

EST



1
00:00:09,830 --> 00:00:07,510
good afternoon i'm john yemerick with

2
00:00:12,470 --> 00:00:09,840
nasa's office of communications welcome

3
00:00:14,470 --> 00:00:12,480
to the nasa social to preview orion's

4
00:00:17,510 --> 00:00:14,480
first flight test which is scheduled to

5
00:00:19,429 --> 00:00:17,520
launch at 7 05 a.m eastern

6
00:00:32,229 --> 00:00:19,439
from cape canaveral air force station in

7
00:00:36,229 --> 00:00:34,470
thank you very much we have uh for those

8
00:00:38,069 --> 00:00:36,239
watching at home we have about 150

9
00:00:39,990 --> 00:00:38,079
people in the room here at kennedy space

10
00:00:42,310 --> 00:00:40,000
center the majority of them are nasa

11
00:00:44,310 --> 00:00:42,320
social media followers uh we also have

12
00:00:46,229 --> 00:00:44,320
connected to us and tuning in social

13
00:00:47,830 --> 00:00:46,239

media followers from eight field centers

14

00:00:50,069 --> 00:00:47,840

across the country

15

00:00:53,110 --> 00:00:50,079

the hashtag for today's event

16

00:00:55,510 --> 00:00:53,120

is simply orion that's also the hashtag

17

00:00:57,029 --> 00:00:55,520

for the test flight

18

00:00:58,549 --> 00:00:57,039

if you hear us talk about something that

19

00:01:00,470 --> 00:00:58,559

doesn't quite sound like orion if you

20

00:01:02,470 --> 00:01:00,480

still continues that hashtag that would

21

00:01:04,310 --> 00:01:02,480

be appreciated and we're going to be

22

00:01:06,550 --> 00:01:04,320

talking about things other than just

23

00:01:08,230 --> 00:01:06,560

orion today at this briefing we're also

24

00:01:10,230 --> 00:01:08,240

going to talk about for example our

25

00:01:12,230 --> 00:01:10,240

commercial crew program

26

00:01:14,550 --> 00:01:12,240

soon we're going to be flying us

27

00:01:16,630 --> 00:01:14,560

astronauts on american spacecraft to the

28

00:01:18,230 --> 00:01:16,640

international space station and back and

29

00:01:20,630 --> 00:01:18,240

also we're gonna be talking about our

30

00:01:22,469 --> 00:01:20,640

journey to mars and how the orion test

31

00:01:24,950 --> 00:01:22,479

flight is a stepping stone to that

32

00:01:27,109 --> 00:01:24,960

endeavor so to get us kicked off let us

33

00:01:29,109 --> 00:01:27,119

start with our first speaker

34

00:01:31,030 --> 00:01:29,119

he is a veteran of four

35

00:01:32,630 --> 00:01:31,040

space flight missions and also the

36

00:01:34,149 --> 00:01:32,640

director here at kennedy space center

37

00:01:40,950 --> 00:01:34,159

please help me welcome to the stage bob

38

00:01:45,749 --> 00:01:42,630

thanks john hey are you guys ready to

39

00:01:49,510 --> 00:01:47,910

so you realize if you've done the math

40

00:01:52,710 --> 00:01:49,520

you know we our last flight to the moon

41

00:01:55,190 --> 00:01:52,720

was in 1972 it's been 52 years since

42

00:01:57,030 --> 00:01:55,200

we've had a human spacecraft even though

43

00:01:58,950 --> 00:01:57,040

there isn't a crew member in it go as

44

00:02:01,190 --> 00:01:58,960

far from planet earth

45

00:02:03,030 --> 00:02:01,200

as orion is going tomorrow that's pretty

46

00:02:05,350 --> 00:02:03,040

darn neat this is our stepping stone to

47

00:02:07,350 --> 00:02:05,360

the future this is our first step into

48

00:02:08,949 --> 00:02:07,360

deep space exploration into going to

49

00:02:10,389 --> 00:02:08,959

mars and i think it's absolutely

50

00:02:12,309 --> 00:02:10,399

outstanding

51
00:02:13,830 --> 00:02:12,319
uh the administrator is going to be here

52
00:02:14,949 --> 00:02:13,840
shortly and before he does i just want

53
00:02:16,550 --> 00:02:14,959
to tell you a little bit about some of

54
00:02:18,390 --> 00:02:16,560
the transformation going on here at the

55
00:02:19,990 --> 00:02:18,400
kennedy space center preparing for that

56
00:02:21,589 --> 00:02:20,000
future i don't know if you've had a

57
00:02:23,510 --> 00:02:21,599
chance to look out the window here on

58
00:02:25,110 --> 00:02:23,520
the patio but if you look out to launch

59
00:02:27,830 --> 00:02:25,120
pad 39b

60
00:02:29,350 --> 00:02:27,840
the northernmost pad

61
00:02:30,550 --> 00:02:29,360
it's totally different from how it was

62
00:02:32,390 --> 00:02:30,560
during shuttle all the shuttle

63
00:02:34,710 --> 00:02:32,400

infrastructure is off there those three

64

00:02:36,869 --> 00:02:34,720

big lightning protection system towers

65

00:02:38,390 --> 00:02:36,879

that are put in place you know that's

66

00:02:40,470 --> 00:02:38,400

the launch pad we're going to go to mars

67

00:02:43,030 --> 00:02:40,480

from you know we're flying orion on a

68

00:02:44,229 --> 00:02:43,040

delta iv heavy right now but the delta

69

00:02:46,550 --> 00:02:44,239

iv heavy the furthest it's going to get

70

00:02:48,070 --> 00:02:46,560

orion away from earth it's 3 600

71

00:02:49,750 --> 00:02:48,080

nautical miles all right it's going to

72

00:02:51,670 --> 00:02:49,760

re-enter at about 85 percent lunar

73

00:02:53,350 --> 00:02:51,680

re-entry velocity but that's the best we

74

00:02:54,949 --> 00:02:53,360

can do with the delta iv we're building

75

00:02:56,790 --> 00:02:54,959

a space launch system and it's going to

76
00:02:58,630 --> 00:02:56,800
launch from that pad and it's going to

77
00:03:01,110 --> 00:02:58,640
eventually take us to mars from that

78
00:03:03,350 --> 00:03:01,120
launch pad right out that window all the

79
00:03:05,509 --> 00:03:03,360
shuttle infrastructure is gone it's got

80
00:03:07,030 --> 00:03:05,519
a new propellant distribution system

81
00:03:09,350 --> 00:03:07,040
totally refurbished it's got a

82
00:03:11,670 --> 00:03:09,360
refurbished water suppression system

83
00:03:13,350 --> 00:03:11,680
it's got fiber optics it's got new

84
00:03:15,270 --> 00:03:13,360
computers it's going to have a new flame

85
00:03:16,710 --> 00:03:15,280
trench that is our launch pad for the

86
00:03:18,070 --> 00:03:16,720
next 30 years over in the vehicle

87
00:03:20,790 --> 00:03:18,080
assembly building right out the window

88
00:03:22,149 --> 00:03:20,800

here high bay three all the shuttle

89

00:03:23,270 --> 00:03:22,159

platforms are gone and when we say

90

00:03:24,710 --> 00:03:23,280

platform you know you think about

91

00:03:26,869 --> 00:03:24,720

something the size of the floor of this

92

00:03:28,869 --> 00:03:26,879

room that's not a platform the platforms

93

00:03:30,390 --> 00:03:28,879

in there are the size of small buildings

94

00:03:32,949 --> 00:03:30,400

all that shuttle infrastructure is out

95

00:03:34,710 --> 00:03:32,959

of there new platforms are going in to

96

00:03:36,550 --> 00:03:34,720

accommodate the space launch system now

97

00:03:39,270 --> 00:03:36,560

this rocket starts out at 70 to 90

98

00:03:41,670 --> 00:03:39,280

metric tons right but it grows to 130

99

00:03:44,149 --> 00:03:41,680

well those platforms are designed to

100

00:03:45,750 --> 00:03:44,159

accommodate the evolving outer mold line

101
00:03:47,910 --> 00:03:45,760
of the vehicle as it gets wider and

102
00:03:49,990 --> 00:03:47,920
taller up at the top so those platforms

103
00:03:51,589 --> 00:03:50,000
are designed to adjust eight to ten feet

104
00:03:52,949 --> 00:03:51,599
up and down and they've got inserts in

105
00:03:55,270 --> 00:03:52,959
them so that as the outer mold line gets

106
00:03:56,789 --> 00:03:55,280
wider you can pull out the one insert

107
00:03:58,550 --> 00:03:56,799
stick in another one and you don't have

108
00:04:01,270 --> 00:03:58,560
to redo everything it's going to be

109
00:04:03,030 --> 00:04:01,280
awesome the crawler transporter

110
00:04:04,869 --> 00:04:03,040
totally redone crawler transporter two

111
00:04:06,789 --> 00:04:04,879
we got two of them crawler transporter

112
00:04:08,309 --> 00:04:06,799
two got new wheel bearings in it to

113
00:04:09,910 --> 00:04:08,319

accommodate the heavier weights of the

114

00:04:11,990 --> 00:04:09,920

mobile launcher and the space launch

115

00:04:13,509 --> 00:04:12,000

system it's got new jacking elevation

116

00:04:15,589 --> 00:04:13,519

and leveling cylinders it's got new

117

00:04:17,590 --> 00:04:15,599

brakes it's got new generators it is

118

00:04:20,069 --> 00:04:17,600

totally being refurbished to be our

119

00:04:22,150 --> 00:04:20,079

crawler transporter for another 30 years

120

00:04:24,070 --> 00:04:22,160

it's going to take that mobile launcher

121

00:04:26,629 --> 00:04:24,080

that you see out next to the vehicle

122

00:04:28,469 --> 00:04:26,639

assembly building that's being modified

123

00:04:29,990 --> 00:04:28,479

for the space launch system it's gonna

124

00:04:31,590 --> 00:04:30,000

weigh about six million pounds the

125

00:04:33,510 --> 00:04:31,600

rocket's gonna weigh another six million

126

00:04:35,350 --> 00:04:33,520

pounds so crawler transporter weighs six

127

00:04:37,590 --> 00:04:35,360

million pounds that eighteen million

128

00:04:39,670 --> 00:04:37,600

pounds is going to roll three miles out

129

00:04:41,670 --> 00:04:39,680

to pad b we're gonna fuel that rocket

130

00:04:44,070 --> 00:04:41,680

and in fiscal year 2018 we're going to

131

00:04:46,070 --> 00:04:44,080

be launching on orion on another test

132

00:04:48,310 --> 00:04:46,080

flight again without a crew on its way

133

00:04:50,390 --> 00:04:48,320

to the moon and at this time i want to

134

00:04:54,870 --> 00:04:50,400

welcome our administrator charlie bolden

135

00:04:58,870 --> 00:04:57,270

how you doing

136

00:05:00,629 --> 00:04:58,880

thanks very much for everybody who's on

137

00:05:02,230 --> 00:05:00,639

the net i understand there are people on

138

00:05:04,870 --> 00:05:02,240

from every nasa center around the

139

00:05:06,390 --> 00:05:04,880

country i hope anyway uh real quick

140

00:05:07,909 --> 00:05:06,400

because i know you all have questions

141

00:05:09,830 --> 00:05:07,919

you want to ask hopefully bob's giving

142

00:05:11,430 --> 00:05:09,840

you a lot of the technical stuff and all

143

00:05:13,510 --> 00:05:11,440

the details so i'm not going to repeat

144

00:05:15,189 --> 00:05:13,520

anything but again i want to thank all

145

00:05:16,950 --> 00:05:15,199

of you for coming

146

00:05:19,029 --> 00:05:16,960

it's a really exciting time for all of

147

00:05:20,469 --> 00:05:19,039

us and i can only imagine how exciting

148

00:05:21,830 --> 00:05:20,479

it is for you

149

00:05:24,390 --> 00:05:21,840

did you already ask them how many people

150

00:05:27,830 --> 00:05:24,400

have done this before no how many of you

151
00:05:29,830 --> 00:05:27,840
have seen a launch of any kind before

152
00:05:31,510 --> 00:05:29,840
wow this is pretty let me put it this

153
00:05:33,670 --> 00:05:31,520
way who's not seen a launch of any kind

154
00:05:37,430 --> 00:05:33,680
before all right hey now that's good

155
00:05:39,990 --> 00:05:37,440
okay uh it's going to be pretty neat so

156
00:05:41,670 --> 00:05:40,000
sort of that's an understatement

157
00:05:43,510 --> 00:05:41,680
but you you said this morning what it

158
00:05:47,189 --> 00:05:43,520
was going to be it is it's going to be a

159
00:05:49,029 --> 00:05:47,199
bfd but but other than that it's uh

160
00:05:50,550 --> 00:05:49,039
bob and i had the privilege earlier this

161
00:05:52,870 --> 00:05:50,560
morning of actually going out with the

162
00:05:54,230 --> 00:05:52,880
folk from ula and lockheed martin and

163
00:05:56,710 --> 00:05:54,240

kind of standing right beneath the

164

00:05:58,790 --> 00:05:56,720

vehicle and and it is very very very

165

00:06:00,629 --> 00:05:58,800

impressive so again thank you all for

166

00:06:03,029 --> 00:06:00,639

coming thanks for what you do

167

00:06:05,189 --> 00:06:03,039

um why don't we try to go to questions

168

00:06:08,390 --> 00:06:05,199

and since i've got bob captured here

169

00:06:09,189 --> 00:06:08,400

he's gonna have to go do work but uh

170

00:06:13,350 --> 00:06:09,199

two

171

00:06:15,909 --> 00:06:13,360

we'll try to push it charlie okay okay

172

00:06:17,270 --> 00:06:15,919

uh hands please here we go

173

00:06:19,110 --> 00:06:17,280

any questions coming in from the

174

00:06:20,550 --> 00:06:19,120

hinterland

175

00:06:22,710 --> 00:06:20,560

um no

176

00:06:24,309 --> 00:06:22,720

according to uh uh al warden from what

177

00:06:26,230 --> 00:06:24,319

i've heard from him uh when the

178

00:06:27,029 --> 00:06:26,240

parachute failed on apollo 15 it was due

179

00:06:29,990 --> 00:06:27,039

to

180

00:06:32,390 --> 00:06:30,000

low winds that day allowing rcs

181

00:06:34,230 --> 00:06:32,400

fumes from the rcs fuel dump to travel

182

00:06:36,390 --> 00:06:34,240

up the lines up to the parachute has

183

00:06:38,309 --> 00:06:36,400

that been accounted for in the new orion

184

00:06:40,150 --> 00:06:38,319

capsule design and how much redundancy

185

00:06:43,110 --> 00:06:40,160

is there for safety in case of shoot

186

00:06:44,710 --> 00:06:43,120

failure you you have just surpassed the

187

00:06:46,710 --> 00:06:44,720

technical knowledge that both charlie

188

00:06:48,950 --> 00:06:46,720

and i have

189

00:06:51,029 --> 00:06:48,960

hey this is why we have really smart

190

00:06:52,950 --> 00:06:51,039

people working for us who unfortunately

191

00:06:54,790 --> 00:06:52,960

are not here with us right now

192

00:06:58,150 --> 00:06:54,800

you picked the two guys who really don't

193

00:06:59,830 --> 00:06:58,160

like using parachutes as has two pilots

194

00:07:01,350 --> 00:06:59,840

and so we're just going to be very we

195

00:07:03,990 --> 00:07:01,360

did use a parachute it was just to slow

196

00:07:05,749 --> 00:07:04,000

down slow down one on the runway so we

197

00:07:07,589 --> 00:07:05,759

apologize we'll get you an answer though

198

00:07:09,510 --> 00:07:07,599

okay don't don't forget but you know the

199

00:07:12,390 --> 00:07:09,520

answer to that

200

00:07:13,189 --> 00:07:12,400

you don't you're smart rex oh man we

201
00:07:14,790 --> 00:07:13,199
have

202
00:07:17,589 --> 00:07:14,800
rex knows the answer he'll tell you when

203
00:07:20,870 --> 00:07:17,599
he comes up the parachutes were designed

204
00:07:22,309 --> 00:07:20,880
uh at the johnson space center uh it's a

205
00:07:24,230 --> 00:07:22,319
great design they've been thoroughly

206
00:07:25,670 --> 00:07:24,240
tested and i'm confident that they're

207
00:07:27,510 --> 00:07:25,680
going to work exactly as they were

208
00:07:28,550 --> 00:07:27,520
designed

209
00:07:30,390 --> 00:07:28,560
we learned a lot of stuff about

210
00:07:33,350 --> 00:07:30,400
parachutes though like trying to get to

211
00:07:35,110 --> 00:07:33,360
mars and that kind of stuff

212
00:07:37,189 --> 00:07:35,120
first off thanks for uh coming over here

213
00:07:38,070 --> 00:07:37,199

today and uh spending some time with us

214

00:07:40,550 --> 00:07:38,080

um

215

00:07:43,270 --> 00:07:40,560

i've seen in a few of the social media

216

00:07:44,870 --> 00:07:43,280

boards uh a bunch of naysayers saying

217

00:07:46,550 --> 00:07:44,880

that this is not such a big deal and all

218

00:07:47,350 --> 00:07:46,560

this other stuff how do you guys go

219

00:07:49,670 --> 00:07:47,360

ahead and

220

00:07:51,990 --> 00:07:49,680

respond to somebody like that i i said

221

00:07:54,629 --> 00:07:52,000

it's a bfd and you know so that's that's

222

00:07:56,950 --> 00:07:54,639

my no but in all in all seriousness it

223

00:07:58,469 --> 00:07:56,960

is it is a big deal and it's it's a huge

224

00:08:00,469 --> 00:07:58,479

deal for the nation

225

00:08:02,629 --> 00:08:00,479

uh when you stop and think that this

226

00:08:04,469 --> 00:08:02,639

will be the first time we've launched a

227

00:08:07,430 --> 00:08:04,479

vehicle intended to carry humans beyond

228

00:08:10,469 --> 00:08:07,440

low earth orbit in more than 40 years

229

00:08:12,869 --> 00:08:10,479

people ask what's taken so long so that

230

00:08:14,710 --> 00:08:12,879

is a legitimate question uh to to

231

00:08:17,270 --> 00:08:14,720

question whether it's a big deal or not

232

00:08:20,390 --> 00:08:17,280

i i don't think is is fair or legitimate

233

00:08:22,469 --> 00:08:20,400

at all uh it is a huge deal because this

234

00:08:25,350 --> 00:08:22,479

is a continuation of what the apollo

235

00:08:27,029 --> 00:08:25,360

astronauts started uh you know i

236

00:08:29,350 --> 00:08:27,039

when i talked to neil armstrong when i

237

00:08:31,909 --> 00:08:29,360

did talk to neil armstrong and others

238

00:08:34,070 --> 00:08:31,919

they went to the moon not just to go to

239

00:08:36,230 --> 00:08:34,080

the moon they viewed they viewed their

240

00:08:38,709 --> 00:08:36,240

lunar missions as a precursor for humans

241

00:08:41,750 --> 00:08:38,719

going on to other places mars being one

242

00:08:43,990 --> 00:08:41,760

of them so uh we have taken a 40-year

243

00:08:46,070 --> 00:08:44,000

hiatus in trying to make this trek and

244

00:08:48,630 --> 00:08:46,080

now we're back on the path i think for

245

00:08:50,870 --> 00:08:48,640

the first time at least since bob and i

246

00:08:53,110 --> 00:08:50,880

have been engaged in the space program

247

00:08:54,790 --> 00:08:53,120

we're closer than 30 years away from

248

00:08:56,310 --> 00:08:54,800

from going and the team is really

249

00:08:57,750 --> 00:08:56,320

excited about when charlie mentions that

250

00:08:59,590 --> 00:08:57,760

they were looking forward to mars even

251
00:09:01,829 --> 00:08:59,600
when they went on the moon that first

252
00:09:03,190 --> 00:09:01,839
apollo 11 crew you know that went to the

253
00:09:04,470 --> 00:09:03,200
moon the first crew that actually be on

254
00:09:06,230 --> 00:09:04,480
the surface

255
00:09:08,470 --> 00:09:06,240
brought us a patch we have a patch

256
00:09:10,790 --> 00:09:08,480
signed and it's signed by the apollo 11

257
00:09:12,550 --> 00:09:10,800
crew to be taken you know it's for the

258
00:09:15,509 --> 00:09:12,560
crew to take to mars when they go to

259
00:09:17,430 --> 00:09:15,519
mars and that was that was back in 1969

260
00:09:19,110 --> 00:09:17,440
they thought of that uh you know the

261
00:09:21,350 --> 00:09:19,120
other part of this is if you look at the

262
00:09:23,430 --> 00:09:21,360
apollo missions the longest apollo

263
00:09:25,430 --> 00:09:23,440

mission was like 12 days the orion

264

00:09:27,430 --> 00:09:25,440

capsule it's bigger it's designed for a

265

00:09:30,230 --> 00:09:27,440

crew of four it has with a crew of four

266

00:09:31,990 --> 00:09:30,240

it has a 21 day design life in space it

267

00:09:34,389 --> 00:09:32,000

is a big deal it's a it's a much bigger

268

00:09:35,910 --> 00:09:34,399

design and we know a lot more now than

269

00:09:37,670 --> 00:09:35,920

we knew back during the apollo program

270

00:09:40,310 --> 00:09:37,680

to really make this our deep space

271

00:09:42,389 --> 00:09:40,320

vehicle now obviously it has to hook up

272

00:09:45,430 --> 00:09:42,399

with a habitability module to be you

273

00:09:47,430 --> 00:09:45,440

know for extended periods of time but

274

00:09:49,110 --> 00:09:47,440

with a crew 2 we got at least 27 days

275

00:09:51,990 --> 00:09:49,120

with it who's here from somewhere other

276

00:09:53,110 --> 00:09:52,000

than the u.s i know there are a lot

277

00:09:54,949 --> 00:09:53,120

you know

278

00:09:55,910 --> 00:09:54,959

you weren't a partner when we went to

279

00:09:58,150 --> 00:09:55,920

the moon

280

00:10:00,150 --> 00:09:58,160

uh we didn't have any partners

281

00:10:01,829 --> 00:10:00,160

when we went to the moon there was no

282

00:10:03,829 --> 00:10:01,839

commercial space

283

00:10:05,590 --> 00:10:03,839

when we went to the moon so what is what

284

00:10:07,670 --> 00:10:05,600

is big about this

285

00:10:09,750 --> 00:10:07,680

is that we have now reached out and

286

00:10:11,190 --> 00:10:09,760

we're engaging more people in actually

287

00:10:13,670 --> 00:10:11,200

being a part

288

00:10:15,590 --> 00:10:13,680

of this than i think many people ever

289

00:10:19,670 --> 00:10:15,600

dreamed of when in the days of the

290

00:10:21,509 --> 00:10:19,680

apollo era uh you know the cold war

291

00:10:23,430 --> 00:10:21,519

uh we were involved in a space race

292

00:10:25,590 --> 00:10:23,440

we're not in a space race anymore no

293

00:10:27,269 --> 00:10:25,600

matter what anybody tells you there it

294

00:10:29,910 --> 00:10:27,279

there is sort of a little space race but

295

00:10:31,750 --> 00:10:29,920

that space race thank goodness is among

296

00:10:34,150 --> 00:10:31,760

american companies

297

00:10:35,829 --> 00:10:34,160

trying to see who can be the best who

298

00:10:37,670 --> 00:10:35,839

can be the most efficient who can get

299

00:10:40,710 --> 00:10:37,680

the cost down the most and they're

300

00:10:42,790 --> 00:10:40,720

forcing uh you know manufacturers around

301
00:10:44,550 --> 00:10:42,800
the world to take a look at their

302
00:10:46,069 --> 00:10:44,560
processes at their pricing and

303
00:10:47,910 --> 00:10:46,079
everything so that is a tremendous

304
00:10:49,910 --> 00:10:47,920
difference we're we're not only doing

305
00:10:52,550 --> 00:10:49,920
technological advances in terms of

306
00:10:54,790 --> 00:10:52,560
hardware but we're doing game changing

307
00:10:57,269 --> 00:10:54,800
advances in terms of business practices

308
00:10:58,790 --> 00:10:57,279
how you do things okay and when i look

309
00:11:00,389 --> 00:10:58,800
at international partnerships i look at

310
00:11:02,790 --> 00:11:00,399
the international space station when you

311
00:11:06,630 --> 00:11:02,800
consider you know we got russia canada

312
00:11:09,030 --> 00:11:06,640
tomorrow is his anniversary space agency

313
00:11:10,949 --> 00:11:09,040

you know uh we have learned how to work

314

00:11:12,550 --> 00:11:10,959

together in space the agreements that

315

00:11:14,790 --> 00:11:12,560

had to go into place to make that happen

316

00:11:16,550 --> 00:11:14,800

and i think it's a model for how we

317

00:11:18,630 --> 00:11:16,560

explore in space how we work in space

318

00:11:20,230 --> 00:11:18,640

together and it set the stage for how

319

00:11:21,990 --> 00:11:20,240

we're going to explore when we go beyond

320

00:11:23,590 --> 00:11:22,000

planet earth and as charlie mentioned i

321

00:11:24,710 --> 00:11:23,600

do have to throw this out i think it's

322

00:11:27,030 --> 00:11:24,720

kind of cool

323

00:11:28,870 --> 00:11:27,040

tomorrow is the

324

00:11:30,470 --> 00:11:28,880

16th anniversary the first space station

325

00:11:32,630 --> 00:11:30,480

assembly mission and we're launching the

326

00:11:35,269 --> 00:11:32,640

very first mission on our new vehicle to

327

00:11:38,310 --> 00:11:35,279

explore beyond starting by his truly an

328

00:11:39,829 --> 00:11:38,320

inter in but that doesn't matter

329

00:11:41,110 --> 00:11:39,839

charlie bob this is a unique event we

330

00:11:42,949 --> 00:11:41,120

actually have eight uh space flight

331

00:11:44,790 --> 00:11:42,959

centers or nasa field centers on the

332

00:11:47,750 --> 00:11:44,800

line we have a question from nasa ames

333

00:11:50,870 --> 00:11:48,949

go ahead

334

00:11:52,790 --> 00:11:50,880

great hey we're happy to be here and

335

00:11:54,389 --> 00:11:52,800

representing nasa ames we wanted to ask

336

00:11:57,190 --> 00:11:54,399

you what the significance of the name

337

00:11:59,430 --> 00:11:57,200

orion is and um it seems to pop up in a

338

00:12:00,470 --> 00:11:59,440

lot of programs but it is attached to

339

00:12:01,509 --> 00:12:00,480

this program we want to find out a

340

00:12:03,110 --> 00:12:01,519

little bit more about why it was named

341

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

orion thank you i have a clue but i'm

342

00:12:07,509 --> 00:12:06,000

going to tell you what i read okay

343

00:12:09,590 --> 00:12:07,519

i i really don't

344

00:12:11,030 --> 00:12:09,600

i and i just read this the other day and

345

00:12:12,949 --> 00:12:11,040

i'm counting on because it came from a

346

00:12:15,190 --> 00:12:12,959

media person so i'm counting on it being

347

00:12:17,670 --> 00:12:15,200

true and well researched

348

00:12:19,910 --> 00:12:17,680

that is not tongue said tongue-in-cheek

349

00:12:22,230 --> 00:12:19,920

orion came about in the constellation

350

00:12:24,069 --> 00:12:22,240

program and and the team at the time

351
00:12:26,230 --> 00:12:24,079
felt that what more appropriate to be a

352
00:12:27,750 --> 00:12:26,240
part of of a constellation program than

353
00:12:30,150 --> 00:12:27,760
to name it for a constellation

354
00:12:31,750 --> 00:12:30,160
constellation orion so that's what i'm i

355
00:12:34,069 --> 00:12:31,760
am told that that's how the name came

356
00:12:36,310 --> 00:12:34,079
about you know subsequently or most of

357
00:12:39,030 --> 00:12:36,320
the times we go out nowadays and we ask

358
00:12:41,269 --> 00:12:39,040
kids to help us name things i think nasa

359
00:12:42,310 --> 00:12:41,279
named it internally but but i don't know

360
00:12:43,509 --> 00:12:42,320
for real

361
00:12:45,110 --> 00:12:43,519
sounds good to me

362
00:12:47,110 --> 00:12:45,120
bob says it's close and he was still

363
00:12:49,190 --> 00:12:47,120

around but that's the answer i got when

364

00:12:52,710 --> 00:12:49,200

i consulted one of my most

365

00:12:54,150 --> 00:12:52,720

valuable assets which is u.s media

366

00:12:55,190 --> 00:12:54,160

we'll come back to the room in a second

367

00:12:57,509 --> 00:12:55,200

we have one more question from field

368

00:13:01,269 --> 00:12:57,519

center we have a question from uh glenn

369

00:13:06,710 --> 00:13:04,150

hi um can you tell us what factors go

370

00:13:08,790 --> 00:13:06,720

into the launch

371

00:13:10,870 --> 00:13:08,800

window because you're not trying to

372

00:13:12,470 --> 00:13:10,880

rendezvous with anything

373

00:13:13,910 --> 00:13:12,480

so could you just explain that to us

374

00:13:15,190 --> 00:13:13,920

please

375

00:13:17,829 --> 00:13:15,200

i think we got about a two and a half

376

00:13:19,030 --> 00:13:17,839

hour launch window on this one and

377

00:13:20,949 --> 00:13:19,040

it's

378

00:13:22,790 --> 00:13:20,959

you know i don't know what the

379

00:13:24,230 --> 00:13:22,800

end cut off is the requirement i'm sure

380

00:13:25,670 --> 00:13:24,240

it's requirements on the vehicle and

381

00:13:27,110 --> 00:13:25,680

fueling and a few other things it

382

00:13:28,310 --> 00:13:27,120

depends on where they are in account if

383

00:13:31,030 --> 00:13:28,320

it were a shuttle i could tell you

384

00:13:32,870 --> 00:13:31,040

precisely but uh yeah i don't know what

385

00:13:35,030 --> 00:13:32,880

the limiting factor is on why it's where

386

00:13:37,509 --> 00:13:35,040

it is but the weather forecast for

387

00:13:39,269 --> 00:13:37,519

tomorrow is 70 percent go uh the weather

388

00:13:41,590 --> 00:13:39,279

off the california coast is great for

389

00:13:43,509 --> 00:13:41,600

recovery uh with the two and a half hour

390

00:13:45,350 --> 00:13:43,519

launch window i'm fairly confident we're

391

00:13:46,870 --> 00:13:45,360

going to find time to get off rex where

392

00:13:49,350 --> 00:13:46,880

are you

393

00:13:53,030 --> 00:13:49,360

is rex coming on next

394

00:13:54,949 --> 00:13:53,040

year later okay go find out two things

395

00:13:56,069 --> 00:13:54,959

why did we pick orion

396

00:13:58,069 --> 00:13:56,079

as a name

397

00:13:59,910 --> 00:13:58,079

and and so you can answer his question

398

00:14:04,870 --> 00:13:59,920

about why two and a half hours instead

399

00:14:09,910 --> 00:14:06,629

ah

400

00:14:12,069 --> 00:14:09,920

spoken as a true expert did did you

401
00:14:13,990 --> 00:14:12,079
hey come get a mic real quick here you

402
00:14:15,670 --> 00:14:14,000
go come on up rex i know you're

403
00:14:19,189 --> 00:14:15,680
we're cheating bringing rex up early

404
00:14:23,590 --> 00:14:21,590
come on up come on sure

405
00:14:25,750 --> 00:14:23,600
explain that so what's your answer there

406
00:14:27,110 --> 00:14:25,760
it's a it's kind of a complicated uh

407
00:14:28,550 --> 00:14:27,120
calculus they have to go into because

408
00:14:29,750 --> 00:14:28,560
they have to maintain the ability to

409
00:14:30,790 --> 00:14:29,760
launch the vehicle from here but they

410
00:14:32,790 --> 00:14:30,800
also have to have the ability to

411
00:14:34,230 --> 00:14:32,800
retrieve it and we're trying this out

412
00:14:36,389 --> 00:14:34,240
for the first time this is not easy to

413
00:14:37,670 --> 00:14:36,399

pull a vehicle into a well deck ship the

414

00:14:39,110 --> 00:14:37,680

way we're recovering it so they have to

415

00:14:40,790 --> 00:14:39,120

have enough crew duty day enough

416

00:14:42,310 --> 00:14:40,800

lighting out in the pacific to recover

417

00:14:44,550 --> 00:14:42,320

it in time so they i think that kind of

418

00:14:46,790 --> 00:14:44,560

narrows down the window see i would have

419

00:14:48,870 --> 00:14:46,800

guessed that

420

00:14:50,710 --> 00:14:48,880

but it would have been a guess and rex

421

00:14:52,150 --> 00:14:50,720

is a current active astronaut and he's

422

00:14:54,069 --> 00:14:52,160

been involved in all this stuff so he's

423

00:14:56,470 --> 00:14:54,079

going to give you all the straight scoop

424

00:15:00,150 --> 00:14:58,389

we have time for one more question uh

425

00:15:01,750 --> 00:15:00,160

and then i know the administrator has to

426
00:15:02,949 --> 00:15:01,760
run so

427
00:15:04,790 --> 00:15:02,959
this is just easy it's right here in

428
00:15:07,430 --> 00:15:04,800
front

429
00:15:08,790 --> 00:15:07,440
i'm curious to know are there any

430
00:15:10,710 --> 00:15:08,800
scientific

431
00:15:12,550 --> 00:15:10,720
experiments or missions that we're

432
00:15:14,150 --> 00:15:12,560
leveraging as part of this test launch

433
00:15:15,670 --> 00:15:14,160
so even though it's a test launch are

434
00:15:17,509 --> 00:15:15,680
there even some short experiments that

435
00:15:19,509 --> 00:15:17,519
we're sending up the one that i'm most

436
00:15:22,550 --> 00:15:19,519
proud of is coming out of something

437
00:15:23,670 --> 00:15:22,560
called the uh the exploration design

