



1
00:00:00,359 --> 00:00:18,240
but we continue to search

2
00:00:44,950 --> 00:00:27,460
[Music]

3
00:00:44,960 --> 00:00:59,090
original goal

4
00:01:03,590 --> 00:01:00,470
s

5
00:01:06,950 --> 00:01:05,030
you're in for an extraordinary event

6
00:01:08,929 --> 00:01:06,960
today I'm Michelle Thaller from the NASA

7
00:01:11,690 --> 00:01:08,939
Goddard space flight center and this is

8
00:01:13,969 --> 00:01:11,700
live coverage of real-time operations as

9
00:01:15,469 --> 00:01:13,979
Mission managers continue the process of

10
00:01:16,910 --> 00:01:15,479
commissioning the James Webb Space

11
00:01:19,609 --> 00:01:16,920
Telescope

12
00:01:21,109 --> 00:01:19,619
this is a historic event web is the

13
00:01:23,330 --> 00:01:21,119

largest and most complex space

14

00:01:25,850 --> 00:01:23,340

Observatory ever launched and it's

15

00:01:27,890 --> 00:01:25,860

currently more than 650 000 miles away

16

00:01:29,749 --> 00:01:27,900

from Earth traveling out to its final

17

00:01:31,429 --> 00:01:29,759

parking orbit at a point in the solar

18

00:01:33,109 --> 00:01:31,439

system called L2

19

00:01:35,090 --> 00:01:33,119

shortly after it left the plan on

20

00:01:36,830 --> 00:01:35,100

December 25th Engineers have been

21

00:01:38,990 --> 00:01:36,840

following a detailed step-by-step

22

00:01:40,730 --> 00:01:39,000

checklist to get the telescope unfolded

23

00:01:42,350 --> 00:01:40,740

from its initial launch configuration

24

00:01:44,330 --> 00:01:42,360

and that's what brings us to today's

25

00:01:45,649 --> 00:01:44,340

live event

26

00:01:47,510 --> 00:01:45,659

now

27

00:01:49,310 --> 00:01:47,520

today the team plans to complete the

28

00:01:51,350 --> 00:01:49,320

Assembly of the telescope's main mirror

29

00:01:53,090 --> 00:01:51,360

that's this this huge golden eye that

30

00:01:54,109 --> 00:01:53,100

will gather light from distant points in

31

00:01:56,450 --> 00:01:54,119

the universe

32

00:01:59,149 --> 00:01:56,460

and and to be clear this is coverage of

33

00:02:01,190 --> 00:01:59,159

a real-time event so operations are

34

00:02:03,230 --> 00:02:01,200

happening as we speak to you I'm

35

00:02:05,389 --> 00:02:03,240

actually here at the Space Telescope

36

00:02:07,190 --> 00:02:05,399

Science Institute in Baltimore and above

37

00:02:08,809 --> 00:02:07,200

me is the mission operations center or

38

00:02:10,669 --> 00:02:08,819

the mock where people are actually

39

00:02:11,449 --> 00:02:10,679

sending commands to the telescope right

40

00:02:13,910 --> 00:02:11,459

now

41

00:02:16,010 --> 00:02:13,920

because this is a real-time event the

42

00:02:17,869 --> 00:02:16,020

actual schedule and and people that we

43

00:02:20,030 --> 00:02:17,879

have able to talk to us and all of that

44

00:02:21,949 --> 00:02:20,040

is pretty much in flux this is really

45

00:02:23,869 --> 00:02:21,959

happening uh the engineers will decide

46

00:02:26,330 --> 00:02:23,879

when the best times is to send different

47

00:02:28,790 --> 00:02:26,340

commands and we're also operating under

48

00:02:31,430 --> 00:02:28,800

some pretty amazing circumstances we had

49

00:02:33,170 --> 00:02:31,440

this uh incredibly beautiful set built

50

00:02:34,790 --> 00:02:33,180

at Goddard space flight center but then

51
00:02:37,369 --> 00:02:34,800
with the copen search we all went back

52
00:02:38,869 --> 00:02:37,379
to our homes and today I'm isolated in a

53
00:02:40,910 --> 00:02:38,879
room so I can talk to you without a mask

54
00:02:42,410 --> 00:02:40,920
and we're all trying to operate under

55
00:02:44,809 --> 00:02:42,420
these these very extraordinary

56
00:02:46,570 --> 00:02:44,819
conditions but the reason we're doing

57
00:02:48,710 --> 00:02:46,580
this is because this is something

58
00:02:51,229 --> 00:02:48,720
wonderful this is something really

59
00:02:53,270 --> 00:02:51,239
historic this incredible Observatory

60
00:02:54,470 --> 00:02:53,280
this commissioning unfolding of it is

61
00:02:57,050 --> 00:02:54,480
something that's never been done before

62
00:02:58,550 --> 00:02:57,060
and we wanted all of you along with us

63
00:03:00,470 --> 00:02:58,560

as we do this

64

00:03:01,729 --> 00:03:00,480

so today we will have time hopefully to

65

00:03:03,890 --> 00:03:01,739

take some of your questions through

66

00:03:06,290 --> 00:03:03,900

social media via the social media tag

67

00:03:08,210 --> 00:03:06,300

we're asking you to use today is hashtag

68

00:03:12,589 --> 00:03:08,220

unfold the universe

69

00:03:14,809 --> 00:03:12,599

hopefully get to as many of those

70

00:03:17,930 --> 00:03:14,819

questions as we can

71

00:03:19,190 --> 00:03:17,940

so moving on from there

72

00:03:21,710 --> 00:03:19,200

um throughout the process of watching

73

00:03:22,910 --> 00:03:21,720

live throughout the process we're going

74

00:03:24,170 --> 00:03:22,920

to be watching live footage from the

75

00:03:25,869 --> 00:03:24,180

mission operations center at the Space

76
00:03:28,369 --> 00:03:25,879
Telescope Science Institute in Baltimore

77
00:03:31,070 --> 00:03:28,379
and we also have an extraordinary

78
00:03:32,630 --> 00:03:31,080
real-time visualization which is an

79
00:03:34,550 --> 00:03:32,640
animation that's based on Telemetry

80
00:03:36,830 --> 00:03:34,560
actual data coming down from the James

81
00:03:38,630 --> 00:03:36,840
Webb Space Telescope to show us exactly

82
00:03:41,089 --> 00:03:38,640
what configuration the telescope is in

83
00:03:43,250 --> 00:03:41,099
so even though there are no cameras for

84
00:03:45,110 --> 00:03:43,260
us to see what's going on today this uh

85
00:03:47,210 --> 00:03:45,120
this animation will help us see exactly

86
00:03:48,170 --> 00:03:47,220
what's going on when this mirror Wing

87
00:03:50,690 --> 00:03:48,180
that we're going to deploy today

88
00:03:52,009 --> 00:03:50,700

actually gets into place so that will

89

00:03:53,809 --> 00:03:52,019

that will allow us to follow along

90

00:03:55,729 --> 00:03:53,819

pretty much as if we were there

91

00:03:57,170 --> 00:03:55,739

uh today I'm going to be joined by a

92

00:03:59,990 --> 00:03:57,180

