



1
00:00:06,110 --> 00:00:02,930
hello and welcome to another edition of

2
00:00:08,150 --> 00:00:06,120
the 2023 Von carbon talks my name is

3
00:00:10,490 --> 00:00:08,160
Nikki Wyrick from jpl's Office of

4
00:00:11,930 --> 00:00:10,500
communications and education and I will

5
00:00:14,690 --> 00:00:11,940
be your host for this evening's

6
00:00:17,390 --> 00:00:14,700
discussion on the Earth surface mineral

7
00:00:22,189 --> 00:00:17,400
dust Source investigation better known

8
00:00:23,390 --> 00:00:22,199
as emit emit launched July 14 2022 and

9
00:00:24,910 --> 00:00:23,400
observes the Earth from the

10
00:00:27,589 --> 00:00:24,920
International Space Station today

11
00:00:30,050 --> 00:00:27,599
studying mineral Rock Dust blown by the

12
00:00:32,210 --> 00:00:30,060
wind and suspended in the air which can

13
00:00:35,330 --> 00:00:32,220

affect the heating and cooling of the

14

00:00:37,910 --> 00:00:35,340

atmosphere and Earth's surface emit is

15

00:00:40,310 --> 00:00:37,920

also capable of mapping super emitters

16

00:00:42,530 --> 00:00:40,320

of methane which is already contributing

17

00:00:44,810 --> 00:00:42,540

to meaningful climate action

18

00:00:48,470 --> 00:00:44,820

now joining us as co-host this evening

19

00:00:50,690 --> 00:00:48,480

is Josh Jocelyn argeta Jocelyn is a

20

00:00:53,029 --> 00:00:50,700

public Outreach specialist for NASA

21

00:00:55,490 --> 00:00:53,039

Earth where she shares stories of how

22

00:00:57,590 --> 00:00:55,500

NASA data helps us learn more about our

23

00:00:58,670 --> 00:00:57,600

home planet so hi Jocelyn how are you

24

00:01:01,729 --> 00:00:58,680

today

25

00:01:03,830 --> 00:01:01,739

hi Nikki so great to be here tonight and

26
00:01:06,410 --> 00:01:03,840
I want to remind everyone watching that

27
00:01:08,390 --> 00:01:06,420
this is your space program and we want

28
00:01:10,609 --> 00:01:08,400
you involved in the conversation tonight

29
00:01:13,010 --> 00:01:10,619
so wherever you're watching us from

30
00:01:15,050 --> 00:01:13,020
please ask your questions in the chat

31
00:01:17,030 --> 00:01:15,060
box and our social media team is going

32
00:01:19,490 --> 00:01:17,040
to bring in as many as we can fit into

33
00:01:22,130 --> 00:01:19,500
our talk tonight if you don't see your

34
00:01:24,050 --> 00:01:22,140
chat box then reload your page and it'll

35
00:01:26,210 --> 00:01:24,060
be right there

36
00:01:27,770 --> 00:01:26,220
awesome thank you Jocelyn it's great to

37
00:01:29,390 --> 00:01:27,780
have you as always

38
00:01:31,010 --> 00:01:29,400

um now I want to remind our audience if

39

00:01:33,350 --> 00:01:31,020

we do run into any technical

40

00:01:35,450 --> 00:01:33,360

difficulties or small failures we please

41

00:01:37,490 --> 00:01:35,460

ask your patients and stick with us

42

00:01:40,249 --> 00:01:37,500

we'll get them sorted out as quickly as

43

00:01:42,590 --> 00:01:40,259

we can and now let's introduce our

44

00:01:45,469 --> 00:01:42,600

speaker for this evening Dr Robert o

45

00:01:48,230 --> 00:01:45,479

green is a senior research scientist JPL

46

00:01:50,810 --> 00:01:48,240

fellow and director of the JPL Micro

47

00:01:53,270 --> 00:01:50,820

Devices laboratory he was the principal

48

00:01:55,190 --> 00:01:53,280

investigator for avarice and the

49

00:01:58,190 --> 00:01:55,200

instrument scientist for the NASA Moon

50

00:02:00,649 --> 00:01:58,200

mineralogy mapper he is also a science

51
00:02:03,170 --> 00:02:00,659
co-investigator on the mapping Imaging

52
00:02:06,709 --> 00:02:03,180
spectrometer for Europa better known as

53
00:02:08,930 --> 00:02:06,719
Mize and the NASA lunar Trailblazer

54
00:02:11,210 --> 00:02:08,940
Mission Dr Green is also the instrument

55
00:02:13,550 --> 00:02:11,220
scientist for the carbon plume mapper

56
00:02:16,369 --> 00:02:13,560
Imaging spectrometer and has worked with

57
00:02:19,729 --> 00:02:16,379
imaging spectrometer instrumentation for

58
00:02:21,229 --> 00:02:19,739
more than 25 years hiya Rob it's great

59
00:02:24,170 --> 00:02:21,239
to have you tonight

60
00:02:25,250 --> 00:02:24,180
it's wonderful to be here uh great to

61
00:02:27,589 --> 00:02:25,260
see you all

62
00:02:29,630 --> 00:02:27,599
thanks for being here so I mean you've

63
00:02:31,670 --> 00:02:29,640

been working towards this for over 25

64

00:02:33,410 --> 00:02:31,680

years so tell us a little bit how did

65

00:02:35,690 --> 00:02:33,420

you get into this field and at your

66

00:02:38,510 --> 00:02:35,700

position currently with emit

67

00:02:40,250 --> 00:02:38,520

uh it's a wonderful story for me uh it

68

00:02:42,470 --> 00:02:40,260

began in graduate school at Stanford

69

00:02:44,809 --> 00:02:42,480

University I was studying to for a

70

00:02:48,770 --> 00:02:44,819

graduate degree in geology and I was out

71

00:02:50,869 --> 00:02:48,780

in Nevada learning to map minerals and

72

00:02:52,729 --> 00:02:50,879

realized there were new technologies

73

00:02:54,890 --> 00:02:52,739

coming that could allow us to map

74

00:02:56,809 --> 00:02:54,900

minerals directly from their

75

00:02:59,030 --> 00:02:56,819

spectroscopic signatures and a

76

00:03:01,309 --> 00:02:59,040

spectroscopic signature is just the way

77

00:03:03,170 --> 00:03:01,319

that mineral reflects light at many many

78

00:03:06,229 --> 00:03:03,180

wavelengths from the visible out into

79

00:03:08,390 --> 00:03:06,239

the infrared that the molecules of those

80

00:03:10,190 --> 00:03:08,400

minerals they absorb light differently

81

00:03:12,470 --> 00:03:10,200

at different wavelengths it becomes a

82

00:03:14,809 --> 00:03:12,480

fingerprint of different minerals so I

83

00:03:17,290 --> 00:03:14,819

understood that there was a new approach

84

00:03:19,430 --> 00:03:17,300

something called Imaging spectroscopy

85

00:03:21,470 --> 00:03:19,440

where you could build a new instrument

86

00:03:24,050 --> 00:03:21,480

that measured a spectrum for every point

87

00:03:25,729 --> 00:03:24,060

in that image and then map the minerals

88

00:03:27,910 --> 00:03:25,739

based on their spectral signatures or

89

00:03:30,949 --> 00:03:27,920

their spectral fingerprints and that's

90

00:03:32,509 --> 00:03:30,959

where I got inspired I learned JPL was

91

00:03:34,670 --> 00:03:32,519

building the very first Imaging

92

00:03:36,470 --> 00:03:34,680

spectrometer called The Airborne Imaging

93

00:03:38,210 --> 00:03:36,480

spectrometer and soon follow-on

94

00:03:41,750 --> 00:03:38,220

instrument called avarice

95

00:03:44,089 --> 00:03:41,760

and that Drew me to come to JPL and to

96

00:03:46,729 --> 00:03:44,099

learn about this new measurement

97

00:03:49,789 --> 00:03:46,739

technique and I've been able to work

98

00:03:51,589 --> 00:03:49,799

with it through now more than 25 years

99

00:03:53,930 --> 00:03:51,599

with increasingly sophisticated

100

00:03:55,550 --> 00:03:53,940

instruments and brought me to my current

101
00:03:58,130 --> 00:03:55,560