438
00:15:25,990 --> 00:15:23,680

challenge

439

00:15:27,990 --> 00:15:26,000

and uh and the scientist are high school

440

00:15:29,350 --> 00:15:28,000

students from the hampton roads virginia

441

00:15:30,949 --> 00:15:29,360

area who won

442

00:15:33,350 --> 00:15:30,959

the exploration design challenge

443

00:15:35,269 --> 00:15:33,360

co-sponsored by lockheed martin and nasa

444

00:15:36,710 --> 00:15:35,279

where we went out and said look we um

445

00:15:39,030 --> 00:15:36,720

radiation is one of the biggest

446

00:15:41,110 --> 00:15:39,040

challenges for us radiation and its

447

00:15:43,350 --> 00:15:41,120

potential damage to the crew

448

00:15:45,910 --> 00:15:43,360

can somebody help us come up with a way

449

00:15:49,110 --> 00:15:45,920

to protect the crew during long duration

450

00:15:52,790 --> 00:15:49,120

flights to mars and um and there were

451
00:15:54,389 --> 00:15:52,800
like 25 000 responses within a day

452
00:15:56,710 --> 00:15:54,399
i think in the end we had a hundred

453
00:15:58,710 --> 00:15:56,720
thousand or so contestants and and an

454
00:16:02,629 --> 00:15:58,720
expert panel of people picked the five

455
00:16:04,710 --> 00:16:02,639
finalists so all five teams should be uh

456
00:16:07,110 --> 00:16:04,720
here at the cape for the launch in the

457
00:16:09,350 --> 00:16:07,120
morning and the winning team from the

458
00:16:11,350 --> 00:16:09,360
hampton roads area near langley

459
00:16:14,310 --> 00:16:11,360
research center actually have their

460
00:16:15,670 --> 00:16:14,320
experiment inside orion being flown so

461
00:16:17,749 --> 00:16:15,680
that's one

462
00:16:20,949 --> 00:16:17,759
science experiment that i know is being

463
00:16:23,590 --> 00:16:20,959

done the other experiments uh relate to

464

00:16:25,030 --> 00:16:23,600

to um thermodynamics we're looking at

465

00:16:27,030 --> 00:16:25,040

the heat shield

466

00:16:28,629 --> 00:16:27,040

and whether or not it is strong enough

467

00:16:30,949 --> 00:16:28,639

to withstand the temperatures and

468

00:16:32,790 --> 00:16:30,959

pressures of re-entry in a in in about

469

00:16:36,069 --> 00:16:32,800

an 85

470

00:16:38,710 --> 00:16:36,079

scenario for coming back from the moon

471

00:16:39,749 --> 00:16:38,720

we're looking at it it's communications

472

00:16:42,069 --> 00:16:39,759

and other stuff looking at the

473

00:16:43,990 --> 00:16:42,079

navigation and control on board during

474

00:16:46,230 --> 00:16:44,000

the flight and then the going back to

475

00:16:48,389 --> 00:16:46,240

the parachutes um that that really is

476

00:16:50,949 --> 00:16:48,399

aerodynamics and so we're looking at

477

00:16:52,870 --> 00:16:50,959

we're looking at essentially um

478

00:16:55,269 --> 00:16:52,880

high-speed aerodynamics the performance

479

00:16:57,430 --> 00:16:55,279

of the parachutes as they try to open

480

00:16:59,509 --> 00:16:57,440

uh in a case where we're coming back you

481

00:17:01,430 --> 00:16:59,519

know starting out at 20 000 miles per

482

00:17:02,790 --> 00:17:01,440

hour and then decelerating

483

00:17:04,390 --> 00:17:02,800

it's a great test flight i mean we're

484

00:17:07,270 --> 00:17:04,400

looking at separation of the launch

485

00:17:10,150 --> 00:17:07,280

abort system the panels on the

486

00:17:12,470 --> 00:17:10,160

service module it's got 1200 sensors on

487

00:17:15,110 --> 00:17:12,480

it that are specific for getting data

488

00:17:16,470 --> 00:17:15,120

there's like 50 miles of wiring just for

489

00:17:18,470 --> 00:17:16,480

the sensors

490

00:17:21,909 --> 00:17:18,480

that are unique to this flight for

491

00:17:24,069 --> 00:17:21,919

gathering data any of you sailors

492

00:17:25,750 --> 00:17:24,079

uh okay you know how when you're trying

493

00:17:27,270 --> 00:17:25,760

to go back and forth and you're trying

494

00:17:28,630 --> 00:17:27,280

to get to something in the ocean and

495

00:17:30,310 --> 00:17:28,640

you're you're doing this mental

496

00:17:32,710 --> 00:17:30,320

gymnastics you're doing the trigonometry

497

00:17:34,870 --> 00:17:32,720

and the geometry in your brain uh we've

498

00:17:37,750 --> 00:17:34,880

got the crew of the uss anchorage that

499

00:17:38,950 --> 00:17:37,760

is um a helicopter well it's a it's a an

500

00:17:40,630 --> 00:17:38,960

amphibious

501
00:17:42,070 --> 00:17:40,640
readiness vehicle that carries marines

502
00:17:44,630 --> 00:17:42,080
around the world and they're getting

503
00:17:45,830 --> 00:17:44,640
ready to deploy but before they deploy

504
00:17:48,070 --> 00:17:45,840
they're actually going to recover the

505
00:17:50,230 --> 00:17:48,080
vehicle tomorrow afternoon and having

506
00:17:52,310 --> 00:17:50,240
been aboard watching them go through one

507
00:17:54,710 --> 00:17:52,320
of the final exercises it was actually

508
00:17:56,870 --> 00:17:54,720
incredible to watch this crew

509
00:17:58,870 --> 00:17:56,880
the navigator working with the officer

510
00:18:00,630 --> 00:17:58,880
of the deck underway to determine

511
00:18:02,789 --> 00:18:00,640
exactly where they go and how they

512
00:18:04,150 --> 00:18:02,799
approach the capsule that's floating out

513
00:18:07,029 --> 00:18:04,160

there they had to take winds into

514

00:18:09,029 --> 00:18:07,039

consideration the the you know the drift

515

00:18:10,870 --> 00:18:09,039

of the of the ocean waves and all this

516

00:18:12,789 --> 00:18:10,880

other kind of stuff so that when they

517

00:18:14,150 --> 00:18:12,799

got there the vehicle wouldn't go

518

00:18:16,470 --> 00:18:14,160

zipping by them and they wouldn't have

519

00:18:17,430 --> 00:18:16,480

to do u-turns and everything else so

520

00:18:19,430 --> 00:18:17,440

it's

521

00:18:21,270 --> 00:18:19,440

it isn't it is an art as much as a

522

00:18:23,270 --> 00:18:21,280

science just to pick the vehicle up and

523

00:18:25,110 --> 00:18:23,280

i didn't even mention that as a test but

524

00:18:27,110 --> 00:18:25,120

this will be a very important test for

525

00:18:29,590 --> 00:18:27,120

the u.s navy to make sure that they

526

00:18:31,909 --> 00:18:29,600

understand how do we successfully pick

527

00:18:33,669 --> 00:18:31,919

up this vehicle because a couple of

528

00:18:35,430 --> 00:18:33,679

flights from now it's actually going to

529

00:18:37,430 --> 00:18:35,440

have people in it and we want to make

530

00:18:39,750 --> 00:18:37,440

sure that we pick them up as quickly as

531

00:18:41,110 --> 00:18:39,760

we can first pass so we can get them out

532

00:18:43,909 --> 00:18:41,120

of that thing because they will have

533

00:18:45,750 --> 00:18:43,919

been you know in space uh around the

534

00:18:46,950 --> 00:18:45,760

moon and doing all kinds of stuff and we

535

00:18:49,990 --> 00:18:46,960

really want to get them out as quickly

536

00:18:52,630 --> 00:18:50,000

and safely as we can so this is a that's

537

00:18:54,470 --> 00:18:52,640

probably the final test for the vehicle

538

00:18:55,990 --> 00:18:54,480

is to see if we can integrate the navy

539

00:18:57,669 --> 00:18:56,000

in and make the successful pickup so

540

00:18:59,110 --> 00:18:57,679

that's it you all have been great thanks

541

00:19:02,549 --> 00:18:59,120

so much for letting bob and me come in

542

00:19:15,190 --> 00:19:03,870

thank

543

00:19:19,350 --> 00:19:17,110

so we are going to mars

544

00:19:20,870 --> 00:19:19,360

nasa is going to mars what are we doing

545

00:19:23,029 --> 00:19:20,880

right now to learn about how we're going

546

00:19:24,310 --> 00:19:23,039

to get there what are we doing on mars

547

00:19:26,230 --> 00:19:24,320

right now and how is this helping tell

548

00:19:27,669 --> 00:19:26,240

that story not only that what kind of

549

00:19:42,549 --> 00:19:27,679

technology do we need to do to actually

550

00:19:46,470 --> 00:19:44,870

as we expand our presence into the solar

551
00:19:48,630 --> 00:19:46,480
system with human and robotic

552
00:19:50,870 --> 00:19:48,640
exploration we're learning more about

553
00:19:52,870 --> 00:19:50,880
the formation and evolution of mars

554
00:19:56,150 --> 00:19:52,880
which can help us learn more about our

555
00:19:58,230 --> 00:19:56,160
own planet's history and future

556
00:20:00,310 --> 00:19:58,240
in the past the red planet had

557
00:20:02,630 --> 00:20:00,320
conditions suitable for life

558
00:20:04,150 --> 00:20:02,640
and future exploration may uncover

559
00:20:06,789 --> 00:20:04,160
evidence of life

560
00:20:09,830 --> 00:20:06,799
answering one of the oldest questions

561
00:20:11,750 --> 00:20:09,840
does life exist beyond earth nasa is on

562
00:20:13,669 --> 00:20:11,760
a journey to mars and the first humans

563
00:20:16,470 --> 00:20:13,679

who'll set foot on mars are alive on

564

00:20:22,470 --> 00:20:19,510

rovers and spacecraft are on and around

565

00:20:24,549 --> 00:20:22,480

mars studying its conditions revealing

566

00:20:27,110 --> 00:20:24,559

its history and showing us the red

567

00:20:29,830 --> 00:20:27,120

planet like never before

568

00:20:31,590 --> 00:20:29,840

on earth and in space we're doing the

569

00:20:34,470 --> 00:20:31,600

hard work to prepare for missions

570

00:20:38,230 --> 00:20:34,480

farther than ever before first to an

571

00:20:40,870 --> 00:20:38,240

asteroid and then onward to pioneer mars

572

00:20:43,350 --> 00:20:40,880

during the past 40 years nasa explored

573

00:20:45,669 --> 00:20:43,360

mars through robotic spacecraft landers

574

00:20:47,669 --> 00:20:45,679

and rovers dramatically increasing our

575

00:20:49,270 --> 00:20:47,679

knowledge about the red planet and

576
00:20:50,549 --> 00:20:49,280
paving the way for future human

577
00:20:52,630 --> 00:20:50,559
explorers

578
00:20:55,270 --> 00:20:52,640
future missions seeking signs of past

579
00:20:57,270 --> 00:20:55,280
life will demonstrate new technology

580
00:20:59,270 --> 00:20:57,280
that could help astronauts survive on

581
00:21:01,270 --> 00:20:59,280
mars i think some of the most amazing

582
00:21:02,950 --> 00:21:01,280
things that we're learning are actually

583
00:21:04,470 --> 00:21:02,960
how to be really good detectives on

584
00:21:07,029 --> 00:21:04,480
another planet which is a really

585
00:21:09,830 --> 00:21:07,039
difficult job nasa's human mission to

586
00:21:12,149 --> 00:21:09,840
mars begins in low earth orbit aboard

587
00:21:14,230 --> 00:21:12,159
the international space station where

588
00:21:16,789 --> 00:21:14,240

astronauts are approving technologies

589

00:21:19,270 --> 00:21:16,799

and communications systems needed for

590

00:21:21,270 --> 00:21:19,280

human missions into deep space

591

00:21:23,590 --> 00:21:21,280

the space station also teaches us how

592

00:21:26,230 --> 00:21:23,600

the human body changes in space

593

00:21:28,310 --> 00:21:26,240

so we can protect astronaut health on

594

00:21:31,110 --> 00:21:28,320

long-duration missions deeper into the

595

00:21:33,270 --> 00:21:31,120

solar system nasa will test other new

596

00:21:35,669 --> 00:21:33,280

technologies needed to send humans to

597

00:21:38,710 --> 00:21:35,679

mars in the first ever mission to

598

00:21:41,350 --> 00:21:38,720

capture and redirect an asteroid mass to

599

00:21:42,950 --> 00:21:41,360

a stable orbit around the moon

600

00:21:45,430 --> 00:21:42,960

astronauts aboard nasa's orion

601
00:21:47,590 --> 00:21:45,440
spacecraft will explore the asteroid in

602
00:21:48,789 --> 00:21:47,600
the 2020s and return to earth with

603
00:21:51,110 --> 00:21:48,799
samples

604
00:21:53,909 --> 00:21:51,120
this experience will help nasa test new

605
00:21:56,230 --> 00:21:53,919
systems and capabilities such as solar

606
00:21:58,630 --> 00:21:56,240
electric propulsion which is a highly

607
00:22:00,950 --> 00:21:58,640
efficient way to send heavy cargo ahead

608
00:22:03,270 --> 00:22:00,960
of human missions to mars

609
00:22:05,110 --> 00:22:03,280
astronauts will travel in an orion

610
00:22:07,350 --> 00:22:05,120
launched atop a space launch system

611
00:22:09,750 --> 00:22:07,360
heavy lift rocket which will be the most

612
00:22:12,149 --> 00:22:09,760
powerful rocket ever flown apollo

613
00:22:14,070 --> 00:22:12,159

happened before i was born so this for

614

00:22:15,830 --> 00:22:14,080

our generation will be

615

00:22:22,549 --> 00:22:15,840

the exploration missions that we get to

616

00:22:27,430 --> 00:22:24,630

the journey to mars will improve lives

617

00:22:29,510 --> 00:22:27,440

on earth in important ways we'll

618

00:22:31,990 --> 00:22:29,520

increase scientific knowledge that could

619

00:22:34,149 --> 00:22:32,000

help us better understand earth

620

00:22:36,630 --> 00:22:34,159

we'll also develop new technologies and

621

00:22:38,230 --> 00:22:36,640

economic opportunities right here in the

622

00:22:40,630 --> 00:22:38,240

united states

623

00:22:42,710 --> 00:22:40,640

and will advance u.s leadership in the

624

00:22:43,909 --> 00:22:42,720

peaceful international exploration of

625

00:22:46,710 --> 00:22:43,919

space

626
00:22:49,110 --> 00:22:46,720
but make no mistake the journey to mars

627
00:22:50,950 --> 00:22:49,120
will be the challenge of a generation

628
00:22:53,990 --> 00:22:50,960
to send humans to the red planet and

629
00:22:55,830 --> 00:22:54,000
return them safely so we can go back

630
00:22:58,390 --> 00:22:55,840
keep exploring and

631
00:23:01,990 --> 00:22:58,400
push the frontiers of discoveries

632
00:23:03,110 --> 00:23:02,000
it's a journey well worth the risks

633
00:23:05,590 --> 00:23:03,120
today

634
00:23:07,990 --> 00:23:05,600
our engineers and scientists are working

635
00:23:10,870 --> 00:23:08,000
hard to develop the technologies

636
00:23:13,350 --> 00:23:10,880
astronauts will use to travel to

637
00:23:14,470 --> 00:23:13,360
and work on the red planet

638
00:23:26,470 --> 00:23:14,480

join us

639

00:23:29,830 --> 00:23:27,990

and joining us live here today to talk

640

00:23:31,270 --> 00:23:29,840

about nasa's journey to mars

641

00:23:32,870 --> 00:23:31,280

from left to right is the associate

642

00:23:39,510 --> 00:23:32,880

administrator for human explorer

643

00:23:42,549 --> 00:23:40,789

to his left is the association

644

00:23:44,950 --> 00:23:42,559

administrator for a science mission

645

00:23:50,149 --> 00:23:44,960

director and a veteran of five space

646

00:23:53,029 --> 00:23:51,270

following him is the associate

647

00:23:57,669 --> 00:23:53,039

administrator for space technology mike

648

00:23:57,679 --> 00:24:04,070

our chief scientist ellen stofan

649

00:24:04,080 --> 00:24:09,029

and our chief technologist david miller

650

00:24:14,230 --> 00:24:11,269

let's start with mr gerschmeyer

651
00:24:15,909 --> 00:24:14,240
thanks john it's uh great to be here

652
00:24:17,750 --> 00:24:15,919
it's really exciting to look out in this

653
00:24:19,750 --> 00:24:17,760
audience and see a lot of young faces

654
00:24:21,029 --> 00:24:19,760
and and folks that are actually excited

655
00:24:22,310 --> 00:24:21,039
about what we're talking about and what

656
00:24:24,310 --> 00:24:22,320
we're doing and

657
00:24:25,750 --> 00:24:24,320
and it's not that i i meet other

658
00:24:27,190 --> 00:24:25,760
audiences that aren't there but i don't

659
00:24:28,950 --> 00:24:27,200
typically meet audiences with this

660
00:24:31,269 --> 00:24:28,960
demographic so this is pretty awesome

661
00:24:33,110 --> 00:24:31,279
for me to get a chance to to see you and

662
00:24:34,630 --> 00:24:33,120
get a chance to interact with you we'll

663
00:24:36,070 --> 00:24:34,640

talk to you a little bit about the

664

00:24:37,909 --> 00:24:36,080

journey to mars and we'll answer a lot

665

00:24:39,909 --> 00:24:37,919

of questions i think the thing that's

666

00:24:41,590 --> 00:24:39,919

important and john will talk about it in

667

00:24:43,909 --> 00:24:41,600

a minute is you know we're really on

668

00:24:45,669 --> 00:24:43,919

mars today and john will describe that

669

00:24:47,269 --> 00:24:45,679

so we're already there we're doing the

670

00:24:48,870 --> 00:24:47,279

international space station where we've

671

00:24:50,870 --> 00:24:48,880

got crews on orbit today that are

672

00:24:52,549 --> 00:24:50,880

actually preparing and understanding how

673

00:24:54,870 --> 00:24:52,559

the human body performs in the

674

00:24:56,470 --> 00:24:54,880

microgravity environment of space we're

675

00:24:58,310 --> 00:24:56,480

understanding how our hardware systems

676

00:24:59,990 --> 00:24:58,320

operate onboard space station for the

677

00:25:01,990 --> 00:25:00,000

long durations will be required to go to

678

00:25:04,070 --> 00:25:02,000

mars so we're really gaining really

679

00:25:06,070 --> 00:25:04,080

critical data today that helps us kind

680

00:25:07,590 --> 00:25:06,080

of pave that way going forward on space

681

00:25:09,590 --> 00:25:07,600

station next year we'll have the

682

00:25:11,669 --> 00:25:09,600

one-year expedition on board space

683

00:25:13,669 --> 00:25:11,679

station it'll be great to just get a

684

00:25:15,269 --> 00:25:13,679

data point to see what the what it's

685

00:25:16,630 --> 00:25:15,279

really like to go beyond the six month

686

00:25:18,549 --> 00:25:16,640

period and see if there's anything from

687

00:25:21,110 --> 00:25:18,559

a human physiological standpoint that

688

00:25:22,789 --> 00:25:21,120

changes that requires some extra help

689

00:25:24,950 --> 00:25:22,799

um you've got the expiration flight test

690

00:25:27,350 --> 00:25:24,960

which are all down here to see today to

691

00:25:29,190 --> 00:25:27,360

see the orion capsule fly it's pretty

692

00:25:30,870 --> 00:25:29,200

exciting seeing all the work that's come

693

00:25:32,630 --> 00:25:30,880

together to put that vehicle together

694

00:25:34,549 --> 00:25:32,640

and and to see the teams that are really

695

00:25:36,230 --> 00:25:34,559

ready to go execute that mission and and

696

00:25:38,070 --> 00:25:36,240

we're kind of beginning to move forward

697

00:25:39,750 --> 00:25:38,080

so i think you can start to see real

698

00:25:41,190 --> 00:25:39,760

progress as we're moving on this this

699

00:25:43,590 --> 00:25:41,200

journey to mars

700

00:25:45,350 --> 00:25:43,600

you know i often put the focus really on

701
00:25:47,029 --> 00:25:45,360
to be on journey this is something that

702
00:25:49,590 --> 00:25:47,039
is not easy it's not going to be easy

703
00:25:51,110 --> 00:25:49,600
for us to go do the scientific

704
00:25:52,630 --> 00:25:51,120
information that we're getting from john

705
00:25:54,710 --> 00:25:52,640
is absolutely critical we have a

706
00:25:56,470 --> 00:25:54,720
radiation monitor on mars today which is

707
00:25:58,950 --> 00:25:56,480
helpful for the human aspects we're

708
00:26:01,190 --> 00:25:58,960
going to do a 2020 rover with john and

709
00:26:02,789 --> 00:26:01,200
mike gazerick and we're going to have a

710
00:26:04,390 --> 00:26:02,799
ability to pull oxygen out of the

711
00:26:06,230 --> 00:26:04,400
martian atmosphere to go look at the

712
00:26:07,909 --> 00:26:06,240
ability that we could use

713
00:26:09,430 --> 00:26:07,919

some of the resources at mars so we

714

00:26:11,430 --> 00:26:09,440

don't have to carry everything with us

715

00:26:13,430 --> 00:26:11,440

so so to go from where we are today in

716

00:26:15,190 --> 00:26:13,440

the earth reliant region to the proving

717

00:26:17,350 --> 00:26:15,200

ground to earth independent is going to

718

00:26:19,350 --> 00:26:17,360

be just a huge journey a huge challenge

719

00:26:21,510 --> 00:26:19,360

and that's really what we're all about

720

00:26:23,430 --> 00:26:21,520

so it's it's not just mars it's not just

721

00:26:25,590 --> 00:26:23,440

a single mission it's actually pushing

722

00:26:28,230 --> 00:26:25,600

human human presence into the solar

723

00:26:30,470 --> 00:26:28,240

system so john

724

00:26:32,710 --> 00:26:30,480

thanks uh welcome everyone this is

725

00:26:34,870 --> 00:26:32,720

really exciting uh of course i grew up

726
00:26:36,789 --> 00:26:34,880
always wanting to launch rockets and had

727
00:26:38,630 --> 00:26:36,799
the privilege to fly on some and

728
00:26:40,149 --> 00:26:38,640
tomorrow we get to watch a really cool

729
00:26:41,750 --> 00:26:40,159
rocket launch

730
00:26:42,950 --> 00:26:41,760
at nasa i believe our mission is to

731
00:26:45,830 --> 00:26:42,960
innovate

732
00:26:48,710 --> 00:26:45,840
to explore when we explore we discover

733
00:26:53,590 --> 00:26:48,720
and when we discover things it inspires

734
00:26:56,070 --> 00:26:53,600
how many of you were born after 1976

735
00:26:58,789 --> 00:26:56,080
yeah quite a few hands going up no you

736
00:27:02,950 --> 00:27:00,789
well for all of the those of you that

737
00:27:05,110 --> 00:27:02,960
were born after 1976

738
00:27:07,590 --> 00:27:05,120

you've never known a time when we have

739

00:27:08,549 --> 00:27:07,600

not been exploring on the surface of

740

00:27:11,110 --> 00:27:08,559

mars

741

00:27:13,590 --> 00:27:11,120

and right now we have amazing fleet of

742

00:27:14,789 --> 00:27:13,600

spacecraft at mars both in orbit

743

00:27:16,870 --> 00:27:14,799

and on the surface and i think i have

744

00:27:18,470 --> 00:27:16,880

one chart that that shows this if we can

745

00:27:21,190 --> 00:27:18,480

bring that up

746

00:27:23,269 --> 00:27:21,200

much of which you already know but what

747

00:27:25,830 --> 00:27:23,279

we found out about mars is really

748

00:27:27,510 --> 00:27:25,840

amazing you know and especially the

749

00:27:30,390 --> 00:27:27,520

curiosity rover how many of you have

750

00:27:31,190 --> 00:27:30,400

heard of curiosity right so curiosity

751
00:27:33,669 --> 00:27:31,200
she

752
00:27:37,029 --> 00:27:33,679
has a twitter account and a facebook

753
00:27:38,390 --> 00:27:37,039
page and she tweets

754
00:27:40,710 --> 00:27:38,400
but in fact it really is human

755
00:27:43,029 --> 00:27:40,720
exploration it's all about engineers

756
00:27:45,750 --> 00:27:43,039
driving curiosity scientists getting the

757
00:27:47,990 --> 00:27:45,760
scientific information and vicariously

758
00:27:50,470 --> 00:27:48,000
exploring mars through the eyes through

759
00:27:53,190 --> 00:27:50,480
the cameras through the selfies of

760
00:27:54,870 --> 00:27:53,200
curiosity and it's really exciting our

761
00:27:57,430 --> 00:27:54,880
goal was to find out

762
00:27:59,029 --> 00:27:57,440
was mars ever habitable

763
00:28:00,789 --> 00:27:59,039

could it have had an environment that

764

00:28:02,630 --> 00:28:00,799

would sustain life

765

00:28:04,789 --> 00:28:02,640

and that was the big goal really

766

00:28:06,549 --> 00:28:04,799

challenging hard to get to the ground

767

00:28:08,230 --> 00:28:06,559

seven minutes of terror

768

00:28:10,549 --> 00:28:08,240

curiosity lands

769

00:28:11,990 --> 00:28:10,559

looks around and says

770

00:28:14,549 --> 00:28:12,000

holy beep

771

00:28:16,710 --> 00:28:14,559

i i landed in a dry riverbed i mean

772

00:28:18,870 --> 00:28:16,720

literally the geologists the planetary

773

00:28:21,990 --> 00:28:18,880

scientists looked around and said this

774

00:28:25,190 --> 00:28:22,000

looks like a dry riverbed in west texas

775

00:28:27,430 --> 00:28:25,200

rounded pebbles concretions riverbank

776

00:28:29,669 --> 00:28:27,440

encoded in the rock the rock tells the

777

00:28:31,990 --> 00:28:29,679

story about an ancient mars

778

00:28:33,510 --> 00:28:32,000

that probably had a thick atmosphere

779

00:28:35,190 --> 00:28:33,520

puffy clouds

780

00:28:37,190 --> 00:28:35,200

rain

781

00:28:39,190 --> 00:28:37,200

snow-capped peaks

782

00:28:40,710 --> 00:28:39,200

and so now we're driving along exploring

783

00:28:43,269 --> 00:28:40,720

what looks like

784

00:28:45,510 --> 00:28:43,279

terrain that supports that hypothesis

785

00:28:48,230 --> 00:28:45,520

that mars was really a happening place

786

00:28:50,549 --> 00:28:48,240

mars was once habitable

787

00:28:52,070 --> 00:28:50,559

and as bill said there are resources on

788

00:28:53,990 --> 00:28:52,080

mars today what happened to that water

789

00:28:55,909 --> 00:28:54,000

well we just have the maven spacecraft

790

00:28:58,470 --> 00:28:55,919

enter mars orbit and start science and

791

00:29:01,750 --> 00:28:58,480

it's orbiting high in the atmosphere and

792

00:29:04,470 --> 00:29:01,760

seeing mars lose hydrogen today hydrogen

793

00:29:06,149 --> 00:29:04,480

from water that's been dissociated by

794

00:29:08,950 --> 00:29:06,159

ultraviolet light from the sun the

795

00:29:10,389 --> 00:29:08,960

oxygen stays hydrogen's really light

796

00:29:11,590 --> 00:29:10,399

off into space

797

00:29:14,149 --> 00:29:11,600

and so we're seeing that process

798

00:29:16,149 --> 00:29:14,159

happening today but something in mars

799

00:29:18,230 --> 00:29:16,159

ancient history between three and a half

800

00:29:19,990 --> 00:29:18,240

four billion years ago and today caused

801

00:29:21,590 --> 00:29:20,000

it to lose that thick atmosphere and so

802

00:29:23,669 --> 00:29:21,600

we're trying to read the rock record and

803

00:29:27,269 --> 00:29:23,679

figure out what what happened but even

804

00:29:29,669 --> 00:29:27,279

today the mars atmosphere is mostly co2

805

00:29:33,510 --> 00:29:29,679

anybody know what the next most abundant

806

00:29:37,510 --> 00:29:34,549

argon

807

00:29:38,830 --> 00:29:37,520

really interesting

808

00:29:42,549 --> 00:29:38,840

then

809

00:29:45,269 --> 00:29:42,559

um nitrogen in that there's a

810

00:29:47,350 --> 00:29:45,279

co2 argon we see nitrogen atmosphere we

811

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

see oxygen atmosphere we see

812

00:29:51,350 --> 00:29:49,679

carbon monoxide in the atmosphere

813

00:29:53,190 --> 00:29:51,360

as far as i know we haven't seen methane

814

00:29:55,029 --> 00:29:53,200

yet which would be really interesting

815

00:29:57,350 --> 00:29:55,039

but we also know that in the rocks

816

00:29:59,750 --> 00:29:57,360

themselves is a lot of water trapped in

817

00:30:01,430 --> 00:29:59,760

the minerals few percent and we may be

818

00:30:02,950 --> 00:30:01,440

able to drive that water out same is

819

00:30:04,310 --> 00:30:02,960

true on the moon

820

00:30:06,389 --> 00:30:04,320

really interesting so that's a resource

821

00:30:07,750 --> 00:30:06,399

we might use if you have water you have

822

00:30:09,029 --> 00:30:07,760

hydrogen and oxygen you can make a

823

00:30:11,350 --> 00:30:09,039

rocket fuel

824

00:30:12,789 --> 00:30:11,360

you can breathe the oxygen i suppose if

825

00:30:14,470 --> 00:30:12,799

you really wanted to you could drink the

826

00:30:17,029 --> 00:30:14,480

water too

827

00:30:18,630 --> 00:30:17,039

and you probably would

828

00:30:20,870 --> 00:30:18,640

and there's a lot of ice still on mars

829

00:30:22,710 --> 00:30:20,880

we've seen brand new craters from our

830

00:30:24,870 --> 00:30:22,720

mars reconnaissance orbiter where some

831

00:30:26,870 --> 00:30:24,880

meteorites hit the surface of mars

832

00:30:29,029 --> 00:30:26,880

created a new crater and when all the

833

00:30:32,230 --> 00:30:29,039

dust gets blown out of the crater we see

834

00:30:34,710 --> 00:30:32,240

ice that then over subsequent orbits

835

00:30:36,230 --> 00:30:34,720

sublimates into the atmosphere so if we

836

00:30:38,230 --> 00:30:36,240

land on mars with humans sometime in the

837

00:30:39,510 --> 00:30:38,240

near future and i hope we do

838

00:30:41,830 --> 00:30:39,520

we'll be able to use those water

839

00:30:43,430 --> 00:30:41,840

resources and just melt the ice and

840

00:30:45,350 --> 00:30:43,440

create rocket fuel drink the water

841

00:30:48,230 --> 00:30:45,360

create oxygen so it's really exciting

842

00:30:50,870 --> 00:30:48,240

time but message is we're exploring mars

843

00:30:52,630 --> 00:30:50,880

today the opportunity rover has driven

844

00:30:53,350 --> 00:30:52,640

over 40 kilometers

845

00:30:55,110 --> 00:30:53,360

the

846

00:30:56,630 --> 00:30:55,120

curiosity rover is driving around trying

847

00:30:58,789 --> 00:30:56,640

to answer these really incredible

848

00:31:00,870 --> 00:30:58,799

questions about past habitability and

849

00:31:02,230 --> 00:31:00,880

maybe even if detect if there are

850

00:31:07,110 --> 00:31:02,240

organics

851
00:31:09,269 --> 00:31:07,120
past life who knows we're working on a

852
00:31:11,430 --> 00:31:09,279
lander in 2016 that's going to be a

853
00:31:13,990 --> 00:31:11,440
geology field station

854
00:31:16,870 --> 00:31:14,000
2016 and 18 partnering with the european

855
00:31:18,950 --> 00:31:16,880
space agency uh how about that rosetta

856
00:31:20,630 --> 00:31:18,960
mission and the philae lander pretty

857
00:31:21,830 --> 00:31:20,640
cool

858
00:31:24,149 --> 00:31:21,840
you know

859
00:31:25,430 --> 00:31:24,159
isa has really got their game up and

860
00:31:27,750 --> 00:31:25,440
we're partnering with them on those

861
00:31:30,149 --> 00:31:27,760
missions and then in 2020 we have a

862
00:31:32,230 --> 00:31:30,159
collaborative effort to send a rover

863
00:31:33,909 --> 00:31:32,240

that's going to drive around really

864

00:31:35,990 --> 00:31:33,919

great instrumentation it's going to grab

865

00:31:38,149 --> 00:31:36,000

samples it's going to convert co2 to

866

00:31:39,750 --> 00:31:38,159

oxygen and store it in a tank and it's a

867

00:31:41,990 --> 00:31:39,760

partnership between

868

00:31:44,310 --> 00:31:42,000

really a one nasa partnership and one of

869

00:31:45,029 --> 00:31:44,320

the partners is michael gazarick over to

870

00:31:46,710 --> 00:31:45,039

you

871

00:31:49,430 --> 00:31:46,720

thanks sean

872

00:31:52,389 --> 00:31:51,190

well i too i'm really excited to be here

873

00:31:53,590 --> 00:31:52,399

there's nothing like a rocket launch

874

00:31:55,190 --> 00:31:53,600

right and i don't know about you but i

875

00:31:56,630 --> 00:31:55,200

think about all the hard work that went

876

00:31:58,870 --> 00:31:56,640

into the vehicle for tomorrow all the

877

00:32:00,470 --> 00:31:58,880

engineering all the design for years you

878

00:32:01,990 --> 00:32:00,480

know it all it all comes down to those

879

