



1
00:00:09,020 --> 00:00:04,820
NASA's Jet Propulsion Laboratory

2
00:00:11,450 --> 00:00:09,030
presents the von Karman lecture a series

3
00:00:13,820 --> 00:00:11,460
of talks by scientists and engineers who

4
00:00:16,590 --> 00:00:13,830
are exploring our planet our solar

5
00:00:36,780 --> 00:00:16,600
system and all that lies beyond

6
00:00:42,310 --> 00:00:39,729
we hear the announcer counting down the

7
00:00:45,670 --> 00:00:42,320
final minutes and the final seconds all

8
00:00:47,319 --> 00:00:45,680
of your senses are heightened your

9
00:00:50,290 --> 00:00:47,329
emotions are running an overdrive

10
00:00:53,350 --> 00:00:50,300
because all of those years work is

11
00:00:54,819 --> 00:00:53,360
finally leading up to this culmination

12
00:01:01,060 --> 00:00:54,829
in the project's development lifecycle

13
00:01:03,310 --> 00:01:01,070

eight seven six just kind of waiting

14

00:01:06,999 --> 00:01:03,320

together for that brilliant flash of

15

00:01:09,999 --> 00:01:07,009

light and we have liftoff and I have to

16

00:01:13,749 --> 00:01:10,009

say that on the 24th of February 2009

17

00:01:16,090 --> 00:01:13,759

you couldn't ask for a better day as far

18

00:01:18,639 --> 00:01:16,100

as the weather goes all of us were glued

19

00:01:19,120 --> 00:01:18,649

to the screens or the monitors in front

20

00:01:22,960 --> 00:01:19,130

of us

21

00:01:24,790 --> 00:01:22,970

few minutes into the OTO mission that

22

00:01:27,399 --> 00:01:24,800

was an excellent two minutes after the

23

00:01:30,040 --> 00:01:27,409

launch you know this was a great start

24

00:01:32,380 --> 00:01:30,050

you know the images were perfect it

25

00:01:35,590 --> 00:01:32,390

looks like we Anna we had a great first

26
00:01:37,510 --> 00:01:35,600
stage taking off page one step stage 2

27
00:01:39,280 --> 00:01:37,520
ignition vehicle attitude nominal power

28
00:01:41,230 --> 00:01:39,290
buses nominal stage two burn will last

29
00:01:43,899 --> 00:01:41,240
approximately 70 seconds and then I

30
00:01:45,969 --> 00:01:43,909
started to hear some chatter you know on

31
00:01:47,649 --> 00:01:45,979
one of the engineering channels fairing

32
00:01:49,270 --> 00:01:47,659
separation vehicle attitude nominal

33
00:01:52,480 --> 00:01:49,280
following jettison of payload fairing

34
00:01:56,520 --> 00:01:52,490
and there was a trajectory engineer and

35
00:01:59,319 --> 00:01:56,530
said they calculated a negative perigee

36
00:02:01,840 --> 00:01:59,329
that means that the lowest point in the

37
00:02:03,880 --> 00:02:01,850
orbit is going to be below the surface

38
00:02:06,069 --> 00:02:03,890

of the earth and they just meant to me

39

00:02:12,059 --> 00:02:06,079

that basically the launch vehicle upper

40

00:02:18,390 --> 00:02:14,429

several minutes after that there was

41

00:02:20,910 --> 00:02:18,400

utter silence I think we all understood

42

00:02:24,660 --> 00:02:20,920

at that point in time that we had lost

43

00:02:27,720 --> 00:02:24,670

the mission and you know all of the work

44

00:02:30,569 --> 00:02:27,730

leading up to that the five six seven

45

00:02:34,140 --> 00:02:30,579

years that all of us had had work - for

46

00:02:37,920 --> 00:02:34,150

this single point in time was for not

47

00:02:41,940 --> 00:02:37,930

none of us treated this like a job we

48

00:02:42,809 --> 00:02:41,950

all treated this like something worth

49

00:02:46,630 --> 00:02:42,819

doing

50

00:02:49,420 --> 00:02:46,640

we're committed not only to the mission

51
00:02:51,950 --> 00:02:49,430
but committed to ourselves and that was

52
00:02:57,210 --> 00:02:51,960
the hardest part to really accept

53
00:03:00,390 --> 00:02:57,220
[Music]

