,029 --> 00:08:04,639
uh

60
00:08:09,110 --> 00:08:07,039
an aircraft to actually fly a rotorcraft

61
00:08:11,189 --> 00:08:09,120
could fly in that very thin

62
00:08:13,270 --> 00:08:11,199
low-density atmosphere environment of

63
00:08:15,510 --> 00:08:13,280

mars and they demonstrated that in a

64
00:08:17,189 --> 00:08:15,520
mars chamber back at jpl

65
00:08:19,350 --> 00:08:17,199
before we ever even launched so that was

66
00:08:20,150 --> 00:08:19,360
the first goal the second goal was to

67
00:08:23,350 --> 00:08:20,160
show

68
00:08:27,270 --> 00:08:23,360
that we could actually fly on mars to

69
00:08:30,070 --> 00:08:27,280
to do that powered and controlled flight

70
00:08:31,110 --> 00:08:30,080
on mars and that was completed in the

71
00:08:34,469 --> 00:08:31,120
early morning

72
00:08:36,630 --> 00:08:34,479
on monday april 19th

73
00:08:38,630 --> 00:08:36,640
and then the third requirement is to not

74
00:08:42,389 --> 00:08:38,640
just fly but to return

75
00:08:44,710 --> 00:08:42,399
the critical flight data back to earth

76
00:08:46,870 --> 00:08:44,720
transfer it through perseverance back to

77
00:08:47,910 --> 00:08:46,880
earth so that we can study and analyze

78
00:08:50,230 --> 00:08:47,920
those data

79
00:08:52,389 --> 00:08:50,240
and help us plan for the aerial systems

80
00:08:54,389 --> 00:08:52,399
of the future and if you could show the

81
00:08:55,509 --> 00:08:54,399
video now please i'd like to share this

82
00:08:58,630 --> 00:08:55,519
one with you

83
00:09:02,070 --> 00:08:58,640
products dnc avr is looking nominal

84
00:09:05,110 --> 00:09:02,080
we see z going to

85
00:09:06,230 --> 00:09:05,120
5 meters and then in the y axis which is

86
00:09:07,670 --> 00:09:06,240
relative

87
00:09:09,430 --> 00:09:07,680
to the starting position we see the

88
00:09:16,710 --> 00:09:09,440

helicopter going out

89
00:09:21,670 --> 00:09:19,030
of course was the helicopter operations

90
00:09:23,190 --> 00:09:21,680
room as they celebrated mission success

91
00:09:24,949 --> 00:09:23,200
as they received the data

92
00:09:26,710 --> 00:09:24,959
from flight number three where they

93
00:09:29,190 --> 00:09:26,720
confirmed the last major objective of

94
00:09:32,630 --> 00:09:29,200
the mission to fly 50 meters downrange

95
00:09:35,110 --> 00:09:32,640
and back again technology demonstrations

96
00:09:36,870 --> 00:09:35,120
like ingenuity are really really

97
00:09:39,269 --> 00:09:36,880
important

98
00:09:41,430 --> 00:09:39,279
may recall nasa's first mobile surface

99
00:09:43,990 --> 00:09:41,440
explorer the sojourner rover

100
00:09:45,509 --> 00:09:44,000
launched in 1997 and completely shifted

101
00:09:47,750 --> 00:09:45,519
our paradigm forever

102
00:09:49,350 --> 00:09:47,760
changing how we think about exploring

103
00:09:51,110 --> 00:09:49,360
the surface of mars

104
00:09:53,350 --> 00:09:51,120
i mean ingenuity is going to do the same

105
00:09:55,269 --> 00:09:53,360
thing we've learned so much from this

106
00:09:57,670 --> 00:09:55,279
little technology demonstration

107
00:09:59,350 --> 00:09:57,680
that will enable future aerial systems

108
00:10:01,269 --> 00:09:59,360
and explorers

109
00:10:03,509 --> 00:10:01,279
i also want to give a quick shout out to

110
00:10:04,550 --> 00:10:03,519
the moxie technology demonstration on

111
00:10:06,710 --> 00:10:04,560
perseverance

112
00:10:08,710 --> 00:10:06,720
that also had a major success last week

113
00:10:10,630 --> 00:10:08,720

when they successfully converted

114
00:10:12,150 --> 00:10:10,640
the carbon dioxide from the mars

115
00:10:14,949 --> 00:10:12,160
atmosphere into

116
00:10:17,990 --> 00:10:14,959
oxygen which has major implications for

117
00:10:18,870 --> 00:10:18,000
future human exploration of mars with

118
00:10:20,630 --> 00:10:18,880
the success

119
00:10:23,350 --> 00:10:20,640
of these amazing technology

120
00:10:25,430 --> 00:10:23,360
demonstrations it's now time to pivot

121
00:10:27,430 --> 00:10:25,440
and start perseverance's sampling

122
00:10:28,630 --> 00:10:27,440
campaign as the rover starts to head

123
00:10:30,150 --> 00:10:28,640
south

124
00:10:32,069 --> 00:10:30,160
and ken's going to be talking in a few

125
00:10:33,590 --> 00:10:32,079
minutes about the exciting science plans

126
00:10:36,470 --> 00:10:33,600
for the coming weeks

127
00:10:38,310 --> 00:10:36,480
i'm also very excited to announce that

128
00:10:38,949 --> 00:10:38,320
after assessing the perseverance science

129
00:10:41,829 --> 00:10:38,959
strategy

130
00:10:44,069 --> 00:10:41,839
there's room to expand the ingenuity

131
00:10:46,389 --> 00:10:44,079
demonstration into a new phase

132
00:10:48,069 --> 00:10:46,399
what you'll hear about today from mimi

133
00:10:50,389 --> 00:10:48,079
bob jennifer and ken

134
00:10:52,710 --> 00:10:50,399
is how ingenuity is going to transition

135
00:10:54,630 --> 00:10:52,720
from a technology demonstration where we

136
00:10:55,829 --> 00:10:54,640
proved the technical capabilities of the

137
00:10:58,150 --> 00:10:55,839
helicopter

138
00:10:59,990 --> 00:10:58,160

to an operations demonstration where

139
00:11:02,310 --> 00:11:00,000
we're going to gather information

140
00:11:03,509 --> 00:11:02,320
on the operational support capability of

141
00:11:05,750 --> 00:11:03,519
the helicopter

142
00:11:07,030 --> 00:11:05,760
while perseverance focuses on its

143
00:11:08,550 --> 00:11:07,040
science mission

144
00:11:10,710 --> 00:11:08,560
so what i'd like to do is hand it over

145
00:11:12,389 --> 00:11:10,720
to mimi to talk about where we are today

146
00:11:14,230 --> 00:11:12,399
what this transition is going to look

147
00:11:16,069 --> 00:11:14,240
like and where what we're hoping to

148
00:11:18,069 --> 00:11:16,079
achieve during the ingenuity operations

149
00:11:21,430 --> 00:11:18,079
demonstration

150
00:11:24,389 --> 00:11:21,440
thank you lori we truly appreciate the

151
00:11:27,750 --> 00:11:24,399
opportunity that nasa has given us

152
00:11:30,230 --> 00:11:27,760
for ingenuity to now enter a new phase

153
00:11:31,990 --> 00:11:30,240
operational demonstration phase our team

154
00:11:35,030 --> 00:11:32,000
has been extremely happy

155
00:11:35,590 --> 00:11:35,040
and proud of the ingenuity's flight to

156
00:11:37,269 --> 00:11:35,600
date

157
00:11:40,150 --> 00:11:37,279
and now it's like ingenuity is

158
00:11:42,630 --> 00:11:40,160
graduating from the tech demo phase to

159
00:11:45,750 --> 00:11:42,640
now the new ops demo phase

160
00:11:46,870 --> 00:11:45,760
where we can show the how a rotorcraft

161
00:11:49,350 --> 00:11:46,880
can be used

162
00:11:50,949 --> 00:11:49,360
and and show products that only an

163
00:11:53,990 --> 00:11:50,959

aerial platform

164
00:11:57,350 --> 00:11:54,000
from an aerial dimension can give so if

165
00:12:00,310 --> 00:11:57,360
we can play the video

166
00:12:01,910 --> 00:12:00,320
this is a video of our flight number

167
00:12:05,350 --> 00:12:01,920
three

168
00:12:08,310 --> 00:12:05,360
and through these flights that we've had

169
00:12:10,790 --> 00:12:08,320
we've been able to conclusively confirm

170
00:12:13,350 --> 00:12:10,800
our models and simulations that

171
00:12:14,949 --> 00:12:13,360
and tests that we've done on the earth

172
00:12:15,750 --> 00:12:14,959
and in this flight here there's

173
00:12:18,470 --> 00:12:15,760
ingenuity

174
00:12:19,829 --> 00:12:18,480
flying free it's finally flying 50

175
00:12:21,829 --> 00:12:19,839
meters out

176
00:12:23,350 --> 00:12:21,839
in fact so far it got out of the field

177
00:12:25,990 --> 00:12:23,360
of view of mask mz

178
00:12:27,110 --> 00:12:26,000
that's very carefully videotaping the

179
00:12:29,590 --> 00:12:27,120
flight

180
00:12:30,230 --> 00:12:29,600
and it was a joyous moment for our team

181
00:12:31,750 --> 00:12:30,240
because

182
00:12:33,750 --> 00:12:31,760
you know the ingenuity had only been

183
00:12:35,430 --> 00:12:33,760
flying in chambers and constrained

184
00:12:39,110 --> 00:12:35,440
volumes until now but

185
00:12:41,670 --> 00:12:39,120
there went it it

186
00:12:43,190 --> 00:12:41,680
it does come back into the field of view

187
00:12:47,269 --> 00:12:43,200
of a mask mc

188
00:12:48,389 --> 00:12:47,279

camera and uh uh that was a fantastic

189
00:12:50,150 --> 00:12:48,399
day so

190
00:12:52,150 --> 00:12:50,160
there was ingenuity flying free and with

191
00:12:54,230 --> 00:12:52,160
that uh we have been

192
00:12:55,509 --> 00:12:54,240
met all of our technology uh technical

193
00:12:57,750 --> 00:12:55,519
goals uh

194
00:12:58,870 --> 00:12:57,760
early in our first uh three flights uh

195
00:13:01,269 --> 00:12:58,880
we're very happy

196
00:13:03,590 --> 00:13:01,279
in addition we've captured images from

197
00:13:04,550 --> 00:13:03,600
this uh first ever aerial images taken

198
00:13:07,590 --> 00:13:04,560
at mars

199
00:13:09,670 --> 00:13:07,600
next please first from our engineering

200
00:13:10,389 --> 00:13:09,680
camera the black and white uh camera

201
00:13:11,829 --> 00:13:10,399
that we have

202
00:13:13,910 --> 00:13:11,839
that we use for engineering here is one

203
00:13:15,910 --> 00:13:13,920
of our favorite black and white pictures

204
00:13:17,110 --> 00:13:15,920
and icing on the cake we've been able to

205
00:13:20,470 --> 00:13:17,120
also capture

206
00:13:20,790 --> 00:13:20,480
color uh images and here is uh one of

207
00:13:23,750 --> 00:13:20,800
them

208
00:13:24,629 --> 00:13:23,760
in fact in the top left corner we caught

209
00:13:28,389 --> 00:13:24,639
a glimpse of

210
00:13:30,949 --> 00:13:28,399
perseverance rover so um

211
00:13:31,990 --> 00:13:30,959
you know essa the the with this new face

212
00:13:35,269 --> 00:13:32,000
uh we will now

213
00:13:38,310 --> 00:13:35,279

uh concentrate on utility of an

214
00:13:41,350 --> 00:13:38,320
aerial platform and work on

215
00:13:43,590 --> 00:13:41,360
operational products such as

216
00:13:44,710 --> 00:13:43,600
aerial observation of specific science

217
00:13:47,910 --> 00:13:44,720
targets or

218
00:13:48,870 --> 00:13:47,920
looking at context features from you

219
00:13:51,590 --> 00:13:48,880
know places that

220
00:13:53,189 --> 00:13:51,600
are not accessible by rovers another

221
00:13:56,790 --> 00:13:53,199
operational product we'll look at

222
00:13:59,030 --> 00:13:56,800
is scouting scouting for potential

223
00:14:01,670 --> 00:13:59,040
science observations scouting for

224
00:14:02,710 --> 00:14:01,680
a future rover traverse or scouting for

225
00:14:05,990 --> 00:14:02,720
new airfields

226
00:14:09,350 --> 00:14:06,000
for the helicopter to transfer to

227
00:14:12,550 --> 00:14:09,360
we can also look at stereo imaging of

228
00:14:15,990 --> 00:14:12,560
digital elevation maps so as we

229
00:14:18,629 --> 00:14:16,000
make these products and the lessons

230
00:14:19,910 --> 00:14:18,639
learned from that exercise will benefit

231
00:14:23,189 --> 00:14:19,920
future

232
00:14:24,150 --> 00:14:23,199
missions with aerial platforms

233
00:14:26,790 --> 00:14:24,160
tremendously

234
00:14:27,590 --> 00:14:26,800
definitely feed forward and as we pursue

235
00:14:29,350 --> 00:14:27,600
these

236
00:14:32,069 --> 00:14:29,360
operational products we will also

237
00:14:34,870 --> 00:14:32,079
continue to push the capability

238
00:14:35,750 --> 00:14:34,880

of ingenuity so a little more on the

239
00:14:38,470 --> 00:14:35,760
timing

240
00:14:40,230 --> 00:14:38,480
this is a 30-day operational

241
00:14:42,790 --> 00:14:40,240
demonstration phase

242
00:14:44,150 --> 00:14:42,800
but uh also note that ingenuity was

243
00:14:47,269 --> 00:14:44,160
built and tested

244
00:14:48,710 --> 00:14:47,279
for the original 30 days of technology

245
00:14:51,430 --> 00:14:48,720
demonstration flights

246
00:14:53,750 --> 00:14:51,440
so we will be celebrating each day the

247
00:14:55,110 --> 00:14:53,760
ingenuity survives and operates beyond

248
00:14:57,829 --> 00:14:55,120
the original window

249
00:14:58,470 --> 00:14:57,839
as we enter into this operational demo

250
00:15:00,230 --> 00:14:58,480
phase

251
00:15:02,470 --> 00:15:00,240
so at this time ingenuity remains

252
00:15:03,590 --> 00:15:02,480
healthy and we will try our flight

253
00:15:06,629 --> 00:15:03,600
number four again

254
00:15:08,629 --> 00:15:06,639
today and flight number four in fact

255
00:15:10,870 --> 00:15:08,639
takes the first step into the

256
00:15:14,310 --> 00:15:10,880
operational demonstration phase

257
00:15:18,069 --> 00:15:14,320
uh flight 4 we will attempt the scouting

258
00:15:19,590 --> 00:15:18,079
functionality ingenuity will fly 133

259
00:15:22,790 --> 00:15:19,600
meters south

260
00:15:24,069 --> 00:15:22,800
and take 60 black and white engineering

261
00:15:27,829 --> 00:15:24,079
camera images

262
00:15:29,670 --> 00:15:27,839
and five color images and ingenuity will

263
00:15:33,509 --> 00:15:29,680

fly back to the current

264
00:15:36,389 --> 00:15:33,519
wright brothers field and after lending

265
00:15:38,230 --> 00:15:36,399
we will make three dimensional digital

266
00:15:39,269 --> 00:15:38,240
elevation maps with the engineering

267
00:15:41,350 --> 00:15:39,279
images

268
00:15:43,749 --> 00:15:41,360
and then we'll use the 3d digital

269
00:15:47,590 --> 00:15:43,759
elevation maps and the color images

270
00:15:51,110 --> 00:15:47,600
to pick a safest new airfield

271
00:15:53,749 --> 00:15:51,120
that we can see and on flight 5

272
00:15:54,310 --> 00:15:53,759
we will send ingenuity on a one-way

273
00:15:57,030 --> 00:15:54,320
flight

274
00:15:57,749 --> 00:15:57,040
to transfer to the new airfield and

275
00:15:59,509 --> 00:15:57,759
after

276
00:16:01,269 --> 00:15:59,519
it arrives at the new airfield we're

277
00:16:05,110 --> 00:16:01,279
going to work very closely with

278
00:16:08,230 --> 00:16:05,120
jennifer's and ken's teams to identify

279
00:16:10,069 --> 00:16:08,240
the new um you know operational products

280
00:16:11,269 --> 00:16:10,079
and scenarios that we want to test

281
00:16:13,269 --> 00:16:11,279
forward so

282
00:16:14,310 --> 00:16:13,279
i can't tell you how excited about we're

283
00:16:16,870 --> 00:16:14,320
about this new face

284
00:16:17,509 --> 00:16:16,880
and you know i want to thank uh ken

285
00:16:20,710 --> 00:16:17,519
farley

286
00:16:23,670 --> 00:16:20,720
ken thank you for the first 30 souls

287
00:16:25,910 --> 00:16:23,680
really the precious days on mars that

288
00:16:26,629 --> 00:16:25,920

really allowed us to show that we can

289
00:16:29,829 --> 00:16:26,639
design

290
00:16:30,389 --> 00:16:29,839
and build and operate a rotorcraft for

291
00:16:32,790 --> 00:16:30,399
mars

292
00:16:33,509 --> 00:16:32,800
and this opportunity to continue forward

293
00:16:36,230 --> 00:16:33,519
and

294
00:16:37,350 --> 00:16:36,240
jennifer thank you for the perseverance

295
00:16:39,430 --> 00:16:37,360
operations team

296
00:16:40,629 --> 00:16:39,440
the all the imaging uh the video

297
00:16:43,269 --> 00:16:40,639
coverage and

298
00:16:43,910 --> 00:16:43,279
your team absolutely coddled ingenuity

299
00:16:46,069 --> 00:16:43,920
to give it

300
00:16:47,749 --> 00:16:46,079
all the chance that it could cap

301
00:16:49,430 --> 00:16:47,759
possibly have to succeed so really

302
00:16:52,470 --> 00:16:49,440
looking forward to continuing

303
00:16:54,629 --> 00:16:52,480
so we are now on we can only think of

304
00:16:55,509 --> 00:16:54,639
this off demo phase because of how well

305
00:16:57,509 --> 00:16:55,519
ingenuity is

306
00:16:58,870 --> 00:16:57,519
um you know operating the stellar

307
00:17:00,710 --> 00:16:58,880
performance is set to date

308
00:17:02,230 --> 00:17:00,720
and so i'll turn it over to bob to

309
00:17:05,270 --> 00:17:02,240
discuss it now

310
00:17:08,309 --> 00:17:05,280
bob is our chief engineer and innovator

311
00:17:10,309 --> 00:17:08,319
of engineering's original design bob you

312
00:17:12,470 --> 00:17:10,319
shepherded this design through making

313
00:17:14,069 --> 00:17:12,480

sure it fits in this 1.8 kilogram

314
00:17:17,669 --> 00:17:14,079
through his entire journey

315
00:17:20,630 --> 00:17:17,679
and i can't express how impressive it is

316
00:17:22,549 --> 00:17:20,640
that ingenuity today looks almost

317
00:17:24,069 --> 00:17:22,559
exactly like the ingenuity

318
00:17:26,870 --> 00:17:24,079
initial concept that was sketched in

319
00:17:29,190 --> 00:17:26,880
2013. so bob congratulations

320
00:17:30,390 --> 00:17:29,200
for your vision coming into fruition to

321
00:17:32,390 --> 00:17:30,400
reality so

322
00:17:34,789 --> 00:17:32,400
over to you bob thank you mimi and thank

323
00:17:35,750 --> 00:17:34,799
you for your fantastic uh project uh

324
00:17:37,669 --> 00:17:35,760
leadership uh

325
00:17:39,029 --> 00:17:37,679
and thank you perseverance folks for

326
00:17:40,150 --> 00:17:39,039
really just getting us through to this

327
00:17:42,630 --> 00:17:40,160
point

328
00:17:43,750 --> 00:17:42,640
so it's it's been great just watching

329
00:17:46,070 --> 00:17:43,760
ingenuity you know

330
00:17:48,070 --> 00:17:46,080
take flight in those martian skies as

331
