



1  
00:00:00,340 --> 00:01:52,950

[Music]

2  
00:01:56,789 --> 00:01:54,789

nasa's james webb space telescope

3  
00:01:58,630 --> 00:01:56,799

launched just eight days ago

4  
00:02:00,789 --> 00:01:58,640

right now we are streaming the final

5  
00:02:02,310 --> 00:02:00,799

stages of the sunshield unfolding from

6  
00:02:04,950 --> 00:02:02,320

the mission control room in baltimore

7  
00:02:07,190 --> 00:02:04,960

maryland this is live coverage of a

8  
00:02:09,029 --> 00:02:07,200

real-time space flight operation as

9  
00:02:12,390 --> 00:02:09,039

controllers prepare the james webb space

10  
00:02:16,309 --> 00:02:14,150

on the morning of december 25th a

11  
00:02:17,750 --> 00:02:16,319

massive rocket called an ariane 5 lifted

12  
00:02:19,910 --> 00:02:17,760

off from a state-of-the-art facility

13  
00:02:22,790 --> 00:02:19,920

located in french guiana

14

00:02:25,030 --> 00:02:22,800

on board the james webb space telescope

15

00:02:26,710 --> 00:02:25,040

bound for a point in space a million

16

00:02:28,710 --> 00:02:26,720

miles away

17

00:02:30,790 --> 00:02:28,720

the process of preparing web for actual

18

00:02:32,550 --> 00:02:30,800

operations is called commissioning and

19

00:02:34,390 --> 00:02:32,560

the majority of that work is taking

20

00:02:36,390 --> 00:02:34,400

place here

21

00:02:38,550 --> 00:02:36,400

at the space telescope science institute

22

00:02:39,830 --> 00:02:38,560

in baltimore

23

00:02:41,990 --> 00:02:39,840

what you're looking at now is some

24

00:02:43,350 --> 00:02:42,000

incredible footage actually live taken

25

00:02:45,350 --> 00:02:43,360

live from the uh the james webb space

26  
00:02:47,509 --> 00:02:45,360  
telescope during launch and here we now

27  
00:02:55,030 --> 00:02:47,519  
see uh the mission operations center in

28  
00:02:55,040 --> 00:03:01,990  
it works

29  
00:03:06,550 --> 00:03:04,149  
and the better status between so

30  
00:03:08,229 --> 00:03:06,560  
i'm your host michelle thawler today and

31  
00:03:10,390 --> 00:03:08,239  
um this is really a momentous and

32  
00:03:11,670 --> 00:03:10,400  
historic event that you're looking at uh

33  
00:03:14,790 --> 00:03:11,680  
we are actually going to be with you

34  
00:03:17,110 --> 00:03:14,800  
live as we finish the major unfolding of

35  
00:03:18,710 --> 00:03:17,120  
the james webb space telescope sunshield

36  
00:03:20,869 --> 00:03:18,720  
this is something that has never been

37  
00:03:22,309 --> 00:03:20,879  
done in space before this is a

38  
00:03:25,030 --> 00:03:22,319

technology that's never been used in

39

00:03:27,270 --> 00:03:25,040

space before i am really really excited

40

00:03:28,550 --> 00:03:27,280

to uh to be here and i want to give you

41

00:03:29,589 --> 00:03:28,560

a little bit of a sense of what's going

42

00:03:31,509 --> 00:03:29,599

on here

43

00:03:32,390 --> 00:03:31,519

a lot of things have been changing very

44

00:03:34,550 --> 00:03:32,400

rapidly

45

00:03:36,229 --> 00:03:34,560

we have a beautiful set at goddard space

46

00:03:37,830 --> 00:03:36,239

flight center uh where we are going to

47

00:03:38,949 --> 00:03:37,840

give you a very well rehearsed live

48

00:03:41,190 --> 00:03:38,959

broadcast

49

00:03:43,270 --> 00:03:41,200

because of the resurgence of covid we

50

00:03:45,670 --> 00:03:43,280

are no longer operating on that set and

51  
00:03:47,350 --> 00:03:45,680  
so those of us who can be at home are at

52  
00:03:49,110 --> 00:03:47,360  
home for the protection and the health

53  
00:03:50,630 --> 00:03:49,120  
of our colleagues and the people that

54  
00:03:53,030 --> 00:03:50,640  
absolutely need to be at the mission

55  
00:03:54,710 --> 00:03:53,040  
operations center in baltimore are there

56  
00:03:55,990 --> 00:03:54,720  
that means that i'm doing this from my

57  
00:03:58,149 --> 00:03:56,000  
home and that you're looking at

58  
00:03:59,429 --> 00:03:58,159  
something that is also unrehearsed this

59  
00:04:01,670 --> 00:03:59,439  
is a live event that we haven't really

60  
00:04:04,229 --> 00:04:01,680  
had a chance to uh to put together in a

61  
00:04:05,910 --> 00:04:04,239  
very polished way so as we do this you

62  
00:04:07,509 --> 00:04:05,920  
know we're all in this together i ask

63  
00:04:09,350 --> 00:04:07,519

for your patience if things are a little

64

00:04:11,350 --> 00:04:09,360

rough around the edges of this broadcast

65

00:04:13,429 --> 00:04:11,360

that's the reason why uh we also

66

00:04:14,949 --> 00:04:13,439

received a foot of snow yesterday here

67

00:04:16,629 --> 00:04:14,959

in maryland where i live so i'm having

68

00:04:18,629 --> 00:04:16,639

sporadic power outages hopefully we

69

00:04:20,870 --> 00:04:18,639

won't be worrying about that but the the

70

00:04:23,030 --> 00:04:20,880

reason we've decided to do this live is

71

00:04:25,510 --> 00:04:23,040

that this is something that everybody

72

00:04:28,070 --> 00:04:25,520

around the world is is with us on the

73

00:04:30,070 --> 00:04:28,080

james webb space telescope is a true

74

00:04:32,790 --> 00:04:30,080

milestone for humanity

75

00:04:35,430 --> 00:04:32,800

and it is a really historic momentous

76

00:04:37,030 --> 00:04:35,440

day and we want you with us on this day

77

00:04:39,670 --> 00:04:37,040

so later in the broadcast we'll be

78

00:04:41,030 --> 00:04:39,680

taking questions from social media but

79

00:04:42,790 --> 00:04:41,040

to begin with i want to begin

80

00:04:44,230 --> 00:04:42,800

discussions with somebody that's been

81

00:04:47,270 --> 00:04:44,240

with the web mission for quite a long

82

00:04:48,870 --> 00:04:47,280

time and uh this is uh keith parrish uh

83

00:04:51,990 --> 00:04:48,880

keith parish let's see your uh your

84

00:04:54,310 --> 00:04:52,000

title now is the uh uh the the the the

85

00:04:55,350 --> 00:04:54,320

the spacecraft deployment engineer is

86

00:04:57,670 --> 00:04:55,360

that correct

87

00:04:59,430 --> 00:04:57,680

no no i'm the commissioning manager for

88

00:05:00,550 --> 00:04:59,440

for web commissioning manager thank you

89

00:05:01,590 --> 00:05:00,560

thank you very much the commissioning

90

00:05:03,029 --> 00:05:01,600

manager

91

00:05:05,350 --> 00:05:03,039

yeah that's right

92

00:05:10,710 --> 00:05:05,360

good morning

93

00:05:12,710 --> 00:05:10,720

uh well we're great right now i'm just

94

00:05:14,310 --> 00:05:12,720

uh i'm up i'm upstairs from that

95

00:05:16,150 --> 00:05:14,320

operation center that you see there so

96

00:05:18,710 --> 00:05:16,160

i'm one floor up from uh from the

97

00:05:19,590 --> 00:05:18,720

operations engineers right now

98

00:05:21,749 --> 00:05:19,600

right

99

00:05:23,110 --> 00:05:21,759

well let's start about you know the

100

00:05:24,790 --> 00:05:23,120

people that are joining us perhaps some

101  
00:05:26,870 --> 00:05:24,800  
of the people that didn't see the actual

102  
00:05:29,350 --> 00:05:26,880  
live broadcast of the launch that we did

103  
00:05:31,189 --> 00:05:29,360  
um let's talk about what's happened

104  
00:05:32,390 --> 00:05:31,199  
in the eight days since the launch so so

105  
00:05:33,909 --> 00:05:32,400  
what's happened and what's going on

106  
00:05:36,230 --> 00:05:33,919  
right now

107  
00:05:38,310 --> 00:05:36,240  
yeah so we had an absolutely beautiful

108  
00:05:40,070 --> 00:05:38,320  
launch on christmas morning i think it

109  
00:05:42,150 --> 00:05:40,080  
was the best christmas gift under the

110  
00:05:44,150 --> 00:05:42,160  
tree for a lot of people including our

111  
00:05:45,990 --> 00:05:44,160  
operations team and all the folks that

112  
00:05:46,870 --> 00:05:46,000  
have been working on this for so many

113  
00:05:48,710 --> 00:05:46,880

years

114

00:05:50,550 --> 00:05:48,720

you know right off the bat we got a

115

00:05:51,990 --> 00:05:50,560

beautiful launch from arion put us right

116

00:05:54,629 --> 00:05:52,000

where we wanted to be as far as our

117

00:05:56,230 --> 00:05:54,639

velocity uh that evening on christmas

118

00:05:59,189 --> 00:05:56,240

evening we actually did our first

119

00:06:00,070 --> 00:05:59,199

mid-course correction burn and that was

120

00:06:04,790 --> 00:06:00,080

uh

121

00:06:07,590 --> 00:06:04,800

the almost the minimal amount of fuel

122

00:06:09,510 --> 00:06:07,600

that we needed to do that so uh and that

123

00:06:11,830 --> 00:06:09,520

that burn didn't happen by accident that

124

00:06:13,670 --> 00:06:11,840

was years in planning so just you know

125

00:06:15,830 --> 00:06:13,680

big shout out to our flight dynamics

126

00:06:17,350 --> 00:06:15,840

team and our delta v team and our

127

00:06:19,029 --> 00:06:17,360

propulsion and all of our teams so they

128

00:06:21,670 --> 00:06:19,039

they pulled that off flawlessly at

129

00:06:24,070 --> 00:06:21,680

exactly 12 and a half hours after launch

130

00:06:26,230 --> 00:06:24,080

uh then the next day we did some more uh

131

00:06:29,350 --> 00:06:26,240

turn-on of activities we got our antenna

132

00:06:31,350 --> 00:06:29,360

deployed uh eventually we got into uh

133

00:06:33,430 --> 00:06:31,360

getting our uh

134

00:06:35,510 --> 00:06:33,440

another burn a couple days later we did

135

00:06:37,350 --> 00:06:35,520

a small mid-course correction and then

136

00:06:39,029 --> 00:06:37,360

the next day we actually started doing

137

00:06:42,870 --> 00:06:39,039

our deployment so we deployed our

138

00:06:45,670 --> 00:06:42,880

forward uh and aft ups shells uh we

139

00:06:48,070 --> 00:06:45,680

deployed that big uh tower that gets the

140

00:06:50,469 --> 00:06:48,080

telescope up away from uh from the

141

00:06:51,749 --> 00:06:50,479

spacecraft uh and then i got the and

142

00:06:53,270 --> 00:06:51,759

then it just then it started then the

143

00:06:55,430 --> 00:06:53,280

pace started really really picking up

144

00:06:56,870 --> 00:06:55,440

and i had to it's been such a blur i had

145

00:06:58,710 --> 00:06:56,880

to write down just to make sure i didn't

146

00:07:00,950 --> 00:06:58,720

forget it all uh

147

00:07:03,270 --> 00:07:00,960

on about five days in we actually did

148

00:07:05,510 --> 00:07:03,280

our roll-up covers and those roll-up

149

00:07:07,510 --> 00:07:05,520

covers come in three stages uh we

150

00:07:09,749 --> 00:07:07,520

release a bunch of

151

00:07:11,909 --> 00:07:09,759

pins that hold those covers to the shell

152

00:07:13,670 --> 00:07:11,919

uh we released those they rolled up into

153

00:07:14,950 --> 00:07:13,680

two out of the three stages and we held

154

00:07:17,990 --> 00:07:14,960

them there

155

00:07:19,589 --> 00:07:18,000

and then uh on new year's eve uh we did

156

00:07:21,189 --> 00:07:19,599

what what i would think is our most

157

00:07:23,110 --> 00:07:21,199

exciting deployment and that's where we

158

00:07:24,150 --> 00:07:23,120

actually deployed our plus and minus

159

00:07:29,430 --> 00:07:24,160

booms

160

00:07:32,230 --> 00:07:29,440

of the real thing uh when we tested this

161

00:07:33,749 --> 00:07:32,240

on the ground for the last time so uh

162

00:07:35,749 --> 00:07:33,759

everything you're seeing in that footage

163

00:07:37,990 --> 00:07:35,759

uh is uh what we're doing right now but

164

00:07:40,790 --> 00:07:38,000

those plus and minus j2 booms came out

165

00:07:43,189 --> 00:07:40,800

on new year's eve uh we had we had a

166

00:07:45,110 --> 00:07:43,199

great new year's eve here in the in the

167

00:07:46,550 --> 00:07:45,120

in the mission operations center and the

168

00:07:48,390 --> 00:07:46,560

big thing about those booms coming out

169

00:07:50,550 --> 00:07:48,400

is that's when we plunged our telescope

170

00:07:53,189 --> 00:07:50,560

in the darkness uh for the first time

171

00:07:55,670 --> 00:07:53,199

our telescope is has no more sun on it

172

00:07:57,990 --> 00:07:55,680

and uh it's been cooling as it should

173

00:07:59,510 --> 00:07:58,000

ever since uh and then over the last

174

00:08:01,430 --> 00:07:59,520

couple days we took a little bit of a

175

00:08:03,830 --> 00:08:01,440

break over the weekend as you've heard

176

00:08:05,350 --> 00:08:03,840

uh in in the news there which was much

177

00:08:08,070 --> 00:08:05,360

needed for our team because they were

178

00:08:10,309 --> 00:08:08,080

going uh like gangbusters for that week

179

00:08:11,830 --> 00:08:10,319

uh and then and then yesterday morning

180

00:08:13,990 --> 00:08:11,840

we started what we're doing right now

181

00:08:16,070 --> 00:08:14,000

which is actually pulling in uh the

182

00:08:18,150 --> 00:08:16,080

corners and actually tensioning up the

183

00:08:19,749 --> 00:08:18,160

five layers of the sun shield so it's

184

00:08:21,189 --> 00:08:19,759

been an absolutely

185

00:08:22,790 --> 00:08:21,199

you know just a whirlwind and a

186

00:08:24,710 --> 00:08:22,800

fantastic week since since we've

187

00:08:26,230 --> 00:08:24,720

launched

188

00:08:28,390 --> 00:08:26,240

that's incredible you know it's so many

189

00:08:29,270 --> 00:08:28,400

congratulations and i know that uh one

190

00:08:31,110 --> 00:08:29,280

of the things that's been sort of

191

00:08:32,550 --> 00:08:31,120

popular on the internet is uh we have a

192

00:08:34,230 --> 00:08:32,560

website actually where you can track

193

00:08:36,149 --> 00:08:34,240

where web is now can you give us a

194

00:08:38,709 --> 00:08:36,159

little bit of updates so

195

00:08:40,469 --> 00:08:38,719

where exactly is web now

196

00:08:43,110 --> 00:08:40,479

i haven't checked that today the last

197

00:08:46,070 --> 00:08:43,120

time i saw it it was roughly about 500

198

00:08:47,750 --> 00:08:46,080

maybe 600 000 miles uh

199

00:08:50,230 --> 00:08:47,760

from from earth uh we're on our way to

200

00:08:51,670 --> 00:08:50,240

l2 uh one thing you'll notice on that

201  
00:08:53,030 --> 00:08:51,680  
website that i think we get a lot of

202  
00:08:55,509 --> 00:08:53,040  
questions on is it looks like we're

203  
00:08:57,590 --> 00:08:55,519  
slowing down and uh that's exactly right

204  
00:08:59,750 --> 00:08:57,600  
we should be slowing down so uh we want

205  
00:09:01,269 --> 00:08:59,760  
to go out and sort of be uh we want to

206  
00:09:02,949 --> 00:09:01,279  
be pretty much

207  
00:09:05,110 --> 00:09:02,959  
absolutely stopped when we get to that

208  
00:09:06,389 --> 00:09:05,120  
roughly million miles away and that's

209  
00:09:08,870 --> 00:09:06,399  
when we'll sort of be in our orbit

210  
00:09:11,030 --> 00:09:08,880  
around l2 so our our velocity with

211  
00:09:13,110 --> 00:09:11,040  
respect to the earth is is actually is

212  
00:09:15,670 --> 00:09:13,120  
actually coming down you also see some

213  
00:09:17,750 --> 00:09:15,680

temperatures on that page uh that kind

214

00:09:19,430 --> 00:09:17,760

of gives a little bit of a feel we have

215

00:09:21,430 --> 00:09:19,440

thousands of temperature monitors all

216

00:09:23,350 --> 00:09:21,440

around web we we try to pick some that

217

00:09:24,870 --> 00:09:23,360

give you a little bit of a flavor of

218

00:09:26,470 --> 00:09:24,880

what's happening on the hot side and

219

00:09:28,710 --> 00:09:26,480

what's happening on the cold side and so

220

00:09:30,310 --> 00:09:28,720

far everything is performing as as it

221

00:09:31,910 --> 00:09:30,320

should from a temperatures

222

00:09:33,509 --> 00:09:31,920

perspective

223

00:09:34,710 --> 00:09:33,519

i think some other things you'll see on

224

00:09:36,870 --> 00:09:34,720

our website is where we are in our

225

00:09:39,030 --> 00:09:36,880

deployments uh and you should be able to

226

00:09:41,829 --> 00:09:39,040

track that all on our website so you

227

00:09:43,750 --> 00:09:41,839

know huge shout out to our our our media

228

00:09:45,590 --> 00:09:43,760

team that does those websites and does

229

00:09:47,350 --> 00:09:45,600

everything you're doing today because uh

230

00:09:49,269 --> 00:09:47,360

we're we're a fast moving thing and you

231

00:09:52,389 --> 00:09:49,279

guys are keeping up with us so it's uh

232

00:09:53,670 --> 00:09:52,399

you know kudos to you guys

233

00:09:55,509 --> 00:09:53,680

yeah we were talking about some of the

234

00:09:57,030 --> 00:09:55,519

challenges with this yeah the resurgence

235

00:09:58,470 --> 00:09:57,040

of covent has created

236

00:10:00,230 --> 00:09:58,480

what's going on at the mock and with

237

00:10:02,470 --> 00:10:00,240

your team to to make sure people are are

238

00:10:03,269 --> 00:10:02,480

safe you know what to tell tell me a bit

239

00:10:05,190 --> 00:10:03,279

about how you're dealing with the

240

00:10:07,910 --> 00:10:05,200

challenges right now

241

00:10:10,310 --> 00:10:07,920

yeah so um you know like the rest of the

242

00:10:12,230 --> 00:10:10,320

rest of our nation right now we're we're

243

00:10:14,550 --> 00:10:12,240

dealing with the surge right right when

244

00:10:16,069 --> 00:10:14,560

we're doing all this so uh uh we've

245

00:10:18,710 --> 00:10:16,079

known this uh we've been in our

246

00:10:20,870 --> 00:10:18,720

rehearsal stage for a couple years now

247

00:10:22,230 --> 00:10:20,880

since the reality of covet hit the

248

00:10:24,150 --> 00:10:22,240

entire world

249

00:10:25,829 --> 00:10:24,160

so we've started planning for dealing

250

00:10:26,710 --> 00:10:25,839

with kova bent you know a couple years

251  
00:10:28,470 --> 00:10:26,720  
back

252  
00:10:30,150 --> 00:10:28,480  
and so we were ready for it

253  
00:10:33,030 --> 00:10:30,160  
we weren't quite

254  
00:10:35,430 --> 00:10:33,040  
anticipating a surge like we just got uh

255  
00:10:37,670 --> 00:10:35,440  
on right on top of our first week of of

256  
00:10:39,590 --> 00:10:37,680  
the of the mission uh but uh we have

257  
00:10:42,949 --> 00:10:39,600  
protocols in place to keep everybody

258  
00:10:45,430 --> 00:10:42,959  
safe uh we do testing uh we try to keep

259  
00:10:47,750 --> 00:10:45,440  
our numbers down we do what we can uh

260  
00:10:50,870 --> 00:10:47,760  
practically and then uh

261  
00:10:53,190 --> 00:10:50,880  
you know we do have cases uh and and and

262  
00:10:55,030 --> 00:10:53,200  
our our team handles that and and and we

263  
00:10:56,949 --> 00:10:55,040

keep those they keep those folks uh

264

00:10:59,670 --> 00:10:56,959

isolated one of the one of the things

265

00:11:01,750 --> 00:10:59,680

that has been a challenge is people who

266

00:11:03,750 --> 00:11:01,760

you know worked a long time on this and

267

00:11:05,750 --> 00:11:03,760

and they and and we had to isolate them

268

00:11:07,110 --> 00:11:05,760

now fortunately in this day and age we

269

00:11:09,269 --> 00:11:07,120

can uh get them hooked up to our

270

00:11:12,150 --> 00:11:09,279

operations loop and they can uh help us

271

00:11:14,790 --> 00:11:12,160

remotely from wherever they are so uh um

272

00:11:16,550 --> 00:11:14,800

we are handling it very well uh but uh

273

00:11:18,630 --> 00:11:16,560

it has been it has you know it's just

274

00:11:21,509 --> 00:11:18,640

another challenge that uh we just roll

275

00:11:22,949 --> 00:11:21,519

with it we just roll with it

276

00:11:25,110 --> 00:11:22,959

well let's talk a bit about what's going

277

00:11:26,870 --> 00:11:25,120

on today because as we mentioned there's

278

00:11:29,350 --> 00:11:26,880

something something quite significant

279

00:11:30,870 --> 00:11:29,360

happening so so take us through you know

280

00:11:33,430 --> 00:11:30,880

what's going to happen in the next say

281

00:11:36,069 --> 00:11:33,440

hour or so and and really what that

282

00:11:38,150 --> 00:11:36,079

means what the significance of that is

283

00:11:39,910 --> 00:11:38,160

yeah so yesterday so we you know we put

284

00:11:41,590 --> 00:11:39,920

out all these five layers of the sun

285

00:11:42,949 --> 00:11:41,600

shield and they're just kind of you know

286

00:11:44,230 --> 00:11:42,959

they're not really tight they're kind of

287

00:11:47,829 --> 00:11:44,240

and then actually what we've been doing

288

00:11:50,389 --> 00:11:47,839

since yesterday is our sun shield team

289

00:11:53,110 --> 00:11:50,399

uh again right downstairs right now uh

290

00:11:55,430 --> 00:11:53,120

they're actually reeling in uh cables

291

00:11:57,430 --> 00:11:55,440

from each of the six pull points around

292

00:12:00,310 --> 00:11:57,440

the periphery of the sun shield so each

293

00:12:02,949 --> 00:12:00,320

one of those corners actually has three

294

00:12:04,710 --> 00:12:02,959

cables uh related to it

295

00:12:06,870 --> 00:12:04,720

one cable actually pulls it really

296

00:12:09,269 --> 00:12:06,880

really tight and then two cables on that

297

00:12:11,269 --> 00:12:09,279

corner actually are lightly pulled and

298

00:12:13,590 --> 00:12:11,279

they're connected to the periphery all

299

00:12:15,110 --> 00:12:13,600

around the perimeter of the sun shield

300

00:12:17,590 --> 00:12:15,120

and that's what gives us

301  
00:12:20,550 --> 00:12:17,600  
a very very precise control over the

302  
00:12:21,829 --> 00:12:20,560  
shape of the edge uh in addition to

303  
00:12:23,750 --> 00:12:21,839  
spreading the layers we want to make

304  
00:12:25,910 --> 00:12:23,760  
sure that the the layers are actually

305  
00:12:27,509 --> 00:12:25,920  
positioned correctly around the edge so

306  
00:12:29,910 --> 00:12:27,519  
huge amount of engineering went into

307  
00:12:31,670 --> 00:12:29,920  
controlling those edges so again each

308  
00:12:34,150 --> 00:12:31,680  
layer has

309  
00:12:36,069 --> 00:12:34,160  
each corner has three cables and again

310  
00:12:38,389 --> 00:12:36,079  
we have six corners so you can start

311  
00:12:40,150 --> 00:12:38,399  
doing the math on those and all over

312  
00:12:43,269 --> 00:12:40,160  
we have 90 different cables that have

313  
00:12:46,230 --> 00:12:43,279

been reeled in over the last day

314

00:12:48,470 --> 00:12:46,240

as we as we tension layer one

315

00:12:51,110 --> 00:12:48,480

we're reeling in 90 cables as we as we

316

00:12:52,870 --> 00:12:51,120

tension layer 2 we're down to 72 cables

317

00:12:55,590 --> 00:12:52,880

and today we're really only working with

318

00:12:57,430 --> 00:12:55,600

18 cables so we've gone from 90 cables

319

00:13:00,389 --> 00:12:57,440

and today we're working with uh you know

320

00:13:02,550 --> 00:13:00,399

36 cables for layer 4 right now

321

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

when we start layer 5 in a little bit

322

00:13:07,590 --> 00:13:04,720

we'll be down to 18 cables and we have

323

00:13:10,710 --> 00:13:07,600

motors uh that actually reel all those

324

00:13:13,430 --> 00:13:10,720

cables in very precise uh you know very

325

00:13:17,110 --> 00:13:13,440

very well uh slowly done uh those those

326

00:13:18,470 --> 00:13:17,120

motors turn and then uh eventually uh

327

00:13:20,310 --> 00:13:18,480

we'll turn all those motors off and

328

00:13:21,829 --> 00:13:20,320

we'll be we'll be fully tensioned uh

329

00:13:24,069 --> 00:13:21,839

when we get into layer five here in a

330

00:13:25,590 --> 00:13:24,079

little bit you'll notice that we uh we

331

00:13:27,670 --> 00:13:25,600

actually go around the corners we

332

00:13:29,750 --> 00:13:27,680

tension each corner up separately so

333

00:13:32,710 --> 00:13:29,760

that's what's going on today and uh

334

00:13:35,030 --> 00:13:32,720

we'll finish up here shortly

335

00:13:36,150 --> 00:13:35,040

that's absolutely wonderful so uh you

336

00:13:37,509 --> 00:13:36,160

know just to kind of talk a bit about

337

00:13:39,910 --> 00:13:37,519

this heat shield uh give us a sense

338

00:13:40,949 --> 00:13:39,920

about how large this heat shield is and

339

00:13:42,710 --> 00:13:40,959

and what are the temperature

340

00:13:45,269 --> 00:13:42,720

differentials how cold is it on the cold

341

00:13:46,629 --> 00:13:45,279

side versus the warm side

342

00:13:48,230 --> 00:13:46,639

yeah so we you know we always throw

343

00:13:50,150 --> 00:13:48,240

around the tennis court analogy i guess

344

00:13:51,509 --> 00:13:50,160

if you play tennis you know exactly what

345

00:13:52,790 --> 00:13:51,519

we're talking about if you don't play

346

00:13:54,949 --> 00:13:52,800

tennis you're probably like well i think

347

00:13:56,389 --> 00:13:54,959

that's big i don't know uh roughly you

348

00:13:59,030 --> 00:13:56,399

know i'm gonna i'm gonna use feet here i

349

00:14:03,350 --> 00:13:59,040

know i know um but it's roughly 70 feet

350

00:14:05,030 --> 00:14:03,360

uh 70 feet long and uh and about 54 feet

351  
00:14:07,750 --> 00:14:05,040  
wide so you can see some dimensions

352  
00:14:10,230 --> 00:14:07,760  
there uh thank you for for providing

353  
00:14:12,310 --> 00:14:10,240  
that in the meters so uh yeah very very

354  
00:14:14,710 --> 00:14:12,320  
large it's one of the largest structures

355  
00:14:17,030 --> 00:14:14,720  
uh that that has flown that has been

356  
00:14:20,069 --> 00:14:17,040  
sort of robotically or automatically uh

357  
00:14:22,310 --> 00:14:20,079  
deployed so uh yeah quite large again

358  
00:14:25,030 --> 00:14:22,320  
all the edge control all the uh edge

359  
00:14:27,829 --> 00:14:25,040  
separation and again we're doing five of

360  
00:14:29,590 --> 00:14:27,839  
these we're not just doing one uh so you

361  
00:14:31,910 --> 00:14:29,600  
know again a huge shout out to our

362  
00:14:34,310 --> 00:14:31,920  
sunshield team uh they've been at this

363  
00:14:36,150 --> 00:14:34,320

for many many years and and you cannot

364

00:14:39,590 --> 00:14:36,160

overstate what an engineering

365

00:14:42,710 --> 00:14:41,030

the thing that's so exciting about so

366

00:14:43,990 --> 00:14:42,720

many aspects of the web oh i see here

367

00:14:45,030 --> 00:14:44,000

we've got a graphic about this oh yeah

368

00:14:47,189 --> 00:14:45,040

yeah yeah

369

00:14:49,430 --> 00:14:47,199

yeah so yeah this is dramatic again we

370

00:14:51,829 --> 00:14:49,440

try to put this out on our website uh

371

00:14:54,310 --> 00:14:51,839

but roughly we we get about again in

372

00:14:57,430 --> 00:14:54,320

fahrenheit uh we get about 100 degree

373

00:14:59,509 --> 00:14:57,440

fahrenheit drop per layer uh overall we

374

00:15:01,590 --> 00:14:59,519

get about you know 600 degrees between

375

00:15:03,110 --> 00:15:01,600

the hot side and what i call our coldest

376

00:15:05,350 --> 00:15:03,120

temperature on the observatory which is

377

00:15:07,430 --> 00:15:05,360

our instrument detectors uh our

378

00:15:10,150 --> 00:15:07,440

instrument detectors are running right

379

00:15:11,829 --> 00:15:10,160

around minus 400 degrees so

380

00:15:14,949 --> 00:15:11,839

you could boil water probably on the

381

00:15:16,710 --> 00:15:14,959

front side of us uh and and and and on

382

00:15:21,030 --> 00:15:16,720

the back side of us you're you're almost

383

00:15:24,870 --> 00:15:22,949

so the you know the the huge size of

384

00:15:26,790 --> 00:15:24,880

this uh has to do with the just the

385

00:15:29,269 --> 00:15:26,800

general size of this observatory you

386

00:15:31,670 --> 00:15:29,279

know in total and of course this idea

387

00:15:33,509 --> 00:15:31,680

that it had to actually be folded up to

388

00:15:35,350 --> 00:15:33,519

actually launch inside the area and five

389

00:15:36,550 --> 00:15:35,360

rocket and i just want to take you back

390

00:15:37,670 --> 00:15:36,560

a little bit through that launch you

391

00:15:41,030 --> 00:15:37,680

know i know that this was something that

392

00:15:43,910 --> 00:15:41,040

was an incredible day for all of us uh

393

00:15:44,710 --> 00:15:43,920

i'm sorry i'm getting a perhaps getting

394

00:15:49,509 --> 00:15:44,720

yes

395

00:15:52,870 --> 00:15:50,870

i'm just getting instructions that we

396

00:15:54,949 --> 00:15:52,880

have a wonderful chance to talk with you

397

00:15:56,949 --> 00:15:54,959

another person that's had uh you know

398

00:16:00,230 --> 00:15:56,959

truly a historic day jim flynn from

399

00:16:02,069 --> 00:16:00,240

northrop grumman and so so um jim please

400

00:16:03,990 --> 00:16:02,079

introduce yourself to us and tell us a

401  
00:16:06,550 --> 00:16:04,000  
bit about how you're doing today

402  
00:16:08,710 --> 00:16:06,560  
uh yeah i'm jim i'm the uh original

403  
00:16:10,550 --> 00:16:08,720  
essential manager at northrop grumman

404  
00:16:12,629 --> 00:16:10,560  
working with in partnership with the

405  
00:16:13,990 --> 00:16:12,639  
with the nasa team i've been involved in

406  
00:16:16,310 --> 00:16:14,000  
the sunshield all the way from the

407  
00:16:18,150 --> 00:16:16,320  
original development concept development

408  
00:16:19,110 --> 00:16:18,160  
through the design all the build and

409  
00:16:21,350 --> 00:16:19,120  
tests

410  
00:16:25,590 --> 00:16:21,360  
uh and through this final great phase of

411  
00:16:29,910 --> 00:16:27,509  
so let's talk a bit about the sunshield

412  
00:16:31,430 --> 00:16:29,920  
in details i mean for one thing i mean

413  
00:16:33,350 --> 00:16:31,440

what an incredible story for you that

414

00:16:34,949 --> 00:16:33,360

you've been working on this for so long

415

00:16:37,910 --> 00:16:34,959

tell us a bit about what the sun shield

416

00:16:39,430 --> 00:16:37,920

is is made of and and can i i also you

417

00:16:41,110 --> 00:16:39,440

know let's start with the technical i'd

418

00:16:42,710 --> 00:16:41,120

also like to end you know ask you some

419

00:16:44,150 --> 00:16:42,720

personal questions about some of the

420

00:16:45,829 --> 00:16:44,160

challenges you faced some of the things

421

00:16:48,389 --> 00:16:45,839

you had to overcome but let's describe

422

00:16:50,389 --> 00:16:48,399

this sun shield so to begin with

423

00:16:52,790 --> 00:16:50,399

what is it made of

424

00:16:56,069 --> 00:16:52,800

so um the the layers are made out of a

425

00:16:57,910 --> 00:16:56,079

capped on e was made by dupont uh coated

426  
00:16:59,910 --> 00:16:57,920  
to get the correct optical properties

427  
00:17:00,710 --> 00:16:59,920  
for thermal performance

428  
00:17:03,110 --> 00:17:00,720  
um

429  
00:17:05,429 --> 00:17:03,120  
the bottom layer is is two millisticks

430  
00:17:07,750 --> 00:17:05,439  
that's .002 inches thick and the other

431  
00:17:09,829 --> 00:17:07,760  
four layers are one one mil thick very

432  
00:17:11,350 --> 00:17:09,839  
very thin material but very very strong

433  
00:17:13,909 --> 00:17:11,360  
when you you're pulling on it so it's

434  
00:17:15,510 --> 00:17:13,919  
very very robust uh you know in terms of

435  
00:17:17,829 --> 00:17:15,520  
