



SILICON
VALLEY
LIVE



SILICON
VALLEY

AMES RESEARCH CENTER

1
00:00:00,030 --> 00:00:08,500
seven six five four three two

2
00:00:28,150 --> 00:00:22,000
[Music]

3
00:00:31,720 --> 00:00:28,160
what is up everybody you are watching

4
00:00:35,950 --> 00:00:31,730
NASA in Silicon Valley live for Thursday

5
00:00:39,580 --> 00:00:35,960
December 20th 2018 I am your host Matt

6
00:00:42,040 --> 00:00:39,590
Buffington and as my co-host we have you

7
00:00:44,680 --> 00:00:42,050
might recognize her from our Halloween

8
00:00:47,829 --> 00:00:44,690
episode you also might recognize her

9
00:00:49,720 --> 00:00:47,839
sultry voice from our star wash video we

10
00:00:54,160 --> 00:00:49,730
have our very own Danielle Carmichael

11
00:00:56,079 --> 00:00:54,170
over here I told her I had something in

12
00:00:58,389 --> 00:00:56,089
store for the for the introduction but

13
00:01:01,509 --> 00:00:58,399

didn't want to spoil it completely for

14

00:01:03,340 --> 00:01:01,519

is that going you know it's going great

15

00:01:05,560 --> 00:01:03,350

I can't I can't wait we're gonna have a

16

00:01:08,529 --> 00:01:05,570

really exciting show up for us today we

17

00:01:10,930 --> 00:01:08,539

have a fun unboxing episode for you guys

18

00:01:13,060 --> 00:01:10,940

you see sporting my kind of ugly

19

00:01:14,770 --> 00:01:13,070

Christmas sweater going on over here

20

00:01:16,840 --> 00:01:14,780

don't mind the reindeer floating in

21

00:01:22,029 --> 00:01:16,850

space see Danielle you got your you got

22

00:01:23,770 --> 00:01:22,039

your necklace going she came up with

23

00:01:27,609 --> 00:01:23,780

just the polo shirt and I was like I

24

00:01:29,440 --> 00:01:27,619

want more Christmas more stuff so but

25

00:01:31,809 --> 00:01:29,450

speaking of having more Christmas Dave

26
00:01:35,169 --> 00:01:31,819
sitting on over here and I promised Dave

27
00:01:36,850 --> 00:01:35,179
that I had this hat for him you think

28
00:01:38,589 --> 00:01:36,860
I'm not quite Christmassy enough about

29
00:01:41,199 --> 00:01:38,599
you like we needed to turn up the

30
00:01:45,089 --> 00:01:41,209
Christmas a little bit more see look at

31
00:01:48,040 --> 00:01:45,099
that that is pretty awesome to the right

32
00:01:51,999 --> 00:01:48,050
I think it works so if folks if you

33
00:01:53,949 --> 00:01:52,009
can't tell it is the holidays here and

34
00:01:55,570 --> 00:01:53,959
we are excited and getting into the

35
00:01:58,029 --> 00:01:55,580
holiday spirit and we're gonna be

36
00:02:00,790 --> 00:01:58,039
opening up a whole bunch of gifts today

37
00:02:03,249 --> 00:02:00,800
this is the unboxing show that you have

38
00:02:04,690 --> 00:02:03,259

all been looking forward to we're have a

39

00:02:07,749 --> 00:02:04,700

whole bunch of different gifts that are

40

00:02:10,570 --> 00:02:07,759

unique to NASA's Ames Research Center in

41

00:02:12,070 --> 00:02:10,580

Silicon Valley and this is gonna be

42

00:02:13,990 --> 00:02:12,080

pretty crazy we have a whole bunch of

43

00:02:16,300 --> 00:02:14,000

people lined up with boxes that we're

44

00:02:19,119 --> 00:02:16,310

gonna unwrap so awesome we've got so

45

00:02:21,220 --> 00:02:19,129

much tremendous stuff here it's gonna be

46

00:02:23,020 --> 00:02:21,230

a fun time but if you didn't know this

47

00:02:25,000 --> 00:02:23,030

is NASA in Silicon Valley live it is a

48

00:02:27,100 --> 00:02:25,010

conversational show out of NASA's Ames

49

00:02:28,180 --> 00:02:27,110

Research Center here in Silicon Valley

50

00:02:30,640 --> 00:02:28,190

where we talked to the various

51
00:02:33,100 --> 00:02:30,650
scientists researchers engineers and

52
00:02:34,900 --> 00:02:33,110
all-around cool people at NASA where we

53
00:02:35,950 --> 00:02:34,910
talked about all of the nerdy NASA news

54
00:02:37,690 --> 00:02:35,960
that you need to know about and if you

55
00:02:40,360 --> 00:02:37,700
like that we are right now

56
00:02:43,720 --> 00:02:40,370
live on twitch.tv slash NASA as this

57
00:02:45,759 --> 00:02:43,730
wonderful lower-third indicates we're

58
00:02:47,500 --> 00:02:45,769
also live on Facebook and YouTube but if

59
00:02:49,270 --> 00:02:47,510
you want to participate in the chat live

60
00:02:51,490 --> 00:02:49,280
you have to go to Twitter on TV slash

61
00:02:53,050 --> 00:02:51,500
NASA and we are going to be collecting

62
00:02:55,210 --> 00:02:53,060
those questions throughout the episode

63
00:02:56,530 --> 00:02:55,220

so you come on in like typing your

64

00:02:58,660 --> 00:02:56,540

questions we're gonna answer as many as

65

00:03:00,670 --> 00:02:58,670

we human ly possibly can if you can't

66

00:03:02,589 --> 00:03:00,680

catch us live that's no big deal we will

67

00:03:03,400 --> 00:03:02,599

be on demand immediately when the show

68

00:03:06,009 --> 00:03:03,410

is over

69

00:03:09,070 --> 00:03:06,019

we'll also be on reruns on NASA TV and

70

00:03:10,960 --> 00:03:09,080

if you're an audio podcast listener we

71

00:03:13,750 --> 00:03:10,970

will be on podcast services throughout

72

00:03:15,580 --> 00:03:13,760

the solar system and beyond but I can

73

00:03:18,759 --> 00:03:15,590

tell you if you're sitting on the 101 or

74

00:03:21,400 --> 00:03:18,769

on the five and traffic or if you're in

75

00:03:22,630 --> 00:03:21,410

DC on 95 this is probably the episode

76

00:03:24,039 --> 00:03:22,640

that you're not going to want to listen

77

00:03:26,949 --> 00:03:24,049

to you're gonna want to watch this we've

78

00:03:47,830 --> 00:03:26,959

got a lot of cool stuff but our guests

79

00:03:50,199 --> 00:03:47,840

we have Dave Coors Meyer this is also a

80

00:03:53,050 --> 00:03:50,209

special birthday it is did you know did

81

00:03:56,890 --> 00:03:53,060

you know that today is the 79th birthday

82

00:03:59,259 --> 00:03:56,900

of one NASA Ames Research Center nice

83

00:04:02,259 --> 00:03:59,269

very important it is to this exact date

84

00:04:04,599 --> 00:04:02,269

to this exact date that 79 years ago we

85

00:04:06,729 --> 00:04:04,609

were founded as part of the National

86

00:04:09,610 --> 00:04:06,739

Advisory Committee on aeronautics we

87

00:04:17,680 --> 00:04:09,620

were around we are so hold we are so

88

00:04:19,360 --> 00:04:17,690

assuming that we were before NASA was

89

00:04:21,550 --> 00:04:19,370

just Orange Valley Orange Grove oh yes

90

00:04:24,640 --> 00:04:21,560

we existed before that we were we were

91

00:04:26,230 --> 00:04:24,650

the second NASA Advisory National

92

00:04:28,570 --> 00:04:26,240

Advisory Committee on Aeronautics Center

93

00:04:30,790 --> 00:04:28,580

the first one was in Langley which is in

94

00:04:31,719 --> 00:04:30,800

Hampton Virginia it was set up there and

95

00:04:34,089 --> 00:04:31,729

they had all these kind of radical

96

00:04:36,040 --> 00:04:34,099

people that didn't get along and had

97

00:04:37,779 --> 00:04:36,050

these crazy ideas no that's not entirely

98

00:04:39,400 --> 00:04:37,789

true though they did but they said hey

99

00:04:42,370 --> 00:04:39,410

we need another site on the other side

100

00:04:44,650 --> 00:04:42,380

of this the country and they set it us

101

00:04:47,620 --> 00:04:44,660

up here at Moffett Field and we were

102

00:04:50,970 --> 00:04:47,630

founded seventy-nine years ago and we

103

00:04:52,650 --> 00:04:50,980

have been doing phenomenal wide value in

104

00:04:54,150 --> 00:04:52,660

credibly breakthrough research since

105

00:04:56,610 --> 00:04:54,160

that time we're starting our 80th year

106

00:04:57,960 --> 00:04:56,620

right now yeah it's just tremendous

107

00:04:59,850 --> 00:04:57,970

stuff we're kicking off because this is

108

00:05:02,610 --> 00:04:59,860

the 79th birthday but coming into this

109

00:05:07,530 --> 00:05:02,620

next year is gonna be 80 years we got we

110

00:05:08,970 --> 00:05:07,540

got 50th we got NASA 60th itself and

111

00:05:19,680 --> 00:05:08,980

then you know of course the most

112

00:05:27,420 --> 00:05:19,690

important is the Ames 80th Jim

113

00:05:28,530 --> 00:05:27,430

brightenstein talking to us well this

114

00:05:30,060 --> 00:05:28,540

whole episode we're gonna be bringing

115

00:05:32,030 --> 00:05:30,070

out people who are gonna be bringing out

116

00:05:34,740 --> 00:05:32,040

gifts and talking about the different

117

00:05:37,020 --> 00:05:34,750

gifts as you could say that NASA Ames

118

00:05:38,970 --> 00:05:37,030

has contributed to NASA's mission but of

119

00:05:40,320 --> 00:05:38,980

all of the things Dave what would you

120

00:05:43,380 --> 00:05:40,330

what would you come up with like what is

121

00:05:44,760 --> 00:05:43,390

the most impactful or your favorite what

122

00:05:47,550 --> 00:05:44,770

comes to mind when you think about the

123

00:05:47,970 --> 00:05:47,560

gifts so Ames is the gift that keeps on

124

00:05:51,060 --> 00:05:47,980

giving

125

00:05:52,170 --> 00:05:51,070

we have done so much over the years you

126
00:05:56,970 --> 00:05:52,180
know you asked me this question and I

127
00:05:58,620 --> 00:05:56,980
can't we were the first in hypersonic

128
00:06:00,690 --> 00:05:58,630
research we were the first that came up

129
00:06:02,520 --> 00:06:00,700
with a blunt body that basically the

130
00:06:03,900 --> 00:06:02,530
shape of the spacecraft so you can come

131
00:06:05,040 --> 00:06:03,910
into the atmosphere and slow down we did

132
00:06:07,110 --> 00:06:05,050
the first high-performance

133
00:06:08,910 --> 00:06:07,120
supercomputing we do quantum computing

134
00:06:11,340 --> 00:06:08,920
now with the first telescope in the back

135
00:06:12,690 --> 00:06:11,350
of an airplane we do thermal protection

136
00:06:15,270 --> 00:06:12,700
systems to allow us to slow in the

137
00:06:17,250 --> 00:06:15,280
atmosphere we do the first AI in space

138
00:06:19,050 --> 00:06:17,260

we have done so much here and we will

139

00:06:20,640 --> 00:06:19,060

continue to do so much we do the air

140

00:06:23,310 --> 00:06:20,650

traffic management software tools for

141

00:06:24,720 --> 00:06:23,320

the rest of the NASA and the FAA so the

142

00:06:27,210 --> 00:06:24,730

phenomenal breadth of the stuff we do

143

00:06:29,610 --> 00:06:27,220

here at space biology astrobiology life

144

00:06:31,200 --> 00:06:29,620

sciences it's just it's it's

145

00:06:33,480 --> 00:06:31,210

mind-boggling which is why it's such a

146

00:06:34,980 --> 00:06:33,490

great place to work why NASA is still

147

00:06:38,160 --> 00:06:34,990

number one in the federal government to

148

00:06:39,870 --> 00:06:38,170

be the best place to work a little known

149

00:06:42,240 --> 00:06:39,880

fact and I'm not sure will document it

150

00:06:45,960 --> 00:06:42,250

because it's probably not Ames is the

151
00:06:47,580 --> 00:06:45,970
best place to work within NASA I know

152
00:06:51,420 --> 00:06:47,590
that but I will assert that until proven

153
00:06:56,400 --> 00:06:54,990
others deal with that nice I do have to

154
00:06:58,740 --> 00:06:56,410
say can we get a first shout out from

155
00:07:04,620 --> 00:06:58,750
little fox one he said hi Dave so cool

156
00:07:08,310 --> 00:07:04,630
in the Hat thank you sleepy underscore

157
00:07:10,470 --> 00:07:08,320
Gary was like Santa hat and I liked her

158
00:07:12,360 --> 00:07:10,480
honest games with the number one from

159
00:07:17,250 --> 00:07:12,370
fortnight that's an awesome emote that

160
00:07:19,860 --> 00:07:17,260
you have going on there like so we're

161
00:07:21,690 --> 00:07:19,870
looking at the 80th a whole bunch of

162
00:07:22,950 --> 00:07:21,700
stuff that Ames has been working on so

163
00:07:24,660 --> 00:07:22,960

and you've talked about a lot of the

164

00:07:25,920 --> 00:07:24,670

accomplishments things that the Ames has

165

00:07:28,650 --> 00:07:25,930

done what do you have what you thinking

166

00:07:29,880 --> 00:07:28,660

going forward what's kind of so that's

167

00:07:32,040 --> 00:07:29,890

one of our big things is we're looking

168

00:07:33,300 --> 00:07:32,050

at we just finished our first 79 we're

169

00:07:35,340 --> 00:07:33,310

in our youth year what are we gonna do

170

00:07:36,300 --> 00:07:35,350

in our next 80 right I mean that that's

171

00:07:38,820 --> 00:07:36,310

the real challenge this is a real

172

00:07:40,290 --> 00:07:38,830

challenge for NASA to just finished our

173

00:07:42,360 --> 00:07:40,300

first 60 what we're gonna do in our next

174

00:07:43,890 --> 00:07:42,370

60 we have so much to do you know the

175

00:07:45,900 --> 00:07:43,900

great thing about space is there's

176
00:07:51,480 --> 00:07:45,910
always more of it yes you can always go

177
00:07:53,550 --> 00:07:51,490
farther up yes we do now we're going

178
00:07:55,860 --> 00:07:53,560
we're gonna put a lot more stuff in the

179
00:07:56,520 --> 00:07:55,870
called cislunar space between the Earth

180
00:07:58,950 --> 00:07:56,530
and the moon

181
00:08:00,780 --> 00:07:58,960
you're gonna we have things going up on

182
00:08:02,250 --> 00:08:00,790
Mars we just landed inside on mars names

183
00:08:04,980 --> 00:08:02,260
as part of that doing the analysis try

184
00:08:07,740 --> 00:08:04,990
to get into the yes atmosphere right

185
00:08:10,500 --> 00:08:07,750
there putting a Mars quake since ometer

186
00:08:12,750 --> 00:08:10,510
in there it's a it's great stuff we've

187
00:08:14,480 --> 00:08:12,760
got so much more to do there's the ocean

188
00:08:16,620 --> 00:08:14,490

worlds you're gonna do every guy's ten a

189

00:08:18,380 --> 00:08:16,630

thing on the ocean worlds yet I think

190

00:08:24,060 --> 00:08:18,390

it's in the works

191

00:08:26,460 --> 00:08:24,070

this is there are there are 29 planets

192

00:08:28,560 --> 00:08:26,470

in our solar system that have much more

193

00:08:33,240 --> 00:08:28,570

water than we do you got the stuff we

194

00:08:35,430 --> 00:08:33,250

can do another shout out and cave on is

195

00:08:36,450 --> 00:08:35,440

over in the chat on at NASA so for the

196

00:08:38,520 --> 00:08:36,460

folks if you're putting in those

197

00:08:40,980 --> 00:08:38,530

questions cave on is actually be at NASA

198

00:08:42,540 --> 00:08:40,990

so be nice to him but also there's a

199

00:08:44,810 --> 00:08:42,550

shout out for Danielle we had the more

200

00:08:47,310 --> 00:08:44,820

planets and stars video that Danielle

201
00:08:50,130 --> 00:08:47,320
dealer of course we've discovered so

202
00:08:52,560 --> 00:08:50,140
much that literally there are more

203
00:08:54,420 --> 00:08:52,570
planets and stars in the universe and in

204
00:08:56,970 --> 00:08:54,430
the galaxy and it's just mind-boggling

205
00:08:58,020 --> 00:08:56,980
yeah it's a it's like we have a couple

206
00:08:59,640 --> 00:08:58,030
people were gonna be coming on out

207
00:09:02,940 --> 00:08:59,650
talking about that we're gonna be

208
00:09:04,699 --> 00:09:02,950
talking about aeronautics space biology

209
00:09:07,460 --> 00:09:04,709
we have a whole slew of

210
00:09:09,530 --> 00:09:07,470
so we're stuck this is gonna be fun and

211
00:09:12,110 --> 00:09:09,540
you know what the actual people that

212
00:09:15,439 --> 00:09:12,120
know are hiding behind the walls over

213
00:09:16,850 --> 00:09:15,449

there yes people are in the chat in the

214

00:09:18,889 --> 00:09:16,860

chat you can't really see it but just

215

00:09:20,240 --> 00:09:18,899

over that way we have a whole room full

216

00:09:22,309 --> 00:09:20,250

of people who are on deck

217

00:09:23,720 --> 00:09:22,319

so speaking of which about time Daniel

218

00:09:25,670 --> 00:09:23,730

we might move along I think it is I

219

00:09:26,840 --> 00:09:25,680

think it's finally time for us to say

220

00:09:30,410 --> 00:09:26,850

goodbye a day well I really appreciate

221

00:09:33,110 --> 00:09:30,420

that I'm gonna have to retreat it serves

222

00:09:35,480 --> 00:09:33,120

a purpose there's a role for the Hat

223

00:09:38,360 --> 00:09:35,490

while I'm gone and and I thank you so

224

00:09:41,240 --> 00:09:38,370

much for including me I was great fun on

225

00:09:51,019 --> 00:09:41,250

behalf of Ames I appreciate the viewing

226

00:09:52,189 --> 00:09:51,029

audience so don't forget we have a new

227

00:09:53,930 --> 00:09:52,199

site where you can get all the

228

00:09:56,800 --> 00:09:53,940

information about our Stroh schedule

229

00:09:59,240 --> 00:09:56,810

links to our past episodes as well as

230

00:10:01,819 --> 00:09:59,250

checking out some of these old episodes

231

00:10:05,689 --> 00:10:01,829

and you can visit our URL it's gonna be

232

00:10:08,509 --> 00:10:05,699

nasa.gov backslash Ames NASA in Silicon

233

00:10:10,280 --> 00:10:08,519

Valley live all right so while we're

234

00:10:13,400 --> 00:10:10,290

waiting for the next person who's on

235

00:10:17,389 --> 00:10:13,410

deck to be coming on over I think Avon's

236

00:10:19,069 --> 00:10:17,399

gonna be sending them on over the way so

237

00:10:24,680 --> 00:10:19,079

I think it's about time so let's go

238

00:10:27,350 --> 00:10:24,690

ahead and welcome out Romana II oh and

239

00:10:31,670 --> 00:10:27,360

we have Kimberly our ego let's begin

240

00:10:35,000 --> 00:10:31,680

folks all right I mean one of our

241

00:10:42,889 --> 00:10:35,010

returning jeopardy champions folks how's

242

00:10:44,480 --> 00:10:42,899

it going so if you can't get on the on

243

00:10:46,850 --> 00:10:44,490

the shot you have to get that that is an

244

00:10:53,449 --> 00:10:46,860

amazing shirt that we have going on not

245

00:10:55,910 --> 00:10:53,459

my stuff yeah everybody loves Pluto New

246

00:10:57,620 --> 00:10:55,920

Horizons but I see up theirs

247

00:11:01,280 --> 00:10:57,630

yeah this is New Horizons flying by

248

00:11:03,530 --> 00:11:01,290

Pluto Oh excellent so we got to jump

249

00:11:04,639 --> 00:11:03,540

into the unboxing and as I said so at

250

00:11:07,160 --> 00:11:04,649

least for me I don't know about for

251
00:11:09,019 --> 00:11:07,170
y'all but at my house growing up when

252
00:11:11,720 --> 00:11:09,029
you opened up gifts you had to wear the

253
00:11:13,670 --> 00:11:11,730
Santa hat it was just a rule so that I'm

254
00:11:15,350 --> 00:11:13,680
gonna maintain that the Santa hat has to

255
00:11:16,680 --> 00:11:15,360
count when you're doing the gifts so the

256
00:11:19,499 --> 00:11:16,690
first one

257
00:11:21,990 --> 00:11:19,509
before we get started please Kimberly

258
00:11:23,160 --> 00:11:22,000
introduce you to our audience tell us a

259
00:11:25,800 --> 00:11:23,170
little bit about what you do here

260
00:11:27,600 --> 00:11:25,810
I'm dr. Kimberly Annika Smith I'm a

261
00:11:28,290 --> 00:11:27,610
research astrophysicists here at NASA

262
00:11:30,600 --> 00:11:28,300
Ames

263
00:11:33,420 --> 00:11:30,610

so as an astrophysicists I'm studying

264

00:11:36,150 --> 00:11:33,430

the universe but I also and I also

265

00:11:37,889 --> 00:11:36,160

design and review missions for NASA

266

00:11:41,150 --> 00:11:37,899

descend into space to do astrophysics

267

00:11:43,829 --> 00:11:41,160

okay solar system and beyond

268

00:11:45,389 --> 00:11:43,839

well even like the first the first chat

269

00:11:47,009 --> 00:11:45,399

question that comes right out for

270

00:11:48,509 --> 00:11:47,019

Kimberly was like will we see a moon

271

00:11:50,850 --> 00:11:48,519

landing in our lifetime that's from

272

00:11:53,999 --> 00:11:50,860

pogchamp from digital dawn Jerr so

273

00:11:55,740 --> 00:11:54,009

absolutely in fact there is a landing

274

00:11:57,780 --> 00:11:55,750

that's going to happen on the far side

275

00:11:59,400 --> 00:11:57,790

of the Moon by the Chinese Space Agency

276
00:12:01,259 --> 00:11:59,410
next month which is going to be awesome

277
00:12:03,720 --> 00:12:01,269
they're going to a sample return from an

278
00:12:06,179 --> 00:12:03,730
ancient impact crater and so we're all

279
00:12:08,400 --> 00:12:06,189
the world is looking exploration of the

280
00:12:11,189 --> 00:12:08,410
moon is happening today we have orbital

281
00:12:13,019 --> 00:12:11,199
assets involved and Landers in the

282
00:12:16,110 --> 00:12:13,029
future yes man it's gonna be so awesome

283
00:12:19,470 --> 00:12:16,120
are we ready to rock and roll so Matt go

284
00:12:21,660 --> 00:12:19,480
ahead okay so I've learned they told me

285
00:12:25,350 --> 00:12:21,670
to do not shake any of the gifts that

286
00:12:27,960 --> 00:12:25,360
come out and this is this is quite

287
00:12:31,970 --> 00:12:27,970
amazing so I'm gonna pull this bad boy

288
00:12:36,559 --> 00:12:31,980

on out of here and this is very delicate

289

00:12:39,720 --> 00:12:36,569

we're gonna toss that box just over here

290

00:12:45,960 --> 00:12:39,730

so Kimberly why don't you tell everybody

291

00:12:49,259 --> 00:12:45,970

what are we looking at well Matt well

292

00:12:51,689 --> 00:12:49,269

Santa did not bring you coal no but it

293

00:12:55,160 --> 00:12:51,699

looks a little bit slightly different

294

00:12:58,470 --> 00:12:55,170

you have an moon rock

295

00:13:00,509 --> 00:12:58,480

they're not sensing moon this is real

296

00:13:04,949 --> 00:13:00,519

right this is real this is from Apollo

297

00:13:06,509 --> 00:13:04,959

15 the fourth landing that we did with

298

00:13:12,720 --> 00:13:06,519

humans on the moon and it's a sample

299

00:13:14,910 --> 00:13:12,730

return rare precious beautiful 3.4

300

00:13:19,350 --> 00:13:14,920

billion years old taken from the elbow

301
00:13:21,540 --> 00:13:19,360
crater just a piece of history and a

302
00:13:23,910 --> 00:13:21,550
piece of solar system history okay you

303
00:13:25,920 --> 00:13:23,920
know I think we have a really cool photo

304
00:13:27,179 --> 00:13:25,930
that was part of this mission so hey

305
00:13:29,910 --> 00:13:27,189
bill can we get that brought up on

306
00:13:33,229 --> 00:13:31,710
yeah you're at you're looking at

307
00:13:37,530 --> 00:13:33,239
astronaut

308
00:13:40,439 --> 00:13:37,540
Arwen actually Apollo 15 was the first

309
00:13:42,929 --> 00:13:40,449
of our lunar human explorations of the

310
00:13:45,900 --> 00:13:42,939
moon where we were doing proper geology

311
00:13:48,169 --> 00:13:45,910
and you see him digging a trench these

312
00:13:52,429 --> 00:13:48,179
are geologic ease tool geologists tools

313
00:13:55,769 --> 00:13:52,439

and excavating rocks the later Apollo

314

00:13:57,960 --> 00:13:55,779

missions had the Rovers that extended

315

00:14:00,359 --> 00:13:57,970

the range for the astronauts to collect

316

00:14:02,759 --> 00:14:00,369

a variety of rock samples from so many

317

00:14:06,539 --> 00:14:02,769

different terrains and gave us fresh new

318

00:14:08,429 --> 00:14:06,549

insights into the moon Wow and as I

319

00:14:14,129 --> 00:14:08,439

recently learned there's also a lot of

320

00:14:16,349 --> 00:14:14,139

paperwork that goes into keeping and

321

00:14:17,609 --> 00:14:16,359

also has a history you think you look at

322

00:14:18,869 --> 00:14:17,619

this piece of rock you say oh that's a

323

00:14:21,479 --> 00:14:18,879

piece of rock something in my backyard

324

00:14:23,159 --> 00:14:21,489

but just think of what it took to get

325

00:14:24,239 --> 00:14:23,169

something like this and bring it back to

326

00:14:27,780 --> 00:14:24,249

us for us to study

327

00:14:30,119 --> 00:14:27,790

I mean first we had a design a rocket to

328

00:14:31,409 --> 00:14:30,129

leave the earth to get to the moon and

329

00:14:33,869 --> 00:14:31,419

so we had was you know design the

330

00:14:36,150 --> 00:14:33,879

technology to escape the Earth's gravity

331

00:14:37,619 --> 00:14:36,160

then we had to travel a quarter of a

332

00:14:39,989 --> 00:14:37,629

million miles to get to the moon and

333

00:14:41,639 --> 00:14:39,999

know to actually you know get near the

334

00:14:44,249 --> 00:14:41,649

moon within a reasonable amount I know

335

00:14:47,669 --> 00:14:44,259

with accuracy perhaps then orbit the

336

00:14:51,119 --> 00:14:47,679

moon then land on the moon land safely

337

00:14:54,659 --> 00:14:51,129

no big crunch then go excavate and

338

00:14:56,850 --> 00:14:54,669

sample and then bring it back leave the

339

00:15:00,090 --> 00:14:56,860

moon come back to the earth and then

340

00:15:04,799 --> 00:15:00,100

survive reentry a lot of things had to

341

00:15:07,289 --> 00:15:04,809

happen to make this so the chat is all

342

00:15:10,590 --> 00:15:07,299

about like having questions there's one

343

00:15:12,539 --> 00:15:10,600

person sorex surah X is asking is the

344

00:15:14,069 --> 00:15:12,549

cheese from the moon any good which is a

345

00:15:17,100 --> 00:15:14,079

ridiculous question because we learned

346

00:15:18,720 --> 00:15:17,110

on the at Jim bridenstine episode that

347

00:15:20,669 --> 00:15:18,730

the moon is not made of cheese it is

348

00:15:23,609 --> 00:15:20,679

made of barbecue spareribs so I

349

00:15:24,929 --> 00:15:23,619

recommend you go into the on demand on

350

00:15:27,479 --> 00:15:24,939

the twitch chat and you will find that

351

00:15:28,300 --> 00:15:27,489

one kimberly's laughing therefore I

352

00:15:31,780 --> 00:15:28,310

assumed

353

00:15:34,900 --> 00:15:31,790

one of my all-time favorite characters

354

00:15:36,730 --> 00:15:34,910

as well as in Gromit and they do a

355

00:15:38,290 --> 00:15:36,740

picnic on the moon because you know as

356

00:15:40,179 --> 00:15:38,300

British characters they want to have

357

00:15:41,920 --> 00:15:40,189

their you know their tea and they'll

358

00:15:42,970 --> 00:15:41,930

have cheese and biscuits and because

359

00:15:48,850 --> 00:15:42,980

they go to the moon because it has

360

00:15:50,350 --> 00:15:48,860

cheese so this is basalt it's a rock

361

00:15:53,980 --> 00:15:50,360

that would have been created from a

362

00:15:55,780 --> 00:15:53,990

volcanic eruption on on the moon and so

363

00:15:57,850 --> 00:15:55,790

it has a lot of similarities to earth

364

00:15:59,350 --> 00:15:57,860

minerals but they tend to be higher the

365