collection of experts to help explain

93

00:04:01,670 --> 00:04:00,000

the operations the engineering and of

94

00:04:03,170 --> 00:04:01,680

course the science that this telescope

95

00:04:05,449 --> 00:04:03,180

was designed for because that's the real

96

00:04:07,250 --> 00:04:05,459

reason we're here is that this telescope

97

00:04:09,470 --> 00:04:07,260

was was made to answer some really

98

00:04:11,929 --> 00:04:09,480

extraordinary questions about the

99

00:04:13,670 --> 00:04:11,939

universe and also our own Origins where

100

00:04:16,610 --> 00:04:13,680

everything around us including you and

101
00:04:18,229 --> 00:04:16,620
me comes from and that's really exciting

102
00:04:19,909 --> 00:04:18,239
so uh what you're seeing on the screen

103
00:04:22,069 --> 00:04:19,919
is the real times that we mentioned the

104
00:04:24,530 --> 00:04:22,079
real-time Mission operations center and

105
00:04:27,050 --> 00:04:24,540
also this ovt The Observatory

106
00:04:28,670 --> 00:04:27,060
visualization tool and as we said this

107
00:04:30,469 --> 00:04:28,680
is a simulation that shows you exactly

108
00:04:33,590 --> 00:04:30,479
what it looks like in space

109
00:04:35,450 --> 00:04:33,600
so uh it's based on Telemetry but we

110
00:04:37,010 --> 00:04:35,460
consider this tool to be real time it's

111
00:04:38,749 --> 00:04:37,020
kind of worth mentioning that at the

112
00:04:40,909 --> 00:04:38,759
distance it takes signals to travel it's

113
00:04:42,230 --> 00:04:40,919

about three three light seconds away so

114

00:04:43,969 --> 00:04:42,240

there's a tiny little delay but of

115

00:04:45,170 --> 00:04:43,979

course that won't get in our our way of

116

00:04:47,270 --> 00:04:45,180

covering this

117

00:04:49,909 --> 00:04:47,280

so to begin with um I'm going to be

118

00:04:51,650 --> 00:04:49,919

joined Now by Julie van kampen and Julie

119

00:04:53,090 --> 00:04:51,660

is the Deputy commissioning lead and

120

00:04:55,070 --> 00:04:53,100

she's our gonna be our expert guide

121

00:04:57,950 --> 00:04:55,080

today of much of what's Happening that

122

00:04:59,810 --> 00:04:57,960

we watch unfolding so um Julie welcome

123

00:05:03,230 --> 00:04:59,820

how are you doing today

124

00:05:04,610 --> 00:05:03,240

I'm doing great good morning to you

125

00:05:06,770 --> 00:05:04,620

so one of the things I think that's

126

00:05:09,890 --> 00:05:06,780

worth oh please

127

00:05:12,350 --> 00:05:09,900

uh they're uh also doing well downstairs

128

00:05:16,490 --> 00:05:12,360

they're getting ready to to

129

00:05:19,610 --> 00:05:16,500

have us uh follow along with them

130

00:05:21,350 --> 00:05:19,620

yeah absolutely so um yeah the the the

131

00:05:22,969 --> 00:05:21,360

thing that we're going to be doing today

132

00:05:25,730 --> 00:05:22,979

is that pretty soon they're going to

133

00:05:27,710 --> 00:05:25,740

start unfolding this final wing of the

134

00:05:29,689 --> 00:05:27,720

mirror and when that happens we're going

135

00:05:31,010 --> 00:05:29,699

to be listening to real-time calls from

136

00:05:33,110 --> 00:05:31,020

the mock from the mission operations

137

00:05:34,249 --> 00:05:33,120

center so again what you're looking at

138

00:05:36,650 --> 00:05:34,259

on your screen is you see the mission

139

00:05:38,930 --> 00:05:36,660

operations center above Julie and myself

140

00:05:42,409 --> 00:05:38,940

and then over to the left you see this

141

00:05:44,689 --> 00:05:42,419

uh this uh wonderful simulation and uh

142

00:05:47,150 --> 00:05:44,699

yesterday we had the uh the deployment

143

00:05:49,249 --> 00:05:47,160

of the first of the side wings of the

144

00:05:50,990 --> 00:05:49,259

telescope which happened extremely

145

00:05:52,370 --> 00:05:51,000

successfully it was wonderful to to be

146

00:05:54,770 --> 00:05:52,380

there and today we're going to do the

147

00:05:58,490 --> 00:05:54,780

final Wing uh of the uh of the primary

148

00:06:00,050 --> 00:05:58,500

mirror so as throughout the day as calls

149

00:06:02,270 --> 00:06:00,060

come from the mock we're going to be

150

00:06:03,590 --> 00:06:02,280

pausing conversation so please bear with

151

00:06:05,330 --> 00:06:03,600

us because we might be sort of

152

00:06:06,469 --> 00:06:05,340

mid-conversation and we'll hear some

153

00:06:08,930 --> 00:06:06,479

sort of command that they're issuing

154

00:06:10,070 --> 00:06:08,940

from the mission control here and uh and

155

00:06:11,510 --> 00:06:10,080

we'll stop and make sure we know what's

156

00:06:14,029 --> 00:06:11,520

going on and Julie will give us some

157

00:06:15,409 --> 00:06:14,039

guide to that so uh please uh please

158

00:06:17,090 --> 00:06:15,419

bear with us if that seems a little bit

159

00:06:18,710 --> 00:06:17,100

rough around the edges but I think

160

00:06:21,710 --> 00:06:18,720

that's kind of the fun part about doing

161

00:06:23,689 --> 00:06:21,720

this live so um Julie I just sort of

162

00:06:25,370 --> 00:06:23,699

said it in general but give us some some

163

00:06:28,370 --> 00:06:25,380

more background so so what exactly is

164

00:06:30,409 --> 00:06:28,380

happening today that we're waiting for

165

00:06:32,809 --> 00:06:30,419

sure what they're currently working on

166

00:06:35,270 --> 00:06:32,819

right now is configuring The Observatory

167

00:06:38,450 --> 00:06:35,280

and specifically the the deployment

168

00:06:40,490 --> 00:06:38,460

voter and the uh Actuator motor to make

169

00:06:43,129 --> 00:06:40,500

sure that they are checked out and ready

170

00:06:45,710 --> 00:06:43,139

to go before we start using them so once

171

00:06:49,189 --> 00:06:45,720

those are checked out then we'll fire

172

00:06:51,650 --> 00:06:49,199

the final pins that are holding it in

173

00:06:53,570 --> 00:06:51,660

its launch locked configuration with the

174

00:06:55,850 --> 00:06:53,580

mirrors off to the side and then we'll

175

00:06:57,890 --> 00:06:55,860

use the deployment mirror I'm sorry the

176
00:07:00,589 --> 00:06:57,900
deployment motor to move the mirror into

177
00:07:03,650 --> 00:07:00,599
position and then use the Actuator motor

