



NASA  
SILICON VALLEY  
L I

COUNTDOWN TO 2024  
DAYS HOURS MIN SEC  
1529 06:37:56

NASA  
SILICON VALLEY  
AMES RESEARCH CENTER

1  
00:00:10,459 --> 00:00:07,270

[Music]

2  
00:00:12,560 --> 00:00:10,469

hello everybody and welcome back to

3  
00:00:13,490 --> 00:00:12,570

another episode of NASA and Silicon

4  
00:00:16,400 --> 00:00:13,500

Valley live

5  
00:00:18,109 --> 00:00:16,410

I'm your host a detailer and if this is

6  
00:00:19,460 --> 00:00:18,119

your first time tuning in to the show

7  
00:00:21,710 --> 00:00:19,470

NASA and Silicon Valley live is a

8  
00:00:23,929 --> 00:00:21,720

conversational show out of NASA's Ames

9  
00:00:26,089 --> 00:00:23,939

Research Center where we talk about all

10  
00:00:28,970 --> 00:00:26,099

the nerdy NASA news you need to know

11  
00:00:31,880 --> 00:00:28,980

about so today I have with me my friend

12  
00:00:33,170 --> 00:00:31,890

and office mate Tiffany hey hi everyone

13  
00:00:35,030 --> 00:00:33,180

I am your co-host

14

00:00:37,850 --> 00:00:35,040

Tiffany Blake if you didn't know we are

15

00:00:39,979 --> 00:00:37,860

live on twitch YouTube Facebook and

16

00:00:41,540 --> 00:00:39,989

periscope but if you want to participate

17

00:00:43,220 --> 00:00:41,550

in the chat and eggs our guests some

18

00:00:48,650 --> 00:00:43,230

questions there's only one place you can

19

00:00:51,860 --> 00:00:48,660

do that and that is @ww twitch TV / NASA

20

00:00:54,350 --> 00:00:51,870

right and we are excited today to be

21

00:00:57,410 --> 00:00:54,360

holding our second annual NASA themes

22

00:01:00,529 --> 00:00:57,420

Halloween costume and cosplay contest

23

00:01:02,389 --> 00:01:00,539

yes I'm excited and find it if you're a

24

00:01:04,850 --> 00:01:02,399

NASA fan like a Ferrari last-minute

25

00:01:06,469 --> 00:01:04,860

Halloween outfits you're in luck

26  
00:01:09,050 --> 00:01:06,479  
we are going to show you a collection of

27  
00:01:11,000 --> 00:01:09,060  
NASA inspired costumes and tell you how

28  
00:01:13,820 --> 00:01:11,010  
you can recreate them at home right and

29  
00:01:15,740 --> 00:01:13,830  
if you do end up using any of our space

30  
00:01:17,840 --> 00:01:15,750  
themed costumes for Halloween or some

31  
00:01:19,940 --> 00:01:17,850  
other NASA inspired costume we want to

32  
00:01:22,789 --> 00:01:19,950  
see it so you can share those with us on

33  
00:01:24,859 --> 00:01:22,799  
social media using the hashtag NASA

34  
00:01:27,050 --> 00:01:24,869  
costume yeah

35  
00:01:29,569 --> 00:01:27,060  
so before we start Abby how about we

36  
00:01:32,510 --> 00:01:29,579  
remind the people about Michael oh okay

37  
00:01:34,670 --> 00:01:32,520  
yes so this is our moon countdown clock

38  
00:01:37,069 --> 00:01:34,680

that you see right here and that is

39

00:01:39,469 --> 00:01:37,079

because five years from now in 2024 we

40

00:01:42,440 --> 00:01:39,479

are planning to send humans to the moon

41

00:01:43,639 --> 00:01:42,450

as part of our Artemis program so this

42

00:01:46,639 --> 00:01:43,649

clock right here is counting down the

43

00:01:49,819 --> 00:01:46,649

days hours minutes and seconds until the

44

00:01:52,370 --> 00:01:49,829

next man and the first woman will set

45

00:01:53,990 --> 00:01:52,380

foot on the South Pole of the moon so to

46

00:01:58,100 --> 00:01:54,000

learn more about that you can go to

47

00:01:59,660 --> 00:01:58,110

nasa.gov slash artemis so should we get

48

00:02:03,050 --> 00:01:59,670

right into it yeah should we see some

49

00:02:06,560 --> 00:02:03,060

cards yes okay so our first category is

50

00:02:07,789 --> 00:02:06,570

everyday NASA looks so the outfits are

51

00:02:10,070 --> 00:02:07,799

going to see are things that are

52

00:02:12,020 --> 00:02:10,080

researchers and engineers wear day to

53

00:02:13,059 --> 00:02:12,030

day doing their work doing special tests

54

00:02:16,420 --> 00:02:13,069

you'll see them around

55

00:02:23,740 --> 00:02:16,430

wearing these things so let's bring out

56

00:02:33,149 --> 00:02:23,750

our first guest come on out Marybeth hey

57

00:02:37,119 --> 00:02:33,159

now excellent we'll give you a minute to

58

00:02:40,059 --> 00:02:37,129

get your tools set there get all tucked

59

00:02:46,119 --> 00:02:40,069

in and you might have to take off your

60

00:02:47,710 --> 00:02:46,129

gas mask there so why don't you start by

61

00:02:49,569 --> 00:02:47,720

introducing yourself to the audience on

62

00:02:52,929 --> 00:02:49,579

tell us what you do good so my name is

63

00:02:54,670 --> 00:02:52,939

dr. Mary Beth Wilhelm and I'm a research

64

00:02:56,530 --> 00:02:54,680

scientist here at NASA and I'm an

65

00:02:59,379 --> 00:02:56,540

astrobiologist which means I study the

66

00:03:01,149 --> 00:02:59,389

origin of life the evolution of it and

67

00:03:04,330 --> 00:03:01,159

then I search for it elsewhere in our

68

00:03:08,259 --> 00:03:04,340

solar system so tell us about what

69

00:03:10,659 --> 00:03:08,269

you're wearing alright so this look is

70

00:03:14,409 --> 00:03:10,669

what I wear when I'm collecting samples

71

00:03:17,229 --> 00:03:14,419

in a Mars analog environment on earth so

72

00:03:19,059 --> 00:03:17,239

because Mars is so far away and it's so

73

00:03:21,879 --> 00:03:19,069

expensive to get there we often go to

74

00:03:24,390 --> 00:03:21,889

places on earth that are like Mars so we

75

00:03:26,469 --> 00:03:24,400

can study certain things about it and

76

00:03:27,849 --> 00:03:26,479

take things back to our lab and study

77

00:03:30,069 --> 00:03:27,859

them what kind of environments on earth

78

00:03:34,569 --> 00:03:30,079

are actually like Mars like what are you

79

00:03:35,890 --> 00:03:34,579

looking for there right so right now I'm

80

00:03:37,899 --> 00:03:35,900

studying this place called the Atacama

81

00:03:39,789 --> 00:03:37,909

Desert in Chile and it's one of the

82

00:03:42,250 --> 00:03:39,799

driest places in the world it only rains

83

00:03:42,699 --> 00:03:42,260

in the region that I visit once per

84

00:03:45,550 --> 00:03:42,709

decade

85

00:03:46,809 --> 00:03:45,560

that's absurd wow it's crazy dry like I

86

00:03:48,550 --> 00:03:46,819

can count the number of plants that I

87

00:03:50,170 --> 00:03:48,560

saw on one hand during our field trip

88

00:03:52,539 --> 00:03:50,180

that's so screaming because of that it

89

00:03:53,589 --> 00:03:52,549

has some of the lowest levels of biomass

90

00:03:55,149 --> 00:03:53,599

on the entire planet

91

00:03:58,719 --> 00:03:55,159

so there's very very few living

92

00:04:01,240 --> 00:03:58,729

organisms there and us humans are very

93

00:04:02,949 --> 00:04:01,250

dirty yeah and that's why I'm wearing

94

00:04:04,960 --> 00:04:02,959

the suit because when I'm taking samples

95

00:04:06,610 --> 00:04:04,970

I don't want to contaminate the samples

96

00:04:09,729 --> 00:04:06,620

I'm working with right right with your

97

00:04:11,649 --> 00:04:09,739

own skin cells and whatever exactly of

98

00:04:14,319 --> 00:04:11,659

them we have a photo don't we I think so

99

00:04:16,029 --> 00:04:14,329

yeah very best in the Atacama all right

100

00:04:19,330 --> 00:04:16,039

so that's what we're seeing here right

101  
00:04:20,680 --> 00:04:19,340  
so this is a me taking a sample from one

102  
00:04:22,810 --> 00:04:20,690  
of the driest places on the planet and

103  
00:04:24,519 --> 00:04:22,820  
here I'm trying to study the extreme

104  
00:04:26,830 --> 00:04:24,529  
limits of life and then trying to

105  
00:04:28,000 --> 00:04:26,840  
understand whether any remnant

106  
00:04:30,520 --> 00:04:28,010  
of life get preserved in the fossil

107  
00:04:32,530 --> 00:04:30,530  
record Wow so you're talking about

108  
00:04:35,230 --> 00:04:32,540  
lifelike bacteria and things like that

109  
00:04:37,360 --> 00:04:35,240  
yeah exactly microscopic life okay so

110  
00:04:39,490 --> 00:04:37,370  
we're looking for the chemical evidence

111  
00:04:42,879 --> 00:04:39,500  
of life that gets preserved in the rock

112  
00:04:44,830 --> 00:04:42,889  
record and specifically I'm studying a

113  
00:04:46,990 --> 00:04:44,840

type of molecule called lipid alipin

114

00:04:50,439 --> 00:04:47,000

some fats which we love to eat obviously

115

00:04:52,540 --> 00:04:50,449

yes and the cool thing about lipids is

116

00:04:54,700 --> 00:04:52,550

that they're extremely well preserved in

117

00:04:56,590 --> 00:04:54,710

the fossil record so if you look back at

118

00:04:58,210 --> 00:04:56,600

the very oldest rocks on earth and

119

00:04:59,860 --> 00:04:58,220

you're looking for evidence of life you

120

00:05:01,450 --> 00:04:59,870

can still find some of the lipid

121

00:05:02,920 --> 00:05:01,460

molecules from those organisms that

122

00:05:05,050 --> 00:05:02,930

lived in those environments the first

123

00:05:07,000 --> 00:05:05,060

life on Earth yeah and find traces of it

124

00:05:09,400 --> 00:05:07,010

okay well that's still around yeah

125

00:05:11,770 --> 00:05:09,410

anything and so like when we're thinking

126

00:05:13,719 --> 00:05:11,780

about what we want to look for on Mars

127

00:05:15,430 --> 00:05:13,729

we want to try to target these types of

128

00:05:17,080 --> 00:05:15,440

molecules they can live for that can

129

00:05:19,779 --> 00:05:17,090

that can stick around for long long

130

00:05:22,450 --> 00:05:19,789

periods of time because Mars used to

131

00:05:23,680 --> 00:05:22,460

have really nice conditions for life but

132

00:05:27,790 --> 00:05:23,690

like three billion years ago

133

00:05:29,200 --> 00:05:27,800

okay used to have a sphere and yeah like

134

00:05:31,180 --> 00:05:29,210

would water on the surface and so we

135

00:05:32,890 --> 00:05:31,190

have to look for the remainder of what

136

00:05:35,920 --> 00:05:32,900

might have lived on Mars right right if

137

00:05:37,510 --> 00:05:35,930

there were any little micro part of them

138

00:05:39,400 --> 00:05:37,520

would survive that long that's what

139

00:05:41,950 --> 00:05:39,410

you're looking for you know have you use

140

00:05:44,740 --> 00:05:41,960

your tools here yeah okay so like I'm

141

00:05:47,200 --> 00:05:44,750

kind of a cool hybrid scientist so I do

142

00:05:50,140 --> 00:05:47,210

a mix of geology and biochemistry so I

143

00:05:51,490 --> 00:05:50,150

have my handy rock hammer mm-hmm so I

144

00:05:55,870 --> 00:05:51,500

can break open the rocks and then

145

00:05:58,150 --> 00:05:55,880

further really for the really tricky

146

00:05:59,500 --> 00:05:58,160

samples we have a this is a drill string

147

00:06:01,450 --> 00:05:59,510

so you can see like I have some of the

148

00:06:06,190 --> 00:06:01,460

atacama still stuck on yeah I see the

149

00:06:08,050 --> 00:06:06,200

red dust on there and then once we get

150

00:06:11,020 --> 00:06:08,060

this stuff out of the rock we'll put it

151  
00:06:12,940 --> 00:06:11,030  
in our sample jar out in the desert your

152  
00:06:20,230 --> 00:06:12,950  
desert being soil samples and you get it

153  
00:06:22,540 --> 00:06:20,240  
in the bottle there these are some

154  
00:06:25,890 --> 00:06:22,550  
really cool samples that I collected

155  
00:06:28,960 --> 00:06:25,900  
from an ancient salt flat so this is a

156  
00:06:31,480 --> 00:06:28,970  
probably about a few million years old

157  
00:06:33,040 --> 00:06:31,490  
and you can see some of that black stuff

158  
00:06:35,469 --> 00:06:33,050  
in there those are some of the remnants

159  
00:06:38,950 --> 00:06:35,479  
of the life that lived and there's a

160  
00:06:41,379 --> 00:06:38,960  
body of water that formed this

161  
00:06:43,840 --> 00:06:41,389  
assault yeah this is a milky result yeah

162  
00:06:48,070 --> 00:06:43,850  
yeah so this took a couple drills to get

163  
00:06:49,390 --> 00:06:48,080

out so what do you guys do with

164

00:06:53,140 --> 00:06:49,400

assembles when you bring them back to

165

00:06:54,430 --> 00:06:53,150

the lab right yeah we take back all the

166

00:06:57,249 --> 00:06:54,440

samples were interested in and then I

167

00:07:00,580 --> 00:06:57,259

take them to my biochemistry lab here at

168

00:07:02,650 --> 00:07:00,590

NASA and we dissolve the rock and we

169

00:07:04,480 --> 00:07:02,660

pull out all of the chemicals and then

170

00:07:07,659 --> 00:07:04,490

we study them with analytical

171

00:07:10,240 --> 00:07:07,669

instruments that tell us a lot about the

172

00:07:13,390 --> 00:07:10,250

sample like what who it is what it might

173

00:07:15,670 --> 00:07:13,400

have eaten like no source information so

174

00:07:17,830 --> 00:07:15,680

we'll spend years studying a particular

175

00:07:21,040 --> 00:07:17,840

site and I did my whole PhD in the

176

00:07:27,460 --> 00:07:21,050

atacama so I've worn these suits for a

177

00:07:30,189 --> 00:07:27,470

long time oh you learned to love the

178

00:07:31,839 --> 00:07:30,199

heat I guess yeah yeah like a few years

179

00:07:33,850 --> 00:07:31,849

ago and we went like the ground

180

00:07:35,529 --> 00:07:33,860

temperatures were like well over a

181

00:07:54,800 --> 00:07:35,539

hundred degrees so yeah I know and

182

00:07:59,330 --> 00:07:57,140

think it's ever been care uh ever been

183

00:08:00,980 --> 00:07:59,340

seen before maybe maybe a long time ago

184

00:08:02,480 --> 00:08:00,990

there may have been I'd have to look

185

00:08:05,540 --> 00:08:02,490

back at the literature but right now no

186

00:08:08,240 --> 00:08:05,550

Mars is one big giant desert and

187

00:08:13,010 --> 00:08:08,250

actually for comparison the Atacama is a

188

00:08:14,840 --> 00:08:13,020

thousand times wetter than than Mars and

189

00:08:16,520 --> 00:08:14,850

it's a surface of Mars okay so the

190

00:08:18,379 --> 00:08:16,530

driest place on or driest place on earth

191

00:08:20,060 --> 00:08:18,389

thousands a wetter thousand times wetter

192

00:08:21,890 --> 00:08:20,070

so it's like comparing the driest place

193

00:08:25,280 --> 00:08:21,900

on earth to the Amazon that's the Delta

194

00:08:27,080 --> 00:08:25,290

ah ha ha Mars is extremely dry Wow but

195

00:08:28,460 --> 00:08:27,090

but it's the best place you can practice

196

00:08:31,850 --> 00:08:28,470

on earth it's a really good place to

197

00:08:33,829 --> 00:08:31,860

practice standing ok let me get through

198

00:08:36,279 --> 00:08:33,839

some more there's probably five in line

199

00:08:39,019 --> 00:08:36,289

for you here Speed Racer

200

00:08:41,959 --> 00:08:39,029

2:16 what material is the suit made of

201  
00:08:45,079 --> 00:08:41,969  
and does it keep cool so the suit does

202  
00:08:46,970 --> 00:08:45,089  
not keep cool at all and their special

203  
00:08:49,130 --> 00:08:46,980  
clean suits so like when you buy them

204  
00:08:51,710 --> 00:08:49,140  
there's very few microbes on it and it

205  
00:08:54,800 --> 00:08:51,720  
keeps all of your microbes on the inside

206  
00:08:56,690 --> 00:08:54,810  
and humans actually will emit about a

207  
00:08:58,460 --> 00:08:56,700  
million particles per hour and that's

208  
00:08:59,030 --> 00:08:58,470  
like after showering we're really yeah

209  
00:09:01,850 --> 00:08:59,040  
exactly

210  
00:09:04,220 --> 00:09:01,860  
we're just shedding shedding bacteria

211  
00:09:05,720 --> 00:09:04,230  
and organic molecules all the time so

212  
00:09:08,630 --> 00:09:05,730  
you can imagine if you're studying a

213  
00:09:11,240 --> 00:09:08,640

sample that has maybe only a few hundred

214

00:09:13,550 --> 00:09:11,250

cells that a million cells is going to

215

00:09:14,570 --> 00:09:13,560

be like totally overwhelmed my friends

216

00:09:16,190 --> 00:09:14,580

you don't want to take that back to your

217

00:09:22,970 --> 00:09:16,200

lab and then analyze yourself like that

218

00:09:25,280 --> 00:09:22,980

right yeah let's see if you can give us

219

00:09:27,020 --> 00:09:25,290

a number for this Bala Sparkle asks is

220

00:09:29,240 --> 00:09:27,030

there a percentage of how much less

221

00:09:31,280 --> 00:09:29,250

microscopic life there is in that desert

222

00:09:33,020 --> 00:09:31,290

compared to an average environment yeah

223

00:09:35,390 --> 00:09:33,030

so in an average environment like if you

224

00:09:36,829 --> 00:09:35,400

took like a the same amount of seawater

225

00:09:39,320 --> 00:09:36,839

you'd probably find about a million

226

00:09:40,910 --> 00:09:39,330

bacteria and compare that to the driest

227

00:09:43,910 --> 00:09:40,920

place in the Atacama where you only find

228

00:09:47,500 --> 00:09:43,920

about a hundred so it's significant

229

00:09:51,350 --> 00:09:47,510

that's ridiculous well we have a

230

00:09:54,079 --> 00:09:51,360

question here from Z track how did you

231

00:09:56,660 --> 00:09:54,089

get a degree in this how did you what

232

00:09:58,610 --> 00:09:56,670

was your journey to become a scientist

233

00:10:01,519 --> 00:09:58,620

yeah scientist out you are I've loved

234

00:10:04,400 --> 00:10:01,529

geology since I was in first grade and I

235

00:10:05,480 --> 00:10:04,410

loved space too and I actually got an

236

00:10:07,140 --> 00:10:05,490

internship here when I was in high

237

00:10:09,030 --> 00:10:07,150

school and then

238

00:10:10,830 --> 00:10:09,040

I went to college and I studied geology

239

00:10:12,810 --> 00:10:10,840

and planetary science and then I went on

240

00:10:15,960 --> 00:10:12,820

to get my PhD and Earth and Atmospheric

241

00:10:18,570 --> 00:10:15,970

Sciences with a focus on biochemistry oh

242

00:10:20,160 --> 00:10:18,580

yeah but I think a lot about being a

243

00:10:21,810 --> 00:10:20,170

student is about being self-motivated

244

00:10:23,040 --> 00:10:21,820

and coming up with a set of questions

245

00:10:25,110 --> 00:10:23,050

that you're really interested in

246

00:10:26,970 --> 00:10:25,120

answering and then learning whatever you

247

00:10:28,950 --> 00:10:26,980

need to learn to pursue those questions

248

00:10:31,590 --> 00:10:28,960

whether that's geology or physics or

249

00:10:33,180 --> 00:10:31,600

chemistry or biology or even English and

250

00:10:37,680 --> 00:10:33,190

gosh I'll tell you being at NASA a lot

251

00:10:39,540 --> 00:10:37,690

of what I do is writing yeah yeah so

252

00:10:40,890 --> 00:10:39,550

there's no one right path it's know

253

00:10:44,670 --> 00:10:40,900

there's follow what you want to do and

254

00:10:47,310 --> 00:10:44,680

do whatever you need to do exactly let's

255

00:10:50,100 --> 00:10:47,320

take a couple quick ones and eman says

256

00:10:55,020 --> 00:10:50,110

working at NASA is awesome it certainly

257

00:10:57,570 --> 00:10:55,030

sounds it if you're Mary Beth um ian is

258

00:11:00,480 --> 00:10:57,580

a d-bag so she's wearing her work outfit

259

00:11:02,430 --> 00:11:00,490

is his question so to clarify yes indeed

260

00:11:04,440 --> 00:11:02,440

you do work in this yeah so this is what

261

00:11:06,870 --> 00:11:04,450

I wear when I'm doing fieldwork in the

262

00:11:09,120 --> 00:11:06,880

atacama but actually I did do some work

263

00:11:11,040 --> 00:11:09,130

once in this on ancient DNA laboratory

264

00:11:12,660 --> 00:11:11,050

where people have to wear suits like

265

00:11:15,180 --> 00:11:12,670

this probably even more restrictive with

266

00:11:16,920 --> 00:11:15,190

complete coveralls every day while

267

00:11:18,240 --> 00:11:16,930