the handling and the deployment you have

436  
00:17:20,230 --> 00:17:17,839  
to be careful not to you know tear it or

437  
00:17:22,230 --> 00:17:20,240  
puncture it but it's a very robust

438  
00:17:24,949 --> 00:17:22,240

material um so

439

00:17:27,590 --> 00:17:24,959

basically uh you know we if we make big

440

00:17:29,510 --> 00:17:27,600

long rolls of this material and then at

441

00:17:31,350 --> 00:17:29,520

our vendor that made the membranes for

442

00:17:34,789 --> 00:17:31,360

us at nexhall in huntsville there's a

443

00:17:37,590 --> 00:17:34,799

very detailed process where we design

444

00:17:39,430 --> 00:17:37,600

build scene the gores together and build

445

00:17:41,270 --> 00:17:39,440

the assembly that goes along with the

446

00:17:43,909 --> 00:17:41,280

big deployable structure system that you

447

00:17:47,029 --> 00:17:45,190

one of the things that i found really

448

00:17:48,789 --> 00:17:47,039

fascinating was how many of these

449

00:17:51,029 --> 00:17:48,799

actuators these these non-explosive

450

00:17:52,950 --> 00:17:51,039

actuators have to have to work to get

451  
00:17:54,789 --> 00:17:52,960  
this thing to unfold could you describe

452  
00:17:57,590 --> 00:17:54,799  
a bit you know what what these actuators

453  
00:17:59,990 --> 00:17:57,600  
are and what has to happen

454  
00:18:01,990 --> 00:18:00,000  
so um the majority of the actuators are

455  
00:18:03,350 --> 00:18:02,000  
really holding this the folded essential

456  
00:18:05,110 --> 00:18:03,360  
down to the structure we need to make

457  
00:18:06,950 --> 00:18:05,120  
sure that it's in a nice repeatable

458  
00:18:08,870 --> 00:18:06,960  
fashion from all the ground testing

459  
00:18:10,789 --> 00:18:08,880  
keeping it all you know in a controlled

460  
00:18:12,390 --> 00:18:10,799  
fashion and then releasing it very

461  
00:18:14,549 --> 00:18:12,400  
sequentially so that we have a very

462  
00:18:15,750 --> 00:18:14,559  
controlled deployment these actuators

463  
00:18:17,909 --> 00:18:15,760

basically hold that down and

464

00:18:19,669 --> 00:18:17,919

electrically actuate and release the

465

00:18:22,070 --> 00:18:19,679

system you know in a very controlled

466

00:18:24,390 --> 00:18:22,080

fashion that we test on the ground and

467

00:18:27,270 --> 00:18:24,400

we've we've shown multiple times is

468

00:18:30,310 --> 00:18:28,870

one of the questions i had of course is

469

00:18:31,830 --> 00:18:30,320

that when you're testing on the ground

470

00:18:33,590 --> 00:18:31,840

you have to deal with the effect of

471

00:18:35,750 --> 00:18:33,600

gravity during your test and you know

472

00:18:38,150 --> 00:18:35,760

now where web is you know up up you know

473

00:18:39,990 --> 00:18:38,160

in space on its way to I2 it's different

474

00:18:41,669 --> 00:18:40,000

i mean how how do you simulate that in

475

00:18:43,510 --> 00:18:41,679

your tests you know the the lack of

476

00:18:45,029 --> 00:18:43,520

gravity

477

00:18:46,870 --> 00:18:45,039

yeah so we had to kind of break the test

478

00:18:48,789 --> 00:18:46,880

program into pieces and at the big

479

00:18:51,430 --> 00:18:48,799

assembly level you really just can't do

480

00:18:52,950 --> 00:18:51,440

that so we made some system articles we

481

00:18:54,710 --> 00:18:52,960

would hang them almost in a shower

482

00:18:56,710 --> 00:18:54,720

curtain fashion to play them out

483

00:18:59,350 --> 00:18:56,720

offloaded like you would see in zero

484

00:19:01,029 --> 00:18:59,360

gravity so it's really a building up of

485

00:19:03,510 --> 00:19:01,039

a lot of different test articles in

486

00:19:05,909 --> 00:19:03,520

different orientations to show how it

487

00:19:07,909 --> 00:19:05,919

would perform in a zero g environment so

488

00:19:09,669 --> 00:19:07,919

you have to do it kind of in pieces

489

00:19:12,310 --> 00:19:09,679

rather than all at once with the final

490

00:19:15,750 --> 00:19:14,150

and what were some of the the major

491

00:19:16,710 --> 00:19:15,760

engineering challenges i mean can you

492

00:19:18,150 --> 00:19:16,720

you know

493

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

over your many years working on the sun

494

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

shield you know what were some of the

495

00:19:22,789 --> 00:19:21,200

stories of okay

496

00:19:24,549 --> 00:19:22,799

at first we didn't know how to do this

497

00:19:25,909 --> 00:19:24,559

and and then we figured it out but what

498

00:19:27,750 --> 00:19:25,919

were some of the big things that stand

499

00:19:29,750 --> 00:19:27,760

out in your memory

500

00:19:31,510 --> 00:19:29,760

yeah i mean the you know originally it's

501  
00:19:33,430 --> 00:19:31,520  
just it's you know we had an idea what

502  
00:19:35,350 --> 00:19:33,440  
this needed to look like you know in its

503  
00:19:38,390 --> 00:19:35,360  
deployed state but it was really how do

504  
00:19:40,789 --> 00:19:38,400  
we take these five very thin membranes

505  
00:19:42,950 --> 00:19:40,799  
fold them up and get them to fit within

506  
00:19:45,029 --> 00:19:42,960  
the payload fairing of the the launch

507  
00:19:47,029 --> 00:19:45,039  
vehicle and then be able to deploy it on

508  
00:19:48,870 --> 00:19:47,039  
orbit very reliably

509  
00:19:50,870 --> 00:19:48,880  
and uh you know with a lot of confidence

510  
00:19:53,110 --> 00:19:50,880  
so i think that's probably you know in

511  
00:19:55,270 --> 00:19:53,120  
the big picture just the ability to take

512  
00:19:57,190 --> 00:19:55,280  
these you know five thin layers fold

513  
00:19:58,710 --> 00:19:57,200

them up and then make sure that we know

514

00:20:00,150 --> 00:19:58,720

how we're going to deploy them to get to

515

00:20:02,149 --> 00:20:00,160

that final shape that's probably the

516

00:20:07,750 --> 00:20:02,159

biggest challenge that we had you know

517

00:20:11,110 --> 00:20:09,590

i know that you know whenever we've been

518

00:20:12,630 --> 00:20:11,120

uh talking about you they've been saying

519

00:20:14,070 --> 00:20:12,640

you know you've got to get jim on this

520

00:20:15,669 --> 00:20:14,080

because he's the one that they they feel

521

00:20:17,669 --> 00:20:15,679

was sort of the lead on this i mean the

522

00:20:19,190 --> 00:20:17,679

person that has been on that so long how

523

00:20:20,549 --> 00:20:19,200

long how long have you been on this

524

00:20:21,590 --> 00:20:20,559

project when did you start working on

525

00:20:24,470 --> 00:20:21,600

web

526

00:20:26,710 --> 00:20:24,480

uh it seems like uh my whole life now

527

00:20:32,470 --> 00:20:26,720

i think uh probably like uh you know

528

00:20:36,310 --> 00:20:34,950

so uh yeah so since the very beginning

529

00:20:38,630 --> 00:20:36,320

since we were trying to figure out what

530

00:20:40,870 --> 00:20:38,640

the concepts were building maturing and

531

00:20:43,510 --> 00:20:40,880

iterating along the way and slowly

532

00:20:45,430 --> 00:20:43,520

improving the product and reducing the

533

00:20:47,590 --> 00:20:45,440

complexity and then getting a very

534

00:20:50,549 --> 00:20:47,600

reliable uh system at the very at the

535

00:20:53,029 --> 00:20:51,830

keith is there anything you'd like to

536

00:20:54,630 --> 00:20:53,039

add to the story i think you've been

537

00:20:56,789 --> 00:20:54,640

working with jim for quite a while i

538

00:20:59,270 --> 00:20:56,799

mean obviously jim is understating the

539

00:21:01,110 --> 00:20:59,280

challenges because he has overcome many

540

00:21:02,870 --> 00:21:01,120

along the way so uh you know the only

541

00:21:05,190 --> 00:21:02,880

thing i would say that uh people may not

542

00:21:06,149 --> 00:21:05,200

appreciate is uh the rocket launch

543

00:21:09,190 --> 00:21:06,159

itself

544

00:21:11,430 --> 00:21:09,200

uh and and and just getting the air out

545

00:21:13,510 --> 00:21:11,440

of all these layers so i you know i'm

546

00:21:15,270 --> 00:21:13,520

sure jim would like to to add a little

547

00:21:17,029 --> 00:21:15,280

bit of detail there on

548

00:21:19,430 --> 00:21:17,039

how that that was probably one of the

549

00:21:21,350 --> 00:21:19,440

biggest challenges

550

00:21:23,029 --> 00:21:21,360

yeah when you take the the five layers

551  
00:21:24,950 --> 00:21:23,039  
and then you have to fold them and fold

552  
00:21:26,789 --> 00:21:24,960  
them again you know you have to be

553  
00:21:28,789 --> 00:21:26,799  
careful about how that air is trapped in

554  
00:21:30,870 --> 00:21:28,799  
between the layers and how you can get

555  
00:21:32,149 --> 00:21:30,880  
it out in a controlled fashion and that

556  
00:21:33,909 --> 00:21:32,159  
was definitely one of the biggest

557  
00:21:35,830 --> 00:21:33,919  
challenges understanding what that

558  
00:21:38,230 --> 00:21:35,840  
environment was in the rocket how

559  
00:21:40,390 --> 00:21:38,240  
quickly the air needs to evacuate the

560  
00:21:42,070 --> 00:21:40,400  
loads from basically this this billowing

561  
00:21:44,230 --> 00:21:42,080  
inside the fairing

562  
00:21:46,950 --> 00:21:44,240  
we ran a lot of tests we we built uh

563  
00:21:48,789 --> 00:21:46,960

full-scale mock-ups in uh in chambers

564

00:21:50,789 --> 00:21:48,799

that depressurized really quickly to

565

00:21:53,430 --> 00:21:50,799

verify the concepts

566

00:21:55,750 --> 00:21:53,440

we had to um you know design the system

567

00:21:57,510 --> 00:21:55,760

basically so that it was controlled

568

00:21:59,430 --> 00:21:57,520

through that depressurization

569

00:22:01,510 --> 00:21:59,440

environment and iterate you know several

570

00:22:03,350 --> 00:22:01,520

times in terms of making sure that that

571

00:22:04,870 --> 00:22:03,360

was a robust solution so it's definitely

572

00:22:06,789 --> 00:22:04,880

one of the challenges

573

00:22:09,029 --> 00:22:06,799

not just having it folded up and

574

00:22:11,590 --> 00:22:09,039

repeatably getting it on orbit but but

575

00:22:13,270 --> 00:22:11,600

being able to vent that air that was

576

00:22:16,390 --> 00:22:13,280

trapped in between the layers in a

577

00:22:18,470 --> 00:22:16,400

controlled reliable fashion so that the

578

00:22:20,630 --> 00:22:18,480

system basically could withstand those

579

00:22:22,549 --> 00:22:20,640

depressurization loads and deploy on

580

00:22:24,310 --> 00:22:22,559

orbit

581

00:22:25,590 --> 00:22:24,320

yeah what we're looking at here the the

582

00:22:26,390 --> 00:22:25,600

image that they have for us it was that

583

00:22:28,310 --> 00:22:26,400

spectacular

584

00:22:30,630 --> 00:22:28,320

uh you know real image of the

585

00:22:32,149 --> 00:22:30,640

observatory pulling away from the rocket

586

00:22:34,070 --> 00:22:32,159

and uh this was one of these things that

587

00:22:35,990 --> 00:22:34,080

i could hardly believe was was real when

588

00:22:37,590 --> 00:22:36,000

it was happening it was an absolutely

589

00:22:41,669 --> 00:22:37,600

gorgeous shot

590

00:22:44,310 --> 00:22:43,029

oh sorry i'm just hearing an instruction

591

00:22:46,230 --> 00:22:44,320

from the mock i was wondering if that

592

00:22:48,870 --> 00:22:46,240

was

593

00:22:51,029 --> 00:22:48,880

right yes yes so they finished the layer

594

00:22:53,190 --> 00:22:51,039

four forward the tensioning they'll move

595

00:22:55,029 --> 00:22:53,200

on to the aft and layer four is almost

596

00:22:58,149 --> 00:22:55,039

complete we'll be complete after the

597

00:23:01,029 --> 00:22:59,669

just just amazing

598

00:23:02,549 --> 00:23:01,039

um one of the questions we've been

599

00:23:04,149 --> 00:23:02,559

getting from social media is that you

600

00:23:06,070 --> 00:23:04,159

know we we had that image of the

601  
00:23:06,830 --> 00:23:06,080  
observatory pulling away

602  
00:23:08,549 --> 00:23:06,840  
at

603  
00:23:12,070 --> 00:23:08,559  
622.01

604  
00:23:13,830 --> 00:23:12,080  
ready to go to do you operate for intent

605  
00:23:18,950 --> 00:23:13,840  
the command line looks good you're good

606  
00:23:22,549 --> 00:23:20,870  
okay so i guess i've heard i've heard

607  
00:23:24,390 --> 00:23:22,559  
that jim needs to go to the console that

608  
00:23:26,549 --> 00:23:24,400  
uh that that where we're coming up on

609  
00:23:29,990 --> 00:23:26,559  
the very end of this so jim thank you so

610  
00:23:31,590 --> 00:23:30,000  
much for for joining us and uh uh

611  
00:23:33,590 --> 00:23:31,600  
congratulations on everything and best

612  
00:23:35,110 --> 00:23:33,600  
of luck for the rest of today

613  
00:23:37,029 --> 00:23:35,120

yeah i just wanted to say just wanted to

614

00:23:39,110 --> 00:23:37,039

congratulate the entire team it's just

615

00:23:41,830 --> 00:23:39,120

been a hugely talented team from

616

00:23:43,510 --> 00:23:41,840

beginning to end on the north nasa side

617

00:23:46,149 --> 00:23:43,520

you know a lot of you know brilliant

618

00:23:47,909 --> 00:23:46,159

people working a lot of hours and really

619

00:23:49,990 --> 00:23:47,919

a lot of dedication to get us here to

620

00:23:51,510 --> 00:23:50,000

this point and there's a lot of people

621

00:23:53,750 --> 00:23:51,520

out there that really deserve a lot of

622

00:23:57,350 --> 00:23:53,760

credit hey i can confirm kudos for the

623

00:24:01,710 --> 00:23:59,669

well thank you so much for joining us

624

00:24:03,430 --> 00:24:01,720

all right thank you at

625

00:24:05,669 --> 00:24:03,440

622.019

626  
00:24:07,190 --> 00:24:05,679  
we are ready to um

627  
00:24:08,630 --> 00:24:07,200  
execute

628  
00:24:11,590 --> 00:24:08,640  
that

629  
00:24:13,590 --> 00:24:11,600  
clock looks good you're going to execute

630  
00:24:14,950 --> 00:24:13,600  
yeah so keith can you give us an idea

631  
00:24:17,110 --> 00:24:14,960  
we're hearing these instructions coming

632  
00:24:18,950 --> 00:24:17,120  
over right now what's what's happening

633  
00:24:20,630 --> 00:24:18,960  
at this very moment

634  
00:24:22,390 --> 00:24:20,640  
yeah so what you're here you're hearing

635  
00:24:25,750 --> 00:24:22,400  
you're hearing the voice of our dev ops

636  
00:24:27,830 --> 00:24:25,760  
lead uh nancy um and uh she's awesome

637  
00:24:29,590 --> 00:24:27,840  
and she is coordinating between our

638  
00:24:32,070 --> 00:24:29,600

flight operations team which is actually

639

00:24:34,789 --> 00:24:32,080

sending commands up to the spacecraft

640

00:24:36,149 --> 00:24:34,799

and uh she's sort of the liaison between

641

00:24:39,029 --> 00:24:36,159

that group of folks and actually our

642

00:24:42,710 --> 00:24:39,039

deployment engineers and i see you are

643

00:24:46,230 --> 00:24:44,870

and what she did there she just told

644

00:24:48,870 --> 00:24:46,240

them to send the command to start

645

00:24:50,870 --> 00:24:48,880

running the motor on the aft uh aft

646

00:24:52,630 --> 00:24:50,880

tensioning mechanism and uh if you look

647

00:24:54,230 --> 00:24:52,640

at the obt right there if you can see

648

00:24:56,870 --> 00:24:54,240

you'll see three layers

649

00:24:58,789 --> 00:24:56,880

uh and um

650

00:25:00,950 --> 00:24:58,799

you stop

651  
00:25:03,909 --> 00:25:00,960  
roger you'll see uh you'll see the

652  
00:25:06,230 --> 00:25:03,919  
fourth layer uh rise here pretty soon

653  
00:25:08,310 --> 00:25:06,240  
and the meter status for the f pair is

654  
00:25:10,230 --> 00:25:08,320  
moving

655  
00:25:11,909 --> 00:25:10,240  
and it's worth mentioning you you used

656  
00:25:13,590 --> 00:25:11,919  
an acronym but this is actually a

657  
00:25:14,950 --> 00:25:13,600  
real-time animation that although we

658  
00:25:16,789 --> 00:25:14,960  
can't see what's going on with the

659  
00:25:18,470 --> 00:25:16,799  
observatory this is actually showing you

660  
00:25:19,430 --> 00:25:18,480  
what configuration it's in at the moment

661  
00:25:21,590 --> 00:25:19,440  
it's crazy

662  
00:25:23,190 --> 00:25:21,600  
based on that data it brings up yeah and

663  
00:25:25,029 --> 00:25:23,200

that brings up a good point i know folks

664

00:25:26,870 --> 00:25:25,039

have been interested in you know why

665

00:25:28,549 --> 00:25:26,880

don't we have cameras

666

00:25:30,950 --> 00:25:28,559

uh you know nobody would love to see

667

00:25:34,070 --> 00:25:30,960

webb doing its thing right now than than

668

00:25:36,310 --> 00:25:34,080

us um so it's uh you know and and you

669

00:25:39,110 --> 00:25:36,320

know one of the things we we we really

670

00:25:42,230 --> 00:25:39,120

did want to put cameras on web uh

671

00:25:44,230 --> 00:25:42,240

however uh web changes shape a lot you

672

00:25:45,590 --> 00:25:44,240

can tell over over its deployment it's

673

00:25:47,830 --> 00:25:45,600

going through a multiple different

674

00:25:49,990 --> 00:25:47,840

configurations so we just didn't need

675

00:25:52,789 --> 00:25:50,000

one camera we would need multiple

676

00:25:54,549 --> 00:25:52,799

cameras in multiple locations uh the

677

00:25:55,909 --> 00:25:54,559

other thing about web is it's very very

678

00:25:57,990 --> 00:25:55,919

shiny

679

00:26:00,310 --> 00:25:58,000

on one side and it's incredibly dark on

680

00:26:02,630 --> 00:26:00,320

the other side by design and so we would

681

00:26:04,310 --> 00:26:02,640

have to take artificial lighting

682

00:26:07,990 --> 00:26:04,320

ultimately

683

00:26:09,909 --> 00:26:08,000

engineering

684

00:26:11,430 --> 00:26:09,919

usefulness of those cameras just wasn't

685

00:26:13,110 --> 00:26:11,440

there unless it got really really

686

00:26:14,710 --> 00:26:13,120

complex fast

687

00:26:16,630 --> 00:26:14,720

the other thing is our cold side is

688

00:26:18,070 --> 00:26:16,640

really cold so any camera on that side

689

00:26:20,870 --> 00:26:18,080

would have to be designed almost from

690

00:26:23,110 --> 00:26:20,880

the ground up to survive on that side

691

00:26:25,750 --> 00:26:23,120

it would fall apart if not and we'd have

692

00:26:27,510 --> 00:26:25,760

debris floating around possibly it would

693

00:26:29,430 --> 00:26:27,520

it would uh you know unless we started

694

00:26:30,710 --> 00:26:29,440

from scratch so and then the other thing

695

00:26:32,390 --> 00:26:30,720

we're trying to keep our heat loads on

696

00:26:35,590 --> 00:26:32,400

that side very very low so all those

697

00:26:38,310 --> 00:26:35,600

things kind of combine together uh to uh

698

00:26:40,230 --> 00:26:38,320

to to say we we really want these uh but

699

00:26:41,990 --> 00:26:40,240

but we would we just can't we just can't

700

00:26:44,230 --> 00:26:42,000

do it so uh

701  
00:26:45,830 --> 00:26:44,240  
maybe from scratch from day one if we

702  
00:26:49,590 --> 00:26:45,840  
started over again we could implement

703  
00:26:51,430 --> 00:26:49,600  
them in so all that being said um we we

704  
00:26:52,950 --> 00:26:51,440  
take all of our telemetry that's coming

705  
00:26:55,430 --> 00:26:52,960  
down from web that's actually the

706  
00:26:57,510 --> 00:26:55,440  
numbers that we see on our screens and

707  
00:26:59,350 --> 00:26:57,520  
all the different information web is

708  
00:27:01,110 --> 00:26:59,360  
incredibly instrumented it's telling us

709  
00:27:02,630 --> 00:27:01,120  
everything about itself at all times

710  
00:27:03,990 --> 00:27:02,640  
it's position where all these

711  
00:27:05,430 --> 00:27:04,000  
deployments are

712  
00:27:07,590 --> 00:27:05,440  
but we take all that data and we

713  
00:27:10,230 --> 00:27:07,600

synthesize it into a visual which we're

714

00:27:11,990 --> 00:27:10,240

seeing on the screen right now and uh so

715

00:27:13,909 --> 00:27:12,000

it we don't use it from an engineering

716

00:27:15,269 --> 00:27:13,919

perspective as far as

717

00:27:17,269 --> 00:27:15,279

this is what's really happening the

718

00:27:19,909 --> 00:27:17,279

numbers tell us what's really happening

719

00:27:23,350 --> 00:27:19,919

uh but uh our incredible ovt our

720

00:27:28,950 --> 00:27:23,360

observatory uh visualization tool and

721

00:27:32,470 --> 00:27:30,950

they put a very cool tool together and

722

00:27:34,070 --> 00:27:32,480

uh this kind of gives us a little

723

00:27:35,110 --> 00:27:34,080

connection to web even though we can't

724

00:27:37,110 --> 00:27:35,120

see it

725

00:27:38,789 --> 00:27:37,120

this gives us that visual and spatial

726

00:27:41,110 --> 00:27:38,799

recognition of what's going on and it's

727

00:27:42,870 --> 00:27:41,120

been very useful to our engineers

728

00:27:45,990 --> 00:27:42,880

as we work through different uh you know

729

00:27:47,110 --> 00:27:46,000

different things that have been going on

730

00:27:49,830 --> 00:27:47,120

wonderful

731

00:27:51,190 --> 00:27:49,840

so um keith do you have any idea

732

00:27:52,870 --> 00:27:51,200

are we on sort of that and so a

733

00:27:56,470 --> 00:27:52,880

countdown about how much time it'll be

734

00:27:58,870 --> 00:27:56,480

until we know that this is completed

735

00:28:01,830 --> 00:27:58,880

let's see we're uh you can i you should

736

00:28:05,350 --> 00:28:01,840

be doing layer four on the aft right now

737

00:28:10,549 --> 00:28:07,669

that's quite a long motor move uh for

738

00:28:14,230 --> 00:28:12,630

and i'm just i always pull up that here

739

00:28:16,549 --> 00:28:14,240

i'm listening to a bunch of different

740

00:28:18,549 --> 00:28:16,559

operational loops uh but they have got

741

00:28:21,430 --> 00:28:18,559

that started so we we should see that

742

00:28:23,430 --> 00:28:21,440

that going right now

743

00:28:24,310 --> 00:28:23,440

and again right now

744

00:28:25,909 --> 00:28:24,320

okay

745

00:28:28,950 --> 00:28:25,919

go ahead and show

746

00:28:29,269 --> 00:28:28,960

oh no please please go ahead keith

747

00:28:30,950 --> 00:28:29,279

just no

748

00:28:32,549 --> 00:28:30,960

re you know just going to reiterate that

749

00:28:34,070 --> 00:28:32,559

we have two corners there you can see in

750

00:28:36,549 --> 00:28:34,080

that view of the ovt there's actually

751  
00:28:38,950 --> 00:28:36,559  
two corners uh so we actually have two

752  
00:28:40,950 --> 00:28:38,960  
sets of mechanisms winding uh two sets

753  
00:28:42,389 --> 00:28:40,960  
of cables for each of those uh corners

754  
00:28:44,389 --> 00:28:42,399  
right now

755  
00:28:46,630 --> 00:28:44,399  
um you can see up in the corner there i

756  
00:28:48,389 --> 00:28:46,640  
must uh maybe you can see in the corner

757  
00:28:50,950 --> 00:28:48,399  
you'll see uh some of that data that's

758  
00:28:53,269 --> 00:28:50,960  
coming down from web that's counting up

759  
00:28:55,669 --> 00:28:53,279  
uh those are our uh instrumentation that

760  
00:28:57,750 --> 00:28:55,679  
tells us our our position of our motors

761  
00:29:02,870 --> 00:28:57,760  
and how many uh you know how our motors

762  
00:29:05,830 --> 00:29:04,310  
i think that we have a few minutes here

763  
00:29:08,149 --> 00:29:05,840

to maybe go back into some of the

764

00:29:10,310 --> 00:29:08,159

explanation as to why this heat shield

765

00:29:12,710 --> 00:29:10,320

is required you know the whole idea

766

00:29:14,310 --> 00:29:12,720

about infrared astronomy and why it's so

767

00:29:16,950 --> 00:29:14,320

imperative to keep this particular

768

00:29:18,310 --> 00:29:16,960

observatory so cold

769

00:29:20,149 --> 00:29:18,320

so um

770

00:29:22,950 --> 00:29:20,159

maybe i'll just start by you know a bit

771

00:29:24,470 --> 00:29:22,960

of background about the infrared and um

772

00:29:26,549 --> 00:29:24,480

infrared astronomy is something that

773

00:29:29,350 --> 00:29:26,559

i've been involved in uh since i was

774

00:29:30,710 --> 00:29:29,360

right out of my phd i i started working

775

00:29:32,549 --> 00:29:30,720

at the jet propulsion laboratory in

776

00:29:35,350 --> 00:29:32,559

caltech on the spitzer mission a long

777

00:29:37,110 --> 00:29:35,360

time ago um infrared radiation is

778

00:29:38,789 --> 00:29:37,120

something that we commonly think of as

779

00:29:41,269 --> 00:29:38,799

as heat radiation

780

00:29:44,710 --> 00:29:41,279

and uh you know infrared the uh the

781

00:29:47,590 --> 00:29:44,720

actual word infrared means beyond red so

782

00:29:49,590 --> 00:29:47,600

this is a color that our eyes don't see

783

00:29:52,070 --> 00:29:49,600

uh our eyes are only sensitive to a

784

00:29:54,630 --> 00:29:52,080

small range of all the colors of light

785

00:29:56,230 --> 00:29:54,640

or as we say electromagnetic radiation

786

00:29:59,110 --> 00:29:56,240

and uh infrared is what we commonly

787

00:30:00,870 --> 00:29:59,120

think of as as heat radiation and uh so

788

00:30:02,950 --> 00:30:00,880

that's uh that's something that we we

789

00:30:05,590 --> 00:30:02,960

need to keep the observatory very very

790

00:30:08,310 --> 00:30:05,600

cold in order to detect heat radiation

791

00:30:10,389 --> 00:30:08,320

from objects very very far away in space

792

00:30:12,230 --> 00:30:10,399

and in fact uh the science goals of web

793

00:30:14,710 --> 00:30:12,240

include detecting perhaps the farthest

794

00:30:16,389 --> 00:30:14,720

things we've ever discovered um one of

795

00:30:17,909 --> 00:30:16,399

the real advantages to infrared as you

796

00:30:19,909 --> 00:30:17,919

see here this is a hubble space

797

00:30:21,990 --> 00:30:19,919

telescope visible light image of the

798

00:30:24,470 --> 00:30:22,000

famous pillars of creation that's a

799

00:30:26,950 --> 00:30:24,480

giant gas cloud that's producing several

800

00:30:29,190 --> 00:30:26,960

stars inside it stars are being born and

801  
00:30:31,350 --> 00:30:29,200  
when you go to the infrared um hubble

802  
00:30:33,750 --> 00:30:31,360  
did have an instrument nick moss that

803  
00:30:39,590 --> 00:30:33,760  
did see a little bit into the infrared

804  
00:30:42,710 --> 00:30:41,909  
so the uh those those two images are

805  
00:30:44,549 --> 00:30:42,720  
both

806  
00:30:46,470 --> 00:30:44,559  
absolutely real it's just that the

807  
00:30:49,110 --> 00:30:46,480  
second one is an infrared light which is

808  
00:30:51,029 --> 00:30:49,120  
invisible radiation to your eyes uh

809  
00:30:52,470 --> 00:30:51,039  
infrared light has the ability to cut

810  
00:30:54,549 --> 00:30:52,480  
through dust

811  
00:30:56,630 --> 00:30:54,559  
and this is one of the the amazing

812  
00:30:59,029 --> 00:30:56,640  
properties uh just like you saw if you

813  
00:31:02,070 --> 00:30:59,039

want to see stars and planets forming

814

00:31:03,110 --> 00:31:02,080

they do so inside giant clouds of dust

815

00:31:04,630 --> 00:31:03,120

and gas

816

00:31:06,950 --> 00:31:04,640

and normally the visible light is

817

00:31:08,470 --> 00:31:06,960

completely obscured by all of that dust

818

00:31:10,710 --> 00:31:08,480

uh there are other things like the very

819

00:31:13,430 --> 00:31:10,720

center of our galaxy uh the milky way

820

00:31:15,590 --> 00:31:13,440

galaxy which is a family of about a half

821

00:31:17,909 --> 00:31:15,600

a trillion stars that we belong to the

822

00:31:20,549 --> 00:31:17,919

center of the galaxy is on the order of

823

00:31:22,950 --> 00:31:20,559

about 30 000 light years away from us a

824

00:31:25,590 --> 00:31:22,960

light year being about 6 trillion miles

825

00:31:28,389 --> 00:31:25,600

the distance light travels in a year

826

00:31:30,149 --> 00:31:28,399

and that is also obscured by big clouds

827

00:31:32,389 --> 00:31:30,159

of dust we can't see into the center of

828

00:31:34,230 --> 00:31:32,399

our galaxy invisible light

829

00:31:35,750 --> 00:31:34,240

so there there are so many objects that

830

00:31:39,669 --> 00:31:35,760

infrared is going to be you know really

831

00:31:43,909 --> 00:31:41,669

we uh we we may also have some some

832

00:31:45,990 --> 00:31:43,919

roland's uh oh here we go yes uh here's

833

00:31:48,630 --> 00:31:46,000

a really lovely role in showing you that

834

00:31:50,470 --> 00:31:48,640

web and hubble uh hubble space telescope

835

00:31:51,830 --> 00:31:50,480

was designed mainly to see visible light

836

00:31:53,190 --> 00:31:51,840

the kind of light that our eye sees it

837

00:31:55,830 --> 00:31:53,200

did see a little bit into the

838

00:31:58,630 --> 00:31:55,840

ultraviolet and infrared uh web is

839

00:32:00,710 --> 00:31:58,640

optimized and designed to see infrared

840

00:32:03,110 --> 00:32:00,720

and amazingly that allows you to see

841

00:32:05,509 --> 00:32:03,120

farther away in the universe and that

842

00:32:08,310 --> 00:32:05,519

means farther back in time the farther

843

00:32:10,470 --> 00:32:08,320

away you look in space the longer light

844

00:32:12,310 --> 00:32:10,480

has taken to travel to you

845

00:32:14,549 --> 00:32:12,320

and there's an amazing property of our

846

00:32:16,789 --> 00:32:14,559

universe so the universe is expanding

847

00:32:19,110 --> 00:32:16,799

space itself is expanding

848

00:32:21,430 --> 00:32:19,120

and as that light from the very early

849

00:32:23,350 --> 00:32:21,440

universe travels through space the

850

00:32:24,870 --> 00:32:23,360

wavelength is actually stretched by the

851

00:32:26,950 --> 00:32:24,880

expansion of space

852

00:32:28,950 --> 00:32:26,960

so light that might have begun from

853

00:32:31,909 --> 00:32:28,960

starlight in the ultraviolet or visible

854

00:32:33,750 --> 00:32:31,919

light from the first generation of stars

855

00:32:36,149 --> 00:32:33,760

that wavelength of light has actually

856

00:32:38,230 --> 00:32:36,159

been stretched out into the infrared

857

00:32:40,230 --> 00:32:38,240

and so if you want to see galaxies that

858

00:32:42,310 --> 00:32:40,240

are very far away and very distant and

859

00:32:45,590 --> 00:32:42,320

here we actually see a graphic of how

860

00:32:47,350 --> 00:32:45,600

that works a galaxy uh is actually it

861

00:32:49,669 --> 00:32:47,360

seems to be receding from us in the

862

00:32:51,110 --> 00:32:49,679

expansion of space and that that light

863

00:32:53,269 --> 00:32:51,120

that would have started as visible or

864

00:32:55,590 --> 00:32:53,279

ultraviolet becomes infrared

865

00:32:57,190 --> 00:32:55,600

so one of the amazing science goals of

866

00:32:59,830 --> 00:32:57,200

webb is to be able to look back to a

867

00:33:02,070 --> 00:32:59,840

time probably only about 200 million

868

00:33:03,750 --> 00:33:02,080

years after the big bang and this is the

869

00:33:05,830 --> 00:33:03,760

era that we think the very first stars

870

00:33:07,990 --> 00:33:05,840

and galaxies were forming and so the

871

00:33:10,310 --> 00:33:08,000

amazing thing is the infrared light will

