



1  
00:00:06,550 --> 00:00:03,990  
hello and welcome to nasa headquarters

2  
00:00:08,629 --> 00:00:06,560  
in washington dc i'm steve cole with the

3  
00:00:10,709 --> 00:00:08,639  
office of communications we're here

4  
00:00:13,030 --> 00:00:10,719  
today to tell you about nasa's next

5  
00:00:15,990 --> 00:00:13,040  
earth science mission the orbiting

6  
00:00:17,349 --> 00:00:16,000  
carbon observatory 2 set to launch on

7  
00:00:20,310 --> 00:00:17,359  
july 1st

8  
00:00:23,029 --> 00:00:20,320  
oco-2 is nasa's first dedicated

9  
00:00:25,349 --> 00:00:23,039  
spacecraft to measuring carbon dioxide

10  
00:00:27,670 --> 00:00:25,359  
and earth's atmosphere this greenhouse

11  
00:00:29,189 --> 00:00:27,680  
gas is a key factor in understanding

12  
00:00:30,950 --> 00:00:29,199  
climate change

13  
00:00:32,870 --> 00:00:30,960

today we have four panelists here to

14

00:00:34,950 --> 00:00:32,880

talk to you from the mission let me

15

00:00:38,790 --> 00:00:34,960

introduce you to them first will be

16

00:00:40,310 --> 00:00:38,800

betsy edwards oco-2 program executive

17

00:00:42,869 --> 00:00:40,320

from the science mission directorate

18

00:00:46,709 --> 00:00:42,879

here at nasa headquarters

19

00:00:49,270 --> 00:00:46,719

ralph basilio oco-2 project manager

20

00:00:51,990 --> 00:00:49,280

at nasa's jet propulsion laboratory in

21

00:00:55,830 --> 00:00:52,000

pasadena california

22

00:00:56,830 --> 00:00:55,840

mike gunson oco-2 project scientist also

23

00:00:59,029 --> 00:00:56,840

from

24

00:01:02,470 --> 00:00:59,039

jpl and our fourth presenter is

25

00:01:05,109 --> 00:01:02,480

anne-marie eldering oco-2 deputy project

26

00:01:06,710 --> 00:01:05,119

scientist at jpl

27

00:01:08,630 --> 00:01:06,720

after our presentations we'll take

28

00:01:11,670 --> 00:01:08,640

questions from the media here in the

29

00:01:13,350 --> 00:01:11,680

auditorium on the phone line and from

30

00:01:15,749 --> 00:01:13,360

people who are watching on nasa

31

00:01:18,310 --> 00:01:15,759

television if you're watching online and

32

00:01:20,469 --> 00:01:18,320

would like to ask a question

33

00:01:22,870 --> 00:01:20,479

during the question and answer period

34

00:01:27,429 --> 00:01:22,880

you can do post it to twitter

35

00:01:31,749 --> 00:01:27,439

and use the hashtag ask nasa

36

00:01:34,069 --> 00:01:31,759

okay then we'll begin with betsy

37

00:01:36,789 --> 00:01:34,079

good afternoon

38

00:01:39,190 --> 00:01:36,799

the orbiting carbon observatory ii

39

00:01:41,910 --> 00:01:39,200

we call it oco-2

40

00:01:43,350 --> 00:01:41,920

we'll join our 17 operational earth

41

00:01:46,550 --> 00:01:43,360

science missions

42

00:01:48,149 --> 00:01:46,560

in studying the earth as a system when

43

00:01:52,069 --> 00:01:48,159

it launches from the vanderberg air

44

00:01:55,830 --> 00:01:52,079

force base in california on july the 1st

45

00:01:57,990 --> 00:01:55,840

we could have our first picture please

46

00:02:01,429 --> 00:01:58,000

these missions together with our

47

00:02:04,789 --> 00:02:01,439

ambitious set of earth science

48

00:02:08,869 --> 00:02:04,799

airborne and ground-based measurements

49

00:02:11,029 --> 00:02:08,879

will monitor the earth's vital signs

50

00:02:13,030 --> 00:02:11,039

oco2 in particular

51  
00:02:15,750 --> 00:02:13,040  
will measure carbon global

52  
00:02:17,830 --> 00:02:15,760  
concentrations of carbon dioxide and

53  
00:02:19,589 --> 00:02:17,840  
watch the earth breathe

54  
00:02:22,309 --> 00:02:19,599  
as we measure

55  
00:02:24,070 --> 00:02:22,319  
the greenhouse gas that drives climate

56  
00:02:26,390 --> 00:02:24,080  
change

57  
00:02:28,550 --> 00:02:26,400  
the timing for this mission couldn't be

58  
00:02:30,949 --> 00:02:28,560  
more appropriate given the

59  
00:02:32,550 --> 00:02:30,959  
administration's climate action plan

60  
00:02:35,990 --> 00:02:32,560  
recently released

61  
00:02:37,430 --> 00:02:36,000  
focused on reducing carbon emissions

62  
00:02:39,990 --> 00:02:37,440  
as steve said

63  
00:02:43,110 --> 00:02:40,000

oco-2 is our first nasa mission

64

00:02:45,030 --> 00:02:43,120

dedicated to studying carbon dioxide

65

00:02:47,030 --> 00:02:45,040

and this makes it of critical importance

66

00:02:50,309 --> 00:02:47,040

to the scientists who are trying to

67

00:02:53,270 --> 00:02:50,319

understand the impact of humans on our

68

00:02:56,790 --> 00:02:53,280

global climate change

69

00:02:59,910 --> 00:02:56,800

we could start the first video please

70

00:03:01,830 --> 00:02:59,920

this calendar year has been will be an

71

00:03:04,630 --> 00:03:01,840

auspicious year for earth science as it

72

00:03:06,229 --> 00:03:04,640

will see five mission launches we are

73

00:03:08,630 --> 00:03:06,239

number two

74

00:03:11,030 --> 00:03:08,640

these launches will seek to address the

75

00:03:12,229 --> 00:03:11,040

most pressing issues facing our planet

76

00:03:13,830 --> 00:03:12,239

today

77

00:03:15,990 --> 00:03:13,840

issues like

78

00:03:18,470 --> 00:03:16,000

sea level change

79

00:03:21,990 --> 00:03:18,480

fresh water resources extreme weather

80

00:03:24,710 --> 00:03:22,000

events and of course climate change

81

00:03:26,229 --> 00:03:24,720

climate change is the challenge of our

82

00:03:30,229 --> 00:03:26,239

generation

83

00:03:33,190 --> 00:03:30,239

and nasa is particularly ready to study

84

00:03:35,270 --> 00:03:33,200

things and to provide information on

85

00:03:37,509 --> 00:03:35,280

documenting and understanding what these

86

00:03:39,270 --> 00:03:37,519

changes are in the climate

87

00:03:41,190 --> 00:03:39,280

in predicting the impacts of these

88

00:03:43,030 --> 00:03:41,200

changes to the earth

89

00:03:44,949 --> 00:03:43,040

and in sharing all of this information

90

00:03:47,430 --> 00:03:44,959

that we gather for the benefit of

91

00:03:49,589 --> 00:03:47,440

society

92

00:03:51,830 --> 00:03:49,599

as we launch oco2

93

00:03:53,910 --> 00:03:51,840

the data we provide will help our

94

00:03:56,630 --> 00:03:53,920

decision makers at both the local and

95

00:03:58,869 --> 00:03:56,640

federal levels to better be to be better

96

00:04:01,990 --> 00:03:58,879

equipped to understand

97

00:04:03,990 --> 00:04:02,000

carbon dioxide's role in climate change

98

00:04:07,030 --> 00:04:04,000

because oco2 will be measuring this

99

00:04:10,710 --> 00:04:07,040

greenhouse globally and understanding

100

00:04:13,910 --> 00:04:10,720

and providing new insight into where and

101  
00:04:18,629 --> 00:04:13,920  
how the carbon dioxide is moving into

102  
00:04:25,749 --> 00:04:22,150  
the oco2 satellite has one instrument

103  
00:04:28,469 --> 00:04:25,759  
a three-channel grating spectrometer

104  
00:04:30,550 --> 00:04:28,479  
but with that one instrument we're going

105  
00:04:32,790 --> 00:04:30,560  
to collect hundreds of thousands of

106  
00:04:34,390 --> 00:04:32,800  
measurements each day

107  
00:04:37,270 --> 00:04:34,400  
which will then provide a global

108  
00:04:39,110 --> 00:04:37,280  
description of carbon dioxide in the

109  
00:04:41,510 --> 00:04:39,120  
atmosphere and it's going to be an

110  
00:04:43,749 --> 00:04:41,520  
unprecedented level of coverage and

111  
00:04:47,510 --> 00:04:43,759  
resolution something we've not seen

112  
00:04:50,070 --> 00:04:47,520  
before with previous spacecraft

113  
00:04:51,830 --> 00:04:50,080

if we could see our start our next video

114

00:04:54,390 --> 00:04:51,840

please

115

00:04:56,230 --> 00:04:54,400

the oco-2 spacecraft

116

00:04:59,189 --> 00:04:56,240

because of the way it's orbiting in its

117

00:05:02,710 --> 00:04:59,199

polar orbit we'll see locations on the

118

00:05:05,990 --> 00:05:02,720

earth at the same time of day but every

119

00:05:09,510 --> 00:05:06,000

16 days and then over the change of

120

00:05:11,990 --> 00:05:09,520

seasons providing new insight into how

121

00:05:13,110 --> 00:05:12,000

carbon dioxide levels are changing over

122

00:05:16,469 --> 00:05:13,120

time

123

00:05:20,310 --> 00:05:16,479

and this change will ultimately provide

124

00:05:23,189 --> 00:05:20,320

patterns over weeks or months or years

125

00:05:27,350 --> 00:05:23,199

as scientists attempt to unravel

126  
00:05:33,510 --> 00:05:30,870  
the oco-2 spacecraft came into being as

127  
00:05:35,510 --> 00:05:33,520  
the result of the unfortunate 2009

128  
00:05:39,590 --> 00:05:35,520  
failure of the launch vehicle that

129  
00:05:41,350 --> 00:05:39,600  
contained the original oco spacecraft

130  
00:05:44,230 --> 00:05:41,360  
but due to the importance of this

131  
00:05:45,590 --> 00:05:44,240  
mission to the scientific community and

132  
00:05:48,070 --> 00:05:45,600  
to society

133  
00:05:51,270 --> 00:05:48,080  
nasa was given permission to rebuild the

134  
00:05:55,670 --> 00:05:54,070  
shortly after the launch the loss of our

135  
00:05:58,070 --> 00:05:55,680  
first satellite

136  
00:06:00,950 --> 00:05:58,080  
the science team from the japanese

137  
00:06:02,150 --> 00:06:00,960  
greenhouse gases observing satellite or

138  
00:06:05,270 --> 00:06:02,160

gosat

139

00:06:08,309 --> 00:06:05,280

reached out to nasa and invited our oco

140

00:06:11,270 --> 00:06:08,319

science team to participate with them

141

00:06:12,870 --> 00:06:11,280

in evaluating and understanding the

142

00:06:14,870 --> 00:06:12,880

gosat data

143

00:06:16,550 --> 00:06:14,880

and this collaboration has now gone on

144

00:06:20,629 --> 00:06:16,560

for several years

145

00:06:22,870 --> 00:06:20,639

after the launch of gosat in 2009

146

00:06:25,110 --> 00:06:22,880

and the the science team here has now

147

00:06:27,990 --> 00:06:25,120

been using that gosat data for the past

148

00:06:30,790 --> 00:06:28,000

several years in helping to refine their

149

00:06:33,029 --> 00:06:30,800

data processing algorithms

150

00:06:34,629 --> 00:06:33,039

of course this cooperation is benefiting

151  
00:06:36,550 --> 00:06:34,639  
both teams

152  
00:06:39,590 --> 00:06:36,560  
and it will be strengthened as soon as

153  
00:06:41,510 --> 00:06:39,600  
we get oco2 on orbit and can share our

154  
00:06:43,749 --> 00:06:41,520  
data with them

155  
00:06:47,350 --> 00:06:43,759  
the scientists are eagerly anticipating

156  
00:06:49,909 --> 00:06:47,360  
the ability to merge our oco2 data with

157  
00:06:52,550 --> 00:06:49,919  
their gosat data and helping them to

158  
00:06:55,110 --> 00:06:52,560  
advance their knowledge in understanding

159  
00:06:57,909 --> 00:06:55,120  
the carbon cycle

160  
00:06:59,350 --> 00:06:57,919  
the oco-2 mission in conjunction with

161  
00:07:02,309 --> 00:06:59,360  
our robust

162  
00:07:05,350 --> 00:07:02,319  
set of earth science space-based and

163  
00:07:06,629 --> 00:07:05,360

airborne observations our ground-based

164

00:07:09,589 --> 00:07:06,639

measurements

165

00:07:12,950 --> 00:07:09,599

and our data processing activities

166

00:07:17,510 --> 00:07:12,960

will yield unparalleled new insights

167

00:07:20,230 --> 00:07:17,520

into the the earth as a system

168

00:07:22,550 --> 00:07:20,240

we are eagerly anticipating the july 1st

169

00:07:26,950 --> 00:07:22,560

launch of oco-2

170

00:07:28,550 --> 00:07:26,960

so we can all watch the earth breathe

171

00:07:31,110 --> 00:07:28,560

and now i'd like to turn it over to our

172

00:07:33,110 --> 00:07:31,120

project manager ralph brasilio

173

00:07:35,510 --> 00:07:33,120

thank you very much betsy

174

00:07:37,430 --> 00:07:35,520

so nasa's jet propulsion laboratory and

175

00:07:40,309 --> 00:07:37,440

orbital sciences corporation have been

176

00:07:43,830 --> 00:07:40,319

working quite diligently since the oco2

177

00:07:45,510 --> 00:07:43,840

project's inception in march of 2010.

