1
00:00:04,230 --> 00:00:01,829
wanted to take a minute and celebrate

2
00:00:06,190 --> 00:00:04,240
the first powered controlled flight on

3
00:00:07,220 --> 00:00:06,200
another planet

4
00:00:12,740 --> 00:00:07,230
[Music]

5
00:00:14,789 --> 00:00:12,750
[Applause]

6
00:00:17,269 --> 00:00:14,799
[Laughter]

7
00:00:18,390 --> 00:00:17,279
virtual high fives all around covent

8
00:00:20,390 --> 00:00:18,400
safe

9
00:00:22,630 --> 00:00:20,400
all right now i wanted to note that we

10
00:00:24,790 --> 00:00:22,640
are going to take some questions

11
00:00:26,550 --> 00:00:24,800
those of you on the media telecon if you

12
00:00:28,550 --> 00:00:26,560
want to put yourself in the queue please

13
00:00:30,630 --> 00:00:28,560

press star one

14
00:00:33,270 --> 00:00:30,640
anyone with questions can also ask

15
00:00:34,950 --> 00:00:33,280
questions using the hashtag mars

16
00:00:36,630 --> 00:00:34,960
helicopter

17
00:00:39,510 --> 00:00:36,640
okay so let's get started with steve

18
00:00:41,670 --> 00:00:39,520
jurusik who will then hand over to uh

19
00:00:43,990 --> 00:00:41,680
michael watkins at the lectern

20
00:00:46,950 --> 00:00:44,000
go ahead

21
00:00:49,430 --> 00:00:46,960
hey thank you um so first i just want to

22
00:00:51,270 --> 00:00:49,440
congratulate the team on an amazing

23
00:00:55,110 --> 00:00:51,280
historic first

24
00:00:57,430 --> 00:00:55,120
um congratulations uh to mimi bob and

25
00:00:59,910 --> 00:00:57,440
ovard um

26
00:01:02,229 --> 00:00:59,920
just amazing like you said first control

27
00:01:03,670 --> 00:01:02,239
power flight on another planet planet

28
00:01:05,509 --> 00:01:03,680
just truly amazing i also want to

29
00:01:07,830 --> 00:01:05,519
congratulate the entire perseverance

30
00:01:09,590 --> 00:01:07,840
team uh you know this the helicopter was

31
00:01:11,270 --> 00:01:09,600
added somewhat late you know to the

32
00:01:13,190 --> 00:01:11,280
project which made it really challenging

33
00:01:15,429 --> 00:01:13,200
not only for the helicopter team but

34
00:01:18,789 --> 00:01:15,439
also for the perseverance team

35
00:01:19,830 --> 00:01:18,799
um so for for uh john and

36
00:01:22,390 --> 00:01:19,840
matt

37
00:01:23,429 --> 00:01:22,400
um and the perseverance team who had a

38
00:01:25,590 --> 00:01:23,439

integrate that figured out how to

39
00:01:28,070 --> 00:01:25,600
integrate the helicopter on perseverance

40
00:01:31,190 --> 00:01:28,080
and deliver to the surface and deploy it

41
00:01:33,350 --> 00:01:31,200
and uh and for jen and uh and her team

42
00:01:35,350 --> 00:01:33,360
the ops team who supported

43
00:01:37,670 --> 00:01:35,360
uh this historic first flight

44
00:01:40,630 --> 00:01:37,680
congratulations to everybody

45
00:01:43,910 --> 00:01:40,640
this was this wasn't really a um

46
00:01:45,670 --> 00:01:43,920
all hands on deck effort um it involved

47
00:01:47,190 --> 00:01:45,680
aeronautics research mission directorate

48
00:01:49,030 --> 00:01:47,200
the space technology mission director

49
00:01:50,310 --> 00:01:49,040
and the science mission directorate it

50
00:01:53,030 --> 00:01:50,320
involved

51
00:01:54,550 --> 00:01:53,040
um jpl of course but also the ames

52
00:01:56,550 --> 00:01:54,560
research center and the langley research

53
00:01:59,190 --> 00:01:56,560
center is really

54
00:02:02,230 --> 00:01:59,200
a unique somewhat unique integration

55
00:02:04,630 --> 00:02:02,240
of our air and rs research

56
00:02:06,389 --> 00:02:04,640
talent capabilities and our space

57
00:02:09,190 --> 00:02:06,399
systems development

58
00:02:11,990 --> 00:02:09,200
capability um that reel is was able to

59
00:02:14,150 --> 00:02:12,000
uh to do that accomplish this amazing

60
00:02:15,270 --> 00:02:14,160
amazing flight uh very early this

61
00:02:18,470 --> 00:02:15,280
morning

62
00:02:21,110 --> 00:02:18,480
uh justin i feel like i've followed

63
00:02:22,869 --> 00:02:21,120

along with the team um while i was at

64
00:02:24,630 --> 00:02:22,879
langley and then at headquarters in

65
00:02:26,630 --> 00:02:24,640
space tech and then in the

66
00:02:29,110 --> 00:02:26,640
in the associate administrator role i

67
00:02:30,710 --> 00:02:29,120
think a trip to jpl about once every

68
00:02:33,589 --> 00:02:30,720
year and they'd always take me over to

69
00:02:35,430 --> 00:02:33,599
mimi's mimi's lab the mars helicopter

70
00:02:36,949 --> 00:02:35,440
lab and mimi would tell me

71
00:02:38,470 --> 00:02:36,959
what they've accomplished and all the

72
00:02:40,070 --> 00:02:38,480
challenges they've had and what they've

73
00:02:41,350 --> 00:02:40,080
had to overcome

74
00:02:44,710 --> 00:02:41,360
and her

75
00:02:46,630 --> 00:02:44,720
just excitement and food and enthusiasm

76
00:02:48,309 --> 00:02:46,640
for making this happen making this

77
00:02:51,190 --> 00:02:48,319
happen was infectious

78
00:02:52,869 --> 00:02:51,200
um and uh i think her leadership along

79
00:02:54,150 --> 00:02:52,879
with the talent of the team

80
00:02:56,390 --> 00:02:54,160
uh

81
00:02:59,830 --> 00:02:56,400
made me believe that they could do it

82
00:03:00,630 --> 00:02:59,840
and they did so again congratulations

83
00:03:03,190 --> 00:03:00,640
um

84
00:03:04,390 --> 00:03:03,200
many many challenges uh including having

85
00:03:06,470 --> 00:03:04,400
to complete

86
00:03:09,270 --> 00:03:06,480
um complete the helicopter develop

87
00:03:11,350 --> 00:03:09,280
during a global pandemic um

88
00:03:13,110 --> 00:03:11,360

they had to get the size and weight of

89
00:03:14,149 --> 00:03:13,120
the helicopter down so they could

90
00:03:17,350 --> 00:03:14,159
achieve

91
00:03:20,309 --> 00:03:17,360
you know lift uh using rotary blades in

92
00:03:21,830 --> 00:03:20,319
a in a very thin atmosphere

93
00:03:22,710 --> 00:03:21,840
and uh and then of course they had

94
00:03:24,710 --> 00:03:22,720
another

95
00:03:25,750 --> 00:03:24,720
late challenge with having to do a

96
00:03:26,869 --> 00:03:25,760
software

97
00:03:33,670 --> 00:03:26,879
uh

98
00:03:36,390 --> 00:03:33,680
a helicopter 180 million miles from from

99
00:03:38,789 --> 00:03:36,400
earth so just a just an amazing job um

100
00:03:41,030 --> 00:03:38,799
this really is a wright brothers moment

101
00:03:42,949 --> 00:03:41,040
um it's a start of a whole new kind of

102
00:03:45,110 --> 00:03:42,959
planetary exploration

103
00:03:46,630 --> 00:03:45,120
um and uh engine and will build on

104
00:03:48,229 --> 00:03:46,640
ingenuity success

105
00:03:50,309 --> 00:03:48,239
um to see how we can deploy this

106
00:03:51,430 --> 00:03:50,319
capability on future future mars

107
00:03:53,830 --> 00:03:51,440
missions

108
00:03:55,509 --> 00:03:53,840
um we we have this evolution of

109
00:03:57,190 --> 00:03:55,519
exploring um

110
00:03:59,429 --> 00:03:57,200
planets in the solar system first we do

111
00:04:01,190 --> 00:03:59,439
a flyby then we'll do an orbiter mission

112
00:04:04,470 --> 00:04:01,200
then we'll do a land remission and we'll

113
00:04:06,869 --> 00:04:04,480

land a rover and now we've added another

114
00:04:08,630 --> 00:04:06,879
evolutional capability there of flight

115
00:04:10,869 --> 00:04:08,640
on another planet

116
00:04:13,509 --> 00:04:10,879
um ingenuity is a top was a technology

117
00:04:15,750 --> 00:04:13,519
demonstration an experimental mission

118
00:04:18,390 --> 00:04:15,760
um and um budget

119
00:04:21,270 --> 00:04:18,400
its success is is is truly remarkable

120
00:04:25,189 --> 00:04:21,280
and it gives us this this new capability

121
00:04:28,070 --> 00:04:25,199
i believe um along with uh with mike and

122
00:04:29,990 --> 00:04:28,080
thomas that we should be doing these uh

123
00:04:32,310 --> 00:04:30,000
types of technology demonstrations on

124
00:04:35,110 --> 00:04:32,320
all our science missions um to take

125
00:04:37,670 --> 00:04:35,120
advantage of of the ability to prove out

126
00:04:39,990 --> 00:04:37,680
new technologies and capabilities

127
00:04:42,469 --> 00:04:40,000
that will then feed forward to even more

128
00:04:43,909 --> 00:04:42,479
uh ambitious and productive missions in

129
00:04:46,310 --> 00:04:43,919
the future

130
00:04:49,030 --> 00:04:46,320
uh so you all exemplified what it means

131
00:04:49,990 --> 00:04:49,040
to be part of this this amazing nasa

132
00:04:51,830 --> 00:04:50,000
team

133
00:04:55,189 --> 00:04:51,840
um

134
00:04:57,990 --> 00:04:55,199
many many uh many organizations

135
00:05:00,710 --> 00:04:58,000
and um and you came up with this sort of

136
00:05:02,469 --> 00:05:00,720
this dream and this innovative idea and

137
00:05:04,150 --> 00:05:02,479
you can't overcame all the challenges

138
00:05:06,629 --> 00:05:04,160

and made it happen this could be not

139
00:05:08,150 --> 00:05:06,639
more could not be more proud of the team

140
00:05:10,950 --> 00:05:08,160
um

141
00:05:12,710 --> 00:05:10,960
again you know in in the global pandemic

142
00:05:14,550 --> 00:05:12,720
launching perseverance landing

143
00:05:17,189 --> 00:05:14,560
perseverance and now deploying and

144
00:05:18,550 --> 00:05:17,199
flying the helicopter um just just

145
00:05:20,230 --> 00:05:18,560
incredible just incredible

146
00:05:23,749 --> 00:05:20,240
congratulations again

147
00:05:26,710 --> 00:05:23,759
um you do you all really personify

148
00:05:28,469 --> 00:05:26,720
the motto of dare mighty things and

149
00:05:30,629 --> 00:05:28,479
embody our nation's spirit of

150
00:05:32,150 --> 00:05:30,639
persevering even the most challenging

151
00:05:34,390 --> 00:05:32,160
situation

152
00:05:36,310 --> 00:05:34,400
and you are providing inspiration and

153
00:05:38,230 --> 00:05:36,320
advancing science and exploration for

154
00:05:40,790 --> 00:05:38,240
not only the united states but for the

155
00:05:43,510 --> 00:05:40,800
world so congratula congratulations

156
00:05:46,310 --> 00:05:43,520
again and with that i'd like to hand it

157
00:05:47,830 --> 00:05:46,320
over to mike watkins

158
00:05:50,070 --> 00:05:47,840
okay thank you steve

159
00:05:52,230 --> 00:05:50,080
um it has been a great day here at jpl

160
00:05:54,390 --> 00:05:52,240
and we're very proud that we are are

161
00:05:55,909 --> 00:05:54,400
continuing to be at the forefront of

162
00:05:57,510 --> 00:05:55,919
daring mighty things in planetary

163
00:05:58,790 --> 00:05:57,520

exploration

164
00:06:01,430 --> 00:05:58,800
and i wanted to build on something that

165
00:06:04,230 --> 00:06:01,440
you noted uh which is that uh ingenuity

166
00:06:06,870 --> 00:06:04,240
is a technology demonstration right it

167
00:06:09,670 --> 00:06:06,880
builds for the future and in many ways

168
00:06:11,110 --> 00:06:09,680
uh it is a perfect example of how we

169
00:06:13,430 --> 00:06:11,120
need to be doing technology and how we

170
00:06:14,790 --> 00:06:13,440
need to develop technology and the

171
00:06:15,510 --> 00:06:14,800
brilliant engineers some of whom you'll

172
00:06:17,909 --> 00:06:15,520
see

173
00:06:19,670 --> 00:06:17,919
in the orange shirts um you know came up

174
00:06:21,590 --> 00:06:19,680
with the idea for ingenuity for a mars

175
00:06:24,710 --> 00:06:21,600
helicopter before we had a name

176
00:06:26,790 --> 00:06:24,720
ingenuity uh over seven years ago

177
00:06:28,150 --> 00:06:26,800
and uh and and there was a push from

178
00:06:30,390 --> 00:06:28,160
technology

179
00:06:32,150 --> 00:06:30,400
but it wasn't quite clear at that time

180
00:06:35,189 --> 00:06:32,160
was it really the right uh instrument

181
00:06:37,029 --> 00:06:35,199
was really the right uh

182
00:06:38,550 --> 00:06:37,039
thing a helicopter to put on on the

183
00:06:41,189 --> 00:06:38,560
perseverance rover

184
00:06:43,189 --> 00:06:41,199
and so we did what we felt was right

185
00:06:45,670 --> 00:06:43,199
which was we stuck to it and we kept

186
00:06:47,909 --> 00:06:45,680
working on on on the mars helicopter we

187
00:06:49,510 --> 00:06:47,919
kept overcoming technological hurdles

188
00:06:51,430 --> 00:06:49,520

and we kept showing why would be

189
00:06:52,790 --> 00:06:51,440
valuable as a scientific instrument in

190
00:06:55,909 --> 00:06:52,800
the future

191
00:06:58,870 --> 00:06:55,919
and a combination of of rugged support

192
00:07:01,749 --> 00:06:58,880
uh from jpl in terms of of of technology

193
00:07:03,589 --> 00:07:01,759
development as well as nasa headquarters

194
00:07:05,189 --> 00:07:03,599
and an exceptional team that overcame

195
00:07:07,670 --> 00:07:05,199
all the technical technological

196
00:07:09,510 --> 00:07:07,680
challenges one by one until it became

197
00:07:11,189 --> 00:07:09,520
obvious that the right thing to do was

198
00:07:14,309 --> 00:07:11,199
to put it on perseverance and fly it to

199
00:07:15,909 --> 00:07:14,319
mars as a full demonstration and i think

200
00:07:17,430 --> 00:07:15,919
that's the kind of partnership the kind

201
00:07:19,589 --> 00:07:17,440
of push of technology and pull of

202
00:07:21,589 --> 00:07:19,599
science uh that we are now seeing to be

203
00:07:23,350 --> 00:07:21,599
very productive within nasa and actually

204
00:07:25,909 --> 00:07:23,360
we're working on several other missions

205
00:07:27,749 --> 00:07:25,919
uh that have technology uh components uh

206
00:07:29,589 --> 00:07:27,759
much like ingenuity uh but going to

207
00:07:31,110 --> 00:07:29,599
other parts of the solar system

208
00:07:33,990 --> 00:07:31,120
as well

209
00:07:36,309 --> 00:07:34,000
now our brilliant team

210
00:07:37,830 --> 00:07:36,319
has overcome a number of challenges

211
00:07:39,749 --> 00:07:37,840
and for those of you that remember back

212
00:07:41,589 --> 00:07:39,759
in 1997

213
00:07:44,309 --> 00:07:41,599

we had a mission called mars pathfinder

214
00:07:46,390 --> 00:07:44,319
and had effectively a technology demo

215
00:07:48,950 --> 00:07:46,400
called the sojourner rover and that

216
00:07:50,710 --> 00:07:48,960
freed us up from being in this plot the

217
00:07:52,469 --> 00:07:50,720
place we stuck the landing to being able

218
00:07:54,629 --> 00:07:52,479
to drive around and now of course those

219
00:07:56,869 --> 00:07:54,639
rovers have become curiosity and our

220
00:07:58,869 --> 00:07:56,879
latest perseverance capable of driving

221
00:08:00,790 --> 00:07:58,879
tens of miles on the surface

222
00:08:03,189 --> 00:08:00,800
and going to the best places for

223
00:08:05,589 --> 00:08:03,199
scientific discovery well what what the

224
00:08:07,350 --> 00:08:05,599
ingenuity team has done is given us the

225
00:08:09,189 --> 00:08:07,360
third dimension they freed us from the

226
00:08:11,029 --> 00:08:09,199
surface now forever in planetary

227
00:08:12,950 --> 00:08:11,039
exploration so that we can now make a

228
00:08:14,869 --> 00:08:12,960
combination of course of driving on the

229
00:08:17,029 --> 00:08:14,879
surface and sampling the surface and

230
00:08:19,589 --> 00:08:17,039
doing reconnaissance and even scientific

231
00:08:20,950 --> 00:08:19,599
experimentation on inaccessible places

232
00:08:22,710 --> 00:08:20,960
for a rover

233
00:08:24,629 --> 00:08:22,720
and i think this is exactly

234
00:08:26,309 --> 00:08:24,639
the way we build the future

235
00:08:29,110 --> 00:08:26,319
and i think you'll hear a lot more about

236
00:08:32,149 --> 00:08:29,120
the scientific promise uh of of uh

237
00:08:34,469 --> 00:08:32,159
rotorcraft on mars as part of of and

238
00:08:36,389 --> 00:08:34,479

other planets uh as part of the science

239
00:08:38,550 --> 00:08:36,399
mission directorate portfolio and to

240
00:08:40,230 --> 00:08:38,560
talk about the importance of ingenuity

241
00:08:42,790 --> 00:08:40,240
and some of the future i'd like to turn

242
00:08:44,310 --> 00:08:42,800
over to my colleague dr thomas zurbukin

243
00:08:45,910 --> 00:08:44,320
who is the associate administrator for

244
00:08:47,030 --> 00:08:45,920
the science mission directorate at nasa

245
00:08:48,070 --> 00:08:47,040
headquarters

246
00:08:50,630 --> 00:08:48,080
thomas

247
00:08:52,790 --> 00:08:50,640
yeah thanks so much mike and uh i just

248
00:08:55,030 --> 00:08:52,800
want to tell you uh as i'm starting here

249
00:08:57,990 --> 00:08:55,040
i'm just so proud to be on the up here

250
00:09:00,310 --> 00:08:58,000
or next to me you know especially that

251
00:09:02,550 --> 00:09:00,320
team here also on the monitor and i just

252
00:09:05,590 --> 00:09:02,560
want to tell you on behalf of all of us

253
00:09:08,710 --> 00:09:05,600
at nasa science how proud we are of you

254
00:09:11,670 --> 00:09:08,720
and how we recognize how important you

255
00:09:13,829 --> 00:09:11,680
are for this particular success so just

256
00:09:15,270 --> 00:09:13,839
want to ask one more time everybody to

257
00:09:22,630 --> 00:09:15,280
join me

258
00:09:26,630 --> 00:09:22,640
[Applause]