00:16:01,299 --> 00:15:59,360

moon rocks tend to be higher in iron and

366

00:16:04,629 --> 00:16:01,309

magnesium than their earth equivalents

367

00:16:06,850 --> 00:16:04,639

so rare rare entity here so it's a

368

00:16:08,559 --> 00:16:06,860

couple quick questions I see space TV

369

00:16:10,360 --> 00:16:08,569

net is a reoccurring guest over in the

370

00:16:15,160 --> 00:16:10,370

chat so welcome back was asking how can

371

00:16:17,970 --> 00:16:15,170

i buy that rock you can't but then

372

00:16:21,790 --> 00:16:17,980

another person this is uh let me see

373

00:16:23,559 --> 00:16:21,800

they move around many Miep one asked

374

00:16:25,840 --> 00:16:23,569

what types of hand on things has

375

00:16:29,759 --> 00:16:25,850

kimberly done at NASA and I was gonna

376

00:16:34,030 --> 00:16:32,470

in a previous incarnation of things I do

377

00:16:35,679 --> 00:16:34,040

it now sig is working at NASA I get to

378

00:16:37,179 --> 00:16:35,689

working on a variety for missions and I

379

00:16:38,619 --> 00:16:37,189

was very privileged to working on the

380

00:16:41,110 --> 00:16:38,629

young New Horizons mission that flew by

381

00:16:45,249 --> 00:16:41,120

Pluto and New Horizons gonna fly by a

382

00:16:47,470 --> 00:16:45,259

very old and ancient object in the outer

383

00:16:47,710 --> 00:16:47,480

solar system called MU 69 on New Year's

384

00:16:50,490 --> 00:16:47,720

Day

385

00:16:53,679 --> 00:16:50,500

so in January first stay tuned for the

386

00:16:54,939 --> 00:16:53,689

farthest spacecraft encounter with a

387

00:16:57,100 --> 00:16:54,949

body in our solar system

388

00:16:59,590 --> 00:16:57,110

I mean 69 but yeah I worked on Pluto

389

00:17:01,480 --> 00:16:59,600

beautiful planet geologically active

390

00:17:03,850 --> 00:17:01,490

totally full of surprises no one

391

00:17:06,939 --> 00:17:03,860

expected a world that's the size of the

392

00:17:09,850 --> 00:17:06,949

moon to be so active with glaciers yeah

393

00:17:13,630 --> 00:17:09,860

and I was also fortunate to work on a

394

00:17:15,279 --> 00:17:13,640

mission a few years ago where we

395

00:17:18,760 --> 00:17:15,289

deliberately intersected with the moon

396

00:17:21,850 --> 00:17:18,770

and we discovered water and change the

397

00:17:24,220 --> 00:17:21,860

way we're thinking about how resources

398

00:17:28,510 --> 00:17:24,230

are in the moon and where water came

399

00:17:29,799 --> 00:17:28,520

from um from the original measurements

400

00:17:32,649 --> 00:17:29,809

of the Apollo samples yeah

401
00:17:35,080 --> 00:17:32,659
they were dry what's also very but with

402
00:17:36,639 --> 00:17:35,090
these recent robotic explorations of the

403
00:17:38,710 --> 00:17:36,649
moon we've gone back with more modern

404
00:17:41,529 --> 00:17:38,720
instruments and we've been able to map

405
00:17:44,080 --> 00:17:41,539
and look at different mineralogy and

406
00:17:50,229 --> 00:17:44,090
of the last five robotic missions Ames

407
00:17:51,669 --> 00:17:50,239
has led three of them we then with the

408
00:17:53,320 --> 00:17:51,679
impactor mission that I worked on I

409
00:17:56,080 --> 00:17:53,330
built the payload for that we crashed

410
00:17:58,450 --> 00:17:56,090
into the moon and we discovered water

411
00:18:00,729 --> 00:17:58,460
and again changing the way we do

412
00:18:02,590 --> 00:18:00,739
textbooks understanding the moon it's

413
00:18:04,619 --> 00:18:02,600

also kind of interesting Apollo 15

414

00:18:07,239 --> 00:18:04,629

you're looking at the sample here yeah

415

00:18:10,210 --> 00:18:07,249

during the mission revent recently

416

00:18:14,739 --> 00:18:10,220

researchers have taken samples from the

417

00:18:17,710 --> 00:18:14,749

Apollo 15 16 17 and reanalyze them with

418

00:18:20,469 --> 00:18:17,720

modern instruments and were able to show

419

00:18:23,320 --> 00:18:20,479

that they also have water which had not

420

00:18:26,019 --> 00:18:23,330

been you know imagined it turns out it's

421

00:18:28,060 --> 00:18:26,029

a sampling sensitivity our instruments

422

00:18:30,310 --> 00:18:28,070

now our labs today have much better

423

00:18:33,759 --> 00:18:30,320

sensitivities so you can even probe down

424

00:18:36,549 --> 00:18:33,769

to smaller concentrations and so rocks

425

00:18:38,589 --> 00:18:36,559

like this basalt I don't have water but

426

00:18:41,409 --> 00:18:38,599

they have though hydrogen and oxygen in

427

00:18:43,509 --> 00:18:41,419

form of hydroxyl Oh H and so what's

428

00:18:46,299 --> 00:18:43,519

curious about rocks like this that are

429

00:18:48,879 --> 00:18:46,309

very old is perhaps now the water is

430

00:18:50,619 --> 00:18:48,889

coming from interior of the moon whereas

431

00:18:52,599 --> 00:18:50,629

other measurements of water seemed to be

432

00:18:55,509 --> 00:18:52,609

more surface and so we have may have

433

00:18:56,649 --> 00:18:55,519

multiple theories of how water is on the

434

00:18:58,930 --> 00:18:56,659

moon and then to that same point

435

00:19:00,969 --> 00:18:58,940

Santiago was asking how old is that rock

436

00:19:03,369 --> 00:19:00,979

it's about three and a half billion

437

00:19:05,349 --> 00:19:03,379

years old Wow Wow

438

00:19:07,089 --> 00:19:05,359

so I actually kind of want to circle

439

00:19:08,649 --> 00:19:07,099

back so you mentioned that you know this

440

00:19:10,509 --> 00:19:08,659

is the fourth you know man mission that

441

00:19:11,979 --> 00:19:10,519

we've gone in the moon like how much did

442

00:19:13,719 --> 00:19:11,989

we actually bring back because that's

443

00:19:15,249 --> 00:19:13,729

always a question that folks want to

444

00:19:17,169 --> 00:19:15,259

know and why it's so rare and why you

445

00:19:20,919 --> 00:19:17,179

can buy this at your you know local

446

00:19:22,479 --> 00:19:20,929

store with the six with the human

447

00:19:25,239 --> 00:19:22,489

missions to the moon and we brought

448

00:19:28,479 --> 00:19:25,249

about 2,000 samples or about 800 pounds

449

00:19:30,460 --> 00:19:28,489

of rocks that's it like oh that's all we

450

00:19:32,799 --> 00:19:30,470

have and we have also samples from the

451
00:19:35,289 --> 00:19:32,809
three robotic Soviet missions from that

452
00:19:37,060 --> 00:19:35,299
era as well but it's a very limited

453
00:19:38,499 --> 00:19:37,070
resource and they're also all from the

454
00:19:41,529 --> 00:19:38,509
near side of the moon we don't have any

455
00:19:47,349 --> 00:19:41,539
samples yet from the the far side of the

456
00:19:48,700 --> 00:19:47,359
Moon so how are we doing on time Dan go

457
00:19:50,259 --> 00:19:48,710
crazy on the chat there's tons of

458
00:19:52,659 --> 00:19:50,269
questions coming in have time for about

459
00:19:54,639 --> 00:19:52,669
one more question all right we'll pick

460
00:19:55,299 --> 00:19:54,649
up something okay this is flats three is

461
00:19:57,009 --> 00:19:55,309
asking

462
00:19:59,590 --> 00:19:57,019
really what kind of work will astronauts

463
00:20:03,129 --> 00:19:59,600

do when we go back to the moon as a

464

00:20:04,899 --> 00:20:03,139

great question and well not only

465

00:20:05,889 --> 00:20:04,909

discovering the water and the different

466

00:20:08,440 --> 00:20:05,899

mineralogy

467

00:20:10,810 --> 00:20:08,450

there is a prospect you know prospect

468

00:20:13,600 --> 00:20:10,820

for these elements and these molecules

469

00:20:15,820 --> 00:20:13,610

and to use them for a more sustained

470

00:20:17,470 --> 00:20:15,830

presence on the moon and also by

471

00:20:20,049 --> 00:20:17,480

understanding a little bit more about we

472

00:20:21,749 --> 00:20:20,059

still don't know how the moon formed we

473

00:20:24,570 --> 00:20:21,759

have some hypotheses out there but

474

00:20:26,590 --> 00:20:24,580

further studies to do a lot of

475

00:20:28,060 --> 00:20:26,600

excavations in different areas of the

476
00:20:29,590 --> 00:20:28,070
Moon that we haven't sampled before like

477
00:20:31,720 --> 00:20:29,600
the far side of the Moon and the bottoms

478
00:20:33,580 --> 00:20:31,730
of permanently shadowed craters will be

479
00:20:36,039 --> 00:20:33,590
ripe for exploration we have hardly

480
00:20:37,539 --> 00:20:36,049
touched the surface and a lot of lunar

481
00:20:39,960 --> 00:20:37,549
exploration our nearest neighbor has

482
00:20:42,609 --> 00:20:39,970
been neglected for too long

483
00:20:44,590 --> 00:20:42,619
well thank you Kimberly

484
00:20:46,840 --> 00:20:44,600
as much as we would love to have you

485
00:20:49,149 --> 00:20:46,850
hang around for the rest of the show we

486
00:20:52,930 --> 00:20:49,159
do have some other presents that Matt is

487
00:20:54,129 --> 00:20:52,940
eagerly yes coming my way but this is

488
00:20:55,450 --> 00:20:54,139

like in a short amount of time this is

489

00:20:56,739 --> 00:20:55,460

the second time you're on the show so

490

00:20:58,480 --> 00:20:56,749

I'm feeling we're gonna be seeing a lot

491

00:21:00,399 --> 00:20:58,490

of Kimberly in the future don't forget

492

00:21:01,989 --> 00:21:00,409

we have a past episode if you want to

493

00:21:03,549 --> 00:21:01,999

learn more about NASA's robotics

494

00:21:06,039 --> 00:21:03,559

exploration of the moon you can go ahead

495

00:21:09,039 --> 00:21:06,049

and visit our page that we have set up a

496

00:21:10,659 --> 00:21:09,049

NASA gov backslash Ames backslash NASA

497

00:21:24,489 --> 00:21:10,669

in Silicon Valley live I think they're

498

00:21:40,239 --> 00:21:24,499

also sitting on the on demand if the

499

00:21:43,749 --> 00:21:40,249

rock it's precious okay so up next we're

500

00:21:52,419 --> 00:21:43,759

gonna go ahead and bring out John John

501
00:21:55,299 --> 00:21:52,429
come on down then yes but first can we

502
00:22:05,710 --> 00:21:55,309
go ahead and shout out John's shirt yes

503
00:22:08,600 --> 00:22:05,720
we gotta see Dave should have learned

504
00:22:12,430 --> 00:22:08,610
from John on sport and the awesome

505
00:22:14,840 --> 00:22:12,440
so alright don't be shy on the mic

506
00:22:16,490 --> 00:22:14,850
before we get started so tell us a

507
00:22:17,570 --> 00:22:16,500
little bit about yourself and what you

508
00:22:20,330 --> 00:22:17,580
do here at Ames

509
00:22:21,919 --> 00:22:20,340
okay well I'm dr. John Jenkins and I'm a

510
00:22:24,169 --> 00:22:21,929
research scientist here at Ames Research

511
00:22:29,899 --> 00:22:24,179
Center I also make my own shirts this is

512
00:22:32,299 --> 00:22:29,909
one of them a scientist you have to be

513
00:22:33,529 --> 00:22:32,309

able to design and build things and you

514

00:22:36,200 --> 00:22:33,539

can design and build things that you can

515

00:22:40,009 --> 00:22:36,210

wear as well so that's for exciting but

516

00:22:42,860 --> 00:22:40,019

my day job is to find exoplanets to

517

00:22:47,480 --> 00:22:42,870

discover planets around other Suns in

518

00:22:49,990 --> 00:22:47,490

the neighborhood of the earth okay okay

519

00:22:52,759 --> 00:22:50,000

excellent Kepler has been you know

520

00:22:56,000 --> 00:22:52,769

exoplanets as Danielle already knows has

521

00:22:57,529 --> 00:22:56,010

been quite topic of late but all right

522

00:22:59,330 --> 00:22:57,539

are we going or we jump a night I think

523

00:23:01,460 --> 00:22:59,340

Matt go ahead if you guys can't tell

524

00:23:03,110 --> 00:23:01,470

Danielle's moving things along I'm just

525

00:23:05,120 --> 00:23:03,120

like anxious to like open the stuff up

526
00:23:07,299 --> 00:23:05,130
but another shout out to Melissa art who

527
00:23:10,070 --> 00:23:07,309
was saying that wrapping paper

528
00:23:11,539 --> 00:23:10,080
exclamation point I think did we have a

529
00:23:13,789 --> 00:23:11,549
place where people can go and grab it

530
00:23:18,440 --> 00:23:13,799
and download it you know I think you do

531
00:23:20,450 --> 00:23:18,450
if you go to our page for the podcast

532
00:23:23,360 --> 00:23:20,460
I'm pretty sure you can download this

533
00:23:25,789 --> 00:23:23,370
snazzy wrapping paper so also shout out

534
00:23:28,340 --> 00:23:25,799
to the rest the rest of our comms team

535
00:23:31,129 --> 00:23:28,350
spent last night wrapping all of these

536
00:23:33,649 --> 00:23:31,139
lovely presents that you have you have

537
00:23:36,200 --> 00:23:33,659
here so for the folks in the chat go bug

538
00:23:43,820 --> 00:23:36,210

Kavon and he will hook you up with that

539

00:23:46,490 --> 00:23:43,830

I gotta be ginger with just moving stuff

540

00:23:48,250 --> 00:23:46,500

out of the way as I gently bring it out

541

00:23:50,539 --> 00:23:48,260

cuz I'm not supposed to shake anything

542

00:23:54,139 --> 00:23:50,549

OOP and it's got little like spiny

543

00:23:57,919 --> 00:23:54,149

things so take oh yeah great great shot

544

00:23:59,389 --> 00:23:57,929

Mack here we go and as the camera tries

545

00:24:01,789 --> 00:23:59,399

to follow and I'm slowly gonna bring

546

00:24:05,360 --> 00:24:01,799

this on over to John what are folks

547

00:24:07,970 --> 00:24:05,370

looking at here right so this is NASA's

548

00:24:11,180 --> 00:24:07,980

first planet hunter this is the Kepler

549

00:24:15,289 --> 00:24:11,190

spacecraft which was launched in 2009

550

00:24:17,120 --> 00:24:15,299

and I was up there taking images of

551
00:24:19,700 --> 00:24:17,130
stars and looking for instances where

552
00:24:21,409 --> 00:24:19,710
the stars would wink at us as a planet

553
00:24:22,730 --> 00:24:21,419
cross in front of the face of the star

554
00:24:24,770 --> 00:24:22,740
caused a

555
00:24:26,390 --> 00:24:24,780
a drop in brightness kind of similar to

556
00:24:29,270 --> 00:24:26,400
the total eclipse of the Sun that

557
00:24:31,400 --> 00:24:29,280
happened last year except that it's a

558
00:24:33,260 --> 00:24:31,410
much smaller signal a very weak signal

559
00:24:36,530 --> 00:24:33,270
it's very difficult to detect which is

560
00:24:38,830 --> 00:24:36,540
why we have to launch spacecraft like

561
00:24:41,360 --> 00:24:38,840
this with an exquisitely sensitive

562
00:24:44,720 --> 00:24:41,370
photometers this is a telescope that

563
00:24:46,790 --> 00:24:44,730

measures the brightness of over 160,000

564

00:24:49,760 --> 00:24:46,800

stars during the primary mission and

565

00:24:52,460 --> 00:24:49,770

over the course of nine years the Kepler

566

00:24:56,020 --> 00:24:52,470

spacecraft helped discover over 20 s

567

00:25:02,450 --> 00:24:56,030

about 2700 planets around other stars

568

00:25:04,490 --> 00:25:02,460

okay we have a really cool photo so

569

00:25:06,350 --> 00:25:04,500

please get bill to bring this up and I'd

570

00:25:09,230 --> 00:25:06,360

love to have John you know explain to us

571

00:25:10,760 --> 00:25:09,240

like what are we seeing yeah so Danielle

572

00:25:14,210 --> 00:25:10,770

right now you're looking at

573

00:25:15,980 --> 00:25:14,220

four-and-a-half million stars in this

574

00:25:19,070 --> 00:25:15,990

photo this was the first light image

575

00:25:20,750 --> 00:25:19,080

from Kepler it was snapped a month after

576

00:25:23,180 --> 00:25:20,760

we launched it was our first indication

577

00:25:25,610 --> 00:25:23,190

that Kepler actually worked that

578

00:25:27,350 --> 00:25:25,620

everything looked like we could do

579

00:25:29,720 --> 00:25:27,360

the job and complete the mission and

580

00:25:33,170 --> 00:25:29,730

find planets it's an absolutely gorgeous

581

00:25:34,970 --> 00:25:33,180

view I've got one 400th of the sky all

582

00:25:36,350 --> 00:25:34,980

at once so it's about the size of the

583

00:25:38,330 --> 00:25:36,360

palm of your hand held at arm's length

584

00:25:43,340 --> 00:25:38,340

if you go out look up at the night sky

585

00:25:45,500 --> 00:25:43,350

tonight and we chose 160,000 stars in

586

00:25:48,650 --> 00:25:45,510

this field of you to observe over four

587

00:25:51,050 --> 00:25:48,660

years looking for planets and indeed we

588

00:25:52,280 --> 00:25:51,060

were very successful of that so there

589

00:25:54,080 --> 00:25:52,290

was a question that came up for Dave a

590

00:25:57,020 --> 00:25:54,090

while back but I think this is relevant

591

00:25:58,610 --> 00:25:57,030

to Kepler as well it asked how can the

592

00:26:00,560 --> 00:25:58,620

research community contribute to the

593

00:26:03,320 --> 00:26:00,570

space research without having access to

594

00:26:05,690 --> 00:26:03,330

resources that NASA does but and I know

595

00:26:08,030 --> 00:26:05,700

like scientific community is a big part

596

00:26:09,860 --> 00:26:08,040

of what like Kepler was doing and you

597

00:26:12,200 --> 00:26:09,870

know as the mission is recently ended

598

00:26:14,090 --> 00:26:12,210

but still like like even now the

599

00:26:15,410 --> 00:26:14,100

scientific community is a huge part of

600

00:26:19,220 --> 00:26:15,420

the science it's still being like

601
00:26:22,190 --> 00:26:19,230
crunched oh absolutely so we ignited the

602
00:26:25,040 --> 00:26:22,200
fire of the exoplanet community and had

603
00:26:26,900 --> 00:26:25,050
over 600 scientists in Europe that

604
00:26:29,180 --> 00:26:26,910
actually were very much interested in

605
00:26:31,100 --> 00:26:29,190
the Stars so Kepler not only found

606
00:26:33,230 --> 00:26:31,110
planets but also revolutionized the

607
00:26:35,420 --> 00:26:33,240
field of asteroseismology that's the

608
00:26:35,869 --> 00:26:35,430
study of star quakes and it's amazing

609
00:26:38,779 --> 00:26:35,879
because

610
00:26:40,939 --> 00:26:38,789
you can measure the oscillations of

611
00:26:43,099 --> 00:26:40,949
stars they kind of are like big bowls of

612
00:26:45,949 --> 00:26:43,109
jell-o that shake and they have star

613
00:26:48,199 --> 00:26:45,959

quakes they oscillate they're kind of a

614

00:26:49,969 --> 00:26:48,209

bell ring like bells and if you can

615

00:26:51,829 --> 00:26:49,979

measure the frequency of the Bell you

616

00:26:55,249 --> 00:26:51,839

can determine the size and the mass of

617

00:26:57,529 --> 00:26:55,259

it so so this is amazing the Omni / 79

618

00:26:59,659 --> 00:26:57,539

just chimed in with NASA how can you

619

00:27:03,829 --> 00:26:59,669

determine if the bright dot is a star or

620

00:27:06,019 --> 00:27:03,839

a galaxy right so in most cases you can

621

00:27:07,969 --> 00:27:06,029

tell the difference but because galaxies

622

00:27:10,849 --> 00:27:07,979

are not point sources they actually are

623

00:27:24,889 --> 00:27:10,859

the light is distributed over a region

624

00:27:27,169 --> 00:27:24,899

or fuzzy yeah question that somebody

625

00:27:29,629 --> 00:27:27,179

asked was how can people contribute to

626
00:27:31,999 --> 00:27:29,639
exoplanet science and in fact both with

627
00:27:33,709 --> 00:27:32,009
Kepler but also with NASA's newest

628
00:27:35,509 --> 00:27:33,719
mission to find Earth's nearest

629
00:27:37,069 --> 00:27:35,519
neighbors the transiting exoplanet

630
00:27:40,399 --> 00:27:37,079
survey satellite which just launched

631
00:27:43,309 --> 00:27:40,409
last April there is a universe project

632
00:27:46,430 --> 00:27:43,319
called planet hunters and so citizen

633
00:27:49,219 --> 00:27:46,440
scientists can take the data that we've

634
00:27:53,509 --> 00:27:49,229
collected from the Kepler spacecraft and

635
00:27:55,159 --> 00:27:53,519
now from Tess and help identify planets

636
00:27:58,729 --> 00:27:55,169
and other interesting Astrophysical

637
00:28:00,169 --> 00:27:58,739
phenomena in the light curves nice well

638
00:28:02,239 --> 00:28:00,179

that was like I was teasing Danielle

639

00:28:03,589 --> 00:28:02,249

earlier because we'd put out a video

640

00:28:04,969 --> 00:28:03,599

it's if the folks are watching on

641

00:28:06,169 --> 00:28:04,979

YouTube it's somewhere in that leaves

642

00:28:07,969 --> 00:28:06,179

one of the latest videos we pulled up

643

00:28:10,279 --> 00:28:07,979

was an animation where we talked about

644

00:28:12,349 --> 00:28:10,289

the star wash and how the scientific

645

00:28:14,299 --> 00:28:12,359

community gets that data and cleans it

646

00:28:16,189 --> 00:28:14,309

up I'm no cape on her I had it lined up

647

00:28:18,109 --> 00:28:16,199

for it for the chat but at some point

648

00:28:20,419 --> 00:28:18,119

he's like crunching and getting all this

649

00:28:22,729 --> 00:28:20,429

thing folks if you want it go demand it

650

00:28:25,249 --> 00:28:22,739

from Kavon if you want that link and so

651
00:28:26,989 --> 00:28:25,259
the star wash actually illustrates one

652
00:28:29,419 --> 00:28:26,999
of the biggest contributions the Ames

653
00:28:32,119 --> 00:28:29,429
makes to exoplanet science that is not

654
00:28:34,219 --> 00:28:32,129
only did Ames manage the flight

655
00:28:36,619 --> 00:28:34,229
operations of the Kepler spacecraft and

656
00:28:38,959 --> 00:28:36,629
the instrument but we also processed all

657
00:28:40,639 --> 00:28:38,969
the data so my job was to design and

658
00:28:42,739 --> 00:28:40,649
build that the science pipeline which is

659
00:28:44,839 --> 00:28:42,749
is the software that we use to crunch

660
00:28:46,849 --> 00:28:44,849
all that all the numbers all that all

661
00:28:49,520 --> 00:28:46,859
the images that come down from the

662
00:28:52,010 --> 00:28:49,530
spacecraft and to identify the telltale

663
00:28:55,310 --> 00:28:52,020

signatures of the planets in that data

664

00:28:58,570 --> 00:28:55,320

and it's a really big job and in fact we

665

00:29:00,440 --> 00:28:58,580

use the facility here the NASA the

666

00:29:02,480 --> 00:29:00,450

supercomputer then played a

667

00:29:04,700 --> 00:29:02,490

supercomputer to do a lot of the number

668

00:29:06,500 --> 00:29:04,710

crunching so you know you brought up

669

00:29:09,110 --> 00:29:06,510

tests and we actually have a really cool

670

00:29:16,010 --> 00:29:09,120

animation so bill can we get that up on

671

00:29:17,030 --> 00:29:16,020

screen please oh no not ready for it but

672

00:29:21,130 --> 00:29:17,040

when they are any point they're gonna

673

00:29:27,290 --> 00:29:24,680

from d'Alene asks how does John how does

674

00:29:28,820 --> 00:29:27,300

Kepler make pictures how does Kepler

675

00:29:30,620 --> 00:29:28,830

make pictures well if you're able to

676

00:29:33,380 --> 00:29:30,630

stare down the barrel of this telescope

677

00:29:36,980 --> 00:29:33,390

you would be able to see a focal plane

678

00:29:39,200 --> 00:29:36,990

that's about a foot across and it has 42

679

00:29:41,570 --> 00:29:39,210

charged coupled devices these are called

680

00:29:43,880 --> 00:29:41,580

CC DS and they're essentially light

681

00:29:45,350 --> 00:29:43,890

sensitive computer chips in fact you

682

00:29:48,350 --> 00:29:45,360

have one in every one of your cell

683

00:29:51,260 --> 00:29:48,360

phones or digital digital camcorders or

684

00:29:54,020 --> 00:29:51,270

cameras yeah and and in this case for

685

00:29:55,370 --> 00:29:54,030

Kepler are our chips are one inches by

686

00:29:57,710 --> 00:29:55,380

two inches so they're much bigger than

687

00:30:01,790 --> 00:29:57,720

the CCDs that you have in your phone and

688

00:30:04,340 --> 00:30:01,800

electronics right but so essentially

689

00:30:06,590 --> 00:30:04,350

this is a digital camera but with a very

690

00:30:08,330 --> 00:30:06,600

large focal plane and just to give you a

691

00:30:10,850 --> 00:30:08,340

sense of the size and scale of this

692

00:30:13,280 --> 00:30:10,860

instrument the backside the bottom of

693

00:30:16,070 --> 00:30:13,290

this telescope which is the primary

694

00:30:20,450 --> 00:30:16,080

mirror back here is 1.4 meters across

695

00:30:23,180 --> 00:30:20,460

and the aperture here is 0.95 meters so

696

00:30:25,610 --> 00:30:23,190

it's about about 30 it's about a yard

697

00:30:28,930 --> 00:30:25,620

across so that tells you the size of

698

00:30:31,730 --> 00:30:28,940

this telescope and it's able to make

699

00:30:33,650 --> 00:30:31,740

what I consider be beautiful images of

700

00:30:36,050 --> 00:30:33,660

the sky although from an astronomical

701
00:30:38,540 --> 00:30:36,060
perspective they're not terribly sharp

702
00:30:40,640 --> 00:30:38,550
because we're not about making pretty

703
00:30:42,080 --> 00:30:40,650
pictures we're about measuring the

704
00:30:44,540 --> 00:30:42,090
brightness of the stars so that we can

705
00:30:46,970 --> 00:30:44,550
actually measure the small drops and

706
00:30:49,190 --> 00:30:46,980
brightness or responding to when planets

707
00:30:51,440 --> 00:30:49,200
cross the face of their star but the

708
00:30:53,480 --> 00:30:51,450
exquisite sensitivity and dynamic range

709
00:30:55,670 --> 00:30:53,490
of this instrument allow us to study all

710
00:30:58,010 --> 00:30:55,680
kinds of phenomena not just planets not

711
00:31:00,710 --> 00:30:58,020
just stars but also we're able to catch

712
00:31:03,410 --> 00:31:00,720
stars and active of going supernova and

713
00:31:06,380 --> 00:31:03,420

and we're able to study galactic or

714

00:31:08,620 --> 00:31:06,390

geology by doing asteroseismology of

715

00:31:11,030 --> 00:31:08,630

lots of different kinds of stars

716

00:31:13,670 --> 00:31:11,040

especially during the k2 mission which

717

00:31:16,640 --> 00:31:13,680

was the mission a second version of

718

00:31:18,110 --> 00:31:16,650

Kepler after we lost two of our reaction

719

00:31:20,510 --> 00:31:18,120

wheels unfortunately we had to stop

720

00:31:22,840 --> 00:31:20,520

there's a the primary mission and here's

721

00:31:25,790 --> 00:31:22,850

where the reaction wheels are down here

722

00:31:28,640 --> 00:31:25,800

but we were able to thanks to a very

723

00:31:31,040 --> 00:31:28,650

clever engineer at Ball Aerospace design

724

00:31:33,440 --> 00:31:31,050

a mission whereby we could point the

725

00:31:36,500 --> 00:31:33,450

spacecraft in along the line of sight in

726

00:31:38,450 --> 00:31:36,510

its orbit and continue the mission but

727

00:31:39,560 --> 00:31:38,460

instead of observing the kepler field of

728