872

00:33:12,789 --> 00:33:10,320

allow us to actually see that far back

873

00:33:17,750 --> 00:33:12,799

looking at the origins of galaxies and

874

00:33:17,760 --> 00:33:21,110

all right and uh michelle

875

00:33:24,149 --> 00:33:22,389

i'm sorry i'm just saying you can start

876

00:33:27,190 --> 00:33:24,159

seeing if you see you start to see that

877

00:33:29,750 --> 00:33:27,200

layer uh starting to rise up uh layer

878

00:33:34,070 --> 00:33:29,760

four on that aft side so uh slowly

879

00:33:37,110 --> 00:33:35,590

this must be very exciting for you can

880

00:33:37,990 --> 00:33:37,120

you can you give us a sense about uh

881

00:33:39,590 --> 00:33:38,000

here

882

00:33:41,029 --> 00:33:39,600

right now

883

00:33:44,230 --> 00:33:41,039

but we like the grass to grow really

884

00:33:45,990 --> 00:33:44,240

really slow uh so yes this is uh

885

00:33:47,430 --> 00:33:46,000

this is exciting i mean yesterday we did

886

00:33:50,789 --> 00:33:47,440

not think we were going to get through

887

00:33:53,190 --> 00:33:50,799

the first three layers um but the team

888

00:33:55,350 --> 00:33:53,200

you know again the the entire team uh

889

00:33:57,430 --> 00:33:55,360

just executed everything flawlessly we

890

00:33:59,190 --> 00:33:57,440

were only planning to do one yesterday

891

00:34:01,830 --> 00:33:59,200

but that went so well they said hey can

892

00:34:03,269 --> 00:34:01,840

we just keep going uh and we almost had

893

00:34:05,110 --> 00:34:03,279

to hold him back a little bit you know

894

00:34:06,870 --> 00:34:05,120

as the day was getting long and uh you

895

00:34:08,629 --> 00:34:06,880

know we don't want uh we want to make

896

00:34:11,270 --> 00:34:08,639

sure they're well rested uh but they

897

00:34:12,790 --> 00:34:11,280

were eager to go and uh so uh

898

00:34:15,669 --> 00:34:12,800

they're all excited this morning getting

899

00:34:16,790 --> 00:34:15,679

these last two out

900

00:34:18,310 --> 00:34:16,800

this was one of the things that we were

901  
00:34:19,669 --> 00:34:18,320  
talking about about the live broadcast

902  
00:34:21,349 --> 00:34:19,679  
you know we we uh

903  
00:34:23,109 --> 00:34:21,359  
we've just been following exactly when

904  
00:34:24,950 --> 00:34:23,119  
this is happening of course you know the

905  
00:34:26,790 --> 00:34:24,960  
communications team does not dictate how

906  
00:34:28,310 --> 00:34:26,800  
the observatory is unfolded the

907  
00:34:30,629 --> 00:34:28,320  
engineers do it when the conditions are

908  
00:34:32,790 --> 00:34:30,639  
right and people around the world have

909  
00:34:34,869 --> 00:34:32,800  
been joining us you know i i i actually

910  
00:34:37,030 --> 00:34:34,879  
uh was talking to somebody who was a

911  
00:34:38,470 --> 00:34:37,040  
fisherman up in alaska and i was telling

912  
00:34:40,230 --> 00:34:38,480  
him that okay now things are going

913  
00:34:41,589 --> 00:34:40,240

faster than we expected now and the

914

00:34:43,430 --> 00:34:41,599

thing that he said to me was you have to

915

00:34:45,030 --> 00:34:43,440

respect the respect the catch you know

916

00:34:46,389 --> 00:34:45,040

where the things go go slow and when the

917

00:34:48,629 --> 00:34:46,399

way when the fish are biting you keep

918

00:34:50,389 --> 00:34:48,639

going and uh that's the the amazing

919

00:34:52,230 --> 00:34:50,399

thing that things were going so well

920

00:34:54,230 --> 00:34:52,240

that they decided to just go ahead and

921

00:34:55,589 --> 00:34:54,240

uh and keep on keep unfolding via the

922

00:34:57,670 --> 00:34:55,599

sunshield so that's what we're looking

923

00:34:59,109 --> 00:34:57,680

at right now

924

00:35:01,510 --> 00:34:59,119

and and michelle i think you're you're

925

00:35:03,670 --> 00:35:01,520

seeing two different rooms uh on the

926

00:35:06,069 --> 00:35:03,680

broadcast we have we have two main rooms

927

00:35:08,630 --> 00:35:06,079

we actually have multiple rooms uh but

928

00:35:10,470 --> 00:35:08,640

our one room uh that's shown below there

929

00:35:12,230 --> 00:35:10,480

uh that's our that's actually our flight

930

00:35:13,190 --> 00:35:12,240

control room so that's sort of the nerve

931

00:35:15,670 --> 00:35:13,200

center

932

00:35:17,109 --> 00:35:15,680

uh of the con of the entire mission op

933

00:35:20,069 --> 00:35:17,119

center that's where actually commands

934

00:35:21,750 --> 00:35:20,079

get sent uh to to web so you can imagine

935

00:35:23,349 --> 00:35:21,760

that's a that's a that's a key room we

936

00:35:24,230 --> 00:35:23,359

have our controller sitting on the front

937

00:35:25,510 --> 00:35:24,240

row

938

00:35:27,829 --> 00:35:25,520

um

939

00:35:29,510 --> 00:35:27,839

we have our mission ops manager uh who's

940

00:35:31,589 --> 00:35:29,520

uh sort of the ring ringleader

941

00:35:32,710 --> 00:35:31,599

controlling the whole show he's in there

942

00:35:35,349 --> 00:35:32,720

right now

943

00:35:37,910 --> 00:35:35,359

along with our management team uh all of

944

00:35:40,630 --> 00:35:37,920

our ground communications through our uh

945

00:35:43,030 --> 00:35:40,640

our ground stations around the world i'm

946

00:35:46,230 --> 00:35:43,040

not quite sure what station we're on now

947

00:35:48,710 --> 00:35:46,240

uh but uh madrid uh in spain canberra in

948

00:35:51,109 --> 00:35:48,720

australia and goldstone in california

949

00:35:52,550 --> 00:35:51,119

those are our ground stations and and

950

00:35:55,109 --> 00:35:52,560

all those coordination with them is

951  
00:35:57,030 --> 00:35:55,119  
actually done from that room uh our

952  
00:35:58,390 --> 00:35:57,040  
timeline people those are folks that are

953  
00:35:59,670 --> 00:35:58,400  
very very busy

954  
00:36:02,390 --> 00:35:59,680  
um

955  
00:36:04,230 --> 00:36:02,400  
creating schedules for us uh minute by

956  
00:36:06,230 --> 00:36:04,240  
minute of operation we change those

957  
00:36:08,390 --> 00:36:06,240  
timelines slightly every day and they're

958  
00:36:10,470 --> 00:36:08,400  
just they're incredible what they do

959  
00:36:12,790 --> 00:36:10,480  
keeping us uh keeping us straight and

960  
00:36:14,150 --> 00:36:12,800  
keeping everybody on schedule the top

961  
00:36:15,990 --> 00:36:14,160  
the top view there is actually our

962  
00:36:17,589 --> 00:36:16,000  
engineering support room that's where

963  
00:36:19,750 --> 00:36:17,599

our deployments team is back in that

964

00:36:22,550 --> 00:36:19,760

back corner uh we have all of our

965

00:36:24,630 --> 00:36:22,560

subsystems our attitude control our

966

00:36:27,430 --> 00:36:24,640

propulsion engineers our communication

967

00:36:30,950 --> 00:36:27,440

engineers thermal engineers and and our

968

00:36:33,349 --> 00:36:30,960

system engineers are all in that room uh

969

00:36:34,790 --> 00:36:33,359

watching uh and and watching over and

970

00:36:39,270 --> 00:36:34,800

making sure everything's safely

971

00:36:39,280 --> 00:36:42,790

excellent

972

00:36:46,550 --> 00:36:44,790

but just for any people that are joining

973

00:36:48,150 --> 00:36:46,560

us now on our broadcast um you're

974

00:36:50,310 --> 00:36:48,160

joining us for the the live

975

00:36:52,470 --> 00:36:50,320

commissioning of the james webb space

976  
00:36:55,270 --> 00:36:52,480  
telescope what's happening today is the

977  
00:36:57,910 --> 00:36:55,280  
very final stages of unfolding the the

978  
00:36:59,910 --> 00:36:57,920  
large incredibly innovative sun shield

979  
00:37:02,310 --> 00:36:59,920  
that will keep this telescope very very

980  
00:37:04,470 --> 00:37:02,320  
cold and the uh the ability to see very

981  
00:37:06,230 --> 00:37:04,480  
far into the infrared

982  
00:37:08,550 --> 00:37:06,240  
um infrared light as we were saying

983  
00:37:10,310 --> 00:37:08,560  
before is a form of heat that's that's

984  
00:37:12,069 --> 00:37:10,320  
how we normally think of it as the way

985  
00:37:13,589 --> 00:37:12,079  
we experience it but one of the things

986  
00:37:15,750 --> 00:37:13,599  
people often don't know

987  
00:37:17,910 --> 00:37:15,760  
is that objects that we think are very

988  
00:37:20,790 --> 00:37:17,920

cold to human standards still emit quite

989

00:37:23,109 --> 00:37:20,800

a lot of infrared light and as keith had

990

00:37:25,270 --> 00:37:23,119

said before the uh the operating uh

991

00:37:27,990 --> 00:37:25,280

temperature of the telescope itself once

992

00:37:30,150 --> 00:37:28,000

it's shielded from the sun will be

993

00:37:32,310 --> 00:37:30,160

key that's pretty close to minus 400

994

00:37:33,829 --> 00:37:32,320

degrees below zero fahrenheit is that

995

00:37:38,150 --> 00:37:33,839

correct

996

00:37:40,069 --> 00:37:38,160

in uh you know on our side we always use

997

00:37:42,710 --> 00:37:40,079

kelvins uh which is an absolute scale

998

00:37:45,829 --> 00:37:42,720

from zero so yeah right around minus 400

999

00:37:47,670 --> 00:37:45,839

uh our you know our telescope

1000

00:37:50,310 --> 00:37:47,680

uh our instruments we have you know we

1001  
00:37:53,109 --> 00:37:50,320  
have four instruments on board and it's

1002  
00:37:54,310 --> 00:37:53,119  
really those camera detectors that are

1003  
00:37:57,190 --> 00:37:54,320  
you know

1004  
00:37:58,550 --> 00:37:57,200  
not not too much unlike your your your

1005  
00:38:00,790 --> 00:37:58,560  
camera that you have on your phone but

1006  
00:38:02,790 --> 00:38:00,800  
obviously much more elaborate and cold

1007  
00:38:04,710 --> 00:38:02,800  
uh so it's those detectors that we're

1008  
00:38:06,630 --> 00:38:04,720  
really trying to keep at that you know

1009  
00:38:07,990 --> 00:38:06,640  
minus 400 degree

1010  
00:38:10,630 --> 00:38:08,000  
rough temperature range to make sure

1011  
00:38:11,990 --> 00:38:10,640  
they're absolutely uh the only photons

1012  
00:38:14,390 --> 00:38:12,000  
of energy that are hitting those

1013  
00:38:18,630 --> 00:38:14,400

detectors are really coming from the

1014

00:38:20,230 --> 00:38:18,640

object that that web is observing

1015

00:38:22,150 --> 00:38:20,240

and of course it's an incredible idea to

1016

00:38:24,069 --> 00:38:22,160

test something to that temperature and i

1017

00:38:26,310 --> 00:38:24,079

believe we might actually have some some

1018

00:38:28,310 --> 00:38:26,320

b-roll and some footage of testing of

1019

00:38:29,829 --> 00:38:28,320

the web telescope i remember that some

1020

00:38:31,990 --> 00:38:29,839

of that happened at the goddard space

1021

00:38:33,510 --> 00:38:32,000

flight center we we have a uh a space

1022

00:38:35,430 --> 00:38:33,520

environment chamber which actually

1023

00:38:37,190 --> 00:38:35,440

simulates uh going down to very cold

1024

00:38:40,150 --> 00:38:37,200

temperatures but then there was also

1025

00:38:41,750 --> 00:38:40,160

testing done in houston as well um keith

1026  
00:38:43,109 --> 00:38:41,760  
maybe you can talk to us a bit about

1027  
00:38:44,470 --> 00:38:43,119  
some of the tests that web went through

1028  
00:38:46,550 --> 00:38:44,480  
before its launch

1029  
00:38:49,510 --> 00:38:46,560  
yeah um you know

1030  
00:38:51,589 --> 00:38:49,520  
being being a cryogenic uh

1031  
00:38:53,750 --> 00:38:51,599  
observatory presents incredible

1032  
00:38:56,310 --> 00:38:53,760  
challenges on the ground for testing uh

1033  
00:38:58,230 --> 00:38:56,320  
you know testing it at room temperature

1034  
00:39:00,310 --> 00:38:58,240  
doesn't tell us a whole lot um

1035  
00:39:02,150 --> 00:39:00,320  
everything about web is designed to be

1036  
00:39:04,790 --> 00:39:02,160  
operated at these incredibly cold

1037  
00:39:07,270 --> 00:39:04,800  
temperatures so like the mirror itself

1038  
00:39:09,190 --> 00:39:07,280

uh it actually is not a very good mirror

1039

00:39:11,190 --> 00:39:09,200

at these temperatures it's actually gets

1040

00:39:14,150 --> 00:39:11,200

better as it gets colder so in order for

1041

00:39:15,829 --> 00:39:14,160

us to test the optical system or the

1042

00:39:17,430 --> 00:39:15,839

instruments we have to take them into

1043

00:39:18,950 --> 00:39:17,440

incredibly cold temperatures so we did

1044

00:39:21,670 --> 00:39:18,960

some testing at the goddard space flight

1045

00:39:24,069 --> 00:39:21,680

center uh in maryland uh that's where we

1046

00:39:26,310 --> 00:39:24,079

took our entire instrument package uh

1047

00:39:29,430 --> 00:39:26,320

put it in one of these chambers uh we

1048

00:39:31,270 --> 00:39:29,440

actually pump liquid helium uh around

1049

00:39:33,030 --> 00:39:31,280

the walls of this vacuum chamber and

1050

00:39:35,109 --> 00:39:33,040

that's what drives us down to these uh

1051  
00:39:37,349 --> 00:39:35,119  
really really cold temperatures once

1052  
00:39:39,030 --> 00:39:37,359  
that instrument package was tested at

1053  
00:39:42,069 --> 00:39:39,040  
those temperatures we introduced it to

1054  
00:39:43,750 --> 00:39:42,079  
the telescope uh and uh the telescope

1055  
00:39:44,950 --> 00:39:43,760  
and the instruments were integrated and

1056  
00:39:47,190 --> 00:39:44,960  
it was too big

1057  
00:39:48,390 --> 00:39:47,200  
for our facilities at the goddard space

1058  
00:39:50,950 --> 00:39:48,400  
flight center so we took it all the way

1059  
00:39:53,190 --> 00:39:50,960  
down to houston uh in texas to the

1060  
00:39:55,349 --> 00:39:53,200  
johnson space center in chamber a

1061  
00:39:58,390 --> 00:39:55,359  
chamber a is famous

1062  
00:40:00,630 --> 00:39:58,400  
uh for being built to test the uh

1063  
00:40:02,790 --> 00:40:00,640

for the apollo program so

1064

00:40:04,550 --> 00:40:02,800

again we completely retrofitted again

1065

00:40:07,190 --> 00:40:04,560

worked with our team down at the johnson

1066

00:40:09,430 --> 00:40:07,200

space center again incredible nasa team

1067

00:40:11,750 --> 00:40:09,440

uh between centers and what we did there

1068

00:40:14,390 --> 00:40:11,760

is we completely turned that chamber

1069

00:40:17,670 --> 00:40:14,400

into an optical test facility that could

1070

00:40:19,990 --> 00:40:17,680

be operated at our temperatures uh and

1071

00:40:22,069 --> 00:40:20,000

and that that again an incredible

1072

00:40:23,030 --> 00:40:22,079

achievement by by the team that did that

1073

00:40:24,470 --> 00:40:23,040

work

1074

00:40:28,069 --> 00:40:24,480

we were under

1075

00:40:30,470 --> 00:40:28,079

down there

1076

00:40:32,309 --> 00:40:30,480

i i want to say well over 100 days it

1077

00:40:33,829 --> 00:40:32,319

was almost nearly four months uh yeah

1078

00:40:35,030 --> 00:40:33,839

you can see some of the footage of us

1079

00:40:36,950 --> 00:40:35,040

coming out

1080

00:40:38,950 --> 00:40:36,960

of the chamber into the clean room so

1081

00:40:41,750 --> 00:40:38,960

this was after the testing testing was

1082

00:40:43,510 --> 00:40:41,760

done um so yeah we had a team we had

1083

00:40:45,430 --> 00:40:43,520

pretty much the entire telescope and

1084

00:40:47,270 --> 00:40:45,440

instrument team and spacecraft team down

1085

00:40:48,150 --> 00:40:47,280

at johnson space center for nearly 100

1086

00:40:50,870 --> 00:40:48,160

days

1087

00:40:53,190 --> 00:40:50,880

uh and if i think that was in 2017 so

1088

00:40:55,349 --> 00:40:53,200

that was when hurricane harvey uh

1089

00:40:58,309 --> 00:40:55,359

happened to to come through houston and

1090

00:41:00,230 --> 00:40:58,319

uh and presented some challenges for us

1091

00:41:01,829 --> 00:41:00,240

and our team down there uh supporting

1092

00:41:03,990 --> 00:41:01,839

that test but we were able to test

1093

00:41:05,589 --> 00:41:04,000

through through that hurricane uh you

1094

00:41:07,589 --> 00:41:05,599

know that that really devastated that

1095

00:41:10,150 --> 00:41:07,599

area and it actually you know a lot of

1096

00:41:11,910 --> 00:41:10,160

the people that worked on the facilities

1097

00:41:14,309 --> 00:41:11,920

and and were working at a johnson space

1098

00:41:16,790 --> 00:41:14,319

sites space flight center were highly

1099

00:41:19,109 --> 00:41:16,800

impacted in their personal life by

1100

00:41:20,950 --> 00:41:19,119

harvey but they they kept at it and

1101  
00:41:22,950 --> 00:41:20,960  
supported us so that was that was quite

1102  
00:41:25,349 --> 00:41:22,960  
a that was quite a uh you know

1103  
00:41:26,790 --> 00:41:25,359  
achievement for for for our team to and

1104  
00:41:28,309 --> 00:41:26,800  
nothing's been done like that before

1105  
00:41:30,950 --> 00:41:28,319  
you've net we've never taken something

1106  
00:41:32,710 --> 00:41:30,960  
this large down an optical system uh to

1107  
00:41:35,190 --> 00:41:32,720  
these temperatures and been able to do

1108  
00:41:36,790 --> 00:41:35,200  
that so uh quite an end you know really

1109  
00:41:38,550 --> 00:41:36,800  
really tough testing web on the ground

1110  
00:41:39,990 --> 00:41:38,560  
that's why we like it in space

1111  
00:41:41,349 --> 00:41:40,000  
it's at home it's always wanted to be

1112  
00:41:43,349 --> 00:41:41,359  
there so that's why we're so excited

1113  
00:41:44,550 --> 00:41:43,359

where it is now

1114

00:41:45,750 --> 00:41:44,560

absolutely

1115

00:41:47,510 --> 00:41:45,760

well let's talk about you know you

1116

00:41:49,430 --> 00:41:47,520

mentioned his home in space it's going

1117

00:41:51,190 --> 00:41:49,440

to a very specific location in space

1118

00:41:52,550 --> 00:41:51,200

it's not just going anywhere out there

1119

00:41:55,270 --> 00:41:52,560

it's going to a point that we call the

1120

00:41:56,710 --> 00:41:55,280

second lagrange point or or l2

1121

00:41:58,630 --> 00:41:56,720

and and maybe you can give us a little

1122

00:42:01,030 --> 00:41:58,640

bit of a talk about you know

1123

00:42:02,470 --> 00:42:01,040

where is this and and why would we put

1124

00:42:03,910 --> 00:42:02,480

web at the lagrange point what is the

1125

00:42:06,069 --> 00:42:03,920

lagrange point to begin with how about

1126

00:42:07,990 --> 00:42:06,079

that yeah yeah so you know these

1127

00:42:10,069 --> 00:42:08,000

lagrange points are interesting places

1128

00:42:12,150 --> 00:42:10,079

where two large bodies like the earth

1129

00:42:14,230 --> 00:42:12,160

and sun the gravity of them sort of

1130

00:42:17,349 --> 00:42:14,240

interacts in a way where you can put

1131

00:42:18,950 --> 00:42:17,359

objects there and with some control you

1132

00:42:21,829 --> 00:42:18,960

can kind of keep them there so what's

1133

00:42:23,910 --> 00:42:21,839

really nice about lagrange point two uh

1134

00:42:26,790 --> 00:42:23,920

every large two body system has five

1135

00:42:28,950 --> 00:42:26,800

lagrange points uh we use lagrange point

1136

00:42:31,270 --> 00:42:28,960

two which is on the opposite side of the

1137

00:42:33,349 --> 00:42:31,280

sun so the sun line and the earth we're

1138

00:42:36,069 --> 00:42:33,359

a million miles away from the sun on the

1139

00:42:37,750 --> 00:42:36,079

other side uh and and and what's nice

1140

00:42:40,630 --> 00:42:37,760

about that as the earth goes around the

1141

00:42:42,470 --> 00:42:40,640

sun uh the web just kind of tracks along

1142

00:42:44,630 --> 00:42:42,480

with the with the earth as it goes in

1143

00:42:46,309 --> 00:42:44,640

this animation you can see and we're

1144

00:42:48,630 --> 00:42:46,319

always able to keep the earth and the

1145

00:42:51,510 --> 00:42:48,640

sun uh in a line with us and that's

1146

00:42:53,270 --> 00:42:51,520

really what lets us use a sun shade uh

1147

00:42:55,990 --> 00:42:53,280

our sun shield like we have with webb

1148

00:42:58,470 --> 00:42:56,000

that blocks out the earth and the sun

1149

00:42:59,910 --> 00:42:58,480

and keeps webb in darkness all the time

1150

00:43:02,069 --> 00:42:59,920

the other nice thing about the lagrange

1151

00:43:04,630 --> 00:43:02,079

point is it is a million miles away but

1152

00:43:06,790 --> 00:43:04,640

that's really not that far so it allows

1153

00:43:09,430 --> 00:43:06,800

us to uh have a reasonably sized

1154

00:43:11,750 --> 00:43:09,440

communication system uh we can we're

1155

00:43:13,829 --> 00:43:11,760

going to create gigabytes of data every

1156

00:43:15,910 --> 00:43:13,839

day from our cameras and our and our

1157

00:43:17,430 --> 00:43:15,920

instrument detectors uh we have to get

1158

00:43:20,309 --> 00:43:17,440

all that data to the ground and we don't

1159

00:43:22,069 --> 00:43:20,319

really need huge antennas uh to do that

1160

00:43:23,589 --> 00:43:22,079

so that's one nice thing about million

1161

00:43:25,270 --> 00:43:23,599

miles sounds far

1162

00:43:27,190 --> 00:43:25,280

but remember we're sending data from

1163

00:43:28,710 --> 00:43:27,200

pluto and other missions back to earth

1164

00:43:30,630 --> 00:43:28,720

and it takes a long time so this is good

1165

00:43:32,230 --> 00:43:30,640

for us uh the other thing about lagrange

1166

00:43:34,069 --> 00:43:32,240

point two is it's it's an it's far

1167

00:43:36,950 --> 00:43:34,079

enough away from the earth also that uh

1168

00:43:39,109 --> 00:43:36,960

it creates a nice cold area for us uh to

1169

00:43:41,109 --> 00:43:39,119

do that so it's almost like it was uh

1170

00:43:42,390 --> 00:43:41,119

it's just the best place to go if you

1171

00:43:43,510 --> 00:43:42,400

want to do you know you want to do

1172

00:43:44,790 --> 00:43:43,520

astronomy

1173

00:43:46,790 --> 00:43:44,800

especially and if you want a cold

1174

00:43:49,190 --> 00:43:46,800

telescope and that's just everything

1175

00:43:50,870 --> 00:43:49,200

about the architecture the orbit

1176  
00:43:52,550 --> 00:43:50,880  
everything has been about getting this

1177  
00:43:54,150 --> 00:43:52,560  
telescope cold

1178  
00:43:57,829 --> 00:43:54,160  
but in a reasonable distance to the

1179  
00:44:00,790 --> 00:43:59,510  
thank you for that again for people

1180  
00:44:02,230 --> 00:44:00,800  
joining us you're looking at live

1181  
00:44:04,230 --> 00:44:02,240  
coverage of the commissioning of the

1182  
00:44:06,550 --> 00:44:04,240  
james webb space telescope the final

1183  
00:44:08,790 --> 00:44:06,560  
stages of the unfolding of its huge

1184  
00:44:10,710 --> 00:44:08,800  
incredibly spectacular heat shield and

1185  
00:44:12,390 --> 00:44:10,720  
you're looking at a live image there

1186  
00:44:14,150 --> 00:44:12,400  
from the mock the mission operations

1187  
00:44:15,750 --> 00:44:14,160  
center that's at the space telescope

1188  
00:44:17,910 --> 00:44:15,760

science institute at johns hopkins

1189

00:44:20,630 --> 00:44:17,920

university so as you can see there's all

1190

00:44:22,790 --> 00:44:20,640

kinds of people standing around there i

1191

00:44:24,230 --> 00:44:22,800

know that for me the last couple of days

1192

00:44:26,230 --> 00:44:24,240

it's almost been like a kid getting up

1193

00:44:28,230 --> 00:44:26,240

on christmas morning i've been checking

1194

00:44:30,390 --> 00:44:28,240

my my email to see what was happening

1195

00:44:32,069 --> 00:44:30,400

and how quickly this was going and today

1196

00:44:34,309 --> 00:44:32,079

we're looking at the final stages of

1197

00:44:36,710 --> 00:44:34,319

unfolding this uh this heat shield uh

1198

00:44:38,710 --> 00:44:36,720

this is truly one of the most incredible

1199

00:44:40,390 --> 00:44:38,720

and engineering marvels of the web

1200

00:44:42,309 --> 00:44:40,400

telescope there are there are many but

1201

00:44:43,829 --> 00:44:42,319

this is the first one that has to be uh

1202

00:44:45,270 --> 00:44:43,839

accomplished before the rest of them can

1203

00:44:47,109 --> 00:44:45,280

start to turn on

1204

00:44:49,510 --> 00:44:47,119

and uh keith maybe this is a good time

1205

00:44:51,589 --> 00:44:49,520

for a look ahead so you know once we

1206

00:44:53,750 --> 00:44:51,599

have and i'm touching wood because we're

1207

00:44:55,750 --> 00:44:53,760

still doing it but once we have these uh

1208

00:44:57,190 --> 00:44:55,760

the sunshield completely unfolded what

1209

00:44:59,190 --> 00:44:57,200

are some of the next things that need to

1210

00:45:01,589 --> 00:44:59,200

happen before we have a full

1211

00:45:03,910 --> 00:45:01,599

commissioned observatory

1212

00:45:06,870 --> 00:45:03,920

yeah so you know for for our sunshield

1213

00:45:08,950 --> 00:45:06,880

team um this this is this is a big day

1214

00:45:12,150 --> 00:45:08,960

this is a big day for all of us uh to

1215

00:45:14,309 --> 00:45:12,160

get this this sun shield out um so we

1216

00:45:16,870 --> 00:45:14,319

will we will we will let them revel

1217

00:45:18,309 --> 00:45:16,880

quite a bit um uh for the for the rest

1218

00:45:20,950 --> 00:45:18,319

of the team uh for the rest of the

1219

00:45:22,470 --> 00:45:20,960

deployments team that's still here um

1220

00:45:24,309 --> 00:45:22,480

and for the rest of commissioning we

1221

00:45:26,550 --> 00:45:24,319

have a lot of work to do uh we got a

1222

00:45:28,870 --> 00:45:26,560

long way to go here so uh we'll we'll

1223

00:45:31,109 --> 00:45:28,880

take this uh as we get it uh we take

1224

00:45:33,190 --> 00:45:31,119

each one of our deployments as a small

1225

00:45:35,109 --> 00:45:33,200

you know it's a small touchdown but the

1226

00:45:37,829 --> 00:45:35,119

game's still going so next up is our

1227

00:45:39,910 --> 00:45:37,839

telescope and you know that is

1228

00:45:44,550 --> 00:45:39,920

you know that that's what it's all about

1229

00:45:46,790 --> 00:45:44,560

uh so uh starting uh this evening uh

1230

00:45:48,470 --> 00:45:46,800

we're gonna get some heaters on to start

1231

00:45:50,710 --> 00:45:48,480

heating up the motors

1232

00:45:54,230 --> 00:45:50,720

uh that actually do the deployment of

1233

00:45:56,950 --> 00:45:54,240

our secondary mirror uh system uh we'll

1234

00:45:59,030 --> 00:45:56,960

get that heated up uh and uh and and

1235

00:46:01,270 --> 00:45:59,040

we'll get we'll get on with that uh

1236

00:46:03,510 --> 00:46:01,280

tomorrow uh we'll start we'll start

1237

00:46:05,190 --> 00:46:03,520

doing that operation so uh that's that's

1238

00:46:06,470 --> 00:46:05,200

that's you know really

1239

00:46:08,550 --> 00:46:06,480

again i got to make sure my timeline

1240

00:46:10,230 --> 00:46:08,560

depending on how long the day goes

1241

00:46:11,910 --> 00:46:10,240

we'll we'll update everybody when we're

1242

00:46:13,670 --> 00:46:11,920

actually right actually going to do that

1243

00:46:15,910 --> 00:46:13,680

so our secondary mirror system comes out

1244

00:46:17,430 --> 00:46:15,920

you can see in this animation here and

1245

00:46:19,430 --> 00:46:17,440

we actually have a lot of other

1246

00:46:21,589 --> 00:46:19,440

deployables on web that we don't really

1247

00:46:23,589 --> 00:46:21,599

talk about uh and not just because

1248

00:46:25,910 --> 00:46:23,599

they're uh you know they're not as

1249

00:46:27,589 --> 00:46:25,920

newsworthy maybe as a telescope or or

1250

00:46:29,109 --> 00:46:27,599

the sun shield but we have a lot of

1251

00:46:31,910 --> 00:46:29,119

radiator shades we have to get out

1252

00:46:34,150 --> 00:46:31,920

tonight on the spacecraft uh the the

1253

00:46:36,069 --> 00:46:34,160

sunshield and the telescope get all the

1254

00:46:37,910 --> 00:46:36,079

attention sometime but our spacecraft is

1255

00:46:39,829 --> 00:46:37,920

critical that we control all its

1256

00:46:40,790 --> 00:46:39,839

temperatures and we don't quite have all

1257

00:46:45,349 --> 00:46:40,800

of the

1258

00:46:47,829 --> 00:46:45,359

our radiators which cool off our

1259

00:46:49,990 --> 00:46:47,839

spacecraft we have to get those out uh

1260

00:46:51,750 --> 00:46:50,000

this this evening they're much more i

1261

00:46:53,910 --> 00:46:51,760

don't want to call them simple uh but

1262

00:46:55,829 --> 00:46:53,920

they're they're much more typical type

1263

00:46:57,910 --> 00:46:55,839

deployments uh that what that will do

1264

00:46:59,750 --> 00:46:57,920

this evening for the spacecraft

1265

00:47:01,829 --> 00:46:59,760

and then again we get into our telescope

1266

00:47:04,790 --> 00:47:01,839

deployments over the next couple days uh

1267

00:47:07,430 --> 00:47:04,800

culminating in the two wings which each

1268

00:47:08,230 --> 00:47:07,440

wing has three of the 18 segments on it

1269

00:47:09,910 --> 00:47:08,240

so

1270

00:47:13,349 --> 00:47:09,920

you can see we'll do that uh what we

1271

00:47:15,030 --> 00:47:13,359

call our port wing uh our plus j2 side

1272

00:47:16,550 --> 00:47:15,040

and our in our coordinate system we call

1273

00:47:18,630 --> 00:47:16,560

that port as you're looking forward and

1274

00:47:20,950 --> 00:47:18,640

then our starboard wing uh on the other

1275

00:47:23,990 --> 00:47:20,960

side so that should be later uh in the

1276

00:47:25,990 --> 00:47:24,000

week and uh we have and then yes we will

1277

00:47:27,349 --> 00:47:26,000

we will uh breathe a big sigh of relief

1278

00:47:30,710 --> 00:47:27,359

at that point because we will have a

1279

00:47:32,390 --> 00:47:30,720

fully deployed observatory um the next

1280

00:47:34,309 --> 00:47:32,400

the next thing that our team will get

1281

00:47:37,430 --> 00:47:34,319

into i'm just i'm just listening to see

1282

00:47:39,510 --> 00:47:37,440

when this motor move will start um

1283

00:47:42,630 --> 00:47:39,520

this is our longest move by the way this

1284

00:47:44,549 --> 00:47:42,640

one on the app so this is a very long uh

1285

00:47:45,510 --> 00:47:44,559

move on the aft on layer 4 here so

1286

00:47:47,670 --> 00:47:45,520

that's why

1287

00:47:49,829 --> 00:47:47,680

this is going on a little long a lot a

1288

00:47:52,390 --> 00:47:49,839

lot of cable has to be drawn in for this

1289

00:47:54,150 --> 00:47:52,400

specific configuration uh but next uh

1290

00:47:56,950 --> 00:47:54,160

what what uh then we kind of turn over

1291

00:47:59,190 --> 00:47:56,960

the telescope to the telescope team uh

1292

00:48:00,950 --> 00:47:59,200

hopefully next week uh and what they're

1293

00:48:02,710 --> 00:48:00,960

gonna start doing is uh we have all

1294

00:48:05,349 --> 00:48:02,720

those 18 segments they're all locked

1295

00:48:07,510 --> 00:48:05,359

down uh for launch we actually sort of

1296

00:48:09,750 --> 00:48:07,520

snubbed them up tight for launch uh

1297

00:48:11,430 --> 00:48:09,760

they're going to move those mirrors

1298

00:48:16,230 --> 00:48:11,440

lead on up

1299

00:48:16,240 --> 00:48:21,510

which then indicates that layer 4 is now

1300

00:48:21,520 --> 00:48:32,790

[Music]

