



1
00:01:54,630 --> 00:00:56,650

[Music]

2
00:01:59,910 --> 00:01:56,789

welcome to nasa's jet propulsion

3
00:02:02,389 --> 00:01:59,920

laboratory in southern california nasa's

4
00:02:05,510 --> 00:02:02,399

ingenuity mars helicopter hitched a ride

5
00:02:07,590 --> 00:02:05,520

to the red planet on the mars 2020

6
00:02:11,110 --> 00:02:07,600

perseverance rover which landed in

7
00:02:13,589 --> 00:02:11,120

jezreel crater on february 18. earlier

8
00:02:16,390 --> 00:02:13,599

today ingenuity should have autonomously

9
00:02:18,869 --> 00:02:16,400

performed its first flight attempt on

10
00:02:20,710 --> 00:02:18,879

mars now the team is ready to receive

11
00:02:22,470 --> 00:02:20,720

the data that will tell them whether

12
00:02:25,350 --> 00:02:22,480

we've made history with the first

13
00:02:27,589 --> 00:02:25,360

controlled flight on another planet

14

00:02:30,630 --> 00:02:27,599

thank you for joining us at this early

15

00:02:33,190 --> 00:02:30,640

hour i'm marina jurica of the jpl news

16

00:02:35,509 --> 00:02:33,200

office ingenuity is a technology

17

00:02:38,390 --> 00:02:35,519

demonstration which means it is a proof

18

00:02:40,949 --> 00:02:38,400

of concept experiment after years of

19

00:02:43,670 --> 00:02:40,959

development on earth the team has one

20

00:02:45,830 --> 00:02:43,680

month to test the technology on mars

21

00:02:48,070 --> 00:02:45,840

tonight we'll talk to a few team members

22

00:02:50,309 --> 00:02:48,080

and then keep our eyes on the room where

23

00:02:53,110 --> 00:02:50,319

the helicopter operations team will be

24

00:02:55,190 --> 00:02:53,120

receiving and studying their data to

25

00:02:58,070 --> 00:02:55,200

assist us in that room is one of the

26

00:02:59,670 --> 00:02:58,080

ingenuity helicopter engineers taryn

27

00:03:01,990 --> 00:02:59,680

bailey who will help guide us through

28

00:03:04,149 --> 00:03:02,000

the steps the helicopter team is taking

29

00:03:07,430 --> 00:03:04,159

to see the results of their first flight

30

00:03:09,509 --> 00:03:07,440

and begin the month of ingenuity welcome

31

00:03:11,910 --> 00:03:09,519

taryn hi marina thanks so much for

32

00:03:14,550 --> 00:03:11,920

having me super excited to be here it's

33

00:03:16,070 --> 00:03:14,560

flight night oh yes it's flight night

34

00:03:17,990 --> 00:03:16,080

you had an integral part with the

35

00:03:19,030 --> 00:03:18,000

helicopter team can you tell us about

36

00:03:21,110 --> 00:03:19,040

your role

37

00:03:22,869 --> 00:03:21,120

yeah so i'm a mechanical engineer and i

38

00:03:25,110 --> 00:03:22,879

helped in the assembly integration and

39

00:03:26,710 --> 00:03:25,120

testing of the ingenuity vehicle and it

40

00:03:29,190 --> 00:03:26,720

was really important that we simulate a

41

00:03:30,630 --> 00:03:29,200

mars-like atmosphere in our testing and

42

00:03:32,229 --> 00:03:30,640

in doing so we knew it would give us the

43

00:03:34,789 --> 00:03:32,239

best chance to execute a real flight on

44

00:03:36,710 --> 00:03:34,799

mars and that's not an easy feat flying

45

00:03:39,350 --> 00:03:36,720

on mars is much different than flying on

46

00:03:41,190 --> 00:03:39,360

earth very difficult it's less than one

47

00:03:42,789 --> 00:03:41,200

percent of earth's atmosphere making it

48

00:03:44,309 --> 00:03:42,799

very difficult to fly and generate

49

00:03:46,229 --> 00:03:44,319

enough lift

50

00:03:47,830 --> 00:03:46,239

so taran what is the ingenuity team

51
00:03:49,270 --> 00:03:47,840
preparing for right now what are they

52
00:03:53,190 --> 00:03:49,280
waiting to see

53
00:03:55,030 --> 00:03:53,200
that we executed our first flight the

54
00:03:57,949 --> 00:03:55,040
actual flight of ours took place earlier

55
00:04:00,390 --> 00:03:57,959
today and that's because mars is over

56
00:04:01,910 --> 00:04:00,400
178 million miles away so there's a

57
00:04:03,830 --> 00:04:01,920
little bit of a delay

58
00:04:06,789 --> 00:04:03,840
the data is expected to hit the deep

59
00:04:08,630 --> 00:04:06,799
space network at about 3 34

60
00:04:10,149 --> 00:04:08,640
a.m pacific time and we'll start

61
00:04:12,309 --> 00:04:10,159
processing the data shortly after that

62
00:04:14,309 --> 00:04:12,319
to see how we did

63
00:04:15,910 --> 00:04:14,319

fingers crossed thanks so much taryn

64

00:04:18,310 --> 00:04:15,920

we'll be coming back to you shortly as

65

00:04:19,509 --> 00:04:18,320

we get closer to the start of the data

66

00:04:21,509 --> 00:04:19,519

downlink

67

00:04:23,670 --> 00:04:21,519

what started out as a dream is now

68

00:04:25,909 --> 00:04:23,680

becoming reality for the ingenuity

69

00:04:28,790 --> 00:04:25,919

helicopter team let's take a look at

70

00:04:31,110 --> 00:04:28,800

their journey

71

00:04:33,110 --> 00:04:31,120

sometimes you have to do something just

72

00:04:35,030 --> 00:04:33,120

to show that you can do it

73

00:04:37,030 --> 00:04:35,040

when the wright brothers flew for the

74

00:04:38,150 --> 00:04:37,040

first time this new an experimental

75

00:04:40,390 --> 00:04:38,160

aircraft

76
00:04:42,310 --> 00:04:40,400
and in the same way the mars helicopter

77
00:04:44,550 --> 00:04:42,320
is designed to show that we can fly

78
00:04:52,230 --> 00:04:44,560
power helicopter flight in the martian

79
00:04:57,350 --> 00:04:54,790
from day one this was the unwavering

80
00:04:59,270 --> 00:04:57,360
dream of our team to get our helicopter

81
00:05:01,350 --> 00:04:59,280
launched to mars

82
00:05:04,070 --> 00:05:01,360
so that we can get the opportunity to do

83
00:05:06,629 --> 00:05:04,080
that very first rotograph flight test

84
00:05:09,189 --> 00:05:06,639
in the actual environment of mars

85
00:05:11,270 --> 00:05:09,199
it's extremely difficult to fly

86
00:05:12,550 --> 00:05:11,280
at mars because atmosphere is so thin

87
00:05:14,629 --> 00:05:12,560
compared to earth

88
00:05:16,950 --> 00:05:14,639

at mars it's less than one percent so

89

00:05:19,270 --> 00:05:16,960

the first and foremost challenge is to

90

00:05:21,430 --> 00:05:19,280

make a vehicle that's light enough to be

91

00:05:23,350 --> 00:05:21,440

lifted and then the second is to

92

00:05:29,189 --> 00:05:23,360

generate lift the rotor system is to

93

00:05:33,670 --> 00:05:31,990

we're spinning between 2 000 and 3000

94

00:05:36,550 --> 00:05:33,680

revolutions per minute and it takes a

95

00:05:39,029 --> 00:05:36,560

lot of energy so it's that balance of a

96

00:05:41,670 --> 00:05:39,039

very light system yet

97

00:05:44,070 --> 00:05:41,680

having enough energy that's needed to

98

00:05:46,790 --> 00:05:44,080

you know spin the rotor so fast to lift

99

00:05:48,550 --> 00:05:46,800

and on top of it having to design in the

100

00:05:50,230 --> 00:05:48,560

autonomy

101
00:05:52,310 --> 00:05:50,240
it has to be fully autonomous from the

102
00:05:53,990 --> 00:05:52,320
time it takes off the time it lands what

103
00:05:56,550 --> 00:05:54,000
we do do on the ground is we plan the

104
00:06:00,390 --> 00:05:56,560
flights and so we determine from here

105
00:06:04,469 --> 00:06:00,400
where we want the helicopter to go

106
00:06:06,390 --> 00:06:04,479
our experiment window is 30 martian days

107
00:06:07,909 --> 00:06:06,400
so we have planned

108
00:06:10,550 --> 00:06:07,919
up to five flights

109
00:06:12,710 --> 00:06:10,560
of incremental difficulty

110
00:06:14,790 --> 00:06:12,720
very first flight the main thing is we

111
00:06:17,110 --> 00:06:14,800
want to get the legs off the ground and

112
00:06:18,710 --> 00:06:17,120
so we will basically go up

113
00:06:21,029 --> 00:06:18,720

about three meters

114