54
00:03:03,450 --> 00:03:00,400
in that the day or two after the loss of

55
00:03:05,490 --> 00:03:03,460
the original Osio mission we got

56
00:03:07,800 --> 00:03:05,500
together here at JPL including our

57
00:03:09,540 --> 00:03:07,810
center director we had put together a

58
00:03:13,470 --> 00:03:09,550
proposal that we submitted the NASA

59
00:03:15,570 --> 00:03:13,480
which we later called Osio - once we got

60
00:03:18,330 --> 00:03:15,580
the go-ahead we never looked back

61
00:03:21,660 --> 00:03:18,340
liftoff of the delta ii rocket with a

62
00:03:23,490 --> 00:03:21,670
co2 and co2 has been operating now for

63
00:03:25,920 --> 00:03:23,500

nearly five years the orbiting carbon

64

00:03:28,050 --> 00:03:25,930

Observatory and is now separated from

65

00:03:30,300 --> 00:03:28,060

the second stage and it's flying on its

66

00:03:32,640 --> 00:03:30,310

own during development of orbiting

67

00:03:35,190 --> 00:03:32,650

carbon Observatory number two we built

68

00:03:37,460 --> 00:03:35,200

the flight unit but we also built a

69

00:03:41,100 --> 00:03:37,470

flight spare we made some modifications

70

00:03:44,450 --> 00:03:41,110

to adapt that instrument for use on the

71

00:03:47,580 --> 00:03:44,460

international space station as I was co3

72

00:03:50,070 --> 00:03:47,590

the world is changing the climate is

73

00:03:52,590 --> 00:03:50,080

changing and the best way to be able to

74

00:03:56,100 --> 00:03:52,600

deal with changes it's really to

75

00:03:58,470 --> 00:03:56,110

understand the problem itself o co3 in

76

00:04:00,300 --> 00:03:58,480

conjunction with oco-2 are going to help

77

00:04:02,730 --> 00:04:00,310

us to better understand the problem and

78

00:04:05,490 --> 00:04:02,740

be able to put processes procedures in

79

00:04:06,900 --> 00:04:05,500

place on how to cope not just for

80

00:04:11,220 --> 00:04:06,910

today's generation but for future

81

00:04:13,410 --> 00:04:11,230

generations that's life of the space

82

00:04:15,979 --> 00:04:13,420

business it's a calculated risk but it's

83

00:04:20,810 --> 00:04:15,989

a risk worth 15

84

00:04:23,400 --> 00:04:20,820

you have to be bold you have to be dairy

85

00:04:27,379 --> 00:04:23,410

you have to be willing to risk the

86

00:04:31,710 --> 00:04:27,389

lowest lows to achieve the highest highs

87

00:04:36,960 --> 00:04:31,720

for me that the primary lesson is don't

88

00:04:39,600 --> 00:04:36,970

give up keep moving forward and good

89

00:04:43,620 --> 00:04:39,610

things will happen and all of those good

90

00:04:48,240 --> 00:04:43,630

things aren't going to be much more

91

00:04:57,010 --> 00:04:48,250

valuable in knowing what it took to get

92

00:05:00,740 --> 00:05:00,050

good evening folks wherever you are on

93

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

this planet

94

00:05:04,760 --> 00:05:02,760

welcome to the von Karman series live

95

00:05:06,110 --> 00:05:04,770

here from the von Karman auditorium here

96

00:05:08,360 --> 00:05:06,120

at JPL at NASA's Jet Propulsion

97

00:05:09,560 --> 00:05:08,370

Laboratory my name is Bryan white from

98

00:05:13,430 --> 00:05:09,570

the Office of Communications in

99

00:05:15,830 --> 00:05:13,440

education and tonight we look at hope we

100

00:05:17,150 --> 00:05:15,840

will get home we look at the place where

101
00:05:19,700 --> 00:05:17,160
everybody you've ever known has ever

102
00:05:21,740 --> 00:05:19,710
lived this is looking home Oh CEO three

103
00:05:23,210 --> 00:05:21,750
and science from the ISS now we got a

104
00:05:25,040 --> 00:05:23,220
great panel this evening but they will

105
00:05:27,770 --> 00:05:25,050
be the first to tell you that this is a

106
00:05:30,440 --> 00:05:27,780
very small part of this incredible

107
00:05:31,940 --> 00:05:30,450
amazing team while we're talking you're

108
00:05:35,090 --> 00:05:31,950
gonna see some images behind us of

109
00:05:37,340 --> 00:05:35,100
people doing the work of the work that's

110
00:05:39,890 --> 00:05:37,350
actually happening but I want to get to

111
00:05:41,720 --> 00:05:39,900
our panel cuz there's a lot of great

112
00:05:43,160 --> 00:05:41,730
stuff coming out of them tonight Lido

113
00:05:45,800 --> 00:05:43,170

golf we have a start the star of our

114

00:05:53,210 --> 00:05:45,810

opening video Ralph Basilio project

115

00:05:54,590 --> 00:05:53,220

manager of Ocoee and next to him the

116

00:06:00,010 --> 00:05:54,600

science data applications and

117

00:06:08,230 --> 00:06:02,500

Matt Bennett the project systems

118

00:06:10,300 --> 00:06:08,240

engineer and finally last but certainly

119

00:06:11,680 --> 00:06:10,310

not least Graziella Keller Rodriguez

120

00:06:16,950 --> 00:06:11,690

engineering applications software

121

00:06:20,680 --> 00:06:19,240

now we're Ralph's we're gonna start with

122

00:06:22,750 --> 00:06:20,690

you because we got so much of you in

123

00:06:23,500 --> 00:06:22,760

that video I feel we should just but

124

00:06:27,820 --> 00:06:23,510

that's okay

125

00:06:29,770 --> 00:06:27,830

I don't think we did how did you I mean

126

00:06:33,610 --> 00:06:29,780

get not necessarily here but on to these

127

00:06:37,600 --> 00:06:33,620

Oh Co missions well it started out as a

128

00:06:40,690 --> 00:06:37,610

part-time job believe it or not so yeah

129

00:06:42,940 --> 00:06:40,700

it was about 16 years ago and and I know

130

00:06:45,790 --> 00:06:42,950

it was 16 years ago because I looked at

131

00:06:50,410 --> 00:06:45,800

my computer and I found an old Oh Co

132

00:06:54,460 --> 00:06:50,420

file that was dated April 16 2003 so it

133

00:06:56,860 --> 00:06:54,470

doesn't go back that far so that was my

134

00:06:59,890 --> 00:06:56,870

first affiliation with the OSI Oh series

135

00:07:02,500 --> 00:06:59,900

of missions and at that time I was

136

00:07:05,530 --> 00:07:02,510

working on another Space Flight mission

137

00:07:07,030 --> 00:07:05,540

here at JPL so I was a flight system

138

00:07:11,320 --> 00:07:07,040

manager for another Earth orbiting

139

00:07:13,930 --> 00:07:11,330

satellite system and one day early in

140

00:07:17,860 --> 00:07:13,940

the week our project manager called his

141

00:07:19,510 --> 00:07:17,870

staff into the room and said hey we got

142

00:07:22,120 --> 00:07:19,520

a little bit of a slowdown we got some

143

00:07:23,710 --> 00:07:22,130

budget issues you know where all of us

144

00:07:27,250 --> 00:07:23,720

are gonna have to look for part-time

145

00:07:31,540 --> 00:07:27,260

jobs and take the pressure off of our

146

00:07:36,070 --> 00:07:31,550

accounts here so said ok that's great

147

00:07:41,110 --> 00:07:36,080

and by the end of the week all of us on

148

00:07:43,300 --> 00:07:41,120

the staff found part-time jobs so so the

149

00:07:46,210 --> 00:07:43,310

project manager had some mixed emotions

150

00:07:47,890 --> 00:07:46,220

on one hand he was quite pleased he was

151
00:07:50,110 --> 00:07:47,900
happy that we followed through on his

152
00:07:52,300 --> 00:07:50,120
directions but we all yeah we all

153
00:07:53,770 --> 00:07:52,310
listened to it but on the other hand he

154
00:07:56,020 --> 00:07:53,780
was a little bit dismayed some probs a

155
00:07:59,320 --> 00:07:56,030
little bit saddened that we not only

156
00:08:02,140 --> 00:07:59,330
took his order but we did it posthaste

157
00:08:04,360 --> 00:08:02,150
so there was a sense of immediacy to get

158
00:08:05,650 --> 00:08:04,370
it done because the following week I

159
00:08:07,690 --> 00:08:05,660
don't think anybody showed up for the

160
00:08:10,180 --> 00:08:07,700
staff meeting so because we're all

161
00:08:11,770 --> 00:08:10,190
working on our other jobs so with that

162
00:08:12,620 --> 00:08:11,780
being said you know it was really an

163
00:08:16,550 --> 00:08:12,630

exciting time

164

00:08:21,800 --> 00:08:16,560

ran back in 2003 that was my first

165

00:08:24,770 --> 00:08:21,810

opportunity to work on OC L & O CO was

166

00:08:27,760 --> 00:08:24,780

really that was NASA's first dedicated

167

00:08:30,860 --> 00:08:27,770

mission devoted to understanding

168

00:08:33,080 --> 00:08:30,870

atmospheric carbon dioxide we're really

169

00:08:34,490 --> 00:08:33,090

the purpose of improving our

170

00:08:37,490 --> 00:08:34,500

understanding of the climate proper

171

00:08:39,409 --> 00:08:37,500

excuse me the carbon cycle so that we

172

00:08:41,330 --> 00:08:39,419

could better understand the processes

173

00:08:43,640 --> 00:08:41,340

that are driving climate change today

174

00:08:45,560 --> 00:08:43,650

and Osio

175

00:08:48,230 --> 00:08:45,570

was designed to be the first satellite

176

00:08:50,690 --> 00:08:48,240

to have the precision resolution and

177

00:08:53,360 --> 00:08:50,700

coverage needed so that we can

178

00:08:57,460 --> 00:08:53,370

understand where these sources or

179

00:09:00,680 --> 00:08:57,470

emitters of co2 and sinks or observer

180

00:09:03,230 --> 00:09:00,690

absorbers of co2 are okay regional

181

00:09:05,900 --> 00:09:03,240

scales throughout the world so it was a

182

00:09:08,780 --> 00:09:05,910

it was an honorable endeavor at that

183

00:09:12,560 --> 00:09:08,790

time and it still is very cool and Karin

184

00:09:14,720 --> 00:09:12,570

you you were early on Oh Co but you like

185

00:09:16,940 --> 00:09:14,730

to point out that Ralph's doing it

186

00:09:20,000 --> 00:09:16,950

longer if I worked is that correctly no

187

00:09:23,690 --> 00:09:20,010

actually I'm very proud to say so last

188

00:09:26,630 --> 00:09:23,700

week I celebrated my 18 years at JPL and

189

00:09:29,150 --> 00:09:26,640

one of the first tasks that I had was to

190

00:09:30,710 --> 00:09:29,160

support these four proposals that were

191

00:09:34,130 --> 00:09:30,720

going through and there were the SSP

192

00:09:35,840 --> 00:09:34,140

proposals and no Co was one of them in

193

00:09:38,270 --> 00:09:35,850

fact I see a familiar face than the

194

00:09:41,390 --> 00:09:38,280

audience is somebody that I met very

195

00:09:44,140 --> 00:09:41,400

early on and I got on with these folks

196

00:09:46,310 --> 00:09:44,150

and it's been quite a ride ever since

197

00:09:48,260 --> 00:09:46,320

okay I guess I'll stick with you on this

198

00:09:52,090 --> 00:09:48,270

is why why earth why did you want to

199

00:09:55,010 --> 00:09:52,100

kind of these o co missions and well

200

00:09:57,500 --> 00:09:55,020

okay yes everything that Ralph said that

201

00:09:59,360 --> 00:09:57,510

it is very honorable and and with my

202

00:10:01,580 --> 00:09:59,370

background I wanted to do it but I would

203

00:10:03,440 --> 00:10:01,590

be lying to you if I didn't say he gave

204

00:10:06,240 --> 00:10:03,450

me the job and I just did what they told

205

00:10:12,100 --> 00:10:08,889

okay well thank you for your honesty

206

00:10:14,410 --> 00:10:12,110

here we're watching this video and you

207

00:10:16,720 --> 00:10:14,420

have this this wonderful spacecraft and

208

00:10:20,610 --> 00:10:16,730

then there's an anomaly and that would

209

00:10:22,240 --> 00:10:20,620

be I know would be crushing for mating

210

00:10:26,920 --> 00:10:22,250

how do you how do you deal with

211

00:10:29,290 --> 00:10:26,930

something like that it really starts

212

00:10:33,490 --> 00:10:29,300

with working on things that are

213

00:10:35,889 --> 00:10:33,500

meaningful for you something that

214

00:10:39,310 --> 00:10:35,899

inspires you something that drives you

215

00:10:41,620 --> 00:10:39,320

and for all of us working on OSI oh that

216

00:10:43,840 --> 00:10:41,630

was definitely a true statement that we

217

00:10:46,480 --> 00:10:43,850

are all focused on getting the job done

218

00:10:49,480 --> 00:10:46,490

so it was obviously quite devastating

219

00:10:50,889 --> 00:10:49,490

when we lost those CEO I think the other

220

00:10:53,860 --> 00:10:50,899

important thing about overcoming

221

00:10:56,110 --> 00:10:53,870

adversity is knowing that it's a it's a

222

00:10:59,980 --> 00:10:56,120

process now nothing happens overnight

223

00:11:02,440 --> 00:10:59,990

and for us a necessary first step was

224

00:11:05,130 --> 00:11:02,450

the grieving process you know

225

00:11:09,430 --> 00:11:05,140

immediately after that field launch we

226

00:11:12,910 --> 00:11:09,440

convened our science team and we had a

227

00:11:16,930 --> 00:11:12,920

long talk and I would say that there

228

00:11:19,449 --> 00:11:16,940

wasn't a dry eye in the room but after

229

00:11:22,210 --> 00:11:19,459

that greeting process however short it

230

00:11:24,130 --> 00:11:22,220

was we all drove back here to JPL

231

00:11:25,600 --> 00:11:24,140

because I remember it was already one

232

00:11:27,819 --> 00:11:25,610

morning our lab director was in the

233

00:11:30,490 --> 00:11:27,829

conference room with us and that meant

234

00:11:32,050 --> 00:11:30,500

yeah this is pretty serious stuff we

235

00:11:35,560 --> 00:11:32,060

need to figure out what to do here

236

00:11:37,449 --> 00:11:35,570

and we set out to basically assess the

237

00:11:40,569 --> 00:11:37,459

situation what do we know what do we

238

00:11:42,579 --> 00:11:40,579

don't know and we developed a plan and

239

00:11:45,940 --> 00:11:42,589

after we put together that plan we set

240

00:11:48,670 --> 00:11:45,950

out to do what it took for as long as it

241

00:11:51,040 --> 00:11:48,680

took to get the job done and I think the

242

00:11:53,560 --> 00:11:51,050

most important thing for for me the main

243

00:11:56,319 --> 00:11:53,570

takeaway was that you know you don't

244

00:11:59,260 --> 00:11:56,329

really know what you're truly capable of

245

00:12:01,750 --> 00:11:59,270

until you you meet adversity you have

246

00:12:04,690 --> 00:12:01,760

challenges you have these obstacles to

247

00:12:09,069 --> 00:12:04,700

overcome and I feel it made us a

248

00:12:11,949 --> 00:12:09,079

stronger team after that and we lost one

249

00:12:13,900 --> 00:12:11,959

satellite but today we have an operating

250

00:12:16,180 --> 00:12:13,910

satellite and we have a payload

