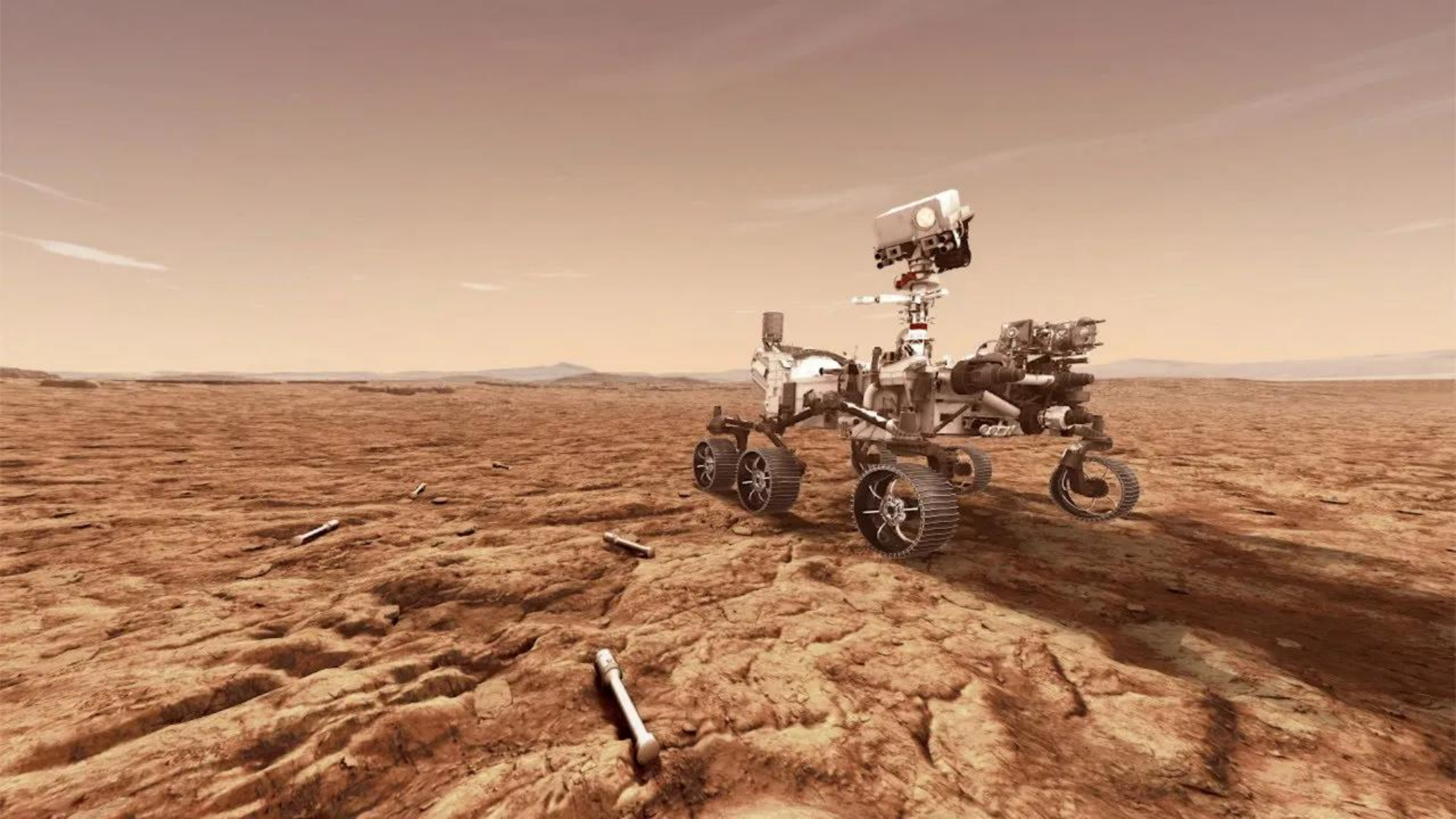

1
00:01:15,190 --> 00:01:13,429
hello i'm tom zelabor ceo of the space

2
00:01:18,149 --> 00:01:15,200
foundation and it's my pleasure to

3
00:01:20,789 --> 00:01:18,159
welcome you to space foundation presents

4
00:01:23,030 --> 00:01:20,799
our webinar series that showcases the

5
00:01:25,670 --> 00:01:23,040
missions and leaders that are pioneering

6
00:01:27,190 --> 00:01:25,680
new opportunities here on earth in orbit

7
00:01:29,510 --> 00:01:27,200
and beyond

8
00:01:31,510 --> 00:01:29,520
today's program will focus on the next

9
00:01:33,990 --> 00:01:31,520
giant leap we'll be taking to the red

10
00:01:36,149 --> 00:01:34,000
planet mars there could not be a better

11
00:01:38,550 --> 00:01:36,159
day to hear from our very special guests

12
00:01:41,429 --> 00:01:38,560
about this new adventure

13
00:01:43,830 --> 00:01:41,439

exactly 51 years ago today

14
00:01:45,910 --> 00:01:43,840
the world watched nasa astronauts neil

15
00:01:48,950 --> 00:01:45,920
armstrong and buzz aldrin take

16
00:01:51,670 --> 00:01:48,960
humanity's first small steps on a world

17
00:01:55,190 --> 00:01:51,680
that was not our home

18
00:01:56,389 --> 00:01:55,200
51 years later we have three nations the

19
00:01:59,109 --> 00:01:56,399
uae

20
00:02:01,590 --> 00:01:59,119
china and the united states all taking

21
00:02:03,990 --> 00:02:01,600
their own giant leaps to mars with

22
00:02:06,389 --> 00:02:04,000
multiple spacecraft and by the way

23
00:02:09,029 --> 00:02:06,399
congratulations to the uae for their

24
00:02:11,830 --> 00:02:09,039
successful launch yesterday

25
00:02:14,309 --> 00:02:11,840
while this is a source of great national

26
00:02:16,869 --> 00:02:14,319
pride for each of these nations

27
00:02:19,190 --> 00:02:16,879
globally we can celebrate what humanity

28
00:02:22,790 --> 00:02:19,200
can learn and achieve when we invest in

29
00:02:25,030 --> 00:02:22,800
people curiosity and pursue bold

30
00:02:26,869 --> 00:02:25,040
challenging frontiers

31
00:02:29,350 --> 00:02:26,879
at space foundation

32
00:02:31,030 --> 00:02:29,360
that is part of our mission

33
00:02:33,910 --> 00:02:31,040
we are looking forward to bringing the

34
00:02:36,550 --> 00:02:33,920
world space community together again at

35
00:02:39,670 --> 00:02:36,560
the 36th space symposium this coming

36
00:02:42,390 --> 00:02:39,680
october 31st through november 2nd both

37
00:02:44,070 --> 00:02:42,400
in person in colorado springs and

38
00:02:46,229 --> 00:02:44,080

virtually

39
00:02:49,270 --> 00:02:46,239
we are also doing our part through our

40
00:02:52,470 --> 00:02:49,280
center for innovation and education to

41
00:02:55,589 --> 00:02:52,480
drive to drive diverse workforce

42
00:02:57,589 --> 00:02:55,599
development and economic opportunity so

43
00:03:00,309 --> 00:02:57,599
everyone can find their place in the

44
00:03:02,630 --> 00:03:00,319
growing space economy

45
00:03:05,509 --> 00:03:02,640
at no other time in our history have we

46
00:03:08,869 --> 00:03:05,519
seen anything like what is unfolding

47
00:03:10,790 --> 00:03:08,879
with these three unique missions to mars

48
00:03:13,190 --> 00:03:10,800
each of them is a science and

49
00:03:15,990 --> 00:03:13,200
engineering marvel but today we want to

50
00:03:18,550 --> 00:03:16,000
specifically call out the nasa and jpl

51
00:03:21,190 --> 00:03:18,560
team for building another remarkable

52
00:03:23,830 --> 00:03:21,200
rover the perseverance that will kick up

53
00:03:25,750 --> 00:03:23,840
even more dust on the red planet but

54
00:03:28,229 --> 00:03:25,760
also for building the aptly named

55
00:03:30,470 --> 00:03:28,239
ingenuity mars helicopter the first

56
00:03:31,509 --> 00:03:30,480
aircraft to attempt controlled flight on

57
00:03:32,710 --> 00:03:31,519
another

58
00:03:34,710 --> 00:03:32,720
planet

59
00:03:37,270 --> 00:03:34,720
and let me personally add from this

60
00:03:40,550 --> 00:03:37,280
retired naval aviator to those who will

61
00:03:42,949 --> 00:03:40,560
fly ingenuity over the landscape of mars

62
00:03:45,350 --> 00:03:42,959
your flights and performance really will

63
00:03:47,670 --> 00:03:45,360

change the universe and we can't wait to

64
00:03:49,350 --> 00:03:47,680
see what we learned from this

65
00:03:52,550 --> 00:03:49,360
the missions of perseverance and

66
00:03:55,350 --> 00:03:52,560
ingenuity along with mars-bound

67
00:03:57,589 --> 00:03:55,360
spacecraft from the uae and china could

68
00:03:59,030 --> 00:03:57,599
not be happening at a more important

69
00:04:02,550 --> 00:03:59,040
time

70
00:04:05,589 --> 00:04:02,560
as the world continues to fight covet 19

71
00:04:07,830 --> 00:04:05,599
missions like those going to mars give

72
00:04:08,789 --> 00:04:07,840
us hope and inspiration for the days to

73
00:04:10,869 --> 00:04:08,799
come

74
00:04:13,429 --> 00:04:10,879
the mission teams behind this new round

75
00:04:14,390 --> 00:04:13,439
of visitors to mars have certainly done

76
00:04:16,789 --> 00:04:14,400
their part

77
00:04:18,870 --> 00:04:16,799
to adapt to this difficult environment

78
00:04:21,670 --> 00:04:18,880
and lead by example

79
00:04:26,390 --> 00:04:21,680
so to each of those team members at nasa

80
00:04:29,590 --> 00:04:26,400
jpl the utl ula atlas team and the uae

81
00:04:30,950 --> 00:04:29,600
space agency in the china national space

82
00:04:32,950 --> 00:04:30,960
administration

83
00:04:35,350 --> 00:04:32,960
on behalf of the space foundation and

84
00:04:37,670 --> 00:04:35,360
the global space community thank you for

85
00:04:38,710 --> 00:04:37,680
your courage and character and showing

86
00:04:41,350 --> 00:04:38,720
us all

87
00:04:43,749 --> 00:04:41,360
that pioneering never stops

88
00:04:46,469 --> 00:04:43,759

today's webinar is part of our ongoing

89
00:04:48,950 --> 00:04:46,479
series called space foundation presents

90
00:04:51,270 --> 00:04:48,960
which is co-sponsored by boeing it's

91
00:04:52,070 --> 00:04:51,280
another example of our mission to bring

92
00:04:53,990 --> 00:04:52,080
you

93
00:04:56,950 --> 00:04:54,000
the pioneering leaders that are making

94
00:04:59,189 --> 00:04:56,960
our universe more accessible to everyone

95
00:05:00,950 --> 00:04:59,199
and we are grateful to boeing for their

96
00:05:02,710 --> 00:05:00,960
support

97
00:05:05,350 --> 00:05:02,720
to make sure you can

98
00:05:09,110 --> 00:05:05,360
be part of today's conversation we are

99
00:05:11,270 --> 00:05:09,120
taking questions via twitter using

100
00:05:13,270 --> 00:05:11,280
ask sf

101
00:05:14,550 --> 00:05:13,280
and with that it's time to begin our

102
00:05:16,870 --> 00:05:14,560
program

103
00:05:20,150 --> 00:05:16,880
joining us today is the honorable jim

104
00:05:22,950 --> 00:05:20,160
bridenstine nasa administrator and like

105
00:05:25,189 --> 00:05:22,960
me another proud naval aviator he is

106
00:05:27,590 --> 00:05:25,199
also a former member of the u.s house of

107
00:05:29,990 --> 00:05:27,600
representatives having been elected to

108
00:05:32,310 --> 00:05:30,000
serve the first district of oklahoma

109
00:05:34,629 --> 00:05:32,320
three times

110
00:05:37,430 --> 00:05:34,639
also part of today's prague program is

111
00:05:40,390 --> 00:05:37,440
dr thomas zurbukin

112
00:05:43,029 --> 00:05:40,400
nasa associate administrator for the

113
00:05:45,670 --> 00:05:43,039

science mission directorate we also have

114
00:05:48,870 --> 00:05:45,680
dr michael watkins director of nasa's

115
00:05:52,150 --> 00:05:48,880
jet propulsion laboratory and finally ms

116
00:05:54,790 --> 00:05:52,160
mimi young who is the project manager

117
00:05:57,749 --> 00:05:54,800
for the ingenuity mars helicopter out of

118
00:06:01,670 --> 00:05:57,759
nasa jpl

119
00:06:04,150 --> 00:06:01,680
it's an honor to have them join us today

120
00:06:07,029 --> 00:06:04,160
now before i turn the program over to

121
00:06:09,749 --> 00:06:07,039
thomas dormie space foundation vice

122
00:06:11,510 --> 00:06:09,759
president of washington operations to

123
00:06:13,430 --> 00:06:11,520
moderate the discussion

124
00:06:14,870 --> 00:06:13,440
we have a short video highlighting

125
00:06:16,870 --> 00:06:14,880
nasa's effort

126
00:06:18,790 --> 00:06:16,880
it clearly shows that despite the

127
00:06:21,510 --> 00:06:18,800
challenge

128
00:06:25,110 --> 00:06:21,520
nasa continues to inspire a nation and

129
00:06:27,350 --> 00:06:25,120
future generations of exploration

130
00:06:33,590 --> 00:06:27,360
the videos appropriately

131
00:06:40,070 --> 00:06:37,350
we are a species of explorers

132
00:06:42,550 --> 00:06:40,080
believers we choose to go to the moon in

133
00:06:45,029 --> 00:06:42,560
this decade and do the other things

134
00:06:47,430 --> 00:06:45,039
not because they are easy but because

135
00:06:49,749 --> 00:06:47,440
they are hard we are willing to do the

136
00:06:51,270 --> 00:06:49,759
hard things to overcome the many

137
00:06:54,170 --> 00:06:51,280
challenges

138
00:06:55,749 --> 00:06:54,180

this is what brings out the best in us

139
00:06:58,469 --> 00:06:55,759
[Music]

140
00:07:00,629 --> 00:06:58,479
our path has led to success

141
00:07:03,110 --> 00:07:00,639
and to better losses we come together

142
00:07:04,629 --> 00:07:03,120
today to mourn the loss of seven brave

143
00:07:05,510 --> 00:07:04,639
americans

144
00:07:08,870 --> 00:07:05,520
yet

145
00:07:10,710 --> 00:07:08,880
even when faced with tragedy

146
00:07:13,029 --> 00:07:10,720
and setbacks

147
00:07:15,189 --> 00:07:13,039
we persevere

148
00:07:17,990 --> 00:07:15,199
we keep striving

149
00:07:21,749 --> 00:07:18,000
we keep believing

150
00:07:24,629 --> 00:07:21,759
from space we see our planet as a whole

151
00:07:26,790 --> 00:07:24,639
we see the challenges facing it and we

152
00:07:28,309 --> 00:07:26,800
face those challenges

153
00:07:30,790 --> 00:07:28,319
together

154
00:07:32,790 --> 00:07:30,800
we will not give up

155
00:07:35,670 --> 00:07:32,800
we challenge convention

156
00:07:37,270 --> 00:07:35,680
we refuse to accept the status quo

157
00:07:38,710 --> 00:07:37,280
the time at hand

158
00:07:41,189 --> 00:07:38,720
is hard

159
00:07:43,510 --> 00:07:41,199
but we will persevere

160
00:07:45,189 --> 00:07:43,520
we can still draw hope from the moon and

161
00:07:46,560 --> 00:07:45,199
the stars

162
00:07:48,070 --> 00:07:46,570
from space

163
00:07:49,830 --> 00:07:48,080

[Music]

164
00:07:52,390 --> 00:07:49,840
from exploration

165
00:07:55,270 --> 00:07:52,400
there is a new day beyond the challenges

166
00:07:57,270 --> 00:07:55,280
we face now

167
00:07:58,390 --> 00:07:57,280
insight spirit

168
00:08:00,790 --> 00:07:58,400
opportunity

169
00:08:02,869 --> 00:08:00,800
if you think about it all of these names

170
00:08:06,390 --> 00:08:02,879
of past mars rovers are qualities we

171
00:08:10,469 --> 00:08:08,629
we have ignition sequence stars but if

172
00:08:21,310 --> 00:08:10,479
rovers are to be the qualities of us as

173
00:08:21,320 --> 00:08:24,790
[Music]