00:32:03,029 --> 00:32:02,000

crucial moments of launch it's just it's

880

00:32:05,430 --> 00:32:03,039

just really i don't know about you but

881

00:32:07,909 --> 00:32:05,440

it kind of brings out uh the excitement

882

00:32:10,149 --> 00:32:07,919

uh in me and this whole and so what's

883

00:32:11,990 --> 00:32:10,159

gonna happen you know tomorrow morning

884

00:32:13,669 --> 00:32:12,000

deep space exploration that's what this

885

00:32:15,509 --> 00:32:13,679

is about right and really as bill

886

00:32:17,269 --> 00:32:15,519

mentioned the journey the journey begins

887

00:32:19,110 --> 00:32:17,279

tomorrow for the first time right

888

00:32:20,549 --> 00:32:19,120

putting this vehicle further away from

889

00:32:21,830 --> 00:32:20,559

earth we've ever had in decades and

890

00:32:24,230 --> 00:32:21,840

bringing it back

891

00:32:26,070 --> 00:32:24,240

uh safely that that's really excitement

892

00:32:27,190 --> 00:32:26,080

it really leads the way so let's and

893

00:32:29,029 --> 00:32:27,200

that's really the journey the journey

894

00:32:30,470 --> 00:32:29,039

for deep space exploration the journey

895

00:32:32,310 --> 00:32:30,480

to mars so who would like to go to mars

896

00:32:34,549 --> 00:32:32,320

anyone anyone interested yeah yeah me

897

00:32:35,590 --> 00:32:34,559

too yeah i know me too me too uh here's

898

00:32:37,350 --> 00:32:35,600

the thing though we got a couple things

899

00:32:39,110 --> 00:32:37,360

we got to do to get there right we know

900

00:32:40,470 --> 00:32:39,120

there's some challenges to get to mars

901
00:32:41,830 --> 00:32:40,480
uh there's some capabilities that we

902
00:32:43,509 --> 00:32:41,840
need to get to mars and this is where

903
00:32:44,789 --> 00:32:43,519
technology as you can imagine really

904
00:32:46,470 --> 00:32:44,799
plays a role

905
00:32:47,909 --> 00:32:46,480
so we talk about getting to mars there's

906
00:32:49,669 --> 00:32:47,919
challenges to get there we got

907
00:32:51,029 --> 00:32:49,679
challenges we got to land there and then

908
00:32:52,630 --> 00:32:51,039
we got challenges where we got to live

909
00:32:54,710 --> 00:32:52,640
there and you know and eventually then

910
00:32:56,389 --> 00:32:54,720
get you know get back so that's what

911
00:32:59,190 --> 00:32:56,399
technology is about and we're working on

912
00:33:01,509 --> 00:32:59,200
those things today just just last month

913
00:33:03,269 --> 00:33:01,519

off the coast of hawaii uh maybe maybe

914

00:33:05,110 --> 00:33:03,279

some of you saw it if you don't uh we

915

00:33:07,590 --> 00:33:05,120

just launched what the la times called

916

00:33:09,990 --> 00:33:07,600

nasa's flying saucer we didn't label it

917

00:33:12,310 --> 00:33:10,000

that we had a more you know acronym name

918

00:33:14,630 --> 00:33:12,320

ldst but we kind of went with the flying

919

00:33:16,950 --> 00:33:14,640

saucer right it's kind of cool but we we

920

00:33:18,630 --> 00:33:16,960

took that up at high altitude conditions

921

00:33:20,310 --> 00:33:18,640

like mars to go figure out better ways

922

00:33:21,750 --> 00:33:20,320

to slow down why do we want to slow down

923

00:33:23,669 --> 00:33:21,760

we got to get more mass to the surface

924

00:33:25,029 --> 00:33:23,679

of mars that we can today we've got to

925

00:33:27,590 --> 00:33:25,039

get we got to land on more of the

926

00:33:29,590 --> 00:33:27,600

planet's surface than we can today

927

00:33:31,669 --> 00:33:29,600

today we land in craters we need every

928

00:33:33,269 --> 00:33:31,679

ounce of that atmosphere to slow down we

929

00:33:35,029 --> 00:33:33,279

want to do better than that we got more

930

00:33:36,950 --> 00:33:35,039

things to go put on mars that we're

931

00:33:38,310 --> 00:33:36,960

going to need to go live there so we got

932

00:33:40,230 --> 00:33:38,320

to figure out how to do that and we

933

00:33:42,470 --> 00:33:40,240

learned a lot about how to slow down on

934

00:33:43,430 --> 00:33:42,480

mars in fact we shredded a parachute if

935

00:33:45,750 --> 00:33:43,440

you've seen the video it's pretty

936

00:33:46,870 --> 00:33:45,760

awesome yup so we're learning

937

00:33:48,870 --> 00:33:46,880

just to be clear we're learning that's

938

00:33:51,350 --> 00:33:48,880

what we're doing today we have we know

939

00:33:53,350 --> 00:33:51,360

now today more about this supersonic

940

00:33:55,830 --> 00:33:53,360

inflation dynamics of a parachute than

941

00:33:57,029 --> 00:33:55,840

we did three years ago three years ago

942

00:33:59,029 --> 00:33:57,039

we set up the mission directorate of

943

00:34:00,710 --> 00:33:59,039

technology and we're developing new

944

00:34:02,310 --> 00:34:00,720

capabilities today

945

00:34:03,990 --> 00:34:02,320

we also have developed a composite

946

00:34:05,590 --> 00:34:04,000

cryotank what's so important about that

947

00:34:07,110 --> 00:34:05,600

well it can store the look fuel the

948

00:34:09,190 --> 00:34:07,120

rocket fuel that we need and it reduces

949

00:34:11,270 --> 00:34:09,200

the mass it allows more payload to get

950

00:34:13,270 --> 00:34:11,280

more things to the surface of mars we

951
00:34:15,349 --> 00:34:13,280
demonstrated that this summer

952
00:34:17,109 --> 00:34:15,359
when we talk about going to mars we need

953
00:34:18,230 --> 00:34:17,119
a bet we need a propulsion system and

954
00:34:19,750 --> 00:34:18,240
one of the ways we're looking at is

955
00:34:21,589 --> 00:34:19,760
something called solar electric using

956
00:34:23,190 --> 00:34:21,599
the sun's energy and then turning that

957
00:34:24,629 --> 00:34:23,200
into these hull thrusters that send out

958
00:34:27,109 --> 00:34:24,639
ions off the back to give us this

959
00:34:28,869 --> 00:34:27,119
continuous thrust to get to mars well we

960
00:34:31,109 --> 00:34:28,879
need bigger solar arrays didn't have

961
00:34:33,270 --> 00:34:31,119
them three years ago we do today we did

962
00:34:34,710 --> 00:34:33,280
that this summer as well so all across

963
00:34:36,629 --> 00:34:34,720

the board we are flying and

964

00:34:38,950 --> 00:34:36,639

demonstrating where we have to above the

965

00:34:40,389 --> 00:34:38,960

skies of hawaii on a flying saucer that

966

00:34:42,149 --> 00:34:40,399

we had to build we're using the

967

00:34:43,990 --> 00:34:42,159

international space station across the

968

00:34:46,310 --> 00:34:44,000

board to develop better thermal

969

00:34:49,030 --> 00:34:46,320

exchangers to develop better navigation

970

00:34:51,030 --> 00:34:49,040

systems the better life support systems

971

00:34:53,109 --> 00:34:51,040

we have worked today in how to recycle

972

00:34:55,109 --> 00:34:53,119

the oxygen on board we know we can't

973

00:34:56,790 --> 00:34:55,119

take it all with us we have to recycle

974

00:34:58,870 --> 00:34:56,800

the water of course and getting to

975

00:35:00,710 --> 00:34:58,880

closed-loop systems so we can recycle

976
00:35:02,630 --> 00:35:00,720
the water recycle the air we're working

977
00:35:04,550 --> 00:35:02,640
on all those today we're working on

978
00:35:06,630 --> 00:35:04,560
better batteries the same battery life

979
00:35:08,550 --> 00:35:06,640
issues we all have on all the cool cool

980
00:35:09,990 --> 00:35:08,560
iphone speaking of technology right same

981
00:35:11,109 --> 00:35:10,000
problems you have right we all got to go

982
00:35:12,230 --> 00:35:11,119
home and charge them tonight and if you

983
00:35:13,190 --> 00:35:12,240
forget you're not going to you know

984
00:35:14,230 --> 00:35:13,200
you're not going to set your alarm

985
00:35:15,589 --> 00:35:14,240
you're going to miss a launch so make

986
00:35:17,349 --> 00:35:15,599
sure everybody please charge your phone

987
00:35:18,710 --> 00:35:17,359
tonight uh if you're looking at using

988
00:35:20,550 --> 00:35:18,720

that alarm but we've got to work on

989

00:35:22,710 --> 00:35:20,560

better battery density well we have work

990

00:35:24,390 --> 00:35:22,720

on that as well today so that's just a

991

00:35:26,710 --> 00:35:24,400

couple examples we're working on all

992

00:35:29,030 --> 00:35:26,720

those how to get there how to land there

993

00:35:30,790 --> 00:35:29,040

how to live there all working today with

994

00:35:32,390 --> 00:35:30,800

the international space station and

995

00:35:35,030 --> 00:35:32,400

whatever we need to do whatever we need

996

00:35:37,109 --> 00:35:35,040

to go fly on to develop the capabilities

997

00:35:45,670 --> 00:35:37,119

so the journey starts tomorrow and i

998

00:35:49,510 --> 00:35:47,430

you know nasa is the keeper of the

999

00:35:53,030 --> 00:35:49,520

future and a big part of that future is

1000

00:35:54,550 --> 00:35:53,040

mars um and as john talked about why uh

1001
00:35:56,230 --> 00:35:54,560
and it's because of this issue that we

1002
00:35:58,230 --> 00:35:56,240
really do think that the conditions on

1003
00:36:00,710 --> 00:35:58,240
mars we know we just don't think we know

1004
00:36:02,630 --> 00:36:00,720
the conditions on mars existed for long

1005
00:36:04,870 --> 00:36:02,640
periods of time where life could have

1006
00:36:06,710 --> 00:36:04,880
evolved so we can really get at that

1007
00:36:08,870 --> 00:36:06,720
fundamental question that has been

1008
00:36:10,390 --> 00:36:08,880
around in humanity for so long are we

1009
00:36:12,150 --> 00:36:10,400
alone you know we're addressing it in

1010
00:36:14,150 --> 00:36:12,160
other cool ways to the james webb space

1011
00:36:16,630 --> 00:36:14,160
telescope after 2018 we'll start looking

1012
00:36:18,150 --> 00:36:16,640
at the atmospheres of extrasolar planets

1013
00:36:20,630 --> 00:36:18,160

you know we want to go study europa

1014

00:36:22,390 --> 00:36:20,640

jupiter's moon that has these uh

1015

00:36:24,390 --> 00:36:22,400

sub-crustal oceans that we think are

1016

00:36:26,390 --> 00:36:24,400

super interesting so there's lots of

1017

00:36:27,990 --> 00:36:26,400

amazing things we want to go do

1018

00:36:30,550 --> 00:36:28,000

but right now we're really focused on

1019

00:36:33,430 --> 00:36:30,560

mars and to me this is incredibly

1020

00:36:35,510 --> 00:36:33,440

important because i'm i'm a geologist um

1021

00:36:38,230 --> 00:36:35,520

i go out in the field and bang on rocks

1022

00:36:41,190 --> 00:36:38,240

with my rock hammer and i i think that

1023

00:36:42,790 --> 00:36:41,200

piece of human sending humans to mars is

1024

00:36:45,030 --> 00:36:42,800

critical to understanding the science in

1025

00:36:47,510 --> 00:36:45,040

the long run finding life on mars may

1026
00:36:49,349 --> 00:36:47,520
not be easy studying life on mars is

1027
00:36:51,510 --> 00:36:49,359
going to be challenging and having

1028
00:36:53,589 --> 00:36:51,520
humans on the surface who can be

1029
00:36:55,270 --> 00:36:53,599
creative who can be iterative who can be

1030
00:36:57,589 --> 00:36:55,280
innovative and how they're approaching

1031
00:36:59,510 --> 00:36:57,599
it who can cover large distances in

1032
00:37:01,750 --> 00:36:59,520
short amounts of time

1033
00:37:02,710 --> 00:37:01,760
who can adapt to new information as they

1034
00:37:04,390 --> 00:37:02,720
get it

1035
00:37:06,630 --> 00:37:04,400
robotic exploration is great don't get

1036
00:37:09,030 --> 00:37:06,640
me wrong we've done amazing things

1037
00:37:11,349 --> 00:37:09,040
with opportunity with curiosity but we

1038
00:37:14,150 --> 00:37:11,359

need humans to go to that next step of

1039

00:37:16,230 --> 00:37:14,160

really understanding mars um in a true

1040

00:37:19,430 --> 00:37:16,240

scientific sense

1041

00:37:21,270 --> 00:37:19,440

so what we're doing tomorrow um to me is

1042

00:37:23,109 --> 00:37:21,280

incredibly exciting because we talk

1043

00:37:25,349 --> 00:37:23,119

about this and a lot of us see the

1044

00:37:27,349 --> 00:37:25,359

progress behind the scenes that some of

1045

00:37:28,550 --> 00:37:27,359

you might not be aware of the research

1046

00:37:30,470 --> 00:37:28,560

we're doing every day on the

1047

00:37:32,950 --> 00:37:30,480

international space station is so

1048

00:37:34,150 --> 00:37:32,960

critical to this journey to mars

1049

00:37:36,150 --> 00:37:34,160

understanding the effects of

1050

00:37:37,589 --> 00:37:36,160

microgravity on the human body you know

1051
00:37:40,550 --> 00:37:37,599
we you have all these conditions that

1052
00:37:42,069 --> 00:37:40,560
occur muscle wasting muscle wasting bone

1053
00:37:44,310 --> 00:37:42,079
density loss

1054
00:37:46,069 --> 00:37:44,320
changes in intracranial pressure these

1055
00:37:47,910 --> 00:37:46,079
are effects that we're studying we're

1056
00:37:49,670 --> 00:37:47,920
finding ways to mitigate so that we can

1057
00:37:51,430 --> 00:37:49,680
send astronauts safely on that eight

1058
00:37:53,190 --> 00:37:51,440
month journey to mars eight months back

1059
00:37:55,349 --> 00:37:53,200
and and have them healthy that's what

1060
00:37:57,829 --> 00:37:55,359
nasa does so that research that we're

1061
00:38:00,150 --> 00:37:57,839
doing every day on the iss is really

1062
00:38:01,589 --> 00:38:00,160
critical to this journey to mars

1063
00:38:03,589 --> 00:38:01,599

mike was just talking about the the

1064

00:38:05,430 --> 00:38:03,599

technology work we're doing every day

1065

00:38:07,430 --> 00:38:05,440

that's critical to this journey of mars

1066

00:38:09,430 --> 00:38:07,440

the work we do every day with curiosity

1067

00:38:11,430 --> 00:38:09,440

and opportunity and maven that are

1068

00:38:13,430 --> 00:38:11,440

helping us on this journey to mars so

1069

00:38:15,349 --> 00:38:13,440

we're on our way but tomorrow is such a

1070

00:38:17,829 --> 00:38:15,359

visible sense of you know we're on the

1071

00:38:18,790 --> 00:38:17,839

cusp of sending humans beyond low earth

1072

00:38:20,470 --> 00:38:18,800

orbit

1073

00:38:21,910 --> 00:38:20,480

which we haven't been able to do in such

1074

00:38:24,069 --> 00:38:21,920

a long time

1075

00:38:26,310 --> 00:38:24,079

that we're really excited about tomorrow

1076
00:38:27,750 --> 00:38:26,320
and i hope everybody sees this as we're

1077
00:38:34,550 --> 00:38:27,760
on our way to mars

1078
00:38:37,270 --> 00:38:36,310
it's great to be here today it's very

1079
00:38:39,430 --> 00:38:37,280
exciting

1080
00:38:40,950 --> 00:38:39,440
uh in advance of the launch tomorrow

1081
00:38:42,710 --> 00:38:40,960
when i think about the journey to mars i

1082
00:38:43,990 --> 00:38:42,720
really think about it as a technological

1083
00:38:46,470 --> 00:38:44,000
journey it's one of many different

1084
00:38:48,390 --> 00:38:46,480
journeys we're making and tomorrow is a

1085
00:38:50,069 --> 00:38:48,400
very big step in that technological

1086
00:38:51,829 --> 00:38:50,079
journey but as mike has mentioned you

1087
00:38:53,829 --> 00:38:51,839
know we've already been working on in

1088
00:38:55,829 --> 00:38:53,839

other avenues as well on space station

1089

00:38:58,150 --> 00:38:55,839

in our labs developing all the other

1090

00:38:59,990 --> 00:38:58,160

types of technology we need so

1091

00:39:02,069 --> 00:39:00,000

this is not the first step in our

1092

00:39:03,670 --> 00:39:02,079

technological journey to to mars it's an

1093

00:39:05,109 --> 00:39:03,680

important step but we've been working on

1094

00:39:06,230 --> 00:39:05,119

this journey i'd say we're well on our

1095

00:39:08,310 --> 00:39:06,240

way

1096

00:39:09,990 --> 00:39:08,320

the um one of the things i want you to

1097

00:39:11,670 --> 00:39:10,000

remember and think about and i try to

1098

00:39:13,270 --> 00:39:11,680

remind myself every time

1099

00:39:15,589 --> 00:39:13,280

that a lot of times we think about

1100

00:39:16,390 --> 00:39:15,599

technology as performance enhancing it

1101
00:39:18,310 --> 00:39:16,400
is

1102
00:39:20,150 --> 00:39:18,320
but i think we also need to think about

1103
00:39:21,349 --> 00:39:20,160
it in terms of affordability and

1104
00:39:23,829 --> 00:39:21,359
sustainment

1105
00:39:26,630 --> 00:39:23,839
this is a very long journey and we also

1106
00:39:29,190 --> 00:39:26,640
want to want to in the process pioneer

1107
00:39:31,990 --> 00:39:29,200
that path and that means it's a long

1108
00:39:34,150 --> 00:39:32,000
journey so technology is going to help

1109
00:39:34,950 --> 00:39:34,160
us to be able to afford it and sustain

1110
00:39:37,349 --> 00:39:34,960
it

1111
00:39:39,670 --> 00:39:37,359
and over time as technology emerges we

1112
00:39:41,349 --> 00:39:39,680
need to think about technology refresh

1113
00:39:43,670 --> 00:39:41,359

because on a long journey that's

1114

00:39:44,710 --> 00:39:43,680

essential to being able to sustain that

1115

00:39:47,270 --> 00:39:44,720

journey

1116

00:39:48,630 --> 00:39:47,280

another aspect is technology drives

1117

00:39:50,870 --> 00:39:48,640

exploration it's kind of in the

1118

00:39:52,230 --> 00:39:50,880

background sometimes but we need to

1119

00:39:54,550 --> 00:39:52,240

think about

1120

00:39:56,550 --> 00:39:54,560

not only that technology is essential

1121

00:39:58,550 --> 00:39:56,560

for sustaining exploration

1122

00:40:00,710 --> 00:39:58,560

sustained investment in technology is

1123

00:40:03,589 --> 00:40:00,720

also essential and we need to keep that

1124

00:40:05,589 --> 00:40:03,599

in mind you know i like to sort of

1125

00:40:07,349 --> 00:40:05,599

draw an analogy with a water faucet and

1126

00:40:09,030 --> 00:40:07,359

a sink you know

1127

00:40:11,030 --> 00:40:09,040

we can't think about it as something we

1128

00:40:12,790 --> 00:40:11,040

can turn on today and then turn off and

1129

00:40:14,230 --> 00:40:12,800

in a few years hence we can turn it back

1130

00:40:15,990 --> 00:40:14,240

on and innovation is just going to

1131

00:40:17,750 --> 00:40:16,000

sprout like water from a faucet it

1132

00:40:19,349 --> 00:40:17,760

doesn't work that way we really need to

1133

00:40:21,589 --> 00:40:19,359

keep that sustained investment so we can

1134

00:40:23,270 --> 00:40:21,599

keep this journey going

1135

00:40:25,349 --> 00:40:23,280

so let me uh

1136

00:40:28,790 --> 00:40:25,359

ask you about uh anyone seen a launch

1137

00:40:30,390 --> 00:40:28,800

before on tv or your computer okay i

1138

00:40:32,870 --> 00:40:30,400

figured we're with this crowd how about

1139

00:40:35,349 --> 00:40:32,880

seeing it live

1140

00:40:37,109 --> 00:40:35,359

okay anybody anyone been actually on a

1141

00:40:39,349 --> 00:40:37,119

launch

1142

00:40:41,349 --> 00:40:39,359

okay well it narrows down quickly

1143

00:40:42,150 --> 00:40:41,359

doesn't it

1144

00:40:43,750 --> 00:40:42,160

so

1145

00:40:46,310 --> 00:40:43,760

what what i would say i guess i'm i'm

1146

00:40:48,470 --> 00:40:46,320

speaking to the people on on uh on

1147

00:40:50,550 --> 00:40:48,480

through the camera here uh for those of

1148

00:40:53,030 --> 00:40:50,560

you who've only seen it on tv you're

1149

00:40:55,829 --> 00:40:53,040

really missing a lot it really does

1150

00:40:57,910 --> 00:40:55,839

change your life i encourage you to

1151
00:41:00,150 --> 00:40:57,920
if you go to orlando on a family

1152
00:41:01,030 --> 00:41:00,160
vacation or to dc

1153
00:41:02,630 --> 00:41:01,040
you know

1154
00:41:05,430 --> 00:41:02,640
check on the websites for the wallet

1155
00:41:06,390 --> 00:41:05,440
flight center or kennedy space center to

1156
00:41:08,230 --> 00:41:06,400
see if there's going to be a launch

1157
00:41:10,710 --> 00:41:08,240
watch while you're there and go go see

1158
00:41:12,230 --> 00:41:10,720
it live it really saturates all of your

1159
00:41:14,790 --> 00:41:12,240
senses you know it's brighter than

1160
00:41:16,630 --> 00:41:14,800
anything you that tv can can show you

1161
00:41:17,990 --> 00:41:16,640
it's louder than anything that you can

1162
00:41:21,109 --> 00:41:18,000
hear from tv

1163
00:41:24,230 --> 00:41:21,119

it's uh it actually literally shakes you

1164

00:41:26,790 --> 00:41:24,240

as as it's a very emotional event

1165

00:41:28,390 --> 00:41:26,800

i guess if uh you it saturates your

1166

00:41:30,150 --> 00:41:28,400

senses of taste and smell you might want

1167

00:41:31,349 --> 00:41:30,160

to back up a little bit it might be a

1168

00:41:32,150 --> 00:41:31,359

little close

1169

00:41:34,950 --> 00:41:32,160

so

1170

00:41:36,309 --> 00:41:34,960

uh but but you know the the the build up

1171

00:41:39,030 --> 00:41:36,319

and everything it's really extraordinary

1172

00:41:40,870 --> 00:41:39,040

you really have to see it live uh and i

1173

00:41:43,349 --> 00:41:40,880

encourage everyone to do that i just

1174

00:41:46,230 --> 00:41:43,359

wanted to close by saying that um

1175

00:41:48,390 --> 00:41:46,240

i strongly feel that exploration demands

1176

00:41:50,790 --> 00:41:48,400

a sense of urgency that keeps us on our

1177

00:41:52,390 --> 00:41:50,800

toes as soon as we get on our heels i

1178

00:41:55,270 --> 00:41:52,400

think we're in trouble so it really

1179

00:41:57,990 --> 00:41:55,280

demands that that kind of urgency

1180

00:41:59,750 --> 00:41:58,000

so the um you know when you have a

1181

00:42:02,550 --> 00:41:59,760

launch system like

1182

00:42:04,870 --> 00:42:02,560

like sls and orion as an exploration

1183

00:42:06,710 --> 00:42:04,880

system the best thing you can do is fly

1184

00:42:08,230 --> 00:42:06,720

it a lot and fly it far

1185

00:42:10,230 --> 00:42:08,240

but we really need to be able to afford

1186

00:42:11,270 --> 00:42:10,240

it we really need to be able to sustain

1187

00:42:13,670 --> 00:42:11,280

that

1188

00:42:16,630 --> 00:42:13,680

we need to be able to sustain a cadence

1189

00:42:18,950 --> 00:42:16,640

of missions so that so that

1190

00:42:20,550 --> 00:42:18,960

so that we keep everyone engaged not

1191

00:42:22,390 --> 00:42:20,560

only our engineers and our scientists

1192

00:42:24,230 --> 00:42:22,400

working on the projects but also the

1193

00:42:26,069 --> 00:42:24,240

attend grab the attention of the public

1194

00:42:28,230 --> 00:42:26,079

and keep them in gen engaged on that

1195

00:42:30,309 --> 00:42:28,240

journey as well that's that's essential

1196

00:42:32,309 --> 00:42:30,319

i've seen in the various avenues that

1197

00:42:34,710 --> 00:42:32,319

i've worked that there's a passion out

1198

00:42:36,710 --> 00:42:34,720

there for exploration we need to really

1199

00:42:38,950 --> 00:42:36,720

fan the flames on that passion we need

1200

00:42:40,710 --> 00:42:38,960

to engage it there's a broader community

1201
00:42:42,470 --> 00:42:40,720
that's working on all aspects of this

1202
00:42:45,510 --> 00:42:42,480
problem i think we need to tell their

1203
00:42:48,309 --> 00:42:45,520
story along with our story because if we

1204
00:42:50,950 --> 00:42:48,319
if we can tell their story of

1205
00:42:52,710 --> 00:42:50,960
excitement and achievement then i think

1206
00:42:54,790 --> 00:42:52,720
they'll help us tell our story as well

1207
00:43:00,150 --> 00:42:54,800
and make that journey reality so thank

1208
00:43:03,190 --> 00:43:02,150
thank you david appreciate it and from

1209
00:43:04,309 --> 00:43:03,200
the rest of the panelists well we have

1210
00:43:05,430 --> 00:43:04,319
time for some questions here in the

1211
00:43:06,870 --> 00:43:05,440
audience and then we're going to go to

1212
00:43:08,390 --> 00:43:06,880
our field center if you have a question

1213
00:43:14,309 --> 00:43:08,400

please keep your hand raised high and

1214

00:43:17,990 --> 00:43:16,230

hi there um first of all thank you all

1215

00:43:20,150 --> 00:43:18,000

it was very very informative uh thanks

1216

00:43:22,710 --> 00:43:20,160

for taking the time to talk to us um so

1217

00:43:24,630 --> 00:43:22,720

we talk about orion and it's part of

1218

00:43:27,670 --> 00:43:24,640

nasa's journey to mars

1219

00:43:29,349 --> 00:43:27,680

i have to wonder how would orion

1220

00:43:31,589 --> 00:43:29,359

actually get

1221

00:43:33,589 --> 00:43:31,599

explorers to mars onto the surface of

1222

00:43:35,910 --> 00:43:33,599

mars we see a capsule we see something

1223

00:43:37,430 --> 00:43:35,920

that's made for space flight how will it

1224

00:43:38,470 --> 00:43:37,440

actually land on the surface and then

1225

00:43:39,910 --> 00:43:38,480

return

1226

00:43:43,190 --> 00:43:39,920

is there is there something in the works

1227

00:43:45,750 --> 00:43:43,200

that that we haven't seen yet

1228

00:43:47,990 --> 00:43:45,760

yeah the intent of orion really is not

1229

00:43:49,750 --> 00:43:48,000

to go to the surface of mars

1230

00:43:51,829 --> 00:43:49,760

it's part of the potential

1231

00:43:53,829 --> 00:43:51,839

transportation system that will be used

1232

00:43:55,270 --> 00:43:53,839

as as combined with the habitation

1233

00:43:56,870 --> 00:43:55,280

module that will allow us to make the

1234

00:43:58,150 --> 00:43:56,880

journey but then there will be a descent

1235

00:43:59,670 --> 00:43:58,160

kind of vehicle and then it'll be some

1236

00:44:01,750 --> 00:43:59,680

kind of ascent vehicle to come off the

1237

00:44:03,349 --> 00:44:01,760

surface of mars you know we're we're

1238

00:44:05,030 --> 00:44:03,359

still kind of trading some things in

1239

00:44:06,230 --> 00:44:05,040

terms of how we would actually put this

1240

00:44:07,510 --> 00:44:06,240

together

1241

00:44:09,670 --> 00:44:07,520

we've been working on the asteroid

1242

00:44:11,270 --> 00:44:09,680

redirect mission and and with the

1243

00:44:12,470 --> 00:44:11,280

science technology mission director

1244

00:44:13,910 --> 00:44:12,480

we've been looking at solar electric

1245

00:44:15,589 --> 00:44:13,920

propulsion and that turns out that

1246

00:44:18,150 --> 00:44:15,599

that's a very effective way to move

1247

00:44:19,670 --> 00:44:18,160

large masses around the solar system so

1248

00:44:21,430 --> 00:44:19,680

what we're thinking we may do is we may

1249

00:44:24,150 --> 00:44:21,440

actually pre-position

1250

00:44:25,750 --> 00:44:24,160

cargo and maybe even the ascent vehicle

1251
00:44:27,670 --> 00:44:25,760
and the habitation systems on the

1252
00:44:30,069 --> 00:44:27,680
surface of mars before the crew actually

1253
00:44:31,829 --> 00:44:30,079
goes so we may actually call it a split

1254
00:44:33,750 --> 00:44:31,839
cargo mission so we would actually fly

1255
00:44:35,430 --> 00:44:33,760
the cargo first with electric propulsion

1256
00:44:37,430 --> 00:44:35,440
it takes maybe two three years to get

1257
00:44:40,069 --> 00:44:37,440
there with electric propulsion then we

1258
00:44:42,069 --> 00:44:40,079
pre-position all these assets at mars

1259
00:44:43,589 --> 00:44:42,079
they're there also for repeat journeys

1260
00:44:44,870 --> 00:44:43,599
to come back again later but they're

1261
00:44:47,109 --> 00:44:44,880
there they can be checked out and then

1262
00:44:49,109 --> 00:44:47,119
we bring the crew on chemical propulsion

1263
00:44:50,710 --> 00:44:49,119

and a fairly short trip

1264

00:44:52,150 --> 00:44:50,720

could go down to the surface with some

1265

00:44:54,230 --> 00:44:52,160

kind of lander vehicle and some kind of

1266

00:44:56,069 --> 00:44:54,240

ascent vehicle that potentially used the

1267

00:44:57,190 --> 00:44:56,079

resources on mars to prepare us to come

1268

00:44:58,710 --> 00:44:57,200

back and then we come back to the

1269

00:45:00,309 --> 00:44:58,720

vicinity of the earth and then we return

1270

00:45:02,390 --> 00:45:00,319

from the earth or from the vicinity

1271

00:45:03,829 --> 00:45:02,400

earth down to the surface of the earth

1272

00:45:06,230 --> 00:45:03,839

and that's conceptually what we're

1273

00:45:07,109 --> 00:45:06,240

starting to look at john i'll just add

1274

00:45:11,990 --> 00:45:07,119

one

1275

00:45:14,069 --> 00:45:12,000

step all space journeys start with

1276

00:45:16,230 --> 00:45:14,079

getting off the earth and and orion is

1277

00:45:18,150 --> 00:45:16,240

that peace uh it's that vehicle that

1278

00:45:19,109 --> 00:45:18,160

gets us off the earth and into deep

1279

00:45:20,710 --> 00:45:19,119

space

1280

00:45:22,550 --> 00:45:20,720

where we can start our journey and the

1281

00:45:24,550 --> 00:45:22,560

other key piece is the space launch

1282

00:45:27,030 --> 00:45:24,560

system heavy lift launch vehicle that

1283

00:45:29,270 --> 00:45:27,040

allows us to take large masses to space

1284

00:45:30,950 --> 00:45:29,280

and those masses are needed for the mars

1285

00:45:33,030 --> 00:45:30,960

class mission because if you look at the

1286

00:45:35,670 --> 00:45:33,040

resources space station roughly weighs

1287

00:45:37,510 --> 00:45:35,680

900 000 pounds we kind of estimate for a

1288

00:45:39,510 --> 00:45:37,520

surface landing on mars we roughly need

1289

00:45:41,430 --> 00:45:39,520

to have about that same same mass

1290

00:45:42,950 --> 00:45:41,440

roughly uh to go do that kind of

1291

00:45:44,790 --> 00:45:42,960

activity so it's

1292

00:45:46,069 --> 00:45:44,800

this is really a big endeavor to go to

1293

00:45:47,510 --> 00:45:46,079

mars which is which is why we're

1294

00:45:49,190 --> 00:45:47,520

shredding parachutes to go figure out

1295

00:45:50,710 --> 00:45:49,200

how to get on yeah you know bill could

1296

00:45:52,950 --> 00:45:50,720

you you know go with a little less maybe

1297

00:45:54,470 --> 00:45:52,960

right so it just you know yeah that's

1298

00:45:56,309 --> 00:45:54,480

that's the challenge

1299

00:45:57,990 --> 00:45:56,319

because again john's landed roughly a

1300

00:45:59,670 --> 00:45:58,000

metric ton with the rovers on the

1301
00:46:02,550 --> 00:45:59,680
surface of mars we're thinking we need

1302
00:46:04,150 --> 00:46:02,560
to 20 times that maybe 20 metric tons 30

1303
00:46:06,390 --> 00:46:04,160
metric tons to land on the surface of

1304
00:46:08,710 --> 00:46:06,400
mars so that's where mike comes in with

1305
00:46:11,510 --> 00:46:08,720
how do we do entry descent landing into

1306
00:46:13,510 --> 00:46:11,520
this into this atmosphere that's thick

1307
00:46:15,589 --> 00:46:13,520
enough to provide heating but not thick

1308
00:46:16,870 --> 00:46:15,599
enough to provide significant braking

1309
00:46:19,109 --> 00:46:16,880
yeah i think just for the record i think