251
00:12:17,550 --> 00:12:16,190
operating on the space station so we

252
00:12:19,800 --> 00:12:17,560
couldn't ask for any more than that

253
00:12:21,300 --> 00:12:19,810
it's true that's that's a good point

254
00:12:24,540 --> 00:12:21,310
without that you wouldn't have these

255
00:12:26,939 --> 00:12:24,550
other two up there and I'm gonna switch

256
00:12:29,160 --> 00:12:26,949
to some of our newer members on the team

257
00:12:30,989 --> 00:12:29,170
Graziella because the big question that

258
00:12:32,910 --> 00:12:30,999
we're gonna be getting a lot or at least

259
00:12:36,960 --> 00:12:32,920
as I have a tendency to hear a lot with

260
00:12:40,350 --> 00:12:36,970
our science is the why can you talk to

261
00:12:45,150 --> 00:12:40,360
us about the why of Oh co 3 & O CO 2 and

262
00:12:47,069 --> 00:12:45,160
the O cos we care about carbon dioxide

263
00:12:49,920 --> 00:12:47,079

because it's a very important greenhouse

264

00:12:52,619 --> 00:12:49,930

gas and it's driving global warming and

265

00:12:54,290 --> 00:12:52,629

as humans we are dumping huge amounts of

266

00:12:57,960 --> 00:12:54,300

carbon dioxide into the atmosphere

267

00:12:59,819 --> 00:12:57,970

mainly by burning fossil fuels and we

268

00:13:02,489 --> 00:12:59,829

are are actually the ones responsible

269

00:13:05,749 --> 00:13:02,499

for the increase in the concentrations

270

00:13:08,850 --> 00:13:05,759

of carbon dioxide in the atmosphere

271

00:13:10,889 --> 00:13:08,860

actually we have a very famous example

272

00:13:13,819 --> 00:13:10,899

most people have heard of the Keeling

273

00:13:16,259 --> 00:13:13,829

curve and the Keeling curve is actually

274

00:13:18,179 --> 00:13:16,269

established by dr. Charles Keeling back

275

00:13:22,170 --> 00:13:18,189

in 1958 for the International

276

00:13:24,780 --> 00:13:22,180

Geophysical Year and it's an important

277

00:13:26,249 --> 00:13:24,790

point to look at because if you think

278

00:13:29,069 --> 00:13:26,259

about where atmospheric carbon dioxide

279

00:13:30,689 --> 00:13:29,079

was in the beginning of the Industrial

280

00:13:35,040 --> 00:13:30,699

Revolution and we usually say it's about

281

00:13:38,160 --> 00:13:35,050

1850 from 1850 to 1958 so it's a hundred

282

00:13:41,910 --> 00:13:38,170

eight years it went from 280 parts per

283

00:13:43,889 --> 00:13:41,920

million to 310 parts per million and the

284

00:13:48,179 --> 00:13:43,899

interesting thing so that's 30 parts per

285

00:13:49,829 --> 00:13:48,189

million in 108 years from 1958 to 2008

286

00:13:53,519 --> 00:13:49,839

which was just a year before the Oh co

287

00:13:55,530 --> 00:13:53,529

launched we grew 70 parts per million so

288

00:13:57,660 --> 00:13:55,540

that it was up to 385 parts per million

289

00:14:00,449 --> 00:13:57,670

so basically in the span of 50 years we

290

00:14:02,490 --> 00:14:00,459

more than doubled that amount and folks

291

00:14:04,679 --> 00:14:02,500

should know that back in 2013 that was

292

00:14:06,869 --> 00:14:04,689

the first time in human history that we

293

00:14:11,129 --> 00:14:06,879

reached 400 parts per million but if you

294

00:14:13,980 --> 00:14:11,139

take 2008 until 2019 we actually grew

295

00:14:17,939 --> 00:14:13,990

another 30 parts per million and and

296

00:14:20,759 --> 00:14:17,949

this was I'm sorry - yeah 2019 May we

297

00:14:22,040 --> 00:14:20,769

were at 415 parts per million so what we

298

00:14:24,170 --> 00:14:22,050

did in 180

299

00:14:26,619 --> 00:14:24,180

we did in 11 years we grew another 30

300

00:14:29,629 --> 00:14:26,629

parts per million in the same location

301
00:14:31,309 --> 00:14:29,639
that's not even the whole story right

302
00:14:34,879 --> 00:14:31,319
there is two missing pieces to this

303
00:14:36,679 --> 00:14:34,889
puzzle for example not all of the carbon

304
00:14:39,139 --> 00:14:36,689
dioxide that we dumped into the

305
00:14:41,019 --> 00:14:39,149
atmosphere as humans actually stays

306
00:14:44,540 --> 00:14:41,029
there and contributes to global warming

307
00:14:46,939 --> 00:14:44,550
about half of it the oceans and the

308
00:14:49,610 --> 00:14:46,949
plants are taken down so in the sense

309
00:14:51,740 --> 00:14:49,620
they are doing us this huge favor so

310
00:14:54,889 --> 00:14:51,750
things could be worse

311
00:14:59,269 --> 00:14:54,899
of taking more carbon dioxide than they

312
00:15:01,100 --> 00:14:59,279
emit and but that's on average because

313
00:15:03,230 --> 00:15:01,110

some years they are capable of taking

314

00:15:05,740 --> 00:15:03,240

down a lot more than other years and

315

00:15:08,660 --> 00:15:05,750

it's very important for us to understand

316

00:15:11,090 --> 00:15:08,670

the processes that control these

317

00:15:13,129 --> 00:15:11,100

variations because we want to be able to

318

00:15:14,869 --> 00:15:13,139

predict what the concentrations of

319

00:15:16,939 --> 00:15:14,879

carbon dioxide will be in the future

320

00:15:18,499 --> 00:15:16,949

especially in an earth that's going to

321

00:15:21,019 --> 00:15:18,509

be different from the earth that we have

322

00:15:22,490 --> 00:15:21,029

today is going to be warmer and it will

323

00:15:25,600 --> 00:15:22,500

have more carbon dioxide in the

324

00:15:28,610 --> 00:15:25,610

atmosphere and these factors they have

325

00:15:32,119 --> 00:15:28,620

potential to impact the ability of these

326

00:15:35,960 --> 00:15:32,129

carbon sinks to absorb carbon dioxide

327

00:15:38,540 --> 00:15:35,970

and the way we have to answer these

328

00:15:42,650 --> 00:15:38,550

questions is by getting data it's by

329

00:15:45,980 --> 00:15:42,660

getting measurements you see some of the

330

00:15:47,689 --> 00:15:45,990

spots so manalo be an example of one of

331

00:15:49,730 --> 00:15:47,699

these spots and that's great you have a

332

00:15:51,610 --> 00:15:49,740

lot of information there but what we

333

00:15:54,470 --> 00:15:51,620

really need to do is to get this

334

00:15:55,160 --> 00:15:54,480

globally and that's what we did with O

335

00:15:57,309 --> 00:15:55,170

co2

336

00:15:59,480 --> 00:15:57,319

basically you took a very precise

337

00:16:01,879 --> 00:15:59,490

instrument and you were able to put it

338

00:16:04,939 --> 00:16:01,889

out in space and provide that global

339

00:16:06,619 --> 00:16:04,949

coverage and and this gives you an idea

340

00:16:08,780 --> 00:16:06,629

of what you saw before with the spots

341

00:16:12,490 --> 00:16:08,790

you able to see this is actual data of

342

00:16:14,900 --> 00:16:12,500

level 2 data that we have for o co2 and

343

00:16:17,119 --> 00:16:14,910

this information is really important

344

00:16:18,679 --> 00:16:17,129

because the folks who are working with

345

00:16:20,629 --> 00:16:18,689

the climate models they're able to take

346

00:16:24,379 --> 00:16:20,639

our data and actually incorporate into

347

00:16:27,319 --> 00:16:24,389

their models and you'll see in the later

348

00:16:28,730 --> 00:16:27,329

animation they're able to do the work

349

00:16:29,310 --> 00:16:28,740

that they they do and get that

350

00:16:32,880 --> 00:16:29,320

understand

351
00:16:37,020 --> 00:16:32,890
and trusts what we provide for them and

352
00:16:38,820 --> 00:16:37,030
and the other thing is also establishing

353
00:16:41,070 --> 00:16:38,830
this very important baseline for the

354
00:16:45,450 --> 00:16:41,080
first time with the precision that we

355
00:16:48,270 --> 00:16:45,460
need relative to the ground stations not

356
00:16:50,190 --> 00:16:48,280
only not only the coverage the spatial

357
00:16:54,900 --> 00:16:50,200
coverage that we see that we can already

358
00:16:56,490 --> 00:16:54,910
only get from space is important but we

359
00:16:59,280 --> 00:16:56,500
also need an instrument that is very

360
00:17:00,870 --> 00:16:59,290
precise because why all the carbon

361
00:17:04,770 --> 00:17:00,880
dioxide concentrations in the atmosphere

362
00:17:07,710 --> 00:17:04,780
are high there are big numbers we are

363
00:17:09,930 --> 00:17:07,720

trying to measure local variations and

364

00:17:12,120 --> 00:17:09,940

these are tiny numbers in comparison so

365

00:17:15,630 --> 00:17:12,130

these are very difficult measurements to

366

00:17:18,300 --> 00:17:15,640

make and we also need to be able to take

367

00:17:19,890 --> 00:17:18,310

these measurements for many years right

368

00:17:21,949 --> 00:17:19,900

so we can really understand what's going

369

00:17:26,670 --> 00:17:21,959

on despite the fact that these missions

370

00:17:30,180 --> 00:17:26,680

they only last some years right some

371

00:17:33,120 --> 00:17:30,190

years yes well already lasted a lot

372

00:17:34,620 --> 00:17:33,130

longer right what was the day initiation

373

00:17:36,270 --> 00:17:34,630

and we have one baseline but we can't

374

00:17:38,850 --> 00:17:36,280

assume that's gonna last forever so

375

00:17:40,800 --> 00:17:38,860

that's why when like you mentioned we

376

00:17:43,770 --> 00:17:40,810

having the flight spare now we have the

377

00:17:47,090 --> 00:17:43,780

twin sister up on the International

378

00:17:51,390 --> 00:17:47,100

Space Station that's a great transition

379

00:17:54,660 --> 00:17:51,400

so the why is important we've you've got

380

00:17:56,370 --> 00:17:54,670

OC o2 it's been up there for close to a

381

00:17:58,530 --> 00:17:56,380

little over five years and now you've

382

00:18:00,360 --> 00:17:58,540

got the twin sister and you sent the

383

00:18:02,550 --> 00:18:00,370

twin sister up to the to the

384

00:18:04,530 --> 00:18:02,560

International Space Station man talk to

385

00:18:06,060 --> 00:18:04,540

us a little bit about about Oh co 3 in

386

00:18:09,300 --> 00:18:06,070

the build and the design and all that

387

00:18:11,280 --> 00:18:09,310

great stuff sure sure so we really like

388

00:18:12,630 --> 00:18:11,290

the space station is a platform for the

389

00:18:15,180 --> 00:18:12,640

O CO 3 mission because offers us a

390

00:18:17,070 --> 00:18:15,190

number of advantages the first is that

391

00:18:18,750 --> 00:18:17,080

it's already a spacecraft that's built

392

00:18:21,210 --> 00:18:18,760

for us so I'm like ah no co2 where we

393

00:18:23,730 --> 00:18:21,220

had to go by a spacecraft and integrate

394

00:18:25,620 --> 00:18:23,740

our instrument into that the ISS is our

395

00:18:27,510 --> 00:18:25,630

spacecraft it was built for us with the

396

00:18:29,670 --> 00:18:27,520

intent of hosting external payloads that

397

00:18:31,400 --> 00:18:29,680

can look at earth or can look out into

398

00:18:34,290 --> 00:18:31,410

space and do some scientific studies

399

00:18:36,540 --> 00:18:34,300

we're flying on the Japanese module of

400

00:18:38,430 --> 00:18:36,550

the space station and this called the

401
00:18:41,730 --> 00:18:38,440
Japanese experiment module external

402
00:18:43,230 --> 00:18:41,740
facility or Jimmy F and Jimmy F has a

403
00:18:44,669 --> 00:18:43,240
site specifically where you

404
00:18:46,380 --> 00:18:44,679
plug in your instrument and it gives you

405
00:18:47,549 --> 00:18:46,390
the power you need it has a data

406
00:18:49,049 --> 00:18:47,559
interface where you can send

407
00:18:51,060 --> 00:18:49,059
instructions to your instrument and you

408
00:18:52,440 --> 00:18:51,070
can get your science data back down it

409
00:18:54,240 --> 00:18:52,450
has a cooling system so it can help

410
00:18:55,440 --> 00:18:54,250
remove the heat from your instrument so

411
00:18:57,330 --> 00:18:55,450
that you can stay up there and operate

412
00:18:58,530 --> 00:18:57,340
so it's built for that and as it wasn't

413
00:18:59,760 --> 00:18:58,540

one of the advantages that we had of

414

00:19:01,350 --> 00:18:59,770

both co3 that we didn't have to go out

415

00:19:02,790 --> 00:19:01,360

and buy or build a spacecraft for the

416

00:19:04,290 --> 00:19:02,800

mission you got to save some of that

417

00:19:07,140 --> 00:19:04,300

time and energy that would go towards

418

00:19:12,390 --> 00:19:07,150

those things you got the USB essentially

419

00:19:14,100 --> 00:19:12,400

on the back another advantage is we

420

00:19:15,870 --> 00:19:14,110

didn't have to go out and buy a rocket

421

00:19:19,200 --> 00:19:15,880

for this particular mission so the ISS

422

00:19:20,460 --> 00:19:19,210

is scheduling launches to the space

423

00:19:22,169 --> 00:19:20,470

station on a regular basis they're

424

00:19:23,970 --> 00:19:22,179

giving supplies for the astronauts

425

00:19:26,160 --> 00:19:23,980

experiments for the for the crew and

426

00:19:27,990 --> 00:19:26,170

then we we basically hitch a ride on one

427

00:19:29,460 --> 00:19:28,000

of those already pre scheduled launches

428

00:19:32,150 --> 00:19:29,470

and that's how we get up to the space

429

00:19:34,710 --> 00:19:32,160

station okay

430

00:19:36,030 --> 00:19:34,720

what are some of the advantages of so

431

00:19:38,490 --> 00:19:36,040

that's some of the advantages but

432

00:19:41,490 --> 00:19:38,500

science wise or working wise what why

433

00:19:44,010 --> 00:19:41,500

the ISS another good reason another

434

00:19:46,470 --> 00:19:44,020

advantage of ISS is that it's in a

435

00:19:50,190 --> 00:19:46,480

precessing orbit so what that means is

436

00:19:51,930 --> 00:19:50,200

that when it if it revisits a site on

437

00:19:53,850 --> 00:19:51,940

earth a common site it doesn't do it at

438

00:19:56,040 --> 00:19:53,860

the same time every day so sometimes it

439

00:19:58,020 --> 00:19:56,050

can arrive in the morning afternoon you

440

00:19:59,700 --> 00:19:58,030

know early evening and that gives us a

441

00:20:01,440 --> 00:19:59,710

chance to sample the state of carbon

442

00:20:03,630 --> 00:20:01,450

dioxide across the full daylight cycle

443

00:20:05,130 --> 00:20:03,640

in contrast Oh co2 is in a

444

00:20:06,960 --> 00:20:05,140

sun-synchronous orbit which means that

445

00:20:09,000 --> 00:20:06,970

it is seeing the roughly same spot on

446

00:20:11,130 --> 00:20:09,010

earth at roughly the same time of day so

447

00:20:13,500 --> 00:20:11,140