178

00:07:47,510 --> 00:07:45,520

project team has actually been working

179

00:07:49,350 --> 00:07:47,520

quite hard to deliver on the promises

180

00:07:50,309 --> 00:07:49,360

that were made on the original ocl

181

00:07:51,510 --> 00:07:50,319

mission

182

00:07:53,589 --> 00:07:51,520

basically

183

00:07:57,029 --> 00:07:53,599

obtaining measurements of carbon dioxide

184

00:07:59,110 --> 00:07:57,039

from space with the precision resolution

185

00:08:01,110 --> 00:07:59,120

and coverage that's required in order

186

00:08:03,110 --> 00:08:01,120

for us to improve our understanding of

187

00:08:04,950 --> 00:08:03,120

the carbon cycle and the global climate

188

00:08:07,029 --> 00:08:04,960

change processes

189

00:08:09,110 --> 00:08:07,039

now we've taken full advantage of all of

190

00:08:11,510 --> 00:08:09,120

the existing designs and documentation

191

00:08:13,830 --> 00:08:11,520

from the original oco mission

192

00:08:16,790 --> 00:08:13,840

sometimes we refer to oco 2 as a carbon

193

00:08:18,950 --> 00:08:16,800

copy of the original oco mission

194

00:08:20,550 --> 00:08:18,960

well it's not quite an identical twin

195

00:08:22,950 --> 00:08:20,560

but i am happy to report as the project

196

00:08:24,790 --> 00:08:22,960

manager as team has done a great job we

197

00:08:27,430 --> 00:08:24,800

fully expect to meet the technical

198

00:08:30,390 --> 00:08:27,440

schedule and cost commitments

199

00:08:31,189 --> 00:08:30,400

now may please roll the first clip

200

00:08:33,029 --> 00:08:31,199

so

201  
00:08:35,350 --> 00:08:33,039  
in the eight months since

202  
00:08:38,070 --> 00:08:35,360  
august of 2013

203  
00:08:40,149 --> 00:08:38,080  
to april of this year the observatory

204  
00:08:42,870 --> 00:08:40,159  
which consists of a standard spacecraft

205  
00:08:45,190 --> 00:08:42,880  
bus and a single instrument went through

206  
00:08:46,790 --> 00:08:45,200  
a comprehensive and successful ground

207  
00:08:50,790 --> 00:08:46,800  
test program

208  
00:08:52,710 --> 00:08:50,800  
simulation of the environments that the

209  
00:08:54,630 --> 00:08:52,720  
observatory is going to see

210  
00:08:57,110 --> 00:08:54,640  
during the launch and actually during

211  
00:08:58,150 --> 00:08:57,120  
space operations so the dynamic

212  
00:09:01,030 --> 00:08:58,160  
environment

213  
00:09:02,630 --> 00:09:01,040

of launch vehicle as well as the cold

214

00:09:03,990 --> 00:09:02,640

and hot temperature extremes and the

215

00:09:05,990 --> 00:09:04,000

vacuum of space

216

00:09:08,389 --> 00:09:06,000

after the observatory was tested at the

217

00:09:10,389 --> 00:09:08,399

orbital facility in gilbert arizona it

218

00:09:11,990 --> 00:09:10,399

was transported overland to the

219

00:09:13,990 --> 00:09:12,000

vandenberg air force base on

220

00:09:15,590 --> 00:09:14,000

california's central coast

221

00:09:17,190 --> 00:09:15,600

and upon arrival at the payload

222

00:09:19,990 --> 00:09:17,200

processing facility

223

00:09:21,910 --> 00:09:20,000

the shipping container half was hoisted

224

00:09:24,070 --> 00:09:21,920

off of the observatory and the

225

00:09:26,389 --> 00:09:24,080

protective black plastic covering

226

00:09:29,269 --> 00:09:26,399

covering the observatory was removed

227

00:09:31,350 --> 00:09:29,279

and once that was completed the process

228

00:09:33,829 --> 00:09:31,360

team there at vanderberg was able to

229

00:09:34,550 --> 00:09:33,839

complete some additional activities

230

00:09:36,470 --> 00:09:34,560

so

231

00:09:37,990 --> 00:09:36,480

upon arrival at that payload processing

232

00:09:39,670 --> 00:09:38,000

facility we've done three important

233

00:09:41,590 --> 00:09:39,680

things number one

234

00:09:43,430 --> 00:09:41,600

we've gone ahead and reconditioned and

235

00:09:45,269 --> 00:09:43,440

recharged our battery

236

00:09:47,590 --> 00:09:45,279

number two we've gone ahead and

237

00:09:49,990 --> 00:09:47,600

performed what we call a series of post

238

00:09:52,150 --> 00:09:50,000

shipment tests we really want to make

239

00:09:53,269 --> 00:09:52,160

sure that the spacecraft meets our

240

00:09:55,750 --> 00:09:53,279

functional and performance

241

00:09:57,110 --> 00:09:55,760

specifications even after the overland

242

00:09:59,350 --> 00:09:57,120

transportation

243

00:10:01,910 --> 00:09:59,360

and finally we've added enough hydrazine

244

00:10:03,910 --> 00:10:01,920

fuel on the observatory to make sure

245

00:10:08,069 --> 00:10:03,920

that we can operate the mission well

246

00:10:09,030 --> 00:10:08,079

beyond the nominal two-year lifetime

247

00:10:11,829 --> 00:10:09,040

now

248

00:10:13,190 --> 00:10:11,839

combined operations meaning operations

249

00:10:15,829 --> 00:10:13,200

between the launch vehicle and the

250

00:10:17,750 --> 00:10:15,839

observatory commenced this last tuesdays

251  
00:10:19,829 --> 00:10:17,760  
june 10th

252  
00:10:21,190 --> 00:10:19,839  
and combined operations will continue

253  
00:10:23,990 --> 00:10:21,200  
through launch

254  
00:10:26,389 --> 00:10:24,000  
so we can roll the second clip

255  
00:10:28,550 --> 00:10:26,399  
so the united launch alliance delta ii

256  
00:10:29,990 --> 00:10:28,560  
rocket will launch the

257  
00:10:33,030 --> 00:10:30,000  
oco-2

258  
00:10:37,110 --> 00:10:33,040  
observatory into space on july 1st

259  
00:10:39,110 --> 00:10:37,120  
at 2 56 a.m pacific daylight time

260  
00:10:41,269 --> 00:10:39,120  
about five minutes into the flight the

261  
00:10:43,269 --> 00:10:41,279  
booster or the first stage will burn out

262  
00:10:45,430 --> 00:10:43,279  
and be jettisoned the launch vehicle's

263  
00:10:48,230 --> 00:10:45,440

second stage will ignite and shortly

264

00:10:50,710 --> 00:10:48,240

after the two protective halves of the

265

00:10:54,150 --> 00:10:50,720

payload fairing will separate exposing

266

00:10:56,949 --> 00:10:54,160

the observatory to the space environment

267

00:10:58,630 --> 00:10:56,959

now after a relatively long unpowered

268

00:11:00,150 --> 00:10:58,640

cruise phase

269

00:11:02,470 --> 00:11:00,160

this observatory will actually be

270

00:11:05,030 --> 00:11:02,480

separated from the launch vehicle second

271

00:11:07,910 --> 00:11:05,040

stage we hope to be able to capture this

272

00:11:09,829 --> 00:11:07,920

separation event through a camera that's

273

00:11:11,030 --> 00:11:09,839

mounted on the launch vehicle second

274

00:11:13,110 --> 00:11:11,040

stage

275

00:11:14,710 --> 00:11:13,120

the separation work will occur in broad

276

00:11:16,150 --> 00:11:14,720

daylight

277

00:11:18,069 --> 00:11:16,160

now about three minutes after the

278

00:11:20,470 --> 00:11:18,079

separation there'll be an onboard

279

00:11:22,230 --> 00:11:20,480

command sequence in the observatory that

280

00:11:23,990 --> 00:11:22,240

will begin executing

281

00:11:25,190 --> 00:11:24,000

so three primary things will happen

282

00:11:27,110 --> 00:11:25,200

number one we'll establish

283

00:11:29,829 --> 00:11:27,120

communications with the ground

284

00:11:32,069 --> 00:11:29,839

number two this observatory will begin

285

00:11:34,630 --> 00:11:32,079

stabilizing itself and finally number

286

00:11:36,949 --> 00:11:34,640

three the solar rays will deploy

287

00:11:38,630 --> 00:11:36,959

and we expect the observatory to be in

288

00:11:40,150 --> 00:11:38,640

what we call a power positive state

289

00:11:42,710 --> 00:11:40,160

about two and a half minutes after

290

00:11:43,750 --> 00:11:42,720

launch or two hours and 30 minutes after

291

00:11:45,350 --> 00:11:43,760

launch

292

00:11:47,030 --> 00:11:45,360

and what does that mean that means that

293

00:11:49,590 --> 00:11:47,040

the sole arrays are going to provide

294

00:11:51,990 --> 00:11:49,600

weld and enough power to go ahead and

295

00:11:54,790 --> 00:11:52,000

provide the resources that are required

296

00:11:57,030 --> 00:11:54,800

on the observatory

297

00:11:59,430 --> 00:11:57,040

so after the spacecraft has been

298

00:12:02,389 --> 00:11:59,440

stabilized we will basically go through

299

00:12:04,389 --> 00:12:02,399

what we call a spacecraft spacecraft

300

00:12:05,990 --> 00:12:04,399

checkout phase that'll take on the order

301  
00:12:08,310 --> 00:12:06,000  
about a week or two

302  
00:12:10,710 --> 00:12:08,320  
and what does that mean we will go ahead

303  
00:12:12,550 --> 00:12:10,720  
and configure spacecraft components for

304  
00:12:15,110 --> 00:12:12,560  
in-flight operations

305  
00:12:16,790 --> 00:12:15,120  
for example turning on the gps or the

306  
00:12:18,069 --> 00:12:16,800  
global positioning satellite system

307  
00:12:19,829 --> 00:12:18,079  
receiver

308  
00:12:22,230 --> 00:12:19,839  
and upon completing that spacecraft

309  
00:12:24,470 --> 00:12:22,240  
checkout period we'll go ahead and start

310  
00:12:25,829 --> 00:12:24,480  
what we call the ascent phase or

311  
00:12:27,829 --> 00:12:25,839  
maneuver phase

312  
00:12:29,990 --> 00:12:27,839  
so if i can get the next graphic on the

313  
00:12:32,230 --> 00:12:30,000

slide please

314

00:12:34,470 --> 00:12:32,240

so we'll can we'll perform a series of

315

00:12:37,430 --> 00:12:34,480

what's called propulsive maneuvers to

316

00:12:41,190 --> 00:12:37,440

raise the altitude of the observatory to

317

00:12:43,350 --> 00:12:41,200

the 705 kilometer orbiting altitude

318

00:12:45,110 --> 00:12:43,360

or operational altitude and the

319

00:12:46,949 --> 00:12:45,120

spacecraft will take its place as the

320

00:12:49,910 --> 00:12:46,959

lead satellite and what we call the

321

00:12:51,670 --> 00:12:49,920

afternoon or the a-train constellation

322

00:12:53,509 --> 00:12:51,680

now the constellation is a group of

323

00:12:55,430 --> 00:12:53,519

satellites that will be flying in

324

00:12:56,949 --> 00:12:55,440

formation with one another

325

00:12:59,110 --> 00:12:56,959

and they fly in formation because we

326

00:13:02,550 --> 00:12:59,120

want to get a comprehensive and

327

00:13:04,710 --> 00:13:02,560

complementary set of science data

328

00:13:06,629 --> 00:13:04,720

now once in the a train operational

329

00:13:08,310 --> 00:13:06,639

altitude we will check out the

330

00:13:10,310 --> 00:13:08,320