00:31:41,810 --> 00:31:39,570

view during that we observe during the

729

00:31:43,910 --> 00:31:41,820

primary mission and we observed over a

730

00:31:46,460 --> 00:31:43,920

dozen fields of view along the ecliptic

731

00:31:49,790 --> 00:31:46,470

as the spacecraft orbited the Sun it's

732

00:31:51,980 --> 00:31:49,800

pretty cool so we have Delano 316 we are

733

00:31:54,410 --> 00:31:51,990

in the twitch chat and we see you

734

00:31:56,240 --> 00:31:54,420

he felt like we were we almost said his

735

00:31:57,920 --> 00:31:56,250

name but didn't quite do it but yeah

736

00:32:00,070 --> 00:31:57,930

jump on into the chat send in your

737

00:32:02,660 --> 00:32:00,080

questions like in fact we have one from

738

00:32:04,940 --> 00:32:02,670

electromagnetism as asking John why do

739

00:32:05,510 --> 00:32:04,950

we see stars as they as they were in the

740

00:32:07,040 --> 00:32:05,520

past

741

00:32:09,410 --> 00:32:07,050

how does scientists factor this

742

00:32:11,750 --> 00:32:09,420

information in their studies right so

743

00:32:13,670 --> 00:32:11,760

everything you look at is happening in

744

00:32:16,130 --> 00:32:13,680

the past even as you talk to somebody

745

00:32:17,930 --> 00:32:16,140

across the room from you because light

746

00:32:20,930 --> 00:32:17,940

travels at a finite speed although it's

747

00:32:23,870 --> 00:32:20,940

very fast right so the nearest star

748

00:32:25,880 --> 00:32:23,880

system to us the Alpha Centauri system

749

00:32:28,310 --> 00:32:25,890

actually one of the things we learned

750

00:32:29,600 --> 00:32:28,320

from Kepler was that that there are more

751

00:32:31,610 --> 00:32:29,610

planets than there are stars that

752

00:32:33,350 --> 00:32:31,620

planets are ubiquitous and based on the

753

00:32:35,600 --> 00:32:33,360

statistics how that Kepler mission we

754

00:32:36,800 --> 00:32:35,610

predicted that the nearest earth-sized

755

00:32:38,660 --> 00:32:36,810

planet was probably just around the

756

00:32:41,780 --> 00:32:38,670

corner and indeed it turns out that the

757

00:32:45,650 --> 00:32:41,790

closest star to the Sun Proxima Centauri

758

00:32:48,620 --> 00:32:45,660

has a near earth mass planet in a very

759

00:32:51,680 --> 00:32:48,630

tight orbit about that star so it takes

760

00:32:54,110 --> 00:32:51,690

4.2 years for that light to reach us and

761

00:32:56,900 --> 00:32:54,120

so that means that everything we see

762

00:32:59,750 --> 00:32:56,910

there is as four years in the past most

763

00:33:02,000 --> 00:32:59,760

of Kepler's targets were 1,000 to 3,000

764

00:33:04,340 --> 00:33:02,010

light years away so that means that that

765

00:33:07,280 --> 00:33:04,350

when you see a transit it happened 1,000

766

00:33:08,870 --> 00:33:07,290

to 3,000 years ago from a science

767

00:33:12,980 --> 00:33:08,880

perspective that's not very important

768

00:33:14,750 --> 00:33:12,990

for exoplanets but we do time the

769

00:33:17,600 --> 00:33:14,760

transits of the exoplanets because if

770

00:33:19,520 --> 00:33:17,610

the timing of the transits vary

771

00:33:20,660 --> 00:33:19,530

could be that this that the planets are

772

00:33:22,789 --> 00:33:20,670

tugging on each other and you can

773

00:33:24,470 --> 00:33:22,799

actually use that information the delays

774

00:33:26,960 --> 00:33:24,480

or advances in the timing of the

775

00:33:28,549 --> 00:33:26,970

transits to infer the masses of some of

776

00:33:29,390 --> 00:33:28,559

these planets and that's that's really

777

00:33:33,590 --> 00:33:29,400

cool as well

778

00:33:35,299 --> 00:33:33,600

but what makes Kepler so successful is

779

00:33:37,850 --> 00:33:35,309

that's opened the door to a lot of other

780

00:33:41,680 --> 00:33:37,860

missions so that you know I've worked on

781

00:33:47,299 --> 00:33:41,690

Kepler for 23 years 23 24 25 years ago

782

00:33:49,310 --> 00:33:47,309

this was kind of fun this was a this was

783

00:33:51,620 --> 00:33:49,320

a French concept it wasn't mainstream in

784

00:33:53,930 --> 00:33:51,630

fact one of the first astronomical

785

00:33:56,720 --> 00:33:53,940

meetings I went to with a poster about

786

00:33:58,669 --> 00:33:56,730

Kepler there were no exoplanet sessions

787

00:34:00,049 --> 00:33:58,679

I was put in the miscellaneous poster

788

00:34:03,799 --> 00:34:00,059

session right next to a face on Mars

789

00:34:07,250 --> 00:34:03,809

poster so that's where that's where the

790

00:34:08,780 --> 00:34:07,260

field was 25 years ago but today we have

791

00:34:11,149 --> 00:34:08,790

we have the Kepler mission the k2

792

00:34:12,950 --> 00:34:11,159

mission we have the the test mission we

793

00:34:14,119 --> 00:34:12,960

have James Webb going up in a couple of

794

00:34:16,700 --> 00:34:14,129

years it's going to follow up and

795

00:34:19,250 --> 00:34:16,710

characterize the atmospheres of many of

796

00:34:21,050 --> 00:34:19,260

the planets that we find through the

797

00:34:23,780 --> 00:34:21,060

test mission test is about finding

798

00:34:25,340 --> 00:34:23,790

Earth's closest cousins most of Kepler

799

00:34:26,840 --> 00:34:25,350

planets we only know the size of the

800

00:34:28,940 --> 00:34:26,850

planet we don't know much more about it

801
00:34:31,760 --> 00:34:28,950
with tests we're looking at the whole

802
00:34:34,720 --> 00:34:31,770
sky so take kepler Kepler's field of

803
00:34:36,649 --> 00:34:34,730
view multiply it by 400 oh wow right

804
00:34:38,690 --> 00:34:36,659
that's right so the planets are going to

805
00:34:40,159 --> 00:34:38,700
be found around stars that are ten times

806
00:34:42,230 --> 00:34:40,169
closer a hundred times brighter that

807
00:34:43,909 --> 00:34:42,240
means we can put lots of telescopes on

808
00:34:45,800 --> 00:34:43,919
these new planets that we're going to

809
00:34:48,050 --> 00:34:45,810
find and learn much more about them

810
00:34:49,399 --> 00:34:48,060
including their mass their density once

811
00:34:51,349 --> 00:34:49,409
you have the density you can argue what

812
00:34:52,879 --> 00:34:51,359
they're made of and eventually we're

813
00:34:55,070 --> 00:34:52,889

going to learn what their atmospheres

814

00:34:57,670 --> 00:34:55,080

are made of and look for bio signatures

815

00:35:02,270 --> 00:34:57,680

look look for chemical signatures of

816

00:35:03,410 --> 00:35:02,280

oxygen methane carbon dioxide that runs

817

00:35:05,330 --> 00:35:03,420

into one of the questions from Rep

818

00:35:07,430 --> 00:35:05,340

Atilla who is asking eventually you guys

819

00:35:09,080 --> 00:35:07,440

will discover life outside earth do you

820

00:35:11,000 --> 00:35:09,090

guys think you're close to it like in

821

00:35:16,099 --> 00:35:11,010

the next couple of years so what's your

822

00:35:17,570 --> 00:35:16,109

opinion do you think not what is I think

823

00:35:20,300 --> 00:35:17,580

it's gonna be a race so the question is

824

00:35:22,400 --> 00:35:20,310

are we gonna find signs of life inside

825

00:35:24,650 --> 00:35:22,410

our own solar system perhaps in the last

826
00:35:27,620 --> 00:35:24,660
couple years in the next couple years or

827
00:35:29,780 --> 00:35:27,630
decades as we explore the solar system

828
00:35:30,740 --> 00:35:29,790
in these water worlds like Europa or are

829
00:35:33,890 --> 00:35:30,750
we going to find

830
00:35:35,570 --> 00:35:33,900
of life in that Monsieur planets so

831
00:35:37,790 --> 00:35:35,580
these are both worthy goals NASA is

832
00:35:40,700 --> 00:35:37,800
going full-bore towards understanding

833
00:35:42,350 --> 00:35:40,710
and learning whether there's life extent

834
00:35:44,480 --> 00:35:42,360
elsewhere in our own solar system

835
00:35:46,130 --> 00:35:44,490
and we're also proceeding with the

836
00:35:48,800 --> 00:35:46,140
technology with missions that eventually

837
00:35:50,420 --> 00:35:48,810
will allow us to at attempt to answer

838
00:35:54,320 --> 00:35:50,430

the question is there life outside of

839

00:35:55,400 --> 00:35:54,330

Earth around these other planets so we

840

00:35:56,770 --> 00:35:55,410

have a bunch of questions in the chat

841

00:35:59,120 --> 00:35:56,780

Danielle what are we looking at

842

00:36:02,990 --> 00:35:59,130

unfortunately we cannot get to them

843

00:36:04,910 --> 00:36:03,000

right now but go for it but I'm pretty

844

00:36:07,370 --> 00:36:04,920

sure we're gonna have a future episode

845

00:36:08,720 --> 00:36:07,380

where we talk all things Kepler's so you

846

00:36:10,700 --> 00:36:08,730

guys will have to go ahead and hold on

847

00:36:12,830 --> 00:36:10,710

to those questions at another time and

848

00:36:14,690 --> 00:36:12,840

unfortunately John we are going to have

849

00:36:16,310 --> 00:36:14,700

to say goodbye I'm so sorry

850

00:36:18,830 --> 00:36:16,320

well that's okay it's been my pleasure

851
00:36:23,030 --> 00:36:18,840
and Merry Christmas and Happy Holidays

852
00:36:26,660 --> 00:36:23,040
to everybody all right who do we have

853
00:36:29,060 --> 00:36:26,670
coming up next in now we have Eduardo

854
00:36:31,850 --> 00:36:29,070
he's going to go ahead and talk to us

855
00:36:34,760 --> 00:36:31,860
about his cool area of research so

856
00:36:41,600 --> 00:36:34,770
Eduardo go ahead and come on out

857
00:36:43,640 --> 00:36:41,610
excellent oh it is bringing gifts I'm

858
00:36:47,570 --> 00:36:43,650
doing awesome I've been getting presents

859
00:36:50,150 --> 00:36:47,580
all day this is so tell us a little bit

860
00:36:52,160 --> 00:36:50,160
about what you do here at Ames well my

861
00:36:53,960 --> 00:36:52,170
name is Eduardo Benedict and I work here

862
00:36:57,320 --> 00:36:53,970
at Ames as a research scientist

863
00:37:00,500 --> 00:36:57,330

developing new technologies to image

864

00:37:03,140 --> 00:37:00,510

exoplanet to image planets beyond our

865

00:37:05,570 --> 00:37:03,150

solar system so basically is

866

00:37:08,000 --> 00:37:05,580

complementing what Givens was explaining

867

00:37:16,460 --> 00:37:08,010

about Kepler almost like we plan to that

868

00:37:17,900 --> 00:37:16,470

transition all right so this is all

869

00:37:28,940 --> 00:37:17,910

right let's see let's see when Eduardo

870

00:37:31,850 --> 00:37:28,950

has brought for us here we go all right

871

00:37:35,579 --> 00:37:31,860

I know I was like freaking out like

872

00:37:40,680 --> 00:37:35,589

don't spin it around too many times bro

873

00:37:44,249 --> 00:37:40,690

no shaking okay and what we have here

874

00:37:49,789 --> 00:37:44,259

and I will hand this over to you Wow and

875

00:37:54,630 --> 00:37:49,799

it that's got some weight to it okay so

876

00:37:59,690 --> 00:37:54,640

lookie lookie what do we got here there

877

00:38:02,459 --> 00:37:59,700

you go so what we have here is the

878

00:38:05,370 --> 00:38:02,469

critical part of a coronagraph a

879

00:38:08,069 --> 00:38:05,380

chronograph is the new technology that

880

00:38:10,499 --> 00:38:08,079

will allow us to see planets around

881

00:38:13,559 --> 00:38:10,509

other stars now will allow us to

882

00:38:15,269 --> 00:38:13,569

separate the light of the star from the

883

00:38:17,729 --> 00:38:15,279

light of the planet okay

884

00:38:20,009 --> 00:38:17,739

the coolest I know you have an awesome

885

00:38:26,789 --> 00:38:20,019

trick with this camera where you line it

886

00:38:29,130 --> 00:38:26,799

up perfectly with your eye Jesse and

887

00:38:31,920 --> 00:38:29,140

Mark are gonna try to line this on up if

888

00:38:35,039 --> 00:38:31,930

I aim to the camera probably you'll see

889

00:38:39,690 --> 00:38:35,049

my eye they're getting deformed and

890

00:38:43,920 --> 00:38:39,700

that's because the system the optical

891

00:38:45,870 --> 00:38:43,930

system focuses the light focuses the

892

00:38:47,609 --> 00:38:45,880

light of the star on a very small point

893

00:38:49,380 --> 00:38:47,619

to be able to separate it from the

894

00:38:52,529 --> 00:38:49,390

planet so is that similar to like a

895

00:38:55,079 --> 00:38:52,539

telescope or well what's going on there

896

00:38:56,910 --> 00:38:55,089

the telescope comes before so the first

897

00:38:59,309 --> 00:38:56,920

element is a telescope that's the one

898

00:39:03,059 --> 00:38:59,319

that captured the light and then final

899

00:39:05,489 --> 00:39:03,069

slide into these optical train and these

900

00:39:07,410 --> 00:39:05,499

special optics that separate the night

901
00:39:09,420 --> 00:39:07,420
because mainly comes a star and the

902
00:39:12,809 --> 00:39:09,430
planet is very close to a star when when

903
00:39:14,609 --> 00:39:12,819
we see Kepler images you see just a star

904
00:39:15,870 --> 00:39:14,619
but there is a star there are more

905
00:39:17,309 --> 00:39:15,880
planets there are a bunch of things that

906
00:39:20,339 --> 00:39:17,319
in the case of Kepler they are all in

907
00:39:23,910 --> 00:39:20,349
one pixel or multiple fuzzy pixels as

908
00:39:26,219 --> 00:39:23,920
you said before in the case of on this

909
00:39:28,680 --> 00:39:26,229
technology we zoom in into that pixel

910
00:39:32,819 --> 00:39:28,690
and separate that into two different

911
00:39:35,910 --> 00:39:32,829
elements so so that's the way that this

912
00:39:37,910 --> 00:39:35,920
works okay so one question that you know

913
00:39:43,289 --> 00:39:37,920

sometimes comes out like why are we

914

00:39:45,390 --> 00:39:43,299

imaging versus detecting well the first

915

00:39:47,969 --> 00:39:45,400

step is detect and what Kepler has done

916

00:39:49,410 --> 00:39:47,979

is detect many planets now we know that

917

00:39:51,809 --> 00:39:49,420

the planets out there

918

00:39:54,210 --> 00:39:51,819

we know the demographics that means we

919

00:39:57,390 --> 00:39:54,220

know how many how they are how many big

920

00:40:00,180 --> 00:39:57,400

how many small all kind of information

921

00:40:02,250 --> 00:40:00,190

about the planet population now imaging

922

00:40:04,200 --> 00:40:02,260

is the next step in which we know the

923

00:40:05,970 --> 00:40:04,210

most interesting ones and we go after

924

00:40:07,260 --> 00:40:05,980

them that's not just like okay there's a

925

00:40:08,609 --> 00:40:07,270

dip in the light we know it's there

926
00:40:10,109 --> 00:40:08,619
you're talking about you actually want

927
00:40:12,450 --> 00:40:10,119
to take a picture of the exoplanet

928
00:40:15,359 --> 00:40:12,460
correct it's actually get reflected

929
00:40:17,609 --> 00:40:15,369
light from the planet yeah it's not an

930
00:40:19,200 --> 00:40:17,619
indirect this is direct imaging yeah and

931
00:40:22,049 --> 00:40:19,210
the beauty of that is that then you can

932
00:40:24,270 --> 00:40:22,059
see the color okay by watching the color

933
00:40:26,280 --> 00:40:24,280
for example if you look at the Earth

934
00:40:28,410 --> 00:40:26,290
from the moon it looks blueish if you

935
00:40:30,809 --> 00:40:28,420
look to Mars it looks orange yeah and

936
00:40:33,450 --> 00:40:30,819
those colors tell us something about the

937
00:40:35,250 --> 00:40:33,460
planet but it's a lot of information

938
00:40:37,049 --> 00:40:35,260

where we have learned we can learn what

939

00:40:40,109 --> 00:40:37,059

kind of chemicals are in the atmosphere

940

00:40:42,089 --> 00:40:40,119

what kind of weather rotation period a

941

00:40:45,510 --> 00:40:42,099

lot of information and you know speaking

942

00:40:49,410 --> 00:40:45,520

of images we actually have one you guys

943

00:40:52,710 --> 00:40:49,420

could we get that brother oh yeah so

944

00:40:55,859 --> 00:40:52,720

what's going on here well that that's

945

00:41:01,079 --> 00:40:55,869

one of the few images of exoplanets is a

946

00:41:04,410 --> 00:41:01,089

real image of a Starke HR 8799 that is

947

00:41:07,530 --> 00:41:04,420

around 120 light 29 light years away so

948

00:41:10,260 --> 00:41:07,540

it's fairly close for our galaxy

949

00:41:13,440 --> 00:41:10,270

standards but is very far from our human

950

00:41:16,260 --> 00:41:13,450

everyday scale and what you see there is

951
00:41:19,349 --> 00:41:16,270
that star that is blocked do you cannot

952
00:41:21,750 --> 00:41:19,359
see a star anymore and the white circle

953
00:41:24,420 --> 00:41:21,760
shows three planets around that star so

954
00:41:28,049 --> 00:41:24,430
this is a planetary system is a solar

955
00:41:30,960 --> 00:41:28,059
system with three planets this image was

956
00:41:34,049 --> 00:41:30,970
taken on the by the sewer telescope in

957
00:41:36,870 --> 00:41:34,059
Hawaii in which they were using a very

958
00:41:38,789 --> 00:41:36,880
similar technology to this one so this

959
00:41:40,289 --> 00:41:38,799
technology that we have here at NASA is

960
00:41:43,079 --> 00:41:40,299
also implemented on ground-based

961
00:41:45,390 --> 00:41:43,089
telescopes to be able to image stars but

962
00:41:47,730 --> 00:41:45,400
if you look at in the image there are a

963
00:41:49,230 --> 00:41:47,740

lot of grains and noise that caused by

964

00:41:50,520 --> 00:41:49,240

the atmosphere you see that grains

965

00:41:52,319 --> 00:41:50,530

grainy everywhere

966

00:41:55,349 --> 00:41:52,329

that's the turbulence on the atmosphere

967

00:41:57,120 --> 00:41:55,359

so the goal that we have here is to take

968

00:41:59,579 --> 00:41:57,130

the same technology bring it to space

969

00:42:01,410 --> 00:41:59,589

and then from space you don't have the

970

00:42:02,609 --> 00:42:01,420

animals here okay so we have a question

971

00:42:04,049 --> 00:42:02,619

that came in I'd like to

972

00:42:06,089 --> 00:42:04,059

if there's anything we were looking for

973

00:42:08,489 --> 00:42:06,099

specifically within with the imaging or

974

00:42:10,589 --> 00:42:08,499

rather taking the pictures first then

975

00:42:11,789 --> 00:42:10,599

deciphering what is there that is from

976
00:42:14,549 --> 00:42:11,799
the Senate

977
00:42:16,410 --> 00:42:14,559
aka Emperor Palpatine because he is the

978
00:42:18,569 --> 00:42:16,420
Senate so well that's an excellent

979
00:42:20,370 --> 00:42:18,579
question that's a big problem

980
00:42:21,960 --> 00:42:20,380
in this kind of missions which is a

981
00:42:24,539 --> 00:42:21,970
strategy is how do you spend the time

982
00:42:27,089 --> 00:42:24,549
because you can allocate a very little

983
00:42:30,839 --> 00:42:27,099
time just to the detection or you can

984
00:42:33,180 --> 00:42:30,849
spend more time trying to recognize the

985
00:42:35,819 --> 00:42:33,190
different colors and assess the chemical

986
00:42:38,130 --> 00:42:35,829
composition of the atmosphere so there

987
00:42:40,620 --> 00:42:38,140
is a very big trade-off between serving

988
00:42:43,739 --> 00:42:40,630

many stars and do kind of a blind search

989

00:42:45,390 --> 00:42:43,749

or a targeted search of a target that we

990

00:42:47,279 --> 00:42:45,400

already know and focus there and learn

991

00:42:49,769 --> 00:42:47,289

as much as possible so normally there is

992

00:42:51,539 --> 00:42:49,779

a priori strategy but then as the

993

00:42:53,279 --> 00:42:51,549

mission goes on you can adapt that

994

00:42:56,160 --> 00:42:53,289

depending the value of the target that

995

00:42:57,269 --> 00:42:56,170

we find okay I'm looking at there's a

996

00:42:59,339 --> 00:42:57,279

whole bunch of questions that are coming

997

00:43:01,620 --> 00:42:59,349

in we have that's awesome from RJ the

998

00:43:03,630 --> 00:43:01,630

newb and we also have how long until we

999

00:43:04,380 --> 00:43:03,640

can image moons and other satellites of

1000

00:43:07,680 --> 00:43:04,390

exoplanets

1001
00:43:09,660 --> 00:43:07,690
that's from Eskridge that's not a great

1002
00:43:12,960 --> 00:43:09,670
question actually imaging moons

1003
00:43:14,910 --> 00:43:12,970
sometimes it's not that difficult as it

1004
00:43:16,499 --> 00:43:14,920
seems because moons tend to be hotter

1005
00:43:19,200 --> 00:43:16,509
than the planet during the formation

1006
00:43:22,289 --> 00:43:19,210
process so the planet forms and then the

1007
00:43:25,109 --> 00:43:22,299
moon around still solidifying I could be

1008
00:43:27,089 --> 00:43:25,119
as like as a lava ball and then emits

1009
00:43:29,789 --> 00:43:27,099
light on infrared wavelength so it is

1010
00:43:32,609 --> 00:43:29,799
possible to see moves on their formation

1011
00:43:35,430 --> 00:43:32,619
process and then a shadow over or a

1012
00:43:37,049 --> 00:43:35,440
friend Delano 3:16 I'm reading some of

1013
00:43:39,329 --> 00:43:37,059

the questions that are on a slight delay

1014

00:43:41,370 --> 00:43:39,339

because I came on sending them on over

1015

00:43:43,049 --> 00:43:41,380

to me so if you don't get them in real

1016

00:43:44,759 --> 00:43:43,059

time we're getting some of the older

1017

00:43:48,299 --> 00:43:44,769

questions as they come on through but

1018

00:43:50,160 --> 00:43:48,309

Danny I'll keep going well I say X arrow

1019

00:43:53,069 --> 00:43:50,170

says that it looks the image sort of

1020

00:43:57,079 --> 00:43:53,079

looks like a lunar eclipse well that's

1021

00:44:00,690 --> 00:43:57,089

exactly what it is a lunar eclipse is

1022

00:44:04,680 --> 00:44:00,700

the process in which the moon goes in

1023

00:44:06,660 --> 00:44:04,690

front of the Sun because of the

1024

00:44:08,970 --> 00:44:06,670

distances under sizes it happened to be

1025

00:44:10,430 --> 00:44:08,980

angular the same so they look like the

1026
00:44:13,650 --> 00:44:10,440
same size but they are very different

1027
00:44:15,620 --> 00:44:13,660
okay so what this device does is a

1028
00:44:18,650 --> 00:44:15,630
device to miniatura

1029
00:44:22,790 --> 00:44:18,660
and Eclipse basically we compress alight

1030
00:44:24,800 --> 00:44:22,800
and we have a tiny blocker that blocks

1031
00:44:26,390 --> 00:44:24,810
the light of the star so it's like

1032
00:44:28,340 --> 00:44:26,400
having an eclipse but since you don't

1033
00:44:30,080 --> 00:44:28,350
have a moon that you can move around we

1034
00:44:33,230 --> 00:44:30,090
do it on a microscopic way and still

1035
00:44:40,370 --> 00:44:33,240
inside this device that I can bring us a

1036
00:44:43,100 --> 00:44:40,380
gift for you questions coming in this is

1037
00:44:45,290 --> 00:44:43,110
from Oprah underscore FT Winfrey which I

1038
00:44:47,060 --> 00:44:45,300

assume is the real Oprah which should be

1039

00:44:49,550 --> 00:44:47,070

bringing us gifts because I think that's

1040

00:44:51,770 --> 00:44:49,560

kind of how that works but Oprah is

1041

00:44:53,720 --> 00:44:51,780

asking us how to exoplanet hunters know

1042

00:44:55,430 --> 00:44:53,730

which stars to look at there are so many

1043

00:44:56,180 --> 00:44:55,440

to choose from in the Milky Way where do

1044

00:44:59,780 --> 00:44:56,190

you even start

1045

00:45:01,730 --> 00:44:59,790

well there's where we complement with

1046

00:45:03,080 --> 00:45:01,740

ground-based observatories at Kepler

1047

00:45:07,430 --> 00:45:03,090

mission and other missions there are

1048

00:45:11,690 --> 00:45:07,440

some indications of presence of planets

1049

00:45:13,670 --> 00:45:11,700

that have been concluded by Kepler and

1050

00:45:16,430 --> 00:45:13,680

ground-based observatories and the goal

1051
00:45:19,070 --> 00:45:16,440
is that then when we have the best clues

1052
00:45:22,280 --> 00:45:19,080
that there is a very high-value target

1053
00:45:24,440 --> 00:45:22,290
we go with this more focused mission and

1054
00:45:27,350 --> 00:45:24,450
I stay there and Esther so it's Anna

1055
00:45:29,600 --> 00:45:27,360
strategy that uses the a priori

1056
00:45:31,850 --> 00:45:29,610
knowledge of other astronomical

1057
00:45:33,490 --> 00:45:31,860
community instruments okay so Matt I

1058
00:45:37,910 --> 00:45:33,500
think we have time for one more question

1059
00:45:40,490 --> 00:45:37,920
okay with Omni slash 79 who asks how

1060
00:45:42,620 --> 00:45:40,500
close did the planet have to be from the

1061
00:45:45,560 --> 00:45:42,630
star along with its size for the camera

1062
00:45:48,980 --> 00:45:45,570
to pick up the planet that's that's a

1063
00:45:51,560 --> 00:45:48,990

real key parameter here if the planet is

1064

00:45:54,110 --> 00:45:51,570

too close to a star then you cannot

1065

00:45:56,270 --> 00:45:54,120

separate it because the light of the

1066

00:45:58,220 --> 00:45:56,280

star overwhelms the planet so this

1067

00:45:59,960 --> 00:45:58,230

device helps to separate but it's not

1068

00:46:03,830 --> 00:45:59,970

perfect

1069

00:46:06,320 --> 00:46:03,840

normally the shape of the optics that we

1070

00:46:08,480 --> 00:46:06,330

design here all the surface of the

1071

00:46:11,720 --> 00:46:08,490

optical surfaces that you hear see here

1072

00:46:14,270 --> 00:46:11,730

though that shape defines how close you

1073

00:46:16,100 --> 00:46:14,280

can get the planet but as you design the

1074

00:46:18,290 --> 00:46:16,110

system to be able to be much planet that

1075

00:46:20,990 --> 00:46:18,300

are closer and closer it gets more

1076
00:46:22,700 --> 00:46:21,000
sensitive to any air or on the Poynting

1077
00:46:25,130 --> 00:46:22,710
on how you're aiming to a star

1078
00:46:28,580 --> 00:46:25,140
so if you make it very very precise then

1079
00:46:30,980 --> 00:46:28,590
any shaking of the spacecraft will bring

1080
00:46:35,030 --> 00:46:30,990
process so there is a trade-off of how

1081
00:46:37,430 --> 00:46:35,040
close you can image now for this this

1082
00:46:39,350 --> 00:46:37,440
device is designed to be able to see a

1083
00:46:42,350 --> 00:46:39,360
planet like the earth around a sun-like

1084
00:46:45,080 --> 00:46:42,360
star at 10 parsecs so basically if we

1085
00:46:46,940 --> 00:46:45,090
look at nearby star ya then and there is

1086
00:46:49,100 --> 00:46:46,950
a planet in the habitable zone where

1087
00:46:52,830 --> 00:46:49,110
like similar to the orbit of the earth

1088
00:46:55,630 --> 00:46:52,840

we'll be able to see it with this device

1089

00:47:09,890 --> 00:46:55,640

[Laughter]