259
00:09:27,829 --> 00:09:26,640
the story of this team is

260
00:09:29,829 --> 00:09:27,839
compelling

261
00:09:31,910 --> 00:09:29,839
it's a story of a

262
00:09:33,750 --> 00:09:31,920
great perhaps even a crazy idea

263
00:09:35,590 --> 00:09:33,760

initially many people

264
00:09:37,670 --> 00:09:35,600
uh you know have a really hard time it

265
00:09:40,070 --> 00:09:37,680
turns out we all have a hard time

266
00:09:41,430 --> 00:09:40,080
you know finding that right

267
00:09:43,110 --> 00:09:41,440
line between

268
00:09:45,910 --> 00:09:43,120
crazy and innovative if it turns out

269
00:09:47,269 --> 00:09:45,920
we're often wrong with that line a crazy

270
00:09:49,670 --> 00:09:47,279
idea that

271
00:09:52,310 --> 00:09:49,680
was being developed and this team

272
00:09:54,070 --> 00:09:52,320
put the idea into reality

273
00:09:56,070 --> 00:09:54,080
the most important thing that takes of

274
00:09:57,910 --> 00:09:56,080
course is hope

275
00:10:02,150 --> 00:09:57,920
it's the hope that that is actually

276
00:10:04,230 --> 00:10:02,160
possible to come together with the me

277
00:10:05,269 --> 00:10:04,240
with everything this team has with the

278
00:10:08,230 --> 00:10:05,279
personal

279
00:10:10,389 --> 00:10:08,240
education with the commitment to success

280
00:10:11,509 --> 00:10:10,399
and with learning from each other

281
00:10:14,550 --> 00:10:11,519
until

282
00:10:17,030 --> 00:10:14,560
it actually works so for me uh what i

283
00:10:18,949 --> 00:10:17,040
want to point to is the first picture

284
00:10:21,509 --> 00:10:18,959
here and i want to just tell you

285
00:10:23,670 --> 00:10:21,519
this picture means two things for me

286
00:10:27,350 --> 00:10:23,680
on the fir one hand i recognize that

287
00:10:29,750 --> 00:10:27,360
this picture was taken from the fun seal

288
00:10:32,069 --> 00:10:29,760

overlook and my friend jacob is no

289
00:10:34,630 --> 00:10:32,079
longer with me i see in this picture

290
00:10:37,910 --> 00:10:34,640
because i know that he was an important

291
00:10:40,069 --> 00:10:37,920
part of making this helicopter happen

292
00:10:41,590 --> 00:10:40,079
the second thing that is important in

293
00:10:43,990 --> 00:10:41,600
this picture is what you don't know

294
00:10:47,750 --> 00:10:44,000
right now as you look at it it's

295
00:10:51,190 --> 00:10:47,760
actually the after flight picture and so

296
00:10:52,550 --> 00:10:51,200
it landed there and it landed on the

297
00:10:55,590 --> 00:10:52,560
surface

298
00:10:57,750 --> 00:10:55,600
after this flight and it did so safely

299
00:11:00,069 --> 00:10:57,760
and so for me again what i see in this

300
00:11:01,190 --> 00:11:00,079
is now not only this amazing little

301
00:11:03,430 --> 00:11:01,200
machine

302
00:11:05,030 --> 00:11:03,440
but the team that actually

303
00:11:05,829 --> 00:11:05,040
achieved that and

304
00:11:09,750 --> 00:11:05,839
it

305
00:11:13,670 --> 00:11:09,760
relates this to a story that's 117 years

306
00:11:17,190 --> 00:11:13,680
apart and 173 million miles apart a

307
00:11:19,269 --> 00:11:17,200
story that actually started

308
00:11:21,430 --> 00:11:19,279
even earlier with a little toy that a

309
00:11:23,430 --> 00:11:21,440
father brought home to two kids they

310
00:11:25,590 --> 00:11:23,440
were about 10 years old it's a rubber

311
00:11:27,990 --> 00:11:25,600
band with a little rotor it's a little

312
00:11:30,230 --> 00:11:28,000
toy that never got out of their mind

313
00:11:32,949 --> 00:11:30,240

that became bicycle mechanics

314
00:11:34,630 --> 00:11:32,959
and they started working on this

315
00:11:36,790 --> 00:11:34,640
and actually

316
00:11:39,990 --> 00:11:36,800
did that famous

317
00:11:42,150 --> 00:11:40,000
record in 1903 when i achieved first

318
00:11:43,910 --> 00:11:42,160
control flight on this earth so when we

319
00:11:45,670 --> 00:11:43,920
look at the

320
00:11:47,990 --> 00:11:45,680
previous picture that i just saw i want

321
00:11:50,150 --> 00:11:48,000
to just tell you that in homage of this

322
00:11:52,949 --> 00:11:50,160
amazing achievement we have designated

323
00:11:56,550 --> 00:11:52,959
and please pull up the next picture

324
00:11:59,750 --> 00:11:56,560
i've designated this landing site as

325
00:12:01,910 --> 00:11:59,760
the wright brothers field we are so

326
00:12:02,870 --> 00:12:01,920
excited to have these two stories the

327
00:12:06,550 --> 00:12:02,880
story

328
00:12:09,110 --> 00:12:06,560
of ingenuity and their team related

329
00:12:12,470 --> 00:12:09,120
to the wright brothers and i just want

330
00:12:14,069 --> 00:12:12,480
to tell you as we uh go forward actually

331
00:12:16,629 --> 00:12:14,079
that connection has already been made

332
00:12:19,590 --> 00:12:16,639
and we talk about it i have here in

333
00:12:23,190 --> 00:12:19,600
front of me a little sample

334
00:12:27,030 --> 00:12:23,200
of the flyer actually the actual fabric

335
00:12:29,509 --> 00:12:27,040
that did that historic act in 1903

336
00:12:30,470 --> 00:12:29,519
and what i want to show you in the next

337
00:12:33,030 --> 00:12:30,480
movie

338
00:12:34,710 --> 00:12:33,040

is actually how this sample you see

339
00:12:36,870 --> 00:12:34,720
there's a piece missing in what i just

340
00:12:39,590 --> 00:12:36,880
showed you in the next movie i show how

341
00:12:40,870 --> 00:12:39,600
this piece that is missing was actually

342
00:12:43,670 --> 00:12:40,880
included

343
00:12:45,269 --> 00:12:43,680
on this flyer and this morning made

344
00:12:48,389 --> 00:12:45,279
history together

345
00:12:51,190 --> 00:12:48,399
with it so so for me uh mimi team

346
00:12:53,430 --> 00:12:51,200
ingenuity team you know history

347
00:12:55,990 --> 00:12:53,440
connecting those two amazing stories

348
00:12:58,629 --> 00:12:56,000
together has been made this morning and

349
00:13:00,230 --> 00:12:58,639
uh why don't you tell us more mimi young

350
00:13:02,550 --> 00:13:00,240
about it

351
00:13:03,350 --> 00:13:02,560
great thank you thomas

352
00:13:05,670 --> 00:13:03,360
well

353
00:13:07,350 --> 00:13:05,680
our team has been working over six years

354
00:13:09,030 --> 00:13:07,360
some even longer

355
00:13:11,750 --> 00:13:09,040
towards that dream

356
00:13:14,629 --> 00:13:11,760
of experimenting the first ever flight

357
00:13:15,750 --> 00:13:14,639
at mars and this morning our dream came

358
00:13:17,910 --> 00:13:15,760
true

359
00:13:20,629 --> 00:13:17,920
if we can play this video

360
00:13:22,230 --> 00:13:20,639
this is from taken from perseverance

361
00:13:35,269 --> 00:13:22,240
rover

362
00:13:38,550 --> 00:13:36,629
taking off

363
00:13:41,269 --> 00:13:38,560

goosebumps it looks

364
00:13:43,829 --> 00:13:41,279
just the way we had tested in our test

365
00:13:46,310 --> 00:13:43,839
chamber space simulation simulator

366
00:13:47,030 --> 00:13:46,320
chamber here absolutely beautiful flight

367
00:13:56,949 --> 00:13:47,040
i

368
00:14:00,150 --> 00:13:58,870
and lance

369
00:14:02,710 --> 00:14:00,160
well

370
00:14:04,550 --> 00:14:02,720
when things work um it looks easy i

371
00:14:06,870 --> 00:14:04,560
would like to take this opportunity to

372
00:14:09,750 --> 00:14:06,880
remind how difficult it is to fly a

373
00:14:11,030 --> 00:14:09,760
rotorcraft at mars uh first and foremost

374
00:14:12,870 --> 00:14:11,040
uh because

375
00:14:14,629 --> 00:14:12,880
the atmosphere there is so thin right

376
00:14:17,030 --> 00:14:14,639
about one percent compared to that at

377
00:14:18,870 --> 00:14:17,040
earth that's like on earth being

378
00:14:21,269 --> 00:14:18,880
elevation three times the height of

379
00:14:24,310 --> 00:14:21,279
himalayas so the air is very thin and

380
00:14:25,590 --> 00:14:24,320
ingenuity had to be really light small

381
00:14:27,110 --> 00:14:25,600
and

382
00:14:29,829 --> 00:14:27,120
has to be able to fly in this thin

383
00:14:30,949 --> 00:14:29,839
atmosphere and survive on its own it did

384
00:14:32,710 --> 00:14:30,959
all of that

385
00:14:35,269 --> 00:14:32,720
under four pounds

386
00:14:38,470 --> 00:14:35,279
so um bob bellarum will be talking more

387
00:14:40,150 --> 00:14:38,480
about but i did want to remind that

388
00:14:42,870 --> 00:14:40,160

well this morning was an incredible

389
00:14:46,470 --> 00:14:42,880
moment our team reaction here this

390
00:14:48,069 --> 00:14:46,480
morning this video

391
00:14:50,710 --> 00:14:48,079
it was around

392
00:14:52,550 --> 00:14:50,720
3 30 a.m this morning but it sure didn't

393
00:14:54,230 --> 00:14:52,560
feel like early in the morning it just

394
00:14:56,870 --> 00:14:54,240
felt like a

395
00:14:59,189 --> 00:14:56,880
very normal middle of the day

396
00:15:01,590 --> 00:14:59,199
extraordinary exciting data products

397
00:15:03,350 --> 00:15:01,600
confirming that we unpacked image and

398
00:15:05,189 --> 00:15:03,360
one hertz data

399
00:15:07,430 --> 00:15:05,199
this is downlink handing off to flight

400
00:15:10,230 --> 00:15:07,440
control for telemetry analysis

401
00:15:12,710 --> 00:15:10,240
swashblade servos appear healthy overall

402
00:15:14,629 --> 00:15:12,720
actuators appear healthy this flight

403
00:15:16,790 --> 00:15:14,639
control confirming that we have evrs

404
00:15:19,350 --> 00:15:16,800
from ingenuity

405
00:15:20,710 --> 00:15:19,360
engineers reporting having performed

406
00:15:22,230 --> 00:15:20,720
spin up

407
00:15:23,990 --> 00:15:22,240
takeoff

408
00:15:25,430 --> 00:15:24,000
slime

409
00:15:27,030 --> 00:15:25,440
hover

410
00:15:28,230 --> 00:15:27,040
descent

411
00:15:29,749 --> 00:15:28,240
landing

412
00:15:41,030 --> 00:15:29,759
touchdown

413
00:15:44,550 --> 00:15:42,150

and our

414
00:15:46,230 --> 00:15:44,560
altimeter data

415
00:15:48,470 --> 00:15:46,240
confirmed

416
00:15:49,910 --> 00:15:48,480
that ingenuity has performed its first

417
00:15:55,700 --> 00:15:49,920
flight

418
00:16:12,790 --> 00:16:09,430
[Applause]