00:17:50,150 --> 00:17:48,080
mimi said you know we

332
00:17:51,430 --> 00:17:50,160
put it in various torture chambers here

333
00:17:54,870 --> 00:17:51,440
you know tethered

334
00:17:56,710 --> 00:17:54,880
and little metal boxes and you know all

335
00:17:57,990 --> 00:17:56,720
kinds of gadgets connected to it and to

336
00:18:01,029 --> 00:17:58,000
see it fly freely

337
00:18:02,710 --> 00:18:01,039
in that thin martian atmosphere in that

338
00:18:04,230 --> 00:18:02,720

jezreel crater this area is just

339
00:18:05,990 --> 00:18:04,240
fantastic

340
00:18:07,830 --> 00:18:06,000
now i've been watching that video the

341
00:18:09,430 --> 00:18:07,840
same video that you guys have been

342
00:18:11,270 --> 00:18:09,440
watching you know over and over again

343
00:18:12,630 --> 00:18:11,280
and it's just just it plays peekaboo

344
00:18:14,310 --> 00:18:12,640
going off the screen and then it comes

345
00:18:16,390 --> 00:18:14,320
back and every time i just

346
00:18:18,390 --> 00:18:16,400
love it but you know there's a lot of

347
00:18:21,350 --> 00:18:18,400
engineering performance that

348
00:18:22,950 --> 00:18:21,360
does fantastic also on this vehicle what

349
00:18:23,590 --> 00:18:22,960
you may not realize is in that flight

350
00:18:26,310 --> 00:18:23,600
where we

351
00:18:27,430 --> 00:18:26,320
traveled that far and came back ingenity

352
00:18:29,270 --> 00:18:27,440
knew where it was

353
00:18:30,950 --> 00:18:29,280
on the surface of mars within five

354
00:18:33,029 --> 00:18:30,960
centimeters that's two inches

355
00:18:34,710 --> 00:18:33,039
it knew exactly where it was when it

356
00:18:36,230 --> 00:18:34,720
descended to land and it landed within a

357
00:18:38,150 --> 00:18:36,240
foot

358
00:18:40,230 --> 00:18:38,160
it's been there it's been riding the

359
00:18:42,710 --> 00:18:40,240
winds it's been taking off great

360
00:18:43,350 --> 00:18:42,720
it's been having everything's working

361
00:18:45,750 --> 00:18:43,360
very well

362
00:18:47,430 --> 00:18:45,760
all the engineering systems the solar

363
00:18:50,950 --> 00:18:47,440

panel the battery

364
00:18:53,190 --> 00:18:50,960
the radio the um the tel

365
00:18:55,029 --> 00:18:53,200
is all this avionics the computers

366
00:18:57,590 --> 00:18:55,039
everything just going fantastic

367
00:18:58,789 --> 00:18:57,600
and so i wanted to just draw attention

368
00:19:00,470 --> 00:18:58,799
to sort of some of the

369
00:19:02,950 --> 00:19:00,480
the flight performance so could i have

370
00:19:05,350 --> 00:19:02,960
my first slide please

371
00:19:06,950 --> 00:19:05,360
uh what you see on this slide is what

372
00:19:09,110 --> 00:19:06,960
ingenuity sees with its

373
00:19:10,950 --> 00:19:09,120
camera looking down on the ground and

374
00:19:12,390 --> 00:19:10,960
that's that image on the left

375
00:19:13,990 --> 00:19:12,400
and what you will see as we play the

376
00:19:15,830 --> 00:19:14,000
animation in a little bit is

377
00:19:17,110 --> 00:19:15,840
you will see the features that ingenuity

378
00:19:18,870 --> 00:19:17,120
is tracking

379
00:19:20,390 --> 00:19:18,880
on the ground which then it combines

380
00:19:22,630 --> 00:19:20,400
with inertial sensors and it

381
00:19:24,150 --> 00:19:22,640
achieves those kinds of accuracies now

382
00:19:25,990 --> 00:19:24,160
this data is from flight two where it's

383
00:19:27,110 --> 00:19:26,000
particularly easy to see all of this uh

384
00:19:28,710 --> 00:19:27,120
performance

385
00:19:30,549 --> 00:19:28,720
and there are three plots that will

386
00:19:31,830 --> 00:19:30,559
animate uh the first one shows the

387
00:19:34,070 --> 00:19:31,840
position

388
00:19:35,430 --> 00:19:34,080

um and you can see that the we'll see

389
00:19:38,470 --> 00:19:35,440
that the altitude is held

390
00:19:40,630 --> 00:19:38,480
within one centimeter so that's a great

391
00:19:42,390 --> 00:19:40,640
performance from the altimeter and this

392
00:19:44,549 --> 00:19:42,400
and the the flight control system that's

393
00:19:47,110 --> 00:19:44,559
keeping that and the positions

394
00:19:48,230 --> 00:19:47,120
as we are fighting in the wind you know

395
00:19:51,270 --> 00:19:48,240
and sort of

396
00:19:51,990 --> 00:19:51,280
surfing or riding the wind is within 25

397
00:19:54,230 --> 00:19:52,000
centimeters that's

398
00:19:56,630 --> 00:19:54,240
less than a foot the second plot you'll

399
00:19:57,590 --> 00:19:56,640
see is the velocities as the system is

400
00:20:00,390 --> 00:19:57,600
going you know

401
00:20:01,990 --> 00:20:00,400
forward and back and the third plot

402
00:20:03,669 --> 00:20:02,000
shows the heading you know how well are

403
00:20:04,710 --> 00:20:03,679
we pointed and we have incredible

404
00:20:06,789 --> 00:20:04,720
pointing like it's

405
00:20:08,390 --> 00:20:06,799
one and a half degrees in fact some of

406
00:20:10,470 --> 00:20:08,400
the imaging folks have been taking some

407
00:20:11,909 --> 00:20:10,480
of our images and overlaying them

408
00:20:13,430 --> 00:20:11,919
they haven't had to do much in the way

409
00:20:15,270 --> 00:20:13,440
of correction because the initial

410
00:20:16,470 --> 00:20:15,280
pointing information we give to them is

411
00:20:18,710 --> 00:20:16,480
just perfect

412
00:20:20,470 --> 00:20:18,720
so all in all it's really a great

413
00:20:21,270 --> 00:20:20,480

well-performing vehicle and now if you

414
00:20:23,669 --> 00:20:21,280
can roll the

415
00:20:24,950 --> 00:20:23,679
animation you can see what ingenuity

416
00:20:27,830 --> 00:20:24,960
sees

417
00:20:28,789 --> 00:20:27,840
as it takes off all the green features

418
00:20:31,110 --> 00:20:28,799
are what it likes

419
00:20:32,789 --> 00:20:31,120
red features are what is rejecting as

420
00:20:34,390 --> 00:20:32,799
being outliers

421
00:20:36,710 --> 00:20:34,400
and you can see that every time the

422
00:20:38,549 --> 00:20:36,720
vehicle approaches a turn you'll see all

423
00:20:42,149 --> 00:20:38,559
the features sort of uh

424
00:20:43,590 --> 00:20:42,159
spiral out um and it's just

425
00:20:45,830 --> 00:20:43,600
it's just great watching this this is

426
00:20:48,390 --> 00:20:45,840
the hardcore engineering data that

427
00:20:49,430 --> 00:20:48,400
lets us validate our models so when we

428
00:20:51,909 --> 00:20:49,440
go off to design

429
00:20:53,029 --> 00:20:51,919
the future helicopter we have a solid

430
00:20:55,270 --> 00:20:53,039
basis of data

431
00:20:56,310 --> 00:20:55,280
that we have confidence in we know that

432
00:20:57,590 --> 00:20:56,320
things work

433
00:21:00,390 --> 00:20:57,600
and there's a treasure trove of this

434
00:21:02,230 --> 00:21:00,400
data that's really allows us to

435
00:21:04,070 --> 00:21:02,240
finish this technology demonstration

436
00:21:05,510 --> 00:21:04,080
phase and you know take on the

437
00:21:07,990 --> 00:21:05,520
opportunities to go to

438
00:21:08,710 --> 00:21:08,000

other aspects of the mission which is

439
00:21:12,549 --> 00:21:08,720
you know us

440
00:21:14,390 --> 00:21:12,559
to serve as a scout to be explorers

441
00:21:15,669 --> 00:21:14,400
and so i again i want to thank the

442
00:21:17,510 --> 00:21:15,679
perseverance team and

443
00:21:19,350 --> 00:21:17,520
everybody at nasa for that opportunity

444
00:21:19,990 --> 00:21:19,360
for us to showcase this next phase of

445
00:21:23,909 --> 00:21:20,000
the mission

446
00:21:26,230 --> 00:21:23,919
thank you well thanks bob jennifer

447
00:21:27,029 --> 00:21:26,240
thank you thanks and congratulations

448
00:21:29,590 --> 00:21:27,039
again to you

449
00:21:30,390 --> 00:21:29,600
and mimi and the whole ingenuity team

450
00:21:33,430 --> 00:21:30,400
for

451
00:21:35,830 --> 00:21:33,440
just a fantastic tech demo it's been a

452
00:21:38,549 --> 00:21:35,840
great month of ingenuity

453
00:21:39,669 --> 00:21:38,559
can i see my first slide here i think

454
00:21:41,990 --> 00:21:39,679
perseverance has

455
00:21:44,070 --> 00:21:42,000
enjoyed having a little buddy there on

456
00:21:46,149 --> 00:21:44,080
the surface this is our selfie

457
00:21:47,909 --> 00:21:46,159
i call it our vacation photo of

458
00:21:50,149 --> 00:21:47,919
perseverance and ingenuity sitting there

459
00:21:51,909 --> 00:21:50,159
together on mars

460
00:21:54,630 --> 00:21:51,919
and perseverance over this month has

461
00:21:55,669 --> 00:21:54,640
really just been focused on supporting

462
00:21:58,230 --> 00:21:55,679
perseverance

463
00:21:58,870 --> 00:21:58,240

or ingenuity and what it does to support

464
00:22:01,750 --> 00:21:58,880
it is

465
00:22:03,830 --> 00:22:01,760
it transmits the data back and forth for

466
00:22:05,430 --> 00:22:03,840
ingenuity and it also as you can see

467
00:22:06,149 --> 00:22:05,440
from a lot of the images that we've

468
00:22:07,909 --> 00:22:06,159
shown

469
00:22:09,350 --> 00:22:07,919
is a pretty good photographer of the

470
00:22:11,590 --> 00:22:09,360
ingenuity flights

471
00:22:13,590 --> 00:22:11,600
and now that the tech demo has been just

472
00:22:15,830 --> 00:22:13,600
amazingly successful

473
00:22:16,789 --> 00:22:15,840
we are transitioning and pivoting to

474
00:22:19,669 --> 00:22:16,799
focusing more

475
00:22:20,149 --> 00:22:19,679
back on our science mission we will do

476
00:22:22,390 --> 00:22:20,159
that

477
00:22:23,590 --> 00:22:22,400
over flights four and five mimi talked

478
00:22:25,350 --> 00:22:23,600
about how

479
00:22:27,590 --> 00:22:25,360
the helicopter is starting to look at

480
00:22:29,990 --> 00:22:27,600
areas of interest to the rover

481
00:22:32,149 --> 00:22:30,000
and then after flight 5 we will actually

482
00:22:33,990 --> 00:22:32,159
begin the set of activities that we need

483
00:22:37,350 --> 00:22:34,000
to complete on perseverance

484
00:22:40,549 --> 00:22:37,360
in order to enable sampling so

485
00:22:42,870 --> 00:22:40,559
some folks may not may wonder why we are

486
00:22:44,070 --> 00:22:42,880
doing this operational demo we had not

487
00:22:46,230 --> 00:22:44,080
originally planned to do this

488
00:22:47,430 --> 00:22:46,240

operational demo with a helicopter

489
00:22:49,590 --> 00:22:47,440
but a few things have happened that

490
00:22:51,590 --> 00:22:49,600
really have enabled us to do it

491
00:22:52,789 --> 00:22:51,600
the first thing is that originally we

492
00:22:54,630 --> 00:22:52,799
thought that would

493
00:22:55,909 --> 00:22:54,640
we would be driving away from the

494
00:22:58,149 --> 00:22:55,919
location that we landed

495
00:22:59,750 --> 00:22:58,159
at but that's not true the science team

496
00:23:02,149 --> 00:22:59,760
is actually very interested

497
00:23:02,950 --> 00:23:02,159
in getting the initial samples from this

498
00:23:05,110 --> 00:23:02,960
region

499
00:23:07,029 --> 00:23:05,120
that we're in right now and ken farley

500
00:23:08,549 --> 00:23:07,039
will talk to you about that

501
00:23:09,990 --> 00:23:08,559
another thing that's happened and you

502
00:23:11,110 --> 00:23:10,000
heard about it from bob and mimi the

503
00:23:14,230 --> 00:23:11,120
helicopter is

504
00:23:17,510 --> 00:23:14,240
operating in a fantastic way

505
00:23:19,909 --> 00:23:17,520
such that even the communications link

506
00:23:21,830 --> 00:23:19,919
has a lot of margin is over performing

507
00:23:22,390 --> 00:23:21,840
and so even if we move further away from

508
00:23:23,669 --> 00:23:22,400
it

509
00:23:25,190 --> 00:23:23,679
we believe that the rover and the

510
00:23:26,390 --> 00:23:25,200
helicopter will still have strong

511
00:23:27,830 --> 00:23:26,400
communications

512
00:23:30,310 --> 00:23:27,840
and we'll be able to continue this

513
00:23:31,830 --> 00:23:30,320

operational demo but in order to make

514
00:23:33,750 --> 00:23:31,840
the operational demo

515
00:23:35,669 --> 00:23:33,760
not have a big impact on the science

516
00:23:37,830 --> 00:23:35,679
mission in fact we call it uh

517
00:23:39,590 --> 00:23:37,840
not to interfere we have to operate

518
00:23:40,789 --> 00:23:39,600
ingenuity slightly differently than we

519
00:23:42,549 --> 00:23:40,799
did before

520
00:23:45,430 --> 00:23:42,559
what that means this new paradigm of

521
00:23:46,710 --> 00:23:45,440
operations means ingenuity will only fly

522
00:23:49,350 --> 00:23:46,720
every few weeks

523
00:23:50,950 --> 00:23:49,360
instead of every few saws we leave it

524
00:23:52,470 --> 00:23:50,960
open a little bit because it depends on

525
00:23:54,310 --> 00:23:52,480
what perseverance is doing

526
00:23:55,830 --> 00:23:54,320
as to where we want to fit in the the

527
00:23:57,909 --> 00:23:55,840
ingenuity flights

528
00:24:00,070 --> 00:23:57,919
another thing and mimi talked about this

529
00:24:01,190 --> 00:24:00,080
is ingenuity is scouting for its own

530
00:24:03,029 --> 00:24:01,200
landing sites

531
00:24:04,470 --> 00:24:03,039
perseverance is not taking imaging in

532
00:24:05,269 --> 00:24:04,480
fact can't even get imaging of the

533
00:24:08,390 --> 00:24:05,279
area's

534
00:24:11,510 --> 00:24:08,400
ingenuity is now going to go land in in

535
00:24:13,750 --> 00:24:11,520
and then the final thing is ingenuity

536
00:24:16,630 --> 00:24:13,760
will be sending down those images

537
00:24:18,789 --> 00:24:16,640
from her flights through the rover and

538
00:24:20,070 --> 00:24:18,799

we'll do this for 30 sols and we'll see

539
00:24:22,390 --> 00:24:20,080
how it goes

540
00:24:24,470 --> 00:24:22,400
uh the reason we're doing this is

541
00:24:27,110 --> 00:24:24,480
because as you can see from those

542
00:24:28,149 --> 00:24:27,120
images that a future mission that wants

543
00:24:30,830 --> 00:24:28,159
to integrate

544
00:24:32,549 --> 00:24:30,840
aerial reconnaissance into the mission

545
00:24:35,029 --> 00:24:32,559
scenario

546
00:24:36,870 --> 00:24:35,039
we can inform how to design the

547
00:24:38,789 --> 00:24:36,880
helicopter how to design the mission

548
00:24:41,350 --> 00:24:38,799
scenario how to design

549
00:24:43,350 --> 00:24:41,360
this mission to be very effective by

550
00:24:45,110 --> 00:24:43,360
taking these products that mimi talked

551
00:24:46,549 --> 00:24:45,120
about we'll take color images we'll take

552
00:24:48,070 --> 00:24:46,559
stereo products

553
00:24:49,830 --> 00:24:48,080
we'll take them from different vantage

554
00:24:51,510 --> 00:24:49,840
points we'll take them of different

555
00:24:52,149 --> 00:24:51,520
areas that the rover can't get and we'll

556
00:24:53,990 --> 00:24:52,159
have

557
00:24:55,990 --> 00:24:54,000
a lot of information that these future

558
00:24:57,909 --> 00:24:56,000
missions can use for design requirements

559
00:24:59,750 --> 00:24:57,919
and scenario planning

560
00:25:02,070 --> 00:24:59,760
and i'm very excited about doing that

561
00:25:03,590 --> 00:25:02,080
and continuing to work with mimi and bob

562
00:25:05,510 --> 00:25:03,600
and their team what a great team the

563
00:25:07,190 --> 00:25:05,520

ingenuity team and the perseverance team

564
00:25:09,990 --> 00:25:07,200
we've just had a lot of fun

565
00:25:11,909 --> 00:25:10,000
doing this tech demo and i'm also super

566
00:25:13,990 --> 00:25:11,919
excited about

567
00:25:15,750 --> 00:25:14,000
releasing the new set of capabilities

568
00:25:18,230 --> 00:25:15,760
that we need in order to get to a

569
00:25:19,990 --> 00:25:18,240
sampling capability on perseverance

570
00:25:22,310 --> 00:25:20,000
so what does that mean what do we need

571
00:25:25,350 --> 00:25:22,320
to do in order to get our first sample

572
00:25:27,510 --> 00:25:25,360
we have three major areas of capability

573
00:25:29,350 --> 00:25:27,520
that we're still working on getting

574
00:25:31,190 --> 00:25:29,360
released on perseverance the first one

575
00:25:32,950 --> 00:25:31,200
is that we need to upgrade our driving

576
00:25:34,549 --> 00:25:32,960
capability so if you bring up my next

577
00:25:39,430 --> 00:25:34,559
graphic

578
00:25:41,750 --> 00:25:39,440
we have been driving the white lines

579
00:25:43,590 --> 00:25:41,760
are our drives the blue is the

580
00:25:45,590 --> 00:25:43,600
helicopter airfield

581
00:25:47,510 --> 00:25:45,600
and the you can see the picture of the

582
00:25:49,110 --> 00:25:47,520
rover where the rover is now

583
00:25:51,669 --> 00:25:49,120
but we've been using just our

584
00:25:53,750 --> 00:25:51,679
rudimentary drive capability

585
00:25:54,950 --> 00:25:53,760
to get into more difficult terrains we

586
00:25:56,470 --> 00:25:54,960
have to do something

587
00:25:59,110 --> 00:25:56,480
we have to use our visual odometry

588
00:26:00,870 --> 00:25:59,120

capability visual odometry

589
00:26:03,590 --> 00:26:00,880
is where we use the images from the

590
00:26:05,430 --> 00:26:03,600
navigation cameras and we compare them

591
00:26:07,029 --> 00:26:05,440
as we drive and make sure

592
00:26:09,110 --> 00:26:07,039
that we're making the progress that we

593
00:26:11,909 --> 00:26:09,120
expect that we're not digging into the

594
00:26:13,110 --> 00:26:11,919
dirt or slipping so we should have that

595
00:26:15,029 --> 00:26:13,120
released shortly

596
00:26:16,390 --> 00:26:15,039
and that will help us traverse in more