position

102
00:04:00,110 --> 00:03:58,140
I mean you are incredibly dedicated to

103
00:04:02,869 --> 00:04:00,120
the work that you're doing and that is

104
00:04:04,369 --> 00:04:02,879
so honorable can you tell us what is

105
00:04:07,910 --> 00:04:04,379
emit

106
00:04:09,890 --> 00:04:07,920
okay Amit is an instrument designed to

107
00:04:11,449 --> 00:04:09,900
answer a specific question but because

108
00:04:14,750 --> 00:04:11,459
it's answering that question it can also

109
00:04:17,030 --> 00:04:14,760
answer other questions it turns out that

110
00:04:19,370 --> 00:04:17,040
the Earth has a mineral dust cycle when

111
00:04:21,229 --> 00:04:19,380
there are high winds blowing across arid

112
00:04:23,450 --> 00:04:21,239
lands dust is emitted into the

113
00:04:26,390 --> 00:04:23,460

atmosphere where it starts to interact

114

00:04:28,010 --> 00:04:26,400

with your system it uh immediately

115

00:04:29,930 --> 00:04:28,020

changes the chemistry of the atmosphere

116

00:04:32,270 --> 00:04:29,940

it can play a role in how clouds are

117

00:04:34,730 --> 00:04:32,280

formed it can scatter light back into

118

00:04:36,110 --> 00:04:34,740

space those little mineral particles it

119

00:04:38,330 --> 00:04:36,120

can absorb light if they're dark

120

00:04:41,450 --> 00:04:38,340

particles and heat the Earth and then

121

00:04:43,969 --> 00:04:41,460

when it's deposited in terrestrial

122

00:04:46,730 --> 00:04:43,979

ecosystems in in plants on the surface

123

00:04:49,189 --> 00:04:46,740

it can fight a nutrient it does so for

124

00:04:50,870 --> 00:04:49,199

the Brazilian rainforests when it lands

125

00:04:52,909 --> 00:04:50,880

in oceans it can provide a nutrient when

126

00:04:55,670 --> 00:04:52,919

it lands on snow it can change how they

127

00:04:58,249 --> 00:04:55,680

melt that impacts uh Water Resources

128

00:04:59,749 --> 00:04:58,259

here in California for example and then

129

00:05:01,550 --> 00:04:59,759

when it arrives in our cities at little

130

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

dust particles they can be a visibility

131

00:05:05,689 --> 00:05:03,360

Hazard they can also be a bit of a toxic

132

00:05:08,990 --> 00:05:05,699

Hazard so there is this important cycle

133

00:05:11,050 --> 00:05:09,000

of dust and emit is designed to help us

134

00:05:15,050 --> 00:05:11,060

answer a really important question is

135

00:05:16,129 --> 00:05:15,060

what is the dust made of and because

136

00:05:17,810 --> 00:05:16,139

there are different minerals and

137

00:05:20,870 --> 00:05:17,820

different places of the Earth

138

00:05:22,370 --> 00:05:20,880

we want to know when the winds blow what

139

00:05:24,110 --> 00:05:22,380

kind of particles are being blown into

140

00:05:26,090 --> 00:05:24,120

the atmosphere are they light particles

141

00:05:28,249 --> 00:05:26,100

dark particles more acidic particles

142

00:05:29,870 --> 00:05:28,259

more basic particles and how are those

143

00:05:32,450 --> 00:05:29,880

going to interact with our Earth system

144

00:05:33,590 --> 00:05:32,460

and I can show just an example if we

145

00:05:35,870 --> 00:05:33,600

bring up

146

00:05:37,730 --> 00:05:35,880

um one of the the charts you prepared

147

00:05:40,610 --> 00:05:37,740

for me uh

148

00:05:42,529 --> 00:05:40,620

I just have to grab the uh the one with

149

00:05:44,330 --> 00:05:42,539

the conveyor belt that would be ideal I

150

00:05:46,670 --> 00:05:44,340

believe it's uh

151
00:05:49,490 --> 00:05:46,680
chart three thank you yeah so this is a

152
00:05:52,070 --> 00:05:49,500
in a nutshell the emit um

153
00:05:54,710 --> 00:05:52,080
uh Mission uh we've got a situation

154
00:05:56,390 --> 00:05:54,720
where winds are blowing along the

155
00:05:58,670 --> 00:05:56,400
Earth's surface and arid lands they

156
00:06:01,189 --> 00:05:58,680
launched that dust into the atmosphere

157
00:06:02,810 --> 00:06:01,199
it can heat or cool the Earth we call

158
00:06:04,790 --> 00:06:02,820
that radiator forcing and then when it's

159
00:06:06,350 --> 00:06:04,800
deposited on the earth it can have all

160
00:06:09,590 --> 00:06:06,360
those effects that I talked about so

161
00:06:11,629 --> 00:06:09,600
that's what a mid is designed to help us

162
00:06:13,370 --> 00:06:11,639
understand this dust cycle and the

163
00:06:16,370 --> 00:06:13,380

particular problem I made is tackling is

164

00:06:19,129 --> 00:06:16,380

that currently when we model dust in the

165

00:06:21,469 --> 00:06:19,139

earth system we rely on only 5 000

166

00:06:23,210 --> 00:06:21,479

measurements around planet Earth for the

167

00:06:26,870 --> 00:06:23,220

whole planet where we know the mineral

168

00:06:29,990 --> 00:06:26,880

for those locations with emits Imaging

169

00:06:33,170 --> 00:06:30,000

spectroscopy we can take that from 5000

170

00:06:35,450 --> 00:06:33,180

to a billion measurements all over the

171

00:06:37,309 --> 00:06:35,460

air land and really improve our ability

172

00:06:38,870 --> 00:06:37,319

to understand

173

00:06:41,749 --> 00:06:38,880

um radiator forcing and the other

174

00:06:44,210 --> 00:06:41,759

elements of mineral dust in the earth

175

00:06:46,490 --> 00:06:44,220

system so that's what emit is it's an

176
00:06:48,830 --> 00:06:46,500
instrument to collect Spectra for the

177
00:06:50,870 --> 00:06:48,840
Arid land reasons of our planet to

178
00:06:52,490 --> 00:06:50,880
address that import question of heating

179
00:06:55,909 --> 00:06:52,500
or cooling of our planet and the other

180
00:06:58,249 --> 00:06:55,919
interaction throughout the Earth system

181
00:07:01,249 --> 00:06:58,259
so it's great to know what a MIT does

182
00:07:03,650 --> 00:07:01,259
but how does emit specifically study the

183
00:07:05,570 --> 00:07:03,660
spectral range of mineral dust why is

184
00:07:07,670 --> 00:07:05,580
this so important what is the Prime

185
00:07:10,309 --> 00:07:07,680
mission of emit

186
00:07:12,710 --> 00:07:10,319
so the Prime mission really is to

187
00:07:14,450 --> 00:07:12,720
understand if mineral does currently is

188
00:07:16,850 --> 00:07:14,460

heating or cooling our planet we don't

189

00:07:18,529 --> 00:07:16,860

know whether it's heating or Cooling and

190

00:07:21,110 --> 00:07:18,539

then the secondary objective is to

191

00:07:23,390 --> 00:07:21,120

understand with these climate models

192

00:07:25,010 --> 00:07:23,400

constrained by emit measurements how

193

00:07:26,749 --> 00:07:25,020

will the dust cycle change in the future

194

00:07:29,089 --> 00:07:26,759

would there be more regions for mineral

195

00:07:30,950 --> 00:07:29,099

dust or less regions and how will that

196

00:07:33,230 --> 00:07:30,960

impact the climate in the future so it's

197

00:07:35,570 --> 00:07:33,240

got two climate objectives understanding

198

00:07:37,790 --> 00:07:35,580

how dust is impacting our climate today

199

00:07:39,830 --> 00:07:37,800

and how it might impact our climate in