174
00:08:31,670 --> 00:08:26,750
of explorers

175
00:08:32,949 --> 00:08:31,680
[Music]

176
00:08:36,949 --> 00:08:32,959
we will meet

177
00:08:38,949 --> 00:08:36,959
many obstacles on our way to mars

178
00:08:40,630 --> 00:08:38,959
but as humans

179
00:08:43,909 --> 00:08:40,640
will not

180
00:08:47,000 --> 00:08:46,150
we will always

181
00:08:52,870 --> 00:08:47,010
persevere

182
00:08:57,190 --> 00:08:54,389
wow that was a

183
00:08:59,110 --> 00:08:57,200
inspiring video hello i'm tom stormy

184
00:09:01,190 --> 00:08:59,120
with the space foundation it's my

185
00:09:03,509 --> 00:09:01,200
privilege to moderate today's event and

186
00:09:05,110 --> 00:09:03,519
our live discussion with nasolution

187
00:09:07,110 --> 00:09:05,120
i want to invite the nasa team to join

188
00:09:09,269 --> 00:09:07,120

me on our virtual stage and in order if

189
00:09:11,750 --> 00:09:09,279
i could ask mr jim breinstein the nasa

190
00:09:13,350 --> 00:09:11,760
administrator

191
00:09:15,110 --> 00:09:13,360
thomas zurbukin

192
00:09:17,910 --> 00:09:15,120
the associate administrator for nasa's

193
00:09:20,150 --> 00:09:17,920
science mission directorate

194
00:09:22,230 --> 00:09:20,160
michael watkins director of nasa's jet

195
00:09:24,389 --> 00:09:22,240
propulsion laboratory

196
00:09:27,030 --> 00:09:24,399
and mimi on the ingenuity helicopter

197
00:09:28,630 --> 00:09:27,040
project manager to join me

198
00:09:30,070 --> 00:09:28,640
first as we get started administrative

199
00:09:31,910 --> 00:09:30,080
reinstall i want to thank you and your

200
00:09:34,070 --> 00:09:31,920
team for joining us here today and i

201
00:09:36,710 --> 00:09:34,080
have to say that was truly an incredible

202
00:09:38,389 --> 00:09:36,720
and inspiring video

203
00:09:41,190 --> 00:09:38,399
well thank you and i just want to say

204
00:09:43,269 --> 00:09:41,200
thank you to the space foundation um

205
00:09:45,030 --> 00:09:43,279
this is a relationship that i've had

206
00:09:46,150 --> 00:09:45,040
with your organization that goes back to

207
00:09:48,550 --> 00:09:46,160
my days

208
00:09:50,310 --> 00:09:48,560
in the house of representatives

209
00:09:53,990 --> 00:09:50,320
and the great scholarly work and the

210
00:09:57,750 --> 00:09:55,350
the committees are putting together as

211
00:10:00,710 --> 00:09:57,760
it relates to space and um

212
00:10:02,389 --> 00:10:00,720
it it really has been a real pleasure uh

213
00:10:04,150 --> 00:10:02,399

working with the space foundation for

214
00:10:05,030 --> 00:10:04,160
all of these years and of course as the

215
00:10:08,550 --> 00:10:05,040
head of

216
00:10:10,389 --> 00:10:08,560
relationship that i see

217
00:10:11,750 --> 00:10:10,399
uh continuing along into the future so

218
00:10:13,829 --> 00:10:11,760
thank you for your great work and thank

219
00:10:16,310 --> 00:10:13,839
you for hosting this

220
00:10:17,910 --> 00:10:16,320
uh and and thank you and we do have a

221
00:10:19,590 --> 00:10:17,920
great strong relationship and look

222
00:10:20,870 --> 00:10:19,600
forward to keeping that going in the

223
00:10:22,389 --> 00:10:20,880
future

224
00:10:24,710 --> 00:10:22,399
so we're going to begin with some

225
00:10:26,710 --> 00:10:24,720
opening comments from nasa followed by a

226
00:10:28,230 --> 00:10:26,720
question and answer session as a quick

227
00:10:30,069 --> 00:10:28,240
note for those that have joined us and

228
00:10:32,470 --> 00:10:30,079
are watching live feel free to join the

229
00:10:34,870 --> 00:10:32,480
conversation and ask a question using

230
00:10:36,389 --> 00:10:34,880
our hashtag ask sf

231
00:10:37,750 --> 00:10:36,399
so now let's begin and i think we're

232
00:10:40,630 --> 00:10:37,760
going to start with some comments from

233
00:10:42,550 --> 00:10:40,640
dr zerbookin so thomas

234
00:10:44,790 --> 00:10:42,560
hey thank you so much i'm so excited to

235
00:10:46,389 --> 00:10:44,800
be here with the team

236
00:10:48,949 --> 00:10:46,399
before i get started i wanted to

237
00:10:51,030 --> 00:10:48,959
congratulate the united arab emirates

238
00:10:52,550 --> 00:10:51,040

for their successful launch of the hope

239
00:10:54,389 --> 00:10:52,560
mission to mars

240
00:10:56,150 --> 00:10:54,399
along with their japanese launch

241
00:10:58,630 --> 00:10:56,160
partners that's a truly amazing

242
00:11:01,269 --> 00:10:58,640
accomplishment and we're happy to join

243
00:11:03,190 --> 00:11:01,279
them soon with perseverance because

244
00:11:05,829 --> 00:11:03,200
together hope and perseverance are

245
00:11:08,630 --> 00:11:05,839
essential ingredients of exploration

246
00:11:11,190 --> 00:11:08,640
it's truly an exciting decade ahead of

247
00:11:15,269 --> 00:11:11,200
us as the entire world sends missions to

248
00:11:17,670 --> 00:11:15,279
mars to study and explore the red planet

249
00:11:19,110 --> 00:11:17,680
next week the united states returns to

250
00:11:21,030 --> 00:11:19,120
mars

251
00:11:21,990 --> 00:11:21,040
it's the next step in putting together a

252
00:11:24,550 --> 00:11:22,000
puzzle

253
00:11:27,190 --> 00:11:24,560
we've been working on for centuries

254
00:11:29,910 --> 00:11:27,200
which has accelerated in the last 55

255
00:11:32,069 --> 00:11:29,920
years beginning with the first flyby of

256
00:11:33,990 --> 00:11:32,079
mars by mariner 4.