1090

00:47:11,780 --> 00:47:09,900

you know cheesy Star Wars little

1091

00:47:13,160 --> 00:47:11,790

housekeeping so as a reminder this is a

1092

00:47:14,600 --> 00:47:13,170

you're watching NASA in Silicon Valley

1093

00:47:16,430 --> 00:47:14,610

live and if you have a question for our

1094

00:47:19,910 --> 00:47:16,440

gas our guests definitely write it in

1095

00:47:27,830 --> 00:47:19,920

the chat and so let's go ahead and bring

1096

00:47:33,070 --> 00:47:27,840

out the here so here come on down good

1097

00:47:35,600 --> 00:47:33,080

have a seat and get on up on that mic so

1098

00:47:37,070 --> 00:47:35,610

tell us a little bit about yourself in

1099

00:47:41,240 --> 00:47:37,080

some of the research that you do here at

1100

00:47:44,090 --> 00:47:41,250

Ames so I'm a scientist with the Sofia

1101
00:47:46,940 --> 00:47:44,100
program I used to actually be based out

1102
00:47:48,350 --> 00:47:46,950
of Palmdale and where I took care of the

1103
00:47:50,360 --> 00:47:48,360
science instruments that's kind of the

1104
00:47:58,400 --> 00:47:50,370
cameras that we mount to what we're

1105
00:48:00,110 --> 00:47:58,410
going to open here but these days these

1106
00:48:02,720 --> 00:48:00,120
days I'm helping make sure that the

1107
00:48:04,400 --> 00:48:02,730
software is right for our program okay

1108
00:48:07,160 --> 00:48:04,410
so before we you know move a little

1109
00:48:08,750 --> 00:48:07,170
further so what is Sofia because you

1110
00:48:10,610 --> 00:48:08,760
know everything on the government has an

1111
00:48:13,640 --> 00:48:10,620
acronym this is Sofia is not just a name

1112
00:48:17,650 --> 00:48:13,650
it's a fancy acronym that's right it's

1113
00:48:22,010 --> 00:48:17,660

all in the name it's the stratospheric

1114

00:48:23,720 --> 00:48:22,020

Observatory for infrared astronomy which

1115

00:48:27,980 --> 00:48:23,730

I like to affectionately refer to it is

1116

00:48:29,930 --> 00:48:27,990

it's a telescope on a plane it's the

1117

00:48:32,300 --> 00:48:29,940

largest telescope on a plane in the

1118

00:48:36,050 --> 00:48:32,310

world we fly at night to look at the

1119

00:48:38,480 --> 00:48:36,060

Stars and it flies out of Palmdale where

1120

00:48:40,360 --> 00:48:38,490

the operation center is with Armstrong

1121

00:48:43,160 --> 00:48:40,370

and in Southern Cal

1122

00:48:46,490 --> 00:48:43,170

the Science Center is here at Ames and

1123

00:48:48,700 --> 00:48:46,500

so here we have the science team that

1124

00:48:52,280 --> 00:48:48,710

looks at all the data that comes in

1125

00:48:54,200 --> 00:48:52,290

sorts it out does reduction pipeline

1126

00:48:56,720 --> 00:48:54,210

stuff and then sends it out to the

1127

00:48:57,980 --> 00:48:56,730

community to do work on it in the

1128

00:49:00,260 --> 00:48:57,990

community sense where a lot of the

1129

00:49:07,490 --> 00:49:00,270

science questions are answered okay

1130

00:49:10,610 --> 00:49:07,500

so Matt let's go ahead and I know the

1131

00:49:12,950 --> 00:49:10,620

general rule is like don't shake it and

1132

00:49:20,660 --> 00:49:12,960

let's get this awesome wrapping paper

1133

00:49:24,670 --> 00:49:20,670

out of the way as then I try to undo

1134

00:49:26,960 --> 00:49:24,680

this box which is slightly there we go

1135

00:49:30,140 --> 00:49:26,970

I'm just gonna rip this thing off

1136

00:49:34,640 --> 00:49:30,150

because for whatever reason it's Oh take

1137

00:49:43,360 --> 00:49:34,650

a look at this and then here we go for

1138

00:49:45,890 --> 00:49:43,370

the unboxing so guys this is Sofia

1139

00:49:47,570 --> 00:49:45,900

Observatory for it for an astronomy get

1140

00:49:49,640 --> 00:49:47,580

on that side because that's where it is

1141

00:49:52,880 --> 00:49:49,650

turning this towards you is because over

1142

00:50:00,110 --> 00:49:52,890

here you see our telescope it's about

1143

00:50:03,110 --> 00:50:00,120

two meters it's about two meters 2.5

1144

00:50:08,540 --> 00:50:03,120

meters sorry in diameter about twice as

1145

00:50:11,030 --> 00:50:08,550

tall as a person and it is aluminum

1146

00:50:13,250 --> 00:50:11,040

coated and what we do is we fly it at

1147

00:50:18,320 --> 00:50:13,260

night and look at the Stars kind of in

1148

00:50:22,100 --> 00:50:18,330

this way why do we fly a telescope it's

1149

00:50:25,460 --> 00:50:22,110

because to do infrared astronomy we need

1150

00:50:27,860 --> 00:50:25,470

to get through the the water vapor that

1151
00:50:30,410 --> 00:50:27,870
hugs close to the earth okay so speaking

1152
00:50:32,630 --> 00:50:30,420
of that I bill I think we have a really

1153
00:50:37,090 --> 00:50:32,640
cool clip that talks a little bit about

1154
00:50:43,190 --> 00:50:40,220
so you're seeing Sofia in flight there's

1155
00:50:44,750 --> 00:50:43,200
the telescope opening door rather the

1156
00:50:47,960 --> 00:50:44,760
door the telescope's inside they're

1157
00:50:51,860 --> 00:50:47,970
probably taken from one of the f-18

1158
00:50:53,000 --> 00:50:51,870
chase planes and this is what we do in

1159
00:50:54,950 --> 00:50:53,010
flight

1160
00:50:56,330 --> 00:50:54,960
the telescope opens up it's kind of like

1161
00:50:58,460 --> 00:50:56,340
a big garage door you can see there's

1162
00:51:00,109 --> 00:50:58,470
actually an apse your aperture that

1163
00:51:03,080 --> 00:51:00,119

tracks with the telescope as it moves up

1164

00:51:04,790 --> 00:51:03,090

and down and to point the telescope you

1165

00:51:08,030 --> 00:51:04,800

can move the telescope what's called as

1166

00:51:09,200 --> 00:51:08,040

mythili up and down but then to look in

1167

00:51:11,420 --> 00:51:09,210

a different direction you actually have

1168

00:51:17,090 --> 00:51:11,430

to turn the plane so our flight plans

1169

00:51:18,290 --> 00:51:17,100

are pretty interesting probably well

1170

00:51:24,280 --> 00:51:18,300

it's hard to tell that sunset or sunrise

1171

00:51:28,490 --> 00:51:24,290

coming in but it's quite quite a

1172

00:51:31,490 --> 00:51:28,500

operation to be flying a telescope so

1173

00:51:34,330 --> 00:51:31,500

have you ever gotten to fly to fly

1174

00:51:39,020 --> 00:51:34,340

several times it is really spectacular

1175

00:51:41,030 --> 00:51:39,030

to be in near space conditions and

1176
00:51:42,950 --> 00:51:41,040
what's really amazing is that keep in

1177
00:51:46,130 --> 00:51:42,960
mind that telescope that's open to

1178
00:51:47,720 --> 00:51:46,140
45,000 feet and then in the cabin I'm

1179
00:51:58,640 --> 00:51:47,730
sitting there in a coaches like I am now

1180
00:52:00,290 --> 00:51:58,650
not in this actual plane for ants like

1181
00:52:02,120 --> 00:52:00,300
you're riding in that thing the

1182
00:52:05,870 --> 00:52:02,130
turbulence how does that affect when you

1183
00:52:07,820 --> 00:52:05,880
open that door does it matter it's a

1184
00:52:09,560 --> 00:52:07,830
testament to the engineers that designed

1185
00:52:12,740 --> 00:52:09,570
this it's kind of hard to see on this

1186
00:52:14,720 --> 00:52:12,750
model but actually the windscreen comes

1187
00:52:17,690 --> 00:52:14,730
this way there's a kick out here and

1188
00:52:19,550 --> 00:52:17,700

then and then a matched slope in the

1189

00:52:22,340 --> 00:52:19,560

back and there's actually a baffling

1190

00:52:23,720 --> 00:52:22,350

inside that keeps what is called a

1191

00:52:25,430 --> 00:52:23,730

venturi effect from happening that's

1192

00:52:27,200 --> 00:52:25,440

kind of there's an effect that would

1193

00:52:29,930 --> 00:52:27,210

happen when you have air going this way

1194

00:52:32,960 --> 00:52:29,940

it would feel like there's a pressure

1195

00:52:35,750 --> 00:52:32,970

orthogonal to it think of the effect of

1196

00:52:37,099 --> 00:52:35,760

wind going against two buildings that

1197

00:52:38,840 --> 00:52:37,109

are really close together when you stand

1198

00:52:40,280 --> 00:52:38,850

between buildings you get a rush of air

1199

00:52:42,109 --> 00:52:40,290

with wind going across the other way

1200

00:52:44,540 --> 00:52:42,119

that's what would happen here but the

1201

00:52:46,970 --> 00:52:44,550

engineering so good that when we opened

1202

00:52:48,290 --> 00:52:46,980

the door for the first time they

1203

00:52:50,150 --> 00:52:48,300

actually had to call to the chase plane

1204

00:52:52,609 --> 00:52:50,160

and say hey is the door open really

1205

00:52:54,440 --> 00:52:52,619

because the pilots could not feel it on

1206

00:52:56,750 --> 00:52:54,450

the stick they had an indicator in the

1207

00:52:59,599 --> 00:52:56,760

cockpit that it was open but they wanted

1208

00:53:02,570 --> 00:52:59,609

to confirm so one of the questions that

1209

00:53:04,099 --> 00:53:02,580

comes from digital Don Don sure he wants

1210

00:53:06,240 --> 00:53:04,109

to know does the telescope need any

1211

00:53:08,640 --> 00:53:06,250

stabilization yes

1212

00:53:11,760 --> 00:53:08,650

great question there is actually a very

1213

00:53:14,160 --> 00:53:11,770

special type of engineering around that

1214

00:53:16,080 --> 00:53:14,170

stabilization so for takeoff and landing

1215

00:53:18,870 --> 00:53:16,090

we actually locked the telescope in a

1216

00:53:21,840 --> 00:53:18,880

specific way to safe it against the

1217

00:53:25,050 --> 00:53:21,850

impact of a landing and the rumble of a

1218

00:53:27,240 --> 00:53:25,060

take-off and that is a bladder on

1219

00:53:28,950 --> 00:53:27,250

bladder rubber bladder on bladder that

1220

00:53:31,200 --> 00:53:28,960

is very similar to air ride trucking

1221

00:53:33,060 --> 00:53:31,210

technology so that's for takeoff and

1222

00:53:33,600 --> 00:53:33,070

landing we call it caging the telescope

1223

00:53:36,710 --> 00:53:33,610

okay

1224

00:53:39,720 --> 00:53:36,720

now in flight the telescope is actually

1225

00:53:41,460 --> 00:53:39,730

suspended half the telescope is in the

1226

00:53:43,590 --> 00:53:41,470

cabin half the telescope is in what we

1227

00:53:46,380 --> 00:53:43,600

called CellScope cavity the back area

1228

00:53:49,440 --> 00:53:46,390

that's open to 45,000 feet there's a the

1229

00:53:51,810 --> 00:53:49,450

fulcrum on which it rests is actually a

1230

00:53:55,620 --> 00:53:51,820

spherical bearing kind of like a gimbal

1231

00:54:00,990 --> 00:53:55,630

and that bearing is on pressurized oil

1232

00:54:03,090 --> 00:54:01,000

that is as thin as a human hair but when

1233

00:54:05,010 --> 00:54:03,100

what we do is we balance the telescope

1234

00:54:07,170 --> 00:54:05,020

so perfectly and I've literally done

1235

00:54:09,150 --> 00:54:07,180

this that I've moved 17 tons with my

1236

00:54:11,340 --> 00:54:09,160

pinky because there's no moment of

1237

00:54:14,040 --> 00:54:11,350

inertia you can just move it around on

1238

00:54:16,740 --> 00:54:14,050

that bearing it's spectacular one that

1239

00:54:19,700 --> 00:54:16,750

isolates it from the turbulence so the

1240

00:54:22,020 --> 00:54:19,710

aircraft is doing this and the telescope

1241

00:54:24,090 --> 00:54:22,030

the aircraft is moving around the

1242

00:54:27,270 --> 00:54:24,100

bearing and the telescope is locked onto

1243

00:54:29,040 --> 00:54:27,280

a star so we have an antiparticle 73 was

1244

00:54:30,870 --> 00:54:29,050

asking about images captured by Sofie

1245

00:54:33,030 --> 00:54:30,880

but I also want to add on top of rage

1246

00:54:34,470 --> 00:54:33,040

Jordan asks that can Sophia see black

1247

00:54:35,700 --> 00:54:34,480

holes because I know like when you're

1248

00:54:38,070 --> 00:54:35,710

looking at things in the infrared it's

1249

00:54:39,780 --> 00:54:38,080

different from your visual light so our

1250

00:54:41,070 --> 00:54:39,790

black holes in the game is that stuff

1251
00:54:42,960 --> 00:54:41,080
that you're looking at so we actually

1252
00:54:46,110 --> 00:54:42,970
have a very famous image looking at the

1253
00:54:50,550 --> 00:54:46,120
center of the galaxy that I urge people

1254
00:54:52,890 --> 00:54:50,560
to look up where we look at the matter

1255
00:54:55,470 --> 00:54:52,900
that's being sucked in and therefore

1256
00:54:57,690 --> 00:54:55,480
push it putting off a lot of light into

1257
00:54:58,740 --> 00:54:57,700
a black hole but the black hole is not

1258
00:54:59,250 --> 00:54:58,750
able to be imaged that's why it's a

1259
00:55:08,490 --> 00:54:59,260
black hole

1260
00:55:09,660 --> 00:55:08,500
you see everything around exactly and

1261
00:55:12,180 --> 00:55:09,670
nothing's coming out but what you

1262
00:55:14,970 --> 00:55:12,190
actually can see if you go look this

1263
00:55:18,130 --> 00:55:14,980

image up on the Sofia webpage is you see

1264

00:55:21,070 --> 00:55:18,140

this beautiful Corona

1265

00:55:23,140 --> 00:55:21,080

around we're at the very center of that

1266

00:55:25,930 --> 00:55:23,150

image the black hole would be and that

1267

00:55:27,220 --> 00:55:25,940

is that was a very important important

1268

00:55:28,810 --> 00:55:27,230

science result because it was basically

1269

00:55:30,340 --> 00:55:28,820

an independent confirmation of a

1270

00:55:32,650 --> 00:55:30,350

supermassive black hole at the center of

1271

00:55:34,000 --> 00:55:32,660

the galaxy so this is actually really

1272

00:55:36,670 --> 00:55:34,010

good questions it just popped up in the

1273

00:55:38,890 --> 00:55:36,680

chat is from president underscore donald

1274

00:55:40,870 --> 00:55:38,900

underscore trump asked nasa why use a

1275

00:55:42,430 --> 00:55:40,880

plane when we have satellites and what

1276
00:55:43,810 --> 00:55:42,440
are the benefits of using a plane so

1277
00:55:45,760 --> 00:55:43,820
yeah let's talk about this we have they

1278
00:55:47,290 --> 00:55:45,770
are space telescopes that we learned

1279
00:55:49,390 --> 00:55:47,300
from Kepler we have satellites that

1280
00:55:51,640 --> 00:55:49,400
circle the earth so and there's

1281
00:55:54,070 --> 00:55:51,650
land-based telescopes so talk about that

1282
00:55:56,110 --> 00:55:54,080
unique world where a telescope on a

1283
00:55:59,260 --> 00:55:56,120
plane is is critical yes that's a great

1284
00:56:02,890 --> 00:55:59,270
question thank you mister president so

1285
00:56:07,090 --> 00:56:02,900
Sofia bridges a gap between ground-based

1286
00:56:10,440 --> 00:56:07,100
telescopes and satellites so when we get

1287
00:56:13,720 --> 00:56:10,450
above the water vapor we're seeing

1288
00:56:16,030 --> 00:56:13,730

99.99% transmission in infrared on the

1289

00:56:18,460 --> 00:56:16,040

top of Mauna Kea in Hawaii which is

1290

00:56:21,700 --> 00:56:18,470

where there are several amazing infrared

1291

00:56:23,590 --> 00:56:21,710

observatories and an infrared

1292

00:56:26,650 --> 00:56:23,600

Observatory and other observatories you

1293

00:56:28,780 --> 00:56:26,660

get about 25% transmission so you're

1294

00:56:30,670 --> 00:56:28,790

still in the soup as it were when you're

1295

00:56:32,920 --> 00:56:30,680

even on top of mountain when you get

1296

00:56:34,270 --> 00:56:32,930

Sofia you get too near space I'm gonna

1297

00:56:36,370 --> 00:56:34,280

say you're gonna want to keep the mic up

1298

00:56:41,520 --> 00:56:36,380

on the mic yeah I can imagine Eric or

1299

00:56:47,500 --> 00:56:45,220

so so what act so what Sofia does is it

1300

00:56:50,320 --> 00:56:47,510

gives you an ability to have near

1301
00:56:52,660 --> 00:56:50,330
satellite quality but it comes home

1302
00:56:54,670 --> 00:56:52,670
every night so we actually have had a

1303
00:56:57,970 --> 00:56:54,680
suite of seven different types of

1304
00:57:02,020 --> 00:56:57,980
instruments or cameras in different

1305
00:57:03,970 --> 00:57:02,030
types of cameras that have we've been

1306
00:57:05,860 --> 00:57:03,980
able to field at different times when

1307
00:57:08,080 --> 00:57:05,870
you launch a satellite that's all you

1308
00:57:09,970 --> 00:57:08,090
got and that lasts a certain amount of

1309
00:57:12,760 --> 00:57:09,980
time and then it's done whereas Sofia

1310
00:57:14,530 --> 00:57:12,770
can fly for 25 or 30 years train a lot

1311
00:57:17,140 --> 00:57:14,540
of scientists trained a lot of graduate

1312
00:57:19,510 --> 00:57:17,150
students helped develop technology by

1313
00:57:20,800 --> 00:57:19,520

testing it in Sofia where there's a lot

1314

00:57:22,780 --> 00:57:20,810

less risk because it comes home every

1315

00:57:25,150 --> 00:57:22,790

night if that camera breaks you've got

1316

00:57:26,650 --> 00:57:25,160

six more that you can change out to si

1317

00:57:28,930 --> 00:57:26,660

that's also a unique thing normally like

1318

00:57:30,700 --> 00:57:28,940

when you send Hubble I mean though they

1319

00:57:32,810 --> 00:57:30,710

did service Hubble but like

1320

00:57:34,280 --> 00:57:32,820

take your space block it's not exactly

1321

00:57:36,170 --> 00:57:34,290

easy to do but but these Space

1322

00:57:37,910 --> 00:57:36,180

Telescope's like you can change out

1323

00:57:40,310 --> 00:57:37,920

those instruments technology improves

1324

00:57:42,350 --> 00:57:40,320

you come up with actually on our

1325

00:57:46,820 --> 00:57:42,360

third-generation instrument that's being

1326

00:57:48,950 --> 00:57:46,830

developed now recently we've finally hit

1327

00:57:50,990 --> 00:57:48,960

our stride with the hawk instrument

1328

00:57:53,090 --> 00:57:51,000

which was our second generation and it's

1329

00:57:55,790 --> 00:57:53,100

producing absolutely amazing science

1330

00:57:58,970 --> 00:57:55,800

that's really revolutionizing things in

1331

00:58:01,130 --> 00:57:58,980

fact it the double-a s in January we've

1332

00:58:10,840 --> 00:58:01,140

got some featured presentations that are

1333

00:58:15,050 --> 00:58:13,520

and we'll have you back on and we'll

1334

00:58:16,850 --> 00:58:15,060

talk more about that stuff how are we

1335

00:58:19,070 --> 00:58:16,860

doing on time Daniel we do have to move

1336

00:58:22,130 --> 00:58:19,080

on so I just want to say thank you so

1337

00:58:24,140 --> 00:58:22,140

here and if you guys want to learn more

1338

00:58:25,880 --> 00:58:24,150

about the world's largest flying

1339

00:58:28,340 --> 00:58:25,890

Observatory you can check out our past

1340

00:58:31,100 --> 00:58:28,350

episode about Sofia in the history of

1341

00:58:34,070 --> 00:58:31,110

airborne astronomy awesome thank you

1342

00:58:37,400 --> 00:58:34,080

very much awesome all right we got more

1343

00:58:42,680 --> 00:58:37,410

gifts coming right so let's go ahead and

1344

00:58:58,700 --> 00:58:42,690

bring out yeah oh yeah we need some

1345

00:59:01,130 --> 00:58:58,710

intro music over here first things first

1346

00:59:02,660 --> 00:59:01,140

welcome and if you guys want to want to

1347

00:59:05,240 --> 00:59:02,670

tell our viewers like a little bit about

1348

00:59:07,310 --> 00:59:05,250

what you do here yeah so I'm a support

1349

00:59:09,800 --> 00:59:07,320

scientist here at Ames and I work with

1350

00:59:11,690 --> 00:59:09,810

space biology and space Biosciences

1351

00:59:13,970 --> 00:59:11,700

helping other people do space

1352

00:59:16,400 --> 00:59:13,980

Biosciences research that's pretty cool

1353

00:59:21,320 --> 00:59:16,410

so are you the one that's actually doing

1354

00:59:22,760 --> 00:59:21,330

the science nope support scientist and

1355

00:59:24,650 --> 00:59:22,770

research scientist

1356

00:59:26,300 --> 00:59:24,660

right so there's a lot of different

1357

00:59:28,610 --> 00:59:26,310

things that go on behind the scenes

1358

00:59:30,650 --> 00:59:28,620

research there's actual work in the lab

1359

00:59:32,090 --> 00:59:30,660

and then there's also like you know

1360

00:59:34,910 --> 00:59:32,100

getting the grants and then there's

1361

00:59:36,500 --> 00:59:34,920

administering everything and then a lot

1362

00:59:38,240 --> 00:59:36,510

of what we do here at Ames also is

1363

00:59:41,180 --> 00:59:38,250

helping experiments actually get to the

1364

00:59:43,100 --> 00:59:41,190

space station so and I help the people

1365

00:59:44,060 --> 00:59:43,110

who do all those things plus a little

1366

00:59:52,670 --> 00:59:44,070

bit of outreach light

1367

00:59:57,080 --> 00:59:52,680

that's to shake it too much we've got

1368

00:59:59,240 --> 00:59:57,090

some cool stuff over here so oh wow so

1369

01:00:03,800 --> 00:59:59,250

you know some people get puppies or

1370

01:00:05,450 --> 01:00:03,810

kittens for Christmas we're getting a

1371

01:00:08,600 --> 01:00:05,460

little something else I'm gonna hand

1372

01:00:11,810 --> 01:00:08,610

this on over to you cuz so that mark and

1373

01:00:24,880 --> 01:00:11,820

Jesse can get in on that shot as close

1374

01:00:30,790 --> 01:00:24,890

as they can there we go oh look at that

1375

01:00:32,810 --> 01:00:30,800

so what are those things

1376

01:00:36,020 --> 01:00:32,820

these are fruit flies

1377

01:00:38,420 --> 01:00:36,030

they're totally ordinary fruit flies

1378

01:00:43,460 --> 01:00:38,430

like you get around your compost bin or

1379

01:00:45,050 --> 01:00:43,470

fruit house and they're model organisms

1380

01:00:46,280 --> 01:00:45,060

for research which means that which

1381

01:00:48,130 --> 01:00:46,290

means that a lot of scientists around

1382

01:00:50,540 --> 01:00:48,140

the world use them to do their research

1383

01:00:52,760 --> 01:00:50,550

now I see we're still here we go yeah

1384

01:00:54,920 --> 01:00:52,770

look at that shot yeah can you see those

1385

01:00:57,310 --> 01:00:54,930

flies maybe if I move these guys you

1386

01:01:02,180 --> 01:00:57,320

have this whole bunch of flies in there

1387

01:01:04,010 --> 01:01:02,190

so yeah so scientists at Ames have sent

1388

01:01:06,230 --> 01:01:04,020

fruit flies to the space station on

1389

01:01:08,510 --> 01:01:06,240

numerous occasions and it turns out I

1390

01:01:10,370 --> 01:01:08,520

was told yesterday that fruit flies were

1391

01:01:12,650 --> 01:01:10,380

one of the first organisms that actually

1392

01:01:14,960 --> 01:01:12,660

ever went to space interesting they've

1393

01:01:22,610 --> 01:01:14,970

been they've been space adventurers

1394

01:01:23,960 --> 01:01:22,620