597
00:26:17,830 --> 00:26:16,400
hazardous terrains and then

598
00:26:19,669 --> 00:26:17,840
and then we have an auto navigation

599
00:26:20,950 --> 00:26:19,679
capability where the rover will

600
00:26:22,630 --> 00:26:20,960
autonomously drive

601
00:26:24,710 --> 00:26:22,640
we have four or five activities that we

602
00:26:26,630 --> 00:26:24,720
need to do in order to characterize

603
00:26:27,750 --> 00:26:26,640
and release that and once that is

604
00:26:29,669 --> 00:26:27,760
released

605
00:26:31,909 --> 00:26:29,679
perseverance will be able to drive up to

606
00:26:33,029 --> 00:26:31,919
three times further on any given saw

607
00:26:34,950 --> 00:26:33,039
than curiosity

608
00:26:36,710 --> 00:26:34,960
ever did so it's a great capability so

609
00:26:38,789 --> 00:26:36,720
that's one set of capabilities

610
00:26:40,789 --> 00:26:38,799
the next set of capabilities is are the

611
00:26:42,870 --> 00:26:40,799
proximity science capabilities so

612
00:26:44,310 --> 00:26:42,880
we also so proximity science the

613
00:26:45,590 --> 00:26:44,320

instruments and the camera on the end of

614
00:26:47,590 --> 00:26:45,600
the robotic arm

615
00:26:48,950 --> 00:26:47,600
we've obviously been using those we used

616
00:26:50,950 --> 00:26:48,960
them to take the selfie

617
00:26:52,870 --> 00:26:50,960
we've been taking images of the surface

618
00:26:53,830 --> 00:26:52,880
of mars from a standoff of about 10

619
00:26:55,590 --> 00:26:53,840
centimeters

620
00:26:57,269 --> 00:26:55,600
but we need to get much closer we need

621
00:26:58,870 --> 00:26:57,279
to get to about two centimeters so we

622
00:27:00,630 --> 00:26:58,880
have a set of activities

623
00:27:02,230 --> 00:27:00,640
to calibrate and characterize our

624
00:27:04,149 --> 00:27:02,240
ability to get within that two

625
00:27:06,870 --> 00:27:04,159
centimeters on the surface

626
00:27:08,710 --> 00:27:06,880
and then finally we also need to finish

627
00:27:10,789 --> 00:27:08,720
our checkout of the sampling system

628
00:27:12,149 --> 00:27:10,799
itself the adaptive caching assembly

629
00:27:12,789 --> 00:27:12,159
which sits in the front of the rover and

630
00:27:14,950 --> 00:27:12,799
the sample

631
00:27:16,070 --> 00:27:14,960
handling arm which manipulates the

632
00:27:17,909 --> 00:27:16,080
sample tubes

633
00:27:19,350 --> 00:27:17,919
still needs to complete its checkouts

634
00:27:20,149 --> 00:27:19,360
which we'll be doing the last few weeks

635
00:27:22,470 --> 00:27:20,159
of may

636
00:27:24,470 --> 00:27:22,480
so when we finish all of that we will

637
00:27:25,590 --> 00:27:24,480
have a full sampling capability where we

638
00:27:27,990 --> 00:27:25,600

can quickly get

639
00:27:30,870 --> 00:27:28,000
to the locations the science team wants

640
00:27:33,269 --> 00:27:30,880
to explore we'll be able to investigate

641
00:27:34,710 --> 00:27:33,279
what rocks are best for sampling with

642
00:27:35,510 --> 00:27:34,720
our instrument suite on the end of the

643
00:27:36,870 --> 00:27:35,520
arm

644
00:27:39,110 --> 00:27:36,880
and then we'll be able to actually

645
00:27:41,110 --> 00:27:39,120
sample and and get a sample so with that

646
00:27:43,510 --> 00:27:41,120
i will hand it over to our project

647
00:27:44,389 --> 00:27:43,520
scientist ken farley who will talk a

648
00:27:46,630 --> 00:27:44,399
little bit

649
00:27:50,389 --> 00:27:46,640
about where we think these first samples

650
00:27:54,549 --> 00:27:52,710
thanks jennifer on behalf of the science

651
00:27:56,149 --> 00:27:54,559
team i'd also like to offer my

652
00:27:59,669 --> 00:27:56,159
congratulations to the

653
00:28:01,990 --> 00:27:59,679
ingenuity team it has been a very fun

654
00:28:02,710 --> 00:28:02,000
uh ride for the science team to be

655
00:28:04,470 --> 00:28:02,720
supporting

656
00:28:06,149 --> 00:28:04,480
heli and to really have the front row

657
00:28:07,590 --> 00:28:06,159
seats of watching this uh

658
00:28:11,110 --> 00:28:07,600
really remarkable technology

659
00:28:13,510 --> 00:28:11,120
demonstration succeed

660
00:28:14,470 --> 00:28:13,520
beyond that it has it has been a very

661
00:28:16,470 --> 00:28:14,480
busy time for

662
00:28:18,389 --> 00:28:16,480
the science team uh the last two months

663
00:28:21,510 --> 00:28:18,399

we have gotten an enormous amount done

664
00:28:21,990 --> 00:28:21,520
jennifer has told you about the checkout

665
00:28:24,789 --> 00:28:22,000
of

666
00:28:26,470 --> 00:28:24,799
capabilities uh that are now completed

667
00:28:29,510 --> 00:28:26,480
on the rover and that will continue for

668
00:28:31,430 --> 00:28:29,520
a short amount of time going forward

669
00:28:33,510 --> 00:28:31,440
but really this is the time that we are

670
00:28:36,149 --> 00:28:33,520
transitioning into

671
00:28:36,870 --> 00:28:36,159
uh the science mission uh we have

672
00:28:39,110 --> 00:28:36,880
acquired

673
00:28:39,990 --> 00:28:39,120
enough information from the instruments

674
00:28:41,830 --> 00:28:40,000
already

675
00:28:43,669 --> 00:28:41,840
literally thousands of images which are

676
00:28:46,310 --> 00:28:43,679
now up on the nasa websites

677
00:28:48,070 --> 00:28:46,320
i'll go and look at and this is this

678
00:28:49,190 --> 00:28:48,080
information has told us a lot about our

679
00:28:52,470 --> 00:28:49,200
landing site and this

680
00:28:55,110 --> 00:28:52,480
has allowed us to prepare a plan

681
00:28:56,149 --> 00:28:55,120
for how we will proceed and as jennifer

682
00:28:58,630 --> 00:28:56,159
mentioned

683
00:28:59,350 --> 00:28:58,640
what we are going to be doing is an

684
00:29:01,669 --> 00:28:59,360
intensive

685
00:29:03,430 --> 00:29:01,679
investigation uh which we call a

686
00:29:04,789 --> 00:29:03,440
scientific campaign

687
00:29:07,110 --> 00:29:04,799
uh in the region if i could have the

688
00:29:11,190 --> 00:29:07,120

first graphic um in the region

689
00:29:14,230 --> 00:29:11,200
uh in this red red bounded zone

690
00:29:16,549 --> 00:29:14,240
for reference here the perseverance

691
00:29:19,190 --> 00:29:16,559
rover is at the blue dot

692
00:29:20,310 --> 00:29:19,200
and the distance the diagonal distance

693
00:29:22,710 --> 00:29:20,320
of that red zone

694
00:29:23,590 --> 00:29:22,720
is a little over a mile so we are

695
00:29:27,269 --> 00:29:23,600
expecting to

696
00:29:29,510 --> 00:29:27,279
explore in this area looking for

697
00:29:30,630 --> 00:29:29,520
interesting rocks what we believe we

698
00:29:33,909 --> 00:29:30,640
will find

699
00:29:34,549 --> 00:29:33,919
in this area are rocks that likely

700
00:29:36,950 --> 00:29:34,559
represent

701
00:29:38,470 --> 00:29:36,960
the oldest material which is present in

702
00:29:40,870 --> 00:29:38,480
the crater floor and that's the very

703
00:29:43,750 --> 00:29:40,880
heavily cratered area

704
00:29:44,310 --> 00:29:43,760
on the eastern side of the of the

705
00:29:49,590 --> 00:29:44,320
previous

706
00:29:53,430 --> 00:29:52,470
exploration that we will do will also

707
00:29:56,310 --> 00:29:53,440
bring us to

708
00:29:57,750 --> 00:29:56,320
what we think are likely to be rocks

709
00:29:59,590 --> 00:29:57,760
that were deposited

710
00:30:01,190 --> 00:29:59,600
in the middle of the lake that once

711
00:30:03,269 --> 00:30:01,200
filled jezreel crater

712
00:30:04,549 --> 00:30:03,279
these rocks are likely to be mudstones

713
00:30:07,110 --> 00:30:04,559

very fine grained

714
00:30:08,789 --> 00:30:07,120
uh once mud at the bottom of the lake

715
00:30:10,230 --> 00:30:08,799
and these are very important for our

716
00:30:11,990 --> 00:30:10,240
investigation because

717
00:30:14,389 --> 00:30:12,000
this is the kind of environment that we

718
00:30:16,230 --> 00:30:14,399
expect to be most habitable

719
00:30:17,990 --> 00:30:16,240
by organisms that might have existed on

720
00:30:19,590 --> 00:30:18,000
mars billions of years ago

721
00:30:21,669 --> 00:30:19,600
as well as having the capability to

722
00:30:25,750 --> 00:30:21,679
preserve bio signatures

723
00:30:27,669 --> 00:30:25,760
over the billions of years since the

724
00:30:29,909 --> 00:30:27,679
the lake dried climate changed in the

725
00:30:32,950 --> 00:30:29,919
lake drive

726
00:30:35,990 --> 00:30:32,960
so that is the plan for the next

727
00:30:39,269 --> 00:30:36,000
um probably several hundred saws we

728
00:30:40,710 --> 00:30:39,279
expect to collect uh a small number of

729
00:30:43,350 --> 00:30:40,720
samples perhaps three or four

730
00:30:44,630 --> 00:30:43,360
samples in this time period um and then

731
00:30:47,110 --> 00:30:44,640
we are likely to

732
00:30:48,470 --> 00:30:47,120
move off towards the delta and what you

733
00:30:51,110 --> 00:30:48,480
see in this image here

734
00:30:52,710 --> 00:30:51,120
is an indication of the terrain in that

735
00:30:55,510 --> 00:30:52,720
in that red zone

736
00:30:56,789 --> 00:30:55,520
and what the the the important features

737
00:30:58,149 --> 00:30:56,799
you can see the rover tracks you can see

738
00:31:01,750 --> 00:30:58,159

we're going to backtrack a little bit

739
00:31:03,669 --> 00:31:01,760
past where we initially landed which is

740
00:31:04,870 --> 00:31:03,679
only something like 100 meters away from

741
00:31:07,590 --> 00:31:04,880
where we are

742
00:31:09,110 --> 00:31:07,600
and we will trek um you know something

743
00:31:10,950 --> 00:31:09,120
like a mile

744
00:31:13,190 --> 00:31:10,960
and one of the very fortuitous things is

745
00:31:15,269 --> 00:31:13,200
the location that we landed

746
00:31:17,350 --> 00:31:15,279
actually involves multiple different

747
00:31:21,029 --> 00:31:17,360
rocks exposed at the surface

748
00:31:24,389 --> 00:31:21,039
as well as a safe and straightforward

749
00:31:26,230 --> 00:31:24,399
pathway for traversing we have um

750
00:31:27,830 --> 00:31:26,240
quite a narrow corridor actually that we

751
00:31:29,830 --> 00:31:27,840
can drive through on the ones on the one

752
00:31:31,350 --> 00:31:29,840
side we have sand dunes that are too

753
00:31:32,549 --> 00:31:31,360
risky to drive through and the other we

754
00:31:34,149 --> 00:31:32,559
have boulders

755
00:31:35,750 --> 00:31:34,159
and we have this nice corridor that is

756
00:31:37,909 --> 00:31:35,760
going to direct us

757
00:31:39,430 --> 00:31:37,919
into this area where we will undertake

758
00:31:41,350 --> 00:31:39,440
our first campaign

759
00:31:42,870 --> 00:31:41,360
uh and really get the the science

760
00:31:45,590 --> 00:31:42,880
mission started this is a

761
00:31:47,190 --> 00:31:45,600
of course a multi-year uh scientific

762
00:31:48,149 --> 00:31:47,200
investigation but we're very excited to

763
00:31:51,190 --> 00:31:48,159

be getting this

764
00:31:52,149 --> 00:31:51,200
this first step going and the other

765
00:31:54,230 --> 00:31:52,159
thing i like to say is

766
00:31:55,190 --> 00:31:54,240
it is is very interesting for us in the

767
00:31:58,389 --> 00:31:55,200
science side

768
00:32:00,470 --> 00:31:58,399
to be able to participate in this

769
00:32:01,430 --> 00:32:00,480
demonstration of the operational

770
00:32:03,750 --> 00:32:01,440
capability

771
00:32:05,750 --> 00:32:03,760
of a helicopter of course we recognize

772
00:32:08,389 --> 00:32:05,760
that the ability to both

773
00:32:10,070 --> 00:32:08,399
scout rover traverse directions making

774
00:32:11,590 --> 00:32:10,080
sure that there are pathways that are

775
00:32:12,710 --> 00:32:11,600
safe and efficient to get us to where we

776
00:32:14,950 --> 00:32:12,720
want to go

777
00:32:17,110 --> 00:32:14,960
and the ability to fly the helicopter

778
00:32:18,870 --> 00:32:17,120
out into terrain that the rover cannot

779
00:32:20,310 --> 00:32:18,880
possibly traverse to bring back

780
00:32:22,710 --> 00:32:20,320
scientific data

781
00:32:23,430 --> 00:32:22,720
this is extremely important for future

782
00:32:26,549 --> 00:32:23,440
missions that

783
00:32:29,029 --> 00:32:26,559
that could combine a rover

784
00:32:30,630 --> 00:32:29,039
with a reconnaissance helicopter and so

785
00:32:31,190 --> 00:32:30,640
the science team is excited about being

786
00:32:32,870 --> 00:32:31,200
able to

787
00:32:35,190 --> 00:32:32,880
play its part in uh in further

788
00:32:38,310 --> 00:32:35,200

supporting this uh this demonstration

789
00:32:39,269 --> 00:32:38,320
for ingenuity and with that i will turn

790
00:32:42,630 --> 00:32:39,279
it back to

791
00:32:45,669 --> 00:32:42,640
jpl and raquel thanks ken we

792
00:32:47,990 --> 00:32:45,679
are now ready to take media questions

793
00:32:48,870 --> 00:32:48,000
remember to press star one to get put in

794
00:32:51,190 --> 00:32:48,880
the queue

795
00:32:52,470 --> 00:32:51,200
and please direct your questions to one

796
00:32:54,470 --> 00:32:52,480
of the panelists

797
00:32:56,870 --> 00:32:54,480
we're also taking questions through the

798
00:32:59,350 --> 00:32:56,880
mars helicopter hashtag

799
00:33:03,430 --> 00:32:59,360
to start we have marcia dunn from the

800
00:33:08,389 --> 00:33:05,990
if flight 4 takes off today as planned

801
00:33:10,710 --> 00:33:08,399
when will flight 5 be

802
00:33:13,029 --> 00:33:10,720
and am i correct in understanding that

803
00:33:15,190 --> 00:33:13,039
you will the helicopter is going to have

804
00:33:18,389 --> 00:33:15,200
30 souls on top of the first

805
00:33:20,230 --> 00:33:18,399
30 souls for operations which would take

806
00:33:21,590 --> 00:33:20,240
potential flights into the beginning of

807
00:33:24,789 --> 00:33:21,600
june and

808
00:33:27,190 --> 00:33:24,799
how far can these two vehicles be apart

809
00:33:28,950 --> 00:33:27,200
and still be able to communicate and

810
00:33:30,470 --> 00:33:28,960
will the new air fields be along the

811
00:33:33,750 --> 00:33:30,480
rover's

812
00:33:40,630 --> 00:33:37,110
i can start yes so first yes

813
00:33:43,430 --> 00:33:40,640

uh 30 souls beyond the initial 30 salts

814
00:33:44,549 --> 00:33:43,440
so uh and the vehicles can be apart up

815
00:33:46,870 --> 00:33:44,559
to a kilometer

816
00:33:49,110 --> 00:33:46,880
or even further as bob mentioned the

817
00:33:51,830 --> 00:33:49,120
signal to noise ratio is extremely

818
00:33:53,509 --> 00:33:51,840
extremely good so we can go even beyond

819
00:33:56,389 --> 00:33:53,519
one kilometer distance

820
00:33:58,070 --> 00:33:56,399
so in terms of flight four uh and then

821
00:34:00,389 --> 00:33:58,080
the timing to flight five

822
00:34:03,269 --> 00:34:00,399
flight four is first of all bold it's

823
00:34:05,590 --> 00:34:03,279
going to be a 266 meters round trip

824
00:34:07,669 --> 00:34:05,600
and then after it lands uh we are going

825
00:34:10,069 --> 00:34:07,679
to be processing these 60

826
00:34:11,030 --> 00:34:10,079
black and white images to generate these

827
00:34:13,270 --> 00:34:11,040
three-dimensional

828
00:34:15,030 --> 00:34:13,280
digital elevation maps and then based on

829
00:34:17,750 --> 00:34:15,040
that make the decision on where

830
00:34:19,909 --> 00:34:17,760
flight 5 will go so the timing between

831
00:34:21,669 --> 00:34:19,919
flight 4 and 5 will be longer than usual

832
00:34:24,869 --> 00:34:21,679
instead of the three-day cadence

833
00:34:29,990 --> 00:34:24,879
it will be close to another week

834
00:34:33,109 --> 00:34:32,069
thanks and marcia you had several

835
00:34:34,310 --> 00:34:33,119
questions did you

836
00:34:36,149 --> 00:34:34,320
have another one you'd like to get

837
00:34:39,750 --> 00:34:36,159
answered

838
00:34:40,230 --> 00:34:39,760

uh i uh let me just i'm sorry i've got

839
00:34:43,909 --> 00:34:40,240
all this

840
00:34:46,310 --> 00:34:43,919
uh i gotta mute my audio uh

841
00:34:48,069 --> 00:34:46,320
um i think that answers it so you'll be

842
00:34:49,669 --> 00:34:48,079
having tests through june oh and will

843
00:34:52,550 --> 00:34:49,679
the flight path will you be

844
00:34:54,230 --> 00:34:52,560
sort of trying to find airfields along

845
00:34:57,670 --> 00:34:54,240
the route of the rover

846
00:34:59,670 --> 00:34:57,680
or will the rover sort of be trying to

847
00:35:02,470 --> 00:34:59,680
tag along where the helicopter is going

848
00:35:06,069 --> 00:35:02,480
who's leading who here thank you

849
00:35:06,870 --> 00:35:06,079
oh absolutely the rover is primary going

850
00:35:09,589 --> 00:35:06,880
forward

851
00:35:10,150 --> 00:35:09,599
so yes we'll be working with jennifer

852
00:35:12,390 --> 00:35:10,160
and ken

853
00:35:13,190 --> 00:35:12,400
extremely closely and in fact not just

854
00:35:15,030 --> 00:35:13,200
even the path

855
00:35:16,550 --> 00:35:15,040
even the kinds of products that we want

856
00:35:19,829 --> 00:35:16,560
to prioritize so

857
00:35:21,990 --> 00:35:19,839
yes definitely a shift from our 30 days

858
00:35:24,390 --> 00:35:22,000
of being spoiled jennifer

859
00:35:25,910 --> 00:35:24,400
to now yes we will be on uh you know

860
00:35:27,670 --> 00:35:25,920
working with the convenience of the

861
00:35:30,150 --> 00:35:27,680
rover

862
00:35:39,030 --> 00:35:30,160
thank you mimi up next we have kenneth

863
00:35:43,109 --> 00:35:40,790

didn't enter flight mode i understand