257
00:11:36,230 --> 00:11:34,000
the world's eyes were opened when the

258
00:11:38,470 --> 00:11:36,240
viking landers sent back transformative

259
00:11:40,550 --> 00:11:38,480
pictures of the surface of another

260
00:11:42,710 --> 00:11:40,560
planet for the first time

261
00:11:43,910 --> 00:11:42,720
and the world got to see for itself the

262
00:11:45,350 --> 00:11:43,920
color

263
00:11:47,829 --> 00:11:45,360

mars red

264
00:11:50,949 --> 00:11:47,839
with its own eyes and we saw how it

265
00:11:52,389 --> 00:11:50,959
remember resembled our great american

266
00:11:54,550 --> 00:11:52,399
desert scapes

267
00:11:56,389 --> 00:11:54,560
and we wandered and knew

268
00:11:57,750 --> 00:11:56,399
what our two planets might have in

269
00:11:59,750 --> 00:11:57,760
common

270
00:12:03,430 --> 00:11:59,760
where all the ingredients necessary to

271
00:12:06,069 --> 00:12:03,440
life carbon other elements water energy

272
00:12:09,750 --> 00:12:06,079
were they present on mars and had the

273
00:12:13,030 --> 00:12:09,760
su-produce microbes as it did on earth

274
00:12:15,269 --> 00:12:13,040
that did unhappy celestial occurrences

275
00:12:16,870 --> 00:12:15,279
for the neighbors snuff out that agent's

276
00:12:19,269 --> 00:12:16,880
life

277
00:12:21,269 --> 00:12:19,279
as we strive here on flourish here on

278
00:12:24,230 --> 00:12:21,279
earth as life

279
00:12:26,629 --> 00:12:24,240
is an important part of our planet these

280
00:12:28,550 --> 00:12:26,639
are questions scientists have pondered

281
00:12:30,949 --> 00:12:28,560
for decades and more

282
00:12:33,590 --> 00:12:30,959
so now we send perseverance the most

283
00:12:35,590 --> 00:12:33,600
capable robotic scientists ever sent to

284
00:12:37,430 --> 00:12:35,600
the surface of another planet

285
00:12:39,430 --> 00:12:37,440
to the most promising place we could

286
00:12:41,509 --> 00:12:39,440
determine from here

287
00:12:43,590 --> 00:12:41,519
that could have supported life

288
00:12:47,110 --> 00:12:43,600

an ancient river delta

289
00:12:49,030 --> 00:12:47,120
by what might once have been a huge lake

290
00:12:51,509 --> 00:12:49,040
the perseverance rover built

291
00:12:52,550 --> 00:12:51,519
on the legacy of nasa's mars exploration

292
00:12:54,629 --> 00:12:52,560
program

293
00:12:56,310 --> 00:12:54,639
and joins a fleet that right now

294
00:12:59,190 --> 00:12:56,320
includes our rover

295
00:13:00,949 --> 00:12:59,200
a lander and multiple orbiters it's our

296
00:13:03,670 --> 00:13:00,959
ninth mission to land

297
00:13:05,590 --> 00:13:03,680
and our fifth rover

298
00:13:08,470 --> 00:13:05,600
perseverance is our first mission to

299
00:13:10,870 --> 00:13:08,480
have astrobiology

300
00:13:14,470 --> 00:13:10,880
in this case the search for ancient life

301
00:13:17,190 --> 00:13:14,480
as part of its top-line science goals

302
00:13:20,790 --> 00:13:17,200
that current fleet of mars including

303
00:13:23,829 --> 00:13:20,800
the rovers uh planet uh made curiosity

304
00:13:25,910 --> 00:13:23,839
which is still roving five years in

305
00:13:28,230 --> 00:13:25,920
and all the missions we have sent

306
00:13:30,790 --> 00:13:28,240
historically these other missions have

307
00:13:32,629 --> 00:13:30,800
all found things that led us to keep

308
00:13:34,550 --> 00:13:32,639
going down this path

309
00:13:37,110 --> 00:13:34,560
having found organics

310
00:13:39,430 --> 00:13:37,120
methane signs of water in the past and

311
00:13:41,829 --> 00:13:39,440
even now perseverance suites of

312
00:13:43,670 --> 00:13:41,839
instruments will take the next step

313
00:13:45,829 --> 00:13:43,680

perseverance is also the bridge between

314
00:13:48,069 --> 00:13:45,839
science and human exploration that

315
00:13:49,829 --> 00:13:48,079
demonstrates how the two can support and

316
00:13:52,069 --> 00:13:49,839
reinforce each other

317
00:13:54,150 --> 00:13:52,079
it will do incredible things until human

318
00:13:56,389 --> 00:13:54,160
scientists with their own unique

319
00:13:59,910 --> 00:13:56,399
perspectives and ability to make science

320
00:14:02,230 --> 00:13:59,920
judgments are able to walk the surface i

321
00:14:03,269 --> 00:14:02,240
look forward to that personally many of

322
00:14:05,350 --> 00:14:03,279
us too

323
00:14:08,710 --> 00:14:05,360
and made advance is a set of tools that

324
00:14:11,590 --> 00:14:08,720
have to have on the surface of mars

325
00:14:14,230 --> 00:14:11,600
well 55 years ago we got a quick image

326
00:14:16,230 --> 00:14:14,240
as the spacecraft rushed by

327
00:14:18,550 --> 00:14:16,240
now we can contemplate evaluating

328
00:14:20,150 --> 00:14:18,560
samples and collecting them and bring

329
00:14:22,710 --> 00:14:20,160
them back to earth

330
00:14:25,030 --> 00:14:22,720
so what will perseverance do

331
00:14:27,590 --> 00:14:25,040
the planet's story is told in parts

332
00:14:29,910 --> 00:14:27,600
through its climate and meta will tell

333
00:14:31,750 --> 00:14:29,920
us more about the weather on mars and

334
00:14:33,910 --> 00:14:31,760
the prevalence of dust and how it

335
00:14:36,069 --> 00:14:33,920
affects human missions

336
00:14:37,990 --> 00:14:36,079
rimfacts will probe beneath the surface

337
00:14:39,590 --> 00:14:38,000
perhaps finding ice deposits human

338
00:14:41,829 --> 00:14:39,600

missions could use

339
00:14:44,310 --> 00:14:41,839
supercam and masscam will survey and

340
00:14:46,069 --> 00:14:44,320
study the environment and turn amazing

341
00:14:48,710 --> 00:14:46,079
images basically

342
00:14:51,670 --> 00:14:48,720
perseverance will bring all human senses

343
00:14:53,910 --> 00:14:51,680
to mars will sense the air around it

344
00:14:56,310 --> 00:14:53,920
see and scan the horizon

345
00:14:58,550 --> 00:14:56,320
hear the planet with microphones on the

346
00:15:00,629 --> 00:14:58,560
surface for the first time

347
00:15:03,670 --> 00:15:00,639
feel it as it picks up samples into

348
00:15:05,350 --> 00:15:03,680
cache perhaps even taste it in a sense

349
00:15:07,030 --> 00:15:05,360
as pixel and other instruments sample

350
00:15:08,230 --> 00:15:07,040
the chemistry and the rocks and soul

351
00:15:10,069 --> 00:15:08,240
around it

352
00:15:11,509 --> 00:15:10,079
as humans prefer for the greatest

353
00:15:12,949 --> 00:15:11,519
adventure

354
00:15:15,910 --> 00:15:12,959
here in

355
00:15:19,430 --> 00:15:15,920
in person exploration of mars our robots

356
00:15:21,990 --> 00:15:19,440
can help moxie will help demonstrate how

357
00:15:24,310 --> 00:15:22,000
we might live off the land by converting

358
00:15:26,870 --> 00:15:24,320
carbon dioxide into oxygen that we can

359
00:15:28,870 --> 00:15:26,880
breathe or for rocket fuel

360
00:15:31,430 --> 00:15:28,880
sherlock in addition to searching for

361
00:15:33,829 --> 00:15:31,440
organics uses spacesuit material for

362
00:15:35,990 --> 00:15:33,839
calibration which will also help us

363
00:15:38,790 --> 00:15:36,000

learn how it degrades on mars and

364
00:15:41,910 --> 00:15:38,800
technologies such as medley and terrain

365
00:15:44,230 --> 00:15:41,920
relative navigation trn will help us

366
00:15:45,990 --> 00:15:44,240
help our rover to the surface and also

367
00:15:49,030 --> 00:15:46,000
provide data that is important to

368
00:15:50,949 --> 00:15:49,040
landing future human missions on mars

369
00:15:52,949 --> 00:15:50,959
jim is going to talk a lot about this

370
00:15:54,710 --> 00:15:52,959
and this important context of human

371
00:15:57,110 --> 00:15:54,720
exploration as well

372
00:15:59,350 --> 00:15:57,120
a helicopter named ingenuity will

373
00:16:01,749 --> 00:15:59,360
demonstrate powered flight on another

374
00:16:03,670 --> 00:16:01,759
planet for the first time i really look

375
00:16:06,550 --> 00:16:03,680
forward to seeing this

376
00:16:08,870 --> 00:16:06,560
martian wright brothers moment mimi will

377
00:16:11,110 --> 00:16:08,880
tell us more about this just so excited

378
00:16:13,829 --> 00:16:11,120
about it and perseverance is going to

379
00:16:17,350 --> 00:16:13,839
prepare for humanity as long last to

380
00:16:19,749 --> 00:16:17,360
hold a piece of mars uh in our hand not

381
00:16:21,590 --> 00:16:19,759
just a meteorite from somewhere but a

382
00:16:23,350 --> 00:16:21,600
piece of an actual surface with its

383
00:16:25,269 --> 00:16:23,360
geologic context

384
00:16:27,829 --> 00:16:25,279
analyzed with the best instruments there

385
00:16:29,189 --> 00:16:27,839
for us to study back on earth with the

386
00:16:33,910 --> 00:16:29,199
instruments

387
00:16:36,470 --> 00:16:33,920
available to them itself not only today

388
00:16:37,350 --> 00:16:36,480

but also in the future this is the first

389
00:16:39,590 --> 00:16:37,360
lag

390
00:16:41,189 --> 00:16:39,600
of the humanities first ever round trip

391
00:16:43,269 --> 00:16:41,199
to another planet

392
00:16:46,150 --> 00:16:43,279
and this amazing explorer could not have

393
00:16:48,150 --> 00:16:46,160
been ready for launch in this transient

394
00:16:49,829 --> 00:16:48,160
window we have without the perseverance

395
00:16:52,870 --> 00:16:49,839
of teams across the country and the

396
00:16:54,870 --> 00:16:52,880
world who struggled and sacrificed

397
00:16:56,949 --> 00:16:54,880
through the global pandemic to keep

398
00:16:59,430 --> 00:16:56,959
their sights on them this milestone of

399
00:17:02,230 --> 00:16:59,440
humanity their work and this mission

400
00:17:03,269 --> 00:17:02,240
embodied the agencies and our nation

401
00:17:05,270 --> 00:17:03,279
spirit

402
00:17:07,350 --> 00:17:05,280
of persevering even in the most

403
00:17:09,750 --> 00:17:07,360
challenging of situations providing

404
00:17:11,110 --> 00:17:09,760
inspiration and advancing science and

405
00:17:13,270 --> 00:17:11,120
exploration

406
00:17:15,510 --> 00:17:13,280
and the mission itself personifies the

407
00:17:17,829 --> 00:17:15,520
human ideal of persevering towards the

408
00:17:20,309 --> 00:17:17,839
future mike is going to tell us more

409
00:17:22,549 --> 00:17:20,319
about this especially

410
00:17:24,710 --> 00:17:22,559
perseverance cares our hopes and dreams

411
00:17:27,110 --> 00:17:24,720
the names of 11 million people from

412
00:17:28,549 --> 00:17:27,120
across the world who sent in their names

413
00:17:31,270 --> 00:17:28,559

to go with us

414
00:17:32,950 --> 00:17:31,280
under the plaque we read explorers one i

415
00:17:35,029 --> 00:17:32,960
just want to tell you both of my parents

416
00:17:37,110 --> 00:17:35,039
who are no longer with us their names

417
00:17:39,430 --> 00:17:37,120
are there that is really meaningful to

418
00:17:41,750 --> 00:17:39,440
me from that perspective as well as also

419
00:17:44,470 --> 00:17:41,760
my family who's here who's all of their

420
00:17:47,190 --> 00:17:44,480
names are on these on this list and

421
00:17:49,350 --> 00:17:47,200
perseverance carries the good will

422
00:17:51,750 --> 00:17:49,360
of the entire space community that we

423
00:17:54,789 --> 00:17:51,760
and other nations all send missions to

424
00:17:56,710 --> 00:17:54,799
mars this decade it reinforces nasa's

425
00:17:58,950 --> 00:17:56,720
commitment to working with our

426
00:18:01,190 --> 00:17:58,960
international partners to accomplish

427
00:18:03,350 --> 00:18:01,200
stunning achievements in science

428
00:18:05,029 --> 00:18:03,360
technology and exploration

429
00:18:07,110 --> 00:18:05,039
so when persevering

430
00:18:09,270 --> 00:18:07,120
and perseverance launches

431
00:18:11,590 --> 00:18:09,280
it takes us all

432
00:18:13,510 --> 00:18:11,600
every one of us will have a chance to

433
00:18:14,870 --> 00:18:13,520
learn from and be inspired by this

434
00:18:17,190 --> 00:18:14,880
mission

435
00:18:19,830 --> 00:18:17,200
anytime we attend something that pushes

436
00:18:23,110 --> 00:18:19,840
us to the next threshold is a time to

437
00:18:26,070 --> 00:18:23,120
celebrate it is a big moment

438
00:18:27,190 --> 00:18:26,080

a milestone for humanity that we all

439
00:18:28,870 --> 00:18:27,200
share

440
00:18:31,029 --> 00:18:28,880
we explore

441
00:18:34,549 --> 00:18:31,039
and discover together

442
00:18:37,669 --> 00:18:34,559
and together we persevere and with that

443
00:18:39,430 --> 00:18:37,679
thomas i'm sending it back to you

444
00:18:41,669 --> 00:18:39,440
hey thanks thomas thanks for that that

445
00:18:43,830 --> 00:18:41,679
was a really great overview i think it

446
00:18:46,150 --> 00:18:43,840
framed the importance of not just this

447
00:18:47,750 --> 00:18:46,160
mission but what nasa you know is doing

448
00:18:48,950 --> 00:18:47,760
at large with these scientific

449
00:18:51,750 --> 00:18:48,960
explorations

450
00:18:54,070 --> 00:18:51,760
and now i'd like to invite dr watkins

451
00:18:57,190 --> 00:18:54,080
from jpl to make some comments uh mike

452
00:18:58,310 --> 00:18:57,200
over to you okay thank you thomas and

453
00:19:03,029 --> 00:18:58,320
thomas

454
00:19:05,430 --> 00:19:03,039
zurbukin said

455
00:19:07,110 --> 00:19:05,440
the um you know the name perseverance to

456
00:19:09,270 --> 00:19:07,120
a certain extent it means two things it

457
00:19:11,590 --> 00:19:09,280
means a rover that's the most capable

458
00:19:14,150 --> 00:19:11,600
rover ever sent to another planet

459
00:19:16,310 --> 00:19:14,160
it also means the thousand team members

460
00:19:18,230 --> 00:19:16,320
or even more than a thousand that built

461
00:19:19,909 --> 00:19:18,240
perseverance uh and will operate it on

462
00:19:22,310 --> 00:19:19,919
the surface and i want to talk a little

463
00:19:24,789 --> 00:19:22,320

bit about that team before we uh talk

464
00:19:27,110 --> 00:19:24,799
more about the uh the machine

465
00:19:28,549 --> 00:19:27,120
you know to to to make a mission like

466
00:19:29,990 --> 00:19:28,559
this be successful to get it to the

467
00:19:31,590 --> 00:19:30,000
launch pad to get it finished to get it

468
00:19:33,029 --> 00:19:31,600
to mars

469
00:19:35,909 --> 00:19:33,039
it takes a lot of perseverance it takes

470
00:19:37,190 --> 00:19:35,919
a lot of brilliant hard work in the best

471
00:19:39,430 --> 00:19:37,200
of times

472
00:19:41,590 --> 00:19:39,440
and i don't think any of us anticipated

473
00:19:43,510 --> 00:19:41,600
uh this covet pandemic

474
00:19:44,950 --> 00:19:43,520
and right during the most busy time of

475
00:19:47,430 --> 00:19:44,960
the mission so the time when we are

476
00:19:49,510 --> 00:19:47,440
working three shifts a day 24 by seven

477
00:19:52,070 --> 00:19:49,520
trying to finish up the final assembly

478
00:19:53,590 --> 00:19:52,080
put the clean flight hardware on do all

479
00:19:56,070 --> 00:19:53,600
the final testing and make sure that we

480
00:19:58,630 --> 00:19:56,080
are ready to go that's right when we

481
00:20:00,549 --> 00:19:58,640
uh were hit by the by the pandemic

482
00:20:02,549 --> 00:20:00,559
and so what what we have done of course

483
00:20:04,549 --> 00:20:02,559
is is pull out all the stops and making

484
00:20:06,630 --> 00:20:04,559
sure that our team stayed safe

485
00:20:08,070 --> 00:20:06,640
so that means lots and lots of telework

486
00:20:09,909 --> 00:20:08,080
so lots of folks staying at home just

487
00:20:11,510 --> 00:20:09,919
like everyone watching you know trying

488
00:20:13,830 --> 00:20:11,520

to operate the test beds trying to write

489
00:20:15,110 --> 00:20:13,840
software trying to do lots of work um

490
00:20:16,630 --> 00:20:15,120
from home

491
00:20:17,750 --> 00:20:16,640
um and then when they're in the office

492
00:20:19,990 --> 00:20:17,760
when they had to actually get in there

493
00:20:22,390 --> 00:20:20,000
and touch hardware and assemble hardware

494
00:20:23,990 --> 00:20:22,400
uh you know lots of ppe lots of social

495
00:20:25,270 --> 00:20:24,000
distancing

496
00:20:27,350 --> 00:20:25,280
and really you know lots of lots of

497
00:20:29,190 --> 00:20:27,360