200

00:07:42,710 --> 00:07:39,840

the future

201
00:07:44,330 --> 00:07:42,720
and how is

202
00:07:47,330 --> 00:07:44,340
emissions

203
00:07:49,189 --> 00:07:47,340
okay mitt really is the first of its

204
00:07:51,589 --> 00:07:49,199
kind of this class of Imaging

205
00:07:54,170 --> 00:07:51,599
spectrometer we brought technology

206
00:07:55,550 --> 00:07:54,180
that's only just become available even

207
00:07:58,249 --> 00:07:55,560
though we did the first Imaging

208
00:08:01,129 --> 00:07:58,259
spectrometer quite a while ago this one

209
00:08:04,670 --> 00:08:01,139
has the very latest detector the very

210
00:08:06,469 --> 00:08:04,680
latest design it has very high signal to

211
00:08:09,589 --> 00:08:06,479
noise they're very high Precision we can

212
00:08:11,870 --> 00:08:09,599
see very small variations in minerals

213
00:08:15,050 --> 00:08:11,880

and other elements of the earth system

214

00:08:17,930 --> 00:08:15,060

so it's really the first of this next

215

00:08:19,670 --> 00:08:17,940

class of Imaging spectrometer and it's

216

00:08:21,589 --> 00:08:19,680

here to study our Earth with the focus

217

00:08:23,210 --> 00:08:21,599

on the emit science objectives but it

218

00:08:25,189 --> 00:08:23,220

may also help with other science

219

00:08:27,290 --> 00:08:25,199

objectives

220

00:08:29,629 --> 00:08:27,300

so Rob you just mentioned other science

221

00:08:32,089 --> 00:08:29,639

objectives emit has also been able to

222

00:08:34,190 --> 00:08:32,099

study greenhouse gases in a new way was

223

00:08:36,050 --> 00:08:34,200

this something we were expecting and can

224

00:08:38,389 --> 00:08:36,060

you tell me more about that

225

00:08:40,310 --> 00:08:38,399

yes this is an interesting added value

226

00:08:42,350 --> 00:08:40,320

from Amit we had to measure this

227

00:08:44,269 --> 00:08:42,360

spectral range where minerals absorb

228

00:08:45,829 --> 00:08:44,279

light so we could answer our question of

229

00:08:48,230 --> 00:08:45,839

what minerals are on the surface of the

230

00:08:50,329 --> 00:08:48,240

Earth so that range extends us out into

231

00:08:52,370 --> 00:08:50,339

the short wavelength infrared as we

232

00:08:55,490 --> 00:08:52,380

would call it it turns out that the

233

00:08:58,130 --> 00:08:55,500

absorption of methane and carbon dioxide

234

00:09:00,590 --> 00:08:58,140

these gases into your system also occur

235

00:09:02,449 --> 00:09:00,600

in this spectral range so we thought

236

00:09:04,850 --> 00:09:02,459

there would be some sensitivity with a

237

00:09:07,490 --> 00:09:04,860

myth when it was launched and began

238

00:09:09,110 --> 00:09:07,500

Imaging our Earth and it's turned out

239

00:09:12,350 --> 00:09:09,120

there is it's better than our

240

00:09:16,370 --> 00:09:12,360

expectations so we are now able to map

241

00:09:19,070 --> 00:09:16,380

plumes of methane uh coming from various

242

00:09:20,870 --> 00:09:19,080

Point sources and also carbon dioxide

243

00:09:24,350 --> 00:09:20,880

also coming from point sources so we're

244

00:09:28,210 --> 00:09:24,360

seeing some new spectacular plumes and I

245

00:09:31,370 --> 00:09:28,220

can jump to an image I would call Emma

246

00:09:34,790 --> 00:09:31,380

image 11 will show you one of those

247

00:09:37,730 --> 00:09:34,800

examples of these additional benefits so

248

00:09:41,329 --> 00:09:37,740

uh this is a data set from a MIT near

249

00:09:45,050 --> 00:09:41,339

the Caspian Sea what you're seeing uh in

250

00:09:46,970 --> 00:09:45,060

the upper left are the plumes that we've

251

00:09:49,250 --> 00:09:46,980

mapped from the emit Spectra in the

252

00:09:52,910 --> 00:09:49,260

spatial domains you can see these large

253

00:09:54,769 --> 00:09:52,920

plumes these are really extraordinary uh

254

00:09:56,630 --> 00:09:54,779

emissions of methane into our atmosphere

255

00:09:58,310 --> 00:09:56,640

and then on the lower right you're

256

00:10:00,110 --> 00:09:58,320

seeing the actual spectral fingerprint

257

00:10:02,329 --> 00:10:00,120

that was measured by a mid we measured

258

00:10:03,829 --> 00:10:02,339

that blue spectral fingerprint we have a

259

00:10:05,690 --> 00:10:03,839

model that says what methane should look

260

00:10:08,210 --> 00:10:05,700

like and that's red spectral fingerprint

261

00:10:10,250 --> 00:10:08,220

you can see how well those fingerprints

262

00:10:12,350 --> 00:10:10,260

match so that we know we're seeing the

263

00:10:15,170 --> 00:10:12,360

molecule methane in the Earth's

264

00:10:17,930 --> 00:10:15,180

atmosphere and we've now been asked by

265

00:10:19,430 --> 00:10:17,940

NASA to map the methane plumes that we

266

00:10:20,990 --> 00:10:19,440

see with Emit and make those available

267

00:10:23,449 --> 00:10:21,000

for others

268

00:10:26,449 --> 00:10:23,459

um to make decisions about how they

269

00:10:28,730 --> 00:10:26,459

might want to address these these

270

00:10:32,329 --> 00:10:28,740

methane sources and I think if we look

271

00:10:34,250 --> 00:10:32,339

at um chart 14 you can see how well

272

00:10:37,730 --> 00:10:34,260

we've done with greenhouse gases with

273

00:10:40,190 --> 00:10:37,740

emit today so these are the plumes of

274

00:10:42,470 --> 00:10:40,200

methane across six continents that has

275

00:10:44,509 --> 00:10:42,480

emit has seen even though it was

276
00:10:47,690 --> 00:10:44,519
launched less than a year ago and we're

277
00:10:49,550 --> 00:10:47,700
we're up into many hundred plumes and

278
00:10:51,290 --> 00:10:49,560
we're making this available to all who

279
00:10:53,690 --> 00:10:51,300
are interested to understand those

280
00:10:56,090 --> 00:10:53,700
plumes and think about how they they

281
00:10:58,550 --> 00:10:56,100
might choose to address those methane uh

282
00:11:01,250 --> 00:10:58,560
occurrences

283
00:11:03,050 --> 00:11:01,260
absolutely and just so you folks know

284
00:11:05,030 --> 00:11:03,060
what Rob is talking about is this is

285
00:11:07,190 --> 00:11:05,040
available online publicly to all of you

286
00:11:09,889 --> 00:11:07,200
our wonderful social media team is

287
00:11:11,030 --> 00:11:09,899
sharing some links in the chat with you

288
00:11:11,990 --> 00:11:11,040

um and this is one of the links that

289

00:11:14,150 --> 00:11:12,000

they'll be sharing throughout the

290

00:11:15,769 --> 00:11:14,160

lecture tonight for this interactive you

291

00:11:17,990 --> 00:11:15,779

can check on it this is a screenshot

292

00:11:20,569 --> 00:11:18,000

from yesterday but it updates regularly

293

00:11:23,090 --> 00:11:20,579

so you can check that online as well so

294

00:11:24,290 --> 00:11:23,100

Rob what's next for a mitt I mean it

295

00:11:26,630 --> 00:11:24,300

sounds like it's already been doing

296

00:11:28,069 --> 00:11:26,640

incredible work but what are you most

297

00:11:30,470 --> 00:11:28,079

looking forward to learning about

298

00:11:32,509 --> 00:11:30,480

because of emit