178
00:07:04,730 --> 00:07:03,660
to lock it into that position

179
00:07:06,589 --> 00:07:04,740
foreign

180
00:07:08,870 --> 00:07:06,599
now this is something that is happening

181
00:07:10,670 --> 00:07:08,880
at extremely cold temperatures uh it was

182
00:07:12,350 --> 00:07:10,680
about uh you know I forget exactly how

183
00:07:14,150 --> 00:07:12,360
many days now we've also lost track of

184
00:07:15,409 --> 00:07:14,160
time I know I think Julia I heard you

185
00:07:18,230 --> 00:07:15,419
saying that you've lost track of whether

186
00:07:20,029 --> 00:07:18,240
it's night or day well you've been sort

187
00:07:22,730 --> 00:07:20,039
of you know in the command center this

188
00:07:25,249 --> 00:07:22,740

whole time but uh we had the the sun

189

00:07:26,990 --> 00:07:25,259

shield deployed and those uh that five

190

00:07:29,029 --> 00:07:27,000

layer sun shield each layer being about

191

00:07:30,950 --> 00:07:29,039

the size of tennis courts it has been

192

00:07:32,990 --> 00:07:30,960

cooling the telescope down blocking the

193

00:07:34,610 --> 00:07:33,000

sunlight and I think you one of the

194

00:07:36,350 --> 00:07:34,620

interesting challenges of these motors

195

00:07:38,450 --> 00:07:36,360

is that these motors are operating at

196

00:07:39,290 --> 00:07:38,460

such low temperatures is that correct

197

00:07:42,290 --> 00:07:39,300

Julie

198

00:07:44,210 --> 00:07:42,300

yeah yeah the uh the motors are designed

199

00:07:47,510 --> 00:07:44,220

to operate at this temperature

200

00:07:49,189 --> 00:07:47,520

um uh however what we do do is have uh

201
00:07:51,650 --> 00:07:49,199
some heaters on them so we can warm them

202
00:07:53,689 --> 00:07:51,660
up to exactly the temperature we want

203
00:07:56,570 --> 00:07:53,699
them at for the deployments because it's

204
00:07:59,749 --> 00:07:56,580
a for contingency you also want to make

205
00:08:02,150 --> 00:07:59,759
sure that you could handle this no

206
00:08:05,270 --> 00:08:02,160
matter how long it took to take out the

207
00:08:07,790 --> 00:08:05,280
sun shield and get that tension so the

208
00:08:10,070 --> 00:08:07,800
actual final temperature of these

209
00:08:12,409 --> 00:08:10,080
assemblies could be very different at

210
00:08:14,689 --> 00:08:12,419
this time depending on how quickly or

211
00:08:16,969 --> 00:08:14,699
slowly those first steps of deployment

212
00:08:19,249 --> 00:08:16,979
went so what we have is we have some

213
00:08:21,230 --> 00:08:19,259

heaters on these motors and and some of

214

00:08:22,969 --> 00:08:21,240

the interfaces to make sure that they're

215

00:08:24,890 --> 00:08:22,979

at the exact temperature

216

00:08:26,809 --> 00:08:24,900

that we know that they can perform very

217

00:08:29,570 --> 00:08:26,819

well so that we have a very reliable

218

00:08:31,129 --> 00:08:29,580

operation today

219

00:08:33,409 --> 00:08:31,139

and just giving people a sense of what

220

00:08:34,790 --> 00:08:33,419

cold is so I know one of the things that

221

00:08:36,889 --> 00:08:34,800

people can do is actually follow along

222

00:08:38,630 --> 00:08:36,899

on a website that's that's where is web

223

00:08:41,149 --> 00:08:38,640

you can actually see where it is on its

224

00:08:43,610 --> 00:08:41,159

Journey out to the LaGrange Point L2 A

225

00:08:45,230 --> 00:08:43,620

Million Miles Away beyond the moon and

226

00:08:46,790 --> 00:08:45,240

you can see where it is there's also a

227

00:08:49,009 --> 00:08:46,800

measurement of temperature as to what

228

00:08:51,410 --> 00:08:49,019

the current temperature is both on the

229

00:08:53,930 --> 00:08:51,420

the warm side of the sun shield and then

230

00:08:55,370 --> 00:08:53,940

the cool side so uh what would what's

231

00:08:58,210 --> 00:08:55,380

our approximate operating temperature

232

00:09:02,329 --> 00:08:58,220

today do you happen to know Julie

233

00:09:05,030 --> 00:09:02,339

I didn't look specifically today at the

234

00:09:06,530 --> 00:09:05,040

uh overall telescope temperatures but we

235

00:09:09,290 --> 00:09:06,540

were running

236

00:09:13,790 --> 00:09:09,300

um down into the structural temperatures

237

00:09:16,009 --> 00:09:13,800

in the almost getting to a 140 Kelvin uh

238

00:09:19,550 --> 00:09:16,019

which I don't do the conversions in my

239

00:09:23,449 --> 00:09:19,560

head I just work in Kelvin

240

00:09:24,530 --> 00:09:23,459

but uh is scientists use and for those

241

00:09:26,630 --> 00:09:24,540

of you out there that don't know that

242

00:09:30,650 --> 00:09:26,640

scale it's the Celsius scale you know

243

00:09:33,889 --> 00:09:30,660

scientists uh use metric and um zero is

244

00:09:35,690 --> 00:09:33,899

defined as absolute zero so when Julie's

245

00:09:38,990 --> 00:09:35,700

talking about she's talking about you

246

00:09:40,970 --> 00:09:39,000

know 140 degrees above absolute zero uh

247

00:09:43,190 --> 00:09:40,980

and uh so so that's that's probably

248

00:09:45,350 --> 00:09:43,200

something well under under 300 degrees

249

00:09:49,070 --> 00:09:45,360

or so or maybe something around there

250

00:09:51,110 --> 00:09:49,080

but but yeah yeah so are there

251
00:09:52,550 --> 00:09:51,120
yeah right now in the mock are they are

252
00:09:54,949 --> 00:09:52,560
they are they checking on those Motors

253
00:09:57,350 --> 00:09:54,959
or what's going on right now

254
00:09:59,030 --> 00:09:57,360
right now in the mock yes they are

255
00:10:01,910 --> 00:09:59,040
checking out those Motors they're doing

256
00:10:04,310 --> 00:10:01,920
the um in the middle of an aliveness

257
00:10:07,069 --> 00:10:04,320
test and then what they do is they they

258
00:10:09,170 --> 00:10:07,079
make sure that the motor is right in the

259
00:10:12,230 --> 00:10:09,180
position that they want to start in

260
00:10:15,530 --> 00:10:13,910
one thing that I was rather surprised at

261
00:10:17,210 --> 00:10:15,540
yesterday during the deployment of the

262
00:10:19,990 --> 00:10:17,220
first Wing was just how quickly that

263
00:10:22,430 --> 00:10:20,000

goes so um today what we're going to see

264

00:10:25,850 --> 00:10:22,440