mental stress i think all of us

498
00:20:30,310 --> 00:20:29,200
have experienced that but this team had

499
00:20:32,470 --> 00:20:30,320
a doubly

500
00:20:33,990 --> 00:20:32,480
we have about a hundred folks down uh at

501
00:20:35,750 --> 00:20:34,000
the cape at the kennedy space center in

502
00:20:38,390 --> 00:20:35,760
florida doing the final assembly that's

503
00:20:41,190 --> 00:20:38,400
where uh perseverance is right now uh

504
00:20:42,710 --> 00:20:41,200
and another several hundred uh at jpl uh

505
00:20:44,070 --> 00:20:42,720
you know working on the on the final

506
00:20:45,830 --> 00:20:44,080
testing and in some cases of final

507
00:20:47,510 --> 00:20:45,840
hardware that we shipped out to uh to

508
00:20:49,590 --> 00:20:47,520
ksc just recently

509
00:20:51,190 --> 00:20:49,600
uh you know those folks not only had to

510
00:20:52,710 --> 00:20:51,200
deal with uh you know having a sometimes

511
00:20:54,310 --> 00:20:52,720
family at home and another kind of

512
00:20:56,630 --> 00:20:54,320
stress in some cases they were separated

513
00:20:58,390 --> 00:20:56,640

sometimes they they had to self-isolate

514
00:21:00,149 --> 00:20:58,400
or they had to be quarantined

515
00:21:02,549 --> 00:21:00,159
um and they and they couldn't uh you

516
00:21:04,870 --> 00:21:02,559
know have the normal distress behaviors

517
00:21:06,950 --> 00:21:04,880
and so i really just cannot say enough

518
00:21:08,549 --> 00:21:06,960
about how incredible this team was um

519
00:21:10,870 --> 00:21:08,559
you know as i mentioned it is a heroic

520
00:21:13,590 --> 00:21:10,880
effort you know in the best of times

521
00:21:15,990 --> 00:21:13,600
and uh this team really knuckled down

522
00:21:18,149 --> 00:21:16,000
uh and completed this uh really on

523
00:21:19,430 --> 00:21:18,159
schedule and we are ready to go

524
00:21:21,029 --> 00:21:19,440
and uh and i will acknowledge you know

525
00:21:22,549 --> 00:21:21,039
not just the jbl team but of course the

526
00:21:24,710 --> 00:21:22,559
ula launch team

527
00:21:27,430 --> 00:21:24,720
um a lot of our instrument uh

528
00:21:29,590 --> 00:21:27,440
folks and uh uh and the ksc team as well

529
00:21:31,909 --> 00:21:29,600
so it's really a team effort um i'll

530
00:21:34,070 --> 00:21:31,919
also say that uh the nasa that says an

531
00:21:36,070 --> 00:21:34,080
agency really came together as a family

532
00:21:37,750 --> 00:21:36,080
you know we're in terms of transporting

533
00:21:38,549 --> 00:21:37,760
people transporting critical hardware

534
00:21:41,590 --> 00:21:38,559
out

535
00:21:43,590 --> 00:21:41,600
um and uh really it's just been a a a

536
00:21:46,549 --> 00:21:43,600
surprisingly smooth experience given all

537
00:21:49,110 --> 00:21:46,559
the troubles with uh with covet

538
00:21:51,830 --> 00:21:49,120

um and so you know here we are basically

539
00:21:53,029 --> 00:21:51,840
at the pad uh ready to go and so uh you

540
00:21:54,070 --> 00:21:53,039
know we intend to launch at the end of

541
00:21:58,390 --> 00:21:54,080
july

542
00:22:00,390 --> 00:21:58,400
and we will get to mars uh in february

543
00:22:02,789 --> 00:22:00,400
now when we get to mars we're headed for

544
00:22:05,590 --> 00:22:02,799
a landing spot jezreel crater now the

545
00:22:07,350 --> 00:22:05,600
scientists have poured over every image

546
00:22:09,590 --> 00:22:07,360
of mars we have from mars reconnaissance

547
00:22:11,350 --> 00:22:09,600
orbiter and and characterizations from

548
00:22:14,230 --> 00:22:11,360
the charism instrument and others in

549
00:22:16,549 --> 00:22:14,240
terms of what is the best site on mars

550
00:22:18,149 --> 00:22:16,559
that had ancient habitability we believe

551
00:22:21,669 --> 00:22:18,159
had ancient habitability we learned a

552
00:22:24,549 --> 00:22:21,679
lot from curiosity at gale crater

553
00:22:26,230 --> 00:22:24,559
but also can preserve signs of that

554
00:22:28,470 --> 00:22:26,240
habitability maybe signs of

555
00:22:30,470 --> 00:22:28,480
biosignatures if they existed

556
00:22:32,789 --> 00:22:30,480
and so the scientists selected a jezreel

557
00:22:34,950 --> 00:22:32,799
crater it is in fact a crater on mars it

558
00:22:36,630 --> 00:22:34,960
has a river delta in it

559
00:22:38,310 --> 00:22:36,640
uh it looks just like river delta that

560
00:22:40,549 --> 00:22:38,320
you'd find on uh you know somewhere on

561
00:22:43,270 --> 00:22:40,559
planet earth but it dried up about three

562
00:22:44,950 --> 00:22:43,280
billion years ago so we are looking for

563
00:22:47,029 --> 00:22:44,960

ancient biosignatures we're looking for

564
00:22:48,870 --> 00:22:47,039
the best spots on mars it's a clay-rich

565
00:22:51,350 --> 00:22:48,880
environment where

566
00:22:52,830 --> 00:22:51,360
these signs could have both formed and

567
00:22:54,870 --> 00:22:52,840
then been

568
00:22:56,870 --> 00:22:54,880
preserved but of course when we land

569
00:22:59,350 --> 00:22:56,880
even with our great landing system and

570
00:23:01,909 --> 00:22:59,360
with our terrain relative navigation

571
00:23:05,029 --> 00:23:01,919
we touch down somewhere in in our

572
00:23:07,029 --> 00:23:05,039
landing zone our landing lips we call it

573
00:23:08,789 --> 00:23:07,039
and then our scientists have to find the

574
00:23:11,190 --> 00:23:08,799
very best spots right they've got to

575
00:23:12,630 --> 00:23:11,200
find those gems you know those

576
00:23:14,789 --> 00:23:12,640
pots of gold that are there that

577
00:23:17,029 --> 00:23:14,799
represent this critical habitable

578
00:23:18,390 --> 00:23:17,039
environment and possible biosignatures

579
00:23:20,549 --> 00:23:18,400
as well

580
00:23:22,630 --> 00:23:20,559
and that is where

581
00:23:23,669 --> 00:23:22,640
the mission again becomes a human and

582
00:23:25,350 --> 00:23:23,679
machine

583
00:23:27,350 --> 00:23:25,360
mission together becomes a partnership

584
00:23:28,950 --> 00:23:27,360
between robotics and humans

585
00:23:30,549 --> 00:23:28,960
so you know we've talked about the

586
00:23:33,350 --> 00:23:30,559
complexity

587
00:23:35,110 --> 00:23:33,360
of perseverance and how that helps us

588
00:23:37,029 --> 00:23:35,120

understand how to send humans to mars

589
00:23:37,909 --> 00:23:37,039
later it helps us understand

590
00:23:41,350 --> 00:23:37,919
the

591
00:23:43,110 --> 00:23:41,360
us understand navigation helps us

592
00:23:44,789 --> 00:23:43,120
understand landing systems

593
00:23:46,149 --> 00:23:44,799
helps us understand in-situ resource

594
00:23:48,470 --> 00:23:46,159
utilization

595
00:23:50,870 --> 00:23:48,480
so all of these help us understand how

596
00:23:53,750 --> 00:23:50,880
to send humans to mars but even with our

597
00:23:55,990 --> 00:23:53,760
robot there we still have humans on mars

598
00:23:58,630 --> 00:23:56,000
because as thomas said it's really it's

599
00:24:00,470 --> 00:23:58,640
our eyes and our ears right so we have

600
00:24:03,190 --> 00:24:00,480
the world's best team

601
00:24:04,950 --> 00:24:03,200
a planetary scientist of mars experts

602
00:24:07,269 --> 00:24:04,960
and they direct that rover and

603
00:24:08,950 --> 00:24:07,279
personally having worked on curiosity

604
00:24:11,029 --> 00:24:08,960
having led the surface team

605
00:24:13,669 --> 00:24:11,039
for curiosity i think the most fantastic

606
00:24:16,070 --> 00:24:13,679
thing about these missions is that

607
00:24:17,990 --> 00:24:16,080
you land on a new mars and then almost

608
00:24:19,590 --> 00:24:18,000
every day it's another new mars all

609
00:24:21,190 --> 00:24:19,600
right every day you drive a few hundred

610
00:24:22,789 --> 00:24:21,200
meters and you look around and you see

611
00:24:25,190 --> 00:24:22,799
something fascinating

612
00:24:27,269 --> 00:24:25,200
and we actually release those photos to

613
00:24:29,190 --> 00:24:27,279

the public as soon as we get them so you

614
00:24:31,269 --> 00:24:29,200
get up in the morning and you click uh

615
00:24:32,549 --> 00:24:31,279
you know on the on the mars website on

616
00:24:33,909 --> 00:24:32,559
the perseverance website you'll see the

617
00:24:36,149 --> 00:24:33,919
pictures about the same time that the

618
00:24:37,269 --> 00:24:36,159
scientists do and it is just fascinating

619
00:24:38,870 --> 00:24:37,279
to see you know

620
00:24:39,990 --> 00:24:38,880
where are we and what's the best place

621
00:24:41,909 --> 00:24:40,000
to go

622
00:24:43,430 --> 00:24:41,919
and our scientists actually then

623
00:24:45,190 --> 00:24:43,440
interact

624
00:24:46,950 --> 00:24:45,200
with the rover engineers with the

625
00:24:48,630 --> 00:24:46,960
instrument teams and actually decide you

626
00:24:50,070 --> 00:24:48,640
know that place over there that looks

627
00:24:52,789 --> 00:24:50,080
like something i've seen on the earth

628
00:24:54,390 --> 00:24:52,799
and that that had a microbial mat or

629
00:24:56,789 --> 00:24:54,400
that's an area that that i've seen on

630
00:24:59,269 --> 00:24:56,799
the earth ancient preserved organics so

631
00:25:01,029 --> 00:24:59,279
let's go over there and let's sample it

632
00:25:03,430 --> 00:25:01,039
and we have a fantastic set of

633
00:25:05,269 --> 00:25:03,440
instrumentation we can detect organics

634
00:25:07,269 --> 00:25:05,279
uh very strongly

635
00:25:09,110 --> 00:25:07,279
with some of our instruments we can we

636
00:25:11,269 --> 00:25:09,120
can use x-rays we can use ultraviolet we

637
00:25:14,230 --> 00:25:11,279
can use a whole range of things

638
00:25:15,990 --> 00:25:14,240

besides cameras to really hone in on on

639
00:25:17,430 --> 00:25:16,000
whether these are the right sites and

640
00:25:19,909 --> 00:25:17,440
then when they are the right sites of

641
00:25:22,149 --> 00:25:19,919
course we have this fantastic coring

642
00:25:24,630 --> 00:25:22,159
machine that goes in collects a sample

643
00:25:26,390 --> 00:25:24,640
of that rock

644
00:25:27,909 --> 00:25:26,400
seals it up in a tube

645
00:25:29,830 --> 00:25:27,919
and later we're gonna go bring it back

646
00:25:31,909 --> 00:25:29,840
and that's as thomas said that's a

647
00:25:34,070 --> 00:25:31,919
that's the first step in our round trip

648
00:25:36,149 --> 00:25:34,080
for mars sample return

649
00:25:37,830 --> 00:25:36,159
so really this mission we're out there

650
00:25:39,990 --> 00:25:37,840
trying to find something we've never

651
00:25:42,549 --> 00:25:40,000
found before on another planet and then

652
00:25:44,710 --> 00:25:42,559
we're trying to capture it and isolate

653
00:25:46,070 --> 00:25:44,720
it and bring those samples back to take

654
00:25:48,630 --> 00:25:46,080
a close look at that much like you do

655
00:25:50,390 --> 00:25:48,640
with the moon rocks

656
00:25:52,870 --> 00:25:50,400
because we don't really

657
00:25:54,390 --> 00:25:52,880
land on mars that often so this is you

658
00:25:56,310 --> 00:25:54,400
we've done it eight times this is our

659
00:25:57,830 --> 00:25:56,320
ninth uh hopefully be our ninth

660
00:25:59,830 --> 00:25:57,840
successful landing

661
00:26:01,990 --> 00:25:59,840
we use these advantages on the surface

662
00:26:04,149 --> 00:26:02,000
to also test out new technologies right

663
00:26:06,630 --> 00:26:04,159

we wanna keep pushing the envelope

664
00:26:07,909 --> 00:26:06,640
forward of what we are capable of on the

665
00:26:09,510 --> 00:26:07,919
planet mars

666
00:26:11,590 --> 00:26:09,520
and so in this case we carry a couple of

667
00:26:13,990 --> 00:26:11,600
technical demonstration experiments and

668
00:26:15,590 --> 00:26:14,000
the mimi ong is going to uh tell us a

669
00:26:19,830 --> 00:26:15,600
little bit more about that so thomas let

670
00:26:24,070 --> 00:26:21,830
yeah mike and thanks for that i mean you

671
00:26:26,390 --> 00:26:24,080
really highlight the complexity but not

672
00:26:27,669 --> 00:26:26,400
but also the team effort from start to

673
00:26:30,230 --> 00:26:27,679
finish not just

674
00:26:31,669 --> 00:26:30,240
now but once we land on the planet it's

675
00:26:33,110 --> 00:26:31,679
it's really great to hear how the public

676
00:26:35,190 --> 00:26:33,120
can follow along through that whole

677
00:26:37,350 --> 00:26:35,200
process so that's that's amazing

678
00:26:39,190 --> 00:26:37,360
so yeah let's let's hear from uh miss

679
00:26:41,510 --> 00:26:39,200
hong who is leading the effort with the

680
00:26:43,029 --> 00:26:41,520
bars ingenuity helicopter mimi over to

681
00:26:49,830 --> 00:26:43,039
you

682
00:26:52,310 --> 00:26:49,840
exciting to be here

683
00:26:54,470 --> 00:26:52,320
and as mike mentioned uh there are three

684
00:26:57,590 --> 00:26:54,480
technologies being demonstrated on mars

685
00:27:00,070 --> 00:26:57,600
2020. the terrain relative navigation

686
00:27:02,470 --> 00:27:00,080
for safer landing and has lower mars

687
00:27:04,950 --> 00:27:02,480
from spacecraft in orbit and rovers

688
00:27:07,190 --> 00:27:04,960

rubbing on the surface in the future

689
00:27:08,950 --> 00:27:07,200
there'll be astronauts on the surface

690
00:27:11,909 --> 00:27:08,960
and the helicopter

691
00:27:14,390 --> 00:27:11,919
can serve as scout for

692
00:27:17,669 --> 00:27:14,400
rovers and astronauts

693
00:27:20,230 --> 00:27:17,679
helicopter can also allow us to reach

694
00:27:23,909 --> 00:27:20,240
places that are simply not accessible

695
00:27:26,789 --> 00:27:23,919
today uh without being able to fly

696
00:27:29,990 --> 00:27:26,799
so uh yet a tech demo on mars

697
00:27:32,070 --> 00:27:30,000
helicopters never done before why

698
00:27:35,909 --> 00:27:32,080
it's not easy to build a rotorcraft to

699
00:27:38,230 --> 00:27:35,919
fly at mars so the atmosphere is really

700
00:27:39,750 --> 00:27:38,240
thin i mean compared to earth's it's

701
00:27:43,510 --> 00:27:39,760
about one percent

702
00:27:45,029 --> 00:27:43,520
so a vehicle to fly in mars has to be uh

703
00:27:47,830 --> 00:27:45,039
really light

704
00:27:51,029 --> 00:27:47,840
and it has to you know spin really fast

705
00:27:53,909 --> 00:27:51,039
so for this technology demonstration on

706
00:27:56,789 --> 00:27:53,919
the mars 2020 opportunity the helicopter

707
00:27:59,590 --> 00:27:56,799
we've built is named ingenuity

708
00:28:02,870 --> 00:27:59,600
and ingenuity has a rotor system that's

709
00:28:06,630 --> 00:28:02,880
1.2 meter in diameter and the entire

710
00:28:08,710 --> 00:28:06,640
vehicle has to weigh under two kilograms

711
00:28:10,710 --> 00:28:08,720
that's about four pounds

712
00:28:13,590 --> 00:28:10,720
so to build this vehicle

713
00:28:16,149 --> 00:28:13,600

that weighs about four pounds

714
00:28:18,630 --> 00:28:16,159
have while having the capability to fly

715
00:28:21,669 --> 00:28:18,640
and land autonomously and to survive and

716
00:28:23,990 --> 00:28:21,679
operate autonomously at mars right

717
00:28:26,389 --> 00:28:24,000
remotely operated from earth

718
00:28:28,789 --> 00:28:26,399
that's a huge challenge it's a tiny

719
00:28:30,789 --> 00:28:28,799
package with tons of

720
00:28:32,789 --> 00:28:30,799
capability packed

721
00:28:35,830 --> 00:28:32,799
so to build this

722
00:28:38,310 --> 00:28:35,840
there is a significant team uh behind

723
00:28:40,070 --> 00:28:38,320
this team and i wish really our team i'm

724
00:28:41,830 --> 00:28:40,080
here to represent our team i wish

725
00:28:44,389 --> 00:28:41,840
everybody on our team could be here to

726
00:28:46,470 --> 00:28:44,399
share the stories we really have so many

727
00:28:48,149 --> 00:28:46,480
uh everyone from different disciplines

728
00:28:50,789 --> 00:28:48,159
involving from the fundamental

729
00:28:54,630 --> 00:28:50,799
mathematical equations to mechanical

730
00:28:57,590 --> 00:28:54,640
electrical software um you know thermal

731
00:29:00,149 --> 00:28:57,600
avionics materials and processes and

732
00:29:02,870 --> 00:29:00,159
even the special test equipment and

733
00:29:05,669 --> 00:29:02,880
facilities that it takes to build and