419
00:16:15,590 --> 00:16:12,800
it's unforgettable day unforgettable day

420
00:16:17,990 --> 00:16:15,600
and you know it's all about the team to

421
00:16:20,389 --> 00:16:18,000
start with really you know our team

422
00:16:22,790 --> 00:16:20,399
across jpl ames

423
00:16:25,670 --> 00:16:22,800
langley with our industrial partners our

424
00:16:28,230 --> 00:16:25,680
environment qualcomm celero lockheed

425
00:16:29,590 --> 00:16:28,240
others we were a team i mean just a

426
00:16:31,670 --> 00:16:29,600
strong team

427
00:16:33,110 --> 00:16:31,680
and during this morning downlink i did

428
00:16:35,430 --> 00:16:33,120
say that we had many friends who

429
00:16:38,310 --> 00:16:35,440
contributed to our success okay and

430
00:16:40,790 --> 00:16:38,320
including perseverance rover team and

431
00:16:43,350 --> 00:16:40,800
many many others and some of them are

432
00:16:44,949 --> 00:16:43,360
far away now and again as thomas

433
00:16:47,430 --> 00:16:44,959
mentioned

434
00:16:50,629 --> 00:16:47,440
jacob jacob vancil i'm i'm sure you were

435
00:16:53,350 --> 00:16:50,639
watching our first flight from the jacob

436
00:16:55,110 --> 00:16:53,360
overlook so

437
00:16:57,829 --> 00:16:55,120
we're thinking about you david

438
00:17:00,550 --> 00:16:57,839

i'm thinking about you jacob so

439
00:17:02,389 --> 00:17:00,560
with that um this early morning uh

440
00:17:04,630 --> 00:17:02,399
flight what it means for our mission

441
00:17:06,949 --> 00:17:04,640
success

442
00:17:09,510 --> 00:17:06,959
mars helicopter ingenuity technology

443
00:17:11,829 --> 00:17:09,520
demonstration project has three goals in

444
00:17:13,909 --> 00:17:11,839
align with nasa's agency level

445
00:17:16,150 --> 00:17:13,919
objectives so the first

446
00:17:18,309 --> 00:17:16,160
is to show

447
00:17:20,710 --> 00:17:18,319
on earth that it is possible to fly

448
00:17:23,189 --> 00:17:20,720
power control flight at mars we did that

449
00:17:25,590 --> 00:17:23,199
uh before we were launched and then the

450
00:17:27,750 --> 00:17:25,600
second goal was to actually fly at mars

451
00:17:29,909 --> 00:17:27,760
we have done it this is the first time

452
00:17:32,789 --> 00:17:29,919
i've been able to say we've done it and

453
00:17:35,510 --> 00:17:32,799
the third goal is to

454
00:17:37,190 --> 00:17:35,520
get data back that will inform engineers

455
00:17:39,830 --> 00:17:37,200
that are going to design that are

456
00:17:42,150 --> 00:17:39,840
designing future generations of mars

457
00:17:44,070 --> 00:17:42,160
helicopters and we have done that too

458
00:17:46,150 --> 00:17:44,080
and we're going to continue so beyond

459
00:17:48,950 --> 00:17:46,160
this first flight over the next coming

460
00:17:51,750 --> 00:17:48,960
days we have up to four flights planned

461
00:17:54,150 --> 00:17:51,760
and increasingly difficult flights

462
00:17:55,909 --> 00:17:54,160
challenging flights and we are going to

463
00:17:57,990 --> 00:17:55,919

continually push all the way to the

464
00:17:59,990 --> 00:17:58,000
limit of this rotograph we really want

465
00:18:02,150 --> 00:18:00,000
to push the rotorcraft flights to the

466
00:18:04,870 --> 00:18:02,160
limit and really learn and get

467
00:18:08,150 --> 00:18:04,880
information back from that so with that

468
00:18:10,950 --> 00:18:08,160
i like to hand over to bob bellarum

469
00:18:13,590 --> 00:18:10,960
our chief engineer and really the

470
00:18:16,310 --> 00:18:13,600
innovator of our original design from

471
00:18:17,750 --> 00:18:16,320
mars helicopter over to you bob

472
00:18:20,150 --> 00:18:17,760
uh thank you mimi

473
00:18:22,310 --> 00:18:20,160
uh first i'd like to just take a moment

474
00:18:23,830 --> 00:18:22,320
to thank all of you for being on this

475
00:18:25,669 --> 00:18:23,840
journey with me

476
00:18:28,549 --> 00:18:25,679
uh there's been a mania technical

477
00:18:31,190 --> 00:18:28,559
conversation many a late night

478
00:18:32,630 --> 00:18:31,200
many year tests and i thank want to

479
00:18:34,150 --> 00:18:32,640
thank all of you who have been part of

480
00:18:36,789 --> 00:18:34,160
that and their families and your loved

481
00:18:37,990 --> 00:18:36,799
ones who helped you know get us to this

482
00:18:40,630 --> 00:18:38,000
point

483
00:18:41,750 --> 00:18:40,640
ingenuity itself is extremely healthy at

484
00:18:44,070 --> 00:18:41,760
this point

485
00:18:46,070 --> 00:18:44,080
in fact she's even healthier than she

486
00:18:48,230 --> 00:18:46,080
was before this flight she shook off

487
00:18:50,230 --> 00:18:48,240
some of her dust that had been covering

488
00:18:52,789 --> 00:18:50,240

her solar panels and is in fact

489
00:18:54,310 --> 00:18:52,799
producing even more solar energy uh than

490
00:18:56,549 --> 00:18:54,320
before

491
00:18:57,909 --> 00:18:56,559
the batteries are looking good

492
00:19:00,470 --> 00:18:57,919
the uh

493
00:19:02,070 --> 00:19:00,480
communication system is fantastic

494
00:19:04,470 --> 00:19:02,080
uh the landing gear appears to have

495
00:19:06,710 --> 00:19:04,480
worked well all these server mechanisms

496
00:19:07,430 --> 00:19:06,720
and motors are doing great

497
00:19:12,470 --> 00:19:07,440
the

498
00:19:13,990 --> 00:19:12,480
flawlessly so all in all it's in a

499
00:19:16,310 --> 00:19:14,000
perfect state

500
00:19:17,990 --> 00:19:16,320
and i'm just really excited to see

501
00:19:19,430 --> 00:19:18,000
what all she can teach us over the next

502
00:19:22,150 --> 00:19:19,440
few weeks

503
00:19:24,630 --> 00:19:22,160
as we explore aerial mobility on mars

504
00:19:26,630 --> 00:19:24,640
and with that uh hovard if you can tell

505
00:19:28,470 --> 00:19:26,640
us about exactly what happened during

506
00:19:30,549 --> 00:19:28,480
this flight uh that would be great thank

507
00:19:33,190 --> 00:19:30,559
you

508
00:19:35,270 --> 00:19:33,200
yeah this uh flight was all about

509
00:19:36,230 --> 00:19:35,280
proving that it is possible to fly on

510
00:19:38,549 --> 00:19:36,240
mars

511
00:19:42,230 --> 00:19:38,559
uh so to that end uh what we had

512
00:19:43,029 --> 00:19:42,240
instructed ingenuity to do was to climb

513
00:19:45,510 --> 00:19:43,039

uh

514
00:19:47,590 --> 00:19:45,520
to altitude of three meters

515
00:19:48,549 --> 00:19:47,600
hover there for a little bit about five

516
00:19:52,710 --> 00:19:48,559
seconds

517
00:19:55,430 --> 00:19:52,720
then make a turn of about 96 degrees

518
00:19:57,510 --> 00:19:55,440
hover for another 20 seconds and then go

519
00:19:59,830 --> 00:19:57,520
to land again in the same place that it

520
00:20:00,950 --> 00:19:59,840
took off from

521
00:20:02,710 --> 00:20:00,960
and

522
00:20:05,510 --> 00:20:02,720
we told that's what we told ingenuity to

523
00:20:07,350 --> 00:20:05,520
do and it did exactly that and it did it

524
00:20:09,909 --> 00:20:07,360
just perfectly

525
00:20:11,909 --> 00:20:09,919
from everything we've seen so far

526
00:20:14,470 --> 00:20:11,919
it was a flawless flight

527
00:20:16,870 --> 00:20:14,480
it was a gentle takeoff

528
00:20:19,430 --> 00:20:16,880
at altitude it gets pushed around a

529
00:20:22,070 --> 00:20:19,440
little bit by the winds but

530
00:20:24,950 --> 00:20:22,080
but it really just maintained station

531
00:20:26,870 --> 00:20:24,960
very well and it stopped the landing

532
00:20:29,029 --> 00:20:26,880
right in the place where it was supposed

533
00:20:30,390 --> 00:20:29,039
to go

534
00:20:32,710 --> 00:20:30,400
um

535
00:20:34,470 --> 00:20:32,720
when we were looking at the downlink

536
00:20:35,830 --> 00:20:34,480
data this morning

537
00:20:37,350 --> 00:20:35,840
one of the first things or the one of

538
00:20:40,230 --> 00:20:37,360

the most important things that we were

539
00:20:43,830 --> 00:20:40,240
looking for was uh this plot that you

540
00:20:46,549 --> 00:20:43,840
can see which is a plot of the altimeter

541
00:20:49,830 --> 00:20:46,559
that was really our first indication or

542
00:20:52,470 --> 00:20:49,840
real proof i should say that yeah we

543
00:20:56,310 --> 00:20:52,480
really did leave the ground uh

544
00:21:01,830 --> 00:20:59,830
uh in addition to this kind of telemetry

545
00:21:03,430 --> 00:21:01,840
during the flight itself ingenuity was

546
00:21:05,029 --> 00:21:03,440
telling us all along

547
00:21:06,710 --> 00:21:05,039
what it was doing

548
00:21:09,590 --> 00:21:06,720
and so what we were able to do with that

549
00:21:11,350 --> 00:21:09,600
data is we could take that data and and

550
00:21:13,110 --> 00:21:11,360
reconstruct the flight and create an

551
00:21:14,230 --> 00:21:13,120
animation out of it so what we're going

552
00:21:17,350 --> 00:21:14,240
to see here

553
00:21:19,669 --> 00:21:17,360
is such a reconstruction uh

554
00:21:22,310 --> 00:21:19,679
we've taken that engineering data and

555
00:21:24,310 --> 00:21:22,320
and animated the flight accordingly and

556
00:21:25,510 --> 00:21:24,320
what that allows us to do is it allows

557
00:21:27,830 --> 00:21:25,520
us to

558
00:21:30,710 --> 00:21:27,840
look at the flight in a different way

559
00:21:32,950 --> 00:21:30,720
uh for example from different angles up

560
00:21:34,549 --> 00:21:32,960
close and see kind of the small motions

561
00:21:36,470 --> 00:21:34,559
of the vehicle

562
00:21:39,350 --> 00:21:36,480
and what you will see here

563
00:21:42,390 --> 00:21:39,360

is that it's just really you know really

564
00:21:49,270 --> 00:21:42,400
steady um

565
00:21:56,070 --> 00:21:52,149
this is the initial hover

566
00:21:59,909 --> 00:21:57,110
and then

567
00:22:16,870 --> 00:21:59,919
hover again for

568
00:22:21,190 --> 00:22:19,190
and then the landing

569
00:22:24,630 --> 00:22:21,200
and just the tiniest little bounce that

570
00:22:29,830 --> 00:22:24,640
you can see there on the landing

571
00:22:32,149 --> 00:22:31,350
i think we

572
00:22:34,630 --> 00:22:32,159
have

573
00:22:36,070 --> 00:22:34,640
a video as well from the rover that we

574
00:22:36,950 --> 00:22:36,080
looked at before that we're going to see

575
00:22:40,390 --> 00:22:36,960
again

576
00:22:41,590 --> 00:22:40,400
same thing this time

577
00:22:43,830 --> 00:22:41,600
with

578
00:22:46,149 --> 00:22:43,840
real images

579
00:22:50,070 --> 00:22:46,159
from the vantage point

580
00:22:55,190 --> 00:22:52,149
and it shows you when you get up to

581
00:22:56,149 --> 00:22:55,200
altitude here a little bit more clearly

582
00:23:03,590 --> 00:22:56,159
how

583
00:23:12,230 --> 00:23:03,600
gently makes its way back and and lands

584
00:23:16,230 --> 00:23:13,510
and

585
00:23:19,590 --> 00:23:16,240
what's exciting about this is

586
00:23:21,430 --> 00:23:19,600
this is a flight that we've done

587
00:23:23,270 --> 00:23:21,440
hundreds if not you know a thousand

588
00:23:24,789 --> 00:23:23,280

times before

589
00:23:26,310 --> 00:23:24,799
but always

590
00:23:28,710 --> 00:23:26,320
in simulation

591
00:23:31,669 --> 00:23:28,720
it's always been on a computer

592
00:23:33,430 --> 00:23:31,679
and to see it now finally happen on mars

593
00:23:36,390 --> 00:23:33,440
and happen exactly the way that we

594
00:23:38,789 --> 00:23:36,400
imagine it it's just a really incredible

595
00:23:39,510 --> 00:23:38,799
uh feeling

596
00:23:41,350 --> 00:23:39,520
now

597
00:23:42,390 --> 00:23:41,360
while it was flying

598
00:23:44,390 --> 00:23:42,400
um

599
00:23:45,830 --> 00:23:44,400
it while it's flying it has to keep

600
00:23:48,710 --> 00:23:45,840
track of where it is and the way that it

601
00:23:51,269 --> 00:23:48,720
does that in part is by taking images of

602
00:23:52,870 --> 00:23:51,279
the ground below it 30 images per second

603
00:23:54,950 --> 00:23:52,880
and analyzing those in order to

604
00:23:57,269 --> 00:23:54,960
understand how it's moving now those are

605
00:23:59,750 --> 00:23:57,279
those images are primarily

606
00:24:01,590 --> 00:23:59,760
there exactly for that purpose not

607
00:24:06,070 --> 00:24:01,600
necessarily there to be

608
00:24:08,470 --> 00:24:06,080
looked at you know but it turns out you

609
00:24:10,789 --> 00:24:08,480
know we grabbed a few of those images

610
00:24:13,350 --> 00:24:10,799
uh and downlinked them to earth this

611
00:24:15,830 --> 00:24:13,360
morning and it turns out they're they're

612
00:24:18,549 --> 00:24:15,840
absolutely stunning in what they show

613
00:24:21,029 --> 00:24:18,559

what we see here is ingenuity

614
00:24:22,149 --> 00:24:21,039
taking a picture of its own shadow right

615
00:24:24,390 --> 00:24:22,159
below it

616
00:24:27,110 --> 00:24:24,400
and i think this is just a stunning uh

617
00:24:29,669 --> 00:24:27,120
image notwithstanding the fact that it's

618
00:24:31,190 --> 00:24:29,679
you know a low resolution

619
00:24:33,029 --> 00:24:31,200
black and white

620
00:24:34,310 --> 00:24:33,039
photograph

621
00:24:36,390 --> 00:24:34,320
we have another

622
00:24:37,909 --> 00:24:36,400
image from the same camera

623
00:24:40,390 --> 00:24:37,919
which shows

624
00:24:42,470 --> 00:24:40,400
just a moment right before

625
00:24:43,510 --> 00:24:42,480
touchdown you can see the legs are just

626
00:24:45,590 --> 00:24:43,520
about

627
00:24:47,269 --> 00:24:45,600
to meet the ground here and this is a

628
00:24:49,909 --> 00:24:47,279
very interesting image to me in part

629
00:24:51,909 --> 00:24:49,919
because of what it doesn't show which is

630
00:24:54,390 --> 00:24:51,919
it doesn't show a lot of observation

631
00:24:58,390 --> 00:24:54,400
from dust which is one of the things

632
00:25:00,070 --> 00:24:58,400
that we weren't so sure about prior to

633
00:25:02,950 --> 00:25:00,080
prior to doing this experiment so

634
00:25:05,750 --> 00:25:02,960
already we're learning things here uh

635
00:25:07,430 --> 00:25:05,760
and in particular here dust is did not

636
00:25:09,269 --> 00:25:07,440
seem to be an issue in terms of

637
00:25:14,070 --> 00:25:09,279
obscuring the

638
00:25:16,950 --> 00:25:15,669

in the next few days

639
00:25:18,870 --> 00:25:16,960
we expect

640
00:25:21,190 --> 00:25:18,880
to perform further flights and we also

641
00:25:23,830 --> 00:25:21,200
expect to get color images down from the

642
00:25:25,430 --> 00:25:23,840
helicopter

643
00:25:26,789 --> 00:25:25,440
now

644
00:25:29,110 --> 00:25:26,799
one more thing that i want to mention

645
00:25:30,870 --> 00:25:29,120
here is that the international civil

646
00:25:32,870 --> 00:25:30,880
aviation organization

647
00:25:36,669 --> 00:25:32,880
has assigned us

648
00:25:38,310 --> 00:25:36,679
a three-letter designator for ingenuity

649
00:25:40,070 --> 00:25:38,320
e-i-g-y

650
00:25:42,549 --> 00:25:40,080
india golf yankee

651
00:25:44,310 --> 00:25:42,559
with the callsign ingenuity and those

652
00:25:47,110 --> 00:25:44,320
details will be officially included in

653
00:25:49,909 --> 00:25:47,120
the next edition of icao's designators

654
00:25:53,110 --> 00:25:49,919
for aircraft operating agencies

655
00:25:54,870 --> 00:25:53,120
aeronautical authorities and services

656
00:25:57,110 --> 00:25:54,880
and the location

657
00:25:59,350 --> 00:25:57,120
of the flight was

658
00:26:01,990 --> 00:25:59,360
assigned an ikea locator location

659
00:26:04,149 --> 00:26:02,000
designator jzro

660
00:26:08,070 --> 00:26:04,159
for jezero crater

661
00:26:09,830 --> 00:26:08,080
where the nasa mars operation took place

662
00:26:13,269 --> 00:26:09,840
and of course um

663
00:26:14,470 --> 00:26:13,279

these designators come in handy uh when

664
00:26:16,470 --> 00:26:14,480
we go to

665
00:26:18,630 --> 00:26:16,480
write our log in our logbook this is

666
00:26:20,549 --> 00:26:18,640
something that should be very familiar

667
00:26:22,710 --> 00:26:20,559
to any pilot out there we always want to

668
00:26:25,590 --> 00:26:22,720
log our flight so we don't forget that

669
00:26:27,350 --> 00:26:25,600
we did them and so for that purpose

670
00:26:29,830 --> 00:26:27,360
we have you know this i have this log

671
00:26:33,750 --> 00:26:29,840
book with me it says uh the nominal

672
00:26:36,470 --> 00:26:33,760
pilot's logbook for planets and moons

673
00:26:40,630 --> 00:26:36,480
because we're always thinking ahead here

674
00:26:42,710 --> 00:26:40,640
at nasa so with that um i'd like to talk

675
00:26:44,070 --> 00:26:42,720
to uh to justin who will talk more about

676
00:26:46,470 --> 00:26:44,080
the imaging

677
00:26:48,710 --> 00:26:46,480
okay thank you havard i'm justin mackey

678
00:26:51,269 --> 00:26:48,720
i'm the perseverance rover imaging

679
00:26:52,950 --> 00:26:51,279
scientist and also the deputy pi of

680
00:26:55,750 --> 00:26:52,960
masscam z

681
00:26:57,830 --> 00:26:55,760
and i'm here just really happy to be

682
00:26:59,190 --> 00:26:57,840
here to share with you the results of

683
00:27:02,630 --> 00:26:59,200
our imaging

684
00:27:04,630 --> 00:27:02,640
over the last few hours on mars

685
00:27:06,870 --> 00:27:04,640
i there's sort of two cameras that we're

686
00:27:09,830 --> 00:27:06,880
talking about the the video camera is

687
00:27:13,029 --> 00:27:09,840
the masscam z camera which is a science

688
00:27:14,789 --> 00:27:13,039

camera that uh pi's jim bell at arizona

689
00:27:16,390 --> 00:27:14,799
state university and his team over there

690
00:27:18,549 --> 00:27:16,400
and it was built by mainland space

691
00:27:19,269 --> 00:27:18,559
science systems and san diego

692
00:27:20,389 --> 00:27:19,279
mike

693
00:27:22,630 --> 00:27:20,399
kaplinger

694
00:27:24,230 --> 00:27:22,640
uh michael vine with the hardware group

695
00:27:26,710 --> 00:27:24,240
built an excellent piece of hardware for

696
00:27:29,350 --> 00:27:26,720
us and also jensen jensen running the

697
00:27:32,470 --> 00:27:29,360
ops team down there uh and kim saxon

698
00:27:34,389 --> 00:27:32,480
here at jpl as our instrument engineer

699
00:27:35,990 --> 00:27:34,399
and a whole team of people

700
00:27:38,070 --> 00:27:36,000
uh made this happen so i just want to

701
00:27:40,149 --> 00:27:38,080
just thank all of them

702
00:27:41,590 --> 00:27:40,159
for getting us to this point

703
00:27:44,630 --> 00:27:41,600
and then the other camera i'll show some

704
00:27:47,029 --> 00:27:44,640
pictures of from the ecam system the nav

705
00:27:49,029 --> 00:27:47,039
navigation cameras on the rover

706
00:27:50,710 --> 00:27:49,039
with our ops team those cameras were

707
00:27:53,350 --> 00:27:50,720
built here at jpl on our ops team nick

708
00:27:55,909 --> 00:27:53,360
ruoff and amy culver so i've just credit

709
00:27:57,430 --> 00:27:55,919
to the entire rover team i'm wearing my

710
00:27:58,950 --> 00:27:57,440
rover blue here i'm actually on the heli

711
00:28:00,870 --> 00:27:58,960
team also but i had to pick a color so

712
00:28:02,470 --> 00:28:00,880
i'm representing the rover team here

713
00:28:03,669 --> 00:28:02,480

the uplink and down lake engineering

714
00:28:05,110 --> 00:28:03,679
teams

715
00:28:07,909 --> 00:28:05,120
just keeping the rover running the

716
00:28:09,909 --> 00:28:07,919
orbiters our partners

717
00:28:11,830 --> 00:28:09,919
getting us all this data is just really

718
00:28:14,230 --> 00:28:11,840
amazing and we thank all of them both

719
00:28:16,310 --> 00:28:14,240
here in nasa and esa

720
00:28:17,830 --> 00:28:16,320
tgo and also the deep space network so i

721
00:28:19,430 --> 00:28:17,840
just wanted to thank all of these people

722
00:28:21,029 --> 00:28:19,440
for making this really happen they

723
00:28:22,310 --> 00:28:21,039
enable all this work

724
00:28:24,230 --> 00:28:22,320
um so

725
00:28:25,750 --> 00:28:24,240
with that um without further ado i guess

726
00:28:27,830 --> 00:28:25,760
we'll go to the video one more time

727
00:28:29,110 --> 00:28:27,840
because you cannot see this enough by

728
00:28:30,549 --> 00:28:29,120
the way it only came down about two

729
00:28:32,310 --> 00:28:30,559
hours ago the full frame so let's go

730
00:28:33,669 --> 00:28:32,320
ahead and show the video i'll talk a

731
00:28:37,510 --> 00:28:33,679
little bit about it

732
00:28:39,110 --> 00:28:37,520
it's a 720p video it's 1280 by 720

733
00:28:43,029 --> 00:28:39,120
pixels

734
00:28:45,590 --> 00:28:43,039
it runs at about 6.7 frames per second

735
00:28:47,830 --> 00:28:45,600
and we originally had the strategy of

736
00:28:49,110 --> 00:28:47,840
download downlinking the 2.4 second

737
00:28:50,470 --> 00:28:49,120
snippet so there it goes you can see it

738
00:28:52,549 --> 00:28:50,480

taking off and if you look carefully you

739
00:28:53,750 --> 00:28:52,559
can see it turning in flight people

740
00:28:55,190 --> 00:28:53,760
talked about that

741
00:28:57,110 --> 00:28:55,200
and this is new this just came down

742
00:28:58,789 --> 00:28:57,120
right before this press conference

743
00:29:00,070 --> 00:28:58,799
turning in flight and then coming back

744
00:29:02,230 --> 00:29:00,080
and landing

745
00:29:03,590 --> 00:29:02,240
um so i mentioned the the frame rate

746
00:29:05,510 --> 00:29:03,600
this is with our wide angle one of our

747
00:29:07,029 --> 00:29:05,520
wider angle settings on the camera 34

748
00:29:10,230 --> 00:29:07,039
millimeters so it's a little more

749
00:29:12,070 --> 00:29:10,240
contextual shot we also shot a full

750
00:29:13,830 --> 00:29:12,080
zoomed version on the heli itself where

751
00:29:15,669 --> 00:29:13,840
the heli flies out of the field of view

752
00:29:17,269 --> 00:29:15,679
we have not downlinked those full frame

753
00:29:18,630 --> 00:29:17,279
images yet

754
00:29:19,750 --> 00:29:18,640
so we're expecting those in the coming

755
00:29:21,909 --> 00:29:19,760
days

756
00:29:23,909 --> 00:29:21,919
we did verify from the imagery that the

757
00:29:25,110 --> 00:29:23,919
heli did take off about three meters

758
00:29:26,950 --> 00:29:25,120
above the surface so that's an

759
00:29:28,950 --> 00:29:26,960
independent verification

760
00:29:31,269 --> 00:29:28,960
um the the heli blades are a little

761
00:29:34,710 --> 00:29:31,279
blurred due to the uh it's about a 10

762
00:29:37,190 --> 00:29:34,720
millisecond exposure which is about an

763
00:29:41,430 --> 00:29:37,200

one-half rotation of the blade at 2 600

764
00:29:44,070 --> 00:29:41,440
rpm roughly like 0.4 um and let's see

765
00:29:46,070 --> 00:29:44,080
and we've so far we've received about 14

766