they're doing extractions from really

268

00:11:21,030 --> 00:11:18,250

precious samples they don't want to

269

00:11:23,670 --> 00:11:21,040

contaminate okay yeah alright so yes

270

00:11:25,770 --> 00:11:23,680

this is Mary Beth's real work outfit but

271

00:11:28,650 --> 00:11:25,780

if you want this to be your Halloween

272

00:11:29,750 --> 00:11:28,660

costume can you help us figure out some

273

00:11:31,680 --> 00:11:29,760

ways we could recreate this look

274

00:11:35,990 --> 00:11:31,690

absolutely I think it's gonna take a

275

00:11:38,550 --> 00:11:36,000

good trip to the hardware store yeah

276

00:11:40,440 --> 00:11:38,560

yeah a lot of what I'm actually from the

277

00:11:43,170 --> 00:11:40,450

hardware store really yeah yeah it makes

278

00:11:44,790 --> 00:11:43,180

sense it's all the same stuff yeah yeah

279

00:11:48,540 --> 00:11:44,800

yeah give me your hands dirty out there

280

00:11:50,670 --> 00:11:48,550

for sure right well awesome thank you

281

00:11:53,040 --> 00:11:50,680

yes answering questions we're gonna

282

00:11:56,670 --> 00:11:53,050

bring you back later on for the voting

283

00:12:00,330 --> 00:11:56,680

so good but thank you for bringing your

284

00:12:03,140 --> 00:12:00,340

samples and your tools and we will see

285

00:12:04,320 --> 00:12:03,150

you in a bit all right thanks guys hey

286

00:12:06,810 --> 00:12:04,330

cool

287

00:12:09,240 --> 00:12:06,820

pretty impressive yes but you know

288

00:12:11,160 --> 00:12:09,250

doable I feel like I've could put

289

00:12:12,960 --> 00:12:11,170

together that costume yeah it might be

290

00:12:16,800 --> 00:12:12,970

Mary Beth one day you know for one day

291

00:12:18,830 --> 00:12:16,810

why not don't ya think he's wanted to be

292

00:12:20,350 --> 00:12:18,840

Mary Beth yeah Halloween is grade-a

293

00:12:23,889 --> 00:12:20,360

awesome already

294

00:12:27,020 --> 00:12:23,899

move on to our next contender up next we

295

00:12:40,780 --> 00:12:27,030

have Chuck come on out Chuck

296

00:12:45,940 --> 00:12:43,540

some gloves and dirts and gloves and

297

00:12:47,710 --> 00:12:45,950

girls feel free to come right on up to

298

00:12:51,819 --> 00:12:47,720

the table over here those chairs are

299

00:12:54,430 --> 00:12:51,829

hard to tuck in go ahead tell us your

300

00:12:56,350 --> 00:12:54,440

name and what you do sure my name is

301  
00:12:58,000 --> 00:12:56,360  
Chuck Cornelison I'm a mechanical

302  
00:13:00,030 --> 00:12:58,010  
engineer and I work in the ballistic

303  
00:13:02,259 --> 00:13:00,040  
ranges here at Ames Research Center

304  
00:13:04,329 --> 00:13:02,269  
sounds quite interesting we'll hear more

305  
00:13:07,360 --> 00:13:04,339  
about that in a second tell us what

306  
00:13:09,699 --> 00:13:07,370  
you're wearing I'm wearing basically the

307  
00:13:11,410 --> 00:13:09,709  
standard attire we wear when we're

308  
00:13:13,960 --> 00:13:11,420  
conducting experiments in the ballistic

309  
00:13:15,670 --> 00:13:13,970  
ranges it's a it's a fun place to work

310  
00:13:17,980 --> 00:13:15,680  
but it can be quite dirty so we

311  
00:13:20,980 --> 00:13:17,990  
typically wear lab coats protect our

312  
00:13:23,860 --> 00:13:20,990  
clothes mm-hmm we typically handle

313  
00:13:25,480 --> 00:13:23,870

explosives and in various hazardous

314

00:13:26,290 --> 00:13:25,490

materials so we have the safety

315

00:13:29,290 --> 00:13:26,300

accoutrements

316

00:13:30,519 --> 00:13:29,300

you know yes all these things yeah you

317

00:13:32,019 --> 00:13:30,529

want to go home with the same number of

318

00:13:34,420 --> 00:13:32,029

fingers and eyebrows that you come in

319

00:13:36,069 --> 00:13:34,430

with so goal so this is yeah standard

320

00:13:39,240 --> 00:13:36,079

ballistic range attire it's been

321

00:13:42,370 --> 00:13:39,250

approved by Ralph Lauren I believe

322

00:13:44,350 --> 00:13:42,380

designer lab that's right okay so you're

323

00:13:46,900 --> 00:13:44,360

dirty and you work with explosives what

324

00:13:48,160 --> 00:13:46,910

exactly is going on good range

325

00:13:50,079 --> 00:13:48,170

well the ballistic ranges there is

326

00:13:51,490 --> 00:13:50,089

actually two facilities within the

327

00:13:53,860 --> 00:13:51,500

ballistic range complex that are

328

00:13:56,110 --> 00:13:53,870

currently active one of them is called

329

00:13:57,819 --> 00:13:56,120

the Ames vertical gun range and what we

330

00:14:00,370 --> 00:13:57,829

do there is we use a large gun to shoot

331

00:14:02,199 --> 00:14:00,380

high speed projectiles into targets to

332

00:14:04,120 --> 00:14:02,209

simulate what happens when an asteroid

333

00:14:05,889 --> 00:14:04,130

or a meteor impacts a planet or moon

334

00:14:09,160 --> 00:14:05,899

surface we observed the formation of the

335

00:14:11,050 --> 00:14:09,170

crater where the debris goes etc in fact

336

00:14:15,160 --> 00:14:11,060

I've got a a brief video that

337

00:14:17,050 --> 00:14:15,170

demonstrates that there is the blue

338

00:14:18,550 --> 00:14:17,060

chambers where we place our targets and

339

00:14:21,100 --> 00:14:18,560

adjust the environment according to

340

00:14:23,410 --> 00:14:21,110

whatever conditions were trying to

341

00:14:25,840 --> 00:14:23,420

simulate the orange section was our gun

342

00:14:29,019 --> 00:14:25,850

beam there's a nice impact you see the

343

00:14:31,210 --> 00:14:29,029

the create the debris curtain evolving

344

00:14:33,010 --> 00:14:31,220

and his materials being excavated and as

345

00:14:37,690 --> 00:14:33,020

soon as the smoke clears while

346

00:14:40,540 --> 00:14:37,700

there you go there's the crater regular

347

00:14:42,730 --> 00:14:40,550

gun no no it's not not a typical gun

348

00:14:44,860 --> 00:14:42,740

it's it's what we use is what's called a

349

00:14:47,290 --> 00:14:44,870

two-stage light gas gun and the way it

350

00:14:49,720 --> 00:14:47,300

operates is you you use gunpowder to

351  
00:14:51,090 --> 00:14:49,730  
shoot a piston down a tube that's filled

352  
00:14:53,170 --> 00:14:51,100  
with hydrogen and as the piston

353  
00:14:56,020 --> 00:14:53,180  
traverses the tube it compresses the

354  
00:14:58,170 --> 00:14:56,030  
hydrogen to extreme pressure tens of

355  
00:15:00,550 --> 00:14:58,180  
thousands of pounds per square inch and

356  
00:15:02,380 --> 00:15:00,560  
we then use that high pressure hydrogen

357  
00:15:05,500 --> 00:15:02,390  
as our propellant medium or what we use

358  
00:15:07,480 --> 00:15:05,510  
to launch the bullet out of our gun

359  
00:15:09,130 --> 00:15:07,490  
barrel and the reason we do that is you

360  
00:15:12,430 --> 00:15:09,140  
can get much higher velocities than you

361  
00:15:14,680 --> 00:15:12,440  
can with a standard gun our guns in the

362  
00:15:17,160 --> 00:15:14,690  
range complex top out at about eight

363  
00:15:19,720 --> 00:15:17,170

kilometers per second which is roughly

364

00:15:21,070 --> 00:15:19,730

18,000 miles per hour or think this way

365

00:15:22,930 --> 00:15:21,080

if you're traveling that speed you could

366

00:15:24,270 --> 00:15:22,940

fly from San Francisco to New York in

367

00:15:26,860 --> 00:15:24,280

about 10 minutes

368

00:15:35,890 --> 00:15:26,870

fun fact for you we are in fact the

369

00:15:37,360 --> 00:15:35,900

fastest gun in the West I know you have

370

00:15:40,000 --> 00:15:37,370

you have another one yeah one here that

371

00:15:43,360 --> 00:15:40,010

is we we have some hellos for you okay

372

00:15:47,200 --> 00:15:43,370

just jump into the chat here as dad's x3

373

00:15:49,600 --> 00:15:47,210

hey Chuck hello caps big hello

374

00:15:52,870 --> 00:15:49,610

Speed Racer 216 are those mechanics

375

00:15:55,090 --> 00:15:52,880

gloves I love those gloves yeah we have

376

00:15:56,860 --> 00:15:55,100

various types of gloves on often you

377

00:16:00,070 --> 00:15:56,870

know depending on what we're trying to

378

00:16:03,580 --> 00:16:00,080

do some of them have this you know Geico

379

00:16:05,110 --> 00:16:03,590

gecko like texture yes in addition to

380

00:16:09,070 --> 00:16:05,120

working in the ballistic ranges I can

381

00:16:10,810 --> 00:16:09,080

save you 50% on your contract it's we

382

00:16:12,490 --> 00:16:10,820

have text you know to improve manual

383

00:16:14,590 --> 00:16:12,500

dexterity depending on what what you're

384

00:16:15,790 --> 00:16:14,600

doing thank you yeah and in what sort of

385

00:16:17,560 --> 00:16:15,800

chemicals you're working with because

386

00:16:20,800 --> 00:16:17,570

you want to protect your ear skin and

387

00:16:25,630 --> 00:16:20,810

whatnot from acetone akule sleepy

388

00:16:27,790 --> 00:16:25,640

underscore Jerry so cool Jerry and I

389

00:16:29,050 --> 00:16:27,800

know we're gonna hear more about the

390

00:16:30,280 --> 00:16:29,060

other facilities so let's do that first

391

00:16:31,810 --> 00:16:30,290

sure let's see if you answer some of

392

00:16:34,750 --> 00:16:31,820

these questions okay that the vertical

393

00:16:37,030 --> 00:16:34,760

gun that was range number one thank

394

00:16:39,220 --> 00:16:37,040

hypervelocity impact testing the other

395

00:16:41,560 --> 00:16:39,230

facilities called the hypervelocity free

396

00:16:44,050 --> 00:16:41,570

flight facility we use the same sort of

397

00:16:46,390 --> 00:16:44,060

gun technology but rather than looking

398

00:16:48,610 --> 00:16:46,400

at the impact we shoot small scale

399

00:16:51,700 --> 00:16:48,620

models planetary entry vehicles down a

400

00:16:53,740 --> 00:16:51,710

long flight corridor we take a lot of

401  
00:16:55,990 --> 00:16:53,750  
pictures of them as they fly to to map

402  
00:16:57,940 --> 00:16:56,000  
out the trajectory and from that

403  
00:17:00,430 --> 00:16:57,950  
information we can infer the aerodynamic

404  
00:17:02,890 --> 00:17:00,440  
characteristics of these planetary entry

405  
00:17:07,260 --> 00:17:02,900  
vehicles and I have one right here yeah

406  
00:17:09,579 --> 00:17:07,270  
yes this is a picture of one of the

407  
00:17:12,370 --> 00:17:09,589  
models that we've we've shot over the

408  
00:17:13,990 --> 00:17:12,380  
years now it may look like some sort of

409  
00:17:15,579 --> 00:17:14,000  
a drawer pole that you would buy at Home

410  
00:17:18,040 --> 00:17:15,589  
Depot you know for five bucks but I

411  
00:17:20,890 --> 00:17:18,050  
assure you this is actually a precise

412  
00:17:24,250 --> 00:17:20,900  
scale model of the Orion capsule yeah

413  
00:17:26,410 --> 00:17:24,260

and so we do have a video of one of

414

00:17:29,140 --> 00:17:26,420

these tests these arrow ballistic tests

415

00:17:31,090 --> 00:17:29,150

let's have a look there you go there's

416

00:17:32,920 --> 00:17:31,100

the test section notice all the windows

417

00:17:34,900 --> 00:17:32,930

that's one of the reasons you get dirty

418

00:17:38,200 --> 00:17:34,910

you have 64 windows to clean after every

419

00:17:39,850 --> 00:17:38,210

test and we launched the models here's

420

00:17:43,270 --> 00:17:39,860

that here's a video of a model in flight

421

00:17:45,520 --> 00:17:43,280

and we take 32 still images from which

422

00:17:48,220 --> 00:17:45,530

we can map out the trajectory and one

423

00:17:49,900 --> 00:17:48,230

thing that was enough blaze of glory I

424

00:17:51,400 --> 00:17:49,910

didn't blaze you can see it's turning

425

00:17:52,540 --> 00:17:51,410

there yeah yeah what one thing that was

426

00:17:55,060 --> 00:17:52,550

kind of cool from that video you

427

00:17:57,040 --> 00:17:55,070

probably noticed was the gas cap in

428

00:17:58,420 --> 00:17:57,050

front of the model was was glowing and

429

00:18:00,810 --> 00:17:58,430

even though we were simulating flight

430

00:18:04,240 --> 00:18:00,820

you know way up high in the atmosphere

431

00:18:06,550 --> 00:18:04,250

where it's fairly thin and not a lot of

432

00:18:08,500 --> 00:18:06,560

air molecules the fact you're traveling

433

00:18:10,090 --> 00:18:08,510

say 25 times the speed of sound you're

434

00:18:11,830 --> 00:18:10,100

still compressing and heating this gas

435

00:18:13,870 --> 00:18:11,840

to extreme temperatures and that's what

436

00:18:15,790 --> 00:18:13,880

causes it to glow like that which is a

437

00:18:17,200 --> 00:18:15,800

nice visual indication of why you need

438

00:18:18,310 --> 00:18:17,210

to have a heat shield on your vehicle

439

00:18:20,890 --> 00:18:18,320

when you're entering a planisphere

440

00:18:23,440 --> 00:18:20,900

that's a wise precaution so that that's

441

00:18:27,310 --> 00:18:23,450

the that's the free flight range it's

442

00:18:29,740 --> 00:18:27,320

it's geared towards aerodynamics we've

443

00:18:34,180 --> 00:18:29,750

been in business or that facility not me

444

00:18:36,040 --> 00:18:34,190

but he's been business since mid 60s it

445

00:18:38,350 --> 00:18:36,050

started off supporting Apollo and

446

00:18:40,390 --> 00:18:38,360

virtually with just a few exceptions

447

00:18:42,700 --> 00:18:40,400

every NASA probe that's entered a

448

00:18:44,800 --> 00:18:42,710

planet's atmosphere has had some sort of

449

00:18:47,590 --> 00:18:44,810

testing done in the ballistic range

450

00:18:49,480 --> 00:18:47,600

combat names we've also been involved

451

00:18:52,000 --> 00:18:49,490

with some private industries such as

452

00:18:55,120 --> 00:18:52,010

SpaceX Dragon capsule and Blue Origin

453

00:18:57,310 --> 00:18:55,130

the new Shepherd capsule so basically my

454

00:18:59,360 --> 00:18:57,320

team and I we we provide a testing

455

00:19:00,560 --> 00:18:59,370

service we we operate the facility

456

00:19:03,050 --> 00:19:00,570

conduct the test for visiting

457

00:19:04,460 --> 00:19:03,060

researchers who pay for access and then

458

00:19:06,110 --> 00:19:04,470

we delivered the data and then they go

459

00:19:09,080 --> 00:19:06,120

off publish their papers whatever yeah

460

00:19:18,710 --> 00:19:09,090

so in that sense we really are a gun for

461

00:19:26,720 --> 00:19:18,720

hire I should have dressed like Clint

462

00:19:32,450 --> 00:19:26,730

Eastwood benefi intro for him - that's

463

00:19:35,210 --> 00:19:32,460

right cowboy music yeah next year I

464

00:19:42,100 --> 00:19:35,220

can't wait I some more questions for you

465

00:19:48,380 --> 00:19:44,990

how third of us again do you use lasers

466

00:19:51,140 --> 00:19:48,390

no yes do you use lasers oh we do use

467

00:19:53,270 --> 00:19:51,150

lasers for various applications for

468

00:19:55,490 --> 00:19:53,280

example in the vertical gun range we use

469

00:19:58,550 --> 00:19:55,500

lasers for our model detection system

470

00:20:00,710 --> 00:19:58,560

that is - we have laser light sheets at

471

00:20:02,740 --> 00:20:00,720

specific distances and when the particle

472

00:20:05,690 --> 00:20:02,750

passes through these beams they stop

473

00:20:07,310 --> 00:20:05,700

timers so knowing the time elapsed and

474

00:20:09,410 --> 00:20:07,320

the distance traveled you can then

475

00:20:10,820 --> 00:20:09,420

calculate the velocity so that that's

476

00:20:12,950 --> 00:20:10,830

how we measure the velocity of the

477

00:20:14,140 --> 00:20:12,960

particle so that's one application thank

478

00:20:17,450 --> 00:20:14,150

you sir

479

00:20:22,430 --> 00:20:17,460

I'll stick 6es --cz is the gun test

480

00:20:23,990 --> 00:20:22,440

performed in a vacuum yes both for both

481

00:20:26,150 --> 00:20:24,000

facilities actually they're their vacuum

482

00:20:28,220 --> 00:20:26,160

chamber so you can you can pump the

483

00:20:29,960 --> 00:20:28,230

pressure way down and the protocol gun

484

00:20:32,060 --> 00:20:29,970

you can simulate impact on an airless

485

00:20:33,830 --> 00:20:32,070

body or you can backfill with different

486

00:20:36,080 --> 00:20:33,840

test gasses if let's say if you're

487

00:20:37,760 --> 00:20:36,090

simulating an impact on Mars for example

488

00:20:39,980 --> 00:20:37,770

you can put a low level of carbon

489

00:20:42,470 --> 00:20:39,990

dioxide in there so we we can test it

490

00:20:47,840 --> 00:20:42,480

vacuum or in variable gases for

491

00:20:50,360 --> 00:20:47,850

different atmospheres as death x3 says

492

00:20:50,990 --> 00:20:50,370

our acts what is the craziest experiment

493

00:20:55,070 --> 00:20:51,000

you've ever done

494

00:20:58,310 --> 00:20:55,080

ooh craziest well let's see there's a

495

00:21:00,020 --> 00:20:58,320

couple that come to mind one that was

496

00:21:01,720 --> 00:21:00,030

fun this was a couple decades ago we

497

00:21:05,870 --> 00:21:01,730

were we had a researcher who is

498

00:21:07,070 --> 00:21:05,880

simulating the impact that we believe

499

00:21:09,930 --> 00:21:07,080

triggered the extinction of the

500

00:21:12,870 --> 00:21:09,940

dinosaurs 65 million years ago yes

501  
00:21:15,300 --> 00:21:12,880  
mount ever sized asteroid that slammed

502  
00:21:17,460 --> 00:21:15,310  
into just off the coast of the Yucatan

503  
00:21:19,980 --> 00:21:17,470  
and caused a big crater and so that was

504  
00:21:22,980 --> 00:21:19,990  
that was a very cool project because

505  
00:21:24,840 --> 00:21:22,990  
what he demonstrated was if the impactor

506  
00:21:26,520 --> 00:21:24,850  
comes straight in normal to the earth

507  
00:21:29,100 --> 00:21:26,530  
most of the ejected material would have

508  
00:21:30,600 --> 00:21:29,110  
gone straight back up out into space but

509  
00:21:33,120 --> 00:21:30,610  
looking at the shape of the crater and

510  
00:21:35,460 --> 00:21:33,130  
the iridium deposits that came from the

511  
00:21:37,650 --> 00:21:35,470  
impact or the way they're scattered

512  
00:21:39,510 --> 00:21:37,660  
across the earth it would indicate that

513  
00:21:41,520 --> 00:21:39,520

it came in at a very shallow angle and

514

00:21:43,770 --> 00:21:41,530

because of that you had this wall of

515

00:21:45,240 --> 00:21:43,780

destruction of material going into the

516

00:21:46,500 --> 00:21:45,250

northern hemisphere and then a lot of

517

00:21:49,110 --> 00:21:46,510

stuff getting a trained in the

518

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

atmosphere that cause dramatic climatic

519

00:21:53,940 --> 00:21:51,130

changes so what he was showing was that

520

00:21:55,350 --> 00:21:53,950

you know if we might we might not be

521

00:21:56,790 --> 00:21:55,360

here in dinosaurs might still be around

522

00:22:01,200 --> 00:21:56,800

if it had come in in a different angle

523

00:22:06,630 --> 00:22:01,210

you know say that's a great example I

524

00:22:07,860 --> 00:22:06,640

know right spacecraft a dinosaur we're

525

00:22:09,840 --> 00:22:07,870

gonna have to let you go really soon but

526

00:22:12,120 --> 00:22:09,850

there two more good questions so we'll

527

00:22:15,330 --> 00:22:12,130

do a rapid-fire thing here Nikki cakes

528

00:22:16,950 --> 00:22:15,340

ask can we shoot a spacecraft at another

529

00:22:19,980 --> 00:22:16,960

planet or towards another planet instead

530

00:22:21,360 --> 00:22:19,990

of using rockets well from from the

531

00:22:22,710 --> 00:22:21,370

surface of Earth that would be very

532

00:22:24,570 --> 00:22:22,720

difficult because you know you've got

533

00:22:26,640 --> 00:22:24,580

gravity and you've got the atmosphere to

534

00:22:30,390 --> 00:22:26,650

get through and so they've been trying

535

00:22:32,690 --> 00:22:30,400