734
00:29:07,830 --> 00:29:05,679
test something for the very first time

735
00:29:10,149 --> 00:29:07,840
so it everybody in each of our

736
00:29:12,310 --> 00:29:10,159
discipline really had to reach out out

737
00:29:14,950 --> 00:29:12,320
of the box excel in our own discipline

738
00:29:17,510 --> 00:29:14,960

and really work truly as a team

739
00:29:21,190 --> 00:29:17,520
all to pack all of this into this 1.8

740
00:29:23,510 --> 00:29:21,200
kilogram uh four pound uh limit

741
00:29:25,430 --> 00:29:23,520
and the day our vehicle weighed in it

742
00:29:27,590 --> 00:29:25,440
weighed in a hair under 1.8 kilogram

743
00:29:30,070 --> 00:29:27,600
that was a huge day for us

744
00:29:32,789 --> 00:29:30,080
so since then we've performed the

745
00:29:35,669 --> 00:29:32,799
helicopter test flights in a simulated

746
00:29:37,750 --> 00:29:35,679
mars atmosphere uh in the 25-foot

747
00:29:38,950 --> 00:29:37,760
diameter space simulator chamber here at

748
00:29:41,669 --> 00:29:38,960
jpl

749
00:29:43,110 --> 00:29:41,679
with perform test flights and compare

750
00:29:45,190 --> 00:29:43,120
the flight performance to the

751
00:29:47,669 --> 00:29:45,200
mathematical models that we started the

752
00:29:50,070 --> 00:29:47,679
design with originally we've tested the

753
00:29:52,710 --> 00:29:50,080
vehicle and simulated a thermal

754
00:29:55,350 --> 00:29:52,720
environment dynamics environment

755
00:29:56,310 --> 00:29:55,360
we have tested it uh with perseverance

756
00:29:58,549 --> 00:29:56,320
rover

757
00:30:01,350 --> 00:29:58,559
and very importantly perseverance has

758
00:30:03,990 --> 00:30:01,360
tested deploying us from the belly pin

759
00:30:06,870 --> 00:30:04,000
of the perseverance rover successfully

760
00:30:08,710 --> 00:30:06,880
to the surface so at this point

761
00:30:12,070 --> 00:30:08,720
we've performed all the tests that we

762
00:30:14,549 --> 00:30:12,080
can on earth and the next step really is

763
00:30:16,630 --> 00:30:14,559

now to do it in the real environment

764
00:30:19,669 --> 00:30:16,640
this mars helicopter ingenuity is

765
00:30:21,590 --> 00:30:19,679
designed for in space vacuum

766
00:30:24,549 --> 00:30:21,600
as soon as after launch

767
00:30:26,789 --> 00:30:24,559
and finally on the surface of mars so at

768
00:30:28,149 --> 00:30:26,799
this very moment ingenuity is

769
00:30:30,310 --> 00:30:28,159
accommodated

770
00:30:32,389 --> 00:30:30,320
on perseverance rover

771
00:30:34,870 --> 00:30:32,399
waiting for the upcoming launch and

772
00:30:37,269 --> 00:30:34,880
after perseverance rover lands on the

773
00:30:39,190 --> 00:30:37,279
surface and has done the rover checkout

774
00:30:42,070 --> 00:30:39,200
the rover will deploy the helicopter to

775
00:30:44,470 --> 00:30:42,080
the surface of mars and from then

776
00:30:46,070 --> 00:30:44,480
we have a 30 martian day window to do

777
00:30:48,630 --> 00:30:46,080
our flight experiments

778
00:30:50,870 --> 00:30:48,640
so we have up to five flight plans to be

779
00:30:52,710 --> 00:30:50,880
performed in that time period

780
00:30:55,510 --> 00:30:52,720
and the first and foremost the most

781
00:30:58,310 --> 00:30:55,520
important flight for us for our team is

782
00:31:00,789 --> 00:30:58,320
the very first flight where we'll repeat

783
00:31:03,190 --> 00:31:00,799
the flight that we have tested multiple

784
00:31:06,070 --> 00:31:03,200
times in our test chamber here on earth

785
00:31:08,630 --> 00:31:06,080
so doing that in situ at earth on earth

786
00:31:10,549 --> 00:31:08,640
and the in situ at mars really in the

787
00:31:12,630 --> 00:31:10,559
mars environment will confirm the

788
00:31:14,230 --> 00:31:12,640

algorithms the tests that we performed

789
00:31:16,230 --> 00:31:14,240
on earth

790
00:31:19,350 --> 00:31:16,240
so and then after getting that first

791
00:31:21,909 --> 00:31:19,360
flight then we will be performing uh

792
00:31:24,149 --> 00:31:21,919
more bolder and bolder flights of higher

793
00:31:27,110 --> 00:31:24,159
heights and further distances

794
00:31:29,350 --> 00:31:27,120
so here we are exciting days ahead

795
00:31:32,470 --> 00:31:29,360
helicopter is about to be launched

796
00:31:36,310 --> 00:31:32,480
our team is thrilled it's truly the

797
00:31:39,190 --> 00:31:36,320
highest high reward phase of our project

798
00:31:40,870 --> 00:31:39,200
high risk because every step forward

799
00:31:43,190 --> 00:31:40,880
starting from launch

800
00:31:46,070 --> 00:31:43,200
every event that we have will be a first

801
00:31:48,230 --> 00:31:46,080
time event right first in faith vacuum

802
00:31:51,830 --> 00:31:48,240
and then in the environment of mars but

803
00:31:54,149 --> 00:31:51,840
more importantly high reward because uh

804
00:31:56,950 --> 00:31:54,159
you know our algorithms and the tests

805
00:32:00,149 --> 00:31:56,960
that we have done on earth and really

806
00:32:01,269 --> 00:32:00,159
then uh you know operating in situ and

807
00:32:04,950 --> 00:32:01,279
learning

808
00:32:07,669 --> 00:32:04,960
from how to operate the very first

809
00:32:11,269 --> 00:32:07,679
rotograph vehicle in space from earth

810
00:32:15,509 --> 00:32:11,279
all of that experiences will be feeding

811
00:32:18,310 --> 00:32:15,519
into future much more capable rotograph

812
00:32:20,310 --> 00:32:18,320
uh that we envision you know and really

813
00:32:23,509 --> 00:32:20,320

add that aerial dimension to space

814
00:32:26,230 --> 00:32:23,519
exploration and for our team that is the

815
00:32:28,710 --> 00:32:26,240
ultimate reward uh that we've worked

816
00:32:31,350 --> 00:32:28,720
really really really hard for

817
00:32:33,509 --> 00:32:31,360
so along that lines uh while i have the

818
00:32:35,190 --> 00:32:33,519
opportunity to be in the same virtual

819
00:32:36,549 --> 00:32:35,200
room with you

820
00:32:39,190 --> 00:32:36,559
with you jim

821
00:32:41,350 --> 00:32:39,200
thomas mike i really want to take this

822
00:32:42,950 --> 00:32:41,360
opportunity on the behalf of our team

823
00:32:44,710 --> 00:32:42,960
for having been there for your

824
00:32:45,669 --> 00:32:44,720
unwavering support through these past

825
00:32:47,990 --> 00:32:45,679
years

826
00:32:49,990 --> 00:32:48,000
on taking on this endeavor uh it's been

827
00:32:51,750 --> 00:32:50,000
really important you know for us to have

828
00:32:54,070 --> 00:32:51,760
the unwavering support as we took on

829
00:32:57,029 --> 00:32:54,080
this really high challenge

830
00:33:00,070 --> 00:32:57,039
and so finally also if i may on a

831
00:33:02,149 --> 00:33:00,080
personal note uh i came to nasa inspired

832
00:33:05,029 --> 00:33:02,159
to for the opportunity to contribute to

833
00:33:06,789 --> 00:33:05,039
space exploration and along the way i

834
00:33:10,070 --> 00:33:06,799
also fell in love with

835
00:33:12,549 --> 00:33:10,080
making first of a kind capabilities work

836
00:33:15,509 --> 00:33:12,559
for increasingly autonomous advanced

837
00:33:17,750 --> 00:33:15,519
space systems and here today is an

838
00:33:20,070 --> 00:33:17,760

example of that dream come true

839
00:33:21,029 --> 00:33:20,080
here we are on a historical

840
00:33:22,389 --> 00:33:21,039
mission

841
00:33:24,950 --> 00:33:22,399
perseverance

842
00:33:28,470 --> 00:33:24,960
working on a tech demo mars helicopter

843
00:33:30,870 --> 00:33:28,480
engineering thank you so much

844
00:33:32,710 --> 00:33:30,880
mimi thank you and and i can sense your

845
00:33:34,310 --> 00:33:32,720
enthusiasm which you you show for the

846
00:33:36,950 --> 00:33:34,320
whole team with this tech demo that's

847
00:33:39,669 --> 00:33:36,960
amazing and i i think we're all excited

848
00:33:41,750 --> 00:33:39,679
uh to help or to watch and see ingenuity

849
00:33:42,630 --> 00:33:41,760
take flight so thank you very much thank

850
00:33:44,549 --> 00:33:42,640
you

851
00:33:46,389 --> 00:33:44,559
jim such a tremendous team i mean a team

852
00:33:48,470 --> 00:33:46,399
of experts and and certainly plenty of

853
00:33:50,149 --> 00:33:48,480
accomplishments along the way would you

854
00:33:51,669 --> 00:33:50,159
like to share some thoughts with uh with

855
00:33:54,230 --> 00:33:51,679
our viewers

856
00:33:57,110 --> 00:33:54,240
absolutely and and mimi uh

857
00:33:58,230 --> 00:33:57,120
your enthusiasm is palpable and i just

858
00:34:00,070 --> 00:33:58,240
want to say

859
00:34:01,350 --> 00:34:00,080
uh to all the young people that might be

860
00:34:05,509 --> 00:34:01,360
watching today

861
00:34:09,190 --> 00:34:05,519
mimi is a shining example of the hope um

862
00:34:11,109 --> 00:34:09,200
that that nasa brings to the world

863
00:34:12,629 --> 00:34:11,119

think of a young girl who was growing up

864
00:34:14,389 --> 00:34:12,639
in myanmar

865
00:34:17,030 --> 00:34:14,399
during some really difficult times who

866
00:34:19,669 --> 00:34:17,040
had a dream of one day coming to the

867
00:34:23,030 --> 00:34:19,679
united states and working for nasa that

868
00:34:25,030 --> 00:34:23,040
is who mimi ung is and now she is she is

869
00:34:28,069 --> 00:34:25,040
leading a team that will for the first

870
00:34:31,030 --> 00:34:28,079
time in humanity fly a helicopter on

871
00:34:33,829 --> 00:34:31,040
another world so i just want to say um

872
00:34:36,550 --> 00:34:33,839
this is this is a great it's a it really

873
00:34:39,349 --> 00:34:36,560
is it's it's your story mimi is a story

874
00:34:41,589 --> 00:34:39,359
of perseverance and this mission that is

875
00:34:42,950 --> 00:34:41,599
perseverance with ingenuity as the

876
00:34:43,829 --> 00:34:42,960
helicopter is

877
00:34:45,909 --> 00:34:43,839
um

878
00:34:47,909 --> 00:34:45,919
this is emblematic of

879
00:34:50,069 --> 00:34:47,919
greatness that comes from these kind of

880
00:34:51,430 --> 00:34:50,079
exploration initiatives

881
00:34:53,510 --> 00:34:51,440
a couple of things that i want to

882
00:34:55,510 --> 00:34:53,520
highlight of course everybody has said

883
00:34:57,430 --> 00:34:55,520
so much already

884
00:34:58,390 --> 00:34:57,440
but i want you to think about for a

885
00:35:00,950 --> 00:34:58,400
second

886
00:35:03,109 --> 00:35:00,960
what we learned from two little rovers

887
00:35:05,190 --> 00:35:03,119
spirit and opportunity

888
00:35:05,990 --> 00:35:05,200

we learned from these two rovers years

889
00:35:08,150 --> 00:35:06,000
ago

890
00:35:10,950 --> 00:35:08,160
that the northern hemisphere of mars was

891
00:35:13,109 --> 00:35:10,960
largely covered with water two-thirds of

892
00:35:15,910 --> 00:35:13,119
the northern hemisphere of mars was

893
00:35:17,829 --> 00:35:15,920
covered with water we learned that that

894
00:35:19,030 --> 00:35:17,839
mars at one time had a very thick

895
00:35:21,589 --> 00:35:19,040
atmosphere

896
00:35:23,670 --> 00:35:21,599
and so it likely also had a

897
00:35:25,670 --> 00:35:23,680
magnetosphere that protected it from the

898
00:35:28,550 --> 00:35:25,680
radiation of deep space

899
00:35:30,710 --> 00:35:28,560
in other words mars was at one time

900
00:35:33,190 --> 00:35:30,720
habitable i'm not saying it was

901
00:35:35,349 --> 00:35:33,200
inhabited nobody knows i don't know

902
00:35:36,310 --> 00:35:35,359
neither does anybody else but at one

903
00:35:38,550 --> 00:35:36,320
time

904
00:35:41,670 --> 00:35:38,560
it had the ingredients necessary for

905
00:35:43,270 --> 00:35:41,680
having life even on its surface

906
00:35:45,990 --> 00:35:43,280
and now we think about what we have

907
00:35:48,630 --> 00:35:46,000
learned because of curiosity and some of

908
00:35:51,589 --> 00:35:48,640
our international partners we've learned

909
00:35:54,230 --> 00:35:51,599
that that mars has complex organic

910
00:35:57,190 --> 00:35:54,240
compounds on its surface all over the

911
00:36:00,230 --> 00:35:57,200
surface so the building blocks of life

912
00:36:02,550 --> 00:36:00,240
actually exist on the surface of mars

913
00:36:04,470 --> 00:36:02,560

they don't exist on the moon at all but

914
00:36:06,470 --> 00:36:04,480
they're all over the surface

915
00:36:09,190 --> 00:36:06,480
we have learned that the methane cycles

916
00:36:11,829 --> 00:36:09,200
of mars actually match the seasons of

917
00:36:14,710 --> 00:36:11,839
mars so the probability of finding life

918
00:36:17,109 --> 00:36:14,720
on another world just went up again

919
00:36:19,910 --> 00:36:17,119
and we have now discovered that

920
00:36:23,270 --> 00:36:19,920
what we believe to be liquid water

921
00:36:25,190 --> 00:36:23,280
12 kilometers under the surface of mars

922
00:36:28,230 --> 00:36:25,200
what do we know about liquid water on

923
00:36:31,270 --> 00:36:28,240
earth wherever it is there is life

924
00:36:33,750 --> 00:36:31,280
is that true maybe on another planet

925
00:36:36,710 --> 00:36:33,760
we don't know but but we need to go find

926
00:36:39,349 --> 00:36:36,720
out and recently we have seen plumes of

927
00:36:42,069 --> 00:36:39,359
methane coming from mars that increase

928
00:36:45,750 --> 00:36:42,079
the probability of finding life even

929
00:36:48,230 --> 00:36:45,760
more these are very very exciting times

930
00:36:50,950 --> 00:36:48,240
for a mission like perseverance and like

931
00:36:53,670 --> 00:36:50,960
ingenuity to help us make even more

932
00:36:55,510 --> 00:36:53,680
discoveries in this effort

933
00:36:57,829 --> 00:36:55,520
and when we think about the jezreel

934
00:36:59,190 --> 00:36:57,839
crater which mike talked about just a

935
00:37:01,750 --> 00:36:59,200
few minutes ago

936
00:37:04,230 --> 00:37:01,760
yes we believe at one time the the

937
00:37:05,990 --> 00:37:04,240
jezreel crater was a lake bed

938
00:37:07,510 --> 00:37:06,000

but if you look at where we're going on

939
00:37:10,069 --> 00:37:07,520
the jezreel crater we're not just

940
00:37:13,510 --> 00:37:10,079
looking for a dry lake bed we're looking

941
00:37:15,829 --> 00:37:13,520
at at what filled that lake bed and what

942
00:37:18,790 --> 00:37:15,839
we have is we have a river that at one

943
00:37:21,030 --> 00:37:18,800
time flowed into the jezreel crater and

944
00:37:22,470 --> 00:37:21,040
a river delta that

945
00:37:24,630 --> 00:37:22,480
where there could be

946
00:37:28,310 --> 00:37:24,640
again i'm not saying there is but there

947
00:37:30,150 --> 00:37:28,320
could be um signatures of of biology

948
00:37:31,670 --> 00:37:30,160
from an ancient past

949
00:37:34,230 --> 00:37:31,680
these are the things that we need to

950
00:37:36,550 --> 00:37:34,240
look for um and if we look at like if we

951
00:37:38,390 --> 00:37:36,560
look at the rocks the the mississippi

952
00:37:41,190 --> 00:37:38,400
river delta for example we look at the

953
00:37:43,670 --> 00:37:41,200
rocks and the sediments we can find bio

954
00:37:45,589 --> 00:37:43,680
signatures of ancient life and can we

955
00:37:48,630 --> 00:37:45,599
take that what we understand from our

956
00:37:49,670 --> 00:37:48,640
own planet and learn from from mars and

957
00:37:54,069 --> 00:37:49,680
make

958
00:37:57,030 --> 00:37:54,079
there was or was not life there

959
00:37:58,950 --> 00:37:57,040
um but but i think more importantly is

960
00:38:01,109 --> 00:37:58,960
we're gonna cash samples we're gonna go

961
00:38:04,470 --> 00:38:01,119
to those places where we believe have

962
00:38:06,550 --> 00:38:04,480
the the highest scientific value we're

963
00:38:09,670 --> 00:38:06,560

actually going to cash samples

964
00:38:11,750 --> 00:38:09,680
for a mars return mission that we're

965
00:38:14,630 --> 00:38:11,760
going to do in 2026

966
00:38:16,069 --> 00:38:14,640
where scientists american scientists and

967
00:38:17,190 --> 00:38:16,079
scientists from around the world are

968
00:38:19,829 --> 00:38:17,200
going to be able to look at those

969
00:38:21,829 --> 00:38:19,839
samples and make very specific

970
00:38:23,030 --> 00:38:21,839
determinations about the history and the