instrument and that tool will take about

331

00:13:12,069 --> 00:13:10,320

a week or two to complete we really want

332

00:13:14,550 --> 00:13:12,079

to make sure that the instrument again

333

00:13:16,310 --> 00:13:14,560

performs and functions the way it did on

334

00:13:18,310 --> 00:13:16,320

the ground

335

00:13:20,150 --> 00:13:18,320

what so once that's completed we'll go

336

00:13:21,990 --> 00:13:20,160

ahead and conduct normal operations

337

00:13:23,910 --> 00:13:22,000

which will consist of basically

338

00:13:25,990 --> 00:13:23,920

transitioning between what we call nader

339

00:13:27,910 --> 00:13:26,000

mode where the instrument is pointed

340

00:13:29,990 --> 00:13:27,920

straight down towards the earth

341

00:13:31,990 --> 00:13:30,000

and what we call glint mode so glint

342

00:13:34,710 --> 00:13:32,000

mode is where the instrument is pointed

343

00:13:36,230 --> 00:13:34,720

to the sun's glint spot on the globe we

344

00:13:39,030 --> 00:13:36,240

want to make sure that we get acceptable

345

00:13:41,910 --> 00:13:39,040

measurements from the dark oceans

346

00:13:43,509 --> 00:13:41,920

in addition to that each day we'll be

347

00:13:45,829 --> 00:13:43,519

looking at a what we call a ground

348

00:13:48,150 --> 00:13:45,839

validation target maybe like the one at

349

00:13:49,509 --> 00:13:48,160

lamont oklahoma or maybe park falls

350

00:13:51,590 --> 00:13:49,519

wisconsin

351  
00:13:53,590 --> 00:13:51,600  
we get that data because we'd like to be

352  
00:13:55,590 --> 00:13:53,600  
able to go ahead and make comparisons

353  
00:13:59,110 --> 00:13:55,600  
with the space based measurements and

354  
00:14:01,189 --> 00:13:59,120  
make sure that they meet requirements

355  
00:14:02,790 --> 00:14:01,199  
now i'm an engineer

356  
00:14:03,750 --> 00:14:02,800  
and an engineer is trained to solve

357  
00:14:05,590 --> 00:14:03,760  
problems

358  
00:14:07,670 --> 00:14:05,600  
with the complete loss of the original

359  
00:14:09,110 --> 00:14:07,680  
oco mission

360  
00:14:11,030 --> 00:14:09,120  
it was heartbreak

361  
00:14:14,069 --> 00:14:11,040  
the entire mission was lost we didn't

362  
00:14:16,069 --> 00:14:14,079  
even have one problem to solve

363  
00:14:18,069 --> 00:14:16,079

on behalf of the entire team that worked

364

00:14:20,230 --> 00:14:18,079

on the original oco mission we're

365

00:14:22,790 --> 00:14:20,240

excited about this opportunity this

366

00:14:25,829 --> 00:14:22,800

opportunity to finally be able to

367

00:14:27,590 --> 00:14:25,839

complete some unfinished business

368

00:14:29,590 --> 00:14:27,600

so without any further ado i'd like to

369

00:14:31,030 --> 00:14:29,600

introduce you to mike gunson mike is our

370

00:14:32,310 --> 00:14:31,040

project scientist

371

00:14:35,590 --> 00:14:32,320

and he'll explain to you why this

372

00:14:37,509 --> 00:14:35,600

mission is as urgent as it is important

373

00:14:39,110 --> 00:14:37,519

thank you ralph yes i'm going to talk

374

00:14:41,910 --> 00:14:39,120

briefly about some of the science

375

00:14:43,990 --> 00:14:41,920

motivations for this mission and why

376

00:14:46,790 --> 00:14:44,000

atmospheric observations from space of

377

00:14:49,350 --> 00:14:46,800

carbon dioxide provide new insight into

378

00:14:51,670 --> 00:14:49,360

the underlying carbon cycle processes

379

00:14:54,710 --> 00:14:51,680

which we'd like to understand better

380

00:14:57,189 --> 00:14:54,720

today much of what we know comes from a

381

00:14:58,790 --> 00:14:57,199

few extremely important ground-based

382

00:15:00,550 --> 00:14:58,800

observations

383

00:15:02,629 --> 00:15:00,560

one of which is

384

00:15:05,750 --> 00:15:02,639

quite famously the keeling curve a

385

00:15:08,629 --> 00:15:05,760

series of measurements started in 1957

386

00:15:11,590 --> 00:15:08,639

by charles keeling from mauna loa and to

387

00:15:14,550 --> 00:15:11,600

date this this kind of measurement made

388

00:15:16,870 --> 00:15:14,560

in a number of stations around the world

389

00:15:19,189 --> 00:15:16,880

has provided us the insight we have into

390

00:15:21,670 --> 00:15:19,199

what's happening in the carbon cycle

391

00:15:22,790 --> 00:15:21,680

what these if you run the animation what

392

00:15:24,550 --> 00:15:22,800

it shows

393

00:15:26,389 --> 00:15:24,560

is quite clearly that there's a steady

394

00:15:28,710 --> 00:15:26,399

increase in atmospheric carbon dioxide

395

00:15:30,790 --> 00:15:28,720

concentrations with time

396

00:15:32,949 --> 00:15:30,800

over this period of time human beings

397

00:15:35,829 --> 00:15:32,959

have released hundreds of billions of

398

00:15:37,350 --> 00:15:35,839

tons of carbon into the atmosphere so

399

00:15:39,509 --> 00:15:37,360

that even today

400

00:15:41,829 --> 00:15:39,519

with the modernization of the developing

401  
00:15:43,990 --> 00:15:41,839  
world we start to see that we're we're

402  
00:15:46,150 --> 00:15:44,000  
releasing something like 40 billion tons

403  
00:15:47,749 --> 00:15:46,160  
of carbon dioxide each each year and

404  
00:15:50,470 --> 00:15:47,759  
this is increasing

405  
00:15:52,629 --> 00:15:50,480  
but at the same time as betsy remarked

406  
00:15:55,749 --> 00:15:52,639  
we can see that this has this annual

407  
00:15:57,189 --> 00:15:55,759  
cycle of dropping every summer as the

408  
00:15:59,189 --> 00:15:57,199  
northern hem in this case is the

409  
00:16:00,710 --> 00:15:59,199  
northern hemisphere as the forests and

410  
00:16:03,269 --> 00:16:00,720  
plants start to grow and this is the

411  
00:16:05,509 --> 00:16:03,279  
earth breathing and that's why we've

412  
00:16:06,629 --> 00:16:05,519  
used that to describe some of what we

413  
00:16:08,790 --> 00:16:06,639

see here

414

00:16:10,790 --> 00:16:08,800

but it's not just the

415

00:16:13,430 --> 00:16:10,800

planet planets

416

00:16:15,509 --> 00:16:13,440

plants and forests the oceans play an

417

00:16:17,269 --> 00:16:15,519

equal role as well in absorbing some of

418

00:16:19,430 --> 00:16:17,279

this carbon dioxide

419

00:16:21,670 --> 00:16:19,440

and every year what's quite remarkable

420

00:16:23,749 --> 00:16:21,680

is that over time half of what we've

421

00:16:25,990 --> 00:16:23,759

released has been absorbed by either

422

00:16:27,990 --> 00:16:26,000

plants or the ocean but it's very

423

00:16:29,749 --> 00:16:28,000

variable from year to year

424

00:16:31,829 --> 00:16:29,759

understanding what understanding what

425

00:16:34,470 --> 00:16:31,839

controls that variability is really

426

00:16:36,230 --> 00:16:34,480

crucial if we can do that today it might

427

00:16:39,509 --> 00:16:36,240

inform us about what might happen in the

428

00:16:40,949 --> 00:16:39,519

future will those process continue or

429

00:16:43,350 --> 00:16:40,959

will we see an abatement in their

430

00:16:45,509 --> 00:16:43,360

ability to absorb carbon dioxide and

431

00:16:47,509 --> 00:16:45,519

does that increase the amount that

432

00:16:50,069 --> 00:16:47,519

resides in the atmosphere obviously

433

00:16:52,870 --> 00:16:50,079

having climate change impacts enforcing

434

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

perhaps more more change

435

00:16:56,870 --> 00:16:55,279

so to do this what we'd like to do is

436

00:16:59,430 --> 00:16:56,880

extend the measurements that have been

437

00:17:01,430 --> 00:16:59,440

made so carefully at the surface at

438

00:17:02,550 --> 00:17:01,440

places like mauna loa and do this

439

00:17:05,750 --> 00:17:02,560

globally

440

00:17:09,270 --> 00:17:05,760

so we've planned very carefully uh with

441

00:17:12,390 --> 00:17:09,280

oco 2 to make these very careful

442

00:17:14,309 --> 00:17:12,400

precise measurements a number of in a

443

00:17:16,630 --> 00:17:14,319

truly global sense to give us a better

444

00:17:19,510 --> 00:17:16,640

insight into the underlying regional

445

00:17:21,669 --> 00:17:19,520

behavior of the processes which control

446

00:17:23,669 --> 00:17:21,679

carbon exchange between the surface and

447

00:17:25,590 --> 00:17:23,679

the atmosphere

448

00:17:26,949 --> 00:17:25,600

in doing this we were very fortunate

449

00:17:28,470 --> 00:17:26,959

because this is

450

00:17:30,070 --> 00:17:28,480

to say at least in my experience a

451

00:17:31,510 --> 00:17:30,080

tricky measurement

452

00:17:33,029 --> 00:17:31,520

we are very fortunate to have the

453

00:17:35,110 --> 00:17:33,039

collaboration with our colleagues in

454

00:17:37,190 --> 00:17:35,120

japan and the gosat team

455

00:17:39,990 --> 00:17:37,200

they provided us with a data stream

456

00:17:42,390 --> 00:17:40,000

which was a great example of what we

457

00:17:44,870 --> 00:17:42,400

think we will see and hope to see with

458

00:17:46,710 --> 00:17:44,880

oco2 and we've developed both the

459

00:17:48,630 --> 00:17:46,720

processes for

460

00:17:50,630 --> 00:17:48,640

processing that data but the validation

461

00:17:53,190 --> 00:17:50,640

techniques we will need

462

00:17:55,270 --> 00:17:53,200

but in doing so one thing that certainly

463

00:17:56,630 --> 00:17:55,280

was a surprise to me was that a couple

464

00:17:58,470 --> 00:17:56,640

of my colleagues

465

00:18:00,630 --> 00:17:58,480

also made one what i think is a

466

00:18:02,789 --> 00:18:00,640

fantastic discovery it's been known for

467

00:18:05,270 --> 00:18:02,799

some time that when plants absorb

468

00:18:07,110 --> 00:18:05,280

sunlight and undergo photosynthesis a

469

00:18:09,270 --> 00:18:07,120

tiny amount of that energy

470

00:18:10,630 --> 00:18:09,280

is released as a fluorescence photon

471

00:18:13,590 --> 00:18:10,640

back to space

472

00:18:15,990 --> 00:18:13,600

so we believe we'll have the opportunity

473

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

to provide some new insight into what's

474

00:18:19,750 --> 00:18:18,160

happening at the surface in plants by

475

00:18:21,190 --> 00:18:19,760

looking at what we call solar induced

476  
00:18:23,590 --> 00:18:21,200  
fluorescence

477  
00:18:25,990 --> 00:18:23,600  
in this still

478  
00:18:28,470 --> 00:18:26,000  
one of my colleagues went as far as to

479  
00:18:31,510 --> 00:18:28,480  