now we get this new enhanced capability

448

00:20:16,200 --> 00:20:13,510

with OC o3 that we don't have a no co2

449

00:20:18,960 --> 00:20:16,210

the other enhancement we have is because

450

00:20:23,040 --> 00:20:18,970

oh co2 would point the instrument using

451
00:20:24,870 --> 00:20:23,050
the spacecraft we can't ask ISS 2.0 Co 3

452
00:20:26,520 --> 00:20:24,880
so we had to add a pointing mechanism to

453
00:20:29,070 --> 00:20:26,530
it and that pointing mechanism is very

454
00:20:31,049 --> 00:20:29,080
agile and it can allow us to scan large

455
00:20:33,810 --> 00:20:31,059
areas in a single pass so as an example

456
00:20:36,480 --> 00:20:33,820
o co2 takes multiple passes before it

457
00:20:38,850 --> 00:20:36,490
can scan the entire LA basin that takes

458
00:20:40,110 --> 00:20:38,860
multiple days to do o co 3 we can do it

459
00:20:41,700 --> 00:20:40,120
in a single pass and now you get a

460
00:20:43,620 --> 00:20:41,710
snapshot in time of what the carbon

461
00:20:46,530 --> 00:20:43,630
dioxide state is at any given time of

462
00:20:47,970 --> 00:20:46,540
the day so we could see what if it was

463
00:20:52,190 --> 00:20:47,980

going over right now we could see what's

464

00:20:54,950 --> 00:20:53,750

so it was a great question right now

465

00:20:57,020 --> 00:20:54,960

somebody could be watching it tomorrow

466

00:20:58,940 --> 00:20:57,030

during the day that's true if I wouldn't

467

00:21:00,620 --> 00:20:58,950

see it but that's it would see yes I

468

00:21:02,390 --> 00:21:00,630

actually like your question because one

469

00:21:03,590 --> 00:21:02,400

of the interesting facts about how we

470

00:21:05,390 --> 00:21:03,600

make that measurement it relies on

471

00:21:07,490 --> 00:21:05,400

reflected sunlight so the way we make

472

00:21:09,440 --> 00:21:07,500

the measurement is that the Sun shines

473

00:21:12,260 --> 00:21:09,450

down onto the earth and it reflects up

474

00:21:14,500 --> 00:21:12,270

into the instrument and we know what

475

00:21:16,700 --> 00:21:14,510

wavelengths of light that carbon dioxide

476

00:21:18,440 --> 00:21:16,710

absorbs so we call these absorption

477

00:21:20,510 --> 00:21:18,450

lines what we do is we look at these

478

00:21:21,230 --> 00:21:20,520

wavelengths of lights that are in the

479

00:21:23,480 --> 00:21:21,240

near-infrared

480

00:21:25,700 --> 00:21:23,490

and when we see the absence of that

481

00:21:27,049 --> 00:21:25,710

light in these very specific wavelengths

482

00:21:29,630 --> 00:21:27,059

that's how we know how many molecules

483

00:21:31,370 --> 00:21:29,640

are of carbon dioxide are there we can

484

00:21:33,380 --> 00:21:31,380

only do this during the daytime so oh Co

485

00:21:35,620 --> 00:21:33,390

30 co2 can only make these measurements

486

00:21:37,340 --> 00:21:35,630

in the daytime so that seems like

487

00:21:40,430 --> 00:21:37,350

calibrating something like this would be

488

00:21:42,110 --> 00:21:40,440

a little hard because you have to have

489

00:21:43,909 --> 00:21:42,120

the entire International Space Station

490

00:21:45,140 --> 00:21:43,919

kind of on your side or I mean you talk

491

00:21:48,169 --> 00:21:45,150

about calibration a little bit here of

492

00:21:51,310 --> 00:21:48,179

this one way that will show true and

493

00:21:55,789 --> 00:21:51,320

also tree are working together yeah is

494

00:21:59,870 --> 00:21:55,799

by help iesous to helping Osseo tree on

495

00:22:03,380 --> 00:21:59,880

its radiometric calibration why because

496

00:22:05,810 --> 00:22:03,390

differently from Oh co2 no co3 cannot

497

00:22:07,640 --> 00:22:05,820

look at the Sun because it's geometric

498

00:22:10,730 --> 00:22:07,650

constraints from being attached to

499

00:22:14,180 --> 00:22:10,740

International Space Station but why do

500

00:22:15,830 --> 00:22:14,190

we want to look at the Sun right so what

501
00:22:18,560 --> 00:22:15,840
like Matt was saying what these

502
00:22:19,909 --> 00:22:18,570
instruments measure is actually the

503
00:22:23,390 --> 00:22:19,919
amount of light that is hitting the

504
00:22:26,060 --> 00:22:23,400
detector and what they register is

505
00:22:29,450 --> 00:22:26,070
actually an integer number that we call

506
00:22:32,240 --> 00:22:29,460
counts and that don't really have a

507
00:22:34,730 --> 00:22:32,250
physical meaning attached them just

508
00:22:38,600 --> 00:22:34,740
counts and it's up to us to give a

509
00:22:40,659 --> 00:22:38,610
meaning to this number and what we do we

510
00:22:43,340 --> 00:22:40,669
solve that through a process called

511
00:22:45,890 --> 00:22:43,350
radiometric calibration and what we do

512
00:22:47,870 --> 00:22:45,900
is we grab a source of light that we

513
00:22:50,390 --> 00:22:47,880

know very well we know how much light

514

00:22:55,070 --> 00:22:50,400

that source is outputting we know it's

515

00:22:57,440 --> 00:22:55,080

radiance and we we observe the source of

516

00:22:59,810 --> 00:22:57,450

light with our instrument and we compare

517

00:23:02,120 --> 00:22:59,820

the radiance from the source with the

518

00:23:05,120 --> 00:23:02,130

counts from the instrument and we

519

00:23:05,870 --> 00:23:05,130

derived these factors that allow us to

520

00:23:08,540 --> 00:23:05,880

transform

521

00:23:10,310 --> 00:23:08,550

from counts into radians thus giving

522

00:23:14,990 --> 00:23:10,320

meaning to the reading of the instrument

523

00:23:17,360 --> 00:23:15,000

and on-orbit one obvious choice of a

524

00:23:19,730 --> 00:23:17,370

source that we know very well is the Sun

525

00:23:22,760 --> 00:23:19,740

so lots of the instruments that orbit

526

00:23:27,290 --> 00:23:22,770

the earth calibrate themselves by

527

00:23:28,460 --> 00:23:27,300

looking at the Sun so that's one of the

528

00:23:30,740 --> 00:23:28,470

so one of the ways that they're working

529

00:23:33,160 --> 00:23:30,750

together is with alright so the point is

530

00:23:37,090 --> 00:23:33,170

with also - being able to have this

531

00:23:40,070 --> 00:23:37,100

precise calibration we are able to

532

00:23:41,870 --> 00:23:40,080

sometimes both of you to you know switch

533

00:23:44,480 --> 00:23:41,880

we are able to see the same place on the

534

00:23:46,130 --> 00:23:44,490

ground within a certain time span and

535

00:23:48,800 --> 00:23:46,140

then we can compare the outputs of the

536

00:23:49,940 --> 00:23:48,810

two instruments so these spacecraft are

537

00:23:51,890 --> 00:23:49,950

bringing they're sending all this data

538

00:23:57,650 --> 00:23:51,900

back Karen how would we be able to find

539

00:23:59,840 --> 00:23:57,660

and see this this data well now I'm

540

00:24:02,960 --> 00:23:59,850

gonna put on my captain do a little

541

00:24:04,430 --> 00:24:02,970

spiel for NASA so we actually archive

542

00:24:08,690 --> 00:24:04,440

all the day that it comes back so all

543

00:24:10,370 --> 00:24:08,700

the NASA missions actually bring the

544

00:24:12,020 --> 00:24:10,380

data back and they actually go into

545

00:24:16,160 --> 00:24:12,030

these libraries and then we call them

546

00:24:17,810 --> 00:24:16,170

the archives and this is something

547

00:24:20,480 --> 00:24:17,820

that's very valuable because this is

548

00:24:22,760 --> 00:24:20,490

taxpayer funded effort and all the data

549

00:24:26,330 --> 00:24:22,770

is publicly available so you would go to

550

00:24:28,510 --> 00:24:26,340

the docs and you can go in and you would

551
00:24:31,700 --> 00:24:28,520
be able to request data and be able to

552
00:24:35,270 --> 00:24:31,710
play with it and use it I am going to

553
00:24:36,530 --> 00:24:35,280
qualify that the the there are file

554
00:24:38,750 --> 00:24:36,540
formats that you have to know how to

555
00:24:41,900 --> 00:24:38,760
work with but we have people that can

556
00:24:44,680 --> 00:24:41,910
help folks with that but it's it's it's

557
00:24:48,440 --> 00:24:44,690
publicly available anyone can use it and

558
00:24:49,370 --> 00:24:48,450
they can do what they want and in fact

559
00:24:52,040 --> 00:24:49,380
that's something that we're actually

560
00:24:54,910 --> 00:24:52,050
looking forward to because you're

561
00:24:57,020 --> 00:24:54,920
talking about oco-2 and no co3

562
00:24:59,480 --> 00:24:57,030
we're waiting to release the us go

563
00:25:01,580 --> 00:24:59,490

through data but since i co - no co 3

564

00:25:03,890 --> 00:25:01,590

will be it's the same data sets will be

565

00:25:05,780 --> 00:25:03,900

using the same algorithm a lot of the

566

00:25:07,430 --> 00:25:05,790

users that's interested in the data we

567

00:25:09,410 --> 00:25:07,440

actually train them with the oco-2 data

568

00:25:09,800 --> 00:25:09,420

so they know how to use it and then when

569

00:25:11,570 --> 00:25:09,810

we

570

00:25:13,150 --> 00:25:11,580

release the oshio three data it's not

571

00:25:15,800 --> 00:25:13,160

going to be such a surprise for them

572

00:25:17,690 --> 00:25:15,810

this is everybody in this room can get

573

00:25:20,930 --> 00:25:17,700

this data today where they go to

574

00:25:23,330 --> 00:25:20,940

nasa.gov urge APL nasa.gov were well I

575

00:25:27,620 --> 00:25:23,340

would encourage them to go to for the

576
00:25:29,840 --> 00:25:27,630
moment it would be Oh co2 nasa.gov and

577
00:25:32,060 --> 00:25:29,850
if you go in there you would see our art

578
00:25:35,900 --> 00:25:32,070
we have some links that will take you

579
00:25:36,590 --> 00:25:35,910
there so co2 at JPL nasa.gov I'll say it

580
00:25:41,210 --> 00:25:36,600
one more time

581
00:25:44,240 --> 00:25:41,220
Oh co2 at JPL NASA ah cool that's all

582
00:25:47,030 --> 00:25:44,250
this data is ours and it's not easy to

583
00:25:49,220 --> 00:25:47,040
get it there are a lot of risks that

584
00:25:50,930 --> 00:25:49,230
come with a mission like this as we saw

585
00:25:53,870 --> 00:25:50,940
from the very beginning there's a lot of

586
00:25:56,960 --> 00:25:53,880
hope there's a lot of perseverance that

587
00:25:58,820 --> 00:25:56,970
comes in missions like this what were

588
00:26:02,980 --> 00:25:58,830

some of these risks even here on the

589

00:26:07,550 --> 00:26:02,990

ground for something like this 30:12

590

00:26:11,330 --> 00:26:07,560

yeah so aside from the technical risks

591

00:26:14,390 --> 00:26:11,340

right so you know we're the space

592

00:26:16,940 --> 00:26:14,400

business is unforgiving there no

593

00:26:19,040 --> 00:26:16,950

guarantees right so it's all calculated

594

00:26:20,990 --> 00:26:19,050

risk especially when you're building one

595

00:26:25,430 --> 00:26:21,000

of a kind which is what we did with

596

00:26:27,740 --> 00:26:25,440

yellow CoCl_2 and no Co_3 but it's not

597

00:26:30,200 --> 00:26:27,750

just all technical challenges and we had

598

00:26:35,540 --> 00:26:30,210

a couple of programmatic challenges on

599

00:26:39,140 --> 00:26:35,550

OSI o_3 we survived not one but two

600

00:26:41,000 --> 00:26:39,150

threats of cancellation and that was a

601
00:26:42,290 --> 00:26:41,010
significant challenge and trying to keep

602
00:26:45,200 --> 00:26:42,300
the team together and keep them

603
00:26:47,030 --> 00:26:45,210
motivated and making sure that we were

604
00:26:50,990 --> 00:26:47,040
all still working towards a common goal

605
00:26:54,230 --> 00:26:51,000
and we trusted and the nation's

606
00:26:57,410 --> 00:26:54,240
appropriations process to come through

607
00:27:01,250 --> 00:26:57,420
for us and and it did we eventually got

608
00:27:06,380 --> 00:27:01,260
reinstated funded and we launched o co 3

609
00:27:07,820 --> 00:27:06,390
on the 4th of May of this year so we've

610
00:27:11,180 --> 00:27:07,830
had a lot of challenges along the way

611
00:27:13,670 --> 00:27:11,190
and a lot of obstacles to overcome but

612
00:27:15,530 --> 00:27:13,680
we've had a great team and you know

613
00:27:17,810 --> 00:27:15,540

that's one of the greatest privileges I

614

00:27:20,180 --> 00:27:17,820

think in working here at JPL is working

615

00:27:22,610 --> 00:27:20,190

with a talented group of individuals

616

00:27:23,810 --> 00:27:22,620

working together as a team working

617

00:27:27,289 --> 00:27:23,820

towards a common

618

00:27:30,590 --> 00:27:27,299

and for me that that's been a fantastic

619

00:27:33,110 --> 00:27:30,600

experience overall and maybe to tag on

620

00:27:36,500 --> 00:27:33,120

to what Karen was saying in Graziella

621

00:27:40,180 --> 00:27:36,510

with the science data records science

622

00:27:43,669 --> 00:27:40,190

data product to low co2 and OC o3

623

00:27:46,789 --> 00:27:43,679

they're great on their own but we're

624

00:27:48,590 --> 00:27:46,799

gonna have even greater synergy with

625

00:27:51,830 --> 00:27:48,600

other measurements that are being made

626
00:27:53,539 --> 00:27:51,840
on the international space station there

627
00:27:56,210 --> 00:27:53,549
are two other NASA instruments that are

628
00:28:00,580 --> 00:27:56,220
flying right now what a mom is called

629
00:28:03,409 --> 00:28:00,590
eco stress so that's the ecosystem

630
00:28:06,019 --> 00:28:03,419
spaceborne thermal radiometer experience

631
00:28:09,019 --> 00:28:06,029
experiment on the space station is

632
00:28:10,970 --> 00:28:09,029
another one like I don't know rip that

633
00:28:12,860 --> 00:28:10,980
off that's a hard acronym man there's

634
00:28:14,510 --> 00:28:12,870
another one that's also flying at the

635
00:28:18,139 --> 00:28:14,520
Japanese experiment module

636
00:28:22,070 --> 00:28:18,149
it's called Jedi and so that's the

637
00:28:25,220 --> 00:28:22,080
global ecosystem was that dynamics

638
00:28:28,730 --> 00:28:25,230

investigation lidar system so Eco stress

639

00:28:32,120 --> 00:28:28,740

gives us evapotranspiration Jedi

640

00:28:35,930 --> 00:28:32,130

provides us biomass information so the

641

00:28:38,419 --> 00:28:35,940

one thing that we developed on the oco-2

642

00:28:40,610 --> 00:28:38,429

mission was actually a bonus data

643

00:28:43,630 --> 00:28:40,620

product called solar induced

644

00:28:46,580 --> 00:28:43,640

fluorescence so we all know that plants