uh hopefully when they get the command

265

00:10:27,590 --> 00:10:25,860

is a relatively quick movement of the

266

00:10:29,150 --> 00:10:27,600

mirrors it takes it took was it was

267

00:10:31,430 --> 00:10:29,160

about four minutes or so that it took to

268

00:10:34,069 --> 00:10:31,440

actually swing that that Wing around and

269

00:10:35,569 --> 00:10:34,079

then after that comes a long series of

270

00:10:38,150 --> 00:10:35,579

locking it into place

271

00:10:39,530 --> 00:10:38,160

and and as we lock the mirror into place

272

00:10:41,690 --> 00:10:39,540

that's when we'll have a chance to bring

273

00:10:43,430 --> 00:10:41,700

on lots of guests talk a bit about some

274

00:10:45,050 --> 00:10:43,440

of the uh the other things that have

275

00:10:47,990 --> 00:10:45,060

been going on in the mission so that's

276

00:10:51,050 --> 00:10:48,000

that's part of our rundown today

277

00:10:52,550 --> 00:10:51,060

so let's see here

278

00:10:59,389 --> 00:10:52,560

I guess right now we're not getting any

279

00:11:04,550 --> 00:11:02,389

it's about right Julia is it

280

00:11:08,690 --> 00:11:04,560

is it about four minutes for the the

281

00:11:10,730 --> 00:11:08,700

actual uh movement of the mirror itself

282

00:11:12,110 --> 00:11:10,740

the movement of the mirror takes yeah

283

00:11:14,569 --> 00:11:12,120

just a few minutes

284

00:11:16,250 --> 00:11:14,579

um this it's all the setup and the

285

00:11:18,350 --> 00:11:16,260

preparation and the double checks that

286

00:11:20,329 --> 00:11:18,360

they do when they when they finally

287

00:11:23,569 --> 00:11:20,339

start to move the mirror they'll move at

288

00:11:26,389 --> 00:11:23,579

just a small amount just a 1.3 and a

289

00:11:28,610 --> 00:11:26,399

half degrees uh and then they'll stop

290

00:11:30,530 --> 00:11:28,620

and then they'll make sure that they go

291

00:11:32,150 --> 00:11:30,540

through all of their Telemetry to verify

292

00:11:34,069 --> 00:11:32,160

that everything's moving exactly the way

293

00:11:36,230 --> 00:11:34,079

they want before they complete the mood

294

00:11:39,610 --> 00:11:36,240

uh the move of the motor all the way out

295

00:11:44,090 --> 00:11:42,410

and uh I I can sort of think myself as

296

00:11:45,350 --> 00:11:44,100

to why that's a good idea but why was

297

00:11:46,550 --> 00:11:45,360

that particular procedure put in place

298

00:11:48,650 --> 00:11:46,560

that you move the mirror just a little

299

00:11:50,870 --> 00:11:48,660

bit and then and then you go ahead and

300

00:11:52,790 --> 00:11:50,880

make the large movement

301

00:11:56,389 --> 00:11:52,800

yeah if you had any

302

00:11:58,850 --> 00:11:56,399

um concern about your motor or your uh

303

00:12:00,889 --> 00:11:58,860

hinge or possibly any of the soft

304

00:12:03,410 --> 00:12:00,899

structure around it

305

00:12:06,050 --> 00:12:03,420

um being affected by this move you would

306

00:12:09,230 --> 00:12:06,060

want to stop and evaluate before you

307

00:12:10,850 --> 00:12:09,240

moved further you know possibly uh you

308

00:12:13,730 --> 00:12:10,860

needed to run your heater a little bit

309

00:12:16,069 --> 00:12:13,740

more or maybe back up and retry your

310

00:12:19,069 --> 00:12:16,079

your move if you're not seeing the

311

00:12:21,470 --> 00:12:19,079

expected results so there's a whole

312

00:12:24,050 --> 00:12:21,480

series of telemetry that we get we have

313

00:12:25,810 --> 00:12:24,060

so much instrumentation

314

00:12:29,449 --> 00:12:25,820

um all over the telescope whether it's

315

00:12:31,250 --> 00:12:29,459

motor Telemetry thermal telemetry

316

00:12:33,470 --> 00:12:31,260

whether it's

317

00:12:36,410 --> 00:12:33,480

um indications that the entire

318

00:12:39,050 --> 00:12:36,420

spacecraft has seen

319

00:12:43,129 --> 00:12:39,060

oh now we hear our

320

00:12:48,290 --> 00:12:45,170

so as you hear the control room speak

321

00:12:51,410 --> 00:12:48,300

you'll hear a couple of people uh

322

00:12:54,829 --> 00:12:51,420

talking a lot uh there's our deployment

323

00:12:57,769 --> 00:12:54,839

bleed uh she'll be walking through the

324

00:13:00,190 --> 00:12:57,779

procedures to handle all of the steps

325

00:13:03,290 --> 00:13:00,200

and going back and forth with our

326

00:13:05,710 --> 00:13:03,300

operational control center our flight

327

00:13:08,509 --> 00:13:05,720

control room our OC in the front room

328

00:13:10,970 --> 00:13:08,519

and if you look on your top picture

329

00:13:14,690 --> 00:13:10,980

they'll be the person and that

330

00:13:16,610 --> 00:13:14,700

closest row all the way in the center of

331

00:13:18,230 --> 00:13:16,620

the actually it's going to be to the

332

00:13:20,690 --> 00:13:18,240

right of everyone's screen but she's in

333

00:13:22,430 --> 00:13:20,700

the center there and she's the

334

00:13:24,170 --> 00:13:22,440

operational controller and she works

335

00:13:26,750 --> 00:13:24,180

with our deployment lead to walk through

336

00:13:27,829 --> 00:13:26,760

all the steps of today's procedure one

337

00:13:29,769 --> 00:13:27,839

by one

338

00:13:32,569 --> 00:13:29,779

you'll hear them talk back and forth

339

00:13:35,269 --> 00:13:32,579

confirm everything and every step along

340

00:13:37,550 --> 00:13:35,279

the way they'll they'll talk about what

341

00:13:40,550 --> 00:13:37,560

is into the command line and that means

342

00:13:42,530 --> 00:13:40,560

what has been put onto the the

343

00:13:44,449 --> 00:13:42,540

workstation in front of them and before

344

00:13:47,269 --> 00:13:44,459

the command is sent up to the

345

00:13:49,730 --> 00:13:47,279

observatory the deployment will check

346

00:13:52,970 --> 00:13:49,740

and verify that it's configured properly

347

00:13:55,250 --> 00:13:52,980

and written properly and ready to go and

348

00:13:57,170 --> 00:13:55,260

hit send and then once they hit send in

349

00:13:58,910 --> 00:13:57,180

the and the script starts you'll hear a

350

00:14:00,850 --> 00:13:58,920

lot of times that the script will

351

00:14:03,710 --> 00:14:00,860

confirm that it's been

352