look at what we might expect to see with

480  
00:18:33,270 --> 00:18:31,520  
oco2 over a month's period and as you

481  
00:18:35,510 --> 00:18:33,280  
can see what

482  
00:18:38,070 --> 00:18:35,520  
what is shown or highlighted in the

483  
00:18:39,990 --> 00:18:38,080  
brighter colors the reds and oranges are

484  
00:18:42,950 --> 00:18:40,000  
the great forests of the world like the

485  
00:18:44,390 --> 00:18:42,960  
in the amazon the congo basin and in

486  
00:18:46,789 --> 00:18:44,400  
southeast

487  
00:18:48,630 --> 00:18:46,799  
asia and indonesia but you can also see

488  
00:18:49,830 --> 00:18:48,640

other regions as well which are probably

489

00:18:51,590 --> 00:18:49,840

important

490

00:18:53,190 --> 00:18:51,600

which in the eastern united states

491

00:18:55,510 --> 00:18:53,200

there's an awful lot of

492

00:18:58,789 --> 00:18:55,520

forest and agriculture and you can also

493

00:18:59,990 --> 00:18:58,799

see in in eurasia the broad expanse of

494

00:19:02,310 --> 00:19:00,000

forests

495

00:19:03,430 --> 00:19:02,320

that are so critical to the carbon cycle

496

00:19:05,830 --> 00:19:03,440

there too

497

00:19:07,270 --> 00:19:05,840

so with these we hope to provide not

498

00:19:09,590 --> 00:19:07,280

only

499

00:19:12,150 --> 00:19:09,600

very precise detailed measurements of

500

00:19:14,390 --> 00:19:12,160

carbon dioxide but also potentially a

501  
00:19:16,390 --> 00:19:14,400  
new measurement which could inform

502  
00:19:18,070 --> 00:19:16,400  
carbon cycle science

503  
00:19:20,310 --> 00:19:18,080  
and with this

504  
00:19:22,549 --> 00:19:20,320  
i'm just excited to get my hands on some

505  
00:19:23,750 --> 00:19:22,559  
new data in the next couple of months

506  
00:19:25,430 --> 00:19:23,760  
it's what we've been waiting for for

507  
00:19:27,029 --> 00:19:25,440  
some time and with that i'd like to

508  
00:19:29,669 --> 00:19:27,039  
introduce emory aldring the deputy

509  
00:19:31,110 --> 00:19:29,679  
project scientist thanks mike so mike

510  
00:19:33,430 --> 00:19:31,120  
talked a little bit about the big

511  
00:19:35,590 --> 00:19:33,440  
questions in the carbon cycle science

512  
00:19:37,510 --> 00:19:35,600  
and the measurements oco-2 will make but

513  
00:19:39,669 --> 00:19:37,520

how well does oco-2 need to measure

514

00:19:41,029 --> 00:19:39,679

carbon dioxide to answer that question

515

00:19:43,190 --> 00:19:41,039

and how are we going to do it with our

516

00:19:45,029 --> 00:19:43,200

instrument so the short answer to my

517

00:19:47,190 --> 00:19:45,039

first question is one one part per

518

00:19:48,710 --> 00:19:47,200

million is our goal for the sensitivity

519

00:19:50,789 --> 00:19:48,720

of this measurement and to give you an

520

00:19:52,630 --> 00:19:50,799

idea of how much that is we made a

521

00:19:54,950 --> 00:19:52,640

little jar of black beans that

522

00:19:56,390 --> 00:19:54,960

represents the concentration of co2 in

523

00:19:58,390 --> 00:19:56,400

the atmosphere which if you saw on

524

00:20:00,789 --> 00:19:58,400

mike's graph is something on the order

525

00:20:03,270 --> 00:20:00,799

of 400 parts per million so if this was

526

00:20:04,630 --> 00:20:03,280

400 parts per million carbon dioxide

527

00:20:06,789 --> 00:20:04,640

molecules and i want to know when it

528

00:20:08,549 --> 00:20:06,799

changes by one i've got to be able to

529

00:20:10,310 --> 00:20:08,559

tell when i add that many beans to the

530

00:20:12,149 --> 00:20:10,320

column so it's a really sensitive

531

00:20:14,070 --> 00:20:12,159

measurement that we're aiming at and

532

00:20:15,830 --> 00:20:14,080

mike also mentioned the fluorescence the

533

00:20:19,510 --> 00:20:15,840

fluorescence change to the radiance is

534

00:20:21,750 --> 00:20:19,520

maybe one or two beans that change so we

535

00:20:23,750 --> 00:20:21,760

have a real challenge and an instrument

536

00:20:26,390 --> 00:20:23,760

that we think is up to it to make these

537

00:20:28,710 --> 00:20:26,400

precise measurements of carbon dioxide

538

00:20:30,390 --> 00:20:28,720

another way to help you see why we need

539

00:20:32,630 --> 00:20:30,400

this precision

540

00:20:35,510 --> 00:20:32,640

is this movie of a model field of carbon

541

00:20:37,350 --> 00:20:35,520

dioxide so we're showing you a movie

542

00:20:39,669 --> 00:20:37,360

that was generated by our colleague

543

00:20:41,830 --> 00:20:39,679

leslie ott over at goddard space flight

544

00:20:43,830 --> 00:20:41,840

center of the total column of carbon

545

00:20:46,390 --> 00:20:43,840

dioxide the amount between the surface

546

00:20:48,710 --> 00:20:46,400

and the ground which is what oco-2 has

547

00:20:50,549 --> 00:20:48,720

sensitivity to and you'll see the

548

00:20:53,430 --> 00:20:50,559

lighter blues or the deep blues are

549

00:20:56,870 --> 00:20:53,440

about 370 parts per million lack of

550

00:20:58,310 --> 00:20:56,880

colors about 380 and 390 is shown in the

551  
00:20:59,909 --> 00:20:58,320  
deep reds

552  
00:21:01,350 --> 00:20:59,919  
one thing you'll notice is if you just

553  
00:21:03,430 --> 00:21:01,360  
look from the northern reaches of the

554  
00:21:05,430 --> 00:21:03,440  
globe to the southern there's just some

555  
00:21:07,590 --> 00:21:05,440  
small changes from a moderate blue to

556  
00:21:09,430 --> 00:21:07,600  
maybe a moderate red something like 10

557  
00:21:10,710 --> 00:21:09,440  
parts per million change from the north

558  
00:21:12,390 --> 00:21:10,720  
to the south

559  
00:21:14,310 --> 00:21:12,400  
but if i was trying to understand the

560  
00:21:16,470 --> 00:21:14,320  
role of the forest in north america and

561  
00:21:18,310 --> 00:21:16,480  
eurasia you can see that the changes

562  
00:21:20,470 --> 00:21:18,320  
from those two regions are smaller on

563  
00:21:22,710 --> 00:21:20,480

the order of one two maybe three parts

564

00:21:24,470 --> 00:21:22,720

per million so we really have to get at

565

00:21:26,149 --> 00:21:24,480

these details and these precise

566

00:21:28,310 --> 00:21:26,159

measurements of carbon dioxide to

567

00:21:30,149 --> 00:21:28,320

understand the transfer

568

00:21:31,909 --> 00:21:30,159

the other features you see in this map

569

00:21:33,430 --> 00:21:31,919

are things like the low concentrations

570

00:21:35,430 --> 00:21:33,440

in the northern hemisphere because the

571

00:21:37,669 --> 00:21:35,440

active plants and trees are drawing in

572

00:21:39,669 --> 00:21:37,679

the carbon dioxide and there's some

573

00:21:42,549 --> 00:21:39,679

areas that actually have fires and

574

00:21:44,230 --> 00:21:42,559

biomass burning going on that show up as

575

00:21:46,630 --> 00:21:44,240

red because of the sources of carbon

576  
00:21:48,230 --> 00:21:46,640  
dioxide so we'll learn more about these

577  
00:21:49,669 --> 00:21:48,240  
sorts of features with our measurements

578  
00:21:51,510 --> 00:21:49,679  
from oco2

579  
00:21:53,750 --> 00:21:51,520  
so how are we going to do this well the

580  
00:21:55,909 --> 00:21:53,760  
main principle of our measurement is

581  
00:21:58,149 --> 00:21:55,919  
shown in this still where a measurement

582  
00:22:00,549 --> 00:21:58,159  
that relies on sunlight reflected off of

583  
00:22:03,029 --> 00:22:00,559  
earth's surface back into the instrument

584  
00:22:04,789 --> 00:22:03,039  
so we look at reflected sunlight

585  
00:22:06,630 --> 00:22:04,799  
and that light is changed a little bit

586  
00:22:08,070 --> 00:22:06,640  
by the molecules that we're looking

587  
00:22:10,149 --> 00:22:08,080  
through that absorb light and

588  
00:22:11,990 --> 00:22:10,159

specifically we'll focus on the

589

00:22:13,510 --> 00:22:12,000

absorption changes because of the carbon

590

00:22:15,830 --> 00:22:13,520

dioxide

591

00:22:17,510 --> 00:22:15,840

another feature of this measurement is

592

00:22:19,669 --> 00:22:17,520

that we want to look at just a small

593

00:22:21,510 --> 00:22:19,679

area at a time we actually only measure

594

00:22:22,710 --> 00:22:21,520

over one square mile with each

595

00:22:23,990 --> 00:22:22,720

measurement

596

00:22:25,909 --> 00:22:24,000

because if you're trying to make a

597

00:22:28,310 --> 00:22:25,919

measurement from a satellite clouds can

598

00:22:29,909 --> 00:22:28,320

get in the way and the smaller the area

599

00:22:31,830 --> 00:22:29,919

you measure the more likely you are to

600

00:22:32,710 --> 00:22:31,840

see around those clouds or to be able to

601  
00:22:35,110 --> 00:22:32,720  
look

602  
00:22:36,870 --> 00:22:35,120  
in areas that are cloud free so that's

603  
00:22:37,909 --> 00:22:36,880  
the general principle of how we make the

604  
00:22:39,750 --> 00:22:37,919  
measurement

605  
00:22:41,909 --> 00:22:39,760  
and in my last graphic i'm just showing

606  
00:22:44,789 --> 00:22:41,919  
you a little more detail of the how it

607  
00:22:46,310 --> 00:22:44,799  
operates so the telescope here the part

608  
00:22:48,149 --> 00:22:46,320  
that looks like an eye is where the

609  
00:22:50,470 --> 00:22:48,159  
light goes into our instrument and then

610  
00:22:52,310 --> 00:22:50,480  
we've just traced the light through as

611  
00:22:54,710 --> 00:22:52,320  
it goes from the telescope through some

612  
00:22:57,190 --> 00:22:54,720  
lenses and then hit hits what we call a

613  
00:22:58,549 --> 00:22:57,200

grading now the grading has an important

614

00:23:00,710 --> 00:22:58,559

function because it's the part of the

615

00:23:02,710 --> 00:23:00,720

instrument that splits the light into a

616

00:23:04,470 --> 00:23:02,720

thousand different colors and you can

617

00:23:06,149 --> 00:23:04,480

look at the back of a cd i don't know if

618

00:23:08,549 --> 00:23:06,159

i can shine it into your eyes but it's

619

00:23:10,710 --> 00:23:08,559

the same concept that these grooves on

620

00:23:12,149 --> 00:23:10,720

the back of the cd disperse the light

621

00:23:13,669 --> 00:23:12,159

into many colors and that's what the

622

00:23:15,430 --> 00:23:13,679

grading does for us

623

00:23:17,110 --> 00:23:15,440

so once the light hits the grading and

624

00:23:19,029 --> 00:23:17,120

is dispersed into a thousand colors it

625

00:23:21,190 --> 00:23:19,039

goes to the detector where we actually