971
00:38:23,750 --> 00:38:23,040
formation

972
00:38:28,470 --> 00:38:23,760
and

973
00:38:30,630 --> 00:38:28,480
again determine whether or not we

974
00:38:33,670 --> 00:38:30,640
believe there could have at one time

975
00:38:36,870 --> 00:38:33,680
been life on mars so these are such

976
00:38:39,190 --> 00:38:36,880
exciting times but i also want to say

977
00:38:40,390 --> 00:38:39,200
that all of these robotic precursor

978
00:38:42,230 --> 00:38:40,400
missions

979
00:38:45,030 --> 00:38:42,240
are leading up to something that i think

980
00:38:47,829 --> 00:38:45,040
is even more magnificent and that is to

981
00:38:50,230 --> 00:38:47,839
a day when we plant an american flag on

982
00:38:52,950 --> 00:38:50,240
mars this is in the president's space

983
00:38:55,349 --> 00:38:52,960
policy directive one he wants us to lead

984
00:38:57,670 --> 00:38:55,359
an effort to go to mars and he wants us

985
00:38:59,670 --> 00:38:57,680
to lead a coalition of international

986
00:39:01,910 --> 00:38:59,680
partners and he wants us to go with

987
00:39:04,390 --> 00:39:01,920
commercial partners he wants us to go to

988
00:39:05,910 --> 00:39:04,400

mars in a way that that we've never done

989
00:39:07,510 --> 00:39:05,920
well obviously nobody's ever gone to

990
00:39:09,510 --> 00:39:07,520
mars certainly we've gone to the moon

991
00:39:11,910 --> 00:39:09,520
but when we think about the moon to mars

992
00:39:13,270 --> 00:39:11,920
program that nasa has initiated we're

993
00:39:15,030 --> 00:39:13,280
going to the moon in a way that we've

994
00:39:17,109 --> 00:39:15,040
never done before with commercial and

995
00:39:19,109 --> 00:39:17,119
international partners and we're doing

996
00:39:21,030 --> 00:39:19,119
it with a purpose how do we live and

997
00:39:23,670 --> 00:39:21,040
work on another world for long periods

998
00:39:26,310 --> 00:39:23,680
of time so that we can go to mars where

999
00:39:28,550 --> 00:39:26,320
we will absolutely have to live for long

1000
00:39:30,950 --> 00:39:28,560
periods of time in order to do what we

1001
00:39:33,349 --> 00:39:30,960
need to do on the on the surface of mars

1002
00:39:36,150 --> 00:39:33,359
the moon is the proving ground mars is

1003
00:39:39,510 --> 00:39:36,160
the destination so with the moon program

1004
00:39:41,510 --> 00:39:39,520
to mars and the robotic precursors all

1005
00:39:44,550 --> 00:39:41,520
of this is leading to a day

1006
00:39:46,310 --> 00:39:44,560
when when we have humans living and

1007
00:39:48,390 --> 00:39:46,320
working not just on the moon but on

1008
00:39:50,870 --> 00:39:48,400
another planet in this case

1009
00:39:53,190 --> 00:39:50,880
mars so the future is very bright

1010
00:39:55,430 --> 00:39:53,200
there's lots of opportunities

1011
00:39:58,069 --> 00:39:55,440
nasa's budget is as high now as it's

1012
00:40:00,069 --> 00:39:58,079
ever been in history in nominal dollars

1013
00:40:02,310 --> 00:40:00,079

the budget request now before the house

1014
00:40:04,550 --> 00:40:02,320
and the senate that takes it up even

1015
00:40:07,109 --> 00:40:04,560
even more so than it is right now but

1016
00:40:10,150 --> 00:40:07,119
it's intentional we are building what is

1017
00:40:12,150 --> 00:40:10,160
necessary to make more discoveries learn

1018
00:40:14,550 --> 00:40:12,160
more about our own solar system learn

1019
00:40:17,270 --> 00:40:14,560
more about our own galaxy and universe

1020
00:40:19,750 --> 00:40:17,280
than we've ever been able to know before

1021
00:40:23,109 --> 00:40:19,760
so this is just a really really exciting

1022
00:40:25,910 --> 00:40:23,119
time to be at the helm of this storied

1023
00:40:28,309 --> 00:40:25,920
agency that is making history every day

1024
00:40:30,630 --> 00:40:28,319
and this mission is yet another example

1025
00:40:32,069 --> 00:40:30,640
of that history in the making so thomas

1026
00:40:34,790 --> 00:40:32,079
i'll turn it back over to you but i'm

1027
00:40:36,790 --> 00:40:34,800
certainly here for questions

1028
00:40:38,710 --> 00:40:36,800
and thank you and and thank you thank

1029
00:40:41,030 --> 00:40:38,720
you all for those initial comments so

1030
00:40:43,270 --> 00:40:41,040
yeah let's move into some questions and

1031
00:40:45,349 --> 00:40:43,280
and some discussion and i'll we're

1032
00:40:46,790 --> 00:40:45,359
getting some good feedback in from our

1033
00:40:49,190 --> 00:40:46,800
audience so i'd like to try to get us

1034
00:40:50,710 --> 00:40:49,200
through as many as i can so jim i want

1035
00:40:52,470 --> 00:40:50,720
to kind of start with

1036
00:40:53,990 --> 00:40:52,480
kind of where you left this i mean it is

1037
00:40:56,550 --> 00:40:54,000
this idea about

1038
00:40:58,470 --> 00:40:56,560

both nasa what it's done historically

1039
00:41:01,190 --> 00:40:58,480
through jpl

1040
00:41:03,510 --> 00:41:01,200
nasa and its partners

1041
00:41:05,829 --> 00:41:03,520
these inspirational endeavors so in

1042
00:41:07,670 --> 00:41:05,839
these times why is it important to

1043
00:41:08,950 --> 00:41:07,680
continue these exploration missions i

1044
00:41:11,109 --> 00:41:08,960
mean you highlighted on some of the

1045
00:41:12,710 --> 00:41:11,119
specifics of this mission but how how

1046
00:41:13,829 --> 00:41:12,720
will this inspire a nation and more

1047
00:41:15,670 --> 00:41:13,839
importantly

1048
00:41:18,069 --> 00:41:15,680
how will it enable the next generation

1049
00:41:19,910 --> 00:41:18,079
of mars exploration

1050
00:41:21,510 --> 00:41:19,920
yeah i know it's important you know

1051
00:41:23,990 --> 00:41:21,520
there was a seventh grader and you guys

1052
00:41:26,230 --> 00:41:24,000
had him in the video at the beginning

1053
00:41:28,390 --> 00:41:26,240
alex mather who's the one who named the

1054
00:41:30,790 --> 00:41:28,400
perseverance rover

1055
00:41:32,550 --> 00:41:30,800
and i think it was it was a perfect name

1056
00:41:34,790 --> 00:41:32,560
at the time and of course it's more

1057
00:41:36,790 --> 00:41:34,800
important today than it even was

1058
00:41:38,630 --> 00:41:36,800
when when thomas zurbukin came to me and

1059
00:41:41,109 --> 00:41:38,640
said hey here's here's what we want to

1060
00:41:43,030 --> 00:41:41,119
do we want to name it perseverance we've

1061
00:41:45,270 --> 00:41:43,040
got the seventh grader's name is alex

1062
00:41:47,190 --> 00:41:45,280
mather and he wants to name it this and

1063
00:41:48,950 --> 00:41:47,200

we think it's the right it's the right

1064
00:41:51,109 --> 00:41:48,960
name and of course at the time i said

1065
00:41:52,470 --> 00:41:51,119
sounds great to me let's do it and that

1066
00:41:54,950 --> 00:41:52,480
was before

1067
00:41:57,030 --> 00:41:54,960
before the coronavirus pandemic broke

1068
00:41:58,550 --> 00:41:57,040
out which of course has

1069
00:42:00,069 --> 00:41:58,560
wreaked a lot of havoc and of course

1070
00:42:02,870 --> 00:42:00,079
it's made everything challenging for

1071
00:42:05,670 --> 00:42:02,880
everybody but again the perseverance

1072
00:42:07,750 --> 00:42:05,680
mission is about persevering um and when

1073
00:42:09,990 --> 00:42:07,760
we think about you know we think about a

1074
00:42:11,750 --> 00:42:10,000
seventh grader that named it we think

1075
00:42:13,270 --> 00:42:11,760
about probably a fifth grade or a fourth

1076
00:42:15,910 --> 00:42:13,280
grader who are the people that are going

1077
00:42:18,069 --> 00:42:15,920
to be inspired by these monumental

1078
00:42:20,150 --> 00:42:18,079
achievements and and what is it that

1079
00:42:21,510 --> 00:42:20,160
they're going to do and become

1080
00:42:24,790 --> 00:42:21,520
like how are they going to live their

1081
00:42:26,470 --> 00:42:24,800
lives this is about inspiration um

1082
00:42:28,950 --> 00:42:26,480
and it's about bringing the nations of

1083
00:42:30,950 --> 00:42:28,960
the world together in a very meaningful

1084
00:42:32,710 --> 00:42:30,960
way at a time when you know there's a

1085
00:42:34,470 --> 00:42:32,720
lot of there's a there's a lot of

1086
00:42:35,270 --> 00:42:34,480
geopolitical challenges in the world and

1087
00:42:37,430 --> 00:42:35,280
yet

1088
00:42:39,910 --> 00:42:37,440

space exploration brings people together

1089
00:42:41,750 --> 00:42:39,920
in a way that i think is inspirational

1090
00:42:43,750 --> 00:42:41,760
in and of itself

1091
00:42:45,910 --> 00:42:43,760
and i would also say that you know there

1092
00:42:48,630 --> 00:42:45,920
are some very specific

1093
00:42:50,550 --> 00:42:48,640
challenges when it comes to mars where

1094
00:42:53,510 --> 00:42:50,560
we have a we have a short window of

1095
00:42:55,510 --> 00:42:53,520
opportunity every 26 months

1096
00:42:58,390 --> 00:42:55,520
to launch something to mars and and if

1097
00:42:59,270 --> 00:42:58,400
we didn't move forward with perseverance

1098
00:43:01,349 --> 00:42:59,280
um

1099
00:43:03,750 --> 00:43:01,359
you know our perseverance rover would go

1100
00:43:05,750 --> 00:43:03,760
into storage for the next two years and

1101
00:43:07,589 --> 00:43:05,760
of course that entails a whole host of

1102
00:43:09,829 --> 00:43:07,599
risks in itself

1103
00:43:11,829 --> 00:43:09,839
and of course it costs you know half a

1104
00:43:13,190 --> 00:43:11,839
billion dollars so there's a lot of

1105
00:43:15,270 --> 00:43:13,200
reasons to move forward with this

1106
00:43:17,589 --> 00:43:15,280
mission i will tell you when i look at

1107
00:43:19,990 --> 00:43:17,599
what mike watkins and his team at jpl

1108
00:43:22,230 --> 00:43:20,000
have done when i look at what tory bruno

1109
00:43:24,870 --> 00:43:22,240
and his team at united launch alliance

1110
00:43:27,829 --> 00:43:24,880
what they have done thomas zurbukin and

1111
00:43:30,550 --> 00:43:27,839
his team at nasa um

1112
00:43:32,630 --> 00:43:30,560
we have done everything in our power

1113
00:43:35,030 --> 00:43:32,640

to make working

1114
00:43:37,589 --> 00:43:35,040
as safe as you would be if you were at

1115
00:43:39,670 --> 00:43:37,599
home whether it's you know dividing up

1116
00:43:42,390 --> 00:43:39,680
the shifts whether it's

1117
00:43:44,069 --> 00:43:42,400
the personal protective equipment

1118
00:43:46,390 --> 00:43:44,079
you know all of these things social

1119
00:43:48,390 --> 00:43:46,400
distancing that we have to do

1120
00:43:50,150 --> 00:43:48,400
in order to keep this mission on track

1121
00:43:52,150 --> 00:43:50,160
we have done and we've done it with

1122
00:43:54,309 --> 00:43:52,160
great success so i just want to say

1123
00:43:56,390 --> 00:43:54,319
thank you to the team that has enabled

1124
00:43:58,710 --> 00:43:56,400
it to happen but i do believe without

1125
00:44:01,430 --> 00:43:58,720
question uh we do need to persevere in

1126
00:44:02,309 --> 00:44:01,440
these challenging times

1127
00:44:04,309 --> 00:44:02,319
thank you

1128
00:44:06,790 --> 00:44:04,319
it's funny i mean in light of everything

1129
00:44:09,270 --> 00:44:06,800
going on such an appropriate name

1130
00:44:11,109 --> 00:44:09,280
perseverance and and really

1131
00:44:13,270 --> 00:44:11,119
and and for those that have not had a

1132
00:44:15,750 --> 00:44:13,280
chance to see alex mather's essay i mean

1133
00:44:17,750 --> 00:44:15,760
it's just from a young man that's a you

1134
00:44:18,950 --> 00:44:17,760
know young teacher leader that's that's

1135
00:44:21,190 --> 00:44:18,960
an amazing

1136
00:44:22,950 --> 00:44:21,200
amazing name um

1137
00:44:24,470 --> 00:44:22,960
thomas this is mike watkins i wanted to

1138
00:44:25,750 --> 00:44:24,480

just add one thing in terms of

1139
00:44:28,630 --> 00:44:25,760
inspiration

1140
00:44:30,470 --> 00:44:28,640
um you know every after we land that's

1141
00:44:31,910 --> 00:44:30,480
the beginning of the mission

1142
00:44:34,069 --> 00:44:31,920
we all celebrate that we landed but

1143
00:44:36,230 --> 00:44:34,079
really that's the beginning of this

1144
00:44:38,550 --> 00:44:36,240
journey of discovery on mars and we

1145
00:44:41,030 --> 00:44:38,560
share that with the public every day so

1146
00:44:43,270 --> 00:44:41,040
everybody can go in there

1147
00:44:44,470 --> 00:44:43,280
every school kid you know every person

1148
00:44:46,150 --> 00:44:44,480
can go and take a look at what's

1149
00:44:47,750 --> 00:44:46,160
happening today with the rover what new

1150
00:44:50,550 --> 00:44:47,760
discovery was made today and there are

1151
00:44:52,309 --> 00:44:50,560
discoveries coming constantly and to me

1152
00:44:53,990 --> 00:44:52,319
that's a fantastic way for folks to

1153
00:44:56,150 --> 00:44:54,000
follow along and really get pulled into

1154
00:44:58,470 --> 00:44:56,160
the space program and get pulled into

1155
00:44:59,670 --> 00:44:58,480
you know sometimes we anthropomorphize

1156
00:45:01,829 --> 00:44:59,680
our rovers

1157
00:45:03,990 --> 00:45:01,839
but there's also a fantastic human team

1158
00:45:05,589 --> 00:45:04,000
working those and i think really that's

1159
00:45:08,630 --> 00:45:05,599
something that uh that folks can just

1160
00:45:10,309 --> 00:45:08,640
live along with the mission it's unusual

1161
00:45:11,990 --> 00:45:10,319
yeah mike that's it and that's a great

1162
00:45:13,430 --> 00:45:12,000
yeah i think we see it today we've got

1163
00:45:15,109 --> 00:45:13,440

such a large audience i think we've got

1164
00:45:16,950 --> 00:45:15,119
2 000 people right now following on

1165
00:45:19,109 --> 00:45:16,960
twitter and nasa tv and a variety of

1166
00:45:21,670 --> 00:45:19,119
things so people are certainly following

1167
00:45:22,870 --> 00:45:21,680
along and i'm sure they will let me

1168
00:45:25,430 --> 00:45:22,880
uh

1169
00:45:27,109 --> 00:45:25,440
similar question on on kind of why now

1170
00:45:29,270 --> 00:45:27,119
but a little different angle this this

1171
00:45:31,270 --> 00:45:29,280
question actually um comes from our

1172
00:45:33,990 --> 00:45:31,280
co-sponsor uh

1173
00:45:36,069 --> 00:45:34,000
who who is sponsoring our series um the

1174
00:45:38,790 --> 00:45:36,079
question is is with curiosity and

1175
00:45:40,870 --> 00:45:38,800
insight still active on mars why send

1176
00:45:43,109 --> 00:45:40,880
perseverance now why why is now the

1177
00:45:45,829 --> 00:45:43,119
right time and what are the benefits of

1178
00:45:48,069 --> 00:45:45,839
returning with a new probe so soon we

1179
00:45:49,510 --> 00:45:48,079
kind of highlighted that but uh

1180
00:45:52,069 --> 00:45:49,520
thomas i'll throw that over to you your

1181
00:45:54,069 --> 00:45:52,079
thoughts on that question

1182
00:45:56,790 --> 00:45:54,079
so first of all i do think it's the

1183
00:45:58,870 --> 00:45:56,800
ideal time frankly i i'm you know it

1184
00:46:00,870 --> 00:45:58,880
would be and you know mike may have a

1185
00:46:03,109 --> 00:46:00,880
different opinion and i know item uh of

1186
00:46:05,109 --> 00:46:03,119
course but uh but it would be have been

1187
00:46:07,349 --> 00:46:05,119
very difficult to kind of imagine doing

1188
00:46:09,670 --> 00:46:07,359

this 20 years ago frankly or even 10

1189
00:46:11,750 --> 00:46:09,680
years ago the instruments that are

1190
00:46:13,510 --> 00:46:11,760
currently there and are

1191
00:46:14,790 --> 00:46:13,520
sitting on top of the rock together of

1192
00:46:17,510 --> 00:46:14,800
course with

1193
00:46:19,990 --> 00:46:17,520
uh you know mimi's treasure you know uh

1194
00:46:22,950 --> 00:46:20,000
uh ingenuity right uh

1195
00:46:25,430 --> 00:46:22,960
it they're the best that we can do now i

1196
00:46:27,349 --> 00:46:25,440
really you know and i think uh you know

1197
00:46:29,990 --> 00:46:27,359
together with the academy's endorsement

1198
00:46:31,270 --> 00:46:30,000
and encouragement we are we know this is

1199
00:46:33,510 --> 00:46:31,280
the most important question we could

1200
00:46:36,150 --> 00:46:33,520
address right now uh going there we're

1201
00:46:38,710 --> 00:46:36,160