00:29:47,909 --> 00:29:46,080
or a little over a thousand image frames

767
00:29:50,310 --> 00:29:47,919
i counted fourteen hundred less

768
00:29:51,909 --> 00:29:50,320
last check out of about two thousand so

769
00:29:53,029 --> 00:29:51,919
once again the orbiter performance has

770
00:29:54,630 --> 00:29:53,039
really made this

771
00:29:56,950 --> 00:29:54,640
possible to even show you this so

772
00:29:58,950 --> 00:29:56,960
quickly to get high to get video from

773
00:29:59,909 --> 00:29:58,960
the surface of mars so um it's really an

774
00:30:05,269 --> 00:29:59,919
amazing

775
00:30:09,190 --> 00:30:05,279
so uh the next image then is again going

776
00:30:10,870 --> 00:30:09,200
back to the fully zoomed 110 millimeter

777
00:30:13,909 --> 00:30:10,880
mass cam z

778
00:30:16,310 --> 00:30:13,919
a picture of the heli on the ground

779
00:30:18,149 --> 00:30:16,320
again this is just a nice shot showing

780
00:30:19,669 --> 00:30:18,159
if you look closely it may be hard to

781
00:30:21,590 --> 00:30:19,679
tell if you if you look closely at the

782
00:30:22,870 --> 00:30:21,600
center you can see that there's a camera

783
00:30:24,630 --> 00:30:22,880
on the

784
00:30:26,710 --> 00:30:24,640
helicopter itself that is now facing the

785
00:30:28,789 --> 00:30:26,720
rover and that was not facing the rubber

786
00:30:30,470 --> 00:30:28,799
before so that's proof that it did

787
00:30:32,630 --> 00:30:30,480
turn in flight

788
00:30:34,789 --> 00:30:32,640

and it's just a nice shot showing that

789
00:30:36,470 --> 00:30:34,799
the heli landed safely and

790
00:30:38,389 --> 00:30:36,480
that's just a great picture to have so

791
00:30:39,909 --> 00:30:38,399
then the next picture

792
00:30:42,230 --> 00:30:39,919
is now switching cameras we're going to

793
00:30:45,430 --> 00:30:42,240
go to the nav cam

794
00:30:47,029 --> 00:30:45,440
camera and the nav cam camera is does

795
00:30:49,430 --> 00:30:47,039
not have the video capabilities like

796
00:30:50,789 --> 00:30:49,440
mass cam z but we did take pictures

797
00:30:52,389 --> 00:30:50,799
during the flight

798
00:30:53,669 --> 00:30:52,399
and this this blink hopefully it'll

799
00:30:55,750 --> 00:30:53,679
blink you'll see the heli that's the

800
00:30:58,070 --> 00:30:55,760
heli on the ground there

801
00:30:59,350 --> 00:30:58,080
looking carefully

802
00:31:00,470 --> 00:30:59,360
look okay now actually you know what

803
00:31:01,590 --> 00:31:00,480
this is the difference this is the other

804
00:31:02,710 --> 00:31:01,600
one now if you look carefully at the

805
00:31:03,830 --> 00:31:02,720
hill you should be able to see it

806
00:31:05,590 --> 00:31:03,840
shifting

807
00:31:07,590 --> 00:31:05,600
that shows the difference between the

808
00:31:09,750 --> 00:31:07,600
takeoff location

809
00:31:11,110 --> 00:31:09,760
and the landing location may be hard to

810
00:31:12,950 --> 00:31:11,120
see in the video

811
00:31:14,149 --> 00:31:12,960
but we'll put that out on on the we'll

812
00:31:16,310 --> 00:31:14,159
release that so people could look at

813
00:31:17,909 --> 00:31:16,320

that more closely

814
00:31:19,590 --> 00:31:17,919
i can see it from here but hopefully

815
00:31:21,269 --> 00:31:19,600
it'll come out in the video uh so it

816
00:31:22,870 --> 00:31:21,279
just shows that the landing was just

817
00:31:24,950 --> 00:31:22,880
sort of a real pinpoint landing there by

818
00:31:27,830 --> 00:31:24,960
the team and uh so congrats to the heli

819
00:31:30,389 --> 00:31:27,840
team for just nailing it arden company

820
00:31:33,190 --> 00:31:30,399
uh and then the last video um or the

821
00:31:35,430 --> 00:31:33,200
last blink gif shows hopefully it shows

822
00:31:37,430 --> 00:31:35,440
the full height there there it is okay

823
00:31:39,590 --> 00:31:37,440
so we have the full height of the the

824
00:31:40,710 --> 00:31:39,600
helicopter there captured by the nav cam

825
00:31:42,710 --> 00:31:40,720
mid-flight

826
00:31:45,509 --> 00:31:42,720
and then uh that comparison with the

827
00:31:47,750 --> 00:31:45,519
hilly then on the ground

828
00:31:48,870 --> 00:31:47,760
which will show the um the full height

829
00:31:51,430 --> 00:31:48,880
it's hard to

830
00:31:53,269 --> 00:31:51,440
see the video there from here but

831
00:31:54,470 --> 00:31:53,279
the main summary is that we actually

832
00:31:56,470 --> 00:31:54,480
know what i'm looking at this this looks

833
00:31:59,029 --> 00:31:56,480
like this is

834
00:32:00,470 --> 00:31:59,039
the mass cam z again well we just got

835
00:32:02,070 --> 00:32:00,480
the data all down so it sounds like it

836
00:32:04,070 --> 00:32:02,080
might be slightly out of order i think

837
00:32:06,630 --> 00:32:04,080
the main point here is that we are

838
00:32:08,630 --> 00:32:06,640

swimming in data right now and we are

839
00:32:10,710 --> 00:32:08,640
we're just just cataloging it basically

840
00:32:13,029 --> 00:32:10,720
and learning about the flight uh we're

841
00:32:16,149 --> 00:32:13,039
just extremely happy for this uh this

842
00:32:18,870 --> 00:32:16,159
whole team uh the rover team and the the

843
00:32:21,190 --> 00:32:18,880
heli team uh and i just wanted to close

844
00:32:22,789 --> 00:32:21,200
my statements by mentioning uh i

845
00:32:25,269 --> 00:32:22,799
mentioned that i'm on i was on the heli

846
00:32:26,789 --> 00:32:25,279
team this is like with with bob like

847
00:32:27,509 --> 00:32:26,799
seven years ago where we were talking

848
00:32:29,669 --> 00:32:27,519
about

849
00:32:31,590 --> 00:32:29,679
taking pictures from a heli

850
00:32:33,269 --> 00:32:31,600
seeing it all come together like this is

851
00:32:34,549 --> 00:32:33,279
really reminiscent of another project

852
00:32:37,830 --> 00:32:34,559
that i worked on

853
00:32:39,350 --> 00:32:37,840
24 years ago this the mars pathfinder

854
00:32:41,190 --> 00:32:39,360
mission where we had

855
00:32:42,549 --> 00:32:41,200
a the sojourner rover which was a new

856
00:32:44,070 --> 00:32:42,559
technology

857
00:32:45,990 --> 00:32:44,080
a new capability

858
00:32:46,950 --> 00:32:46,000
there were skeptics at the beginning and

859
00:32:49,350 --> 00:32:46,960
then

860
00:32:51,909 --> 00:32:49,360
once something like this happens on mars

861
00:32:53,909 --> 00:32:51,919
the skeptics get converted and it soon

862
00:32:55,190 --> 00:32:53,919
becomes a new way of doing things and i

863
00:32:56,389 --> 00:32:55,200

really feel

864
00:32:58,630 --> 00:32:56,399
this project

865
00:33:01,430 --> 00:32:58,640
this team has the same vibe that that we

866
00:33:03,909 --> 00:33:01,440
had 24 years ago with sojourner

867
00:33:05,590 --> 00:33:03,919
just seeing going from a concept to

868
00:33:07,750 --> 00:33:05,600
demonstration like this is going to open

869
00:33:08,470 --> 00:33:07,760
up new avenues and new ways of exploring

870
00:33:10,870 --> 00:33:08,480
so

871
00:33:13,350 --> 00:33:10,880
it's very exciting we're very excited

872
00:33:16,310 --> 00:33:13,360
that this is all working so well and

873
00:33:18,470 --> 00:33:16,320
just happy to get all this data back

874
00:33:20,230 --> 00:33:18,480
all right thanks justin and thanks for

875
00:33:22,149 --> 00:33:20,240
rolling with it as justin says the

876
00:33:23,110 --> 00:33:22,159
images are all coming down in a fire

877
00:33:25,110 --> 00:33:23,120
hose

878
00:33:27,430 --> 00:33:25,120
and we will make the images available

879
00:33:29,830 --> 00:33:27,440
for you all online so look for it on the

880
00:33:33,190 --> 00:33:29,840
website so we're going to transition now

881
00:33:34,230 --> 00:33:33,200
into q a um so a reminder for our

882
00:33:35,990 --> 00:33:34,240
colleagues

883
00:33:38,389 --> 00:33:36,000
from the media if you're on the telecon

884
00:33:39,350 --> 00:33:38,399
line please press star one to get into

885
00:33:40,950 --> 00:33:39,360
the queue

886
00:33:43,430 --> 00:33:40,960
and for others who are using social

887
00:33:45,669 --> 00:33:43,440
media you can use the hashtag mars

888
00:33:48,149 --> 00:33:45,679

helicopter our first question on the

889
00:33:49,909 --> 00:33:48,159
media line comes from marcia dunn of the

890
00:33:52,549 --> 00:33:49,919
ap

891
00:33:54,470 --> 00:33:52,559
yes hi congratulations um i've got a

892
00:33:56,389 --> 00:33:54,480
couple questions for the chief pilot i

893
00:33:58,549 --> 00:33:56,399
believe mr grip

894
00:34:00,149 --> 00:33:58,559
what was the wind speed at wright

895
00:34:01,830 --> 00:34:00,159
brothers field

896
00:34:04,710 --> 00:34:01,840
today for the flight

897
00:34:06,549 --> 00:34:04,720
and when are you anticipating to attempt

898
00:34:08,869 --> 00:34:06,559
flight two i know you had a schedule

899
00:34:10,710 --> 00:34:08,879
laid out at advanced but since you're a

900
00:34:12,310 --> 00:34:10,720
week down on the timeline i wasn't sure

901
00:34:14,550 --> 00:34:12,320
if you were going to try to rush things

902
00:34:16,790 --> 00:34:14,560
along thank you

903
00:34:20,230 --> 00:34:16,800
yeah so in terms of the wins

904
00:34:23,270 --> 00:34:20,240
we did take additional data during uh

905
00:34:24,629 --> 00:34:23,280
the flight and and we expect to get uh

906
00:34:28,069 --> 00:34:24,639
some more information about what the

907
00:34:30,550 --> 00:34:28,079
actual wins were at that time

908
00:34:33,190 --> 00:34:30,560
what we what we can operate with this at

909
00:34:35,270 --> 00:34:33,200
this point is the forecast that we have

910
00:34:37,510 --> 00:34:35,280
based on prior data and there is some

911
00:34:39,990 --> 00:34:37,520
uncertainty on that but the most recent

912
00:34:42,069 --> 00:34:40,000
uh indications that i have

913
00:34:44,470 --> 00:34:42,079

is that it was on the order of somewhere

914
00:34:47,349 --> 00:34:44,480
between two to six meters

915
00:34:50,069 --> 00:34:47,359
per second of uh of wind and that's what

916
00:34:51,990 --> 00:34:50,079
we were dealing with and that would seem

917
00:34:54,069 --> 00:34:52,000
just eyeballing the behavior of the

918
00:34:55,349 --> 00:34:54,079
flights that doesn't seem inconsistent

919
00:34:57,349 --> 00:34:55,359
with with the

920
00:35:00,390 --> 00:34:57,359
behavior although it's hard to to say

921
00:35:02,390 --> 00:35:00,400
much more than that as far as when we

922
00:35:04,550 --> 00:35:02,400
perform next flight specifically i'll

923
00:35:06,470 --> 00:35:04,560
let mimi perhaps answer that question

924
00:35:08,470 --> 00:35:06,480
sure yeah so we'll get the high rate

925
00:35:09,589 --> 00:35:08,480
data downlink from the helicopter to us

926
00:35:12,710 --> 00:35:09,599
tomorrow

927
00:35:14,790 --> 00:35:12,720
and and then um we will be uh attempting

928
00:35:17,190 --> 00:35:14,800
to fly within the next few days so we're

929
00:35:19,190 --> 00:35:17,200
targeting for this thursday

930
00:35:22,069 --> 00:35:19,200
but we'll know more after we get the

931
00:35:28,710 --> 00:35:24,790
great thank you our next caller is

932
00:35:31,589 --> 00:35:28,720
kenneth chang from the new york times

933
00:35:33,030 --> 00:35:31,599
hi um so i was wondering if you had

934
00:35:34,630 --> 00:35:33,040
better plans for the fourth and fifth

935
00:35:36,790 --> 00:35:34,640
flights i guess when i talked to mimi

936
00:35:39,349 --> 00:35:36,800
and bob and over last year you had

937
00:35:41,829 --> 00:35:39,359
mentioned aiming for 500 feet at 50

938
00:35:43,589 --> 00:35:41,839

15 meters i was also wondering when

939
00:35:48,630 --> 00:35:43,599
classically might there be a second

940
00:35:52,710 --> 00:35:51,270
so in terms of the uh of flights four

941
00:35:53,990 --> 00:35:52,720
and five uh

942
00:35:56,790 --> 00:35:54,000
i think we still have a little bit of

943
00:35:58,710 --> 00:35:56,800
team discussion you know on basis of

944
00:36:00,230 --> 00:35:58,720
just today's flight the results of that

945
00:36:01,910 --> 00:36:00,240
and what we're going to get

946
00:36:03,910 --> 00:36:01,920
over the next two flights you know

947
00:36:06,950 --> 00:36:03,920
flights two and three and that will

948
00:36:08,470 --> 00:36:06,960
inform what we do for that but in just

949
00:36:11,589 --> 00:36:08,480
in general terms what we're talking

950
00:36:14,390 --> 00:36:11,599
about here is going higher going further

951
00:36:16,550 --> 00:36:14,400
going faster stretching the capabilities

952
00:36:19,190 --> 00:36:16,560
of the helicopter in those ways but

953
00:36:22,630 --> 00:36:19,200
exactly how far in those directions is

954
00:36:24,390 --> 00:36:22,640
is a discussion that we uh need to have

955
00:36:26,470 --> 00:36:24,400
so regardless i can add that we will be

956
00:36:27,910 --> 00:36:26,480
pushing the envelope so as we succeed in

957
00:36:30,310 --> 00:36:27,920
certain lateral flies we're going to go

958
00:36:31,750 --> 00:36:30,320
further faster definitely especially

959
00:36:34,150 --> 00:36:31,760
towards the end of the experimental

960
00:36:36,069 --> 00:36:34,160
window we will be pushing the envelope

961
00:36:38,870 --> 00:36:36,079
and really stretching and understanding

962
00:36:40,870 --> 00:36:38,880
how well you know we can fly so for the

963
00:36:43,030 --> 00:36:40,880

second helicopter question i think uh

964
00:36:45,430 --> 00:36:43,040
i'll pass it to you thomas yeah and of

965
00:36:47,430 --> 00:36:45,440
course second the answer is i don't know

966
00:36:49,990 --> 00:36:47,440
uh what the answer is uh when are we

967
00:36:52,390 --> 00:36:50,000
gonna fly i mean what i'm really

968
00:36:54,790 --> 00:36:52,400
interested in is frankly the science

969
00:36:57,030 --> 00:36:54,800
community's ideas about how to turn this

970
00:36:59,510 --> 00:36:57,040
into a science machine you know from a

971
00:37:01,589 --> 00:36:59,520
tech demo into a science machine

972
00:37:03,030 --> 00:37:01,599
and uh you see uh what the opportunities

973
00:37:05,510 --> 00:37:03,040
are to fly to

974
00:37:08,230 --> 00:37:05,520
uh flight to mars you know that we have

975
00:37:11,349 --> 00:37:08,240
something scheduled in 2628

976
00:37:13,990 --> 00:37:11,359
with more sample return and but uh we we

977
00:37:14,790 --> 00:37:14,000
do competitions on a regular basis for

978
00:37:21,430 --> 00:37:14,800
uh

979
00:37:23,510 --> 00:37:21,440
we're really interested now going

980
00:37:26,390 --> 00:37:23,520
forward but there's nothing set right

981
00:37:29,670 --> 00:37:26,400
now into stone as to when the next

982
00:37:32,550 --> 00:37:29,680
helicopter will be going to mars

983
00:37:39,270 --> 00:37:32,560
okay great thank you our next caller is

984
00:37:39,280 --> 00:37:43,430
are you there with us bill

985
00:37:47,990 --> 00:37:45,349
i'm sorry can you hear me now yes there

986
00:37:50,790 --> 00:37:48,000
you are oh sorry sorry about that uh

987
00:37:52,550 --> 00:37:50,800
this is a question for mimi um

988
00:37:53,829 --> 00:37:52,560

you said in your blog post uh over the

989
00:37:55,589 --> 00:37:53,839
weekend that you guys have come up with

990
00:37:58,150 --> 00:37:55,599
this software fix and you warned us that

991
00:37:59,349 --> 00:37:58,160
there was a you know maybe a 15 chance

992
00:38:01,589 --> 00:37:59,359
it wasn't going to work you didn't know

993
00:38:03,750 --> 00:38:01,599
for sure and then if it didn't you just

994
00:38:06,470 --> 00:38:03,760
would try again what is the strategy

995
00:38:08,390 --> 00:38:06,480
going forward given the results today

996
00:38:09,829 --> 00:38:08,400
is that what you would do on flights two

997
00:38:10,870 --> 00:38:09,839
three or four if one of them gets

998
00:38:12,710 --> 00:38:10,880
delayed

999
00:38:14,870 --> 00:38:12,720
by this software problem you would just

1000
00:38:17,510 --> 00:38:14,880
try again and i'm wondering is there a

1001
00:38:19,510 --> 00:38:17,520
deadline where the perseverance folks

1002
00:38:21,030 --> 00:38:19,520
really want you to be finished so they

1003
00:38:23,430 --> 00:38:21,040
can go on with their mission i'm trying

1004
00:38:25,510 --> 00:38:23,440
to wonder um if there's some clock

1005
00:38:29,670 --> 00:38:25,520
running on you guys thanks

1006
00:38:31,990 --> 00:38:29,680
absolutely so this uh command uh only

1007
00:38:34,150 --> 00:38:32,000
option that we chose the simpler option

1008
00:38:36,950 --> 00:38:34,160
uh it has paid off we got our first

1009
00:38:38,550 --> 00:38:36,960
flight in hand and uh for the second

1010
00:38:41,109 --> 00:38:38,560
flight we will be using the same

1011
00:38:42,630 --> 00:38:41,119
technique and so far it's been it's

1012
00:38:44,470 --> 00:38:42,640
working well we've been testing it on

1013
00:38:47,030 --> 00:38:44,480

ingenuity and then today it worked well

1014
00:38:48,710 --> 00:38:47,040
so we're to proceed in that direction

1015
00:38:51,430 --> 00:38:48,720
in terms of the duration

1016
00:38:53,990 --> 00:38:51,440
yes we have a 30-day experiment window

1017
00:38:55,670 --> 00:38:54,000
and so we have about two weeks left and

1018
00:38:57,829 --> 00:38:55,680
we will we believe we'll be able to

1019
00:38:59,829 --> 00:38:57,839
squeeze the next four flights that we

1020
00:39:02,069 --> 00:38:59,839
have planned this increasingly boulder

1021
00:39:04,150 --> 00:39:02,079
flies we want to go hundreds of meters

1022
00:39:06,630 --> 00:39:04,160
out towards the end we do want to push

1023
00:39:09,750 --> 00:39:06,640
it and i believe we have enough time to

1024
00:39:11,990 --> 00:39:09,760
squeeze the next four uh flights in the

1025
00:39:14,630 --> 00:39:12,000
next two weeks left so again

1026
00:39:17,349 --> 00:39:14,640
thank you to ken farley the you know

1027
00:39:19,910 --> 00:39:17,359
perseverance rover team uh we we will be

1028
00:39:21,430 --> 00:39:19,920
done in our month and you know the rover

1029
00:39:23,270 --> 00:39:21,440
needs to go on for his primary mission

1030
00:39:24,069 --> 00:39:23,280
that's it you know it's very important

1031
00:39:26,710 --> 00:39:24,079
so

1032
00:39:28,710 --> 00:39:26,720
that's the plan

1033
00:39:30,230 --> 00:39:28,720
okay great yes we have a month of

1034
00:39:32,390 --> 00:39:30,240
ingenuity

1035
00:39:34,550 --> 00:39:32,400
and still some time left all right our

1036
00:39:37,910 --> 00:39:34,560
next call comes from steve gorman of

1037
00:39:40,550 --> 00:39:37,920
reuters go ahead go ahead hi i hope you

1038
00:39:42,390 --> 00:39:40,560

can hear me thanks very much um i just

1039
00:39:43,990 --> 00:39:42,400
wanted to know uh i'm not sure you can

1040
00:39:45,829 --> 00:39:44,000
direct this question to exactly but are

1041
00:39:47,190 --> 00:39:45,839
there practical implications of the

1042
00:39:49,670 --> 00:39:47,200
success

1043
00:39:52,150 --> 00:39:49,680
of of ingenuity not only for expanded

1044
00:39:54,550 --> 00:39:52,160
enhanced mars exploration but for

1045
00:39:58,069 --> 00:39:54,560
similar modes of aerial exploration in

1046
00:39:59,510 --> 00:39:58,079
other worlds such as venus or titan

1047
00:40:01,510 --> 00:39:59,520
sure

1048
00:40:03,430 --> 00:40:01,520
bob bellerin my chief engineer bob do

1049
00:40:04,309 --> 00:40:03,440
you want to take that

1050
00:40:05,349 --> 00:40:04,319
yes

1051
00:40:07,510 --> 00:40:05,359
you know the

1052
00:40:09,510 --> 00:40:07,520
general the technique of aerial flight

1053
00:40:12,069 --> 00:40:09,520
is applicable to you know places like

1054
00:40:13,750 --> 00:40:12,079
titan and venus uh the specific vehicle

1055
00:40:15,670 --> 00:40:13,760
i think will be quite different uh

1056
00:40:17,990 --> 00:40:15,680
titan's a much easier place to fly

1057
00:40:19,750 --> 00:40:18,000
easier even than earth in some regards

1058
00:40:21,030 --> 00:40:19,760
and venus says depending on where you

1059
00:40:22,630 --> 00:40:21,040
want to fly has you know at certain

1060
00:40:25,430 --> 00:40:22,640
temperature issues so the specific

1061
00:40:26,390 --> 00:40:25,440
designs and will be you know quite

1062
00:40:28,470 --> 00:40:26,400
different

1063
00:40:30,630 --> 00:40:28,480

but yes this does open up that uh

1064
00:40:32,790 --> 00:40:30,640
doorway and i think the the bigger uh

1065
00:40:34,470 --> 00:40:32,800
lesson here i think is uh

1066
00:40:36,309 --> 00:40:34,480
also how do we operate these vehicles

1067
00:40:38,550 --> 00:40:36,319
how do we test these vehicles so there

1068
00:40:41,030 --> 00:40:38,560
is uh that kind of knowledge that we

1069
00:40:42,710 --> 00:40:41,040
have learned from this uh process of

1070
00:40:45,030 --> 00:40:42,720
flying ingenuity that will definitely

1071
00:40:46,470 --> 00:40:45,040
transfer over and be useful for the

1072
00:40:48,950 --> 00:40:46,480
folks who will be considering missions

1073
00:40:50,309 --> 00:40:48,960
to those places

1074
00:40:52,309 --> 00:40:50,319
thank you very much

1075
00:40:54,790 --> 00:40:52,319
congratulations

1076
00:41:00,470 --> 00:40:54,800
okay all right thanks steve uh next up

1077
00:41:04,829 --> 00:41:02,710
thank you all for doing this um

1078
00:41:07,990 --> 00:41:04,839
just just a quick question for probably

1079
00:41:09,190 --> 00:41:08,000
justin um just like could you just just

1080
00:41:11,829 --> 00:41:09,200
kind of talk a little bit about how

1081
00:41:13,349 --> 00:41:11,839
difficult it was to to get those shots

1082
00:41:15,109 --> 00:41:13,359
it seems like everything is perfectly

1083
00:41:16,870 --> 00:41:15,119
centered and everything worked extremely

1084
00:41:18,150 --> 00:41:16,880
well and i know you guys practiced but

1085
00:41:20,230 --> 00:41:18,160
was that tough

1086
00:41:22,150 --> 00:41:20,240
and a quick second one do you guys plan

1087
00:41:24,390 --> 00:41:22,160
to actually try to capture audio on the

1088
00:41:26,630 --> 00:41:24,400

next flight like whenever it happens

1089
00:41:28,309 --> 00:41:26,640
thank you

1090
00:41:30,069 --> 00:41:28,319
yeah so that's a great question i can

1091
00:41:32,710 --> 00:41:30,079
tell you from first-hand experience that

1092
00:41:34,550 --> 00:41:32,720
that was harder than it looks uh in fact

1093
00:41:35,829 --> 00:41:34,560
i think i speak for our entire imaging

1094
00:41:37,910 --> 00:41:35,839
team that we're kind of relieved that we

1095
00:41:40,030 --> 00:41:37,920
caught it uh in flight

1096
00:41:41,190 --> 00:41:40,040
we had practiced this um

1097
00:41:43,589 --> 00:41:41,200
[Music]