1301  
00:48:35,510 --> 00:48:33,990  
you can tell the team maybe we're

1302  
00:48:39,430 --> 00:48:35,520  
getting old hat at this after four

1303  
00:48:43,670 --> 00:48:41,750  
so uh so yeah when layer one yesterday

1304  
00:48:45,270 --> 00:48:43,680  
was uh quite the celebration in layer

1305  
00:48:47,670 --> 00:48:45,280  
two maybe a little you know still some

1306  
00:48:49,990 --> 00:48:47,680  
celebration but uh layer four we have to

1307  
00:48:51,750 --> 00:48:50,000  
give it a little bit of love too uh and

1308  
00:48:53,670 --> 00:48:51,760  
cheer it on so layer five is the big one

1309  
00:48:56,630 --> 00:48:53,680  
coming up uh but yeah we're gonna turn

1310  
00:48:58,309 --> 00:48:56,640  
that telescope over to our uh our

1311  
00:49:00,790 --> 00:48:58,319  
telescope team and they're gonna move

1312  
00:49:01,670 --> 00:49:00,800  
all those 18 mirrors off their launch

1313  
00:49:03,589 --> 00:49:01,680

stops

1314

00:49:05,430 --> 00:49:03,599

each one will be moved a little bit

1315

00:49:08,309 --> 00:49:05,440

they'll go around all 18 and that's

1316

00:49:09,990 --> 00:49:08,319

pretty much a 24 hour operation uh and

1317

00:49:13,270 --> 00:49:10,000

it's going to take them about 10 days to

1318

00:49:15,430 --> 00:49:13,280

do that um so for for a lot of us we're

1319

00:49:18,069 --> 00:49:15,440

looking forward to

1320

00:49:19,750 --> 00:49:18,079

the grass growing even slower uh when it

1321

00:49:21,109 --> 00:49:19,760

comes to deployment so

1322

00:49:23,270 --> 00:49:21,119

we're actually looking forward to a

1323

00:49:25,430 --> 00:49:23,280

little bit of a pace break there and and

1324

00:49:26,950 --> 00:49:25,440

actually let them our telescope team is

1325

00:49:29,349 --> 00:49:26,960

uh sort of biting at the bit to get

1326

00:49:31,510 --> 00:49:29,359

started uh so they they can't wait to

1327

00:49:33,430 --> 00:49:31,520

get that going so once they do all that

1328

00:49:34,950 --> 00:49:33,440

uh once they wiggle those mirrors around

1329

00:49:38,069 --> 00:49:34,960

and make sure they move and track their

1330

00:49:39,829 --> 00:49:38,079

positions uh uh you know we'll we'll

1331

00:49:41,109 --> 00:49:39,839

we'll be turning on a whole lot of other

1332

00:49:43,030 --> 00:49:41,119

equipment we're actually got our

1333

00:49:45,270 --> 00:49:43,040

instruments we're turning them on over

1334

00:49:47,430 --> 00:49:45,280

the next couple weeks getting them going

1335

00:49:48,710 --> 00:49:47,440

we have a cryo cooler on board i

1336

00:49:49,910 --> 00:49:48,720

mentioned really really cold

1337

00:49:52,069 --> 00:49:49,920

temperatures

1338

00:49:53,750 --> 00:49:52,079

but we have one instrument that needs it

1339

00:49:55,430 --> 00:49:53,760

needs it to be really really cold and

1340

00:49:57,910 --> 00:49:55,440

that's our mid-infrared instrument

1341

00:49:59,829 --> 00:49:57,920

provided by our european partners uh we

1342

00:50:01,109 --> 00:49:59,839

actually have a cooler on board that

1343

00:50:02,870 --> 00:50:01,119

takes that instrument all the way down

1344

00:50:04,150 --> 00:50:02,880

to 6 kelvin

1345

00:50:05,589 --> 00:50:04,160

so that's

1346

00:50:08,309 --> 00:50:05,599

i don't know that's that's getting

1347

00:50:10,309 --> 00:50:08,319

really really close to the minus 460

1348

00:50:12,390 --> 00:50:10,319

degree you know really really close to

1349

00:50:15,190 --> 00:50:12,400

zero there so you see this animation of

1350

00:50:18,309 --> 00:50:15,200

our instrument package in there

1351

00:50:20,630 --> 00:50:18,319

that's our four instruments uh buried in

1352

00:50:22,710 --> 00:50:20,640

the heart of web there so one of them is

1353

00:50:24,230 --> 00:50:22,720

the the mid infrared instrument it's

1354

00:50:26,870 --> 00:50:24,240

kind of uh

1355

00:50:28,390 --> 00:50:26,880

covered up there on the left side and uh

1356

00:50:31,510 --> 00:50:28,400

we actually going to turn on a cooler

1357

00:50:34,150 --> 00:50:31,520

tonight uh to begin circulating warm gas

1358

00:50:35,349 --> 00:50:34,160

up through its plumbing supplies uh to

1359

00:50:37,589 --> 00:50:35,359

make sure we don't get any ice

1360

00:50:38,950 --> 00:50:37,599

contamination on the lines because

1361

00:50:40,309 --> 00:50:38,960

everything on the cold side right now

1362

00:50:42,549 --> 00:50:40,319

it's getting really really cold and we

1363

00:50:43,990 --> 00:50:42,559

don't want any water ice to contaminate

1364

00:50:46,230 --> 00:50:44,000

their their cooler line so we'll be

1365

00:50:48,790 --> 00:50:46,240

doing that tonight actually

1366

00:50:52,150 --> 00:50:48,800

but yeah all this is about that 29 to 30

1367

00:50:54,309 --> 00:50:52,160

days of uh of uh on the edge

1368

00:50:56,630 --> 00:50:54,319

but over the next two weeks uh it'll be

1369

00:50:58,870 --> 00:50:56,640

a little bit slower pace uh ultimately

1370

00:51:01,430 --> 00:50:58,880

culminating in our final mid-course

1371

00:51:04,069 --> 00:51:01,440

correction uh sometime in late january

1372

00:51:06,390 --> 00:51:04,079

which will insert us officially into

1373

00:51:09,190 --> 00:51:06,400

that I2 orbit and at that point we would

1374

00:51:11,750 --> 00:51:09,200

consider our spacecraft uh

1375

00:51:13,510 --> 00:51:11,760

basically commissioned uh and at that

1376

00:51:15,109 --> 00:51:13,520

point it's all about the telescope and

1377

00:51:17,510 --> 00:51:15,119

the instruments and we just can't wait

1378

00:51:18,230 --> 00:51:17,520

to turn it over to them

1379

00:51:19,910 --> 00:51:18,240

well

1380

00:51:21,750 --> 00:51:19,920

you mentioned the miri instrument and

1381

00:51:23,670 --> 00:51:21,760

let's talk a bit about the sort of the

1382

00:51:25,430 --> 00:51:23,680

whole instrument you know package that

1383

00:51:26,470 --> 00:51:25,440

web has that the different instruments

1384

00:51:28,630 --> 00:51:26,480

that are that are on it and the

1385

00:51:29,829 --> 00:51:28,640

different capabilities they have uh so

1386

00:51:33,030 --> 00:51:29,839

do you want to sort of walk us through

1387

00:51:35,109 --> 00:51:33,040

the the four main science instruments

1388

00:51:36,309 --> 00:51:35,119

yeah so we have a near infrared

1389

00:51:37,750 --> 00:51:36,319

instrument again we're going to talk a

1390

00:51:40,630 --> 00:51:37,760

little bit about the wavelengths that

1391

00:51:42,630 --> 00:51:40,640

these are in our our our one instrument

1392

00:51:44,870 --> 00:51:42,640

uh that's the we call the us

1393

00:51:47,349 --> 00:51:44,880

contribution to the instrument package

1394

00:51:49,270 --> 00:51:47,359

uh is the is the near camera

1395

00:51:52,150 --> 00:51:49,280

that's been provided by the university

1396

00:51:53,829 --> 00:51:52,160

of arizona uh in a partnership with with

1397

00:51:55,190 --> 00:51:53,839

uh with lockheed

1398

00:51:58,630 --> 00:51:55,200

so they have built that that is a

1399

00:52:01,510 --> 00:51:58,640

fantastic imaging uh camera uh that will

1400

00:52:04,630 --> 00:52:01,520

be one of our workhorse cameras uh uh

1401  
00:52:06,950 --> 00:52:04,640  
doing a lot of lot of imaging for us

1402  
00:52:09,829 --> 00:52:06,960  
the one the one interesting thing about

1403  
00:52:11,589 --> 00:52:09,839  
that camera is uh uh if they are

1404  
00:52:13,910 --> 00:52:11,599  
telescope scientists

1405  
00:52:15,829 --> 00:52:13,920  
um i just want to

1406  
00:52:20,150 --> 00:52:15,839  
let you know that those motor alarms

1407  
00:52:24,069 --> 00:52:21,030  
okay

1408  
00:52:26,390 --> 00:52:24,079  
yep so as you heard nancy

1409  
00:52:29,430 --> 00:52:26,400  
as you heard nancy say there uh we

1410  
00:52:30,870 --> 00:52:29,440  
typically get some alarms uh but uh over

1411  
00:52:32,950 --> 00:52:30,880  
the course we've learned that those

1412  
00:52:35,750 --> 00:52:32,960  
alarms are can be dismissed or they're

1413  
00:52:37,430 --> 00:52:35,760

just uh they're just routine now so uh

1414

00:52:39,829 --> 00:52:37,440

everything about i mentioned all that

1415

00:52:42,309 --> 00:52:39,839

data that comes down from web uh any

1416

00:52:44,549 --> 00:52:42,319

spacecraft it's it's uh

1417

00:52:46,710 --> 00:52:44,559

we we have alarms on them to alert

1418

00:52:49,190 --> 00:52:46,720

engineers if there's any problems but we

1419

00:52:51,589 --> 00:52:49,200

have a formal dismissive dismissing

1420

00:52:53,270 --> 00:52:51,599

process which she was just referring to

1421

00:52:54,150 --> 00:52:53,280

yeah so back to that near camera real

1422

00:52:55,109 --> 00:52:54,160

fast

1423

00:52:58,710 --> 00:52:55,119

it

1424

00:53:00,790 --> 00:52:58,720

wavefront sensing

1425

00:53:02,710 --> 00:53:00,800

camera and what that means is uh that

1426

00:53:03,829 --> 00:53:02,720

camera is used by our telescope

1427

00:53:06,710 --> 00:53:03,839

scientists

1428

00:53:08,069 --> 00:53:06,720

to determine the uh optical imaging

1429

00:53:09,750 --> 00:53:08,079

quality that's coming out of our

1430

00:53:12,390 --> 00:53:09,760

telescope so they'll actually retrieve

1431

00:53:15,030 --> 00:53:12,400

an image uh using near cam they'll study

1432

00:53:16,390 --> 00:53:15,040

it on the ground they'll use that image

1433

00:53:17,829 --> 00:53:16,400

on the ground to determine all the

1434

00:53:20,150 --> 00:53:17,839

different settings that they need to do

1435

00:53:23,829 --> 00:53:20,160

to align these 18 mirror segments so

1436

00:53:28,630 --> 00:53:27,030

if you if you move on we have a camera

1437

00:53:31,670 --> 00:53:28,640

or another instrument called the fine

1438

00:53:33,910 --> 00:53:31,680

guider uh and nearest uh that's a near

1439

00:53:36,710 --> 00:53:33,920

end another near infrared instrument uh

1440

00:53:38,390 --> 00:53:36,720

but it's also our fine guider and uh

1441

00:53:41,349 --> 00:53:38,400

that's provided by the canadian space

1442

00:53:43,270 --> 00:53:41,359

agency uh in partnership with them and

1443

00:53:45,750 --> 00:53:43,280

what that instrument does it also does

1444

00:53:48,630 --> 00:53:45,760

it does incredible science uh with with

1445

00:53:51,030 --> 00:53:48,640

some spectroscopy and uh it also is our

1446

00:53:52,790 --> 00:53:51,040

guider uh so that guider actually works

1447

00:53:56,230 --> 00:53:52,800

with our spacecraft attitude control

1448

00:53:57,910 --> 00:53:56,240

system it also works with our uh what we

1449

00:53:59,910 --> 00:53:57,920

call our fine steering mirror which is

1450

00:54:01,829 --> 00:53:59,920

on the telescope and those all those

1451

00:54:04,390 --> 00:54:01,839

systems working together

1452

00:54:06,390 --> 00:54:04,400

uh actually help web point at whatever

1453

00:54:08,950 --> 00:54:06,400

it's trying to image and take data from

1454

00:54:10,950 --> 00:54:08,960

we have incredible precision pointing uh

1455

00:54:13,670 --> 00:54:10,960

and we have observations that can be

1456

00:54:15,990 --> 00:54:13,680

done up to 14 days so we can hold steady

1457

00:54:18,309 --> 00:54:16,000

on anything that we're looking at for 14

1458

00:54:20,309 --> 00:54:18,319

days and the fine guider from canada is

1459

00:54:22,549 --> 00:54:20,319

is a key part of that

1460

00:54:24,950 --> 00:54:22,559

we have a near infrared spectrograph

1461

00:54:27,589 --> 00:54:24,960

again that's sort of a partnership uh

1462

00:54:31,190 --> 00:54:27,599

between our european partners and the

1463

00:54:32,950 --> 00:54:31,200

united states um and and that is really

1464

00:54:34,630 --> 00:54:32,960

one of our key science instruments

1465

00:54:36,390 --> 00:54:34,640

you're not going to get you know the

1466

00:54:38,789 --> 00:54:36,400

images out of that what that instrument

1467

00:54:41,510 --> 00:54:38,799

does is it breaks light down into its

1468

00:54:42,870 --> 00:54:41,520

wavelengths and that's really a key uh

1469

00:54:44,230 --> 00:54:42,880

you know i'll let you talk about that in

1470

00:54:46,470 --> 00:54:44,240

a second michelle i'm gonna i'm just

1471

00:54:48,549 --> 00:54:46,480

saying but that's a near spectrograph um

1472

00:54:50,710 --> 00:54:48,559

i'll let you go into breaking down light

1473

00:54:52,390 --> 00:54:50,720

uh because that is key for for what

1474

00:54:53,910 --> 00:54:52,400

we're trying to do science-wise

1475

00:54:55,829 --> 00:54:53,920

uh and then we have this mid-infrared

1476

00:54:58,230 --> 00:54:55,839

instrument which is going further into

1477

00:54:59,910 --> 00:54:58,240

the deep infrared uh and that's really

1478

00:55:02,470 --> 00:54:59,920

one of the key instruments for helping

1479

00:55:04,230 --> 00:55:02,480

us confirm some other observations as

1480

00:55:06,069 --> 00:55:04,240

far as how far away different objects

1481

00:55:07,589 --> 00:55:06,079

are but michelle you can definitely

1482

00:55:09,910 --> 00:55:07,599

definitely pick it up from there i'm

1483

00:55:11,829 --> 00:55:09,920

running out of my knowledge based on on

1484

00:55:13,270 --> 00:55:11,839

these instruments

1485

00:55:15,030 --> 00:55:13,280

yeah this is the thing that you know as

1486

00:55:16,870 --> 00:55:15,040

astronomers we're just so excited about

1487

00:55:18,789 --> 00:55:16,880

there's so many different uh components

1488

00:55:20,870 --> 00:55:18,799

of web i mean not just the the beautiful

1489

00:55:22,230 --> 00:55:20,880

images that will be produced but as you

1490

00:55:24,150 --> 00:55:22,240

said keith the idea of breaking light

1491

00:55:25,670 --> 00:55:24,160

into its components is a technique

1492

00:55:28,630 --> 00:55:25,680

called spectroscopy

1493

00:55:30,549 --> 00:55:28,640

and uh this is really an incredibly

1494

00:55:32,870 --> 00:55:30,559

powerful technique because you might ask

1495

00:55:34,549 --> 00:55:32,880

yourself when astronomers say you know

1496

00:55:35,990 --> 00:55:34,559

we know what the stars are made of you

1497

00:55:37,829 --> 00:55:36,000

know they're made of you know mostly

1498

00:55:39,910 --> 00:55:37,839

hydrogen and helium but usually a little

1499

00:55:41,430 --> 00:55:39,920

smattering of everything else uh you

1500

00:55:43,589 --> 00:55:41,440

know what you know when we see a star

1501  
00:55:45,430 --> 00:55:43,599  
exploding and we say oh you know we've

1502  
00:55:48,230 --> 00:55:45,440  
just seen the generation of the element

1503  
00:55:49,829 --> 00:55:48,240  
gold how do we know that um and then

1504  
00:55:51,829 --> 00:55:49,839  
there are also questions about you know

1505  
00:55:54,549 --> 00:55:51,839  
how do we know for example how far away

1506  
00:55:56,630 --> 00:55:54,559  
a galaxy is or how fast the expansion of

1507  
00:55:58,309 --> 00:55:56,640  
the universe is taking something away

1508  
00:56:01,270 --> 00:55:58,319  
and all of that goes down to this

1509  
00:56:03,910 --> 00:56:01,280  
technique called spectroscopy so um very

1510  
00:56:05,589 --> 00:56:03,920  
simply put spectroscopy is separating

1511  
00:56:07,109 --> 00:56:05,599  
light out into a rainbow that that's

1512  
00:56:09,030 --> 00:56:07,119  
really all it is

1513  
00:56:11,589 --> 00:56:09,040

but the amazing thing is is that

1514

00:56:13,750 --> 00:56:11,599

scientists can then analyze very very

1515

00:56:15,670 --> 00:56:13,760

carefully how much light is coming in

1516

00:56:17,510 --> 00:56:15,680

each color and the the graphic that

1517

00:56:20,069 --> 00:56:17,520

you're looking at shows you

1518

00:56:22,549 --> 00:56:20,079

so this is a light from a uh in this

1519

00:56:24,309 --> 00:56:22,559

case from a star that has a planet

1520

00:56:27,109 --> 00:56:24,319

around it the idea is that there is an

1521

00:56:29,190 --> 00:56:27,119

exoplanet planet around another star

1522

00:56:31,430 --> 00:56:29,200

and the uh the one of the incredible

1523

00:56:33,589 --> 00:56:31,440

science goals of web is to be able to

1524

00:56:36,069 --> 00:56:33,599

analyze the atmospheres of planets

1525

00:56:37,990 --> 00:56:36,079

around other stars and if you if you can

1526

00:56:39,750 --> 00:56:38,000

pass the light that's shining through

1527

00:56:41,589 --> 00:56:39,760

the atmosphere of a planet so the

1528

00:56:43,990 --> 00:56:41,599

starlight is shining through the

1529

00:56:45,670 --> 00:56:44,000

atmosphere of a planet around it as the

1530

00:56:47,190 --> 00:56:45,680

planet goes through basically a little

1531

00:56:49,510 --> 00:56:47,200

eclipse it's actually in front of the

1532

00:56:52,230 --> 00:56:49,520

star and then you take that light and

1533

00:56:54,470 --> 00:56:52,240

you separate it out into a rainbow and

1534

00:56:56,230 --> 00:56:54,480

we see here the graphic so this is a

1535

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

planet you can see that little dark disk

1536

00:56:59,510 --> 00:56:58,160

represents a planet that's going in

1537

00:57:01,910 --> 00:56:59,520

front of a star

1538

00:57:03,910 --> 00:57:01,920

and the planet has an atmosphere there

1539

00:57:06,069 --> 00:57:03,920

are different layers of the atmosphere

1540

00:57:06,950 --> 00:57:06,079

here in different colors green purple

1541

00:57:11,430 --> 00:57:06,960

and

1542

00:57:13,910 --> 00:57:11,440

star behind the planet shines through

1543

00:57:15,990 --> 00:57:13,920

that atmosphere then we get some amazing

1544

00:57:18,870 --> 00:57:16,000

observations about what the atmosphere

1545

00:57:20,150 --> 00:57:18,880

is made of and if i could go to the the

1546

00:57:21,270 --> 00:57:20,160

graphic that we were looking at just a

1547

00:57:23,910 --> 00:57:21,280

minute ago

1548

00:57:26,470 --> 00:57:23,920

when you actually take that rainbow of

1549

00:57:28,950 --> 00:57:26,480

light and you measure the the the very

1550

00:57:31,510 --> 00:57:28,960

jagged kind of squiggly uh blue line you

1551

00:57:33,510 --> 00:57:31,520

see there is simply a graph of how much

1552

00:57:35,030 --> 00:57:33,520

light is coming in each color

1553

00:57:37,270 --> 00:57:35,040

and the incredible thing is that

1554

00:57:40,789 --> 00:57:37,280

different atoms and molecules so for

1555

00:57:42,870 --> 00:57:40,799

example oxygen or the molecule  $O_2$  which

1556

00:57:45,430 --> 00:57:42,880

is how oxygen usually appears in an

1557

00:57:49,109 --> 00:57:45,440

atmosphere or say nitrogen or carbon

1558

00:57:52,230 --> 00:57:49,119

dioxide important molecules water vapor

1559

00:57:54,549 --> 00:57:52,240

we can actually detect those molecules

1560

00:57:57,030 --> 00:57:54,559

because every atom and every molecule

1561

00:57:59,349 --> 00:57:57,040

will absorb light slightly differently

1562

00:58:01,109 --> 00:57:59,359

and if we can measure very carefully how

1563

00:58:02,950 --> 00:58:01,119

much light is coming in each color we

1564

00:58:04,950 --> 00:58:02,960

can actually see the presence of

1565

00:58:07,670 --> 00:58:04,960

molecules that are absorbing different

1566

00:58:09,750 --> 00:58:07,680

color bands of light and so here you see

1567

00:58:11,510 --> 00:58:09,760

an atmosphere where it's possible that

1568

00:58:14,390 --> 00:58:11,520

we can actually detect if there's oxygen

1569

00:58:16,549 --> 00:58:14,400

in the atmosphere or ozone which is  $O_3$

1570

00:58:19,829 --> 00:58:16,559

three oxygen atoms water vapor carbon

1571

00:58:21,349 --> 00:58:19,839

dioxide and um one thing that that web

1572

00:58:23,510 --> 00:58:21,359

may or may not be able to do this is

1573

00:58:24,870 --> 00:58:23,520

this is certainly very ambitious is it

1574

00:58:28,630 --> 00:58:24,880

might be able to detect things called

1575

00:58:30,230 --> 00:58:28,640

bio markers and those are uh

1576

00:58:32,390 --> 00:58:30,240

basically

1577

00:58:34,710 --> 00:58:32,400

fingerprints in the spectrum that could

1578

00:58:36,470 --> 00:58:34,720

be related to the presence of life

1579

00:58:38,789 --> 00:58:36,480

the the main science goal of course is

1580

00:58:40,230 --> 00:58:38,799

to find environments that might be

1581

00:58:41,829 --> 00:58:40,240

earth-like they might be friendly to

1582

00:58:44,390 --> 00:58:41,839

life but you see something there called

1583

00:58:47,030 --> 00:58:44,400

the vegetation jump and uh that actually

1584

00:58:49,190 --> 00:58:47,040

may be present due to uh plant life

1585

00:58:50,549 --> 00:58:49,200

absorbing certain life and again you

1586

00:58:51,829 --> 00:58:50,559

know while we don't know that this will

1587

00:58:53,109 --> 00:58:51,839

be possible you know the main thing that

1588

00:58:54,950 --> 00:58:53,119

we're looking for are environments

1589

00:58:56,710 --> 00:58:54,960

friendly to life there is a small

1590

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

possibility that we could actually look

1591

00:59:00,789 --> 00:58:58,559

at an exoplanet and see something that

1592

00:59:02,470 --> 00:59:00,799

indicated a possible likelihood of life

1593

00:59:03,910 --> 00:59:02,480

there so that's that's something that's

1594

00:59:05,589 --> 00:59:03,920

that's very exciting for us so that's

1595

00:59:07,589 --> 00:59:05,599

about spectroscopy

1596

00:59:09,430 --> 00:59:07,599

so yeah these are all you know

1597

00:59:10,789 --> 00:59:09,440

incredibly powerful techniques that

1598

00:59:12,789 --> 00:59:10,799

we're looking forward to doing in the

1599

00:59:15,109 --> 00:59:12,799

infrared infrared turns out to be the

1600

00:59:17,030 --> 00:59:15,119

best place to do these a lot of the most

1601  
00:59:19,270 --> 00:59:17,040  
important molecules for life have very

1602  
00:59:21,589 --> 00:59:19,280  
important absorption bands they absorb

1603  
00:59:23,270 --> 00:59:21,599  
light in the infrared and so that's

1604  
00:59:24,870 --> 00:59:23,280  
another incredible use of infrared

1605  
00:59:26,710 --> 00:59:24,880  
astronomy

1606  
00:59:28,309 --> 00:59:26,720  
so um just for those of you that are

1607  
00:59:30,710 --> 00:59:28,319  
joining us uh you are now looking up

1608  
00:59:33,109 --> 00:59:30,720  
here we see an animation of some of the

1609  
00:59:34,710 --> 00:59:33,119  
very important molecules for life and as

1610  
00:59:36,150 --> 00:59:34,720  
we mentioned before as a planet goes

1611  
00:59:38,630 --> 00:59:36,160  
around a star

1612  
00:59:41,030 --> 00:59:38,640  
some of that star light shines through

1613  
00:59:42,950 --> 00:59:41,040

the atmosphere of the planet itself and

1614

00:59:44,710 --> 00:59:42,960

when that happens we can look very

1615

00:59:47,910 --> 00:59:44,720

carefully at the different colors that

1616

00:59:50,230 --> 00:59:47,920

are absorbed uh and we actually find out

1617

00:59:52,150 --> 00:59:50,240

what chemistry is in that atmosphere

1618

00:59:53,430 --> 00:59:52,160

itself so you see that that

1619

00:59:54,789 --> 00:59:53,440

the starlight shining through the

1620

00:59:57,030 --> 00:59:54,799

atmosphere of a planet around another

1621

00:59:58,630 --> 00:59:57,040

star and eventually ending up inside the

1622

01:00:00,710 --> 00:59:58,640

james webb space telescope and we'll be

1623

01:00:02,549 --> 01:00:00,720

able to analyze it from there

1624

01:00:04,390 --> 01:00:02,559

so for those of you that are joining us

1625

01:00:05,670 --> 01:00:04,400

uh you are looking at live coverage of

1626

01:00:08,069 --> 01:00:05,680