864
00:35:45,109 --> 00:35:43,119
that from testing

865
00:35:46,470 --> 00:35:45,119
it didn't the your fix that you had

866
00:35:48,150 --> 00:35:46,480
didn't work about 15

867
00:35:49,990 --> 00:35:48,160
time i was just wondering what sort of

868
00:35:52,870 --> 00:35:50,000
conditions lead you

869
00:35:53,750 --> 00:35:52,880
not to enter flight and i was also

870
00:35:55,270 --> 00:35:53,760
wondering um

871
00:35:56,550 --> 00:35:55,280
there's talk about trying to get sound

872
00:36:00,790 --> 00:35:56,560
as a helicopter i was wondering what the

873
00:36:04,230 --> 00:36:02,550
i'm not sure i heard the question it was

874
00:36:06,950 --> 00:36:04,240
a little chopped up there

875
00:36:07,670 --> 00:36:06,960
could you repeat your question please oh

876
00:36:11,589 --> 00:36:07,680
sure

877
00:36:12,069 --> 00:36:11,599
um yesterday's attempt to do the flight

878
00:36:15,750 --> 00:36:12,079
didn't

879
00:36:16,950 --> 00:36:15,760
enter flight mode um from ground testing

880
00:36:19,510 --> 00:36:16,960
i know about 15

881
00:36:20,470 --> 00:36:19,520
of time you it did your fix that you had

882
00:36:22,550 --> 00:36:20,480
did not work

883
00:36:24,069 --> 00:36:22,560
i was wondering what were the specifics

884
00:36:27,030 --> 00:36:24,079
of the conditions that

885
00:36:28,710 --> 00:36:27,040
lead it not to work and i was also

886
00:36:31,349 --> 00:36:28,720
wondering what the status of was of

887
00:36:33,990 --> 00:36:31,359
trying to get sound of the helicopter

888
00:36:35,190 --> 00:36:34,000

yeah let me talk to the uh the the going

889
00:36:38,150 --> 00:36:35,200
into flight mode question

890
00:36:40,390 --> 00:36:38,160
so we had a choice of uh two you know

891
00:36:41,430 --> 00:36:40,400
possible ways to fix it one was a

892
00:36:42,550 --> 00:36:41,440
software fix

893
00:36:45,349 --> 00:36:42,560
which would have taken a little bit

894
00:36:47,990 --> 00:36:45,359
longer to get onto the aircraft

895
00:36:49,990 --> 00:36:48,000
and the other one was this uh sort of

896
00:36:51,670 --> 00:36:50,000
little bit of a random

897
00:36:53,430 --> 00:36:51,680
touching of the registers if you will

898
00:36:55,430 --> 00:36:53,440
that would

899
00:36:56,870 --> 00:36:55,440
flip the mode you know good eighty

900
00:36:59,109 --> 00:36:56,880
percent of the time

901
00:37:00,710 --> 00:36:59,119
uh we chose that path because it was the

902
00:37:02,390 --> 00:37:00,720
most expedient path and it didn't

903
00:37:03,589 --> 00:37:02,400
disturb the existing software which

904
00:37:04,950 --> 00:37:03,599
otherwise has been doing you know

905
00:37:07,670 --> 00:37:04,960
extremely well

906
00:37:07,990 --> 00:37:07,680
and uh it's just a matter of timing uh

907
00:37:13,190 --> 00:37:08,000
the

908
00:37:14,870 --> 00:37:13,200
and if we're exploiting some slight

909
00:37:16,550 --> 00:37:14,880
idiosyncrasies in the timing

910
00:37:19,589 --> 00:37:16,560
of the way the computers talk to each

911
00:37:21,829 --> 00:37:19,599
other to sort of fool the system into

912
00:37:23,670 --> 00:37:21,839
being okay and accepting the the

913
00:37:25,510 --> 00:37:23,680

transition to flight mode

914
00:37:26,870 --> 00:37:25,520
so that was the sort of the trick it

915
00:37:30,230 --> 00:37:26,880
worked out perfectly well

916
00:37:31,829 --> 00:37:30,240
you know three times and the yesterday

917
00:37:33,589 --> 00:37:31,839
didn't quite work and we'll see today

918
00:37:35,910 --> 00:37:33,599
whether we got past that uh

919
00:37:37,430 --> 00:37:35,920
little block but it's just a it was a

920
00:37:39,589 --> 00:37:37,440
known way of doing it

921
00:37:40,950 --> 00:37:39,599
and it was quite successful so we're

922
00:37:44,310 --> 00:37:40,960
quite happy with it

923
00:37:45,190 --> 00:37:44,320
but uh as this uh this proceed we might

924
00:37:47,510 --> 00:37:45,200
you know choose to

925
00:37:49,109 --> 00:37:47,520
get the more permanent uh fix you know

926
00:37:50,310 --> 00:37:49,119
into the system so we don't have to play

927
00:37:53,349 --> 00:37:50,320
this uh

928
00:37:54,550 --> 00:37:53,359
dice game every time we try to fly and

929
00:37:56,310 --> 00:37:54,560
then there was a second part of that

930
00:37:58,550 --> 00:37:56,320
question which i've forgotten about the

931
00:37:59,910 --> 00:37:58,560
status of getting sound do you want to

932
00:38:01,990 --> 00:37:59,920
talk about that jennifer he's saying

933
00:38:04,230 --> 00:38:02,000
what is the status of getting sound

934
00:38:06,390 --> 00:38:04,240
from the flight yeah i can just briefly

935
00:38:08,230 --> 00:38:06,400
say we we did a characterization test

936
00:38:10,230 --> 00:38:08,240
earlier in the week where we're running

937
00:38:13,750 --> 00:38:10,240
the cameras and the supercam microphone

938
00:38:15,910 --> 00:38:13,760

um and the the radios and that worked so

939
00:38:19,589 --> 00:38:15,920
we are going to attempt to get sound

940
00:38:22,470 --> 00:38:19,599
uh from flight number four

941
00:38:23,430 --> 00:38:22,480
okay thank you and up next we have paul

942
00:38:31,349 --> 00:38:23,440
brinkman from

943
00:38:34,870 --> 00:38:33,510
vape and all systems are are functioning

944
00:38:36,310 --> 00:38:34,880
well i was wondering if you just talk

945
00:38:38,710 --> 00:38:36,320
about

946
00:38:39,829 --> 00:38:38,720
your best estimate right now as to how

947
00:38:42,790 --> 00:38:39,839
long

948
00:38:43,430 --> 00:38:42,800
ingenuity could remain functional uh in

949
00:38:46,550 --> 00:38:43,440
this

950
00:38:49,829 --> 00:38:46,560
given what you've learned

951
00:38:51,589 --> 00:38:49,839
yeah let me take that one so right now

952
00:38:53,750 --> 00:38:51,599
you know ingenuity is healthy

953
00:38:54,790 --> 00:38:53,760
but it wasn't really designed for a long

954
00:38:56,390 --> 00:38:54,800
mission so

955
00:38:58,230 --> 00:38:56,400
all the parts that are there in the

956
00:39:01,270 --> 00:38:58,240
system have not

957
00:39:03,510 --> 00:39:01,280
gone through a validation of you know

958
00:39:05,990 --> 00:39:03,520
how many freeze and thought cycles they

959
00:39:08,310 --> 00:39:06,000
can go through before something breaks

960
00:39:09,829 --> 00:39:08,320
um the number of commercial parts which

961
00:39:11,190 --> 00:39:09,839
were not explicitly designed for the

962
00:39:13,190 --> 00:39:11,200
space environment

963
00:39:15,109 --> 00:39:13,200

so the expectation is that at some point

964
00:39:15,990 --> 00:39:15,119
with enough thermal cycling you know

965
00:39:18,470 --> 00:39:16,000
that something will

966
00:39:19,510 --> 00:39:18,480
a solder joint or something will snap

967
00:39:22,390 --> 00:39:19,520
but that said

968
00:39:23,190 --> 00:39:22,400
there are no consumables on this uh

969
00:39:26,150 --> 00:39:23,200
helicopter

970
00:39:28,069 --> 00:39:26,160
you know the only consumable if you will

971
00:39:29,430 --> 00:39:28,079
is a landing gear which is probably good

972
00:39:31,670 --> 00:39:29,440
up to 100 landings

973
00:39:32,630 --> 00:39:31,680
and as you can see in all the videos we

974
00:39:34,390 --> 00:39:32,640
really haven't been stressing the

975
00:39:36,550 --> 00:39:34,400
landing gear at all

976
00:39:39,349 --> 00:39:36,560
everything else is just a function of uh

977
00:39:40,950 --> 00:39:39,359
you know energy availability

978
00:39:43,109 --> 00:39:40,960
there is dust in the atmosphere that

979
00:39:45,510 --> 00:39:43,119
will build up as the month's progress

980
00:39:47,190 --> 00:39:45,520
uh you know and right but right now is a

981
00:39:48,310 --> 00:39:47,200
good time to fly and we'll probably be

982
00:39:49,990 --> 00:39:48,320
good for

983
00:39:51,990 --> 00:39:50,000
from an energy perspective at least for

984
00:39:54,150 --> 00:39:52,000
a few months and if

985
00:39:55,109 --> 00:39:54,160
the luck holds out as far as the parts

986
00:39:56,950 --> 00:39:55,119
go you know we

987
00:40:01,430 --> 00:39:56,960
should survive all those freestyle

988
00:40:05,510 --> 00:40:04,710

thank you bob and we have a social media

989
00:40:09,190 --> 00:40:05,520
question coming

990
00:40:12,630 --> 00:40:09,200
in it's on twitter from head crab zombie

991
00:40:16,550 --> 00:40:12,640
asks three flights so far what has been

992
00:40:20,630 --> 00:40:18,790
well i think the surprise has been on

993
00:40:22,470 --> 00:40:20,640
the positive aspect the

994
00:40:24,069 --> 00:40:22,480
the data that we're seeing what bob

995
00:40:25,270 --> 00:40:24,079
showed and to quote

996
00:40:28,069 --> 00:40:25,280
you know some of the team members

997
00:40:30,309 --> 00:40:28,079
directly it's been just phenomenal just

998
00:40:31,670 --> 00:40:30,319
the currents and the voltages and you

999
00:40:32,390 --> 00:40:31,680
know and the flight performance have

1000
00:40:34,309 --> 00:40:32,400
been

1001
00:40:35,510 --> 00:40:34,319
exactly the way we have seen in our

1002
00:40:38,230 --> 00:40:35,520
tests here on earth

1003
00:40:38,710 --> 00:40:38,240
and i that is bob when you say that is a

1004
00:40:41,109 --> 00:40:38,720
super

1005
00:40:42,150 --> 00:40:41,119
surprise because we plan on the first

1006
00:40:44,630 --> 00:40:42,160
three flights

1007
00:40:46,309 --> 00:40:44,640
with the two contingency flights to make

1008
00:40:48,630 --> 00:40:46,319
up for surprises and

1009
00:40:50,230 --> 00:40:48,640
differences you know in our models any

1010
00:40:50,710 --> 00:40:50,240
any unknown unknowns that we would have

1011
00:40:52,390 --> 00:40:50,720
had

1012
00:40:54,309 --> 00:40:52,400
and that's what those extra two flies

1013
00:40:55,829 --> 00:40:54,319

for and we have not had to use it

1014
00:40:57,510 --> 00:40:55,839
we've been able to wrap up in three

1015
00:40:59,430 --> 00:40:57,520
flights yeah i think

1016
00:41:00,790 --> 00:40:59,440
technical performance has been fantastic

1017
00:41:02,950 --> 00:41:00,800
and that is you know

1018
00:41:03,910 --> 00:41:02,960
exceeding all our expectations i think

1019
00:41:05,910 --> 00:41:03,920
we had in

1020
00:41:06,950 --> 00:41:05,920
in our mind that we you know there would

1021
00:41:08,630 --> 00:41:06,960
be some issues

1022
00:41:10,790 --> 00:41:08,640
on that level and we'd have to work with

1023
00:41:12,309 --> 00:41:10,800
them but the only issue we had was the

1024
00:41:14,069 --> 00:41:12,319
little gremlin that you know prevented

1025
00:41:15,990 --> 00:41:14,079
us from going into flight mode

1026
00:41:17,750 --> 00:41:16,000
and uh in a way that it was very

1027
00:41:19,510 --> 00:41:17,760
satisfying to see all of this great

1028
00:41:20,309 --> 00:41:19,520
performance come after we sort of got

1029
00:41:23,190 --> 00:41:20,319
past that

1030
00:41:24,309 --> 00:41:23,200
hiccup uh yeah so it's the other thing

1031
00:41:27,190 --> 00:41:24,319
that i think uh

1032
00:41:28,230 --> 00:41:27,200
surprised me a little bit uh is that uh

1033
00:41:29,670 --> 00:41:28,240
we're actually getting very good

1034
00:41:31,109 --> 00:41:29,680
visibility into

1035
00:41:32,790 --> 00:41:31,119
you know what's happening inside the

1036
00:41:35,109 --> 00:41:32,800
helicopter i mean we knew we

1037
00:41:36,630 --> 00:41:35,119
planned it and we designed for it but i

1038
00:41:37,430 --> 00:41:36,640

always had this fear that we'd get to

1039
00:41:38,950 --> 00:41:37,440
mars and

1040
00:41:41,670 --> 00:41:38,960
not be able to get all the data we

1041
00:41:43,589 --> 00:41:41,680
wanted and not get that visibility into

1042
00:41:45,109 --> 00:41:43,599
what's happening you know

1043
00:41:46,790 --> 00:41:45,119
we get a lot of visibility here when we

1044
00:41:47,910 --> 00:41:46,800
test here on earth because we highly

1045
00:41:50,230 --> 00:41:47,920
instrumented

1046
00:41:51,829 --> 00:41:50,240
in our test chambers but thanks to

1047
00:41:53,829 --> 00:41:51,839
perseverance's videos

1048
00:41:55,430 --> 00:41:53,839
thanks to the sheer data volume that

1049
00:41:57,190 --> 00:41:55,440
they're able to process the through all

1050
00:41:58,870 --> 00:41:57,200
the orbiters back to earth

1051
00:42:01,349 --> 00:41:58,880
we're getting so much data and that's

1052
00:42:02,950 --> 00:42:01,359
been a very pleasant surprise that

1053
00:42:04,390 --> 00:42:02,960
essentially everything we've asked for

1054
00:42:05,750 --> 00:42:04,400
from an engineering sense

1055
00:42:07,589 --> 00:42:05,760
all the data we've been getting the

1056
00:42:09,430 --> 00:42:07,599
performance has been superb

1057
00:42:12,069 --> 00:42:09,440
and all the contingencies we've worried

1058
00:42:14,790 --> 00:42:12,079
about you know not surviving the night

1059
00:42:16,230 --> 00:42:14,800
not having enough energy solar panels

1060
00:42:17,829 --> 00:42:16,240
you know perhaps not working as

1061
00:42:19,910 --> 00:42:17,839
well as expected all of those things

1062
00:42:23,349 --> 00:42:19,920
have just gone away and it's been

1063
00:42:23,750 --> 00:42:23,359

working exceedingly well great and up

1064
00:42:26,870 --> 00:42:23,760
next

1065
00:42:31,109 --> 00:42:26,880
we have bill harwood from cbs

1066
00:42:33,430 --> 00:42:31,119
news yeah hi hi guys um

1067
00:42:35,990 --> 00:42:33,440
the 30-day op demo that you're getting

1068
00:42:37,349 --> 00:42:36,000
ready to embark upon is that a firm line

1069
00:42:39,190 --> 00:42:37,359
in the sand in other words if you're

1070
00:42:40,150 --> 00:42:39,200
still fully operational is there any

1071
00:42:42,550 --> 00:42:40,160
chance

1072
00:42:43,190 --> 00:42:42,560
uh that you could extend farther or will

1073
00:42:45,510 --> 00:42:43,200
that be

1074
00:42:47,270 --> 00:42:45,520
it and when you get to the end of that

1075
00:42:49,910 --> 00:42:47,280
30 days or wherever

1076
00:42:51,990 --> 00:42:49,920
the end comes what's your plan for the

1077
00:42:53,829 --> 00:42:52,000
helicopter do you park it somewhere and

1078
00:42:57,349 --> 00:42:53,839
perseverance drives away or is there

1079
00:43:01,349 --> 00:42:58,870
lori do you want to answer part of that

1080
00:43:03,349 --> 00:43:01,359
question sure i'd like to take private

1081
00:43:06,069 --> 00:43:03,359
hi bill thank you for the question

1082
00:43:07,829 --> 00:43:06,079
um so we're you know as a demonstration

1083
00:43:09,670 --> 00:43:07,839
in the operational demo mode

1084
00:43:12,150 --> 00:43:09,680
uh that we're we're going to move into

1085
00:43:13,750 --> 00:43:12,160
after the fourth and fifth flight

1086
00:43:15,270 --> 00:43:13,760
you know we're going to kind of see how

1087
00:43:18,230 --> 00:43:15,280
it goes

1088
00:43:19,349 --> 00:43:18,240

phase so we're going to watch the

1089
00:43:20,790 --> 00:43:19,359
performance we're going to see

1090
00:43:23,270 --> 00:43:20,800
the kind of data products that we can

1091
00:43:25,670 --> 00:43:23,280
get back and see how the um the two

1092
00:43:27,829 --> 00:43:25,680
flight systems work with each other with

1093
00:43:29,910 --> 00:43:27,839
perseverance taking the lead and

1094
00:43:31,829 --> 00:43:29,920
being very focused on its science and

1095
00:43:33,510 --> 00:43:31,839
after that 30 sold period

1096
00:43:35,030 --> 00:43:33,520
we know we'll assess where we are we'll

1097
00:43:37,190 --> 00:43:35,040
see where we are we'll check on the

1098
00:43:39,750 --> 00:43:37,200
health of the helicopter we'll see how

1099
00:43:40,630 --> 00:43:39,760
um if it's being helpful to perseverance

1100
00:43:41,750 --> 00:43:40,640
or if there are

1101
00:43:43,670 --> 00:43:41,760
are impacts to the ability of

1102
00:43:46,550 --> 00:43:43,680
perseverance to do its its

1103
00:43:48,069 --> 00:43:46,560
core science jobs and we'll we'll assess

1104
00:43:49,109 --> 00:43:48,079
the whole picture and see where we are

1105
00:43:50,950 --> 00:43:49,119
at that time

1106
00:43:52,390 --> 00:43:50,960
um so there is a potential to go beyond

1107
00:43:53,990 --> 00:43:52,400
but we'll have to we'll have to assess

1108
00:43:56,230 --> 00:43:54,000
it after 30 days

1109
00:43:57,030 --> 00:43:56,240
um and then i you know i don't know if

1110
00:43:59,030 --> 00:43:57,040
jennifer or

1111
00:44:01,030 --> 00:43:59,040
or mimi want to to take the second half

1112
00:44:03,750 --> 00:44:01,040
of the question

1113
00:44:05,589 --> 00:44:03,760

go ahead mimi if you want oh absolutely

1114
00:44:08,790 --> 00:44:05,599
i think we engage as we go

1115
00:44:11,670 --> 00:44:08,800
again a reminder ingenuity was built

1116
00:44:13,270 --> 00:44:11,680
and tested for 30 days of operation so i

1117
00:44:16,550 --> 00:44:13,280
think as bob reminded

1118
00:44:18,069 --> 00:44:16,560
we really do expect some finite life

1119
00:44:21,030 --> 00:44:18,079
and so it will be a race you know

1120
00:44:23,990 --> 00:44:21,040
between how long these parts surprise us

1121
00:44:26,069 --> 00:44:24,000
in surviving and also in doing these

1122
00:44:28,150 --> 00:44:26,079
operational scenarios we will naturally

1123
00:44:30,710 --> 00:44:28,160
be pushing the limits of ingenuity

1124
00:44:32,150 --> 00:44:30,720
we hope we will be flying over

1125
00:44:34,470 --> 00:44:32,160
unsurveyed terrains

1126
00:44:35,910 --> 00:44:34,480