to use like guns to launch satellites

536

00:22:37,650 --> 00:22:32,700

into space and it's really not a very

537

00:22:39,270 --> 00:22:37,660

feasible means of doing so maybe if you

538

00:22:41,100 --> 00:22:39,280

built something you know that's an

539

00:22:42,600 --> 00:22:41,110

orbital platform and launched it from

540

00:22:44,400 --> 00:22:42,610

there that might be a good way to get it

541

00:22:49,560 --> 00:22:44,410

there but from the surface of planet

542

00:22:53,370 --> 00:22:49,570

that too much yeah you don't take the

543

00:22:57,960 --> 00:22:53,380

last women ah yes so we have scary crazy

544

00:23:00,720 --> 00:22:57,970

butter knife check have you done any

545

00:23:01,560 --> 00:23:00,730

impact or microscopic impact testing on

546

00:23:05,760 --> 00:23:01,570

spacecraft

547

00:23:07,320 --> 00:23:05,770

yes yes we have the Cassini mission Mars

548

00:23:10,100 --> 00:23:07,330

rovers and when we looked at some

549

00:23:13,410 --> 00:23:10,110

vehicle survivability or vulnerability

550

00:23:15,030 --> 00:23:13,420

tests where we took JPL came to us with

551  
00:23:16,350 --> 00:23:15,040  
certain components of the spacecraft

552  
00:23:18,840 --> 00:23:16,360  
they were concerned about see if they

553  
00:23:21,310 --> 00:23:18,850  
had adequate shielding so we replicated

554  
00:23:22,860 --> 00:23:21,320  
micrometeoroid impacts on those compared

555  
00:23:25,860 --> 00:23:22,870  
so you can so they could get a better

556  
00:23:28,930 --> 00:23:25,870  
probabilistic model of what sort of

557  
00:23:31,450 --> 00:23:28,940  
survivability of the vehicle or how

558  
00:23:33,670 --> 00:23:31,460  
likely with this vehicle survive getting

559  
00:23:35,950 --> 00:23:33,680  
to its destination so we have done some

560  
00:23:38,800 --> 00:23:35,960  
micrometeoroid the impact tests on

561  
00:23:43,510 --> 00:23:38,810  
spacecraft do so many different kinds of

562  
00:23:46,990 --> 00:23:43,520  
things in there cool well thank you for

563  
00:23:48,550 --> 00:23:47,000

coming sure all this you get out of here

564

00:23:50,860 --> 00:23:48,560

for now and we're gonna invite you back

565

00:23:55,330 --> 00:23:50,870

later when it's time to vote okay all

566

00:23:59,020 --> 00:23:55,340

right did you know half of that stuff

567

00:24:01,060 --> 00:23:59,030

nope I knew it I knew they did the

568

00:24:04,930 --> 00:24:01,070

impact crater formation with the

569

00:24:09,550 --> 00:24:04,940

dinosaurs so cool who never think like

570

00:24:11,740 --> 00:24:09,560

so much on the show I know so let's move

571

00:24:26,160 --> 00:24:11,750

on and learn some more from our next

572

00:24:31,000 --> 00:24:26,170

guest yeah come on out Lindley glasses

573

00:24:33,160 --> 00:24:31,010

cool necessary see welcome scoot right

574

00:24:35,680 --> 00:24:33,170

in there yeah get nice and close to the

575

00:24:37,540 --> 00:24:35,690

mic all right so why don't you tell

576

00:24:37,870 --> 00:24:37,550

everybody your name and what you do here

577

00:24:40,330 --> 00:24:37,880

at Ames

578

00:24:42,010 --> 00:24:40,340

so I'm Lyn listen George and I am an

579

00:24:44,950 --> 00:24:42,020

intern here at Ames working with the

580

00:24:47,610 --> 00:24:44,960

intelligent robotics group creating 3d

581

00:24:49,780 --> 00:24:47,620

visualizations using novel media

582

00:24:51,690 --> 00:24:49,790

particularly of geological and

583

00:24:54,310 --> 00:24:51,700

geospatial data oh wow

584

00:24:56,950 --> 00:24:54,320

all right well we're gonna hear more

585

00:25:00,370 --> 00:24:56,960

about that I hope describe for us your

586

00:25:02,740 --> 00:25:00,380

attire today so I'm dressed as a regular

587

00:25:04,750 --> 00:25:02,750

intern in my normal everyday outfit so

588

00:25:22,610 --> 00:25:04,760

we get a lot of personal expression with

589

00:25:27,649 --> 00:25:24,140

that's a little bit about what you're

590

00:25:30,490 --> 00:25:27,659

working on 3d printers 3d glasses what

591

00:25:33,350 --> 00:25:30,500

are you working on so I work on creating

592

00:25:36,620 --> 00:25:33,360

3d visualizations including our 3d

593

00:25:38,870 --> 00:25:36,630

printed models maybe if you hold that

594

00:25:42,649 --> 00:25:38,880

still there yes we could get a close-up

595

00:25:47,000 --> 00:25:42,659

on a 3d printed model of what so this is

596

00:25:48,980 --> 00:25:47,010

a bore hole drilled by curiosity and it

597

00:25:51,919 --> 00:25:48,990

was create this 3d model was created

598

00:25:55,220 --> 00:25:51,929

from stereoscopic images that it took of

599

00:25:57,470 --> 00:25:55,230

that borehole angle okay the rover on

600

00:25:59,899 --> 00:25:57,480

Mars is drilling it's drilling a bore

601  
00:26:02,539 --> 00:25:59,909  
holes to see if it can get samples from

602  
00:26:05,000 --> 00:26:02,549  
I believe they're called mud stones to

603  
00:26:07,610 --> 00:26:05,010  
see what kind of chemicals and if

604  
00:26:11,210 --> 00:26:07,620  
there's any proteins or anything sort of

605  
00:26:12,409 --> 00:26:11,220  
like in the in those rocks and so

606  
00:26:15,380 --> 00:26:12,419  
curiosity Rover's in Gale Crater

607  
00:26:17,090 --> 00:26:15,390  
creating these balls and taking

608  
00:26:18,919 --> 00:26:17,100  
stereoscopic images which are images

609  
00:26:21,799 --> 00:26:18,929  
from two angles and from that you can

610  
00:26:23,149 --> 00:26:21,809  
create this is an incomplete 3d mesh so

611  
00:26:24,680 --> 00:26:23,159  
if you hold it the right angle there's

612  
00:26:27,620 --> 00:26:24,690  
actually little holes in the bottom and

613  
00:26:29,480 --> 00:26:27,630

then fixing those holes and seeing the

614

00:26:33,350 --> 00:26:29,490

best ways to take photos to get complete

615

00:26:35,690 --> 00:26:33,360

meshes as hard of what I do but mostly

616

00:26:39,380 --> 00:26:35,700

what I do is I take various stereoscopic

617

00:26:42,289 --> 00:26:39,390

images and use 3d printing and Holograms

618

00:26:44,750 --> 00:26:42,299

and augmented reality to see what types

619

00:26:46,669 --> 00:26:44,760

of visualizations we can make in the

620

00:26:49,130 --> 00:26:46,679

hopes that scientists who we can't just

621

00:26:51,560 --> 00:26:49,140

casually drop off on Mars you can make

622

00:26:53,389 --> 00:26:51,570

earth-like observations so observations

623

00:26:55,820 --> 00:26:53,399

like Mary Beth earlier was making in the

624

00:26:58,909 --> 00:26:55,830

desert using just these images that

625

00:27:00,889 --> 00:26:58,919

we've collected from Mars Wow okay right

626

00:27:02,630 --> 00:27:00,899

so scientists on earth could be yeah

627

00:27:04,460 --> 00:27:02,640

watching what can be watching through

628

00:27:07,190 --> 00:27:04,470

the rover and making yeah correct

629

00:27:08,600 --> 00:27:07,200

scientific observation awesome yeah so

630

00:27:10,130 --> 00:27:08,610

you're you're just getting started in

631

00:27:11,450 --> 00:27:10,140

your internship and you're showing us

632

00:27:14,810 --> 00:27:11,460

some examples of the kinds of work that

633

00:27:17,330 --> 00:27:14,820

you're gonna be yeah this is just a test

634

00:27:19,820 --> 00:27:17,340

print we're doing things like creating

635

00:27:21,889 --> 00:27:19,830

multi material multicolored prints that

636

00:27:23,720 --> 00:27:21,899

will have more realistic effects oh cool

637

00:27:26,360 --> 00:27:23,730

and one of the things that we're most

638

00:27:28,880 --> 00:27:26,370

focused on is realistic optical effects

639

00:27:31,430 --> 00:27:28,890

because it's very difficult in just a

640

00:27:34,360 --> 00:27:31,440

flat two-dimensional photo to see sort

641

00:27:36,050 --> 00:27:34,370

of what kind of specularly or shininess

642

00:27:37,550 --> 00:27:36,060

essentially earth

643

00:27:55,000 --> 00:27:37,560

the rocks are exhibiting which is a very

644

00:27:57,430 --> 00:27:57,220

the couple of images you have the kinds

645

00:28:00,879 --> 00:27:57,440

of

646

00:28:03,129 --> 00:28:00,889

that I work with so I have here a 3d

647

00:28:09,450 --> 00:28:03,139

image of Mars taken by curiosity yes

648

00:28:13,899 --> 00:28:12,399

glasses you can see it in 3d if any of

649

00:28:17,560 --> 00:28:13,909

you at home casually have some of these

650

00:28:22,600 --> 00:28:17,570

lying around from from your favorite 90s

651  
00:28:25,980 --> 00:28:22,610  
movies as a kid is Mount sharp seen

652  
00:28:30,639 --> 00:28:25,990  
through curiosity's navigation camera

653  
00:28:31,990 --> 00:28:30,649  
with just this 3d layer of rocks in

654  
00:28:33,519 --> 00:28:32,000  
front of it that you can see kind of

655  
00:28:37,690 --> 00:28:33,529  
coming out of the screen again we're

656  
00:28:39,310 --> 00:28:37,700  
gonna write really are yeah so it it

657  
00:28:41,470 --> 00:28:39,320  
really shows you how different it is

658  
00:28:43,409 --> 00:28:41,480  
observing in 3d versus two days right

659  
00:28:47,950 --> 00:28:43,419  
right all the difference that could make

660  
00:28:50,139 --> 00:28:47,960  
yeah observing this way fantastic and is

661  
00:28:53,080 --> 00:28:50,149  
there another one there is another one

662  
00:28:54,159 --> 00:28:53,090  
3d image of Mars taken from orbit I see

663  
00:29:00,909 --> 00:28:54,169

yes

664

00:29:03,460 --> 00:29:00,919

fellas nice and Welsh name which is one

665

00:29:05,110 --> 00:29:03,470

of the oldest valleys on Mars and this

666

00:29:06,850 --> 00:29:05,120

was taken from orbit I believe because

667

00:29:08,320 --> 00:29:06,860

they were scouting it as a possible

668

00:29:10,720 --> 00:29:08,330

landing site okay

669

00:29:13,269 --> 00:29:10,730

and it also shows that really intense

670

00:29:16,269 --> 00:29:13,279

sort of jaggedness of the rocks when you

671

00:29:18,580 --> 00:29:16,279

look at it in three days yep and these

672

00:29:20,710 --> 00:29:18,590

these images are available on NASA's

673

00:29:22,090 --> 00:29:20,720

website if any of you at home want to

674

00:29:25,090 --> 00:29:22,100

nip out and get yourself some of these

675

00:29:26,850 --> 00:29:25,100

for later today I'm just gonna wear

676

00:29:31,539 --> 00:29:26,860

these for the rest of the show I think

677

00:29:32,680 --> 00:29:31,549

good luck yeah and very cheap so great

678

00:29:36,899 --> 00:29:32,690

for making your own costume at home

679

00:29:41,980 --> 00:29:38,950

sure is tie up your hair and get

680

00:29:43,899 --> 00:29:41,990

yourself a pair of 3d losses how long

681

00:29:45,220 --> 00:29:43,909

have you been an intern here so I've

682

00:29:47,409 --> 00:29:45,230

been an intern here for eight and a half

683

00:29:49,810 --> 00:29:47,419

weeks and I'm here for another seven and

684

00:29:52,389 --> 00:29:49,820

a half so standard 16 week autumn

685

00:29:56,499 --> 00:29:52,399

internship yeah you guys get to work and

686

00:29:57,789 --> 00:29:56,509

you do sort of you get it described to

687

00:29:59,619 --> 00:29:57,799

you is just gonna hit the ground running

688

00:30:00,940 --> 00:29:59,629

and just keep going and then eventually

689

00:30:06,320 --> 00:30:00,950

you'll get to leave but not before you

690

00:30:09,560 --> 00:30:06,330

get it done we've questions and comments

691

00:30:11,899 --> 00:30:09,570

yeah yeah we have a Biff who is asking

692

00:30:15,110 --> 00:30:11,909

what kind of CAD software do you use if

693

00:30:19,310 --> 00:30:15,120

any so we actually work with a variety

694

00:30:21,019 --> 00:30:19,320

of things so we don't do like geometric

695

00:30:22,549 --> 00:30:21,029

CAD style stuff because what we're

696

00:30:24,409 --> 00:30:22,559

working with is very organic forms were

697

00:30:27,769 --> 00:30:24,419

working with meshes and so you can use

698

00:30:29,960 --> 00:30:27,779

tools like mesh mixer what I use

699

00:30:32,090 --> 00:30:29,970

actually varies depending on what I'm

700

00:30:33,590 --> 00:30:32,100

working with in that moment so there's

701  
00:30:37,190 --> 00:30:33,600  
certain programs that you need to make

702  
00:30:39,409 --> 00:30:37,200  
STL's for 3d printing we use a Prusa

703  
00:30:43,639 --> 00:30:39,419  
printer but there are different types

704  
00:30:45,470 --> 00:30:43,649  
and I also use mesh mixer combined with

705  
00:30:47,240 --> 00:30:45,480  
unity for some of my augmented reality

706  
00:30:49,850 --> 00:30:47,250  
stuff so there's lots of different

707  
00:30:52,970 --> 00:30:49,860  
programs that you need to combine to be

708  
00:30:55,039 --> 00:30:52,980  
able to do related stealthy sumo asks

709  
00:30:58,460 --> 00:30:55,049  
what kind of 3d printing stereo

710  
00:31:01,340 --> 00:30:58,470  
lithography yes so this is a fused

711  
00:31:03,169 --> 00:31:01,350  
deposition modeling it's not stereo

712  
00:31:05,350 --> 00:31:03,179  
lithography but you can use stereo

713  
00:31:08,060 --> 00:31:05,360

lithography to achieve a similar effect

714

00:31:17,600 --> 00:31:08,070

but the texture would come off sort of

715

00:31:18,889 --> 00:31:17,610

almost inverted okay if you have chunks

716

00:31:20,330 --> 00:31:18,899

out of a surface so that when you hold

717

00:31:23,240 --> 00:31:20,340

it up to the light you can look through

718

00:31:24,500 --> 00:31:23,250

it and you can see a 3d image yeah so

719

00:31:26,480 --> 00:31:24,510

you're essentially making pots of a

720

00:31:26,810 --> 00:31:26,490

translucent to look through yeah all

721

00:31:30,500 --> 00:31:26,820

right

722

00:31:36,980 --> 00:31:30,510

a while ago RJ the newb declared that's

723

00:31:41,810 --> 00:31:36,990

awesome doing stuff to do with my

724

00:31:43,940 --> 00:31:41,820

research it's all awesome you could say

725

00:31:49,340 --> 00:31:43,950

yeah how do we get that awesome accent

726  
00:31:51,320 --> 00:31:49,350  
for our costume so I'm from New Zealand

727  
00:31:53,210 --> 00:31:51,330  
and I ended up here on a partnership

728  
00:31:54,620 --> 00:31:53,220  
with the New Zealand government the

729  
00:31:56,299 --> 00:31:54,630  
Ministry of business innovation and

730  
00:31:59,509 --> 00:31:56,309  
employment in particular the New Zealand

731  
00:32:11,120 --> 00:31:59,519  
space administration administration

732  
00:32:13,220 --> 00:32:11,130  
agency yeah so hang out in New Zealand

733  
00:32:17,139 --> 00:32:13,230  
for a while really relax your vocal

734  
00:32:19,700 --> 00:32:17,149  
cords to be a bit more as well

735  
00:32:21,470 --> 00:32:19,710  
the really key thing if you want to be

736  
00:32:24,950 --> 00:32:21,480  
an international intern is really

737  
00:32:26,629 --> 00:32:24,960  
bringing parts of home with you you're

738  
00:32:27,710 --> 00:32:26,639

speaking to someone out there Wordsworth

739

00:32:34,639 --> 00:32:27,720

says nice to hear in New Zealand

740

00:32:36,820 --> 00:32:34,649

excellent yes all right we'll have to

741

00:32:40,669 --> 00:32:36,830

move on soon but we have a couple more

742

00:32:42,980 --> 00:32:40,679

if you know this gay Eskimo asks what

743

00:32:45,680 --> 00:32:42,990

clay types are the most common on Mars

744

00:32:48,799 --> 00:32:45,690

do you know I don't know off the top of

745

00:32:52,220 --> 00:32:48,809

my head that is probably something that

746

00:32:54,139 --> 00:32:52,230

that yeah more geologists would know

747

00:32:55,730 --> 00:32:54,149

part of what we're hoping to do in

748

00:32:57,560 --> 00:32:55,740

future with this is partnering with

749

00:32:59,450 --> 00:32:57,570

geologists to find out what is key to

750

00:33:00,500 --> 00:32:59,460

them with their work but one of the

751  
00:33:02,810 --> 00:33:00,510  
things that you face when you're

752  
00:33:04,250 --> 00:33:02,820  
designing for scientists is a kind of

753  
00:33:05,960 --> 00:33:04,260  
what's called like their you know it

754  
00:33:08,000 --> 00:33:05,970  
when you see it problem it's very

755  
00:33:10,039 --> 00:33:08,010  
difficult to quantify what you're

756  
00:33:11,960 --> 00:33:10,049  
looking at until you can actually show

757  
00:33:16,930 --> 00:33:11,970  
it to somebody and be like is this what

758  
00:33:22,789 --> 00:33:19,940  
updating your designs excellent all

759  
00:33:29,269 --> 00:33:22,799  
right touching zombies so she uses two

760  
00:33:31,639 --> 00:33:29,279  
intelligence I would agree RJ the new

761  
00:33:33,919 --> 00:33:31,649  
best so how many different angled images

762  
00:33:37,129 --> 00:33:33,929  
of that drill site do you need to be

763  
00:33:41,470 --> 00:33:37,139

able to make an accurate 3d model this

764

00:33:44,240 --> 00:33:41,480

was just made from two but there's a

765

00:33:46,610 --> 00:33:44,250

method of creating images that involves

766

00:33:49,369 --> 00:33:46,620

taking entire images that are rotated

767

00:33:51,619 --> 00:33:49,379

around a single rock and thinking of

768

00:33:53,510 --> 00:33:51,629

ways to get cameras like that to remote

769

00:33:56,330 --> 00:33:53,520

places is one of the big challenges that

770

00:33:59,029 --> 00:33:56,340

the intelligent robotics group faces yes

771

00:34:01,850 --> 00:33:59,039

just before I go and I plug that you

772

00:34:04,909 --> 00:34:01,860

know if you two want to be an intern

773

00:34:08,359 --> 00:34:04,919

here the website for that is intern acid

774

00:34:10,490 --> 00:34:08,369

gov if you are a domestic intern which

775

00:34:12,320 --> 00:34:10,500

is somebody from the US and if you go

776

00:34:14,300 --> 00:34:12,330

there and you are an international

777

00:34:17,349 --> 00:34:14,310

student who's interested in becoming an

778

00:34:18,680 --> 00:34:17,359

intern if you go to the section on

779

00:34:20,649 --> 00:34:18,690

requirements

780

00:34:22,520 --> 00:34:20,659

there's a link to the page for

781

00:34:26,270 --> 00:34:22,530

international interns which has an

782

00:34:29,020 --> 00:34:26,280

incredibly long URL that I know which is

783

00:34:35,510 --> 00:34:29,030

why you have to do it that way that's

784

00:34:37,159 --> 00:34:35,520

all right excellent tip very good yeah I

785

00:34:41,419 --> 00:34:37,169

think we know how to recreate your look

786

00:34:42,889 --> 00:34:41,429

we're gonna take her back bobby pins if

787

00:34:44,569 --> 00:34:42,899

you want to do this because I forgot to

788

00:34:48,020 --> 00:34:44,579

bring some from New Zealand and I had to

789

00:34:49,450 --> 00:34:48,030

borrow some from another antenna always

790

00:34:51,440 --> 00:34:49,460

looking out for each other

791

00:34:58,220 --> 00:34:51,450

all right well we'll see you in a little

792

00:35:01,039 --> 00:34:58,230

bit we'll bring you back alright so yes

793

00:35:03,170 --> 00:35:01,049

in turn dot nasa.gov is where you want

794

00:35:06,440 --> 00:35:03,180

to be yeah and we did a whole episode

795

00:35:08,539 --> 00:35:06,450

about how to become an intern and we met

796

00:35:10,460 --> 00:35:08,549

some interns and some full-time

797

00:35:12,559 --> 00:35:10,470

employees who were once interns so

798

00:35:13,819 --> 00:35:12,569

there's lots of info on that episode if

799

00:35:15,829 --> 00:35:13,829

you wanna look that up interns are

800

00:35:18,680 --> 00:35:15,839

always fun all right well let's keep the

801  
00:35:24,849 --> 00:35:18,690  
party going let's bring out our next two

802  
00:35:24,859 --> 00:35:30,240  
wow

803  
00:35:42,540 --> 00:35:33,090  
[Music]