the commissioning of the james webb

1627

01:00:09,349 --> 01:00:08,079

space telescope today is an exciting day

1628

01:00:11,430 --> 01:00:09,359

because we were looking we're looking at

1629

01:00:14,150 --> 01:00:11,440

the completion of the uh the

1630

01:00:16,309 --> 01:00:14,160

commissioning the unfolding and and in

1631

01:00:18,390 --> 01:00:16,319

just a little while the tensioning of

1632

01:00:20,309 --> 01:00:18,400

the very last bit of the james webb

1633

01:00:21,990 --> 01:00:20,319

space telescope heat shield

1634

01:00:24,309 --> 01:00:22,000

um i think that actually it might be a

1635

01:00:26,950 --> 01:00:24,319

nice time to uh to go to our our social

1636

01:00:28,950 --> 01:00:26,960

media feed because uh we bet we will be

1637

01:00:30,069 --> 01:00:28,960

able to take some of your questions live

1638

01:00:32,789 --> 01:00:30,079

uh for those of you that would like to

1639

01:00:34,150 --> 01:00:32,799

do this you can use the hashtag asknasa

1640

01:00:36,870 --> 01:00:34,160

and i have been receiving some of the

1641

01:00:38,870 --> 01:00:36,880

social media questions right now so uh

1642

01:00:40,789 --> 01:00:38,880

so keith as we look in here at the live

1643

01:00:42,390 --> 01:00:40,799

footage of the mission operations center

1644

01:00:44,309 --> 01:00:42,400

at the johns hopkins university

1645

01:00:46,309 --> 01:00:44,319

the space telescope science institute

1646

01:00:48,390 --> 01:00:46,319

maybe you and i can take a bit of a hack

1647

01:00:49,589 --> 01:00:48,400

at some of these uh uh social media

1648

01:00:51,670 --> 01:00:49,599

questions

1649

01:00:53,589 --> 01:00:51,680

the the first one comes from one of our

1650

01:00:55,510 --> 01:00:53,599

users on twitter that says will the

1651

01:00:57,670 --> 01:00:55,520

telescope need periodic tensioning

1652

01:00:59,829 --> 01:00:57,680

during its lifetime or is this a one-off

1653

01:01:00,710 --> 01:00:59,839

thing so so keith could you answer that

1654

01:01:02,710 --> 01:01:00,720

question is this something that we're

1655

01:01:04,150 --> 01:01:02,720

going to do again or is this just the

1656

01:01:05,670 --> 01:01:04,160

one time we ever tensioned this heat

1657

01:01:09,349 --> 01:01:05,680

shield

1658

01:01:10,630 --> 01:01:09,359

um no we do not plan to ever retention

1659

01:01:13,670 --> 01:01:10,640

uh

1660

01:01:15,990 --> 01:01:13,680

and that was that was a chosen thing to

1661

01:01:17,829 --> 01:01:16,000

do in the design so all the materials

1662

01:01:18,870 --> 01:01:17,839

everything about the analysis of the

1663

01:01:19,670 --> 01:01:18,880

design

1664

01:01:21,430 --> 01:01:19,680

uh

1665

01:01:24,390 --> 01:01:21,440

has shown that we don't we don't need to

1666

01:01:27,430 --> 01:01:24,400

do that so uh uh everything will wear

1667

01:01:30,309 --> 01:01:27,440

but but we have uh our our layers are

1668

01:01:32,069 --> 01:01:30,319

actually tensioned on springs

1669

01:01:34,309 --> 01:01:32,079

over its lifetime those springs will

1670

01:01:37,270 --> 01:01:34,319

sort of take out any of those uh those

1671

01:01:42,710 --> 01:01:40,069

let's see we have a question um

1672

01:01:44,789 --> 01:01:42,720

uh that somebody from bob on twitter is

1673

01:01:46,630 --> 01:01:44,799

saying um how do you keep the sun shield

1674

01:01:49,109 --> 01:01:46,640

in the correct orientation does it

1675

01:01:50,789 --> 01:01:49,119

require constant adjustments over time

1676

01:01:52,549 --> 01:01:50,799

or is the orbit set and it stays in the

1677

01:01:54,950 --> 01:01:52,559

correct position forever

1678

01:01:57,829 --> 01:01:54,960

so that's a question about unfolding the

1679

01:02:00,470 --> 01:01:57,839

telescope yes yeah it's it's yeah it's

1680

01:02:02,710 --> 01:02:00,480

it's locked in position uh we if this is

1681

01:02:05,349 --> 01:02:02,720

its final position it'll stay in that

1682

01:02:07,750 --> 01:02:05,359

again everything is designed to uh

1683

01:02:09,109 --> 01:02:07,760

be a little flexible uh as temperature

1684

01:02:10,549 --> 01:02:09,119

changes

1685

01:02:17,510 --> 01:02:10,559

uh

1686

01:02:19,910 --> 01:02:17,520

vary but it's all gone

1687

01:02:22,150 --> 01:02:19,920

all patients this is mama on ops let me

1688

01:02:24,069 --> 01:02:22,160

just give you a quick status of where

1689

01:02:26,630 --> 01:02:24,079

we're at

1690

01:02:29,430 --> 01:02:26,640

you can see we've completed car 622

1691

01:02:32,069 --> 01:02:29,440

player 4 and that call was made earlier

1692

01:02:34,230 --> 01:02:32,079

before we get into layer 5 on car 626

1693

01:02:36,230 --> 01:02:34,240

we're going to go ahead and reassess our

1694

01:02:37,990 --> 01:02:36,240

our uh our communications with our

1695

01:02:39,910 --> 01:02:38,000

medium gain antenna

1696

01:02:41,990 --> 01:02:39,920

and uh and our signal strength there so

1697

01:02:43,510 --> 01:02:42,000

once we evaluate that and see if we need

1698

01:02:45,910 --> 01:02:43,520

to repoint the dish

1699

01:02:48,230 --> 01:02:45,920

or continue on uh we'll take either of

1700

01:02:49,270 --> 01:02:48,240

those actions before we proceed so

1701

01:02:50,470 --> 01:02:49,280

that's where we'll stay for just a

1702

01:02:52,950 --> 01:02:50,480

little bit while we let the team in the

1703

01:02:54,789 --> 01:02:52,960

back go ahead and uh do that analysis so

1704

01:02:56,230 --> 01:02:54,799

standby

1705

01:02:58,309 --> 01:02:56,240

okay um

1706

01:03:00,710 --> 01:02:58,319

i think i think you heard our our

1707

01:03:02,309 --> 01:03:00,720

mission ops manager there uh we are

1708

01:03:03,589 --> 01:03:02,319

playing the ops loop right how can i ask

1709

01:03:07,349 --> 01:03:03,599

that

1710

01:03:10,069 --> 01:03:07,359

um yeah so uh we finished layer four um

1711

01:03:11,270 --> 01:03:10,079

uh as you this is live

1712

01:03:13,270 --> 01:03:11,280

you're getting to hear some of the stuff

1713

01:03:14,950 --> 01:03:13,280

that goes on every minute of every day

1714

01:03:17,349 --> 01:03:14,960

uh and one thing we're trying to do is

1715

01:03:18,630 --> 01:03:17,359

make sure our communication coverage is

1716

01:03:21,670 --> 01:03:18,640

good so they're going to take a little

1717

01:03:23,910 --> 01:03:21,680

pause it sounds like uh to to to to do

1718

01:03:25,670 --> 01:03:23,920

that so we can take some more questions

1719

01:03:28,230 --> 01:03:25,680

while they uh get their uh

1720

01:03:31,270 --> 01:03:28,240

communications uh established web is

1721

01:03:32,549 --> 01:03:31,280

communicating right now uh just fine but

1722

01:03:35,910 --> 01:03:32,559

uh they sounds like they want to make

1723

01:03:38,630 --> 01:03:37,190

so we were just talking a little bit

1724

01:03:41,109 --> 01:03:38,640

about the question that we got uh when

1725

01:03:43,109 --> 01:03:41,119

we were when we were getting uh

1726

01:03:45,510 --> 01:03:43,119

uh we were getting an announcement from

1727

01:03:47,109 --> 01:03:45,520

the mock uh the the uh the viewer was

1728

01:03:48,069 --> 01:03:47,119

actually asking about whether there's a

1729

01:03:50,390 --> 01:03:48,079

any sort of correction to the

1730

01:03:52,230 --> 01:03:50,400

orientation needed so i mean but will

1731

01:03:54,150 --> 01:03:52,240

will web have any any sort of engines to

1732

01:03:55,990 --> 01:03:54,160

kind of keep its orientation right

1733

01:03:58,990 --> 01:03:56,000

shield pointing toward the sun

1734

01:04:01,589 --> 01:03:59,000

yeah yeah so we we we move the entire

1735

01:04:03,910 --> 01:04:01,599

observatory when we pull so the

1736

01:04:07,510 --> 01:04:03,920

all of web moves together as one sort of

1737

01:04:10,150 --> 01:04:07,520

rigid body when we uh move move around

1738

01:04:11,750 --> 01:04:10,160

uh to look at things so uh and we and we

1739

01:04:14,390 --> 01:04:11,760

maneuver it with reaction wheels we

1740

01:04:16,309 --> 01:04:14,400

actually spin their six wheels and side

1741

01:04:19,670 --> 01:04:16,319

we spin those wheels up to different

1742

01:04:22,150 --> 01:04:19,680

speeds uh the the torque on those motors

1743

01:04:24,710 --> 01:04:22,160

uh the web will actually spin around

1744

01:04:26,950 --> 01:04:24,720

that so uh you know it's the classic uh

1745

01:04:29,029 --> 01:04:26,960

you know the bicycle wheel and trying to

1746

01:04:30,789 --> 01:04:29,039

turn things up you turn the other way uh

1747

01:04:32,630 --> 01:04:30,799

web has nothing to hold on to so when

1748

01:04:34,549 --> 01:04:32,640

those wheels spin it gets spun the other

1749

01:04:36,390 --> 01:04:34,559

way so really really slowly so we use

1750

01:04:39,029 --> 01:04:36,400

those wheels is actually how we uh

1751

01:04:41,510 --> 01:04:39,039

maneuver and point every once in a while

1752

01:04:44,789 --> 01:04:41,520

we we we do have a

1753

01:04:46,630 --> 01:04:44,799

a propulsion system on ball engines uh

1754

01:04:50,710 --> 01:04:46,640

and they can be fired too for more

1755

01:04:53,910 --> 01:04:51,670

okay

1756

01:04:55,190 --> 01:04:53,920

looking uh see another another answer

1757

01:04:56,150 --> 01:04:55,200

from twitter

1758

01:04:58,789 --> 01:04:56,160

um

1759

01:05:00,470 --> 01:04:58,799

i uh it says is it extremely hot just

1760

01:05:02,069 --> 01:05:00,480

behind the shield and extremely cold

1761

01:05:03,270 --> 01:05:02,079

just in front of the shield and this is

1762

01:05:04,950 --> 01:05:03,280

a question that we talked about a little

1763

01:05:06,789 --> 01:05:04,960

bit earlier in the broadcast but there

1764

01:05:08,549 --> 01:05:06,799

are people that uh that are just joining

1765

01:05:10,630 --> 01:05:08,559

us can you talk a bit about the the

1766

01:05:12,309 --> 01:05:10,640

temperature differential uh between the

1767

01:05:13,829 --> 01:05:12,319

uh the hot side and the cold side of the

1768

01:05:16,390 --> 01:05:13,839

heat shield

1769

01:05:18,470 --> 01:05:16,400

yeah so i yeah so the hot side that that

1770

01:05:20,470 --> 01:05:18,480

sun-facing layer we've done everything

1771

01:05:23,510 --> 01:05:20,480

we can to make it as cool as possible

1772

01:05:25,910 --> 01:05:23,520

but it's still really really hot uh it

1773

01:05:27,270 --> 01:05:25,920

it runs around the temperature of you

1774

01:05:28,950 --> 01:05:27,280

know of

1775

01:05:29,990 --> 01:05:28,960

boiling water

1776

01:05:31,670 --> 01:05:30,000

um

1777

01:05:33,829 --> 01:05:31,680

you can see some of the temperature some

1778

01:05:36,549 --> 01:05:33,839

of the temperatures right there honey we

1779

01:05:39,510 --> 01:05:36,559

roughly say 200 degrees fahrenheit on

1780

01:05:41,750 --> 01:05:39,520

that on that hot side so each layer

1781

01:05:44,150 --> 01:05:41,760

gives us about a hundred year drop

1782

01:05:46,870 --> 01:05:44,160

uh so the cold side layer

1783

01:05:48,230 --> 01:05:46,880

uh it runs about

1784

01:05:50,630 --> 01:05:48,240

uh

1785

01:05:52,870 --> 01:05:50,640

i i we're in celsius or whatever but in

1786

01:05:56,710 --> 01:05:52,880

kelvins uh the warm side is roughly

1787

01:05:58,309 --> 01:05:56,720

about minus 350 degrees fahrenheit uh

1788

01:06:00,309 --> 01:05:58,319

and then that telescope is right around

1789

01:06:02,309 --> 01:06:00,319

minus 400 so that kind of gives you an

1790

01:06:04,549 --> 01:06:02,319

idea that differential check out our

1791

01:06:06,150 --> 01:06:04,559

where is web website and that'll kind of

1792

01:06:09,510 --> 01:06:06,160

give you a flavor for the the

1793

01:06:12,789 --> 01:06:11,510

you were mentioning the where is web uh

1794

01:06:14,309 --> 01:06:12,799

website and that can show you actually

1795

01:06:16,069 --> 01:06:14,319

you know where the observatory is on its

1796

01:06:17,670 --> 01:06:16,079

way out to l2

1797

01:06:19,270 --> 01:06:17,680

and uh um

1798

01:06:21,109 --> 01:06:19,280

one of the things that we actually uh

1799

01:06:22,390 --> 01:06:21,119

mentioned briefly at the beginning of

1800

01:06:24,630 --> 01:06:22,400

the broadcast but we haven't had a

1801

01:06:26,630 --> 01:06:24,640

chance to go into any detail is the fact

1802

01:06:28,309 --> 01:06:26,640

that um there was something happened

1803

01:06:30,710 --> 01:06:28,319

during the launch that was actually very

1804

01:06:33,109 --> 01:06:30,720

uh very fortunate and will extend the

1805

01:06:35,349 --> 01:06:33,119

life of the the observatory we hope uh

1806

01:06:36,950 --> 01:06:35,359

so keith give us a sense about what that

1807

01:06:38,470 --> 01:06:36,960

was what what what happened and what was

1808

01:06:40,309 --> 01:06:38,480

the advantage of it

1809

01:06:43,109 --> 01:06:40,319

yeah so again going all the way back to

1810

01:06:45,990 --> 01:06:43,119

launch day uh the error we asked arion

1811

01:06:48,069 --> 01:06:46,000

give us a velocity uh when they when

1812

01:06:51,349 --> 01:06:48,079

they separated from us in that video so

1813

01:06:53,270 --> 01:06:51,359

we we specified exactly what velocity

1814

01:06:56,390 --> 01:06:53,280

which is speed and direction uh we

1815

01:06:58,470 --> 01:06:56,400

wanted uh from them and uh and and that

1816

01:07:01,990 --> 01:06:58,480

that velocity that we expect from them

1817

01:07:04,549 --> 01:07:02,000

uh is what uh was aiming us towards I2

1818

01:07:06,309 --> 01:07:04,559

uh at the right speed that we needed uh

1819

01:07:08,950 --> 01:07:06,319

however you know there is some small

1820

01:07:11,829 --> 01:07:08,960

errors to that and we don't quite know

1821

01:07:12,630 --> 01:07:11,839

uh how much those errors are so we we

1822

01:07:14,549 --> 01:07:12,640

plan

1823

01:07:16,950 --> 01:07:14,559

and for the worst case

1824

01:07:19,829 --> 01:07:16,960

uh we and and and webb will need to use

1825

01:07:22,789 --> 01:07:19,839

its onboard propulsion system to sort of

1826  
01:07:24,549 --> 01:07:22,799  
make up that uh so uh um but since we

1827  
01:07:26,870 --> 01:07:24,559  
got such a good trajectory or good

1828  
01:07:28,710 --> 01:07:26,880  
performance out of the ariane 5 which we

1829  
01:07:31,109 --> 01:07:28,720  
which we counted we would given their

1830  
01:07:32,710 --> 01:07:31,119  
their history of good performance uh we

1831  
01:07:35,829 --> 01:07:32,720  
didn't use very much we didn't use as

1832  
01:07:37,750 --> 01:07:35,839  
much fuel as we needed for that first

1833  
01:07:38,870 --> 01:07:37,760  
correction we had designed everything in

1834  
01:07:41,270 --> 01:07:38,880  
the system

1835  
01:07:43,190 --> 01:07:41,280  
if everything goes worst case

1836  
01:07:45,270 --> 01:07:43,200  
we would still have at least 10 years of

1837  
01:07:47,430 --> 01:07:45,280  
mission life but basically everything

1838  
01:07:50,950 --> 01:07:47,440

went best case uh so we have

1839

01:07:52,870 --> 01:07:50,960

significantly more uh than than 10 years

1840

01:07:55,029 --> 01:07:52,880

we don't have the exact number yet but

1841

01:07:57,910 --> 01:07:55,039

eventually over commissioning as we can

1842

01:07:59,910 --> 01:07:57,920

continue to study our propulsion system

1843

01:08:01,829 --> 01:07:59,920

uh as we continue to learn more about

1844

01:08:03,750 --> 01:08:01,839

how web operates will fine-tune that

1845

01:08:06,069 --> 01:08:03,760

number and and get it out later in

1846

01:08:07,750 --> 01:08:06,079

commissioning uh but uh when the number

1847

01:08:09,349 --> 01:08:07,760

comes out i think everybody will really

1848

01:08:12,309 --> 01:08:09,359

really pleased uh that we're

1849

01:08:13,750 --> 01:08:12,319

significantly uh use less fuel and we're

1850

01:08:15,750 --> 01:08:13,760

going to significantly exceed that

1851  
01:08:18,789 --> 01:08:15,760  
10-year mission life

1852  
01:08:19,990 --> 01:08:18,799  
of fuels yeah

1853  
01:08:22,229 --> 01:08:20,000  
excellent

1854  
01:08:23,590 --> 01:08:22,239  
all right going back to our social media

1855  
01:08:29,349 --> 01:08:23,600  
questions here

1856  
01:08:34,149 --> 01:08:31,829  
so we have a uh somebody named sun frog

1857  
01:08:36,390 --> 01:08:34,159  
on twitch is saying how much space is

1858  
01:08:37,749 --> 01:08:36,400  
between the shield layers in in inches

1859  
01:08:39,829 --> 01:08:37,759  
or feet how far apart are these

1860  
01:08:40,789 --> 01:08:39,839  
different layers we're looking at yeah

1861  
01:08:42,550 --> 01:08:40,799  
um

1862  
01:08:45,189 --> 01:08:42,560  
yeah i don't know if they can roll that

1863  
01:08:47,510 --> 01:08:45,199

test roll again uh from from from the

1864

01:08:52,470 --> 01:08:47,520

test that we did i it it's roughly a

1865

01:08:56,709 --> 01:08:54,630

roughly a foot and a half to hold if

1866

01:08:59,269 --> 01:08:56,719

it's about six feet from

1867

01:09:00,709 --> 01:08:59,279

uh one side to the other so uh you know

1868

01:09:03,269 --> 01:09:00,719

depending on where it is it's a little

1869

01:09:06,070 --> 01:09:03,279

bit thinner uh on once you know down

1870

01:09:07,829 --> 01:09:06,080

towards the uh the short side and it's a

1871

01:09:10,870 --> 01:09:07,839

little bit further spread on the fore

1872

01:09:13,110 --> 01:09:10,880

and aft as you see in that obt right now

1873

01:09:15,669 --> 01:09:13,120

um so yeah roughly five to six feet of

1874

01:09:17,030 --> 01:09:15,679

separation uh one foot between each

1875

01:09:19,749 --> 01:09:17,040

layer i don't know what that is maybe

1876

01:09:21,189 --> 01:09:19,759

this this it's not that far apart but

1877

01:09:23,430 --> 01:09:21,199

that's all it takes to provide the

1878

01:09:24,709 --> 01:09:23,440

coolant

1879

01:09:26,229 --> 01:09:24,719

excellent

1880

01:09:29,269 --> 01:09:26,239

all right

1881

01:09:33,510 --> 01:09:31,590

john hague on twitter asks what would

1882

01:09:35,269 --> 01:09:33,520

happen if the sunshield tore while you

1883

01:09:37,030 --> 01:09:35,279

were deploying it is there a backup for

1884

01:09:38,229 --> 01:09:37,040

this it was it probably there were

1885

01:09:39,590 --> 01:09:38,239

actually several different questions

1886

01:09:41,030 --> 01:09:39,600

that we got about this about little

1887

01:09:44,229 --> 01:09:41,040

tears or anything

1888

01:09:46,229 --> 01:09:44,239

yeah yeah uh yeah tears or tears are a

1889

01:09:48,789 --> 01:09:46,239

big concern uh and then again everything

1890

01:09:50,630 --> 01:09:48,799

that's been done as far as the design

1891

01:09:53,030 --> 01:09:50,640

if we do get a tear

1892

01:09:55,189 --> 01:09:53,040

what we want what what concerns us even

1893

01:09:57,270 --> 01:09:55,199

more than a tear is that tear

1894

01:09:58,950 --> 01:09:57,280

propagating throughout the entire sun

1895

01:10:00,950 --> 01:09:58,960

shield so what we have we have a system

1896

01:10:03,270 --> 01:10:00,960

of rip stops incorporated into each

1897

01:10:05,110 --> 01:10:03,280

layer so if we do get any small tears

1898

01:10:07,430 --> 01:10:05,120

it'll only go a short distance and then

1899

01:10:09,669 --> 01:10:07,440

stop as we have reinforcements around so

1900

01:10:11,189 --> 01:10:09,679

that's all been incorporated into design

1901

01:10:12,950 --> 01:10:11,199

and then again everything you're seeing

1902

01:10:15,189 --> 01:10:12,960

about the deployment why it looks like

1903

01:10:16,790 --> 01:10:15,199

it's grass growing is to be slow

1904

01:10:18,229 --> 01:10:16,800

methodical

1905

01:10:22,229 --> 01:10:18,239

so we make sure that we're not putting

1906

01:10:25,590 --> 01:10:23,270

excellent

1907

01:10:27,430 --> 01:10:25,600

um so one of the things that people saw

1908

01:10:28,550 --> 01:10:27,440

when they actually went to the uh the

1909

01:10:30,390 --> 01:10:28,560

website

1910

01:10:32,310 --> 01:10:30,400

where is webb is that the web appears to

1911

01:10:33,990 --> 01:10:32,320

be slowing down right now

1912

01:10:35,669 --> 01:10:34,000

so uh um

1913

01:10:37,990 --> 01:10:35,679

can you give us a sense about why why

1914

01:10:40,790 --> 01:10:38,000

would it seem like web is slowing down

1915

01:10:42,470 --> 01:10:40,800

yeah yeah so really it's uh we

1916

01:10:44,310 --> 01:10:42,480

uh as we leave the earth we're going to

1917

01:10:46,229 --> 01:10:44,320

l2 we're going to that million mile mark

1918

01:10:48,709 --> 01:10:46,239

and then we kind of you know for

1919

01:10:51,590 --> 01:10:48,719

in very simplistic term think about we

1920

01:10:54,550 --> 01:10:51,600

stop uh we don't really stop but uh

1921

01:10:56,790 --> 01:10:54,560

we we with our relative velocity to the

1922

01:10:58,630 --> 01:10:56,800

earth remember as we go around the sun a

1923

01:11:01,189 --> 01:10:58,640

web is going with us and it's always

1924

01:11:03,030 --> 01:11:01,199

maintaining that million mile distance

1925

01:11:05,430 --> 01:11:03,040

so essentially we're stopped with

1926

01:11:06,950 --> 01:11:05,440

respect to the earth so we see we left

1927

01:11:08,709 --> 01:11:06,960

uh we were multiple we were several

1928

01:11:10,070 --> 01:11:08,719

kilometers per second

1929

01:11:11,990 --> 01:11:10,080

in our speed

1930

01:11:13,510 --> 01:11:12,000

when we came off the arion and as we get

1931

01:11:16,070 --> 01:11:13,520

further and further from earth the

1932

01:11:18,149 --> 01:11:16,080

earth's gravity is slowing us down uh

1933

01:11:20,149 --> 01:11:18,159

and we're trying everything is about

1934

01:11:22,470 --> 01:11:20,159

making our speed just right so as we get

1935

01:11:24,950 --> 01:11:22,480

about a million miles away uh we get

1936

01:11:27,270 --> 01:11:24,960

into that I2 orbit so you'll see that

1937

01:11:30,550 --> 01:11:27,280

you'll see that slow down more and more

1938

01:11:32,790 --> 01:11:30,560

as we get closer to uh our I2 uh orbit

1939

01:11:33,830 --> 01:11:32,800

insertions

1940

01:11:35,510 --> 01:11:33,840

thank you

1941

01:11:36,870 --> 01:11:35,520

so i just got the message that we're

1942

01:11:38,149 --> 01:11:36,880

going to take a brief pause on our

1943

01:11:40,470 --> 01:11:38,159

commentary while they look at some

1944

01:11:42,630 --> 01:11:40,480

communication uh up to the telescope

1945

01:11:44,310 --> 01:11:42,640

we will be back and we will be taking

1946

01:11:46,790 --> 01:11:44,320

more of your social media questions you

1947

01:11:48,790 --> 01:11:46,800

can use the hashtag asknasa and i'm

1948

01:11:50,070 --> 01:11:48,800

michelle thaller here with keith parrish

1949

01:11:51,669 --> 01:11:50,080

and you are looking at live

1950

01:11:53,430 --> 01:11:51,679

commissioning of the james webb space

1951

01:11:55,590 --> 01:11:53,440

telescope the final phases of the

1952

01:11:57,510 --> 01:11:55,600

unfolding of the heat shield and we will

1953

01:11:59,110 --> 01:11:57,520

be here throughout the process we'll

1954

01:12:00,470 --> 01:11:59,120

take a brief pause now but we'll be back

1955

01:14:28,310 --> 01:12:00,480

very soon so thank you so much for

1956

01:14:30,730 --> 01:14:29,669

uh

1957

01:14:32,149 --> 01:14:30,740

yeah mom um

1958

01:14:34,630 --> 01:14:32,159

[Music]

1959

01:14:36,870 --> 01:14:34,640

we can talk about that uh later if you

1960

01:15:42,390 --> 01:14:36,880

want but or i can um

1961

01:15:42,400 --> 01:16:15,350

yeah we will execute 12.