299

00:11:34,009 --> 00:11:32,519

well let me jump back a little bit to

300

00:11:36,170 --> 00:11:34,019

our Prime objective which is the

301
00:11:38,509 --> 00:11:36,180
mineralogy and and show you some of the

302
00:11:40,790 --> 00:11:38,519
things we're learning right now and so

303
00:11:43,190 --> 00:11:40,800
I'll jump to image nine if I could and

304
00:11:44,870 --> 00:11:43,200
this will show an example of how we're

305
00:11:47,150 --> 00:11:44,880
doing just what we said we would do when

306
00:11:49,009 --> 00:11:47,160
we propose this mission to NASA at the

307
00:11:52,009 --> 00:11:49,019
lower left you're seeing an image Cube

308
00:11:54,769 --> 00:11:52,019
that's an emit data set of more than a

309
00:11:57,110 --> 00:11:54,779
million Spectra uh with a spectrum for

310
00:11:58,850 --> 00:11:57,120
each point in that image and above there

311
00:12:00,470 --> 00:11:58,860
you're seeing the radiance that's the

312
00:12:02,329 --> 00:12:00,480
signature emit C's at the top of the

313
00:12:04,190 --> 00:12:02,339

atmosphere so that's the fingerprint of

314

00:12:07,250 --> 00:12:04,200

the whole earth system that's got the

315

00:12:09,410 --> 00:12:07,260

atmosphere and all elements of the

316

00:12:11,210 --> 00:12:09,420

surface and then to the upper right

317

00:12:12,829 --> 00:12:11,220

you're seeing once we peel back the

318

00:12:14,930 --> 00:12:12,839

atmosphere now we have the spectral

319

00:12:17,569 --> 00:12:14,940

signatures of the minerals so we can see

320

00:12:19,190 --> 00:12:17,579

iron oxide minerals which are dark and

321

00:12:21,710 --> 00:12:19,200

could heat the Earth and we could see

322

00:12:24,050 --> 00:12:21,720

evidence of Clays and carbonates which

323

00:12:26,870 --> 00:12:24,060

are brighter and could um scatter light

324

00:12:29,810 --> 00:12:26,880

and and have a cooling effect and then

325

00:12:31,310 --> 00:12:29,820

down below in the the middle and the the

326

00:12:34,370 --> 00:12:31,320

right you're seeing we're already

327

00:12:36,530 --> 00:12:34,380

producing these mineral Maps uh for the

328

00:12:38,870 --> 00:12:36,540

Earth system and again each one of these

329

00:12:41,630 --> 00:12:38,880

cubes has a million measurements and

330

00:12:43,550 --> 00:12:41,640

remember we're trying to replace uh the

331

00:12:45,949 --> 00:12:43,560

current situation with only 5 000

332

00:12:48,410 --> 00:12:45,959

measurements and here we are beginning

333

00:12:51,530 --> 00:12:48,420

on that journey and then to give you an

334

00:12:55,030 --> 00:12:51,540

idea of how far along I'll ask what we

335

00:12:59,870 --> 00:12:57,590

this is the amount of coverage emit has

336

00:13:02,030 --> 00:12:59,880

already collected on our planet in less

337

00:13:04,730 --> 00:13:02,040

than a year you can see we've got large

338

00:13:06,290 --> 00:13:04,740

areas of blue those blue are orbit

339

00:13:08,389 --> 00:13:06,300

segments from the International Space

340

00:13:10,250 --> 00:13:08,399

Station where we've collected emit data

341

00:13:12,290 --> 00:13:10,260

sets each one of those blue stripes

342

00:13:14,509 --> 00:13:12,300

consists of a number of those little

343

00:13:17,210 --> 00:13:14,519

cubes each Cube having about a million

344

00:13:19,610 --> 00:13:17,220

Spectra and this is how far we are

345

00:13:21,889 --> 00:13:19,620

already in collecting that data set to

346

00:13:24,350 --> 00:13:21,899

update the air system models so I'm very

347

00:13:27,650 --> 00:13:24,360

excited about achieving emits primary

348

00:13:32,870 --> 00:13:27,660

objectives with this uh spectacular data

349

00:13:37,069 --> 00:13:34,550

great things but there's a lot more

350

00:13:39,410 --> 00:13:37,079

things to come right we're looking at we

351
00:13:42,170 --> 00:13:39,420
talked about greenhouse gases but you

352
00:13:45,230 --> 00:13:42,180
also touched on Water Resources mineral

353
00:13:47,150 --> 00:13:45,240
resources studying the oceans and coral

354
00:13:48,430 --> 00:13:47,160
I mean this has so many applications

355
00:13:50,030 --> 00:13:48,440
right Rob

356
00:13:51,590 --> 00:13:50,040
absolutely

357
00:13:54,230 --> 00:13:51,600
um the data set while we're focused on

358
00:13:56,090 --> 00:13:54,240
the air land regions we collect adjacent

359
00:13:58,069 --> 00:13:56,100
data sets which have all these different

360
00:14:00,710 --> 00:13:58,079
signatures or Fingerprints of the earth

361
00:14:02,810 --> 00:14:00,720
system so some related to snow and ice

362
00:14:05,690 --> 00:14:02,820
when we capture those we can understand

363
00:14:07,370 --> 00:14:05,700

is there dust on the snow what's the

364

00:14:09,290 --> 00:14:07,380

brightness of the snow is it going to

365

00:14:12,009 --> 00:14:09,300

melt more quickly or more slowly so that

366

00:14:14,509 --> 00:14:12,019

relates to water resources and hydrology

367

00:14:16,670 --> 00:14:14,519

in many of the air then regions where

368

00:14:18,949 --> 00:14:16,680

we're next to an ocean that's often an

369

00:14:21,290 --> 00:14:18,959

area where there are coral reefs and sea

370

00:14:22,850 --> 00:14:21,300

grass so the emit data set can be used

371

00:14:25,069 --> 00:14:22,860

well not for the prime objective

372

00:14:26,509 --> 00:14:25,079

scientists who are interested in using

373

00:14:28,910 --> 00:14:26,519

the emit dataset to investigate

374

00:14:31,850 --> 00:14:28,920

important questions about aquatic

375

00:14:34,069 --> 00:14:31,860

systems seagrass coral reefs and then

376

00:14:36,949 --> 00:14:34,079

there are terrestrial ecosystems around

377

00:14:39,769 --> 00:14:36,959

all these arid land systems uh like we

378

00:14:41,990 --> 00:14:39,779

have here in in California and the

379

00:14:44,269 --> 00:14:42,000

spectral Fingerprints of vegetation are

380

00:14:46,009 --> 00:14:44,279

also available for people to pose and

381

00:14:48,410 --> 00:14:46,019

answer questions and pursue applications

382

00:14:50,990 --> 00:14:48,420

in fact excitedly NASA has just really

383

00:14:53,569 --> 00:14:51,000

least an opportunity for scientists and

384

00:14:56,569 --> 00:14:53,579

others to propose to use these data sets

385

00:14:57,829 --> 00:14:56,579

and support their use of these data sets

386

00:14:59,389 --> 00:14:57,839

and that's just been released in the

387

00:15:02,810 --> 00:14:59,399

last couple of weeks so that will really

388

00:15:05,329 --> 00:15:02,820

grow the utility of these spectacular

389

00:15:07,189 --> 00:15:05,339

new measurements that really are first

390

00:15:11,269 --> 00:15:07,199

in their class in terms of their signals

391

00:15:16,970 --> 00:15:15,110

so what comes next after a mitt Rob

392

00:15:19,670 --> 00:15:16,980

yeah that that's where it's even more

393

00:15:23,689 --> 00:15:19,680

exciting that the the National Academy

394

00:15:26,810 --> 00:15:23,699

of Science decadal survey called for uh

395

00:15:29,750 --> 00:15:26,820