really lucky that curiosity is there and

1202
00:46:40,710 --> 00:46:38,720
is is continuing to do amazing research

1203
00:46:42,870 --> 00:46:40,720
you know don't think of those things

1204
00:46:45,750 --> 00:46:42,880
as missions that somehow step on each

1205
00:46:48,470 --> 00:46:45,760
other's feet right get off the curiosity

1206
00:46:51,030 --> 00:46:48,480
our mission is continuing to do amazing

1207
00:46:53,510 --> 00:46:51,040
work for example focused on organics uh

1208
00:46:56,230 --> 00:46:53,520
there's a new work that just recently

1209
00:46:58,550 --> 00:46:56,240
came out i know just recently being in

1210
00:46:59,589 --> 00:46:58,560
in touch with uh with the mission team

1211
00:47:02,069 --> 00:46:59,599
there's

1212
00:47:04,870 --> 00:47:02,079
new insights that are coming from there

1213
00:47:06,790 --> 00:47:04,880

that are also informing what's going on

1214
00:47:08,230 --> 00:47:06,800
with perseverance what is unique though

1215
00:47:11,109 --> 00:47:08,240
about perseverance and the reason we

1216
00:47:13,030 --> 00:47:11,119
wanted to do it now is we're we can't

1217
00:47:15,270 --> 00:47:13,040
wait to get those samples back because

1218
00:47:18,150 --> 00:47:15,280
we the questions that we want to address

1219
00:47:20,069 --> 00:47:18,160
now are really so much different than

1220
00:47:21,670 --> 00:47:20,079
the ones that 20 years ago we might have

1221
00:47:23,109 --> 00:47:21,680
asked uh the questions we want to

1222
00:47:25,430 --> 00:47:23,119
address now we'd like to have these

1223
00:47:28,230 --> 00:47:25,440
samples in our labs now but mike how

1224
00:47:30,390 --> 00:47:28,240
would you have answered that

1225
00:47:31,829 --> 00:47:30,400
uh almost the same way uh you know i

1226
00:47:33,750 --> 00:47:31,839
think i think it is clear you know we

1227
00:47:35,829 --> 00:47:33,760
wanted to first understand the history

1228
00:47:37,510 --> 00:47:35,839
of mars we wanted to follow the water we

1229
00:47:39,430 --> 00:47:37,520
wanted to find a habitable environment

1230
00:47:41,109 --> 00:47:39,440
we've done all of those things

1231
00:47:42,710 --> 00:47:41,119
so from the scientific perspective it's

1232
00:47:43,430 --> 00:47:42,720
about astrobiology now it's about you

1233
00:47:45,349 --> 00:47:43,440
know

1234
00:47:47,589 --> 00:47:45,359
these complex organics what's their

1235
00:47:49,510 --> 00:47:47,599
history can we find them preserved um

1236
00:47:51,589 --> 00:47:49,520
you know can we find biosignatures i

1237
00:47:53,030 --> 00:47:51,599
mean this is really the next step i mean

1238
00:47:54,870 --> 00:47:53,040

it's the it's where we want to go it's

1239
00:47:56,309 --> 00:47:54,880
where the program's been building up to

1240
00:47:58,390 --> 00:47:56,319
at this point and that's recognized by

1241
00:48:00,870 --> 00:47:58,400
the by the academy as well

1242
00:48:02,549 --> 00:48:00,880
i would add one other um item beyond

1243
00:48:03,990 --> 00:48:02,559
just the engineering

1244
00:48:05,750 --> 00:48:04,000
uh knowledge and maturity that we've

1245
00:48:06,870 --> 00:48:05,760
gained through these missions and that

1246
00:48:08,870 --> 00:48:06,880
is that

1247
00:48:11,829 --> 00:48:08,880
you know we're not alone on mars in fact

1248
00:48:13,910 --> 00:48:11,839
we rely heavily on uh on orbiters to

1249
00:48:16,470 --> 00:48:13,920
relay our communications so we can get

1250
00:48:18,150 --> 00:48:16,480
much high bandwidth our videos are these

1251
00:48:21,430 --> 00:48:18,160
beautiful panoramas you see those all

1252
00:48:22,790 --> 00:48:21,440
come back from the rover talking by uhf

1253
00:48:24,950 --> 00:48:22,800
for example tomorrow's reconnaissance

1254
00:48:26,150 --> 00:48:24,960
orbiter or to maven or to european

1255
00:48:27,829 --> 00:48:26,160
missions

1256
00:48:29,829 --> 00:48:27,839
and then those are related at high rate

1257
00:48:32,710 --> 00:48:29,839
back back to the earth and so actually

1258
00:48:34,230 --> 00:48:32,720
going back and doing sample return

1259
00:48:35,510 --> 00:48:34,240
while we have that infrastructure in

1260
00:48:38,230 --> 00:48:35,520
place and we don't need to rebuild and

1261
00:48:40,710 --> 00:48:38,240
replace that entire infrastructure uh of

1262
00:48:42,790 --> 00:48:40,720
of comstats basically and and and of

1263
00:48:44,790 --> 00:48:42,800

photographic reconnaissance satellites

1264
00:48:46,230 --> 00:48:44,800
um is another efficiency that i think

1265
00:48:47,349 --> 00:48:46,240
it's really worth it to take advantage

1266
00:48:48,950 --> 00:48:47,359
of that

1267
00:48:50,630 --> 00:48:48,960
really significant investment in

1268
00:48:55,030 --> 00:48:50,640
building that that infrastructure both

1269
00:49:00,630 --> 00:48:56,549
and i would say

1270
00:49:03,190 --> 00:49:00,640
uh curiosity and perseverance uh look

1271
00:49:05,910 --> 00:49:03,200
mike and i were talking earlier we think

1272
00:49:08,069 --> 00:49:05,920
about the total land mass of mars it's

1273
00:49:10,549 --> 00:49:08,079
equivalent to the total land mass of the

1274
00:49:13,190 --> 00:49:10,559
world when you take away the oceans

1275
00:49:16,069 --> 00:49:13,200
um you know imagine if you were to study

1276
00:49:17,430 --> 00:49:16,079
earth for the first time and you landed

1277
00:49:19,750 --> 00:49:17,440
in in maybe

1278
00:49:21,589 --> 00:49:19,760
northern africa and from that you made a

1279
00:49:23,750 --> 00:49:21,599
determination as to what the rest of the

1280
00:49:27,109 --> 00:49:23,760
earth was like you you would miss a

1281
00:49:29,829 --> 00:49:27,119
whole lot of things so um so it is a big

1282
00:49:31,670 --> 00:49:29,839
planet there is a whole lot to learn

1283
00:49:33,190 --> 00:49:31,680
and and yes these missions don't step on

1284
00:49:34,790 --> 00:49:33,200
each other they really do complement

1285
00:49:36,710 --> 00:49:34,800
each other and we're trying to trying to

1286
00:49:39,109 --> 00:49:36,720
understand a whole lot more than just

1287
00:49:40,790 --> 00:49:39,119
you know one footprint on a really big

1288
00:49:42,630 --> 00:49:40,800

planet

1289
00:49:45,030 --> 00:49:42,640
so let me probe into that one a little

1290
00:49:47,190 --> 00:49:45,040
bit and and no offense to anybody but

1291
00:49:49,430 --> 00:49:47,200
mimi you seem your initiative seems to

1292
00:49:51,510 --> 00:49:49,440
be getting the most uh question so i'm

1293
00:49:54,630 --> 00:49:51,520
gonna you know mike both for you and

1294
00:49:57,510 --> 00:49:54,640
mimi perhaps so uh you know jpl has long

1295
00:49:58,549 --> 00:49:57,520
been a pioneer of space exploration and

1296
00:50:00,710 --> 00:49:58,559
innovation

1297
00:50:03,190 --> 00:50:00,720
um so the question on ingenuity

1298
00:50:05,589 --> 00:50:03,200
helicopter um can you speak more of the

1299
00:50:06,870 --> 00:50:05,599
challenges that so i'm actually going to

1300
00:50:08,470 --> 00:50:06,880
kind of throw some of this out there

1301
00:50:09,990 --> 00:50:08,480
that i get from the questions you know

1302
00:50:12,309 --> 00:50:10,000
the challenges in the absence of

1303
00:50:15,190 --> 00:50:12,319
atmosphere for aerodynamic guidance can

1304
00:50:16,549 --> 00:50:15,200
control and then the next question kind

1305
00:50:18,230 --> 00:50:16,559
of as a

1306
00:50:20,150 --> 00:50:18,240
rapid fire just to

1307
00:50:22,390 --> 00:50:20,160
to let you for you know get this out

1308
00:50:25,190 --> 00:50:22,400
there you know with less gravity and the

1309
00:50:27,670 --> 00:50:25,200
possible extreme martian wind you know

1310
00:50:29,430 --> 00:50:27,680
um are we able to overcome these

1311
00:50:31,349 --> 00:50:29,440
challenges for uav

1312
00:50:33,670 --> 00:50:31,359
and then the last thing um as part of

1313
00:50:35,750 --> 00:50:33,680

that is if if the first five flights are

1314
00:50:40,230 --> 00:50:35,760
successful is there will there be time

1315
00:50:43,109 --> 00:50:40,240
energy to be able to do some more

1316
00:50:45,670 --> 00:50:43,119
okay uh i'll start it up so definitely

1317
00:50:47,910 --> 00:50:45,680
uh the challenge uh first and foremost

1318
00:50:49,990 --> 00:50:47,920
is of course that lightweight uh you

1319
00:50:52,870 --> 00:50:50,000
know beating down that capability and

1320
00:50:55,190 --> 00:50:52,880
the way we addressed it is really

1321
00:50:56,710 --> 00:50:55,200
removing all the traditional walls

1322
00:50:58,790 --> 00:50:56,720
between the different disciplines that

1323
00:51:01,510 --> 00:50:58,800
we tend to have in much larger you know

1324
00:51:03,829 --> 00:51:01,520
systems that we traditionally have so we

1325
00:51:06,390 --> 00:51:03,839
really had to learn to work together

1326
00:51:08,950 --> 00:51:06,400
starting from this aerodynamic challenge

1327
00:51:11,510 --> 00:51:08,960
you know optimizing the lift even the

1328
00:51:14,790 --> 00:51:11,520
way the blade how can we maximize the

1329
00:51:16,710 --> 00:51:14,800
lift to how can we build that blade that

1330
00:51:18,309 --> 00:51:16,720
is still light it has to be very light

1331
00:51:20,549 --> 00:51:18,319
but it has to be strong enough it has to

1332
00:51:23,190 --> 00:51:20,559
be able to spin enough and all the walls

1333
00:51:24,870 --> 00:51:23,200
between aerodynamics and

1334
00:51:28,390 --> 00:51:24,880
gnmc and

1335
00:51:30,150 --> 00:51:28,400
the power the thermal the structure all

1336
00:51:32,390 --> 00:51:30,160
of it really had to go away because we

1337
00:51:34,710 --> 00:51:32,400
were really forced because of this mass

1338
00:51:36,790 --> 00:51:34,720

constraint so that's the very first you

1339
00:51:39,349 --> 00:51:36,800
know answer is that it really has been

1340
00:51:40,950 --> 00:51:39,359
an extremely it's an engineer's uh

1341
00:51:43,910 --> 00:51:40,960
engineering project a dream engineering

1342
00:51:46,549 --> 00:51:43,920
project to say um and then in terms of

1343
00:51:49,270 --> 00:51:46,559
the atmosphere we worked with the uh

1344
00:51:51,750 --> 00:51:49,280
scientists uh way from the from the very

1345
00:51:54,549 --> 00:51:51,760
beginning in terms of understanding the

1346
00:51:57,430 --> 00:51:54,559
atmospheric densities and the winds and

1347
00:52:00,630 --> 00:51:57,440
we did take the scientists knowledge of

1348
00:52:02,790 --> 00:52:00,640
the martian uh winds and built the

1349
00:52:04,630 --> 00:52:02,800
helicopter the response rates of the you

1350
00:52:05,829 --> 00:52:04,640
know blade control systems and all of

1351
00:52:07,430 --> 00:52:05,839
that are

1352
00:52:09,670 --> 00:52:07,440
sized to

1353
00:52:11,990 --> 00:52:09,680
exceed with margin the expected level of

1354
00:52:14,630 --> 00:52:12,000
winds that we expect so

1355
00:52:17,589 --> 00:52:14,640
um to add to that in parallel to

1356
00:52:19,670 --> 00:52:17,599
inventing this first helicopter to fly

1357
00:52:21,109 --> 00:52:19,680
you know so light and so capable and we

1358
00:52:23,190 --> 00:52:21,119
talked about autonomous it has to

1359
00:52:25,109 --> 00:52:23,200
survive autonomously and you know be

1360
00:52:28,630 --> 00:52:25,119
able to keep itself warm and that

1361
00:52:31,829 --> 00:52:28,640
capability um we also had to

1362
00:52:33,990 --> 00:52:31,839
invent in parallel the test system

1363
00:52:36,950 --> 00:52:34,000

we've never you know built an aerial

1364
00:52:39,589 --> 00:52:36,960
vehicle for for mars and so parallel to

1365
00:52:41,670 --> 00:52:39,599
inventing the helicopter was parallel a

1366
00:52:43,990 --> 00:52:41,680
parallel system to invent the entire

1367
00:52:45,510 --> 00:52:44,000
test system how do you you know after

1368
00:52:47,270 --> 00:52:45,520
building the vehicle it's not like we

1369
00:52:48,710 --> 00:52:47,280
take it to a chamber and say now let's

1370
00:52:51,270 --> 00:52:48,720
fly it right we really had to

1371
00:52:53,589 --> 00:52:51,280
incrementally check all the assumptions

1372
00:52:56,230 --> 00:52:53,599
that we made in our models and carefully

1373
00:52:57,910 --> 00:52:56,240
check it off so there was that invention

1374
00:52:59,670 --> 00:52:57,920
and then there's the third lake that we

1375
00:53:00,870 --> 00:52:59,680
don't talk as much about which we should

1376
00:53:03,109 --> 00:53:00,880
hear is

1377
00:53:04,950 --> 00:53:03,119
how to get it to mars you know the

1378
00:53:07,430 --> 00:53:04,960
perseverance rover team did an

1379
00:53:09,829 --> 00:53:07,440
incredible job accommodating now that

1380
00:53:11,670 --> 00:53:09,839
it's all working it looks easy there it

1381
00:53:14,230 --> 00:53:11,680
is sitting on the belly pin

1382
00:53:17,190 --> 00:53:14,240
but the helicopter is one of the most

1383
00:53:19,589 --> 00:53:17,200
tedious things to accommodate on the on

1384
00:53:21,670 --> 00:53:19,599
the rover and the rover team put us in a

1385
00:53:23,670 --> 00:53:21,680
really nice location on the belly pan

1386
00:53:25,910 --> 00:53:23,680
and to minimize protrusion below the

1387
00:53:27,589 --> 00:53:25,920
belly pan you know the two teams work

1388
00:53:29,430 --> 00:53:27,599

together the rover team and the

1389
00:53:31,750 --> 00:53:29,440
helicopter team we figured out how to

1390
00:53:33,430 --> 00:53:31,760
put it on the side on the helicopter we

1391
00:53:35,990 --> 00:53:33,440
had to adjust you know some of the

1392
00:53:38,309 --> 00:53:36,000
features and there it is accommodated

1393
00:53:41,190 --> 00:53:38,319
and able to deploy so

1394
00:53:45,190 --> 00:53:41,200
quite a lot of innovation all in one

1395
00:53:48,870 --> 00:53:46,950
who um

1396
00:53:51,109 --> 00:53:48,880
thank you but and i noticed that that's

1397
00:53:53,750 --> 00:53:51,119
a it's a copy of the ingenuity behind

1398
00:53:56,390 --> 00:53:53,760
you of a

1399
00:53:57,829 --> 00:53:56,400
very full scale

1400
00:53:58,950 --> 00:53:57,839
yeah exciting

1401
00:54:00,870 --> 00:53:58,960
so um

1402
00:54:02,710 --> 00:54:00,880
we've got a little bit of time left and

1403
00:54:05,190 --> 00:54:02,720
i i want to get to a few other questions

1404
00:54:07,589 --> 00:54:05,200
so um administrator this is kind of more

1405
00:54:09,750 --> 00:54:07,599
directed to you um you know china and

1406
00:54:12,069 --> 00:54:09,760
the uae are also sending spacecrafts to

1407
00:54:14,150 --> 00:54:12,079
the red planet this month and

1408
00:54:16,870 --> 00:54:14,160
what we noted earlier uae successful

1409
00:54:18,309 --> 00:54:16,880
launch of the hope orbiter uh earlier or

1410
00:54:19,990 --> 00:54:18,319
yesterday

1411
00:54:22,470 --> 00:54:20,000
what are the opportunities for nasa to

1412
00:54:24,150 --> 00:54:22,480
collaborate on these type initiatives i

1413
00:54:26,790 --> 00:54:24,160

know you're heavily partnered on on a

1414
00:54:28,069 --> 00:54:26,800
lot of others but how can we how can we

1415
00:54:29,910 --> 00:54:28,079
uh collaborate with the national

1416
00:54:32,230 --> 00:54:29,920
partners for mars exploration or other

1417
00:54:33,990 --> 00:54:32,240
places beyond that

1418
00:54:36,309 --> 00:54:34,000
yeah that's a it's an important question

1419
00:54:38,630 --> 00:54:36,319
and we do that quite frequently um

1420
00:54:40,950 --> 00:54:38,640
throughout all of our programs and as as

1421
00:54:43,990 --> 00:54:40,960
a matter of fact we have right now

1422
00:54:45,990 --> 00:54:44,000
over 700 agreements um

1423
00:54:48,470 --> 00:54:46,000
between nasa and and other space

1424
00:54:50,069 --> 00:54:48,480
agencies throughout the world um and

1425
00:54:53,190 --> 00:54:50,079
even other countries that don't have

1426
00:54:55,109 --> 00:54:53,200
space agencies yet we encourage

1427
00:54:57,190 --> 00:54:55,119
everybody to get a space agency because

1428
00:55:00,069 --> 00:54:57,200
we want them to to be able to partner

1429
00:55:03,510 --> 00:55:00,079
with us on on our big missions but um

1430
00:55:05,670 --> 00:55:03,520
but we nasa is a great tool of diplomacy