1962

01:16:20,550 --> 01:16:16,990

oh see this

1963

01:16:21,669 --> 01:16:20,560

is on us

1964

01:16:24,390 --> 01:16:21,679

yes sir we're going to go ahead and get

1965

01:16:26,070 --> 01:16:24,400

ready for car 626 are you ready

1966

01:16:31,430 --> 01:16:26,080

who will see us go

1967

01:16:35,030 --> 01:16:33,030

yeah msu's ago

1968

01:16:39,590 --> 01:16:35,040

have to go sir you go

1969

01:16:43,270 --> 01:16:41,350

wayfriends go

1970

01:16:45,430 --> 01:16:43,280

up it goes all stations this is mom on

1971

01:16:48,070 --> 01:16:45,440

ops we're go at this time to finish sun

1972

01:16:49,430 --> 01:16:48,080

steel tensioning layer five oh see this

1973

01:16:51,189 --> 01:16:49,440

is mama knox

1974

01:16:52,709 --> 01:16:51,199

let me see

1975

01:16:54,630 --> 01:16:52,719

yes sir you can go ahead and pick up at

1976

01:16:57,430 --> 01:16:54,640

step two of car 626 and you can

1977

01:16:58,950 --> 01:16:57,440

coordinate with dev ops on this loop

1978

01:17:02,149 --> 01:16:58,960

copy that mom

1979

01:17:05,030 --> 01:17:02,159

and oc uh you will be executing steps

1980

01:17:06,950 --> 01:17:05,040

one through twelve twelve inclusive

1981

01:17:09,030 --> 01:17:06,960

uh one through twelve only and then we

1982

01:17:10,870 --> 01:17:09,040

will hold

1983

01:17:13,030 --> 01:17:10,880

copy steps one through twelve including

1984

01:17:14,229 --> 01:17:13,040

twelve

1985

01:17:17,350 --> 01:17:14,239

thank you

1986

01:17:18,790 --> 01:17:17,360

and i see this is depop sign up

1987

01:17:21,590 --> 01:17:18,800

go ahead depops

1988

01:17:24,310 --> 01:17:21,600

yeah so when you're ready we can go um

1989

01:17:26,870 --> 01:17:24,320

pull up 626.002

1990

01:17:29,510 --> 01:17:26,880

due to frame eight

1991

01:17:31,350 --> 01:17:29,520

adapts rock looks good that command line

1992

01:17:35,110 --> 01:17:31,360

looks good you're going to execute

1993

01:18:13,430 --> 01:17:37,189

and your go to continue

1994

01:18:17,750 --> 01:18:15,990

okay i can confirm operations frame

1995

01:18:22,630 --> 01:18:17,760

eight

1996

01:18:29,430 --> 01:18:26,470

um we are below the t temperature 290 so

1997

01:18:35,750 --> 01:18:29,440

we do require self heating

1998

01:18:41,669 --> 01:18:38,870

copy that depops we have cr349

1999

01:18:43,830 --> 01:18:41,679

queued up in the central window now

2000

01:18:45,590 --> 01:18:43,840

um yeah i see that i don't sit on the

2001

01:18:48,950 --> 01:18:45,600

command line though the

2002

01:18:52,149 --> 01:18:50,630

and that command line looks good you're

2003

01:18:55,030 --> 01:18:52,159

good to execute

2004

01:18:59,750 --> 01:18:55,040

executing

2005

01:19:03,990 --> 01:19:01,990

okay stand by while we review the motor

2006

01:19:20,310 --> 01:19:04,000

move parameter

2007

01:19:24,790 --> 01:19:22,630

and oc uh the parameters look good

2008

01:19:26,630 --> 01:19:24,800

you're going to move the plus j2 mid

2009

01:19:33,510 --> 01:19:26,640

boom motor

2010

01:19:38,550 --> 01:19:35,669

and in the yellow window you can queue

2011

01:19:42,709 --> 01:19:40,550

ratchet

2012

01:22:27,830 --> 01:19:42,719

and we will hang out here waiting for

2013

01:22:27,840 --> 01:23:51,830

okay

2014

01:23:51,840 --> 01:27:17,030

huh

2015

01:27:17,040 --> 01:27:20,870

i see this is step up on up

2016

01:27:25,350 --> 01:27:23,350

oc go ahead

2017

01:27:29,189 --> 01:27:25,360

okay at this time you are going to

2018

01:27:30,950 --> 01:27:29,199

execute the du stop deploy at step five

2019

01:27:34,790 --> 01:27:30,960

uh command line looks good you go to

2020

01:27:57,990 --> 01:27:36,629

and you're going to continue

2021

01:28:02,470 --> 01:28:00,870

okay i can confirm motor stop

2022

01:28:08,229 --> 01:28:02,480

and then we are going to execute the

2023

01:28:13,750 --> 01:28:09,750

and that command line looks good you're

2024

01:28:19,750 --> 01:28:17,830

and you're going to continue happy gap

2025

01:28:36,470 --> 01:28:19,760

stand by while we review our motor move

2026

01:28:40,390 --> 01:28:39,270

and oc your go to move the plus j2 mid

2027

01:29:04,950 --> 01:28:40,400

boom motor

2028

01:29:04,960 --> 01:32:31,430

and diameter move status with moving

2029

01:34:42,629 --> 01:32:33,270

project science tomorrowland office and

2030

01:34:49,430 --> 01:34:45,510

step lead on off deployment status

2031

01:34:53,750 --> 01:34:49,440

update i can confirm the plus j2 latch

2032

01:35:03,430 --> 01:34:55,510

thank you dev ops that's good news good

2033

01:35:07,189 --> 01:35:05,590

oh see this is step up

2034

01:35:09,590 --> 01:35:07,199

you are going to

2035

01:35:13,430 --> 01:35:09,600

execute du stop deploy

2036

01:35:13,440 --> 01:35:33,669

and you're going to continue copy go

2037

01:35:36,870 --> 01:35:35,270

you're watching live coverage of the

2038

01:35:39,270 --> 01:35:36,880

historic event of commissioning the

2039

01:35:41,189 --> 01:35:39,280

james webb space telescope today we are

2040

01:35:44,070 --> 01:35:41,199

looking to actually finalize the

2041

01:35:45,590 --> 01:35:44,080

tensioning of the amazing heat shield

2042

01:35:47,590 --> 01:35:45,600

the uh the fifth layer of the heat

2043

01:35:49,590 --> 01:35:47,600

shield has begun tensioning

2044

01:35:51,030 --> 01:35:49,600

and uh we are going to be continuing

2045

01:35:53,270 --> 01:35:51,040

continuing with you here through this

2046

01:35:58,070 --> 01:35:53,280

amazing event our live coverage and

2047

01:36:02,550 --> 01:36:00,149

so please submit your social media

2048

01:36:04,709 --> 01:36:02,560

questions using the hashtag asknasa and

2049

01:36:07,030 --> 01:36:04,719

at 11 30 a.m eastern time we will begin

2050

01:36:09,109 --> 01:36:07,040

our live commentary again week the other

2051

01:36:10,950 --> 01:36:09,119

the the fifth

2052

01:36:12,870 --> 01:36:10,960

the fifth layer of the heat shield is

2053

01:36:14,229 --> 01:36:12,880

currently being depleted

2054

01:36:16,070 --> 01:36:14,239

being tensioned so

2055

01:36:17,350 --> 01:36:16,080

everything is going well we'll see you

2056

01:36:18,629 --> 01:36:17,360

in just a few minutes and you're going

2057

01:36:22,550 --> 01:36:18,639

to continue

2058

01:36:25,750 --> 01:36:24,470

and by while we review our motor move

2059

01:36:51,189 --> 01:36:25,760

parameters

2060

01:36:55,189 --> 01:36:53,590

and oc you're going to move the minus j2

2061

01:37:04,629 --> 01:36:55,199

mid boom motor

2062

01:37:15,910 --> 01:37:07,430

and then oh so you can queue up the stop

2063

01:37:21,590 --> 01:37:18,709

and the minus j2 mid boom motor

2064

01:37:23,270 --> 01:37:21,600

status was moving and it's gone to hold

2065

01:37:26,310 --> 01:37:23,280

we are going to

2066

01:37:27,750 --> 01:37:26,320

stay here until we reach

2067

01:41:04,470 --> 01:37:27,760

approximately

2068

01:41:09,510 --> 01:41:07,189

okay and oc we can execute the d e stop

2069

01:41:12,950 --> 01:41:09,520

deploy at this time

2070

01:41:33,590 --> 01:41:15,350

execute

2071

01:41:36,950 --> 01:41:35,510

and i can confirm the meter stopped and

2072

01:41:42,470 --> 01:41:36,960

we're going to

2073

01:41:47,350 --> 01:41:44,070

and that command line looks good you're

2074

01:41:49,590 --> 01:41:47,360

going to execute execute

2075

01:41:52,310 --> 01:41:49,600

and you'll go to continue copy go to

2076

01:42:10,310 --> 01:41:54,070

standby for review

2077

01:42:33,830 --> 01:42:12,550

and oc you're going to move the minus j2

2078

01:42:33,840 --> 01:42:56,550

and the motor status is moving

2079

01:43:01,109 --> 01:42:59,189

oh and oc you can cue up the stop

2080

01:45:10,390 --> 01:43:01,119

command in step 12

2081

01:45:15,990 --> 01:45:12,310

project science this is mom on ops

2082

01:47:53,910 --> 01:45:16,000

report to the flight control room please

2083

01:48:17,350 --> 01:47:58,030

set bleed on off i can confirm the minus

2084

01:48:23,910 --> 01:48:20,629

and oc this is step up on ops you are

2085

01:48:26,470 --> 01:48:23,920

going to execute the deu stop deploy

2086

01:48:50,149 --> 01:48:26,480

it's kidding

2087

01:48:53,830 --> 01:48:51,990

okay and i can confirm that the motor

2088

01:48:57,030 --> 01:48:53,840

move is stopped we're ready to continue

2089

01:48:59,430 --> 01:48:57,040  
with 626.013

2090

01:49:01,030 --> 01:48:59,440  
uh du to operate frame zero

2091

01:49:05,430 --> 01:49:01,040  
command line looks good you're going to

2092

01:49:05,440 --> 01:49:37,669  
and you're going to continue now begin

2093

01:49:42,030 --> 01:49:40,550  
okay i can confirm operations frame zero

2094

01:49:45,030 --> 01:49:42,040  
and if step

2095

01:49:50,070 --> 01:49:45,040  
626.014 depth lead has confirmed the

2096

01:49:55,589 --> 01:49:53,830  
and we're ready for 66.015.