NASA to work on the Next Generation

396

00:15:31,069 --> 00:15:29,760

observations for our planet and we call

397

00:15:33,590 --> 00:15:31,079

those part of the earth system

398

00:15:35,329 --> 00:15:33,600

Observatory one key element of that

399

00:15:37,910 --> 00:15:35,339

Earth system Observatory is called

400

00:15:40,250 --> 00:15:37,920

surface biology and geology and it

401
00:15:43,129 --> 00:15:40,260
includes a wide swath Imaging

402
00:15:45,050 --> 00:15:43,139
spectrometer of the emit type except

403
00:15:48,829 --> 00:15:45,060
scale to the next level using the next

404
00:15:51,410 --> 00:15:48,839
level of technology so SBG or Surface

405
00:15:55,129 --> 00:15:51,420
biology and geology will map the entire

406
00:15:57,590 --> 00:15:55,139
Earth pole to pole every 16 days and

407
00:15:58,569 --> 00:15:57,600
those data will allow us to take all

408
00:16:01,310 --> 00:15:58,579
these

409
00:16:02,870 --> 00:16:01,320
science and application objectives that

410
00:16:05,509 --> 00:16:02,880
we're testing with emit that's risk

411
00:16:07,970 --> 00:16:05,519
reduction we'll be able to use them now

412
00:16:10,189 --> 00:16:07,980
routinely into the future with the

413
00:16:12,350 --> 00:16:10,199

surface biology and geology data set so

414

00:16:14,329 --> 00:16:12,360

I'm very excited about where we're going

415

00:16:17,990 --> 00:16:14,339

and how emit can play an important role

416

00:16:20,150 --> 00:16:18,000

in preparing us for that era of global

417

00:16:22,490 --> 00:16:20,160

coverage

418

00:16:25,009 --> 00:16:22,500

so you've talked about Amazing Earth

419

00:16:27,490 --> 00:16:25,019

applications of this technology but are

420

00:16:30,590 --> 00:16:27,500

there any outside of planet Earth

421

00:16:32,329 --> 00:16:30,600

yes absolutely in fact uh Imaging

422

00:16:36,050 --> 00:16:32,339

spectroscopy is used throughout the

423

00:16:39,110 --> 00:16:36,060

solar system and JPL has is playing a

424

00:16:40,910 --> 00:16:39,120

major role right now we just finished an

425

00:16:43,009 --> 00:16:40,920

instrument called the

426

00:16:46,189 --> 00:16:43,019

um high resolution volatiles minerals

427

00:16:47,569 --> 00:16:46,199

Moon mapper and that's part of the lunar

428

00:16:49,490 --> 00:16:47,579

Trailblazer mission that will be

429

00:16:51,769 --> 00:16:49,500

launched to the Moon

430

00:16:53,930 --> 00:16:51,779

um uh fairly soon to look at the

431

00:16:57,170 --> 00:16:53,940

minerals on the moon and question of

432

00:17:00,470 --> 00:16:57,180

volatiles that's water and and materials

433

00:17:02,090 --> 00:17:00,480

like that so that's the best way to

434

00:17:04,490 --> 00:17:02,100

answer that questions quickly in the

435

00:17:07,090 --> 00:17:04,500

moon as we think about how humans will

436

00:17:09,530 --> 00:17:07,100

be interacting in the moon going forward

437

00:17:11,329 --> 00:17:09,540

uh and then further out in the solar

438

00:17:13,669 --> 00:17:11,339

system we're also building an Imaging

439

00:17:16,669 --> 00:17:13,679

spectrometer called uh the mapping

440

00:17:18,590 --> 00:17:16,679

Imaging spectrometer for Europa and that

441

00:17:21,350 --> 00:17:18,600

spectrometer will head out on a mission

442

00:17:23,390 --> 00:17:21,360

called Europa Clipper uh to look at that

443

00:17:25,370 --> 00:17:23,400

moon of Jupiter which has an ocean under

444

00:17:26,870 --> 00:17:25,380

a nice shell and we can look at the

445

00:17:28,970 --> 00:17:26,880

signatures of what's on the surface of

446

00:17:30,890 --> 00:17:28,980

that ice shell well and perhaps answer

447

00:17:32,570 --> 00:17:30,900

some questions about habitability in

448

00:17:35,029 --> 00:17:32,580

some really interesting questions about

449

00:17:37,010 --> 00:17:35,039

what might be happening on an icy moon

450

00:17:39,590 --> 00:17:37,020

with an ocean below it because some of

451

00:17:41,630 --> 00:17:39,600

that ocean periodically Rises to the

452

00:17:42,710 --> 00:17:41,640

surface is left on the surface and of

453

00:17:44,630 --> 00:17:42,720

course there has also been a

454

00:17:46,130 --> 00:17:44,640

spectrometer in orbit around Mars for

455

00:17:48,409 --> 00:17:46,140

quite a few years though it just

456

00:17:51,409 --> 00:17:48,419

finished its mission in the last month

457

00:17:56,570 --> 00:17:54,409

well rob it sounds like there's a lot of

458

00:17:58,370 --> 00:17:56,580

great technology that can use this or a

459

00:18:00,409 --> 00:17:58,380

lot of things that can use this through

460

00:18:02,570 --> 00:18:00,419

our many conversations we've also talked

461

00:18:04,250 --> 00:18:02,580

a lot about the team and so before we

462

00:18:05,510 --> 00:18:04,260

open up for Q a I do want to give you a

463

00:18:08,210 --> 00:18:05,520

moment to talk about that I'm going to

464

00:18:10,010 --> 00:18:08,220

ask the team to start with uh Image six

465

00:18:11,210 --> 00:18:10,020

for us please and you can flip through a

466

00:18:12,950 --> 00:18:11,220

couple of those and talk about the team

467

00:18:15,350 --> 00:18:12,960

behind emit

468

00:18:18,830 --> 00:18:15,360

please again it's an extraordinary team

469

00:18:20,450 --> 00:18:18,840

of well over 100 people we spent 41

470

00:18:21,710 --> 00:18:20,460

months building this instrument and

471

00:18:24,409 --> 00:18:21,720

getting it launched at the space station

472

00:18:26,570 --> 00:18:24,419

this is a part of that process where

473

00:18:29,150 --> 00:18:26,580

we're attaching the telescope

474

00:18:31,070 --> 00:18:29,160

spectrometer system to the electronic

475

00:18:32,390 --> 00:18:31,080

system in the laboratory so we're

476
00:18:33,830 --> 00:18:32,400
bringing down that upper thing and

477
00:18:36,529 --> 00:18:33,840
here's the team

478
00:18:37,970 --> 00:18:36,539
following all the guidelines ever so

479
00:18:40,789 --> 00:18:37,980
carefully to bring this instrument

480
00:18:42,590 --> 00:18:40,799
together to create this instrument

481
00:18:44,510 --> 00:18:42,600
um from from from a large number of

482
00:18:47,270 --> 00:18:44,520
parts and then if we can jump to the

483
00:18:49,669 --> 00:18:47,280
next image it's really spectacular uh

484
00:18:51,230 --> 00:18:49,679
this is another subset of the team after

485
00:18:53,210 --> 00:18:51,240
the instrument is pulled together we've

486
00:18:55,250 --> 00:18:53,220
got the telescope and the electronics

487
00:18:58,250 --> 00:18:55,260
bench below later I'll go into a thermal

488
00:18:59,930 --> 00:18:58,260

enclosure and then uh what came next

489

00:19:01,669 --> 00:18:59,940

though I don't have all the intermediate

490

00:19:03,409 --> 00:19:01,679

shots we can jump to the next image

491

00:19:05,570 --> 00:19:03,419

which is image eight

492

00:19:07,310 --> 00:19:05,580

this is actually an image of what

493

00:19:11,210 --> 00:19:07,320

happened in the period from the 14th of

494

00:19:13,190 --> 00:19:11,220