and over time continuing to transfer to

1127
00:44:36,950 --> 00:44:35,920
airfields that are not well

1128
00:44:40,390 --> 00:44:36,960
characterized so

1129
00:44:43,109 --> 00:44:40,400
there is a higher probability of uh bad

1130
00:44:43,829 --> 00:44:43,119
landing so you know definitely we see

1131
00:44:45,990 --> 00:44:43,839
how we go

1132
00:44:48,069 --> 00:44:46,000
forward yeah and i'll just add we have

1133
00:44:50,309 --> 00:44:48,079
there are lots of different ideas about

1134
00:44:51,349 --> 00:44:50,319
how this might end and what the final

1135
00:44:53,990 --> 00:44:51,359
flight might be

1136
00:44:56,150 --> 00:44:54,000
and we've all talked about it many times

1137
00:44:56,870 --> 00:44:56,160
but as we go through our objective here

1138
00:44:59,670 --> 00:44:56,880

is just to

1139
00:45:01,270 --> 00:44:59,680
evaluate every month and see how it's

1140
00:45:02,790 --> 00:45:01,280
going and then determine what the next

1141
00:45:03,990 --> 00:45:02,800
steps are so we're not really ready to

1142
00:45:05,910 --> 00:45:04,000
say what the

1143
00:45:09,109 --> 00:45:05,920
the final step would be because we're

1144
00:45:11,589 --> 00:45:09,119
taking it incrementally at this point

1145
00:45:12,710 --> 00:45:11,599
thanks for your answers up next we have

1146
00:45:16,309 --> 00:45:12,720
lisa grossman

1147
00:45:20,309 --> 00:45:18,150
hi al thank you for taking my question

1148
00:45:21,670 --> 00:45:20,319
um this is probably for mimi i was

1149
00:45:24,550 --> 00:45:21,680
wondering if you could answer

1150
00:45:25,750 --> 00:45:24,560
morphiz the helicopter a little bit now

1151
00:45:27,349 --> 00:45:25,760
that you've gotten to know it

1152
00:45:29,670 --> 00:45:27,359
does it have a personality what's its

1153
00:45:31,270 --> 00:45:29,680
relationship with perseverance like

1154
00:45:33,829 --> 00:45:31,280
and if you were ingenuity how do you

1155
00:45:37,750 --> 00:45:33,839
think you'd feel at this moment

1156
00:45:40,870 --> 00:45:37,760
wow okay so ingenuity

1157
00:45:43,910 --> 00:45:40,880
my summary ingenuity

1158
00:45:46,950 --> 00:45:43,920
loves mars that's just

1159
00:45:49,270 --> 00:45:46,960
we have been shocked and just and just

1160
00:45:51,270 --> 00:45:49,280
you see the flights right it takes off

1161
00:45:51,910 --> 00:45:51,280
and i almost feel the freedom that it

1162
00:45:53,670 --> 00:45:51,920
feels

1163
00:45:56,150 --> 00:45:53,680

no longer tethered like bob was

1164
00:45:58,150 --> 00:45:56,160
describing with you know test cables or

1165
00:46:00,470 --> 00:45:58,160
stuck in a chamber and i really feel

1166
00:46:03,190 --> 00:46:00,480
ingenuity loves mars and

1167
00:46:04,150 --> 00:46:03,200
perseverance as i mentioned has been the

1168
00:46:07,190 --> 00:46:04,160
ultimate

1169
00:46:08,309 --> 00:46:07,200
spoiler and just spoiling ingenuity all

1170
00:46:11,430 --> 00:46:08,319
this time so

1171
00:46:15,190 --> 00:46:11,440
that's how i really see it and yeah

1172
00:46:17,670 --> 00:46:15,200
ingenuity loves mars

1173
00:46:18,710 --> 00:46:17,680
great thank you the ultimate mars duo up

1174
00:46:22,069 --> 00:46:18,720
next is

1175
00:46:24,550 --> 00:46:22,079
joey roulette from the verge

1176
00:46:26,069 --> 00:46:24,560
hey thank you um bill harwood kind of

1177
00:46:27,670 --> 00:46:26,079
asked my question but i wanted to i

1178
00:46:29,750 --> 00:46:27,680
guess expand a little bit

1179
00:46:31,670 --> 00:46:29,760
if things go really well in this new

1180
00:46:34,150 --> 00:46:31,680
operational demonstration phase

1181
00:46:34,790 --> 00:46:34,160
are you guys hoping um that you can

1182
00:46:37,030 --> 00:46:34,800
transition

1183
00:46:38,150 --> 00:46:37,040
or that it'll graduate again into some

1184
00:46:39,910 --> 00:46:38,160
more operational

1185
00:46:41,510 --> 00:46:39,920
uh capability or what are you guys

1186
00:46:43,109 --> 00:46:41,520
hoping for that and

1187
00:46:46,150 --> 00:46:43,119
how many flights are scheduled for that

1188
00:46:52,230 --> 00:46:49,270

yeah i'll go ahead and answer that um

1189
00:46:53,670 --> 00:46:52,240
so initially for in the first 30 saws

1190
00:46:54,710 --> 00:46:53,680
we'll probably after flight five we'll

1191
00:46:56,470 --> 00:46:54,720
get

1192
00:46:59,109 --> 00:46:56,480
one or two flights and then we'll

1193
00:47:02,150 --> 00:46:59,119
evaluate i think

1194
00:47:04,870 --> 00:47:02,160
we are hoping that we can operate

1195
00:47:06,230 --> 00:47:04,880
ingenuity in a not to interfere basis

1196
00:47:09,270 --> 00:47:06,240
with the science mission

1197
00:47:11,990 --> 00:47:09,280
in a way that as long as it's

1198
00:47:12,710 --> 00:47:12,000
available and alive that we'll be able

1199
00:47:15,670 --> 00:47:12,720
to

1200
00:47:16,550 --> 00:47:15,680
continue in a way and learn more things

1201
00:47:18,950 --> 00:47:16,560
likely

1202
00:47:20,710 --> 00:47:18,960
again as i mentioned because ingenuity

1203
00:47:21,670 --> 00:47:20,720
is a tech demo helicopter that wasn't

1204
00:47:25,109 --> 00:47:21,680
designed

1205
00:47:27,030 --> 00:47:25,119
with a hazard avoidance landing system

1206
00:47:28,710 --> 00:47:27,040
it wasn't necessarily designed to do

1207
00:47:30,309 --> 00:47:28,720
an operational reconnaissance for a

1208
00:47:32,390 --> 00:47:30,319
rover but

1209
00:47:33,670 --> 00:47:32,400
as we move forward we'll evaluate how

1210
00:47:35,910 --> 00:47:33,680
it's doing and

1211
00:47:37,829 --> 00:47:35,920
we would like to on a no not to

1212
00:47:39,190 --> 00:47:37,839
interfere basis as long as we can keep

1213
00:47:41,910 --> 00:47:39,200

going with the sampling

1214
00:47:43,430 --> 00:47:41,920
we'd like to continue that if we can but

1215
00:47:46,309 --> 00:47:43,440
again we're evaluating on

1216
00:47:46,950 --> 00:47:46,319
on 30 30 salt increments just to make

1217
00:47:49,109 --> 00:47:46,960
sure

1218
00:47:52,710 --> 00:47:49,119
we understand what's going on and how

1219
00:47:55,750 --> 00:47:52,720
it's proceeding hey thank you

1220
00:47:56,470 --> 00:47:55,760
and up next we have a question on social

1221
00:47:59,829 --> 00:47:56,480
media

1222
00:48:00,309 --> 00:47:59,839
jim on facebook asks are there plans to

1223
00:48:04,790 --> 00:48:00,319
test

1224
00:48:08,470 --> 00:48:07,270
yeah so right now we have found that the

1225
00:48:10,870 --> 00:48:08,480
five meter

1226
00:48:12,950 --> 00:48:10,880
altitude is a sweet spot for us to be it

1227
00:48:13,829 --> 00:48:12,960
gives us good resolution on the ground

1228
00:48:15,829 --> 00:48:13,839
with our

1229
00:48:16,870 --> 00:48:15,839
downward-facing nav camera so when we do

1230
00:48:19,190 --> 00:48:16,880
these

1231
00:48:20,470 --> 00:48:19,200
map transects back and forth it's a good

1232
00:48:22,309 --> 00:48:20,480
place to be we can

1233
00:48:23,750 --> 00:48:22,319
see rocks and hazards and things

1234
00:48:24,710 --> 00:48:23,760
especially if you're picking a new

1235
00:48:27,910 --> 00:48:24,720
landing site

1236
00:48:30,230 --> 00:48:27,920
that's good but as part of this you know

1237
00:48:32,950 --> 00:48:30,240
providing utility to the rover

1238
00:48:34,230 --> 00:48:32,960

i wouldn't be surprised if if it has

1239
00:48:36,069 --> 00:48:34,240
some particular location

1240
00:48:37,829 --> 00:48:36,079
we are asked to go to a higher vantage

1241
00:48:39,270 --> 00:48:37,839
point like let's say 10 meters and you

1242
00:48:42,710 --> 00:48:39,280
know

1243
00:48:45,190 --> 00:48:42,720
some panoramic type imagery

1244
00:48:47,750 --> 00:48:45,200
uh that might be useful uh to the either

1245
00:48:51,270 --> 00:48:47,760
the rover operators or the scientists

1246
00:48:54,069 --> 00:48:51,280
but for the normal sort of transect

1247
00:48:56,630 --> 00:48:54,079
map making the five meters altitude has

1248
00:48:59,750 --> 00:48:56,640
proved to be a good good place to be

1249
00:49:03,270 --> 00:48:59,760
thanks bob and up next we have gina

1250
00:49:06,069 --> 00:49:03,280
sunseri from abc news

1251
00:49:08,549 --> 00:49:06,079
mimi as you watch ingenuity fly are you

1252
00:49:11,270 --> 00:49:08,559
taking notes for a possible successor

1253
00:49:14,790 --> 00:49:11,280
what you would do differently

1254
00:49:15,430 --> 00:49:14,800
oh yes art as we watch the engineering

1255
00:49:17,430 --> 00:49:15,440
data

1256
00:49:19,589 --> 00:49:17,440
really has been examined and combed

1257
00:49:20,390 --> 00:49:19,599
through by the entire team in the

1258
00:49:22,870 --> 00:49:20,400
background

1259
00:49:24,790 --> 00:49:22,880
so absolutely on you know what is the

1260
00:49:26,710 --> 00:49:24,800
attitude and deviations

1261
00:49:28,710 --> 00:49:26,720
uh from the predicted curves to the

1262
00:49:30,390 --> 00:49:28,720
differences those are being watched very

1263
00:49:33,270 --> 00:49:30,400

carefully

1264
00:49:34,309 --> 00:49:33,280
by our chief pilot for our you know the

1265
00:49:35,829 --> 00:49:34,319
operations lead

1266
00:49:38,069 --> 00:49:35,839
and folks looking at the batteries and

1267
00:49:39,589 --> 00:49:38,079
the temperatures and

1268
00:49:42,230 --> 00:49:39,599
so far we haven't had to make any

1269
00:49:44,230 --> 00:49:42,240
variations but yes our downlink

1270
00:49:46,230 --> 00:49:44,240
procedure dialing data review process is

1271
00:49:47,510 --> 00:49:46,240
quite detailed looking at many many

1272
00:49:50,549 --> 00:49:47,520
engineering products

1273
00:49:51,430 --> 00:49:50,559
to to examine the actual detail health

1274
00:49:53,030 --> 00:49:51,440
of the vehicle

1275
00:49:56,069 --> 00:49:53,040
but so far we haven't had to make any

1276
00:50:05,910 --> 00:49:59,349
and then up next is steve gorman

1277
00:50:15,510 --> 00:50:13,670
steve can you hear us

1278
00:50:17,030 --> 00:50:15,520
all right up next we will try to get

1279
00:50:21,349 --> 00:50:17,040
back to steve is

1280
00:50:24,390 --> 00:50:21,359
islam ahmed from afp

1281
00:50:26,790 --> 00:50:24,400
oh hi um i think steve would should i

1282
00:50:29,670 --> 00:50:26,800
just go ahead

1283
00:50:30,230 --> 00:50:29,680
hello hello can you hear us yes i can

1284
00:50:31,990 --> 00:50:30,240
hear you

1285
00:50:33,510 --> 00:50:32,000
yeah um my question was asked so i'll

1286
00:50:35,270 --> 00:50:33,520
ask you a different one um

1287
00:50:36,870 --> 00:50:35,280
i mean how much um i understand you're

1288
00:50:38,230 --> 00:50:36,880

going into a wait and see phase and

1289
00:50:39,990 --> 00:50:38,240
seeing if you can sort of integrate

1290
00:50:43,030 --> 00:50:40,000
these two missions together and

1291
00:50:45,430 --> 00:50:43,040
have um ingenuity contribute to the the

1292
00:50:47,030 --> 00:50:45,440
science and but i was wondering how much

1293
00:50:48,710 --> 00:50:47,040
of a factor is the sort of public

1294
00:50:50,309 --> 00:50:48,720
excitement around ingenuity in this

1295
00:50:51,430 --> 00:50:50,319
decision because obviously it's a really

1296
00:50:54,069 --> 00:50:51,440
cute image

1297
00:50:55,910 --> 00:50:54,079
to imagine these two robots you know

1298
00:50:57,349 --> 00:50:55,920
exploring mars together and is that

1299
00:51:03,430 --> 00:50:57,359
actually a factor in your decision

1300
00:51:07,109 --> 00:51:05,589
yeah i'll take the first part uh which

1301
00:51:09,270 --> 00:51:07,119
is that you know

1302
00:51:10,470 --> 00:51:09,280
yes ingenuity is cute and it's fun and

1303
00:51:14,309 --> 00:51:10,480
it's got an incredible

1304
00:51:16,950 --> 00:51:14,319
uh public outreach uh you know capacity

1305
00:51:18,870 --> 00:51:16,960
uh but in all honesty this is is really

1306
00:51:21,589 --> 00:51:18,880
based on the science of perseverance

1307
00:51:22,230 --> 00:51:21,599
um and so i i'd really like for for ken

1308
00:51:25,190 --> 00:51:22,240
to also

1309
00:51:26,870 --> 00:51:25,200
add um to this because we wouldn't even

1310
00:51:29,510 --> 00:51:26,880
be talking about this

1311
00:51:30,710 --> 00:51:29,520
um if the science team hadn't uh made

1312
00:51:31,510 --> 00:51:30,720
the decisions that they had i mean

1313
00:51:32,870 --> 00:51:31,520

they're they're

1314
00:51:34,950 --> 00:51:32,880
they're driving the show once we

1315
00:51:37,750 --> 00:51:34,960
complete the 30 soul

1316
00:51:38,230 --> 00:51:37,760
technology demonstration you know we're

1317
00:51:40,470 --> 00:51:38,240
we're

1318
00:51:41,349 --> 00:51:40,480
you know really serious business on

1319
00:51:43,829 --> 00:51:41,359
getting down to

1320
00:51:45,109 --> 00:51:43,839
the um you know preparations for taking

1321
00:51:48,069 --> 00:51:45,119
those first samples

1322
00:51:50,069 --> 00:51:48,079
uh in jezreel crater um and so this was

1323
00:51:51,670 --> 00:51:50,079
the science team that was really focused

1324
00:51:53,990 --> 00:51:51,680
on the science they wanted to do and

1325
00:51:54,790 --> 00:51:54,000
when they established what their science

1326
00:51:56,470 --> 00:51:54,800
plan was

1327
00:51:58,150 --> 00:51:56,480
realized that there was an enabling

1328
00:52:00,309 --> 00:51:58,160
opportunity here so i'd like

1329
00:52:02,950 --> 00:52:00,319
um ken to expand on that if he can

1330
00:52:07,349 --> 00:52:06,069
yeah sure uh the the uh to repeat some

1331
00:52:08,790 --> 00:52:07,359
things that we heard earlier but to

1332
00:52:11,190 --> 00:52:08,800
really drive home the point

1333
00:52:12,870 --> 00:52:11,200
the the challenge that we foresaw

1334
00:52:15,430 --> 00:52:12,880
originally with the helicopter

1335
00:52:16,790 --> 00:52:15,440
and the science mission is that we

1336
00:52:18,630 --> 00:52:16,800
thought we would be doing an intensive

1337
00:52:20,790 --> 00:52:18,640
drive campaign in which the helicopter

1338
00:52:22,390 --> 00:52:20,800

would not be able to keep up literally

1339
00:52:24,069 --> 00:52:22,400
because it needs to recharge between

1340
00:52:25,910 --> 00:52:24,079
flights and because we have

1341
00:52:27,910 --> 00:52:25,920
the ability to drive very quickly we

1342
00:52:30,150 --> 00:52:27,920
could get out of range

1343
00:52:31,430 --> 00:52:30,160
based on the rocks that we have seen in

1344
00:52:33,430 --> 00:52:31,440
in the area

1345
00:52:35,270 --> 00:52:33,440
we really wish to spend a considerable

1346
00:52:37,030 --> 00:52:35,280
amount of time where we are and so it's

1347
00:52:39,990 --> 00:52:37,040
sort of a fortuitous alignment

1348
00:52:41,190 --> 00:52:40,000
of these two things but it's also worth

1349
00:52:43,589 --> 00:52:41,200
pointing out um

1350
00:52:44,950 --> 00:52:43,599
in maybe a more clear way you know mimi

1351
00:52:45,430 --> 00:52:44,960
talked about the support that she's

1352
00:52:48,549 --> 00:52:45,440
gotten

1353
00:52:50,309 --> 00:52:48,559
from the perseverance rover and the

1354
00:52:53,910 --> 00:52:50,319
perseverance team

1355
00:52:56,150 --> 00:52:53,920
and um that has come at the expense of

1356
00:52:57,910 --> 00:52:56,160
of being able to do full full-blown

1357
00:52:59,190 --> 00:52:57,920
science and so now that we're moving

1358
00:53:02,230 --> 00:52:59,200
into this additional

1359
00:53:04,230 --> 00:53:02,240
additional um demonstration phase

1360
00:53:05,349 --> 00:53:04,240
we really do have to see whether it is

1361
00:53:07,670 --> 00:53:05,359
possible

1362
00:53:10,230 --> 00:53:07,680
to carry out the science mission and

1363
00:53:12,230 --> 00:53:10,240

support the helicopter simultaneously

1364
00:53:13,829 --> 00:53:12,240
and that's why we're going to do this

1365
00:53:15,910 --> 00:53:13,839
this operational

1366
00:53:19,109 --> 00:53:15,920
demonstration test just to see how it

1367
00:53:23,309 --> 00:53:21,670
great thank you and up next we have

1368
00:53:26,710 --> 00:53:23,319
chelsea goad from

1369
00:53:30,390 --> 00:53:29,349
hi uh my question is for probably mimi

1370
00:53:32,630 --> 00:53:30,400
and jennifer

1371
00:53:34,790 --> 00:53:32,640
uh you mentioned that with the ops demo

1372
00:53:35,270 --> 00:53:34,800
ingenuity will likely apply one or more

1373
00:53:38,870 --> 00:53:35,280
times

1374
00:53:41,670 --> 00:53:38,880
demo how many flights

1375
00:53:41,990 --> 00:53:41,680
are you expecting for the ops demo and

1376
00:53:45,190 --> 00:53:42,000
if

1377
00:53:47,510 --> 00:53:45,200
this edition will perhaps hinder in any

1378
00:53:50,230 --> 00:53:47,520
way per surveillance's science mission

1379
00:53:51,829 --> 00:53:50,240
um as as we know previously the tech

1380
00:53:54,390 --> 00:53:51,839
demo had the rigid timeline

1381
00:53:55,829 --> 00:53:54,400
because perseverance had to go and begin

1382
00:53:57,750 --> 00:53:55,839
its sampling missions so it seems that

1383
00:53:59,030 --> 00:53:57,760
that's changed quite a bit

1384
00:54:01,030 --> 00:53:59,040
and so i'm just curious what those

1385
00:54:03,990 --> 00:54:01,040
expectations are

1386
00:54:06,069 --> 00:54:04,000
okay yeah um so let me expand a little

1387
00:54:07,589 --> 00:54:06,079
bit on the support that perseverance

1388
00:54:09,589 --> 00:54:07,599

provides for ingenuity and

1389
00:54:11,109 --> 00:54:09,599
a few things i think i mentioned but

1390