2097

01:49:56,870 --> 01:49:55,599  
the command line looks good you're going

2098

01:49:59,510 --> 01:49:56,880  
to execute

2099

01:50:04,870 --> 01:50:01,830  
and you're going to continue copy go to

2100

01:50:08,149 --> 01:50:06,950  
and standby while we review motor move

2101  
01:50:20,310 --> 01:50:08,159  
parameters

2102  
01:50:46,149 --> 01:50:22,229  
and oc you are going to move the ford

2103  
01:50:53,430 --> 01:50:49,589  
and the motor status is moving

2104  
01:55:56,310 --> 01:50:53,440  
and oc you can queue up the stop command

2105  
01:55:56,320 --> 01:56:06,070  
i'm here

2106  
01:56:09,270 --> 01:56:07,669  
hello you are watching the live

2107  
01:56:11,510 --> 01:56:09,280  
commissioning of the james webb space

2108  
01:56:13,030 --> 01:56:11,520  
telescope today we have the exciting

2109  
01:56:15,589 --> 01:56:13,040  
news to bring you that we are going we

2110  
01:56:17,750 --> 01:56:15,599  
are looking to finish the uh unfolding

2111  
01:56:19,270 --> 01:56:17,760  
and tensioning of the heat shield and

2112  
01:56:21,189 --> 01:56:19,280  
and right now they are working on the

2113  
01:56:24,070 --> 01:56:21,199

final layer the fifth layer of the heat

2114

01:56:25,669 --> 01:56:24,080

shield and i'm i'm michelle faller i'm

2115

01:56:26,550 --> 01:56:25,679

an astronomer at goddard space flight

2116

01:56:28,790 --> 01:56:26,560

center

2117

01:56:31,510 --> 01:56:28,800

and uh i'm working from my home today

2118

01:56:33,589 --> 01:56:31,520

because of the coveted pandemic so i ask

2119

01:56:35,109 --> 01:56:33,599

that you all uh give us some patience

2120

01:56:37,109 --> 01:56:35,119

with this broadcast we want to make sure

2121

01:56:38,870 --> 01:56:37,119

that people have a chance to see live

2122

01:56:41,589 --> 01:56:38,880

this this this wonderful and historic

2123

01:56:43,830 --> 01:56:41,599

event and i'm joined by keith parish

2124

01:56:45,990 --> 01:56:43,840

keith is actually right now live at the

2125

01:56:48,149 --> 01:56:46,000

space telescope science institute at the

2126  
01:56:50,149 --> 01:56:48,159  
johns hopkins university in baltimore

2127  
01:56:51,990 --> 01:56:50,159  
and above us you can see live footage of

2128  
01:56:53,990 --> 01:56:52,000  
the mock or the mission operations

2129  
01:56:56,310 --> 01:56:54,000  
center and this is where people are

2130  
01:56:58,390 --> 01:56:56,320  
working on the heat shield right now so

2131  
01:57:00,070 --> 01:56:58,400  
um keith we took a brief pause in our

2132  
01:57:02,709 --> 01:57:00,080  
commentary uh could you bring us up to

2133  
01:57:05,109 --> 01:57:02,719  
date what is going on right now with the

2134  
01:57:08,149 --> 01:57:05,119  
james webb space television

2135  
01:57:10,390 --> 01:57:08,159  
yeah we uh took a a short pause uh we're

2136  
01:57:12,229 --> 01:57:10,400  
currently uh in community currently all

2137  
01:57:14,070 --> 01:57:12,239  
of our data coming down from web is

2138  
01:57:16,310 --> 01:57:14,080

coming through our canberra ground

2139

01:57:18,229 --> 01:57:16,320

station on australia so shout out to our

2140

01:57:19,510 --> 01:57:18,239

canberra folks down there uh we're

2141

01:57:21,589 --> 01:57:19,520

currently in communication with them

2142

01:57:23,350 --> 01:57:21,599

we'll be in there uh

2143

01:57:26,470 --> 01:57:23,360

for another couple hours until we hand

2144

01:57:28,149 --> 01:57:26,480

over to our madrid station in spain so

2145

01:57:29,589 --> 01:57:28,159

we took a little pause our you know we

2146

01:57:32,149 --> 01:57:29,599

always want to make sure we're good to

2147

01:57:33,669 --> 01:57:32,159

go before we go into the next operation

2148

01:57:35,510 --> 01:57:33,679

uh so it took a little pause to make

2149

01:57:37,350 --> 01:57:35,520

sure all of our communication

2150

01:57:40,310 --> 01:57:37,360

with canberra

2151  
01:57:43,669 --> 01:57:40,320  
solid and and it is so we just resumed

2152  
01:57:45,830 --> 01:57:43,679  
uh layer five tensioning uh and uh we

2153  
01:57:48,470 --> 01:57:45,840  
actually have done the uh we have six

2154  
01:57:50,229 --> 01:57:48,480  
corners to uh tension uh and we've

2155  
01:57:52,390 --> 01:57:50,239  
tensioned the first two we are actually

2156  
01:57:55,750 --> 01:57:52,400  
currently uh tensioning what we call the

2157  
01:57:57,669 --> 01:57:55,760  
four the the the uh the four side uh

2158  
01:57:59,589 --> 01:57:57,679  
which you can see up on what we call our

2159  
01:58:01,830 --> 01:57:59,599  
observatory visualization tool right

2160  
01:58:03,750 --> 01:58:01,840  
there and you can see just a little bit

2161  
01:58:05,510 --> 01:58:03,760  
of separation up there at the top as

2162  
01:58:08,950 --> 01:58:05,520  
that layer spreads

2163  
01:58:10,390 --> 01:58:08,960

on those uh on that corner

2164

01:58:13,270 --> 01:58:10,400

and once again for those people that are

2165

01:58:15,030 --> 01:58:13,280

just uh joining us um the uh

2166

01:58:17,189 --> 01:58:15,040

the graphic that you're seeing to the

2167

01:58:19,189 --> 01:58:17,199

the left of your screen is actually

2168

01:58:21,109 --> 01:58:19,199

correct in real time as to what web is

2169

01:58:22,310 --> 01:58:21,119

doing right now and that's based on data

2170

01:58:24,629 --> 01:58:22,320

and telemetry coming down from the

2171

01:58:26,390 --> 01:58:24,639

telescope is that correct

2172

01:58:28,470 --> 01:58:26,400

yeah that's right so all that all that

2173

01:58:31,589 --> 01:58:28,480

information is coming down from from web

2174

01:58:33,350 --> 01:58:31,599

right now uh our team that created this

2175

01:58:36,149 --> 01:58:33,360

uh what we call the ovt that's our

2176

01:58:38,470 --> 01:58:36,159

acronym for it uh it takes all that data

2177

01:58:41,030 --> 01:58:38,480

and it creates this uh visualization of

2178

01:58:43,189 --> 01:58:41,040

what's going on on web and it's uh

2179

01:58:45,430 --> 01:58:43,199

it really kind of gives us a connection

2180

01:58:47,990 --> 01:58:45,440

uh to web and is what it's doing we know

2181

01:58:49,750 --> 01:58:48,000

this isn't a live a live shot of web but

2182

01:58:51,910 --> 01:58:49,760

it really does give us sort of that

2183

01:58:54,390 --> 01:58:51,920

spatial awareness uh that that the

2184

01:58:56,709 --> 01:58:54,400

engineers need again we're it's really

2185

01:58:58,629 --> 01:58:56,719

about the data the ones and the zeros

2186

01:59:00,149 --> 01:58:58,639

and all the all the telemetry that's

2187

01:59:01,589 --> 01:59:00,159

coming down and we have thousands and

2188

01:59:03,109 --> 01:59:01,599

thousands of

2189

01:59:05,750 --> 01:59:03,119

data points coming down so we take all

2190

01:59:08,390 --> 01:59:05,760

that data and uh we make these images uh

2191

01:59:10,629 --> 01:59:08,400

to tell us exactly what physical uh

2192

01:59:13,189 --> 01:59:10,639

configuration that that web is in right

2193

01:59:17,910 --> 01:59:15,109

and you can see on the you can kind of

2194

01:59:19,589 --> 01:59:17,920

see as you go down to the to the to the

2195

01:59:21,109 --> 01:59:19,599

i do i have i don't know i do have my

2196

01:59:24,149 --> 01:59:21,119

model here i don't know if i can throw

2197

01:59:26,550 --> 01:59:24,159

it um so what we are doing right now is

2198

01:59:29,750 --> 01:59:26,560

we're tensioning up on this side right

2199

01:59:31,750 --> 01:59:29,760

here uh you kind of see a little bit uh

2200

01:59:34,390 --> 01:59:31,760

at this front corner here we've already

2201  
01:59:35,750 --> 01:59:34,400  
done uh the physical just a note just a

2202  
01:59:39,189 --> 01:59:35,760  
note to the directors of the broadcast

2203  
01:59:40,629 --> 01:59:39,199  
uh could we get a picture of keith

2204  
01:59:45,430 --> 01:59:40,639  
oh i'm sorry i'm pointing to something

2205  
01:59:49,189 --> 01:59:47,030  
can we uh can we get keith back on

2206  
01:59:51,350 --> 01:59:49,199  
camera thank you there you go there you

2207  
01:59:54,229 --> 01:59:51,360  
are um

2208  
01:59:55,750 --> 01:59:54,239  
big too okay uh yeah so uh this is a

2209  
01:59:57,510 --> 01:59:55,760  
model of our and i gotta get it right

2210  
01:59:59,589 --> 01:59:57,520  
here so we're actually

2211  
02:00:01,669 --> 01:59:59,599  
we're actually tensioning up right now

2212  
02:00:03,990 --> 02:00:01,679  
you can see on an ovt when when i'm not

2213  
02:00:05,990 --> 02:00:04,000

on camera you can see uh this is what we

2214

02:00:07,750 --> 02:00:06,000

call our forward uh part of our

2215

02:00:09,589 --> 02:00:07,760

sunshield and we're tensioning layer

2216

02:00:11,910 --> 02:00:09,599

five right there

2217

02:00:13,910 --> 02:00:11,920

if you swing around this way we've

2218

02:00:15,990 --> 02:00:13,920

already done these two we've already

2219

02:00:18,310 --> 02:00:16,000

done this side and we've already done

2220

02:00:20,149 --> 02:00:18,320

this side so right now we're on uh four

2221

02:00:23,350 --> 02:00:20,159

and then we'll eventually do our

2222

02:00:24,229 --> 02:00:23,360

our uh aft this is our aft side we'll do

2223

02:00:26,310 --> 02:00:24,239

that

2224

02:00:28,709 --> 02:00:26,320

and right after we finish our four so

2225

02:00:31,510 --> 02:00:28,719

yeah we are we're running out of cables

2226

02:00:34,390 --> 02:00:31,520

to wind up uh we started out yesterday

2227

02:00:37,990 --> 02:00:34,400

moving 90 cables uh and right now we're

2228

02:00:39,990 --> 02:00:38,000

down to our our last 18 cable so uh the

2229

02:00:41,350 --> 02:00:40,000

team has been winding those up for and

2230

02:00:43,910 --> 02:00:41,360

that and that's what actually creates

2231

02:00:45,109 --> 02:00:43,920

that tension on the sunshield

2232

02:00:46,950 --> 02:00:45,119

you know we've gotten some questions

2233

02:00:48,629 --> 02:00:46,960

from social media and uh remember that

2234

02:00:50,790 --> 02:00:48,639

you can use the hashtag ask nasa if

2235

02:00:52,070 --> 02:00:50,800

you'd like to ask some questions live

2236

02:00:53,990 --> 02:00:52,080

and there's a there's a couple actually

2237

02:00:56,629 --> 02:00:54,000

that talk about the shape of the the sun

2238

02:00:58,470 --> 02:00:56,639

shield so there's uh you know

2239

02:01:00,870 --> 02:00:58,480

what what what why was this shape

2240

02:01:03,270 --> 02:01:00,880

determined uh the the this person says

2241

02:01:04,870 --> 02:01:03,280

why wasn't it oval shaped or circular

2242

02:01:06,950 --> 02:01:04,880

can you give us a sense about the design

2243

02:01:08,790 --> 02:01:06,960

of the sun shield and and why it looks

2244

02:01:10,709 --> 02:01:08,800

the way it does

2245

02:01:13,109 --> 02:01:10,719

yeah the the sun shield is actually

2246

02:01:14,629 --> 02:01:13,119

shaped uh

2247

02:01:17,350 --> 02:01:14,639

basically

2248

02:01:20,229 --> 02:01:17,360

it's no bigger than it has to be

2249

02:01:21,750 --> 02:01:20,239

uh any any larger uh than it is and that

2250

02:01:24,709 --> 02:01:21,760

would have been even more engineering

2251

02:01:26,229 --> 02:01:24,719

challenges so uh we have requirements on

2252

02:01:29,270 --> 02:01:26,239

how much sky

2253

02:01:31,589 --> 02:01:29,280

uh that the telescope is can see at each

2254

02:01:33,189 --> 02:01:31,599

time and then the uh the shape of the

2255

02:01:35,669 --> 02:01:33,199

telescope uh

2256

02:01:37,830 --> 02:01:35,679

of the or the shape of the sun shield

2257

02:01:40,629 --> 02:01:37,840

lets us pretty much observe

2258

02:01:44,149 --> 02:01:40,639

uh 60 of the sky at any time so we can

2259

02:01:46,629 --> 02:01:44,159

pitch forward uh with respect to the sun

2260

02:01:49,589 --> 02:01:46,639

uh and and and still keep our secondary

2261

02:01:51,669 --> 02:01:49,599

mirror in shadow we can pitch back

2262

02:01:54,310 --> 02:01:51,679

quite a way well over 50 degrees and

2263

02:01:56,470 --> 02:01:54,320

still keep our telescope in shadow so we

2264

02:01:57,430 --> 02:01:56,480

can kind of tilt the telescope back and

2265

02:02:00,390 --> 02:01:57,440

forth

2266

02:02:01,830 --> 02:02:00,400

quite a bit uh front and back now on the

2267

02:02:04,629 --> 02:02:01,840

sides

2268

02:02:06,390 --> 02:02:04,639

we only roll about five degrees each way

2269

02:02:08,870 --> 02:02:06,400

to the side so that's why the tel that's

2270

02:02:09,669 --> 02:02:08,880

why the sun shield has this uh sort of

2271

02:02:11,910 --> 02:02:09,679

uh

2272

02:02:14,070 --> 02:02:11,920

narrow shape on the sides it's 50 some

2273

02:02:16,709 --> 02:02:14,080

feet on the sides and it's 70 some feet

2274

02:02:19,830 --> 02:02:16,719

long on the length and then instead of

2275

02:02:21,589 --> 02:02:19,840

making it uh a square uh or or a

2276

02:02:23,750 --> 02:02:21,599

rectangle we don't we don't need it to

2277

02:02:25,830 --> 02:02:23,760

do that so we we tried to we tried to

2278

02:02:28,229 --> 02:02:25,840

limit as much material as we had to

2279

02:02:31,270 --> 02:02:28,239

handle on orbit uh so that's what gave

2280

02:02:33,910 --> 02:02:31,280

it this sort of uh iconic kite shape uh

2281

02:02:36,470 --> 02:02:33,920

is that it didn't need to be a anything

2282

02:02:37,830 --> 02:02:36,480

other than a kite to provide that uh you

2283

02:02:40,390 --> 02:02:37,840

know provide our telescope with that

2284

02:02:41,510 --> 02:02:40,400

view of the sky at all times

2285

02:02:43,270 --> 02:02:41,520

and i should just say as a shout out

2286

02:02:45,589 --> 02:02:43,280

shout out that was andra on twitter that

2287

02:02:47,109 --> 02:02:45,599

asked that question and then uh as we

2288

02:02:48,709 --> 02:02:47,119

see there's a graphic up here about just

2289

02:02:50,390 --> 02:02:48,719

how much temper differential there is

2290

02:02:51,990 --> 02:02:50,400

between the the hot side and the cold

2291

02:02:55,109 --> 02:02:52,000

side of the heat shield

2292

02:02:57,510 --> 02:02:55,119

um one of our uh one of our social media

2293

02:02:59,750 --> 02:02:57,520

guests asked uh does the observatory

2294

02:03:01,910 --> 02:02:59,760

itself does the mirror itself pan around

2295

02:03:04,790 --> 02:03:01,920

a lot look at the sky

2296

02:03:07,750 --> 02:03:04,800

another deployment status update i can

2297

02:03:11,270 --> 02:03:07,760

confirm the latch event on the forward

2298

02:03:13,589 --> 02:03:11,280

mts pair for layer five

2299

02:03:15,350 --> 02:03:13,599

okay all right good news thank you good

2300

02:03:16,790 --> 02:03:15,360

news

2301

02:03:19,030 --> 02:03:16,800

okay so what you just heard there you

2302

02:03:20,870 --> 02:03:19,040

just heard our depth lead hillary uh she

2303

02:03:23,830 --> 02:03:20,880

just told us that uh we are finished

2304

02:03:26,629 --> 02:03:23,840

with the forward uh so we've done uh

2305

02:03:34,870 --> 02:03:26,639

we've done four of our six corners and i

2306

02:03:40,830 --> 02:03:38,390

so uh back to your question uh or back

2307

02:03:43,990 --> 02:03:40,840

to the question we we maneuver the whole

2308

02:03:46,229 --> 02:03:44,000

observatory uh we don't we don't we

2309

02:03:48,069 --> 02:03:46,239

the whole observatory maneuvers to look

2310

02:03:50,629 --> 02:03:48,079

at you know whatever it's imaging

2311

02:03:53,030 --> 02:03:50,639

whether it be a galaxy or other object

2312

02:04:03,430 --> 02:03:53,040

uh there was early studies that actually

2313

02:04:07,589 --> 02:04:05,589

you'll hear us being interrupted by live

2314

02:04:09,669 --> 02:04:07,599

uh updates from the mock the mission

2315

02:04:10,790 --> 02:04:09,679

operations center so uh don't worry for

2316

02:04:12,229 --> 02:04:10,800

pausing we're listening to what they're

2317

02:04:14,229 --> 02:04:12,239

saying

2318

02:04:17,189 --> 02:04:14,239

yeah exactly right so that's our uh

2319

02:04:19,350 --> 02:04:17,199

that's our uh uh devops engineer nancy

2320

02:04:21,990 --> 02:04:19,360

she's uh communicating again with our

2321

02:04:24,229 --> 02:04:22,000

flight controllers in the room to uh

2322

02:04:26,709 --> 02:04:24,239

communicate what commands that our

2323

02:04:27,990 --> 02:04:26,719

deployments team want to send up to uh

2324

02:04:29,589 --> 02:04:28,000

to web so

2325

02:04:31,030 --> 02:04:29,599

yeah again we just we just maneuver the

2326

02:04:33,589 --> 02:04:31,040

whole observatory it's just better to

2327

02:04:35,990 --> 02:04:33,599

maneuver it make it nice and rigid and

2328

02:04:37,750 --> 02:04:36,000

and solid on orbit and just maneuver

2329

02:04:39,589 --> 02:04:37,760

that versus trying to try to maneuver

2330

02:04:41,189 --> 02:04:39,599

the telescope

2331

02:04:43,430 --> 02:04:41,199

that's again that's what really drove

2332

02:04:45,270 --> 02:04:43,440

that sunshield

2333

02:04:46,709 --> 02:04:45,280

zero one eight i have confirmed that

2334

02:04:47,910 --> 02:04:46,719

death lead and the team are ready to

2335

02:04:50,830 --> 02:04:47,920

continue

2336

02:04:57,830 --> 02:04:53,750

626.019 and that command line looks good

2337

02:05:01,669 --> 02:05:00,310

are you starting to get excited keith

2338

02:05:02,950 --> 02:05:01,679

yeah

2339

02:05:06,390 --> 02:05:02,960

we're just we're actually sending the

2340

02:05:08,310 --> 02:05:06,400

command to start turning those moves

2341

02:05:10,069 --> 02:05:08,320

so let's talk a bit about the importance

2342

02:05:12,229 --> 02:05:10,079

of the sunshield and there there are

2343

02:05:13,830 --> 02:05:12,239

many different aspects of that um this

2344

02:05:15,669 --> 02:05:13,840

really is an exciting piece of

2345

02:05:17,669 --> 02:05:15,679

technology and and you know this is

2346

02:05:19,030 --> 02:05:17,679

something that for a space observatory

2347

02:05:21,189 --> 02:05:19,040

like this we've never tried before can

2348

02:05:23,510 --> 02:05:21,199

you can you give us sort of a pan back

2349

02:05:26,069 --> 02:05:23,520

sort of the 30 000 foot look at and why

2350

02:05:29,030 --> 02:05:26,079

the sun shield is so incredible

2351  
02:05:30,390 --> 02:05:29,040  
and i see your vitamin d aft mpf motor

2352  
02:05:32,950 --> 02:05:30,400  
pair

2353  
02:05:34,790 --> 02:05:32,960  
kathy here we go so uh

2354  
02:05:36,550 --> 02:05:34,800  
i i do like to let people hear the

2355  
02:05:39,510 --> 02:05:36,560  
commanding there because it's uh really

2356  
02:05:42,790 --> 02:05:41,189  
uh you know there's

2357  
02:05:45,750 --> 02:05:42,800  
there's more than just one command that

2358  
02:05:48,149 --> 02:05:45,760  
goes up our uh our flight controllers

2359  
02:05:49,510 --> 02:05:48,159  
and our debt ops lead there they're

2360  
02:05:51,109 --> 02:05:49,520  
they're they're checking everything

2361  
02:05:52,950 --> 02:05:51,119  
that's coming back and making sure that

2362  
02:05:54,390 --> 02:05:52,960  
the next command is is the right command

2363  
02:05:56,310 --> 02:05:54,400

so they're double checking and double

2364

02:05:59,270 --> 02:05:56,320

checking so that's a lot of the back and

2365

02:06:01,030 --> 02:05:59,280

forth you hear there uh but uh as you

2366

02:06:02,390 --> 02:06:01,040

can see on the graphic there you'll see

2367

02:06:05,350 --> 02:06:02,400

our motor counter

2368

02:06:07,030 --> 02:06:05,360

status change to moving

2369

02:06:09,350 --> 02:06:07,040

yep there we go so you'll start seeing

2370

02:06:11,350 --> 02:06:09,360

those counts uh that's uh what we call a

2371

02:06:13,270 --> 02:06:11,360

field director which try which keeps

2372

02:06:15,990 --> 02:06:13,280

track of our motor position and you'll

2373

02:06:18,550 --> 02:06:16,000

see those counts starting to uh increase

2374

02:06:21,189 --> 02:06:18,560

as that layer and separate it and those

2375

02:06:22,870 --> 02:06:21,199

cables are or wound in so i think the

2376

02:06:25,750 --> 02:06:22,880

big you know back to your question the

2377

02:06:28,310 --> 02:06:25,760

big the big challenge with with this

2378

02:06:31,270 --> 02:06:28,320

this type of deployment is we're doing

2379

02:06:32,629 --> 02:06:31,280

five layers uh we have to handle five

2380

02:06:34,550 --> 02:06:32,639

layers and

2381

02:06:35,910 --> 02:06:34,560

uh and everything

2382

02:06:38,310 --> 02:06:35,920

it it

2383

02:06:41,109 --> 02:06:38,320

we're pretty good at deploying things

2384

02:06:43,030 --> 02:06:41,119

that are rigid uh but the the membranes

2385

02:06:45,030 --> 02:06:43,040

are rather rather you know they're

2386

02:06:47,189 --> 02:06:45,040

floppy and they they want to float

2387

02:06:49,430 --> 02:06:47,199

around we have cables that we don't want

2388

02:06:51,830 --> 02:06:49,440

to get slack so we're really trying to

2389

02:06:54,709 --> 02:06:51,840

do an intricate operation

2390

02:06:56,310 --> 02:06:54,719

uh right now 560 some thousand miles

2391

02:06:59,030 --> 02:06:56,320

away from the earth

2392

02:07:00,709 --> 02:06:59,040

and control every aspect of the position

2393

02:07:03,030 --> 02:07:00,719

of these layers and i think that's

2394

02:07:03,750 --> 02:07:03,040

really where the challenge has been uh

2395

02:07:08,310 --> 02:07:03,760

is

2396

02:07:10,629 --> 02:07:08,320

every second of the deployment where

2397

02:07:12,950 --> 02:07:10,639

these layers are uh so there's a lot of

2398

02:07:14,390 --> 02:07:12,960

features built in uh that aren't really

2399

02:07:16,149 --> 02:07:14,400

apparent uh

2400

02:07:18,470 --> 02:07:16,159

in any of the things that you're seeing

2401

02:07:20,470 --> 02:07:18,480

right now that keep these layers very

2402

02:07:22,390 --> 02:07:20,480

controlled uh and make sure that they're

2403

02:07:23,990 --> 02:07:22,400

not floating places that we don't want

2404

02:07:25,990 --> 02:07:24,000

them to be and that's that's really been

2405

02:07:27,750 --> 02:07:26,000

the the you know really one of the

2406

02:07:30,390 --> 02:07:27,760

challenges for

2407

02:07:33,589 --> 02:07:30,400

such a large sort of floppy deployable

2408

02:07:34,790 --> 02:07:33,599

item that this sunshield is

2409

02:07:36,709 --> 02:07:34,800

you know speaking of it being kind of

2410

02:07:39,270 --> 02:07:36,719

large and floppy we've gotten several

2411

02:07:41,910 --> 02:07:39,280

questions on social media so um siobhani

2412

02:07:43,750 --> 02:07:41,920

from our youtube feed asks what happens

2413

02:07:45,270 --> 02:07:43,760

if if even one of the sun shields get

2414

02:07:47,910 --> 02:07:45,280

damaged and there are other ones about

2415

02:07:50,470 --> 02:07:47,920

micro meteorites so you know tiny little

2416

02:07:52,310 --> 02:07:50,480

bits of rock flying around in space well

2417

02:07:54,550 --> 02:07:52,320

what's the how resilient does this heat

2418

02:07:56,149 --> 02:07:54,560

shield something like that

2419

02:07:58,149 --> 02:07:56,159

oh it's it's everything from the

2420

02:08:00,790 --> 02:07:58,159

materials that it was that you know sort

2421

02:08:03,430 --> 02:08:00,800

of it's raw materials uh that was chosen

2422

02:08:05,350 --> 02:08:03,440

for its strength uh to be able to handle

2423

02:08:07,350 --> 02:08:05,360

the environment of space that what it's

2424

02:08:08,390 --> 02:08:07,360

coated with to make these uh really you

2425

02:08:11,510 --> 02:08:08,400

know sort of

2426

02:08:13,270 --> 02:08:11,520

uh colors is uh is coded uh is

2427

02:08:15,030 --> 02:08:13,280

everything has been designed it's got

2428

02:08:17,030 --> 02:08:15,040

lots of reinforcements you can see in

2429

02:08:19,990 --> 02:08:17,040

some of these uh this video of the real

2430

02:08:22,069 --> 02:08:20,000

shield now uh you can see a lot of seams

2431

02:08:24,149 --> 02:08:22,079

i do want to give a shout out to our our

2432

02:08:26,069 --> 02:08:24,159

membrane we had a vendor that created

2433

02:08:29,030 --> 02:08:26,079

these membranes and had to stitch them

2434

02:08:31,030 --> 02:08:29,040

all together so to speak uh and and it's

2435

02:08:33,990 --> 02:08:31,040

completely reinforced so that if we do

2436

02:08:36,870 --> 02:08:34,000

get tears uh they won't propagate uh and

2437

02:08:38,709 --> 02:08:36,880

as far as micrometeoroids we do expect

2438

02:08:41,030 --> 02:08:38,719

to be hit with micro meteoroids the good

2439

02:08:43,350 --> 02:08:41,040

thing is that uh they're not very big

2440

02:08:44,790 --> 02:08:43,360

and they won't do much damage so we uh

2441

02:08:46,870 --> 02:08:44,800

we actually one of our early

2442

02:08:49,589 --> 02:08:46,880

developments for this material is we

2443

02:08:52,149 --> 02:08:49,599

actually took it uh and hit it with uh

2444

02:08:54,149 --> 02:08:52,159

high velocity projectiles uh moving

2445

02:08:55,669 --> 02:08:54,159

several kilometers per second to make

2446

02:08:56,950 --> 02:08:55,679

sure that uh make sure the material

2447

02:08:59,109 --> 02:08:56,960

could withstand that so over the

2448

02:09:02,229 --> 02:08:59,119

lifetime we do expect really really tiny

2449

02:09:04,310 --> 02:09:02,239

microscopic holes uh to develop but

2450

02:09:06,790 --> 02:09:04,320

again that's all accounted for in design

2451

02:09:08,870 --> 02:09:06,800

so uh it it it'll it's it's rather

2452

02:09:11,189 --> 02:09:08,880

rugged once it's all tensioned up uh

2453

02:09:12,470 --> 02:09:11,199

it'll it'll be fine

2454

02:09:14,310 --> 02:09:12,480

and uh you were talking about the fact

2455

02:09:16,310 --> 02:09:14,320

that this is this sort of large huge

2456

02:09:18,229 --> 02:09:16,320

sail that we're you know unfolding a

2457

02:09:20,229 --> 02:09:18,239

little bit by a little bit in space and

2458

02:09:21,510 --> 02:09:20,239

of course while there isn't any air or

2459

02:09:23,669 --> 02:09:21,520

atmosphere where webb is there is

2460

02:09:25,270 --> 02:09:23,679

something called the solar wind and the

2461

02:09:26,870 --> 02:09:25,280

solar wind is actually a wind of high

2462

02:09:28,390 --> 02:09:26,880

energy particles that are coming off

2463

02:09:29,990 --> 02:09:28,400

from the sun so not not a wind in the

2464

02:09:31,750 --> 02:09:30,000

way we think of it but a wind of

2465

02:09:33,510 --> 02:09:31,760

actually high energy particles does the

2466

02:09:36,069 --> 02:09:33,520

solar wind have any effect on the heat

2467

02:09:37,430 --> 02:09:36,079

shield and it's appointing

2468

02:09:40,790 --> 02:09:37,440

oh yeah so we get we get something

2469

02:09:41,589 --> 02:09:40,800

called solar pressure uh and again if

2470

02:09:44,390 --> 02:09:41,599

you know

2471

02:09:46,390 --> 02:09:44,400

the whole concept of solar sails uh you

2472

02:09:48,229 --> 02:09:46,400

know to possibly travel around our solar

2473

02:09:50,870 --> 02:09:48,239

system you know with free propulsion

2474

02:09:53,109 --> 02:09:50,880

from the sun uh it's a very small force

2475

02:09:55,750 --> 02:09:53,119

very very tiny it's it's not like the

2476

02:09:57,910 --> 02:09:55,760

wind blowing uh but it is a it is it is

2477

02:10:00,310 --> 02:09:57,920

a force it's a it's a physical force uh

2478

02:10:02,069 --> 02:10:00,320

the sun uh the solar pressure that hits

2479

02:10:04,470 --> 02:10:02,079

the the sun shield so we have to account

2480

02:10:06,629 --> 02:10:04,480

for that uh it will try to move us

2481

02:10:10,229 --> 02:10:06,639

around uh the biggest thing that it does

2482

02:10:12,709 --> 02:10:10,239

to us is it it's offset so uh uh

2483

02:10:15,430 --> 02:10:12,719

what i mean by that is uh the the solar

2484

02:10:18,709 --> 02:10:15,440

pressure will tend to try to turn us uh

2485

02:10:20,390 --> 02:10:18,719

and we counter that churning uh force uh

2486

02:10:23,430 --> 02:10:20,400

with with some reaction wheels in the

2487

02:10:25,350 --> 02:10:23,440

spacecraft and then ultimately uh those

2488

02:10:26,870 --> 02:10:25,360

wheels get spinning so fast we have to

2489

02:10:29,830 --> 02:10:26,880

fire our uh

2490

02:10:33,270 --> 02:10:29,840

onboard propulsion system to unload them

2491

02:10:35,189 --> 02:10:33,280

and that takes fuel to do so uh on uh i

2492

02:10:37,830 --> 02:10:35,199

think early earlier in the week we

2493

02:10:39,750 --> 02:10:37,840

deployed something called our aflap

2494

02:10:41,910 --> 02:10:39,760

off the back of the sunshield

2495

02:10:43,990 --> 02:10:41,920

main structure and that aflap is

2496

02:10:46,149 --> 02:10:44,000

intended to sort of again sort of a

2497

02:10:48,310 --> 02:10:46,159

sailing analogy sort of the counter

2498

02:10:50,229 --> 02:10:48,320

almost like a little bit of a rudder uh

2499

02:10:51,910 --> 02:10:50,239

to help us counter some of those forces

2500

02:10:54,790 --> 02:10:51,920

and ultimately that leads us to using

2501  
02:10:55,990 --> 02:10:54,800  
less fuel on orbit

2502  
02:10:57,669 --> 02:10:56,000  
and is the uh

2503  
02:10:59,669 --> 02:10:57,679  
that's something that is a limitation to

2504  
02:11:01,830 --> 02:10:59,679  
some degree for this observatory it does

2505  
02:11:03,430 --> 02:11:01,840  
have a finite amount of fuel to do that

2506  
02:11:05,910 --> 02:11:03,440  
is is that correct that's that'll be one

2507  
02:11:08,149 --> 02:11:05,920  
of the lifetime limitations

2508  
02:11:10,390 --> 02:11:08,159  
that's right so uh you know fuel fuel is

2509  
02:11:13,109 --> 02:11:10,400  
our only known uh

2510  
02:11:15,350 --> 02:11:13,119  
limiting life item on board uh so so

2511  
02:11:18,390 --> 02:11:15,360  
obviously we wanted to take a lot of it

2512  
02:11:20,950 --> 02:11:18,400  
uh and and we everything worked we worse

2513  
02:11:22,550 --> 02:11:20,960

cased everything uh and then we said hey

2514

02:11:25,109 --> 02:11:22,560

how once we worst case all of our

2515

02:11:28,629 --> 02:11:25,119

conditions meaning we don't get a very

2516

02:11:30,470 --> 02:11:28,639

good injection from our arion 5 vehicle

2517

02:11:31,910 --> 02:11:30,480

we do all of our burns late they're not

2518

02:11:33,669 --> 02:11:31,920

very efficient

2519

02:11:35,350 --> 02:11:33,679

we have lots of momentum that we have to

2520

02:11:37,030 --> 02:11:35,360

unload lots of solar pressure all those

2521

02:11:39,270 --> 02:11:37,040

things go bad we still want 10 years of

2522

02:11:41,830 --> 02:11:39,280

fuel and so all of our worst case

2523

02:11:45,030 --> 02:11:41,840

calculations is how we came up

2524

02:11:48,069 --> 02:11:45,040

how many uh kilograms of of fuel to take

2525

02:11:49,910 --> 02:11:48,079

on board uh fortunately so far

2526

02:11:52,550 --> 02:11:49,920

those worst case conditions uh i think

2527

02:11:54,629 --> 02:11:52,560

as amy said yesterday

2528

02:11:57,830 --> 02:11:54,639

we conservative so all those conditions

2529

02:12:00,229 --> 02:11:57,840

so far have not been on the worst case

2530

02:12:02,390 --> 02:12:00,239

our execution

2531

02:12:04,390 --> 02:12:02,400

of that first burn and again everything

2532

02:12:07,030 --> 02:12:04,400

has been really really good so we expect

2533

02:12:10,470 --> 02:12:07,040

to use significantly less than we expect

2534

02:12:11,669 --> 02:12:10,480

to have much more than the 10 years

2535

02:12:13,830 --> 02:12:11,679

i'll just mention that the question

2536

02:12:15,270 --> 02:12:13,840

about the solar sail effect on the uh

2537

02:12:16,950 --> 02:12:15,280

the heat shield comes from alan on

2538

02:12:17,990 --> 02:12:16,960

facebook so thank you very much for your

2539

02:12:19,430 --> 02:12:18,000

question

2540

02:12:20,709 --> 02:12:19,440

there's um

2541

02:12:22,550 --> 02:12:20,719

there's a question coming in that maybe

2542

02:12:24,870 --> 02:12:22,560

i could take a little bit of a crack at

2543

02:12:26,870 --> 02:12:24,880

answering myself and and keith certainly

2544

02:12:29,109 --> 02:12:26,880

you can uh you can chime in on this but

2545

02:12:31,830 --> 02:12:29,119

mike on facebook asks who will be able

2546

02:12:33,750 --> 02:12:31,840

to use web just nasa and i think this is

2547

02:12:35,510 --> 02:12:33,760

a chance to kind of talk a bit about the

2548

02:12:36,470 --> 02:12:35,520

international nature of this this

2549

02:12:38,950 --> 02:12:36,480

mission

2550

02:12:40,550 --> 02:12:38,960

so um absolutely it will not be just

2551  
02:12:41,669 --> 02:12:40,560  
nasa that is using the web space

2552  
02:12:43,189 --> 02:12:41,679  
telescope

2553  
02:12:45,189 --> 02:12:43,199  
um

2554  
02:12:47,510 --> 02:12:45,199  
the web space telescope has several

2555  
02:12:49,270 --> 02:12:47,520  
major international partners uh our our

2556  
02:12:51,830 --> 02:12:49,280  
big partners are the european space

2557  
02:12:54,550 --> 02:12:51,840  
agency and the canadian space agency and

2558  
02:12:56,790 --> 02:12:54,560  
so there is a time allocation to the

2559  
02:12:58,629 --> 02:12:56,800  
major partners uh you know in this

2560  
02:12:59,830 --> 02:12:58,639  
mission that so so the european

2561  
02:13:01,750 --> 02:12:59,840  
astronomers people working with the

2562  
02:13:04,550 --> 02:13:01,760  
european space agency and also the

2563  
02:13:06,229 --> 02:13:04,560

canadian space agency however

2564

02:13:08,069 --> 02:13:06,239

like hubble

2565

02:13:10,790 --> 02:13:08,079

the webb telescope is

2566

02:13:12,790 --> 02:13:10,800

a world observatory and what will happen

2567

02:13:15,189 --> 02:13:12,800

in the future is that there will be

2568

02:13:17,109 --> 02:13:15,199

committees of astronomers that every

2569

02:13:19,189 --> 02:13:17,119

year will review proposals from all over

2570

02:13:21,189 --> 02:13:19,199

the world from teams of scientists who

2571

02:13:22,470 --> 02:13:21,199

want to use the web telescope for their

2572

02:13:25,270 --> 02:13:22,480

own research

2573

02:13:27,350 --> 02:13:25,280

and again while the main organizations

2574

02:13:29,189 --> 02:13:27,360

responsible for the operation and the

2575

02:13:30,390 --> 02:13:29,199

building and testing of web we'll have

2576

02:13:32,709 --> 02:13:30,400

some time allocated to them

2577

02:13:34,550 --> 02:13:32,719

automatically a lot of this will be open

2578

02:13:36,310 --> 02:13:34,560

to the public in the sense that

2579

02:13:38,229 --> 02:13:36,320

professional astronomers from all around

2580

02:13:41,189 --> 02:13:38,239

the world will be able to use it

2581

02:13:42,870 --> 02:13:41,199

and it's not just the uh the

2582

02:13:45,270 --> 02:13:42,880

observations themselves the other thing

2583