645

00:28:52,100 --> 00:28:46,590

grow but not in Veni of us know that

646

00:28:54,019 --> 00:28:52,110

plants oil and so one of our wavelengths

647

00:28:55,730 --> 00:28:54,029

of the three wavelengths on the the

648

00:28:59,060 --> 00:28:55,740

instrument we can actually see these

649

00:29:00,970 --> 00:28:59,070

plants glowing from space and so that

650

00:29:03,200 --> 00:29:00,980

glow is basically a measure of the

651
00:29:06,260 --> 00:29:03,210
photosynthesis efficiency of the plants

652
00:29:08,149 --> 00:29:06,270
which is a measure of the health so it

653
00:29:11,060 --> 00:29:08,159
provides us an indicator kind of a

654
00:29:13,279 --> 00:29:11,070
leading indicator of plant stress and so

655
00:29:17,750 --> 00:29:13,289
we could use our stiff measurements from

656
00:29:19,880 --> 00:29:17,760
oco-2 no co3 and try to correlate them

657
00:29:22,639 --> 00:29:19,890
with the evapotranspiration measurements

658
00:29:25,730 --> 00:29:22,649
from eco stress and also from the

659
00:29:28,399 --> 00:29:25,740
biomass measurements from Jedi so those

660
00:29:31,310 --> 00:29:28,409
are just some of the you know few things

661
00:29:34,310 --> 00:29:31,320
that can come together and really make

662
00:29:35,919 --> 00:29:34,320
this a boon for the science community

663
00:29:38,460 --> 00:29:35,929

and also the data application

664

00:29:42,600 --> 00:29:38,470

community like remember Karen and I

665

00:29:44,889 --> 00:29:42,610

walked through some cornfields in Iowa

666

00:29:47,590 --> 00:29:44,899

trying to figure out if there was any

667

00:29:49,539 --> 00:29:47,600

kind of a partnership arrangement with

668

00:29:52,109 --> 00:29:49,549

the US Department of Agriculture right

669

00:29:56,350 --> 00:29:52,119

so the Agricultural Research Service and

670

00:30:00,159 --> 00:29:56,360

that was a great experience for us to be

671

00:30:02,830 --> 00:30:00,169

able to understand how we not just JPL

672

00:30:04,629 --> 00:30:02,840

you know and our missions but NASA can

673

00:30:08,169 --> 00:30:04,639

contribute to the success of another

674

00:30:14,169 --> 00:30:08,179

agency and eventually their partnership

675

00:30:17,889 --> 00:30:14,179

can flow down and benefit farmers people

676

00:30:19,980 --> 00:30:17,899

that are looking out for us people that

677

00:30:23,200 --> 00:30:19,990

are interested in food security topics

678

00:30:25,359 --> 00:30:23,210

so I mentioned earlier that you have to

679

00:30:27,759 --> 00:30:25,369

find something that you truly believe in

680

00:30:29,889 --> 00:30:27,769

it was something that inspires you

681

00:30:31,539 --> 00:30:29,899

something that wakes you up in the

682

00:30:33,730 --> 00:30:31,549

morning it says you know I got to get

683

00:30:36,369 --> 00:30:33,740

into work because I've got to put in a

684

00:30:38,680 --> 00:30:36,379

good day and I have to contribute to the

685

00:30:41,830 --> 00:30:38,690

success as part of a member of a larger

686

00:30:42,070 --> 00:30:41,840

team I mean that's what really motivates

687

00:30:46,629 --> 00:30:42,080

me

688

00:30:49,680 --> 00:30:46,639

it's OC o2 and O co 3 are just just

689

00:30:51,850 --> 00:30:49,690

small pieces you know of greater puzzle

690

00:30:53,259 --> 00:30:51,860

something I have appreciated about

691

00:30:56,019 --> 00:30:53,269

getting to know all of you putting this

692

00:30:57,430 --> 00:30:56,029

together has been not just the teamwork

693

00:30:59,200 --> 00:30:57,440

and the care that you all have for each

694

00:31:01,869 --> 00:30:59,210

other but exactly that we're here

695

00:31:04,810 --> 00:31:01,879

talking about your mission and you want

696

00:31:07,389 --> 00:31:04,820

to talk about everybody's mission and

697

00:31:11,200 --> 00:31:07,399

this I mean this is what it's all about

698

00:31:13,299 --> 00:31:11,210

it's a part of a bigger team not to

699

00:31:15,639 --> 00:31:13,309

sidetrack but if we did do a lecture on

700

00:31:16,899 --> 00:31:15,649

eco stress it's on our website so you

701
00:31:19,180 --> 00:31:16,909
can find that one back if you want more

702
00:31:20,799 --> 00:31:19,190
information about that but the way that

703
00:31:22,299 --> 00:31:20,809
these really all piece together

704
00:31:25,419 --> 00:31:22,309
it is answering some of the bigger

705
00:31:28,330 --> 00:31:25,429
questions rather than it's one data set

706
00:31:30,669 --> 00:31:28,340
for a bigger question right now I don't

707
00:31:32,769 --> 00:31:30,679
know if Erin Karen wants to tag on to

708
00:31:36,399 --> 00:31:32,779
that but you know these are all part and

709
00:31:39,609 --> 00:31:36,409
parcel to us understanding these

710
00:31:41,830 --> 00:31:39,619
different processes and how it'll

711
00:31:45,190 --> 00:31:41,840
influence climate change in the future

712
00:31:47,500 --> 00:31:45,200
and it's a unique opportunity because

713
00:31:50,649 --> 00:31:47,510

if you think about me was designed that

714

00:31:52,990 --> 00:31:50,659

way right and the experiment module

715

00:31:55,930 --> 00:31:53,000

allows different instruments to

716

00:31:58,600 --> 00:31:55,940

basically do what we call almost

717

00:31:59,889 --> 00:31:58,610

coincident measurements because that's a

718

00:32:01,509 --> 00:31:59,899

something that we worry about in

719

00:32:03,190 --> 00:32:01,519

Sciences when you start combining

720

00:32:05,500 --> 00:32:03,200

datasets or even if you're just looking

721

00:32:07,299 --> 00:32:05,510

on its own everyone's thinking where are

722

00:32:09,159 --> 00:32:07,309

you looking at what's the time of day

723

00:32:10,990 --> 00:32:09,169

and you want to start combining the data

724

00:32:12,310 --> 00:32:11,000

that's something that's really important

725

00:32:14,110 --> 00:32:12,320

and you can ask any of the modelers

726

00:32:17,350 --> 00:32:14,120

they're gonna go there's like oh can I

727

00:32:19,990 --> 00:32:17,360

use it this is right and when you pretty

728

00:32:23,259 --> 00:32:20,000

much give them the measurements package

729

00:32:25,480 --> 00:32:23,269

in a way that they say oh okay this part

730

00:32:27,430 --> 00:32:25,490

is already good I know that so how can I

731

00:32:29,500 --> 00:32:27,440

work with it there's just a confidence

732

00:32:32,080 --> 00:32:29,510

level that that's really important and

733

00:32:33,789 --> 00:32:32,090

in fact in a few weeks there's a really

734

00:32:37,450 --> 00:32:33,799

large science conference it's called the

735

00:32:40,060 --> 00:32:37,460

American Geophysical Union and Osio to

736

00:32:41,860 --> 00:32:40,070

know co3 we're putting together workshop

737

00:32:43,360 --> 00:32:41,870

and we actually invite our colleagues

738

00:32:46,570 --> 00:32:43,370

from eco stress to participate with us

739

00:32:48,039 --> 00:32:46,580

and we're actually looking at how we can

740

00:32:50,350 --> 00:32:48,049

look at the data together what makes

741

00:32:52,330 --> 00:32:50,360

sense what doesn't make sense and this

742

00:32:55,960 --> 00:32:52,340

is going back to what I said you know by

743

00:32:57,580 --> 00:32:55,970

looking at what they can together when

744

00:33:01,389 --> 00:32:57,590

we do the training when we teach people

745

00:33:03,460 --> 00:33:01,399

how to use the oco-2 sift data when

746

00:33:05,669 --> 00:33:03,470

they're ready they'll be know how to use

747

00:33:08,110 --> 00:33:05,679

the O Co 3 data and they'll be ready to

748

00:33:09,430 --> 00:33:08,120

explore how else to use the other day

749

00:33:12,029 --> 00:33:09,440

they're either from eco stress or

750

00:33:13,990 --> 00:33:12,039

eventually maybe even Jedi because

751

00:33:15,759 --> 00:33:14,000

jedaiah doesn't have what we call a

752

00:33:20,379 --> 00:33:15,769

temporal aspect because they're actually

753

00:33:22,210 --> 00:33:20,389

putting together a biomass map at a very

754

00:33:24,039 --> 00:33:22,220

high resolution at one kilometer and

755

00:33:26,080 --> 00:33:24,049

there really isn't much change we think

756

00:33:29,200 --> 00:33:26,090

over the force in the course of a year

757

00:33:31,120 --> 00:33:29,210

but we don't have a baseline like that

758

00:33:34,060 --> 00:33:31,130

so going back Oh see Oh to set that

759

00:33:36,610 --> 00:33:34,070

baseline Oh co3 will continue it eco

760

00:33:38,649 --> 00:33:36,620

stress is providing that temperature

761

00:33:40,509 --> 00:33:38,659

data to look at the pant plant stress

762

00:33:43,870 --> 00:33:40,519

and then Jedi were being able to form

763

00:33:46,299 --> 00:33:43,880

the the biomass image I'm sorry the

764

00:33:48,250 --> 00:33:46,309

biomass maps that we need just being

765

00:33:49,750 --> 00:33:48,260

able to look at all that together folks

766

00:33:51,790 --> 00:33:49,760

that are studying biodiversity and

767

00:33:54,130 --> 00:33:51,800

ecosystems this is really a job

768

00:33:56,230 --> 00:33:54,140

for them and you're also what you talk

769

00:33:58,150 --> 00:33:56,240

about with getting the information out

770

00:33:59,920 --> 00:33:58,160

there but teaching but you're creating

771

00:34:01,960 --> 00:33:59,930

earth science literacy you're trying to

772

00:34:03,160 --> 00:34:01,970

get people who are know what they're

773

00:34:05,110 --> 00:34:03,170

looking at rather than what the

774

00:34:06,220 --> 00:34:05,120

scientists and also for the public

775

00:34:08,560 --> 00:34:06,230

because there's always a general

776

00:34:10,360 --> 00:34:08,570

assumption that folks oh they'll just

777

00:34:11,889 --> 00:34:10,370

know how to use the data and that's not

778

00:34:13,300 --> 00:34:11,899

true cuz not everyone's trained to work

779

00:34:14,710 --> 00:34:13,310

with maraud sensing data you can have a

780

00:34:16,180 --> 00:34:14,720

PhD and you don't know how to work with

781

00:34:17,950 --> 00:34:16,190

our data but it does it but you don't

782

00:34:20,950 --> 00:34:17,960

need a PhD to work with our data and

783

00:34:22,810 --> 00:34:20,960

it's just knowing what to do and then

784

00:34:26,889 --> 00:34:22,820

going forward and as I like to say play

785

00:34:29,080 --> 00:34:26,899

with the data know speaking of playing

786

00:34:30,130 --> 00:34:29,090

mat some of these photos and videos it

787

00:34:34,270 --> 00:34:30,140

looks like you're having a lot of fun

788

00:34:37,630 --> 00:34:34,280

building the spacecraft obviously it was

789

00:34:41,889 --> 00:34:37,640

something you enjoyed it didn't go this

790

00:34:44,230 --> 00:34:41,899

fast what were some of the some of the I

791

00:34:45,490 --> 00:34:44,240

guess the risks of the of the full

792

00:34:48,100 --> 00:34:45,500

assembly were talked about technical a

793

00:34:49,930 --> 00:34:48,110

little bit was was it smooth besides the

794

00:34:51,430 --> 00:34:49,940

the kind of delays where the smooth

795

00:34:53,649 --> 00:34:51,440

process yeah overall I think it was

796

00:34:55,600 --> 00:34:53,659

smooth one of you were asking about

797

00:34:57,370 --> 00:34:55,610

risks and one of the early risks very

798

00:34:58,480 --> 00:34:57,380

low likelihood that this was going to be

799

00:35:00,130 --> 00:34:58,490

a problem with something we worried

800

00:35:02,710 --> 00:35:00,140

about was that we were inheriting this

801
00:35:04,360 --> 00:35:02,720
twin sister instrument from oco-2 it had

802
00:35:06,160 --> 00:35:04,370
been a storage container for over three

803
00:35:07,600 --> 00:35:06,170
years so we were really anxious to find

804
00:35:10,300 --> 00:35:07,610
out how well was this isn't gonna work

805
00:35:12,010 --> 00:35:10,310
when we pulled it out of that giant bin

806
00:35:13,570 --> 00:35:12,020
in the high bay and we were really

807
00:35:15,220 --> 00:35:13,580
pleased when we put it into thermal

808
00:35:16,390 --> 00:35:15,230
vacuum and we started doing performance

809
00:35:17,680 --> 00:35:16,400
testing on it we're seeing that it was

810
00:35:19,990 --> 00:35:17,690
functioning really well so that was a

811
00:35:22,420 --> 00:35:20,000
risk we were really happy to retire

812
00:35:25,510 --> 00:35:22,430
another risk I think you have a picture

813
00:35:30,010 --> 00:35:25,520

of it up here Brian from the vibration

814

00:35:35,770 --> 00:35:30,020

test once again lots of pictures of the

815

00:35:41,830 --> 00:35:35,780

team here did I go past it we're great

816

00:35:43,480 --> 00:35:41,840

again yes so this was another of course

817

00:35:44,980 --> 00:35:43,490

scary tests even though we done all the

818

00:35:46,840 --> 00:35:44,990

analysis to prove that this was going to

819

00:35:47,980 --> 00:35:46,850

work so when we fly on a rocket we have

820

00:35:50,560 --> 00:35:47,990

to prove that the instruments going to

821

00:35:52,510 --> 00:35:50,570

survive that launch and so we put it on

822

00:35:53,920 --> 00:35:52,520

a table that shakes the instrument as if

823

00:35:55,480 --> 00:35:53,930

it's going to be shaken on the rocket we

824

00:35:58,090 --> 00:35:55,490

call it a random vibration test and so

825

00:36:00,220 --> 00:35:58,100

this is a picture of that test when we

826

00:36:03,730 --> 00:36:00,230

did it so one of my favorite stories

827

00:36:05,400 --> 00:36:03,740

from this test was that if you see that

828

00:36:07,930 --> 00:36:05,410

long bar that's

829

00:36:10,029 --> 00:36:07,940

horizontally from left to right that was

830

00:36:12,309 --> 00:36:10,039

a late design edition that we found out

831

00:36:14,559 --> 00:36:12,319

we need it in order to survive our ride

832

00:36:16,359 --> 00:36:14,569

on the rocket and the way that that

833

00:36:18,279 --> 00:36:16,369

thing works is it's compliant it's like

834

00:36:19,900 --> 00:36:18,289

a aircraft wing when you fly you can see

835

00:36:21,519 --> 00:36:19,910

our country that thing is supposed to

836

00:36:22,870 --> 00:36:21,529

bend in order to take some of the loads

837

00:36:24,519 --> 00:36:22,880

from the rocket and reduce the

838

00:36:26,559 --> 00:36:24,529

punishment on our sensitive optics

839

00:36:28,870 --> 00:36:26,569

inside the instrument and so I was