626

00:23:22,710 --> 00:23:21,200

collect the measurement

627

00:23:24,470 --> 00:23:22,720

and the lower figures just sort of

628

00:23:27,110 --> 00:23:24,480

showing you how this dispersed light

629

00:23:28,870 --> 00:23:27,120

might look uh over a thousand colors we

630

00:23:30,549 --> 00:23:28,880

actually look at this type of

631

00:23:33,190 --> 00:23:30,559

measurement in three different regions

632

00:23:35,110 --> 00:23:33,200

of light with the oco-2 instrument one

633

00:23:36,870 --> 00:23:35,120

of those is focused on the area where

634

00:23:39,430 --> 00:23:36,880

clouds absorb so we can see if it's

635

00:23:41,590 --> 00:23:39,440

cloud free or not and the other two are

636

00:23:43,669 --> 00:23:41,600

focused on regions where carbon dioxide

637

00:23:44,630 --> 00:23:43,679

specifically absorbs

638

00:23:45,830 --> 00:23:44,640

so

639

00:23:47,269 --> 00:23:45,840

that's a little bit about how the

640

00:23:48,549 --> 00:23:47,279

instrument works and why we're thinking

641

00:23:49,750 --> 00:23:48,559

we can achieve these precise

642

00:23:51,430 --> 00:23:49,760

measurements

643

00:23:53,269 --> 00:23:51,440

so in summary i think it's fair to say

644

00:23:55,990 --> 00:23:53,279

on behalf of the team we're all very

645

00:23:59,190 --> 00:23:56,000

excited about our upcoming launch 2 56

646

00:24:01,830 --> 00:23:59,200

a.m july 1st vanderberg air force base

647

00:24:03,669 --> 00:24:01,840

out in california and we're excited

648

00:24:05,830 --> 00:24:03,679

about the science we'll do the oco2

649

00:24:08,390 --> 00:24:05,840

mission will collect as ralph said the

650

00:24:10,149 --> 00:24:08,400

measurements with the accuracy coverage

651  
00:24:12,230 --> 00:24:10,159  
and resolution that we need to answer

652  
00:24:15,110 --> 00:24:12,240  
these important questions about where

653  
00:24:17,510 --> 00:24:15,120  
carbon dioxide is being absorbed and

654  
00:24:20,310 --> 00:24:17,520  
released in the natural global cycles

655  
00:24:22,310 --> 00:24:20,320  
across the globe thank you

656  
00:24:24,070 --> 00:24:22,320  
okay thank you to our presenters and now

657  
00:24:26,310 --> 00:24:24,080  
we'll take some questions from the media

658  
00:24:28,230 --> 00:24:26,320  
and those watching online again if

659  
00:24:30,950 --> 00:24:28,240  
you're watching online and would like to

660  
00:24:34,070 --> 00:24:30,960  
post a question go to twitter and use

661  
00:24:37,669 --> 00:24:34,080  
the hashtag asknasa

662  
00:24:39,590 --> 00:24:37,679  
first we'll take questions here from

663  
00:24:41,750 --> 00:24:39,600

from the press india auditorium please

664

00:24:44,310 --> 00:24:41,760

identify yourself and go ahead hi i'm

665

00:24:46,230 --> 00:24:44,320

dan vergano i'm with national geographic

666

00:24:48,950 --> 00:24:46,240

i was wondering about the the resolution

667

00:24:51,590 --> 00:24:48,960

you mentioned in uh it's one square mile

668

00:24:53,830 --> 00:24:51,600

that's the grid is that uh a good enough

669

00:24:56,390 --> 00:24:53,840

resolution that we'll be able to see uh

670

00:25:00,390 --> 00:24:56,400

the big stationary emitters that are uh

671

00:25:02,390 --> 00:25:00,400

of such concern uh regulations now

672

00:25:04,070 --> 00:25:02,400

so the question is will that three

673

00:25:05,430 --> 00:25:04,080

square kilometers be enough to resolve

674

00:25:07,830 --> 00:25:05,440

the big emitters

675

00:25:10,310 --> 00:25:07,840

uh we don't i've i've done back at the

676

00:25:11,990 --> 00:25:10,320

envelope calculations that show that

677

00:25:13,909 --> 00:25:12,000

uh some of the big emitters will

678

00:25:15,830 --> 00:25:13,919

certainly stand out if you get close to

679

00:25:20,310 --> 00:25:15,840

the

680

00:25:22,950 --> 00:25:20,320

work done by

681

00:25:24,310 --> 00:25:22,960

colleagues with the ghost out data

682

00:25:26,230 --> 00:25:24,320

showed that

683

00:25:28,470 --> 00:25:26,240

large urban areas like los angeles and

684

00:25:30,549 --> 00:25:28,480

mumbai believe it was in the examples

685

00:25:32,710 --> 00:25:30,559

they looked at you can certainly see the

686

00:25:36,070 --> 00:25:32,720

build-up of carbon dioxide due to human

687

00:25:37,830 --> 00:25:36,080

activity in the cities compared to

688

00:25:38,950 --> 00:25:37,840

nearby regions where there's no human

689

00:25:41,029 --> 00:25:38,960

activity

690

00:25:45,510 --> 00:25:41,039

so yes in principle

691

00:25:47,269 --> 00:25:45,520

we fully expect to be able to see

692

00:25:51,029 --> 00:25:47,279

points where there are large emissions

693

00:25:54,710 --> 00:25:53,669

but the this is really not a mapping

694

00:25:57,830 --> 00:25:54,720

mission

695

00:26:00,470 --> 00:25:57,840

so it depends where our orbital track

696

00:26:02,630 --> 00:26:00,480

crosses this is much more of a sampling

697

00:26:06,149 --> 00:26:02,640

mission than it is uh a true global

698

00:26:11,110 --> 00:26:08,549

okay another question here

699

00:26:14,230 --> 00:26:11,120

oh yeah yeah uh eric hand with science i

700

00:26:16,870 --> 00:26:14,240

guess my question is for betsy um osio

701  
00:26:19,110 --> 00:26:16,880  
three the flight spare

702  
00:26:21,430 --> 00:26:19,120  
uh there were plans to take it up to the

703  
00:26:24,470 --> 00:26:21,440  
space station and have it complement

704  
00:26:26,470 --> 00:26:24,480  
oco two in observations but it was

705  
00:26:28,630 --> 00:26:26,480  
left out of the president's budget

706  
00:26:29,590 --> 00:26:28,640  
um i know budgets are always uncertain

707  
00:26:30,950 --> 00:26:29,600  
but

708  
00:26:33,190 --> 00:26:30,960  
you know as far as i know right now it's

709  
00:26:35,190 --> 00:26:33,200  
essentially sitting in a box but what

710  
00:26:37,669 --> 00:26:35,200  
are the plans to to

711  
00:26:38,870 --> 00:26:37,679  
going forward with with oc03

712  
00:26:40,149 --> 00:26:38,880  
well indeed

713  
00:26:42,390 --> 00:26:40,159

our current

714

00:26:44,870 --> 00:26:42,400

activities with oco-3 are being put on

715

00:26:47,269 --> 00:26:44,880

hold and and we're using the rest of our

716

00:26:48,789 --> 00:26:47,279

fiscal 14 funds to get them into a

717

00:26:50,630 --> 00:26:48,799

stable state so that we can put them

718

00:26:52,870 --> 00:26:50,640

into storage

719

00:26:54,149 --> 00:26:52,880

but it is still an important activity

720

00:26:55,350 --> 00:26:54,159

and you know we've talked about the

721

00:26:56,549 --> 00:26:55,360

importance of this particular

722

00:26:59,350 --> 00:26:56,559

measurement

723

00:27:00,310 --> 00:26:59,360

right now the fiscal 15 budget has been

724

00:27:01,110 --> 00:27:00,320

you know

725

00:27:02,549 --> 00:27:01,120

we're

726

00:27:04,950 --> 00:27:02,559

looking at all of the priorities of the

727

00:27:06,310 --> 00:27:04,960

things that we have um clearly our

728

00:27:07,830 --> 00:27:06,320

operational missions and some of our

729

00:27:10,390 --> 00:27:07,840

development activities

730

00:27:13,269 --> 00:27:10,400

do have a higher priority um we do

731

00:27:14,630 --> 00:27:13,279

expect that at some point you know the

732

00:27:16,230 --> 00:27:14,640

we're getting good data from our

733

00:27:18,149 --> 00:27:16,240

atmospheric

734

00:27:20,389 --> 00:27:18,159

measurements oco2 is going to give us

735

00:27:23,590 --> 00:27:20,399

fabulous data so

736

00:27:25,510 --> 00:27:23,600

we hope to get back to oco3 but right

737

00:27:27,110 --> 00:27:25,520

now the budget doesn't allow for us to

738

00:27:28,710 --> 00:27:27,120

do that but we're putting it into a

739

00:27:31,669 --> 00:27:28,720

position where we could go back to it at

740

00:27:35,110 --> 00:27:33,750

okay we have a number of questions on

741

00:27:36,310 --> 00:27:35,120

social media

742

00:27:37,830 --> 00:27:36,320

jason

743

00:27:40,070 --> 00:27:37,840

indeed hi this question comes from

744

00:27:41,750 --> 00:27:40,080

twitter user colin what possible

745

00:27:43,510 --> 00:27:41,760

problems do you expect with this project

746

00:27:47,029 --> 00:27:43,520

that could potentially prevent accurate

747

00:27:49,909 --> 00:27:48,950

i'll take that one first shall we

748

00:27:51,110 --> 00:27:49,919

um

749

00:27:53,269 --> 00:27:51,120

it each

750

00:27:55,029 --> 00:27:53,279

if the question is what could

751  
00:27:56,950 --> 00:27:55,039  
impede us from getting those accurate

752  
00:27:59,510 --> 00:27:56,960  
numbers um

753  
00:28:01,430 --> 00:27:59,520  
we've taken a lot of care to make ensure

754  
00:28:04,070 --> 00:28:01,440  
that we understand how this whole system

755  
00:28:05,750 --> 00:28:04,080  
works so that we can reduce the the

756  
00:28:09,350 --> 00:28:05,760  
likelihood that anything will impede us

757  
00:28:11,750 --> 00:28:09,360  
get getting those accurate numbers that

758  
00:28:14,070 --> 00:28:11,760  
we need to actually

759  
00:28:17,029 --> 00:28:14,080  
inform carbon cycle science there's

760  
00:28:18,470 --> 00:28:17,039  
always the unexpected uh but you kind of

761  
00:28:19,669 --> 00:28:18,480  
have to roll with those when they when

762  
00:28:21,590 --> 00:28:19,679  
they occur

763  
00:28:23,350 --> 00:28:21,600

but uh we've planned this very very

764

00:28:25,029 --> 00:28:23,360  
carefully and i'm personally not

765

00:28:27,190 --> 00:28:25,039  
expecting uh

766

00:28:29,830 --> 00:28:27,200  
well you can't expect the unexpected but

767

00:28:32,789 --> 00:28:29,840  
there's nothing that we're we're plan we

768

00:28:34,230 --> 00:28:32,799  
foresee impeding our progress on this

769

00:28:35,669 --> 00:28:34,240  
what do you think ralph

770

00:28:37,669 --> 00:28:35,679  
yeah the only thing i would like to add

771

00:28:39,430 --> 00:28:37,679  
is that as i mentioned before we

772

00:28:41,830 --> 00:28:39,440  
subjected the observatory both the

773

00:28:43,909 --> 00:28:41,840  
spacecraft bus and the instrument to a

774

00:28:45,909 --> 00:28:43,919  
comprehensive ground test program the

775

00:28:47,750 --> 00:28:45,919  
instrument was fully calibrated we went

776

00:28:49,190 --> 00:28:47,760

through a lot of different activities

777

00:28:51,909 --> 00:28:49,200

before that instrument left the jet

778