804  
00:35:46,440 --> 00:35:42,550  
I have not seen me before pull up a

805  
00:35:47,160 --> 00:35:46,450  
chair party your nurse I'm gonna help

806  
00:36:04,200 --> 00:35:47,170  
you

807  
00:36:06,600 --> 00:36:04,210  
ruse boom I am an aerospace engineer

808  
00:36:08,220 --> 00:36:06,610  
here and I am Jennifer Barney and I'm

809  
00:36:09,870 --> 00:36:08,230  
also an aerospace engineer and Nettie

810  
00:36:11,700 --> 00:36:09,880  
and I both work in the unitary plan wind

811  
00:36:14,310 --> 00:36:11,710  
tunnel here at Ames the wind tunnels

812  
00:36:16,680 --> 00:36:14,320  
yeah all right tell us first about what

813  
00:36:18,810 --> 00:36:16,690

you're wearing and then both have on

814

00:36:21,780 --> 00:36:18,820

coveralls I am there's nothing really to

815

00:36:23,430 --> 00:36:21,790

the colors we also had two different

816

00:36:25,080 --> 00:36:23,440

kinds of respirators on and the

817

00:36:26,430 --> 00:36:25,090

important part is to protect our lungs

818

00:36:28,530 --> 00:36:26,440

and eyes from the paint that we're using

819

00:36:30,090 --> 00:36:28,540

okay yes all right having some UV

820

00:36:34,110 --> 00:36:30,100

glasses because we also use UV lights

821

00:36:36,270 --> 00:36:34,120

I'm gonna have to hear all about bring

822

00:36:38,160 --> 00:36:36,280

up your respirator yes to get a look wow

823

00:36:40,920 --> 00:36:38,170

that's best is a full-face respirator

824

00:36:43,350 --> 00:36:40,930

it's serious yeah okay so this is to

825

00:36:45,780 --> 00:36:43,360

protect you while you are painting yes

826  
00:36:48,240 --> 00:36:45,790  
what are you painting aerospace engineer

827  
00:36:49,890 --> 00:36:48,250  
is not expected right no it's not

828  
00:36:51,330 --> 00:36:49,900  
normally aerodynamic models but

829  
00:36:55,920 --> 00:36:51,340  
specifically I think we have photos of

830  
00:37:13,339 --> 00:36:55,930  
we are painting rockets hmm cool and

831  
00:37:17,150 --> 00:37:15,499  
scaled models we put them in these

832  
00:37:19,249 --> 00:37:17,160  
facilities where the air moves over them

833  
00:37:22,609 --> 00:37:19,259  
if we could we would watch these ruckus

834  
00:37:26,299 --> 00:37:22,619  
or aircraft every time all the time yeah

835  
00:37:27,499 --> 00:37:26,309  
first we have to first we have to model

836  
00:37:29,420 --> 00:37:27,509  
them and we put them in a controlled

837  
00:37:31,160 --> 00:37:29,430  
environment like the wind tunnel and we

838  
00:37:33,170 --> 00:37:31,170

blow air over them and we measure the

839

00:37:34,640 --> 00:37:33,180

pressure distribution across the model

840

00:37:36,620 --> 00:37:34,650

that's at the heart of what we're

841

00:37:38,539 --> 00:37:36,630

wanting to do most Windtunnel tests okay

842

00:37:45,979 --> 00:37:38,549

right before anybody builds it and tries

843

00:37:48,019 --> 00:37:45,989

to fly it yes the model yeah there's

844

00:37:51,019 --> 00:37:48,029

understanding how it acts under these

845

00:37:52,459 --> 00:37:51,029

controlled environments yeah we have

846

00:37:54,140 --> 00:37:52,469

several wind tunnels here right when we

847

00:38:00,049 --> 00:37:54,150

have the biggest in the world do we not

848

00:38:01,489 --> 00:38:00,059

yes and we have the world's largest but

849

00:38:04,699 --> 00:38:01,499

also the one that we work at it was

850

00:38:06,890 --> 00:38:04,709

built in the 1950s before even NASA was

851

00:38:09,650 --> 00:38:06,900

NASA was under the NACA it has a very

852

00:38:13,099 --> 00:38:09,660

rich history you know the aircraft that

853

00:38:15,319 --> 00:38:13,109

our predecessor the NACA was responsible

854

00:38:16,939 --> 00:38:15,329

for and then all of the the space

855

00:38:19,609 --> 00:38:16,949

missions that have had launch vehicles

856

00:38:22,009 --> 00:38:19,619

and we're screwed missions have been

857

00:38:24,459 --> 00:38:22,019

tested here yeah what a historic place

858

00:38:27,499 --> 00:38:24,469

yeah well okay so you guys are in there

859

00:38:30,769 --> 00:38:27,509

painting is about the paint because that

860

00:38:32,269 --> 00:38:30,779

makes no sense anybody special kind of

861

00:38:34,219 --> 00:38:32,279

paint called pressure sensitive paint

862

00:38:35,809 --> 00:38:34,229

mm-hmm it is a characteristic peak color

863

00:38:37,579 --> 00:38:35,819

because of the chemicals in the paint

864

00:38:39,890 --> 00:38:37,589

but what makes it really special is when

865

00:38:42,799 --> 00:38:39,900

you expose it to UV light it emits or

866

00:38:45,920 --> 00:38:42,809

floures's its own light as well yeah

867

00:38:50,630 --> 00:38:45,930

because we have a picture of one of the

868

00:38:54,349 --> 00:38:50,640

rocket models painted yeah hashtag NASA

869

00:38:56,150 --> 00:38:54,359

power of pink yes there's a you know as

870

00:38:59,269 --> 00:38:56,160

you can see in the photo the the model

871

00:39:00,739 --> 00:38:59,279

to our eyes is pink you see that also

872

00:39:02,569 --> 00:39:00,749

the blue light that's coming around it

873

00:39:05,329 --> 00:39:02,579

that's what Jenny highlighted is that we

874

00:39:08,029 --> 00:39:05,339

have these UV lights look kind of blue

875

00:39:09,979 --> 00:39:08,039

or purplish that's me there in the Test

876

00:39:12,769 --> 00:39:09,989

section so as you can tell this is a

877

00:39:15,019 --> 00:39:12,779

scaled model of a rocket this is the

878

00:39:16,279 --> 00:39:15,029

rocket that is project Artemis this is

879

00:39:18,439 --> 00:39:16,289

going to take the first woman in the

880

00:39:20,239 --> 00:39:18,449

next man to the moon and on on that

881

00:39:22,729 --> 00:39:20,249

picture and there's a place where the

882

00:39:24,490 --> 00:39:22,739

crew will sit and so understanding how

883

00:39:26,650 --> 00:39:24,500

that model

884

00:39:28,900 --> 00:39:26,660

it's designed and how it will be

885

00:39:30,579 --> 00:39:28,910

controlled when it is launched is very

886

00:39:32,710 --> 00:39:30,589

important that's what we do the

887

00:39:34,269 --> 00:39:32,720

extensive studies extensive tests and

888

00:39:36,370 --> 00:39:34,279

now with the pressure-sensitive paint

889

00:39:39,010 --> 00:39:36,380

you know we're sensing that pressure

890

00:39:42,160 --> 00:39:39,020

over the whole vehicle which is that's

891

00:39:43,720 --> 00:39:42,170

that's the new state of the art on what

892

00:39:45,819 --> 00:39:43,730

we're applying to wind tunnel testing oh

893

00:39:46,870 --> 00:39:45,829

yeah how long did it take you to paint

894

00:39:49,150 --> 00:39:46,880

the model

895

00:39:50,740 --> 00:39:49,160

usually a couple hours and we use these

896

00:39:54,099 --> 00:39:50,750

spray guns and that he has model over

897

00:39:55,960 --> 00:39:54,109

here and we apply a primer a base coat

898

00:39:57,099 --> 00:39:55,970

that's white and then a red topcoat

899

00:40:00,220 --> 00:39:57,109

that's very light which is why it gets

900

00:40:03,279 --> 00:40:00,230

that nice pink color awesome I have some

901  
00:40:09,130 --> 00:40:03,289  
comments here verified ami I'm in awe of

902  
00:40:11,079 --> 00:40:09,140  
all of you relevant RJ the noob have you

903  
00:40:13,960 --> 00:40:11,089  
tested any models for the future Artemis

904  
00:40:15,490 --> 00:40:13,970  
missions you're just saying that

905  
00:40:18,519 --> 00:40:15,500  
yeah that's what we're doing right now

906  
00:40:21,490 --> 00:40:18,529  
is testing both for the crude Artemis

907  
00:40:23,319 --> 00:40:21,500  
missions but also the cargo so they may

908  
00:40:24,309 --> 00:40:23,329  
be a few images that you'll see on the

909  
00:40:25,930 --> 00:40:24,319  
internet there are very different

910  
00:40:28,779 --> 00:40:25,940  
vehicles that you use to move people

911  
00:40:31,990 --> 00:40:28,789  
because that has a much higher level of

912  
00:40:34,210 --> 00:40:32,000  
safety to keep people safe but then we

913  
00:40:36,430 --> 00:40:34,220

also move you know satellites we move

914

00:40:39,730 --> 00:40:36,440

we're gonna move Rovers we're gonna move

915

00:40:42,569 --> 00:40:39,740

habitats we're gonna mark Landers yeah a

916

00:40:45,849 --> 00:40:42,579

lot of cargo so there's different rocket

917

00:40:48,130 --> 00:40:45,859

nose fairing shapes that we test and we

918

00:40:50,109 --> 00:40:48,140

actually did one very recently yes yes

919

00:40:52,180 --> 00:40:50,119

and so that that's the rocket you're

920

00:40:55,210 --> 00:40:52,190

talking about right which is called yes

921

00:40:57,309 --> 00:40:55,220

this is this one is a SM one space

922

00:40:58,839 --> 00:40:57,319

efficient one but this is yeah also part

923

00:41:01,630 --> 00:40:58,849

of Artemis right and the rocket is the

924

00:41:04,329 --> 00:41:01,640

Space Launch System and we have time

925

00:41:07,390 --> 00:41:04,339

lapse so you guys can see that you can

926  
00:41:10,539 --> 00:41:07,400  
tell us to show this yeah so as you can

927  
00:41:13,180 --> 00:41:10,549  
see that's our respirators on there and

928  
00:41:16,390 --> 00:41:13,190  
we're moving around the tunnel the

929  
00:41:18,370 --> 00:41:16,400  
there's you know small cylindrical

930  
00:41:20,980 --> 00:41:18,380  
sections that you see there at the left

931  
00:41:23,109 --> 00:41:20,990  
is our the boosters that when this is

932  
00:41:25,599 --> 00:41:23,119  
you see animations you see two boosters

933  
00:41:27,970 --> 00:41:25,609  
in this core and this is gonna lift off

934  
00:41:29,140 --> 00:41:27,980  
up into space so we take those off just

935  
00:41:31,599 --> 00:41:29,150  
for painting and then we'll put them

936  
00:41:34,630 --> 00:41:31,609  
back on but yeah a lot of work goes into

937  
00:41:36,539 --> 00:41:34,640  
that you're getting a wind tunnel model

938  
00:41:38,759 --> 00:41:36,549

even just to that point and

939

00:41:39,959 --> 00:41:38,769

I think it really just it yeah yeah yeah

940

00:41:41,969 --> 00:41:39,969

and it's beautiful because it gives you

941

00:41:43,439 --> 00:41:41,979

a really big appreciation for you know

942

00:41:45,509 --> 00:41:43,449

when that model is on the launch pad

943

00:41:47,640 --> 00:41:45,519

just knowing and how many people had a

944

00:41:49,349 --> 00:41:47,650

fingerprint on that model on who always

945

00:41:53,069 --> 00:41:49,359

involved in all the facilities of NASA

946

00:41:55,049 --> 00:41:53,079

and you know what what rich facilities

947

00:41:58,109 --> 00:41:55,059

technology and people that we have you

948

00:42:00,749 --> 00:41:58,119

know awesome we have snow work questions

949

00:42:02,969 --> 00:42:00,759

some to review and clarify words were

950

00:42:20,470 --> 00:42:02,979

that's what makes it pink the fact

951  
00:42:24,880 --> 00:42:22,630  
special about the paint to keep dust and

952  
00:42:27,700 --> 00:42:24,890  
condensation from accumulating on it

953  
00:42:30,160 --> 00:42:27,710  
while in space so let's clarify do you

954  
00:42:30,910 --> 00:42:30,170  
use the paint only for testing here yes

955  
00:42:32,200 --> 00:42:30,920  
okay

956  
00:42:34,030 --> 00:42:32,210  
it's very particular it's just to help

957  
00:42:36,250 --> 00:42:34,040  
us see how pressures are distributed on

958  
00:42:38,349 --> 00:42:36,260  
the model the actual rocket will be

959  
00:42:40,780 --> 00:42:38,359  
painted with real paints okay not this

960  
00:42:42,910 --> 00:42:40,790  
special page yeah this is a high-tech

961  
00:42:45,220 --> 00:42:42,920  
it's a tool right it's a pressure sensor

962  
00:42:47,020 --> 00:42:45,230  
basically it is a pressure sensor yes so

963  
00:42:49,120 --> 00:42:47,030

traditionally we've had these pressure

964

00:42:51,220 --> 00:42:49,130

sensors that are under the model on the

965

00:42:54,190 --> 00:42:51,230

model and yeah they're they're fairly

966

00:42:55,599 --> 00:42:54,200

fine but in respect to the area of the

967

00:42:57,190 --> 00:42:55,609

model they're really coarse and they're

968

00:42:59,050 --> 00:42:57,200

only in these discrete locations that we

969

00:43:00,370 --> 00:42:59,060

know the pressure really well there yeah

970

00:43:01,359 --> 00:43:00,380

but like I said at the heart of a

971

00:43:03,790 --> 00:43:01,369

Windtunnel tests you want to know the

972

00:43:06,220 --> 00:43:03,800

pressure distribution everywhere on the

973

00:43:07,510 --> 00:43:06,230

model so yeah that's what the the pain

974

00:43:09,069 --> 00:43:07,520

is offering and that's really where the

975

00:43:10,810 --> 00:43:09,079

state of the art is moving it's like how

976

00:43:13,270 --> 00:43:10,820

do we know the pressure across the whole

977

00:43:15,460 --> 00:43:13,280

vehicle mm-hmm in between those sensors

978

00:43:17,290 --> 00:43:15,470

right yeah I can't but yeah it is what

979

00:43:18,880 --> 00:43:17,300

helps you figure out what's in between

980

00:43:20,170 --> 00:43:18,890

yeah because the sensors are so

981

00:43:21,370 --> 00:43:20,180

expensive and you can't put them

982

00:43:22,810 --> 00:43:21,380

everywhere there's not enough room in

983

00:43:24,819 --> 00:43:22,820

certain car models so you'll use this

984

00:43:27,540 --> 00:43:24,829

paint to kind of fill in those gaps yeah

985

00:43:32,920 --> 00:43:31,599

sinful 7cg these painted models that

986

00:43:34,990 --> 00:43:32,930

you're testing for the mission are they

987

00:43:38,620 --> 00:43:35,000

simulated in areas other than the wind

988

00:43:41,829 --> 00:43:38,630

tunnels painted models no I would say

989

00:43:43,300 --> 00:43:41,839

it's mostly wind tunnel technology you

990

00:43:46,870 --> 00:43:43,310

know it certainly could work here on the

991

00:43:48,790 --> 00:43:46,880

bench top but yeah it's I would say the

992

00:43:53,589 --> 00:43:48,800

main application is in a wind tunnel and

993

00:43:54,520 --> 00:43:53,599

of course we we apply as much hardware

994

00:43:57,640 --> 00:43:54,530

as we can see we have multiple

995

00:43:59,050 --> 00:43:57,650

high-speed cameras we will we mount for

996

00:44:00,490 --> 00:43:59,060

we will start melting eight high speed

997

00:44:02,589 --> 00:44:00,500

cameras around the home but that's

998

00:44:05,500 --> 00:44:02,599

that's what we're capturing so the the

999

00:44:07,120 --> 00:44:05,510

paint responds to pressure so it's

1000

00:44:09,760 --> 00:44:07,130

either brighter or dimmer depending on

1001  
00:44:12,040 --> 00:44:09,770  
the oxygen which is the pressure and and

1002  
00:44:15,069 --> 00:44:12,050  
we record that with yes from the wind

1003  
00:44:16,690 --> 00:44:15,079  
tunnel when it's on the pressure over

1004  
00:44:18,640 --> 00:44:16,700  
the vehicle and it's magnitude is

1005  
00:44:21,190 --> 00:44:18,650  
changing as we change conditions until

1006  
00:44:22,750 --> 00:44:21,200  
we take lots of images and and then we

1007  
00:44:25,180 --> 00:44:22,760  
take those images and do a lot of image

1008  
00:44:26,859 --> 00:44:25,190  
processing to say this is you know these

1009  
00:44:30,099 --> 00:44:26,869  
main data products that you want to know

1010  
00:44:32,160 --> 00:44:30,109  
from the from the wind tunnel test right

1011  
00:44:33,960 --> 00:44:32,170  
all the data the designers

1012  
00:44:36,470 --> 00:44:33,970  
yes yes you know do we need to adjust

1013  
00:44:43,770 --> 00:44:36,480

this or is this good yeah yeah yeah

1014

00:44:47,420 --> 00:44:43,780

awesome yeah cool job so how can we

1015

00:44:50,010 --> 00:44:47,430

become aerospace engineers for Halloween

1016

00:44:52,200 --> 00:44:50,020

doing pressure-sensitive paint dusting

1017

00:44:53,130 --> 00:44:52,210

how can we recreate your look so much

1018

00:44:54,630 --> 00:44:53,140

like everyone else we're pretty

1019

00:44:56,280 --> 00:44:54,640

industrial probably want to go to a

1020

00:44:57,870 --> 00:44:56,290

hardware store get some coveralls or a

1021

00:44:59,700 --> 00:44:57,880

paint store get something that looks

1022

00:45:01,800 --> 00:44:59,710

like a respirator someone check your

1023

00:45:04,350 --> 00:45:01,810

eyes that's right yeah I don't forget

1024

00:45:08,700 --> 00:45:04,360

the rest Briggs yeah you could channel

1025

00:45:10,440 --> 00:45:08,710

your inner rosie the riveter know that

1026  
00:45:16,530 --> 00:45:10,450  
you're here with us painting wind tunnel

1027  
00:45:18,240 --> 00:45:16,540  
models all right well you guys can head

1028  
00:45:20,070 --> 00:45:18,250  
backstage and then we're gonna bring you

1029  
00:45:22,140 --> 00:45:20,080  
all back in a minute because it's time

1030  
00:45:27,630 --> 00:45:22,150  
to vote all right thank thanks for

1031  
00:45:30,120 --> 00:45:27,640  
coming on they're the coolest

1032  
00:45:33,390 --> 00:45:30,130  
all these jobs that I didn't even know

1033  
00:45:35,130 --> 00:45:33,400  
knew I didn't know before exist Nessa I

1034  
00:45:37,020 --> 00:45:35,140  
really expected what they do for mission

1035  
00:45:39,540 --> 00:45:37,030  
three it's pretty cool you know a little

1036  
00:45:41,490 --> 00:45:39,550  
painting a model you know who don't know

1037  
00:45:44,040 --> 00:45:41,500  
how you can make help to reengineer if

1038  
00:45:46,800 --> 00:45:44,050

needed yep yep a big the biggest rocket

1039

00:45:49,530 --> 00:45:46,810

will have exactly that's what their work

1040

00:45:53,100 --> 00:45:49,540

yeah he's into yeah that's awesome but

1041

00:45:55,020 --> 00:45:53,110

now you guys it is time to vote yes so

1042

00:45:56,940 --> 00:45:55,030

we're voting here for our favorite

1043

00:45:59,160 --> 00:45:56,950