840

00:36:30,400 --> 00:36:28,880

present for that test and I can't tell

841

00:36:32,500 --> 00:36:30,410

you that was the scariest test I've ever

842

00:36:35,200 --> 00:36:32,510

observed in my life because her seeing

843

00:36:37,059 --> 00:36:35,210

our instrument our baby being shaken

844

00:36:38,559 --> 00:36:37,069

very hard you're seeing this thing Bend

845

00:36:42,490 --> 00:36:38,569

and you know that it's supposed to but

846

00:36:43,839 --> 00:36:42,500

it's still scarce and when we got out of

847

00:36:44,980 --> 00:36:43,849

that test and then we tested the

848

00:36:46,900 --> 00:36:44,990

instrument and proved that everything

849

00:36:49,120 --> 00:36:46,910

was working fine that was a huge relief

850

00:36:50,500 --> 00:36:49,130

so that was a retirement of again a very

851

00:36:51,760 --> 00:36:50,510

low likelihood risk that we had done

852

00:36:55,150 --> 00:36:51,770

something wrong but it felt good to get

853

00:36:56,620 --> 00:36:55,160

past that milestone I this a common term

854

00:36:58,150 --> 00:36:56,630

you're saying a retirement of risk

855

00:36:59,529 --> 00:36:58,160

you've used the word retirement that way

856

00:37:01,000 --> 00:36:59,539

and I've never heard of use that way

857

00:37:03,670 --> 00:37:01,010

it's I'm gonna start using it in my

858

00:37:10,900 --> 00:37:03,680

everyday life that was a retirement of

859

00:37:12,910 --> 00:37:10,910

risk after that one okay well that you

860

00:37:16,089 --> 00:37:12,920

talked about these these delays and

861

00:37:17,620 --> 00:37:16,099

these lessons this is something I've

862

00:37:20,289 --> 00:37:17,630

noticed with your team a lot issues

863

00:37:20,829 --> 00:37:20,299

share with each other too nobody ever

864

00:37:22,930 --> 00:37:20,839

takes them

865

00:37:24,069 --> 00:37:22,940

everybody takes their own blame not

866

00:37:27,059 --> 00:37:24,079

takes their blame everybody's

867

00:37:31,690 --> 00:37:27,069

accountable and this team in particular

868

00:37:35,289 --> 00:37:31,700

and Ralph we talked about how there are

869

00:37:37,210 --> 00:37:35,299

few people on this planet that have

870

00:37:38,589 --> 00:37:37,220

experienced what you have I think you

871

00:37:43,059 --> 00:37:38,599

could count on a couple hands of people

872

00:37:44,740 --> 00:37:43,069

who've had that moment and this goes for

873

00:37:45,910 --> 00:37:44,750

everybody though if there's lessons or

874

00:37:48,190 --> 00:37:45,920

something that you could share there's

875

00:37:49,599 --> 00:37:48,200

some younger budding engineers and

876

00:37:51,670 --> 00:37:49,609

scientists in here but also people

877

00:37:53,920 --> 00:37:51,680

who've been here for 30 years if there's

878

00:37:56,470 --> 00:37:53,930

any advice or lessons that you probably

879

00:38:00,400 --> 00:37:56,480

that you have learned from these

880

00:38:03,940 --> 00:38:00,410

experiences so I mentioned it before

881

00:38:06,099 --> 00:38:03,950

that space business is unforgiving that

882

00:38:08,710 --> 00:38:06,109

it's there are no guarantees

883

00:38:10,299 --> 00:38:08,720

everything's calculated risk so I always

884

00:38:13,089 --> 00:38:10,309

say that your project management it's

885

00:38:17,450 --> 00:38:13,099

just risk management yeah that's what it

886

00:38:20,569 --> 00:38:17,460

is for me and so the thing is that

887

00:38:24,109 --> 00:38:20,579

you can put together a perfect plan but

888

00:38:26,720 --> 00:38:24,119

how many perfect plans get executed you

889

00:38:28,970 --> 00:38:26,730

know the way it was intended to so

890

00:38:32,900 --> 00:38:28,980

there's a famous person out there that

891

00:38:35,839 --> 00:38:32,910

said everyone has a plan until they get

892

00:38:39,020 --> 00:38:35,849

punched in the face so so that was Mike

893

00:38:42,069 --> 00:38:39,030

Tyson the champion boxer but he was

894

00:38:45,710 --> 00:38:42,079

actually profound because you have to

895

00:38:47,240 --> 00:38:45,720

understand that all the best laid plans

896

00:38:49,400 --> 00:38:47,250

could be for naught so you have to

897

00:38:52,460 --> 00:38:49,410

develop contingencies or off ramps

898

00:38:54,079 --> 00:38:52,470

because for us on OC o3d we didn't get

899

00:38:56,630 --> 00:38:54,089

punched in the face once we got punched

900

00:38:59,120 --> 00:38:56,640

in the face twice right with two threats

901
00:39:01,130 --> 00:38:59,130
of cancellation but it's being able to

902
00:39:04,370 --> 00:39:01,140
make sure that you've got the the

903
00:39:06,049 --> 00:39:04,380
resiliency yeah to understand that you

904
00:39:09,740 --> 00:39:06,059
know this happens I think after our

905
00:39:11,510 --> 00:39:09,750
second cancellation we we figured out

906
00:39:14,329 --> 00:39:11,520
how to do this the first time it would

907
00:39:16,400 --> 00:39:14,339
just let it roll off our back but you

908
00:39:18,260 --> 00:39:16,410
know that you mentioned that something

909
00:39:21,589 --> 00:39:18,270
about the team I think it was it all

910
00:39:23,720 --> 00:39:21,599
starts with mutual respect and having a

911
00:39:25,670 --> 00:39:23,730
commitment to the mission and also being

912
00:39:28,760 --> 00:39:25,680
committed to to each other

913
00:39:32,210 --> 00:39:28,770

and holding each other accountable you

914

00:39:35,270 --> 00:39:32,220

know and I don't think I'm setting foot

915

00:39:36,980 --> 00:39:35,280

in any meeting where we were stepping on

916

00:39:39,740 --> 00:39:36,990

each other on conversations or

917

00:39:42,440 --> 00:39:39,750

discussions everyone had an equal voice

918

00:39:44,839 --> 00:39:42,450

and I think everyone felt that they

919

00:39:47,750 --> 00:39:44,849

could be heard and in the end we all

920

00:39:51,980 --> 00:39:47,760

made a decision that was right for the

921

00:39:54,079 --> 00:39:51,990

project and so that was great and those

922

00:39:56,660 --> 00:39:54,089

are the moments I live for all right

923

00:39:58,099 --> 00:39:56,670

many of us here at JPL we're not here to

924

00:39:59,750 --> 00:39:58,109

be billionaires or anything like that

925

00:40:02,900 --> 00:39:59,760

we're here to contribute to the success

926

00:40:05,450 --> 00:40:02,910

of a project or mission the institution

927

00:40:08,289 --> 00:40:05,460

NASA and to provide a value to the

928

00:40:11,930 --> 00:40:08,299

American taxpayer the world at large and

929

00:40:13,849 --> 00:40:11,940

being able to work on a team has really

930

00:40:16,430 --> 00:40:13,859

been at those are the most precious

931

00:40:19,670 --> 00:40:16,440

moments for me to be able to reflect

932

00:40:22,849 --> 00:40:19,680

back on the dozen missions I've worked

933

00:40:24,950 --> 00:40:22,859

on by 30 years here at JPL those are the

934

00:40:26,960 --> 00:40:24,960

special things that I remember you know

935

00:40:28,940 --> 00:40:26,970

being able to you can see people

936

00:40:31,250 --> 00:40:28,950

finishing each other's sentences

937

00:40:34,490 --> 00:40:31,260

or you know what the left hand is doing

938

00:40:37,310 --> 00:40:34,500

you know and it's it's really those kind

939

00:40:39,620 --> 00:40:37,320

of special moments are I think it's

940

00:40:41,870 --> 00:40:39,630

really part and parcel to being here JPL

941

00:40:46,100 --> 00:40:41,880

is a special place and the people that

942

00:40:48,760 --> 00:40:46,110

work here are special I don't even work

943

00:40:51,280 --> 00:40:48,770

for you but you always make me good

944

00:40:53,540 --> 00:40:51,290

let's go

945

00:40:55,490 --> 00:40:53,550

what are what are some other lessons

946

00:40:57,230 --> 00:40:55,500

that we anybody was making on the that's

947

00:40:59,570 --> 00:40:57,240

what some something that a big thing

948

00:41:03,620 --> 00:40:59,580

that you learned on this one well mine

949

00:41:05,180 --> 00:41:03,630

is not exactly comparable to his because

950

00:41:09,500 --> 00:41:05,190

I have been working on this team for

951
00:41:13,460 --> 00:41:09,510
only one year but the story I have to

952
00:41:18,440 --> 00:41:13,470
tell and was stressful for me and and

953
00:41:24,740 --> 00:41:18,450
taught me something was the tale of the

954
00:41:27,950 --> 00:41:24,750
brightening lamps so also tree carries

955
00:41:31,850 --> 00:41:27,960
onboard calibrators lamps that we know

956
00:41:33,710 --> 00:41:31,860
very well and we observe if we look at

957
00:41:37,100 --> 00:41:33,720
them in order to figure out if our

958
00:41:38,930 --> 00:41:37,110
instrument changed in any way right so

959
00:41:41,000 --> 00:41:38,940
you can imagine how important it is that

960
00:41:44,360 --> 00:41:41,010
our lamps are very stable because we

961
00:41:46,670 --> 00:41:44,370
need to know if when we look at them did

962
00:41:48,200 --> 00:41:46,680
they change did our an instrument change

963
00:41:52,250 --> 00:41:48,210

we need to be able to sell so we need

964

00:41:54,710 --> 00:41:52,260

them to be stable and I wrote a lot of

965

00:41:57,110 --> 00:41:54,720

the pipeline that processes that data I

966

00:41:59,540 --> 00:41:57,120

spent months writing it and I was very

967

00:42:01,280 --> 00:41:59,550

excited after first light to have

968

00:42:04,640 --> 00:42:01,290

finally have data to put through the

969

00:42:07,780 --> 00:42:04,650

pipes and look at the results and when I

970

00:42:11,660 --> 00:42:07,790

look at the results we are registering

971

00:42:14,450 --> 00:42:11,670

radiances that are 15% higher than we

972

00:42:18,320 --> 00:42:14,460

were seeing in pre-launch which is very

973

00:42:20,840 --> 00:42:18,330

unexpected and we were super puzzled and

974

00:42:23,930 --> 00:42:20,850

we could think of three options that

975

00:42:26,030 --> 00:42:23,940

would explain that first one the lamps

976
00:42:29,540 --> 00:42:26,040
actually brightened which isn't great

977
00:42:32,000 --> 00:42:29,550
right we need them to be stable the

978
00:42:34,010 --> 00:42:32,010
second one is the lamps did not brighten

979
00:42:36,920 --> 00:42:34,020
but the instrument became more sensitive

980
00:42:39,380 --> 00:42:36,930
that would be a big jump in sensitivity

981
00:42:42,190 --> 00:42:39,390
but that's not a problem that's what our

982
00:42:43,720 --> 00:42:42,200
calibration is for the the reason

983
00:42:45,280 --> 00:42:43,730
our calibration is to account for

984
00:42:47,520 --> 00:42:45,290
changes in the sensitivity of the

985
00:42:50,710 --> 00:42:47,530
instrument so that wouldn't be a problem

986
00:42:53,410 --> 00:42:50,720
the third one and which was the first

987
00:42:58,210 --> 00:42:53,420
one I thought of was I must have done

988
00:42:59,920 --> 00:42:58,220

something wrong and back then we didn't

989

00:43:02,770 --> 00:42:59,930

have a lot of data to actually tell

990

00:43:04,450 --> 00:43:02,780

which one of the three it was and we

991

00:43:07,990 --> 00:43:04,460

were having trouble with data corruption

992

00:43:10,690 --> 00:43:08,000

so it was very possible that it wasn't

993

00:43:13,540 --> 00:43:10,700

going well with the pipeline my dad

994

00:43:17,950 --> 00:43:13,550

those few values and stuff that we had

995

00:43:21,339 --> 00:43:17,960

to take take into consideration so what

996

00:43:24,760 --> 00:43:21,349

I did was to obsess for weeks about

997

00:43:27,040 --> 00:43:24,770

finding the bug I even had a dream was

998

00:43:29,380 --> 00:43:27,050

that I knew where the bug was and I woke

999

00:43:33,220 --> 00:43:29,390

up in the middle of the night thought

1000

00:43:35,950 --> 00:43:33,230

JPL's VPN to be able to connect and went

1001
00:43:40,349 --> 00:43:35,960
to the cold and rewrote pile of it and

1002
00:43:47,440 --> 00:43:43,990
ok so eventually we got enough data and

1003
00:43:49,359 --> 00:43:47,450
we figure out it was in a bug because we

1004
00:43:51,490 --> 00:43:49,369
were seeing other behaviors that I

1005
00:43:55,000 --> 00:43:51,500
couldn't possibly have created by myself

1006
00:43:56,710 --> 00:43:55,010
if a bug and and we also found other

1007
00:44:01,300 --> 00:43:56,720
evidence that the labs had indeed

1008
00:44:04,059 --> 00:44:01,310
brightened so we had to invent a

1009
00:44:06,940 --> 00:44:04,069
workaround and we did but what I learned

1010
00:44:09,250 --> 00:44:06,950
from this experience is that this work

1011
00:44:12,220 --> 00:44:09,260
that we do for these missions it's very

1012
00:44:13,960 --> 00:44:12,230
complex and it's very prone to mistakes

1013
00:44:17,620 --> 00:44:13,970

there are a lot of places where a

1014

00:44:20,170 --> 00:44:17,630

mistake can be hidden and you're forced

1015

00:44:23,680 --> 00:44:20,180

to work very carefully and check your

1016

00:44:25,750 --> 00:44:23,690

work many many many times even if it's

1017

00:44:29,470 --> 00:44:25,760

true Indian find out that you did not

1018

00:44:31,900 --> 00:44:29,480

make a mistake but this gold stuff maybe

1019

00:44:33,940 --> 00:44:31,910

you made a mistake it's constantly

1020

00:44:38,680 --> 00:44:33,950

walking with you and you have to learn

1021

00:44:41,710 --> 00:44:38,690

to accept its presence there live with

1022

00:44:43,839 --> 00:44:41,720

the ghost that's advice maybe it's a bug

1023

00:44:47,620 --> 00:44:43,849

maybe it's a bug maybe you did it but

1024

00:44:49,660 --> 00:44:47,630

also you were owning that - that

1025

00:44:51,640 --> 00:44:49,670

that could it be a possible as I imagine

1026
00:44:52,910 --> 00:44:51,650
nobody wants to make a mistake right

1027
00:44:55,190 --> 00:44:52,920
especially if it

1028
00:44:57,020 --> 00:44:55,200
it's the work of other people imagine

1029
00:44:58,460 --> 00:44:57,030
you stand there and you tell people

1030
00:45:00,260 --> 00:44:58,470
where all the lamps are bright and then

1031
00:45:01,630 --> 00:45:00,270
you find out it's a bug so that's

1032
00:45:04,280 --> 00:45:01,640
different right

1033
00:45:10,550 --> 00:45:04,290
I'm glad you did I'm sorry about the

1034
00:45:11,870 --> 00:45:10,560
dream we're kind of closing up on what

1035
00:45:14,500 --> 00:45:11,880
we're gonna then we're gonna open up for