00:54:13,670 --> 00:54:11,119
when i forgot to

1391
00:54:15,910 --> 00:54:13,680
that will make the the support a little

1392
00:54:17,990 --> 00:54:15,920
bit easier for perseverance um

1393
00:54:20,390 --> 00:54:18,000
one of the things that we are doing so

1394
00:54:22,710 --> 00:54:20,400
in within the next 30 saws within the ex

1395
00:54:23,990 --> 00:54:22,720
the extended or the ops demo 30 saws i

1396
00:54:26,790 --> 00:54:24,000
expect we would fly one or two

1397
00:54:28,549 --> 00:54:26,800
times with the with the ingenuity what

1398
00:54:31,270 --> 00:54:28,559
we aren't going to be doing

1399
00:54:31,829 --> 00:54:31,280
anymore which took an enormous amount of

1400
00:54:34,950 --> 00:54:31,839
time

1401
00:54:35,270 --> 00:54:34,960
is imaging the helicopter flights and

1402
00:54:37,990 --> 00:54:35,280
that

1403
00:54:39,990 --> 00:54:38,000
is what took away from our ability to

1404
00:54:41,910 --> 00:54:40,000
continue with the science mission in

1405
00:54:43,510 --> 00:54:41,920
in one way or another the other thing

1406
00:54:46,150 --> 00:54:43,520
that we didn't do is move

1407
00:54:47,750 --> 00:54:46,160
very far away from the helicopter and we

1408
00:54:48,950 --> 00:54:47,760
are going to move further away from the

1409
00:54:50,309 --> 00:54:48,960
helicopter in fact the helicopter is

1410
00:54:52,150 --> 00:54:50,319
moving further away from us

1411
00:54:53,670 --> 00:54:52,160
on flight 5 to go to a different

1412
00:54:57,430 --> 00:54:53,680
location

1413
00:54:59,829 --> 00:54:57,440

and another thing that that was made it

1414
00:55:01,430 --> 00:54:59,839
take more resources for the helicopter

1415
00:55:03,829 --> 00:55:01,440
during the ingenuity

1416
00:55:06,150 --> 00:55:03,839
the month of ingenuity was that we were

1417
00:55:07,109 --> 00:55:06,160
not moving any mechanisms while we were

1418
00:55:08,470 --> 00:55:07,119
communicating

1419
00:55:10,069 --> 00:55:08,480
with the helicopter and this could have

1420
00:55:11,750 --> 00:55:10,079
been you know some did some calls it was

1421
00:55:13,349 --> 00:55:11,760
two hours sometimes it was one hour to

1422
00:55:16,390 --> 00:55:13,359
get all this data that

1423
00:55:18,069 --> 00:55:16,400
that we got back which is very useful um

1424
00:55:19,750 --> 00:55:18,079
we weren't moving mechanisms because we

1425
00:55:22,630 --> 00:55:19,760
were concerned about interference

1426
00:55:23,589 --> 00:55:22,640
we have worked towards a demo in our

1427
00:55:26,470 --> 00:55:23,599
test beds and

1428
00:55:27,910 --> 00:55:26,480
and we're doing this on on mars to start

1429
00:55:29,270 --> 00:55:27,920
to confirm that we actually

1430
00:55:30,710 --> 00:55:29,280
can move mechanisms while we're

1431
00:55:31,510 --> 00:55:30,720
communicating with the helicopter and

1432
00:55:33,589 --> 00:55:31,520
that would mean

1433
00:55:35,990 --> 00:55:33,599
we can do imaging and things like that

1434
00:55:38,069 --> 00:55:36,000
that are are not just the single images

1435
00:55:39,670 --> 00:55:38,079
of the helicopter but we can do science

1436
00:55:41,670 --> 00:55:39,680
while we're getting images back from the

1437
00:55:43,910 --> 00:55:41,680
helicopter i think things like that

1438
00:55:46,630 --> 00:55:43,920

are things that we're hopeful will work

1439
00:55:49,349 --> 00:55:46,640
but we're cautiously optimistic because

1440
00:55:51,430 --> 00:55:49,359
we have not done those things fully yet

1441
00:55:53,190 --> 00:55:51,440
and so that's why we're looking at this

1442
00:55:55,670 --> 00:55:53,200
every 30 saws to make sure

1443
00:55:56,870 --> 00:55:55,680
we can still do the full operation um

1444
00:55:58,950 --> 00:55:56,880
and we did coddle

1445
00:56:00,630 --> 00:55:58,960
mimi the helicopter and we're and now

1446
00:56:02,789 --> 00:56:00,640
we're taking some of that away and the

1447
00:56:03,430 --> 00:56:02,799
helicopter will have ingenuity will have

1448
00:56:06,950 --> 00:56:03,440
a

1449
00:56:08,470 --> 00:56:06,960
mission proceeds

1450
00:56:10,230 --> 00:56:08,480
you know just to add to that jennifer

1451
00:56:11,829 --> 00:56:10,240
like one of the things we're using doing

1452
00:56:13,349 --> 00:56:11,839
with the helicopter going forward is

1453
00:56:16,230 --> 00:56:13,359
helicopter has a basin

1454
00:56:17,670 --> 00:56:16,240
base built-in hardware capability to

1455
00:56:20,630 --> 00:56:17,680
just wake up every day

1456
00:56:21,910 --> 00:56:20,640
at a given time like 12 30 p.m local you

1457
00:56:23,589 --> 00:56:21,920
know mars center time

1458
00:56:25,750 --> 00:56:23,599
and if it doesn't hear from the base

1459
00:56:27,829 --> 00:56:25,760
station it'll just go back to sleep

1460
00:56:29,750 --> 00:56:27,839
and then wake up again the next day and

1461
00:56:29,990 --> 00:56:29,760
so we don't have to be there is a mode

1462
00:56:32,150 --> 00:56:30,000
where

1463
00:56:33,270 --> 00:56:32,160

we don't have to be talking to it every

1464
00:56:35,430 --> 00:56:33,280
day like we have been

1465
00:56:36,630 --> 00:56:35,440
so that's an example of one of the

1466
00:56:38,069 --> 00:56:36,640
slower cadence

1467
00:56:39,670 --> 00:56:38,079
capabilities that we're going to be

1468
00:56:42,870 --> 00:56:39,680
exercising on the helicopter

1469
00:56:43,190 --> 00:56:42,880
in this phase for the first time thank

1470
00:56:45,750 --> 00:56:43,200
you

1471
00:56:48,549 --> 00:56:45,760
and it looks like we have steve gorman

1472
00:56:50,150 --> 00:56:48,559
from reuters back on the line

1473
00:56:51,589 --> 00:56:50,160
yeah hi thanks for thanks for hanging in

1474
00:56:52,069 --> 00:56:51,599
with me i appreciate it you can hear me

1475
00:56:56,230 --> 00:56:52,079
okay

1476
00:56:59,270 --> 00:56:56,240
had two quick questions one

1477
00:57:01,510 --> 00:56:59,280
um in the last uh news briefing um

1478
00:57:03,030 --> 00:57:01,520
uh mimiong was was talking about how the

1479
00:57:03,750 --> 00:57:03,040
she was emphasizing how they really

1480
00:57:06,150 --> 00:57:03,760
intend to

1481
00:57:07,430 --> 00:57:06,160
push the limits and push the envelopes

1482
00:57:09,030 --> 00:57:07,440
in this helicopter really push it

1483
00:57:10,150 --> 00:57:09,040
through some it's so suggesting i think

1484
00:57:13,109 --> 00:57:10,160
in response to a question

1485
00:57:15,109 --> 00:57:13,119
that that that in the end you know in

1486
00:57:17,349 --> 00:57:15,119
the in the for the sake of engineering

1487
00:57:20,230 --> 00:57:17,359
uh that in engineering would probably

1488
00:57:22,549 --> 00:57:20,240

not meet with a really happy ending

1489
00:57:23,910 --> 00:57:22,559
and like it might they're really gonna

1490
00:57:26,069 --> 00:57:23,920
try to push this thing until

1491
00:57:27,109 --> 00:57:26,079
it couldn't function anymore like maybe

1492
00:57:28,789 --> 00:57:27,119
crash or something

1493
00:57:30,309 --> 00:57:28,799
and it sounds to me like with this new

1494
00:57:31,990 --> 00:57:30,319
operational demo

1495
00:57:32,950 --> 00:57:32,000
that maybe you're not going to push it

1496
00:57:33,349 --> 00:57:32,960
you said there's going to be some

1497
00:57:36,950 --> 00:57:33,359
natural

1498
00:57:38,549 --> 00:57:36,960
out farther and farther fields and so

1499
00:57:41,829 --> 00:57:38,559
forth but maybe you're not going to be

1500
00:57:44,150 --> 00:57:41,839
really as aggressively pushing this this

1501
00:57:45,349 --> 00:57:44,160
aircraft limits as much as you can is

1502
00:57:46,630 --> 00:57:45,359
that correct

1503
00:57:48,549 --> 00:57:46,640
and and set you know during the

1504
00:57:49,510 --> 00:57:48,559
operational demo and secondly what are

1505
00:57:53,190 --> 00:57:49,520
some of the kinds

1506
00:57:54,950 --> 00:57:53,200
of of uh features on locations

1507
00:57:56,630 --> 00:57:54,960
that you might be sending ingenuity out

1508
00:57:59,430 --> 00:57:56,640
to fly to inspect

1509
00:58:02,630 --> 00:57:59,440
uh as a surveillance that the rover

1510
00:58:05,910 --> 00:58:02,640
could not access in the next 30 days

1511
00:58:09,030 --> 00:58:05,920
do you want to take a cut at that point

1512
00:58:10,950 --> 00:58:09,040
okay yes uh we will always be pushing

1513
00:58:13,109 --> 00:58:10,960

ingenuity but you are absolutely right

1514
00:58:16,470 --> 00:58:13,119
in detecting that

1515
00:58:18,390 --> 00:58:16,480
ingenuity surprised us it really did uh

1516
00:58:20,549 --> 00:58:18,400
you know with the from the first flight

1517
00:58:21,670 --> 00:58:20,559
to the last the third flight that we've

1518
00:58:24,309 --> 00:58:21,680
had is

1519
00:58:25,349 --> 00:58:24,319
it's been so perfect that our mindset

1520
00:58:27,270 --> 00:58:25,359
went from

1521
00:58:28,789 --> 00:58:27,280
you know what are the uncertainties like

1522
00:58:31,109 --> 00:58:28,799
what are the differences that we're

1523
00:58:32,870 --> 00:58:31,119
seeing with the flight at mars

1524
00:58:34,710 --> 00:58:32,880
versus the models that we had in our

1525
00:58:37,190 --> 00:58:34,720
hands and in the first

1526
00:58:37,910 --> 00:58:37,200
the press conference our mindset was

1527
00:58:39,589 --> 00:58:37,920
okay

1528
00:58:41,349 --> 00:58:39,599
we're going to see differences and we're

1529
00:58:43,109 --> 00:58:41,359
going to have to update our models

1530
00:58:44,870 --> 00:58:43,119
and let's be updating and pushing the

1531
00:58:46,710 --> 00:58:44,880
envelope as we're having to

1532
00:58:48,470 --> 00:58:46,720
update the models and the beautiful

1533
00:58:50,710 --> 00:58:48,480
surprise here has been

1534
00:58:52,309 --> 00:58:50,720
our models have not had to be touched

1535
00:58:54,710 --> 00:58:52,319
and you know the and they project all

1536
00:58:56,470 --> 00:58:54,720
the way to the future missions of larger

1537
00:58:58,069 --> 00:58:56,480
you know vehicle that we dream of

1538
00:58:59,349 --> 00:58:58,079

building and so that's been the good

1539
00:59:00,630 --> 00:58:59,359
news and you're absolutely right in

1540
00:59:02,870 --> 00:59:00,640
detecting that

1541
00:59:04,230 --> 00:59:02,880
shift now and it's been kind of it's

1542
00:59:05,990 --> 00:59:04,240
been become an opportunity

1543
00:59:08,069 --> 00:59:06,000
right with the opportunistic

1544
00:59:10,390 --> 00:59:08,079
perseverance rover is going to be nearby

1545
00:59:12,150 --> 00:59:10,400
and we get this chance to try out

1546
00:59:13,990 --> 00:59:12,160
operational demonstrations so

1547
00:59:16,069 --> 00:59:14,000
two things are going to happen we are

1548
00:59:18,069 --> 00:59:16,079
going to start getting these products

1549
00:59:20,870 --> 00:59:18,079
that will really feed forward to future

1550
00:59:21,750 --> 00:59:20,880
missions using aerial platforms and as

1551
00:59:23,190 --> 00:59:21,760
we do that

1552
00:59:25,190 --> 00:59:23,200
we are going to have to push the

1553
00:59:27,030 --> 00:59:25,200
envelope because of the unsurveyed

1554
00:59:29,190 --> 00:59:27,040
terrain and more difficult terrain

1555
00:59:31,190 --> 00:59:29,200
terrain that simply the rover cannot get

1556
00:59:31,750 --> 00:59:31,200
to and so that will naturally push the

1557
00:59:33,910 --> 00:59:31,760
limit

1558
00:59:35,589 --> 00:59:33,920
but you're right it you know i think i

1559
00:59:36,789 --> 00:59:35,599
made the comment i was pushing hold our

1560
00:59:38,230 --> 00:59:36,799
grip who was sitting right here and

1561
00:59:40,710 --> 00:59:38,240
saying come on you know we got to go at

1562
00:59:42,390 --> 00:59:40,720
least 600 meters 800 meters

1563
00:59:43,750 --> 00:59:42,400

kind of pushing for pushing for the

1564
00:59:45,270 --> 00:59:43,760
model's sake we

1565
00:59:46,950 --> 00:59:45,280
backed off a little bit just because

1566
00:59:49,030 --> 00:59:46,960
we've had no surprises in the model

1567
00:59:50,549 --> 00:59:49,040
but don't worry we will be pushing the

1568
00:59:51,430 --> 00:59:50,559
vehicle because we'll be using it in

1569
00:59:54,630 --> 00:59:51,440
very uh

1570
00:59:56,390 --> 00:59:54,640
unpredicted ways so

1571
00:59:58,470 --> 00:59:56,400
even on flight four you know we have

1572
00:59:59,990 --> 00:59:58,480
pushed some of the capability uh we are

1573
01:00:02,230 --> 01:00:00,000
flying faster than we flew

1574
01:00:04,470 --> 01:00:02,240
on the third flight we are flying for

1575
01:00:06,789 --> 01:00:04,480
longer than our original design limit

1576
01:00:08,870 --> 01:00:06,799
we absorb all the waste heat in our

1577
01:00:10,950 --> 01:00:08,880
motors in the motor itself

1578
01:00:12,829 --> 01:00:10,960
and originally we thought we would need

1579
01:00:15,270 --> 01:00:12,839
to restrict that to about a minute and a

1580
01:00:17,349 --> 01:00:15,280
half uh flight four is gonna

1581
01:00:19,190 --> 01:00:17,359
fly over two minutes on that motor uh so

1582
01:00:21,829 --> 01:00:19,200
we'll see how well that holds up

1583
01:00:23,750 --> 01:00:21,839
uh we're also currently uh you know not

1584
01:00:24,470 --> 01:00:23,760
optimized enough navigation system to

1585
01:00:26,390 --> 01:00:24,480
fly over

1586
01:00:29,109 --> 01:00:26,400
undulating terrains you know we are sort

1587
01:00:31,109 --> 01:00:29,119
of more of a flat plane

1588
01:00:32,870 --> 01:00:31,119

which is what the airfield and that

1589
01:00:34,390 --> 01:00:32,880
flight zone was selected for

1590
01:00:35,910 --> 01:00:34,400
so we're going to be flying over terrain

1591
01:00:37,430 --> 01:00:35,920
that has will introduce a little bit

1592
01:00:38,390 --> 01:00:37,440
more navigation error we'll see how well

1593
01:00:40,470 --> 01:00:38,400
that works

1594
01:00:42,309 --> 01:00:40,480
so it is being pushed uh but it's being

1595
01:00:43,750 --> 01:00:42,319
pushed you know in a

1596
01:00:45,430 --> 01:00:43,760
good way in the sense that we know what

1597
01:00:46,390 --> 01:00:45,440
the good performance has been and we're

1598
01:00:48,309 --> 01:00:46,400
pushing

1599
01:00:51,430 --> 01:00:48,319
you know cautiously but it's still being

1600
01:00:55,270 --> 01:00:54,150
thank you very much all right and up

1601
01:01:00,230 --> 01:00:55,280
next we have

1602
01:01:03,750 --> 01:01:01,829
good morning a question for the

1603
01:01:05,270 --> 01:01:03,760
ingenuity team just to follow up on on

1604
01:01:06,309 --> 01:01:05,280
some of those earlier questions about

1605
01:01:09,750 --> 01:01:06,319
pushing the limits

1606
01:01:11,349 --> 01:01:09,760
of the helicopter what sort of range do

1607
01:01:13,430 --> 01:01:11,359
you expect to be able to get on these

1608
01:01:15,030 --> 01:01:13,440
flights how far down range and back

1609
01:01:17,750 --> 01:01:15,040
um do you expect to go on some of these

1610
01:01:22,309 --> 01:01:17,760
future flights beyond the 133 meters

1611
01:01:26,710 --> 01:01:25,670
i think total of about maybe 600 meters

1612
01:01:28,630 --> 01:01:26,720
is not unreasonable

1613
01:01:30,470 --> 01:01:28,640

uh two minute flights at five meters per

1614
01:01:31,910 --> 01:01:30,480
second is something that definitely is a

1615
01:01:34,069 --> 01:01:31,920
possibility

1616
01:01:35,510 --> 01:01:34,079
uh that's probably where you know we'll

1617
01:01:35,990 --> 01:01:35,520
see how well it does on that one and see

1618
01:01:37,589 --> 01:01:36,000
whether

1619
01:01:39,349 --> 01:01:37,599
there's even more margin that we can you

1620
01:01:41,750 --> 01:01:39,359
know use for

1621
01:01:43,030 --> 01:01:41,760
further flights but uh that's probably a

1622
01:01:47,030 --> 01:01:43,040
good place to

1623
01:01:50,069 --> 01:01:49,270
thanks bob and up next on the phone

1624
01:01:54,309 --> 01:01:50,079
lines is

1625
01:01:56,390 --> 01:01:54,319
john wentz from inverse

1626
01:01:57,510 --> 01:01:56,400
uh hi i was just wondering what the

1627
01:02:00,710 --> 01:01:57,520
transmission rate

1628
01:02:01,190 --> 01:02:00,720
is between the helicopter and rover and

1629
01:02:03,750 --> 01:02:01,200
also

1630
01:02:05,510 --> 01:02:03,760
you know had you known this would be so

1631
01:02:06,309 --> 01:02:05,520
successful what kind of payload you

1632
01:02:10,710 --> 01:02:06,319
might have wanted to

1633
01:02:15,190 --> 01:02:12,870
well we're we're transmitting data at

1634
01:02:19,190 --> 01:02:15,200
about a hundred kilobits per second

1635
01:02:20,150 --> 01:02:19,200
and we have two legs in that journey one

1636
01:02:21,750 --> 01:02:20,160
is from the helicopter

1637
01:02:24,230 --> 01:02:21,760
to its base station which is a radio

1638
01:02:26,150 --> 01:02:24,240

link and then there is another

1639
01:02:27,349 --> 01:02:26,160
serial line between the base station

1640
01:02:30,069 --> 01:02:27,359
that's mounted on the

1641
01:02:31,829 --> 01:02:30,079
rover to the rover computer itself and

1642
01:02:33,589 --> 01:02:31,839
so it has to make those two hops they're

1643
01:02:35,990 --> 01:02:33,599
comparable speeds that what i

1644
01:02:38,390 --> 01:02:36,000
indicated um and what was the second

1645
01:02:40,950 --> 01:02:38,400
part of the question

1646
01:02:42,710 --> 01:02:40,960
have we known that yeah this was going

1647
01:02:44,309 --> 01:02:42,720
to be as successful as it was what