00:28:54,310 --> 00:28:51,919

propulsion laboratory we feel confident

779

00:28:55,830 --> 00:28:54,320

that this is going to work

780

00:28:56,710 --> 00:28:55,840

we've done everything that we can on the

781

00:28:58,549 --> 00:28:56,720

ground

782

00:29:00,470 --> 00:28:58,559

wonderful this next question comes from

783

00:29:02,230 --> 00:29:00,480

twitter user jill grace will the

784

00:29:04,470 --> 00:29:02,240

instrument be able to differentiate

785

00:29:06,789 --> 00:29:04,480

between natural versus human generated

786

00:29:09,990 --> 00:29:06,799

carbon

787

00:29:13,909 --> 00:29:12,149

she's a middle school teacher in

788

00:29:15,510 --> 00:29:13,919

california i suspect

789

00:29:17,669 --> 00:29:15,520

um

790

00:29:19,430 --> 00:29:17,679

it's very difficult from the

791

00:29:21,269 --> 00:29:19,440

just measuring carbon dioxide along to

792

00:29:24,230 --> 00:29:21,279

distinguish between the two between

793

00:29:27,430 --> 00:29:24,240

anthropogenic and natural changes to

794

00:29:30,310 --> 00:29:27,440

carbon dioxide you have to resort to

795

00:29:32,070 --> 00:29:30,320

other means isotopic signatures are a

796

00:29:34,230 --> 00:29:32,080

very important method for distinguishing

797

00:29:35,669 --> 00:29:34,240

the contribution of anthropogenic

798

00:29:39,590 --> 00:29:35,679

sources

799

00:29:41,590 --> 00:29:39,600

but in the overall use of this data

800

00:29:43,909 --> 00:29:41,600

we do expect to be able to say something

801  
00:29:46,710 --> 00:29:43,919  
about the relative contribution of

802  
00:29:51,510 --> 00:29:46,720  
anthropogenic and natural contributions

803  
00:29:57,590 --> 00:29:53,669  
wonderful then

804  
00:30:00,870 --> 00:29:57,600  
question here from a grace bow

805  
00:30:02,950 --> 00:30:00,880  
uh will oco-2 be high enough to see the

806  
00:30:05,669 --> 00:30:02,960  
ozone layer

807  
00:30:08,710 --> 00:30:05,679  
okay so i'll take that question so the

808  
00:30:11,750 --> 00:30:08,720  
oco-2 is in fact well above the ozone

809  
00:30:13,510 --> 00:30:11,760  
layer we'll be flying at 705 kilometers

810  
00:30:15,029 --> 00:30:13,520  
but we've specifically chosen the

811  
00:30:17,350 --> 00:30:15,039  
wavelengths that we're going to use so

812  
00:30:19,510 --> 00:30:17,360  
that they are not sensitive to ozone so

813  
00:30:21,909 --> 00:30:19,520

there's really no absorption signals no

814

00:30:23,590 --> 00:30:21,919

fingerprint of ozone in the wavelengths

815

00:30:28,870 --> 00:30:23,600

we're going to use we did that on

816

00:30:30,870 --> 00:30:29,750

okay

817

00:30:32,789 --> 00:30:30,880

we have a

818

00:30:38,149 --> 00:30:32,799

question on the phone lines

819

00:30:43,830 --> 00:30:40,549

irene line is open needed a

820

00:30:46,070 --> 00:30:43,840

program cost spacecraft and the launcher

821

00:30:47,990 --> 00:30:46,080

and also if you could

822

00:30:51,110 --> 00:30:48,000

include

823

00:30:54,070 --> 00:30:51,120

what the original oco figures were

824

00:30:58,789 --> 00:30:55,269

to the first part of that was the

825

00:31:00,470 --> 00:30:58,799

question uh what were the original costs

826  
00:31:04,389 --> 00:31:00,480  
of oco and the

827  
00:31:06,149 --> 00:31:04,399  
current cost of oco2 okay i think

828  
00:31:09,029 --> 00:31:06,159  
i guess that one's mine

829  
00:31:11,190 --> 00:31:09,039  
um okay so the

830  
00:31:14,870 --> 00:31:11,200  
get my cheat sheet

831  
00:31:16,870 --> 00:31:14,880  
the original spacecraft was about 275

832  
00:31:18,590 --> 00:31:16,880  
million dollars

833  
00:31:21,430 --> 00:31:18,600  
this one was about

834  
00:31:23,509 --> 00:31:21,440  
465 million dollars so there is about a

835  
00:31:25,750 --> 00:31:23,519  
200 million delta

836  
00:31:27,830 --> 00:31:25,760  
um a lot of that delta is based on the

837  
00:31:29,430 --> 00:31:27,840  
fact that we did change launch vehicle

838  
00:31:31,509 --> 00:31:29,440

we were originally slated on a much

839

00:31:33,990 --> 00:31:31,519

smaller less expensive vehicle and we've

840

00:31:35,830 --> 00:31:34,000

now changed what launch vehicle we're

841

00:31:38,549 --> 00:31:35,840

riding on

842

00:31:41,990 --> 00:31:38,559

we also did have a slight delay

843

00:31:43,909 --> 00:31:42,000

in the development of oco2

844

00:31:46,789 --> 00:31:43,919

actually slide it was about a year just

845

00:31:48,950 --> 00:31:46,799

over a year's delay as we made the shift

846

00:31:50,870 --> 00:31:48,960

as we were doing the competition to

847

00:31:52,710 --> 00:31:50,880

understand what our new launch vehicle

848

00:31:54,789 --> 00:31:52,720

would look like

849

00:31:57,430 --> 00:31:54,799

and the team had to sort of stand down

850

00:31:58,789 --> 00:31:57,440

so there was a period of time when we

851  
00:32:02,070 --> 00:31:58,799  
you know we were trying to

852  
00:32:03,750 --> 00:32:02,080  
keep people working hard but

853  
00:32:05,110 --> 00:32:03,760  
there wasn't as much of the work

854  
00:32:06,549 --> 00:32:05,120  
available for them to do while we made

855  
00:32:08,310 --> 00:32:06,559  
that decision to move to the next

856  
00:32:10,470 --> 00:32:08,320  
vehicle

857  
00:32:11,509 --> 00:32:10,480  
we did make some re-engineering changes

858  
00:32:13,590 --> 00:32:11,519  
we

859  
00:32:15,830 --> 00:32:13,600  
parts obsolescence happens

860  
00:32:17,590 --> 00:32:15,840  
your computers move faster than

861  
00:32:20,230 --> 00:32:17,600  
changeover faster than

862  
00:32:24,149 --> 00:32:20,240  
anything these days um so we had to do a

863  
00:32:27,110 --> 00:32:24,159

lot of some replacement of parts as we

864

00:32:28,230 --> 00:32:27,120

were building up oco2 versus oco1 and so

865

00:32:30,630 --> 00:32:28,240

some of those parts became more

866

00:32:32,710 --> 00:32:30,640

expensive and of course there's the

867

00:32:34,070 --> 00:32:32,720

ubiquitous inflation that also hit us a

868

00:32:37,909 --> 00:32:34,080

little bit so

869

00:32:39,990 --> 00:32:37,919

put all that together it spout the delta

870

00:32:43,029 --> 00:32:40,000

okay we have another question on the

871

00:32:44,549 --> 00:32:43,039

phone lines jonathan amos from the bbc

872

00:32:46,149 --> 00:32:44,559

once again if you do have a question

873

00:32:47,350 --> 00:32:46,159

please press star one make sure you

874

00:32:49,190 --> 00:32:47,360

unmute your phone and record your name

875

00:32:51,430 --> 00:32:49,200

clearly when prompted

876  
00:32:54,070 --> 00:32:51,440  
and your line is now open what are the

877  
00:32:57,669 --> 00:32:54,080  
the key mysteries um

878  
00:32:59,110 --> 00:32:57,679  
that you want to go after uh with oco to

879  
00:33:01,190 --> 00:32:59,120  
close the gap

880  
00:33:03,269 --> 00:33:01,200  
on what we know about

881  
00:33:05,750 --> 00:33:03,279  
where the sources are and

882  
00:33:07,029 --> 00:33:05,760  
and precisely where the sinks are as

883  
00:33:08,389 --> 00:33:07,039  
well what are the what are the key

884  
00:33:10,389 --> 00:33:08,399  
missing ones

885  
00:33:11,990 --> 00:33:10,399  
so um i'll take this first and then add

886  
00:33:13,909 --> 00:33:12,000  
it back to ann marie

887  
00:33:16,389 --> 00:33:13,919  
uh over the past few years there's been

888  
00:33:17,269 --> 00:33:16,399

a number of uh research papers published

889

00:33:19,029 --> 00:33:17,279

which

890

00:33:20,549 --> 00:33:19,039

have talked about the role of

891

00:33:22,230 --> 00:33:20,559

rainforests

892

00:33:23,830 --> 00:33:22,240

uh and whether we've got the balance

893

00:33:25,990 --> 00:33:23,840

right there

894

00:33:28,470 --> 00:33:26,000

whether their response has been muted by

895

00:33:29,990 --> 00:33:28,480

the impacts of drought

896

00:33:32,430 --> 00:33:30,000

there is the

897

00:33:35,990 --> 00:33:32,440

some papers recently suggesting that

898

00:33:37,269 --> 00:33:36,000

semi-arid regions grasslands have play

899

00:33:39,909 --> 00:33:37,279

a bigger role

900

00:33:42,230 --> 00:33:39,919

um in the past there's been speculation

901  
00:33:43,269 --> 00:33:42,240  
that north america

902  
00:33:45,509 --> 00:33:43,279  
is

903  
00:33:47,509 --> 00:33:45,519  
one of the homes of the biggest sinks

904  
00:33:49,269 --> 00:33:47,519  
uh natural sinks at carbon dioxide a

905  
00:33:50,630 --> 00:33:49,279  
greening of

906  
00:33:53,110 --> 00:33:50,640  
of

907  
00:33:55,110 --> 00:33:53,120  
in north america a greening effect but

908  
00:33:56,549 --> 00:33:55,120  
these uh are just some of the examples

909  
00:33:57,509 --> 00:33:56,559  
of some of the

910  
00:33:59,669 --> 00:33:57,519  
um

911  
00:34:01,990 --> 00:33:59,679  
difficult questions that uh our

912  
00:34:04,470 --> 00:34:02,000  
hypotheses that are very difficult to

913  
00:34:07,110 --> 00:34:04,480

test without new data such as those from

914

00:34:09,349 --> 00:34:07,120

oco2 what do you think emery yeah and

915

00:34:12,149 --> 00:34:09,359

similarly the southern oceans have been

916

00:34:14,230 --> 00:34:12,159

uh understood to date to be a big uh

917

00:34:15,909 --> 00:34:14,240

region of exchange of carbon based on

918

00:34:17,589 --> 00:34:15,919

limited sets of measurements so if we

919

00:34:20,310 --> 00:34:17,599

can get these global measurements i

920

00:34:21,669 --> 00:34:20,320

think we can much more firmly

921

00:34:23,109 --> 00:34:21,679

realize if this is the correct

922

00:34:24,869 --> 00:34:23,119

hypothesis or if there's other

923

00:34:27,589 --> 00:34:24,879

explanations and again the other

924

00:34:28,869 --> 00:34:27,599

important aspect of oco2 is each year is

925

00:34:30,389 --> 00:34:28,879

a little bit different so we want to

926  
00:34:32,310 --> 00:34:30,399  
start to understand what drives those

927  
00:34:33,909 --> 00:34:32,320  
differences

928  
00:34:35,669 --> 00:34:33,919  
okay we have another question here in

929  
00:34:37,510 --> 00:34:35,679  
the auditorium

930  
00:34:40,149 --> 00:34:37,520  
hello i'm kate winkle from the scripps

931  
00:34:42,470 --> 00:34:40,159  
howard foundation wire and i know that

932  
00:34:44,149 --> 00:34:42,480  
this project is going to bring a lot of

933  
00:34:45,270 --> 00:34:44,159  
new data new information that scientists