00:06:22,710 --> 00:06:21,039

and we'll hover there and then we'll

115

00:06:25,670 --> 00:06:22,720

come down again and that will be the

116

00:06:27,189 --> 00:06:25,680

first you know really major milestone

117

00:06:29,110 --> 00:06:27,199

most of our flights will be at the three

118

00:06:31,110 --> 00:06:29,120

to five meter height we will be going

119

00:06:33,510 --> 00:06:31,120

horizontally again at a few meters per

120

00:06:35,510 --> 00:06:33,520

second probably go out you know 50 70

121

00:06:37,270 --> 00:06:35,520

meters and come back in successive

122

00:06:39,430 --> 00:06:37,280

flights we'll probably push that further

123

00:06:41,749 --> 00:06:39,440

try to go further so our priority will

124

00:06:43,749 --> 00:06:41,759

be to get back engineering telemetry and

125

00:06:45,189 --> 00:06:43,759

not so much images but i'm sure we'll

126
00:06:47,830 --> 00:06:45,199
return a few you know because they'll

127
00:06:50,469 --> 00:06:47,840
always look cool

128
00:06:52,950 --> 00:06:50,479
this point we've tested all we can on

129
00:06:54,790 --> 00:06:52,960
earth we have mathematical models that

130
00:06:57,430 --> 00:06:54,800
shows how it will fly at mars and we've

131
00:06:59,350 --> 00:06:57,440
tested it in the simulated environment

132
00:07:01,589 --> 00:06:59,360
that we can create on earth

133
00:07:03,909 --> 00:07:01,599
it really is time now to

134
00:07:06,070 --> 00:07:03,919
do the real blood types at mars

135
00:07:08,070 --> 00:07:06,080
nothing is a given but we have done

136
00:07:09,830 --> 00:07:08,080
everything we can in terms of a test

137
00:07:11,670 --> 00:07:09,840
program here on earth the vehicle is

138
00:07:13,589 --> 00:07:11,680

performing extremely well so far it's

139

00:07:14,950 --> 00:07:13,599

been doing exactly the right thing even

140

00:07:17,029 --> 00:07:14,960

right now and it's bolted onto the

141

00:07:19,029 --> 00:07:17,039

perseverance rover so there's a very

142

00:07:21,029 --> 00:07:19,039

good chance that we'll pull it off yes

143

00:07:22,150 --> 00:07:21,039

but it's still high risk

144

00:07:23,909 --> 00:07:22,160

and

145

00:07:25,909 --> 00:07:23,919

none of us forget that you could have a

146

00:07:27,830 --> 00:07:25,919

glitch that you know

147

00:07:31,430 --> 00:07:27,840

could mean end of mission yes it's going

148

00:07:34,870 --> 00:07:31,440

to be exciting reacting to any surprises

149

00:07:39,029 --> 00:07:36,629

what's really most important is

150

00:07:41,430 --> 00:07:39,039

everything we're learning here is for

151
00:07:49,029 --> 00:07:41,440
the future roto craft systems that we

152
00:07:52,869 --> 00:07:51,029
along with your cup of coffee coffee you

153
00:07:55,350 --> 00:07:52,879
can join in on the conversation by

154
00:07:58,629 --> 00:07:55,360
asking the helicopter team questions at

155
00:08:01,670 --> 00:07:58,639
nasa jpl on all social platforms by

156
00:08:03,909 --> 00:08:01,680
using the hashtag mars helicopter we

157
00:08:05,270 --> 00:08:03,919
will get to your questions later on in

158
00:08:07,430 --> 00:08:05,280
the program

159
00:08:10,309 --> 00:08:07,440
mimi ong is the project manager for

160
00:08:12,869 --> 00:08:10,319
ingenuity she joins us now as they wait

161
00:08:15,510 --> 00:08:12,879
for the downlink to start welcome mimi

162
00:08:17,350 --> 00:08:15,520
good morning hi good morning marina

163
00:08:19,909 --> 00:08:17,360

now mimi this has been quite the journey

164

00:08:22,070 --> 00:08:19,919

for you and your team how do you feel

165

00:08:24,150 --> 00:08:22,080

finally reaching this moment

166

00:08:26,629 --> 00:08:24,160

no our team has been working on the mars

167

00:08:29,350 --> 00:08:26,639

helicopter for over six years and for

168

00:08:31,510 --> 00:08:29,360

some even longer towards his ultimate

169

00:08:34,310 --> 00:08:31,520

dream of experimenting the first flight

170

00:08:37,589 --> 00:08:34,320

at mars here we are

171

00:08:39,350 --> 00:08:37,599

yes here we are and last week was a

172

00:08:41,670 --> 00:08:39,360

little bit of a week for you guys you've

173

00:08:43,350 --> 00:08:41,680

had some technical challenges what made

174

00:08:45,910 --> 00:08:43,360

you decide to go ahead with the first

175

00:08:47,990 --> 00:08:45,920

flight attempt this morning

176

00:08:50,710 --> 00:08:48,000

april 9th was a surprise we were two

177

00:08:53,110 --> 00:08:50,720

days away from first flight and just on

178

00:08:55,590 --> 00:08:53,120

to our very last checkout high speed

179

00:08:58,470 --> 00:08:55,600

spin of the rotor system and there we

180

00:09:00,389 --> 00:08:58,480

discovered an intricate uh timing issue

181

00:09:02,550 --> 00:09:00,399

that was preventing the helicopter from

182

00:09:04,550 --> 00:09:02,560

transitioning to flight mode the mode

183

00:09:06,870 --> 00:09:04,560

that we need to be in to spin the rotor

184

00:09:07,910 --> 00:09:06,880

system high speed so right after we

185

00:09:10,310 --> 00:09:07,920

found that

186

00:09:12,550 --> 00:09:10,320

our team went into high gear identified

187

00:09:16,389 --> 00:09:12,560

two possible solutions in a couple of

188

00:09:18,310 --> 00:09:16,399

days and uh we picked the solution that

189

00:09:20,230 --> 00:09:18,320

is really uh the most simple most

190

00:09:22,150 --> 00:09:20,240

straightforward option

191

00:09:23,990 --> 00:09:22,160

so a note there though that the solution

192

00:09:26,230 --> 00:09:24,000

that we have adopted uh it does

193

00:09:28,949 --> 00:09:26,240

transition to the helicopter into flight

194

00:09:31,990 --> 00:09:28,959

mode about 85 percent of the time

195

00:09:34,070 --> 00:09:32,000

so when we go to flight and if we don't

196

00:09:36,230 --> 00:09:34,080

go into flight mode the helicopter will

197

00:09:37,350 --> 00:09:36,240

stay safe and we will attempt the first

198

00:09:40,230 --> 00:09:37,360

flight again

199

00:09:43,030 --> 00:09:40,240

so just last friday we took the solution

200

00:09:46,070 --> 00:09:43,040

applied it to ingenuity and successfully

201
00:09:48,389 --> 00:09:46,080
spun ingenuity's rotor system full speed

202
00:09:50,310 --> 00:09:48,399
so next step is our first light attempt

203
00:09:52,070 --> 00:09:50,320
now

204
00:09:54,070 --> 00:09:52,080
and to give folks at home me some

205
00:09:56,550 --> 00:09:54,080
perspective the goal is to fly on a

206
00:09:58,150 --> 00:09:56,560
planet that has just one percent the

207
00:10:00,670 --> 00:09:58,160
atmosphere of earth and you're

208
00:10:04,150 --> 00:10:00,680
controlling that flight from over

209
00:10:05,509 --> 00:10:04,160
100 million miles away how difficult is

210
00:10:08,150 --> 00:10:05,519
that

211
00:10:10,949 --> 00:10:08,160
very very difficult to fly a rotorcraft

212
00:10:13,269 --> 00:10:10,959
at mars you know a rotorcraft pushes

213
00:10:15,430 --> 00:10:13,279

atmosphere to generate lift and when

214

00:10:17,670 --> 00:10:15,440

there is that little atmosphere the

215

00:10:20,310 --> 00:10:17,680

rotor system has to spin really fast in

216

00:10:22,389 --> 00:10:20,320

fact i will be spinning over 2500

217

00:10:24,710 --> 00:10:22,399

revolutions per minute for this flight

218

00:10:27,350 --> 00:10:24,720

today and ingenuity

219

00:10:29,990 --> 00:10:27,360

is less than 1.8 kilograms right four

220

00:10:32,150 --> 00:10:30,000

pounds and in that four pounds ingenuity

221

00:10:35,190 --> 00:10:32,160

has to be able to fly in that very thin

222

00:10:38,069 --> 00:10:35,200

atmosphere and be able to survive and

223

00:10:40,870 --> 00:10:38,079

operate autonomously at mars

224

00:10:43,670 --> 00:10:40,880