costume in the everyday NASA looks

1044

00:46:00,870 --> 00:45:59,170

category so we're going to bring back

1045

00:46:18,900 --> 00:46:00,880

all of our guests and then you can vote

1046

00:46:29,640 --> 00:46:25,650

mechanical engineer Chuck hey that's

1047

00:46:40,410 --> 00:46:29,650

right next we have that's the intern

1048

00:46:44,060 --> 00:46:40,420

Lindley and lastly here's another look

1049

00:46:51,600 --> 00:46:44,070

at aerospace engineers Nettie and Jenny

1050

00:46:54,150 --> 00:46:51,610

Hey look at that look very nice

1051

00:46:56,670 --> 00:46:54,160

alright yeah look yeah it's your boats

1052

00:46:59,250 --> 00:46:56,680

in it your last looks in their boats are

1053

00:47:01,110 --> 00:46:59,260

coming in they're coming I don't want to

1054

00:47:06,540 --> 00:47:01,120

rush it I don't want to call this too

1055

00:47:07,770 --> 00:47:06,550

soon it's like yoga rose it's your show

1056

00:47:12,980 --> 00:47:07,780

this is your last chance

1057

00:47:17,610 --> 00:47:12,990

Oh what do we get if we win

1058

00:47:21,840 --> 00:47:17,620

Mary Beth asked our undying respect and

1059

00:47:28,350 --> 00:47:21,850

fan and love yes okay ready guys

1060

00:47:34,390 --> 00:47:32,410

our aerospace engineers bray painting

1061

00:47:38,680 --> 00:47:34,400

rocket models with pressure-sensitive

1062

00:47:43,420 --> 00:47:38,690

face yes very Windtunnel right all right

1063

00:47:45,250 --> 00:47:43,430

but you're all fabulous of course yes

1064

00:47:47,650 --> 00:47:45,260

thanks for joining us today we love

1065

00:47:53,860 --> 00:47:47,660

hearing about your work thanks and happy

1066

00:47:56,890 --> 00:47:53,870

Halloween yeah fabulous a quick reminder

1067

00:47:59,470 --> 00:47:56,900

you guys that if you do end up using any

1068

00:48:01,540 --> 00:47:59,480

of these looks for Halloween if you want

1069

00:48:03,400 --> 00:48:01,550

to see them so you can share your NASA

1070

00:48:06,340 --> 00:48:03,410

inspired costumes with us on social

1071

00:48:09,370 --> 00:48:06,350

media using the hashtag NASA costumes

1072

00:48:11,440 --> 00:48:09,380

yes exactly I'm gonna use that now that

1073

00:48:12,910 --> 00:48:11,450

I have all these costume ideas if I

1074

00:48:17,320 --> 00:48:12,920

didn't have a costume as of this morning

1075

00:48:19,600 --> 00:48:17,330

but either so that was fabulous I'm

1076  
00:48:22,180 --> 00:48:19,610  
getting excited about the everyday looks

1077  
00:48:25,000 --> 00:48:22,190  
but now we're going on to our second

1078  
00:48:27,970 --> 00:48:25,010  
category which is NASA inspired cosplay

1079  
00:48:30,490 --> 00:48:27,980  
costumes my favorite do you love yes I

1080  
00:48:32,140 --> 00:48:30,500  
love how creative it yeah things you

1081  
00:48:35,260 --> 00:48:32,150  
would never imagine come out of these

1082  
00:48:38,650 --> 00:48:35,270  
NASA themed costumes yeah all right so

1083  
00:48:40,870 --> 00:48:38,660  
cosplay costumes with a NASA twist let's

1084  
00:48:44,050 --> 00:48:40,880  
bring out our first yes do you want to

1085  
00:48:46,150 --> 00:48:44,060  
introduce yes so if you've watched past

1086  
00:48:49,810 --> 00:48:46,160  
episodes of the show you may recognize

1087  
00:48:52,420 --> 00:48:49,820  
this v Lord from a galaxy not so far far

1088  
00:48:54,040 --> 00:48:52,430

away and I hear that if you truly are

1089

00:48:55,870 --> 00:48:54,050

one with the force

1090

00:48:58,300 --> 00:48:55,880

she may even let you peer through a

1091

00:49:02,580 --> 00:48:58,310

telescope come on out darth Kimberly

1092

00:49:05,290 --> 00:49:02,590

cosplay as astrophysicist an

1093

00:49:19,990 --> 00:49:05,300

astrophysicist

1094

00:49:21,250 --> 00:49:20,000

oh no Kimberly oh my god it was better

1095

00:49:26,700 --> 00:49:21,260

than I ever imagined

1096

00:49:37,470 --> 00:49:26,710

very nice she's constellations oh

1097

00:49:46,960 --> 00:49:41,050

once you decloak there I think people

1098

00:49:48,550 --> 00:49:46,970

might recognize you before but why don't

1099

00:49:52,720 --> 00:49:48,560

you reintroduce yourself

1100

00:49:56,040 --> 00:49:52,730

thank you you are what you do here dames

1101  
00:50:00,490 --> 00:49:56,050  
I'm Kimberly Anika Smith I am a research

1102  
00:50:05,800 --> 00:50:00,500  
astrophysicist in my cosplay as a

1103  
00:50:07,630 --> 00:50:05,810  
research astrophysicist NASA Ames

1104  
00:50:10,750 --> 00:50:07,640  
Research Center in Silicon Valley

1105  
00:50:17,290 --> 00:50:10,760  
California yeah tell us a bit about what

1106  
00:50:21,850 --> 00:50:17,300  
you're wearing today as a my costume I

1107  
00:50:25,270 --> 00:50:21,860  
have a robe of a Sith Lord a Star Wars

1108  
00:50:27,520 --> 00:50:25,280  
universe with my Mahajan all yeah but

1109  
00:50:30,880 --> 00:50:27,530  
I'm also wearing a dress of the

1110  
00:50:33,990 --> 00:50:30,890  
constellations yes and my props being my

1111  
00:50:36,070 --> 00:50:34,000  
Jedi Knight lightsaber from where I

1112  
00:50:38,200 --> 00:50:36,080  
harness the dark energies and a

1113  
00:50:41,650 --> 00:50:38,210

telescope where I can peer into the

1114

00:50:43,180 --> 00:50:41,660

universe excellent and I know that you

1115

00:50:45,880 --> 00:50:43,190

put some thought into this costume and

1116

00:50:47,920 --> 00:50:45,890

this does relate to your work can you

1117

00:50:49,860 --> 00:50:47,930

tell us those connections the kind of

1118

00:50:54,070 --> 00:50:49,870

research you do an astrophysicist

1119

00:50:56,410 --> 00:50:54,080

studies the universe and my training has

1120

00:51:00,340 --> 00:50:56,420

been in a type of light called the

1121

00:51:02,650 --> 00:51:00,350

infrared mom and basically I'm

1122

00:51:04,720 --> 00:51:02,660

interested in the dark universe that's

1123

00:51:08,410 --> 00:51:04,730

weird parts of the universe you cannot

1124

00:51:11,080 --> 00:51:08,420

see with visible light and so I've built

1125

00:51:13,510 --> 00:51:11,090

instruments that have flown on space

1126  
00:51:17,020 --> 00:51:13,520  
observatories and airborne observatories

1127  
00:51:18,300 --> 00:51:17,030  
that exploit this light and peer into

1128  
00:51:23,310 --> 00:51:18,310  
the dark universe

1129  
00:51:26,310 --> 00:51:23,320  
astrophysicist is all about trying to

1130  
00:51:29,850 --> 00:51:26,320  
understand how the universe works how

1131  
00:51:32,940 --> 00:51:29,860  
does the physics behind it the chemistry

1132  
00:51:36,270 --> 00:51:32,950  
the mechanisms to explain how we are

1133  
00:51:41,430 --> 00:51:36,280  
here today is a big humbling task but

1134  
00:51:43,050 --> 00:51:41,440  
worthy of us if well yes sure also well

1135  
00:51:45,060 --> 00:51:43,060  
I love it yeah can you tell us a bit

1136  
00:51:47,850 --> 00:51:45,070  
about how you explore the universe the

1137  
00:51:50,910 --> 00:51:47,860  
instruments that you use or create um

1138  
00:51:53,100 --> 00:51:50,920

yeah so um we see the universe with our

1139

00:51:56,550 --> 00:51:53,110

eyes if you go out at night you see

1140

00:51:58,140 --> 00:51:56,560

invisible wavelengths you see stars if

1141

00:52:00,450 --> 00:51:58,150

you have access to telescopes you can

1142

00:52:03,420 --> 00:52:00,460

see a lot more detail you can see deeper

1143

00:52:05,670 --> 00:52:03,430

you can see further in the infrared of

1144

00:52:08,430 --> 00:52:05,680

built instruments that have peered into

1145

00:52:10,050 --> 00:52:08,440

the cocoons of stars being formed she

1146

00:52:12,780 --> 00:52:10,060

couldn't see with your eyes and have

1147

00:52:15,150 --> 00:52:12,790

peered into the hearts of galaxies to

1148

00:52:17,430 --> 00:52:15,160

look at black holes that are fuelling

1149

00:52:19,190 --> 00:52:17,440

the galaxies and that was enabled by

1150

00:52:22,920 --> 00:52:19,200

looking at the universe in the infrared

1151  
00:52:25,290 --> 00:52:22,930  
oh becomes possible when you're not

1152  
00:52:27,890 --> 00:52:25,300  
looking in only the light we can see yes

1153  
00:52:29,850 --> 00:52:27,900  
yes I mean the most of the universe's is

1154  
00:52:32,370 --> 00:52:29,860  
revealing itself at other wavelengths

1155  
00:52:34,890 --> 00:52:32,380  
and today we live in exciting realm with

1156  
00:52:36,450 --> 00:52:34,900  
gravitational wave astronomy which is

1157  
00:52:38,100 --> 00:52:36,460  
opening up a new dimension to how we

1158  
00:52:41,550 --> 00:52:38,110  
understand the universe oh my gosh it's

1159  
00:52:43,620 --> 00:52:41,560  
exciting times to be an Astrophysical we

1160  
00:52:46,290 --> 00:52:43,630  
have some excitement in the chat a bunch

1161  
00:52:50,190 --> 00:52:46,300  
of comments for you Karen says I love

1162  
00:52:51,330 --> 00:52:50,200  
her ship x arts this is so nerdy and I

1163  
00:52:54,240 --> 00:52:51,340

love it mm-hmm

1164

00:52:56,940 --> 00:52:54,250

I know mck that dress is awesome Alex

1165

00:53:00,450 --> 00:52:56,950

the eunuch at nerd I mean that in the

1166

00:53:05,010 --> 00:53:00,460

most affectionate way a dress is also

1167

00:53:06,180 --> 00:53:05,020

glows in the dark which is turn the

1168

00:53:10,010 --> 00:53:06,190

lights off and then you have the

1169

00:53:13,620 --> 00:53:10,020

consolation oh my gosh just got better

1170

00:53:15,870 --> 00:53:13,630

Amy says first of all awesome and

1171

00:53:17,780 --> 00:53:15,880

Kimberly what first you got what first

1172

00:53:21,690 --> 00:53:17,790

got you interested in your line of work

1173

00:53:23,250 --> 00:53:21,700

um well I was a nerd I'm a nerd today

1174

00:53:26,430 --> 00:53:23,260

and what am I happy nerd yeah and

1175

00:53:28,530 --> 00:53:26,440

there's a nerd was a child and I I got

1176

00:53:31,350 --> 00:53:28,540

my first telescope when I was about

1177

00:53:35,250 --> 00:53:31,360

seven or eight years old I saved up my

1178

00:53:37,710 --> 00:53:35,260

allowance money and I was recently

1179

00:53:39,690 --> 00:53:37,720

reminded of finding some journals I kept

1180

00:53:41,970 --> 00:53:39,700

as a young young child where I would

1181

00:53:43,740 --> 00:53:41,980

take my telescope out and I would plot

1182

00:53:46,470 --> 00:53:43,750

the stars and I would plot the moons of

1183

00:53:50,010 --> 00:53:46,480

Jupiter and I was very conscious of how

1184

00:53:52,020 --> 00:53:50,020

beautiful the night sky is and we live

1185

00:53:54,570 --> 00:53:52,030

in cities and night skies are not as

1186

00:53:56,520 --> 00:53:54,580

dark as more but Econ camping or you get

1187

00:53:59,040 --> 00:53:56,530

away from the city lights and it is

1188

00:54:02,430 --> 00:53:59,050

you're just transformative I think to

1189

00:54:04,740 --> 00:54:02,440

realize we're on this little planet in

1190

00:54:07,800 --> 00:54:04,750

such a beautiful universe and all those

1191

00:54:10,020 --> 00:54:07,810

stars mm-hmm all Harbor planets as well

1192

00:54:11,400 --> 00:54:10,030

which has been so transformative in the

1193

00:54:15,390 --> 00:54:11,410

last decade to learn that there's more

1194

00:54:17,910 --> 00:54:15,400

planets and stars out there do you want

1195

00:54:19,680 --> 00:54:17,920

to tell us some more about observatories

1196

00:54:23,120 --> 00:54:19,690

and telescopes where you've worked on

1197

00:54:25,320 --> 00:54:23,130

instruments or so I got my teeth on

1198

00:54:27,030 --> 00:54:25,330

building an instrument for the spitzer

1199

00:54:28,500 --> 00:54:27,040

space telescope that was launched about

1200

00:54:30,600 --> 00:54:28,510

a decade ago it's just nearing the end

1201

00:54:31,860 --> 00:54:30,610

of its mission and that revealed the

1202

00:54:34,560 --> 00:54:31,870

infrared universe that we had not

1203

00:54:36,690 --> 00:54:34,570

explored these very longer wavelengths

1204

00:54:38,310 --> 00:54:36,700

and we had learned a lot about new types

1205

00:54:40,740 --> 00:54:38,320

of phenomena and then I built an

1206

00:54:42,930 --> 00:54:40,750

instrument for a flying Observatory

1207

00:54:45,900 --> 00:54:42,940

which also does infrared Observatory so

1208

00:54:48,390 --> 00:54:45,910

Sofia is the world's largest flying

1209

00:54:51,570 --> 00:54:48,400

I'm afraid Observatory today that's got

1210

00:54:53,100 --> 00:54:51,580

a plane when the telescope 747 with a

1211

00:54:55,140 --> 00:54:53,110

double-sized telescope and it also

1212

00:54:56,910 --> 00:54:55,150

reveal iam and I built a spectrometer

1213

00:54:58,590 --> 00:54:56,920

for that one and that was all about

1214

00:55:00,150 --> 00:54:58,600

understanding the chemical fingerprints

1215

00:55:04,560 --> 00:55:00,160

as you know trying to understand the

1216

00:55:07,340 --> 00:55:04,570

makeup of the universe and the community

1217

00:55:11,070 --> 00:55:07,350

is very excited about the most ambitious

1218

00:55:13,070 --> 00:55:11,080

infrared Space Telescope to be launched

1219

00:55:17,580 --> 00:55:13,080

in about a year and a half from now

1220

00:55:20,010 --> 00:55:17,590

James Webb Space Telescope and the James

1221

00:55:21,600 --> 00:55:20,020

Webb is a successor to Hubble I didn't

1222

00:55:23,910 --> 00:55:21,610

mention Hubble Hubble is an amazing

1223

00:55:25,920 --> 00:55:23,920

observatory right now and just transform

1224

00:55:27,360 --> 00:55:25,930

the way we understand the universe that

1225

00:55:28,830 --> 00:55:27,370

has worked in the ultraviolet and

1226

00:55:30,630 --> 00:55:28,840

visible with a little bit of infrared

1227

00:55:33,060 --> 00:55:30,640

but it has been most sensitive and the

1228

00:55:34,290 --> 00:55:33,070

show demonstrated the power of putting a

1229

00:55:37,820 --> 00:55:34,300

telescope in space

1230

00:55:41,630 --> 00:55:37,830

oh yes James Webb is very different and

1231

00:55:44,130 --> 00:55:41,640

James Webb is gonna be the biggest yeah

1232

00:55:47,670 --> 00:55:44,140

Observatory we have put in space

1233

00:55:50,520 --> 00:55:47,680

Wow a collecting area almost seven times

1234

00:55:53,250 --> 00:55:50,530

larger than Hubble with a sensitivity a

1235

00:55:55,050 --> 00:55:53,260

hundred times more sensitive than Hubble

1236

00:55:57,750 --> 00:55:55,060

it's crazy the Hubble is already

1237

00:55:58,950 --> 00:55:57,760

incredible with the images it gives us

1238

00:56:01,770 --> 00:55:58,960

but Wow

1239

00:56:06,750 --> 00:56:01,780

gonna be what gets me excited about

1240

00:56:09,210 --> 00:56:06,760

James Webb it's the first time we've had

1241

00:56:11,700 --> 00:56:09,220

a telescope to look at the birth of

1242

00:56:15,720 --> 00:56:11,710

galaxies we have never had an

1243

00:56:17,430 --> 00:56:15,730

observatory that can look that deep into

1244

00:56:20,340 --> 00:56:17,440

the universe because of its sensitivity

1245

00:56:23,670 --> 00:56:20,350

and also exploiting the infrared to peer

1246

00:56:25,950 --> 00:56:23,680

deeper into the universe mm-hmm that

1247

00:56:29,760 --> 00:56:25,960

will potentially catch the birth of

1248

00:56:35,490 --> 00:56:29,770

galaxies you know we will see baby

1249

00:56:35,500 --> 00:56:49,890

you

1250

00:56:56,310 --> 00:56:53,670

work themselves out hmm the baby or the

1251  
00:56:59,640 --> 00:56:56,320  
birth of galaxies is very unknown one of

1252  
00:57:01,980 --> 00:56:59,650  
the biggest unknown questions is you

1253  
00:57:06,120 --> 00:57:01,990  
know how did the galaxies form hmm and

1254  
00:57:09,420 --> 00:57:06,130  
one in particular we now have observed

1255  
00:57:12,450 --> 00:57:09,430  
over the last couple of decades that all

1256  
00:57:15,510 --> 00:57:12,460  
the large massive galaxies are fueled by

1257  
00:57:18,330 --> 00:57:15,520  
a supermassive black hole these are

1258  
00:57:20,160 --> 00:57:18,340  
black holes that are thousands to

1259  
00:57:23,910 --> 00:57:20,170  
millions to billions of solar masses

1260  
00:57:26,790 --> 00:57:23,920  
these are incredible beasts we have no

1261  
00:57:28,860 --> 00:57:26,800  
idea how they form nor do we know

1262  
00:57:32,610 --> 00:57:28,870  
whether you need a supermassive black

1263  
00:57:35,520 --> 00:57:32,620

hole to form a galaxy or whether the

1264

00:57:37,890 --> 00:57:35,530

galaxy has it got massive formed the

1265

00:57:40,200 --> 00:57:37,900

supermassive black hole wow we have a

1266

00:57:45,990 --> 00:57:40,210

chicken and egg dilemma

1267

00:57:50,400 --> 00:57:46,000

so this web is gonna tell us did black

1268

00:57:52,170 --> 00:57:50,410

holes come first right or did gap wow I

1269

00:57:53,430 --> 00:57:52,180

didn't even realize that we didn't know

1270

00:57:55,770 --> 00:57:53,440

these things we do know these things

1271

00:57:58,290 --> 00:57:55,780

exchanged so much I want to learn right

1272

00:58:02,550 --> 00:57:58,300

yeah I think we have an animation I do

1273

00:58:05,070 --> 00:58:02,560

of James Webb yes so let's go don't know

1274

00:58:07,230 --> 00:58:05,080

about this is a most gonna be the

1275

00:58:10,290 --> 00:58:07,240

largest Space Telescope ever launched

1276

00:58:14,220 --> 00:58:10,300

and we launched in March of 2021 you see

1277

00:58:17,160 --> 00:58:14,230

a 18 segmented primary mirror that's

1278

00:58:20,030 --> 00:58:17,170

coated in gold the diameter is 6.5

1279

00:58:22,620 --> 00:58:20,040

meters about the height of a giraffe the

1280

00:58:25,200 --> 00:58:22,630

the bottom part that looks silver Lea

1281

00:58:28,080 --> 00:58:25,210

purple is a sunshade the sun shades

1282

00:58:30,300 --> 00:58:28,090

about the size of the tennis court this

1283