1310
00:46:22,150 --> 00:46:19,119
the scorecard is mars

1311
00:46:25,190 --> 00:46:22,160
i think it's 19 and earth i think it's

1312
00:46:26,870 --> 00:46:25,200
now 20 actually with maven i think it's

1313
00:46:29,670 --> 00:46:26,880

20 successful missions tomorrow so we

1314

00:46:31,510 --> 00:46:29,680

just we just got over 500 so

1315

00:46:33,109 --> 00:46:31,520

go go earth

1316

00:46:34,950 --> 00:46:33,119

i was just going to add that i think

1317

00:46:37,109 --> 00:46:34,960

mike's team really sort of parses it out

1318

00:46:39,030 --> 00:46:37,119

well i think you say we have to go we

1319

00:46:41,349 --> 00:46:39,040

have to land we have to work and we have

1320

00:46:43,510 --> 00:46:41,359

to leave and return home and i think the

1321

00:46:45,670 --> 00:46:43,520

round trip is essential because you need

1322

00:46:47,430 --> 00:46:45,680

those voyagers those sort of ambassadors

1323

00:46:49,430 --> 00:46:47,440

the new world to come back and tell them

1324

00:46:51,430 --> 00:46:49,440

how exciting it is and and they can

1325

00:46:53,030 --> 00:46:51,440

really give that human element to it and

1326

00:46:55,270 --> 00:46:53,040

when you think about those four steps

1327

00:46:57,430 --> 00:46:55,280

you can start seeing where the landing

1328

00:46:58,950 --> 00:46:57,440

high larger mass maybe we can refuel

1329

00:47:00,710 --> 00:46:58,960

rockets by getting some of that water

1330

00:47:02,630 --> 00:47:00,720

out of the out of the out of the

1331

00:47:04,950 --> 00:47:02,640

regolith and so forth and it's a good

1332

00:47:07,190 --> 00:47:04,960

way to sort of think about it

1333

00:47:09,510 --> 00:47:07,200

good afternoon and thank you so much for

1334

00:47:10,470 --> 00:47:09,520

having all of us here with the nasa

1335

00:47:13,109 --> 00:47:10,480

social

1336

00:47:18,470 --> 00:47:14,710

as you were just saying it's going to be

1337

00:47:20,950 --> 00:47:18,480

incredibly difficult to to land on mars

1338

00:47:22,390 --> 00:47:20,960

um and and support habitation on mars

1339

00:47:24,870 --> 00:47:22,400

and and

1340

00:47:27,349 --> 00:47:24,880

it's going to take decades um

1341

00:47:30,230 --> 00:47:27,359

some stepping stones um

1342

00:47:32,550 --> 00:47:30,240

a stepping stone that that certainly on

1343

00:47:35,270 --> 00:47:32,560

you're considering right now is visiting

1344

00:47:37,270 --> 00:47:35,280

the asteroid and retrieving it

1345

00:47:39,349 --> 00:47:37,280

i'm curious about what other stepping

1346

00:47:40,950 --> 00:47:39,359

stones you might be considering for

1347

00:47:43,589 --> 00:47:40,960

example short of

1348

00:47:46,069 --> 00:47:43,599

landing on the surface of the mars

1349

00:47:48,710 --> 00:47:46,079

what a mission to visit phobos for

1350

00:47:51,190 --> 00:47:48,720

example makes sense or or what are what

1351
00:47:53,750 --> 00:47:51,200
are the other waypoints that we may see

1352
00:47:56,150 --> 00:47:53,760
before we get to that step of landing on

1353
00:47:57,750 --> 00:47:56,160
the surface

1354
00:47:59,349 --> 00:47:57,760
again we're we're kind of actively

1355
00:48:01,829 --> 00:47:59,359
trading all those things to figure out

1356
00:48:03,270 --> 00:48:01,839
what the right approach is you know if

1357
00:48:04,630 --> 00:48:03,280
it seems if you're going all the way to

1358
00:48:06,470 --> 00:48:04,640
mars

1359
00:48:08,230 --> 00:48:06,480
you know maybe just passing by and then

1360
00:48:10,230 --> 00:48:08,240
coming back without landing or going to

1361
00:48:11,270 --> 00:48:10,240
phobos or deimos or doing something

1362
00:48:12,870 --> 00:48:11,280
there

1363
00:48:14,950 --> 00:48:12,880

i don't know we need to trade those

1364

00:48:16,710 --> 00:48:14,960

advantages and disadvantages so i think

1365

00:48:18,390 --> 00:48:16,720

if you take a look at it where it's not

1366

00:48:20,870 --> 00:48:18,400

a single mission where we're trying to

1367

00:48:22,150 --> 00:48:20,880

you know essentially do it one time fast

1368

00:48:23,910 --> 00:48:22,160

but we're actually trying to put

1369

00:48:26,150 --> 00:48:23,920

infrastructure in place how do we

1370

00:48:28,230 --> 00:48:26,160

effectively use these other pieces of

1371

00:48:30,069 --> 00:48:28,240

the solar system effectively so do we

1372

00:48:31,750 --> 00:48:30,079

use the moons as a staging point are

1373

00:48:33,510 --> 00:48:31,760

those are there advantages there and

1374

00:48:35,109 --> 00:48:33,520

we're starting to trade with the with

1375

00:48:36,790 --> 00:48:35,119

the whole technical community what the

1376

00:48:38,950 --> 00:48:36,800

right answer is to go do that and there

1377

00:48:40,309 --> 00:48:38,960

may not be one answer there may be

1378

00:48:42,069 --> 00:48:40,319

you know several different approaches

1379

00:48:44,390 --> 00:48:42,079

that we're looking at as we think about

1380

00:48:46,630 --> 00:48:44,400

this activity and others may want to

1381

00:48:47,990 --> 00:48:46,640

comment too

1382

00:48:49,910 --> 00:48:48,000

i'd like to think about it for those of

1383

00:48:51,990 --> 00:48:49,920

us that were born before what was in

1384

00:48:54,309 --> 00:48:52,000

1975

1385

00:48:56,309 --> 00:48:54,319

the uh the uh i like to think you know

1386

00:48:57,510 --> 00:48:56,319

back in the 60s they had some good ideas

1387

00:48:59,430 --> 00:48:57,520

you know there was the mercury the

1388

00:49:02,710 --> 00:48:59,440

gemini the apollo mission

1389

00:49:04,549 --> 00:49:02,720

and and now we're we have this concept

1390

00:49:07,030 --> 00:49:04,559

where there's earth reliant

1391

00:49:09,109 --> 00:49:07,040

uh the proving ground and then mars

1392

00:49:11,910 --> 00:49:09,119

ready and and i think there's a nice

1393

00:49:13,750 --> 00:49:11,920

parallel that can be uh can be made

1394

00:49:15,430 --> 00:49:13,760

because what we're doing on station is

1395

00:49:17,430 --> 00:49:15,440

earth reliant it's low earth orbit it's

1396

00:49:19,349 --> 00:49:17,440

you know we have to we have to resupply

1397

00:49:21,270 --> 00:49:19,359

and so forth and you can get back within

1398

00:49:23,670 --> 00:49:21,280

hours uh but that's where we're learning

1399

00:49:25,990 --> 00:49:23,680

to sort of live it's kind of like what

1400

00:49:27,270 --> 00:49:26,000

we did in mercury and then the proving

1401

00:49:29,349 --> 00:49:27,280

ground is where we're going to go out to

1402

00:49:30,710 --> 00:49:29,359

cislunar space out beyond the moon

1403

00:49:32,309 --> 00:49:30,720

further than we've been before and

1404

00:49:33,910 --> 00:49:32,319

that's where we're going to learn how to

1405

00:49:35,990 --> 00:49:33,920

actually work and be productive and

1406

00:49:37,270 --> 00:49:36,000

exercise these technological tools that

1407

00:49:39,270 --> 00:49:37,280

mike's developing

1408

00:49:41,430 --> 00:49:39,280

and then when we're really ready to go

1409

00:49:43,270 --> 00:49:41,440

then it's the apollo and that's where

1410

00:49:44,790 --> 00:49:43,280

you know the uh where mars ready and we

1411

00:49:47,190 --> 00:49:44,800

can go and be independent we know

1412

00:49:48,630 --> 00:49:47,200

everything's gonna work right

1413

00:49:50,309 --> 00:49:48,640

great thank you now let's take a

1414

00:49:51,910 --> 00:49:50,319

question from one of our field centers i

1415

00:49:59,510 --> 00:49:51,920

believe we have a question from goddard

1416

00:49:59,520 --> 00:50:05,270

this is uh ben at nasa goddard

1417

00:50:12,470 --> 00:50:09,349

so in the book uh the case for mars um a

1418

00:50:15,190 --> 00:50:12,480

case is made for in-situ real

1419

00:50:17,430 --> 00:50:15,200

for manufacturing the propellant to

1420

00:50:20,069 --> 00:50:17,440

return from a mars mission

1421

00:50:22,150 --> 00:50:20,079

on mars using possibly helium or

1422

00:50:23,990 --> 00:50:22,160

hydrogen brought in from earth or other

1423

00:50:27,910 --> 00:50:24,000

means i'm wondering if that is being

1424

00:50:31,510 --> 00:50:27,920

considered for the upcoming plans to

1425

00:50:36,950 --> 00:50:34,630

so in the case for mars

1426

00:50:39,190 --> 00:50:36,960

there was a plan to bring hydrogen from

1427

00:50:40,710 --> 00:50:39,200

the earth to mars and use sabati a

1428

00:50:42,309 --> 00:50:40,720

catalyzation

1429

00:50:44,630 --> 00:50:42,319

to create

1430

00:50:45,990 --> 00:50:44,640

methane for instance

1431

00:50:47,589 --> 00:50:46,000

what we've learned about mars is there

1432

00:50:49,109 --> 00:50:47,599

are plentiful local resources you don't

1433

00:50:50,950 --> 00:50:49,119

need to take hydrogen to mars because

1434

00:50:53,430 --> 00:50:50,960

there's a lot of hydrogen on mars today

1435

00:50:55,589 --> 00:50:53,440

there's water in fact mars has a

1436

00:50:58,150 --> 00:50:55,599

relative humidity we have

1437

00:50:59,750 --> 00:50:58,160

an instrument on the curiosity rover

1438

00:51:01,349 --> 00:50:59,760

that measures the relative humidity in

1439

00:51:02,710 --> 00:51:01,359

principle we could pull water out of the

1440

00:51:05,030 --> 00:51:02,720

atmosphere

1441

00:51:06,630 --> 00:51:05,040

and use that hydrogen and oxygen and if

1442

00:51:08,630 --> 00:51:06,640

you have hydrogen and oxygen you have

1443

00:51:10,470 --> 00:51:08,640

rocket fuel that's what we power the

1444

00:51:12,630 --> 00:51:10,480

space shuttle with that's what we launch

1445

00:51:14,870 --> 00:51:12,640

rockets with a very good fuel or we

1446

00:51:17,190 --> 00:51:14,880

could make hydrocarbons because we have

1447

00:51:19,829 --> 00:51:17,200

hydrogen oxygen and carbon dioxide so we

1448

00:51:22,069 --> 00:51:19,839

have carbon and oxygen there and there's

1449

00:51:24,549 --> 00:51:22,079

a huge gear ratio for using a huge

1450

00:51:25,829 --> 00:51:24,559

advantage for using local resources

1451
00:51:26,630 --> 00:51:25,839
because you don't have to take it with

1452
00:51:29,510 --> 00:51:26,640
you

1453
00:51:31,510 --> 00:51:29,520
and so on the mars 2020 rover we which

1454
00:51:33,910 --> 00:51:31,520
we will launch in 2020

1455
00:51:36,470 --> 00:51:33,920
we have the in-situ resource utilization

1456
00:51:37,430 --> 00:51:36,480
experiment that's a partnership between

1457
00:51:40,069 --> 00:51:37,440
all of us

1458
00:51:43,030 --> 00:51:40,079
to use co2 to produce oxygen so that's a

1459
00:51:45,589 --> 00:51:43,040
first step so that'll be a catalysis

1460
00:51:46,950 --> 00:51:45,599
of stripping off the carbon and saving

1461
00:51:49,109 --> 00:51:46,960
the oxygen

1462
00:51:51,510 --> 00:51:49,119
so that's a first step i think whatever

1463
00:51:52,870 --> 00:51:51,520

our next steps are for surface missions

1464

00:51:54,710 --> 00:51:52,880

we're going to try and increase the

1465

00:51:57,510 --> 00:51:54,720

capability and scope and try different

1466

00:51:59,990 --> 00:51:57,520

things so that hopefully uh you know

1467

00:52:01,349 --> 00:52:00,000

sometime within the next decade or so we

1468

00:52:03,589 --> 00:52:01,359

try something

1469

00:52:08,390 --> 00:52:03,599

at a scale that can create rocket fuel

1470

00:52:12,549 --> 00:52:10,470

first everybody thanks for coming over

1471

00:52:14,870 --> 00:52:12,559

and uh talking to us today john just

1472

00:52:16,150 --> 00:52:14,880

real fast uh quote you would like to say

1473

00:52:16,750 --> 00:52:16,160

is all you

1474

00:52:18,950 --> 00:52:16,760

all

1475

00:52:21,109 --> 00:52:18,960

experience human exploration i've stolen

1476

00:52:22,710 --> 00:52:21,119

that quote several times so you know

1477

00:52:25,030 --> 00:52:22,720

thanks for you know driving that point

1478

00:52:27,990 --> 00:52:25,040

home just through a question with the

1479

00:52:30,309 --> 00:52:28,000

collaboration between the um the

1480

00:52:32,150 --> 00:52:30,319

technology side and the science side how

1481

00:52:33,670 --> 00:52:32,160

closely are you guys working together

1482

00:52:35,750 --> 00:52:33,680

they're like a good com channel between

1483

00:52:37,270 --> 00:52:35,760

you two say the science side finds

1484

00:52:38,950 --> 00:52:37,280

something interesting on you know

1485

00:52:40,230 --> 00:52:38,960

curiosity finds hey this we just found

1486

00:52:41,910 --> 00:52:40,240

something that we should tell the

1487

00:52:43,510 --> 00:52:41,920

technology folks and

1488

00:52:45,270 --> 00:52:43,520

has there been a finding that sort of

1489

00:52:46,470 --> 00:52:45,280

impacted what the technology side has

1490

00:52:48,150 --> 00:52:46,480

been doing

1491

00:52:49,670 --> 00:52:48,160

thanks

1492

00:52:51,349 --> 00:52:49,680

yeah that's a great question so the way

1493

00:52:53,750 --> 00:52:51,359

right abs yeah the answer you know short

1494

00:52:55,510 --> 00:52:53,760

answer would be yes um from a technology

1495

00:52:56,950 --> 00:52:55,520

standpoint we want to develop technology

1496

00:52:58,549 --> 00:52:56,960

with a purpose right we want to solve

1497

00:53:00,150 --> 00:52:58,559

problems so what do we want to solve

1498

00:53:02,309 --> 00:53:00,160

well the customer is the way i look at

1499

00:53:04,150 --> 00:53:02,319

it or john and bill what do you need and

1500

00:53:05,910 --> 00:53:04,160

so we've worked really hard in the three

1501
00:53:07,589 --> 00:53:05,920
years it's the space technology has been

1502
00:53:09,030 --> 00:53:07,599
up and running we've worked really hard

1503
00:53:11,030 --> 00:53:09,040
to improve that connection with science

1504
00:53:13,270 --> 00:53:11,040
and what do you need and we have now

1505
00:53:15,030 --> 00:53:13,280
a number of activities that we're doing

1506
00:53:16,790 --> 00:53:15,040
in support of science and in fact one

1507
00:53:18,870 --> 00:53:16,800
example for those following the

1508
00:53:20,549 --> 00:53:18,880
discovery 14 this is a

1509
00:53:22,630 --> 00:53:20,559
competitive announcement in the science

1510
00:53:24,470 --> 00:53:22,640
community to go do great science uh that

1511
00:53:26,390 --> 00:53:24,480
that announcement of opportunities open

1512
00:53:29,510 --> 00:53:26,400
to the community that list explicitly

1513
00:53:31,750 --> 00:53:29,520

lists uh seven technologies encouraging

1514

00:53:33,589 --> 00:53:31,760

the science community to use there's

1515

00:53:35,109 --> 00:53:33,599

some incentivization in there and those

1516

00:53:36,710 --> 00:53:35,119

are technologies done in combination

1517

00:53:39,270 --> 00:53:36,720

with john hey what do you need what does

1518

00:53:41,349 --> 00:53:39,280

the science community need

1519

00:53:42,790 --> 00:53:41,359

a very specific example about things

1520

00:53:44,790 --> 00:53:42,800

we've learned and it's not necessarily

1521

00:53:46,150 --> 00:53:44,800

just discoveries although that factors

1522

00:53:48,150 --> 00:53:46,160

into it the

1523

00:53:50,150 --> 00:53:48,160

water within rocks that maybe we can

1524

00:53:52,710 --> 00:53:50,160

then extract by heating them and driving

1525

00:53:54,710 --> 00:53:52,720

off the water but more importantly

1526
00:53:57,349 --> 00:53:54,720
sort of a coral area of all exploration

1527
00:53:59,750 --> 00:53:57,359
is human exploration the curiosity rover

1528
00:54:01,430 --> 00:53:59,760
takes a lot of great images with all of

1529
00:54:03,990 --> 00:54:01,440
its cameras

1530
00:54:06,150 --> 00:54:04,000
most of the images stay on mars

1531
00:54:08,710 --> 00:54:06,160
because we don't have the bandwidth

1532
00:54:11,510 --> 00:54:08,720
to get the images back to earth

1533
00:54:12,710 --> 00:54:11,520
and even in the driving the analysis of

1534
00:54:15,349 --> 00:54:12,720
the scene and trying to get high

1535
00:54:16,549 --> 00:54:15,359
resolution images so that we can plan

1536
00:54:19,270 --> 00:54:16,559
what the next

1537
00:54:21,109 --> 00:54:19,280
traverses 100 meters will be like so we

1538
00:54:23,349 --> 00:54:21,119

can tell the rover to drive autonomously

1539

00:54:25,270 --> 00:54:23,359

for instance to get all of those images

1540

00:54:27,349 --> 00:54:25,280

back takes a long time because we're

1541

00:54:29,030 --> 00:54:27,359

railing up through an orbiter and then

1542

00:54:29,910 --> 00:54:29,040

through the deep space network back to

1543

00:54:31,910 --> 00:54:29,920

earth

1544

00:54:34,150 --> 00:54:31,920

if we had optical communications so

1545

00:54:36,630 --> 00:54:34,160

instead of radio we went to optical we

1546

00:54:39,109 --> 00:54:36,640

could have high bandwidth get that

1547

00:54:40,390 --> 00:54:39,119

data back to earth increase the science

1548

00:54:41,510 --> 00:54:40,400

exploration

1549

00:54:43,270 --> 00:54:41,520

but also

1550

00:54:44,710 --> 00:54:43,280

allow us to operate better and when we

1551
00:54:46,309 --> 00:54:44,720
get to human scales we're really going

1552
00:54:48,870 --> 00:54:46,319
to want that and so we're looking

1553
00:54:50,710 --> 00:54:48,880
aggressively at optical communication

1554
00:54:52,710 --> 00:54:50,720
which is

1555
00:54:54,549 --> 00:54:52,720
technology investments by technology and

1556
00:54:55,990 --> 00:54:54,559
then it'll be operational inside of

1557
00:54:57,589 --> 00:54:56,000
human space flight and we'll all take

1558
00:54:59,109 --> 00:54:57,599
advantage of it

1559
00:55:00,630 --> 00:54:59,119
unfortunately we have time for two more

1560
00:55:02,790 --> 00:55:00,640
questions uh i know we have them here in

1561
00:55:04,630 --> 00:55:02,800
the room

1562
00:55:05,750 --> 00:55:04,640
uh hi uh i get like everyone else thank

1563
00:55:07,190 --> 00:55:05,760

you so much for coming and talking to us

1564

00:55:09,910 --> 00:55:07,200

i apologize this is a really nerdy

1565

00:55:12,069 --> 00:55:09,920

question um i've spent a lot of time

1566

00:55:13,510 --> 00:55:12,079

reading the fifth divine design

1567

00:55:15,750 --> 00:55:13,520

reference architecture it's a really

1568

00:55:17,430 --> 00:55:15,760

great document about a possible path to

1569

00:55:18,870 --> 00:55:17,440

mars but it's getting old at this point

1570

00:55:20,710 --> 00:55:18,880

i mean it still basically is referring

1571

00:55:23,270 --> 00:55:20,720

to the constellation program

1572

00:55:25,750 --> 00:55:23,280

is there any plans to kind of be doing a

1573

00:55:27,349 --> 00:55:25,760

dr a6 at some point or is that you is

1574

00:55:29,829 --> 00:55:27,359

that just not where your resources are

1575

00:55:33,510 --> 00:55:31,349

talk to you about the split mission

1576

00:55:35,030 --> 00:55:33,520

concept of where cargo goes first that's

1577

00:55:37,190 --> 00:55:35,040

this next version we call it the

1578

00:55:41,109 --> 00:55:37,200

evolvable mars campaign so

1579

00:55:42,950 --> 00:55:41,119

try instead of being a specific

1580

00:55:44,870 --> 00:55:42,960

design reference mission per se with

1581

00:55:46,230 --> 00:55:44,880

finite points we're going to try to make

1582

00:55:47,910 --> 00:55:46,240

a little bit more flexible with some

1583

00:55:50,069 --> 00:55:47,920

kind of off-ramps and other pieces the

1584

00:55:51,990 --> 00:55:50,079

other piece that's important is is look

1585

00:55:53,829 --> 00:55:52,000

at where we can reuse components so

1586

00:55:55,910 --> 00:55:53,839

maybe the habitation module that goes to

1587

00:55:57,750 --> 00:55:55,920

mars maybe we actually park it someplace

1588

00:55:59,270 --> 00:55:57,760

in a high elliptical earth orbit we may

1589

00:56:00,870 --> 00:55:59,280

park it around the moon in a distant

1590

00:56:03,030 --> 00:56:00,880

retrograde orbit where we might put the

1591

00:56:04,710 --> 00:56:03,040

asteroid there's certain things we're

1592

00:56:06,549 --> 00:56:04,720

looking at to trade to see if those make

1593

00:56:07,910 --> 00:56:06,559

sense from an overall standpoint so

1594

00:56:10,150 --> 00:56:07,920

you're going to see us come out probably

1595

00:56:11,829 --> 00:56:10,160

next year with with kind of an update of

1596

00:56:13,349 --> 00:56:11,839

a plan of how this is starting to come

1597

00:56:15,349 --> 00:56:13,359

together but it's not going to be as

1598

00:56:18,150 --> 00:56:15,359

discreet maybe as a design reference

1599

00:56:19,589 --> 00:56:18,160

mission five it's gonna have a little

1600

00:56:21,349 --> 00:56:19,599

more softness in it a little more

1601

00:56:23,030 --> 00:56:21,359

flexibility in it so it can show the

1602

00:56:25,349 --> 00:56:23,040

paths and then we want the community to

1603

00:56:27,030 --> 00:56:25,359

help us figure out exactly the right way

1604

00:56:28,549 --> 00:56:27,040

to go do this because i think things

1605

00:56:30,390 --> 00:56:28,559

will change over time to think we know

1606

00:56:32,390 --> 00:56:30,400

all the technology that'll be in place

1607

00:56:33,910 --> 00:56:32,400

and exactly how things will work today

1608

00:56:35,829 --> 00:56:33,920

and we try to project that 20 years in

1609

00:56:37,589 --> 00:56:35,839

the future that's not a very effective

1610

00:56:39,349 --> 00:56:37,599

approach you need to be ready and if

1611

00:56:41,589 --> 00:56:39,359

some new technology comes online or a

1612

00:56:43,030 --> 00:56:41,599

new way of doing business is there or

1613

00:56:44,630 --> 00:56:43,040

something's there we're ready adapt and

1614

00:56:46,470 --> 00:56:44,640

move that and we and we haven't built

1615

00:56:48,390 --> 00:56:46,480

such an infrastructure it's so rigid it

1616

00:56:49,750 --> 00:56:48,400

can't adapt and change to those those

1617

00:56:51,510 --> 00:56:49,760

pieces so you'll see something probably

1618

00:56:53,030 --> 00:56:51,520

next year yeah that that's a nice

1619

00:56:54,470 --> 00:56:53,040

difference and a very important one i

1620

00:56:56,069 --> 00:56:54,480

think that we have to emphasize is we

1621

00:56:58,390 --> 00:56:56,079

all operate and live in an uncertain

1622

00:57:00,230 --> 00:56:58,400

world and if and you need to plan

1623

00:57:02,390 --> 00:57:00,240

accordingly and we can't be rigid in our

1624

00:57:04,470 --> 00:57:02,400

plans we really that flexibility i think

1625

00:57:07,190 --> 00:57:04,480

is what makes this this new plan really

1626
00:57:08,870 --> 00:57:07,200
uh uh different and essential and and i

1627
00:57:11,190 --> 00:57:08,880
think the other real strength of it is

1628
00:57:13,430 --> 00:57:11,200
is what you see up here today is science

1629
00:57:15,270 --> 00:57:13,440
technology and human exploration working

1630
00:57:17,349 --> 00:57:15,280
really closely together to say what's

1631
00:57:19,190 --> 00:57:17,359
the best plan to really optimize all the

1632
00:57:21,109 --> 00:57:19,200
different areas of nasa to make sure

1633
00:57:22,309 --> 00:57:21,119
we're coming up with a flexible

1634
00:57:27,829 --> 00:57:22,319
path

1635
00:57:33,750 --> 00:57:31,750
uh hi thank you very much um i'm julia

1636
00:57:35,270 --> 00:57:33,760
and i run a fashion tech blog called

1637
00:57:37,349 --> 00:57:35,280
technically sweet

1638
00:57:39,430 --> 00:57:37,359

and i think there's a lot of people that

1639

00:57:41,670 --> 00:57:39,440

are underrepresented that would like to

1640

00:57:43,990 --> 00:57:41,680

hear about some of the fashion

1641

00:57:45,910 --> 00:57:44,000

technology or the wearable technology

1642

00:57:49,750 --> 00:57:45,920

that the astronauts are pioneering with

1643

00:57:53,349 --> 00:57:49,760

this amazing nasa resources

1644

00:57:54,870 --> 00:57:53,359

are they wearing or or using anything

1645

00:57:57,349 --> 00:57:54,880

any advancements that we might be able

1646

00:57:59,349 --> 00:57:57,359

to trickle down to all of us for

1647

00:58:02,870 --> 00:57:59,359

accessibility purposes

1648

00:58:04,390 --> 00:58:02,880

or for everyone to utilize later on

1649

00:58:06,710 --> 00:58:04,400

well one thing we have on board space

1650

00:58:09,510 --> 00:58:06,720

station today is we have we typically do

1651
00:58:10,789 --> 00:58:09,520
a lot of ekg measurements on our crews

1652
00:58:12,710 --> 00:58:10,799
and typically you have to place the

1653
00:58:14,470 --> 00:58:12,720
electrodes on your body and then stick

1654
00:58:16,069 --> 00:58:14,480
them and adhere them we now have a vest

1655
00:58:17,750 --> 00:58:16,079
and you can just simply put the vest on

1656
00:58:19,430 --> 00:58:17,760
it automatically puts the electrodes in

1657
00:58:21,109 --> 00:58:19,440
the proper position for the crew members

1658
00:58:23,190 --> 00:58:21,119
and then the data can be telemetered

1659
00:58:24,710 --> 00:58:23,200
down to the ground for the folks to look

1660
00:58:26,150 --> 00:58:24,720
at so that's that's one thing we're

1661
00:58:27,990 --> 00:58:26,160
doing and we're starting to use those

1662
00:58:30,710 --> 00:58:28,000
those type of things

1663
00:58:32,470 --> 00:58:30,720

we also use the active watches i think

1664

00:58:35,030 --> 00:58:32,480

john probably wore one when he was in

1665

00:58:36,710 --> 00:58:35,040

space that keeps track of sleep cycles

1666

00:58:38,549 --> 00:58:36,720

and information along those lines they

1667

00:58:40,230 --> 00:58:38,559

all wear dosimeters so they can look at

1668

00:58:41,910 --> 00:58:40,240

the radiation environment during their

1669

00:58:43,510 --> 00:58:41,920

missions those kind of things so there's

1670

00:58:45,990 --> 00:58:43,520

lots of little pieces of medical

1671

00:58:48,470 --> 00:58:46,000

technology that we're starting to to put

1672

00:58:51,349 --> 00:58:48,480

on our crew members to capture data

1673

00:58:53,510 --> 00:58:51,359

unintrusively we also have some

1674

00:58:55,030 --> 00:58:53,520

some new shoes we have with the

1675

00:58:57,109 --> 00:58:55,040

accelerometers in the bottom of the

1676
00:58:58,950 --> 00:58:57,119
shoes so when they run on the treadmill

1677
00:59:00,630 --> 00:58:58,960
or they do the advanced resistive

1678
00:59:02,710 --> 00:59:00,640
exercise device you can actually look at

1679
00:59:06,150 --> 00:59:02,720
the loading that's going into the into

1680
00:59:08,230 --> 00:59:06,160
your in your femurs into your lower

1681
00:59:10,309 --> 00:59:08,240
lower bone structure to see if there's a

1682
00:59:11,430 --> 00:59:10,319
correlation between bone loss and how

1683
00:59:13,589 --> 00:59:11,440
much loading you get through your

1684
00:59:15,270 --> 00:59:13,599
exercise so these are devices that make

1685
00:59:17,270 --> 00:59:15,280
it transparent to the user that they

1686
00:59:19,829 --> 00:59:17,280
don't have to consciously even think

1687
00:59:21,109 --> 00:59:19,839
about it the data just gets collected

1688
00:59:23,270 --> 00:59:21,119

of course

1689

00:59:24,630 --> 00:59:23,280

you can uh address to go spacewalking

1690

00:59:26,230 --> 00:59:24,640

you know we have the helmet mounted

1691

00:59:27,829 --> 00:59:26,240

cameras that we've had for for a number

1692

00:59:29,510 --> 00:59:27,839

of years and i see quite a few

1693

00:59:31,190 --> 00:59:29,520

head-mounted cameras here

1694

00:59:32,950 --> 00:59:31,200

uh you know that that's a critical

1695

00:59:34,230 --> 00:59:32,960

component and the you know the cool

1696

00:59:35,910 --> 00:59:34,240

thing for us is it allows the folks that

1697

00:59:37,990 --> 00:59:35,920

are staying inside of the space station

1698

00:59:39,750 --> 00:59:38,000

to see so we can communicate better but

1699

00:59:41,190 --> 00:59:39,760

more importantly you know folks on earth

1700

00:59:43,109 --> 00:59:41,200

actually can experience this spacewalk

1701

00:59:45,349 --> 00:59:43,119

that way too and i'll just say from a

1702

00:59:46,870 --> 00:59:45,359

more way cool fashion if you ask me of

1703

00:59:48,390 --> 00:59:46,880

course i'm a guy i don't know what i

1704

00:59:50,870 --> 00:59:48,400

know about it but my wife tells me i

1705

00:59:52,870 --> 00:59:50,880

don't know much but david newman at mit

1706

00:59:54,710 --> 00:59:52,880

did some advanced work and under the

1707

00:59:56,870 --> 00:59:54,720

innovative yeah advanced concepts and

1708

00:59:58,069 --> 00:59:56,880

she's been nominated as nasa deputy

1709

01:00:03,270 --> 00:59:58,079

administrator and if you look at some of

1710

01:00:07,430 --> 01:00:05,430

there's a there's a document called uh

1711

01:00:10,230 --> 01:00:07,440

spin-offs and i encourage you to

1712

01:00:12,549 --> 01:00:10,240

download the electronic version because

1713

01:00:14,549 --> 01:00:12,559

the the bound version is so thick and

1714

01:00:16,150 --> 01:00:14,559

heavy but that's because there's so many

1715

01:00:17,109 --> 01:00:16,160

things that that are spinning off out

1716

01:00:24,309 --> 01:00:17,119

into the

1717

01:00:27,270 --> 01:00:25,750

the question was what are the spacesuits

1718

01:00:28,870 --> 01:00:27,280

made out of that going to mars and and

1719

01:00:30,230 --> 01:00:28,880

that's a really anybody here a material

1720

01:00:31,510 --> 01:00:30,240

scientist

1721

01:00:33,510 --> 01:00:31,520

i think actually we probably haven't

1722

01:00:35,270 --> 01:00:33,520

invented the material yet but people are

1723

01:00:37,190 --> 01:00:35,280

working on it that will form the basis

1724

01:00:38,549 --> 01:00:37,200

of those spacesuits that's one of the

1725

01:00:39,589 --> 01:00:38,559

areas

1726

01:00:41,589 --> 01:00:39,599

that's

1727

01:00:44,470 --> 01:00:41,599

you know really ripe for

1728

01:00:46,069 --> 01:00:44,480

discovery is our ability to customize

1729

01:00:47,430 --> 01:00:46,079

and build brand new materials which of

1730

01:00:48,710 --> 01:00:47,440

course is the essence of the fashion

1731

01:00:50,390 --> 01:00:48,720

industry

1732

01:00:52,390 --> 01:00:50,400

and then there's the anti-fashion

1733

01:00:54,710 --> 01:00:52,400

industry this is

1734

01:00:56,549 --> 01:00:54,720

we carry a lot of

1735

01:00:58,390 --> 01:00:56,559

clothes for the crews to wear so we're

1736

01:01:01,109 --> 01:00:58,400

looking at long duration clothing

1737

01:01:03,510 --> 01:01:01,119

material so we have stuff with

1738

01:01:05,829 --> 01:01:03,520

silver fibers in them we have various

1739

01:01:08,309 --> 01:01:05,839

other materials that don't that don't

1740

01:01:09,990 --> 01:01:08,319

absorb sweat and don't let bacteria grow