for example ingenuity our little four

225

00:10:45,829 --> 00:10:43,680

pounder has been on the surface of mars

226

00:10:48,230 --> 00:10:45,839

keeping yourself warm throughout the

227

00:10:49,829 --> 00:10:48,240

cold nights down to minus 130 degrees

228

00:10:52,710 --> 00:10:49,839

fahrenheit and it's been doing that

229

00:10:55,509 --> 00:10:52,720

every day so on top of that our flight

230

00:10:57,829 --> 00:10:55,519

experiment at mars we are operating it

231

00:11:01,110 --> 00:10:57,839

all the way back here from earth so yes

232

00:11:04,389 --> 00:11:01,120

very challenging but we're ready

233

00:11:06,790 --> 00:11:04,399

oh ingenuity is small but it is mighty

234

00:11:08,630 --> 00:11:06,800

and the team has come so far already

235

00:11:10,710 --> 00:11:08,640

what other milestones has the helicopter

236

00:11:11,750 --> 00:11:10,720

team already achieved before this

237

00:11:14,870 --> 00:11:11,760

morning

238

00:11:16,389 --> 00:11:14,880

engine ingenuity has passed all of its

239

00:11:18,790 --> 00:11:16,399

milestones leading up to the first

240

00:11:19,910 --> 00:11:18,800

flight so perform perfectly during

241

00:11:21,430 --> 00:11:19,920

cruise

242

00:11:24,550 --> 00:11:21,440

survive the drop

243

00:11:26,949 --> 00:11:24,560

and has been charging yourself with high

244

00:11:29,350 --> 00:11:26,959

good energy levels each time it's been

245

00:11:31,269 --> 00:11:29,360

communicating daily to the base station

246

00:11:32,870 --> 00:11:31,279

and keeping itself warm

247

00:11:34,550 --> 00:11:32,880

and all with the rotor system all

248

00:11:36,310 --> 00:11:34,560

checked out to full speed ingenuity is

249

00:11:39,030 --> 00:11:36,320

ready to go

250

00:11:41,910 --> 00:11:39,040

and at the high level for the mars

251

00:11:43,829 --> 00:11:41,920

helicopter technology project

252

00:11:46,710 --> 00:11:43,839

we have three goals that are in line

253

00:11:49,110 --> 00:11:46,720

with nasa's agency level objectives the

254

00:11:52,870 --> 00:11:49,120

first is to demonstrate here on earth

255

00:11:54,629 --> 00:11:52,880

that it is possible to fly a controlled

256

00:11:56,629 --> 00:11:54,639

power flight in the thin atmosphere of

257

00:11:58,790 --> 00:11:56,639

mars we've done that the second

258

00:12:00,949 --> 00:11:58,800

objective is to perform that actual

259

00:12:03,110 --> 00:12:00,959

flight at mars well we're about to get

260

00:12:05,990 --> 00:12:03,120

data back very soon here on that first

261

00:12:07,829 --> 00:12:06,000

flight and the third is to return data

262

00:12:10,230 --> 00:12:07,839

to inform engineers

263

00:12:12,389 --> 00:12:10,240

working on designing future generations

264

00:12:15,350 --> 00:12:12,399

of mars helicopter we have received

265

00:12:17,509 --> 00:12:15,360

valuable information data back since we

266

00:12:20,230 --> 00:12:17,519

have dropped on the surface and

267

00:12:23,829 --> 00:12:20,240

tonight's uh data from the first flight

268

00:12:26,230 --> 00:12:23,839

will be extremely important

269

00:12:28,470 --> 00:12:26,240

we're ready to go we are ready to go now

270

00:12:30,150 --> 00:12:28,480

what is success going to look like for

271

00:12:33,350 --> 00:12:30,160

you guys tonight

272

00:12:35,750 --> 00:12:33,360

so there are five scenarios okay so

273

00:12:37,990 --> 00:12:35,760

if the solution we implemented

274

00:12:40,150 --> 00:12:38,000

successfully transitions the helicopter

275

00:12:43,190 --> 00:12:40,160

to the flight mode will be all right but

276

00:12:46,310 --> 00:12:43,200

if it doesn't transition uh then we will

277

00:12:48,470 --> 00:12:46,320

be attempting the flight again tomorrow

278

00:12:51,030 --> 00:12:48,480

if we don't get to flight mode tonight

279

00:12:52,389 --> 00:12:51,040

then we'll go on uh when we if we go

280

00:12:53,910 --> 00:12:52,399

successfully to the flight mode there

281

00:12:56,310 --> 00:12:53,920

are four scenarios

282

00:12:58,870 --> 00:12:56,320

full success in flight second scenario

283

00:13:00,790 --> 00:12:58,880

could be partial success in flight the

284

00:13:02,230 --> 00:13:00,800

third would be not having sufficient

285

00:13:04,069 --> 00:13:02,240

information in which case we'll need

286

00:13:06,230 --> 00:13:04,079

more time to determine what happened the

287

00:13:07,190 --> 00:13:06,240

fourth could be failure so whatever the

288

00:13:10,710 --> 00:13:07,200

outcome

289

00:13:15,750 --> 00:13:13,190

and a bright future is ahead mimi the

290

00:13:17,829 --> 00:13:15,760

risk is huge but the reward is high we

291

00:13:20,790 --> 00:13:17,839

will all be rooting for your team good

292

00:13:22,949 --> 00:13:20,800

luck thank you marina as we get closer

293

00:13:25,430 --> 00:13:22,959

to the data arrival let's talk to tim

294

00:13:27,990 --> 00:13:25,440

cannon ingenuity operations lead thanks

295

00:13:30,629 --> 00:13:28,000

for joining us tim

296

00:13:32,870 --> 00:13:30,639

thanks marina glad to be here

297

00:13:36,150 --> 00:13:32,880

now how does the data even get here from

298

00:13:38,470 --> 00:13:36,160

the helicopter to the team

299

00:13:40,790 --> 00:13:38,480

well they say sometimes it's complicated

300

00:13:43,189 --> 00:13:40,800

right so the helicopter does not have a

301
00:13:45,189 --> 00:13:43,199
radio that can talk directly to earth so

302
00:13:47,509 --> 00:13:45,199
we need the help of the rover as a

303
00:13:49,430 --> 00:13:47,519
matter of fact the rover has an

304
00:13:50,790 --> 00:13:49,440
instrument on board which is also built

305
00:13:53,269 --> 00:13:50,800
by the helicopter team called the

306
00:13:55,189 --> 00:13:53,279
helicopter base station the helicopter

307
00:13:56,550 --> 00:13:55,199
base station has a radio which talks to

308
00:13:59,269 --> 00:13:56,560
the helicopter

309
00:14:00,790 --> 00:13:59,279
so as you have heard earlier today the

310
00:14:02,710 --> 00:14:00,800
helicopter flew

311
00:14:05,430 --> 00:14:02,720
as it was flying and after landed it

312
00:14:07,430 --> 00:14:05,440
transferred its data to the base station

313
00:14:09,910 --> 00:14:07,440

and then the rover takes the data from

314

00:14:11,910 --> 00:14:09,920

the base station and transmits it

315

00:14:14,230 --> 00:14:11,920

to an orbiter that would be the mro

316

00:14:16,550 --> 00:14:14,240

orbiter and then the mro orbiter turns

317

00:14:18,790 --> 00:14:16,560

to earth and then sends all the data to

318

00:14:20,629 --> 00:14:18,800

the deep space network at that point the

319

00:14:22,790 --> 00:14:20,639

deep space network itself turns around

320

00:14:25,110 --> 00:14:22,800

sends it to jpl and into the ground data

321

00:14:27,590 --> 00:14:25,120

systems at that point when it shows up

322

00:14:29,189 --> 00:14:27,600

our team can take that data and decode

323

00:14:31,350 --> 00:14:29,199

it and see what happened during the

324

00:14:32,949 --> 00:14:31,360

flight

325

00:14:35,030 --> 00:14:32,959

it sounds like it has to be well

326

00:14:37,189 --> 00:14:35,040

choreographed him how do you plan the

327

00:14:39,350 --> 00:14:37,199

first flight it's a remote autonomous

328

00:14:41,990 --> 00:14:39,360

operation what goes into the planning

329

00:14:43,350 --> 00:14:42,000

and the execution

330

00:14:45,269 --> 00:14:43,360

well you know we've done it all as a

331

00:14:46,949 --> 00:14:45,279

team as we have all along it's been a

332

00:14:49,590 --> 00:14:46,959

challenge with code to be remote but we

333

00:14:51,269 --> 00:14:49,600

learn new ways to to work together

334

00:14:53,269 --> 00:14:51,279