1098
00:41:47,109 --> 00:41:43,599
three four times before and this was the

1099
00:41:49,109 --> 00:41:47,119
first time that we were able to nail it

1100
00:41:50,710 --> 00:41:49,119
i think uh it's it's an interesting

1101
00:41:52,150 --> 00:41:50,720
problem you have two different

1102
00:41:53,910 --> 00:41:52,160
spacecraft

1103
00:41:55,589 --> 00:41:53,920
with two different time

1104
00:41:57,829 --> 00:41:55,599
they both have this roughly the same

1105
00:41:59,670 --> 00:41:57,839
time but they operate differently

1106
00:42:02,630 --> 00:41:59,680
and so characterizing how the heli

1107
00:42:04,790 --> 00:42:02,640
operates when we tell it to go compared

1108
00:42:07,670 --> 00:42:04,800
to how the rover

1109
00:42:09,190 --> 00:42:07,680
does its thing is actually tricky and it

1110
00:42:10,309 --> 00:42:09,200
i mentioned before we had to do this

1111
00:42:12,470 --> 00:42:10,319
with the searcher in a rover too you

1112
00:42:14,150 --> 00:42:12,480
know two different robots with their own

1113
00:42:15,589 --> 00:42:14,160

with their own system we had to do the

1114
00:42:16,790 --> 00:42:15,599
same thing here

1115
00:42:18,550 --> 00:42:16,800
and i think it's a credit to the team

1116
00:42:19,510 --> 00:42:18,560
that we kept trying and over and over

1117
00:42:20,950 --> 00:42:19,520
and

1118
00:42:24,230 --> 00:42:20,960
we were having debates you know should

1119
00:42:26,150 --> 00:42:24,240
we do one long video one spot or do you

1120
00:42:28,150 --> 00:42:26,160
scatter shot and so we ended up doing a

1121
00:42:30,790 --> 00:42:28,160
mixture of both and um the fact that it

1122
00:42:32,870 --> 00:42:30,800
worked out so well is just amazing to

1123
00:42:34,630 --> 00:42:32,880
all of us and we're very happy to to be

1124
00:42:35,990 --> 00:42:34,640
able to show these videos today

1125
00:42:37,430 --> 00:42:36,000
so that that's

1126
00:42:39,670 --> 00:42:37,440
that's the short that's the long answer

1127
00:42:41,190 --> 00:42:39,680
but it's it wasn't it was tricky i'll

1128
00:42:42,870 --> 00:42:41,200
just say that and like i said we're all

1129
00:42:45,670 --> 00:42:42,880
breathing a sigh of relief

1130
00:42:47,349 --> 00:42:45,680
um the second question

1131
00:42:51,270 --> 00:42:47,359
was

1132
00:42:55,829 --> 00:42:53,430
oh the microphone yes we do have a

1133
00:42:57,589 --> 00:42:55,839
microphone and there is a plan to record

1134
00:43:00,470 --> 00:42:57,599
the sound we didn't want to put that

1135
00:43:02,150 --> 00:43:00,480
into the first observation or the first

1136
00:43:04,309 --> 00:43:02,160
try because it was complicated enough

1137
00:43:06,470 --> 00:43:04,319
just trying to get the the video to work

1138
00:43:07,829 --> 00:43:06,480

uh and so we're going to be putting that

1139
00:43:09,030 --> 00:43:07,839
in an upcoming plan i'm not sure if

1140
00:43:10,710 --> 00:43:09,040
it'll be the second flight but it's

1141
00:43:11,910 --> 00:43:10,720
certainly

1142
00:43:13,349 --> 00:43:11,920
one of our later flights we have two

1143
00:43:14,550 --> 00:43:13,359
microphones we have the edl cam

1144
00:43:15,750 --> 00:43:14,560
microphone and then the super cam

1145
00:43:17,190 --> 00:43:15,760
microphone and

1146
00:43:19,670 --> 00:43:17,200
i can tell you the microphone owners are

1147
00:43:21,589 --> 00:43:19,680
very eager to try and so we're waiting

1148
00:43:23,829 --> 00:43:21,599
in the wings to to get them to get a

1149
00:43:25,510 --> 00:43:23,839
chance to record it

1150
00:43:26,710 --> 00:43:25,520
and that goes along the lines of you

1151
00:43:28,710 --> 00:43:26,720
know starting out conservative and

1152
00:43:30,710 --> 00:43:28,720
getting bolder and one thing one concern

1153
00:43:32,550 --> 00:43:30,720
we have is if we turn on the microphone

1154
00:43:34,870 --> 00:43:32,560
just in case there's a chance of you

1155
00:43:36,790 --> 00:43:34,880
know emi uh interference uh between the

1156
00:43:39,589 --> 00:43:36,800
microphone and the helicopter flight so

1157
00:43:42,390 --> 00:43:39,599
we really want our birds a few birds in

1158
00:43:44,950 --> 00:43:42,400
our hands and then uh we'll uh play with

1159
00:43:46,870 --> 00:43:44,960
the microphone at that point

1160
00:43:52,630 --> 00:43:46,880
okay great

1161
00:43:58,309 --> 00:43:55,670
hi yes thanks for taking my question um

1162
00:44:00,309 --> 00:43:58,319
mimi i guess i would like to know um

1163
00:44:01,829 --> 00:44:00,319

you kind of hinted at this uh several

1164
00:44:03,990 --> 00:44:01,839
times um

1165
00:44:06,630 --> 00:44:04,000
do you actually want to

1166
00:44:07,829 --> 00:44:06,640
or expect to see ingenuity crash at some

1167
00:44:11,109 --> 00:44:07,839
point

1168
00:44:12,630 --> 00:44:11,119
because you've pushed it to its limits

1169
00:44:15,030 --> 00:44:12,640
is that kind of like the ultimate test

1170
00:44:16,390 --> 00:44:15,040
to see how far it can go or

1171
00:44:18,230 --> 00:44:16,400
what do you ultimately think its fate

1172
00:44:20,230 --> 00:44:18,240
will be i've heard some people

1173
00:44:21,510 --> 00:44:20,240
just an idle conversation wondering if

1174
00:44:23,589 --> 00:44:21,520
they could

1175
00:44:26,150 --> 00:44:23,599
tag along with perseverance to stay in

1176
00:44:28,950 --> 00:44:26,160
communication range so what what will

1177
00:44:29,990 --> 00:44:28,960
its ultimate state be

1178
00:44:32,150 --> 00:44:30,000
well

1179
00:44:33,589 --> 00:44:32,160
my current view i believe you know we're

1180
00:44:37,109 --> 00:44:33,599
together on the team we do want to push

1181
00:44:38,390 --> 00:44:37,119
it to the limit well and ultimately uh

1182
00:44:40,550 --> 00:44:38,400
thomas mike

1183
00:44:42,870 --> 00:44:40,560
just getting your permission

1184
00:44:44,950 --> 00:44:42,880
really because by going faster

1185
00:44:46,790 --> 00:44:44,960
further uh you know our models are

1186
00:44:48,870 --> 00:44:46,800
checking out at this time they look good

1187
00:44:50,550 --> 00:44:48,880
you know they match our our models match

1188
00:44:52,390 --> 00:44:50,560

what we saw in our test chamber the

1189
00:44:54,470 --> 00:44:52,400
flight today perfectly matched you know

1190
00:44:55,990 --> 00:44:54,480
what we were predicting and so but we

1191
00:44:57,750 --> 00:44:56,000
want to push we want to push against the

1192
00:44:58,630 --> 00:44:57,760
wind we want to push against the speed

1193
00:45:01,109 --> 00:44:58,640
and

1194
00:45:03,589 --> 00:45:01,119
ultimately we expect the the helicopter

1195
00:45:04,950 --> 00:45:03,599
will meet its limit but that information

1196
00:45:07,750 --> 00:45:04,960
is extremely important this is a

1197
00:45:10,150 --> 00:45:07,760
pathfinder this is about you know

1198
00:45:12,150 --> 00:45:10,160
finding is there any unknown unknowns

1199
00:45:13,510 --> 00:45:12,160
that we can't model and we really want

1200
00:45:15,030 --> 00:45:13,520
to know what the limits are so we will

1201
00:45:16,630 --> 00:45:15,040
be pushing the limit

1202
00:45:19,109 --> 00:45:16,640
very deliberately

1203
00:45:21,190 --> 00:45:19,119
i think it's also important and i think

1204
00:45:23,270 --> 00:45:21,200
i just want to tell you this plan was

1205
00:45:24,710 --> 00:45:23,280
put together by mimi and her team and i

1206
00:45:26,790 --> 00:45:24,720
just want to tell you it's also

1207
00:45:27,910 --> 00:45:26,800
important and totally supportive of that

1208
00:45:28,710 --> 00:45:27,920
plan

1209
00:45:31,750 --> 00:45:28,720
to

1210
00:45:34,550 --> 00:45:31,760
actually deal with this like a tech demo

1211
00:45:36,550 --> 00:45:34,560
if we really want to be sure that when

1212
00:45:38,630 --> 00:45:36,560
everything is said and done we know the

1213
00:45:40,790 --> 00:45:38,640

full scope of what's possible

1214
00:45:42,069 --> 00:45:40,800
uh with that type of flying machine and

1215
00:45:44,150 --> 00:45:42,079
so for us

1216
00:45:46,150 --> 00:45:44,160
that's uh that's really critical and for

1217
00:45:48,870 --> 00:45:46,160
me you kind of really putting kind of a

1218
00:45:49,990 --> 00:45:48,880
scope a constraint around it like the

1219
00:45:52,150 --> 00:45:50,000
month of

1220
00:45:54,550 --> 00:45:52,160
ingenuity is very much in the spirit of

1221
00:45:56,309 --> 00:45:54,560
attack demo that's exactly what you

1222
00:45:57,109 --> 00:45:56,319
would want to do right enough to make

1223
00:45:58,710 --> 00:45:57,119
sure

1224
00:46:01,109 --> 00:45:58,720
that in fact

1225
00:46:03,910 --> 00:46:01,119
we're putting the pedal down and are

1226
00:46:06,710 --> 00:46:03,920
going for it and i just uh applaud the

1227
00:46:07,990 --> 00:46:06,720
entire team and of course uh uh you know

1228
00:46:10,390 --> 00:46:08,000
the entire

1229
00:46:12,870 --> 00:46:10,400
perseverance team to basically who are

1230
00:46:14,390 --> 00:46:12,880
part of this experiment so i just can't

1231
00:46:15,750 --> 00:46:14,400
wait to see what the next flights are

1232
00:46:18,550 --> 00:46:15,760
like mimi and

1233
00:46:20,950 --> 00:46:18,560
and as we go forward how how this story

1234
00:46:22,790 --> 00:46:20,960
will go on

1235
00:46:24,390 --> 00:46:22,800
all right well in the spirit of sort of

1236
00:46:25,910 --> 00:46:24,400
casting ahead i'm going to take a social

1237
00:46:26,950 --> 00:46:25,920
media question and i think this one's

1238
00:46:29,829 --> 00:46:26,960

for bob

1239
00:46:31,910 --> 00:46:29,839
spacetourism on instagram asks do you

1240
00:46:34,790 --> 00:46:31,920
think you will be able to scale up the

1241
00:46:37,030 --> 00:46:34,800
concept and fly heavy payloads and by

1242
00:46:39,750 --> 00:46:37,040
when

1243
00:46:41,990 --> 00:46:39,760
yeah so the

1244
00:46:44,550 --> 00:46:42,000
fundamental you know dynamics of these

1245
00:46:46,550 --> 00:46:44,560
vehicles does scale up uh to fairly

1246
00:46:49,910 --> 00:46:46,560
reasonable sizes so we are thinking of

1247
00:46:51,430 --> 00:46:49,920
things in the uh 25 to 30 kilogram class

1248
00:46:53,270 --> 00:46:51,440
which is you know over the 50 pounds

1249
00:46:55,589 --> 00:46:53,280
type of glass of vehicles

1250
00:46:57,349 --> 00:46:55,599
uh and those vehicles would uh carry

1251
00:46:59,589 --> 00:46:57,359
about maybe about four kilograms of

1252
00:47:02,069 --> 00:46:59,599
science of that order about 10 pounds of

1253
00:47:04,550 --> 00:47:02,079
science instruments and so early design

1254
00:47:06,230 --> 00:47:04,560
work on that has started to in terms of

1255
00:47:08,550 --> 00:47:06,240
conceptual designs

1256
00:47:10,550 --> 00:47:08,560
and to see what would it take to deploy

1257
00:47:12,470 --> 00:47:10,560
these and operate them

1258
00:47:15,430 --> 00:47:12,480
and so that would be i think the uh a

1259
00:47:16,550 --> 00:47:15,440
good sweet spot for the next generation

1260
00:47:18,950 --> 00:47:16,560
design

1261
00:47:20,549 --> 00:47:18,960
anything much larger the packaging of

1262
00:47:22,470 --> 00:47:20,559
the blades and things becomes quite

1263
00:47:24,549 --> 00:47:22,480

awkward so may not be quite feasible in

1264
00:47:26,390 --> 00:47:24,559
the near term but definitely something

1265
00:47:27,670 --> 00:47:26,400
in the 50 pound class

1266
00:47:29,510 --> 00:47:27,680
compared to a little four-pound

1267
00:47:31,829 --> 00:47:29,520
ingenuity is definitely something that's

1268
00:47:33,349 --> 00:47:31,839
uh very feasible and exactly like some

1269
00:47:34,950 --> 00:47:33,359
early progress has been made in that

1270
00:47:37,349 --> 00:47:34,960
direction

1271
00:47:39,589 --> 00:47:37,359
great thank you bob another social media

1272
00:47:41,750 --> 00:47:39,599
question this time for mimi pete on

1273
00:47:44,390 --> 00:47:41,760
twitter asks what has been the most

1274
00:47:46,390 --> 00:47:44,400
challenging part about this process what

1275
00:47:49,270 --> 00:47:46,400
is the most interesting thing y'all have

1276
00:47:51,589 --> 00:47:49,280
learned from this flight

1277
00:47:53,829 --> 00:47:51,599
most challenging well i think bob can

1278
00:47:57,109 --> 00:47:53,839
answer it first was meeting that four

1279
00:47:58,710 --> 00:47:57,119
pound the 1.8 kilogram limit you know uh

1280
00:48:01,349 --> 00:47:58,720
theoretically it was proven you know it

1281
00:48:03,270 --> 00:48:01,359
is possible to lift build a helicopter

1282
00:48:06,549 --> 00:48:03,280
you know we knew early on from analysis

1283
00:48:09,109 --> 00:48:06,559
the real question is 1.8 kilogram and

1284
00:48:12,470 --> 00:48:09,119
bob as the chief engineer managed those

1285
00:48:15,349 --> 00:48:12,480
1800 grams and i once saw him arguing

1286
00:48:16,390 --> 00:48:15,359
with eric archer who again we have lost

1287
00:48:18,710 --> 00:48:16,400
sadly

1288
00:48:20,390 --> 00:48:18,720

over bob do you remember was it over two

1289
00:48:23,109 --> 00:48:20,400
grams or three grams

1290
00:48:24,870 --> 00:48:23,119
eric wanted this uh telecom hardware

1291
00:48:27,750 --> 00:48:24,880
that was two more gram or two more grams

1292
00:48:29,510 --> 00:48:27,760
and bob just wouldn't give up so anyway

1293
00:48:32,309 --> 00:48:29,520
it made a huge impression so the the

1294
00:48:35,030 --> 00:48:32,319
biggest uh challenge was the um the

1295
00:48:37,589 --> 00:48:35,040
mouse to start with okay yes sounds like

1296
00:48:38,870 --> 00:48:37,599
every gram counts okay uh all right

1297
00:48:41,510 --> 00:48:38,880
we're going to go back to the media

1298
00:48:44,230 --> 00:48:41,520
lines and next up is amanda khan of the

1299
00:48:45,750 --> 00:48:44,240
la times

1300
00:48:46,710 --> 00:48:45,760
hi can you hear me

1301
00:48:48,790 --> 00:48:46,720
yes

1302
00:48:51,030 --> 00:48:48,800
hi thanks so much for taking my question

1303
00:48:52,790 --> 00:48:51,040
um i just i have a couple um

1304
00:48:54,390 --> 00:48:52,800
we've touched upon this a little bit um

1305
00:48:55,829 --> 00:48:54,400
already in some of the questions but i'm

1306
00:48:57,430 --> 00:48:55,839
just sort of wondering you know in your

1307
00:48:59,829 --> 00:48:57,440
wildest imaginations we talk about

1308
00:49:00,870 --> 00:48:59,839
sojourner being the trailblazer for all

1309
00:49:04,710 --> 00:49:00,880
these other

1310
00:49:06,309 --> 00:49:04,720
rovers um and uh you know all the ones

1311
00:49:07,670 --> 00:49:06,319
that followed have been so sophisticated

1312
00:49:10,230 --> 00:49:07,680
what is the most

1313
00:49:11,270 --> 00:49:10,240

powerful and sophisticated type of

1314
00:49:13,829 --> 00:49:11,280
flying

1315
00:49:15,750 --> 00:49:13,839
planetary explorer uh you think we might

1316
00:49:18,470 --> 00:49:15,760
have in the next year in the coming

1317
00:49:20,710 --> 00:49:18,480
years and decades and and what kinds of

1318
00:49:23,270 --> 00:49:20,720
um worlds might they explore could you

1319
00:49:25,109 --> 00:49:23,280
just sort of you know wax imaginative

1320
00:49:27,829 --> 00:49:25,119
and and think about what the potential

1321
00:49:29,589 --> 00:49:27,839
really is here in some specific but

1322
00:49:31,030 --> 00:49:29,599
imagined ways i'm not going to hold you

1323
00:49:32,549 --> 00:49:31,040
to it i won't come back in 10 years and

1324
00:49:34,630 --> 00:49:32,559
say hey where's my

1325
00:49:36,710 --> 00:49:34,640
where's my uh rover on where's my flying

1326
00:49:37,829 --> 00:49:36,720
rotocraft on neptune or whatever but i'd

1327
00:49:39,030 --> 00:49:37,839
just like to see it but where do you

1328
00:49:40,790 --> 00:49:39,040
think it could go

1329
00:49:42,790 --> 00:49:40,800
thomas you want to take this one

1330
00:49:44,790 --> 00:49:42,800
so the first application of flying

1331
00:49:47,349 --> 00:49:44,800
vehicles of course is track and fly at

1332
00:49:49,030 --> 00:49:47,359
titan in which we have a very different

1333
00:49:50,870 --> 00:49:49,040
vehicle and bob already mentioned it's

1334
00:49:53,910 --> 00:49:50,880
kind of in many ways simpler because of

1335
00:49:55,910 --> 00:49:53,920
the stronger atmosphere at titan than uh

1336
00:49:57,750 --> 00:49:55,920
than the earth even

1337
00:49:59,990 --> 00:49:57,760
i want to just point out one point i'm

1338
00:50:00,870 --> 00:50:00,000

sure everybody is thinking about already

1339
00:50:05,270 --> 00:50:00,880
but

1340
00:50:07,430 --> 00:50:05,280
that may actually have applications on

1341
00:50:08,950 --> 00:50:07,440
earth too i mean i you know it's that

1342
00:50:11,270 --> 00:50:08,960
planet up there

1343
00:50:13,750 --> 00:50:11,280
uh at these very high altitudes there's

1344
00:50:15,430 --> 00:50:13,760
interesting science that i'm sure

1345
00:50:17,670 --> 00:50:15,440
our earth science friends are thinking

1346
00:50:19,829 --> 00:50:17,680
about also now and whether they're here

1347
00:50:22,950 --> 00:50:19,839
at jpl and elsewhere

1348
00:50:24,950 --> 00:50:22,960
i do believe that uh that the primary

1349
00:50:27,510 --> 00:50:24,960
application beyond that is really going

1350
00:50:30,069 --> 00:50:27,520
to be at mars and frankly what

1351
00:50:31,910 --> 00:50:30,079
what is in my mind right when i look at

1352
00:50:34,230 --> 00:50:31,920
this and uh is

1353
00:50:36,069 --> 00:50:34,240
is the uh you know that much of the

1354
00:50:38,069 --> 00:50:36,079
signs when there's a lot of papers

1355
00:50:39,270 --> 00:50:38,079
written about you know from the

1356
00:50:41,670 --> 00:50:39,280
reconnaissance orbiter mars

1357
00:50:44,150 --> 00:50:41,680
reconnaissance orbiter is about areas

1358
00:50:46,069 --> 00:50:44,160
where we cannot bring a rover there like

1359
00:50:48,470 --> 00:50:46,079
you know crater walls

1360
00:50:51,190 --> 00:50:48,480
are really exciting with perhaps some

1361
00:50:53,190 --> 00:50:51,200
people say water seeping out there or

1362
00:50:55,829 --> 00:50:53,200
some kind of watery mix like we start

1363
00:50:57,750 --> 00:50:55,839

really the case well to actually figure

1364
00:50:59,190 --> 00:50:57,760
that out frankly you want to probably

1365
00:51:01,270 --> 00:50:59,200
fly there

1366
00:51:03,670 --> 00:51:01,280
the final point i'm going to make is

1367
00:51:06,230 --> 00:51:03,680
right after the technology demonstration

1368
00:51:08,470 --> 00:51:06,240
it's it's usually a pretty bad place to

1369
00:51:10,870 --> 00:51:08,480
figure out how big the boxes and which

1370
00:51:11,670 --> 00:51:10,880
the solutions live and and i was not

1371
00:51:13,829 --> 00:51:11,680
there

1372
00:51:15,750 --> 00:51:13,839
uh of course at uh

1373
00:51:17,430 --> 00:51:15,760
at uh sojourner

1374
00:51:20,950 --> 00:51:17,440
but you know

1375
00:51:23,750 --> 00:51:20,960
we are here from 97 uh we're here

1376
00:51:26,309 --> 00:51:23,760
and we have perseverance rover and is

1377
00:51:27,750 --> 00:51:26,319
basically enabling

1378
00:51:29,910 --> 00:51:27,760
sample return

1379
00:51:31,270 --> 00:51:29,920
and for me like did in fact the

1380
00:51:33,270 --> 00:51:31,280
sojourner

1381
00:51:35,349 --> 00:51:33,280
people think about a sample return of

1382
00:51:37,750 --> 00:51:35,359
one of the core

1383
00:51:40,630 --> 00:51:37,760
applications of this kind of mobility

1384
00:51:43,430 --> 00:51:40,640
perhaps they did but the point is that

1385
00:51:46,230 --> 00:51:43,440