00:58:33,150 --> 00:58:30,310

is going to be launched to an orbit

1284

00:58:36,510 --> 00:58:33,160

around the Sun a million miles from

1285

00:58:38,280 --> 00:58:36,520

Earth I mean Hubble right now is at 375

1286

00:58:40,170 --> 00:58:38,290

miles from Earth so this is a very

1287

00:58:42,720 --> 00:58:40,180

different way of running a Space

1288

00:58:45,360 --> 00:58:42,730

Telescope with its large aperture and

1289

00:58:45,930 --> 00:58:45,370

its ability to look in the infrared it's

1290

00:58:48,690 --> 00:58:45,940

cooled

1291

00:58:52,380 --> 00:58:48,700

um this gives it a lot more sensitivity

1292

00:58:59,070 --> 00:58:52,390

and yes it's going to really reveal the

1293

00:59:01,630 --> 00:58:59,080

dark universe not to play up the Star

1294

00:59:06,009 --> 00:59:01,640

Wars thing it is going to bring

1295

00:59:09,069 --> 00:59:06,019

galaxies far far away very much closer

1296

00:59:11,380 --> 00:59:09,079

to home it's really an observatory about

1297

00:59:14,500 --> 00:59:11,390

the first stars in the first galaxies

1298

00:59:16,240 --> 00:59:14,510

Wow amazing yeah what a good story I

1299

00:59:21,670 --> 00:59:16,250

mean I can't right now I always loved

1300

00:59:23,529 --> 00:59:21,680

him Kimberly I know but before we let

1301  
00:59:24,009 --> 00:59:23,539  
you go let's get a couple questions in

1302  
00:59:25,960 --> 00:59:24,019  
here

1303  
00:59:27,609 --> 00:59:25,970  
Valis Sparkle asks what's the coolest

1304  
00:59:31,720 --> 00:59:27,619  
thing that you ever saw looking into

1305  
00:59:35,829 --> 00:59:31,730  
space Wow can it name just one it's

1306  
00:59:37,750 --> 00:59:35,839  
difficult I was very privileged to work

1307  
00:59:41,049 --> 00:59:37,760  
on the New Horizons mission that flew by

1308  
00:59:44,799 --> 00:59:41,059  
Pluto in 2015 I was one of the deputy

1309  
00:59:47,410 --> 00:59:44,809  
project scientist and to actually see a

1310  
00:59:49,029 --> 00:59:47,420  
world that had been just ten pixels in

1311  
00:59:51,730 --> 00:59:49,039  
the Hubble Space Telescope camera very

1312  
00:59:55,359 --> 00:59:51,740  
blurry and have it come in to life and

1313  
00:59:58,599 --> 00:59:55,369

to full color showing glaciers was the

1314

01:00:00,160 --> 00:59:58,609

most unexpected phenomena that no one

1315

01:00:01,930 --> 01:00:00,170

had expected now I know it's closer to

1316

01:00:04,509 --> 01:00:01,940

home rather than the black holes and the

1317

01:00:07,900 --> 01:00:04,519

exotic Dark Matter dark energy that is

1318

01:00:10,749 --> 01:00:07,910

shaping our larger universe it's like

1319

01:00:15,249 --> 01:00:10,759

the fact that we have a lot yet to still

1320

01:00:17,680 --> 01:00:15,259

discover in our home backyard yeah so

1321

01:00:19,359 --> 01:00:17,690

that was just phenomena I we no one

1322

01:00:22,450 --> 01:00:19,369

expected that's amazing your science has

1323

01:00:23,829 --> 01:00:22,460

taken you near and far yeah well studied

1324

01:00:25,269 --> 01:00:23,839

the universe you want to understand and

1325

01:00:28,120 --> 01:00:25,279

plus when we understand that there are

1326

01:00:30,849 --> 01:00:28,130

more planets than stars stars hosting

1327

01:00:32,920 --> 01:00:30,859

lots of these exoplanets and trying to

1328

01:00:34,509 --> 01:00:32,930

understand our solar system in context I

1329

01:00:36,130 --> 01:00:34,519

mean we have a laboratory here trying

1330

01:00:38,559 --> 01:00:36,140

this in our own solar system but then we

1331

01:00:40,480 --> 01:00:38,569

have thousands and now millions of solar

1332

01:00:43,210 --> 01:00:40,490

systems yet to be explored that's right

1333

01:00:46,420 --> 01:00:43,220

there's so much more to do it's seven

1334

01:00:48,549 --> 01:00:46,430

all right well I guess our last question

1335

01:00:51,490 --> 01:00:48,559

for you is how could we recreate your

1336

01:00:56,470 --> 01:00:51,500

look for Halloween well go to a fabric

1337

01:00:58,960 --> 01:00:56,480

store and make a black cloak for my

1338

01:01:01,089 --> 01:00:58,970

dress I just looked for a constellation

1339

01:01:03,940 --> 01:01:01,099

dress online it's been great at parties

1340

01:01:05,920 --> 01:01:03,950

conversation starter for the lightsaber

1341

01:01:07,920 --> 01:01:05,930

I borrowed one off of friends teenage

1342

01:01:09,900 --> 01:01:07,930

child

1343

01:01:13,289 --> 01:01:09,910

it's not if you want to make one at home

1344

01:01:16,019 --> 01:01:13,299

you just take a clear plastic tube and

1345

01:01:19,549 --> 01:01:16,029

attach it to a flashlight with some duct

1346

01:01:22,230 --> 01:01:19,559

tape and I've learned that if I if I

1347

01:01:24,630 --> 01:01:22,240

sanded the outer side of just to make a

1348

01:01:26,010 --> 01:01:24,640

coral pink I created some diffusion

1349

01:01:27,059 --> 01:01:26,020

effects and I was able to scattering

1350

01:01:30,180 --> 01:01:27,069

light effect and I got to see my

1351

01:01:33,720 --> 01:01:30,190

lightsaber Vista - even a duct tape I

1352

01:01:35,940 --> 01:01:33,730

myself project for Halloween right right

1353

01:01:37,740 --> 01:01:35,950

yeah totally doable I think all right

1354

01:01:39,750 --> 01:01:37,750

well thanks for the tips and also the

1355

01:01:42,150 --> 01:01:39,760

wonderful stories about your science

1356

01:01:47,609 --> 01:01:42,160

love it and exploring the universe yes

1357

01:01:49,910 --> 01:01:47,619

and may the force be with you for just

1358

01:01:52,529 --> 01:01:49,920

we learned about the dark universe

1359

01:01:54,390 --> 01:01:52,539

fabulous thank you and we will bring you

1360

01:01:56,250 --> 01:01:54,400

back out later when it's time to vote on

1361

01:01:58,519 --> 01:01:56,260

my favorite costumes yeah thank you

1362

01:02:00,630 --> 01:01:58,529

thanks good really

1363

01:02:02,130 --> 01:02:00,640

you could just listen to kimberly all

1364

01:02:06,150 --> 01:02:02,140

day couldn't I mean really really good

1365

01:02:07,049 --> 01:02:06,160

yes yes and just be mesmerized yes you

1366

01:02:24,010 --> 01:02:07,059

know you almost feel like you're

1367

01:02:28,210 --> 01:02:26,410

hun this pair boldly goes through their

1368

01:02:31,060 --> 01:02:28,220

workday advancing the science of flight

1369

01:02:34,390 --> 01:02:31,070

at our flight simulator facilities come

1370

01:02:48,960 --> 01:02:34,400

on out Sumida and Emily cosplaying as

1371

01:02:51,970 --> 01:02:48,970

NASA Starfleet Command hello very nice I

1372

01:02:56,610 --> 01:02:51,980

love that you have these costume me feel

1373

01:02:58,740 --> 01:02:56,620

of course own Star Trek starveling

1374

01:03:01,840 --> 01:02:58,750

perfect

1375

01:03:04,870 --> 01:03:01,850

tell us your name and what you do

1376

01:03:07,120 --> 01:03:04,880

hi I'm sue maida and I work at the

1377

01:03:09,970 --> 01:03:07,130

flight simulation labs as outreach and

1378

01:03:11,790 --> 01:03:09,980

communications and my name is Emily

1379

01:03:15,130 --> 01:03:11,800

Lewis I'm a simulation engineer

1380

01:03:17,380 --> 01:03:15,140

contractor at the sim labs at Heron s

1381

01:03:21,280 --> 01:03:17,390

Ames all right you're gonna tell us more

1382

01:03:24,640 --> 01:03:21,290

about I know what you're wearing Star

1383

01:03:26,110 --> 01:03:24,650

Trek uniforms uh but tell us why because

1384

01:03:29,050 --> 01:03:26,120

I know there's a connection in your work

1385

01:03:32,650 --> 01:03:29,060

here yes so as a kid I watched Star Trek

1386

01:03:34,540 --> 01:03:32,660

growing up with my dad the reruns and I

1387

01:03:38,170 --> 01:03:34,550

was really inspired by lieutenant Uhura

1388

01:03:41,650 --> 01:03:38,180

oh yeah communications officer and so my

1389

01:03:44,620 --> 01:03:41,660

costume is similar to that and you know

1390

01:03:48,250 --> 01:03:44,630

of course Star Trek with its mission to

1391

01:03:50,410 --> 01:03:48,260

do discovery and explore is you know

1392

01:03:52,840 --> 01:03:50,420

very similar to kind of what our mission

1393

01:03:54,610 --> 01:03:52,850

is at the simulation facilities to

1394

01:03:57,940 --> 01:03:54,620

advance science for that for that reason

1395

01:03:59,800 --> 01:03:57,950

yeah it makes perfect sense and I'm

1396

01:04:01,540 --> 01:03:59,810

wearing a next-generation Star Trek

1397

01:04:04,060 --> 01:04:01,550

costume and I fell in love with Star

1398

01:04:05,650 --> 01:04:04,070

Trek when next-generation was on when I

1399

01:04:07,930 --> 01:04:05,660

was in college so I watched in college

1400

01:04:10,120 --> 01:04:07,940

and I found the vision of Star Trek and

1401

01:04:12,400 --> 01:04:10,130

its positive approach to space

1402

01:04:14,350 --> 01:04:12,410

exploration and technology really

1403

01:04:15,610 --> 01:04:14,360

inspiring and that's one of the main

1404

01:04:17,680 --> 01:04:15,620

reasons that I decided to study

1405

01:04:19,420 --> 01:04:17,690

aerospace engineering and why also I'm

1406

01:04:21,940 --> 01:04:19,430

really happy to be working on NASA here

1407

01:04:23,950 --> 01:04:21,950

and one other connection that we have

1408

01:04:27,040 --> 01:04:23,960

between Star Trek and where we work at

1409

01:04:28,330 --> 01:04:27,050

the simulation laboratory is that Star

1410

01:04:30,190 --> 01:04:28,340

Trek has the holodeck if you're familiar

1411

01:04:33,670 --> 01:04:30,200

with it the holodeck is kind of a really

1412

01:04:34,930 --> 01:04:33,680

cool high-tech virtual reality

1413

01:04:36,819 --> 01:04:34,940

simulation

1414

01:04:38,170 --> 01:04:36,829

yeah and you know we don't have a

1415

01:04:40,750 --> 01:04:38,180

holodeck but we are thinking about

1416

01:04:43,150 --> 01:04:40,760

including a via they are sometime in the

1417

01:04:45,730 --> 01:04:43,160

future but we are advancing aerospace

1418

01:04:47,740 --> 01:04:45,740

technologies and we are supporting the

1419

01:04:50,680 --> 01:04:47,750

development of the next generation

1420

01:04:53,440 --> 01:04:50,690

aircraft the spacecraft yeah yeah so

1421

01:04:55,690 --> 01:04:53,450

tell us what the simulation labs means

1422

01:04:57,099 --> 01:04:55,700

you guys have a flight simulator right

1423

01:04:58,960 --> 01:04:57,109

once you tell everybody about that one

1424

01:05:02,230 --> 01:04:58,970

so the flight simulator can really

1425

01:05:05,559 --> 01:05:02,240

become any aircraft or spacecraft and to

1426

01:05:08,290 --> 01:05:05,569

test out new designs do research for you

1427

01:05:09,579 --> 01:05:08,300

know any kind of new aircraft and maybe

1428

01:05:10,990 --> 01:05:09,589

Emily can tell us a little bit more

1429

01:05:13,660 --> 01:05:11,000

about the vertical motion simulator

1430

01:05:15,099 --> 01:05:13,670

because that's where she's at yes the

1431

01:05:16,780 --> 01:05:15,109

simulation laboratories has to several

1432

01:05:19,089 --> 01:05:16,790

facilities and the vertical motion

1433

01:05:21,970 --> 01:05:19,099

simulator is where I work most the time

1434

01:05:24,160 --> 01:05:21,980

and we call that the VMS and the

1435

01:05:28,030 --> 01:05:24,170

vertical motion simulator the BMS is the

1436

01:05:30,579 --> 01:05:28,040

largest so it's a full motion real-time

1437

01:05:32,470 --> 01:05:30,589

piloted simulation facility it has the

1438

01:05:34,000 --> 01:05:32,480

largest vertical motion space of any

1439

01:05:35,380 --> 01:05:34,010

ground-based simulator in the world

1440

01:05:38,620 --> 01:05:35,390

amazing yes

1441

01:05:40,599 --> 01:05:38,630

and so if designed to be reconfigurable

1442

01:05:44,260 --> 01:05:40,609

and customizable and so we can basically

1443

01:05:46,690 --> 01:05:44,270

simulate any you know vehicle real or

1444

01:05:48,940 --> 01:05:46,700

not real notional that you'd need to set

1445

01:05:51,849 --> 01:05:48,950

it really so yes yeah so sometimes it

1446

01:05:56,280 --> 01:05:51,859

can be a boat or it could be a plane or

1447

01:06:02,310 --> 01:05:58,750

beechnraft it can be spacecraft we've

1448

01:06:06,430 --> 01:06:02,320

done we've done helicopters and no jets

1449

01:06:09,100 --> 01:06:06,440

transports we did a bobsled Wow I've

1450

01:06:12,250 --> 01:06:09,110

been on that whoo yeah they actually

1451

01:06:15,140 --> 01:06:12,260

dropped some fruit flies once to see

1452

01:06:15,150 --> 01:06:29,660

you

1453

01:06:34,160 --> 01:06:32,480

and as I said it's the largest vertical

1454

01:06:39,589 --> 01:06:34,170

motion simulator of any in the world it

1455

01:06:44,770 --> 01:06:39,599

can move plus 60 feet vertically and 40

1456

01:06:47,870 --> 01:06:44,780

feet in the long longitudinal axis and

1457

01:06:50,089 --> 01:06:47,880

it we it offers six we call it six

1458

01:06:52,339 --> 01:06:50,099

degrees of Six and couple degrees of

1459

01:06:54,410 --> 01:06:52,349

freedom and I'll explain what that means

1460

01:06:59,240 --> 01:06:54,420

in a minute when the video is done yeah

1461

01:07:02,240 --> 01:06:59,250

okay okay so we have this model of one

1462

01:07:04,910 --> 01:07:02,250

of our our VMs cabs and just to give you

1463

01:07:06,920 --> 01:07:04,920

a perspective the the pilots sit inside

1464

01:07:10,549 --> 01:07:06,930

this cab and this might fit maybe three

1465

01:07:12,770 --> 01:07:10,559

or four people and inside the cab would

1466

01:07:15,319 --> 01:07:12,780

be configured to be whatever vehicle he

1467

01:07:17,780 --> 01:07:15,329

went to simulate and the VMS would sit

1468

01:07:20,930 --> 01:07:17,790

in that 10 story tower and it's just

1469

01:07:23,120 --> 01:07:20,940

along a beam that is what goes along the

1470

01:07:26,089 --> 01:07:23,130

the axis of the 40-foot long beam beam

1471

01:07:28,039 --> 01:07:26,099

moves up and down to get the vertical

1472

01:07:29,960 --> 01:07:28,049

motion and then the cab moves along the

1473

01:07:31,640 --> 01:07:29,970

beam for the lateral motion Lucy and

1474

01:07:33,650 --> 01:07:31,650

then it moves perpendicular to the beam

1475

01:07:34,730 --> 01:07:33,660

for the longitudinal motion and that's

1476

01:07:37,240 --> 01:07:34,740

the three translational degrees of

1477

01:07:40,549 --> 01:07:37,250

freedom and then it also sits on a

1478

01:07:43,039 --> 01:07:40,559

hydraulic gimbal system to provide the

1479

01:07:44,870 --> 01:07:43,049

rotations and so this is the front of

1480

01:07:47,510 --> 01:07:44,880

the cab so the rotational axis would be

1481

01:07:50,660 --> 01:07:47,520

we're all and then this would be pitch

1482

01:07:52,160 --> 01:07:50,670

yeah and yeah okay and when we say it's

1483

01:07:54,140 --> 01:07:52,170

six and a couple degrees of freedom what

1484

01:07:56,359 --> 01:07:54,150

you mean is that for instance if it has

1485

01:07:58,460 --> 01:07:56,369

a long a large deflection in one axis it

1486

01:08:00,280 --> 01:07:58,470

doesn't have it doesn't reduce the

1487

01:08:15,520 --> 01:08:00,290

amount of travel that it can

1488

01:08:21,430 --> 01:08:18,249

sure and we've had several astronauts

1489

01:08:23,960 --> 01:08:21,440

trained at the simulator for landing the

1490

01:08:23,970 --> 01:08:38,349

you

1491

01:08:44,910 --> 01:08:40,499

it's important for us to

1492

01:08:46,950 --> 01:08:44,920

live long and prosper and so a building

1493

01:08:49,650 --> 01:08:46,960

a plane and simulation is obviously a

1494

01:08:51,510 --> 01:08:49,660

lot safer and it's more cost effective

1495

01:08:54,390 --> 01:08:51,520

and so they can test out the new ideas

1496

01:08:56,579 --> 01:08:54,400

test out new procedures see how we want

1497

01:08:58,680 --> 01:08:56,589

to do this before actually flying in

1498

01:09:01,050 --> 01:08:58,690

real life yeah awesome and then you've

1499

01:09:03,809 --> 01:09:01,060

had astronauts training and yeah every

1500

01:09:05,789 --> 01:09:03,819

single a shuttle pilot trained at the

1501

01:09:09,450 --> 01:09:05,799

vertical motion simulator for landing

1502

01:09:11,700 --> 01:09:09,460

yes fantastic when it came to me and the

1503

01:09:13,079 --> 01:09:11,710

shuttle pilots who flew at the simulator

1504

01:09:15,090 --> 01:09:13,089

and then actually flew in space and came

1505

01:09:17,280 --> 01:09:15,100

back said that the simulator really

1506

01:09:19,950 --> 01:09:17,290

represented what they felt accurately so

1507

01:09:22,079 --> 01:09:19,960

oh wow that's really impressive yeah for

1508

01:09:24,530 --> 01:09:22,089

a facility on the ground yeah it has to

1509

01:09:26,999 --> 01:09:24,540

make it up right exactly

1510

01:09:31,709 --> 01:09:27,009

well we have some comments and questions

1511

01:09:42,030 --> 01:09:31,719

yeah yes we have Amy here says my

1512

01:09:44,880 --> 01:09:42,040

question is how are you so cool cool I

1513

01:09:47,820 --> 01:09:44,890

mean working here is so awesome and with

1514

01:09:50,160 --> 01:09:47,830

the Artemis mission coming up sending

1515

01:09:51,959 --> 01:09:50,170

the first woman and next man to walk on

1516

01:09:54,810 --> 01:09:51,969

the surface of the Moon that is super

1517

01:09:58,020 --> 01:09:54,820

exciting super cool happening in in 2024

1518

01:10:02,550 --> 01:09:58,030

yes that leave us into a question two

1519

01:10:04,620 --> 01:10:02,560

from from the chat our g rj the new did

1520

01:10:07,080 --> 01:10:04,630

they test any landing simulations for

1521

01:10:08,760 --> 01:10:07,090

any lunar landers yes that's a great

1522

01:10:11,010 --> 01:10:08,770

question glad glad you asked that

1523

01:10:13,979 --> 01:10:11,020

because we've had a several lunar lander

1524