00:14:06,050 --> 00:14:03,720

received and it then the next step will

353

00:14:07,910 --> 00:14:06,060

be to hit go it's like a lot of times on

354

00:14:11,389 --> 00:14:07,920

Windows it will say do you really want

355

00:14:12,889 --> 00:14:11,399

to do this so you have to say yes twice

356

00:14:14,569 --> 00:14:12,899

okay

357

00:14:16,910 --> 00:14:14,579

and I understand we're about four

358

00:14:19,490 --> 00:14:16,920

minutes uh from getting the command to

359

00:14:21,230 --> 00:14:19,500

start releasing to uh release to fire as

360

00:14:22,430 --> 00:14:21,240

they say so that will be happening

361

00:14:23,870 --> 00:14:22,440

pretty soon

362

00:14:26,030 --> 00:14:23,880

um another one of the people that you

363

00:14:27,410 --> 00:14:26,040

often hear called out is is sometimes

364

00:14:29,269 --> 00:14:27,420

it's a little bit funny to hear is is

365

00:14:31,670 --> 00:14:29,279

Mom you know he'll he'll say somebody

366

00:14:33,470 --> 00:14:31,680

that referred to as Mom and then tell us

367

00:14:36,050 --> 00:14:33,480

who that is Julie

368

00:14:37,970 --> 00:14:36,060

that's the mission operations manager

369

00:14:41,210 --> 00:14:37,980

and you'll hear him from time to time

370

00:14:43,310 --> 00:14:41,220

come on and do a poll of all of the

371

00:14:45,949 --> 00:14:43,320

various subsystems that are uh

372

00:14:49,069 --> 00:14:45,959

supporting today like the spacecraft

373

00:14:50,810 --> 00:14:49,079

um and the instruments uh Team sure that

374

00:14:52,910 --> 00:14:50,820

everyone's ready to go on with a major

375

00:14:54,829 --> 00:14:52,920

step as we go through our our

376

00:14:58,610 --> 00:14:54,839

deployments today

377

00:15:01,069 --> 00:14:58,620

um so he he's the uh overall lead of

378

00:15:04,389 --> 00:15:01,079

both the front and the back room so the

379

00:15:07,250 --> 00:15:04,399

back room is our spacecraft and our

380

00:15:09,949 --> 00:15:07,260

subsystems that that support that's that

381

00:15:12,110 --> 00:15:09,959

we also have a second back room which we

382

00:15:15,230 --> 00:15:12,120

call the SI room which has our

383

00:15:20,470 --> 00:15:16,970

in fact I think that person on screen

384

00:15:23,150 --> 00:15:20,480

that I see now is is Bill Oaks

385

00:15:25,370 --> 00:15:23,160

yeah exactly that's right so tell us a

386

00:15:26,810 --> 00:15:25,380

bit about Bill Oaks Bill Oaks role in

387

00:15:30,470 --> 00:15:26,820

this mission

388

00:15:33,710 --> 00:15:30,480

he's the program manager for jwst

389

00:15:35,749 --> 00:15:33,720

um and he's uh over over the whole

390

00:15:37,550 --> 00:15:35,759

program both the operation side the

391

00:15:39,170 --> 00:15:37,560

development side

392

00:15:41,810 --> 00:15:39,180

um

393

00:15:44,210 --> 00:15:41,820

everybody eventually works for Bill as

394

00:15:46,129 --> 00:15:44,220

you go up our chain so he's been great

395

00:15:47,810 --> 00:15:46,139

and he probably doesn't even know that

396

00:15:49,370 --> 00:15:47,820

he's currently on camera

397

00:15:51,470 --> 00:15:49,380

it's

398

00:15:53,990 --> 00:15:51,480

so one of the things that people were

399

00:15:55,370 --> 00:15:54,000

asking uh before is is how are we

400

00:15:56,629 --> 00:15:55,380

actually getting this information down

401
00:15:58,069 --> 00:15:56,639
from the spacecraft so you mentioned

402
00:15:59,629 --> 00:15:58,079
that there's Telemetry there are

403
00:16:01,610 --> 00:15:59,639
detectors all over the spacecraft

404
00:16:03,110 --> 00:16:01,620
measuring things like electrical current

405
00:16:04,850 --> 00:16:03,120
or temperature or all of these things

406
00:16:06,530 --> 00:16:04,860
but how is that data actually getting to

407
00:16:07,910 --> 00:16:06,540
us here at the Space Telescope Science

408
00:16:10,310 --> 00:16:07,920
Institute

409
00:16:13,370 --> 00:16:10,320
oh that's that's an interesting point so

410
00:16:17,030 --> 00:16:13,380
we have uh antennas on our Observatory

411
00:16:19,370 --> 00:16:17,040
and if people have watched along one of

412
00:16:21,170 --> 00:16:19,380
our very early deployments was was one

413
00:16:22,310 --> 00:16:21,180

of our antennas

414

00:16:26,829 --> 00:16:22,320

um and

415

00:16:30,230 --> 00:16:26,839

from that it is a signal is transmitted

416

00:16:31,970 --> 00:16:30,240

down to the deep space Network so this

417

00:16:35,810 --> 00:16:31,980

is the same network that we communicate

418

00:16:38,870 --> 00:16:35,820

with let's say the Mars rover uh on its

419

00:16:42,769 --> 00:16:38,880

uh there's a one in Canberra there's one

420

00:16:46,970 --> 00:16:42,779

in Madrid there's one in uh Goldstone uh

421

00:16:50,150 --> 00:16:46,980

and these um very large dishes then take

422

00:16:52,249 --> 00:16:50,160

that signal converted into something

423

00:16:54,829 --> 00:16:52,259

that can be sent on a ground Network and

424

00:16:56,810 --> 00:16:54,839

it's sent by ground Network to here

425

00:16:59,210 --> 00:16:56,820

where we were both we were both the

426
00:17:00,650 --> 00:16:59,220
Space Telescope Science Institute and

427
00:17:04,909 --> 00:17:00,660
the

428
00:17:06,949 --> 00:17:04,919
it goes through a whole series of

429
00:17:09,169 --> 00:17:06,959
processing and then it comes up to our

430
00:17:11,990 --> 00:17:09,179
screens and monitors in a way that we

431
00:17:15,309 --> 00:17:12,000
can interpret uh completed successfully

432
00:17:20,569 --> 00:17:18,590
693.027 bottom one door sink

433
00:17:27,890 --> 00:17:20,579
the command line looks good you're going

434
00:17:32,990 --> 00:17:30,409
and you're good that was the last

435
00:17:36,110 --> 00:17:33,000
if you have

436
00:17:38,810 --> 00:17:36,120
that was the last set of commands sent

437
00:17:40,370 --> 00:17:38,820
to get the motors ready before we to

438
00:17:42,350 --> 00:17:40,380

verify that the motors are ready before

439

00:17:46,510 --> 00:17:42,360

we go ahead and do the lock on our

440

00:17:52,490 --> 00:17:50,450

and manager Don John Vernon

441

00:17:54,890 --> 00:17:52,500

oh I'm not sure

442

00:17:56,690 --> 00:17:54,900

what is his signs that this is