1648
01:02:46,870 --> 01:02:44,319
what kind of payload or you know what

1649
01:02:49,910 --> 01:02:46,880
kind of payload do you anticipate for

1650
01:02:51,670 --> 01:02:49,920
your next helicopter my project manager

1651
01:02:52,630 --> 01:02:51,680
i had to fight to get the color camera

1652
01:02:55,829 --> 01:02:52,640
onto the uh

1653
01:02:57,109 --> 01:02:55,839
helicopter so i'm very happy that we got

1654
01:02:59,829 --> 01:02:57,119
that one little uh

1655
01:03:02,549 --> 01:02:59,839
one gram payload and we couldn't even

1656
01:03:03,670 --> 01:03:02,559
call it a color science camera we

1657
01:03:05,990 --> 01:03:03,680
couldn't call it anything like that we

1658
01:03:09,109 --> 01:03:06,000
had to call it a return to earth

1659
01:03:10,549 --> 01:03:09,119
uh camera so maybe mimi wants to talk

1660
01:03:13,750 --> 01:03:10,559
about uh payloads

1661
01:03:15,750 --> 01:03:13,760
i confess so very focused uh very

1662
01:03:16,549 --> 01:03:15,760
focused right when we started this this

1663
01:03:18,710 --> 01:03:16,559

was about

1664
01:03:20,230 --> 01:03:18,720
showing that we can fly a rotorcraft

1665
01:03:21,670 --> 01:03:20,240
right we started with the question we

1666
01:03:23,029 --> 01:03:21,680
had a lot of people questioning right

1667
01:03:25,750 --> 01:03:23,039
very smart people they said

1668
01:03:26,710 --> 01:03:25,760
really is it possible so yes bob i

1669
01:03:30,069 --> 01:03:26,720
confess

1670
01:03:32,789 --> 01:03:30,079
as very obsessed with engineering data

1671
01:03:33,109 --> 01:03:32,799
on how does a rotor car fly at mars

1672
01:03:37,029 --> 01:03:33,119
right

1673
01:03:38,230 --> 01:03:37,039
flying but really getting the data back

1674
01:03:40,789 --> 01:03:38,240
on how does it fly

1675
01:03:41,750 --> 01:03:40,799
so that we can confirm our model so yes

1676
01:03:43,270 --> 01:03:41,760
i was just

1677
01:03:44,870 --> 01:03:43,280
obsessed with getting the engineering

1678
01:03:49,190 --> 01:03:44,880
data back and payloads

1679
01:03:52,390 --> 01:03:49,200
i admit we're in the back burner for me

1680
01:03:56,710 --> 01:03:52,400
and ken would you like to contribute too

1681
01:03:59,510 --> 01:03:56,720
yeah so i i would suggest that

1682
01:03:59,910 --> 01:03:59,520
the uh the science team would love to

1683
01:04:03,109 --> 01:03:59,920
see

1684
01:04:05,190 --> 01:04:03,119
a capability that effectively takes

1685
01:04:06,470 --> 01:04:05,200
the high-resolution cameras that we have

1686
01:04:09,029 --> 01:04:06,480
on board the rover

1687
01:04:11,029 --> 01:04:09,039
and puts them out over the landscape uh

1688
01:04:13,990 --> 01:04:11,039

that we cannot drive to

1689
01:04:14,950 --> 01:04:14,000
and so it the the color images that we

1690
01:04:17,829 --> 01:04:14,960
are getting there

1691
01:04:18,230 --> 01:04:17,839
already are spectacular um we'll have to

1692
01:04:21,029 --> 01:04:18,240
see

1693
01:04:21,990 --> 01:04:21,039
if we can make out features that are uh

1694
01:04:24,069 --> 01:04:22,000
of interest

1695
01:04:25,510 --> 01:04:24,079
uh to the science team but i think

1696
01:04:28,069 --> 01:04:25,520
imagery is the

1697
01:04:29,750 --> 01:04:28,079
is the key payload for for this um you

1698
01:04:30,230 --> 01:04:29,760
know for a future helicopter is to

1699
01:04:35,670 --> 01:04:30,240
produce

1700
01:04:39,349 --> 01:04:37,270
all right thank you and now we have a

1701
01:04:42,549 --> 01:04:39,359
social media question coming in

1702
01:04:43,109 --> 01:04:42,559
diani on facebook asks how will this

1703
01:04:46,150 --> 01:04:43,119
research

1704
01:04:47,190 --> 01:04:46,160
impact human flight systems for mars

1705
01:04:50,230 --> 01:04:47,200
exploration

1706
01:04:56,630 --> 01:04:54,230
laura would you like to take that sure

1707
01:04:59,029 --> 01:04:56,640
so i i think there's a lot of potential

1708
01:05:02,150 --> 01:04:59,039
here um you know not just in supporting

1709
01:05:04,870 --> 01:05:02,160
a robotic missions but um you know

1710
01:05:05,349 --> 01:05:04,880
an aerial platform can do the same types

1711
01:05:06,390 --> 01:05:05,359
of

1712
01:05:07,990 --> 01:05:06,400
reconnaissance things that we're going

1713
01:05:09,430 --> 01:05:08,000

to test in this operational phase we can

1714
01:05:12,150 --> 01:05:09,440
do the same types of things

1715
01:05:13,190 --> 01:05:12,160
to support a human uh mission uh the

1716
01:05:15,510 --> 01:05:13,200
ability to go

1717
01:05:17,349 --> 01:05:15,520
and and fly to locations that uh perhaps

1718
01:05:18,230 --> 01:05:17,359
are too far or too difficult to traverse

1719
01:05:21,029 --> 01:05:18,240
for the

1720
01:05:22,069 --> 01:05:21,039
human explorers to get to uh using the

1721
01:05:24,789 --> 01:05:22,079
that aerial platform

1722
01:05:27,109 --> 01:05:24,799
to collect data there or to to scope out

1723
01:05:30,230 --> 01:05:27,119
um the path for the most effective and

1724
01:05:32,390 --> 01:05:30,240
and efficient traverse uh for uh for our

1725
01:05:33,270 --> 01:05:32,400
human explorers or for their vehicles

1726
01:05:35,829 --> 01:05:33,280
that they're

1727
01:05:37,270 --> 01:05:35,839
using um to move around on the surface

1728
01:05:38,470 --> 01:05:37,280
and so i think there's a lot of

1729
01:05:39,990 --> 01:05:38,480
similarities there

1730
01:05:41,510 --> 01:05:40,000
uh between the types of things we're

1731
01:05:43,109 --> 01:05:41,520
going to demonstrate um in this

1732
01:05:44,710 --> 01:05:43,119
operational phase

1733
01:05:48,710 --> 01:05:44,720
that'll feed forward not just to the

1734
01:05:50,470 --> 01:05:48,720
robotic but also to to human exploration

1735
01:05:52,309 --> 01:05:50,480
all right thank you lori and we're going

1736
01:05:53,990 --> 01:05:52,319
back to the phone lines now we have

1737
01:05:57,349 --> 01:05:54,000
irene klotz

1738
01:06:00,230 --> 01:05:57,359

from aviation week

1739
01:06:01,029 --> 01:06:00,240
thanks very much um for bob did i hear

1740
01:06:04,150 --> 01:06:01,039
you

1741
01:06:05,029 --> 01:06:04,160
correctly say that the maximum flight

1742
01:06:07,670 --> 01:06:05,039
durations

1743
01:06:08,630 --> 01:06:07,680
is now moving from 90 seconds to

1744
01:06:11,750 --> 01:06:08,640
possibly

1745
01:06:14,230 --> 01:06:11,760
two minutes and for laurie is there a

1746
01:06:15,589 --> 01:06:14,240
cost associated with this mission

1747
01:06:18,069 --> 01:06:15,599
extension

1748
01:06:18,630 --> 01:06:18,079
and realistically how soon do you think

1749
01:06:21,670 --> 01:06:18,640
it'll be

1750
01:06:23,109 --> 01:06:21,680
before a science rotorcraft would be

1751
01:06:26,309 --> 01:06:23,119
flying on mars

1752
01:06:27,190 --> 01:06:26,319
thanks yeah to answer yes even flight 4

1753
01:06:29,190 --> 01:06:27,200
is going to fly

1754
01:06:32,789 --> 01:06:29,200
two minutes and that's where we're

1755
01:06:35,270 --> 01:06:32,799
comfortable right now

1756
01:06:36,470 --> 01:06:35,280
yes and of course you know everything

1757
01:06:39,270 --> 01:06:36,480
comes with some

1758
01:06:41,270 --> 01:06:39,280
cost nothing is ever free but this is

1759
01:06:43,029 --> 01:06:41,280
going to be at a very reduced

1760
01:06:44,470 --> 01:06:43,039
capacity for the operations for the

1761
01:06:46,789 --> 01:06:44,480
ingenuity helicopter

1762
01:06:47,910 --> 01:06:46,799
as you heard jennifer say we're talking

1763
01:06:49,510 --> 01:06:47,920

about you know

1764
01:06:51,029 --> 01:06:49,520
the cadence that has been in every

1765
01:06:52,789 --> 01:06:51,039
three-day flight cadence

1766
01:06:54,630 --> 01:06:52,799
to perhaps you know every couple of

1767
01:06:57,589 --> 01:06:54,640
weeks flying

1768
01:06:59,349 --> 01:06:57,599
um and so this is a much reduced um

1769
01:07:01,910 --> 01:06:59,359
operational scenario for the

1770
01:07:02,390 --> 01:07:01,920
for the helicopter and again uh with a

1771
01:07:04,230 --> 01:07:02,400
very

1772
01:07:06,950 --> 01:07:04,240
you know moving to this focus phase for

1773
01:07:09,750 --> 01:07:06,960
the rover on the science uh very minimal

1774
01:07:10,150 --> 01:07:09,760
low impact on on the rover as well so

1775
01:07:11,990 --> 01:07:10,160
you know

1776
01:07:13,349 --> 01:07:12,000
nothing comes for free but it will be it

1777
01:07:16,630 --> 01:07:13,359
will be very very

1778
01:07:18,390 --> 01:07:16,640
minimal you know as far as the timeline

1779
01:07:19,109 --> 01:07:18,400
for when we can see this you know we've

1780
01:07:22,309 --> 01:07:19,119
got

1781
01:07:24,230 --> 01:07:22,319
an amazing uh community of scientists in

1782
01:07:25,990 --> 01:07:24,240
planetary science that come up with

1783
01:07:28,230 --> 01:07:26,000
great ideas that get proposed through

1784
01:07:30,630 --> 01:07:28,240
our uh

1785
01:07:32,390 --> 01:07:30,640
proposal processes i fully expect to see

1786
01:07:35,270 --> 01:07:32,400
something uh the next time we have an

1787
01:07:36,309 --> 01:07:35,280
opportunity to get some clever ideas

1788
01:07:38,150 --> 01:07:36,319

there and

1789
01:07:39,349 --> 01:07:38,160
you just never know what the the next

1790
01:07:42,710 --> 01:07:39,359
opportunity might be

1791
01:07:45,750 --> 01:07:42,720
but i know we'll see it thank you lori

1792
01:07:51,029 --> 01:07:45,760
and up next we have stephen clark

1793
01:07:54,789 --> 01:07:53,910
thank you stephen clark space flight now

1794
01:07:58,069 --> 01:07:54,799
just to follow up

1795
01:08:01,109 --> 01:07:58,079
on irene's question for uh lori glaze um

1796
01:08:03,109 --> 01:08:01,119
is there any capacity or margin on the

1797
01:08:05,750 --> 01:08:03,119
mars sample return mission

1798
01:08:06,230 --> 01:08:05,760
to put any sort of rotorcraft on board

1799
01:08:10,069 --> 01:08:06,240
or

1800
01:08:12,390 --> 01:08:10,079
considering right now

1801
01:08:14,230 --> 01:08:12,400
and also my my phone dropped out briefly

1802
01:08:15,510 --> 01:08:14,240
so i apologize if i missed this from ken

1803
01:08:18,229 --> 01:08:15,520
farley but

1804
01:08:18,709 --> 01:08:18,239
or jennifer prosper but how soon do you

1805
01:08:20,309 --> 01:08:18,719
think

1806
01:08:23,990 --> 01:08:20,319
it'll be before you can take your first

1807
01:08:26,709 --> 01:08:24,000
sample with perseverance thank you

1808
01:08:28,550 --> 01:08:26,719
so i'll take the first question there

1809
01:08:29,829 --> 01:08:28,560
you know the marsh sample return mission

1810
01:08:32,870 --> 01:08:29,839
is a is a very

1811
01:08:34,789 --> 01:08:32,880
very ambitious mission um requiring

1812
01:08:38,149 --> 01:08:34,799
uh you know multiple launches from earth

1813
01:08:40,070 --> 01:08:38,159

requiring a spacecraft from both

1814
01:08:41,749 --> 01:08:40,080
the united states and from european

1815
01:08:43,749 --> 01:08:41,759
space agency

1816
01:08:46,070 --> 01:08:43,759
and so it's it's very very ambitious as

1817
01:08:46,709 --> 01:08:46,080
it is so i think it's really important

1818
01:08:49,030 --> 01:08:46,719
that that

1819
01:08:51,349 --> 01:08:49,040
mission stay very focused on its mission

1820
01:08:53,110 --> 01:08:51,359
to collect those samples

1821
01:08:55,669 --> 01:08:53,120
from that are going to be collected by

1822
01:09:00,470 --> 01:08:55,679
uh by the perseverance rover

1823
01:09:02,309 --> 01:09:00,480
um and and again with that uh you know

1824
01:09:03,990 --> 01:09:02,319
there's just there's not a lot of room

1825
01:09:05,669 --> 01:09:04,000
to add additional things on to that

1826
01:09:05,990 --> 01:09:05,679
mission it's already got an incredible

1827
01:09:09,349 --> 01:09:06,000
scope

1828
01:09:10,470 --> 01:09:09,359
and an incredible tasking just to bring

1829
01:09:13,269 --> 01:09:10,480
those samples back

1830
01:09:15,030 --> 01:09:13,279
so i don't expect to see any additional

1831
01:09:18,630 --> 01:09:15,040
flight elements going along with

1832
01:09:19,990 --> 01:09:18,640
sample return and i can take the second

1833
01:09:21,990 --> 01:09:20,000
part of the question

1834
01:09:23,669 --> 01:09:22,000
so the laundry list of things i talked

1835
01:09:25,910 --> 01:09:23,679
about we need to do will take us

1836
01:09:26,709 --> 01:09:25,920
a few months so we expect to get our

1837
01:09:30,630 --> 01:09:26,719
first sample

1838
01:09:32,950 --> 01:09:30,640

in july in the summer

1839
01:09:34,229 --> 01:09:32,960
thanks for your answers up next we have

1840
01:09:38,070 --> 01:09:34,239
leo and wright

1841
01:09:39,189 --> 01:09:38,080
from irish television thanks very much

1842
01:09:41,349 --> 01:09:39,199
sir raquel

1843
01:09:43,510 --> 01:09:41,359
um i wanted to ask ken farley about that

1844
01:09:46,470 --> 01:09:43,520
magnificent panorama

1845
01:09:47,910 --> 01:09:46,480
that he showed us in the context of the

1846
01:09:51,030 --> 01:09:47,920
short to medium

1847
01:09:53,349 --> 01:09:51,040
term science plan um am i looking at

1848
01:09:55,189 --> 01:09:53,359
this correctly when i think that the

1849
01:09:57,669 --> 01:09:55,199
the large outcrop in the middle of the

1850
01:10:01,189 --> 01:09:57,679
picture is the katmai

1851
01:10:06,070 --> 01:10:01,199
katamai um outcrop

1852
01:10:06,080 --> 01:10:10,229
is not correct it's called kodiak

1853
01:10:15,270 --> 01:10:14,470
sorry again that that is a delta remnant

1854
01:10:17,510 --> 01:10:15,280
right in the

1855
01:10:19,430 --> 01:10:17,520
in the almost dead center of the image

1856
01:10:20,470 --> 01:10:19,440
uh is the delta remnant that we call

1857
01:10:22,390 --> 01:10:20,480
kodiak

1858
01:10:24,070 --> 01:10:22,400
and we we've obtained some really

1859
01:10:26,950 --> 01:10:24,080
spectacular uh

1860
01:10:27,270 --> 01:10:26,960
images of er that are up on our raw site

1861
01:10:30,550 --> 01:10:27,280
uh

1862
01:10:31,430 --> 01:10:30,560
already and if i could ask then

1863
01:10:34,470 --> 01:10:31,440

obviously your

1864
01:10:36,229 --> 01:10:34,480
your short-term target at the end of

1865
01:10:39,750 --> 01:10:36,239
your ice cream scoop

1866
01:10:41,110 --> 01:10:39,760
red drawing uh is obviously then that

1867
01:10:43,669 --> 01:10:41,120
outcrop at the extreme

1868
01:10:45,030 --> 01:10:43,679
left which would be at the bottom of big

1869
01:10:48,149 --> 01:10:45,040
bend

1870
01:10:51,990 --> 01:10:48,159
um do you think that might be a delta

1871
01:10:54,310 --> 01:10:52,000
remnant or are you ruling that out

1872
01:10:55,830 --> 01:10:54,320
yeah this is a really good question um

1873
01:10:58,790 --> 01:10:55,840
the end of this uh

1874
01:11:01,110 --> 01:10:58,800
this um red zone here the area that we

1875
01:11:03,110 --> 01:11:01,120
will execute our campaign in

1876
01:11:04,950 --> 01:11:03,120
was intentionally drawn to allow the

1877
01:11:06,709 --> 01:11:04,960
team that is going to

1878
01:11:08,630 --> 01:11:06,719
create the campaign that's the way we do

1879
01:11:10,870 --> 01:11:08,640
it we're going to task a small group of

1880
01:11:13,030 --> 01:11:10,880
scientists to prepare a plan

1881
01:11:15,350 --> 01:11:13,040
for what we might do within this red

1882
01:11:18,070 --> 01:11:15,360
zone they're going to be able to choose

1883
01:11:18,630 --> 01:11:18,080
what we what we do and the feature all

1884
01:11:21,990 --> 01:11:18,640
the way

1885
01:11:24,790 --> 01:11:22,000
in the uh southwest corner is a

1886
01:11:26,709 --> 01:11:24,800
small about a 10 meter high hill that we

1887
01:11:29,990 --> 01:11:26,719
call pilot pinnacle

1888
01:11:31,750 --> 01:11:30,000

and uh it could be a delta remnant uh

1889
01:11:33,910 --> 01:11:31,760
it might be something else it looks

1890
01:11:37,430 --> 01:11:33,920
different than kodiak just just

1891
01:11:38,790 --> 01:11:37,440
um even in the in the um high-rise

1892
01:11:42,149 --> 01:11:38,800
images that we're looking at here the

1893
01:11:44,310 --> 01:11:42,159
the orbital images it looks different

1894
01:11:46,310 --> 01:11:44,320
so we're not really sure what that is

1895
01:11:47,510 --> 01:11:46,320
the most likely explanation is that it

1896
01:11:49,270 --> 01:11:47,520
is a delta remnant but

1897
01:11:52,149 --> 01:11:49,280
it could also be something else it could

1898
01:11:56,149 --> 01:11:54,550
raquel i had a follow-up this this time

1899
01:11:58,950 --> 01:11:56,159
yes there is

1900
01:11:59,350 --> 01:11:58,960
uh just uh for jennifer i i was curious

1901
01:12:02,189 --> 01:11:59,360
yeah

1902
01:12:03,830 --> 01:12:02,199
you mentioned the the microphone uh

1903
01:12:06,229 --> 01:12:03,840
characterization test

1904
01:12:08,950 --> 01:12:06,239
and some video that you shot i'm just

1905
01:12:12,149 --> 01:12:08,960
wondering was that the mystery video

1906
01:12:13,830 --> 01:12:12,159
on psalm 67 where absolutely nothing

1907
01:12:16,149 --> 01:12:13,840
happened

1908
01:12:18,390 --> 01:12:16,159
uh it could very well be i'm not sure i

1909
01:12:20,229 --> 01:12:18,400
am that familiar with the mystery video

1910
01:12:23,590 --> 01:12:20,239
but it could have been during that uh

1911
01:12:25,990 --> 01:12:23,600
test yes

1912
01:12:27,910 --> 01:12:26,000
thank you thanks leo work on getting you

1913
01:12:32,310 --> 01:12:27,920