01:10:17,150 --> 01:10:13,989

studies done and what they learned is

1525

01:10:19,770 --> 01:10:17,160

that landing the moon is a very

1526

01:10:22,020 --> 01:10:19,780

difficult from a control point of view

1527

01:10:25,560 --> 01:10:22,030

and so motion based simulation is

1528

01:10:26,760 --> 01:10:25,570

critical for analyzing and testing and

1529

01:10:30,720 --> 01:10:26,770

making sure that the next generation

1530

01:10:32,450 --> 01:10:30,730

lunar lander will be be a really great

1531

01:10:34,560 --> 01:10:32,460

for the artemis astronauts you know

1532

01:10:37,590 --> 01:10:34,570

that's amazing that you can simulate

1533

01:10:40,680 --> 01:10:37,600

that as well you know right yeah we have

1534

01:10:42,510 --> 01:10:40,690

a video of this as well okay Oh fabulous

1535

01:10:45,810 --> 01:10:42,520

you've got one excellent I want to see

1536

01:10:47,910 --> 01:10:45,820

that the lunar lander soon yes this is

1537

01:10:50,030 --> 01:10:47,920

the lunar lander simulation cab the

1538

01:10:52,750 --> 01:10:50,040

interior of it so you can see the

1539

01:10:56,440 --> 01:10:52,760

displays there and there's me

1540

01:10:58,720 --> 01:10:56,450

the moon out there yeah yeah so so we

1541

01:11:00,460 --> 01:10:58,730

have the moon simulated there for the

1542

01:11:02,470 --> 01:11:00,470

landing and you can see the bird's-eye

1543

01:11:04,570 --> 01:11:02,480

view over here and so the researchers

1544

01:11:07,060 --> 01:11:04,580

actually get to have many different

1545

01:11:09,760 --> 01:11:07,070

points of view at this research facility

1546

01:11:11,410 --> 01:11:09,770

so they can really test and see from all

1547

01:11:14,170 --> 01:11:11,420

angles and see how they might want to

1548

01:11:26,530 --> 01:11:14,180

make improvements and make those changes

1549

01:11:29,050 --> 01:11:26,540

in the future so we're gonna have to

1550

01:11:31,390 --> 01:11:29,060

keep moving and have our next contenders

1551

01:11:34,080 --> 01:11:31,400

come on but how can we recreate your

1552

01:11:37,180 --> 01:11:34,090

look do you guys have a price well

1553

01:11:39,400 --> 01:11:37,190

what's really nice about the original

1554

01:11:42,160 --> 01:11:39,410

Star Trek series as the costumes are

1555

01:11:45,400 --> 01:11:42,170

pretty simple you can get a boldly

1556

01:11:48,250 --> 01:11:45,410

colored shirt maybe red or blue add some

1557

01:11:50,170 --> 01:11:48,260

ribbon to the cuffs maybe add a black

1558

01:11:56,470 --> 01:11:50,180

shirt underneath that Peaks out so you

1559

01:11:59,050 --> 01:11:56,480

can simulate having the trim maybe black

1560

01:12:02,200 --> 01:11:59,060

boots black pants of course you want to

1561

01:12:05,590 --> 01:12:02,210

have a Star Trek pin or you can 3d print

1562

01:12:07,120 --> 01:12:05,600

your own communicator you like and then

1563

01:12:10,030 --> 01:12:07,130

you'll have your Starfleet uniform

1564

01:12:13,360 --> 01:12:10,040

excellent nice that's good advice all

1565

01:12:15,850 --> 01:12:13,370

right well thank you thank you been

1566

01:12:18,490 --> 01:12:15,860

fascinating and we will can I say one

1567

01:12:20,440 --> 01:12:18,500

more is Star Trek fan simulation I just

1568

01:12:21,880 --> 01:12:20,450

wanted to say that if you want to boldly

1569

01:12:24,100 --> 01:12:21,890

go where no one has gone before

1570

01:12:25,360 --> 01:12:24,110

yeah but safely then you need to include

1571

01:12:30,070 --> 01:12:25,370

simulation and in your design process

1572

01:12:32,230 --> 01:12:30,080

absolutely thank you this has been

1573

01:12:37,300 --> 01:12:32,240

really cool and we'll see you in a

1574

01:12:41,500 --> 01:12:37,310

little bit thank you Thanks I love the

1575

01:12:44,200 --> 01:12:41,510

variety of costumes and fields of study

1576

01:12:46,600 --> 01:12:44,210

and techniques these guys use also just

1577

01:12:48,400 --> 01:12:46,610

like they can like clear connections to

1578

01:12:50,680 --> 01:12:48,410

a pop culture stuff like you know Star

1579

01:12:52,660 --> 01:12:50,690

Wars Star tag it's just like so easy to

1580

01:12:55,120 --> 01:12:52,670

connect yeah I don't think these are

1581

01:12:58,360 --> 01:12:55,130

that much of a stretch no no no yeah I

1582

01:13:02,620 --> 01:12:58,370

sort of physicist I mean I met one of

1583

01:13:03,260 --> 01:13:02,630

those oh ok so should we go - yeah you

1584

01:13:05,870 --> 01:13:03,270

ready

1585

01:13:08,870 --> 01:13:05,880

next one okay yes so have intro as well

1586

01:13:09,770 --> 01:13:08,880

so she is the daughter of Zeus and twin

1587

01:13:11,900 --> 01:13:09,780

sister of Apollo

1588

01:13:14,300 --> 01:13:11,910

now this Greek goddess shares the name

1589

01:13:16,760 --> 01:13:14,310

of our program that will return humans

1590

01:13:31,310 --> 01:13:16,770

to the moon come on out Daisy cosplaying

1591

01:13:37,160 --> 01:13:31,320

as Artemis let me get a holder for your

1592

01:13:42,440 --> 01:13:37,170

Moon keep that handy okay thank you come

1593

01:13:45,860 --> 01:13:42,450

on right up here yeah you got there

1594

01:13:47,660 --> 01:13:45,870

thank you so much the way here why don't

1595

01:13:49,160 --> 01:13:47,670

you introduce yourself and tell

1596

01:13:50,870 --> 01:13:49,170

everybody what you do here yeah so my

1597

01:13:52,940 --> 01:13:50,880

name is Daisy stock and I'm an intern in

1598

01:13:54,680 --> 01:13:52,950

the exobiology branch and we're

1599

01:13:58,520 --> 01:13:54,690

concerned with origin of life chemistry

1600

01:14:00,800 --> 01:13:58,530

yeah so cool well tell us about your

1601  
01:14:02,930 --> 01:14:00,810  
outfit I'm dressed as you guys gave me

1602  
01:14:04,730 --> 01:14:02,940  
an awesome preamble to as Artemis who is

1603  
01:14:06,620 --> 01:14:04,740  
the goddess of the moon and the twin

1604  
01:14:08,720 --> 01:14:06,630  
sister of Apollo as well as the namesake

1605  
01:14:11,000 --> 01:14:08,730  
for NASA's next program that will take

1606  
01:14:13,400 --> 01:14:11,010  
us to the moon yeah yep yep exactly the

1607  
01:14:15,710 --> 01:14:13,410  
Artemis program the next man and the

1608  
01:14:16,850 --> 01:14:15,720  
first woman by 2020 yeah it's such an

1609  
01:14:18,200 --> 01:14:16,860  
exciting time to be getting involved

1610  
01:14:29,330 --> 01:14:18,210  
here yeah

1611  
01:14:30,740 --> 01:14:29,340  
good time for you to working yeah so

1612  
01:14:32,660 --> 01:14:30,750  
right now I'm studying meteorites we

1613  
01:14:34,670 --> 01:14:32,670

study on extraterrestrial samples that

1614

01:14:36,800 --> 01:14:34,680

have fallen to earth and we look for

1615

01:14:38,720 --> 01:14:36,810

organic known compounds that we can look

1616

01:14:40,970 --> 01:14:38,730

at and kind of get a sense for what was

1617

01:14:42,710 --> 01:14:40,980

going on in the universe about our solar

1618

01:14:43,610 --> 01:14:42,720

system at least about 4.6 billion years

1619

01:14:51,230 --> 01:14:43,620

ago Wow

1620

01:14:53,030 --> 01:14:51,240

yeah is that when the earth some of

1621

01:14:54,800 --> 01:14:53,040

those chunks kind of got like stuck

1622

01:14:56,540 --> 01:14:54,810

floating around in space and are in

1623

01:14:58,760 --> 01:14:56,550

orbit in our solar system and sometimes

1624

01:15:01,790 --> 01:14:58,770

one will land on earth for us to study I

1625

01:15:04,400 --> 01:15:01,800

would stand oh oh we I think we have a

1626

01:15:05,690 --> 01:15:04,410

photo did you bring a photo yeah I

1627

01:15:07,820 --> 01:15:05,700

brought a photo of myself with the

1628

01:15:09,350 --> 01:15:07,830

Murchison meteorite oh yes that's a

1629

01:15:10,820 --> 01:15:09,360

sample that we have we don't get a lot

1630

01:15:12,830 --> 01:15:10,830

of the meteorite at any one time because

1631

01:15:15,410 --> 01:15:12,840

it's very precious and very rare oh yeah

1632

01:15:16,580 --> 01:15:15,420

this particular meteorite came crashing

1633

01:15:21,919 --> 01:15:16,590

through the roof of someone's bar

1634

01:15:23,149 --> 01:15:21,929

in Australia into a while of hay but it

1635

01:15:26,180 --> 01:15:23,159

was good because we were able to get to

1636

01:15:27,919 --> 01:15:26,190

it very quickly and preserve it so it's

1637

01:15:30,859 --> 01:15:27,929

not very contaminated it's really over

1638

01:15:32,660 --> 01:15:30,869

study well and it was that dust from it

1639

01:15:35,419 --> 01:15:32,670

was that it ground up in there yeah yeah

1640

01:15:37,910 --> 01:15:35,429

so it was a bigger meteorite it

1641

01:15:40,189 --> 01:15:37,920

fragmented before it hit earth and that

1642

01:15:43,070 --> 01:15:40,199

is a little fragment of the fragment

1643

01:15:45,020 --> 01:15:43,080

that felt ok so we have just little bits

1644

01:15:47,060 --> 01:15:45,030

of it that we're able to perform tests

1645

01:15:49,370 --> 01:15:47,070

on with our instruments and get a sense

1646

01:15:50,959 --> 01:15:49,380

of what it's made of ok yeah what's the

1647

01:15:53,660 --> 01:15:50,969

big question you're trying to answer

1648

01:15:55,790 --> 01:15:53,670

with your work so we're trying to answer

1649

01:15:58,010 --> 01:15:55,800

the origin of life

1650

01:15:59,419 --> 01:15:58,020

yeah I'll begin yeah when did it all

1651

01:16:01,370 --> 01:15:59,429

begin so we're looking for different

1652

01:16:02,959 --> 01:16:01,380

compounds that could have brought the

1653

01:16:06,020 --> 01:16:02,969

building blocks to earth to start of

1654

01:16:07,970 --> 01:16:06,030

like kick-start life ok right yeah yeah

1655

01:16:10,609 --> 01:16:07,980

you plan to figure that out by the end

1656

01:16:17,810 --> 01:16:10,619

of your internship yeah so I think I can

1657

01:16:26,720 --> 01:16:17,820

get it thank you thank you in the chat

1658

01:16:29,000 --> 01:16:26,730

Lix shocks and says you told us a funny

1659

01:16:33,740 --> 01:16:29,010

story the other day that you had to know

1660

01:16:35,510 --> 01:16:33,750

what meteorite smell like yeah my first

1661

01:16:36,890 --> 01:16:35,520

day and my internship I showed up and I

1662

01:16:39,470 --> 01:16:36,900

was filled with nerves and I was really

1663

01:16:41,510 --> 01:16:39,480

excited and just like just so pumped to

1664

01:16:43,490 --> 01:16:41,520

be here and I meet my mentor for the

1665

01:16:44,689 --> 01:16:43,500

first time and he takes out the sample

1666

01:16:46,070 --> 01:16:44,699

and says you know this is like the most

1667

01:16:48,200 --> 01:16:46,080

precious thing that we have in this lab

1668

01:16:49,790 --> 01:16:48,210

like it's so expensive we have so many

1669

01:16:51,950 --> 01:16:49,800

tests to run on it and so many questions

1670

01:16:53,300 --> 01:16:51,960

about it he takes off the cap and puts

1671

01:16:56,030 --> 01:16:53,310

it under my nose and says what does it

1672

01:16:57,800 --> 01:16:56,040

smell like ha and I was like it's okay

1673

01:17:00,800 --> 01:16:57,810

is this the science fruit ok yeah let's

1674

01:17:01,729 --> 01:17:00,810

do it and it smelled like soil Oh soil

1675

01:17:04,790 --> 01:17:01,739

after it rain

1676

01:17:13,160 --> 01:17:04,800

oh really yeah let's learn that space

1677

01:17:15,410 --> 01:17:13,170

smells like dirt RJ the noob has a

1678

01:17:17,120 --> 01:17:15,420

question for you what elements in the

1679

01:17:19,669 --> 01:17:17,130

meteorites have you found that our

1680

01:17:21,290 --> 01:17:19,679

building blocks for life so previously

1681

01:17:23,209 --> 01:17:21,300

people have been looking at amino acids

1682

01:17:25,070 --> 01:17:23,219

in the meteorites and we're looking at a

1683

01:17:29,660 --> 01:17:25,080

group of compounds called carboxylic

1684

01:17:31,790 --> 01:17:29,670

acids so organic

1685

01:17:34,160 --> 01:17:31,800

three are they related to him you know

1686

01:17:35,689 --> 01:17:34,170

and they are I guess okay okay so some

1687

01:17:41,450 --> 01:17:35,699

kind of like building block of the

1688

01:17:42,260 --> 01:17:41,460

building that's awesome in a related

1689

01:17:44,870 --> 01:17:42,270

question

1690

01:17:46,580 --> 01:17:44,880

yeah goob - what kinds of tests do you

1691

01:17:48,350 --> 01:17:46,590

do on the meteors to see where they come

1692

01:17:50,630 --> 01:17:48,360

from um so right now we're doing ion

1693

01:17:52,790 --> 01:17:50,640

chromatography and gas chromatography

1694

01:17:54,320 --> 01:17:52,800

mass spectrometry so basically we take

1695

01:17:56,209 --> 01:17:54,330

the meteorites and we make them into a

1696

01:17:57,500 --> 01:17:56,219

little solution and get them all

1697

01:17:59,630 --> 01:17:57,510

prepared and inject them into these

1698

01:18:01,040 --> 01:17:59,640

machines that are able to tell us the

1699

01:18:03,260 --> 01:18:01,050

retention times of the different

1700

01:18:05,390 --> 01:18:03,270

compounds within the sample and then

1701

01:18:08,240 --> 01:18:05,400

we're able to run what we expect to find

1702

01:18:10,220 --> 01:18:08,250

it to compare that to to kind of get a

1703

01:18:12,290 --> 01:18:10,230

sense of like if it really is what we

1704

01:18:17,270 --> 01:18:12,300

think it is and how much is in there and

1705

01:18:21,400 --> 01:18:17,280

questions like that was really great for

1706

01:18:26,000 --> 01:18:24,709

do you have any tips for anybody could

1707

01:18:28,790 --> 01:18:26,010

you tell us a little bit about how you

1708

01:18:31,010 --> 01:18:28,800

applied and got in yeah so like when we

1709

01:18:33,080 --> 01:18:31,020

I went to intern nasa.gov where

1710

01:18:35,930 --> 01:18:33,090

undergraduates graduates and high

1711

01:18:38,390 --> 01:18:35,940

schoolers I believe - can yep can all

1712

01:18:39,800 --> 01:18:38,400

apply for a NASA internship and you just

1713

01:18:41,360 --> 01:18:39,810

get to go on and kind of like look for

1714

01:18:43,910 --> 01:18:41,370

what projects interest you my advice

1715

01:18:47,150 --> 01:18:43,920

would be to not like pigeonhole yourself

1716

01:18:48,290 --> 01:18:47,160

into one special like focus this is the

1717

01:18:50,120 --> 01:18:48,300

first formal training I've had in

1718

01:18:51,350 --> 01:18:50,130

organic chemistry and I think the only

1719

01:18:53,840 --> 01:18:51,360

reason I'm here is just because I put

1720

01:18:55,729 --> 01:18:53,850

myself out there so it's a definitely

1721

01:18:56,810 --> 01:18:55,739

like jump for things that you want to do

1722

01:18:58,970 --> 01:18:56,820

or you're interested in because the

1723

01:19:02,770 --> 01:18:58,980

scientists here they're interested in

1724

01:19:05,030 --> 01:19:02,780

educating the future of science so

1725

01:19:08,540 --> 01:19:05,040

awesome story and awesome researcher

1726

01:19:10,880 --> 01:19:08,550

thank you very cool all right well

1727

01:19:13,880 --> 01:19:10,890

before you go can you give some tips on

1728

01:19:15,290 --> 01:19:13,890

recreating your look so my look starting

1729

01:19:18,250 --> 01:19:15,300

with the crown I made it out of

1730

01:19:21,860 --> 01:19:18,260

Christmas decoration that I sacrifice

1731

01:19:23,570 --> 01:19:21,870

sometimes got to do that yeah you can go

1732

01:19:25,390 --> 01:19:23,580

to Goodwill to find they have a lot of

1733

01:19:28,640 --> 01:19:25,400

things like this I keep stirring the

1734

01:19:32,360 --> 01:19:28,650

Halloween season um I made this out of a

1735

01:19:34,370 --> 01:19:32,370

sheet it's like a little tunic I don't

1736

01:19:36,530 --> 01:19:34,380

know if you've seen but I decided to

1737

01:19:38,030 --> 01:19:36,540

give our modern Artemis hiking pants

1738

01:19:41,200 --> 01:19:38,040

because I think she deserves to be able

1739

01:19:46,120 --> 01:19:42,970

notice of the punch s be able to run

1740

01:19:47,200 --> 01:19:46,130

yeah definitely and for the moon which

1741

01:19:49,180 --> 01:19:47,210

you're the goddess of when you're

1742

01:19:51,820 --> 01:19:49,190

Artemis right you can make this out of

1743

01:19:54,490 --> 01:19:51,830

tinfoil paper mache and a balloon you

1744

01:19:58,120 --> 01:19:54,500

know paint yeah or 30 printed if that's

1745

01:19:58,630 --> 01:19:58,130

something you can do really yeah just

1746

01:20:03,729 --> 01:19:58,640

get creative

1747

01:20:07,510 --> 01:20:03,739

alright sweet thank you see you in a

1748

01:20:09,820 --> 01:20:07,520

little bit all right another cool one

1749

01:20:11,080 --> 01:20:09,830

I'm always amazed by our interns gonna

1750

01:20:13,390 --> 01:20:11,090

code the meteorite came just like

1751  
01:20:15,700 --> 01:20:13,400  
landing if someone's bar I know I know

1752  
01:20:17,979 --> 01:20:15,710  
how ridiculous wake up the next time

1753  
01:20:19,600 --> 01:20:17,989  
you're like oh they expect that to be

1754  
01:20:22,150 --> 01:20:19,610  
there I know you're a farmer you've

1755  
01:20:24,040 --> 01:20:22,160  
young no reason to expect NASA to come

1756  
01:20:27,670 --> 01:20:24,050  
knocking but you got a meteor in your

1757  
01:20:31,840 --> 01:20:27,680  
bar alright well let's move on you guys

1758  
01:20:34,330 --> 01:20:31,850  
to our last contenders last but

1759  
01:20:36,970 --> 01:20:34,340  
certainly not least this remarkable duo

1760  
01:20:39,940 --> 01:20:36,980  
just made history by venturing outside

1761  
01:20:42,880 --> 01:20:39,950  
together in the vacuum of space come on

1762  
01:20:48,270 --> 01:20:42,890  
out Lauren and Nicole cosplaying as the

1763  
01:21:00,700 --> 01:20:48,280

first all woman spacewalk yeah

1764

01:21:07,060 --> 01:21:03,630

[Music]