is where we're investing major

1386
00:51:48,870 --> 00:51:46,240
effort and you know dollars attention

1387
00:51:50,870 --> 00:51:48,880
and frankly without mobility i do not

1388
00:51:53,109 --> 00:51:50,880

know how we could do this and it's an

1389
00:51:54,870 --> 00:51:53,119
absolutely critical science application

1390
00:51:56,790 --> 00:51:54,880
so that the most important thing to

1391
00:51:58,630 --> 00:51:56,800
learn about these things it's very hard

1392
00:52:00,470 --> 00:51:58,640
to predict the future

1393
00:52:01,430 --> 00:52:00,480
all right justin also wanted to add

1394
00:52:03,670 --> 00:52:01,440
something

1395
00:52:06,150 --> 00:52:03,680
yeah i just wanted to say you know 24

1396
00:52:08,549 --> 00:52:06,160
years from now it'll be 20

1397
00:52:11,030 --> 00:52:08,559
45 if i did my math right we've been up

1398
00:52:13,270 --> 00:52:11,040
since two in the morning so um

1399
00:52:14,950 --> 00:52:13,280
so i think that the the people to answer

1400
00:52:17,589 --> 00:52:14,960
that question are maybe people watching

1401
00:52:20,150 --> 00:52:17,599
this this press conference right now

1402
00:52:21,910 --> 00:52:20,160
the kids in school the kids studying

1403
00:52:23,670 --> 00:52:21,920
working hard learning about science and

1404
00:52:25,750 --> 00:52:23,680
technology i think

1405
00:52:27,109 --> 00:52:25,760
the answer to that question is up to you

1406
00:52:28,950 --> 00:52:27,119
so those of you that are getting

1407
00:52:30,870 --> 00:52:28,960
inspired by this

1408
00:52:32,470 --> 00:52:30,880
go into fields of science and technology

1409
00:52:34,710 --> 00:52:32,480
and decide for yourself what is what is

1410
00:52:36,150 --> 00:52:34,720
the future look like i think that's what

1411
00:52:39,030 --> 00:52:36,160
the group here did and we just try to be

1412
00:52:40,790 --> 00:52:39,040
an example to those those watching

1413
00:52:44,150 --> 00:52:40,800

to to give you that opportunity to

1414
00:52:48,630 --> 00:52:46,790
thank you and just a clarification on

1415
00:52:51,589 --> 00:52:48,640
ingenuity and testing it to the limits

1416
00:52:54,790 --> 00:52:51,599
are are we looking to fly it as far as

1417
00:52:58,390 --> 00:52:54,800
possible or as as hard as possible if

1418
00:53:03,109 --> 00:53:00,790
it is a question that i don't think

1419
00:53:05,190 --> 00:53:03,119
we're fully decided on yet uh where

1420
00:53:07,190 --> 00:53:05,200
where exactly where we want to push it

1421
00:53:09,510 --> 00:53:07,200
as i mentioned before

1422
00:53:12,549 --> 00:53:09,520
you can you can talk about flying higher

1423
00:53:14,710 --> 00:53:12,559
you can fight farther you can fly faster

1424
00:53:17,510 --> 00:53:14,720
those are three particular areas where

1425
00:53:19,829 --> 00:53:17,520
we'll you know be looking to in terms of

1426
00:53:21,589 --> 00:53:19,839
possibly stretching the capabilities uh

1427
00:53:23,270 --> 00:53:21,599
assuming that things go well over the

1428
00:53:25,910 --> 00:53:23,280
next three flights that's where we'll be

1429
00:53:27,829 --> 00:53:25,920
looking but exactly how we prioritize

1430
00:53:29,670 --> 00:53:27,839
between those different

1431
00:53:31,990 --> 00:53:29,680
things

1432
00:53:34,230 --> 00:53:32,000
i think is still a discussion that we

1433
00:53:36,230 --> 00:53:34,240
need to have as a team

1434
00:53:37,910 --> 00:53:36,240
thanks so much

1435
00:53:39,270 --> 00:53:37,920
thank you hovard i

1436
00:53:41,670 --> 00:53:39,280
think the gist was that it's hard to

1437
00:53:43,270 --> 00:53:41,680
look into the future

1438
00:53:46,630 --> 00:53:43,280

but thank you for the glimpses into the

1439
00:53:49,030 --> 00:53:46,640
future our next caller is eric mack of

1440
00:53:51,510 --> 00:53:49,040
cnet

1441
00:53:53,750 --> 00:53:51,520
yeah hi thank you for taking my call

1442
00:53:56,549 --> 00:53:53,760
this is looking a little bit far down

1443
00:53:59,109 --> 00:53:56,559
the road but i know that nasa has an

1444
00:54:01,190 --> 00:53:59,119
entire technology transfer office and

1445
00:54:02,710 --> 00:54:01,200
often likes to spin off this technology

1446
00:54:05,109 --> 00:54:02,720
so i wonder if there's been

1447
00:54:06,790 --> 00:54:05,119
any discussion within the agency of

1448
00:54:10,150 --> 00:54:06,800
possible applications for this

1449
00:54:12,309 --> 00:54:10,160
technology here on earth

1450
00:54:13,990 --> 00:54:12,319
so i did not um check with the

1451
00:54:15,910 --> 00:54:14,000
technology transfer office of which

1452
00:54:17,670 --> 00:54:15,920
we're really proud uh there's a number

1453
00:54:19,030 --> 00:54:17,680
of technologies that were you know

1454
00:54:21,190 --> 00:54:19,040
transferred in many different

1455
00:54:23,109 --> 00:54:21,200
applications actually i met one of my

1456
00:54:25,349 --> 00:54:23,119
friends told me that he started a whole

1457
00:54:27,270 --> 00:54:25,359
business uh based on one of these

1458
00:54:29,190 --> 00:54:27,280
technologies i just only learned about

1459
00:54:29,990 --> 00:54:29,200
this recently i would not be surprised

1460
00:54:31,829 --> 00:54:30,000
if

1461
00:54:33,510 --> 00:54:31,839
you know a company somewhere basically

1462
00:54:35,589 --> 00:54:33,520
says this is amazing technology i want

1463
00:54:36,470 --> 00:54:35,599

to learn about it or

1464
00:54:39,030 --> 00:54:36,480
you know

1465
00:54:40,230 --> 00:54:39,040
whether or not the work is in this

1466
00:54:41,990 --> 00:54:40,240
particular

1467
00:54:43,990 --> 00:54:42,000
uh you know in the research arena like

1468
00:54:46,069 --> 00:54:44,000
where we're working or in other arenas

1469
00:54:48,390 --> 00:54:46,079
that that could one could imagine right

1470
00:54:50,789 --> 00:54:48,400
i mean you know like so much of this is

1471
00:54:52,789 --> 00:54:50,799
in in the area of dreams right i've been

1472
00:54:55,430 --> 00:54:52,799
thinking you know i can't get out of my

1473
00:54:57,670 --> 00:54:55,440
mind the amazing movie footage this

1474
00:54:59,990 --> 00:54:57,680
would be if if he saw somebody going up

1475
00:55:02,069 --> 00:55:00,000
mount everest and seeing him get off our

1476
00:55:02,870 --> 00:55:02,079
drone on the outside actually covering

1477
00:55:04,789 --> 00:55:02,880
that

1478
00:55:06,789 --> 00:55:04,799
from there i mean we've nobody has ever

1479
00:55:09,430 --> 00:55:06,799
seen this you know like you know how how

1480
00:55:12,789 --> 00:55:09,440
would that look i'm not aware of

1481
00:55:15,030 --> 00:55:12,799
any negotiations right now but i'm sure

1482
00:55:17,349 --> 00:55:15,040
if there's interest the team is ready to

1483
00:55:20,069 --> 00:55:17,359
support it

1484
00:55:22,390 --> 00:55:20,079
thank you great okay next caller is

1485
00:55:26,390 --> 00:55:22,400
stephen clark of space flight now go

1486
00:55:30,150 --> 00:55:27,910
thank you and congratulations to

1487
00:55:33,270 --> 00:55:30,160
everyone uh stephen clark space flight

1488
00:55:37,030 --> 00:55:33,280

now a couple of questions one for hobart

1489
00:55:38,870 --> 00:55:37,040
do you happen to know the velocity

1490
00:55:41,589 --> 00:55:38,880
vertical velocity at takeoff and

1491
00:55:42,950 --> 00:55:41,599
touchdown of the helicopter

1492
00:55:46,069 --> 00:55:42,960
and also

1493
00:55:49,109 --> 00:55:46,079
maybe mimi on can refresh my memory on

1494
00:55:50,950 --> 00:55:49,119
the flight plan uh details for flights

1495
00:55:52,549 --> 00:55:50,960
two and three uh since you have those i

1496
00:55:54,789 --> 00:55:52,559
think already planned out

1497
00:55:57,109 --> 00:55:54,799
and uh just refresh my memory on the

1498
00:55:59,589 --> 00:55:57,119
altitude and uh distance planned on

1499
00:56:01,109 --> 00:55:59,599
those thanks

1500
00:56:03,750 --> 00:56:01,119
so i think the question was about the

1501
00:56:06,309 --> 00:56:03,760
philosophy for takeoff and landing for

1502
00:56:08,789 --> 00:56:06,319
ingenuity and and so to

1503
00:56:11,589 --> 00:56:08,799
take off first uh the way that we take

1504
00:56:13,270 --> 00:56:11,599
off is we we boost off the ground uh

1505
00:56:15,270 --> 00:56:13,280
with the fixed what we call collective

1506
00:56:17,510 --> 00:56:15,280
setting that basically provides a thrust

1507
00:56:20,069 --> 00:56:17,520
that's well above what the aircraft

1508
00:56:21,910 --> 00:56:20,079
needs to hover so it sort of boosts off

1509
00:56:24,950 --> 00:56:21,920
the ground with limited control in that

1510
00:56:26,630 --> 00:56:24,960
very initial you know split second

1511
00:56:28,470 --> 00:56:26,640
and then once it separates from the

1512
00:56:30,630 --> 00:56:28,480
ground uh you know against just a few

1513
00:56:33,270 --> 00:56:30,640

centimeters of altitude then we take

1514
00:56:34,069 --> 00:56:33,280
full control of the vehicle and guide it

1515
00:56:34,950 --> 00:56:34,079
up

1516
00:56:35,670 --> 00:56:34,960
um

1517
00:56:37,750 --> 00:56:35,680
to

1518
00:56:39,670 --> 00:56:37,760
the altitude that it's going

1519
00:56:41,430 --> 00:56:39,680
uh and that is in our because we don't

1520
00:56:42,789 --> 00:56:41,440
want to be fighting against the ground

1521
00:56:44,390 --> 00:56:42,799
with the legs on the ground we don't

1522
00:56:46,630 --> 00:56:44,400
want to be fighting with it

1523
00:56:48,630 --> 00:56:46,640
by applying full control at that point

1524
00:56:50,710 --> 00:56:48,640
we want to separate cleanly get out of

1525
00:56:52,630 --> 00:56:50,720
ground effect and and

1526
00:56:54,789 --> 00:56:52,640
and then

1527
00:56:56,470 --> 00:56:54,799
continue controlling

1528
00:56:59,270 --> 00:56:56,480
on landing

1529
00:57:02,470 --> 00:56:59,280
our philosophy here is to basically fly

1530
00:57:05,510 --> 00:57:02,480
towards the ground at a constant speed

1531
00:57:08,470 --> 00:57:05,520
in fact ingenuity is commanded to

1532
00:57:10,390 --> 00:57:08,480
to fly through the ground and then just

1533
00:57:12,230 --> 00:57:10,400
stop doing that when it detects that

1534
00:57:15,670 --> 00:57:12,240
it's not able to do it anymore because

1535
00:57:18,150 --> 00:57:15,680
that means it's it's met the ground

1536
00:57:19,990 --> 00:57:18,160
so it uses the onboard inertial

1537
00:57:20,789 --> 00:57:20,000
measurement units in order to detect

1538
00:57:24,390 --> 00:57:20,799

that

1539
00:57:27,589 --> 00:57:24,400
progress

1540
00:57:30,069 --> 00:57:27,599
downwards and then it instantly

1541
00:57:34,230 --> 00:57:30,079
lowers the collective to stop producing

1542
00:57:37,270 --> 00:57:35,109
and then

1543
00:57:39,589 --> 00:57:37,280
on the flights uh two and three the

1544
00:57:42,309 --> 00:57:39,599
second flight is to uh take off like

1545
00:57:44,950 --> 00:57:42,319
today except higher to uh three meters

1546
00:57:46,789 --> 00:57:44,960
height instead of two instead of the

1547
00:57:48,309 --> 00:57:46,799
instep to five meters height instead of

1548
00:57:50,390 --> 00:57:48,319
the three meter side that we went up to

1549
00:57:53,750 --> 00:57:50,400
so we'll go up to five meters height and

1550
00:57:55,829 --> 00:57:53,760
then fly laterally for about two meters

1551
00:57:57,430 --> 00:57:55,839
come back the two meters and land uh

1552
00:57:59,750 --> 00:57:57,440
from where the exact spot that the

1553
00:58:01,910 --> 00:57:59,760
vehicle took off on and then following

1554
00:58:04,630 --> 00:58:01,920
that slide three would be again to go up

1555
00:58:06,309 --> 00:58:04,640
to five meters and then fly laterally uh

1556
00:58:08,710 --> 00:58:06,319
50 meters out

1557
00:58:09,670 --> 00:58:08,720
and then come back 50 meters and uh come

1558
00:58:11,829 --> 00:58:09,680
back

1559
00:58:13,510 --> 00:58:11,839
um any description other description you

1560
00:58:15,430 --> 00:58:13,520
want to add to those flights how about

1561
00:58:17,270 --> 00:58:15,440
you know that that that about captures

1562
00:58:19,910 --> 00:58:17,280
it so so it's sort of taking things

1563
00:58:21,430 --> 00:58:19,920

stepwise again the next flight we will

1564
00:58:23,190 --> 00:58:21,440
you know we will be testing higher

1565
00:58:25,349 --> 00:58:23,200
altitudes so that will be one aspect of

1566
00:58:26,549 --> 00:58:25,359
it and then the ability to track to

1567
00:58:29,349 --> 00:58:26,559
different waypoints that aren't

1568
00:58:32,069 --> 00:58:29,359
co-located like we have here and then

1569
00:58:34,150 --> 00:58:32,079
for that uh third flight we would be

1570
00:58:35,430 --> 00:58:34,160
translating further and at that point

1571
00:58:37,190 --> 00:58:35,440
also faster

1572
00:58:39,349 --> 00:58:37,200
you know normally two meters per second

1573
00:58:40,470 --> 00:58:39,359
is the is the

1574
00:58:41,349 --> 00:58:40,480
uh

1575
00:58:44,230 --> 00:58:41,359
it's the

1576
00:58:47,349 --> 00:58:44,240
forward velocity that we'll be using for

1577
00:58:48,870 --> 00:58:47,359
that third flight

1578
00:58:51,030 --> 00:58:48,880
okay thank you

1579
00:58:55,190 --> 00:58:51,040
we're gonna go to another media question

1580
00:58:57,510 --> 00:58:55,200
from joey roulette of the verge

1581
00:58:59,589 --> 00:58:57,520
hey thank you for taking my question um

1582
00:59:00,789 --> 00:58:59,599
this one's for thomas and it kind of

1583
00:59:02,789 --> 00:59:00,799
echoes some of the other questions

1584
00:59:04,710 --> 00:59:02,799
already asked but from a broader

1585
00:59:06,950 --> 00:59:04,720
perspective how much more confidence

1586
00:59:09,270 --> 00:59:06,960
does this flight give you for sending

1587
00:59:12,230 --> 00:59:09,280
more helicopters to mars or for other

1588
00:59:13,670 --> 00:59:12,240

planets and for mimi or hervard

1589
00:59:15,349 --> 00:59:13,680
what exactly

1590
00:59:16,470 --> 00:59:15,359
does pushing ingenuity to its limits

1591
00:59:18,549 --> 00:59:16,480
mean and

1592
00:59:20,390 --> 00:59:18,559
how high i guess could it go based on

1593
00:59:22,470 --> 00:59:20,400
the data that you guys are seeing now

1594
00:59:24,309 --> 00:59:22,480
and is there anything that you guys are

1595
00:59:27,349 --> 00:59:24,319
seeing in this data that kind of tells

1596
00:59:29,430 --> 00:59:27,359
you what those limits might be thanks

1597
00:59:31,670 --> 00:59:29,440
hey joey really appreciate the question

1598
00:59:34,309 --> 00:59:31,680
look i mean i think of exploration uh

1599
00:59:36,309 --> 00:59:34,319
you know kind of there's a box somewhere

1600
00:59:38,470 --> 00:59:36,319
in my mind in which kind of all the

1601
00:59:40,150 --> 00:59:38,480
things we know how to do are in that box

1602
00:59:41,270 --> 00:59:40,160
and kind of every mission that we're

1603
00:59:42,789 --> 00:59:41,280
flying

1604
00:59:44,390 --> 00:59:42,799
is a combination of the things we've

1605
00:59:46,069 --> 00:59:44,400
already proven

1606
00:59:49,510 --> 00:59:46,079
well since this morning there's an

1607
00:59:51,829 --> 00:59:49,520
entirely new tool uh in that box

1608
00:59:53,670 --> 00:59:51,839
and it should be combined with the other

1609
00:59:54,870 --> 00:59:53,680
things that are there and i'm very

1610
00:59:57,430 --> 00:59:54,880
confident

1611
00:59:59,670 --> 00:59:57,440
that great ideas will emerge with that

1612
01:00:01,349 --> 00:59:59,680
technology proven here for new missions

1613
01:00:03,109 --> 01:00:01,359

i would be very disappointed in the

1614
01:00:05,030 --> 01:00:03,119
science community and the technology

1615
01:00:07,670 --> 01:00:05,040
community if they didn't come up with

1616
01:00:10,150 --> 01:00:07,680
something utterly amazing because of the

1617
01:00:13,589 --> 01:00:10,160
new dimension that was added by this

1618
01:00:15,430 --> 01:00:13,599
technology to explore so for me i'm

1619
01:00:18,230 --> 01:00:15,440
confident we'll see a lot of this as we

1620
01:00:22,069 --> 01:00:18,240
go forward what it is exactly

1621
01:00:26,549 --> 01:00:25,030
yeah so so again in terms of how

1622
01:00:28,069 --> 01:00:26,559
how far we challenge it in what

1623
01:00:29,430 --> 01:00:28,079
direction is still a little bit of a

1624
01:00:31,190 --> 01:00:29,440
discussion but i can say a little bit

1625
01:00:32,390 --> 01:00:31,200
about this you know what are the things

1626
01:00:34,150 --> 01:00:32,400
that are

1627
01:00:35,750 --> 01:00:34,160
that we are challenging you know if we

1628
01:00:37,910 --> 01:00:35,760
go you know say

1629
01:00:41,349 --> 01:00:37,920
faster with the helicopter

1630
01:00:43,430 --> 01:00:41,359
one of the things is air speed so

1631
01:00:45,910 --> 01:00:43,440
the aircraft is you know tested up to a

1632
01:00:49,270 --> 01:00:45,920
certain uh certain airspeed

1633
01:00:51,990 --> 01:00:49,280
and so by going faster uh we would be

1634
01:00:55,109 --> 01:00:52,000
challenging those limits and that uh

1635
01:00:56,630 --> 01:00:55,119
challenges the uh aircraft in terms of

1636
01:00:59,510 --> 01:00:56,640
of its

1637
01:01:01,990 --> 01:00:59,520
stability margin its ability to

1638
01:01:07,670 --> 01:01:02,000

to handle

1639
01:01:09,589 --> 01:01:07,680
airspeeds

1640
01:01:11,750 --> 01:01:09,599
another aspect that we're challenging in

1641
01:01:13,910 --> 01:01:11,760
that regard is the navigation system

1642
01:01:15,910 --> 01:01:13,920
because as i mentioned before we

1643
01:01:18,710 --> 01:01:15,920
navigate by taking images of the ground

1644
01:01:20,870 --> 01:01:18,720
below and as we're traveling faster

1645
01:01:22,950 --> 01:01:20,880
over the ground those images the

1646
01:01:25,910 --> 01:01:22,960
features in those images disappear from

1647
01:01:27,829 --> 01:01:25,920
you faster and so that's another

1648
01:01:30,630 --> 01:01:27,839
limiting factor if you will that we're

1649
01:01:32,870 --> 01:01:30,640
pushing up against as we start to go

1650
01:01:35,990 --> 01:01:32,880
faster with the helicopter in terms of

1651
01:01:38,470 --> 01:01:36,000
altitude a main limiting factor there is

1652
01:01:40,789 --> 01:01:38,480
our our altimeter which is actually a

1653
01:01:43,109 --> 01:01:40,799
laser range finder that measures the

1654
01:01:46,470 --> 01:01:43,119
distance to the ground and so we're

1655
01:01:50,230 --> 01:01:46,480
limited by how how high we can fly uh

1656
01:01:52,789 --> 01:01:50,240
before uh before that stops working

1657
01:01:55,670 --> 01:01:52,799
properly and so nominally there we're

1658
01:01:58,230 --> 01:01:55,680
looking at uh probably somewhere you

1659
01:02:00,390 --> 01:01:58,240
know at 10 meters or a little bit more

1660
01:02:04,549 --> 01:02:00,400
uh but not much more than that before we

1661
01:02:07,109 --> 01:02:04,559
would start to run into limits with the

1662
01:02:08,950 --> 01:02:07,119
laser rangefinder

1663
01:02:11,510 --> 01:02:08,960

well to put a number on the distance a

1664
01:02:14,630 --> 01:02:11,520
lot i'd love to force it to 600 700

1665
01:02:16,549 --> 01:02:14,640
meters so just putting it on the record

1666
01:02:18,309 --> 01:02:16,559
so anyway this is the further team

1667
01:02:20,309 --> 01:02:18,319
discussion we're gonna have

1668
01:02:23,990 --> 01:02:20,319
i'm being more cautious there but uh

1669
01:02:26,390 --> 01:02:24,000
yeah we'll take that discussion

1670
01:02:31,510 --> 01:02:26,400
okay all right thanks for that uh next