1431
00:55:06,549 --> 00:55:05,680
it's a great tool of bringing nations

1432
00:55:08,470 --> 00:55:06,559
together

1433
00:55:09,829 --> 00:55:08,480
you know here in just a few short months

1434
00:55:12,069 --> 00:55:09,839
in november

1435
00:55:13,750 --> 00:55:12,079
we're going to celebrate 20 years of

1436
00:55:16,470 --> 00:55:13,760
american astronauts and russian

1437
00:55:18,470 --> 00:55:16,480
cosmonauts living and working together

1438
00:55:20,630 --> 00:55:18,480

in space on the international space

1439
00:55:23,190 --> 00:55:20,640
station and of course while that's

1440
00:55:26,309 --> 00:55:23,200
that's 20 years uh working together on

1441
00:55:29,430 --> 00:55:26,319
that project you know going back to 1975

1442
00:55:32,950 --> 00:55:29,440
we had the the shuttle mir or yeah the

1443
00:55:33,750 --> 00:55:32,960
shuttle mir program in the 80s we had um

1444
00:55:39,990 --> 00:55:33,760
the

1445
00:55:41,990 --> 00:55:40,000
is not new um and you know we like to

1446
00:55:43,750 --> 00:55:42,000
think that you know nasa

1447
00:55:44,950 --> 00:55:43,760
and space exploration it kind of

1448
00:55:49,510 --> 00:55:44,960
transcends

1449
00:55:52,710 --> 00:55:49,520
democrats in the united states everybody

1450
00:55:54,630 --> 00:55:52,720
loves space exploration uh it transcends

1451
00:55:56,630 --> 00:55:54,640
geopolitics

1452
00:55:58,390 --> 00:55:56,640
and so i think this is really a great

1453
00:55:59,829 --> 00:55:58,400
opportunity for collaboration and of

1454
00:56:02,470 --> 00:55:59,839
course we do have

1455
00:56:05,109 --> 00:56:02,480
many international partners on the

1456
00:56:07,750 --> 00:56:05,119
on on on perseverance here so it's a

1457
00:56:11,270 --> 00:56:07,760
it's a very exciting time

1458
00:56:14,069 --> 00:56:11,280
so so if i could someone ask a

1459
00:56:15,990 --> 00:56:14,079
follow-up on that i mean

1460
00:56:17,829 --> 00:56:16,000
you make some very persuasive arguments

1461
00:56:19,589 --> 00:56:17,839
for what nasa deserves

1462
00:56:21,430 --> 00:56:19,599
uh and and and the support and it

1463
00:56:23,270 --> 00:56:21,440

resonates across a large variety of

1464
00:56:25,190 --> 00:56:23,280
people so courtney from maryland sends

1465
00:56:26,230 --> 00:56:25,200
this in so um

1466
00:56:27,990 --> 00:56:26,240
you know

1467
00:56:30,069 --> 00:56:28,000
so clearly this

1468
00:56:32,470 --> 00:56:30,079
resonates with space nerds like me but

1469
00:56:34,150 --> 00:56:32,480
what what and how will you persuade your

1470
00:56:36,630 --> 00:56:34,160
former colleagues in congress who are

1471
00:56:38,870 --> 00:56:36,640
facing large deficits exacerbated by

1472
00:56:40,950 --> 00:56:38,880
cogan related stimulus packages

1473
00:56:42,950 --> 00:56:40,960
and is there something that the private

1474
00:56:44,390 --> 00:56:42,960
sector can do more to help augment your

1475
00:56:45,430 --> 00:56:44,400
efforts

1476
00:56:47,510 --> 00:56:45,440
100

1477
00:56:50,549 --> 00:56:47,520
and it's again these are all important

1478
00:56:51,589 --> 00:56:50,559
points we think about um what nasa has

1479
00:56:53,670 --> 00:56:51,599
enabled

1480
00:56:55,270 --> 00:56:53,680
throughout its history

1481
00:56:56,789 --> 00:56:55,280
we think about

1482
00:56:57,990 --> 00:56:56,799
how do we communicate a lot of people

1483
00:57:00,470 --> 00:56:58,000
are going to watch this because they

1484
00:57:02,230 --> 00:57:00,480
have internet broadband from space or if

1485
00:57:05,270 --> 00:57:02,240
you're watching on nasa tv you might

1486
00:57:07,430 --> 00:57:05,280
have dish network or directv

1487
00:57:09,670 --> 00:57:07,440
these are all space-based communication

1488
00:57:11,510 --> 00:57:09,680

capabilities that were born from this

1489
00:57:13,990 --> 00:57:11,520
little agency called nasa that was

1490
00:57:16,309 --> 00:57:14,000
innovating at a level that was well

1491
00:57:18,630 --> 00:57:16,319
beyond what anybody believed was even

1492
00:57:20,710 --> 00:57:18,640
possible back in those days but the way

1493
00:57:23,270 --> 00:57:20,720
we do communications

1494
00:57:24,950 --> 00:57:23,280
over the horizon communications xm radio

1495
00:57:27,589 --> 00:57:24,960
for example

1496
00:57:29,589 --> 00:57:27,599
we talk about how we navigate gps

1497
00:57:30,470 --> 00:57:29,599
technology developed by nasa of course

1498
00:57:32,230 --> 00:57:30,480
now

1499
00:57:34,870 --> 00:57:32,240
operated by the department of defense

1500
00:57:38,150 --> 00:57:34,880
but but again um the way we predict

1501
00:57:39,589 --> 00:57:38,160
weather um the way we um the way we do

1502
00:57:41,510 --> 00:57:39,599
disaster relief and a lot of the

1503
00:57:42,870 --> 00:57:41,520
national security capabilities of the

1504
00:57:46,150 --> 00:57:42,880
nation

1505
00:57:48,309 --> 00:57:46,160
the way we access space in general for a

1506
00:57:50,069 --> 00:57:48,319
whole host of commercial remote sensing

1507
00:57:50,950 --> 00:57:50,079
capabilities

1508
00:57:54,789 --> 00:57:50,960
there

1509
00:57:57,430 --> 00:57:54,799
contributed to

1510
00:57:59,750 --> 00:57:57,440
on the economic side we we think about

1511
00:58:02,150 --> 00:57:59,760
the the the you know we're talking about

1512
00:58:04,789 --> 00:58:02,160
mars right well the camera in your cell

1513
00:58:07,109 --> 00:58:04,799

phone was was created because of a

1514
00:58:09,190 --> 00:58:07,119
mission requirement that nasa had to

1515
00:58:12,309 --> 00:58:09,200
create a really small camera when we

1516
00:58:13,589 --> 00:58:12,319
explore mars that's just one of so many

1517
00:58:15,829 --> 00:58:13,599
examples but

1518
00:58:18,549 --> 00:58:15,839
we think about the improvement of the

1519
00:58:20,630 --> 00:58:18,559
human condition because of what nasa has

1520
00:58:22,230 --> 00:58:20,640
been able to achieve

1521
00:58:24,630 --> 00:58:22,240
you know right now it you know we're

1522
00:58:27,349 --> 00:58:24,640
talking about jpl they have a a number

1523
00:58:29,109 --> 00:58:27,359
of impressive missions um the grace

1524
00:58:31,349 --> 00:58:29,119
follow-on mission which is helping us

1525
00:58:32,789 --> 00:58:31,359
understand where the drought is in the

1526
00:58:34,789 --> 00:58:32,799
world and

1527
00:58:37,510 --> 00:58:34,799
ecostress which is enabling us to

1528
00:58:39,589 --> 00:58:37,520
understand you know can we increase crop

1529
00:58:41,589 --> 00:58:39,599
yields while reducing water usage at the

1530
00:58:44,470 --> 00:58:41,599
same time feeding more of the world than

1531
00:58:46,710 --> 00:58:44,480
ever before with less water usage these

1532
00:58:48,069 --> 00:58:46,720
are missions that nasa can do that

1533
00:58:50,630 --> 00:58:48,079
nobody else

1534
00:58:51,430 --> 00:58:50,640
you know in the world is doing um so

1535
00:58:53,750 --> 00:58:51,440
look

1536
00:58:56,230 --> 00:58:53,760
we are every day improving the human

1537
00:58:58,390 --> 00:58:56,240
condition in ways that are absolutely

1538
00:59:00,710 --> 00:58:58,400

immeasurable and i'll tell you the nasa

1539
00:59:03,510 --> 00:59:00,720
administrator here's what i hear about i

1540
00:59:04,549 --> 00:59:03,520
hear about tang and i hear about velcro

1541
00:59:06,549 --> 00:59:04,559
which

1542
00:59:09,109 --> 00:59:06,559
were two things that we quite frankly

1543
00:59:11,829 --> 00:59:09,119
didn't invent but you know we used back

1544
00:59:14,470 --> 00:59:11,839
in the apollo era um but i'll tell you

1545
00:59:16,870 --> 00:59:14,480
it goes so far beyond that uh if you're

1546
00:59:19,349 --> 00:59:16,880
looking for a return on investment there

1547
00:59:21,670 --> 00:59:19,359
is nothing nothing better than the

1548
00:59:23,190 --> 00:59:21,680
american government could invest in than

1549
00:59:25,430 --> 00:59:23,200
nasa and that's what's happening right

1550
00:59:27,190 --> 00:59:25,440
now with bipartisan support so it's

1551
00:59:28,309 --> 00:59:27,200
really a good a good place to be right

1552
00:59:29,750 --> 00:59:28,319
now

1553
00:59:31,349 --> 00:59:29,760
that's great to hear

1554
00:59:33,990 --> 00:59:31,359
i have to apologize we're

1555
00:59:36,069 --> 00:59:34,000
balanced our time i i do have to ask

1556
00:59:38,710 --> 00:59:36,079
before we go you know commercial crew

1557
00:59:41,030 --> 00:59:38,720
launched you know just over a month ago

1558
00:59:43,030 --> 00:59:41,040
another historic thing how are bob and

1559
00:59:45,510 --> 00:59:43,040
doug doing and how long till they return

1560
00:59:48,549 --> 00:59:45,520
back to earth on dragon

1561
00:59:51,270 --> 00:59:48,559
so bob and doug are doing fantastic um

1562
00:59:52,950 --> 00:59:51,280
you know three space walks uh bob bankin

1563
00:59:55,349 --> 00:59:52,960

and chris cassidy have done three space

1564
00:59:57,109 --> 00:59:55,359
walks of course doug has been inside the

1565
01:00:00,630 --> 00:59:57,119
international space station supporting

1566
01:00:03,349 --> 01:00:00,640
that uh from the inside um and now we've

1567
01:00:05,109 --> 01:00:03,359
got one more spacewalk to go

1568
01:00:07,349 --> 01:00:05,119
and then they're going to be focused uh

1569
01:00:09,990 --> 01:00:07,359
like a laser on coming home

1570
01:00:12,549 --> 01:00:10,000
and right now we're targeting a date of

1571
01:00:14,309 --> 01:00:12,559
august 2nd for a return but again that's

1572
01:00:17,829 --> 01:00:14,319
going to be based on a lot of conditions

1573
01:00:21,190 --> 01:00:17,839
to include weather and sea states um and

1574
01:00:23,990 --> 01:00:21,200
and and other things so um

1575
01:00:26,150 --> 01:00:24,000
yeah we're targeting early august uh but

1576
01:00:27,990 --> 01:00:26,160
so far that mission has gone

1577
01:00:29,750 --> 01:00:28,000
very very well better than expected and

1578
01:00:32,549 --> 01:00:29,760
i'm knocking on wood because it is not

1579
01:00:35,109 --> 01:00:32,559
over until bob and doug are home so

1580
01:00:38,309 --> 01:00:35,119
um we're in good shape there

1581
01:00:40,950 --> 01:00:38,319
so i apologize we are over time um real

1582
01:00:43,829 --> 01:00:40,960
quick uh uh administrator brian said any

1583
01:00:45,910 --> 01:00:43,839
final thoughts before we sign off

1584
01:00:47,510 --> 01:00:45,920
sure thank you and again thank you to

1585
01:00:49,430 --> 01:00:47,520
the space foundation and thank you to

1586
01:00:51,270 --> 01:00:49,440
boeing for hosting this

1587
01:00:52,390 --> 01:00:51,280
um i just want to say

1588
01:00:54,069 --> 01:00:52,400

you know

1589
01:00:56,710 --> 01:00:54,079
this mission that we're about to launch

1590
01:00:59,190 --> 01:00:56,720
is historic in and of itself but what

1591
01:01:00,390 --> 01:00:59,200
it's building towards is something even

1592
01:01:03,589 --> 01:01:00,400
bigger

1593
01:01:05,349 --> 01:01:03,599
we're going to mars as as humanity with

1594
01:01:07,750 --> 01:01:05,359
international partners with commercial

1595
01:01:09,109 --> 01:01:07,760
partners the first step to do that is we

1596
01:01:11,190 --> 01:01:09,119
have to learn how to live and work on

1597
01:01:13,190 --> 01:01:11,200
another world and it just so happens

1598
01:01:15,349 --> 01:01:13,200
that we have this moon that's a three

1599
01:01:18,309 --> 01:01:15,359
day journey away we learned in the

1600
01:01:20,710 --> 01:01:18,319
apollo program apollo 13 specifically

1601
01:01:22,390 --> 01:01:20,720
that things can go very wrong on the way

1602
01:01:24,150 --> 01:01:22,400
to the moon and we can still make it

1603
01:01:25,349 --> 01:01:24,160
home things could go wrong on the

1604
01:01:28,710 --> 01:01:25,359
surface of the moon and we can still

1605
01:01:31,270 --> 01:01:28,720
make it home when we send humans to mars

1606
01:01:33,190 --> 01:01:31,280
we have to make sure that we've got it

1607
01:01:35,190 --> 01:01:33,200
we've got the architecture established

1608
01:01:36,710 --> 01:01:35,200
that we've got the systems proven so

1609
01:01:38,710 --> 01:01:36,720
we're going to the moon to learn how to

1610
01:01:41,030 --> 01:01:38,720
work on another live and work on another

1611
01:01:42,710 --> 01:01:41,040
world so that we can get to mars and

1612
01:01:44,870 --> 01:01:42,720
right now we're doing these robotic

1613
01:01:47,270 --> 01:01:44,880

missions to mars so that when our humans

1614
01:01:50,150 --> 01:01:47,280
do go to mars we know where to go we

1615
01:01:52,549 --> 01:01:50,160
know what to do we have the the absolute

1616
01:01:54,470 --> 01:01:52,559
best locations picked out where we're

1617
01:01:56,630 --> 01:01:54,480
going to be able to maximize the utility

1618
01:01:58,470 --> 01:01:56,640
of the science so all of this works

1619
01:02:00,230 --> 01:01:58,480
together one of the things you know i've

1620
01:02:02,549 --> 01:02:00,240
been working on ever since i've been the

1621
01:02:04,950 --> 01:02:02,559
nasa administrator is wherever there's

1622
01:02:06,710 --> 01:02:04,960
division we need to drive it out people

1623
01:02:09,670 --> 01:02:06,720
used to say well it's either the moon or

1624
01:02:11,750 --> 01:02:09,680
it's mars it is not true we can do both

1625
01:02:13,829 --> 01:02:11,760
and we need to do both people used to

1626
01:02:16,789 --> 01:02:13,839
say well it's either human exploration

1627
01:02:18,549 --> 01:02:16,799
or robotic exploration it is not true

1628
01:02:21,910 --> 01:02:18,559
they we need to do both they work

1629
01:02:23,990 --> 01:02:21,920
together side by side so

1630
01:02:25,750 --> 01:02:24,000
there's a lot of opportunity and and

1631
01:02:27,670 --> 01:02:25,760
bringing everybody together is what's

1632
01:02:29,589 --> 01:02:27,680
going to enable it to happen and again

1633
01:02:31,430 --> 01:02:29,599
we've got right now we've got strong

1634
01:02:33,670 --> 01:02:31,440
bipartisan support we're working every

1635
01:02:36,150 --> 01:02:33,680
day to grow that and anything people out

1636
01:02:38,470 --> 01:02:36,160
there can do to help is what makes these

1637
01:02:40,230 --> 01:02:38,480
programs sustainable we need to think

1638
01:02:42,230 --> 01:02:40,240

not just in terms of you know

1639
01:02:44,950 --> 01:02:42,240
administrations we need to think in

1640
01:02:47,270 --> 01:02:44,960
terms of generations we need long-term

1641
01:02:49,510 --> 01:02:47,280
sustainable programs that can go from

1642
01:02:52,069 --> 01:02:49,520
one generation to the next and if we do

1643
01:02:53,510 --> 01:02:52,079
that we will in fact be on the surface

1644
01:02:59,750 --> 01:02:53,520
of the mars in the not too distant

1645
01:03:02,630 --> 01:03:01,349
so thank you thank you jim thanks for

1646
01:03:04,549 --> 01:03:02,640
that and thanks for the inspiration that

1647
01:03:06,230 --> 01:03:04,559
all of you bring uh and thank you for

1648
01:03:07,829 --> 01:03:06,240
joining us here today this has been a

1649
01:03:09,670 --> 01:03:07,839
great discussion and honor to host you

1650
01:03:11,430 --> 01:03:09,680
on our space foundation present series

1651
01:03:12,470 --> 01:03:11,440
so thank you

1652
01:03:17,510 --> 01:03:12,480
thank you

1653
01:03:18,870 --> 01:03:17,520
i also want to thank everyone for tuning

1654
01:03:22,309 --> 01:03:18,880
in today especially those who are

1655
01:03:23,829 --> 01:03:22,319
participating using our hashtag ask sf i

1656
01:03:25,589 --> 01:03:23,839
also want to recognize our co-sponsor

1657
01:03:27,510 --> 01:03:25,599
boeing for their great support and for

1658
01:03:29,029 --> 01:03:27,520
all their amazing initiatives across the

1659
01:03:31,190 --> 01:03:29,039
space industry

1660
01:03:32,710 --> 01:03:31,200
as a reminder this event will be posted

1661
01:03:34,390 --> 01:03:32,720
online for later viewing at

1662
01:03:36,230 --> 01:03:34,400
spacefoundation.org

1663
01:03:38,230 --> 01:03:36,240

again thank you for joining us from all

1664
01:03:50,890 --> 01:03:38,240
of us here at the space foundation stay