July to the 28th of July 2022 that is a

495

00:19:15,590 --> 00:19:13,200

myth labeled on the space station

496

00:19:17,510 --> 00:19:15,600

looking at our planet this picture was

497

00:19:20,570 --> 00:19:17,520

taken by astronaut Jessica Watkins and

498

00:19:23,450 --> 00:19:20,580

she kindly shared it with us so all that

499

00:19:25,730 --> 00:19:23,460

work that huge team for 41 months

500

00:19:28,730 --> 00:19:25,740

really building this new

501
00:19:31,190 --> 00:19:28,740
state-of-the-art Imaging spectrometer uh

502
00:19:33,770 --> 00:19:31,200
ended in spectacular success with Amit

503
00:19:36,470 --> 00:19:33,780
arriving on the space station thanks to

504
00:19:38,690 --> 00:19:36,480
SpaceX and that spectacular team and

505
00:19:40,610 --> 00:19:38,700
then the ISS team has been amazing

506
00:19:43,669 --> 00:19:40,620
taking care of them it they provide us

507
00:19:45,110 --> 00:19:43,679
all our power and all our commanding and

508
00:19:47,450 --> 00:19:45,120
all our data come down through the

509
00:19:49,430 --> 00:19:47,460
International Space Station system and

510
00:19:51,650 --> 00:19:49,440
and that's worked flawlessly in some

511
00:19:53,990 --> 00:19:51,660
cases we will make a measurement of

512
00:19:55,730 --> 00:19:54,000
Earth on one day and at the within 24

513
00:19:58,130 --> 00:19:55,740

hours we will actually have mapped the

514

00:19:59,990 --> 00:19:58,140

minerals because of the just the

515

00:20:02,450 --> 00:20:00,000

extraordinary teamwork involved in in

516

00:20:05,450 --> 00:20:02,460

moving the data and processing the data

517

00:20:08,330 --> 00:20:05,460

and getting us to this amazing state

518

00:20:09,770 --> 00:20:08,340

that's incredible to hear Rob

519

00:20:12,710 --> 00:20:09,780

um we've had a ton of great questions

520

00:20:14,150 --> 00:20:12,720

come through the chat so Jocelyn I know

521

00:20:15,590 --> 00:20:14,160

they're excited what is the audience

522

00:20:18,110 --> 00:20:15,600

asking of Rob

523

00:20:19,850 --> 00:20:18,120

yeah lots of really great questions out

524

00:20:22,850 --> 00:20:19,860

here and you've given us a great

525

00:20:25,130 --> 00:20:22,860

overview of how emit works and con on

526

00:20:27,529 --> 00:20:25,140

Facebook wants to know how is Amit going

527

00:20:29,810 --> 00:20:27,539

to help us fight climate change caused

528

00:20:33,289 --> 00:20:29,820

by dust storms

529

00:20:34,789 --> 00:20:33,299

so uh what we can really do is Amit can

530

00:20:37,130 --> 00:20:34,799

give you the information to make some

531

00:20:40,190 --> 00:20:37,140

decisions about how you might adjust

532

00:20:43,490 --> 00:20:40,200

land use right you could imagine how you

533

00:20:45,230 --> 00:20:43,500

use the land can can create more cases

534

00:20:48,169 --> 00:20:45,240

where it's easier for dust to launch

535

00:20:49,490 --> 00:20:48,179

into the atmosphere or harder for dust

536

00:20:51,409 --> 00:20:49,500

to launch of the atmosphere in fact

537

00:20:53,270 --> 00:20:51,419

there's a great experiment in California

538

00:20:54,950 --> 00:20:53,280

at Owens Lake where they're they're

539

00:20:56,029 --> 00:20:54,960

looking they know about the dust and

540

00:20:59,750 --> 00:20:56,039

they're figuring out how they would

541

00:21:01,549 --> 00:20:59,760

modify the surface to try to minimize

542

00:21:03,350 --> 00:21:01,559

the dust that's launched into the

543

00:21:07,850 --> 00:21:03,360

atmosphere that that again results in

544

00:21:12,710 --> 00:21:10,190

is wondering can this be used in

545

00:21:14,450 --> 00:21:12,720

disaster recovery for example after an

546

00:21:16,549 --> 00:21:14,460

eruption

547

00:21:19,549 --> 00:21:16,559

yes this can provide important

548

00:21:22,430 --> 00:21:19,559

information for disaster recovery and

549

00:21:24,650 --> 00:21:22,440

understanding disasters after volcanic

550

00:21:26,630 --> 00:21:24,660

eruptions you could understand a number

551
00:21:29,090 --> 00:21:26,640
of things about where the dust particles

552
00:21:31,430 --> 00:21:29,100
went where the damage was we can see

553
00:21:33,289 --> 00:21:31,440
where the lava is Flowing there's

554
00:21:34,909 --> 00:21:33,299
there's information we can provide we

555
00:21:37,130 --> 00:21:34,919
were actually used in Airborne

556
00:21:38,870 --> 00:21:37,140
spectrometer after the gulf oil spill to

557
00:21:41,090 --> 00:21:38,880
understand how much oil was on the water

558
00:21:43,909 --> 00:21:41,100
and how it would impact the ecosystem so

559
00:21:46,909 --> 00:21:43,919
there's a large number of applications

560
00:21:48,890 --> 00:21:46,919
to address hazards and Disaster Response

561
00:21:50,510 --> 00:21:48,900
with this type of Imaging spectroscopy

562
00:21:52,669 --> 00:21:50,520
that will also be true in the future

563
00:21:55,490 --> 00:21:52,679

with the surface and biology and geology

564

00:22:01,370 --> 00:21:58,130

and continuing on that conversational

565

00:22:03,169 --> 00:22:01,380

applications uh Sarah on Facebook wants

566

00:22:05,270 --> 00:22:03,179

to know will we be able to build

567

00:22:07,850 --> 00:22:05,280

predictive models with this data too

568

00:22:10,070 --> 00:22:07,860

they're thinking about applications with

569

00:22:11,330 --> 00:22:10,080

some of the AI tools that currently

570

00:22:13,909 --> 00:22:11,340

exist

571

00:22:15,350 --> 00:22:13,919

yes I think absolutely in fact we're

572

00:22:17,029 --> 00:22:15,360

already using a little bit of machine

573

00:22:19,370 --> 00:22:17,039

learning and Ai and some of our

574

00:22:21,110 --> 00:22:19,380

retrieval algorithms

575

00:22:24,590 --> 00:22:21,120

um in emulators and things like that so

576

00:22:26,270 --> 00:22:24,600

I think yes as this data set is giving a

577

00:22:28,789 --> 00:22:26,280

new comprehensive measurement of the

578

00:22:30,289 --> 00:22:28,799

earth system in those measurements are

579

00:22:32,690 --> 00:22:30,299

patterns and they're not all the

580

00:22:34,310 --> 00:22:32,700

patterns that we can find quickly with

581

00:22:36,049 --> 00:22:34,320

our understanding of Science and physics

582

00:22:38,510 --> 00:22:36,059

today but things like machine learning

583

00:22:41,149 --> 00:22:38,520

and AI might help us discover those

584

00:22:44,630 --> 00:22:41,159

patterns more quickly and then we can

585

00:22:46,730 --> 00:22:44,640

build models that are prognostic and and

586

00:22:48,590 --> 00:22:46,740

more powerful than maybe we would have

587

00:22:50,870 --> 00:22:48,600

through some more traditional methods so

588

00:22:52,430 --> 00:22:50,880

I'm very excited about the potential of

589

00:22:54,770 --> 00:22:52,440

this new data set with all the

590

00:22:56,570 --> 00:22:54,780

information content embedded in it and

591

00:22:58,190 --> 00:22:56,580

people taking advantage of that with

592

00:23:00,409 --> 00:22:58,200

machine learning and artificial

593