since the 40s Wow yeah so I mean these

1395

01:01:25,580 --> 01:01:23,970

fruit flies not maybe not these ones

1396

01:01:28,490 --> 01:01:25,590

specifically but I'm sure they're

1397

01:01:30,200 --> 01:01:28,500

cousins like have been to the space

1398

01:01:32,720 --> 01:01:30,210

station so talk a little bit about that

1399

01:01:38,540 --> 01:01:32,730

what maybe these guys is like great

1400

01:01:40,700 --> 01:01:38,550

great great great aunt or something yes

1401
01:01:42,910 --> 01:01:40,710
lots of different experiments have taken

1402
01:01:45,170 --> 01:01:42,920
fruit flies to the space station and

1403
01:01:46,670 --> 01:01:45,180
they've looked at things like what

1404
01:01:48,050 --> 01:01:46,680
happens to their hearts when they're in

1405
01:01:51,490 --> 01:01:48,060
space what happens to their immune

1406
01:01:54,310 --> 01:01:51,500
system do they get infected by bacteria

1407
01:01:56,960 --> 01:01:54,320
more easily after they've been in space

1408
01:01:57,380 --> 01:01:56,970
and the reason that fruit flies are used

1409
01:01:59,000 --> 01:01:57,390
for

1410
01:02:00,470 --> 01:01:59,010
that kind of research is that they

1411
01:02:05,360 --> 01:02:00,480
actually have a lot in common with

1412
01:02:07,520 --> 01:02:05,370
people and for instance 77% of the

1413
01:02:09,710 --> 01:02:07,530

disease genes in humans also have

1414

01:02:11,660 --> 01:02:09,720

analogs in flies so that means that G

1415

01:02:14,560 --> 01:02:11,670

flies have really similar genes to us

1416

01:02:17,030 --> 01:02:14,570

and then we can use flies to figure out

1417

01:02:18,590 --> 01:02:17,040

what are the risks to astronauts if they

1418

01:02:21,020 --> 01:02:18,600

spend a lot of time in space so like

1419

01:02:23,180 --> 01:02:21,030

flies have really short life cycles it

1420

01:02:24,680 --> 01:02:23,190

only takes them you know they live for

1421

01:02:26,600 --> 01:02:24,690

like a month and a half or something

1422

01:02:28,040 --> 01:02:26,610

like that so we can see there what

1423

01:02:29,870 --> 01:02:28,050

happens to a fly that spends its entire

1424

01:02:31,670 --> 01:02:29,880

life in space and how does that affect

1425

01:02:34,550 --> 01:02:31,680

it because it's a lot harder to do that

1426

01:02:37,070 --> 01:02:34,560

with the human astronauts that's what

1427

01:02:38,900 --> 01:02:37,080

does happen to a fly in space in

1428

01:02:40,820 --> 01:02:38,910

zero-gravity how does it affect it what

1429

01:02:43,370 --> 01:02:40,830

is the how is it different yeah so it's

1430

01:02:44,720 --> 01:02:43,380

the I mean similar to what happens to

1431

01:02:47,270 --> 01:02:44,730

human astronauts like their immune

1432

01:02:48,980 --> 01:02:47,280

systems don't work as well there are

1433

01:02:50,210 --> 01:02:48,990

changes to how their heart works they

1434

01:02:56,360 --> 01:02:50,220

don't have any bones so we can't study

1435

01:02:58,580 --> 01:02:56,370

bones and flies but they even fly it's

1436

01:02:59,990 --> 01:02:58,590

funny they kind of like they can they

1437

01:03:02,510 --> 01:03:00,000

move their wings and they kind of like

1438

01:03:04,520 --> 01:03:02,520

drift around and and then kind of try to

1439

01:03:08,870 --> 01:03:04,530

grab onto the wall like doesn't work as

1440

01:03:13,220 --> 01:03:08,880

well like I don't know is like some

1441

01:03:14,630 --> 01:03:13,230

vibration they like create momentum for

1442

01:03:18,290 --> 01:03:14,640

their wings to push again okay I guess

1443

01:03:22,370 --> 01:03:18,300

yeah but it's confusing I guess and they

1444

01:03:24,020 --> 01:03:22,380

kind of tend to bounce off the walls is

1445

01:03:25,930 --> 01:03:24,030

that yellow stuff in there is that stuff

1446

01:03:29,600 --> 01:03:25,940

that they're eating or what is in this

1447

01:03:34,660 --> 01:03:29,610

vials that's their food it's made out of

1448

01:03:36,920 --> 01:03:34,670

like yeast and sugar and cornmeal and

1449

01:03:38,780 --> 01:03:36,930

there's enough food in there for them to

1450

01:03:41,120 --> 01:03:38,790

live for like a month and they'll also

1451

01:03:48,650 --> 01:03:41,130

lay their eggs in there and their babies

1452

01:03:50,720 --> 01:03:48,660

will grow in it so it's like a fly how

1453

01:03:53,180 --> 01:03:50,730

long do these missions last aboard the

1454

01:03:55,880 --> 01:03:53,190

ISS usually they last for about a month

1455

01:03:57,890 --> 01:03:55,890

a lot of the missions like will go up on

1456

01:04:00,100 --> 01:03:57,900

one spacecraft stuff will happen for a

1457

01:04:02,770 --> 01:04:00,110

month and they'll come back down so that

1458

01:04:05,030 --> 01:04:02,780

the researchers can see what happened

1459

01:04:06,560 --> 01:04:05,040

after they were in space which is really

1460

01:04:09,140 --> 01:04:06,570

neat to actually be able to get samples

1461

01:04:10,320 --> 01:04:09,150

back from space as well so are we

1462

01:04:12,930 --> 01:04:10,330

talking multiple

1463

01:04:15,240 --> 01:04:12,940

generations one generation like you got

1464

01:04:17,670 --> 01:04:15,250

like your great-great-great definitely

1465

01:04:19,680 --> 01:04:17,680

so for flies I think that usually they

1466

01:04:21,390 --> 01:04:19,690

get back around three generations of

1467

01:04:22,710 --> 01:04:21,400

flies I mean if they left them up longer

1468

01:04:24,840 --> 01:04:22,720

than you would get they would just keep

1469

01:04:27,150 --> 01:04:24,850

breeding in there eventually they would

1470

01:04:29,490 --> 01:04:27,160

need new food but ya have a ton of

1471

01:04:32,160 --> 01:04:29,500

questions it's like one is this is from

1472

01:04:34,140 --> 01:04:32,170

row sonic what's your favorite project

1473

01:04:36,720 --> 01:04:34,150

you've helped work on and that has made

1474

01:04:40,350 --> 01:04:36,730

it to the space station so I myself have

1475

01:04:42,090 --> 01:04:40,360

not worked on any single project I'm

1476

01:04:46,380 --> 01:04:42,100

kind of more at the program level

1477

01:05:05,520 --> 01:04:46,390

helping all of the projects take credit

1478

01:05:06,930 --> 01:05:05,530

for several things one thing that I

1479

01:05:10,380 --> 01:05:06,940

think is cool is that there's gonna be

1480

01:05:12,780 --> 01:05:10,390

an experiment coming up I think in 2019

1481

01:05:14,730 --> 01:05:12,790

with tardigrades and I mean you can't

1482

01:05:17,070 --> 01:05:14,740

not like tardigrades they're little

1483

01:05:19,640 --> 01:05:17,080

crazy creatures with claws and they're

1484

01:05:21,600 --> 01:05:19,650

microscopic and they like survive

1485

01:05:23,490 --> 01:05:21,610

radiation and they can survive the

1486

01:05:25,470 --> 01:05:23,500

vacuum of space so they're really neat I

1487

01:05:26,700 --> 01:05:25,480

like them personally interesting Omni

1488

01:05:28,850 --> 01:05:26,710

slash has a question how many

1489

01:05:31,590 --> 01:05:28,860

generations would it take for the Flies

1490

01:05:34,980 --> 01:05:31,600

the Flies take to evolve to get used to

1491

01:05:36,720 --> 01:05:34,990

low gravity I don't know I'm not sure

1492

01:05:39,120 --> 01:05:36,730

that an experiment has been done on that

1493

01:05:41,150 --> 01:05:39,130

yet but fruit flies are used for a lot

1494

01:05:43,920 --> 01:05:41,160

of genetics and evolution research so if

1495

01:05:46,050 --> 01:05:43,930

you know if we could get funding to do

1496

01:05:48,900 --> 01:05:46,060

that then we could just try it out one

1497

01:05:51,330 --> 01:05:48,910

of our reoccurring guests this is space

1498

01:05:53,850 --> 01:05:51,340

TV net have more fruit flies gone to

1499

01:05:56,460 --> 01:05:53,860

space than any other creature and I'm

1500

01:05:59,130 --> 01:05:56,470

actually going to tag on that so like

1501

01:06:02,300 --> 01:05:59,140

what other things have flown oh yeah

1502

01:06:05,880 --> 01:06:02,310

lots of organism so from from Ames

1503

01:06:11,820 --> 01:06:05,890

specifically we have flown mice and

1504

01:06:13,920 --> 01:06:11,830

yeast like plants and then there's also

1505

01:06:15,330 --> 01:06:13,930

been lots of organisms in space in

1506

01:06:20,460 --> 01:06:15,340

general not just from Ames I mean

1507

01:06:22,830 --> 01:06:20,470

there's also been squid what else

1508

01:06:23,790 --> 01:06:22,840

it's ridiculous the list of organisms

1509

01:06:30,240 --> 01:06:23,800

that have been up there I think it

1510

01:06:32,280 --> 01:06:30,250

spiders birds yeah interesting it's more

1511

01:06:33,359 --> 01:06:32,290

like what his not how are we doing we

1512

01:06:39,960 --> 01:06:33,369

have a ton of questions but I knew I

1513

01:06:41,660 --> 01:06:39,970

have there was one thing that I did want

1514

01:06:44,190 --> 01:06:41,670

to show off and this is something that I

1515

01:06:47,700 --> 01:06:44,200

caught in and I'm gonna hand this over

1516

01:06:50,550 --> 01:06:47,710

to you il di oh and like let's zoom in

1517

01:06:56,130 --> 01:06:50,560

on that like it Marc and Jesse will get

1518

01:07:03,750 --> 01:06:56,140

a good shot on this look it's like some

1519

01:07:07,230 --> 01:07:03,760

yeast Christmas art the storyline is so

1520

01:07:09,089 --> 01:07:07,240

yeast is a like a important organism for

1521

01:07:11,849 --> 01:07:09,099

an upcoming mission at Ames called bio

1522

01:07:13,589 --> 01:07:11,859

Sentinel they're gonna send yeast into

1523

01:07:16,260 --> 01:07:13,599

deep space it's gonna be the first time

1524

01:07:18,380 --> 01:07:16,270

there's a organism in deep space outside

1525

01:07:20,970 --> 01:07:18,390

of low-earth orbit since Apollo times

1526

01:07:23,070 --> 01:07:20,980

space station it's going it's going it's

1527

01:07:24,870 --> 01:07:23,080

gonna orbit the Sun on its own and its

1528

01:07:27,810 --> 01:07:24,880

own little small set it's pretty cool

1529

01:07:29,579 --> 01:07:27,820

and yeast are awesome because they're

1530

01:07:32,070 --> 01:07:29,589

eukaryotes like humans and they've got

1531

01:07:35,490 --> 01:07:32,080

complicated cells but they're

1532

01:07:37,320 --> 01:07:35,500

single-celled organisms so we can stick

1533

01:07:40,170 --> 01:07:37,330

them in a satellite and see how they can

1534

01:07:41,190 --> 01:07:40,180

deal with that radiation but they're you

1535

01:07:46,109 --> 01:07:41,200

know you can also make art with them

1536

01:07:48,839 --> 01:07:46,119

nice throw a link over into the chat

1537

01:07:50,609 --> 01:07:48,849

because there's this is just like just

1538

01:07:52,650 --> 01:07:50,619

the surface of some of the different

1539

01:07:55,920 --> 01:07:52,660

yeast art that folks had pulled together

1540

01:07:57,990 --> 01:07:55,930

some holiday themed ones that I think if

1541

01:08:00,420 --> 01:07:58,000

people remember a be one of our co-hosts

1542

01:08:03,270 --> 01:08:00,430

is a help throw together a story with

1543

01:08:04,890 --> 01:08:03,280

the aisle so that in there so you guys

1544

01:08:07,470 --> 01:08:04,900

could check out some other cool holiday

1545

01:08:14,490 --> 01:08:07,480

art they pulled together for the name of

1546

01:08:17,220 --> 01:08:14,500

science so we actually since we pulled

1547

01:08:20,039 --> 01:08:17,230

out this cool yeast art we're gonna have

1548

01:08:21,539 --> 01:08:20,049

to move on and say goodbye but if you

1549

01:08:23,550 --> 01:08:21,549

guys want to learn more about some of

1550

01:08:25,440 --> 01:08:23,560

our life science research aboard the

1551

01:08:27,690 --> 01:08:25,450

international space station you can

1552

01:08:29,870 --> 01:08:27,700

check out our genius space hacks episode

1553

01:08:33,360 --> 01:08:29,880

and you go ahead and visit nasa.gov

1554

01:08:34,559 --> 01:08:33,370

backslash ames bat class NASA in Silicon

1555

01:08:36,780 --> 01:08:34,569

Valley live

1556

01:08:39,559 --> 01:08:36,790

all right so as the IO makes her way out

1557

01:08:42,300 --> 01:08:39,569

who do we have up on deck we have a

1558

01:08:45,990 --> 01:08:42,310

researcher by the name of Robin and

1559

01:08:53,789 --> 01:08:46,000

she's also around here we call her the

1560

01:08:55,740 --> 01:08:53,799

queen of keeping spacecraft cool so the

1561

01:08:57,410 --> 01:08:55,750

folks at who don't remember or if you

1562

01:09:05,430 --> 01:08:57,420

haven't seen the other episode yeah

1563

01:09:44,879 --> 01:09:05,440

Robin was just here yes she is in this

1564

01:09:52,320 --> 01:09:44,889

box over here all right let's do this

1565

01:09:57,089 --> 01:09:52,330

this is the unboxing and keep the lid

1566

01:10:01,850 --> 01:09:57,099

closed bye okay so this is actually a

1567

01:10:08,760 --> 01:10:01,860

tile that could have flown on the

1568

01:10:13,979 --> 01:10:08,770

spacecraft that to Mars so this is a

1569

01:10:17,890 --> 01:10:13,989

shoulder tile and it is installed

1570

01:10:21,310 --> 01:10:17,900

this way so it comes up and over and we

1571

01:10:23,860 --> 01:10:21,320

get the the highest heating is right at

1572

01:10:26,080 --> 01:10:23,870

that intersection so I actually think we

1573

01:10:30,150 --> 01:10:26,090

have a really cool photo so dude can we

1574

01:10:41,979 --> 01:10:35,979

can you see okay so actually I had

1575

01:10:46,810 --> 01:10:41,989

outlined one of these that's the size of

1576

01:10:49,330 --> 01:10:46,820

this tile so this is one tile out of 32

1577

01:10:51,939 --> 01:10:49,340

or 33 that go around that circumference

1578

01:10:53,860 --> 01:10:51,949

there so you can see that I mean that's

1579

01:10:56,650 --> 01:10:53,870

a full-sized man standing underneath

1580

01:10:59,500 --> 01:10:56,660

there it is a four and a half meter

1581

01:11:04,600 --> 01:10:59,510

diameter spacecraft so it's pretty big

1582

01:11:08,080 --> 01:11:04,610

and so we have 30 or so 32 of these

1583

01:11:11,080 --> 01:11:08,090

going around and many many more tiles

1584

01:11:14,470 --> 01:11:11,090

each tile has its own custom-made and

1585

01:11:17,470 --> 01:11:14,480

designed nice foam box that I get

1586

01:11:20,830 --> 01:11:17,480

shipped in to protect it so that when it

1587

01:11:23,790 --> 01:11:20,840

gets to the to be installed it gets

1588

01:11:29,670 --> 01:11:23,800

there hole it's a very fragile and

1589

01:11:40,209 --> 01:11:37,360

this pika we had talked about it also

1590

01:11:43,450 --> 01:11:40,219

made a pika so I fully expect a lot of

1591

01:11:45,459 --> 01:11:43,460

Pikachu notes the back shell is not made

1592

01:11:47,709 --> 01:11:45,469

out of pika that's the forward heat

1593

01:11:51,220 --> 01:11:47,719

shield is all protected with pika and

1594

01:11:56,140 --> 01:11:51,230

pika is phenolic impregnated carbon

1595

01:11:58,990 --> 01:11:56,150

ablator and so it will handle very high

1596

01:12:03,130 --> 01:11:59,000

heating um I went back after we had

1597

01:12:06,070 --> 01:12:03,140

practice rehearse and I looked up and so

1598

01:12:08,290 --> 01:12:06,080

pika can handle heating up to about or

1599

01:12:10,959 --> 01:12:08,300

even higher than a thousand watts per

1600

01:12:16,570 --> 01:12:10,969

square centimeter and when you stand

1601

01:12:19,630 --> 01:12:16,580

outside in the Sun you get about 0.15

1602

01:12:22,780 --> 01:12:19,640

watts per square centimeter of heating

1603

01:12:25,810 --> 01:12:22,790

on your body you so this is ten thousand

1604

01:12:28,150 --> 01:12:25,820

times as high this material can take ten

1605

01:12:30,760 --> 01:12:28,160

thousand times that heating

1606

01:12:33,670 --> 01:12:30,770

so there's tons of Pikachu emotes as I

1607

01:12:35,440 --> 01:12:33,680

expected but one of the questions is

1608

01:12:37,420 --> 01:12:35,450

coming for this is from Lord inter is

1609

01:12:42,070 --> 01:12:37,430

asking could you avoid reentry heat by

1610

01:12:44,650 --> 01:12:42,080

just decelerating more um it would

1611

01:12:47,470 --> 01:12:44,660

reduce it absolutely then you have to

1612

01:12:50,080 --> 01:12:47,480

carry all of that fuel oh yeah the

1613

01:12:51,880 --> 01:12:50,090

problem and we have a lot of scenarios

1614

01:12:55,510 --> 01:12:51,890

where we look especially for the heavy

1615

01:12:57,400 --> 01:12:55,520

heavy mass we do a direct entry right we

1616

01:13:03,610 --> 01:12:57,410

travel I'm gonna set this back yeah yeah

1617

01:13:06,190 --> 01:13:03,620

there we travel and we are in crews we

1618

01:13:08,980 --> 01:13:06,200

are coming close and we release right

1619

01:13:11,560 --> 01:13:08,990

and we enter right away so but there's

1620

01:13:14,650 --> 01:13:11,570

also scenarios where we aerocapture

1621

01:13:17,620 --> 01:13:14,660

where we just skim the atmosphere to

1622

01:13:19,780 --> 01:13:17,630

slow down and to go into orbit and so we

1623

01:13:22,900 --> 01:13:19,790

get heating then not as high as entry

1624

01:13:25,150 --> 01:13:22,910

heating that we do direct so then we we

1625

01:13:28,480 --> 01:13:25,160

circle and go into orbit and then from

1626

01:13:32,200 --> 01:13:28,490

orbit and entry it's a much lower

1627

01:13:33,760 --> 01:13:32,210

heating okay but it but the heavier we

1628

01:13:35,380 --> 01:13:33,770

get the higher the you know the bigger

1629

01:13:38,200 --> 01:13:35,390

we get to higher the heating speeds and

1630

01:13:41,860 --> 01:13:38,210

and volumes and area and everything else

1631

01:13:44,590 --> 01:13:41,870

so we have issues with how we how we

1632

01:13:46,420 --> 01:13:44,600

land big things so hard J the noob is

1633

01:13:49,000 --> 01:13:46,430

asking why do they make the heat shields

1634

01:13:51,580 --> 01:13:49,010

up of many small tiles well that's a

1635

01:13:54,820 --> 01:13:51,590

really good question and that is because

1636

01:13:57,100 --> 01:13:54,830

of how the material is made this

1637

01:13:58,990 --> 01:13:57,110

material this was cut out of a billet

1638

01:14:01,930 --> 01:13:59,000

there were actually six of these cut out

1639

01:14:06,610 --> 01:14:01,940

of a single billet on the bill it's come

1640

01:14:09,190 --> 01:14:06,620

up there about 42 inches long by 22

1641

01:14:13,360 --> 01:14:09,200

inches wide these come out of an 8 inch

1642

01:14:16,600 --> 01:14:13,370

billet because they are cut this way out

1643

01:14:18,520 --> 01:14:16,610

of the billet so they can they can set

1644

01:14:24,540 --> 01:14:18,530

six out of in the billet and they cut

1645

01:14:27,250 --> 01:14:24,550

those out and we have limitations on the

1646

01:14:29,650 --> 01:14:27,260

direction and the angle such that we

1647

01:14:33,760 --> 01:14:29,660

want to have the best properties those

1648

01:14:36,610 --> 01:14:33,770

billets are you know big fat blocks like

1649

01:14:38,620 --> 01:14:36,620

like this solid but the best direction

1650

01:14:40,170 --> 01:14:38,630

the lowest heating our lowest

1651

01:14:42,510 --> 01:14:40,180

conductivity you

1652

01:14:45,180 --> 01:14:42,520

is through the thickness so if we're

1653

01:14:48,150 --> 01:14:45,190

cutting a curved piece out of it we're

1654

01:14:53,280 --> 01:14:48,160

limited also on the size of how far off

1655

01:14:55,530 --> 01:14:53,290

of the normal that we can go to keep low

1656

01:14:56,790 --> 01:14:55,540

connectivity now we have the new

1657

01:14:59,220 --> 01:14:56,800

materials we had talked about where I

1658

01:15:01,560 --> 01:14:59,230

showed the felt where first of all we

1659

01:15:04,830 --> 01:15:01,570

can make much bigger tiles because we

1660

01:15:06,900 --> 01:15:04,840

can shape them such that the low

1661

01:15:10,530 --> 01:15:06,910

connectivity is the connectivity is the

1662

01:15:14,910 --> 01:15:10,540

same everywhere and then we also that

1663

01:15:17,640 --> 01:15:14,920

the broad goods come in the felt comes

1664

01:15:20,190 --> 01:15:17,650

like like cloth almost it comes up to

1665

01:15:23,310 --> 01:15:20,200

sixty inches wide and very very long

1666

01:15:26,630 --> 01:15:23,320

rolls you know so you can make bigger

1667

01:15:29,100 --> 01:15:26,640

pieces there are limitation is our

1668

01:15:31,230 --> 01:15:29,110

processing facilities we're going to do

1669

01:15:35,760 --> 01:15:31,240

that and make bigger and bigger pieces

1670

01:15:38,970 --> 01:15:35,770

these are this tile is among the

1671

01:15:41,490 --> 01:15:38,980

smallest the next tile up those two rows

1672

01:15:45,390 --> 01:15:41,500

have the most tiles around and they are

1673

01:15:47,460 --> 01:15:45,400

the smallest tiles further up we have we

1674

01:15:52,950 --> 01:15:47,470

have larger tiles right by harder to

1675

01:15:55,440 --> 01:15:52,960

bring on set this one has some special

1676

01:15:57,300 --> 01:15:55,450

features that we have just recently come

1677

01:16:00,450 --> 01:15:57,310

across and that's the the lovely

1678

01:16:03,480 --> 01:16:00,460

tiger-stripe I'm all for it I think

1679

01:16:12,570 --> 01:16:03,490

it'll be pretty okay we fly it on Mars

1680

01:16:14,190 --> 01:16:12,580

2020 potentially end up on Mars 2020 we

1681

01:16:16,380 --> 01:16:14,200

took these two out of protect we took

1682

01:16:18,480 --> 01:16:16,390

two tiles out of production because we

1683

01:16:21,180 --> 01:16:18,490

were looking at these dark marks and

1684

01:16:23,340 --> 01:16:21,190

wanting to know could this still fly is

1685

01:16:25,680 --> 01:16:23,350

there a problem with the material and we

1686

01:16:27,990 --> 01:16:25,690

did all kinds of testing we did Arctic

1687

01:16:31,410 --> 01:16:28,000

testing which you saw yeah what that's

1688

01:16:34,410 --> 01:16:31,420

like we did properties testing we did

1689

01:16:36,690 --> 01:16:34,420

everything and have shown that the

1690

01:16:39,660 --> 01:16:36,700

material the black the dark material

1691

01:16:42,690 --> 01:16:39,670

behaves just like the light material so

1692

01:16:45,810 --> 01:16:42,700

we can fly it soak in obey is saying why

1693

01:16:48,090 --> 01:16:45,820

is the material so fragile also Robin's

1694

01:16:54,040 --> 01:16:48,100

grandson Bradley is yelling hi Nona I

1695

01:16:54,050 --> 01:16:58,009

[Music]