that answer and up next we have

1914
01:12:36,390 --> 01:12:32,320
rick lovett from cosmos magazine

1915
01:12:39,189 --> 01:12:36,400
yes thank you my basic question is um

1916
01:12:40,390 --> 01:12:39,199
are so flights four and five are the uh

1917
01:12:42,470 --> 01:12:40,400
the extended mission

1918
01:12:45,590 --> 01:12:42,480
for the first 30 days or could there be

1919
01:12:49,510 --> 01:12:48,229
oh the yeah the flight four and five are

1920
01:12:52,310 --> 01:12:49,520
we're transitioning

1921
01:12:53,430 --> 01:12:52,320
into this operational demo phase so we

1922
01:12:56,149 --> 01:12:53,440
should view them as

1923
01:12:57,189 --> 01:12:56,159
operational demo phase and it is the

1924
01:12:59,830 --> 01:12:57,199
first time

1925
01:13:02,070 --> 01:12:59,840
uh we are flying ahead of the rover

1926
01:13:04,630 --> 01:13:02,080
ingenuity is flying ahead of the rover

1927
01:13:05,270 --> 01:13:04,640
surveying a terrain that we haven't seen

1928
01:13:07,830 --> 01:13:05,280
before

1929
01:13:09,189 --> 01:13:07,840
and picking from it and transferring and

1930
01:13:12,709 --> 01:13:09,199
then from then on after

1931
01:13:14,390 --> 01:13:12,719
for flight five ingenuity will leave

1932
01:13:16,390 --> 01:13:14,400
leave the current airfield the wright

1933
01:13:17,990 --> 01:13:16,400
brothers feel and ingenuity will

1934
01:13:20,630 --> 01:13:18,000
permanently transfer to the net

1935
01:13:22,470 --> 01:13:20,640
new airfield so from there on yes the

1936
01:13:25,030 --> 01:13:22,480
intention is for flight six

1937
01:13:25,669 --> 01:13:25,040
you know and and seven so on uh working

1938
01:13:28,310 --> 01:13:25,679

together

1939
01:13:29,669 --> 01:13:28,320
uh with perseverance uh operations and

1940
01:13:31,750 --> 01:13:29,679
science perspective

1941
01:13:33,430 --> 01:13:31,760
to figure out you know what operational

1942
01:13:35,270 --> 01:13:33,440
products and scenarios that we want to

1943
01:13:37,189 --> 01:13:35,280
explore

1944
01:13:39,110 --> 01:13:37,199
okay well i can follow up that means

1945
01:13:40,630 --> 01:13:39,120
there could be in this 30 days

1946
01:13:43,030 --> 01:13:40,640
more than two flights it could be three

1947
01:13:44,709 --> 01:13:43,040
or four

1948
01:13:47,030 --> 01:13:44,719
yes we're looking every two three week

1949
01:13:49,030 --> 01:13:47,040
cadence yeah we'll do flights

1950
01:13:51,430 --> 01:13:49,040
uh four and five and then we'll probably

1951
01:13:55,990 --> 01:13:51,440
have one or two flights after that

1952
01:13:59,430 --> 01:13:58,790
up next on the phone lines is ken kramer

1953
01:14:03,189 --> 01:13:59,440
from

1954
01:14:05,350 --> 01:14:03,199
space up close ah thank you for taking

1955
01:14:07,430 --> 01:14:05,360
my question and uh congratulations on

1956
01:14:09,990 --> 01:14:07,440
fantastic results so far

1957
01:14:11,669 --> 01:14:10,000
um i'm wondering with the the color

1958
01:14:13,430 --> 01:14:11,679
camera since you're going to stay aerial

1959
01:14:15,669 --> 01:14:13,440
for a while

1960
01:14:16,790 --> 01:14:15,679
would it be possible to do uh stereo

1961
01:14:19,189 --> 01:14:16,800
imaging with that

1962
01:14:20,070 --> 01:14:19,199
um one of you just mentioned that a

1963
01:14:22,229 --> 01:14:20,080

little bit uh

1964
01:14:24,229 --> 01:14:22,239
taking stereo images if you can keep it

1965
01:14:25,910 --> 01:14:24,239
up turn it a little bit

1966
01:14:27,990 --> 01:14:25,920
is that possible and can you get any

1967
01:14:31,270 --> 01:14:28,000
science at all out of that color camera

1968
01:14:31,830 --> 01:14:31,280
thanks yeah i can i can take that yes so

1969
01:14:35,669 --> 01:14:31,840
we can

1970
01:14:36,870 --> 01:14:35,679
do a stereo um and uh it was considered

1971
01:14:40,950 --> 01:14:36,880
as a possible

1972
01:14:42,310 --> 01:14:40,960
you know um demonstration um

1973
01:14:45,030 --> 01:14:42,320
uh it's just that we have a little bit

1974
01:14:48,390 --> 01:14:45,040
of um we our timing on scheduling the

1975
01:14:49,110 --> 01:14:48,400
color camera on the helicopter is not as

1976
01:14:51,110 --> 01:14:49,120
precise

1977
01:14:52,950 --> 01:14:51,120
and as carefully controlled as we can do

1978
01:14:55,189 --> 01:14:52,960
with the navigation camera

1979
01:14:56,310 --> 01:14:55,199
and since the flight force objective is

1980
01:14:58,149 --> 01:14:56,320
really

1981
01:14:59,430 --> 01:14:58,159
to find the new landing field the the

1982
01:15:01,110 --> 01:14:59,440
nader pointed uh

1983
01:15:02,470 --> 01:15:01,120
black and white camera will seem to be

1984
01:15:04,870 --> 01:15:02,480
better for that

1985
01:15:06,070 --> 01:15:04,880
but yes at some future point in time we

1986
01:15:08,790 --> 01:15:06,080
can definitely do

1987
01:15:09,990 --> 01:15:08,800
uh you know uh white baseline stereo

1988
01:15:14,149 --> 01:15:10,000

imaging

1989
01:15:19,350 --> 01:15:17,350
thank you and we also have some social

1990
01:15:22,229 --> 01:15:19,360
media questions coming in

1991
01:15:23,189 --> 01:15:22,239
fred on facebook asks are you going to

1992
01:15:27,990 --> 01:15:23,199
make a map

1993
01:15:31,430 --> 01:15:30,149
so i can take that too uh yes there is

1994
01:15:33,669 --> 01:15:31,440
actually a

1995
01:15:35,350 --> 01:15:33,679
a mapping team that works closely with

1996
01:15:37,510 --> 01:15:35,360
all the perseverance images

1997
01:15:40,229 --> 01:15:37,520
everything that they do there is a whole

1998
01:15:41,750 --> 01:15:40,239
pipeline of processing which results in

1999
01:15:44,870 --> 01:15:41,760
map type products that come out of the

2000
01:15:47,350 --> 01:15:44,880
other end and we have been feeding our

2001
01:15:48,390 --> 01:15:47,360
images from our cameras to that same

2002
01:15:50,229 --> 01:15:48,400
team

2003
01:15:51,750 --> 01:15:50,239
and they have been building up uh and

2004
01:15:53,590 --> 01:15:51,760
they're getting ready in fact to build

2005
01:15:55,990 --> 01:15:53,600
this digital elevation map which is that

2006
01:15:57,669 --> 01:15:56,000
first product from this long transect

2007
01:15:59,350 --> 01:15:57,679
and there are other map products that

2008
01:16:02,470 --> 01:15:59,360
they can do they have the

2009
01:16:04,790 --> 01:16:02,480
good models of both our cameras so as

2010
01:16:06,630 --> 01:16:04,800
long as they get their images which we

2011
01:16:08,470 --> 01:16:06,640
hand on to them they can process it and

2012
01:16:11,270 --> 01:16:08,480
they will prioritize how they process it

2013
01:16:13,350 --> 01:16:11,280

depending upon what the need is

2014
01:16:15,590 --> 01:16:13,360
thanks another social media question

2015
01:16:17,830 --> 01:16:15,600
that guy crafter on twitter asks

2016
01:16:19,669 --> 01:16:17,840
will the data from ingenuity be useful

2017
01:16:22,149 --> 01:16:19,679
for the dragonfly mission on

2018
01:16:22,790 --> 01:16:22,159
titan or are the environments too

2019
01:16:26,390 --> 01:16:22,800
different

2020
01:16:29,830 --> 01:16:26,400
for it to be relevant lori

2021
01:16:31,669 --> 01:16:29,840
sure so i'm sure that that bob and mimi

2022
01:16:34,070 --> 01:16:31,679
can also say but

2023
01:16:35,189 --> 01:16:34,080
the teams have already started talking

2024
01:16:36,790 --> 01:16:35,199
to each other and

2025
01:16:38,229 --> 01:16:36,800
and yes the environments are very

2026
01:16:39,910 --> 01:16:38,239
different but we are talking about

2027
01:16:42,229 --> 01:16:39,920
remotely operating

2028
01:16:44,550 --> 01:16:42,239
um a rotor craft in another environment

2029
01:16:47,750 --> 01:16:44,560
um and so i think there's a lot of

2030
01:16:49,750 --> 01:16:47,760
a lot of of uh information that can feed

2031
01:16:51,590 --> 01:16:49,760
forward about how we're operating this

2032
01:16:53,669 --> 01:16:51,600
rotorcraft on mars that can

2033
01:16:54,630 --> 01:16:53,679
be helpful to the dragonfly team as they

2034
01:16:56,310 --> 01:16:54,640
develop their

2035
01:16:58,709 --> 01:16:56,320
rotorcraft which of course will fly on

2036
01:17:00,390 --> 01:16:58,719
titan and as i said i believe the teams

2037
01:17:02,630 --> 01:17:00,400
are already speaking to each other about

2038
01:17:04,950 --> 01:17:02,640

about how how they can uh how the

2039
01:17:08,790 --> 01:17:04,960
dragonfly team can build on uh what has

2040
01:17:12,630 --> 01:17:10,790
you want to weigh into mimi or bob oh

2041
01:17:14,950 --> 01:17:12,640
okay yeah so one aspect

2042
01:17:15,669 --> 01:17:14,960
i think you know uh bob and i in our

2043
01:17:17,750 --> 01:17:15,679
journey

2044
01:17:19,830 --> 01:17:17,760
from inventing going from inventing the

2045
01:17:20,310 --> 01:17:19,840
helicopter in parallel we found

2046
01:17:22,149 --> 01:17:20,320
ourselves

2047
01:17:23,590 --> 01:17:22,159
inventing the verification and

2048
01:17:25,910 --> 01:17:23,600
validation approach

2049
01:17:28,630 --> 01:17:25,920
how do you test a rotorcraft that's

2050
01:17:30,229 --> 01:17:28,640
going to fly on another planetary target

2051
01:17:32,310 --> 01:17:30,239
right how do you test on earth

2052
01:17:34,550 --> 01:17:32,320
and that itself has been a journey so

2053
01:17:35,750 --> 01:17:34,560
for example that is one area that we can

2054
01:17:38,550 --> 01:17:35,760
really contribute

2055
01:17:39,990 --> 01:17:38,560
to future aerial uh vehicles for other

2056
01:17:41,910 --> 01:17:40,000
planetary targets and yes

2057
01:17:43,270 --> 01:17:41,920
we are in communication in fact uh

2058
01:17:45,430 --> 01:17:43,280
michael rickskivich

2059
01:17:46,950 --> 01:17:45,440
what's our independent review chair for

2060
01:17:49,910 --> 01:17:46,960
the ingenuity's uh

2061
01:17:50,709 --> 01:17:49,920
entire development phase so definitely

2062
01:17:52,709 --> 01:17:50,719
connected

2063
01:17:54,070 --> 01:17:52,719

and the second aspect that ingenuity can

2064
01:17:57,430 --> 01:17:54,080
contribute to future

2065
01:17:59,030 --> 01:17:57,440
aerial uh platform missions is how to

2066
01:17:59,990 --> 01:17:59,040
operate it right at these large

2067
01:18:02,310 --> 01:18:00,000
distances

2068
01:18:03,350 --> 01:18:02,320
how do we operate it from earth and

2069
01:18:05,910 --> 01:18:03,360
that's also a

2070
01:18:07,430 --> 01:18:05,920
very highly valuable information and

2071
01:18:09,030 --> 01:18:07,440
then of course with the latest now the

2072
01:18:11,830 --> 01:18:09,040
opportunity that we're getting

2073
01:18:13,430 --> 01:18:11,840
in the operational demonstration phase

2074
01:18:15,910 --> 01:18:13,440
now we can go a step further

2075
01:18:17,990 --> 01:18:15,920
you know we will be looking at potential

2076
01:18:20,550 --> 01:18:18,000
use cases and potential products

2077
01:18:21,350 --> 01:18:20,560
that can really help operations as well

2078
01:18:23,990 --> 01:18:21,360
as science

2079
01:18:25,430 --> 01:18:24,000
exploration aspects of it and uh will be

2080
01:18:29,030 --> 01:18:25,440
you know we're very proud to be able to

2081
01:18:32,630 --> 01:18:30,630
thank you another question coming in

2082
01:18:35,510 --> 01:18:32,640
from twitter kumar asks

2083
01:18:36,310 --> 01:18:35,520
how long theoretically can it stay

2084
01:18:38,229 --> 01:18:36,320
afloat

2085
01:18:40,149 --> 01:18:38,239
in the air with its batteries fully

2086
01:18:41,830 --> 01:18:40,159
charged by the solar panels soon they're

2087
01:18:44,950 --> 01:18:41,840
talking about ingenuity here

2088
01:18:47,910 --> 01:18:44,960

yeah so our constraint is not the energy

2089
01:18:49,350 --> 01:18:47,920
in the battery uh we actually preserve

2090
01:18:50,310 --> 01:18:49,360
most of the energy for staying warm

2091
01:18:51,830 --> 01:18:50,320
through the night

2092
01:18:53,830 --> 01:18:51,840
the constraint really is a thermal

2093
01:18:54,630 --> 01:18:53,840
constraint on how long we can operate

2094
01:18:57,350 --> 01:18:54,640
the motors

2095
01:18:59,350 --> 01:18:57,360
since we were a technology demonstration

2096
01:19:01,189 --> 01:18:59,360
designed for short flights

2097
01:19:02,709 --> 01:19:01,199
all the waste heat in the motor actually

2098
01:19:05,510 --> 01:19:02,719
gets absorbed in the motor

2099
01:19:06,630 --> 01:19:05,520
and the motor temperature rises by about

2100
01:19:09,590 --> 01:19:06,640
one degrees

2101
01:19:10,790 --> 01:19:09,600
centigrade per every second of operation

2102
01:19:12,390 --> 01:19:10,800
so we have to

2103
01:19:14,229 --> 01:19:12,400
manage that and that's the ultimate

2104
01:19:16,390 --> 01:19:14,239
limit that keeps us uh you know

2105
01:19:18,550 --> 01:19:16,400
puts a constraint on the the time it's

2106
01:19:20,229 --> 01:19:18,560
not so much the energy in the battery

2107
01:19:21,990 --> 01:19:20,239
we have plenty of energy that uh if you

2108
01:19:25,590 --> 01:19:22,000
wanted to fly longer but it's the

2109
01:19:27,990 --> 01:19:25,600
purely a thermal temperature constraint

2110
01:19:29,910 --> 01:19:28,000
and then arno on youtube asks how

2111
01:19:32,550 --> 01:19:29,920
excited are you guys on a scale

2112
01:19:34,830 --> 01:19:32,560
from 1 to 10 now that ingenuity will

2113
01:19:38,630 --> 01:19:34,840

keep flying

2114
01:19:42,709 --> 01:19:40,870
i don't know i think uh i saw mimi jump

2115
01:19:43,830 --> 01:19:42,719
up and down the chair when mentioned ut

2116
01:19:45,830 --> 01:19:43,840
flew that first time

2117
01:19:47,830 --> 01:19:45,840
and i'm not quite sure i can quite get

2118
01:19:49,189 --> 01:19:47,840
that energy level but it's been awesome

2119
01:19:51,030 --> 01:19:49,199
it's been awesome so i don't want to put

2120
01:19:53,030 --> 01:19:51,040
a number to it sounds like it's off the

2121
01:19:55,990 --> 01:19:53,040
charts for you mimi

2122
01:19:56,630 --> 01:19:56,000
and then our final social media question

2123
01:19:59,910 --> 01:19:56,640
charles

2124
01:20:02,790 --> 01:19:59,920
on facebook asks the human race

2125
01:20:04,390 --> 01:20:02,800
at its best when it is trying to achieve

2126
01:20:06,790 --> 01:20:04,400
the impossible

2127
01:20:11,430 --> 01:20:06,800
how can the public help nasa continue

2128
01:20:17,830 --> 01:20:14,709
hi that's a great question

2129
01:20:19,750 --> 01:20:17,840
you know part of what we do with

2130
01:20:22,310 --> 01:20:19,760
everything we're doing in nasa

2131
01:20:23,910 --> 01:20:22,320
is to inspire you know we want to learn

2132
01:20:26,070 --> 01:20:23,920
we want to understand

2133
01:20:27,510 --> 01:20:26,080
uh our you know within planetary we

2134
01:20:29,189 --> 01:20:27,520
understand the solar system and all of

2135
01:20:30,310 --> 01:20:29,199
the the planets and bodies that make up

2136
01:20:31,990 --> 01:20:30,320
our solar system

2137
01:20:33,750 --> 01:20:32,000
but then we want to take that learning

2138
01:20:36,149 --> 01:20:33,760

and what we what we've learned and

2139
01:20:36,870 --> 01:20:36,159
inspire uh the public and everyone

2140
01:20:39,430 --> 01:20:36,880
around

2141
01:20:40,870 --> 01:20:39,440
and so i think uh from the public side

2142
01:20:42,550 --> 01:20:40,880
the support of everything that we're

2143
01:20:44,709 --> 01:20:42,560
doing the incredible support we've seen

2144
01:20:46,709 --> 01:20:44,719
from the public of both perseverance and

2145
01:20:48,790 --> 01:20:46,719
ingenuity has just been

2146
01:20:50,310 --> 01:20:48,800
absolutely wonderful we're just so

2147
01:20:52,709 --> 01:20:50,320
thankful and so happy that

2148
01:20:54,550 --> 01:20:52,719
we can take the whole world uh with us

2149
01:20:55,110 --> 01:20:54,560
along with us on this incredible journey

2150
01:20:58,229 --> 01:20:55,120
to

2151
01:21:01,189 --> 01:20:58,239
explore jezreel crater

2152
01:21:03,189 --> 01:21:01,199
thank you so much now if members of the

2153
01:21:06,629 --> 01:21:03,199
media have additional questions

2154
01:21:07,590 --> 01:21:06,639
please call jpl's digital news and media

2155
01:21:09,350 --> 01:21:07,600
office

2156
01:21:11,110 --> 01:21:09,360
we'll also continue to answer social

2157
01:21:12,950 --> 01:21:11,120
media questions online

2158
01:21:15,110 --> 01:21:12,960
thank you for all your questions and

2159
01:21:16,229 --> 01:21:15,120
thank you to our panelists for joining

2160
01:21:17,990 --> 01:21:16,239
us today

2161
01:21:20,430 --> 01:21:18,000
to learn more about the ingenuity

2162
01:21:23,669 --> 01:21:20,440
helicopter visit

2163
01:21:25,669 --> 01:21:23,679

go.nasa.gov ingenuity

2164
01:21:27,870 --> 01:21:25,679
to learn more about the perseverance

2165
01:21:31,110 --> 01:21:27,880
rover visit

2166
01:21:33,990 --> 01:21:31,120
mars.nasa.gov perseverance

2167
01:21:35,990 --> 01:21:34,000
there you can also see the latest images

2168
01:21:38,149 --> 01:21:36,000
coming down from the rover

2169
01:21:40,470 --> 01:21:38,159
and if you're on social media join the

2170
01:21:43,510 --> 01:21:40,480
conversation about the helicopter

2171
01:21:46,550 --> 01:21:43,520
by following at nasa jpl

2172
01:21:48,310 --> 01:21:46,560
and use the hashtag mars helicopter

2173
01:21:49,830 --> 01:21:48,320
you can join the conversation about the

2174
01:21:53,350 --> 01:21:49,840
rover by following