00:23:03,890 --> 00:23:00,419

intelligence

594

00:23:06,230 --> 00:23:03,900

and um a speaking about the measurements

595

00:23:08,930 --> 00:23:06,240

D on YouTube is wondering how much

596

00:23:12,049 --> 00:23:08,940

surface area does one measurement cover

597

00:23:14,750 --> 00:23:12,059

in square miles square kilometers

598

00:23:16,730 --> 00:23:14,760

the one spectrum is about 60 by 60

599

00:23:20,090 --> 00:23:16,740

meters so you can think of it as a

600

00:23:21,230 --> 00:23:20,100

football field class observation but

601
00:23:23,570 --> 00:23:21,240
there's something extraordinary about

602
00:23:25,430 --> 00:23:23,580
spectroscopy if in that field you have

603
00:23:26,330 --> 00:23:25,440
only a quarter of it filled with one

604
00:23:28,549 --> 00:23:26,340
mineral

605
00:23:30,649 --> 00:23:28,559
we can still see the spectral signature

606
00:23:33,649 --> 00:23:30,659
of that mineral even though it's only

607
00:23:35,810 --> 00:23:33,659
occupying a quarter of that 60 by 60

608
00:23:37,909 --> 00:23:35,820
meter this is called spectral and mixing

609
00:23:39,950 --> 00:23:37,919
so because that spectral signature is

610
00:23:42,350 --> 00:23:39,960
unique in present we may not be able to

611
00:23:44,270 --> 00:23:42,360
say which quarter has that mineral but

612
00:23:46,250 --> 00:23:44,280
we could say that mineral is there so we

613
00:23:49,250 --> 00:23:46,260

we have sort of a spectral Zoom

614

00:23:51,890 --> 00:23:49,260

capability to look at concentrations of

615

00:23:54,190 --> 00:23:51,900

materials much smaller than the the

616

00:23:57,230 --> 00:23:54,200

nominal spatial scale and that's another

617

00:24:00,409 --> 00:23:57,240

powerful uh result of using uh High

618

00:24:02,570 --> 00:24:00,419

Fidelity spectroscopy

619

00:24:05,450 --> 00:24:02,580

a great follow-up question here from

620

00:24:08,210 --> 00:24:05,460

Jenny on YouTube which is can emit tell

621

00:24:12,049 --> 00:24:08,220

the height of different particles or

622

00:24:13,370 --> 00:24:12,059

dust storms when those are airborne

623

00:24:15,110 --> 00:24:13,380

um it's a little tricky there are

624

00:24:16,970 --> 00:24:15,120

different ways to do that

625

00:24:19,549 --> 00:24:16,980

um basically we can look at

626
00:24:21,169 --> 00:24:19,559
um uh shadowing effects and and things

627
00:24:23,810 --> 00:24:21,179
along those lines but we don't naturally

628
00:24:25,789 --> 00:24:23,820
have the vertical profile

629
00:24:28,010 --> 00:24:25,799
um in the emit measurement and again the

630
00:24:30,649 --> 00:24:28,020
quarter measurement is to look at the

631
00:24:32,810 --> 00:24:30,659
composition of the source regions that

632
00:24:34,970 --> 00:24:32,820
get blown into the atmosphere so that we

633
00:24:37,370 --> 00:24:34,980
can make predictions if it's coming from

634
00:24:39,649 --> 00:24:37,380
this location is it it's likely to be

635
00:24:41,870 --> 00:24:39,659
maybe a toxic mineral asbestos that

636
00:24:43,549 --> 00:24:41,880
happens in California for example or is

637
00:24:45,289 --> 00:24:43,559
it a mineral that's going to heat or

638
00:24:48,169 --> 00:24:45,299

cool the atmosphere so mostly we're

639

00:24:49,730 --> 00:24:48,179

focused on the surface Source regions

640

00:24:52,490 --> 00:24:49,740

that then we can use with different

641

00:24:54,169 --> 00:24:52,500

methodologies to predict where they

642

00:24:56,090 --> 00:24:54,179

might go and how they might interact

643

00:24:58,310 --> 00:24:56,100

with your system including including

644

00:25:00,649 --> 00:24:58,320

ourselves

645

00:25:03,470 --> 00:25:00,659

and I've got to say I love those photos

646

00:25:05,690 --> 00:25:03,480

of the instrument being built and Amy on

647

00:25:07,909 --> 00:25:05,700

Facebook is wondering where all of the

648

00:25:11,270 --> 00:25:07,919

elements of the event instrument

649

00:25:13,070 --> 00:25:11,280

developed by JPL or were other industry

650

00:25:15,409 --> 00:25:13,080

Partnerships involved

651
00:25:17,510 --> 00:25:15,419
oh we had many wonderful industry

652
00:25:18,950 --> 00:25:17,520
Partners the detector came from an

653
00:25:21,710 --> 00:25:18,960
industry partner the heat rejection

654
00:25:24,769 --> 00:25:21,720
system came from an industry pardon the

655
00:25:27,590 --> 00:25:24,779
mirrors for the telescope so yes it is a

656
00:25:29,570 --> 00:25:27,600
a wonderful collaboration

657
00:25:32,750 --> 00:25:29,580
um and sometimes whole subsystems came

658
00:25:34,789 --> 00:25:32,760
for industry Partners so absolutely the

659
00:25:37,310 --> 00:25:34,799
JPL has focused just on the core element

660
00:25:38,750 --> 00:25:37,320
that spectrometer and some of the

661
00:25:41,269 --> 00:25:38,760
components for it are actually made here

662
00:25:43,430 --> 00:25:41,279
at JPL but industry is involved

663
00:25:46,850 --> 00:25:43,440

throughout the process of building an

664

00:25:52,070 --> 00:25:49,730

and Tara on LinkedIn is asking about how

665

00:25:53,990 --> 00:25:52,080

to get involved they write how can a

666

00:25:56,269 --> 00:25:54,000

person like me who does not have a

667

00:25:58,610 --> 00:25:56,279

science background help with data sets

668

00:26:01,010 --> 00:25:58,620

is it possible

669

00:26:02,690 --> 00:26:01,020

that's a great question and I I think

670

00:26:05,390 --> 00:26:02,700

there are ways

671

00:26:07,430 --> 00:26:05,400

um I don't have any uh quick answers but

672

00:26:09,950 --> 00:26:07,440

for example we're going to be producing

673

00:26:11,930 --> 00:26:09,960

data products from emit like you've seen

674

00:26:13,970 --> 00:26:11,940

the methane product and there'll be a

675

00:26:17,810 --> 00:26:13,980

CO2 product and we have mineral products

676

00:26:19,250 --> 00:26:17,820

so even you could with not too much

677

00:26:20,930 --> 00:26:19,260

effort be able to download those

678

00:26:23,029 --> 00:26:20,940

products and see the distribution of

679

00:26:26,090 --> 00:26:23,039

minerals or methane and then you might

680

00:26:27,409 --> 00:26:26,100

think about how how to get involved and

681

00:26:29,390 --> 00:26:27,419

take advantage of that new information

682

00:26:31,490 --> 00:26:29,400

that comes from emit to address

683

00:26:35,649 --> 00:26:31,500

questions and areas that are important

684

00:26:41,330 --> 00:26:38,750

we also have a question here from Dee on

685

00:26:43,850 --> 00:26:41,340

YouTube that is wondering are the scopes

686

00:26:46,130 --> 00:26:43,860

on emit using certain wavelengths on the

687

00:26:50,810 --> 00:26:46,140

EM spectrum

688

00:26:52,490 --> 00:26:50,820

yes we measure uh 285 wavelengths in the

689

00:26:55,070 --> 00:26:52,500

electromagnetic spectrum starting from

690

00:26:57,409 --> 00:26:55,080

the visible where our eyes see well out

691

00:27:00,409 --> 00:26:57,419

into the short wavelength infrared so yes

692

00:27:03,289 --> 00:27:00,419

we we have like if we like you have a