934  
00:34:46,470 --> 00:34:45,280  
can use

935  
00:34:47,990 --> 00:34:46,480  
but i know that you all are also

936  
00:34:49,829 --> 00:34:48,000  
concerned about what business people and

937  
00:34:51,510 --> 00:34:49,839  
what politicians do with this new

938  
00:34:53,990 --> 00:34:51,520

information and new knowledge so what

939

00:34:58,230 --> 00:34:54,000

specifically do you hope they take from

940

00:35:03,670 --> 00:35:00,550

thank you emery

941

00:35:05,349 --> 00:35:03,680

so uh really the bigger questions here

942

00:35:07,670 --> 00:35:05,359

uh uh are fundamentally driven by

943

00:35:08,550 --> 00:35:07,680

science questions uh

944

00:35:13,190 --> 00:35:08,560

the

945

00:35:15,510 --> 00:35:13,200

about human activities

946

00:35:17,990 --> 00:35:15,520

uh is primarily driven by what we call

947

00:35:19,670 --> 00:35:18,000

accounting or inventory processes

948

00:35:23,030 --> 00:35:19,680

we can actually count how many barrels

949

00:35:24,550 --> 00:35:23,040

of oil tons of carb coal etc that we

950

00:35:26,310 --> 00:35:24,560

we consume

951  
00:35:28,310 --> 00:35:26,320  
it's really the fate of carbon dioxide

952  
00:35:30,950 --> 00:35:28,320  
once it's in the atmosphere that we're

953  
00:35:32,310 --> 00:35:30,960  
trying to really put our finger on and

954  
00:35:33,750 --> 00:35:32,320  
if we can understand what's happening

955  
00:35:36,310 --> 00:35:33,760  
today

956  
00:35:38,710 --> 00:35:36,320  
i think it's quite remarkable that

957  
00:35:40,390 --> 00:35:38,720  
over the past decades

958  
00:35:42,150 --> 00:35:40,400  
we've been we've seen that half the

959  
00:35:44,390 --> 00:35:42,160  
carbon dioxide we put in the atmosphere

960  
00:35:46,870 --> 00:35:44,400  
has been removed by natural processes

961  
00:35:48,870 --> 00:35:46,880  
but we still aren't quite sure what the

962  
00:35:50,710 --> 00:35:48,880  
details are of which of those

963  
00:35:51,589 --> 00:35:50,720

which are the key processes involved

964

00:35:53,829 --> 00:35:51,599

here

965

00:35:56,310 --> 00:35:53,839

and so trying to get to a point of

966

00:35:58,390 --> 00:35:56,320

understanding the details of those

967

00:36:00,710 --> 00:35:58,400

processes will give us some insight

968

00:36:03,349 --> 00:36:00,720

into about the future and what's likely

969

00:36:05,349 --> 00:36:03,359

to happen over the next decades

970

00:36:07,670 --> 00:36:05,359

even if we continue to

971

00:36:09,030 --> 00:36:07,680

consume more and more fossil fuels and

972

00:36:10,150 --> 00:36:09,040

more and more carbon dioxide into the

973

00:36:12,310 --> 00:36:10,160

atmosphere

974

00:36:13,910 --> 00:36:12,320

i think we would also be hoping that um

975

00:36:16,630 --> 00:36:13,920

policymakers might use some of this

976

00:36:18,470 --> 00:36:16,640

information to for example

977

00:36:19,910 --> 00:36:18,480

start to take a look at the impact of

978

00:36:22,470 --> 00:36:19,920

some of the

979

00:36:23,349 --> 00:36:22,480

emission reduction activities that go on

980

00:36:28,710 --> 00:36:23,359

or

981

00:36:30,069 --> 00:36:28,720

happening globally

982

00:36:31,349 --> 00:36:30,079

okay we have some more questions on

983

00:36:32,950 --> 00:36:31,359

social media

984

00:36:35,349 --> 00:36:32,960

wonderful this comes from twitter user

985

00:36:36,870 --> 00:36:35,359

naresh asking what is the life of this

986

00:36:43,750 --> 00:36:36,880

mission and how long will it take to

987

00:36:47,990 --> 00:36:46,230

uh this mission is uh set for uh two

988

00:36:49,750 --> 00:36:48,000

years nominal mission

989

00:36:51,589 --> 00:36:49,760

uh as i mentioned before we have more

990

00:36:53,510 --> 00:36:51,599

than enough fuel on board the

991

00:36:55,030 --> 00:36:53,520

observatory to last within next two

992

00:36:56,390 --> 00:36:55,040

years

993

00:36:58,310 --> 00:36:56,400

we're going to be doing what we call a

994

00:36:59,829 --> 00:36:58,320

16 day repeat cycle meaning that we're

995

00:37:01,750 --> 00:36:59,839

going to be looking at the same spot on

996

00:37:02,630 --> 00:37:01,760

the globe effectively every couple of

997

00:37:04,790 --> 00:37:02,640

weeks

998

00:37:06,950 --> 00:37:04,800

we'd like to be able to look at data

999

00:37:10,950 --> 00:37:06,960

look at the seasonal variations as well

1000

00:37:14,550 --> 00:37:12,870

wonderful this question comes from

1001  
00:37:16,870 --> 00:37:14,560  
twitter user robert

1002  
00:37:19,270 --> 00:37:16,880  
asking what do you hope to gain via

1003  
00:37:21,670 --> 00:37:19,280  
future collaboration with other co2

1004  
00:37:23,829 --> 00:37:21,680  
missions such as gosat2 and potentially

1005  
00:37:26,950 --> 00:37:23,839  
carbon sap

1006  
00:37:27,829 --> 00:37:26,960  
so let me take a shot at that one

1007  
00:37:30,710 --> 00:37:27,839  
so

1008  
00:37:33,349 --> 00:37:30,720  
the end use of our data in terms of the

1009  
00:37:35,750 --> 00:37:33,359  
science is by people who have models of

1010  
00:37:37,510 --> 00:37:35,760  
the global atmosphere the movement of

1011  
00:37:39,109 --> 00:37:37,520  
carbon dioxide the exchange of carbon

1012  
00:37:41,270 --> 00:37:39,119  
dioxide they basically compare our

1013  
00:37:44,310 --> 00:37:41,280

measurements with their models and the

1014

00:37:46,150 --> 00:37:44,320

more data they have in general the more

1015

00:37:47,589 --> 00:37:46,160

precise they are the less uncertainty

1016

00:37:49,750 --> 00:37:47,599

they'll have on the answers that they

1017

00:37:52,310 --> 00:37:49,760

get so we've already had discussions of

1018

00:37:54,069 --> 00:37:52,320

how people would do this uh analysis

1019

00:37:56,790 --> 00:37:54,079

with our data and the gosat data

1020

00:37:58,790 --> 00:37:56,800

together and it's even been

1021

00:38:00,630 --> 00:37:58,800

started some folks have started working

1022

00:38:03,829 --> 00:38:00,640

also using data sets like the airs

1023

00:38:05,510 --> 00:38:03,839

another nasa mission and test data so

1024

00:38:07,190 --> 00:38:05,520

the more data that they use in this

1025

00:38:08,950 --> 00:38:07,200

analysis they're still going to get

1026

00:38:10,710 --> 00:38:08,960

improved answers at some point you can

1027

00:38:13,030 --> 00:38:10,720

have enough data it doesn't matter but

1028

00:38:14,470 --> 00:38:13,040

we're not near that point yet so

1029

00:38:16,550 --> 00:38:14,480

we believe the answers about the

1030

00:38:18,710 --> 00:38:16,560

exchange of carbon the sources and sinks

1031

00:38:20,950 --> 00:38:18,720

will be better the more data we use in

1032

00:38:22,470 --> 00:38:20,960

this analysis ours and everybody else's

1033

00:38:24,870 --> 00:38:22,480

together so

1034

00:38:27,109 --> 00:38:24,880

there's one little um other benefit of

1035

00:38:28,310 --> 00:38:27,119

the collaborations so as america was

1036

00:38:31,109 --> 00:38:28,320

saying it's

1037

00:38:33,030 --> 00:38:31,119

this is very much a data limited problem

1038

00:38:34,150 --> 00:38:33,040

in understanding what's happening at the

1039

00:38:35,910 --> 00:38:34,160

surface

1040

00:38:36,790 --> 00:38:35,920

and extending the record is important

1041

00:38:38,470 --> 00:38:36,800

but

1042

00:38:40,550 --> 00:38:38,480

to repeat this is a very tricky

1043

00:38:42,390 --> 00:38:40,560

measurement and

1044

00:38:45,030 --> 00:38:42,400

we can learn an awful lot from each

1045

00:38:47,510 --> 00:38:45,040

other in understanding

1046

00:38:49,750 --> 00:38:47,520

what it means to actually provide a

1047

00:38:51,990 --> 00:38:49,760

measurement that's at 0.25 percent one

1048

00:38:54,470 --> 00:38:52,000

part in 400 there's a lot of lessons

1049

00:38:55,750 --> 00:38:54,480

learned from the gosat experience that

1050

00:38:57,670 --> 00:38:55,760

we've shared in the international

1051  
00:38:59,910 --> 00:38:57,680  
community and there's a lot more to be

1052  
00:39:01,829 --> 00:38:59,920  
learned with oco 2 and then with our

1053  
00:39:03,670 --> 00:39:01,839  
international partners it's not a

1054  
00:39:05,510 --> 00:39:03,680  
problem simply solved in california let

1055  
00:39:07,430 --> 00:39:05,520  
me say

1056  
00:39:08,790 --> 00:39:07,440  
okay thank you another question from the

1057  
00:39:10,630 --> 00:39:08,800  
audience here dan

1058  
00:39:12,230 --> 00:39:10,640  
dan vagano at national geographic again

1059  
00:39:14,230 --> 00:39:12,240  
i just i wonder if you could speak a

1060  
00:39:16,150 --> 00:39:14,240  
little make sure i understand are there

1061  
00:39:18,230 --> 00:39:16,160  
limitations in the sort of looking down

1062  
00:39:19,750 --> 00:39:18,240  
to the atmospheric column approach i

1063  
00:39:20,870 --> 00:39:19,760

mean is all the action happening at the

1064

00:39:22,150 --> 00:39:20,880

surface that you're seeing are you going

1065

00:39:23,270 --> 00:39:22,160

to be able to say something about what's

1066

00:39:24,790 --> 00:39:23,280

going on at different levels in the

1067

00:39:27,349 --> 00:39:24,800

atmosphere well

1068

00:39:30,069 --> 00:39:27,359

that's a very good question um carbon

1069

00:39:32,150 --> 00:39:30,079

dioxide once it's in the atmosphere is

1070

00:39:35,109 --> 00:39:32,160

very very stable there are very few loss

1071

00:39:37,109 --> 00:39:35,119

processes if any until it reaches very

1072

00:39:39,430 --> 00:39:37,119

high altitudes in the atmosphere

1073

00:39:42,470 --> 00:39:39,440

all the action as it were

1074

00:39:43,910 --> 00:39:42,480

is the collision of a carbon dioxide

1075

00:39:45,349 --> 00:39:43,920

model with the surface so it's either

1076

00:39:47,510 --> 00:39:45,359

absorbed by a plant

1077

00:39:50,150 --> 00:39:47,520

and taken up in photosynthesis or is

1078

00:39:52,310 --> 00:39:50,160

absorbed by the ocean and

1079

00:39:55,190 --> 00:39:52,320

dissolved into the water

1080

00:39:57,190 --> 00:39:55,200

so you the real challenge of making a

1081

00:39:59,109 --> 00:39:57,200

measurement is to get that information

1082

00:40:00,790 --> 00:39:59,119

nearest the surface

1083

00:40:03,270 --> 00:40:00,800

when you look at the keeling curve or

1084

00:40:05,910 --> 00:40:03,280

any measurement taken

1085

00:40:07,589 --> 00:40:05,920