1036
00:45:16,580 --> 00:45:14,510
some questions here in the audience

1037
00:45:18,320 --> 00:45:16,590
while we're kind of showing these final

1038
00:45:20,750 --> 00:45:18,330

images behind behind you while you're

1039

00:45:22,670 --> 00:45:20,760

talking you're seeing the the kind of

1040

00:45:24,080 --> 00:45:22,680

final end of when it gets to the

1041

00:45:28,220 --> 00:45:24,090

International Space Station and all

1042

00:45:30,500 --> 00:45:28,230

those cool moments you you feel like a

1043

00:45:31,700 --> 00:45:30,510

family you feel like a positive group no

1044

00:45:38,030 --> 00:45:31,710

matter whether you've been here a year

1045

00:45:39,950 --> 00:45:38,040

or longer than that what I mean

1046

00:45:44,060 --> 00:45:39,960

Ralph you talk about your pride in this

1047

00:45:46,970 --> 00:45:44,070

and your pride and in the project but

1048

00:45:49,520 --> 00:45:46,980

also the work we do here at JPL

1049

00:45:51,200 --> 00:45:49,530

what is everybody most proud of with

1050

00:45:53,780 --> 00:45:51,210

this mission as we kind of see these

1051
00:45:58,010 --> 00:45:53,790
images of this hovering over that our

1052
00:46:00,290 --> 00:45:58,020
planet like this hovering over home you

1053
00:46:03,290 --> 00:46:00,300
have to pride in the mission because of

1054
00:46:06,860 --> 00:46:03,300
I know for me it's it's what it's doing

1055
00:46:09,350 --> 00:46:06,870
it's actually I'm gonna go back having

1056
00:46:12,590 --> 00:46:09,360
that baseline and that data record that

1057
00:46:14,540 --> 00:46:12,600
wasn't there before that's a first and

1058
00:46:18,170 --> 00:46:14,550
being able to do it with an amazing

1059
00:46:21,940 --> 00:46:18,180
group of people that you call yours

1060
00:46:24,470 --> 00:46:21,950
another family it's it's a great feeling

1061
00:46:27,470 --> 00:46:24,480
and it's one thing I've been able to

1062
00:46:28,910 --> 00:46:27,480
pass on to my daughter that it's she's

1063
00:46:30,740 --> 00:46:28,920

never seen me say oh god if they're

1064

00:46:32,000 --> 00:46:30,750

gonna work it's always like hurry up

1065

00:46:33,620 --> 00:46:32,010

hurry up we gotta get to school I mom's

1066

00:46:35,000 --> 00:46:33,630

gonna get to work you know because I

1067

00:46:36,980 --> 00:46:35,010

will I want to go to work and it's a

1068

00:46:39,230 --> 00:46:36,990

great thing to be able to pass on to a

1069

00:46:41,570 --> 00:46:39,240

child to be enthusiastic and happy at

1070

00:46:44,750 --> 00:46:41,580

work and I'm gonna take this moment to

1071

00:46:47,320 --> 00:46:44,760

say I would not be as exciting each day

1072

00:46:50,810 --> 00:46:47,330

if I didn't have a fantastic manager and

1073

00:46:53,480 --> 00:46:50,820

with the pride that Ralph has shown and

1074

00:46:56,000 --> 00:46:53,490

the trust that he's had in us to do our

1075

00:46:58,010 --> 00:46:56,010

jobs to not be afraid to come to him and

1076

00:46:59,480 --> 00:46:58,020

I have this idea I know this is crazy

1077

00:47:02,300 --> 00:46:59,490

but what do you think about doing this

1078

00:47:06,260 --> 00:47:02,310

for application and he was like okay

1079

00:47:08,090 --> 00:47:06,270

prove it to me do it and you go back and

1080

00:47:11,000 --> 00:47:08,100

say oh crap I gotta come up with I'm

1081

00:47:13,220 --> 00:47:11,010

gonna do this and and he let you do that

1082

00:47:21,500 --> 00:47:13,230

and it's it's a wonderful feeling

1083

00:47:23,060 --> 00:47:21,510

so thank you Ralph I'm certainly proud

1084

00:47:25,370 --> 00:47:23,070

of this team like and what we've

1085

00:47:26,510 --> 00:47:25,380

accomplished there was kind of going

1086

00:47:28,460 --> 00:47:26,520

along with what Karen was saying there

1087

00:47:31,010 --> 00:47:28,470

was no challenge that this team said I

1088

00:47:33,080 --> 00:47:31,020

don't know how to solve right if we had

1089

00:47:34,880 --> 00:47:33,090

a problem the team would work late

1090

00:47:37,220 --> 00:47:34,890

nights coming on the weekends whatever

1091

00:47:39,200 --> 00:47:37,230

it took to get us past that to keep us

1092

00:47:41,030 --> 00:47:39,210

moving and ultimately up to the space

1093

00:47:42,890 --> 00:47:41,040

station and I couldn't be prouder to

1094

00:47:44,600 --> 00:47:42,900

work with this group of people who had

1095

00:47:46,700 --> 00:47:44,610

the can-do attitude we're not gonna let

1096

00:47:48,020 --> 00:47:46,710

anything get us down you know whatever

1097

00:47:49,430 --> 00:47:48,030

that problem would be technical

1098

00:47:51,230 --> 00:47:49,440

programmatic we're gonna get this thing

1099

00:47:52,820 --> 00:47:51,240

up to the space station we're gonna make

1100

00:47:56,630 --> 00:47:52,830

this measurement and I'm certainly

1101

00:48:01,630 --> 00:47:56,640

grateful to be a part of that team well

1102

00:48:05,630 --> 00:48:01,640

I'm very proud that I'm doing work that

1103

00:48:10,010 --> 00:48:05,640

has an immediate impact in our ability

1104

00:48:12,140 --> 00:48:10,020

to to reach our our scientific goals and

1105

00:48:14,720 --> 00:48:12,150

our scientific goals are something that

1106

00:48:21,010 --> 00:48:14,730

everybody should be proud of because

1107

00:48:26,300 --> 00:48:21,020

they will give us knowledge that will be

1108

00:48:29,810 --> 00:48:26,310

important for us humans as a society and

1109

00:48:31,610 --> 00:48:29,820

even for our future as it species since

1110

00:48:33,530 --> 00:48:31,620

they for inform us so much about

1111

00:48:37,220 --> 00:48:33,540

something that is tracked me for us

1112

00:48:41,420 --> 00:48:37,230

which is global warming and I think the

1113

00:48:45,950 --> 00:48:41,430

work that is that we do is amazing just

1114

00:48:49,760 --> 00:48:45,960

because of that Ralph you know it's

1115

00:48:52,250 --> 00:48:49,770

working these endeavors that prove our

1116

00:48:55,610 --> 00:48:52,260

quality of life on Earth I mean you

1117

00:48:56,360 --> 00:48:55,620

opened up with this that everyone we've

1118

00:48:58,220 --> 00:48:56,370

ever known

1119

00:49:01,340 --> 00:48:58,230

you know they've lived on planet earth

1120

00:49:04,040 --> 00:49:01,350

and so this would be the only home many

1121

00:49:06,440 --> 00:49:04,050

of us most of us will ever know so the

1122

00:49:09,030 --> 00:49:06,450

work that we do is part and parcel to

1123

00:49:11,700 --> 00:49:09,040

making sure that we

1124

00:49:14,540 --> 00:49:11,710

take care of Mother Earth today yeah

1125

00:49:16,560 --> 00:49:14,550

there were good stores that we could

1126

00:49:18,810 --> 00:49:16,570

hand something down the future

1127

00:49:22,230 --> 00:49:18,820

generations our children and in future

1128

00:49:25,530 --> 00:49:22,240

generations that were proud of and

1129

00:49:29,250 --> 00:49:25,540

that's the main driver for me and and in

1130

00:49:30,660 --> 00:49:29,260

the end I am a firm believer that you

1131

00:49:32,760 --> 00:49:30,670

know it's really the team the people

1132

00:49:34,680 --> 00:49:32,770

that you work with yeah you need the

1133

00:49:36,630 --> 00:49:34,690

hardware yeah you need the software but

1134

00:49:38,940 --> 00:49:36,640

who develops all that who tests that who

1135

00:49:44,130 --> 00:49:38,950

who operates all that equipment up there

1136

00:49:48,480 --> 00:49:44,140

in space so it's those precious moments

1137

00:49:51,030 --> 00:49:48,490

working with a team and I think when my

1138

00:49:52,890 --> 00:49:51,040

career is over here at JPL when I walk

1139

00:49:56,340 --> 00:49:52,900

out the door for the last time

1140

00:49:59,490 --> 00:49:56,350

it'll be those moments you know those

1141

00:50:03,320 --> 00:49:59,500

teams I've worked with that I will carry

1142

00:50:06,450 --> 00:50:03,330

with me as you know the most memorable

1143

00:50:09,930 --> 00:50:06,460

memories from my experiences here at JPL

1144

00:50:12,030 --> 00:50:09,940

and I'm proud to be part of the JPL

1145

00:50:17,030 --> 00:50:12,040

community proud to be part of you know

1146

00:50:19,290 --> 00:50:17,040

the co2 you know co3 teams very cool

1147

00:50:20,640 --> 00:50:19,300

we're now gonna open it up for your

1148

00:50:22,220 --> 00:50:20,650

questions and I know there are a few of

1149

00:50:24,630 --> 00:50:22,230

you online you've been asking questions

1150

00:50:27,630 --> 00:50:24,640

those are gonna work their way up here

1151

00:50:28,859 --> 00:50:27,640

if you do have a question I just asked

1152

00:50:32,250 --> 00:50:28,869

that you just step up to that microphone

1153

00:50:34,140 --> 00:50:32,260

right over there we'll get to as many as

1154

00:50:35,220 --> 00:50:34,150

we possibly can and if we do not get to

1155

00:50:37,140 --> 00:50:35,230

your question tonight

1156

00:50:38,730 --> 00:50:37,150

please don't fret they're gonna hang out

1157

00:50:41,240 --> 00:50:38,740

for a little bit you can come on up and

1158

00:50:44,820 --> 00:50:41,250

ask some questions all right number one

1159

00:50:48,300 --> 00:50:44,830

thanks for great talking at a two part

1160

00:50:52,410 --> 00:50:48,310

two part question first one was with

1161

00:50:57,050 --> 00:50:52,420

your vantage point on this data set how

1162

00:50:58,710 --> 00:50:57,060

do how do you see this this data set

1163

00:51:00,060 --> 00:50:58,720

playing forward in terms of

1164

00:51:03,180 --> 00:51:00,070

ramifications of our understanding of

1165

00:51:04,859 --> 00:51:03,190

climate change and how that will play

1166

00:51:08,640 --> 00:51:04,869

out over the next a little bit the

1167

00:51:10,830 --> 00:51:08,650

second question is programmatic with the

1168

00:51:13,200 --> 00:51:10,840

eventual change of the SS to private

1169

00:51:16,440 --> 00:51:13,210

operation how does that impact okhla

1170

00:51:20,430 --> 00:51:16,450

threes future and and future missions

1171

00:51:22,740 --> 00:51:20,440

along those lines the first part of the

1172

00:51:27,570 --> 00:51:25,590

we actually we we have modelers that's

1173

00:51:29,670 --> 00:51:27,580

on the science team so those are the

1174

00:51:31,470 --> 00:51:29,680

folks that we know if they trust the

1175

00:51:35,310 --> 00:51:31,480

data or not because they'll tell us if

1176

00:51:36,930 --> 00:51:35,320

it's not good enough and that's what

1177

00:51:43,020 --> 00:51:36,940

we're getting to right now we're always

1178

00:51:45,210 --> 00:51:43,030

fine-tuning fine-tuning I think that we

1179

00:51:48,150 --> 00:51:45,220

are seeing in Phoenix and-and-and

1180

00:51:52,380 --> 00:51:48,160

feeling changes now we just need to be

1181

00:51:54,390 --> 00:51:52,390

able to have those models because I have

1182

00:51:55,650 --> 00:51:54,400

those models show us what we hope to see

1183

00:51:58,920 --> 00:51:55,660

because right now I think we're quite

1184

00:52:00,210 --> 00:51:58,930

good with what they're trying to do is

1185

00:52:01,500 --> 00:52:00,220

predict what happened in the past they

1186

00:52:03,810 --> 00:52:01,510

take a data and it's like we know what

1187

00:52:05,640 --> 00:52:03,820

happened is it doing the same thing what

1188

00:52:07,830 --> 00:52:05,650

we eventually like to see is when then

1189

00:52:10,650 --> 00:52:07,840

the the models can start predicting what

1190

00:52:12,600 --> 00:52:10,660

will happen to the future and there's no

1191

00:52:14,550 --> 00:52:12,610

better way to have that than to have our

1192

00:52:16,740 --> 00:52:14,560

our kind of data set that's really

1193

00:52:19,290 --> 00:52:16,750

precise and be able to help them with

1194

00:52:21,840 --> 00:52:19,300

that and we'll just keep working with

1195

00:52:25,110 --> 00:52:21,850

the scientists that do that can I also

1196

00:52:33,560 --> 00:52:25,120

just tag on to that so maybe a couple of

1197

00:52:39,150 --> 00:52:33,570

specific examples so I know co2 el nino

1198

00:52:41,190 --> 00:52:39,160

2015-2016 we were able to see from our

1199

00:52:44,760 --> 00:52:41,200

global perspective that there was a

1200

00:52:47,160 --> 00:52:44,770

increased amount of co2 being emitted to

1201
00:52:49,350 --> 00:52:47,170
the atmosphere during that El Nino cycle

1202
00:52:53,660 --> 00:52:49,360
and it looks like those missions were

1203
00:52:56,910 --> 00:52:53,670
coming from South America Africa and

1204
00:52:58,860 --> 00:52:56,920
Southeast Asia and what we understood

1205
00:53:03,410 --> 00:52:58,870
from doing a little bit more research we

1206
00:53:06,540 --> 00:53:03,420
found out that South America was dry

1207
00:53:10,860 --> 00:53:06,550
Africa wasn't just dry but it was hot

1208
00:53:15,300 --> 00:53:10,870
and Southeast Asia was basically on fire

1209
00:53:17,910 --> 00:53:15,310
and so all of those data sets including

1210
00:53:19,850 --> 00:53:17,920
the ones that we got from IO co2 helped

1211
00:53:23,760 --> 00:53:19,860
us understand what was happening today

1212
00:53:25,860 --> 00:53:23,770
now as far as for the future so here's

1213
00:53:27,780 --> 00:53:25,870

the data applications example and I'm

1214

00:53:32,880 --> 00:53:27,790

sure Karen will resume and she'll

1215

00:53:34,870 --> 00:53:32,890

remember this that the lab director for

1216

00:53:36,880 --> 00:53:34,880

the National Lab for

1217

00:53:39,970 --> 00:53:36,890

agriculture in the environment Gerry

1218

00:53:42,819 --> 00:53:39,980

Hatfield few years ago when we were in

1219

00:53:44,740 --> 00:53:42,829

Iowa he enlightened me so we were

1220

00:53:48,299 --> 00:53:44,750

talking about well you know how can we

1221

00:53:52,359 --> 00:53:48,309

benefit people in the future and

1222

00:53:53,920 --> 00:53:52,369

producers farmers and I think is one

1223

00:53:57,279 --> 00:53:53,930

after one these walks in the cornfield

1224

00:53:59,950 --> 00:53:57,289

so the the interesting thing for me was

1225

00:54:02,079 --> 00:53:59,960

that you know he was excited to be able

1226
00:54:04,599 --> 00:54:02,089
to say look if we get remote sensing

1227
00:54:08,319 --> 00:54:04,609
data from Osio to combine it with our AG

1228