1741

01:01:12,789 --> 01:01:10,000

so we're looking at how long you can go

1742

01:01:15,589 --> 01:01:12,799

without changing your clothes so so this

1743

01:01:17,829 --> 01:01:15,599

is kind of the the the anti-fashion

1744

01:01:20,390 --> 01:01:17,839

world so so you would have one outfit

1745

01:01:22,309 --> 01:01:20,400

for your entire mars duration of 360

1746

01:01:23,990 --> 01:01:22,319

days now no one may ever talk to you and

1747

01:01:25,349 --> 01:01:24,000

the martians will run away from you when

1748

01:01:26,470 --> 01:01:25,359

you get there but but we're we're

1749

01:01:27,910 --> 01:01:26,480

starting to experiment with some of that

1750

01:01:29,910 --> 01:01:27,920

because it is a big volume if you have

1751

01:01:31,990 --> 01:01:29,920

to carry a lot of clothes and a lot of

1752

01:01:34,069 --> 01:01:32,000

material with you

1753

01:01:35,510 --> 01:01:34,079

explorers mountaineers and long system

1754

01:01:37,670 --> 01:01:35,520

sailors they typically only bring one

1755

01:01:39,030 --> 01:01:37,680

pair of clothes for months so it's it's

1756

01:01:40,630 --> 01:01:39,040

no big deal

1757

01:01:42,309 --> 01:01:40,640

and gilligan's island's on for years and

1758

01:01:43,270 --> 01:01:42,319

they just wore the same outfits

1759

01:01:44,870 --> 01:01:43,280

unfortunately that's all the time we

1760

01:01:48,230 --> 01:01:44,880

have with our panel uh give a round of

1761

01:01:48,240 --> 01:01:56,390

thank you

1762

01:01:59,510 --> 01:01:58,150

so while our exploration goals are going

1763

01:02:00,630 --> 01:01:59,520

deeper and further into space than ever

1764

01:02:02,630 --> 01:02:00,640

before

1765

01:02:05,349 --> 01:02:02,640

we're also investing in commercial

1766

01:02:07,109 --> 01:02:05,359

companies to keep us fly astronauts in

1767

01:02:30,789 --> 01:02:07,119

low earth orbit let's roll the next

1768

01:02:30,799 --> 01:02:52,950

first stages

1769

01:03:01,109 --> 01:02:54,789

commercial crew program phil mcallister

1770

01:03:05,190 --> 01:03:03,510

so i only have five minutes i've got so

1771

01:03:06,870 --> 01:03:05,200

much to tell you guys in five minutes

1772

01:03:09,190 --> 01:03:06,880

it's really hard for me to say

1773

01:03:12,390 --> 01:03:09,200

commercial crew in five minutes plus i

1774

01:03:14,549 --> 01:03:12,400

can't use acronyms now it's doubly hard

1775

01:03:16,309 --> 01:03:14,559

for someone from nasa but you know we do

1776

01:03:18,549 --> 01:03:16,319

hard things at nasa so i will give it a

1777

01:03:21,029 --> 01:03:18,559

try so what is this thing we're calling

1778

01:03:23,430 --> 01:03:21,039

uh commercial crew um

1779

01:03:24,870 --> 01:03:23,440

i think the best way to describe it

1780

01:03:26,470 --> 01:03:24,880

you know you've seen the shuttle

1781

01:03:28,150 --> 01:03:26,480

everybody's kind of familiar with that

1782

01:03:29,589 --> 01:03:28,160

and now you hear commercial crew and you

1783

01:03:31,430 --> 01:03:29,599

think was nasa getting out of the

1784

01:03:32,390 --> 01:03:31,440

business of transporting astronauts up

1785

01:03:34,630 --> 01:03:32,400

and down

1786

01:03:35,910 --> 01:03:34,640

to low earth orbit and the answer is no

1787

01:03:38,230 --> 01:03:35,920

we're just doing it in a slightly

1788

01:03:39,109 --> 01:03:38,240

different way if you remember the

1789

01:03:40,710 --> 01:03:39,119

shuttle

1790

01:03:42,470 --> 01:03:40,720

uh we all have a

1791

01:03:44,230 --> 01:03:42,480

soft spot in our hearts for the shuttle

1792

01:03:45,670 --> 01:03:44,240

particularly us here at nasa if you

1793

01:03:47,829 --> 01:03:45,680

think about how that was

1794

01:03:49,510 --> 01:03:47,839

produced and how it was made nasa was

1795

01:03:51,910 --> 01:03:49,520

really in charge of just about every

1796

01:03:54,390 --> 01:03:51,920

aspect of that development right we we

1797

01:03:55,990 --> 01:03:54,400

owned and operated the hardware we made

1798

01:03:58,150 --> 01:03:56,000

every decision about how it was going to

1799

01:03:59,990 --> 01:03:58,160

operate we did have the private sector

1800

01:04:02,549 --> 01:04:00,000

produce it for us but under very

1801
01:04:04,789 --> 01:04:02,559
exacting specifications we had over 12

1802
01:04:06,309 --> 01:04:04,799
000 requirements that we gave to the

1803
01:04:08,309 --> 01:04:06,319
private sector for them to build the

1804
01:04:10,309 --> 01:04:08,319
space shuttle and at the end of the day

1805
01:04:12,230 --> 01:04:10,319
we were the only customers

1806
01:04:13,510 --> 01:04:12,240
that's how we did it before and how

1807
01:04:15,349 --> 01:04:13,520
would we like to do it in the future if

1808
01:04:17,670 --> 01:04:15,359
you think about when we think about the

1809
01:04:20,069 --> 01:04:17,680
vision for transporting people to low

1810
01:04:22,230 --> 01:04:20,079
earth orbit out in the future it's very

1811
01:04:24,470 --> 01:04:22,240
much like aviation so i live in dc when

1812
01:04:26,630 --> 01:04:24,480
i came down here to orlando i bought a

1813
01:04:27,910 --> 01:04:26,640

ticket on united i went to the airport

1814

01:04:30,710 --> 01:04:27,920

got on the plane with a lot of other

1815

01:04:32,309 --> 01:04:30,720

customers and got down here to orlando

1816

01:04:34,069 --> 01:04:32,319

for a reasonably

1817

01:04:35,670 --> 01:04:34,079

good price i'd always like it to be

1818

01:04:37,990 --> 01:04:35,680

lower but you know it was something that

1819

01:04:39,910 --> 01:04:38,000

a normal person like myself could afford

1820

01:04:42,549 --> 01:04:39,920

that's how we would like it to be in the

1821

01:04:44,789 --> 01:04:42,559

future uh going up and down to low earth

1822

01:04:45,750 --> 01:04:44,799

orbit where nasa employees just buy a

1823

01:04:47,190 --> 01:04:45,760

ticket

1824

01:04:49,270 --> 01:04:47,200

from a company that's providing this

1825

01:04:51,109 --> 01:04:49,280

service to multiple customers to go up

1826

01:04:52,950 --> 01:04:51,119

and down to low earth orbit now that's

1827

01:04:54,789 --> 01:04:52,960

in the future so what are we doing today

1828

01:04:56,950 --> 01:04:54,799

that's really commercial crew and what

1829

01:04:59,029 --> 01:04:56,960

we're doing today is a public-private

1830

01:05:00,870 --> 01:04:59,039

partnership where we are

1831

01:05:03,349 --> 01:05:00,880

sharing the risks we're sharing the

1832

01:05:05,589 --> 01:05:03,359

financing we're sharing uh

1833

01:05:08,390 --> 01:05:05,599

the design decisions about how we're

1834

01:05:10,069 --> 01:05:08,400

going to develop these next systems to

1835

01:05:11,510 --> 01:05:10,079

get our people up and down to low earth

1836

01:05:13,829 --> 01:05:11,520

orbit so

1837

01:05:15,910 --> 01:05:13,839

the private sector is bringing their on

1838

01:05:17,910 --> 01:05:15,920

ingenuity their innovation and their

1839

01:05:20,309 --> 01:05:17,920

attention to cost effectiveness which is

1840

01:05:22,309 --> 01:05:20,319

really important and nasa is bringing

1841

01:05:24,549 --> 01:05:22,319

some financing ourselves as well as our

1842

01:05:25,829 --> 01:05:24,559

experience and lessons learned from all

1843

01:05:28,069 --> 01:05:25,839

of our previous human space flight

1844

01:05:30,150 --> 01:05:28,079

generations to to do something that we

1845

01:05:32,470 --> 01:05:30,160

think is going to be super powerful have

1846

01:05:34,150 --> 01:05:32,480

safe reliable and cost-effective space

1847

01:05:36,150 --> 01:05:34,160

transportation to and from the

1848

01:05:37,270 --> 01:05:36,160

international space station and to low

1849

01:05:39,510 --> 01:05:37,280

earth orbit

1850

01:05:42,470 --> 01:05:39,520

and we think that's going to be

1851
01:05:44,549 --> 01:05:42,480
an effective way to move forward

1852
01:05:46,630 --> 01:05:44,559
but we're only again talking about low

1853
01:05:47,910 --> 01:05:46,640
earth orbit you've seen all these great

1854
01:05:50,870 --> 01:05:47,920
things that we're doing

1855
01:05:53,029 --> 01:05:50,880
tomorrow's test launch we're going to

1856
01:05:54,870 --> 01:05:53,039
mars and the and the planets and that's

1857
01:05:57,109 --> 01:05:54,880
really more of a traditional nasa role

1858
01:06:00,309 --> 01:05:57,119
we don't see many customers for going to

1859
01:06:01,430 --> 01:06:00,319
mars besides nasa in the near term so i

1860
01:06:03,190 --> 01:06:01,440
think

1861
01:06:05,349 --> 01:06:03,200
having this combination of the private

1862
01:06:06,870 --> 01:06:05,359
sector taking more responsibility for

1863
01:06:08,630 --> 01:06:06,880

low earth orbit operations which is

1864

01:06:10,150 --> 01:06:08,640

something that we've been doing for 40

1865

01:06:11,910 --> 01:06:10,160

50 years now

1866

01:06:13,510 --> 01:06:11,920

it's still hard but it's gotten to be a

1867

01:06:15,029 --> 01:06:13,520

little bit more routine so it's a little

1868

01:06:17,430 --> 01:06:15,039

bit more

1869

01:06:19,510 --> 01:06:17,440

easy to see a transition for the private

1870

01:06:21,270 --> 01:06:19,520

sector to take more of a role in doing

1871

01:06:23,670 --> 01:06:21,280

that but when you're going out to say

1872

01:06:25,670 --> 01:06:23,680

the moon and mars that's a really really

1873

01:06:28,069 --> 01:06:25,680

difficult thing that we see more of a

1874

01:06:29,670 --> 01:06:28,079

traditional nasa mission if you want to

1875

01:06:32,470 --> 01:06:29,680

think about it the international space

1876

01:06:33,510 --> 01:06:32,480

station it's about 250 miles away from

1877

01:06:36,870 --> 01:06:33,520

the earth

1878

01:06:39,109 --> 01:06:36,880

the moon is about 250 000 miles away so

1879

01:06:42,230 --> 01:06:39,119

that's a lot harder and mars is about

1880

01:06:44,390 --> 01:06:42,240

150 million miles away so that's even

1881

01:06:46,230 --> 01:06:44,400

that's even much harder obviously so

1882

01:06:47,990 --> 01:06:46,240

this combination of having the private

1883

01:06:49,910 --> 01:06:48,000

sector take more of a role to low earth

1884

01:06:52,150 --> 01:06:49,920

orbit and nasa is still pushing the

1885

01:06:54,230 --> 01:06:52,160

state of the art we think that's what

1886

01:06:56,390 --> 01:06:54,240

america's human space flight program

1887

01:06:58,390 --> 01:06:56,400

should look like in the 21st century

1888

01:07:00,549 --> 01:06:58,400

where private sector is bringing their

1889

01:07:03,750 --> 01:07:00,559

skills and ingenuity and we are bringing

1890

01:07:05,270 --> 01:07:03,760

our experience and also our uh history

1891

01:07:07,829 --> 01:07:05,280

and knowledge and together we build

1892

01:07:10,069 --> 01:07:07,839

these really really strong systems and i

1893

01:07:12,390 --> 01:07:10,079

think that's going to make space travel

1894

01:07:14,230 --> 01:07:12,400

more accessible to everybody that is

1895

01:07:15,750 --> 01:07:14,240

certainly the hope in the future that we

1896

01:07:17,510 --> 01:07:15,760

drive down the cost we've seen this in

1897

01:07:19,349 --> 01:07:17,520

just about every mode of transportation

1898

01:07:21,589 --> 01:07:19,359

initially it's very very expensive but

1899

01:07:24,470 --> 01:07:21,599

as entrepreneurs come in

1900

01:07:26,150 --> 01:07:24,480

and they and innovations and competition

1901

01:07:28,630 --> 01:07:26,160

and you really drive the cost down we

1902

01:07:30,549 --> 01:07:28,640

see it a good analogy is uh climbing

1903

01:07:32,230 --> 01:07:30,559

mount everest if you think those first

1904

01:07:34,470 --> 01:07:32,240

expeditions up to mount everest they

1905

01:07:36,710 --> 01:07:34,480

were government financed they were very

1906

01:07:38,069 --> 01:07:36,720

expensive took a very long time

1907

01:07:40,069 --> 01:07:38,079

today

1908

01:07:41,670 --> 01:07:40,079

many many more people can can do that

1909

01:07:43,430 --> 01:07:41,680

you don't see governments doing it it's

1910

01:07:45,349 --> 01:07:43,440

personally financed you have commercial

1911

01:07:47,589 --> 01:07:45,359

operators doing that and helping people

1912

01:07:50,950 --> 01:07:47,599

go up and down we hope to see that kind

1913

01:07:53,430 --> 01:07:50,960

of transition as well and the reason why

1914

01:07:54,870 --> 01:07:53,440

i think this is so important

1915

01:07:57,510 --> 01:07:54,880

to bring the private sector more

1916

01:08:00,069 --> 01:07:57,520

involved in if nasa

1917

01:08:02,710 --> 01:08:00,079

was the only organization that did space

1918

01:08:05,109 --> 01:08:02,720

exploration we would always be limited

1919

01:08:05,990 --> 01:08:05,119

in our space aspirations by the nasa

1920

01:08:08,069 --> 01:08:06,000

budget

1921

01:08:09,829 --> 01:08:08,079

we get between 15 and 20 billion dollars

1922

01:08:12,230 --> 01:08:09,839

a year and if we were the only ones

1923

01:08:13,990 --> 01:08:12,240

doing it that's as much as we could do

1924

01:08:15,829 --> 01:08:14,000

in space when you bring the private

1925

01:08:17,910 --> 01:08:15,839

sector and they can help with this

1926

01:08:19,430 --> 01:08:17,920

financing you think about it there's

1927

01:08:21,829 --> 01:08:19,440

really no limit to what we can do in

1928

01:08:23,269 --> 01:08:21,839

space except our imaginations and that's

1929

01:08:25,110 --> 01:08:23,279

what's really cool to me that's why i

1930

01:08:27,910 --> 01:08:25,120

get really excited about

1931

01:08:30,390 --> 01:08:27,920

commercial crew we're trying to expand

1932

01:08:33,749 --> 01:08:30,400

our economic sphere out into low earth

1933

01:08:36,550 --> 01:08:33,759

orbit and the solar system and why that

1934

01:08:38,309 --> 01:08:36,560

is so important is we've seen over time

1935

01:08:40,470 --> 01:08:38,319

how tenuous our human space flight

1936

01:08:43,030 --> 01:08:40,480

programs can be

1937

01:08:45,189 --> 01:08:43,040

once we get economic interests out into

1938

01:08:47,590 --> 01:08:45,199

low earth orbit there will be no turning

1939

01:08:50,309 --> 01:08:47,600

back we will have planted as i like to

1940

01:08:52,630 --> 01:08:50,319

say our first sustainable flagpole in

1941

01:08:54,229 --> 01:08:52,640

our exploration of space once we have

1942

01:08:56,630 --> 01:08:54,239

economic interests and the private

1943

01:08:58,149 --> 01:08:56,640

sector more involved in space

1944

01:09:00,070 --> 01:08:58,159

exploration and particularly low earth

1945

01:09:02,149 --> 01:09:00,080

orbit so where are we i'm i'm going to

1946

01:09:03,829 --> 01:09:02,159

stop talking really fast right am i up

1947

01:09:07,669 --> 01:09:03,839

over my five minutes i'm sure i am yes i

1948

01:09:09,510 --> 01:09:07,679

am of course sorry yeah okay uh lastly

1949

01:09:11,910 --> 01:09:09,520

just where are we in this development uh

1950

01:09:13,669 --> 01:09:11,920

we started in about 2010 so we're about

1951

01:09:15,269 --> 01:09:13,679

halfway there we'd like to see the first

1952

01:09:18,229 --> 01:09:15,279

missions to low-earth orbit around the

1953

01:09:20,630 --> 01:09:18,239

2017 time frame so again this is it

1954

01:09:22,390 --> 01:09:20,640

takes a long time i know in today's day

1955

01:09:24,709 --> 01:09:22,400

and age if we have a six month old

1956

01:09:26,630 --> 01:09:24,719

smartphone it's a dinosaur these things

1957

01:09:27,990 --> 01:09:26,640

are hard they take a long time but

1958

01:09:29,349 --> 01:09:28,000

hopefully we'll see the first commercial

1959

01:09:31,590 --> 01:09:29,359

crew missions to the international space

1960

01:09:37,349 --> 01:09:31,600

station by about the 2017 time frame

1961

01:09:39,910 --> 01:09:38,870

we have to start with take questions in

1962

01:09:41,269 --> 01:09:39,920

the room and it'll go to some of our

1963

01:09:48,229 --> 01:09:41,279

field centers

1964

01:09:51,110 --> 01:09:49,269

hi

1965

01:09:52,709 --> 01:09:51,120

what sort of research is being done on

1966

01:09:54,149 --> 01:09:52,719

the international space station to

1967

01:09:56,310 --> 01:09:54,159

prepare for

1968

01:09:59,350 --> 01:09:56,320

long deep space exploration as far as

1969

01:10:00,709 --> 01:09:59,360

muscle loss uh for the astronauts that's

1970

01:10:02,470 --> 01:10:00,719

a great question

1971

01:10:03,350 --> 01:10:02,480

i'm probably not the best one to answer

1972

01:10:04,709 --> 01:10:03,360

that

1973

01:10:06,229 --> 01:10:04,719

probably somebody from the international

1974

01:10:07,910 --> 01:10:06,239

space station can talk to you about that

1975

01:10:10,070 --> 01:10:07,920

we've got plenty of research but that is

1976

01:10:11,590 --> 01:10:10,080

one of the keys to the international

1977

01:10:13,189 --> 01:10:11,600

space station is trying to figure out

1978

01:10:15,910 --> 01:10:13,199

how we can live and operate long

1979

01:10:17,669 --> 01:10:15,920

duration in space so though that is one

1980

01:10:19,669 --> 01:10:17,679

of the key functions and once commercial

1981

01:10:21,270 --> 01:10:19,679

crew becomes operational the key is

1982

01:10:23,990 --> 01:10:21,280

we're going to be able to add an

1983

01:10:25,990 --> 01:10:24,000

additional astronaut on space station

1984

01:10:28,149 --> 01:10:26,000

that's dedicated specifically to

1985

01:10:30,470 --> 01:10:28,159

research and helping us figure out those

1986

01:10:32,470 --> 01:10:30,480

things um and so that's one of the

1987

01:10:34,149 --> 01:10:32,480

reasons why we think commercial crew is

1988

01:10:36,550 --> 01:10:34,159

really important if you think about it

1989

01:10:38,870 --> 01:10:36,560

we've had continuous human

1990

01:10:40,950 --> 01:10:38,880

people in space for 16 years there's six

1991

01:10:42,790 --> 01:10:40,960

people on orbit right now you can see

1992

01:10:44,149 --> 01:10:42,800

them fly overhead about every 90 minutes

1993

01:10:45,590 --> 01:10:44,159

on the space station if the conditions

1994

01:10:47,669 --> 01:10:45,600

are right

1995

01:10:49,669 --> 01:10:47,679

so we've learned a lot but we have a lot

1996

01:10:51,189 --> 01:10:49,679

more to learn in order to go to mars in

1997

01:10:53,030 --> 01:10:51,199

terms of the things you've heard about

1998

01:10:54,709 --> 01:10:53,040

muscle deterioration bone loss and

1999

01:10:56,070 --> 01:10:54,719

things like that and that's why getting

2000

01:10:57,430 --> 01:10:56,080

up and down to the international space

2001
01:10:59,750 --> 01:10:57,440
station is so important and we want to

2002
01:11:04,550 --> 01:10:59,760
do it often we want to do it safely and

2003
01:11:08,470 --> 01:11:07,110
hi thank you for coming and real quick

2004
01:11:12,149 --> 01:11:08,480
for

2005
01:11:14,550 --> 01:11:12,159
other providers who is going to provide

2006
01:11:15,590 --> 01:11:14,560
uh the actual control of the vehicle and

2007
01:11:17,030 --> 01:11:15,600
training of the vehicle is that all

2008
01:11:19,030 --> 01:11:17,040
going to be done at houston or is that

2009
01:11:20,870 --> 01:11:19,040
going to be done at spacex at court

2010
01:11:22,630 --> 01:11:20,880
headquarters right so that's really up

2011
01:11:24,790 --> 01:11:22,640
to the companies uh they're going to be

2012
01:11:26,630 --> 01:11:24,800
responsible for training the crew and

2013
01:11:29,350 --> 01:11:26,640

they're going to be responsible for

2014

01:11:30,550 --> 01:11:29,360

operating the spacecraft so it's really

2015

01:11:32,550 --> 01:11:30,560

up to them

2016

01:11:34,070 --> 01:11:32,560

we will probably see some sort of

2017

01:11:36,950 --> 01:11:34,080

partnership again we've got a lot of

2018

01:11:38,470 --> 01:11:36,960

training facilities within nasa and

2019

01:11:39,750 --> 01:11:38,480

if the companies want to utilize them

2020

01:11:41,750 --> 01:11:39,760

we're going to make them available on a

2021

01:11:43,510 --> 01:11:41,760

reimbursable basis but i would suspect

2022

01:11:46,070 --> 01:11:43,520

most of that activity to happen at the

2023

01:11:48,390 --> 01:11:46,080

company's facilities and that's i think

2024

01:11:51,110 --> 01:11:48,400

that's appropriate we want them to be

2025

01:11:53,189 --> 01:11:51,120

able to do not only nasa people but

2026

01:11:55,110 --> 01:11:53,199

again other customers and so they have

2027

01:11:56,470 --> 01:11:55,120

to be able to do this without nasa and

2028

01:11:58,070 --> 01:11:56,480

we really hope that

2029

01:11:59,590 --> 01:11:58,080

they're able to accomplish that because

2030

01:12:02,950 --> 01:11:59,600

again that's in our interest because

2031

01:12:03,990 --> 01:12:02,960

then prices go down and we like that

2032

01:12:05,270 --> 01:12:04,000

phil we're now going to take a question

2033

01:12:10,550 --> 01:12:05,280

from the jet propulsion laboratory in

2034

01:12:14,390 --> 01:12:12,550

hi um i've been following all the

2035

01:12:16,870 --> 01:12:14,400

innovations that sierra nevada and

2036

01:12:18,630 --> 01:12:16,880

spacex have been doing with designing

2037

01:12:19,830 --> 01:12:18,640

their spacecraft i was wondering if any

2038

01:12:22,149 --> 01:12:19,840

of those companies comes up with

2039

01:12:24,550 --> 01:12:22,159

anything really innovative like a system

2040

01:12:27,189 --> 01:12:24,560

to return the rocket back to the um back

2041

01:12:29,270 --> 01:12:27,199

to the launch area or being able to land

2042

01:12:31,510 --> 01:12:29,280

with propulsion lockets on land will

2043

01:12:33,750 --> 01:12:31,520

nasa be adopting any of those activities

2044

01:12:34,790 --> 01:12:33,760

or any of those innovations if they turn

2045

01:12:36,870 --> 01:12:34,800

out to be something really

2046

01:12:38,790 --> 01:12:36,880

groundbreaking

2047

01:12:40,790 --> 01:12:38,800

that's another advantage to commercial

2048

01:12:43,750 --> 01:12:40,800

crew we we've had multiple companies

2049

01:12:45,270 --> 01:12:43,760

competing for these uh

2050

01:12:46,470 --> 01:12:45,280

for our agreements and contracts for

2051
01:12:47,990 --> 01:12:46,480
commercial crew and they all have a

2052
01:12:49,910 --> 01:12:48,000
different way of going about doing it

2053
01:12:51,669 --> 01:12:49,920
we're all going up and down to low earth

2054
01:12:54,709 --> 01:12:51,679
orbit but as an engineer it's really

2055
01:12:55,830 --> 01:12:54,719
cool to see how they the different ways

2056
01:12:57,830 --> 01:12:55,840
that they come up and do with these

2057
01:13:00,709 --> 01:12:57,840
things and really bringing their own

2058
01:13:02,229 --> 01:13:00,719
ideas and innovations uh to the task of

2059
01:13:02,950 --> 01:13:02,239
getting people up and down so i would

2060
01:13:07,430 --> 01:13:02,960
like

2061
01:13:10,390 --> 01:13:07,440
as these companies get better at it then

2062
01:13:12,070 --> 01:13:10,400
that that can actually spin in

2063
01:13:13,669 --> 01:13:12,080

to nasa and we've seen some of that

2064

01:13:15,189 --> 01:13:13,679

already it's actually helped with the

2065

01:13:16,790 --> 01:13:15,199

way we're doing commercial crew with

2066

01:13:18,790 --> 01:13:16,800

more of a

2067

01:13:20,709 --> 01:13:18,800

trying to trying to reduce our

2068

01:13:22,310 --> 01:13:20,719

requirements set and things like that

2069

01:13:23,750 --> 01:13:22,320

and using that for a more traditional

2070

01:13:26,390 --> 01:13:23,760

mission so that's another way commercial

2071

01:13:28,149 --> 01:13:26,400

crews and advantaging the agency if you

2072

01:13:29,910 --> 01:13:28,159

remember i said we had about 12 000

2073

01:13:33,030 --> 01:13:29,920

requirements for shuttle for commercial

2074

01:13:35,669 --> 01:13:33,040

crew it's about 300. so the companies

2075

01:13:36,950 --> 01:13:35,679

have significant flexibility to innovate

2076

01:13:39,270 --> 01:13:36,960

and come up with these interesting

2077

01:13:40,790 --> 01:13:39,280

propulsion mechanisms abort systems is

2078

01:13:42,709 --> 01:13:40,800

another innovative area that we found

2079

01:13:44,310 --> 01:13:42,719

our crew commercial crew partners coming

2080

01:13:45,669 --> 01:13:44,320

up with and several others and i would

2081

01:13:47,350 --> 01:13:45,679

expect to see some of that spin back

2082

01:13:48,470 --> 01:13:47,360

into nasa

2083

01:13:50,709 --> 01:13:48,480

okay we're now going to take a question

2084

01:13:52,870 --> 01:13:50,719

from the johnson space center in houston

2085

01:13:56,870 --> 01:13:52,880

johnson

2086

01:13:58,149 --> 01:13:56,880

hi sir uh thank you for your time today

2087

01:13:59,350 --> 01:13:58,159

um just wondering if you could speak to

2088

01:14:00,950 --> 01:13:59,360

maybe some of the other commercial

2089

01:14:03,750 --> 01:14:00,960

opportunities you might envision for

2090

01:14:04,870 --> 01:14:03,760

private sector in uh besides space taxi

2091

01:14:07,830 --> 01:14:04,880

operations

2092

01:14:10,310 --> 01:14:07,840

uh going up into orbit

2093

01:14:12,830 --> 01:14:10,320

a lot of ideas uh from the from

2094

01:14:15,110 --> 01:14:12,840

companies either asteroid mining

2095

01:14:17,510 --> 01:14:15,120

uh putting up

2096

01:14:20,229 --> 01:14:17,520

on their own private space stations

2097

01:14:22,310 --> 01:14:20,239

satellite servicing the moon has a lot

2098

01:14:25,669 --> 01:14:22,320

of opportunities you've got the google

2099

01:14:26,950 --> 01:14:25,679

lunar x prize and things like that

2100

01:14:29,030 --> 01:14:26,960

i almost see

2101

01:14:30,790 --> 01:14:29,040

not limitless but there's so many

2102

01:14:32,070 --> 01:14:30,800

potential ideas

2103

01:14:33,910 --> 01:14:32,080

again we're only limited by our

2104

01:14:35,910 --> 01:14:33,920

imagination and of course a good

2105

01:14:37,990 --> 01:14:35,920

business plan uh that's what's important

2106

01:14:40,149 --> 01:14:38,000

these companies are in in this to make

2107

01:14:41,510 --> 01:14:40,159

make money and to make a profit and

2108

01:14:43,510 --> 01:14:41,520

that's where this all has to come

2109

01:14:46,790 --> 01:14:43,520

together so there's really just a whole

2110

01:14:48,870 --> 01:14:46,800

laundry list of things that i think um

2111

01:14:51,350 --> 01:14:48,880

that people have proposed and companies

2112

01:14:53,270 --> 01:14:51,360

are working on uh i would use up all my

2113

01:14:55,350 --> 01:14:53,280

time if i started listing those but i

2114

01:14:56,470 --> 01:14:55,360

gave you just a few we already go take

2115

01:14:57,990 --> 01:14:56,480

one more question field center we'll

2116

01:15:00,070 --> 01:14:58,000

come back here to the room we have a

2117

01:15:06,550 --> 01:15:00,080

question from langley research center in

2118

01:15:06,560 --> 01:15:19,750

hi kind of continuing on uh

2119

01:15:24,630 --> 01:15:22,470

technical problems

2120

01:15:27,990 --> 01:15:24,640

sorry uh but what do you think can be

2121

01:15:30,470 --> 01:15:28,000

done uh perhaps either with orion or to

2122

01:15:32,630 --> 01:15:30,480

encourage the private sector to want to

2123

01:15:35,110 --> 01:15:32,640

pursue that um

2124

01:15:36,950 --> 01:15:35,120

commercialization of the space industry

2125

01:15:38,630 --> 01:15:36,960

a little more because i mean in my

2126
01:15:39,910 --> 01:15:38,640
opinion and i'm sure many others that

2127
01:15:41,590 --> 01:15:39,920
you work with

2128
01:15:45,189 --> 01:15:41,600
that could be a dramatic impact on the

2129
01:15:47,030 --> 01:15:45,199
american economy if it really grew

2130
01:15:49,189 --> 01:15:47,040
to be bigger than what it is right now

2131
01:15:51,910 --> 01:15:49,199
so what are ways that we could encourage

2132
01:15:53,350 --> 01:15:51,920
more companies to invest

2133
01:15:55,030 --> 01:15:53,360
in those things or the ones that already

2134
01:15:56,310 --> 01:15:55,040
are to invest more

2135
01:15:57,910 --> 01:15:56,320
yeah i think one of the biggest things

2136
01:16:00,470 --> 01:15:57,920
that we're doing is reducing the risk

2137
01:16:02,229 --> 01:16:00,480
for these companies so by doing things

2138
01:16:06,630 --> 01:16:02,239

like orion and our deep space

2139

01:16:08,390 --> 01:16:06,640

exploration we get better smarter about

2140

01:16:10,229 --> 01:16:08,400

how to do this in a safe and reliable

2141

01:16:12,550 --> 01:16:10,239

manner so i think that's a good role for

2142

01:16:14,390 --> 01:16:12,560

the for the us government is to reduce

2143

01:16:16,790 --> 01:16:14,400

the risk associated with these really

2144

01:16:17,750 --> 01:16:16,800

difficult difficult endeavors and that

2145

01:16:19,669 --> 01:16:17,760

way

2146

01:16:20,630 --> 01:16:19,679

a private company can come in with a

2147

01:16:22,870 --> 01:16:20,640

more

2148

01:16:25,430 --> 01:16:22,880

definitive business plan where the risks

2149

01:16:28,310 --> 01:16:25,440

are smaller where investors can see a

2150

01:16:30,149 --> 01:16:28,320

true profit potential here and i think

2151
01:16:32,070 --> 01:16:30,159
that is an appropriate role for nasa and

2152
01:16:33,750 --> 01:16:32,080
something that we are definitely

2153
01:16:35,189 --> 01:16:33,760
pursuing and

2154
01:16:37,270 --> 01:16:35,199
if you look back in history that's a

2155
01:16:39,270 --> 01:16:37,280
very uh common

2156
01:16:40,709 --> 01:16:39,280
transition where the government has

2157
01:16:42,310 --> 01:16:40,719
pushed the state of the art for like

2158
01:16:44,390 --> 01:16:42,320
railroads and aviation and then the

2159
01:16:45,750 --> 01:16:44,400
private sector comes behind when those

2160
01:16:47,510 --> 01:16:45,760
activities become a little bit more

2161
01:16:49,430 --> 01:16:47,520
routine a little bit less risky and you

2162
01:16:51,189 --> 01:16:49,440
can see a profit potential so i see that

2163
01:16:53,830 --> 01:16:51,199

as definitely one of the ways and also

2164

01:16:55,590 --> 01:16:53,840

reducing regulation reducing bureaucracy

2165

01:16:57,030 --> 01:16:55,600

uh review reducing the overhead

2166

01:16:59,430 --> 01:16:57,040

associated with doing that that's

2167

01:17:01,030 --> 01:16:59,440

another thing that we're working on

2168

01:17:03,990 --> 01:17:01,040

we only have time for one more question

2169

01:17:06,950 --> 01:17:04,000

we're taking in here in the room it's uh

2170

01:17:09,350 --> 01:17:06,960

the corn over there uh quick question uh

2171