in the middle of los angeles you can see

1086

00:40:09,670 --> 00:40:07,599

the influence of all those surface

1087

00:40:12,390 --> 00:40:09,680

processes whether it's emission or its

1088

00:40:15,109 --> 00:40:12,400

absorption of the carbon dioxide we need

1089

00:40:16,710 --> 00:40:15,119

to do that globally so that's why we

1090

00:40:19,349 --> 00:40:16,720

we're trying we've developed a satellite

1091

00:40:21,109 --> 00:40:19,359

approach which particularly probes the

1092

00:40:23,270 --> 00:40:21,119

atmosphere nearest the surface by using

1093

00:40:25,430 --> 00:40:23,280

reflected sunlight so that's where most

1094

00:40:27,190 --> 00:40:25,440

of the air is so that's where most of

1095

00:40:28,630 --> 00:40:27,200

the information in the observation we're

1096

00:40:30,069 --> 00:40:28,640

making comes from

1097

00:40:31,829 --> 00:40:30,079

it does have

1098

00:40:32,790 --> 00:40:31,839

it is influenced by what's happening up

1099

00:40:35,030 --> 00:40:32,800

above

1100

00:40:36,790 --> 00:40:35,040

but that's more about atmospheric

1101

00:40:38,390 --> 00:40:36,800

transport processes and

1102

00:40:39,750 --> 00:40:38,400

which way the wind's blowing

1103

00:40:41,349 --> 00:40:39,760

what we really want to know is what's

1104

00:40:42,150 --> 00:40:41,359

happening in the exchange at the surface

1105

00:40:44,390 --> 00:40:42,160

so

1106

00:40:47,030 --> 00:40:44,400

um fortunately there's less air above

1107

00:40:48,870 --> 00:40:47,040

the surface and that that signal is is

1108

00:40:52,390 --> 00:40:48,880

much smaller in the uh and the influence

1109

00:40:56,150 --> 00:40:54,550

okay thank you uh let's see do we have

1110

00:40:59,589 --> 00:40:56,160

some additional questions from social

1111

00:41:05,349 --> 00:41:02,630

indeed this question comes from twitter

1112

00:41:07,430 --> 00:41:05,359

user patrick butler how long will it be

1113

00:41:09,430 --> 00:41:07,440

before you have good data to work with

1114

00:41:13,750 --> 00:41:09,440

for plant and water absorption as

1115

00:41:16,550 --> 00:41:15,109

could you say that again

1116

00:41:18,790 --> 00:41:16,560

sure this comes from twitter user

1117

00:41:21,270 --> 00:41:18,800

patrick butler asking how long will it

1118

00:41:23,589 --> 00:41:21,280

be before you will have good data to

1119

00:41:26,950 --> 00:41:23,599

work with for plant and water absorption

1120

00:41:27,750 --> 00:41:26,960

as opposed to release in the atmosphere

1121

00:41:30,790 --> 00:41:27,760

so

1122

00:41:32,390 --> 00:41:30,800

if you understand a really good question

1123

00:41:33,910 --> 00:41:32,400

some of these

1124

00:41:35,030 --> 00:41:33,920

are measurement approach as ralph

1125

00:41:37,430 --> 00:41:35,040

mentioned

1126

00:41:40,630 --> 00:41:37,440

is to take what we call a repeat cycle

1127

00:41:42,550 --> 00:41:40,640

every 16 days so we'll we'll come back

1128

00:41:44,550 --> 00:41:42,560

to the same point in the earth every 16

1129

00:41:47,510 --> 00:41:44,560

days or two or three weeks

1130

00:41:50,309 --> 00:41:47,520

um that really kind of gives you an idea

1131

00:41:52,470 --> 00:41:50,319

of the kind of information content that

1132

00:41:55,670 --> 00:41:52,480

we can recover from these observations

1133

00:41:57,589 --> 00:41:55,680

it's temporarily resolved at roughly

1134

00:41:59,270 --> 00:41:57,599

two or three weeks to a month

1135

00:42:04,230 --> 00:41:59,280

so

1136

00:42:06,470 --> 00:42:04,240

variations and and changes over the year

1137

00:42:08,470 --> 00:42:06,480

so you have to really have good data

1138

00:42:10,470 --> 00:42:08,480

that extends over several months before

1139

00:42:11,910 --> 00:42:10,480

you can really inform

1140

00:42:13,270 --> 00:42:11,920

yourself about what's happening at the

1141

00:42:15,430 --> 00:42:13,280

surface so

1142

00:42:17,670 --> 00:42:15,440

both from an emission point of view or

1143

00:42:19,430 --> 00:42:17,680

from an absorption of the carbon dioxide

1144

00:42:21,270 --> 00:42:19,440

at the surface it's going to take us

1145

00:42:22,710 --> 00:42:21,280

quite a few months of good data before

1146

00:42:24,230 --> 00:42:22,720

you can actually speak to what's

1147

00:42:26,550 --> 00:42:24,240

happened

1148

00:42:29,030 --> 00:42:26,560

at the surface itself i just want to

1149

00:42:31,190 --> 00:42:29,040

throw in one other comment on that topic

1150

00:42:32,630 --> 00:42:31,200

even to date folks have published some

1151  
00:42:35,109 --> 00:42:32,640  
interesting results where they use the

1152  
00:42:36,710 --> 00:42:35,119  
carbon dioxide information the solar

1153  
00:42:38,950 --> 00:42:36,720  
induced fluorescence that mike has

1154  
00:42:40,710 --> 00:42:38,960  
mentioned and then other measures of

1155  
00:42:41,990 --> 00:42:40,720  
water availability and the science

1156  
00:42:44,150 --> 00:42:42,000  
community is already learning how to

1157  
00:42:46,790 --> 00:42:44,160  
combine those three variables to

1158  
00:42:48,309 --> 00:42:46,800  
understand the plant related processes

1159  
00:42:49,990 --> 00:42:48,319  
and how that interacts with carbon

1160  
00:42:52,150 --> 00:42:50,000  
dioxide so i think there's already been

1161  
00:42:54,390 --> 00:42:52,160  
pioneering work and our data set can

1162  
00:42:56,710 --> 00:42:54,400  
probably be used in continued analysis

1163  
00:42:58,630 --> 00:42:56,720

on that theme

1164

00:43:01,670 --> 00:42:58,640

wonderful this next question comes from

1165

00:43:03,510 --> 00:43:01,680

twitter user dd here asking are federal

1166

00:43:06,309 --> 00:43:03,520

agencies or ngos engaged with the

1167

00:43:09,910 --> 00:43:06,319

science team to use the co2 data set for

1168

00:43:13,109 --> 00:43:09,920

verifying carbon source reporting

1169

00:43:14,230 --> 00:43:13,119

so we've had um we had our first

1170

00:43:15,910 --> 00:43:14,240

workshop

1171

00:43:17,750 --> 00:43:15,920

earlier this year

1172

00:43:20,230 --> 00:43:17,760

nearby in maryland

1173

00:43:21,589 --> 00:43:20,240

which started to engage

1174

00:43:24,710 --> 00:43:21,599

those kinds of

1175

00:43:27,430 --> 00:43:24,720

folks in what particular use this kind

1176  
00:43:28,470 --> 00:43:27,440  
of observation and measurement could be

1177  
00:43:30,150 --> 00:43:28,480  
we still are very much of the

1178  
00:43:33,190 --> 00:43:30,160  
exploratory stage at the moment and i

1179  
00:43:35,349 --> 00:43:33,200  
think a lot of

1180  
00:43:37,270 --> 00:43:35,359  
further progress hinges on when we can

1181  
00:43:40,309 --> 00:43:37,280  
make good data available and see what

1182  
00:43:42,710 --> 00:43:40,319  
those folks can make of it

1183  
00:43:44,309 --> 00:43:42,720  
okay one more question from social media

1184  
00:43:47,349 --> 00:43:44,319  
wonderful this comes from twitter user

1185  
00:43:49,510 --> 00:43:47,359  
daniel here asking do we know the ratio

1186  
00:43:51,349 --> 00:43:49,520  
per year of the amount of co2 being

1187  
00:43:52,829 --> 00:43:51,359  
added and the amount being removed to

1188  
00:43:56,069 --> 00:43:52,839

give us that

1189

00:43:57,190 --> 00:43:56,079

ratio very good question

1190

00:43:59,829 --> 00:43:57,200

of the

1191

00:44:01,670 --> 00:43:59,839

roughly 40

1192

00:44:03,190 --> 00:44:01,680

billion tons of carbon dioxide that's

1193

00:44:05,270 --> 00:44:03,200

put in the atmosphere

1194

00:44:06,790 --> 00:44:05,280

roughly half is taken out

1195

00:44:09,190 --> 00:44:06,800

that's one of the

1196

00:44:11,270 --> 00:44:09,200

more robust numbers over the past number

1197

00:44:13,270 --> 00:44:11,280

of decades so it's a two to one kind of

1198

00:44:14,870 --> 00:44:13,280

ratio at the moment but whether that's

1199

00:44:16,710 --> 00:44:14,880

sustained in the future is one of the

1200

00:44:18,710 --> 00:44:16,720

things we hope to start being able to

1201  
00:44:20,230 --> 00:44:18,720  
probe and address and there's and

1202  
00:44:22,069 --> 00:44:20,240  
there's actually a science community

1203  
00:44:24,150 --> 00:44:22,079  
that every year publishes an update on

1204  
00:44:26,309 --> 00:44:24,160  
the global carbon budget and they

1205  
00:44:28,870 --> 00:44:26,319  
actually provide a year by year estimate

1206  
00:44:30,150 --> 00:44:28,880  
so we have the 50 on average and folks

1207  
00:44:31,829 --> 00:44:30,160  
have looked into what it is in

1208  
00:44:34,069 --> 00:44:31,839  
particular each year or the best

1209  
00:44:36,390 --> 00:44:34,079  
estimates the best estimates although

1210  
00:44:39,430 --> 00:44:36,400  
the why is still not answered so we have

1211  
00:44:43,109 --> 00:44:41,109  
okay and i think we have one additional

1212  
00:44:46,230 --> 00:44:43,119  
question on the phone bridge if that's

1213  
00:44:49,670 --> 00:44:48,870

maybe we lost that question

1214

00:44:51,750 --> 00:44:49,680

okay

1215

00:44:53,990 --> 00:44:51,760

well i think that ends the questions for

1216

00:44:56,790 --> 00:44:54,000

today and thank you for watching uh

1217

00:44:59,829 --> 00:44:56,800

please uh stay online for more

1218

00:45:02,630 --> 00:44:59,839

information about oco2 uh leading up to

1219

00:45:04,230 --> 00:45:02,640

launch as has been said july 1st we have

1220

00:45:09,349 --> 00:45:04,240

a website that we can get a lot more

1221

00:45:14,710 --> 00:45:12,870

oco2 and oco2 is the second of five

1222

00:45:16,950 --> 00:45:14,720

earth science launches this year it's a

1223

00:45:20,230 --> 00:45:16,960

very busy year for nasa we also have

1224

00:45:22,470 --> 00:45:20,240

quite a few exciting airborne and field

1225

00:45:23,910 --> 00:45:22,480

campaigns coming up as well there's a

1226

00:45:27,069 --> 00:45:23,920

website where you can keep up with all

1227

00:45:30,790 --> 00:45:27,079

that activity and that is

1228

00:45:32,309 --> 00:45:30,800

www.nasa.gov slash earthrightnow and of

1229

00:45:34,790 --> 00:45:32,319

course you can follow along on all the

1230

00:45:36,630 --> 00:45:34,800

different nasa social media channels as

1231

00:45:38,550 --> 00:45:36,640

well to keep up with all this all these

1232

00:45:39,750 --> 00:45:38,560

missions uh it's exciting year for earth

1233

00:45:41,670 --> 00:45:39,760

science