we're a small team but we're a fast

335

00:14:55,829 --> 00:14:53,279

moving team we practiced all of these

336

00:14:57,590 --> 00:14:55,839

things over the course of the last year

337

00:14:59,350 --> 00:14:57,600

from getting the data from the rover to

338

00:15:00,470 --> 00:14:59,360

decoding it to interpreting what it

339

00:15:01,670 --> 00:15:00,480

meant

340

00:15:06,470 --> 00:15:01,680

and

341

00:15:08,310 --> 00:15:06,480

us safely we were able to start our

342

00:15:10,710 --> 00:15:08,320

survey for right field and we found it

343

00:15:12,710 --> 00:15:10,720

fortunately right near where we landed

344

00:15:14,550 --> 00:15:12,720

and so working with other instruments on

345

00:15:16,870 --> 00:15:14,560

the rover like meta with the weather

346

00:15:18,710 --> 00:15:16,880

instrument and zcam which is this

347

00:15:20,710 --> 00:15:18,720

beautiful camera to take pictures we

348

00:15:22,710 --> 00:15:20,720

planned our flight the flight will be

349

00:15:24,069 --> 00:15:22,720

about 40 seconds long

350

00:15:26,389 --> 00:15:24,079

we'll lift off

351

00:15:27,990 --> 00:15:26,399

we'll pivot towards the rover

352

00:15:29,670 --> 00:15:28,000

and then we'll land

353

00:15:31,749 --> 00:15:29,680

it's going to be very basic flight just

354

00:15:33,430 --> 00:15:31,759

to we want to do the very uh basic

355

00:15:34,790 --> 00:15:33,440

things first to make sure that we can do

356

00:15:36,550 --> 00:15:34,800

our flight

357

00:15:38,069 --> 00:15:36,560

and then at that point

358

00:15:39,509 --> 00:15:38,079

we will get all our data back and look

359

00:15:41,269 --> 00:15:39,519

at it but we had to practice all those

360

00:15:42,470 --> 00:15:41,279

things and we've been using this time on

361

00:15:43,990 --> 00:15:42,480

the surface to get familiar with the

362

00:15:45,509 --> 00:15:44,000

vehicle and how it operates and work

363

00:15:49,590 --> 00:15:45,519

around those various troubles that mimi

364

00:15:51,269 --> 00:15:49,600

talked about and the team is ready to go

365

00:15:53,670 --> 00:15:51,279

and tim what specifically will the

366

00:15:55,910 --> 00:15:53,680

helicopter team be looking for as we go

367

00:15:57,269 --> 00:15:55,920

through this morning

368

00:15:59,030 --> 00:15:57,279

so one of the great things about this

369

00:16:00,150 --> 00:15:59,040

helicopter is has a very powerful

370

00:16:02,230 --> 00:16:00,160

processor

371

00:16:04,470 --> 00:16:02,240

it's tiny but it's powerful and we get

372

00:16:07,189 --> 00:16:04,480

lots and lots of data the processor

373

00:16:09,189 --> 00:16:07,199

itself is about 100 times as powerful as

374

00:16:11,189 --> 00:16:09,199

the processor even on the rover

375

00:16:13,110 --> 00:16:11,199

and so we get all this data as i

376

00:16:15,590 --> 00:16:13,120

mentioned that gets sent to the rover

377

00:16:17,590 --> 00:16:15,600

and then the rover sends it to us so as

378

00:16:19,910 --> 00:16:17,600

our downlink lead michael starch sees

379

00:16:21,910 --> 00:16:19,920

that data arrive in the data center he

380

00:16:23,990 --> 00:16:21,920

will decode it and look for you will

381

00:16:25,670 --> 00:16:24,000

look for the successful arrival of the

382

00:16:30,230 --> 00:16:25,680

data

383

00:16:32,069 --> 00:16:30,240

hovard grip our chief pilot and he will

384

00:16:33,590 --> 00:16:32,079

look at the portion of the data that

385

00:16:35,189 --> 00:16:33,600

relates to how the flight went there are

386

00:16:36,790 --> 00:16:35,199

series of events that the helicopter

387

00:16:38,550 --> 00:16:36,800

sends as it transitions through each

388

00:16:41,670 --> 00:16:38,560

stage of the flight

389

00:16:43,509 --> 00:16:41,680

and when hovard is able to verify that

390

00:16:45,910 --> 00:16:43,519

the progression went as planned then

391

00:16:47,509 --> 00:16:45,920

he'll turn to the actual data

392

00:16:48,389 --> 00:16:47,519

and look at

393

00:17:11,189 --> 00:16:48,399

a

394

00:17:13,189 --> 00:17:11,199

so if everything goes well we should see

395

00:17:14,870 --> 00:17:13,199

some of those landing pictures and be

396

00:17:16,470 --> 00:17:14,880

able to look at them on the screen so

397

00:17:19,270 --> 00:17:16,480

hobart will display those as well and

398

00:17:20,870 --> 00:17:19,280

then finally if all goes well there

399

00:17:22,549 --> 00:17:20,880

should be at the same time our data is

400

00:17:24,230 --> 00:17:22,559

coming down there should be

401
00:17:25,909 --> 00:17:24,240
data coming down from the z cam

402
00:17:27,669 --> 00:17:25,919
instrument that i mentioned the mask mz

403
00:17:29,590 --> 00:17:27,679
a really powerful camera system that's

404
00:17:30,950 --> 00:17:29,600
going to try to capture us in flight so

405
00:17:32,549 --> 00:17:30,960
if they were if they were able to

406
00:17:34,390 --> 00:17:32,559
capture that moment of flight then they

407
00:17:35,830 --> 00:17:34,400
will be able to display those

408
00:17:37,590 --> 00:17:35,840
images on their screen and be able to

409
00:17:38,630 --> 00:17:37,600
see a quick view of how the helicopter

410
00:17:41,029 --> 00:17:38,640
flew

411
00:17:42,870 --> 00:17:41,039
that's how it's going to go

412
00:17:44,950 --> 00:17:42,880
well tim we can't wait to see those

413
00:17:46,950 --> 00:17:44,960

photos for sure thank you so much and

414

00:17:48,390 --> 00:17:46,960

good luck to you

415

00:17:50,070 --> 00:17:48,400

thank you

416

00:17:53,029 --> 00:17:50,080

we will get back to the action in the

417

00:17:55,029 --> 00:17:53,039

room in just a moment now joining us is

418

00:17:57,110 --> 00:17:55,039

associate administrator of nasa's

419

00:17:59,350 --> 00:17:57,120

science mission directorate thomas

420

00:18:01,990 --> 00:17:59,360

zurbukin who is here at jpl for the

421

00:18:04,710 --> 00:18:02,000

helicopter's first test flight welcome

422

00:18:07,270 --> 00:18:04,720

thomas i'm so glad to be here marina hi

423

00:18:10,150 --> 00:18:07,280

hi now how important is tonight to space

424

00:18:11,830 --> 00:18:10,160

exploration oh it's techno technology

425

00:18:14,230 --> 00:18:11,840

demonstrations are really important for

426

00:18:16,150 --> 00:18:14,240

all of us you know it's really taking a

427

00:18:18,230 --> 00:18:16,160

tool that we haven't been able to use

428

00:18:20,310 --> 00:18:18,240

and put it in the box of tools that is

429

00:18:22,950 --> 00:18:20,320

available for all of our missions going

430

00:18:24,390 --> 00:18:22,960

forward at mars so for me it's really

431

00:18:28,070 --> 00:18:24,400

exciting personally and for the

432

00:18:29,990 --> 00:18:28,080

community overall it opens up new doors

433

00:18:31,750 --> 00:18:30,000

and thomas why is it important to have

434

00:18:33,350 --> 00:18:31,760

that aerial dimension to space

435

00:18:35,190 --> 00:18:33,360

exploration

436

00:18:37,430 --> 00:18:35,200

there's many applications that require

437

00:18:40,230 --> 00:18:37,440

that imagine for example going into

438

00:18:41,750 --> 00:18:40,240

areas of you know and exploring them

439

00:18:43,590 --> 00:18:41,760

that we cannot

440

00:18:45,510 --> 00:18:43,600

use a rover for that some of these

441

00:18:47,510 --> 00:18:45,520

crater walls that are so exciting

442

00:18:49,830 --> 00:18:47,520

scientists have been writing papers

443

00:18:51,750 --> 00:18:49,840

about it it's also important to have the

444

00:18:53,430 --> 00:18:51,760

aerial dimension in the context of human

445

00:18:55,909 --> 00:18:53,440

exploration of mars of which we're

446

00:18:58,549 --> 00:18:55,919

dreaming even now and that aerial