443

00:17:59,390 --> 00:17:56,700

commissioning manager but he's the

444

00:18:02,090 --> 00:17:59,400

deputy project manager he works directly

445

00:18:05,750 --> 00:18:03,650

I believe we're about two minutes now

446

00:18:07,130 --> 00:18:05,760

away from firing for those of you who

447

00:18:10,310 --> 00:18:07,140

may have just joined us you're watching

448

00:18:12,169 --> 00:18:10,320

at live coverage of the unfolding of the

449

00:18:13,850 --> 00:18:12,179

primary mirror of for the James Webb

450

00:18:16,490 --> 00:18:13,860

Space Telescope yesterday they

451
00:18:18,169 --> 00:18:16,500
successfully unfolded one of the Wings I

452
00:18:20,570 --> 00:18:18,179
believe that was the port the left side

453
00:18:22,490 --> 00:18:20,580
wing and today we are doing the final

454
00:18:24,470 --> 00:18:22,500
Wing which will hopefully by the end of

455
00:18:27,409 --> 00:18:24,480
the day leave the primary mirror

456
00:18:29,270 --> 00:18:27,419
completely extended and unfolded so

457
00:18:32,510 --> 00:18:29,280
we're only a few minutes away from that

458
00:18:34,070 --> 00:18:32,520
command to uh to start first slowly and

459
00:18:36,470 --> 00:18:34,080
then and then a little bit more quickly

460
00:18:38,090 --> 00:18:36,480
unfolding that one of the telescope and

461
00:18:39,590 --> 00:18:38,100
you can see the configuration the

462
00:18:42,350 --> 00:18:39,600
telescope is in the left side of your

463
00:18:44,930 --> 00:18:42,360

screen this is a computer image but it's

464

00:18:46,730 --> 00:18:44,940

based on actual real-time data from The

465

00:18:48,049 --> 00:18:46,740

Observatory so this is what web would

466

00:18:49,549 --> 00:18:48,059

look like if you were out there to see

467

00:18:52,669 --> 00:18:49,559

it of course it would also look a lot

468

00:18:55,250 --> 00:18:52,679

darker because the uh the sun shield now

469

00:18:56,990 --> 00:18:55,260

is completely blocking uh light from the

470

00:18:58,669 --> 00:18:57,000

sun and any sort of heat from the Earth

471

00:19:00,470 --> 00:18:58,679

and the moon and the telescope is

472

00:19:01,730 --> 00:19:00,480

operating very dark and very cold as it

473

00:19:03,770 --> 00:19:01,740

was designed to do

474

00:19:05,150 --> 00:19:03,780

so we're very close

475

00:19:06,890 --> 00:19:05,160

I believe the calls will be coming

476

00:19:09,169 --> 00:19:06,900

shortly so we will uh we'll probably

477

00:19:10,730 --> 00:19:09,179

take a pause on conversation now and uh

478

00:19:12,770 --> 00:19:10,740

and begin listening to the calls and and

479

00:19:14,750 --> 00:19:12,780

Julie as as we have time in the

480

00:19:16,250 --> 00:19:14,760

conversation and the calls come uh

481

00:19:19,070 --> 00:19:16,260

please step in to tell us what those

482

00:19:20,630 --> 00:19:19,080

commands mean and be our interpreter so

483

00:19:25,490 --> 00:19:20,640

that we know how this uh how this

484

00:19:29,150 --> 00:19:27,770

to say it's tremendously exciting for me

485

00:19:32,270 --> 00:19:29,160

um you know I have been looking forward

486

00:19:33,770 --> 00:19:32,280

to this quite literally for decades uh

487

00:19:36,289 --> 00:19:33,780

and uh you know this is something that

488

00:19:38,870 --> 00:19:36,299

is uh has been a part of my my family uh

489

00:19:40,370 --> 00:19:38,880

have worked on this so this is a very

490

00:19:57,529 --> 00:19:40,380

proud and very exciting moment for me

491

00:20:01,730 --> 00:19:59,150

Julie how are you feeling I know

492

00:20:03,590 --> 00:20:01,740

yesterday we ended up smiling a lot as

493

00:20:06,470 --> 00:20:03,600

we as we as we saw that we move into

494

00:20:08,570 --> 00:20:06,480

place big smiles I I know that um you

495

00:20:09,710 --> 00:20:08,580

know one of the things that was uh uh

496

00:20:11,810 --> 00:20:09,720

tremendously important to the the

497

00:20:19,610 --> 00:20:11,820

unfolding of this telescope

498

00:20:19,620 --> 00:20:27,649

I

499

00:20:33,230 --> 00:20:29,890

am the only one left right

500

00:20:34,909 --> 00:20:33,240

I have confirmation from definitely that

501
00:20:36,950 --> 00:20:34,919
they agree that all of the pink moves

502
00:20:39,409 --> 00:20:36,960
look good we're ready to command the

503
00:20:40,870 --> 00:20:39,419
launch lock releases they're ready to go

504
00:20:44,330 --> 00:20:40,880
with

505
00:20:46,549 --> 00:20:44,340
693.029 all Channel 5 verified

506
00:20:54,289 --> 00:20:46,559
the command line looks good your go to

507
00:20:54,299 --> 00:21:04,370
you go to continue

508
00:21:07,669 --> 00:21:05,750
and at this point they're going to send

509
00:21:11,270 --> 00:21:07,679
the command with

510
00:21:13,909 --> 00:21:11,280
um puts a current through a fuse wire

511
00:21:16,490 --> 00:21:13,919
and releases the launch locks that are

512
00:21:20,210 --> 00:21:16,500
holding the side of the mirrors back

513
00:21:22,010 --> 00:21:20,220

against the structure of the back plane

514

00:21:24,350 --> 00:21:22,020

of the mirror and that was done so that

515

00:21:26,450 --> 00:21:24,360

we fit inside our fairing of our

516

00:21:29,029 --> 00:21:26,460

telescope we were all folded up like

517

00:21:30,409 --> 00:21:29,039

origami obviously the sun shield has

518

00:21:33,409 --> 00:21:30,419

been deployed and you can see how big

519

00:21:35,810 --> 00:21:33,419

that is relative to the to the mirror

520

00:21:38,630 --> 00:21:35,820

itself right now so the last of this is

521

00:21:40,789 --> 00:21:38,640

to bring out the mirrors and uh

522

00:21:44,450 --> 00:21:40,799

then we will have our telescope near

523

00:21:47,630 --> 00:21:46,190

and that's what makes this such a

524

00:21:49,610 --> 00:21:47,640

historic moment is that this is the

525

00:21:52,070 --> 00:21:49,620

first time we've unfolded such a large

526
00:21:54,470 --> 00:21:52,080
space Observatory and uh you know first

527
00:21:56,149 --> 00:21:54,480
came the the sun shield uh then there

528
00:21:58,070 --> 00:21:56,159
was the uh the secondary mirror the

529
00:21:59,630 --> 00:21:58,080
focus the focusing mirror that had to

530
00:22:02,029 --> 00:21:59,640