1671
01:02:33,510 --> 01:02:31,520
caller is guy norris of aviation week

1672
01:02:35,349 --> 01:02:33,520
yes thanks for taking my call and

1673
01:02:37,190 --> 01:02:35,359
congratulations on an amazing

1674
01:02:38,950 --> 01:02:37,200
achievement um

1675
01:02:41,349 --> 01:02:38,960
obviously you are at the beginning of

1676
01:02:43,510 --> 01:02:41,359
the first ever extraterrestrial flight

1677
01:02:45,510 --> 01:02:43,520
test program i guess and one of the

1678
01:02:47,109 --> 01:02:45,520
things i was wondering about just to to

1679
01:02:48,390 --> 01:02:47,119
go back a little bit to what mimi was

1680
01:02:50,309 --> 01:02:48,400
saying was the

1681
01:02:52,470 --> 01:02:50,319
the lessons learned you know how quickly

1682
01:02:54,069 --> 01:02:52,480
you'll be able to draw on these lessons

1683
01:02:56,150 --> 01:02:54,079
learned from the following flight test

1684
01:02:57,670 --> 01:02:56,160
program um or sorry for the following

1685
01:03:02,309 --> 01:02:57,680
flight test

1686
01:03:04,309 --> 01:03:02,319
specifically the rpm the the liftoff rpm

1687
01:03:08,390 --> 01:03:04,319
and the descent rate that you saw on

1688
01:03:10,309 --> 01:03:08,400

this first flight will you be able to uh

1689
01:03:12,470 --> 01:03:10,319
basically work on

1690
01:03:15,190 --> 01:03:12,480
analyzing whether those were within

1691
01:03:16,950 --> 01:03:15,200
predictions as you said and

1692
01:03:18,950 --> 01:03:16,960
the last part is just could you say what

1693
01:03:19,829 --> 01:03:18,960
these vertical velocities were on the

1694
01:03:22,150 --> 01:03:19,839
top and

1695
01:03:25,029 --> 01:03:22,160
touchdown

1696
01:03:26,789 --> 01:03:25,039
yeah so so we will be getting

1697
01:03:29,029 --> 01:03:26,799
so the data that we've seen so far is

1698
01:03:30,630 --> 01:03:29,039
actually fairly limited uh we will be

1699
01:03:32,069 --> 01:03:30,640
getting in the next few days we'll be

1700
01:03:33,750 --> 01:03:32,079
getting a lot more data down from the

1701
01:03:35,829 --> 01:03:33,760
helicopter and that'll tell us a lot

1702
01:03:38,630 --> 01:03:35,839
about how it performs so in relation to

1703
01:03:40,630 --> 01:03:38,640
the rpm for example the rpm is set based

1704
01:03:42,230 --> 01:03:40,640
on what we expected the density to be at

1705
01:03:43,829 --> 01:03:42,240
the time of flight

1706
01:03:45,750 --> 01:03:43,839
in order to put us in a particular

1707
01:03:47,910 --> 01:03:45,760
operating regime and so we what we will

1708
01:03:49,430 --> 01:03:47,920
see when we get data down is we'll see

1709
01:03:51,430 --> 01:03:49,440
what did the helicopter have to do in

1710
01:03:54,150 --> 01:03:51,440
terms of the controls operating at that

1711
01:03:55,990 --> 01:03:54,160
rpm where we operating at the set point

1712
01:03:57,430 --> 01:03:56,000
that we thought we would be

1713
01:03:59,430 --> 01:03:57,440

or were we off from that and that'll

1714
01:04:00,390 --> 01:03:59,440
tell us among other things you know

1715
01:04:02,470 --> 01:04:00,400
something

1716
01:04:05,589 --> 01:04:02,480
at least tell us to what extent was the

1717
01:04:08,549 --> 01:04:05,599
rpm appropriate for the density uh that

1718
01:04:10,470 --> 01:04:08,559
we that we were at uh so that's one

1719
01:04:12,150 --> 01:04:10,480
example of that we'll also get a lot of

1720
01:04:14,470 --> 01:04:12,160
metrics that will help us analyze the

1721
01:04:16,789 --> 01:04:14,480
navigation system

1722
01:04:18,950 --> 01:04:16,799
and and see how well did it do at

1723
01:04:20,950 --> 01:04:18,960
tracking features uh

1724
01:04:22,950 --> 01:04:20,960
uh on the ground during flight

1725
01:04:24,789 --> 01:04:22,960
and then i i didn't actually hear the

1726
01:04:27,430 --> 01:04:24,799
last question that was asked if you

1727
01:04:28,470 --> 01:04:27,440
could repeat that

1728
01:04:30,789 --> 01:04:28,480
um

1729
01:04:33,270 --> 01:04:30,799
it was really just in terms of the uh

1730
01:04:34,789 --> 01:04:33,280
the velocity really of the but as you

1731
01:04:37,270 --> 01:04:34,799
said i think you're still going through

1732
01:04:38,630 --> 01:04:37,280
the data i just wondered if the

1733
01:04:40,870 --> 01:04:38,640
touchdown

1734
01:04:42,549 --> 01:04:40,880
uh did seem rather sporty

1735
01:04:44,789 --> 01:04:42,559
in terms of the descent rate but i

1736
01:04:46,710 --> 01:04:44,799
presume that as you mentioned is part of

1737
01:04:49,190 --> 01:04:46,720
the philosophy of how you will you

1738
01:04:51,829 --> 01:04:49,200

approach that landing sequence

1739
01:04:54,470 --> 01:04:51,839
yes it is it definitely is so uh we

1740
01:04:55,990 --> 01:04:54,480
descend at one meter per second and as

1741
01:04:58,470 --> 01:04:56,000
as you know in terms of sportiness you

1742
01:05:00,309 --> 01:04:58,480
can see we don't slow down when we you

1743
01:05:02,549 --> 01:05:00,319
know start to near the ground and there

1744
01:05:04,230 --> 01:05:02,559
are multiple reasons for that uh one of

1745
01:05:07,910 --> 01:05:04,240
them is we just don't want to hang out

1746
01:05:09,670 --> 01:05:07,920
you know too long in in ground effect

1747
01:05:10,390 --> 01:05:09,680
another reason is

1748
01:05:15,670 --> 01:05:10,400
we

1749
01:05:17,270 --> 01:05:15,680
the ground now as you can see from the

1750
01:05:19,109 --> 01:05:17,280
images we don't see much you know

1751
01:05:20,630 --> 01:05:19,119
indication of that but that's been our

1752
01:05:23,190 --> 01:05:20,640
long-standing assumption and for that

1753
01:05:25,589 --> 01:05:23,200
reason we don't use the camera or the

1754
01:05:27,670 --> 01:05:25,599
laser rangefinder when we're near the

1755
01:05:29,670 --> 01:05:27,680
ground we're just operating based on

1756
01:05:31,990 --> 01:05:29,680
what's called inertial uh inertial

1757
01:05:33,829 --> 01:05:32,000
measurements and those tend to drift

1758
01:05:35,829 --> 01:05:33,839
very quickly so we want to get when

1759
01:05:37,589 --> 01:05:35,839
we're in that mode we need to get down

1760
01:05:39,589 --> 01:05:37,599
to the ground quickly so that's another

1761
01:05:40,950 --> 01:05:39,599
reason to just aim for the ground at a

1762
01:05:45,510 --> 01:05:40,960
high

1763
01:05:47,430 --> 01:05:45,520

try to slow down too much in the process

1764
01:05:49,349 --> 01:05:47,440
and the third reason is

1765
01:05:50,789 --> 01:05:49,359
because we're using

1766
01:05:53,510 --> 01:05:50,799
we're sensing that we're meeting the

1767
01:05:55,430 --> 01:05:53,520
ground we want to do that confidently

1768
01:05:57,190 --> 01:05:55,440
you know if if we if we just barely

1769
01:05:59,829 --> 01:05:57,200
touched it it's hard to detect that you

1770
01:06:01,910 --> 01:05:59,839
that that's what you did and so we we

1771
01:06:04,390 --> 01:06:01,920
touch down confidently we can we can

1772
01:06:07,029 --> 01:06:04,400
very easily detect that we did so and

1773
01:06:08,710 --> 01:06:07,039
then we can stop uh flying

1774
01:06:11,270 --> 01:06:08,720
got it

1775
01:06:13,910 --> 01:06:11,280
okay all right we're gonna take a social

1776
01:06:15,349 --> 01:06:13,920
media question here um

1777
01:06:17,589 --> 01:06:15,359
this is for mimi

1778
01:06:19,829 --> 01:06:17,599
donnie on youtube asks

1779
01:06:22,069 --> 01:06:19,839
what advice would you give for girls and

1780
01:06:24,230 --> 01:06:22,079
young ladies in school around the world

1781
01:06:27,910 --> 01:06:24,240
who are interested in pursuing a career

1782
01:06:29,670 --> 01:06:27,920
in space related technology

1783
01:06:32,950 --> 01:06:29,680
my advice

1784
01:06:35,190 --> 01:06:32,960
if you're attracted to it go for it

1785
01:06:38,710 --> 01:06:35,200
don't let anybody talk you out of it

1786
01:06:40,710 --> 01:06:38,720
including yourself so i like to say

1787
01:06:43,829 --> 01:06:40,720
find an intersection of what you like to

1788
01:06:46,069 --> 01:06:43,839

do what you're good at and the cost that

1789
01:06:47,589 --> 01:06:46,079
you want to you know make and improve on

1790
01:06:49,589 --> 01:06:47,599
find that intersection of those three

1791
01:06:52,309 --> 01:06:49,599
when you find it like it sounds like you

1792
01:06:54,789 --> 01:06:52,319
are attracted to stem

1793
01:06:56,710 --> 01:06:54,799
go for it and put it takes tons of hard

1794
01:06:58,390 --> 01:06:56,720
work but it won't feel like hard work

1795
01:07:00,230 --> 01:06:58,400
because you're going to enjoy it so much

1796
01:07:02,630 --> 01:07:00,240
your passion is going to come out of it

1797
01:07:04,309 --> 01:07:02,640
and you will be able to make whatever

1798
01:07:06,710 --> 01:07:04,319
you want to make happen so yes my

1799
01:07:08,230 --> 01:07:06,720
biggest advice don't let yourself talk

1800
01:07:11,510 --> 01:07:08,240
talk you out of it and definitely don't

1801
01:07:13,430 --> 01:07:11,520
let other people talk you out of it

1802
01:07:16,630 --> 01:07:13,440
thank you mimi okay we're back to the

1803
01:07:18,789 --> 01:07:16,640
media lines uh rick lovett of cosmos

1804
01:07:20,630 --> 01:07:18,799
magazine go ahead

1805
01:07:23,109 --> 01:07:20,640
uh yes thank you very much my question

1806
01:07:24,950 --> 01:07:23,119
has already been answered

1807
01:07:27,510 --> 01:07:24,960
okay all right then we will take the

1808
01:07:30,069 --> 01:07:27,520
next media caller leo and wright of

1809
01:07:32,069 --> 01:07:30,079
irish television

1810
01:07:35,190 --> 01:07:32,079
uh thanks very much jairee and uh

1811
01:07:40,789 --> 01:07:35,200
congratulations to everybody um i have a

1812
01:07:42,549 --> 01:07:40,799
semantic question uh for bob balaram um

1813
01:07:44,309 --> 01:07:42,559

some people may not realize that we

1814
01:07:47,190 --> 01:07:44,319
journalists are people who look over our

1815
01:07:49,349 --> 01:07:47,200
shoulders and check what we write

1816
01:07:51,029 --> 01:07:49,359
in europe and asia we call these people

1817
01:07:57,349 --> 01:07:51,039
sub editors

1818
01:08:00,950 --> 01:07:57,359
why do i keep calling this a helicopter

1819
01:08:04,150 --> 01:08:00,960
and why do i not call it a drone can you

1820
01:08:08,150 --> 01:08:04,160
uh help me answer that and uh if i could

1821
01:08:09,109 --> 01:08:08,160
ask a second question um to uh justin

1822
01:08:11,910 --> 01:08:09,119
mackey

1823
01:08:12,630 --> 01:08:11,920
to know where is perseverance going to

1824
01:08:15,750 --> 01:08:12,640
be

1825
01:08:17,910 --> 01:08:15,760
during this extended flight test program

1826
01:08:19,990 --> 01:08:17,920
is it going to stay in place or will it

1827
01:08:21,189 --> 01:08:20,000
move around

1828
01:08:23,030 --> 01:08:21,199
between

1829
01:08:25,510 --> 01:08:23,040
flights thanks

1830
01:08:27,269 --> 01:08:25,520
yeah so purely as you know as a

1831
01:08:30,149 --> 01:08:27,279
terminology whether you call it a

1832
01:08:31,110 --> 01:08:30,159
rotorcraft or a helicopter or a drone

1833
01:08:33,430 --> 01:08:31,120
you know you could use those

1834
01:08:35,510 --> 01:08:33,440
interchangeably i think

1835
01:08:37,189 --> 01:08:35,520
one of the connotations of drone here is

1836
01:08:38,789 --> 01:08:37,199
that it's uh has a little bit of you

1837
01:08:40,470 --> 01:08:38,799
know an off-the-shelf

1838
01:08:42,229 --> 01:08:40,480

you know you go buy it at your favorite

1839
01:08:43,269 --> 01:08:42,239
store and you know you can fly it out of

1840
01:08:45,990 --> 01:08:43,279
the box

1841
01:08:47,749 --> 01:08:46,000
uh ingenuity is quite different it had

1842
01:08:50,309 --> 01:08:47,759
to be designed from the ground up for a

1843
01:08:52,550 --> 01:08:50,319
very alien very harsh environment we

1844
01:08:55,510 --> 01:08:52,560
don't have drones that you know survive

1845
01:08:57,030 --> 01:08:55,520
minus 130 degrees fahrenheit at night we

1846
01:09:00,229 --> 01:08:57,040
don't have drones that fly in one

1847
01:09:01,749 --> 01:09:00,239
percent of the atmosphere of earth so

1848
01:09:03,990 --> 01:09:01,759
if you're careful about using the word

1849
01:09:06,309 --> 01:09:04,000
drone and you remember that this is a

1850
01:09:07,910 --> 01:09:06,319
very very very special drone you could

1851
01:09:09,349 --> 01:09:07,920
say drone

1852
01:09:11,189 --> 01:09:09,359
but just want to make sure that people

1853
01:09:12,630 --> 01:09:11,199
don't lose track of the fact that it's a

1854
01:09:15,110 --> 01:09:12,640
very special

1855
01:09:16,870 --> 01:09:15,120
aircraft that's quite unique

1856
01:09:17,829 --> 01:09:16,880
but you know if you want to call it a

1857
01:09:20,149 --> 01:09:17,839
drone

1858
01:09:24,149 --> 01:09:20,159
helicopter rotograph depending upon your

1859
01:09:28,870 --> 01:09:26,309
okay and then justin you want to

1860
01:09:30,950 --> 01:09:28,880
yes so the uh the rover is actually

1861
01:09:33,269 --> 01:09:30,960
going to stay at its current location

1862
01:09:35,349 --> 01:09:33,279
during the next few test flights

1863
01:09:37,189 --> 01:09:35,359

this location was actually there was a

1864
01:09:39,590 --> 01:09:37,199
fair amount of discussion about where to

1865
01:09:41,510 --> 01:09:39,600
park for the duration of

1866
01:09:44,070 --> 01:09:41,520
the month of ingenuity and the science

1867
01:09:45,749 --> 01:09:44,080
team spent time debating that and

1868
01:09:47,110 --> 01:09:45,759
picked this location there there are a

1869
01:09:49,269 --> 01:09:47,120
lot of interesting

1870
01:09:50,070 --> 01:09:49,279
nearby rocks that the team has actually

1871
01:09:52,149 --> 01:09:50,080
been

1872
01:09:53,910 --> 01:09:52,159
actually over the weekend uh doing a lot

1873
01:09:55,910 --> 01:09:53,920
of interesting discussion about what

1874
01:09:57,189 --> 01:09:55,920
trying to understand where the the local

1875
01:09:59,270 --> 01:09:57,199
geology

1876
01:10:00,149 --> 01:09:59,280
and um and they're keeping very busy

1877
01:10:03,270 --> 01:10:00,159
actually

1878
01:10:05,430 --> 01:10:03,280
uh i will also um mention too that this

1879
01:10:07,270 --> 01:10:05,440
is this is giving the team a chance to

1880
01:10:09,750 --> 01:10:07,280
just look at all the data we've been

1881
01:10:12,870 --> 01:10:09,760
also been using mass cam z and the

1882
01:10:14,870 --> 01:10:12,880
supercam rmi remote microscopic imager

1883
01:10:17,189 --> 01:10:14,880
to take really detailed pictures of the

1884
01:10:19,590 --> 01:10:17,199
delta remnants and there's been a lot of

1885
01:10:21,270 --> 01:10:19,600
discussion about which way should we

1886
01:10:22,790 --> 01:10:21,280
head into the delta should we do should

1887
01:10:24,709 --> 01:10:22,800
we go one way or the other way and so

1888
01:10:26,470 --> 01:10:24,719

this is giving the team a chance to

1889
01:10:27,590 --> 01:10:26,480
get caught up on all of that too so so

1890
01:10:28,470 --> 01:10:27,600
we're going to be parked right where we

1891
01:10:30,550 --> 01:10:28,480
are

1892
01:10:31,669 --> 01:10:30,560
we like this location and i would i

1893
01:10:34,310 --> 01:10:31,679
don't know if any of us mentioned the

1894
01:10:37,110 --> 01:10:34,320
the heli is about 70 meters away from

1895
01:10:38,950 --> 01:10:37,120
where we are right now 69 to 70 meters

1896
01:10:40,310 --> 01:10:38,960
so we like that vantage point as you can

1897
01:10:42,830 --> 01:10:40,320
see we get a good view of the heli so

1898
01:10:46,229 --> 01:10:42,840
we're happy with the current

1899
01:10:48,470 --> 01:10:46,239
location okay um we're going to take

1900
01:10:54,390 --> 01:10:48,480
another media question

1901
01:10:56,390 --> 01:10:54,400
this one is rose and aragon from kprc tv

1902
01:10:58,229 --> 01:10:56,400
thank you so much for taking my question

1903
01:11:00,149 --> 01:10:58,239
and congratulations

1904
01:11:01,510 --> 01:11:00,159
this is sort of whoever would like to

1905
01:11:03,990 --> 01:11:01,520
answer this

1906
01:11:06,390 --> 01:11:04,000
i understand that you have done hundreds

1907
01:11:07,189 --> 01:11:06,400
of simulations of this i'm interested to

1908
01:11:09,830 --> 01:11:07,199
know

1909
01:11:11,430 --> 01:11:09,840
is there something that you have learned

1910
01:11:13,110 --> 01:11:11,440
that's significant

1911
01:11:15,350 --> 01:11:13,120
that was not

1912
01:11:17,830 --> 01:11:15,360
in line with what you had predicted with

1913
01:11:20,550 --> 01:11:17,840

the simulation other than the dust and

1914
01:11:23,590 --> 01:11:20,560
the cameras of course

1915
01:11:26,229 --> 01:11:23,600
it looks like uh you know like it did in

1916
01:11:28,229 --> 01:11:26,239
simulation it's you know again we we're

1917
01:11:29,510 --> 01:11:28,239
going to get more data and so we're

1918
01:11:30,709 --> 01:11:29,520
going to mine through that and we're

1919
01:11:32,790 --> 01:11:30,719
going to learn things from that and

1920
01:11:34,390 --> 01:11:32,800
there may be things there that that are

1921
01:11:36,709 --> 01:11:34,400
unexpected

1922
01:11:37,510 --> 01:11:36,719
but just looking at what we've seen so

1923
01:11:39,990 --> 01:11:37,520
far

1924
01:11:42,310 --> 01:11:40,000
it certainly you know flies very much

1925
01:11:44,630 --> 01:11:42,320
like what we uh predicted in our

1926
01:11:45,510 --> 01:11:44,640
simulations which is which is really uh

1927
01:11:48,310 --> 01:11:45,520
great

1928
01:11:50,950 --> 01:11:48,320
and as far as the dust yes uh

1929
01:11:53,669 --> 01:11:50,960
our you know fears about having

1930
01:11:56,070 --> 01:11:53,679
obscurations from dust uh near the

1931
01:11:57,590 --> 01:11:56,080
ground do not seem to be born out we've

1932
01:11:59,110 --> 01:11:57,600
always knew that there was uncertainty

1933
01:12:00,709 --> 01:11:59,120
with that and we always took a cautious

1934
01:12:03,110 --> 01:12:00,719
approach to it in terms of how we

1935
01:12:04,310 --> 01:12:03,120
designed it and i'm happy that we did

1936
01:12:05,350 --> 01:12:04,320
and

1937
01:12:07,750 --> 01:12:05,360
but

1938
01:12:10,149 --> 01:12:07,760

it doesn't seem like the the worst

1939
01:12:11,430 --> 01:12:10,159
concerns in that area

1940
01:12:13,830 --> 01:12:11,440
came through

1941
01:12:15,910 --> 01:12:13,840
and just to add to that uh this morning

1942
01:12:18,470 --> 01:12:15,920
uh jaco karas who was looking at the

1943
01:12:21,189 --> 01:12:18,480
telemetry from the motor and the server

1944
01:12:23,350 --> 01:12:21,199
controls he said telemetry just looks

1945
01:12:26,310 --> 01:12:23,360
exactly like what we see in the chamber

1946
01:12:28,630 --> 01:12:26,320
so uh anyway over the it is looking

1947
01:12:30,950 --> 01:12:28,640
really good and uh but we'll be scarring

1948
01:12:32,870 --> 01:12:30,960
through the data this is what tech demo

1949
01:12:35,590 --> 01:12:32,880
is about so we will be looking at the

1950
01:12:38,709 --> 01:12:35,600
high definition you know high rate data

1951
01:12:40,709 --> 01:12:38,719
to over the next few days

1952
01:12:42,630 --> 01:12:40,719
oh justin you want to add something i'll

1953
01:12:44,550 --> 01:12:42,640
just add from the imaging point of view

1954
01:12:46,550 --> 01:12:44,560
we've learned a lot from this first

1955
01:12:47,830 --> 01:12:46,560
flight uh it's very hard as you might

1956
01:12:51,669 --> 01:12:47,840
imagine it's very hard to simulate a

1957