447

00:19:03,270 --> 00:18:58,559

dimension being kind of able to scout

448

00:19:08,150 --> 00:19:04,870

well thank you so much for joining

449

00:19:09,750 --> 00:19:08,160

joining us dr z hey thanks

450

00:19:11,830 --> 00:19:09,760

let's check back in now with taryn

451
00:19:14,630 --> 00:19:11,840
bailey to see how things are shaping up

452
00:19:17,029 --> 00:19:14,640
with the team's next steps hey taryn

453
00:19:19,270 --> 00:19:17,039
hey marina we're moments away from

454
00:19:20,710 --> 00:19:19,280
receiving that all-important data and

455
00:19:23,590 --> 00:19:20,720
the anticipation is definitely building

456
00:19:25,350 --> 00:19:23,600
in the room everyone's very focused just

457
00:19:27,430 --> 00:19:25,360
waiting on pins and needles eagerly

458
00:19:28,789 --> 00:19:27,440
waiting for that data to arrive and

459
00:19:29,909 --> 00:19:28,799
we're just preparing ourselves for what

460
00:19:31,669 --> 00:19:29,919
comes down

461
00:19:33,270 --> 00:19:31,679
and you know this was such a big

462
00:19:34,710 --> 00:19:33,280
challenge for us to embark upon as a

463
00:19:36,070 --> 00:19:34,720

team and we are such a small and

464

00:19:37,830 --> 00:19:36,080

close-knit team

465

00:19:39,510 --> 00:19:37,840

so it was really it's really great to be

466

00:19:42,070 --> 00:19:39,520

back in the room with all of my

467

00:19:44,230 --> 00:19:42,080

colleagues and my teammates uh we're all

468

00:19:46,630 --> 00:19:44,240

here in support of one another we have

469

00:19:48,390 --> 00:19:46,640

bob dylan watching and he's been the

470

00:19:49,750 --> 00:19:48,400

vision behind this so from the very

471

00:19:52,710 --> 00:19:49,760

beginning so we have such great

472

00:19:55,590 --> 00:19:52,720

leadership on this team and

473

00:19:57,350 --> 00:19:55,600

very excited to be here

474

00:19:59,590 --> 00:19:57,360

and we're going to be hearing from a lot

475

00:20:01,270 --> 00:19:59,600

of people taryn so can you let us know

476
00:20:03,029 --> 00:20:01,280
who we're going to be hearing from as we

477
00:20:04,710 --> 00:20:03,039
progress through the morning

478
00:20:06,390 --> 00:20:04,720
yes we'll first hear from our down

479
00:20:08,230 --> 00:20:06,400
league lead michael starch

480
00:20:10,789 --> 00:20:08,240
and he's going to be the person that

481
00:20:12,630 --> 00:20:10,799
first lays eyes on the data and when he

482
00:20:15,510 --> 00:20:12,640
receives it he'll unpack it he'll run

483
00:20:18,230 --> 00:20:15,520
through a data receivable procedure

484
00:20:20,470 --> 00:20:18,240
make his call out and then he'll hand it

485
00:20:22,950 --> 00:20:20,480
over to our guidance navigation and

486
00:20:24,149 --> 00:20:22,960
control lead also our chief pilot havard

487
00:20:26,789 --> 00:20:24,159
grip

488
00:20:29,029 --> 00:20:26,799

he'll interpret that data and

489

00:20:30,149 --> 00:20:29,039

display an altimeter plot to indicate if

490

00:20:32,789 --> 00:20:30,159

we flew

491

00:20:34,630 --> 00:20:32,799

some other voices we'll hear on voca

492

00:20:36,870 --> 00:20:34,640

will be

493

00:20:39,029 --> 00:20:36,880

our deputy ops lead teddy zenetos who

494

00:20:41,430 --> 00:20:39,039

will report on the battery status and

495

00:20:45,669 --> 00:20:41,440

our systems engineer jaco karis who will

496

00:20:49,590 --> 00:20:47,430

and we're going to be taking a couple of

497

00:20:51,350 --> 00:20:49,600

your social media questions right now as

498

00:20:54,149 --> 00:20:51,360

we wait for michael to make that

499

00:20:55,909 --> 00:20:54,159

announcement that the data is coming in

500

00:20:59,110 --> 00:20:55,919

so taryn

501
00:21:01,430 --> 00:20:59,120
a man named flo on instagram asks why

502
00:21:03,590 --> 00:21:01,440
did we send a helicopter to mars in the

503
00:21:05,909 --> 00:21:03,600
first place

504
00:21:08,549 --> 00:21:05,919
great question why not

505
00:21:11,909 --> 00:21:09,590
um

506
00:21:14,070 --> 00:21:11,919
sending a an aerial vehicle

507
00:21:17,909 --> 00:21:14,080
at this stage especially you know we

508
00:21:20,630 --> 00:21:17,919
have sent five rovers to mars and now we

509
00:21:21,909 --> 00:21:20,640
have an aerial dimension which dr

510
00:21:23,430 --> 00:21:21,919
zurbukin

511
00:21:25,430 --> 00:21:23,440
pointed out that it's really important

512
00:21:27,190 --> 00:21:25,440
because it elevates the next stage of

513
00:21:29,110 --> 00:21:27,200

space exploration

514

00:21:31,110 --> 00:21:29,120

and we can do more science with it it

515

00:21:34,070 --> 00:21:31,120

can be a coordinated effort for future

516

00:21:37,190 --> 00:21:34,080

missions it also opens the doorway for

517

00:21:39,830 --> 00:21:37,200

human exploration and the helicopter can

518

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

go into areas where the rover can so

519

00:21:43,990 --> 00:21:41,679

there are a lot of

520

00:21:45,750 --> 00:21:44,000

caves and the rover has to overcome a

521

00:21:48,870 --> 00:21:45,760

lot of obstacles on the ground that the

522

00:21:51,110 --> 00:21:48,880

helicopter can ideally move around and

523

00:21:53,190 --> 00:21:51,120

that's why it's such a great option for

524

00:21:54,870 --> 00:21:53,200

uh putting an aerial vehicle on another

525

00:21:57,029 --> 00:21:54,880

planet

526

00:21:59,909 --> 00:21:57,039

and as tim mentioned it has to be well

527

00:22:02,870 --> 00:21:59,919

choreographed this flight and so elio on

528

00:22:05,029 --> 00:22:02,880

instagram asks why is the first flight

529

00:22:07,350 --> 00:22:05,039

only vertical

530

00:22:09,270 --> 00:22:07,360

so every flight we're gonna build upon

531

00:22:10,789 --> 00:22:09,280

it but this first flight our mission

532

00:22:13,350 --> 00:22:10,799

success criteria is really to

533

00:22:15,110 --> 00:22:13,360

demonstrate that we can fly and so

534

00:22:16,950 --> 00:22:15,120

that's why this first flight is really

535

00:22:19,669 --> 00:22:16,960

all about being able to demonstrate that

536

00:22:21,190 --> 00:22:19,679

we can fly on another planet and so that

537

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

means we'll do

538

00:22:24,310 --> 00:22:22,159

a three

539

00:22:26,950 --> 00:22:24,320

meter hover above the martian surface

540

00:22:28,310 --> 00:22:26,960

touch back down to signal success and

541

00:22:30,549 --> 00:22:28,320

then we can

542

00:22:32,149 --> 00:22:30,559

advance from there

543

00:22:34,149 --> 00:22:32,159

and getting back to what everyone's

544

00:22:35,990 --> 00:22:34,159

going to be looking at you had mentioned

545

00:22:38,149 --> 00:22:36,000

that hovard is going to be looking at a

546

00:22:40,070 --> 00:22:38,159

plot what exactly is that going to look

547

00:22:41,830 --> 00:22:40,080

like is it easy to see if the flight

548

00:22:44,310 --> 00:22:41,840

actually took place

549

00:22:46,710 --> 00:22:44,320

yes so his altimeter plot will

550

00:22:49,029 --> 00:22:46,720

indicate a peak and

551
00:22:51,350 --> 00:22:49,039
we'll start off with a flat line

552
00:22:52,950 --> 00:22:51,360
indicating that we were grounded then

553
00:22:55,190 --> 00:22:52,960
we'll spin up and it'll have a steep

554
00:22:57,110 --> 00:22:55,200
incline to show that we've

555
00:22:59,110 --> 00:22:57,120
risen and then at the top we'll have a

556
00:23:00,149 --> 00:22:59,120
dwell where we're hovering and then

557
00:23:02,070 --> 00:23:00,159
another

558
00:23:04,470 --> 00:23:02,080
steep decline in the graph to show that

559
00:23:06,789 --> 00:23:04,480
we've touched down so it should be

560
00:23:10,470 --> 00:23:06,799
pretty cut and dry to see

561
00:23:15,110 --> 00:23:12,950