01:17:13,030 --> 01:17:09,360

which do we see carrying astronauts next

2172

01:17:17,030 --> 01:17:13,040

for american space program spacex boeing

2173

01:17:19,510 --> 01:17:17,040

is it gonna be orion which is to be

2174

01:17:21,750 --> 01:17:19,520

well uh currently like i said uh we're

2175

01:17:24,229 --> 01:17:21,760

targeting commercial crew for 2017 both

2176

01:17:26,149 --> 01:17:24,239

companies we just let some contracts for

2177

01:17:27,510 --> 01:17:26,159

the final development effort to both

2178

01:17:29,590 --> 01:17:27,520

spacex and boeing that's what he's

2179

01:17:32,149 --> 01:17:29,600

referring to and they are both targeting

2180

01:17:34,470 --> 01:17:32,159

2017 to have their systems ready so let

2181

01:17:37,430 --> 01:17:34,480

the race begin we'll see uh we are not

2182

01:17:39,030 --> 01:17:37,440

going to sacrifice safety for schedule

2183

01:17:41,430 --> 01:17:39,040

obviously we really really want these

2184

01:17:43,110 --> 01:17:41,440

systems to come online soon but we are

2185

01:17:44,950 --> 01:17:43,120

going to maintain our safety posture to

2186

01:17:46,630 --> 01:17:44,960

make sure that our astronauts are safe i

2187

01:17:47,990 --> 01:17:46,640

think the first flight of orion is now

2188

01:17:52,070 --> 01:17:48,000

scheduled for

2189

01:17:53,590 --> 01:17:52,080

with with people sometime after 2017 but

2190

01:17:54,870 --> 01:17:53,600

again we don't see that as a competition

2191

01:17:56,390 --> 01:17:54,880

these are two very very different

2192

01:17:58,149 --> 01:17:56,400

missions whichever one goes first that's

2193

01:18:01,110 --> 01:17:58,159

great and i'll be happy and hopefully

2194

01:18:02,229 --> 01:18:01,120

down here at kennedy to see the launch

2195

01:18:08,870 --> 01:18:02,239

thanks bill appreciate you coming out

2196

01:18:12,310 --> 01:18:10,470

you know we do a lot of talking about

2197

01:18:13,430 --> 01:18:12,320

the spacecraft and with orion and

2198

01:18:15,669 --> 01:18:13,440

today's launch and tests and the

2199

01:18:17,030 --> 01:18:15,679

parachutes and the re-entry but one of

2200

01:18:19,590 --> 01:18:17,040

the reasons we're really flying orion is

2201

01:18:47,669 --> 01:18:19,600

to send humans into space exploration so

2202

01:18:47,679 --> 01:19:01,350

so

2203

01:19:04,630 --> 01:19:02,950

thanks everybody and and thanks for

2204

01:19:06,229 --> 01:19:04,640

being here and it's such a pleasure to

2205

01:19:08,229 --> 01:19:06,239

uh to be here and to share this with you

2206

01:19:09,590 --> 01:19:08,239

it's an exciting time here and you can

2207

01:19:11,590 --> 01:19:09,600

feel the excitement there you really can

2208

01:19:13,110 --> 01:19:11,600

i haven't felt this excitement at ksc

2209

01:19:15,590 --> 01:19:13,120

for for quite a while so i'm glad you're

2210

01:19:18,070 --> 01:19:15,600

here to uh to share in it and also to uh

2211

01:19:19,270 --> 01:19:18,080

to help tell everybody else about it too

2212

01:19:21,189 --> 01:19:19,280

now uh

2213

01:19:23,669 --> 01:19:21,199

about uh four and four years ago when i

2214

01:19:25,270 --> 01:19:23,679

was training for sts-135 that was the

2215

01:19:26,870 --> 01:19:25,280

final space shuttle mission

2216

01:19:28,950 --> 01:19:26,880

i often got the question

2217

01:19:30,070 --> 01:19:28,960

was it a mistake to retire the space

2218

01:19:32,630 --> 01:19:30,080

shuttle

2219

01:19:34,229 --> 01:19:32,640

and i would reply well it depends

2220

01:19:35,669 --> 01:19:34,239

if we do what we say we're going to do

2221

01:19:38,070 --> 01:19:35,679

and we take the money that we were

2222

01:19:39,750 --> 01:19:38,080

spending on shuttle operations

2223

01:19:40,950 --> 01:19:39,760

and take that and buy these new vehicles

2224

01:19:43,189 --> 01:19:40,960

and build these new vehicles they can go

2225

01:19:44,870 --> 01:19:43,199

farther than we've ever gone as humans

2226

01:19:46,630 --> 01:19:44,880

ever in the history of the earth then

2227

01:19:48,630 --> 01:19:46,640

it's not a mistake

2228

01:19:49,910 --> 01:19:48,640

well this eft-1 mission now four years

2229

01:19:51,830 --> 01:19:49,920

from that time of the last shuttle

2230

01:19:53,590 --> 01:19:51,840

mission or three and a half years

2231

01:19:55,189 --> 01:19:53,600

it's a big step

2232

01:19:56,310 --> 01:19:55,199

toward fulfilling a promise we made to

2233

01:19:57,590 --> 01:19:56,320

the american people that we're going to

2234

01:19:59,189 --> 01:19:57,600

take that money and we're going to build

2235

01:20:01,270 --> 01:19:59,199

some incredible vehicles that can do

2236

01:20:02,790 --> 01:20:01,280

amazing things and you guys are all here

2237

01:20:04,709 --> 01:20:02,800

to witness it

2238

01:20:07,189 --> 01:20:04,719

now in the aviation business

2239

01:20:08,229 --> 01:20:07,199

we refer to our our aircraft by their

2240

01:20:10,310 --> 01:20:08,239

tail numbers you guys have probably

2241

01:20:13,669 --> 01:20:10,320

heard that before and so in that vein

2242

01:20:16,310 --> 01:20:13,679

this makes it uh eft one orion tail

2243

01:20:18,790 --> 01:20:16,320

number zero zero one

2244

01:20:20,229 --> 01:20:18,800

and uh so now is it as a as a four-hour

2245

01:20:21,510 --> 01:20:20,239

flight you know and with no crew on

2246

01:20:22,709 --> 01:20:21,520

board you might think well that's not so

2247

01:20:23,750 --> 01:20:22,719

impressive

2248

01:20:25,110 --> 01:20:23,760

but what i think you need to do is you

2249

01:20:27,270 --> 01:20:25,120

need to take a little little bigger

2250

01:20:28,709 --> 01:20:27,280

picture and look what this amazing

2251

01:20:30,310 --> 01:20:28,719

credit vehicle is going to do not just

2252

01:20:31,830 --> 01:20:30,320

this one but the fleet of vehicles

2253

01:20:33,990 --> 01:20:31,840

because it really is an orion fleet it's

2254

01:20:35,910 --> 01:20:34,000

not just one orion and a different orion

2255

01:20:37,750 --> 01:20:35,920

and and so on

2256

01:20:39,270 --> 01:20:37,760

this is a vehicle that can go basically

2257

01:20:40,310 --> 01:20:39,280

anywhere it's it's not destination

2258

01:20:41,350 --> 01:20:40,320

specific as you heard everybody else

2259

01:20:43,189 --> 01:20:41,360

talk about which is really the

2260

01:20:45,510 --> 01:20:43,199

flexibility of this vehicle

2261

01:20:47,430 --> 01:20:45,520

and so it's uh it's really got in some

2262

01:20:49,110 --> 01:20:47,440

incredible capabilities now

2263

01:20:50,709 --> 01:20:49,120

you've also heard that it's not easy to

2264

01:20:51,990 --> 01:20:50,719

do this you know we have all the

2265

01:20:53,350 --> 01:20:52,000

technical challenges they've had in the

2266

01:20:54,550 --> 01:20:53,360

past programs uh you know with the

2267

01:20:55,750 --> 01:20:54,560

apollo program there's all sorts of

2268

01:20:57,669 --> 01:20:55,760

technical challenges we have to get

2269

01:20:59,270 --> 01:20:57,679

through but to be honest one of our big

2270

01:21:01,350 --> 01:20:59,280

challenges is that we do this in a very

2271

01:21:02,790 --> 01:21:01,360

constrained budget environment

2272

01:21:04,630 --> 01:21:02,800

that's not necessarily what we'd want

2273

01:21:06,229 --> 01:21:04,640

but that's the way things are and that's

2274

01:21:07,510 --> 01:21:06,239

okay we can deal with that it just takes

2275

01:21:09,350 --> 01:21:07,520

longer

2276

01:21:11,189 --> 01:21:09,360

to do these things and it's also harder

2277

01:21:12,870 --> 01:21:11,199

one of the problems is that we can't do

2278

01:21:14,550 --> 01:21:12,880

everything we want to do

2279

01:21:16,149 --> 01:21:14,560

sometimes with the earlier programs you

2280

01:21:17,270 --> 01:21:16,159

could try a few different things and if

2281

01:21:19,430 --> 01:21:17,280

they didn't work you figure out which

2282

01:21:20,229 --> 01:21:19,440

one works best and you pick that one

2283

01:21:21,590 --> 01:21:20,239

and then

2284

01:21:22,630 --> 01:21:21,600

but with this one with orion we pretty

2285

01:21:24,070 --> 01:21:22,640

much have to do everything right the

2286

01:21:27,030 --> 01:21:24,080

first time because we just don't have

2287

01:21:28,390 --> 01:21:27,040

time to uh to do it over again

2288

01:21:29,910 --> 01:21:28,400

so uh

2289

01:21:31,189 --> 01:21:29,920

one of the things that uh some of the

2290

01:21:33,430 --> 01:21:31,199

folks in the apollo program would tell

2291

01:21:35,030 --> 01:21:33,440

me is that they wish they had done a had

2292

01:21:36,390 --> 01:21:35,040

chance to take a step back once a while

2293

01:21:38,149 --> 01:21:36,400

and appreciate what they were doing you

2294

01:21:39,350 --> 01:21:38,159

know they were working so hard and when

2295

01:21:40,790 --> 01:21:39,360

sending people to the moon they didn't

2296

01:21:42,790 --> 01:21:40,800

step back and say wow look at look at

2297

01:21:44,390 --> 01:21:42,800

what we're doing and so i think that's

2298

01:21:47,110 --> 01:21:44,400

important for us to do

2299

01:21:48,630 --> 01:21:47,120

and uh because it's a uh we just don't

2300

01:21:50,630 --> 01:21:48,640

really have the chance to to really

2301

01:21:51,669 --> 01:21:50,640

enjoy the milestone sometimes so i i

2302

01:21:52,950 --> 01:21:51,679

kind of want to take a look at that

2303

01:21:55,350 --> 01:21:52,960

amidst the hard work that everybody's

2304

01:21:56,950 --> 01:21:55,360

doing to see what's ahead because now as

2305

01:21:58,629 --> 01:21:56,960

amazing and impressive as this first

2306

01:22:00,310 --> 01:21:58,639

launch as eft one

2307

01:22:02,149 --> 01:22:00,320

you know there's a just it only gets

2308

01:22:04,790 --> 01:22:02,159

better from here and just down the road

2309

01:22:06,070 --> 01:22:04,800

is orion tail number zero zero two now

2310

01:22:08,070 --> 01:22:06,080

you've probably heard of that as

2311

01:22:10,070 --> 01:22:08,080

expiration mission one

2312

01:22:11,510 --> 01:22:10,080

this is the second mission of orion and

2313

01:22:13,910 --> 01:22:11,520

it's going to go farther than ever any

2314

01:22:16,310 --> 01:22:13,920

human rated spacecraft has ever gone on

2315

01:22:19,430 --> 01:22:16,320

its second flight so it's going to be a

2316

01:22:21,110 --> 01:22:19,440

big challenge and uh it it's it takes a

2317

01:22:23,350 --> 01:22:21,120

while to get there but it's amazing how

2318

01:22:25,590 --> 01:22:23,360

what we're doing with each step

2319

01:22:27,110 --> 01:22:25,600

now then comes orion tail number zero

2320

01:22:30,870 --> 01:22:27,120

zero three

2321

01:22:32,229 --> 01:22:30,880

a special place in my heart because four

2322

01:22:33,990 --> 01:22:32,239

of my colleagues from the astronauts are

2323

01:22:35,910 --> 01:22:34,000

gonna be climbing on board that and go

2324

01:22:37,270 --> 01:22:35,920

on an adventure of a lifetime so it's

2325

01:22:38,629 --> 01:22:37,280

gonna be uh it's gonna be absolutely

2326

01:22:40,709 --> 01:22:38,639

amazing

2327

01:22:42,149 --> 01:22:40,719

now farther down the road there's also

2328

01:22:43,430 --> 01:22:42,159

going to be another orion on top of the

2329

01:22:44,790 --> 01:22:43,440

launch pad

2330

01:22:46,950 --> 01:22:44,800

now i don't know what the tail number of

2331

01:22:49,189 --> 01:22:46,960

this orion is but they're on board on

2332

01:22:50,790 --> 01:22:49,199

top of the space launch system we'll be

2333

01:22:52,149 --> 01:22:50,800

in over the familiar shape of the orion

2334

01:22:54,470 --> 01:22:52,159

spacecraft and on board will be people

2335

01:22:55,430 --> 01:22:54,480

going to mars for the very first time

2336

01:22:56,790 --> 01:22:55,440

it's an absolutely amazing

2337

01:22:58,629 --> 01:22:56,800

accomplishment that uh that's going to

2338

01:22:59,830 --> 01:22:58,639

happen one of those you know points in

2339

01:23:02,149 --> 01:22:59,840

history do you remember where they were

2340

01:23:04,149 --> 01:23:02,159

when when people went to mars

2341

01:23:05,510 --> 01:23:04,159

and it all traces back to what's

2342

01:23:06,950 --> 01:23:05,520

happening tomorrow with the launch of

2343

01:23:08,229 --> 01:23:06,960

eft-1

2344

01:23:09,590 --> 01:23:08,239

this is the first flight of a new

2345

01:23:11,189 --> 01:23:09,600

vehicle and the first flight of vehicle

2346

01:23:13,350 --> 01:23:11,199

is always a big deal and that's what is

2347

01:23:14,870 --> 01:23:13,360

so important about it

2348

01:23:16,070 --> 01:23:14,880

now

2349

01:23:17,350 --> 01:23:16,080

it's going to be a long time it's going

2350

01:23:18,709 --> 01:23:17,360

to be a long journey there's no question

2351

01:23:19,830 --> 01:23:18,719

there's going to be things that things

2352

01:23:21,110 --> 01:23:19,840

that don't always go right and we're

2353

01:23:23,030 --> 01:23:21,120

gonna learn from them and we're gonna

2354

01:23:24,950 --> 01:23:23,040

and we're going to uh recover and

2355

01:23:26,390 --> 01:23:24,960

continue on but it's gonna be a fun one

2356

01:23:27,830 --> 01:23:26,400

i'm glad to be part of it it's an

2357

01:23:29,430 --> 01:23:27,840

amazing team everybody has to do their

2358

01:23:31,110 --> 01:23:29,440

jobs everybody from the from the

2359

01:23:32,790 --> 01:23:31,120

engineers to the managers to the folks

2360

01:23:34,950 --> 01:23:32,800

in washington we've all got a job to do

2361

01:23:36,870 --> 01:23:34,960

and it's a long hard job but we're up to

2362

01:23:38,470 --> 01:23:36,880

it to see to have a chance to

2363

01:23:40,229 --> 01:23:38,480

have a chance to get on that path to

2364

01:23:41,590 --> 01:23:40,239

send folks to mars

2365

01:23:43,990 --> 01:23:41,600

now as you know when that crew is on the

2366

01:23:46,149 --> 01:23:44,000

board that or that orion tail number x

2367

01:23:48,470 --> 01:23:46,159

that's going to mars

2368

01:23:50,229 --> 01:23:48,480

it's going to be incredibly historic day

2369

01:23:52,550 --> 01:23:50,239

but then when when that happens amidst

2370

01:23:54,390 --> 01:23:52,560

all the celebration stuff i think a few

2371

01:23:57,430 --> 01:23:54,400

of us will take a look back all the way

2372

01:23:59,830 --> 01:23:57,440

back to a december day in florida when

2373

01:24:01,990 --> 01:23:59,840

we set off the very first orion tail

2374

01:24:03,189 --> 01:24:02,000

number 001 on his maiden journey and

2375

01:24:04,709 --> 01:24:03,199

that's happening tomorrow and that's why

2376

01:24:07,189 --> 01:24:04,719

it's so important to me

2377

01:24:08,550 --> 01:24:07,199

so i'm uh that's all i had to say for uh

2378

01:24:09,750 --> 01:24:08,560

kind of prepared march but i want to

2379

01:24:10,870 --> 01:24:09,760

open up for some questions if you guys

2380

01:24:12,229 --> 01:24:10,880

had any

2381

01:24:13,669 --> 01:24:12,239

thanks rex we'll take a couple questions

2382

01:24:19,990 --> 01:24:13,679

here in the room and then if we have

2383

01:24:24,470 --> 01:24:22,070

so obviously the pilots that are going

2384

01:24:28,229 --> 01:24:24,480

to be on these future orion missions may

2385

01:24:31,110 --> 01:24:28,239

not even be born yet yes so how are you

2386

01:24:33,030 --> 01:24:31,120

and nasa planning to start to

2387

01:24:34,390 --> 01:24:33,040

provide an excitement for the younger

2388

01:24:36,070 --> 01:24:34,400

generation that's going to be piloting

2389

01:24:37,669 --> 01:24:36,080

these future generations you know i

2390

01:24:39,750 --> 01:24:37,679

think that the biggest thing you can do

2391

01:24:41,110 --> 01:24:39,760

to excite the next generation is to show

2392

01:24:42,310 --> 01:24:41,120

them you know there's a lot of people

2393

01:24:43,669 --> 01:24:42,320

talk about they don't know about what

2394

01:24:44,870 --> 01:24:43,679

the space program is doing but when you

2395

01:24:46,550 --> 01:24:44,880

show them

2396

01:24:48,310 --> 01:24:46,560

they understand you know when i go to

2397

01:24:49,750 --> 01:24:48,320

schools and i and i talk to kids i show

2398

01:24:51,990 --> 01:24:49,760

them my pictures and they understand

2399

01:24:53,510 --> 01:24:52,000

that but the best way is what's going to

2400

01:24:55,030 --> 01:24:53,520

happen tomorrow when you guys see a

2401

01:24:56,229 --> 01:24:55,040

rocket launch you know those you've seen

2402

01:24:58,229 --> 01:24:56,239

it one before that you know what it's

2403

01:25:00,629 --> 01:24:58,239

like you don't just see a rocket launch

2404

01:25:02,629 --> 01:25:00,639

you experience it and tomorrow just take

2405

01:25:04,870 --> 01:25:02,639

it all in i mean feel the vibrations

2406

01:25:06,709 --> 01:25:04,880

from that rocket it's absolutely amazing

2407

01:25:08,870 --> 01:25:06,719

and when people see that it

2408

01:25:10,709 --> 01:25:08,880

the general reaction is pride in their

2409

01:25:12,310 --> 01:25:10,719

country when i see a rocket launch from

2410

01:25:14,390 --> 01:25:12,320

here it's just i have this incredible

2411

01:25:15,830 --> 01:25:14,400

sense of pride that i live in a country

2412

01:25:17,590 --> 01:25:15,840

where we have the capability of

2413

01:25:19,350 --> 01:25:17,600

rocketing people just slinging them off

2414

01:25:21,030 --> 01:25:19,360

the planet all the way into low earth

2415

01:25:23,189 --> 01:25:21,040

orbit and now we're working towards

2416

01:25:25,189 --> 01:25:23,199

slinging them off into deep space

2417

01:25:27,110 --> 01:25:25,199

so if you get them to see the program to

2418

01:25:28,390 --> 01:25:27,120

feel it i think they get excited about

2419

01:25:30,470 --> 01:25:28,400

it and the more we do the more they're

2420

01:25:31,750 --> 01:25:30,480

gonna get excited so ift ones tomorrow

2421

01:25:33,750 --> 01:25:31,760

it's gonna be it's gonna be really neat

2422

01:25:35,669 --> 01:25:33,760

to see it on top of a delta iv heavy

2423

01:25:37,110 --> 01:25:35,679

like i say orion tail number zero zero

2424

01:25:38,870 --> 01:25:37,120

two what's unique about that is the ride

2425

01:25:41,110 --> 01:25:38,880

is taken to orbit the space launch

2426
01:25:42,870 --> 01:25:41,120
system an incredible mighty rocket and

2427
01:25:44,629 --> 01:25:42,880
that thing is going to expire people

2428
01:25:46,550 --> 01:25:44,639
even before it flies you look at that

2429
01:25:48,310 --> 01:25:46,560
vab out there and you just imagine the

2430
01:25:50,229 --> 01:25:48,320
sls rolling out of there it is going to

2431
01:25:53,270 --> 01:25:50,239
take your breath away and then when it

2432
01:25:54,390 --> 01:25:53,280
flies when it flies america and the rest

2433
01:25:55,750 --> 01:25:54,400
of the world they're going to sit up and

2434
01:25:57,510 --> 01:25:55,760
take notice and there's going to be no

2435
01:25:59,110 --> 01:25:57,520
doubt about the vitality of the american

2436
01:26:00,390 --> 01:25:59,120
space program it is going to get

2437
01:26:02,550 --> 01:26:00,400
people's notice and it's going to be

2438
01:26:04,629 --> 01:26:02,560

exciting so i don't see any problem the

2439

01:26:06,310 --> 01:26:04,639

pro the hard part is just moving on and

2440

01:26:07,590 --> 01:26:06,320

getting piece by piece and getting there

2441

01:26:10,470 --> 01:26:07,600

but it's going it's going to get more

2442

01:26:13,030 --> 01:26:10,480

and more exciting right from here

2443

01:26:14,870 --> 01:26:13,040

yes hi a question along the same thread

2444

01:26:16,790 --> 01:26:14,880

sure obviously being an astronaut is a

2445

01:26:17,990 --> 01:26:16,800

dream for a lot of people what advice

2446

01:26:19,110 --> 01:26:18,000

would you give the kids and the young

2447

01:26:21,030 --> 01:26:19,120

adults who would like to be in your

2448

01:26:22,390 --> 01:26:21,040

position one day

2449

01:26:23,669 --> 01:26:22,400

there's a couple of things the first

2450

01:26:25,590 --> 01:26:23,679

obviously is to work hard in school and

2451
01:26:26,550 --> 01:26:25,600
people go well what what what should i

2452
01:26:27,510 --> 01:26:26,560
study

2453
01:26:28,790 --> 01:26:27,520
well you know the scientific and

2454
01:26:30,470 --> 01:26:28,800
technical fields of the where the

2455
01:26:32,390 --> 01:26:30,480
majority of the astronauts come from so

2456
01:26:34,470 --> 01:26:32,400
science medicine technology that kind of

2457
01:26:35,910 --> 01:26:34,480
thing is is important and then getting a

2458
01:26:37,270 --> 01:26:35,920
getting a hook into the space program

2459
01:26:38,550 --> 01:26:37,280
too you know working at one of this one

2460
01:26:40,470 --> 01:26:38,560
of the field centers working from the

2461
01:26:41,830 --> 01:26:40,480
contractors that type of thing then

2462
01:26:43,430 --> 01:26:41,840
being persistent it takes a lot of

2463
01:26:44,709 --> 01:26:43,440

persistence and you know the neat part

2464

01:26:46,070 --> 01:26:44,719

about it is if you try to be an

2465

01:26:47,270 --> 01:26:46,080

astronaut and you and you work in the

2466

01:26:48,870 --> 01:26:47,280

space industry for a while and you don't

2467

01:26:51,030 --> 01:26:48,880

get to become one you're still in the

2468

01:26:52,629 --> 01:26:51,040

space industry i remember when i was i

2469

01:26:54,390 --> 01:26:52,639

was a flight controller once and so back

2470

01:26:55,590 --> 01:26:54,400

in this is a long time ago before well

2471

01:26:56,870 --> 01:26:55,600

before i was an astronaut i was a flight

2472

01:26:58,950 --> 01:26:56,880

controller

2473

01:27:00,470 --> 01:26:58,960

the you know sts-26 out shortly after

2474

01:27:01,830 --> 01:27:00,480

the challenger mission

2475

01:27:03,910 --> 01:27:01,840

and i came down here as an engineer i

2476
01:27:05,830 --> 01:27:03,920
was working as part of the uh as part of

2477
01:27:07,990 --> 01:27:05,840
nasa kind of a back room for the control

2478
01:27:09,270 --> 01:27:08,000
center so a very small part of it but i

2479
01:27:11,189 --> 01:27:09,280
remember coming i had one trip at the

2480
01:27:13,030 --> 01:27:11,199
kennedy space center before the sts-26

2481
01:27:14,470 --> 01:27:13,040
launch and i remember standing right out

2482
01:27:17,189 --> 01:27:14,480
in that field out there and looking out

2483
01:27:19,350 --> 01:27:17,199
in the distance and i saw and i saw the

2484
01:27:21,189 --> 01:27:19,360
the vehicle it was uh was it was in the

2485
01:27:22,470 --> 01:27:21,199
last clown it was uh

2486
01:27:23,910 --> 01:27:22,480
um

2487
01:27:25,110 --> 01:27:23,920
discovery discovery was on the launch

2488
01:27:26,550 --> 01:27:25,120

pad but far in the distance i just

2489

01:27:27,910 --> 01:27:26,560

looked at discovery and i remember

2490

01:27:29,510 --> 01:27:27,920

thinking to myself

2491

01:27:30,870 --> 01:27:29,520

i can't believe i'm a part of this i

2492

01:27:32,470 --> 01:27:30,880

mean i had a tiny part i was working

2493

01:27:34,149 --> 01:27:32,480

landing gear and brakes but it was so

2494

01:27:35,750 --> 01:27:34,159

incredible for me to be a part of this

2495

01:27:37,350 --> 01:27:35,760

and i feel the same way i look at orion

2496

01:27:39,030 --> 01:27:37,360

you know i honestly i'm not going to get

2497

01:27:40,149 --> 01:27:39,040

a chance to fly on orion it's just it's

2498

01:27:41,990 --> 01:27:40,159

a little bit farther out than i've

2499

01:27:43,430 --> 01:27:42,000

already flown three times but i look at

2500

01:27:45,189 --> 01:27:43,440

that orion on top of the rock and i

2501

01:27:47,750 --> 01:27:45,199

think man i am so proud to be part of

2502

01:27:49,030 --> 01:27:47,760

this it's just such a neat feeling

2503

01:27:52,629 --> 01:27:49,040

we have a lot of questions we'll try to

2504

01:27:58,390 --> 01:27:52,639

get to them all we have next one is at

2505

01:28:02,629 --> 01:28:01,030

hi rex um i'm curious

2506

01:28:04,310 --> 01:28:02,639

my name is mark simpson from visiting

2507

01:28:06,950 --> 01:28:04,320

from chattanooga tennessee

2508

01:28:09,110 --> 01:28:06,960

i'm curious uh if you're aware or have

2509

01:28:10,709 --> 01:28:09,120

been made aware of the quality of life

2510

01:28:12,390 --> 01:28:10,719

uh the astronauts will be experiencing

2511

01:28:13,990 --> 01:28:12,400

in a long distance voyage like going to

2512

01:28:17,030 --> 01:28:14,000

mars

2513

01:28:18,790 --> 01:28:17,040

i've heard some talk about a a

2514

01:28:21,270 --> 01:28:18,800

habitat module

2515

01:28:22,790 --> 01:28:21,280

will the extended module just carry fuel

2516

01:28:23,910 --> 01:28:22,800

or will it be something that the

2517

01:28:26,870 --> 01:28:23,920

astronauts will be able to go in and

2518

01:28:29,590 --> 01:28:26,880

relax in seems kind of odd to me to

2519

01:28:31,910 --> 01:28:29,600

expect four astronauts i mean i know the

2520

01:28:33,590 --> 01:28:31,920

i know it's a roomier capsule but it

2521

01:28:35,350 --> 01:28:33,600

seems kind of odd to me that four guys

2522

01:28:37,110 --> 01:28:35,360

got to stay in a small area for that

2523

01:28:39,110 --> 01:28:37,120

extended period of time going to mars so

2524

01:28:41,750 --> 01:28:39,120

i'm wondering as an astronaut have they

2525

01:28:43,030 --> 01:28:41,760

clued you in on some of the more life

2526

01:28:44,950 --> 01:28:43,040

comfort

2527

01:28:46,310 --> 01:28:44,960

parts of the journey for long distance

2528

01:28:47,510 --> 01:28:46,320

like mars so for the longest the

2529

01:28:48,470 --> 01:28:47,520

habitation module hasn't been designed

2530

01:28:50,070 --> 01:28:48,480

yet but you're absolutely right you

2531

01:28:51,669 --> 01:28:50,080

can't stay in the orion capsule for

2532

01:28:53,270 --> 01:28:51,679

three years i mean a mars mission could

2533

01:28:54,470 --> 01:28:53,280

take three years potentially so you have

2534

01:28:55,830 --> 01:28:54,480

to have a habitation module it's going

2535

01:28:57,430 --> 01:28:55,840

to have some of the comforts of home to

2536

01:28:59,750 --> 01:28:57,440

a certain extent and it's going to be a

2537

01:29:01,830 --> 01:28:59,760

tough journey it is going to one one

2538

01:29:03,110 --> 01:29:01,840

person reckon it to liken it to me like

2539

01:29:04,790 --> 01:29:03,120

when you go to mars you know it's all

2540

01:29:06,950 --> 01:29:04,800

exciting and stuff and and you know i

2541

01:29:07,910 --> 01:29:06,960

love being in space and flying

2542

01:29:10,149 --> 01:29:07,920

but it's gonna be different going to

2543

01:29:12,149 --> 01:29:10,159

mars ever you know several days maybe a

2544

01:29:14,149 --> 01:29:12,159

couple weeks outside after your launch

2545

01:29:15,510 --> 01:29:14,159

you're going to be coasting to mars

2546

01:29:16,629 --> 01:29:15,520

and all you're not going to have the

2547

01:29:17,910 --> 01:29:16,639

beautiful earth to look back on it's

2548

01:29:19,110 --> 01:29:17,920

going to recede into becoming just

2549

01:29:20,149 --> 01:29:19,120

another star

2550

01:29:22,070 --> 01:29:20,159

and all you're going to have around you

2551

01:29:23,510 --> 01:29:22,080

is stars and what some people say and i

2552

01:29:25,110 --> 01:29:23,520

agree is it going to redefine the

2553

01:29:26,709 --> 01:29:25,120

meaning of the word loneliness it's

2554

01:29:28,629 --> 01:29:26,719

going to be tough and not everybody can

2555

01:29:30,149 --> 01:29:28,639

do it but we have explorers the same

2556

01:29:31,750 --> 01:29:30,159

people who cross the oceans way back

2557

01:29:33,350 --> 01:29:31,760

when they have the same kind of grit and

2558

01:29:35,189 --> 01:29:33,360

determination that they can

2559

01:29:37,110 --> 01:29:35,199

that they can can do that kind of thing

2560

01:29:38,550 --> 01:29:37,120

go on an extremely long dangerous voyage

2561

01:29:39,750 --> 01:29:38,560

like that

2562

01:29:40,870 --> 01:29:39,760

we'll take one more for the field

2563

01:29:46,070 --> 01:29:40,880

centers we're going to goddard space

2564

01:29:49,990 --> 01:29:48,390

yeah hi i'm mike from uh calling in from

2565

01:29:50,830 --> 01:29:50,000

goddard

2566

01:29:53,270 --> 01:29:50,840

uh

2567

01:29:55,590 --> 01:29:53,280

yay um

2568

01:29:58,229 --> 01:29:55,600

in the early days of the space program

2569

01:29:59,830 --> 01:29:58,239

you know mercury gemini apollo and the

2570

01:30:02,310 --> 01:29:59,840

shuttle uh

2571

01:30:04,870 --> 01:30:02,320

it was well known that the engineers

2572

01:30:07,750 --> 01:30:04,880

took a lot of input from astronauts on

2573

01:30:09,510 --> 01:30:07,760

uh what the astronauts wanted and were

2574

01:30:11,350 --> 01:30:09,520

looking for as far as

2575

01:30:13,590 --> 01:30:11,360

the design of the space capsule so

2576

01:30:15,110 --> 01:30:13,600

wondering how much input the astronauts

2577

01:30:16,629 --> 01:30:15,120

had in orion

2578

01:30:17,990 --> 01:30:16,639

a lot and actually i am the astronaut

2579

01:30:20,070 --> 01:30:18,000

representative to the orion program so i

2580

01:30:21,430 --> 01:30:20,080

work on mark guyer's staff and i give

2581

01:30:22,709 --> 01:30:21,440

them our input of what we think is

2582

01:30:25,189 --> 01:30:22,719

important and what we think we need for

2583

01:30:26,950 --> 01:30:25,199

this vehicle and so it's a it's a it's a

2584

01:30:28,790 --> 01:30:26,960

hard program like i say it's constrained

2585

01:30:30,310 --> 01:30:28,800

by by money it's constrained by weight

2586

01:30:31,669 --> 01:30:30,320

and it's a difficult engineering problem

2587

01:30:33,189 --> 01:30:31,679

and so we're cognizant of the fact so

2588

01:30:35,189 --> 01:30:33,199

when we when we talk about what we think

2589

01:30:36,950 --> 01:30:35,199

we need we really have to ask do we

2590

01:30:39,030 --> 01:30:36,960

really need this is this essential and

2591

01:30:41,030 --> 01:30:39,040

if it's not essential it gets pushed off

2592

01:30:43,030 --> 01:30:41,040

potentially so it's not an easy process

2593

01:30:44,470 --> 01:30:43,040

but we're we are uh we're a part of it

2594

01:30:48,149 --> 01:30:44,480

and it's uh and it's an interesting

2595

01:30:50,229 --> 01:30:48,159

process to be part of

2596

01:30:51,990 --> 01:30:50,239

another question yes

2597

01:30:53,430 --> 01:30:52,000

first i got to say i saw you launch on

2598

01:30:55,669 --> 01:30:53,440

135.