02:13:47,270 --> 02:13:45,280

that's really really important to talk

2584

02:13:49,030 --> 02:13:47,280

about is the archive

2585

02:13:51,589 --> 02:13:49,040

that's the the data taken by the web

2586

02:13:54,069 --> 02:13:51,599

telescope when you're an astronomer say

2587

02:13:55,830 --> 02:13:54,079

you know i i actually have been honored

2588

02:13:58,870 --> 02:13:55,840

to use the hubble space telescope myself

2589

02:14:00,550 --> 02:13:58,880

in the past um you you write a proposal

2590

02:14:03,669 --> 02:14:00,560

to this committee of scientists every

2591

02:14:05,270 --> 02:14:03,679

year that then ranks uh the proposals in

2592

02:14:06,629 --> 02:14:05,280

terms of their their priority their

2593

02:14:08,790 --> 02:14:06,639

science priority

2594

02:14:10,390 --> 02:14:08,800

and uh and then you you get your data

2595

02:14:12,069 --> 02:14:10,400

based on whether you make that priority

2596

02:14:14,069 --> 02:14:12,079

list and if you don't you can apply

2597

02:14:16,229 --> 02:14:14,079

again next time and all of that but that

2598

02:14:18,470 --> 02:14:16,239

all goes into an archive and that

2599

02:14:21,109 --> 02:14:18,480

archive after a certain amount of time

2600

02:14:22,790 --> 02:14:21,119

is public and anybody can use the data

2601  
02:14:24,870 --> 02:14:22,800  
so if you're a scientist that's won the

2602  
02:14:26,709 --> 02:14:24,880  
proposal you you should get a first

2603  
02:14:28,229 --> 02:14:26,719  
chance to look at your data and make

2604  
02:14:30,390 --> 02:14:28,239  
your discoveries and observations that

2605  
02:14:32,149 --> 02:14:30,400  
you want to but then eventually that

2606  
02:14:34,390 --> 02:14:32,159  
that data gets put into an archive where

2607  
02:14:36,629 --> 02:14:34,400  
anybody can use the data

2608  
02:14:38,229 --> 02:14:36,639  
so this is a world treasure it's not

2609  
02:14:40,390 --> 02:14:38,239  
just nasa that will be using this

2610  
02:14:41,990 --> 02:14:40,400  
observatory and it's not just nasa that

2611  
02:14:43,669 --> 02:14:42,000  
built the observatory and launched the

2612  
02:14:45,669 --> 02:14:43,679  
observatory this has been an

2613  
02:14:47,669 --> 02:14:45,679

international program from the very

2614

02:14:49,910 --> 02:14:47,679

beginning so that's something we're very

2615

02:14:53,030 --> 02:14:49,920

proud of

2616

02:14:54,709 --> 02:14:53,040

let's see so uh um i know you know i

2617

02:14:56,149 --> 02:14:54,719

mean i i'm getting you know more and

2618

02:14:58,470 --> 02:14:56,159

more excited you know the the heat

2619

02:15:00,790 --> 02:14:58,480

shield was a tremendously complex part

2620

02:15:02,390 --> 02:15:00,800

of this observatory so for people that

2621

02:15:04,629 --> 02:15:02,400

are just joining us maybe you could give

2622

02:15:07,030 --> 02:15:04,639

us some sense uh mike a little bit about

2623

02:15:09,109 --> 02:15:07,040

uh the number of actuators maybe talk

2624

02:15:10,870 --> 02:15:09,119

about what an actuator is and the number

2625

02:15:13,910 --> 02:15:10,880

of things that had to happen to get this

2626

02:15:15,589 --> 02:15:13,920

thing to to unfold and detention it was

2627

02:15:17,270 --> 02:15:15,599

it's something that you know all of us

2628

02:15:19,589 --> 02:15:17,280

are just you know thrilled to see

2629

02:15:21,990 --> 02:15:19,599

happening so beautifully in front of us

2630

02:15:24,390 --> 02:15:22,000

okay give us a sense of that

2631

02:15:26,790 --> 02:15:24,400

yeah so uh you know one of the big the

2632

02:15:29,270 --> 02:15:26,800

big things that you know as we've talked

2633

02:15:30,629 --> 02:15:29,280

about is the amount of mechanisms that

2634

02:15:33,750 --> 02:15:30,639

that we use

2635

02:15:36,870 --> 02:15:33,760

uh specifically the the pin so when we

2636

02:15:38,790 --> 02:15:36,880

fold up we fold up all these layers

2637

02:15:40,790 --> 02:15:38,800

we have to sort of secure them to the

2638

02:15:43,589 --> 02:15:40,800

primary structure which we deployed uh

2639

02:15:46,149 --> 02:15:43,599

back on day three after we launched so

2640

02:15:48,790 --> 02:15:46,159

those those pins there was 107 of them

2641

02:15:51,030 --> 02:15:48,800

uh and and we had to sort of spear all

2642

02:15:52,870 --> 02:15:51,040

the material put holes in the material

2643

02:15:54,470 --> 02:15:52,880

and actually push them through to

2644

02:15:56,709 --> 02:15:54,480

connect our structure here you're seeing

2645

02:15:58,310 --> 02:15:56,719

our solar array come out in this graphic

2646

02:15:59,510 --> 02:15:58,320

again we got we were able to capture

2647

02:16:01,669 --> 02:15:59,520

that live

2648

02:16:03,109 --> 02:16:01,679

uh on launch day and that's that antenna

2649

02:16:04,470 --> 02:16:03,119

that's currently communicating with

2650

02:16:05,589 --> 02:16:04,480

canberra so here's these forward

2651

02:16:08,310 --> 02:16:05,599

structures

2652

02:16:10,950 --> 02:16:08,320

all of the material that's now out uh

2653

02:16:12,870 --> 02:16:10,960

you know out is as was pinned to this

2654

02:16:14,470 --> 02:16:12,880

structure meaning it was actually uh

2655

02:16:16,069 --> 02:16:14,480

there was 107

2656

02:16:17,830 --> 02:16:16,079

pins that went through it and actually

2657

02:16:21,350 --> 02:16:17,840

held it down to that structure we had to

2658

02:16:22,950 --> 02:16:21,360

release all 107 of those uh pins and and

2659

02:16:24,950 --> 02:16:22,960

we and we did that over the last few

2660

02:16:27,270 --> 02:16:24,960

days and you know and then we had this

2661

02:16:29,270 --> 02:16:27,280

cover roll up this cover rolls up as we

2662

02:16:31,189 --> 02:16:29,280

release those pins you can see the aft

2663

02:16:33,190 --> 02:16:31,199

going there and in the front you can see

2664

02:16:34,629 --> 02:16:33,200

our cover rolling up as we release these

2665

02:16:36,469 --> 02:16:34,639

pins

2666

02:16:37,589 --> 02:16:36,479

now this was our big event on new year's

2667

02:16:39,509 --> 02:16:37,599

eve

2668

02:16:41,270 --> 02:16:39,519

when we released the final set of pins

2669

02:16:44,709 --> 02:16:41,280

and the covers unrolled and we actually

2670

02:16:47,910 --> 02:16:44,719

used these telescoping booms to pull out

2671

02:16:50,070 --> 02:16:47,920

all five layers so this was quite uh the

2672

02:16:52,950 --> 02:16:50,080

big event for us as far as changing

2673

02:16:55,429 --> 02:16:52,960

webb's overall appearance uh it made a

2674

02:16:57,830 --> 02:16:55,439

dramatic change in our temperatures uh

2675

02:16:59,509 --> 02:16:57,840

when we did these uh two booms again you

2676

02:17:00,870 --> 02:16:59,519

can see that cover rolling under right

2677

02:17:02,549 --> 02:17:00,880

there

2678

02:17:06,230 --> 02:17:02,559

and this is our other side coming out so

2679

02:17:09,030 --> 02:17:06,240

i think releasing those 107 pins uh was

2680

02:17:10,790 --> 02:17:09,040

was quite an achievement uh again uh

2681

02:17:13,270 --> 02:17:10,800

because uh you know one doesn't release

2682

02:17:15,030 --> 02:17:13,280

then then our membranes are trapped and

2683

02:17:17,270 --> 02:17:15,040

we would have had to go into a different

2684

02:17:19,830 --> 02:17:17,280

contingency operation so again you're

2685

02:17:22,150 --> 02:17:19,840

seeing uh what's going on right now uh

2686

02:17:23,509 --> 02:17:22,160

this is uh old footage of when we tested

2687

02:17:26,070 --> 02:17:23,519

the sun shield on the ground for the

2688

02:17:27,669 --> 02:17:26,080

very last time uh so everything you're

2689

02:17:28,870 --> 02:17:27,679

seeing in this video right now in this

2690

02:17:31,270 --> 02:17:28,880

time lapse

2691

02:17:33,830 --> 02:17:31,280

uh which is probably just a few seconds

2692

02:17:34,709 --> 02:17:33,840

long is is taking us yesterday and today

2693

02:17:37,830 --> 02:17:34,719

to do

2694

02:17:39,589 --> 02:17:37,840

so uh you can see in this time lapse uh

2695

02:17:42,150 --> 02:17:39,599

the last layer is tensioning up and you

2696

02:17:45,270 --> 02:17:42,160

can see what a dramatic uh change that

2697

02:17:47,990 --> 02:17:45,280

it takes uh as it is uh stretched out

2698

02:17:51,110 --> 02:17:49,190

and uh we have a question from

2699

02:17:52,070 --> 02:17:51,120

gracequirrell on twitter and this is one

2700

02:17:53,750 --> 02:17:52,080

that maybe i can take to give you a

2701

02:17:56,629 --> 02:17:53,760

little bit of a break mike but i'm sorry

2702

02:17:58,389 --> 02:17:56,639

break but you can jump right in so grace

2703

02:18:00,389 --> 02:17:58,399

girl on twitter asks why does it take

2704

02:18:02,230 --> 02:18:00,399

until june to start science operations

2705

02:18:03,830 --> 02:18:02,240

with the james webb space telescope and

2706

02:18:05,589 --> 02:18:03,840

what else needs to happen after reaching

2707

02:18:07,030 --> 02:18:05,599

out too and i think this is a chance to

2708

02:18:08,870 --> 02:18:07,040

give us a little bit of a look ahead

2709

02:18:10,230 --> 02:18:08,880

about what's going to be going on uh

2710

02:18:12,469 --> 02:18:10,240

after today and after the heat shield

2711

02:18:14,230 --> 02:18:12,479

happens so one of the things i can say

2712

02:18:16,389 --> 02:18:14,240

is that a lot of this has to do with

2713

02:18:18,469 --> 02:18:16,399

with cooling the telescope down uh this

2714

02:18:20,549 --> 02:18:18,479

is an infrared telescope the reason we

2715

02:18:22,629 --> 02:18:20,559

have these incredible heat shields is so

2716

02:18:24,709 --> 02:18:22,639

that the observatory itself can be very

2717

02:18:26,469 --> 02:18:24,719

cold very sensitive to the infrared

2718

02:18:27,990 --> 02:18:26,479

radiation from space

2719

02:18:30,150 --> 02:18:28,000

and so the things that will be happening

2720

02:18:31,589 --> 02:18:30,160

in the next few days

2721

02:18:33,509 --> 02:18:31,599

personally i'm really looking forward to

2722

02:18:35,110 --> 02:18:33,519

the deployment of the secondary mirror

2723

02:18:37,110 --> 02:18:35,120

there are these very large boom

2724

02:18:39,030 --> 02:18:37,120

structures that will come out in front

2725

02:18:41,190 --> 02:18:39,040

of web and that will bring the focusing

2726

02:18:44,070 --> 02:18:41,200

mirror the the primary mirror is that

2727

02:18:46,309 --> 02:18:44,080

beautiful 18 segmented gold mirror that

2728

02:18:48,309 --> 02:18:46,319

all of us have been uh talking about but

2729

02:18:50,389 --> 02:18:48,319

then there's also the secondary mirror

2730

02:18:52,230 --> 02:18:50,399

that needs to come out on these booms

2731

02:18:54,309 --> 02:18:52,240

that the uh all of these 18 mirror

2732

02:18:55,990 --> 02:18:54,319

segments will focus the light up to and

2733

02:18:57,830 --> 02:18:56,000

then that light will be actually

2734

02:18:59,270 --> 02:18:57,840

reflected back down into the instrument

2735

02:19:01,110 --> 02:18:59,280

package for web

2736

02:19:03,030 --> 02:19:01,120

and so that's one of the big deployments

2737

02:19:04,870 --> 02:19:03,040

that will happen in the coming week

2738

02:19:06,150 --> 02:19:04,880

just listening exactly right that's our

2739

02:19:07,910 --> 02:19:06,160

next one that we're really really

2740

02:19:09,190 --> 02:19:07,920

excited about because that's uh you know

2741

02:19:11,750 --> 02:19:09,200

again the sun shield is great

2742

02:19:14,790 --> 02:19:11,760

engineering um it's absolutely needed

2743

02:19:16,950 --> 02:19:14,800

for this mission um and and it's it's

2744

02:19:19,429 --> 02:19:16,960

incredible um but the sun shield is

2745

02:19:20,950 --> 02:19:19,439

there to to cool what we really want and

2746

02:19:22,790 --> 02:19:20,960

that's the that's that telescope and

2747

02:19:24,790 --> 02:19:22,800

their science instruments so we really

2748

02:19:27,910 --> 02:19:24,800

want to get those deployed

2749

02:19:31,509 --> 02:19:29,270

and then after that we have the full

2750

02:19:34,150 --> 02:19:31,519

deployment of the primary mirror so the

2751

02:19:36,549 --> 02:19:34,160

uh that the that 18 segment mirror has

2752

02:19:38,150 --> 02:19:36,559

two wings uh the wings will both be

2753

02:19:40,070 --> 02:19:38,160

deployed so you can see here in this

2754

02:19:41,910 --> 02:19:40,080

animation there's the secondary mirror

2755

02:19:43,750 --> 02:19:41,920

that's coming out on this large boom

2756

02:19:45,589 --> 02:19:43,760

that's the focusing mirror and you can

2757

02:19:47,270 --> 02:19:45,599

see that it'll be focusing things down

2758

02:19:48,870 --> 02:19:47,280

to the sort of that that black

2759

02:19:50,790 --> 02:19:48,880

protrusion coming out of the center of

2760

02:19:53,270 --> 02:19:50,800

the gold mirror and then after that the

2761

02:19:55,030 --> 02:19:53,280

two wing segments will also be deployed

2762

02:19:58,309 --> 02:19:55,040

and uh once that happens we will have

2763

02:20:00,150 --> 02:19:58,319

the full uh fully commissioned and uh

2764

02:20:02,469 --> 02:20:00,160

huge thing is it takes about two months

2765

02:20:04,630 --> 02:20:02,479

for our telescope

2766

02:20:06,870 --> 02:20:04,640

engineers and scientists to sort of

2767

02:20:09,349 --> 02:20:06,880

align it and and and sort of you know

2768

02:20:11,429 --> 02:20:09,359

focus it so to speak uh and to make it

2769

02:20:13,190 --> 02:20:11,439

working at an operational you know as an

2770

02:20:15,349 --> 02:20:13,200

actual telescope and then it takes

2771

02:20:16,630 --> 02:20:15,359

another couple months you know alongside

2772

02:20:18,070 --> 02:20:16,640

of that it takes another couple months

2773

02:20:20,550 --> 02:20:18,080

for our instrument teams to get their

2774

02:20:22,710 --> 02:20:20,560

instruments calibrated uh and get them

2775

02:20:24,309 --> 02:20:22,720

all uh checked out so it all adds up to

2776

02:20:25,990 --> 02:20:24,319

about six months

2777

02:20:28,710 --> 02:20:26,000

uh before we would actually get some of

2778

02:20:31,349 --> 02:20:28,720

our first science and and it really that

2779

02:20:33,670 --> 02:20:31,359

cool down uh drives a lot of what we

2780

02:20:35,750 --> 02:20:33,680

call our entry criteria like we cannot

2781

02:20:37,670 --> 02:20:35,760

let uh we you know

2782

02:20:39,830 --> 02:20:37,680

the telescope can't do certain things

2783

02:20:41,510 --> 02:20:39,840

until it reaches certain temperatures so

2784

02:20:43,750 --> 02:20:41,520

that cool down on top of these really

2785

02:20:45,510 --> 02:20:43,760

really precise operations that our

2786

02:20:47,270 --> 02:20:45,520

instrument and our telescope teams need

2787

02:20:49,510 --> 02:20:47,280

to do all kind of add up to that that

2788

02:20:51,429 --> 02:20:49,520

six month period or four months period

2789

02:20:53,510 --> 02:20:51,439

on top of the you know what we're doing

2790

02:20:55,990 --> 02:20:53,520

right now in this first month one two

2791

02:20:59,990 --> 02:20:57,590

you've heard us say before just what a

2792

02:21:01,750 --> 02:21:00,000

technological marvel the webb telescope

2793

02:21:03,429 --> 02:21:01,760

is and talking about some of these

2794

02:21:06,150 --> 02:21:03,439

deployment activities these commission

2795

02:21:07,750 --> 02:21:06,160

activities that are going on um uh keith

2796

02:21:09,670 --> 02:21:07,760

there mentioned the the idea that the

2797

02:21:11,990 --> 02:21:09,680

alignment of the mirrors needs to happen

2798

02:21:14,389 --> 02:21:12,000

and of course we have we have 18

2799

02:21:16,309 --> 02:21:14,399

wonderful gold-coated uh segmented

2800

02:21:19,670 --> 02:21:16,319

mirrors but they all need to work as one

2801  
02:21:21,270 --> 02:21:19,680  
continuous telescope mirror and and so

2802  
02:21:24,150 --> 02:21:21,280  
part of this commissioning will be to

2803  
02:21:26,389 --> 02:21:24,160  
actually do focusing of each of the 18

2804  
02:21:28,070 --> 02:21:26,399  
segments the the uh keith maybe you gave

2805  
02:21:30,550 --> 02:21:28,080  
us a sense that the the segments can all

2806  
02:21:32,950 --> 02:21:30,560  
move independently is that correct

2807  
02:21:33,750 --> 02:21:32,960  
that's right they they can they can tilt

2808  
02:21:35,910 --> 02:21:33,760  
uh

2809  
02:21:37,750 --> 02:21:35,920  
they they can yeah they're they can move

2810  
02:21:40,309 --> 02:21:37,760  
they can move in in a lot of different

2811  
02:21:43,270 --> 02:21:40,319  
directions uh and again it's not a lot

2812  
02:21:45,510 --> 02:21:43,280  
of movement uh but but uh but they all

2813  
02:21:48,150 --> 02:21:45,520

can move in different directions uh to

2814

02:21:49,750 --> 02:21:48,160

align themselves uh they can also be

2815

02:21:51,590 --> 02:21:49,760

pushed and pulled a little bit to sort

2816

02:21:54,469 --> 02:21:51,600

of change their radius of curvature a

2817

02:21:57,030 --> 02:21:54,479

tiny tiny bit uh so all those different

2818

02:21:59,990 --> 02:21:57,040

uh movements have to be well well

2819

02:22:02,389 --> 02:22:00,000

coordinated and it's quite the uh uh

2820

02:22:05,349 --> 02:22:02,399

quite the quite the challenge uh that

2821

02:22:07,429 --> 02:22:05,359

the optics team has coming up uh for

2822

02:22:09,750 --> 02:22:07,439

them to do that so that's that's really

2823

02:22:11,030 --> 02:22:09,760

really groundbreaking you know really

2824

02:22:13,429 --> 02:22:11,040

groundbreaking what they're getting

2825

02:22:15,190 --> 02:22:13,439

ready to go into uh which is aligning

2826

02:22:17,510 --> 02:22:15,200

those 18 segments so they have full

2827

02:22:19,190 --> 02:22:17,520

control over all of them uh but even

2828

02:22:20,710 --> 02:22:19,200

though they have full control over them

2829

02:22:22,710 --> 02:22:20,720

they have to get the data back down to

2830

02:22:25,750 --> 02:22:22,720

the ground or where they are uh and

2831

02:22:28,710 --> 02:22:25,760

again the you know a lot a lot of ground

2832

02:22:30,870 --> 02:22:28,720

system processing to compute uh the next

2833

02:22:32,550 --> 02:22:30,880

move and then they'll just keep cycling

2834

02:22:34,150 --> 02:22:32,560

through and at the same time they're

2835

02:22:36,230 --> 02:22:34,160

imaging you know they're taking

2836

02:22:38,230 --> 02:22:36,240

reference stars to make and using those

2837

02:22:40,389 --> 02:22:38,240

reference stars that to help them help

2838

02:22:42,230 --> 02:22:40,399

them align and focus the telescope it's

2839

02:22:44,710 --> 02:22:42,240

a very painstaking process it's

2840

02:22:45,990 --> 02:22:44,720

groundbreaking uh um but it but it but

2841

02:22:48,950 --> 02:22:46,000

it's going to be really really really

2842

02:22:50,710 --> 02:22:48,960

something when they get it all done

2843

02:22:52,070 --> 02:22:50,720

and one of the the other parts of the

2844

02:22:53,830 --> 02:22:52,080

commissioning that i think is is just

2845

02:22:55,429 --> 02:22:53,840

incredible is that because this

2846

02:22:56,950 --> 02:22:55,439

telescope is operating it's just low

2847

02:22:59,110 --> 02:22:56,960

temperatures a lot of people are

2848

02:23:01,190 --> 02:22:59,120

familiar with the idea that materials

2849

02:23:02,870 --> 02:23:01,200

expand and contract and change shape as

2850

02:23:05,110 --> 02:23:02,880

they change temperature

2851  
02:23:07,429 --> 02:23:05,120  
and so these mirror segments which are

2852  
02:23:09,830 --> 02:23:07,439  
are made from beryllium that's it's a

2853  
02:23:12,790 --> 02:23:09,840  
it's a type of metal that behaves very

2854  
02:23:15,030 --> 02:23:12,800  
well under very cold uh circumstances

2855  
02:23:17,349 --> 02:23:15,040  
keeps its shape it works very well

2856  
02:23:19,830 --> 02:23:17,359  
um the beryllium segments actually were

2857  
02:23:22,150 --> 02:23:19,840  
ground uh to a curvature that isn't

2858  
02:23:24,550 --> 02:23:22,160  
correct when it's at room temperature

2859  
02:23:26,070 --> 02:23:24,560  
they actually need to cool down to this

2860  
02:23:28,790 --> 02:23:26,080  
operating temperature that we said which

2861  
02:23:30,389 --> 02:23:28,800  
is close to minus 400 degrees fahrenheit

2862  
02:23:31,830 --> 02:23:30,399  
and it's only at that operating

2863  
02:23:34,550 --> 02:23:31,840

temperature that the curvature of the

2864

02:23:36,309 --> 02:23:34,560

mirrors are correct is that right keith

2865

02:23:37,990 --> 02:23:36,319

yeah yeah and again that you're going

2866

02:23:39,110 --> 02:23:38,000

back you know you know again the

2867

02:23:41,670 --> 02:23:39,120

development

2868

02:23:44,630 --> 02:23:41,680

history of is uh just doing that very

2869

02:23:49,510 --> 02:23:44,640

operation and making it

2870

02:23:53,190 --> 02:23:50,870

i see something happening in the mock

2871

02:23:55,910 --> 02:23:53,200

people are getting excited okay

2872

02:23:58,830 --> 02:23:55,920

here we go mom i can confirm the final

2873

02:24:01,750 --> 02:23:58,840

signature on the aft mts which

2874

02:24:07,750 --> 02:24:01,760

indicates that all five layers of the

2875

02:24:12,230 --> 02:24:10,150

how exciting

2876  
02:24:16,150 --> 02:24:12,240  
significant milestone accomplished job

2877  
02:24:18,950 --> 02:24:16,160  
well done sunshield team job well done

2878  
02:24:21,110 --> 02:24:18,960  
yeah so thank you mom

2879  
02:24:23,830 --> 02:24:21,120  
all stations this is my mind ops all

2880  
02:24:25,190 --> 02:24:23,840  
stations this is my monops standby for

2881  
02:24:26,550 --> 02:24:25,200  
p.m

2882  
02:24:28,550 --> 02:24:26,560  
hey guys

2883  
02:24:30,790 --> 02:24:28,560  
this is the dev ops you can go ahead and

2884  
02:24:34,790 --> 02:24:30,800  
execute ge stop deploy

2885  
02:24:37,670 --> 02:24:36,550  
it's incredible to see you watching live

2886  
02:24:42,309 --> 02:24:37,680  
footage of the mock the mission

2887  
02:24:47,270 --> 02:24:44,309  
it looks like we are very

2888  
02:24:49,429 --> 02:24:47,280

close to declaring victory on the uh the

2889

02:24:52,950 --> 02:24:49,439

deployment of the sun shield

2890

02:24:54,630 --> 02:24:52,960

yeah and i can confirm right or stop

2891

02:24:58,550 --> 02:24:54,640

stand by congratulating the team

2892

02:25:01,670 --> 02:25:00,870

many years in the making right here so

2893

02:25:04,870 --> 02:25:01,680

uh

2894

02:25:07,110 --> 02:25:04,880

industry

2895

02:25:08,469 --> 02:25:07,120

partners uh you know it's just an

2896

02:25:10,150 --> 02:25:08,479

amazing achievements i just want to

2897

02:25:11,510 --> 02:25:10,160

congratulate our sunshield team right

2898

02:25:13,429 --> 02:25:11,520

now um

2899

02:25:15,830 --> 02:25:13,439

what an achievement

2900

02:25:17,910 --> 02:25:15,840

okay hey i just want to take a moment to

2901  
02:25:20,710 --> 02:25:17,920  
congratulate everybody this is a really

2902  
02:25:22,469 --> 02:25:20,720  
big moment we have a bunch of work

2903  
02:25:25,750 --> 02:25:22,479  
front shield

2904  
02:25:27,110 --> 02:25:25,760  
unbelievable after many years

2905  
02:25:29,110 --> 02:25:27,120  
sorry about that

2906  
02:25:30,950 --> 02:25:29,120  
since i don't normally talk uh we bring

2907  
02:25:32,150 --> 02:25:30,960  
the mic down anyway so i said this is a

2908  
02:25:34,389 --> 02:25:32,160  
really big moment i just want to

2909  
02:25:36,309 --> 02:25:34,399  
congratulate the entire team

2910  
02:25:37,510 --> 02:25:36,319  
we still got a lot of work to do but um

2911  
02:25:39,830 --> 02:25:37,520  
but getting the sun shield out and

2912  
02:25:41,670 --> 02:25:39,840  
deployed is really really big

2913  
02:25:43,510 --> 02:25:41,680

um if you constantly constantly

2914

02:25:46,389 --> 02:25:43,520

reinforce what i tell everybody that the

2915

02:25:48,070 --> 02:25:46,399

just team is the best in nasa there's

2916

02:25:50,630 --> 02:25:48,080

hands down nobody better than what we

2917

02:25:52,710 --> 02:25:50,640

have here you guys should all take pride

2918

02:25:54,710 --> 02:25:52,720

in all these accomplishments

2919

02:25:56,950 --> 02:25:54,720

um one of the things i've told folks

2920

02:25:58,710 --> 02:25:56,960

i've been putting emails this is so

2921

02:25:59,590 --> 02:25:58,720

unique what we do in this in this

2922

02:26:01,750 --> 02:25:59,600

mission

2923

02:26:04,070 --> 02:26:01,760

um we are going to be bonded forever by

2924

02:26:05,670 --> 02:26:04,080

what we've experienced through not only

2925

02:26:08,070 --> 02:26:05,680

just through operations with the mission

2926

02:26:09,910 --> 02:26:08,080

ops team but over the last

2927

02:26:11,349 --> 02:26:09,920

all those have worked on over 20 plus

2928

02:26:12,550 --> 02:26:11,359

years

2929

02:26:13,990 --> 02:26:12,560

and finally

2930

02:26:15,670 --> 02:26:14,000

when i i'll just tell you what i put on

2931

02:26:16,630 --> 02:26:15,680

facebook last night when i shared the

2932

02:26:19,750 --> 02:26:16,640

story

2933

02:26:21,270 --> 02:26:19,760

i just said the jvs team kicks butt

2934

02:26:23,349 --> 02:26:21,280

i didn't use the word but i used another

2935

02:26:31,349 --> 02:26:23,359

word but i won't use that word here

2936

02:26:35,190 --> 02:26:34,309

absolutely awesome so yeah this is uh

2937

02:26:37,110 --> 02:26:35,200

you know

2938

02:26:38,469 --> 02:26:37,120

we'll let our we'll let our celebrations

2939

02:26:40,230 --> 02:26:38,479

continue

2940

02:26:42,309 --> 02:26:40,240

this is incredible what an incredible

2941

02:26:43,750 --> 02:26:42,319

week

2942

02:26:46,550 --> 02:26:43,760

but folks like me are looking ahead

2943

02:26:48,630 --> 02:26:46,560

right now i'm looking at

2944

02:26:51,510 --> 02:26:48,640

deployment and uh can't wait to get that

2945

02:26:53,270 --> 02:26:51,520

out so uh but uh congratulations to our

2946

02:26:55,429 --> 02:26:53,280

entire team it's just awesome and just

2947

02:26:57,190 --> 02:26:55,439

want to pass along some thanks

2948

02:26:58,870 --> 02:26:57,200

to you know everybody viewing this

2949

02:27:00,389 --> 02:26:58,880

everybody's been rooting us on all

2950

02:27:01,990 --> 02:27:00,399

stations this is my lineup we're gonna

2951  
02:27:03,270 --> 02:27:02,000  
hold right here for just a moment all

2952  
02:27:07,670 --> 02:27:03,280  
the stations

2953  
02:27:11,030 --> 02:27:09,429  
enjoy your moment and then we'll pick up

2954  
02:27:12,230 --> 02:27:11,040  
with this as you said it's so wonderful

2955  
02:27:14,309 --> 02:27:12,240  
to have all the people that are joining

2956  
02:27:17,670 --> 02:27:14,319  
us around the world for this event uh

2957  
02:27:19,429 --> 02:27:17,680  
this is truly incredible um when i first

2958  
02:27:21,590 --> 02:27:19,439  
saw the design of the james webb space

2959  
02:27:23,750 --> 02:27:21,600  
telescope and just the ambition of it

2960  
02:27:25,510 --> 02:27:23,760  
and the size of it and the scale of it

2961  
02:27:27,429 --> 02:27:25,520  
and this giant heat shield that needed

2962  
02:27:30,230 --> 02:27:27,439  
to come out and so many things needed to

2963  
02:27:32,630 --> 02:27:30,240

work you know it took my breath away and

2964

02:27:34,710 --> 02:27:32,640

uh i'm i'm here i'm actually getting

2965

02:27:36,630 --> 02:27:34,720

goosebumps i mean this is this is a

2966

02:27:39,270 --> 02:27:36,640

wonderful wonderful time how are you

2967

02:27:41,590 --> 02:27:39,280

feeling uh keith oh yeah it's just uh

2968

02:27:43,030 --> 02:27:41,600

like i said my my half my mind is going

2969

02:27:44,389 --> 02:27:43,040

woohoo and then the half of my mind's

2970

02:27:46,389 --> 02:27:44,399

going let's get that you know we gotta

2971

02:27:48,070 --> 02:27:46,399

get that secondary around so that's just

2972

02:27:49,830 --> 02:27:48,080

how my mind works

2973

02:27:51,990 --> 02:27:49,840

but that's good that's good but uh no

2974

02:27:54,389 --> 02:27:52,000

this is really good i mean and webb is

2975

02:27:56,309 --> 02:27:54,399

absolutely hopefully everybody

2976

02:27:58,550 --> 02:27:56,319

is becoming iconic a little bit it is

2977

02:28:01,110 --> 02:27:58,560

absolutely a beautiful spacecraft

2978

02:28:04,309 --> 02:28:01,120

um we did not design it to be beautiful

2979

02:28:06,630 --> 02:28:04,319

we designed it to be functional uh but

2980

02:28:08,469 --> 02:28:06,640

as a as a fact of making it functional

2981

02:28:10,469 --> 02:28:08,479

it's absolutely a stunning spacecraft i

2982

02:28:11,910 --> 02:28:10,479

did get to spend a few minutes with it

2983

02:28:13,990 --> 02:28:11,920

in the clean room before we shipped it

2984

02:28:15,990 --> 02:28:14,000

down to launch and i just i was just

2985

02:28:18,230 --> 02:28:16,000

amazed that just how beautiful of a

2986

02:28:21,590 --> 02:28:18,240

machine it is so and that machine is

2987

02:28:25,990 --> 02:28:21,600

really a function of hand built by by by

2988

02:28:29,349 --> 02:28:26,000

this team so uh so a salute to that

2989

02:28:33,590 --> 02:28:31,830

so to confirm uh keith we we we we have

2990

02:28:38,950 --> 02:28:33,600

final confirmation that the heat shield

2991

02:28:41,670 --> 02:28:39,990

we're we're gonna jump back into the

2992

02:28:43,510 --> 02:28:41,680

cast here and continue with the coolest

2993

02:28:45,190 --> 02:28:43,520

thing in space

2994

02:28:54,389 --> 02:28:45,200

there is nothing cooler in space than

2995

02:28:59,670 --> 02:28:56,190

i love that the coolest thing in space

2996

02:29:01,510 --> 02:28:59,680

[Laughter]

2997

02:29:03,270 --> 02:29:01,520

as you can tell even though we uh finish

2998

02:29:05,429 --> 02:29:03,280

this up we're going to move on to this

2999

02:29:07,110 --> 02:29:05,439

evening's activities right off the bat

3000

02:29:08,150 --> 02:29:07,120

so we have some more

3001

02:29:10,550 --> 02:29:08,160

uh thing

3002

02:29:11,429 --> 02:29:10,560

24-hour operation there and we're

3003

02:29:15,590 --> 02:29:11,439

concerned

3004

02:29:19,670 --> 02:29:17,190

that bleed has confirmed that the

3005

02:29:21,670 --> 02:29:19,680

membrane tensioning is complete

3006

02:29:23,990 --> 02:29:21,680

so this time we're ready to continue

3007

02:29:26,469 --> 02:29:24,000

with 666.022

3008

02:29:28,309 --> 02:29:26,479

d eu to standby

3009

02:29:32,790 --> 02:29:28,319

what's going on

3010

02:29:34,550 --> 02:29:32,800

uh we're going to start shutting down or

3011

02:29:36,950 --> 02:29:34,560

reconfiguring our electronics and

3012

02:29:37,830 --> 02:29:36,960

turning off our motors

3013

02:29:39,590 --> 02:29:37,840

and

3014

02:29:41,349 --> 02:29:39,600

basically tell our electronics that have

3015

02:29:43,830 --> 02:29:41,359

been driving these deployments that

3016

02:29:45,830 --> 02:29:43,840

their job is done uh thank you very much

3017

02:29:48,309 --> 02:29:45,840

you did your job and now you get to move

3018

02:29:49,429 --> 02:29:48,319

on to your next thing uh so that's what

3019

02:29:52,070 --> 02:29:49,439

they're doing right now they're just

3020

02:29:53,750 --> 02:29:52,080

basically shutting things down uh and

3021

02:29:56,870 --> 02:29:53,760

getting configured for the next

3022

02:29:58,950 --> 02:29:56,880

operation so you may hear some of that

3023

02:30:02,070 --> 02:29:58,960

well just many congratulations keith

3024

02:30:04,230 --> 02:30:02,080

this is just just incredible

3025

02:30:06,710 --> 02:30:04,240

so um you hear about the preparations oh

3026

02:30:09,990 --> 02:30:06,720

let's oh sorry

3027

02:30:14,389 --> 02:30:12,710

you you heard about the definitions

3028

02:30:16,150 --> 02:30:14,399

oh i'm sorry i keep stepping i you know

3029

02:30:17,990 --> 02:30:16,160

just want to thank you guys for putting

3030

02:30:20,309 --> 02:30:18,000

these productions together this is

3031

02:30:20,319 --> 02:30:25,510

we're ready to continue with 666.023

3032

02:30:28,150 --> 02:30:27,429

and that flock looks good you're going

3033

02:30:35,110 --> 02:30:28,160

to

3034

02:30:38,870 --> 02:30:37,270

so as keith just said uh they are uh

3035

02:30:41,030 --> 02:30:38,880

they're getting ready to uh to do the

3036

02:30:42,710 --> 02:30:41,040

next things that will happen and uh and

3037

02:30:44,389 --> 02:30:42,720

please note that we will be bringing you

3038

02:30:45,590 --> 02:30:44,399

live coverage of these other major

3039

02:30:47,429 --> 02:30:45,600

deployments

3040

02:30:49,990 --> 02:30:47,439

so the uh the next one i believe will be

3041

02:30:51,510 --> 02:30:50,000

the uh the secondary mirror and uh

3042

02:30:52,710 --> 02:30:51,520

i don't know exactly the schedule of

3043

02:30:54,309 --> 02:30:52,720

these yet that depends on what the

3044

02:30:55,990 --> 02:30:54,319

engineers decide to do but we'll have

3045

02:30:57,590 --> 02:30:56,000

updates with that and you're gonna have

3046

02:30:59,110 --> 02:30:57,600

uh and then

3047

02:31:00,790 --> 02:30:59,120

the deployment of the full primary

3048

02:31:02,550 --> 02:31:00,800

mirror as well so that these things are

3049

02:31:03,830 --> 02:31:02,560

coming up later in the week just

3050

02:31:07,349 --> 02:31:03,840

listening to what's what they're saying

3051

02:31:08,870 --> 02:31:08,070

so

3052

02:31:10,550 --> 02:31:08,880

seeing as we have a little bit of a

3053

02:31:11,670 --> 02:31:10,560

pause for the mission operation center

3054

02:31:14,070 --> 02:31:11,680

i'm

3055

02:31:16,150 --> 02:31:14,080

now

3056

02:31:17,670 --> 02:31:16,160

uh because i think this is a wonderful

3057

02:31:19,590 --> 02:31:17,680

chance to say thank you so much for

3058

02:31:20,950 --> 02:31:19,600

everybody uh keith parish thank you so

3059

02:31:22,469 --> 02:31:20,960

much for watching

3060

02:31:23,510 --> 02:31:22,479

all of the amazing explanations you've

3061

02:31:25,510 --> 02:31:23,520

given us

3062

02:31:27,270 --> 02:31:25,520

and this is a historic day

3063

02:31:28,790 --> 02:31:27,280

the first major phase of the the

3064

02:31:30,790 --> 02:31:28,800

commissioning the deployment of the sun

3065

02:31:32,790 --> 02:31:30,800

shield is complete and successful and

3066

02:31:34,870 --> 02:31:32,800

i'm very excited so thank you so much

3067

02:31:37,750 --> 02:31:34,880

for joining us and

3068

02:31:39,190 --> 02:31:37,760

thank you sunshield team and go web go

3069

02:31:41,349 --> 02:31:39,200

go web

3070

02:31:42,950 --> 02:31:41,359

absolutely thank you for joining us

3071

02:31:49,940 --> 02:31:42,960

please please join us again later in the