and this morning of course as you

562
00:23:17,510 --> 00:23:15,120
mentioned the helicopter flew a few

563
00:23:19,909 --> 00:23:17,520

hours ago and we're waiting to see if it

564

00:23:22,310 --> 00:23:19,919

did happen but you did a whole lot of

565

00:23:24,310 --> 00:23:22,320

testing here on earth before you send

566

00:23:27,350 --> 00:23:24,320

ingenuity up there tell me what it was

567

00:23:29,830 --> 00:23:27,360

like to test the helicopter and simulate

568

00:23:32,870 --> 00:23:29,840

that mars environment

569

00:23:34,789 --> 00:23:32,880

absolutely so it went just just because

570

00:23:37,110 --> 00:23:34,799

the helicopter is the first of its kind

571

00:23:39,669 --> 00:23:37,120

the testing also is very similar in that

572

00:23:42,070 --> 00:23:39,679

way we had to simulate a mars-like

573

00:23:44,470 --> 00:23:42,080

atmosphere by using very large thermal

574

00:23:46,870 --> 00:23:44,480

vacuum chambers to allow us to control

575

00:23:49,590 --> 00:23:46,880

the temperature and pressure so we can

576
00:23:52,070 --> 00:23:49,600
simulate a mars-like atmospheric density

577
00:23:53,830 --> 00:23:52,080
then we also created a gravity offload

578
00:23:55,750 --> 00:23:53,840
system that compensates for the

579
00:23:56,870 --> 00:23:55,760
difference in gravity between earth and

580
00:23:58,549 --> 00:23:56,880
mars

581
00:24:00,230 --> 00:23:58,559
in addition to that we validated a lot

582
00:24:02,470 --> 00:24:00,240
of our requirements with engineering

583
00:24:04,390 --> 00:24:02,480
models so these are developmental models

584
00:24:05,750 --> 00:24:04,400
that we made

585
00:24:07,110 --> 00:24:05,760
and

586
00:24:10,070 --> 00:24:07,120
they went through extensive

587
00:24:11,110 --> 00:24:10,080
environmental and aerodynamic testing

588
00:24:12,870 --> 00:24:11,120

and so

589

00:24:14,630 --> 00:24:12,880

they were the precursors to our flight

590

00:24:17,190 --> 00:24:14,640

vehicle which is of course currently on

591

00:24:22,470 --> 00:24:19,430

and as mimi mentioned before it had to

592

00:24:24,630 --> 00:24:22,480

be super light and super fast why is

593

00:24:26,950 --> 00:24:24,640

that

594

00:24:28,630 --> 00:24:26,960

flying on mars is very difficult you

595

00:24:30,149 --> 00:24:28,640

guys have heard it before it's less than

596

00:24:31,269 --> 00:24:30,159

one percent of earth's atmosphere and

597

00:24:33,029 --> 00:24:31,279

that means that we have to have

598

00:24:35,750 --> 00:24:33,039

something really lightweight

599

00:24:39,269 --> 00:24:35,760

for us to overcome that mass to generate

600

00:24:41,029 --> 00:24:39,279

enough lift and you know kudos and thank

601
00:24:43,830 --> 00:24:41,039
you very much to our friends over at air

602
00:24:47,029 --> 00:24:43,840
environment who designed and built this

603
00:24:49,190 --> 00:24:47,039
custom rotor system that is super

604
00:24:51,750 --> 00:24:49,200
lightweight each blade is less than two

605
00:24:54,070 --> 00:24:51,760
ounces made of composite material for

606
00:24:56,310 --> 00:24:54,080
that very reason and it spans the

607
00:24:59,190 --> 00:24:56,320
distance the wingspan of this helicopter

608
00:25:02,230 --> 00:24:59,200
is four feet tip to tip so that's about

609
00:25:03,909 --> 00:25:02,240
that's 1.2 meters that's super large for

610
00:25:06,390 --> 00:25:03,919
something that's essentially carrying

611
00:25:08,549 --> 00:25:06,400
the size of a tissue box

612
00:25:09,909 --> 00:25:08,559
just to give you a frame of reference

613
00:25:11,430 --> 00:25:09,919

and in addition to that generating

614

00:25:12,549 --> 00:25:11,440

enough lift

615

00:25:15,590 --> 00:25:12,559

involves

616

00:25:21,350 --> 00:25:15,600

having high rpms so we're

617

00:25:21,360 --> 00:25:24,789

2500

618

00:25:28,789 --> 00:25:27,029

rpm i just want everyone to sit with

619

00:25:32,390 --> 00:25:28,799

that for a minute because here on earth

620

00:25:35,110 --> 00:25:32,400

helicopters go 400 to 500 rpm so that is

621

00:25:37,190 --> 00:25:35,120

so much faster taryn

622

00:25:40,870 --> 00:25:37,200

it's incredibly fast incredibly fast

623

00:25:43,269 --> 00:25:40,880

every detail on this vehicle has

624

00:25:45,029 --> 00:25:43,279

is made and designed for it to be the

625

00:25:53,430 --> 00:25:45,039

most efficient

626
00:26:00,149 --> 00:25:55,110
we will continue to watch data products

627
00:26:04,149 --> 00:26:02,070
all right taryn well we just heard from

628
00:26:06,310 --> 00:26:04,159
michael that they are taking a look at

629
00:26:08,950 --> 00:26:06,320
the data just starting to flow into the

630
00:26:10,870 --> 00:26:08,960
deep space network antenna on earth what

631
00:26:13,110 --> 00:26:10,880
happens now that the rover has started

632
00:26:15,190 --> 00:26:13,120
sending that data

633
00:26:16,710 --> 00:26:15,200
yes so for those of you at home the deep

634
00:26:19,830 --> 00:26:16,720
space network is our giant

635
00:26:22,070 --> 00:26:19,840
communications network that downlink

636
00:26:25,510 --> 00:26:22,080
early indications data products look

637
00:26:29,510 --> 00:26:27,669
excellent we'll continue to wait for the

638
00:26:30,789 --> 00:26:29,520

full data set to arrive

639

00:26:32,310 --> 00:26:30,799

in the meantime i'll explain a little

640

00:26:34,149 --> 00:26:32,320

bit about the deep space network and

641

00:26:35,350 --> 00:26:34,159

that it's our main communications tool

642

00:26:39,510 --> 00:26:35,360

to

643

00:26:41,430 --> 00:26:39,520

helicopter from across our solar system

644

00:26:42,870 --> 00:26:41,440

so our downlink lead just announced that

645

00:26:44,390 --> 00:26:42,880

data products have just started to

646

00:26:45,830 --> 00:26:44,400

arrive and they look nominal which is a

647

00:26:48,549 --> 00:26:45,840

good indication

648

00:26:50,310 --> 00:26:48,559

um while we wait for the full data set

649

00:26:51,350 --> 00:26:50,320

to arrive

650

00:26:53,269 --> 00:26:51,360

um

651
00:26:54,630 --> 00:26:53,279
we'll we'll wait

652
00:26:57,029 --> 00:26:54,640
i guess that's what we'll do we'll wait

653
00:26:59,029 --> 00:26:57,039
in the meantime

654
00:27:01,669 --> 00:26:59,039
and we'll answer another social media

655
00:27:03,669 --> 00:27:01,679
question along those lines jose on

656
00:27:06,070 --> 00:27:03,679
youtube asks how long does it take for

657
00:27:09,110 --> 00:27:06,080
the video signal from the helicopter to

658
00:27:13,750 --> 00:27:11,430
sorry can you repeat the question yes

659
00:27:16,390 --> 00:27:13,760
how long does it take for the video

660
00:27:17,510 --> 00:27:16,400
signal from the helicopter to reach

661
00:27:20,470 --> 00:27:17,520
earth

662
00:27:23,510 --> 00:27:20,480
yeah so that goes into having that very

663
00:27:26,149 --> 00:27:23,520

long distance between earth and us

664

00:27:27,669 --> 00:27:26,159

so tim touched on this a little earlier

665

00:27:30,789 --> 00:27:27,679

and that's why we have this delay so the

666

00:27:31,909 --> 00:27:30,799

helicopter flew earlier and similarly

667

00:27:34,149 --> 00:27:31,919

whenever we

668

00:27:36,870 --> 00:27:34,159

send data it's the same process where

669

00:27:38,710 --> 00:27:36,880

there's going to be a delay of when it

670

00:27:41,909 --> 00:27:38,720

when we when we run the data and then

671

00:27:44,310 --> 00:27:41,919

when it hits earth so it's about

672

00:27:46,470 --> 00:27:44,320

um four hours

673

00:27:48,630 --> 00:27:46,480

from when something is executed to when

674

00:27:50,950 --> 00:27:48,640

we receive it for larger files though

675

00:27:53,190 --> 00:27:50,960

sometimes that can take longer so it all