2599

01:30:57,669 --> 01:30:55,679

really nice honor to be here with you

2600

01:30:59,430 --> 01:30:57,679

seeing you i'm glad you were there to

2601
01:31:00,390 --> 01:30:59,440
cheer us on yep you must have been a

2602
01:31:01,910 --> 01:31:00,400
lucky charm it's the first time i

2603
01:31:03,189 --> 01:31:01,920
launched on time so i assume tomorrow

2604
01:31:04,070 --> 01:31:03,199
we're gonna launch on time too is that

2605
01:31:08,550 --> 01:31:04,080
correct

2606
01:31:11,510 --> 01:31:10,229
um so i just wanted if you can tell us

2607
01:31:13,830 --> 01:31:11,520
um what's current what the current

2608
01:31:16,709 --> 01:31:13,840
thoughts are for the flight profile of

2609
01:31:18,229 --> 01:31:16,719
tail number zero zero three yes for okay

2610
01:31:19,990 --> 01:31:18,239
the what's the profile going to be like

2611
01:31:21,669 --> 01:31:20,000
that's why you better where are we going

2612
01:31:23,030 --> 01:31:21,679
exactly so you know

2613
01:31:24,310 --> 01:31:23,040

right to the you know it'll be the lunar

2614

01:31:26,229 --> 01:31:24,320

vicinity you know we've talked about the

2615

01:31:27,830 --> 01:31:26,239

the basic uh trajectory would be to do a

2616

01:31:28,790 --> 01:31:27,840

you know high lunar orbit of that now

2617

01:31:29,990 --> 01:31:28,800

there's still there's still some trade

2618

01:31:31,350 --> 01:31:30,000

space there how do you want to do that

2619

01:31:33,189 --> 01:31:31,360

do you want to do you want to build up

2620

01:31:34,390 --> 01:31:33,199

to go into the moon you know if you have

2621

01:31:36,390 --> 01:31:34,400

depending on what capabilities we have

2622

01:31:38,149 --> 01:31:36,400

we may be able to stay longer in low

2623

01:31:39,669 --> 01:31:38,159

earth orbit because the tricky part

2624

01:31:41,270 --> 01:31:39,679

about tail number zero zero three is

2625

01:31:43,189 --> 01:31:41,280

that's the first one with the eclipse

2626
01:31:44,870 --> 01:31:43,199
system so the life environmental control

2627
01:31:46,149 --> 01:31:44,880
and life support system it's got the

2628
01:31:47,910 --> 01:31:46,159
stuff that keeps us alive you don't need

2629
01:31:49,270 --> 01:31:47,920
that for tail number one and two three

2630
01:31:50,550 --> 01:31:49,280
it's very important

2631
01:31:52,149 --> 01:31:50,560
so you wanna put a little bit of time on

2632
01:31:53,750 --> 01:31:52,159
that before you make that big burn to

2633
01:31:55,110 --> 01:31:53,760
the moon so we're gonna we're gonna see

2634
01:31:56,950 --> 01:31:55,120
what the best trajectory and the best

2635
01:31:58,149 --> 01:31:56,960
profile is but uh i think we can get the

2636
01:31:59,830 --> 01:31:58,159
best of both worlds get a little bit of

2637
01:32:02,149 --> 01:31:59,840
time on it and then then take a shot at

2638
01:32:03,750 --> 01:32:02,159

the moon so it's pretty amazing and it's

2639

01:32:04,950 --> 01:32:03,760

going to be a it's going to be a game

2640

01:32:06,390 --> 01:32:04,960

changer it really is but there's

2641

01:32:08,550 --> 01:32:06,400

there'll be no shortage of astronauts

2642

01:32:11,430 --> 01:32:08,560

volunteering for that mission

2643

01:32:14,870 --> 01:32:13,270

hi there bobby russell and i'm a pilot

2644

01:32:16,790 --> 01:32:14,880

and also a suborbital space flight

2645

01:32:17,910 --> 01:32:16,800

training at xcor oh great and so i

2646

01:32:20,149 --> 01:32:17,920

haven't heard anybody talk about

2647

01:32:21,590 --> 01:32:20,159

tomorrow in flight profile as far as are

2648

01:32:22,470 --> 01:32:21,600

there going to be pitching maneuvers are

2649

01:32:24,310 --> 01:32:22,480

we going to actually test the

2650

01:32:25,669 --> 01:32:24,320

maneuverability of the capsule you bet

2651

01:32:26,950 --> 01:32:25,679

so it's they are going to to a certain

2652

01:32:28,950 --> 01:32:26,960

extent so once it separates from the

2653

01:32:30,709 --> 01:32:28,960

upper stage it has to reorient itself to

2654

01:32:33,189 --> 01:32:30,719

basically uh to basically have the right

2655

01:32:34,470 --> 01:32:33,199

profile for uh uh for re-entries and

2656

01:32:36,070 --> 01:32:34,480

that's that's very important so that is

2657

01:32:37,669 --> 01:32:36,080

a good a good test of the reaction

2658

01:32:38,950 --> 01:32:37,679

control system which you know each one

2659

01:32:40,950 --> 01:32:38,960

of these is not necessarily a long test

2660

01:32:42,950 --> 01:32:40,960

but they're important important ways of

2661

01:32:44,709 --> 01:32:42,960

testing each one of these systems

2662

01:32:45,990 --> 01:32:44,719

because it really does get a good a good

2663

01:32:47,350 --> 01:32:46,000

cross-section of this of the importance

2664

01:32:49,990 --> 01:32:47,360

you can separation systems you do the

2665

01:32:51,750 --> 01:32:50,000

parachute systems and uh so there's a

2666

01:32:52,950 --> 01:32:51,760

and the guidance navigation and

2667

01:32:55,990 --> 01:32:52,960

propulsion system so there's a lot of

2668

01:32:59,990 --> 01:32:57,430

unfortunately that's all the time we

2669

01:33:01,910 --> 01:33:00,000

have left for rex walheim thank you for

2670

01:33:08,310 --> 01:33:01,920

joining us all right thank you

2671

01:33:12,310 --> 01:33:10,390

so a lot of work went into making orion

2672

01:33:13,350 --> 01:33:12,320

this test flight happened tomorrow you

2673

01:33:14,870 --> 01:33:13,360

know there's all kinds of testing that

2674

01:33:16,709 --> 01:33:14,880

happened before a lot of milestones were

2675

01:34:26,550 --> 01:33:16,719

reached um let's check it out let's see

2676

01:34:29,669 --> 01:34:28,390

and for our grand finale let me

2677

01:34:31,590 --> 01:34:29,679

introduce to you the man who can answer

2678

01:34:37,430 --> 01:34:31,600

any of your questions about orion mark

2679

01:34:42,390 --> 01:34:38,390

thank you

2680

01:34:44,070 --> 01:34:42,400

i look forward to some questions i know

2681

01:34:46,629 --> 01:34:44,080

you guys already heard you talking to

2682

01:34:49,910 --> 01:34:46,639

rex and uh you had some great speakers

2683

01:34:51,189 --> 01:34:49,920

today with gerst and charlie and john so

2684

01:34:52,629 --> 01:34:51,199

i'll talk a little bit about orion i

2685

01:34:53,910 --> 01:34:52,639

think you've i already heard some

2686

01:34:55,510 --> 01:34:53,920

questions about orion so you already

2687

01:34:57,590 --> 01:34:55,520

know a lot about it but i'll tell you a

2688

01:34:59,110 --> 01:34:57,600

little bit from my perspective uh and

2689

01:35:01,510 --> 01:34:59,120

then we can dialogue on things that

2690

01:35:04,310 --> 01:35:01,520

you're interested in so orion of course

2691

01:35:06,950 --> 01:35:04,320

is the capsule system that that takes

2692

01:35:09,270 --> 01:35:06,960

the crew out into deep space uh sls

2693

01:35:11,430 --> 01:35:09,280

gives us the velocity but orion is where

2694

01:35:13,510 --> 01:35:11,440

the crew resides and does their work

2695

01:35:14,790 --> 01:35:13,520

it's how uh it's broke up into three

2696

01:35:16,550 --> 01:35:14,800

different pieces

2697

01:35:17,910 --> 01:35:16,560

the crew module is the main focus and

2698

01:35:20,229 --> 01:35:17,920

that's also the main focus of the test

2699

01:35:22,229 --> 01:35:20,239

tomorrow crew module is where the crew

2700

01:35:23,750 --> 01:35:22,239

lives sleeps works it's where they

2701

01:35:25,590 --> 01:35:23,760

interact with the vehicle

2702

01:35:26,950 --> 01:35:25,600

it's where they where their seats are

2703

01:35:28,470 --> 01:35:26,960

it's where they

2704

01:35:30,229 --> 01:35:28,480

have their displays and controls to

2705

01:35:31,910 --> 01:35:30,239

interact with the computers

2706

01:35:34,149 --> 01:35:31,920

it's where they stow their food it's

2707

01:35:36,709 --> 01:35:34,159

where their suits would be

2708

01:35:38,149 --> 01:35:36,719

and also inside the the crew module

2709

01:35:40,070 --> 01:35:38,159

itself can act as an airlock we can

2710

01:35:43,110 --> 01:35:40,080

depress the cabin uh and they can go

2711

01:35:44,390 --> 01:35:43,120

outside and do ebas the crew module also

2712

01:35:46,870 --> 01:35:44,400

then has the heat shields and the

2713

01:35:48,950 --> 01:35:46,880

parachutes and all the computers that do

2714

01:35:51,030 --> 01:35:48,960

all the navigation and guidance the rcs

2715

01:35:53,669 --> 01:35:51,040

system that that

2716

01:35:54,870 --> 01:35:53,679

controls the the how we point orion so

2717

01:35:57,510 --> 01:35:54,880

that we enter

2718

01:35:59,030 --> 01:35:57,520

uh safely behind the crew module is what

2719

01:36:01,030 --> 01:35:59,040

we call the service module the service

2720

01:36:02,870 --> 01:36:01,040

module is where you have the big tanks

2721

01:36:04,470 --> 01:36:02,880

for the water and the air it's also

2722

01:36:06,790 --> 01:36:04,480

where the big prop system is it's where

2723

01:36:08,149 --> 01:36:06,800

the radiators are to cool the systems

2724

01:36:08,870 --> 01:36:08,159

it's where the solar rays are going to

2725

01:36:10,629 --> 01:36:08,880

be

2726
01:36:11,830 --> 01:36:10,639
to generate power when we're in deep

2727
01:36:14,149 --> 01:36:11,840
space

2728
01:36:16,070 --> 01:36:14,159
that service module part is actually

2729
01:36:17,510 --> 01:36:16,080
going to fly a full service module on

2730
01:36:19,110 --> 01:36:17,520
our next flight on this flight it's

2731
01:36:20,790 --> 01:36:19,120
basically a structure it's basically a

2732
01:36:21,910 --> 01:36:20,800
service module structure and we're

2733
01:36:24,229 --> 01:36:21,920
flying it because we're going to test

2734
01:36:25,669 --> 01:36:24,239
some of the key pyrotechnic separation

2735
01:36:27,669 --> 01:36:25,679
events like these fairings you see in

2736
01:36:29,110 --> 01:36:27,679
the movie come off and the separation

2737
01:36:31,189 --> 01:36:29,120
between the crew module and the service

2738
01:36:32,629 --> 01:36:31,199

module which is obviously one that's got

2739

01:36:33,990 --> 01:36:32,639

to work

2740

01:36:35,590 --> 01:36:34,000

and the reason we're testing those

2741

01:36:38,790 --> 01:36:35,600

particular systems on this flight is

2742

01:36:40,390 --> 01:36:38,800

pyrotechnic devices they have to work

2743

01:36:42,149 --> 01:36:40,400

you know they have to work when you need

2744

01:36:44,709 --> 01:36:42,159

them to work so they got to be high

2745

01:36:46,390 --> 01:36:44,719

reliable high reliable parts

2746

01:36:47,990 --> 01:36:46,400

because they are fundamentally critical

2747

01:36:50,149 --> 01:36:48,000

operations

2748

01:36:51,990 --> 01:36:50,159

then on the very top of orion when you

2749

01:36:54,390 --> 01:36:52,000

look at it you see it uh on the top of

2750

01:36:56,390 --> 01:36:54,400

the the rocket you see the pointy part

2751
01:36:58,229 --> 01:36:56,400
and the and the dome part that's what we

2752
01:36:59,990 --> 01:36:58,239
call the launch abort system the launch

2753
01:37:00,870 --> 01:37:00,000
abort system is there that when we fly

2754
01:37:03,109 --> 01:37:00,880
people

2755
01:37:04,790 --> 01:37:03,119
in the very small chance that we have a

2756
01:37:06,870 --> 01:37:04,800
problem with the rocket

2757
01:37:08,709 --> 01:37:06,880
we can get the people safely off the

2758
01:37:11,350 --> 01:37:08,719
rocket and get them out over the water

2759
01:37:12,550 --> 01:37:11,360
and land safely uh in the crew module

2760
01:37:14,229 --> 01:37:12,560
and so that's called the launch abort

2761
01:37:16,629 --> 01:37:14,239
system it's a very large solid rocket

2762
01:37:18,870 --> 01:37:16,639
motor it's about 500 000 pounds it'll

2763
01:37:21,109 --> 01:37:18,880

accelerate the crew at about 12 and a

2764

01:37:23,030 --> 01:37:21,119

half g's 12.5 times the acceleration of

2765

01:37:24,709 --> 01:37:23,040

gravity so it's quite a ride

2766

01:37:26,950 --> 01:37:24,719

but the main thing is to get them out

2767

01:37:29,109 --> 01:37:26,960

get them safe and so that's we tested

2768

01:37:30,390 --> 01:37:29,119

that system fully up in white sands a

2769

01:37:33,030 --> 01:37:30,400

few years ago

2770

01:37:35,990 --> 01:37:33,040

on eft-1 the only part of the last we're

2771

01:37:37,430 --> 01:37:36,000

testing is basically the structure and

2772

01:37:39,510 --> 01:37:37,440

what we call the jettison motor it's the

2773

01:37:41,189 --> 01:37:39,520

motor that basically pulls the cap off

2774

01:37:42,229 --> 01:37:41,199

the crew module in the nominal flight if

2775

01:37:44,310 --> 01:37:42,239

everything's going well and we don't

2776

01:37:46,310 --> 01:37:44,320

need the abort system the jettison motor

2777

01:37:49,750 --> 01:37:46,320

pulls the last off and that part we will

2778

01:37:52,149 --> 01:37:49,760

test tomorrow so that's what orion is um

2779

01:37:53,590 --> 01:37:52,159

a couple things about what orion what

2780

01:37:56,070 --> 01:37:53,600

what makes orion different orion is

2781

01:37:58,310 --> 01:37:56,080

built from the beginning to be a beyond

2782

01:37:59,590 --> 01:37:58,320

low earth orbit spacecraft and what do i

2783

01:38:00,870 --> 01:37:59,600

mean by that when you go beyond

2784

01:38:02,550 --> 01:38:00,880

low-earth orbit there's a lot of things

2785

01:38:04,070 --> 01:38:02,560

that are different number one is the

2786

01:38:06,629 --> 01:38:04,080

duration if you're going to space

2787

01:38:09,109 --> 01:38:06,639

station it's a a day and a half up maybe

2788

01:38:10,310 --> 01:38:09,119

two and a day back down so three to four

2789

01:38:12,390 --> 01:38:10,320

days max

2790

01:38:13,430 --> 01:38:12,400

for our missions at a minimum you know

2791

01:38:15,270 --> 01:38:13,440

getting to the regions that we're

2792

01:38:17,590 --> 01:38:15,280

talking about can be as much as five to

2793

01:38:20,390 --> 01:38:17,600

ten days in one way so orion's built to

2794

01:38:22,070 --> 01:38:20,400

be a 21 day mission for four people so

2795

01:38:23,030 --> 01:38:22,080

that drives obvious things like food

2796

01:38:24,149 --> 01:38:23,040

water

2797

01:38:25,590 --> 01:38:24,159

air those kind of things are pretty

2798

01:38:27,270 --> 01:38:25,600

straightforward the things you need to

2799

01:38:29,590 --> 01:38:27,280

do to pull the carbon dioxide out of the

2800

01:38:30,709 --> 01:38:29,600

air for the crew so we're bigger to

2801
01:38:32,149 --> 01:38:30,719
handle those kind of things we have a

2802
01:38:33,910 --> 01:38:32,159
bigger volume

2803
01:38:35,270 --> 01:38:33,920
also for the crew you know the crews

2804
01:38:36,870 --> 01:38:35,280
together for a longer period of time

2805
01:38:38,950 --> 01:38:36,880
they need a little more volume

2806
01:38:40,550 --> 01:38:38,960
uh also it drives the propulsion system

2807
01:38:43,030 --> 01:38:40,560
is about double what you would need in a

2808
01:38:44,870 --> 01:38:43,040
leo system heat shield

2809
01:38:46,629 --> 01:38:44,880
has to handle entries that are about

2810
01:38:48,310 --> 01:38:46,639
almost one and a half times faster

2811
01:38:49,430 --> 01:38:48,320
coming in so the heat shield's got to be

2812
01:38:50,550 --> 01:38:49,440
different than a low earth orbit

2813
01:38:51,669 --> 01:38:50,560

spacecraft

2814

01:38:53,590 --> 01:38:51,679

and one of the things that people don't

2815

01:38:54,629 --> 01:38:53,600

think about is uh emergencies when

2816

01:38:55,910 --> 01:38:54,639

you're at the

2817

01:38:57,830 --> 01:38:55,920

in low earth orbit you can get to the

2818

01:38:59,750 --> 01:38:57,840

ground in about 45 minutes so if you had

2819

01:39:00,950 --> 01:38:59,760

a leak in the cabin you could crank up

2820

01:39:02,070 --> 01:39:00,960

the oxygen

2821

01:39:03,750 --> 01:39:02,080

get to the ground you're okay when

2822

01:39:04,790 --> 01:39:03,760

you're at the moon you can be as much in

2823

01:39:07,350 --> 01:39:04,800

the missions we're talking about

2824

01:39:08,629 --> 01:39:07,360

anywhere from five to ten days from home

2825

01:39:10,149 --> 01:39:08,639

so your systems have to be highly

2826

01:39:11,669 --> 01:39:10,159

reliable so you don't have those

2827

01:39:12,790 --> 01:39:11,679

problems and then if you do have them

2828

01:39:14,229 --> 01:39:12,800

because you have to protect for the fact

2829

01:39:16,709 --> 01:39:14,239

that you might so we protect people like

2830

01:39:18,470 --> 01:39:16,719

rex you got to have systems

2831

01:39:20,790 --> 01:39:18,480

that can that can protect the crew so

2832

01:39:22,870 --> 01:39:20,800

for an example if we had a depressed

2833

01:39:24,390 --> 01:39:22,880

cabin the whole cabin is depressed all

2834

01:39:26,790 --> 01:39:24,400

the systems will work on orion they're

2835

01:39:28,070 --> 01:39:26,800

built to work and the crew can stay in

2836

01:39:30,229 --> 01:39:28,080

their suits

2837

01:39:31,590 --> 01:39:30,239

on the ecosystem for six days and we can

2838

01:39:32,870 --> 01:39:31,600

get them home

2839

01:39:34,870 --> 01:39:32,880

so that's the kind of thing you need on

2840

01:39:36,709 --> 01:39:34,880

the deep space spacecraft that drives

2841

01:39:37,910 --> 01:39:36,719

complexity in the systems reliability

2842

01:39:38,830 --> 01:39:37,920

those kind of things just just an

2843

01:39:42,229 --> 01:39:38,840

example

2844

01:39:43,910 --> 01:39:42,239

tomorrow is a key test for us it is uh

2845

01:39:45,590 --> 01:39:43,920

as i mentioned before the main test is

2846

01:39:48,629 --> 01:39:45,600

for the crew module we're pushing on the

2847

01:39:50,070 --> 01:39:48,639

key crew module systems entry navigation

2848

01:39:51,669 --> 01:39:50,080

and guidance to make sure a point of the

2849

01:39:53,350 --> 01:39:51,679

computers are working we're going to see

2850

01:39:55,270 --> 01:39:53,360

high radiation so we'll make sure the

2851
01:39:57,669 --> 01:39:55,280
computers can work through that

2852
01:39:59,590 --> 01:39:57,679
uh we'll deploy all the parachutes

2853
01:40:00,709 --> 01:39:59,600
uh it's important to that the parachutes

2854
01:40:02,550 --> 01:40:00,719
all work so we're going to deploy them

2855
01:40:03,990 --> 01:40:02,560
in exactly the

2856
01:40:05,669 --> 01:40:04,000
environment we expect to see on a

2857
01:40:07,030 --> 01:40:05,679
nominal flight

2858
01:40:08,470 --> 01:40:07,040
and then we'll also do these key

2859
01:40:09,990 --> 01:40:08,480
separation events

2860
01:40:11,990 --> 01:40:10,000
i mentioned the press conference i had

2861
01:40:12,950 --> 01:40:12,000
earlier today that the

2862
01:40:14,310 --> 01:40:12,960
it's

2863
01:40:15,750 --> 01:40:14,320

unmanned tests are really important

2864

01:40:17,270 --> 01:40:15,760

because on those tests you want to push

2865

01:40:19,590 --> 01:40:17,280

the vehicle very hard because this is

2866

01:40:22,390 --> 01:40:19,600

your chance to learn things

2867

01:40:24,390 --> 01:40:22,400

that you didn't expect so as i mentioned

2868

01:40:25,590 --> 01:40:24,400

a couple days ago i hope

2869

01:40:27,109 --> 01:40:25,600

certainly part of me hopes that

2870

01:40:28,709 --> 01:40:27,119

everything is perfect and we get the big

2871

01:40:31,270 --> 01:40:28,719

high five at the end right we go have a

2872

01:40:33,030 --> 01:40:31,280

we go have a party but i also what i

2873

01:40:35,030 --> 01:40:33,040

really want though is if there are

2874

01:40:36,550 --> 01:40:35,040

things that are that are eluding us and

2875

01:40:38,310 --> 01:40:36,560

other things that are beyond what our

2876

01:40:40,229 --> 01:40:38,320

models tell us

2877

01:40:42,390 --> 01:40:40,239

but are the truth then i want to learn

2878

01:40:45,030 --> 01:40:42,400

those tomorrow so that we make we can

2879

01:40:46,870 --> 01:40:45,040

adapt to that and make the best system

2880

01:40:49,270 --> 01:40:46,880

to take people beyond low earth orbit

2881

01:40:50,870 --> 01:40:49,280

and and keep people like rex safe so

2882

01:40:52,310 --> 01:40:50,880

that's a key part of tomorrow so i think

2883

01:40:54,709 --> 01:40:52,320

that's enough for me talking i think

2884

01:40:55,669 --> 01:40:54,719

it'd better get get to questions

2885

01:40:56,950 --> 01:40:55,679

two questions in the room we're gonna go

2886

01:40:57,750 --> 01:40:56,960

to the centers and come back here to the

2887

01:40:59,030 --> 01:40:57,760

room

2888

01:41:00,950 --> 01:40:59,040

over here

2889

01:41:02,629 --> 01:41:00,960

hi um anthony jordan i'm freelance

2890

01:41:04,470 --> 01:41:02,639

photographer and social media consultant

2891

01:41:05,669 --> 01:41:04,480

out of miami i just wanted to say thank

2892

01:41:07,030 --> 01:41:05,679

you on behalf of everybody in the room

2893

01:41:10,070 --> 01:41:07,040

for taking your time today and providing

2894

01:41:12,310 --> 01:41:10,080

this information um it's it's a plethora

2895

01:41:13,590 --> 01:41:12,320

of knowledge and a really really amazing

2896

01:41:14,870 --> 01:41:13,600

experience for a lot of us here first

2897

01:41:16,390 --> 01:41:14,880

timers by the way

2898

01:41:18,229 --> 01:41:16,400

my question is what was the creative

2899

01:41:19,590 --> 01:41:18,239

inspiration behind the design of orion

2900

01:41:22,229 --> 01:41:19,600

and the entire system taking the

2901

01:41:25,189 --> 01:41:22,239

spacecraft into orbit tomorrow

2902

01:41:27,750 --> 01:41:25,199

so the inspiration really is about

2903

01:41:29,590 --> 01:41:27,760

getting people out into the solar system

2904

01:41:31,270 --> 01:41:29,600

right and exploring beyond low earth

2905

01:41:33,990 --> 01:41:31,280

orbit getting out and seeing things

2906

01:41:36,950 --> 01:41:34,000

differently um

2907

01:41:37,750 --> 01:41:36,960

many of you i think most of you

2908

01:41:39,109 --> 01:41:37,760

uh

2909

01:41:41,990 --> 01:41:39,119

when you were born we'd already done

2910

01:41:43,350 --> 01:41:42,000

apollo probably so i remember before

2911

01:41:45,189 --> 01:41:43,360

apollo

2912

01:41:47,750 --> 01:41:45,199

uh and i remember the first time we saw

2913

01:41:49,669 --> 01:41:47,760

the earth from the moon

2914

01:41:52,149 --> 01:41:49,679

and it changed our whole perception

2915

01:41:53,910 --> 01:41:52,159

about this planet so exploration is

2916

01:41:55,830 --> 01:41:53,920

about things like that

2917

01:41:57,669 --> 01:41:55,840

is that we go out and we go look at

2918

01:41:59,430 --> 01:41:57,679

these things like these asteroids we go

2919

01:42:01,030 --> 01:41:59,440

out and actually visit the asteroids

2920

01:42:02,870 --> 01:42:01,040

where they are we actually go to mars

2921

01:42:04,790 --> 01:42:02,880

we're going to learn things like that

2922

01:42:05,910 --> 01:42:04,800

and things about life itself on mars

2923

01:42:07,669 --> 01:42:05,920

those kind of things that's that's the

2924

01:42:10,629 --> 01:42:07,679

inspiration for why we want to do this

2925

01:42:12,629 --> 01:42:10,639

kind of a thing the orion design in the

2926

01:42:14,550 --> 01:42:12,639

orion mission really came out of looking

2927

01:42:15,990 --> 01:42:14,560

hard at what what these missions look

2928

01:42:17,910 --> 01:42:16,000

like what are the requirements for the

2929

01:42:19,910 --> 01:42:17,920

mission how long do we need to be how

2930

01:42:22,550 --> 01:42:19,920

safe does it need to be what's the crew

2931

01:42:23,510 --> 01:42:22,560

size we need what's the right shape to

2932

01:42:25,830 --> 01:42:23,520

get the

2933

01:42:27,830 --> 01:42:25,840

the lowest mass

2934

01:42:28,950 --> 01:42:27,840

safest entry right so that's where we

2935

01:42:30,070 --> 01:42:28,960

get to shape that's why it looks like

2936

01:42:31,510 --> 01:42:30,080

apollo because the physics haven't

2937

01:42:33,750 --> 01:42:31,520

changed since the 60s coming back on

2938

01:42:35,510 --> 01:42:33,760

those speeds uh still work the way they

2939

01:42:36,709 --> 01:42:35,520

did then but the insides are totally

2940

01:42:38,470 --> 01:42:36,719

different so they're all

2941

01:42:41,189 --> 01:42:38,480

state-of-the-art computers

2942

01:42:43,189 --> 01:42:41,199

um and other systems so it makes it a

2943

01:42:45,430 --> 01:42:43,199

very much more capable system than we

2944

01:42:46,550 --> 01:42:45,440

had in the 60s yes sir

2945

01:42:49,430 --> 01:42:46,560

oh i'm sorry you're gonna you're gonna

2946

01:42:50,950 --> 01:42:49,440

pick the answer yeah i'll look at you hi

2947

01:42:52,629 --> 01:42:50,960

thank you again for being here i'm emily

2948

01:42:54,830 --> 01:42:52,639

kellendrelli host of exploration outer

2949

01:42:57,590 --> 01:42:54,840

space on fox and as you know public

2950

01:42:59,590 --> 01:42:57,600

support specifically u.s citizen public

2951

01:43:01,590 --> 01:42:59,600

support is essential for the

2952

01:43:03,109 --> 01:43:01,600

sustainability of programs like this

2953

01:43:04,629 --> 01:43:03,119

what advice would you give to u.s

2954

01:43:05,990 --> 01:43:04,639

citizens on

2955

01:43:07,510 --> 01:43:06,000

explaining and communicating the

2956

01:43:10,070 --> 01:43:07,520

importance of these programs to the

2957

01:43:11,910 --> 01:43:10,080

people that represent us in congress so

2958

01:43:13,590 --> 01:43:11,920

two things uh two things i would say

2959

01:43:15,590 --> 01:43:13,600

first was the the comments i made about

2960

01:43:18,070 --> 01:43:15,600

exploration right about how it changes

2961

01:43:19,430 --> 01:43:18,080

how we view the how we view the world i

2962

01:43:21,350 --> 01:43:19,440

also think about

2963

01:43:23,189 --> 01:43:21,360

when we go to mars and we learn about

2964

01:43:24,629 --> 01:43:23,199

the martian atmosphere about what

2965

01:43:27,030 --> 01:43:24,639

happened on mars i think you can tell us

2966

01:43:28,310 --> 01:43:27,040

a lot about or the earth right what some

2967

01:43:30,070 --> 01:43:28,320

of the risks might be on earth so i

2968

01:43:31,669 --> 01:43:30,080

think it can have tangible benefits for

2969

01:43:33,910 --> 01:43:31,679

us as well as just understanding life

2970

01:43:35,189 --> 01:43:33,920

itself if we find life on mars what does

2971

01:43:37,910 --> 01:43:35,199

it tell us about life here so that's

2972

01:43:40,550 --> 01:43:37,920

huge but i think the more tactical or

2973

01:43:42,470 --> 01:43:40,560

more day-to-day stuff all the money

2974

01:43:44,310 --> 01:43:42,480

that's spent on orion is spent on the

2975

01:43:45,830 --> 01:43:44,320

planet obviously it's obvious but it

2976

01:43:48,470 --> 01:43:45,840

goes to people-like

2977

01:43:50,149 --> 01:43:48,480

uh there's there's a there's a um

2978

01:43:53,669 --> 01:43:50,159

a shop just down the road here that

2979

01:43:55,430 --> 01:43:53,679

makes uh parts of orion test parts uh

2980

01:43:57,510 --> 01:43:55,440

there it's it's a little bigger than a

2981

01:43:59,510 --> 01:43:57,520

mom-and-pop shop it's about 30 people

2982

01:44:01,189 --> 01:43:59,520

but the the kind of jobs that we give

2983

01:44:02,790 --> 01:44:01,199

them are high-tech jobs and they're

2984

01:44:04,790 --> 01:44:02,800

they're difficult jobs because we need

2985

01:44:06,790 --> 01:44:04,800

we have very tight tolerances and

2986

01:44:09,030 --> 01:44:06,800

specifications for the kind of parts

2987

01:44:10,229 --> 01:44:09,040

that we need so it requires them to

2988

01:44:12,390 --> 01:44:10,239

train their people

2989

01:44:14,149 --> 01:44:12,400

uh it requires them to to check the

2990

01:44:16,070 --> 01:44:14,159

quality and so what you get then by

2991

01:44:17,830 --> 01:44:16,080

spending money on things like this is

2992

01:44:20,149 --> 01:44:17,840

you get a workforce that has higher

2993

01:44:22,229 --> 01:44:20,159

skills that can be used on any jobs that

2994

01:44:24,550 --> 01:44:22,239

we have so i think it helps the united

2995

01:44:25,910 --> 01:44:24,560

states technology base too so it's

2996

01:44:33,189 --> 01:44:25,920

really important

2997

01:44:37,510 --> 01:44:35,350

hi my name is ryan reed i teach

2998

01:44:39,030 --> 01:44:37,520

engineering at northview high school in

2999

01:44:40,950 --> 01:44:39,040

sylvania ohio

3000

01:44:42,149 --> 01:44:40,960

i just had a question

3001

01:44:44,229 --> 01:44:42,159

concerning

3002

01:44:45,830 --> 01:44:44,239

the advice that you would give students

3003

01:44:47,830 --> 01:44:45,840

across the nation and how they could

3004

01:44:49,189 --> 01:44:47,840

possibly get involved in this program

3005

01:44:51,109 --> 01:44:49,199

this year

3006

01:44:53,350 --> 01:44:51,119

for tomorrow and then possibly in future

3007

01:44:57,109 --> 01:44:53,360

years

3008

01:44:58,870 --> 01:44:57,119

i think there so a couple things one is

3009

01:45:01,430 --> 01:44:58,880

the key thing is to keep focused on math

3010

01:45:03,109 --> 01:45:01,440

and science that's your best opportunity

3011

01:45:06,149 --> 01:45:03,119

for these kind of jobs right a lot of

3012

01:45:08,470 --> 01:45:06,159

engineering jobs are driven by that um

3013

01:45:11,189 --> 01:45:08,480

the nasa i think is doing a very good

3014

01:45:12,550 --> 01:45:11,199

job these days of getting links out and

3015

01:45:13,430 --> 01:45:12,560

descriptions of the work that we're

3016

01:45:16,470 --> 01:45:13,440

doing

3017

01:45:18,229 --> 01:45:16,480

every day so as teachers you can

3018

01:45:20,149 --> 01:45:18,239

you can go to those links you can see

3019

01:45:21,669 --> 01:45:20,159

videos you can see examples of the work

3020

01:45:23,189 --> 01:45:21,679

that we're doing to get kids excited

3021

01:45:24,870 --> 01:45:23,199

about it

3022

01:45:27,430 --> 01:45:24,880

nasa has done a really good job also on

3023

01:45:29,830 --> 01:45:27,440

this flight of having some

3024

01:45:31,830 --> 01:45:29,840

what i would call uh outreach events

3025

01:45:33,669 --> 01:45:31,840

like we had we had a competition you

3026

01:45:35,669 --> 01:45:33,679

might have met these kids already with a

3027

01:45:38,149 --> 01:45:35,679

competition uh to design a radiation

3028

01:45:39,669 --> 01:45:38,159

sensor for this flight uh it was across

3029

01:45:41,430 --> 01:45:39,679

the country there was five teams chosen

3030

01:45:42,390 --> 01:45:41,440

we picked the winner a few months ago

3031

01:45:45,030 --> 01:45:42,400

and they're actually flying their