693

00:27:05,750 --> 00:27:03,299

three color camera it made us like a 285

694

00:27:08,210 --> 00:27:05,760

color camera going into wavelength

695

00:27:10,370 --> 00:27:08,220

ranges that our eyes can't possibly see

696

00:27:12,169 --> 00:27:10,380

another interesting point is when I was

697

00:27:13,970 --> 00:27:12,179

in graduate school I was trying to

698

00:27:15,890 --> 00:27:13,980

measure a spectrum like Emit and it took

699

00:27:19,010 --> 00:27:15,900

me about 10 minutes on a laboratory

700

00:27:21,409 --> 00:27:19,020

spectrometer right now in orbit emit is

701
00:27:24,649 --> 00:27:21,419
measuring 300

702
00:27:26,330 --> 00:27:24,659
000 Spectra per second so that's a

703
00:27:28,070 --> 00:27:26,340
spectacular thing for me to think about

704
00:27:31,130 --> 00:27:28,080
going back to my graduate school days

705
00:27:35,870 --> 00:27:31,140
and what we can do today uh to achieve

706
00:27:40,970 --> 00:27:38,930
and speaking um that going back to dust

707
00:27:42,950 --> 00:27:40,980
Justin on LinkedIn is wondering does

708
00:27:47,390 --> 00:27:42,960
this dust in the atmosphere affect

709
00:27:52,850 --> 00:27:49,909
um it can there is now an era of optical

710
00:27:55,490 --> 00:27:52,860
calm where where we're using lasers to

711
00:27:57,649 --> 00:27:55,500
commute op communicate optically

712
00:28:01,549 --> 00:27:57,659
um between spacecraft and the ground so

713
00:28:04,190 --> 00:28:01,559

if dust was in play in one of those uh

714

00:28:05,870 --> 00:28:04,200

reception uh and transmission links you

715

00:28:08,269 --> 00:28:05,880

could imagine dust would weaken the

716

00:28:10,190 --> 00:28:08,279

signal and that would have impact on

717

00:28:12,409 --> 00:28:10,200

communication it doesn't have so much

718

00:28:14,990 --> 00:28:12,419

impact on radio communication and emit

719

00:28:23,210 --> 00:28:15,000

does use radio communication uh from the

720

00:28:26,990 --> 00:28:25,010

I think we might have covered this

721

00:28:28,730 --> 00:28:27,000

slightly but Robert on LinkedIn is

722

00:28:33,289 --> 00:28:28,740

wondering what is the effective

723

00:28:35,750 --> 00:28:33,299

resolution in area at Earth's surface

724

00:28:38,090 --> 00:28:35,760

so the effective resolution is for a

725

00:28:40,490 --> 00:28:38,100

single Spectrum comes from about a 60 by

726

00:28:43,549 --> 00:28:40,500

60 meter patch

727

00:28:45,830 --> 00:28:43,559

um that's the actual spatial sampling

728

00:28:47,930 --> 00:28:45,840

but as I mentioned earlier if you had

729

00:28:49,850 --> 00:28:47,940

just a 10 by 10 meter patch of a

730

00:28:51,890 --> 00:28:49,860

particular mineral and it had a unique

731

00:28:54,049 --> 00:28:51,900

spectral signature we could say it was

732

00:28:56,510 --> 00:28:54,059

there so we have sort of a spectral Zoom

733

00:28:58,310 --> 00:28:56,520

to allow us to talk about constituents

734

00:29:02,090 --> 00:28:58,320

of the air system that are smaller than

735

00:29:07,190 --> 00:29:04,669

and looking at the applications again

736

00:29:10,010 --> 00:29:07,200

Jenny on YouTube is wondering is emit

737

00:29:13,430 --> 00:29:10,020

able to track and interpret wildfires

738

00:29:16,909 --> 00:29:13,440

and their potential impacts

739

00:29:18,409 --> 00:29:16,919

yes Emit and emit type measurements can

740

00:29:21,110 --> 00:29:18,419

contribute in several ways to

741

00:29:22,730 --> 00:29:21,120

understanding wildfires we can map

742

00:29:24,409 --> 00:29:22,740

species type which relates to

743

00:29:26,690 --> 00:29:24,419

burnability we can look at the dry

744

00:29:28,789 --> 00:29:26,700

biomass how much burnable material is

745

00:29:31,070 --> 00:29:28,799

there and how much water is the leaves

746

00:29:33,649 --> 00:29:31,080

all those are spectral signatures that

747

00:29:35,029 --> 00:29:33,659

emit captures in this spectral range so

748

00:29:37,190 --> 00:29:35,039

those would be things that tell you what

749

00:29:39,169 --> 00:29:37,200

the risk is if we see a fire we can

750

00:29:41,149 --> 00:29:39,179

actually say how hot the fire is very

751

00:29:43,669 --> 00:29:41,159

carefully and what might be next to it

752

00:29:46,430 --> 00:29:43,679

that might burn and after a fire we can

753

00:29:48,769 --> 00:29:46,440

look at burn severity how severe was the

754

00:29:51,049 --> 00:29:48,779

fire how badly was the ecosystem damaged

755

00:29:53,570 --> 00:29:51,059

and then into the future we can look at

756

00:29:55,130 --> 00:29:53,580

how recovery might occur as we look at

757

00:29:56,870 --> 00:29:55,140

data sets how are the ecosystems

758

00:29:58,970 --> 00:29:56,880

evolving after they've lived through a

759

00:30:11,090 --> 00:29:58,980

fire so there are many elements for this

760

00:30:15,590 --> 00:30:12,250

yeah

761

00:30:17,990 --> 00:30:15,600

alrighty so folks that was the last

762

00:30:19,789 --> 00:30:18,000

question we had from the audience we

763

00:30:21,409 --> 00:30:19,799

want to thank you all so much for those

764

00:30:24,230 --> 00:30:21,419

wonderful questions you had this evening

765

00:30:26,510 --> 00:30:24,240

uh Rob is a wonderful and dedicated

766

00:30:28,789 --> 00:30:26,520

speaker and we were so grateful to have

767

00:30:30,590 --> 00:30:28,799

him with us today I want to remind you

768

00:30:33,350 --> 00:30:30,600

as well that if you have more questions

769

00:30:35,389 --> 00:30:33,360

about this Mission you can check out the

770

00:30:37,010 --> 00:30:35,399

link that's going to be posted uh in the

771

00:30:42,549 --> 00:30:37,020

chat as well as showing up on the screen

772

00:30:49,789 --> 00:30:46,789

jpl.nasa.gov slash emit so check that

773

00:30:52,070 --> 00:30:49,799

out and uh thank you all for joining us

774

00:30:54,710 --> 00:30:52,080

thank you to our wonderful speaker Dr

775

00:30:56,690 --> 00:30:54,720

Robert Greene for joining us uh to

776

00:30:58,610 --> 00:30:56,700

discuss admit I also want to thank our

777

00:31:01,789 --> 00:30:58,620

wonderful questions because Jocelyn

778

00:31:03,169 --> 00:31:01,799

thank you for joining us uh and I want

779

00:31:05,510 --> 00:31:03,179

to thank everyone working behind the

780

00:31:07,310 --> 00:31:05,520

scenes to make this possible to all of

781

00:31:09,230 --> 00:31:07,320

you watching every month that take this

782

00:31:10,850 --> 00:31:09,240

time out of your day we want to thank

783

00:31:13,310 --> 00:31:10,860

you and remind you that if you did miss

784

00:31:14,990 --> 00:31:13,320

one of our Von Carmen talks feel free to

785

00:31:17,510 --> 00:31:15,000

check them out they are available for

786

00:31:20,090 --> 00:31:17,520

the past five years on jpl's YouTube

787

00:31:22,669 --> 00:31:20,100

page and please do join us next month

788

00:31:25,250 --> 00:31:22,679

for an incredible discussion about the

789

00:31:27,289 --> 00:31:25,260

Insight Mission thanks again for joining