1696

01:17:06,000 --> 01:17:01,649

he's about 20 months old and cute as a

1697

01:17:10,080 --> 01:17:06,010

button so about why it's so fragile it

1698

01:17:13,759 --> 01:17:10,090

is a very brittle material it it doesn't

1699

01:17:17,310 --> 01:17:13,769

Bend it doesn't stretch at all and so

1700

01:17:19,649 --> 01:17:17,320

it's very sensitive to what we put it on

1701

01:17:22,739 --> 01:17:19,659

so that the great thing about the

1702

01:17:26,160 --> 01:17:22,749

missions that we've flown is we've flown

1703

01:17:29,489 --> 01:17:26,170

this material on Stardust and weave it

1704

01:17:31,410 --> 01:17:29,499

is flying right now on osiris-rex and

1705

01:17:33,660 --> 01:17:31,420

that's those two were single pieces

1706

01:17:36,209 --> 01:17:33,670

because they're about this big less than

1707

01:17:40,560 --> 01:17:36,219

a metre in diameter a single piece of

1708

01:17:42,629 --> 01:17:40,570

pica for Mars for our MSL so for the

1709

01:17:45,080 --> 01:17:42,639

spacecraft that took curiosity and for

1710

01:17:47,700 --> 01:17:45,090

Mars 2020 which will take the next Rover

1711

01:17:50,580 --> 01:17:47,710

we're doing it we have to do it in tiles

1712

01:17:53,609 --> 01:17:50,590

but all of those missions they get to

1713

01:17:57,060 --> 01:17:53,619

they're bonded on to a composite that

1714

01:17:59,370 --> 01:17:57,070

have similar expansion properties when

1715

01:18:02,609 --> 01:17:59,380

you get it warm which is good if we had

1716

01:18:05,339 --> 01:18:02,619

to put this on metal then we might have

1717

01:18:09,509 --> 01:18:05,349

to use strain isolation pads okay so we

1718

01:18:12,930 --> 01:18:09,519

go to the more flexible substrate we

1719

01:18:14,700 --> 01:18:12,940

have a little more flexibility and what

1720

01:18:17,069 --> 01:18:14,710

we did want to because it has a higher

1721

01:18:19,259 --> 01:18:17,079

strain to failure if you pull this it

1722

01:18:21,299 --> 01:18:19,269

goes and breaks into two pieces

1723

01:18:23,970 --> 01:18:21,309

if you pull some of the other materials

1724

01:18:26,430 --> 01:18:23,980

they kind of stretch and and they don't

1725

01:18:27,810 --> 01:18:26,440

break you don't get chunks falling off

1726

01:18:29,430 --> 01:18:27,820

so then we have a ton of questions

1727

01:18:31,140 --> 01:18:29,440

coming in so we can just keep going

1728

01:18:32,700 --> 01:18:31,150

through this what one would this is from

1729

01:18:35,220 --> 01:18:32,710

a while back but it was space TV now

1730

01:18:36,779 --> 01:18:35,230

asked is the peak of material similar to

1731

01:18:41,850 --> 01:18:36,789

what's used to protect the Parker Solar

1732

01:18:45,419 --> 01:18:41,860

Probe no no Parker Solar Probe is carbon

1733

01:18:49,529 --> 01:18:45,429

carbon it is very very dense it's a

1734

01:18:52,250 --> 01:18:49,539

carbon carbon cloth mixture that that's

1735

01:18:54,839 --> 01:18:52,260

filled with carbon it's very dense very

1736

01:18:57,600 --> 01:18:54,849

high conductivity but then that's placed

1737

01:19:00,390 --> 01:18:57,610

over a carbon foam to try to insulate it

1738

01:19:03,060 --> 01:19:00,400

okay yeah this could not handle the

1739

01:19:04,379 --> 01:19:03,070

heating that the woman and Zeller propyl

1740

01:19:06,049 --> 01:19:04,389

see that was another question that came

1741

01:19:08,929 --> 01:19:06,059

through I'm gonna see who

1742

01:19:10,549 --> 01:19:08,939

okay this is a toads ire is asking does

1743

01:19:15,919 --> 01:19:10,559

it insulate as well as provide heat

1744

01:19:19,040 --> 01:19:15,929

resistance yes because of the phenolic

1745

01:19:21,559 --> 01:19:19,050

it's a very and a low-density it's a

1746

01:19:23,659 --> 01:19:21,569

very nice insulator but it also can

1747

01:19:25,459 --> 01:19:23,669

handle very high heating on the surface

1748

01:19:27,889 --> 01:19:25,469

so you get high temperatures at the

1749

01:19:30,619 --> 01:19:27,899

surface but at the at the interface it

1750

01:19:32,509 --> 01:19:30,629

stays cool so it's kind of the people

1751

01:19:35,329 --> 01:19:32,519

have talked about we used to be able to

1752

01:19:40,879 --> 01:19:35,339

have a torch and show a shuttle tile and

1753

01:19:43,159 --> 01:19:40,889

hold it and well no fire here in that

1754

01:19:46,759 --> 01:19:43,169

regard in that the way that the phenolic

1755

01:19:49,219 --> 01:19:46,769

works it will protect the material okay

1756

01:19:50,540 --> 01:19:49,229

now how are we on time I would love to

1757

01:19:52,159 --> 01:19:50,550

sit and talk with you all day Robin

1758

01:19:54,290 --> 01:19:52,169

about all things heat shield but

1759

01:19:57,709 --> 01:19:54,300

unfortunately we do have to say goodbye

1760

01:19:58,969 --> 01:19:57,719

right but for our users our viewers at

1761

01:20:00,619 --> 01:19:58,979

home if you want to learn more about

1762

01:20:03,199 --> 01:20:00,629

Robins research you can check out our

1763

01:20:21,139 --> 01:20:03,209

past episode about the science of heat

1764

01:20:22,399 --> 01:20:21,149

shields alright so let's go ahead and

1765

01:20:31,219 --> 01:20:22,409

bring up our next guest

1766

01:20:33,889 --> 01:20:31,229

Don so Don why don't you yes my lucky

1767

01:20:35,750 --> 01:20:33,899

day today nothing but presents so while

1768

01:20:37,339 --> 01:20:35,760

Matt is going ahead and opening up as

1769

01:20:38,779 --> 01:20:37,349

present so why don't you tell us a

1770

01:20:40,069 --> 01:20:38,789

little bit about yourself in what you do

1771

01:20:42,379 --> 01:20:40,079

here at Ames okay

1772

01:20:45,049 --> 01:20:42,389

well I'm an aerospace engineer at Ames

1773

01:20:46,939 --> 01:20:45,059

and I've done a lot of Windtunnel

1774

01:20:49,159 --> 01:20:46,949

testing of advanced aircraft concepts

1775

01:20:51,949 --> 01:20:49,169

okay so you mentioned wind tunnel like

1776

01:20:54,409 --> 01:20:51,959

what is a wind tunnel wind tunnel it's

1777

01:20:56,479 --> 01:20:54,419

very cool it's basically a large tube

1778

01:20:59,689 --> 01:20:56,489

and we pump air through there sometimes

1779

01:21:01,609 --> 01:20:59,699

at very high speeds okay there are large

1780

01:21:03,799 --> 01:21:01,619

tunnels I can take a full-size airplane

1781

01:21:06,139 --> 01:21:03,809

like a 737 can actually fit in our

1782

01:21:08,239 --> 01:21:06,149

largest wind tunnel and we've put

1783

01:21:10,189 --> 01:21:08,249

fighter airplanes in there there are

1784

01:21:11,989 --> 01:21:10,199

also smaller wind tunnels that are used

1785

01:21:13,669 --> 01:21:11,999

when we need to go to higher speeds in

1786

01:21:16,699 --> 01:21:13,679

the tunnel and then we put in a scale

1787

01:21:17,830 --> 01:21:16,709

model in the wind tunnel okay so I'm

1788

01:21:21,919 --> 01:21:17,840

guessing

1789

01:21:25,129 --> 01:21:21,929

involved in that it may be say it is

1790

01:21:29,330 --> 01:21:25,139

Donner last guess he is not he's not we

1791

01:21:37,729 --> 01:21:33,919

I am very gentle I think okay ready and

1792

01:21:41,419 --> 01:21:37,739

here we go it might be upside down is

1793

01:21:42,770 --> 01:21:41,429

that there we go there we go because I

1794

01:21:46,069 --> 01:21:42,780

don't want to mess it I don't want to

1795

01:22:00,529 --> 01:21:46,079

mess it up I want to be very gentle with

1796

01:22:02,810 --> 01:22:00,539

it there we go okay everything so I love

1797

01:22:04,939 --> 01:22:02,820

these models this is one of our actual

1798

01:22:06,890 --> 01:22:04,949

wind tunnel models that I have run in

1799

01:22:11,569 --> 01:22:06,900

the wind tunnel at speeds of Mach 1.6

1800

01:22:13,339 --> 01:22:11,579

and 1.8 before we know what's dive down

1801
01:22:15,200 --> 01:22:13,349
to details like what is when you're

1802
01:22:17,509 --> 01:22:15,210
talking Mach speed like what is that guy

1803
01:22:20,450 --> 01:22:17,519
so mark is the speed of the airplane

1804
01:22:22,279 --> 01:22:20,460
relative to the speed of sound so Mach 1

1805
01:22:24,080 --> 01:22:22,289
is at the speed of sound

1806
01:22:25,879 --> 01:22:24,090
okay whatever altitude you're at at

1807
01:22:29,359 --> 01:22:25,889
cruising altitude the speed of sound is

1808
01:22:32,750 --> 01:22:29,369
about 660 miles an hour so we've tested

1809
01:22:34,640 --> 01:22:32,760
this up to mach 1.8 which is a little

1810
01:22:37,040 --> 01:22:34,650
bit over 1,100 miles per hour in the

1811
01:22:39,049 --> 01:22:37,050
wind tunnel so I've stood outside the

1812
01:22:40,160 --> 01:22:39,059
wind tunnel watching the wind go by but

1813
01:22:40,790 --> 01:22:40,170

of course you can't see you can't see

1814

01:22:42,680 --> 01:22:40,800

wind

1815

01:22:44,750 --> 01:22:42,690

unless there's fog in the tunnel but

1816

01:22:48,290 --> 01:22:44,760

anyway we watch this ride in the wind

1817

01:22:52,939 --> 01:22:48,300

tunnel with those speeds okay so you had

1818

01:22:54,950 --> 01:22:52,949

mentioned the these you know wind

1819

01:22:57,740 --> 01:22:54,960

tunnels like why do we use them like

1820

01:23:00,500 --> 01:22:57,750

what's so special about him they're

1821

01:23:02,569 --> 01:23:00,510

great because you can test an airplane

1822

01:23:04,939 --> 01:23:02,579

either a full-size airplane or a scale

1823

01:23:06,439 --> 01:23:04,949

model of it in flight I mean in on the

1824

01:23:08,029 --> 01:23:06,449

ground instead of doing it in flight

1825

01:23:09,319 --> 01:23:08,039

where if you don't know what the

1826

01:23:11,509 --> 01:23:09,329

aerodynamics of the airplane are gonna

1827

01:23:13,189 --> 01:23:11,519

be you needs to test the tunnel to

1828

01:23:14,990 --> 01:23:13,199

simulate the real physics of it and

1829

01:23:16,759 --> 01:23:15,000

measure the aerodynamics of it and in my

1830

01:23:20,299 --> 01:23:16,769

case we're measuring the sonic boom of

1831

01:23:22,640 --> 01:23:20,309

these supersonic airliners and so we can

1832

01:23:24,350 --> 01:23:22,650

learn about those characteristics before

1833

01:23:27,200 --> 01:23:24,360

we take the airplane to flight I'll just

1834

01:23:28,100 --> 01:23:27,210

say four that way so Delaine this is the

1835

01:23:29,779 --> 01:23:28,110

first question right out of the gate

1836

01:23:30,590 --> 01:23:29,789

it's like but why is that know so long

1837

01:23:40,190 --> 01:23:30,600

so

1838

01:23:42,050 --> 01:23:40,200

that is the best question regarding sits

1839

01:23:44,660 --> 01:23:42,060

the first one anyway

1840

01:23:48,380 --> 01:23:44,670

the nose is so long because to design

1841

01:23:50,930 --> 01:23:48,390

for a quiet sonic boom you want weak

1842

01:23:52,280 --> 01:23:50,940

shockwaves up in front you don't want

1843

01:23:54,980 --> 01:23:52,290

these strong shock waves like the

1844

01:23:56,810 --> 01:23:54,990

Concorde airliner and modern fighter

1845

01:23:58,220 --> 01:23:56,820

aircraft they do have sharp noses but

1846

01:24:00,770 --> 01:23:58,230

they're not nearly so long and slender

1847

01:24:02,600 --> 01:24:00,780

as this and so they produce a strong

1848

01:24:05,060 --> 01:24:02,610

shockwave a shockwave is a sudden

1849

01:24:08,390 --> 01:24:05,070

pressure rise from one point to the next

1850

01:24:10,070 --> 01:24:08,400

and and if you have a strong shock in

1851

01:24:12,980 --> 01:24:10,080

the front then the sonic boom is gonna

1852

01:24:14,960 --> 01:24:12,990

be a very loud boom boom sound yeah and

1853

01:24:19,760 --> 01:24:14,970

you can feel it thump your chest and all

1854

01:24:22,310 --> 01:24:19,770

that NASA Armstrong over in the Mojave

1855

01:24:24,560 --> 01:24:22,320

Desert and they were running test flight

1856

01:24:27,950 --> 01:24:24,570

flights and NOAA sonic booms it feels

1857

01:24:30,380 --> 01:24:27,960

like a legit earthquake like a 4.5 like

1858

01:24:35,480 --> 01:24:30,390

the whole building shakes yeah but of

1859

01:24:37,160 --> 01:24:35,490

course it's very short yes yes so yeah

1860

01:24:39,370 --> 01:24:37,170

you want weak shocks up in the front and

1861

01:24:41,690 --> 01:24:39,380

then the sonic boom will not be a strong

1862

01:24:43,400 --> 01:24:41,700

sudden pressurize at the ground but it

1863

01:24:45,230 --> 01:24:43,410

would be a gradual pressure rise and

1864

01:24:48,020 --> 01:24:45,240

that will sound more like a sonic thump

1865

01:24:51,680 --> 01:24:48,030

yeah and be much quieter and it won't

1866

01:24:53,870 --> 01:24:51,690

give the earthquake type of sensation oh

1867

01:24:56,750 --> 01:24:53,880

we've got a bunch of questions that are

1868

01:25:00,080 --> 01:24:56,760

coming in so we got black swarm says how

1869

01:25:02,510 --> 01:25:00,090

cool and asks what was the most ordinary

1870

01:25:06,920 --> 01:25:02,520

or most unordinary thing you saw in a

1871

01:25:10,910 --> 01:25:06,930

wind tunnel actually I've seen a picture

1872

01:25:15,380 --> 01:25:10,920

of a submarine in a wind tunnel well

1873

01:25:18,380 --> 01:25:15,390

it's all fluid dynamics right okay fluid

1874

01:25:20,270 --> 01:25:18,390

you measure the air dynamics around

1875

01:25:23,510 --> 01:25:20,280

submarine but I guess we're getting way

1876

01:25:26,510 --> 01:25:23,520

off topic I think coolest thing I've

1877

01:25:28,520 --> 01:25:26,520

seen are these sonic boom models nice no

1878

01:25:30,020 --> 01:25:28,530

these are really nice looking models

1879

01:25:32,480 --> 01:25:30,030

here I'm open when I retire that NASA

1880

01:25:35,060 --> 01:25:32,490

will let me take this a soupy seven was

1881

01:25:37,790 --> 01:25:35,070

asking when will this fly for real for

1882

01:25:41,210 --> 01:25:37,800

real okay that is a good question

1883

01:25:44,020 --> 01:25:41,220

okay this their place yeah we're testing

1884

01:25:47,230 --> 01:25:44,030

it NASA is working on a lot

1885

01:25:49,000 --> 01:25:47,240

technologies to enable future supersonic

1886

01:25:50,980 --> 01:25:49,010

air travel right now it's banned from

1887

01:25:53,140 --> 01:25:50,990

supersonic flight over land because of

1888

01:25:53,920 --> 01:25:53,150

the loudness of the sonic boom but we're

1889

01:25:56,770 --> 01:25:53,930

working on that

1890

01:25:58,390 --> 01:25:56,780

and so NASA's latest and greatest thing

1891

01:26:00,070 --> 01:25:58,400

is that we're taking the lessons learned

1892

01:26:03,310 --> 01:26:00,080

from the tests of these type of models

1893

01:26:04,510 --> 01:26:03,320

and applying it to the next NASA X plane

1894

01:26:11,580 --> 01:26:04,520

which would be the low boom flight

1895

01:26:15,910 --> 01:26:13,630

there's the picture of the low boom

1896

01:26:19,980 --> 01:26:15,920

flight demonstrator has been designed by

1897

01:26:23,050 --> 01:26:19,990

Lockheed Palmdale along with NASA people

1898

01:26:25,270 --> 01:26:23,060

overseeing it so that is being built

1899

01:26:26,590 --> 01:26:25,280

right now it was just started it'll be

1900

01:26:29,500 --> 01:26:26,600

flying a little bit over three years

1901
01:26:31,420 --> 01:26:29,510
from now okay and that will be the first

1902
01:26:32,920 --> 01:26:31,430
airplane in the world ever flown that

1903
01:26:35,320 --> 01:26:32,930
was designed from scratch to have a

1904
01:26:37,330 --> 01:26:35,330
quiet sonic boom it's pretty cool the

1905
01:26:38,920 --> 01:26:37,340
boom level for modern fighter aircraft

1906
01:26:41,170 --> 01:26:38,930
of the Concorde is like a hundred two

1907
01:26:43,960 --> 01:26:41,180
hundred and ten decibels which is like a

1908
01:26:46,030 --> 01:26:43,970
very loud rock concert or something boom

1909
01:26:47,980 --> 01:26:46,040
level from the lb-ft low boom flight

1910
01:26:51,430 --> 01:26:47,990
demonstrator is expecting to be less

1911
01:26:53,380 --> 01:26:51,440
than 75 decibels well realistically how

1912
01:26:55,570 --> 01:26:53,390
does that impact I'm like I recently

1913
01:26:57,460 --> 01:26:55,580

took a flight from San Francisco to DC

1914

01:26:59,740 --> 01:26:57,470

knows about like four or five hours give

1915

01:27:01,090 --> 01:26:59,750

or take what would SuperSonics what

1916

01:27:02,800 --> 01:27:01,100

would that flight eventually look like

1917

01:27:04,630 --> 01:27:02,810

well if we're flying at twice the speed

1918

01:27:06,010 --> 01:27:04,640

of the subsonic airliners we'll get

1919

01:27:09,330 --> 01:27:06,020

there and just a little bit more than

1920

01:27:11,800 --> 01:27:09,340

half the time Wow like two hours well

1921

01:27:14,230 --> 01:27:11,810

closer to three I think okay from here

1922

01:27:23,290 --> 01:27:14,240

to DC but like from here to London and

1923

01:27:26,110 --> 01:27:23,300

five and six hours so a whole bunch of

1924

01:27:28,710 --> 01:27:26,120

questions I see caronia is asking what

1925

01:27:31,360 --> 01:27:28,720

about the many wings and fins it has

1926

01:27:33,970 --> 01:27:31,370

yeah that's a good question here so you

1927

01:27:36,640 --> 01:27:33,980

can see the wing planform it's got a

1928

01:27:38,620 --> 01:27:36,650

very sharp very highly smoked wings here

1929

01:27:40,150 --> 01:27:38,630

and then the wings extend out then it

1930

01:27:43,120 --> 01:27:40,160

has little winglets you've seen the

1931

01:27:45,790 --> 01:27:43,130

winglets on different airplanes it's not

1932

01:27:48,700 --> 01:27:45,800

like 737s they have a lot of winglets so

1933

01:27:50,770 --> 01:27:48,710

these are we call them v tails if you

1934

01:27:53,200 --> 01:27:50,780

look at this view from the front here

1935

01:27:56,080 --> 01:27:53,210

then you can see that they're up at

1936

01:27:57,760 --> 01:27:56,090

about a 45 degree angle they've served

1937

01:27:59,860 --> 01:27:57,770

the function of both a horizontal

1938

01:28:01,930 --> 01:27:59,870

stabilizer in the back as well as the

1939

01:28:03,730 --> 01:28:01,940

vertical stabilizer and there would be

1940

01:28:05,800 --> 01:28:03,740

rudders on these to help steer the

1941

01:28:07,360 --> 01:28:05,810

airplane as well as help it in banks and

1942

01:28:10,540 --> 01:28:07,370

stuff so a question just jumped up from

1943

01:28:15,520 --> 01:28:10,550

the Snack Wrap is I know right these are

1944

01:28:17,440 --> 01:28:15,530

awesome names so the question is like

1945

01:28:19,900 --> 01:28:17,450

would there be a big jump in turbulence

1946

01:28:22,210 --> 01:28:19,910

as the plane hits the sonic boom four

1947

01:28:23,440 --> 01:28:22,220

people in the plane yeah well if any of

1948

01:28:25,000 --> 01:28:23,450

you've seen the movie the right stuff

1949

01:28:27,130 --> 01:28:25,010

when Chuck Yeager broke the sound

1950

01:28:28,600 --> 01:28:27,140

barrier for the first time it shows that

1951

01:28:29,980 --> 01:28:28,610

the airplane shook a lot as he went

1952

01:28:32,740 --> 01:28:29,990

through Mach 1 mm-hmm

1953

01:28:35,470 --> 01:28:32,750

and that's true it did shake a lot for

1954

01:28:37,450 --> 01:28:35,480

him modern airplanes like the f-18

1955

01:28:39,100 --> 01:28:37,460

fighter or the f-15 they don't really

1956

01:28:41,410 --> 01:28:39,110

shake as you go through Mach 1 they're

1957

01:28:43,540 --> 01:28:41,420

designed to go supersonic yeah so the

1958

01:28:45,280 --> 01:28:43,550

turbulence is really very small and I

1959

01:28:46,960 --> 01:28:45,290

think I think these would be even

1960

01:28:49,110 --> 01:28:46,970

smoother the concorde apparently was

1961

01:28:51,220 --> 01:28:49,120

very smooth as it went through Mach 1

1962

01:28:53,110 --> 01:28:51,230

okay so it looks like one of the

1963

01:28:55,030 --> 01:28:53,120

questions that we have is like why

1964

01:29:00,130 --> 01:28:55,040

wouldn't a simulation be sufficient for

1965

01:29:01,870 --> 01:29:00,140

testing that's from a golden luck wind

1966

01:29:03,880 --> 01:29:01,880

tunnels and supercomputers that crunch

1967

01:29:05,950 --> 01:29:03,890

numbers talk about that symbiotic

1968

01:29:09,190 --> 01:29:05,960

relationship well it's really a triad

1969

01:29:11,140 --> 01:29:09,200

research ok so back in the early days of

1970

01:29:13,450 --> 01:29:11,150

aviation we just ran things in the one

1971

01:29:15,010 --> 01:29:13,460

time we didn't have computers okay so we

1972

01:29:17,170 --> 01:29:15,020

do wind tunnel test and it's using real

1973

01:29:18,490 --> 01:29:17,180

air so it's got the real physics but

1974

01:29:20,110 --> 01:29:18,500

it's a scale model and there are

1975

01:29:23,230 --> 01:29:20,120

compromises when you have a model like

1976

01:29:25,410 --> 01:29:23,240

this for a computer simulation we have

1977

01:29:28,510 --> 01:29:25,420

the supercomputer and they can predict

1978

01:29:31,570 --> 01:29:28,520

many great features about the flow but

1979

01:29:33,070 --> 01:29:31,580

they're not quite the real thing so we

1980

01:29:34,810 --> 01:29:33,080

want to go to flight to really

1981

01:29:37,420 --> 01:29:34,820

demonstrate it and in particular for the

1982

01:29:40,150 --> 01:29:37,430

low bloom flight demonstrator we're not

1983

01:29:42,070 --> 01:29:40,160

going to get the FAA and the whole

1984

01:29:44,020 --> 01:29:42,080

international community to believe that

1985

01:29:45,790 --> 01:29:44,030

we know how to design planes for a quiet

1986

01:29:48,340 --> 01:29:45,800

sonic boom until we actually go up and

1987

01:29:51,760 --> 01:29:48,350

fly it so we're gonna do that in the

1988

01:29:54,730 --> 01:29:51,770

years 20 22 through 24 fly that airplane

1989

01:29:56,860 --> 01:29:54,740

over communities all over the US and get

1990

01:29:57,820 --> 01:29:56,870

the public's reaction to the sonic thump

1991

01:30:01,570 --> 01:29:57,830

from it yeah

1992

01:30:02,920 --> 01:30:01,580

no longer be a sonic boom so they're not

1993

01:30:04,390 --> 01:30:02,930

gonna believe it's just from the ground

1994

01:30:06,310 --> 01:30:04,400

test data and from the computer

1995

01:30:07,870 --> 01:30:06,320

simulation they'll believe it when we

1996

01:30:09,130 --> 01:30:07,880

actually fly an airplane and they can

1997

01:30:09,899 --> 01:30:09,140

stand out there and hear it with their

1998

01:30:12,390 --> 01:30:09,909

own ears

1999

01:30:13,950 --> 01:30:12,400

so mr. man 1 to 4 is if I want to work

2000

01:30:15,600 --> 01:30:13,960

at NASA do you think a degree in

2001

01:30:21,030 --> 01:30:15,610

aerospace engineering would help me get

2002

01:30:23,100 --> 01:30:21,040

recruited the whole point mr. man yeah

2003

01:30:28,080 --> 01:30:23,110

that's what my degrees are in aerospace

2004

01:30:31,439 --> 01:30:28,090

engineering I got the job if you want my

2005

01:30:33,510 --> 01:30:31,449

job come and take it in a few years time

2006

01:30:35,370 --> 01:30:33,520

for about one more question before we do

2007

01:30:37,620 --> 01:30:35,380