3032

01:45:46,629 --> 01:45:45,040

experiments so look for those kind of

3033

01:45:48,070 --> 01:45:46,639

things nasa's trying to do more and more

3034

01:45:49,750 --> 01:45:48,080

of those things to make a connection

3035

01:45:52,070 --> 01:45:49,760

with the schools

3036

01:45:53,270 --> 01:45:52,080

and get kids excited

3037

01:45:58,470 --> 01:45:53,280

i take a question now from the jet

3038

01:46:02,709 --> 01:46:00,149

hi my name is laura spencer i'm in

3039

01:46:04,550 --> 01:46:02,719

education from san diego my question is

3040

01:46:06,629 --> 01:46:04,560

with all these satellite locations of

3041

01:46:09,270 --> 01:46:06,639

nasa's social participants how has the

3042

01:46:11,189 --> 01:46:09,280

actual satellite location helped

3043

01:46:12,470 --> 01:46:11,199

contribute to orion's launch tomorrow in

3044

01:46:14,390 --> 01:46:12,480

other words what a jet propulsion

3045

01:46:16,870 --> 01:46:14,400

laboratory contribute to orion's launch

3046

01:46:19,189 --> 01:46:16,880

in the morning

3047

01:46:21,430 --> 01:46:19,199

there's one key part that

3048

01:46:23,669 --> 01:46:21,440

there's a communication network across

3049

01:46:24,709 --> 01:46:23,679

this country that involves include

3050

01:46:27,350 --> 01:46:24,719

including the satellites in

3051
01:46:30,149 --> 01:46:27,360
geostationary orbit the tdrs satellites

3052
01:46:32,470 --> 01:46:30,159
but as well as ground sat ground uh

3053
01:46:34,229 --> 01:46:32,480
ground coverage areas and then all the

3054
01:46:36,229 --> 01:46:34,239
the lines and

3055
01:46:38,229 --> 01:46:36,239
and systems that tie all our pieces

3056
01:46:40,870 --> 01:46:38,239
together because we have people here

3057
01:46:42,470 --> 01:46:40,880
uh at in the onc that will be like our

3058
01:46:44,870 --> 01:46:42,480
engineering experts

3059
01:46:47,030 --> 01:46:44,880
there's people in a hangar across the

3060
01:46:49,030 --> 01:46:47,040
way on the air force side there's people

3061
01:46:50,550 --> 01:46:49,040
at jsc who are going to do contingency

3062
01:46:52,790 --> 01:46:50,560
commands if necessary there's people in

3063
01:46:55,109 --> 01:46:52,800

denver supporting if there's issues so

3064

01:46:57,109 --> 01:46:55,119

you got to tie all those people together

3065

01:46:58,950 --> 01:46:57,119

uh to get that telemetry the data back

3066

01:47:00,229 --> 01:46:58,960

so that whole network integration making

3067

01:47:01,910 --> 01:47:00,239

sure that it's set up that all the

3068

01:47:03,990 --> 01:47:01,920

pieces are there that that we've tested

3069

01:47:07,109 --> 01:47:04,000

them all that was a jpl job specifically

3070

01:47:09,910 --> 01:47:07,119

on this on this task jpl was also a key

3071

01:47:11,669 --> 01:47:09,920

part of uh the team that decided our

3072

01:47:13,189 --> 01:47:11,679

heat shield material a few years ago

3073

01:47:15,510 --> 01:47:13,199

they're a key part of that and they've

3074

01:47:16,470 --> 01:47:15,520

done on their work with us on uh gene

3075

01:47:18,470 --> 01:47:16,480

and c

3076

01:47:21,109 --> 01:47:18,480

uh and in other areas like that so

3077

01:47:27,830 --> 01:47:21,119

they've been a big part of the orion

3078

01:47:32,550 --> 01:47:29,669

i actually have two questions if i may

3079

01:47:33,910 --> 01:47:32,560

the first one is with eft one i've been

3080

01:47:37,109 --> 01:47:33,920

trying to look for information about

3081

01:47:38,149 --> 01:47:37,119

what's inside orion free ft1 in relation

3082

01:47:40,390 --> 01:47:38,159

to

3083

01:47:43,270 --> 01:47:40,400

for astronauts like do we have any crash

3084

01:47:45,750 --> 01:47:43,280

test dummies to measure the g's with the

3085

01:47:48,070 --> 01:47:45,760

all the different stages of slowing down

3086

01:47:50,870 --> 01:47:48,080

and the second question is

3087

01:47:52,709 --> 01:47:50,880

what logistical issues do you foresee

3088

01:47:54,229 --> 01:47:52,719

between the differences of the launch

3089

01:47:56,550 --> 01:47:54,239

vehicle for example tomorrow it's a

3090

01:47:59,830 --> 01:47:56,560

delta iv and it's future vehicle which

3091

01:48:01,750 --> 01:47:59,840

will be sls good good question so

3092

01:48:02,870 --> 01:48:01,760

the inside if you looked at the inside

3093

01:48:05,430 --> 01:48:02,880

you would basically just see the

3094

01:48:06,550 --> 01:48:05,440

computers and you would see some slabs

3095

01:48:08,550 --> 01:48:06,560

of metal

3096

01:48:10,070 --> 01:48:08,560

which we call mass simulators

3097

01:48:12,950 --> 01:48:10,080

so we have we have a

3098

01:48:15,910 --> 01:48:12,960

a concentration of metal that simulates

3099

01:48:17,030 --> 01:48:15,920

the the weight of the seats in the crew

3100

01:48:18,709 --> 01:48:17,040

and we have the same thing for the

3101
01:48:20,149 --> 01:48:18,719
display panel because we don't need to

3102
01:48:21,270 --> 01:48:20,159
fly a real display panel they're fairly

3103
01:48:23,590 --> 01:48:21,280
expensive and there's nobody in it to

3104
01:48:25,510 --> 01:48:23,600
push the buttons but we put but we put

3105
01:48:27,510 --> 01:48:25,520
the mass up there so that the we can

3106
01:48:29,189 --> 01:48:27,520
make we see how the structure reacts to

3107
01:48:31,510 --> 01:48:29,199
having the mass hanging off of it like

3108
01:48:32,390 --> 01:48:31,520
that so we simulate the vehicle is

3109
01:48:35,510 --> 01:48:32,400
flying

3110
01:48:37,270 --> 01:48:35,520
and it it's it it flies as if it had the

3111
01:48:38,709 --> 01:48:37,280
crew and those other pieces in it that

3112
01:48:41,430 --> 01:48:38,719
was a key part that it flies to the

3113
01:48:43,350 --> 01:48:41,440

right pieces as far as measuring

3114

01:48:45,350 --> 01:48:43,360

velocities we have accelerometers and

3115

01:48:48,550 --> 01:48:45,360

other and other load indicators so we'll

3116

01:48:51,350 --> 01:48:48,560

know we'll see those those parameters

3117

01:48:53,189 --> 01:48:51,360

i expect on the next flight on em1 we'll

3118

01:48:55,510 --> 01:48:53,199

actually have a seat

3119

01:48:57,109 --> 01:48:55,520

and some way to measure um in the

3120

01:48:58,149 --> 01:48:57,119

specific locations where the crew is

3121

01:48:59,430 --> 01:48:58,159

going to be

3122

01:49:01,669 --> 01:48:59,440

what we think those responses but you

3123

01:49:03,350 --> 01:49:01,679

you can get a lot by this flight and how

3124

01:49:04,470 --> 01:49:03,360

we expect the loads would transfer

3125

01:49:06,310 --> 01:49:04,480

through a seat because we could do we

3126
01:49:07,669 --> 01:49:06,320
can test we can do tests on the ground

3127
01:49:09,350 --> 01:49:07,679
with a seat and

3128
01:49:11,109 --> 01:49:09,360
crash test dummies to get that last

3129
01:49:12,790 --> 01:49:11,119
piece so it's a great question because

3130
01:49:14,870 --> 01:49:12,800
that's really an important part of the

3131
01:49:17,430 --> 01:49:14,880
landing it's not just that the computers

3132
01:49:19,189 --> 01:49:17,440
are back okay but how did the crew react

3133
01:49:20,870 --> 01:49:19,199
yeah it's a big piece

3134
01:49:22,550 --> 01:49:20,880
yeah

3135
01:49:24,629 --> 01:49:22,560
hi my name is heather hinkle and i

3136
01:49:26,310 --> 01:49:24,639
actually work for one of your sister

3137
01:49:29,990 --> 01:49:26,320
federal agencies for the us geological

3138
01:49:31,189 --> 01:49:30,000

survey and i think the socials at nasa

3139

01:49:32,870 --> 01:49:31,199

runs are really great because i think

3140

01:49:35,430 --> 01:49:32,880

it's a great way to get the public

3141

01:49:37,430 --> 01:49:35,440

involved and also to get the word out

3142

01:49:39,669 --> 01:49:37,440

the question i had was

3143

01:49:41,350 --> 01:49:39,679

there's a 3d printer up on the iss right

3144

01:49:44,149 --> 01:49:41,360

now and i know that they're starting to

3145

01:49:46,709 --> 01:49:44,159

look at um how it could be used and how

3146

01:49:49,510 --> 01:49:46,719

the structures are being formed and i

3147

01:49:52,070 --> 01:49:49,520

was just wondering if orion has given

3148

01:49:53,270 --> 01:49:52,080

any thought to how the 3d printer might

3149

01:49:55,270 --> 01:49:53,280

be using in the future are you just kind

3150

01:49:57,189 --> 01:49:55,280

of waiting to see how it goes on the iss

3151
01:49:59,350 --> 01:49:57,199
so we

3152
01:50:01,270 --> 01:49:59,360
we have actually parts on this flight

3153
01:50:03,270 --> 01:50:01,280
that are made in a similar process

3154
01:50:04,870 --> 01:50:03,280
they're fairly simple part it's a vent

3155
01:50:06,310 --> 01:50:04,880
on the back shell

3156
01:50:07,830 --> 01:50:06,320
because as you go through the atmosphere

3157
01:50:09,350 --> 01:50:07,840
you want to make sure that the air

3158
01:50:11,189 --> 01:50:09,360
that's on the other side gets through

3159
01:50:13,830 --> 01:50:11,199
without causing any damage so we have

3160
01:50:15,030 --> 01:50:13,840
vents that are made in a similar process

3161
01:50:16,870 --> 01:50:15,040
to that

3162
01:50:19,030 --> 01:50:16,880
on em-1

3163
01:50:20,950 --> 01:50:19,040

if you look if you look at the side

3164

01:50:22,790 --> 01:50:20,960

of the orion and you see the service

3165

01:50:24,310 --> 01:50:22,800

module fairings eventually they'll come

3166

01:50:26,629 --> 01:50:24,320

off at the very top of those fairings

3167

01:50:28,149 --> 01:50:26,639

there's a there's a piece of metal

3168

01:50:30,310 --> 01:50:28,159

that is called a snubber it holds the

3169

01:50:32,470 --> 01:50:30,320

fairing on and it makes a it makes it so

3170

01:50:34,390 --> 01:50:32,480

the air can go by that transition very

3171

01:50:35,669 --> 01:50:34,400

easily but it's a fairly complex part it

3172

01:50:37,669 --> 01:50:35,679

has a lot of curvature in it and you

3173

01:50:39,430 --> 01:50:37,679

need a little bulb lip at the end of it

3174

01:50:41,910 --> 01:50:39,440

it's very hard to make

3175

01:50:43,350 --> 01:50:41,920

um on a machine so it turns out on em

3176

01:50:44,790 --> 01:50:43,360

one we're also already for the next

3177

01:50:46,870 --> 01:50:44,800

flight we're already making them in a 3d

3178

01:50:49,350 --> 01:50:46,880

printed like process because you can

3179

01:50:52,070 --> 01:50:49,360

make a very complex part very simply so

3180

01:50:53,669 --> 01:50:52,080

we look at where it makes sense for us

3181

01:50:55,669 --> 01:50:53,679

and i think it's a great advancement and

3182

01:50:58,390 --> 01:50:55,679

i expect it will continue to be that way

3183

01:50:59,990 --> 01:50:58,400

and will adapt to that

3184

01:51:06,070 --> 01:51:00,000

thanks our next question is from the

3185

01:51:10,790 --> 01:51:09,270

mark tim cooper um from here in houston

3186

01:51:12,149 --> 01:51:10,800

long time listener first time caller

3187

01:51:14,149 --> 01:51:12,159

thanks for having me

3188

01:51:16,629 --> 01:51:14,159

uh my question is back to eft one the

3189

01:51:19,270 --> 01:51:16,639

trajectory uh first time we've been this

3190

01:51:20,950 --> 01:51:19,280

deep into space for decades

3191

01:51:23,030 --> 01:51:20,960

is there any special considerations to

3192

01:51:26,229 --> 01:51:23,040

the flight path to avoid all the stuff

3193

01:51:27,750 --> 01:51:26,239

that we've put into orbit since then

3194

01:51:30,550 --> 01:51:27,760

that's that is another really good

3195

01:51:32,550 --> 01:51:30,560

question we did not

3196

01:51:34,790 --> 01:51:32,560

try to avoid

3197

01:51:36,229 --> 01:51:34,800

pieces of the orbit you know we really

3198

01:51:38,070 --> 01:51:36,239

focused on

3199

01:51:39,830 --> 01:51:38,080

what the orbit was that we needed in

3200

01:51:41,510 --> 01:51:39,840

order to get the objectives for this

3201
01:51:43,350 --> 01:51:41,520
flight and as as you remember the main

3202
01:51:45,430 --> 01:51:43,360
objective one of the key objectives

3203
01:51:46,790 --> 01:51:45,440
which is really driving the altitude

3204
01:51:48,629 --> 01:51:46,800
is the heat shield so we're trying to

3205
01:51:51,030 --> 01:51:48,639
get very close to lunar entry velocity

3206
01:51:53,109 --> 01:51:51,040
so we go 3 600 miles up

3207
01:51:54,229 --> 01:51:53,119
we do fly through

3208
01:51:56,790 --> 01:51:54,239
regions

3209
01:51:59,669 --> 01:51:56,800
in lower orbit that actually do have a

3210
01:52:02,550 --> 01:51:59,679
significant amount of orbital debris

3211
01:52:04,390 --> 01:52:02,560
it's still not by itself not a huge

3212
01:52:06,229 --> 01:52:04,400
driver to the risk of the flight but we

3213
01:52:09,030 --> 01:52:06,239

do calculate that nasa has a model a

3214

01:52:10,870 --> 01:52:09,040

very detailed model that we use uh data

3215

01:52:13,030 --> 01:52:10,880

from radars and other things that we can

3216

01:52:14,470 --> 01:52:13,040

kind of tell what these clouds look like

3217

01:52:16,229 --> 01:52:14,480

the speeds and so forth the kind of

3218

01:52:18,070 --> 01:52:16,239

materials and we have a model that helps

3219

01:52:19,270 --> 01:52:18,080

us project that

3220

01:52:23,109 --> 01:52:19,280

orion

3221

01:52:24,310 --> 01:52:23,119

uh is designed to protect itself against

3222

01:52:25,910 --> 01:52:24,320

a lot of that if you look at the back

3223

01:52:27,589 --> 01:52:25,920

shell of orion

3224

01:52:29,430 --> 01:52:27,599

those are actually shuttle-like tiles

3225

01:52:31,350 --> 01:52:29,440

and they actually are pretty good

3226
01:52:35,030 --> 01:52:31,360
for

3227
01:52:36,070 --> 01:52:35,040
getting hit on some from some orbital

3228
01:52:37,830 --> 01:52:36,080
debris

3229
01:52:39,589 --> 01:52:37,840
the heat shield itself the bottom is not

3230
01:52:41,270 --> 01:52:39,599
so much and you might notice that it's

3231
01:52:42,390 --> 01:52:41,280
pretty much protected by the service

3232
01:52:44,070 --> 01:52:42,400
module

3233
01:52:45,750 --> 01:52:44,080
cma so that's part of why that's it we

3234
01:52:47,510 --> 01:52:45,760
try to keep that protected so that is

3235
01:52:49,030 --> 01:52:47,520
one of the things we consider

3236
01:52:50,390 --> 01:52:49,040
and as far as the overall design of

3237
01:52:52,790 --> 01:52:50,400
orion because it will fly through these

3238
01:52:54,629 --> 01:52:52,800

regions but on this particular flight we

3239

01:52:55,830 --> 01:52:54,639

did not change the path but we did do an

3240

01:52:57,510 --> 01:52:55,840

assessment so we understood what we

3241

01:52:59,189 --> 01:52:57,520

thought the risks were

3242

01:53:04,149 --> 01:52:59,199

let's take our next question from

3243

01:53:08,390 --> 01:53:06,470

hi my name is andrea pearson haas i'm a

3244

01:53:10,390 --> 01:53:08,400

student at the university of texas at

3245

01:53:14,550 --> 01:53:10,400

dallas and i am reporting to you from

3246

01:53:16,550 --> 01:53:14,560

stennis space center my question is

3247

01:53:19,270 --> 01:53:16,560

we see robonaut on the international

3248

01:53:21,589 --> 01:53:19,280

space station do we have any measures

3249

01:53:23,669 --> 01:53:21,599

to have a cognitive robot of some sort

3250

01:53:25,189 --> 01:53:23,679

on this long space permission

3251

01:53:27,669 --> 01:53:25,199

space mission

3252

01:53:31,030 --> 01:53:27,679

to assist with the physiological

3253

01:53:33,430 --> 01:53:31,040

conditions and reduce human error

3254

01:53:36,310 --> 01:53:33,440

so on the for the first few missions

3255

01:53:37,750 --> 01:53:36,320

like em em two and three and this uh

3256

01:53:40,709 --> 01:53:37,760

asteroid redirect mission that we're

3257

01:53:42,870 --> 01:53:40,719

talking about today we would not uh you

3258

01:53:45,189 --> 01:53:42,880

know those are relatively short missions

3259

01:53:46,870 --> 01:53:45,199

21 days i think is the is the longest

3260

01:53:48,310 --> 01:53:46,880

period so that on those particular

3261

01:53:49,990 --> 01:53:48,320

missions we wouldn't

3262

01:53:52,229 --> 01:53:50,000

um you know one of the reasons robonaut

3263

01:53:53,990 --> 01:53:52,239

makes a lot of sense eventually

3264

01:53:55,589 --> 01:53:54,000

uh for space station is there it's a lot

3265

01:53:57,109 --> 01:53:55,599

of operations that are somewhat

3266

01:53:59,350 --> 01:53:57,119

repetitive

3267

01:54:01,109 --> 01:53:59,360

um and i know they spent a lot of time

3268

01:54:03,270 --> 01:54:01,119

working on actually being able to move

3269

01:54:05,189 --> 01:54:03,280

the robotic arm from the ground that

3270

01:54:06,390 --> 01:54:05,199

saves crew time on board so that's one

3271

01:54:09,109 --> 01:54:06,400

of the reasons why you like to go to

3272

01:54:11,109 --> 01:54:09,119

robotic operations to save that precious

3273

01:54:13,109 --> 01:54:11,119

crew time that you have on the astronaut

3274

01:54:14,709 --> 01:54:13,119

so when our particular missions today

3275

01:54:16,470 --> 01:54:14,719

the 21 day missions it wouldn't be a big

3276

01:54:17,589 --> 01:54:16,480

driver when you're going on to mars i

3277

01:54:19,350 --> 01:54:17,599

think that's certainly something that

3278

01:54:20,950 --> 01:54:19,360

you would start talking about how can we

3279

01:54:23,830 --> 01:54:20,960

automate more of the work

3280

01:54:25,510 --> 01:54:23,840

uh to reduce the overhead and the work

3281

01:54:27,750 --> 01:54:25,520

the crew has to do i think

3282

01:54:30,390 --> 01:54:27,760

fundamentally though the whole idea

3283

01:54:33,109 --> 01:54:30,400

of of sending humans to mars is because

3284

01:54:35,830 --> 01:54:33,119

you want the human on mars because

3285

01:54:38,629 --> 01:54:35,840

humans adapt very quickly they can think

3286

01:54:40,629 --> 01:54:38,639

uh quickly they can they can adapt to

3287

01:54:42,390 --> 01:54:40,639

scientific things they find very quickly

3288

01:54:44,070 --> 01:54:42,400

like the guys uh like the scientists we

3289

01:54:45,990 --> 01:54:44,080

sent to the service of the moon

3290

01:54:47,589 --> 01:54:46,000

it was a huge advantage to actually have

3291

01:54:49,270 --> 01:54:47,599

humans there

3292

01:54:52,790 --> 01:54:49,280

and update and change their experiments

3293

01:54:55,350 --> 01:54:52,800

based on what they found real time so

3294

01:54:56,310 --> 01:54:55,360

hi my name is sris renivassan i'm the

3295

01:54:57,990 --> 01:54:56,320

chief digital officer at the

3296

01:54:59,430 --> 01:54:58,000

metropolitan museum of art and it's an

3297

01:55:01,510 --> 01:54:59,440

absolute honor to be here and i want to

3298

01:55:03,109 --> 01:55:01,520

thank everybody at nasa for bringing us

3299

01:55:06,310 --> 01:55:03,119

all here so thank you very much we

3300

01:55:11,189 --> 01:55:08,149

good luck tomorrow thank you a quick

3301

01:55:13,430 --> 01:55:11,199

question about the role of animals in

3302

01:55:15,430 --> 01:55:13,440

space research a generation ago or many

3303

01:55:17,109 --> 01:55:15,440

generations ago i guess 40 50 years ago

3304

01:55:19,910 --> 01:55:17,119

there would have been an animal of some

3305

01:55:22,149 --> 01:55:19,920

kind on a mission like this what what

3306

01:55:24,229 --> 01:55:22,159

point did nasa see the light and the

3307

01:55:25,510 --> 01:55:24,239

value of not doing that

3308

01:55:27,669 --> 01:55:25,520

and

3309

01:55:30,550 --> 01:55:27,679

do you ever see a time when not just

3310

01:55:32,550 --> 01:55:30,560

humans but animals would also fly not as

3311

01:55:35,270 --> 01:55:32,560

experiments but because that would be a

3312

01:55:37,669 --> 01:55:35,280

good thing for humans to have animal

3313

01:55:40,229 --> 01:55:37,679

companionship on these long trips or

3314

01:55:41,830 --> 01:55:40,239

once they're there

3315

01:55:43,109 --> 01:55:41,840

well i think yeah a great question about

3316

01:55:44,470 --> 01:55:43,119

companionship because those long

3317

01:55:46,229 --> 01:55:44,480

missions you know

3318

01:55:47,669 --> 01:55:46,239

even though my dog drives me crazy i

3319

01:55:49,990 --> 01:55:47,679

think uh

3320

01:55:51,750 --> 01:55:50,000

i wouldn't want him in orion with me for

3321

01:55:52,950 --> 01:55:51,760

300 you know for three years but still

3322

01:55:54,310 --> 01:55:52,960

he's a great dog

3323

01:55:56,070 --> 01:55:54,320

it's a great question i don't know i

3324

01:55:57,589 --> 01:55:56,080

think that is as far as the one of the

3325

01:55:59,430 --> 01:55:57,599

key things about going to mars that

3326

01:56:01,270 --> 01:55:59,440

could be a very long mission

3327

01:56:02,550 --> 01:56:01,280

is the psychological effects and one of

3328

01:56:04,709 --> 01:56:02,560

the things you can do certainly taking

3329

01:56:05,750 --> 01:56:04,719

other people is a key part of that but

3330

01:56:07,589 --> 01:56:05,760

but i think what you're saying makes a

3331

01:56:08,390 --> 01:56:07,599

lot of sense maybe animals as pets in a

3332

01:56:09,830 --> 01:56:08,400

sense

3333

01:56:11,430 --> 01:56:09,840

as far as experimentation you know

3334

01:56:12,149 --> 01:56:11,440

remember the 60s were a different time

3335

01:56:19,589 --> 01:56:12,159

we

3336

01:56:21,510 --> 01:56:19,599

what was going to happen physiologically

3337

01:56:23,830 --> 01:56:21,520

what would happen so it was a different

3338

01:56:25,830 --> 01:56:23,840

time and i think we we know a lot now

3339

01:56:27,350 --> 01:56:25,840

especially since we have humans on space

3340

01:56:30,310 --> 01:56:27,360

station full-time we know a lot about

3341

01:56:31,669 --> 01:56:30,320

what happens to the human body

3342

01:56:33,990 --> 01:56:31,679

and so i don't think we need to do those

3343

01:56:36,149 --> 01:56:34,000

kind of things today so

3344

01:56:37,750 --> 01:56:36,159

hi my name is katie cersei and i'm

3345

01:56:39,830 --> 01:56:37,760

representing the students at mountain

3346

01:56:42,470 --> 01:56:39,840

park elementary school in roswell

3347

01:56:43,750 --> 01:56:42,480

georgia and luke from the fourth grade

3348

01:56:46,070 --> 01:56:43,760

has a question

3349

01:56:48,629 --> 01:56:46,080

what in the world will the astronauts do

3350

01:56:51,189 --> 01:56:48,639

for that really long trip to mars what

3351

01:56:53,189 --> 01:56:51,199

would they be doing

3352

01:56:54,950 --> 01:56:53,199

great great question i don't think my

3353

01:56:57,430 --> 01:56:54,960

son could go about 10 minutes without

3354

01:56:58,149 --> 01:56:57,440

his phone or his reddit account you know

3355

01:56:59,589 --> 01:56:58,159

so

3356

01:57:01,830 --> 01:56:59,599

um

3357

01:57:03,189 --> 01:57:01,840

i expect that's another great question

3358

01:57:05,189 --> 01:57:03,199

about what you can do certainly there's

3359

01:57:07,669 --> 01:57:05,199

going to be things we can do as far as

3360

01:57:09,910 --> 01:57:07,679

training for the the mission itself you

3361

01:57:10,870 --> 01:57:09,920

know keeping keeping your skills let's

3362

01:57:12,229 --> 01:57:10,880

say if you're if you're going to be the

3363

01:57:14,149 --> 01:57:12,239

pilot that's got to land the mission

3364

01:57:16,229 --> 01:57:14,159

when you get there there's training runs

3365

01:57:17,189 --> 01:57:16,239

you can do so we can make sure they run

3366

01:57:18,310 --> 01:57:17,199

through that

3367

01:57:19,750 --> 01:57:18,320

um

3368

01:57:21,830 --> 01:57:19,760

there's maintenance there's going to

3369

01:57:23,189 --> 01:57:21,840

need to be maintenance on the spacecraft

3370

01:57:25,030 --> 01:57:23,199

that you're flying

3371

01:57:26,790 --> 01:57:25,040

because it's never you're never going to

3372

01:57:28,149 --> 01:57:26,800

be able to put in all the redundancy

3373

01:57:29,270 --> 01:57:28,159

that it's going to fix itself all the

3374

01:57:31,270 --> 01:57:29,280

time you're going to need to take things

3375

01:57:33,430 --> 01:57:31,280

apart much like space station right a

3376

01:57:34,709 --> 01:57:33,440

lot of space station today the crew does

3377

01:57:35,589 --> 01:57:34,719

a lot of the maintenance there today so

3378

01:57:37,430 --> 01:57:35,599

you're going to they're going to have to

3379

01:57:39,189 --> 01:57:37,440

do some of that

3380

01:57:41,109 --> 01:57:39,199

but it's yeah i think that's one of the

3381

01:57:43,750 --> 01:57:41,119

big questions is when you've got a

3382

01:57:44,870 --> 01:57:43,760

year-long mission uh

3383

01:57:46,310 --> 01:57:44,880

i don't think it's certainly not long

3384

01:57:48,790 --> 01:57:46,320

enough to talk about this hibernation

3385

01:57:50,310 --> 01:57:48,800

stuff but uh what else would you do

3386

01:57:51,990 --> 01:57:50,320

one of the other things to keep the crew

3387

01:57:53,669 --> 01:57:52,000

occupied and keep them sharp so it's a

3388

01:57:57,350 --> 01:57:53,679

great question and so maybe he can help

3389

01:57:59,270 --> 01:57:57,360

us as we as we research those things

3390

01:58:01,350 --> 01:57:59,280

one more question it's right here hi i'm

3391

01:58:03,430 --> 01:58:01,360

carrie cucaro from raw science tv and

3392

01:58:06,070 --> 01:58:03,440

i'm wondering we've often heard about

3393

01:58:08,229 --> 01:58:06,080

how much computing and electronics were

3394

01:58:10,229 --> 01:58:08,239

accelerated by the apollo program what

3395

01:58:11,990 --> 01:58:10,239

predictions might you make about orion

3396

01:58:15,669 --> 01:58:12,000

in this mars journey that will be

3397

01:58:19,030 --> 01:58:17,589

well you know what i what i really like

3398

01:58:20,470 --> 01:58:19,040

about

3399

01:58:22,709 --> 01:58:20,480

engineering i'm an engineer what i

3400

01:58:25,350 --> 01:58:22,719

really like about engineering is you

3401
01:58:26,629 --> 01:58:25,360
have to take the theory about what

3402
01:58:28,149 --> 01:58:26,639
somebody says might work and you

3403
01:58:30,709 --> 01:58:28,159
actually have to put it into something

3404
01:58:32,950 --> 01:58:30,719
that actually has to fly and you have to

3405
01:58:35,350 --> 01:58:32,960
face those challenges to make it work so

3406
01:58:37,510 --> 01:58:35,360
i'll give you an example the the network

3407
01:58:39,270 --> 01:58:37,520
on orion as you know the network is how

3408
01:58:40,950 --> 01:58:39,280
the computers talk to each other

3409
01:58:44,950 --> 01:58:40,960
we have a state-of-the-art network that

3410
01:58:47,510 --> 01:58:44,960
was actually an idea about how to get a

3411
01:58:49,910 --> 01:58:47,520
very fast but very reliable ethernet

3412
01:58:51,830 --> 01:58:49,920
capability and it was a called a time

3413
01:58:53,510 --> 01:58:51,840

triggered gigabit ethernet and it was a

3414

01:58:55,030 --> 01:58:53,520

concept that people had started thinking

3415

01:58:57,589 --> 01:58:55,040

about but we actually made it we

3416

01:58:59,669 --> 01:58:57,599

actually built it and now we've actually

3417

01:59:01,830 --> 01:58:59,679

run it and it's actually a capability

3418

01:59:03,990 --> 01:59:01,840

now that that airlines and others can

3419

01:59:05,830 --> 01:59:04,000

use because it's been developed through

3420

01:59:07,030 --> 01:59:05,840

this team uh you know so other people

3421

01:59:08,950 --> 01:59:07,040

had a great idea they were using it for

3422

01:59:10,709 --> 01:59:08,960

other implementations but we needed it

3423

01:59:12,709 --> 01:59:10,719

and we drove it to an implementation so

3424

01:59:14,470 --> 01:59:12,719

those are the kind of things uh what

3425

01:59:16,709 --> 01:59:14,480

will happen to mars it'll be something

3426

01:59:18,709 --> 01:59:16,719

well beyond that i'm sure

3427

01:59:20,470 --> 01:59:18,719

the key i think the key for

3428

01:59:23,830 --> 01:59:20,480

a system like orion

3429

01:59:25,109 --> 01:59:23,840

is it needs to be able to adapt

3430

01:59:27,189 --> 01:59:25,119

because a lot of things are going to

3431

01:59:28,629 --> 01:59:27,199

happen and we need we need to adapt

3432

01:59:30,149 --> 01:59:28,639

because there's a whole bunch of

3433

01:59:32,390 --> 01:59:30,159

technology in the computer world that

3434

01:59:34,149 --> 01:59:32,400

happens outside of nasa

3435

01:59:36,310 --> 01:59:34,159

and it's driven more by these

3436

01:59:37,910 --> 01:59:36,320

communications things that everybody is

3437

01:59:40,070 --> 01:59:37,920

using and we need to take advantage of

3438

01:59:41,669 --> 01:59:40,080

those and build off of those we do have

3439

01:59:42,950 --> 01:59:41,679

special environments like the radiation

3440

01:59:44,390 --> 01:59:42,960

is a big deal so these really fast

3441

01:59:45,830 --> 01:59:44,400

computers are actually very susceptible

3442

01:59:47,990 --> 01:59:45,840

to radiation

3443

01:59:49,830 --> 01:59:48,000

and they have to be highly reliable so

3444

01:59:52,149 --> 01:59:49,840

i think what will the key for us is to

3445

01:59:53,830 --> 01:59:52,159

take those new ideas and put them into

3446

01:59:54,709 --> 01:59:53,840

space application and then make sure

3447

01:59:56,709 --> 01:59:54,719

that we

3448

01:59:58,709 --> 01:59:56,719

open source it so people can use it use

3449

01:59:59,750 --> 01:59:58,719

as an advantage so great question

3450

02:00:00,790 --> 01:59:59,760

because we get we got to be able to

3451
02:00:02,790 --> 02:00:00,800
adapt

3452
02:00:04,070 --> 02:00:02,800
ladies and gentlemen mark ire okay thank

3453
02:00:05,430 --> 02:00:04,080
you

3454
02:00:13,430 --> 02:00:05,440
thanks

3455
02:00:14,390 --> 02:00:13,440
social um hopefully everyone learned

3456
02:00:16,149 --> 02:00:14,400
something a little bit about our

3457
02:00:18,149 --> 02:00:16,159
commercial crew program nasa's journey

3458
02:00:19,669 --> 02:00:18,159
to mars and orion's first flight test

3459
02:00:21,430 --> 02:00:19,679
just a couple quick programming notes

3460
02:00:22,629 --> 02:00:21,440
i'm sure everyone watching and here in

3461
02:00:24,870 --> 02:00:22,639
the room will be up for our television

3462
02:00:26,790 --> 02:00:24,880
broadcast which starts at 4 30 a.m

3463
02:00:30,229 --> 02:00:26,800

eastern time live on nasa television you

3464

02:00:33,109 --> 02:00:30,239

can tune in at www.nasa.gov

3465

02:00:35,430 --> 02:00:33,119

nasa tv excuse me tv

3466

02:00:38,070 --> 02:00:35,440

also remember to use the hashtag orion

3467

02:00:47,350 --> 02:00:38,080

and all your posts and

3468

02:00:49,750 --> 02:00:48,709

we have a short video we're gonna play