1765

01:21:08,530 --> 01:21:07,070

I'm so impressed yeah yeah I am too

1766

01:21:14,530 --> 01:21:08,540

I'm curious how we're gonna recreate

1767

01:21:16,090 --> 01:21:14,540

that but we will come yeah okay so tell

1768

01:21:19,780 --> 01:21:16,100

us your names and tell us what you do

1769

01:21:22,810 --> 01:21:19,790

here yeah so my name is Nicole Carter

1770

01:21:25,240 --> 01:21:22,820

and this is I'm Lauren Abbott I'm a

1771

01:21:28,720 --> 01:21:25,250

material scientist and I am a ceramic

1772

01:21:30,490 --> 01:21:28,730

engineer material engineer Wow

1773

01:21:31,570 --> 01:21:30,500

rebirth part of the material thermal

1774

01:21:34,060 --> 01:21:31,580

protection materials branch system

1775

01:21:35,680 --> 01:21:34,070

mm-hmm yeah so yeah as you mentioned so

1776

01:21:38,860 --> 01:21:35,690

we're here to celebrate the first all

1777

01:21:41,260 --> 01:21:38,870

women spacewalk yeah that yeah so

1778

01:21:43,000 --> 01:21:41,270

astronauts Christina Cooke and Jessica

1779

01:21:44,830 --> 01:21:43,010

Muir just completed this last week the

1780

01:21:47,200 --> 01:21:44,840

first time that we've had a spacewalk

1781

01:21:48,610 --> 01:21:47,210

completed by just women and you know we

1782

01:21:50,620 --> 01:21:48,620

were so pumped about it that we wanted

1783

01:21:56,350 --> 01:21:50,630

to dress up to celebrate this is the

1784

01:22:04,510 --> 01:21:56,360

perfect opportunity for that we have a

1785

01:22:06,340 --> 01:22:04,520

photo of these two astronauts yeah I

1786

01:22:08,200 --> 01:22:06,350

believe they live streamed the spacewalk

1787

01:22:09,940 --> 01:22:08,210

on Twitch right yeah I don't know it's

1788

01:22:11,140 --> 01:22:09,950

pretty early that's awesome it was

1789

01:22:13,150 --> 01:22:11,150

really early in the morning but I caught

1790

01:22:14,650 --> 01:22:13,160

the end of it nice nice yeah I think you

1791

01:22:17,410 --> 01:22:14,660

can go back and see it if you missed it

1792

01:22:18,640 --> 01:22:17,420

mm-hmm seven hours I think oh wow yeah

1793

01:22:20,560 --> 01:22:18,650

that's right that's right that's very

1794

01:22:22,480 --> 01:22:20,570

demanding a lot of it is isn't the

1795

01:22:24,320 --> 01:22:22,490

tedious work and when the vacuum is

1796

01:22:26,720 --> 01:22:24,330

exhausting yeah

1797

01:22:29,300 --> 01:22:26,730

it's amazing cool all right well tell us

1798

01:22:34,700 --> 01:22:29,310

how that relates to the work you do

1799

01:22:37,370 --> 01:22:34,710

I don't really maybe my awesome did you

1800

01:22:38,870 --> 01:22:37,380

astronauts one day but no so we actually

1801

01:22:41,330 --> 01:22:38,880

work on materials that help keep

1802

01:22:43,340 --> 01:22:41,340

astronauts safe so Noble mentioned we

1803

01:22:44,690 --> 01:22:43,350

work on thermal protection materials and

1804

01:22:47,300 --> 01:22:44,700

those are materials that go into heat

1805

01:22:49,280 --> 01:22:47,310

shields that protect the spacecraft when

1806

01:22:50,960 --> 01:22:49,290

coming back into atmosphere and earth so

1807

01:22:52,880 --> 01:22:50,970

they keep passionate safe when they

1808

01:22:54,950 --> 01:22:52,890

reenter its atmosphere all right yeah I

1809

01:22:57,740 --> 01:22:54,960

get some pretty high temperatures like

1810

01:23:01,190 --> 01:22:57,750

you know 20 we even have a model so here

1811

01:23:03,110 --> 01:23:01,200

is here's the like the spacecraft coming

1812

01:23:05,180 --> 01:23:03,120

back into Earth and the heat-ray would

1813

01:23:06,620 --> 01:23:05,190

be right in the front of that spacecraft

1814

01:23:08,420 --> 01:23:06,630

we are going through different

1815

01:23:12,160 --> 01:23:08,430

atmospheres you get a lot of heat coming

1816

01:23:15,650 --> 01:23:12,170

through pushing up against that

1817

01:23:18,170 --> 01:23:15,660

spacecraft right and so the Timnath the

1818

01:23:20,630 --> 01:23:18,180

time material so you use are able to

1819

01:23:22,580 --> 01:23:20,640

either push that heat away or just

1820

01:23:24,380 --> 01:23:22,590

insulate it just like kind of stuff and

1821

01:23:26,360 --> 01:23:24,390

that goes in your walls at home this is

1822

01:23:27,800 --> 01:23:26,370

an isolation type of material oh yeah

1823

01:23:31,450 --> 01:23:27,810

become things cool to keep the

1824

01:23:34,750 --> 01:23:31,460

astronauts yeah yes the structure intact

1825

01:23:40,040 --> 01:23:34,760

yeah same idea just really high-tech

1826

01:23:42,380 --> 01:23:40,050

insulation yes not a typical type of

1827

01:23:44,060 --> 01:23:42,390

environment that we happen to see on

1828

01:23:47,320 --> 01:23:44,070

earth area you know kind of a space

1829

01:23:49,250 --> 01:23:47,330

specialty yeah we actually have a couple

1830

01:23:54,200 --> 01:23:49,260

samples of the materials that are

1831

01:23:59,600 --> 01:23:54,210

getting used we have some gloves if you

1832

01:24:01,480 --> 01:23:59,610

wanted to you may want to take a glove

1833

01:24:05,870 --> 01:24:01,490

just because they have a little bit of

1834

01:24:20,640 --> 01:24:05,880

particulates that come off you know what

1835

01:24:26,729 --> 01:24:23,700

you needed a carbon ablator and a blader

1836

01:24:28,109 --> 01:24:26,739

is something that when it heats up it

1837

01:24:31,439 --> 01:24:28,119

creates a chemical reaction that

1838

01:24:33,330 --> 01:24:31,449

actually throws off heat away from the

1839

01:24:35,370 --> 01:24:33,340

spacecraft you can see it's really light

1840

01:24:36,839 --> 01:24:35,380

so obviously when we're sending stuff to

1841

01:24:39,899 --> 01:24:36,849

space we want to keep it nice and light

1842

01:24:41,520 --> 01:24:39,909

because every every pound matters yeah

1843

01:24:43,500 --> 01:24:41,530

so if we can keep the heat light it

1844

01:24:45,990 --> 01:24:43,510

gives us more more space to put other

1845

01:24:47,939 --> 01:24:46,000

things and more weight that we can you

1846

01:24:49,589 --> 01:24:47,949

know do it science experiments and that

1847

01:24:52,410 --> 01:24:49,599

kind of stuff yeah so that yellow is the

1848

01:24:54,629 --> 01:24:52,420

phenolic resin that we use and then the

1849

01:24:57,270 --> 01:24:54,639

black the you seen there's that carbon

1850

01:24:59,220 --> 01:24:57,280

yeah so one thing we do as material

1851  
01:25:00,689 --> 01:24:59,230  
scientists is we try to understand the

1852  
01:25:03,209 --> 01:25:00,699  
microstructure of the material so we

1853  
01:25:05,939 --> 01:25:03,219  
have here this is a 3d printed

1854  
01:25:07,470 --> 01:25:05,949  
microstructure of the carbon fibers that

1855  
01:25:11,070 --> 01:25:07,480  
are in pekin obviously this isn't a

1856  
01:25:12,149 --> 01:25:11,080  
scale so you can actually see it I don't

1857  
01:25:13,620 --> 01:25:12,159  
know if we can get a close-up of it you

1858  
01:25:17,609 --> 01:25:13,630  
can take a look at that hold it if you

1859  
01:25:19,109 --> 01:25:17,619  
hold it here so we get a close-up of

1860  
01:25:22,229 --> 01:25:19,119  
that you can see all the carbon fibers

1861  
01:25:23,879 --> 01:25:22,239  
that are making up the substrate of that

1862  
01:25:25,830 --> 01:25:23,889  
and so these carbon fibers are on the

1863  
01:25:27,750 --> 01:25:25,840

scale of microns so it's kind of like

1864

01:25:29,520 --> 01:25:27,760

the thickness of your hair oh well that

1865

01:25:31,320 --> 01:25:29,530

would be a good comparison so these are

1866

01:25:33,120 --> 01:25:31,330

obviously much bigger but this is what

1867

01:25:33,629 --> 01:25:33,130

the carbon fiber substrate looks like in

1868

01:25:35,640 --> 01:25:33,639

pika

1869

01:25:38,250 --> 01:25:35,650

and we infuse that with the phenolic

1870

01:25:47,640 --> 01:25:38,260

resin how cool and why are we wearing

1871

01:25:49,740 --> 01:25:47,650

gloves yeah so a little bit of yellowing

1872

01:25:51,419 --> 01:25:49,750

so it's you just don't want it - getting

1873

01:25:53,609 --> 01:25:51,429

it into your skin it's got little carbon

1874

01:25:55,290 --> 01:25:53,619

pieces in it okay just to keep you safe

1875

01:25:57,750 --> 01:25:55,300

I said protection so you would use this

1876

01:26:00,810 --> 01:25:57,760

material for and heat shield yeah so

1877

01:26:03,089 --> 01:26:00,820

this one yeah this one is good for / -

1878

01:26:05,070 --> 01:26:03,099

it's a blade of asthma convention it

1879

01:26:06,990 --> 01:26:05,080

decomposes on reentry

1880

01:26:09,060 --> 01:26:07,000

so it takes away the heat from the

1881

01:26:10,560 --> 01:26:09,070

spacecraft and it's not reusable so it's

1882

01:26:12,750 --> 01:26:10,570

something we would only use one time

1883

01:26:18,510 --> 01:26:12,760

yeah and then it would be thrown away no

1884

01:26:21,060 --> 01:26:18,520

but we do have reusable reusable TPS

1885

01:26:23,189 --> 01:26:21,070

reusable yes so that's the more common

1886

01:26:25,080 --> 01:26:23,199

shuttle tile about a lot of people tend

1887

01:26:27,959 --> 01:26:25,090

to know is back in the shuttle days and

1888

01:26:31,470 --> 01:26:27,969

that's the whole the white silica blocks

1889

01:26:33,649 --> 01:26:31,480

that you'll see and they can typically

1890

01:26:35,689 --> 01:26:33,659

be recycled

1891

01:26:39,469 --> 01:26:35,699

multiple times the only time that really

1892

01:26:41,509 --> 01:26:39,479

gets has to be replaced is when there's

1893

01:26:42,319 --> 01:26:41,519

any damage from asteroids and meteors or

1894

01:26:43,669 --> 01:26:42,329

any just uh

1895

01:26:45,350 --> 01:26:43,679

alrighty clothes that are in space that

1896

01:26:49,069 --> 01:26:45,360

are hard so what kind of material is

1897

01:26:51,859 --> 01:26:49,079

this so this is really alumina and

1898

01:26:53,859 --> 01:26:51,869

borosilicate glass and glass has such a

1899

01:26:56,899 --> 01:26:53,869

high melting temperature so it doesn't

1900

01:26:59,299 --> 01:26:56,909

deform when in the higher reentry

1901

01:27:01,100 --> 01:26:59,309

atmosphere temperatures and it's

1902

01:27:05,149 --> 01:27:01,110

actually super lightweight because air

1903

01:27:08,659 --> 01:27:05,159

is actually a poor conductor of heat so

1904

01:27:10,640 --> 01:27:08,669

with a lot of air in the material the

1905

01:27:13,069 --> 01:27:10,650

heat transfer doesn't want to go through

1906

01:27:17,929 --> 01:27:13,079

it as fast as like metal metal conducts

1907

01:27:18,439 --> 01:27:17,939

heat very quickly yeah very quickly yeah

1908

01:27:20,149 --> 01:27:18,449

well

1909

01:27:21,859 --> 01:27:20,159

so unlike the polymers which like I said

1910

01:27:23,299 --> 01:27:21,869

decompose at high temperatures and we

1911

01:27:26,689 --> 01:27:23,309

start you can actually see the layer

1912

01:27:28,549 --> 01:27:26,699

sure to recede over time these won't do

1913

01:27:29,839 --> 01:27:28,559

do that you'll be able to use them like

1914

01:27:31,250 --> 01:27:29,849

putting them on like we used to have

1915

01:27:33,109 --> 01:27:31,260

them on the spatial and we can use that

1916

01:27:35,000 --> 01:27:33,119

read that spatially we can reuse it at

1917

01:27:36,890 --> 01:27:35,010

several times before we need to replace

1918

01:27:38,929 --> 01:27:36,900

them and so that helps with Causton and

1919

01:27:41,509 --> 01:27:38,939

it has some performance benefits as well

1920

01:27:43,069 --> 01:27:41,519

so how do you guys do this research with

1921

01:27:47,270 --> 01:27:43,079

the materials and find out more about

1922

01:27:49,489 --> 01:27:47,280

them so my side of it I do a lot of the

1923

01:27:52,189 --> 01:27:49,499

physical testing of the material so we

1924

01:27:54,819 --> 01:27:52,199

can we have what's called the arc jet

1925

01:28:06,009 --> 01:27:54,829

which is a plasma gun that shoots up to

1926

01:28:11,390 --> 01:28:08,899

simulation reheat right so we can stick

1927

01:28:13,069 --> 01:28:11,400

these materials in that plasma gun and

1928

01:28:15,319 --> 01:28:13,079

shoots it we'll take a look at it

1929

01:28:17,179 --> 01:28:15,329

afterwards see what it how it deforms

1930

01:28:19,640 --> 01:28:17,189

from different temperatures we can even

1931

01:28:21,350 --> 01:28:19,650

increase the pressure there and do

1932

01:28:23,689 --> 01:28:21,360

different or even lower pressures that

1933

01:28:25,549 --> 01:28:23,699

kind of resem you late the low

1934

01:28:27,169 --> 01:28:25,559

atmospheric pressure in space yeah

1935

01:28:30,350 --> 01:28:27,179

unfortunately we can't just send stuff

1936

01:28:31,759 --> 01:28:30,360

to space and bring it back the best that

1937

01:28:33,500 --> 01:28:31,769

we can do to try to replicate that

1938

01:28:34,759 --> 01:28:33,510

environment on earth right another thing

1939

01:28:36,439 --> 01:28:34,769

we do so what I work on I do

1940

01:28:38,509 --> 01:28:36,449

computational modeling of these

1941

01:28:40,370 --> 01:28:38,519

materials at different length skills and

1942

01:28:42,020 --> 01:28:40,380

the benefit of using computational tools

1943

01:28:43,939 --> 01:28:42,030

is we can do that a little more cheaply

1944

01:28:45,259 --> 01:28:43,949

on the computer than we could a test and

1945

01:28:47,509 --> 01:28:45,269

are an arc jet test can be very

1946

01:28:49,639 --> 01:28:47,519

expensive so we can do some

1947

01:28:50,959 --> 01:28:49,649

materials ahead of time in computer

1948

01:28:53,059 --> 01:28:50,969

simulations and understand how that

1949

01:28:55,129 --> 01:28:53,069

material behaves in these environments

1950

01:28:56,769 --> 01:28:55,139

as well and that's much safer and

1951

01:28:59,539 --> 01:28:56,779

cheaper than the experiments would be

1952

01:29:02,269 --> 01:28:59,549

you might start there and then yeah

1953

01:29:04,309 --> 01:29:02,279

exactly we work very closely together so

1954

01:29:05,929 --> 01:29:04,319

we'll simulate things and they'll test

1955

01:29:08,000 --> 01:29:05,939

them and we'll compare and and it'll

1956

01:29:09,799 --> 01:29:08,010

help iterate the process of testing and

1957

01:29:11,209 --> 01:29:09,809

designing new materials and testing old

1958

01:29:13,579 --> 01:29:11,219

materials and understanding what

1959

01:29:14,689 --> 01:29:13,589

environments they'll work in because you

1960

01:29:21,129 --> 01:29:14,699

would use a different kind of material

1961

01:29:24,799 --> 01:29:23,509

they all have a special purpose and

1962

01:29:26,359 --> 01:29:24,809

depending on what the mission is we'll

1963

01:29:28,489 --> 01:29:26,369

pick the right heat shield just because

1964

01:29:29,629 --> 01:29:28,499

we want to minimize mass so we'll pick

1965

01:29:31,459 --> 01:29:29,639

the right heat shield they'll get the

1966

01:29:33,259 --> 01:29:31,469

job done but not something that's too

1967

01:29:35,299 --> 01:29:33,269

much that way we can keep the mass alone

1968

01:29:38,869 --> 01:29:35,309

and then even like under tiles there are

1969

01:29:41,569 --> 01:29:38,879

like a bunch of different types of

1970

01:29:44,539 --> 01:29:41,579

shuttle tiles that could be more useful

1971

01:29:46,789 --> 01:29:44,549

on certain parts of the ship versus some

1972

01:29:49,279 --> 01:29:46,799

other part of tiles so that I even in

1973

01:29:50,869 --> 01:29:49,289

there have two different tiles that one

1974

01:29:53,029 --> 01:29:50,879

was processed slightly differently and

1975

01:29:54,889 --> 01:29:53,039

they have different properties for so

1976

01:29:57,049 --> 01:29:54,899

being able to test and know where

1977

01:29:58,669 --> 01:29:57,059

exactly should go on the ship or what

1978

01:30:01,429 --> 01:29:58,679

type of mission it should go into is

1979

01:30:06,500 --> 01:30:01,439

really key can I ask you some questions

1980

01:30:08,779 --> 01:30:06,510

quickly from the chat la la 147 says

1981

01:30:11,449 --> 01:30:08,789

that's awesome they love your work

1982

01:30:15,469 --> 01:30:11,459

how third s are there any ceramics

1983

01:30:18,289 --> 01:30:15,479

inside the spacecraft not that I deal

1984

01:30:20,000 --> 01:30:18,299

with okay do the outside of this and we

1985

01:30:21,919 --> 01:30:20,010

have all sorts of materials in space and

1986

01:30:23,539 --> 01:30:21,929

you know ceramics really great in high

1987

01:30:25,339 --> 01:30:23,549

temperatures so we see those a lot in

1988

01:30:26,569 --> 01:30:25,349

environments we're expecting to get up

1989

01:30:27,979 --> 01:30:26,579

to high temperatures because they won't

1990

01:30:30,259 --> 01:30:27,989

melt at these high temperatures and

1991

01:30:32,269 --> 01:30:30,269

ceramics are also there everywhere so a

1992

01:30:33,919 --> 01:30:32,279

lot of people don't know what ceramics

1993

01:30:35,989 --> 01:30:33,929

kind of entail but like they're in your

1994

01:30:37,909 --> 01:30:35,999

car engine actually oh so you have like

1995

01:30:39,829 --> 01:30:37,919

the metal engine but like the oxygen to

1996

01:30:43,000 --> 01:30:39,839

sensor that is a ceramic material it

1997

01:30:45,109 --> 01:30:43,010

gets used glass gets used it's a ceramic

1998

01:30:47,629 --> 01:30:45,119

yeah so there could be plenty of footage

1999

01:30:49,579 --> 01:30:47,639

every day like electronic semiconductors

2000

01:30:52,159 --> 01:30:49,589

so there's definitely some inside the

2001  
01:30:53,779 --> 01:30:52,169  
shuttle I just don't do that yeah so one

2002  
01:30:54,979 --> 01:30:53,789  
other thing we do so sometimes in high

2003  
01:30:56,959 --> 01:30:54,989  
temperatures you just need to coat

2004  
01:30:58,129 --> 01:30:56,969  
material you just add a coating on top

2005  
01:30:59,119 --> 01:30:58,139  
of some kind of material that can

2006  
01:31:00,639 --> 01:30:59,129  
withstand the high temperatures to

2007  
01:31:03,009 --> 01:31:00,649  
protect the material underneath

2008  
01:31:05,139 --> 01:31:03,019  
so this is an example of a material that

2009  
01:31:07,419 --> 01:31:05,149  
has a coating on top that has some kind

2010  
01:31:09,609 --> 01:31:07,429  
of protective properties to it oh yeah

2011  
01:31:11,409 --> 01:31:09,619  
and so it also kind of helps create a

2012  
01:31:13,179 --> 01:31:11,419  
tougher so these guys they're very

2013  
01:31:17,679 --> 01:31:13,189

lightweight they're low-density they're

2014

01:31:19,509 --> 01:31:17,689

kind of susceptible to compression and

2015

01:31:22,080 --> 01:31:19,519

so that glass coating on top of it can

2016

01:31:24,609 --> 01:31:22,090

also help kind of dissipate any sort of

2017

01:31:26,799 --> 01:31:24,619

energy coming across that good Wow

2018

01:31:28,389 --> 01:31:26,809

compress it right yeah so I think we

2019

01:31:29,979 --> 01:31:28,399

have a great movie to show this so as I

2020

01:31:31,509 --> 01:31:29,989

said that we do simulations one of the

2021

01:31:33,069 --> 01:31:31,519

simulations that we do is all the way

2022

01:31:34,869 --> 01:31:33,079

down to the atomistic scale so looking

2023

01:31:37,659 --> 01:31:34,879

at atoms individually in these materials

2024

01:31:39,850 --> 01:31:37,669

okay let the nano scale and if you a

2025

01:31:42,699 --> 01:31:39,860

little the video a video of explain

2026

01:31:44,489 --> 01:31:42,709

that's going on simulation so this is it

2027

01:31:47,020 --> 01:31:44,499

will be a you'll see a microstructure

2028

01:31:48,699 --> 01:31:47,030

once it comes up a microstructure of a

2029

01:31:50,799 --> 01:31:48,709

material and so the microstructure is

2030

01:31:52,449 --> 01:31:50,809

made up of called grains and these are

2031

01:31:54,669 --> 01:31:52,459

crystal lights that are oriented in

2032

01:31:57,790 --> 01:31:54,679

different ways we're at the end of the

2033

01:31:59,020 --> 01:31:57,800

movie can we maybe yeah so so these are

2034

01:32:01,810 --> 01:31:59,030

all the different grains that the blue

2035

01:32:03,429 --> 01:32:01,820

regions are very well ordered crystals

2036

01:32:05,139 --> 01:32:03,439

and then the gray is the boundaries

2037

01:32:06,759 --> 01:32:05,149

between these grains and in the

2038

01:32:08,709 --> 01:32:06,769

simulation so these are now sixteen

2039

01:32:11,109 --> 01:32:08,719

million atoms it's about 60 nanometers

2040

01:32:12,339 --> 01:32:11,119

in scale so you can see as we pull this

2041

01:32:14,109 --> 01:32:12,349

material apart we can start to

2042

01:32:16,179 --> 01:32:14,119

understand how that material fails at

2043

01:32:18,489 --> 01:32:16,189

the atomistic scale so you can see that

2044

01:32:19,899 --> 01:32:18,499

it starts to crack between these on

2045

01:32:21,639 --> 01:32:19,909

these grain boundaries between the

2046

01:32:23,169 --> 01:32:21,649

grains and so now we can start to

2047

01:32:25,629 --> 01:32:23,179

understand the failure mechanisms of

2048

01:32:27,819 --> 01:32:25,639

these other materials by doing that we

2049

01:32:29,619 --> 01:32:27,829

can hopefully improve them and and find

2050

01:32:31,449 --> 01:32:29,629

out when we can use them and what we

2051  
01:32:43,810 --> 01:32:31,459  
can't and how we can make materials that

2052  
01:32:45,369 --> 01:32:43,820  
do better and we do a lot of them here

2053  
01:32:47,049 --> 01:32:45,379  
at NASA NOAA NASA likes to use a lot of

2054  
01:32:48,429 --> 01:32:47,059  
models like like I mentioned already

2055  
01:32:49,629 --> 01:32:48,439  
right it's really expensive to do some

2056  
01:32:51,489 --> 01:32:49,639  
of the tests that we do and it's not

2057  
01:32:53,049 --> 01:32:51,499  
easy to just test things in space right

2058  
01:32:54,699 --> 01:32:53,059  
the more we can do things on computers

2059  
01:32:56,109 --> 01:32:54,709  
the better and computers are getting so

2060  
01:32:59,139 --> 01:32:56,119  
fast we actually have a supercomputer

2061  
01:33:01,479 --> 01:32:59,149  
here at yet so that lets us run very

2062  
01:33:05,350 --> 01:33:01,489  
large simulations like 16 million atoms

2063  
01:33:07,929 --> 01:33:05,360

right yeah impressive so cool very cool

2064

01:33:12,310 --> 01:33:07,939

you guys yeah all right well we should

2065

01:33:14,109 --> 01:33:12,320

let you go and before you go do you have

2066

01:33:14,620 --> 01:33:14,119

any advice for us on how we can't

2067

01:33:18,040 --> 01:33:14,630

recreate

2068

01:33:20,170 --> 01:33:18,050

your costumes well for me I'm wearing

2069

01:33:23,950 --> 01:33:20,180

some pretty cushy pants mm-hmm I feel

2070

01:33:26,410 --> 01:33:23,960

like I'm in a cloud or a pillow and can

2071

01:33:28,180 --> 01:33:26,420

use like this boxy thing to help get

2072

01:33:31,740 --> 01:33:28,190

your little switches which don't work on

2073

01:33:34,120 --> 01:33:31,750

mine that's okay you have to work I mean

2074

01:33:35,680 --> 01:33:34,130

if you're really engineering you can

2075

01:33:45,940 --> 01:33:35,690

like hook these things up some light

2076

01:33:53,980 --> 01:33:45,950

bulb and put a box around like a bicycle

2077

01:33:55,180 --> 01:33:53,990

helmet your lovely outfit

2078

01:33:56,590 --> 01:33:55,190

I mean mine's a little easier we've

2079

01:33:58,240 --> 01:33:56,600

already seen a few of these types of

2080

01:33:59,860 --> 01:33:58,250

outfits like a nice coveralls sued

2081

01:34:01,630 --> 01:33:59,870

something you can pick up at a local

2082

01:34:05,650 --> 01:34:01,640

hardware store something like that yeah

2083

01:34:06,970 --> 01:34:05,660

maybe yeah print out some NASA logos

2084

01:34:08,770 --> 01:34:06,980

maybe you know get the red white and

2085

01:34:10,960 --> 01:34:08,780

blue in there and stop em on put your

2086

01:34:14,080 --> 01:34:10,970

name on it all that stuff yeah represent

2087

01:34:16,030 --> 01:34:14,090

NASA we can manage that

2088

01:34:21,280 --> 01:34:16,040

you know excellent tips thank you thank

2089

01:34:22,960 --> 01:34:21,290

you yeah I've heard about heat shields

2090

01:34:30,820 --> 01:34:22,970

you guys that bring stuff in like oh

2091

01:34:33,430 --> 01:34:30,830

yeah I got me yeah we'll see you in just

2092

01:34:36,370 --> 01:34:33,440

a moment because it's already time to

2093

01:34:37,180 --> 01:34:36,380

vote on our second segment yeah do you

2094

01:34:38,680 --> 01:34:37,190

know who you vote for

2095

01:34:40,480 --> 01:34:38,690

have you voted Tiffany you get to vote

2096

01:34:41,740 --> 01:34:40,490

too though I know who I want to vote for

2097

01:34:45,750 --> 01:34:41,750

but I'm gonna keep it a secret

2098

01:34:49,060 --> 01:34:45,760

ha ha ha you know you don't wanna know

2099

01:34:51,490 --> 01:34:49,070

influences in the chat you know and did

2100

01:34:53,530 --> 01:34:51,500

you get some more ideas I did definitely

2101  
01:34:54,910 --> 01:34:53,540  
so this has been really good cuz I was

2102  
01:35:03,400 --> 01:34:54,920  
not prepared for Crowley you know I

2103  
01:35:05,080 --> 01:35:03,410  
never ideas right are you guys all ready

2104  
01:35:06,850 --> 01:35:05,090  
to vote hmm

2105  
01:35:09,910 --> 01:35:06,860  
all right time to vote for your favorite

2106  
01:35:12,100 --> 01:35:09,920  
cosplay costume we're gonna bring all of

2107  
01:35:13,450 --> 01:35:12,110  
our guests back out and you can vote in

2108  
01:35:18,220 --> 01:35:13,460  
the chat for your favorite look all

2109  
01:35:20,050 --> 01:35:18,230  
right so first up will it be Kimberly as

2110  
01:35:30,020 --> 01:35:20,060  
the astrophysicist

2111  
01:35:39,959 --> 01:35:35,339  
love it or will it be soon Ada and Emily

2112  
01:35:43,080 --> 01:35:39,969  
as NASA's Starfleet Command hello live

2113  
01:35:43,589 --> 01:35:43,090

long and prosper indeed yeah looking

2114

01:35:50,339 --> 01:35:43,599

good

2115

01:35:52,439 --> 01:35:50,349

next is Daisy as Artemis hello and here

2116

01:36:02,189 --> 01:35:52,449

is one more look at Lauren and Nicole as

2117

01:36:02,699 --> 01:36:02,199

the first all woman spacewalk I don't

2118

01:36:07,859 --> 01:36:02,709

know

2119

01:36:09,000 --> 01:36:07,869

so get yours in yeah now it's the time

2120

01:36:12,299 --> 01:36:09,010

to vote

2121

01:36:15,569 --> 01:36:12,309

we are tallying now it's in the child

2122

01:36:19,109 --> 01:36:15,579

it's your last poses in right this is Oh

2123

01:36:28,439 --> 01:36:19,119

too funny a chance last chance to win

2124

01:36:30,270 --> 01:36:28,449

them over all right ready

2125

01:36:32,850 --> 01:36:30,280

Cohen guys my clothes it's a close one

2126

01:36:37,350 --> 01:36:32,860

that's why this is tough all right the

2127

01:36:41,399 --> 01:36:37,360

I've got the answer our winner is Darth

2128

01:36:41,409 --> 01:36:46,040

yeah

2129

01:36:52,860 --> 01:36:49,490

that's so clever I'm stealing that idea

2130

01:36:53,880 --> 01:36:52,870

it's special yeah but you all look

2131

01:36:56,189 --> 01:36:53,890

fabulous

2132

01:36:57,720 --> 01:36:56,199

yes thank you for research with us and

2133

01:37:08,640 --> 01:36:57,730

your costume ideas this has been awesome

2134

01:37:13,320 --> 01:37:11,220

so a quick reminder that if you do end

2135

01:37:16,380 --> 01:37:13,330

up using any of the looks you saw today

2136

01:37:18,600 --> 01:37:16,390

that are space themed space themed

2137

01:37:20,399 --> 01:37:18,610

costumes for Halloween we want to see

2138

01:37:22,709 --> 01:37:20,409

them okay I want to go on Twitter and I

2139

01:37:24,120 --> 01:37:22,719

want to see them you can share your NASA

2140

01:37:27,300 --> 01:37:24,130

inspired costumes with us on social

2141

01:37:28,649 --> 01:37:27,310

using the hashtag NASA costume I'm

2142

01:37:31,500 --> 01:37:28,659

definitely gonna check that out this

2143

01:37:33,930 --> 01:37:31,510

year me too Seabees made it up there in

2144

01:37:35,790 --> 01:37:33,940

the real world yeah anything this has

2145

01:37:38,520 --> 01:37:35,800

been so much fun thank you for joining

2146

01:37:40,830 --> 01:37:38,530

us and a huge thanks for taking part in

2147

01:37:42,899 --> 01:37:40,840

the chat a huge thanks to our guests we

2148

01:37:44,610 --> 01:37:42,909

learned so much from them today so