have to say bye to dot okay let's hit

2008

01:30:39,120 --> 01:30:37,630

this from sometimes I lie is like with

2009

01:30:41,220 --> 01:30:39,130

this technology eventually be used on

2010

01:30:43,320 --> 01:30:41,230

commercial airliners the whole idea that

2011

01:30:44,939 --> 01:30:43,330

is the whole point so there will

2012

01:30:46,919 --> 01:30:44,949

probably be supersonic business jets

2013

01:30:49,080 --> 01:30:46,929

first and there are some companies that

2014

01:30:50,939 --> 01:30:49,090

are starting to make those they think

2015

01:30:53,010 --> 01:30:50,949

that they're going to be flying them for

2016

01:30:55,050 --> 01:30:53,020

the public within five or maybe eight

2017

01:30:58,560 --> 01:30:55,060

years or so I'm not sure there's gonna

2018

01:31:00,720 --> 01:30:58,570

be low boom like the lb-ft will be but

2019

01:31:02,490 --> 01:31:00,730

there'll be business jets first for the

2020

01:31:04,379 --> 01:31:02,500

rich and famous and they'll build

2021

01:31:06,360 --> 01:31:04,389

airliners and granted ticket prices be

2022

01:31:08,370 --> 01:31:06,370

high but hopefully in the coming decades

2023

01:31:14,010 --> 01:31:08,380

ticket prices will come down can hella

2024

01:31:16,020 --> 01:31:14,020

gate normally works exactly okay well

2025

01:31:18,209 --> 01:31:16,030

thank you so much for joining us Don

2026

01:31:21,000 --> 01:31:18,219

it's been a pleasure and just as a

2027

01:31:22,919 --> 01:31:21,010

reminder you're watching NASA in Silicon

2028

01:31:25,879 --> 01:31:22,929

Valley live and if you have any

2029

01:31:30,240 --> 01:31:25,889

questions for our guests feel free to

2030

01:31:32,910 --> 01:31:30,250

write them in the chat so up next we're

2031

01:31:39,350 --> 01:31:32,920

gonna go ahead and bring out my cell by

2032

01:31:39,360 --> 01:31:47,479

everybody else bringing the biggest gift

2033

01:31:51,660 --> 01:31:50,399

a little bit about about yourself at

2034

01:31:54,270 --> 01:31:51,670

some of the research that you do here

2035

01:31:56,160 --> 01:31:54,280

sure so I'm a I'm a researcher engineer

2036

01:31:58,680 --> 01:31:56,170

here at the air space operation

2037

01:32:00,180 --> 01:31:58,690

laboratory I mainly do research and air

2038

01:32:04,760 --> 01:32:00,190

traffic management and air traffic

2039

01:32:08,160 --> 01:32:04,770

systems for both manned and unmanned I

2040

01:32:09,750 --> 01:32:08,170

also do outreach events and on top of

2041

01:32:12,780 --> 01:32:09,760

that when we have where we do a flight

2042

01:32:14,760 --> 01:32:12,790

testing us in the field I do and support

2043

01:32:25,320 --> 01:32:14,770

those flight tests as a human factors

2044

01:32:31,169 --> 01:32:28,990

like my lack of fingernails okay here we

2045

01:32:51,729 --> 01:32:33,910

and I look at five cells face to see if

2046

01:32:55,840 --> 01:32:51,739

he's like cave on more he was like oh no

2047

01:32:56,140 --> 01:32:55,850

it's a very gentle tape all right here

2048

01:33:01,629 --> 01:32:56,150

we go

2049

01:33:03,910 --> 01:33:01,639

oh yeah okay this is what everybody in

2050

01:33:11,620 --> 01:33:03,920

the chat is I'm sure hoping to get for

2051
01:33:16,629 --> 01:33:11,630
Christmas bring this bad boy on out like

2052
01:33:19,840 --> 01:33:16,639
what's obviously everyone knows what is

2053
01:33:22,359 --> 01:33:19,850
but like why drones like why is NASA

2054
01:33:24,520 --> 01:33:22,369
getting involved in this research well

2055
01:33:27,760 --> 01:33:24,530
you just mentioned you know John said

2056
01:33:31,270 --> 01:33:27,770
becoming a hot topic out there and not

2057
01:33:33,280 --> 01:33:31,280
only for commercial use but also for

2058
01:33:35,830 --> 01:33:33,290
government use Public Safety and the

2059
01:33:37,240 --> 01:33:35,840
general public and so when you have so

2060
01:33:38,800 --> 01:33:37,250
many joints up in the air you need to

2061
01:33:41,290 --> 01:33:38,810
have a way to manage them

2062
01:33:42,820 --> 01:33:41,300
yeah and Ames go and talk to talk a

2063
01:33:45,070 --> 01:33:42,830

little bit about Ames Ames has a long

2064

01:33:50,890 --> 01:33:45,080

history in air traffic management

2065

01:33:53,320 --> 01:33:50,900

research and air traffic system research

2066

01:33:56,590 --> 01:33:53,330

as well so they actually took the

2067

01:34:02,709 --> 01:33:56,600

challenge into developing an air traffic

2068

01:34:05,439 --> 01:34:02,719

management system for drones okay so so

2069

01:34:07,030 --> 01:34:05,449

you said that we have this drone traffic

2070

01:34:08,740 --> 01:34:07,040

system but like how is it different from

2071

01:34:10,510 --> 01:34:08,750

air traffic control like is it a

2072

01:34:13,090 --> 01:34:10,520

software-based or is it Hardware base

2073

01:34:19,570 --> 01:34:13,100

it's yeah that's a good question so it's

2074

01:34:22,270 --> 01:34:19,580

a cloud software base and it's different

2075

01:34:24,700 --> 01:34:22,280

because we're talking about hundreds of

2076

01:34:28,000 --> 01:34:24,710

thousands of drones flying in the air so

2077

01:34:30,070 --> 01:34:28,010

with the air traffic management we use

2078

01:34:31,450 --> 01:34:30,080

for manned aviation today you actually

2079

01:34:33,700 --> 01:34:31,460

have a controller on the ground

2080

01:34:34,510 --> 01:34:33,710

controlling each of the aircraft so when

2081

01:34:36,190 --> 01:34:34,520

you have

2082

01:34:38,140 --> 01:34:36,200

of thousands of these John's flying it's

2083

01:34:40,240 --> 01:34:38,150

gonna be very difficult for those

2084

01:34:40,750 --> 01:34:40,250

controllers to manage all of those

2085

01:34:43,780 --> 01:34:40,760

Strong's

2086

01:34:46,210 --> 01:34:43,790

right so what that's decided Oona's aims

2087

01:34:48,370 --> 01:34:46,220

we decided to come up with a fully

2088

01:34:51,120 --> 01:34:48,380

autonomous cloud-based system software

2089

01:34:55,480 --> 01:34:51,130

system that would do most of the job

2090

01:34:57,160 --> 01:34:55,490

with automation okay so I was gonna say

2091

01:34:59,320 --> 01:34:57,170

so if we get mark and Jesse we have

2092

01:35:01,030 --> 01:34:59,330

wobbly waffle over here is yelling in

2093

01:35:03,610 --> 01:35:01,040

the chat saying zoom in on the drone

2094

01:35:05,350 --> 01:35:03,620

Dave so I'm gonna say mark and Jesse

2095

01:35:08,020 --> 01:35:05,360

there we go and then Dave is gonna

2096

01:35:10,750 --> 01:35:08,030

switch it switch over to that okay so

2097

01:35:12,040 --> 01:35:10,760

you know as you know drones come in

2098

01:35:13,390 --> 01:35:12,050

different sizes and shapes and

2099

01:35:15,220 --> 01:35:13,400

performances right you can have drones

2100

01:35:17,140 --> 01:35:15,230

that could fit in the palm of your your

2101

01:35:19,810 --> 01:35:17,150

hand two joints that are as big as a

2102

01:35:21,910 --> 01:35:19,820

manned aviation okay so what we have

2103

01:35:24,280 --> 01:35:21,920

here actually is a quadcopter you have

2104

01:35:26,080 --> 01:35:24,290

four motors here and these drones could

2105

01:35:27,670 --> 01:35:26,090

have different payloads right and for

2106

01:35:29,710 --> 01:35:27,680

this example you have a place here for a

2107

01:35:31,270 --> 01:35:29,720

camera but he can place the camera here

2108

01:35:32,950 --> 01:35:31,280

but others could have like airborne

2109

01:35:38,950 --> 01:35:32,960

radar so you can have drones that would

2110

01:35:40,060 --> 01:35:38,960

do delivery as well okay I mean I mean

2111

01:35:42,580 --> 01:35:40,070

we know that like there's the air

2112

01:35:46,240 --> 01:35:42,590

traffic controllers are human based and

2113

01:35:47,950 --> 01:35:46,250

they're very busy and very stressed and

2114

01:35:49,690 --> 01:35:47,960

you can imagine they're not gonna have a

2115

01:35:52,270 --> 01:35:49,700

good time if you start flooding the

2116

01:35:54,490 --> 01:35:52,280

airspace and they're tracking hundreds

2117

01:35:56,680 --> 01:35:54,500

thousands and thousands of drones so

2118

01:35:58,360 --> 01:35:56,690

that's the whole idea like this traffic

2119

01:36:01,030 --> 01:35:58,370

management is like what is an automated

2120

01:36:04,480 --> 01:36:01,040

traffic management for drone so that's a

2121

01:36:06,850 --> 01:36:04,490

software yeah it's a software based but

2122

01:36:10,270 --> 01:36:06,860

in terms of like those rules that you

2123

01:36:11,710 --> 01:36:10,280

have to follow for example you know one

2124

01:36:15,760 --> 01:36:11,720

of the first things we got to look at is

2125

01:36:17,740 --> 01:36:15,770

how do you what do you do when you're

2126

01:36:20,380 --> 01:36:17,750

using this the software might you would

2127

01:36:22,690 --> 01:36:20,390

submit on an operational volume you know

2128

01:36:25,000 --> 01:36:22,700

and/or you can think about it as a safe

2129

01:36:28,210 --> 01:36:25,010

zone okay so you're telling the system

2130

01:36:30,310 --> 01:36:28,220

you your intention so I'm gonna fly in

2131

01:36:32,380 --> 01:36:30,320

this area between this time and this

2132

01:36:35,140 --> 01:36:32,390

time so that's one the first thing that

2133

01:36:37,660 --> 01:36:35,150

you would do another things that you do

2134

01:36:38,920 --> 01:36:37,670

also is a caddy what do we avoid these

2135

01:36:41,890 --> 01:36:38,930

joints from hitting each other right

2136

01:36:43,510 --> 01:36:41,900

yeah and how do we avoid having these

2137

01:36:46,729 --> 01:36:43,520

drones getting getting in the way of man

2138

01:36:49,160 --> 01:36:46,739

deviations right like GA or

2139

01:36:50,750 --> 01:36:49,170

general aviation aircraft or a

2140

01:36:51,890 --> 01:36:50,760

helicopters I'm also sure people on the

2141

01:36:53,870 --> 01:36:51,900

ground I'm gonna want to hear buzzing

2142

01:36:56,359 --> 01:36:53,880

over their houses non-stop you know

2143

01:36:58,609 --> 01:36:56,369

exactly right so one way is to share

2144

01:37:01,310 --> 01:36:58,619

those intentions and also technologies

2145

01:37:03,259 --> 01:37:01,320

that would be part of this type of

2146

01:37:06,470 --> 01:37:03,269

Joanie's a third thing that we're

2147

01:37:09,379 --> 01:37:06,480

looking at is probably a priori prior to

2148

01:37:11,000 --> 01:37:09,389

priority operations okay so we're

2149

01:37:12,950 --> 01:37:11,010

talking about public safety in this case

2150

01:37:17,600 --> 01:37:12,960

right thank you search-and-rescue might

2151
01:37:19,609 --> 01:37:17,610
get priority over a pizza yes right so

2152
01:37:22,399 --> 01:37:19,619
if you think of I'll give you an example

2153
01:37:25,370 --> 01:37:22,409
so you have hundreds of thousands flying

2154
01:37:27,799 --> 01:37:25,380
of drones flying in there and you have

2155
01:37:30,799 --> 01:37:27,809
different applications from delivery to

2156
01:37:33,080 --> 01:37:30,809
railroad inspection and so on and

2157
01:37:35,120 --> 01:37:33,090
there's a an emergency a fire emergency

2158
01:37:38,149 --> 01:37:35,130
so the fire department would want to

2159
01:37:39,379 --> 01:37:38,159
send their joints up okay so what would

2160
01:37:42,500 --> 01:37:39,389
happen is they would have a higher

2161
01:37:45,709 --> 01:37:42,510
priority credential once they submit

2162
01:37:47,330 --> 01:37:45,719
that anything that actually gets under

2163
01:37:49,489 --> 01:37:47,340

way of that operation would get messages

2164

01:37:50,899 --> 01:37:49,499

right get out of the way for example

2165

01:37:52,489 --> 01:37:50,909

like when you're driving on the road

2166

01:37:53,930 --> 01:37:52,499

today and you hear about the truck

2167

01:38:00,220 --> 01:37:53,940

behind you with the siren woody would

2168

01:38:02,060 --> 01:38:00,230

you it's the same concept there okay so

2169

01:38:03,950 --> 01:38:02,070

actually think we have a really cool

2170

01:38:07,759 --> 01:38:03,960

video if you guys hey Bill can we get

2171

01:38:10,279 --> 01:38:07,769

that brought up lucky so this is one of

2172

01:38:14,600 --> 01:38:10,289

the automations we use for youth UTM

2173

01:38:19,370 --> 01:38:14,610

project so you see those the red area is

2174

01:38:20,509 --> 01:38:19,380

that operation volume or or safe zone as

2175

01:38:23,330 --> 01:38:20,519

you would say and then you see the

2176

01:38:24,529 --> 01:38:23,340

litter on flying and those darker spots

2177

01:38:26,359 --> 01:38:24,539

as behind the joints it's like the

2178

01:38:27,739 --> 01:38:26,369

positions update that is sending the

2179

01:38:30,919 --> 01:38:27,749

system right we want to know where the

2180

01:38:33,109 --> 01:38:30,929

drone is and what it's doing and again

2181

01:38:35,089 --> 01:38:33,119

this is a an application like in

2182

01:38:38,000 --> 01:38:35,099

agriculture so you can see it scan in

2183

01:38:39,919 --> 01:38:38,010

the fields so like the the UTM the the

2184

01:38:41,270 --> 01:38:39,929

traffic management it was where all the

2185

01:38:42,830 --> 01:38:41,280

drones are all the time makes for sure

2186

01:38:45,169 --> 01:38:42,840

they're not clashing keeping them in

2187

01:38:46,970 --> 01:38:45,179

where they need to go exactly so that's

2188

01:38:48,649 --> 01:38:46,980

the idea is sharing your intention to

2189

01:38:51,200 --> 01:38:48,659

those that needs to know we have a ton

2190

01:38:52,669 --> 01:38:51,210

of questions one is that from open I

2191

01:38:54,560 --> 01:38:52,679

just clicked on a button but all right

2192

01:38:56,600 --> 01:38:54,570

wait does the quadcopter configurations

2193

01:38:59,530 --> 01:38:56,610

have any advantages over a tricopter

2194

01:39:04,930 --> 01:39:01,990

no not in this matter yeah it doesn't

2195

01:39:08,500 --> 01:39:04,940

matter all it's mostly like fixed wings

2196

01:39:12,010 --> 01:39:08,510

versus not fixed wings right in terms of

2197

01:39:14,170 --> 01:39:12,020

like if you have more rotors if you lose

2198

01:39:16,810 --> 01:39:14,180

one you can still fly if there was

2199

01:39:19,420 --> 01:39:16,820

safety reasons that would fly a little

2200

01:39:20,770 --> 01:39:19,430

bit better in a wicked tender as asking

2201

01:39:22,630 --> 01:39:20,780

what practical applications have been

2202

01:39:24,130 --> 01:39:22,640

implemented search-and-rescue land

2203

01:39:26,860 --> 01:39:24,140

surveys

2204

01:39:28,570 --> 01:39:26,870

well we test different use cases in our

2205

01:39:31,360 --> 01:39:28,580

test so we do a lot of our testing at

2206

01:39:34,180 --> 01:39:31,370

six fields across the nation's six test

2207

01:39:37,270 --> 01:39:34,190

sites across the nation we do it in New

2208

01:39:41,350 --> 01:39:37,280

York Virginia Texas North Dakota Alaska

2209

01:39:43,300 --> 01:39:41,360

and Nevada each of the test that has

2210

01:39:45,100 --> 01:39:43,310

their own unique characteristic in terms

2211

01:39:47,620 --> 01:39:45,110

of environment you know from the hot to

2212

01:39:51,880 --> 01:39:47,630

the cold from the high elevation to the

2213

01:39:57,040 --> 01:39:51,890

low elevation and so in those test size

2214

01:39:59,770 --> 01:39:57,050

we do search and rescue scenarios we do

2215

01:40:05,190 --> 01:39:59,780

also did Public Safety other public

2216

01:40:07,960 --> 01:40:05,200

safety as fire Jassi scenarios or cell

2217

01:40:10,510 --> 01:40:07,970

cell tower inspection temperature it was

2218

01:40:12,640 --> 01:40:10,520

delivery type of scenario so we do a lot

2219

01:40:14,920 --> 01:40:12,650

of those scenario sites so there's a

2220

01:40:17,080 --> 01:40:14,930

question that just jumped in this is

2221

01:40:18,490 --> 01:40:17,090

from resonator games is asking what's

2222

01:40:20,230 --> 01:40:18,500

the process for moving a consumer

2223

01:40:24,010 --> 01:40:20,240

product like a drone into serious

2224

01:40:25,870 --> 01:40:24,020

research by NASA well most of our flying

2225

01:40:28,570 --> 01:40:25,880

is done by our partners right this does

2226

01:40:31,090 --> 01:40:28,580

this was unique about this project is we

2227

01:40:34,420 --> 01:40:31,100

work very closely with our partners or

2228

01:40:36,010 --> 01:40:34,430

the industry and the FAA and so those

2229

01:40:38,770 --> 01:40:36,020

partners that actually flying drones

2230

01:40:41,560 --> 01:40:38,780

drones that are very similar to this to

2231

01:40:44,610 --> 01:40:41,570

Jones that are much larger so in terms

2232

01:40:48,010 --> 01:40:44,620

of like what you would see in a real

2233

01:40:50,170 --> 01:40:48,020

retail store or online you can find

2234

01:40:53,110 --> 01:40:50,180

these any just by searching you can buy

2235

01:40:55,900 --> 01:40:53,120

them they're okay right how are we

2236

01:40:58,720 --> 01:40:55,910

looking at time one last question I'm

2237

01:41:01,180 --> 01:40:58,730

gonna pick a good one well that's here

2238

01:41:04,120 --> 01:41:01,190

this is golden luck is asking what would

2239

01:41:07,000 --> 01:41:04,130

happen if a rogue drone in interfered

2240

01:41:07,720 --> 01:41:07,010

during a task oh that's a good question

2241

01:41:10,420 --> 01:41:07,730

actually

2242

01:41:11,530 --> 01:41:10,430

good question gold lock we have rules in

2243

01:41:12,879 --> 01:41:11,540

terms stuff like when joints are

2244

01:41:14,109 --> 01:41:12,889

actually following the rules

2245

01:41:15,929 --> 01:41:14,119

what would happen if one of them

2246

01:41:19,149 --> 01:41:15,939

actually gets out of the way right so

2247

01:41:22,179 --> 01:41:19,159

when we talked about the safe zones for

2248

01:41:25,089 --> 01:41:22,189

the operation volumes if that drone or

2249

01:41:27,299 --> 01:41:25,099

operator or the operator of the joint

2250

01:41:29,919 --> 01:41:27,309

gets out of that operation volume

2251

01:41:32,319 --> 01:41:29,929

messages will be sent out to everybody

2252

01:41:34,330 --> 01:41:32,329

that's it's gonna affect right so it

2253

01:41:36,879 --> 01:41:34,340

allows the other drone operators to act

2254

01:41:40,239 --> 01:41:36,889

appropriately if they need to get out of

2255

01:41:42,069 --> 01:41:40,249

the way land so yeah that's that's a

2256

01:41:43,600 --> 01:41:42,079

rogue state of a joint and so we make

2257

01:41:44,859 --> 01:41:43,610

sure that messages are sent out to the

2258

01:41:48,129 --> 01:41:44,869

right people that need to know about it

2259

01:41:50,529 --> 01:41:48,139

okay well thank you for cell for

2260

01:41:52,659 --> 01:41:50,539

definitely joining us and as a reminder

2261

01:41:55,120 --> 01:41:52,669

you're watching a NASA in Silicon Valley

2262

01:41:57,310 --> 01:41:55,130

live and if you have any questions for

2263

01:41:59,949 --> 01:41:57,320

our guests please write it in the chat

2264

01:42:03,609 --> 01:41:59,959

and we're gonna go ahead and bring out

2265

01:42:15,759 --> 01:42:03,619

our next guest next guess we've got

2266

01:42:16,750 --> 01:42:15,769

evade evade I don't know if Caitlyn has

2267

01:42:26,949 --> 01:42:16,760

the link but we also did a podcast

2268

01:42:28,689 --> 01:42:26,959

awhile back for those that have not met

2269

01:42:30,250 --> 01:42:28,699

you before like tell us a little bit

2270

01:42:32,350 --> 01:42:30,260

about yourself like what what area of

2271

01:42:34,239 --> 01:42:32,360

research do you do here at Ames sure so

2272

01:42:35,620 --> 01:42:34,249

my name is dr. van strife and I direct

2273

01:42:37,419 --> 01:42:35,630

something called the laboratory for

2274

01:42:39,639 --> 01:42:37,429

advanced sensing in the Earth Sciences

2275

01:42:41,679 --> 01:42:39,649

Division okay so I get a really cool job

2276

01:42:44,049 --> 01:42:41,689

I get to invent new imaging technologies

2277

01:42:46,600 --> 01:42:44,059

and try to explore things we haven't

2278

01:43:08,770 --> 01:42:46,610

seen yet on planet Earth Oh excellent

2279

01:43:11,350 --> 01:43:08,780

so are we jumping into this almost

2280

01:43:12,939 --> 01:43:11,360

ruined Dave and Bill set design over

2281

01:43:15,760 --> 01:43:12,949

here

2282

01:43:18,910 --> 01:43:15,770

so all right that's a pretty cool one we

2283

01:43:21,820 --> 01:43:18,920

got some toys in here I'm gonna look

2284

01:43:27,010 --> 01:43:21,830

over at vade to let us know all right

2285

01:43:28,660 --> 01:43:27,020

you brought me don't be shy tell us what

2286

01:43:31,000 --> 01:43:28,670

we're looking at over here so this is

2287

01:43:33,400 --> 01:43:31,010

called the NASA food cam instrument and

2288

01:43:35,800 --> 01:43:33,410

what it is is one of the first

2289

01:43:38,860 --> 01:43:35,810

technologies able to look through ocean

2290

01:43:41,380 --> 01:43:38,870

waves so what I specialized in right now

2291

01:43:43,419 --> 01:43:41,390

is studying systems particularly in the

2292

01:43:45,370 --> 01:43:43,429

ocean that we haven't been able to see

2293

01:43:47,860 --> 01:43:45,380

before from satellites or aircraft and

2294

01:43:50,650 --> 01:43:47,870

actually as of 2018 we've been able to

2295

01:43:54,220 --> 01:43:50,660

map all of the Mars all of Mars and the

2296

01:43:56,200 --> 01:43:54,230

moon in optical wavelengths but we have

2297

01:43:58,150 --> 01:43:56,210

only mapped about 5% of the seafloor

2298

01:43:59,979 --> 01:43:58,160

okay and so this is one of the first

2299

01:44:01,689 --> 01:43:59,989

instruments that's able to get down and

2300

01:44:03,310 --> 01:44:01,699

look through ocean waves that really

2301

01:44:06,100 --> 01:44:03,320

cause problems when we try to image

2302

01:44:07,840 --> 01:44:06,110

systems like coral reefs or kelp forests

2303

01:44:09,310 --> 01:44:07,850

yeah and I know like when you're looking

2304

01:44:11,410 --> 01:44:09,320

at through those oceans like looking at

2305

01:44:12,880 --> 01:44:11,420

coral reefs and you know you have the

2306

01:44:13,720 --> 01:44:12,890

waves yeah there's all this distortion

2307

01:44:16,360 --> 01:44:13,730

that's the thing you've been working

2308

01:44:18,400 --> 01:44:16,370

quite a bit on of like an algorithm or

2309

01:44:20,530 --> 01:44:18,410

how do you end up like getting through

2310

01:44:22,090 --> 01:44:20,540

that noise I guess sure so actually if

2311

01:44:24,340 --> 01:44:22,100

you go to a swimming pool you can see

2312

01:44:25,689 --> 01:44:24,350

this phenomena pretty commonly in fact I

2313

01:44:27,130 --> 01:44:25,699

think I have a video showing a

2314

01:44:32,740 --> 01:44:27,140

simulation of the phenomena on our

2315

01:44:34,300 --> 01:44:32,750

supercomputer this is the port so if you

2316

01:44:36,400 --> 01:44:34,310

look on the left you'll actually see

2317

01:44:38,380 --> 01:44:36,410

what a typical image looks like from a

2318

01:44:40,330 --> 01:44:38,390

drone or from an aircraft or spacecraft