676
00:27:56,789 --> 00:27:53,200
depends but today we'll be receiving uh

677
00:27:59,269 --> 00:27:56,799
images still images of the helicopter

678
00:28:00,789 --> 00:27:59,279
and i know we are eagerly anticipating

679
00:28:03,110 --> 00:28:00,799
those images and we talked a little bit

680
00:28:05,590 --> 00:28:03,120
about this before taryn we have been

681
00:28:07,110 --> 00:28:05,600
just floored by all the great images

682
00:28:09,590 --> 00:28:07,120
coming in from perseverance but

683
00:28:12,070 --> 00:28:09,600
ingenuity has cameras as well

684
00:28:14,950 --> 00:28:12,080
absolutely the helicopter is equipped

685
00:28:16,710 --> 00:28:14,960
with two cameras one is our onboard

686
00:28:18,310 --> 00:28:16,720
navigation camera and that's the image

687
00:28:19,909 --> 00:28:18,320
that we'll receive tonight

688
00:28:21,750 --> 00:28:19,919

and that's going to be a black and white

689

00:28:23,990 --> 00:28:21,760

image that's pointed straight down at

690

00:28:25,909 --> 00:28:24,000

the martian surface and will hopefully

691

00:28:27,990 --> 00:28:25,919

be showing us hovering above it

692

00:28:30,789 --> 00:28:28,000

our second camera is our return to earth

693

00:28:34,549 --> 00:28:30,799

camera and that's our higher resolution

694

00:28:37,269 --> 00:28:34,559

camera that is a color photo and shows

695

00:28:40,389 --> 00:28:37,279

more of the martian horizon uh snapshot

696

00:28:42,230 --> 00:28:40,399

the beauty shot if you will and then um

697

00:28:43,990 --> 00:28:42,240

and that that image will be

698

00:28:45,750 --> 00:28:44,000

utilized for future

699

00:28:47,430 --> 00:28:45,760

flight missions

700

00:28:49,350 --> 00:28:47,440

and we have another great social media

701
00:28:52,470 --> 00:28:49,360
question here from hing on facebook

702
00:28:54,510 --> 00:28:52,480
asking what is the biggest question this

703
00:28:58,310 --> 00:28:54,520
first flight will answer about

704
00:29:00,149 --> 00:28:58,320
aerodynamics on mars

705
00:29:01,669 --> 00:29:00,159
the biggest question that we had to

706
00:29:04,389 --> 00:29:01,679
answer

707
00:29:06,789 --> 00:29:04,399
when embarking on this was can we lift

708
00:29:09,430 --> 00:29:06,799
can we generate enough lift and fly in a

709
00:29:13,830 --> 00:29:09,440
martian atmosphere and i think this

710
00:29:15,990 --> 00:29:13,840
first flight will indicate that for sure

711
00:29:18,950 --> 00:29:16,000
and we'll answer that question

712
00:29:21,750 --> 00:29:18,960
and um whatever we receive back

713
00:29:24,389 --> 00:29:21,760

will definitely give us more information

714

00:29:25,909 --> 00:29:24,399

moving forward uh regardless of this

715

00:29:26,630 --> 00:29:25,919

first flight

716

00:29:30,710 --> 00:29:26,640

or

717

00:29:36,950 --> 00:29:33,750

and we've got another question on social

718

00:29:39,029 --> 00:29:36,960

waki on twitter asks happy flight day

719

00:29:40,549 --> 00:29:39,039

why are the blades shaped the way they

720

00:29:42,549 --> 00:29:40,559

are

721

00:29:45,669 --> 00:29:42,559

that's a really great question

722

00:29:47,350 --> 00:29:45,679

so for in order to generate enough lift

723

00:29:49,669 --> 00:29:47,360

each blade i mentioned that these were a

724

00:29:52,870 --> 00:29:49,679

custom design and what we call them are

725

00:29:55,110 --> 00:29:52,880

airfoils and they're developed in a way

726

00:29:55,909 --> 00:29:55,120

so that it generates enough lift for us

727

00:29:59,990 --> 00:29:55,919

to

728

00:30:02,389 --> 00:30:00,000

fly and have enough thrust underneath of

729

00:30:04,950 --> 00:30:02,399

our helicopter vehicle so

730

00:30:06,710 --> 00:30:04,960

they have that funky shape because of

731

00:30:08,870 --> 00:30:06,720

the aerodynamic

732

00:30:11,269 --> 00:30:08,880

elements that help it generate enough

733

00:30:15,110 --> 00:30:13,110

and once again reminding everybody that

734

00:30:17,590 --> 00:30:15,120

you guys are controlling this from over

735

00:30:19,669 --> 00:30:17,600

a hundred million miles away here on

736

00:30:20,830 --> 00:30:19,679

earth i always try to wrap my head

737

00:30:22,389 --> 00:30:20,840

around

738

00:30:25,750 --> 00:30:22,399

that

739

00:30:28,070 --> 00:30:25,760

absolutely it is so far away and it's

740

00:30:29,909 --> 00:30:28,080

it's miraculous to even think that this

741

00:30:32,389 --> 00:30:29,919

is something that's technically already

742

00:30:34,870 --> 00:30:32,399

been executed earlier today we're just

743

00:30:37,029 --> 00:30:34,880

kind of standing by and waiting for that

744

00:30:41,350 --> 00:30:37,039

data to arrive to indicate you know

745

00:30:44,710 --> 00:30:42,870

well we are going to have minimal

746

00:30:46,789 --> 00:30:44,720

commentary during this time as we're

747

00:30:48,630 --> 00:30:46,799

going to let you enjoy this experience

748

00:30:51,350 --> 00:30:48,640

with the team as they go through all the

749

00:31:04,630 --> 00:30:51,360

data to see how ingenuity did so let's

750

00:31:04,640 --> 00:31:36,149

okay

751

00:31:36,159 --> 00:32:12,870

um

752

00:32:17,190 --> 00:32:15,110

this is downlink data products appeared

753

00:32:29,029 --> 00:32:17,200

to be in we will begin processing

754

00:33:07,990 --> 00:32:30,870

this is downlink we are beginning to

755

00:33:51,750 --> 00:33:10,310

this is downlink we've pulled in data

756

00:33:55,350 --> 00:33:53,350

this is downlink

757

00:33:57,590 --> 00:33:55,360

confirming we received mars 2020

758

00:33:59,990 --> 00:33:57,600

telemetry confirming that we received

759

00:34:05,029 --> 00:34:00,000

mars 2020 events confirming that we

760

00:34:09,589 --> 00:34:07,190

confirming that we have data products

761

00:34:23,030 --> 00:34:09,599

confirming that we unpacked image and

762

00:34:23,040 --> 00:35:18,470

oh

763

00:35:27,030 --> 00:35:20,550

this is downlink we have successfully

764

00:35:31,990 --> 00:35:29,670

confirming that we have helicopter

765

00:35:35,109 --> 00:35:32,000

data products helicopter telemetry

766

00:35:38,390 --> 00:35:35,119

helicopter events

767

00:36:01,510 --> 00:35:38,400

confirming helicopter file listing

768

00:36:15,349 --> 00:36:04,790

this is downlink confirming battery

769

00:36:20,550 --> 00:36:17,670

rotor motors appear healthy

770

00:36:26,710 --> 00:36:20,560

swashblade servos appear healthy overall

771

00:36:26,720 --> 00:36:32,630

confirming thermal report generation

772

00:36:32,640 --> 00:37:09,589

confirming analog report generation

773

00:37:09,599 --> 00:37:38,069

confirming telecom report generation

774

00:37:50,950 --> 00:37:39,910

this is downlink handing off to flight

775

00:37:55,670 --> 00:37:52,710

this is flight control confirming that

776
00:37:58,230 --> 00:37:55,680
we have evrs from ingenuity

777
00:37:59,670 --> 00:37:58,240
internet is reporting having performed

778
00:38:01,109 --> 00:37:59,680
spin up

779
00:38:02,870 --> 00:38:01,119
take off

780
00:38:05,910 --> 00:38:02,880
slide

781
00:38:07,190 --> 00:38:05,920
hover descent

782
00:38:08,630 --> 00:38:07,200
landing

783
00:38:11,920 --> 00:38:08,640
touchdown

784
00:38:19,910 --> 00:38:11,930
and spin down

785
00:38:23,510 --> 00:38:21,030
and our

786
00:38:25,190 --> 00:38:23,520
altimeter data

787
00:38:27,430 --> 00:38:25,200
confirms

788
00:38:28,790 --> 00:38:27,440

that ingenuity has performed this first

789

00:38:31,030 --> 00:38:28,800

like

790

00:38:33,710 --> 00:38:31,040

the first flight of a powered aircraft

791

00:38:47,510 --> 00:38:33,720

in another planet

792

00:38:47,520 --> 00:39:13,220

oh

793

00:39:13,230 --> 00:39:26,470

[Applause]