come out in front of the telescope to

531
00:22:04,070 --> 00:22:02,039
focus the light and then yesterday the

532
00:22:07,190 --> 00:22:04,080
uh the first of the the primary mirror

533
00:22:09,890 --> 00:22:07,200
side segments the wings and uh and then

534
00:22:11,570 --> 00:22:09,900
today the second one of that uh this

535
00:22:12,830 --> 00:22:11,580
this will not be the end today of

536
00:22:14,810 --> 00:22:12,840
commissioning the telescope there's

537
00:22:16,730 --> 00:22:14,820
still more to come one of the major

538
00:22:18,950 --> 00:22:16,740

things that needs to happen next is the

539

00:22:21,529 --> 00:22:18,960

focusing of the mirror the mirror has 18

540

00:22:23,690 --> 00:22:21,539

segments that all work independently and

541

00:22:25,430 --> 00:22:23,700

can all be adjusted independently and

542

00:22:27,169 --> 00:22:25,440

we'll talk more about that after we

543

00:22:28,730 --> 00:22:27,179

unfold the uh the wing segment we'll

544

00:22:30,890 --> 00:22:28,740

have some time to talk with some guests

545

00:22:32,690 --> 00:22:30,900

to talk about that but uh but that's the

546

00:22:34,370 --> 00:22:32,700

the incredible thing is that this large

547

00:22:37,070 --> 00:22:34,380

Observatory was folded up to fit inside

548

00:22:39,130 --> 00:22:37,080

the rocket the Ariane 5 rocket launched

549

00:22:41,810 --> 00:22:39,140

from uh Kuru French Guiana South America

550

00:22:43,669 --> 00:22:41,820

and and now we are unfolding this

551
00:22:45,710 --> 00:22:43,679
Observatory and this is the the first

552
00:22:47,690 --> 00:22:45,720
time this particular procedure has been

553
00:22:51,409 --> 00:22:47,700
done in space and this is this is just a

554
00:22:54,770 --> 00:22:52,909
so you were mentioning that there had

555
00:22:56,750 --> 00:22:54,780
you you send a current through these

556
00:22:58,130 --> 00:22:56,760
these is this an example of the

557
00:23:00,770 --> 00:22:58,140
actuators that we've been talking about

558
00:23:02,390 --> 00:23:00,780
before that uh they they're they're

559
00:23:04,250 --> 00:23:02,400
actuators that have to release or this

560
00:23:07,250 --> 00:23:04,260
is something a little bit different

561
00:23:08,510 --> 00:23:07,260
no this is this is the same um

562
00:23:09,169 --> 00:23:08,520
these are like

563
00:23:12,230 --> 00:23:09,179

uh

564

00:23:14,270 --> 00:23:12,240

um a pin that's held in a in a like a

565

00:23:17,930 --> 00:23:14,280

cup cone assembly

566

00:23:21,409 --> 00:23:17,940

um and when the uh fuse wire breaks it

567

00:23:23,930 --> 00:23:21,419

it loosens up our wire that's tightly

568

00:23:26,510 --> 00:23:23,940

wound around it allowing the pin and the

569

00:23:28,669 --> 00:23:26,520

cup to separate all that all those

570

00:23:31,430 --> 00:23:28,679

little components are captured into the

571

00:23:34,250 --> 00:23:31,440

mechanism cell itself so none of it's

572

00:23:36,950 --> 00:23:34,260

free-floating in space is debris but um

573

00:23:39,110 --> 00:23:36,960

it allows those two pieces to move apart

574

00:23:43,130 --> 00:23:39,120

um and there's going to be four that

575

00:23:52,909 --> 00:23:46,190

they're just about ready to continue

576

00:23:52,919 --> 00:23:58,789

she says go to execute executing

577

00:24:08,149 --> 00:24:00,830

and you're go to enable

578

00:24:12,350 --> 00:24:10,549

and what they'll see now in their

579

00:24:15,470 --> 00:24:12,360

Telemetry is they might see a

580

00:24:17,990 --> 00:24:15,480

disturbance on the entire Observatory of

581

00:24:21,169 --> 00:24:18,000

of these launch blocks actually coming

582

00:24:24,110 --> 00:24:21,179

apart the entire Observatory might just

583

00:24:26,750 --> 00:24:24,120

just like when you um unlock your

584

00:24:28,970 --> 00:24:26,760

vehicle you can hear the click of the

585

00:24:32,029 --> 00:24:28,980

door unlocked there's almost like a

586

00:24:33,769 --> 00:24:32,039

little vibe in the whole structure that

587

00:24:37,010 --> 00:24:33,779

comes through

588

00:24:42,049 --> 00:24:37,020

um to that that we can sometimes we can

589

00:24:42,059 --> 00:24:57,049

that these are fully released

590

00:25:00,529 --> 00:24:58,789

in fact I know the design of these

591

00:25:02,510 --> 00:25:00,539

actuators was specifically done so that

592

00:25:04,310 --> 00:25:02,520

they don't jar the telescope very much

593

00:25:05,690 --> 00:25:04,320

they're actually very gentle yes but but

594

00:25:07,490 --> 00:25:05,700

even just that that little bit of

595

00:25:09,169 --> 00:25:07,500

vibration could be detected and firm

596

00:25:11,930 --> 00:25:09,179

armed or waiting on this fourth command

597

00:25:17,409 --> 00:25:14,570

and the stories command sequence

598

00:25:21,250 --> 00:25:17,419

is we don't ever want to break a command

599

00:25:25,010 --> 00:25:21,260

between the time we tell it to Fire and

600

00:25:26,149 --> 00:25:25,020

all stations our next go will uh fire

601
00:25:27,710 --> 00:25:26,159
ordinance

602
00:25:30,169 --> 00:25:27,720
OTE

603
00:25:54,190 --> 00:25:30,179
um lrm group seven

604
00:25:54,200 --> 00:25:57,649
all right

605
00:25:57,659 --> 00:26:02,230
yeah thank you

606
00:26:05,690 --> 00:26:04,190
I believe the music you're hearing

607
00:26:08,169 --> 00:26:05,700
that's real that's in the control room

608
00:26:10,490 --> 00:26:08,179
they're uh yeah

609
00:26:13,490 --> 00:26:10,500
I actually hear it twice because I have

610
00:26:15,049 --> 00:26:13,500
the my my earphone on and then I hear it

611
00:26:16,730 --> 00:26:15,059
through here so I had a hard time

612
00:26:19,250 --> 00:26:16,740
figuring out if you could really hear it

613
00:26:24,350 --> 00:26:19,260

if it was just me for a second

614

00:26:28,850 --> 00:26:26,149

there's obviously an air of excitement

615

00:26:30,470 --> 00:26:28,860

you know and uh you know certainly you

616

00:26:32,990 --> 00:26:30,480

know everybody is a little bit uh you

617

00:26:34,789 --> 00:26:33,000

know the nerves are you know on edge but

618

00:26:37,310 --> 00:26:34,799

but lots of optimism lots of excitement

619

00:26:39,409 --> 00:26:37,320