01:12:53,110 --> 01:12:51,679
helicopter at 70 meters full speed spin

1958
01:12:55,030 --> 01:12:53,120
to get the timing and so we're going to

1959
01:12:57,430 --> 01:12:55,040
take what we learned from our imaging

1960
01:12:59,350 --> 01:12:57,440
today we're going to work to improve the

1961
01:13:01,669 --> 01:12:59,360
additional flight imaging attempts so

1962
01:13:04,630 --> 01:13:01,679
stay tuned and we're hoping to have even

1963
01:13:07,510 --> 01:13:04,640

better video video to show

1964
01:13:10,950 --> 01:13:07,520
great thank you so much and

1965
01:13:13,510 --> 01:13:10,960
with the full scope of understanding the

1966
01:13:15,750 --> 01:13:13,520
the vehicle itself where will this

1967
01:13:18,390 --> 01:13:15,760
helicopter be the most

1968
01:13:21,350 --> 01:13:18,400
productive and that would bring the most

1969
01:13:24,870 --> 01:13:21,360
information on mars

1970
01:13:29,510 --> 01:13:27,350
there are many areas on mars that

1971
01:13:31,110 --> 01:13:29,520
frankly we would like to have more

1972
01:13:32,709 --> 01:13:31,120
information about

1973
01:13:36,149 --> 01:13:32,719
and uh that information is not

1974
01:13:38,870 --> 01:13:36,159
accessible in any fashion by rover and

1975
01:13:39,990 --> 01:13:38,880
so for me if i was to make a prediction

1976
01:13:41,750 --> 01:13:40,000
and again

1977
01:13:43,350 --> 01:13:41,760
you know yogi berra said it's hard to

1978
01:13:45,750 --> 01:13:43,360
make predictions especially about the

1979
01:13:47,270 --> 01:13:45,760
future and that also applies here but uh

1980
01:13:49,750 --> 01:13:47,280
if i was to make a prediction i would

1981
01:13:51,990 --> 01:13:49,760
say the first type of applications are

1982
01:13:54,870 --> 01:13:52,000
in one or another location like this

1983
01:13:57,189 --> 01:13:54,880
especially crater walls or specific

1984
01:13:59,510 --> 01:13:57,199
craters where we just can't get in

1985
01:14:02,070 --> 01:13:59,520
you know and we would like to see what's

1986
01:14:03,590 --> 01:14:02,080
there and how the walls are composed but

1987
01:14:05,350 --> 01:14:03,600
some other somebody else may have a

1988
01:14:07,270 --> 01:14:05,360

different idea here on the panel or i'm

1989
01:14:10,870 --> 01:14:07,280
sure in the science community with 10

1990
01:14:12,470 --> 01:14:10,880
scientists we'll have 20 ideas

1991
01:14:15,030 --> 01:14:12,480
okay thank you all right we're going to

1992
01:14:17,189 --> 01:14:15,040
take another social media question

1993
01:14:19,110 --> 01:14:17,199
uh maybe mimi can start with this but it

1994
01:14:22,149 --> 01:14:19,120
probably applies to everyone especially

1995
01:14:25,030 --> 01:14:22,159
the people on our video conference

1996
01:14:27,350 --> 01:14:25,040
stephanie lee on twitter says

1997
01:14:30,790 --> 01:14:27,360
how is the mars helicopter team going to

1998
01:14:31,990 --> 01:14:30,800
celebrate this amazing accomplishment

1999
01:14:33,669 --> 01:14:32,000
well um

2000
01:14:37,189 --> 01:14:33,679
okay i'll answer

2001
01:14:39,669 --> 01:14:37,199
first of all um this is the first day in

2002
01:14:41,750 --> 01:14:39,679
our six seven years of effort that we

2003
01:14:42,870 --> 01:14:41,760
feel licensed to celebrate just the way

2004
01:14:45,750 --> 01:14:42,880
we are

2005
01:14:47,270 --> 01:14:45,760
the worst one of them john josh ravish

2006
01:14:49,189 --> 01:14:47,280
another one teddy santa thomas is

2007
01:14:51,510 --> 01:14:49,199
another there are a few who have never

2008
01:14:53,110 --> 01:14:51,520
let me celebrate fully and that have

2009
01:14:55,910 --> 01:14:53,120
always said

2010
01:14:57,510 --> 01:14:55,920
not yet not yet and so we've had a long

2011
01:15:00,070 --> 01:14:57,520
journey you know we came from a little

2012
01:15:01,990 --> 01:15:00,080
prototype to a risk reduction vehicle to

2013
01:15:03,910 --> 01:15:02,000

engineering development model to

2014
01:15:05,750 --> 01:15:03,920
ingenuity and then how to get onto the

2015
01:15:07,750 --> 01:15:05,760
rover getting launched and then

2016
01:15:10,149 --> 01:15:07,760
surviving the launch and surviving the

2017
01:15:12,870 --> 01:15:10,159
drop and you know and here we are every

2018
01:15:14,950 --> 01:15:12,880
step has been huge and we have never

2019
01:15:17,189 --> 01:15:14,960
allowed ourselves to celebrate fully so

2020
01:15:19,510 --> 01:15:17,199
yes we will be celebrating 100

2021
01:15:20,310 --> 01:15:19,520
uh fully we're authorized for the first

2022
01:15:22,630 --> 01:15:20,320
time

2023
01:15:24,630 --> 01:15:22,640
but i'm sorry to disappoint you we don't

2024
01:15:27,590 --> 01:15:24,640
know what our party plan is

2025
01:15:30,229 --> 01:15:27,600
at lisa webex happy hour now bob uh do

2026
01:15:31,830 --> 01:15:30,239
you want to chime in bob is usually

2027
01:15:34,070 --> 01:15:31,840
can you tell he's our chief of engineer

2028
01:15:36,149 --> 01:15:34,080
and innovators he always thinks out of

2029
01:15:37,270 --> 01:15:36,159
the box i don't know bob what should we

2030
01:15:39,110 --> 01:15:37,280
say

2031
01:15:41,590 --> 01:15:39,120
oh i don't know mimi i think uh we could

2032
01:15:44,870 --> 01:15:41,600
look to you for our leadership even here

2033
01:15:48,709 --> 01:15:46,950
so anyway that's a great question

2034
01:15:50,470 --> 01:15:48,719
i know we're under covered conditions

2035
01:15:53,590 --> 01:15:50,480
but hopefully you could see everybody

2036
01:15:55,189 --> 01:15:53,600
smiling under their masks

2037
01:15:57,990 --> 01:15:55,199
all right we're going to go back to the

2038
01:16:01,030 --> 01:15:58,000

media lines we have

2039
01:16:02,950 --> 01:16:01,040
kinsong lee from hong kong cable news go

2040
01:16:04,709 --> 01:16:02,960
ahead

2041
01:16:07,030 --> 01:16:04,719
hi thank you

2042
01:16:08,950 --> 01:16:07,040
i like to ask uh what's the meaning of

2043
01:16:10,950 --> 01:16:08,960
this flight for the

2044
01:16:13,270 --> 01:16:10,960
aerodynamic studies

2045
01:16:16,229 --> 01:16:13,280
and i hope you could explain a bit more

2046
01:16:19,350 --> 01:16:16,239
on uh whether we could fly and other

2047
01:16:22,870 --> 01:16:19,360
kinds of aircrafts on other planets

2048
01:16:28,149 --> 01:16:25,270
hovard yeah so it's it's very

2049
01:16:30,070 --> 01:16:28,159
significant in terms of validating

2050
01:16:32,310 --> 01:16:30,080
you know the aerodynamic modeling that

2051
01:16:34,470 --> 01:16:32,320
we've done in this project

2052
01:16:35,510 --> 01:16:34,480
uh so you know i say you know it looks

2053
01:16:37,270 --> 01:16:35,520
like

2054
01:16:39,669 --> 01:16:37,280
what you simulated

2055
01:16:41,830 --> 01:16:39,679
and and and that's great because it it

2056
01:16:44,470 --> 01:16:41,840
validates you know the work that they've

2057
01:16:47,510 --> 01:16:44,480
done it means you know we got it right

2058
01:16:49,990 --> 01:16:47,520
uh and that is a huge uh

2059
01:16:52,390 --> 01:16:50,000
huge thing in this case and we'll of

2060
01:16:54,310 --> 01:16:52,400
course learn more as we get additional

2061
01:16:57,510 --> 01:16:54,320
data and do

2062
01:16:59,510 --> 01:16:57,520
additional flights uh for that and it's

2063
01:17:00,470 --> 01:16:59,520

as as far as

2064
01:17:03,189 --> 01:17:00,480
as

2065
01:17:04,630 --> 01:17:03,199
doing flights elsewhere i think maybe

2066
01:17:08,550 --> 01:17:04,640
thomas uh

2067
01:17:12,310 --> 01:17:10,709
so i think there are a number of flights

2068
01:17:14,149 --> 01:17:12,320
we would like to do on mars right and

2069
01:17:16,709 --> 01:17:14,159
then we need to figure out what the

2070
01:17:18,790 --> 01:17:16,719
right places are to go and the right

2071
01:17:20,310 --> 01:17:18,800
applications for that and my hope is

2072
01:17:22,950 --> 01:17:20,320
that science communities around the

2073
01:17:24,790 --> 01:17:22,960
world are starting to focus on this

2074
01:17:26,630 --> 01:17:24,800
uh going to titan is something we're

2075
01:17:28,790 --> 01:17:26,640
already working on right now with a

2076
01:17:30,550 --> 01:17:28,800
vehicle called dragonfly that were that

2077
01:17:31,910 --> 01:17:30,560
is under development and and even though

2078
01:17:33,510 --> 01:17:31,920
that's a very different atmosphere

2079
01:17:35,270 --> 01:17:33,520
aerodynamically

2080
01:17:38,229 --> 01:17:35,280
a lot of the lessons learned here is how

2081
01:17:39,910 --> 01:17:38,239
to test these vehicles and how to get

2082
01:17:42,550 --> 01:17:39,920
them ready and actually put them in

2083
01:17:43,990 --> 01:17:42,560
place i think a lot of these uh lessons

2084
01:17:45,990 --> 01:17:44,000
learned here are actually utterly

2085
01:17:47,669 --> 01:17:46,000
applicable there's other bodies of

2086
01:17:49,430 --> 01:17:47,679
course in the solar system with

2087
01:17:52,070 --> 01:17:49,440
atmospheres and i would not be surprised

2088
01:17:54,870 --> 01:17:52,080

if great ideas can come about

2089
01:17:56,870 --> 01:17:54,880
to go to these as well but uh but those

2090
01:18:01,030 --> 01:17:56,880
are the two were working the two obvious

2091
01:18:06,709 --> 01:18:04,070
okay um all right we have another caller

2092
01:18:09,669 --> 01:18:06,719
on the media lines uh ken cramer of

2093
01:18:11,590 --> 01:18:09,679
space up close go ahead

2094
01:18:13,030 --> 01:18:11,600
thank you very much and congratulations

2095
01:18:16,310 --> 01:18:13,040
to the whole team

2096
01:18:19,030 --> 01:18:16,320
um i have a question um if you after the

2097
01:18:21,590 --> 01:18:19,040
for the fifth flight if you get that far

2098
01:18:23,910 --> 01:18:21,600
is there any possibility that you might

2099
01:18:25,750 --> 01:18:23,920
fly the helicopter

2100
01:18:27,910 --> 01:18:25,760
towards the the path that you're going

2101
01:18:30,550 --> 01:18:27,920
to drive the rover and then

2102
01:18:33,510 --> 01:18:30,560
drive past if you do that would you then

2103
01:18:34,790 --> 01:18:33,520
drive up to the helicopter and take some

2104
01:18:37,270 --> 01:18:34,800
pictures of it

2105
01:18:40,149 --> 01:18:37,280
and inspect it and see what it looks

2106
01:18:43,189 --> 01:18:40,159
like and for thomas do you have any room

2107
01:18:45,270 --> 01:18:43,199
on the 2026 lander for a helicopter

2108
01:18:47,830 --> 01:18:45,280
thanks

2109
01:18:49,910 --> 01:18:47,840
well um for the fifth flight after

2110
01:18:52,950 --> 01:18:49,920
as much as i can push her bar to go as

2111
01:18:55,350 --> 01:18:52,960
far as possible i i care about going

2112
01:18:57,110 --> 01:18:55,360
really far and really fast um that

2113
01:19:00,390 --> 01:18:57,120

number which i'm really hoping is you

2114
01:19:02,070 --> 01:19:00,400
know 600 meters kind of distance um and

2115
01:19:04,229 --> 01:19:02,080
you know as fast as we can go is what we

2116
01:19:05,270 --> 01:19:04,239
care about i have to say i did share

2117
01:19:08,550 --> 01:19:05,280
with uh

2118
01:19:11,110 --> 01:19:08,560
ken farley and mars 2020 we don't care

2119
01:19:13,510 --> 01:19:11,120
which direction we really want to push

2120
01:19:14,790 --> 01:19:13,520
the helicopter flight in the distance so

2121
01:19:17,110 --> 01:19:14,800
i would like to you know turn the

2122
01:19:19,350 --> 01:19:17,120
question over to uh ken foley and mars

2123
01:19:21,189 --> 01:19:19,360
2020 folks if there is a preferred

2124
01:19:23,189 --> 01:19:21,199
direction so that is the conversation to

2125
01:19:25,350 --> 01:19:23,199
come so from our perspective we want to

2126
01:19:27,990 --> 01:19:25,360
push the distance and the speed so stay

2127
01:19:33,750 --> 01:19:30,709
so you asked me uh hey can you ask me

2128
01:19:34,950 --> 01:19:33,760
about 26 or you know the more sample

2129
01:19:36,229 --> 01:19:34,960
return

2130
01:19:37,830 --> 01:19:36,239
campaign i just want to tell you the

2131
01:19:40,310 --> 01:19:37,840
most simple return campaign the most

2132
01:19:42,950 --> 01:19:40,320
important thing we need to do is

2133
01:19:44,390 --> 01:19:42,960
keep it uh streamlined as possible

2134
01:19:45,830 --> 01:19:44,400
there's a lot of things we could be

2135
01:19:47,590 --> 01:19:45,840
adding to this

2136
01:19:49,669 --> 01:19:47,600
and you know

2137
01:19:52,630 --> 01:19:49,679
science instruments this and other

2138
01:19:54,229 --> 01:19:52,640

things and and and frankly uh the

2139
01:19:56,870 --> 01:19:54,239
campaign that we have in front of us is

2140
01:19:58,390 --> 01:19:56,880
very much focused on one

2141
01:20:00,709 --> 01:19:58,400
exactly one

2142
01:20:03,110 --> 01:20:00,719
key objective and that is to bring the

2143
01:20:04,630 --> 01:20:03,120
samples back to earth and everything

2144
01:20:05,910 --> 01:20:04,640
that we're doing is supporting that

2145
01:20:08,550 --> 01:20:05,920
objective so

2146
01:20:10,550 --> 01:20:08,560
so uh technology demonstrations uh

2147
01:20:12,470 --> 01:20:10,560
you know are really critical part i

2148
01:20:14,149 --> 01:20:12,480
think uh mike watkins said it well at

2149
01:20:15,830 --> 01:20:14,159
the right at the beginning we want to

2150
01:20:18,470 --> 01:20:15,840
see wherever we can do it i just want to

2151
01:20:20,870 --> 01:20:18,480
also uh mentioned that for many missions

2152
01:20:23,189 --> 01:20:20,880
focus is a very critical part as well

2153
01:20:24,709 --> 01:20:23,199
and and so often what we need to do with

2154
01:20:26,070 --> 01:20:24,719
explorers is have

2155
01:20:28,149 --> 01:20:26,080
two opposing

2156
01:20:29,430 --> 01:20:28,159
thoughts in our minds at the same time

2157
01:20:32,709 --> 01:20:29,440
so that's what's going to happen here

2158
01:20:36,550 --> 01:20:34,709
all right so thank you we're going to

2159
01:20:40,870 --> 01:20:36,560
take another media question

2160
01:20:43,990 --> 01:20:40,880
manuel mazzanti from debate

2161
01:20:47,030 --> 01:20:44,000
hello everybody uh congratulations uh

2162
01:20:49,910 --> 01:20:47,040
nasa jpl the entire team even the guys

2163
01:20:52,470 --> 01:20:49,920

remotely this is an historic day uh

2164
01:20:53,590 --> 01:20:52,480
mimi your enthusiasm is contagious

2165
01:20:55,030 --> 01:20:53,600
definitely

2166
01:20:57,430 --> 01:20:55,040
uh

2167
01:21:01,270 --> 01:20:57,440
a question for you or maybe for for

2168
01:21:03,669 --> 01:21:01,280
harvard uh the 96 degree rotation of the

2169
01:21:05,910 --> 01:21:03,679
helicopter was done to see

2170
01:21:08,470 --> 01:21:05,920
how the the helicopter responds to

2171
01:21:11,110 --> 01:21:08,480
certain commands or was it done to point

2172
01:21:13,430 --> 01:21:11,120
the camera towards the rover and i

2173
01:21:17,430 --> 01:21:13,440
wonder if we are going to be able to see

2174
01:21:20,149 --> 01:21:17,440
the rover from the ingenuity perspective

2175
01:21:22,709 --> 01:21:20,159
so we wanted to make a turn because it's

2176
01:21:24,629 --> 01:21:22,719
you know goes a little bit further than

2177
01:21:26,790 --> 01:21:24,639
than just a straight up and down flight

2178
01:21:28,709 --> 01:21:26,800
and the particular

2179
01:21:33,189 --> 01:21:28,719
turn that we did there the 96 degree

2180
01:21:35,030 --> 01:21:33,199
turn uh clockwise uh did put the camera

2181
01:21:36,950 --> 01:21:35,040
the return to earth camera pointed

2182
01:21:38,470 --> 01:21:36,960
towards the rover we did not take a

2183
01:21:40,390 --> 01:21:38,480
picture with that camera during this

2184
01:21:42,550 --> 01:21:40,400
flight but it does set us up for

2185
01:21:45,110 --> 01:21:42,560
potentially doing that for the next

2186
01:21:48,709 --> 01:21:45,120
flight as far as whether we will see the

2187
01:21:50,950 --> 01:21:48,719
rover or not it depends a little bit the

2188
01:21:52,629 --> 01:21:50,960

on on exactly the state that the

2189
01:21:53,830 --> 01:21:52,639
helicopter is in when that picture is

2190
01:21:56,950 --> 01:21:53,840
snapped

2191
01:21:59,270 --> 01:21:56,960
because the camera is angled downwards

2192
01:22:02,709 --> 01:21:59,280
at an angle where it doesn't see all the

2193
01:22:04,470 --> 01:22:02,719
way to the horizon in uh level flight

2194
01:22:05,910 --> 01:22:04,480
and so it you have to get a little bit

2195
01:22:08,229 --> 01:22:05,920
lucky uh

2196
01:22:09,830 --> 01:22:08,239
to to get to catch the rover in that

2197
01:22:13,590 --> 01:22:09,840
image so we don't have any guarantees

2198
01:22:15,910 --> 01:22:13,600
that we will actually have that

2199
01:22:17,669 --> 01:22:15,920
thank you

2200
01:22:19,510 --> 01:22:17,679
i'll just add one thing to that because

2201
01:22:21,350 --> 01:22:19,520
people do ask that question about

2202
01:22:23,750 --> 01:22:21,360
imaging the rover with the camera the

2203
01:22:26,310 --> 01:22:23,760
the original intent or plan was to have

2204
01:22:28,709 --> 01:22:26,320
the camera rotated in portrait mode

2205
01:22:30,070 --> 01:22:28,719
so that the the long end of the field of

2206
01:22:31,750 --> 01:22:30,080
view would look up

2207
01:22:32,709 --> 01:22:31,760
just above the horizon and we would take

2208
01:22:36,070 --> 01:22:32,719
the

2209
01:22:37,669 --> 01:22:36,080
but late during development and bob can

2210
01:22:39,590 --> 01:22:37,679
even talk about a little more the um

2211
01:22:41,189 --> 01:22:39,600
there was there was an issue with the

2212
01:22:43,990 --> 01:22:41,199
the configuration

2213
01:22:45,750 --> 01:22:44,000

and it had to be changed and mounted in

2214
01:22:48,149 --> 01:22:45,760
landscape mode so that's the story of

2215
01:22:50,550 --> 01:22:48,159
why it is tricky to get that picture of

2216
01:22:52,709 --> 01:22:50,560
the rover itself

2217
01:22:54,629 --> 01:22:52,719
okay great thank you and thanks to

2218
01:22:56,149 --> 01:22:54,639
everyone for all of their questions if

2219
01:22:57,669 --> 01:22:56,159
you're a member of the media and you

2220
01:22:59,830 --> 01:22:57,679
still have more questions you can

2221
01:23:01,990 --> 01:22:59,840
contact jpl's digital news and media

2222
01:23:03,750 --> 01:23:02,000
office we will help you get interviews

2223
01:23:05,430 --> 01:23:03,760
or everything you need and if you're on

2224
01:23:06,470 --> 01:23:05,440
social media we'll continue to answer

2225
01:23:10,070 --> 01:23:06,480
questions

2226
01:23:12,950 --> 01:23:10,080
with the hashtag mars helicopter online

2227
01:23:15,790 --> 01:23:12,960
so thank you everyone for this and for

2228
01:23:17,430 --> 01:23:15,800
more on ingenuity you can visit

2229
01:23:18,629 --> 01:23:17,440
go.nasa.gov

2230
01:23:20,390 --> 01:23:18,639
ingenuity

2231
01:23:21,510 --> 01:23:20,400
we'll put the latest updates there and

2232
01:23:24,110 --> 01:23:21,520
if you want to learn more about the

2233
01:23:26,870 --> 01:23:24,120
perseverance rover visit

2234
01:23:28,950 --> 01:23:26,880
mars.nasa.gov perseverance there's a

2235
01:23:30,550 --> 01:23:28,960
link in there to the raw images and so

2236
01:23:32,070 --> 01:23:30,560
if you two want to drink from the fire

2237
01:23:34,310 --> 01:23:32,080
hose

2238
01:23:35,830 --> 01:23:34,320

we have a place for you to go all right

2239
01:23:39,510 --> 01:23:35,840
and if you're on social media you can

2240
01:23:41,590 --> 01:23:39,520
join our conversation at nasa jpl um

2241
01:23:44,470 --> 01:23:41,600
again you can use the hashtag mars