794

00:39:26,480 --> 00:40:07,670

foreign

795

00:40:12,230 --> 00:40:10,470

go ahead and repeat that so the image

796

00:40:14,550 --> 00:40:12,240

we're looking at on the screen is the

797

00:40:16,470 --> 00:40:14,560

image from our onboard navigation camera

798

00:40:19,910 --> 00:40:16,480

showing us hovering above the surface of

799

00:40:22,069 --> 00:40:19,920

mars how incredible

800

00:40:23,750 --> 00:40:22,079

and that's its shadow right taryn yes

801
00:40:25,510 --> 00:40:23,760
that's a shadow so the onboard

802
00:40:29,270 --> 00:40:25,520
navigation camera points straight down

803
00:40:33,190 --> 00:40:30,950
i can just hear mimi in the background

804
00:40:35,990 --> 00:40:33,200
this is real this is real it's so

805
00:40:40,309 --> 00:40:38,550
yeah everyone's really really feeling it

806
00:40:42,470 --> 00:40:40,319
now so

807
00:40:50,100 --> 00:40:42,480
we're uh we're gonna wait for the

808
00:40:50,110 --> 00:40:57,390
[Applause]

809
00:41:12,230 --> 00:40:59,950
oh my god

810
00:41:12,240 --> 00:41:31,589
is

811
00:41:34,870 --> 00:41:33,030
explain what we just saw with the

812
00:41:36,069 --> 00:41:34,880
perseverance image

813
00:41:38,309 --> 00:41:36,079

so the person

814

00:41:40,950 --> 00:41:38,319

perseverance image is showing us um

815

00:41:42,870 --> 00:41:40,960

grounded at first it's actually a video

816

00:41:45,750 --> 00:41:42,880

which is great it's grounded at first

817

00:41:47,829 --> 00:41:45,760

and then shows us hovering our three

818

00:41:50,390 --> 00:41:47,839

meters above the martian surface and

819

00:41:51,990 --> 00:41:50,400

then touching back down it's amazing

820

00:41:54,390 --> 00:41:52,000

brilliant

821

00:41:58,430 --> 00:41:54,400

everyone is super excited

822

00:42:06,630 --> 00:41:58,440

so i would say it's a success

823

00:42:07,750 --> 00:42:06,640

[Applause]

824

00:42:14,230 --> 00:42:07,760

well

825

00:42:19,910 --> 00:42:16,470

but i'm lucky for you i have a much

826

00:42:22,550 --> 00:42:19,920

shorter speed for success

827

00:42:32,950 --> 00:42:22,560

we can now say that human beings have

828

00:42:38,710 --> 00:42:35,829

so we've been talking so long about our

829

00:42:41,270 --> 00:42:38,720

wright brothers moment on mars

830

00:42:44,150 --> 00:42:41,280

and here it is

831

00:42:46,790 --> 00:42:44,160

and this project has had many friends

832

00:42:49,510 --> 00:42:46,800

who contributed to tonight's success

833

00:42:52,390 --> 00:42:49,520

i see many in the room

834

00:42:54,870 --> 00:42:52,400

the team in the room the team on webex

835

00:42:56,950 --> 00:42:54,880

team members who couldn't join us

836

00:42:58,630 --> 00:42:56,960

and a few of our friends who are in

837

00:43:00,710 --> 00:42:58,640

longer with us they're still in our

838

00:43:01,589 --> 00:43:00,720

minds today

839

00:43:03,589 --> 00:43:01,599

and

840

00:43:05,190 --> 00:43:03,599

perseverance rover

841

00:43:14,790 --> 00:43:05,200

the best host

842

00:43:17,910 --> 00:43:15,750

you know

843

00:43:20,790 --> 00:43:17,920

history doesn't we don't know from

844

00:43:22,790 --> 00:43:20,800

history what orville and wilbur did

845

00:43:24,470 --> 00:43:22,800

after their first successful flight the

846

00:43:26,710 --> 00:43:24,480

right brothers but i imagine the two

847

00:43:29,270 --> 00:43:26,720

brothers help each other

848

00:43:31,589 --> 00:43:29,280

well you know i'm hugging you personally

849

00:43:33,589 --> 00:43:31,599

and you guys haven't been with me for

850

00:43:35,430 --> 00:43:33,599

four or five to six years

851
00:43:36,640 --> 00:43:35,440
if it weren't for covert 19 you guys

852
00:43:39,589 --> 00:43:36,650
don't have a chance of

853
00:43:43,510 --> 00:43:39,599
[Music]

854
00:43:46,550 --> 00:43:43,520
all me can do i'm giving you the hooks

855
00:43:48,230 --> 00:43:46,560
we together uh flew at mars

856
00:43:50,870 --> 00:43:48,240
and we together now we have our right

857
00:43:53,349 --> 00:43:50,880
brother's moment so

858
00:43:55,109 --> 00:43:53,359
you know history does tell us that soon

859
00:43:56,950 --> 00:43:55,119
after that first flight

860
00:43:59,030 --> 00:43:56,960
wilbur and orville did go right back to

861
00:44:01,030 --> 00:43:59,040
work they flew

862
00:44:04,950 --> 00:44:01,040
three more flights that day

863
00:44:07,589 --> 00:44:04,960

higher and further than the first ones

864

00:44:09,270 --> 00:44:07,599

so we know you know like the wright

865

00:44:11,109 --> 00:44:09,280

brothers that kidnapped we know that our

866

00:44:14,150 --> 00:44:11,119

time can make a difference

867

00:44:17,190 --> 00:44:14,160

at jezreel crater mars is not yet over

868

00:44:19,430 --> 00:44:17,200

this is just a first great flight

869

00:44:21,270 --> 00:44:19,440

so let's enjoy this moment

870

00:44:23,030 --> 00:44:21,280

but we must enjoy this moment because

871

00:44:24,950 --> 00:44:23,040

over the years and there are a few of

872

00:44:27,430 --> 00:44:24,960

you especially but there's some that

873

00:44:29,750 --> 00:44:27,440

have never let me celebrate fully

874

00:44:31,270 --> 00:44:29,760

every time we have one of these major

875

00:44:34,870 --> 00:44:31,280

milestones

876
00:44:39,510 --> 00:44:37,270
so we must take a moment to celebrate

877
00:44:41,109 --> 00:44:39,520
this moment really important

878
00:44:42,710 --> 00:44:41,119
congratulations everybody

879
00:44:44,790 --> 00:44:42,720
congratulations

880
00:44:46,870 --> 00:44:44,800
take that moment and then after that

881
00:44:49,070 --> 00:44:46,880
let's get back to work and more vlogs

882
00:44:59,670 --> 00:44:49,080
congratulations

883
00:44:59,680 --> 00:45:23,150
all right

884
00:45:28,870 --> 00:45:25,349
congratulations to the ingenuity

885
00:45:31,270 --> 00:45:28,880
helicopter team on making history this

886
00:45:34,630 --> 00:45:31,280
morning to get the latest updates on

887
00:45:37,349 --> 00:45:34,640
ingenuity follow on at nasa jpl on

888
00:45:40,069 --> 00:45:37,359

facebook and twitter i'd like to thank

889

00:45:42,470 --> 00:45:40,079

everyone for joining us at this early

890

00:45:45,109 --> 00:45:42,480

morning hour the journey on this month

891

00:45:47,430 --> 00:45:45,119

of ingenuity continues join us for a

892

00:45:49,990 --> 00:45:47,440

news briefing later this morning at 11

893

00:45:52,870 --> 00:45:50,000

a.m pacific standard time for a deeper

894

00:45:55,430 --> 00:45:52,880

analysis of ingenuity's first flight and

895

00:45:58,150 --> 00:45:55,440

what this means for nasa i'm marina