2319

01:44:42,130 --> 01:44:40,340

looking down at the ocean there's a lot

2320

01:44:44,590 --> 01:44:42,140

of reflection from the surface of the

2321

01:44:46,870 --> 01:44:44,600

ocean as well as distortions caused by

2322

01:44:49,750 --> 01:44:46,880

these waves and those distortions can

2323

01:44:51,490 --> 01:44:49,760

move or move the apparent location of

2324

01:44:53,500 --> 01:44:51,500

things underwater which makes it very

2325

01:44:56,140 --> 01:44:53,510

difficult to study anything that's

2326

01:44:57,430 --> 01:44:56,150

underwater over time because you things

2327

01:44:59,080 --> 01:44:57,440

appear to be moving and you can't

2328

01:45:01,030 --> 01:44:59,090

actually resolve them very well

2329

01:45:02,650 --> 01:45:01,040

so this instruments capable of doing is

2330

01:45:06,220 --> 01:45:02,660

create the picture on the right which is

2331

01:45:08,080 --> 01:45:06,230

a very clear 3d picture of an entire

2332

01:45:10,120 --> 01:45:08,090

marine environment in this case this is

2333

01:45:12,010 --> 01:45:10,130

from a campaign we did in American Samoa

2334

01:45:14,229 --> 01:45:12,020

where we're looking at a coral reef

2335

01:45:16,120 --> 01:45:14,239

ecosystem and you can see you know some

2336

01:45:17,740 --> 01:45:16,130

what's really underneath the surface is

2337

01:45:20,110 --> 01:45:17,750

tremendous there's a huge amount of

2338

01:45:22,060 --> 01:45:20,120

biodiversity Sparco fuan is asking how

2339

01:45:24,880 --> 01:45:22,070

deep can this camera see but that's a

2340

01:45:26,709 --> 01:45:24,890

great question so we use passive light

2341

01:45:28,720 --> 01:45:26,719

and reflected sunlight off of this or

2342

01:45:31,120 --> 01:45:28,730

at the ocean unfortunately because of

2343

01:45:32,560 --> 01:45:31,130

the properties of water sunlight only

2344

01:45:34,510 --> 01:45:32,570

goes down to about a hundred meters

2345

01:45:36,090 --> 01:45:34,520

depth what we call the photic zone

2346

01:45:38,380 --> 01:45:36,100

that's where the majority of

2347

01:45:40,420 --> 01:45:38,390

photosynthetic organisms in the ocean

2348

01:45:42,070 --> 01:45:40,430

are located okay so that means that we

2349

01:45:44,080 --> 01:45:42,080

can only see down to a depth of about

2350

01:45:46,150 --> 01:45:44,090

100 meters with his instrument Amna

2351

01:45:48,430 --> 01:45:46,160

slash 79 was asking that like nasa can

2352

01:45:50,650 --> 01:45:48,440

it mapped the marina trench how deep can

2353

01:45:52,270 --> 01:45:50,660

it map so sure so the first hundred

2354

01:45:54,250 --> 01:45:52,280

meters is really just the surface of the

2355

01:45:56,320 --> 01:45:54,260

ocean the average depth of the ocean is

2356

01:45:57,939 --> 01:45:56,330

four thousand meters so it's a long way

2357

01:45:59,290 --> 01:45:57,949

to go and we actually have another

2358

01:46:01,930 --> 01:45:59,300

instrument that perhaps I'll talk about

2359

01:46:03,370 --> 01:46:01,940

next time that's designed to look in the

2360

01:46:05,590 --> 01:46:03,380

deep-sea environments and be able to

2361

01:46:08,830 --> 01:46:05,600

illuminate them but even if you look at

2362

01:46:11,470 --> 01:46:08,840

the the first 30 meters of water and you

2363

01:46:13,150 --> 01:46:11,480

go from the coastline you mark out that

2364

01:46:14,920 --> 01:46:13,160

encompasses an area of Earth that's

2365

01:46:17,320 --> 01:46:14,930

larger than the land area of Earth it's

2366

01:46:19,510 --> 01:46:17,330

a really a huge region and those regions

2367

01:46:21,790 --> 01:46:19,520

are very productive biologically they're

2368

01:46:23,770 --> 01:46:21,800

responsible for a lot of climate related

2369

01:46:25,990 --> 01:46:23,780

changes in our environment so it's very

2370

01:46:29,709 --> 01:46:26,000

important to understand what they look

2371

01:46:31,000 --> 01:46:29,719

like and how they change over time well

2372

01:46:35,640 --> 01:46:31,010

actually he just answered I was gonna

2373

01:46:38,860 --> 01:46:35,650

have why Weiss why study the oceans it

2374

01:46:40,570 --> 01:46:38,870

sure to be it is fascinating my

2375

01:46:42,160 --> 01:46:40,580

background is actually in astrophysics

2376

01:46:43,990 --> 01:46:42,170

that I was very keen to look for life

2377

01:46:45,760 --> 01:46:44,000

elsewhere in the universe only to

2378

01:46:47,860 --> 01:46:45,770

realize what I got to the field that

2379

01:46:50,770 --> 01:46:47,870

we've barely scratched the surface on

2380

01:46:52,890 --> 01:46:50,780

earth there are tremendous discoveries

2381

01:46:55,060 --> 01:46:52,900

to be made yet in the ocean mega squid

2382

01:46:57,490 --> 01:46:55,070

cephalopods sperm whales you name it

2383

01:46:59,530 --> 01:46:57,500

plate sized amoebas there's just a lot

2384

01:47:02,140 --> 01:46:59,540

of biodiversity in our own backyard then

2385

01:47:04,330 --> 01:47:02,150

unfortunately we're losing very quickly

2386

01:47:07,090 --> 01:47:04,340

and unless we develop new instruments

2387

01:47:09,010 --> 01:47:07,100

new technologies to map the seafloor we

2388

01:47:10,630 --> 01:47:09,020

really won't have a good grasp on the

2389

01:47:11,920 --> 01:47:10,640

life that we know that exists on our own

2390

01:47:14,140 --> 01:47:11,930

planet and this is a cool the

2391

01:47:16,000 --> 01:47:14,150

intersection of astrophysics and then

2392

01:47:19,000 --> 01:47:16,010

like earth science this goes the space

2393

01:47:21,130 --> 01:47:19,010

TV net it was asking could a device like

2394

01:47:23,320 --> 01:47:21,140

this see through ice get something

2395

01:47:25,990 --> 01:47:23,330

similar be used on spacecraft like the

2396

01:47:33,750 --> 01:47:26,000

Europa clipper like spacecraft that's

2397

01:47:38,530 --> 01:47:36,459

but one of the interesting features on

2398

01:47:40,220 --> 01:47:38,540

earth that this instrument utilizes is

2399

01:47:42,800 --> 01:47:40,230

there's sort of it happens to

2400

01:47:45,680 --> 01:47:42,810

we have the properties of water and air

2401
01:47:48,020 --> 01:47:45,690
and gravity that when you see waves at a

2402
01:47:50,090 --> 01:47:48,030
swimming pool or on the ocean they form

2403
01:47:52,700 --> 01:47:50,100
these natural lenses and those lenses

2404
01:47:54,440 --> 01:47:52,710
appear to magnify an object or D magnify

2405
01:47:56,660 --> 01:47:54,450
an object and this instruments capable

2406
01:47:58,520 --> 01:47:56,670
of using those traveling lenses as

2407
01:48:00,470 --> 01:47:58,530
microscopes to see deeper in the water

2408
01:48:02,870 --> 01:48:00,480
column so unfortunately if you if you

2409
01:48:04,490 --> 01:48:02,880
change one of the parameters of the

2410
01:48:07,400 --> 01:48:04,500
earth system let's say you replace the

2411
01:48:08,810 --> 01:48:07,410
oceans with alcohols the properties are

2412
01:48:10,700 --> 01:48:08,820
different and they don't actually form

2413
01:48:12,380 --> 01:48:10,710

lenses in the way that that the ocean

2414

01:48:14,450 --> 01:48:12,390

does so it's really quite fortunate that

2415

01:48:17,030 --> 01:48:14,460

we have the physics that we do on our

2416

01:48:19,700 --> 01:48:17,040

surface but definitely we're looking at

2417

01:48:21,770 --> 01:48:19,710

exploring to use using this technique on

2418

01:48:23,600 --> 01:48:21,780

on different worlds and places like

2419

01:48:27,050 --> 01:48:23,610

Titan where there is liquid hydrocarbons

2420

01:48:28,610 --> 01:48:27,060

the questions come in it may be answered

2421

01:48:29,870 --> 01:48:28,620

by the algorithm and by the stuff that

2422

01:48:32,120 --> 01:48:29,880

you're working on it's like our photos

2423

01:48:34,940 --> 01:48:32,130

generally taken directly above to

2424

01:48:37,540 --> 01:48:34,950

minimize the effects from refractive

2425

01:48:44,710 --> 01:48:37,550

index or does that not matter yes

2426
01:48:49,520 --> 01:48:47,930
underneath a pool and you look up you'll

2427
01:48:51,350 --> 01:48:49,530
notice that there's a certain angle that

2428
01:48:53,900 --> 01:48:51,360
which light appears to reflect off the

2429
01:48:55,610 --> 01:48:53,910
surface so there's really a sweet spot

2430
01:48:56,810 --> 01:48:55,620
in where you want to image so that light

2431
01:48:59,090 --> 01:48:56,820
doesn't completely reflect off the

2432
01:49:01,310 --> 01:48:59,100
surface or cause internal reflection

2433
01:49:03,590 --> 01:49:01,320
typically when we fly this instrument

2434
01:49:04,910 --> 01:49:03,600
this flies on drones a little larger

2435
01:49:06,740 --> 01:49:04,920
than the one that if I saw was showing

2436
01:49:08,690 --> 01:49:06,750
but we fly them over corals using those

2437
01:49:11,900 --> 01:49:08,700
drones and they typically look nadir

2438
01:49:13,970 --> 01:49:11,910

straight down okay so someone actually

2439

01:49:17,660 --> 01:49:13,980

wants to know can this be used to locate

2440

01:49:20,360 --> 01:49:17,670

the garbage in the oceans yes we've

2441

01:49:27,260 --> 01:49:20,370

we've caught a lot of marine debris what

2442

01:49:30,350 --> 01:49:27,270

we call the trash of the ocean she's a

2443

01:49:32,030 --> 01:49:30,360

crafty lady and she debris is really

2444

01:49:34,130 --> 01:49:32,040

scattered unfortunately among a lot of

2445

01:49:37,190 --> 01:49:34,140

the reef systems were looking at we see

2446

01:49:38,780 --> 01:49:37,200

a lot of coral we actually have large

2447

01:49:41,240 --> 01:49:38,790

data sets that we can comb through and

2448

01:49:43,460 --> 01:49:41,250

count the percentage of coral in an area

2449

01:49:46,430 --> 01:49:43,470

or sand and we see a lot of tires a lot

2450

01:49:47,900 --> 01:49:46,440

of use plastics that unfortunately brush

2451
01:49:49,880 --> 01:49:47,910
up on the reef during storm events and

2452
01:49:52,310 --> 01:49:49,890
stay there so question this is

2453
01:49:53,150 --> 01:49:52,320
electromagnetism how and why would you

2454
01:49:55,600 --> 01:49:53,160
use

2455
01:49:58,760 --> 01:49:55,610
this camera to study the health of reefs

2456
01:50:01,130 --> 01:49:58,770
sure so really this systems the first

2457
01:50:02,990 --> 01:50:01,140
that's been able to image them robustly

2458
01:50:04,850 --> 01:50:03,000
through different sea States so by

2459
01:50:06,320 --> 01:50:04,860
looking at them at the scales that they

2460
01:50:07,790 --> 01:50:06,330
grow at which is typically one

2461
01:50:10,070 --> 01:50:07,800
centimetre per year this would be for

2462
01:50:11,450 --> 01:50:10,080
coral reefs we can really understand how

2463
01:50:13,250 --> 01:50:11,460

they're changing as a function of

2464

01:50:15,770 --> 01:50:13,260

changing sea temperatures or climates

2465

01:50:17,030 --> 01:50:15,780

the datasets it produces are very

2466

01:50:18,920 --> 01:50:17,040

similar to what you would see if you

2467

01:50:21,260 --> 01:50:18,930

were diving in a reef system and we

2468

01:50:23,510 --> 01:50:21,270

haven't had that ability to survey

2469

01:50:25,460 --> 01:50:23,520

ecosystems at that scale over large

2470

01:50:27,050 --> 01:50:25,470

areas before typically we would send

2471

01:50:30,290 --> 01:50:27,060

teams of divers to study in the region

2472

01:50:32,000 --> 01:50:30,300

for about a week now we can send a drone

2473

01:50:34,760 --> 01:50:32,010

over and actually map that whole island

2474

01:50:37,730 --> 01:50:34,770

and actually those those datasets can be

2475

01:50:44,740 --> 01:50:37,740

very large and we have a video game

2476
01:50:50,060 --> 01:50:47,600
it's called Nemo net and you'll be able

2477
01:50:52,430 --> 01:50:50,070
to fly around our 3d datasets of coral

2478
01:50:54,230 --> 01:50:52,440
and actually you get trained by a few

2479
01:50:56,510 --> 01:50:54,240
scientists and you can start painting

2480
01:50:58,160 --> 01:50:56,520
and coloring coral in 3d and that data

2481
01:51:01,300 --> 01:50:58,170
helps us understand where the reef we

2482
01:51:04,790 --> 01:51:01,310
need a game Awards style of like

2483
01:51:07,400 --> 01:51:04,800
premiere trailer or something like that

2484
01:51:10,070 --> 01:51:07,410
like an iOS kind of thing or like on a

2485
01:51:11,750 --> 01:51:10,080
phone or is it like an app or something

2486
01:51:14,720 --> 01:51:11,760
sure so right now we've developed it for

2487
01:51:16,070 --> 01:51:14,730
iOS and Android as well as for desktops

2488
01:51:18,830 --> 01:51:16,080

we have a large gaming table that's

2489

01:51:20,600 --> 01:51:18,840

multi-touch so we really just want users

2490

01:51:22,520 --> 01:51:20,610

to be able to see the corals as if you

2491

01:51:24,170 --> 01:51:22,530

were a fish in that system and be able

2492

01:51:25,850 --> 01:51:24,180

to also help classify it because one of

2493

01:51:28,160 --> 01:51:25,860

the challenges with these ecosystems is

2494

01:51:30,500 --> 01:51:28,170

one we don't have really good data about

2495

01:51:33,140 --> 01:51:30,510

this and the data that we do have is so

2496

01:51:35,480 --> 01:51:33,150

complex in diversity that it's very hard

2497

01:51:37,340 --> 01:51:35,490

to classify it by humans so we could

2498

01:51:38,750 --> 01:51:37,350

have teams of graduate students you know

2499

01:51:40,760 --> 01:51:38,760

painstakingly going through and

2500

01:51:43,010 --> 01:51:40,770

classifying them or we can open it up to

2501
01:51:46,220 --> 01:51:43,020
the public oh wow it's just like you

2502
01:51:48,740 --> 01:51:46,230
open-source it everybody else well we

2503
01:51:51,260 --> 01:51:48,750
are fans of doing video game episodes

2504
01:51:52,430 --> 01:51:51,270
over here so when it comes out we'll

2505
01:51:54,050 --> 01:51:52,440
need to have you come on in and we'll

2506
01:51:56,000 --> 01:51:54,060
start you can show everybody how to play

2507
01:51:57,860 --> 01:51:56,010
it and start the ratings in the game so

2508
01:52:02,890 --> 01:51:57,870
whoever classifies it best starts

2509
01:52:04,540 --> 01:52:02,900
ranking trophies in it

2510
01:52:08,020 --> 01:52:04,550
we actually we have a really cool

2511
01:52:09,700 --> 01:52:08,030
question from hak val he wants to know

2512
01:52:11,500 --> 01:52:09,710
is this instrument backed by super

2513
01:52:13,330 --> 01:52:11,510

computers or is it's completely

2514

01:52:15,280 --> 01:52:13,340

standalone that's another good question

2515

01:52:17,350 --> 01:52:15,290

so when I started developing the

2516

01:52:18,930 --> 01:52:17,360

algorithm as a doctoral student it

2517

01:52:21,640 --> 01:52:18,940

required a lot of computational power

2518

01:52:23,410 --> 01:52:21,650

fortunately I was also interning at NASA

2519

01:52:25,270 --> 01:52:23,420

Ames and using using the kids

2520

01:52:27,220 --> 01:52:25,280

supercomputer so it started its life

2521

01:52:28,180 --> 01:52:27,230

there and then that's actually one of

2522

01:52:30,580 --> 01:52:28,190

the reasons why we developed this

2523

01:52:33,360 --> 01:52:30,590

instrument we needed a lot of compute

2524

01:52:35,560 --> 01:52:33,370

power onboard because we're recording

2525

01:52:36,670 --> 01:52:35,570

thousands of frames per second of image

2526

01:52:38,710 --> 01:52:36,680

data and then that data is being

2527

01:52:41,260 --> 01:52:38,720

processed to just produce one high

2528

01:52:43,360 --> 01:52:41,270

resolution 2d picture for region so

2529

01:52:44,440 --> 01:52:43,370

really this is a flying computer and

2530

01:52:45,640 --> 01:52:44,450

this can perform a lot of those

2531

01:52:47,920 --> 01:52:45,650

computations on board

2532

01:52:50,170 --> 01:52:47,930

owing to all the GPUs and CPUs that

2533

01:52:56,320 --> 01:52:50,180

we've packed in there Santiago is asking

2534

01:52:58,390 --> 01:52:56,330

why the USB ports hardware so you can

2535

01:52:59,650 --> 01:52:58,400

see the guts of the instrument but to

2536

01:53:01,240 --> 01:52:59,660

take the data out we actually just

2537

01:53:03,310 --> 01:53:01,250

ripped the hard drives directly out

2538

01:53:05,380 --> 01:53:03,320

because it's too slow to transfer

2539

01:53:07,300 --> 01:53:05,390

otherwise and that's why we put so much

2540

01:53:09,400 --> 01:53:07,310

computing power on board is so that we

2541

01:53:12,100 --> 01:53:09,410

can process the data delete what we

2542

01:53:13,930 --> 01:53:12,110

don't need and only send down the final

2543

01:53:16,150 --> 01:53:13,940

data set so when we eventually put this

2544

01:53:18,040 --> 01:53:16,160

up into orbit to test in the space

2545

01:53:20,640 --> 01:53:18,050

environment we can start pulling down

2546

01:53:23,230 --> 01:53:20,650

data without clogging up all of our

2547

01:53:24,310 --> 01:53:23,240

Brandon not-safe-for-work is asking if

2548

01:53:34,480 --> 01:53:24,320

this is gonna be better than League of

2549

01:53:37,780 --> 01:53:34,490

Legends player get ready for the eSports

2550

01:53:40,180 --> 01:53:37,790

version teams competing and who can like

2551
01:53:42,820 --> 01:53:40,190
classify the most the fastest I'm liking

2552
01:53:44,470 --> 01:53:42,830
it so uh okay Rey sonic was also asking

2553
01:53:46,180 --> 01:53:44,480
well the video game ever be used to

2554
01:53:50,320 --> 01:53:46,190
perform citizen science on the data

2555
01:53:51,880 --> 01:53:50,330
collected yes we want you to classify

2556
01:53:54,520 --> 01:53:51,890
the corals because we really can't all

2557
01:53:55,720 --> 01:53:54,530
do it ourselves there's a citizen

2558
01:53:57,070 --> 01:53:55,730
science component of the game where

2559
01:53:58,720 --> 01:53:57,080
users get trained and they start

2560
01:54:00,970 --> 01:53:58,730
classifying and we have a lot of error

2561
01:54:03,160 --> 01:54:00,980
correction so users that are very good

2562
01:54:05,260 --> 01:54:03,170
we have a lot of examples of coral that

2563
01:54:07,810 --> 01:54:05,270

have been classified by experts those

2564

01:54:09,880 --> 01:54:07,820

can be can be sort of used as references

2565

01:54:11,560 --> 01:54:09,890

for other players to rate them and then

2566

01:54:14,080 --> 01:54:11,570

as users get better we give them harder

2567

01:54:15,549 --> 01:54:14,090

and harder datasets form of active

2568

01:54:17,830 --> 01:54:15,559

learning in the game where we

2569

01:54:19,990 --> 01:54:17,840

give them all the hard cases and then

2570

01:54:21,100 --> 01:54:20,000

that feeds into possibly way more

2571

01:54:23,520 --> 01:54:21,110

interesting than getting a whole bunch

2572

01:54:26,470 --> 01:54:23,530

of students and interns coming in

2573

01:54:28,600 --> 01:54:26,480

forcing it I think we have time for one

2574

01:54:34,560 --> 01:54:28,610

last question one last question before

2575

01:54:38,620 --> 01:54:38,169

all right let's go for okay let's get a

2576

01:54:40,720 --> 01:54:38,630

good one

2577

01:54:42,729 --> 01:54:40,730

all right so golden luck who's been

2578

01:54:44,799 --> 01:54:42,739

doing pretty good so far is the camera

2579

01:54:48,069 --> 01:54:44,809

purely a digital camera or does it

2580

01:54:50,319 --> 01:54:48,079

capture IR data points ah good question

2581

01:54:52,270 --> 01:54:50,329

so infrared unfortunately doesn't

2582

01:54:54,760 --> 01:54:52,280

penetrate through the ocean surface

2583

01:54:57,220 --> 01:54:54,770

water absorbs most of it within the

2584

01:54:59,140 --> 01:54:57,230

first micron of the surface which is why

2585

01:55:01,060 --> 01:54:59,150

it's so hard to study the oceans because

2586

01:55:03,640 --> 01:55:01,070

we just have a narrow band of light in

2587

01:55:05,020 --> 01:55:03,650

the visible to blue an ultraviolet that

2588

01:55:08,709 --> 01:55:05,030

actually gets down into the water column

2589

01:55:11,260 --> 01:55:08,719

so this is primarily an ultraviolet - I

2590

01:55:13,510 --> 01:55:11,270

would say late far-red or in your

2591

01:55:17,649 --> 01:55:13,520

infrared instrument to study things that

2592

01:55:19,689 --> 01:55:17,659

go through underwater I think we're at

2593

01:55:21,459 --> 01:55:19,699

about that time am i right it is it's

2594

01:55:23,740 --> 01:55:21,469

time for us to wrap up and say goodbye

2595

01:55:25,600 --> 01:55:23,750

man this is about that time

2596

01:55:28,240 --> 01:55:25,610

thanks so much mate this has been really

2597

01:55:31,569 --> 01:55:28,250

cool awesome camera you just sit tight

2598

01:55:34,000 --> 01:55:31,579

right there as I get to like look at my

2599

01:55:37,390 --> 01:55:34,010

look all my gifts that I've gotten so

2600

01:55:39,580 --> 01:55:37,400

folks this has been NASA in Silicon

2601

01:55:41,979 --> 01:55:39,590

Valley live it is a conversational show

2602

01:55:43,450 --> 01:55:41,989

from NASA's Ames Research Center in

2603

01:55:44,979 --> 01:55:43,460

Silicon Valley where we talk to the

2604

01:55:47,439 --> 01:55:44,989

various scientists researchers engineers

2605

01:55:49,899 --> 01:55:47,449

and all-around cool people like my buddy

2606

01:55:51,490 --> 01:55:49,909

vade over here we talk about all the

2607

01:55:53,319 --> 01:55:51,500

nerdy NASA news that you know about that

2608

01:55:55,990 --> 01:55:53,329

you want to learn know about and if you

2609

01:55:57,939 --> 01:55:56,000

like it we are live on twitch TV slash

2610

01:55:59,649 --> 01:55:57,949

NASA didn't catch us live don't you

2611

01:56:01,330 --> 01:55:59,659

worry about it it is right after the

2612

01:56:03,160 --> 01:56:01,340

show is over it'll be available on

2613

01:56:05,080 --> 01:56:03,170

demand on Twitch and on YouTube and

2614

01:56:08,080 --> 01:56:05,090

you'll also be catching reruns over on

2615

01:56:09,819 --> 01:56:08,090

NASA TV if you're an audio listener will

2616

01:56:13,240 --> 01:56:09,829

have it on podcast services throughout

2617

01:56:15,549 --> 01:56:13,250

the solar system and beyond so a huge

2618

01:56:17,049 --> 01:56:15,559

thanks to our guests and especially

2619

01:56:18,850 --> 01:56:17,059

everybody who's sitting in the chat who

2620

01:56:20,859 --> 01:56:18,860

submitted a ton of questions over this

2621

01:56:23,830 --> 01:56:20,869

last a little bit um we're gonna be back

2622

01:56:25,720 --> 01:56:23,840

on Thursday as normal but it's gonna be

2623

01:56:29,229 --> 01:56:25,730

a couple days from now Thursday it is

2624

01:56:31,089 --> 01:56:29,239

January 31st is going to be our next

2625

01:56:33,970 --> 01:56:31,099

and we're gonna be talking about making

2626

01:56:36,759 --> 01:56:33,980

new discoveries with NASA's super

2627

01:56:40,089 --> 01:56:36,769

computers like normal computers but

2628

01:56:41,770 --> 01:56:40,099

super but until then thank you so much

2629

01:56:43,750 --> 01:56:41,780

for joining us in the chat so much thank

2630

01:56:45,629 --> 01:56:43,760

you so much to our guests for coming and