00:54:11,740 --> 00:54:08,329
Research Service data we can provide

1229
00:54:15,670 --> 00:54:11,750
better advice for farmers producers so

1230
00:54:20,049 --> 00:54:15,680
that of these 25 varieties are hybrids

1231
00:54:23,789 --> 00:54:20,059
of corn we can advise them what to plant

1232
00:54:26,559 --> 00:54:23,799
next year based on forecast predictions

1233
00:54:29,049 --> 00:54:26,569
and that was exciting you know for me

1234
00:54:31,240 --> 00:54:29,059
that it's not just serving the needs of

1235
00:54:35,019 --> 00:54:31,250
the science and reach research community

1236
00:54:36,910 --> 00:54:35,029
but also people and that our interest in

1237
00:54:40,059 --> 00:54:36,920
science data applications and inform

1238
00:54:41,799 --> 00:54:40,069

decision making and then the second part

1239

00:54:46,109 --> 00:54:41,809

of your question I think is just really

1240

00:54:49,599 --> 00:54:46,119

quickly is that for me

1241

00:54:50,200 --> 00:54:49,609

competition drives out the best in

1242

00:54:53,609 --> 00:54:50,210

people

1243

00:54:56,710 --> 00:54:53,619

so if they're talking about privatizing

1244

00:54:59,109 --> 00:54:56,720

the space station we've actually seen a

1245

00:55:02,170 --> 00:54:59,119

lot of benefit and the launch vehicle

1246

00:55:03,759 --> 00:55:02,180

arena you know 20 30 years ago when I

1247

00:55:05,769 --> 00:55:03,769

first started here we always talked

1248

00:55:09,970 --> 00:55:05,779

about what's the cost of launching a

1249

00:55:11,980 --> 00:55:09,980

brick into space and it was a lot back

1250

00:55:15,339 --> 00:55:11,990

then but you have a lot of competitors

1251

00:55:19,240 --> 00:55:15,349

out there now so Elon Musk you know and

1252

00:55:23,140 --> 00:55:19,250

Jeff Bezos out there that are driving

1253

00:55:25,809 --> 00:55:23,150

the cost down for access to space which

1254

00:55:28,839 --> 00:55:25,819

allows NASA to have more money to

1255

00:55:31,870 --> 00:55:28,849

develop science instruments to produce

1256

00:55:34,480 --> 00:55:31,880

data and information that we need so I

1257

00:55:37,240 --> 00:55:34,490

think it's actually a good thing that we

1258

00:55:39,370 --> 00:55:37,250

have private industry involved in this

1259

00:55:40,900 --> 00:55:39,380

partnership sanitarian question or how

1260

00:55:42,700 --> 00:55:40,910

paths request I'm pretty much although

1261

00:55:44,359 --> 00:55:42,710

it was about the prioritization of there

1262

00:55:46,370 --> 00:55:44,369

ISS yeah

1263

00:55:48,950 --> 00:55:46,380

specifically a three were a three-year

1264

00:55:50,359 --> 00:55:48,960

mission so we'll be done in 2022 there's

1265

00:55:52,309 --> 00:55:50,369

already another instrument that wants to

1266

00:55:54,259 --> 00:55:52,319

take our spot on the space station so

1267

00:55:57,799 --> 00:55:54,269

we'll be out of there before the

1268

00:55:59,480 --> 00:55:57,809

privatization takes over so answering a

1269

00:56:00,769 --> 00:55:59,490

question of specific tow Co three thank

1270

00:56:02,180 --> 00:56:00,779

you we are gonna move on to our next

1271

00:56:05,180 --> 00:56:02,190

question while you're stepping up to the

1272

00:56:06,799 --> 00:56:05,190

mic actually a good segue this is from

1273

00:56:10,190 --> 00:56:06,809

Tyler from YouTube X what's the expected

1274

00:56:12,200 --> 00:56:10,200

lifespan of o SiO 2 and O co 3 so you

1275

00:56:15,769 --> 00:56:12,210

said o co 3 what's the lifespan of oshio

1276

00:56:18,319 --> 00:56:15,779

2 was a two-year mission and we launched

1277

00:56:21,170 --> 00:56:18,329

in 2014 it's now 2019 we're still going

1278

00:56:23,120 --> 00:56:21,180

strong right now there's no indications

1279

00:56:25,970 --> 00:56:23,130

of anything that's gonna prevent OC o2

1280

00:56:28,180 --> 00:56:25,980

from not operating for a while

1281

00:56:30,859 --> 00:56:28,190

I strive we've got ample fuel on board

1282

00:56:32,690 --> 00:56:30,869

the instruments still going strong so we

1283

00:56:37,339 --> 00:56:32,700

want to use o co2 for as long as we

1284

00:56:40,400 --> 00:56:37,349

possibly can it seems that your since

1285

00:56:43,190 --> 00:56:40,410

there was a passive sensor and since you

1286

00:56:46,039 --> 00:56:43,200

integrated onto the space station can't

1287

00:56:48,289 --> 00:56:46,049

you take an energy source and turn it

1288

00:56:50,569 --> 00:56:48,299

into an active sensor and double its

1289

00:56:54,769 --> 00:56:50,579

effectiveness and use it during the

1290

00:56:59,239 --> 00:56:54,779

night and in fact if it turns out to be

1291

00:57:02,180 --> 00:56:59,249

a viable idea you have my permission and

1292

00:57:03,859 --> 00:57:02,190

run with it still his idea but can you

1293

00:57:05,890 --> 00:57:03,869

turn the passive sensor into an active

1294

00:57:09,470 --> 00:57:05,900

sensor so that I think it's short and

1295

00:57:12,349 --> 00:57:09,480

the short answer froze CO₂ and O₃ is

1296

00:57:15,229 --> 00:57:12,359

is no so it definitely is a passive

1297

00:57:18,200 --> 00:57:15,239

sensors looking at spectra of reflected

1298

00:57:21,079 --> 00:57:18,210

sunlight but NASA hasn't involved JPL

1299

00:57:22,910 --> 00:57:21,089

has been involved in you can do an

1300

00:57:25,009 --> 00:57:22,920

emission that would stimulate the

1301

00:57:27,170 --> 00:57:25,019

atmosphere and that and doing the

1302

00:57:30,019 --> 00:57:27,180

breedings at night answering this

1303

00:57:31,460 --> 00:57:30,029

question though so go for it well there

1304

00:57:32,960 --> 00:57:31,470

are systems out there that are being

1305

00:57:35,569 --> 00:57:32,970

developed that could operate at night

1306

00:57:37,400 --> 00:57:35,579

and I think there may be airborne

1307

00:57:40,670 --> 00:57:37,410

systems that are already trying to do

1308

00:57:42,620 --> 00:57:40,680

that so those are active sensors but you

1309

00:57:45,319 --> 00:57:42,630

know trying to convert if you will o co

1310

00:57:47,569 --> 00:57:45,329

2 and O co 3 I can't do that

1311

00:57:51,109 --> 00:57:47,579

unfortunately just different technology

1312

00:57:52,880 --> 00:57:51,119

thank you for the suggestion yeah Ron

1313

00:57:54,559 --> 00:57:52,890

while you're stepping up Ron is asking

1314

00:57:55,999 --> 00:57:54,569

from you too what is the one factor

1315

00:58:00,670 --> 00:57:56,009

about this mission that still stands out

1316

00:58:09,740 --> 00:58:08,270

silence I mean it literally was a ralph

1317

00:58:10,910 --> 00:58:09,750

was in Karen we're talking about how

1318

00:58:12,290 --> 00:58:10,920

long they've been on this mission I also

1319

00:58:14,570 --> 00:58:12,300

went back in IE mails and found out that

1320

00:58:16,460 --> 00:58:14,580

I had been on this mission since 2011 so

1321

00:58:21,290 --> 00:58:16,470

you know there's a lot of a lot of data

1322

00:58:22,730 --> 00:58:21,300

to sift through we're gonna give you a

1323

00:58:24,620 --> 00:58:22,740

chance to think about this sure and

1324

00:58:26,570 --> 00:58:24,630

we'll move on to our next question first

1325

00:58:28,640 --> 00:58:26,580

off I'd like to say thank you for the

1326

00:58:31,850 --> 00:58:28,650

wonderful night um this question goes

1327

00:58:34,340 --> 00:58:31,860

more so to karen Graciela I'm running a

1328

00:58:35,870 --> 00:58:34,350

chapter of the Society of Women and

1329

00:58:38,840 --> 00:58:35,880

space exploration in my school's campus

1330

00:58:40,700 --> 00:58:38,850

and I just had a question for you what

1331

00:58:42,440 --> 00:58:40,710

advice do you have for young girls and

1332

00:58:44,450 --> 00:58:42,450

specifically just the future generation

1333

00:58:47,600 --> 00:58:44,460

of students for who want to take on

1334

00:58:51,280 --> 00:58:47,610

projects like this with NASA when you

1335

00:58:54,080 --> 00:58:51,290

say take on you mean working yeah okay

1336

00:58:55,850 --> 00:58:54,090

well first of all it's fantastic that

1337

00:59:01,340 --> 00:58:55,860

you're doing that we need more women

1338

00:59:03,650 --> 00:59:01,350

doing that so you applaud you just you

1339

00:59:08,750 --> 00:59:03,660

have to just keep studying you have to

1340

00:59:15,140 --> 00:59:08,760

study and be prepared and apply you know

1341

00:59:16,850 --> 00:59:15,150

and and just know that and I'll let

1342

00:59:19,430 --> 00:59:16,860

Graciela speak also I was very fortunate

1343

00:59:20,840 --> 00:59:19,440

and I came here and I started working

1344

00:59:23,420 --> 00:59:20,850

with a great group of people and very

1345

00:59:26,120 --> 00:59:23,430

supportive and I encourage any woman to

1346

00:59:28,010 --> 00:59:26,130

to come here and apply and work here and

1347

00:59:36,050 --> 00:59:28,020

keep studying we need more women and

1348

00:59:41,900 --> 00:59:36,060

stomach first thing is to be aware that

1349

00:59:46,090 --> 00:59:41,910

you can go into stem choose a field you

1350

00:59:48,590 --> 00:59:46,100

find interesting and study a lot I I did

1351

00:59:51,590 --> 00:59:48,600

undergrad master's and PhD degrees in

1352

00:59:55,820 --> 00:59:51,600

astronomy actually back in Brazil where

1353

01:00:02,090 --> 00:59:55,830

I'm from and I wanted to work for NASA

1354

01:00:04,520 --> 01:00:02,100

right but I was in Brazil so I I had

1355

01:00:06,230 --> 01:00:04,530

participated in this program that sent

1356

01:00:10,040 --> 01:00:06,240

me one year to the United States doing

1357

01:00:12,470 --> 01:00:10,050

my PhD and so I met some women that were

1358

01:00:15,410 --> 01:00:12,480

actually doing work for NASA and when I

1359

01:00:18,440 --> 01:00:15,420

finally finished my PhD I just asked

1360

01:00:21,590 --> 01:00:18,450

them can you please send my resume

1361

01:00:23,870 --> 01:00:21,600

around that's what you got to do you

1362

01:00:26,360 --> 01:00:23,880

need to meet some people and be brave

1363

01:00:30,590 --> 01:00:26,370

enough to you can do it send your resume

1364

01:00:33,890 --> 01:00:30,600

ask them for help and eventually someone

1365

01:00:38,780 --> 01:00:33,900

hired me to work on on space missions

1366

01:00:40,970 --> 01:00:38,790

and that's how you have to do it thank

1367

01:00:42,650 --> 01:00:40,980

you so much

1368

01:00:45,380 --> 01:00:42,660

one last question

1369

01:00:46,610 --> 01:00:45,390

yeah that was great see she asked a

1370

01:00:48,160 --> 01:00:46,620

question she already got a business card

1371

01:00:50,690 --> 01:00:48,170

there you go

1372

01:00:51,770 --> 01:00:50,700

that was my question this is the last

1373

01:00:52,070 --> 01:00:51,780

question of the day that was your

1374

01:00:55,160 --> 01:00:52,080

question

1375

01:00:57,470 --> 01:00:55,170

wanted to ask for the other people on

1376
01:00:58,610 --> 01:00:57,480
the panel what steps that you guys take

1377
01:01:01,670 --> 01:00:58,620
to get to where you are today

1378
01:01:07,610 --> 01:01:01,680
like what started your career here at

1379
01:01:10,970 --> 01:01:07,620
NASA I think that one when I was in

1380
01:01:13,970 --> 01:01:10,980
undergrad in college I remember seeing

1381
01:01:16,220 --> 01:01:13,980
the first video come out about the Mars

1382
01:01:19,790 --> 01:01:16,230
exploration Rovers and I was just blown

1383
01:01:21,290 --> 01:01:19,800
away that you know JPL sent two robots

1384
01:01:23,120 --> 01:01:21,300
to Mars to drive around and the

1385
01:01:24,500 --> 01:01:23,130
engineering challenges that it took to

1386
01:01:27,200 --> 01:01:24,510
get there and I'm like I really want to

1387
01:01:29,420 --> 01:01:27,210
to go work here and one of the things

1388
01:01:31,880 --> 01:01:29,430

some of things I got into in college

1389

01:01:33,530 --> 01:01:31,890

were were projects at my university and

1390

01:01:35,360 --> 01:01:33,540

one of those projects was to build a

1391

01:01:37,340 --> 01:01:35,370

small satellite they called them cube

1392

01:01:39,020 --> 01:01:37,350

sets so I started one in my

1393

01:01:40,040 --> 01:01:39,030

undergraduate University when I went to

1394

01:01:42,230 --> 01:01:40,050

grad school I eventually got the

1395

01:01:43,550 --> 01:01:42,240

opportunity to build one that did fly in

1396

01:01:45,830 --> 01:01:43,560

space and that was an incredible

1397

01:01:47,480 --> 01:01:45,840

opportunity so one of the advices I like

1398

01:01:49,580 --> 01:01:47,490

to give people as they're coming through

1399

01:01:51,170 --> 01:01:49,590

their education and trying to figure out

1400

01:01:52,400 --> 01:01:51,180

how to to work in an engineering

1401

01:01:53,930 --> 01:01:52,410

aerospace field is to try to get

1402

01:01:55,490 --> 01:01:53,940

involved in projects as much as you can

1403

01:01:58,130 --> 01:01:55,500

get that hands-on experience how you

1404

01:02:01,700 --> 01:01:58,140

apply what you learn in the classroom to

1405

01:02:03,140 --> 01:02:01,710

two projects is huge and that will be a

1406

01:02:05,060 --> 01:02:03,150

that'll big something that will help you

1407

01:02:07,790 --> 01:02:05,070

as you go into the employment field cool

1408

01:02:09,590 --> 01:02:07,800

thank you well folks if you're in line

1409

01:02:10,880 --> 01:02:09,600

you can come up and ask in just a second

1410

01:02:13,430 --> 01:02:10,890

but that is all the time that we have

1411

01:02:14,720 --> 01:02:13,440

for tonight first off a couple

1412

01:02:17,390 --> 01:02:14,730

housekeeping things will be taking

1413

01:02:18,980 --> 01:02:17,400

December off but please join us in

1414

01:02:21,109 --> 01:02:18,990

January as we say fair

1415

01:02:23,180 --> 01:02:21,119

all to the Spitzer Space Telescope as it

1416

01:02:25,100 --> 01:02:23,190

prepares for its end of mission also

1417

01:02:27,470 --> 01:02:25,110

happening in January I'd like to thank

1418

01:02:28,670 --> 01:02:27,480

our panel one last time for joining us

1419

01:02:34,500 --> 01:02:28,680

tonight can I get a big round of

1420

01:02:38,099 --> 01:02:36,089

and thank you to all of you for joining

1421

01:02:41,590 --> 01:02:38,109

us today have a great rest your night