and lots of smiles so that's uh it's an

620

00:26:41,210 --> 00:26:39,419

emotional moment for all of us

621

00:26:42,890 --> 00:26:41,220

everyone's been working on this since

622

00:26:45,710 --> 00:26:42,900

the day of launch that our launch

623

00:26:47,450 --> 00:26:45,720

deployments started uh with our very

624

00:26:49,490 --> 00:26:47,460

first one that uh

625

00:26:53,029 --> 00:26:49,500

um was caught by the

626

00:26:55,430 --> 00:26:53,039

rocket itself as it floated jwc floated

627

00:26:58,010 --> 00:26:55,440

away from it the upper stage and it's

628

00:27:02,450 --> 00:26:58,020

been non-stop day after day since then

629

00:27:05,049 --> 00:27:02,460

uh having each deployment come along in

630

00:27:08,390 --> 00:27:05,059

series everyone has gone very well

631

00:27:12,710 --> 00:27:08,400

so I can confirm safe and disabled and

632

00:27:12,720 --> 00:27:16,010

still do that

633

00:27:19,789 --> 00:27:17,870

this is the step to actually do the

634

00:27:23,090 --> 00:27:19,799

environment line look good this is for

635

00:27:24,409 --> 00:27:23,100

OTE lrm group eight and you are going to

636

00:27:26,750 --> 00:27:24,419

execute

637

00:27:29,389 --> 00:27:26,760

coffee to see you have to go certificate

638

00:27:31,430 --> 00:27:29,399

executing

639

00:27:35,630 --> 00:27:31,440

and you're going to continue

640

00:27:41,269 --> 00:27:38,210

there's a total of four mechanisms that

641

00:27:43,549 --> 00:27:41,279

do the launch lock uh two are at the

642

00:27:46,490 --> 00:27:43,559

hinge where the uh which is actually

643

00:27:48,649 --> 00:27:46,500

closest to us in the display at the

644

00:27:50,750 --> 00:27:48,659

joints one at the top one at the bottom

645

00:27:53,690 --> 00:27:50,760

and then two kind of hold the wing back

646

00:27:55,669 --> 00:27:53,700

to keep it from rattling during launch

647

00:27:58,850 --> 00:27:55,679

um and are at the at the Far Corners

648

00:28:02,450 --> 00:27:58,860

yeah I can confirm enough

649

00:28:02,460 --> 00:28:20,810

you see Optical term

650

00:28:27,769 --> 00:28:23,210

I can confirm armed waiting for the

651
00:28:30,769 --> 00:28:29,930
I think that's so amazing to me is that

652
00:28:32,690 --> 00:28:30,779
this

653
00:28:36,590 --> 00:28:32,700
what's happening today is the is the end

654
00:28:38,510 --> 00:28:36,600
of the of 178 release mechanisms you

655
00:28:40,610 --> 00:28:38,520
know every single one had to work all

656
00:28:41,630 --> 00:28:40,620
stations authorizations our next go it

657
00:28:44,510 --> 00:28:41,640
will fire

658
00:28:47,409 --> 00:28:44,520
um o t e lrm group eight

659
00:28:54,470 --> 00:28:47,419
OC you are go to fire

660
00:28:57,649 --> 00:28:56,090
yeah this uh

661
00:28:59,389 --> 00:28:57,659
there was a lot of work to put into

662
00:29:01,730 --> 00:28:59,399
these a lot of people have heard about

663
00:29:03,529 --> 00:29:01,740

our single point failures each one of

664

00:29:06,110 --> 00:29:03,539

these itself was a single point failure

665

00:29:08,029 --> 00:29:06,120

in other words if one of those four uh

666

00:29:11,510 --> 00:29:08,039

launch releases does not release it

667

00:29:14,570 --> 00:29:11,520

we're not able to move this uh side of

668

00:29:17,389 --> 00:29:14,580

the mirror forward into position uh so

669

00:29:18,889 --> 00:29:17,399

this would be our last of these four uh

670

00:29:20,570 --> 00:29:18,899

single point failures there's there's

671

00:29:23,210 --> 00:29:20,580

still other single point failures and

672

00:29:24,529 --> 00:29:23,220

some some that stay with us for the life

673

00:29:27,769 --> 00:29:24,539

of the mission

674

00:29:29,930 --> 00:29:27,779

um different areas of structure or a

675

00:29:32,510 --> 00:29:29,940

mechanism that the mechanism fails we

676
00:29:34,970 --> 00:29:32,520
don't we don't have a second path of

677
00:29:35,990 --> 00:29:34,980
light to bring the light down but these

678
00:29:38,510 --> 00:29:36,000
are major

679
00:29:45,830 --> 00:29:38,520
milestones and getting the observatory

680
00:29:49,130 --> 00:29:47,029
for those of you who are joining us

681
00:29:50,570 --> 00:29:49,140
you're looking at live coverage of the

682
00:29:52,850 --> 00:29:50,580
commissioning of the James Webb Space

683
00:29:54,529 --> 00:29:52,860
Telescope today we are unfolding the

684
00:29:56,210 --> 00:29:54,539
second of the wings of the primary

685
00:29:58,490 --> 00:29:56,220
mirrors

686
00:30:00,710 --> 00:29:58,500
joining with joining me is Julie van

687
00:30:02,990 --> 00:30:00,720
kampen she is the Deputy commissioning

688
00:30:07,630 --> 00:30:03,000

engineer

689

00:30:10,610 --> 00:30:07,640

and see people there excited and happy

690

00:30:11,810 --> 00:30:10,620

mom copies thanks Steph lead glad to

691

00:30:14,690 --> 00:30:11,820

have the plot so we could follow along

692

00:30:18,049 --> 00:30:14,700

share your enthusiasm that's awesome 178

693

00:30:20,330 --> 00:30:18,059

out of 178 congratulations

694

00:30:22,250 --> 00:30:20,340

thank you they just fired

695

00:30:30,430 --> 00:30:22,260

it confirms that all of those mechanisms

696

00:30:36,230 --> 00:30:33,789

we're ready to continue with

697

00:30:38,510 --> 00:30:36,240

693.032.eu to stand by

698

00:30:40,570 --> 00:30:38,520

I'll be there

699

00:30:49,730 --> 00:30:40,580

and they could see indications

700

00:30:49,740 --> 00:30:59,630

and you're going to continue

701
00:31:03,529 --> 00:31:01,310
the next couple steps are going to be

702
00:31:05,570 --> 00:31:03,539
getting the um the deployment Motors

703
00:31:07,190 --> 00:31:05,580
ready again so before they check them

704
00:31:09,950 --> 00:31:07,200
out they had to put them into a standby

705
00:31:11,990 --> 00:31:09,960
mode while they were doing the firing uh

706
00:31:14,810 --> 00:31:12,000
that was the safe configuration that you

707
00:31:16,190 --> 00:31:14,820
heard the deployment lead speak to now

708
00:31:19,070 --> 00:31:16,200
they're going to get them back into the

709
00:31:29,750 --> 00:31:19,080
configuration and then uh they'll get

710
00:31:35,409 --> 00:31:32,690
you actually I can confirm uh burn

711
00:31:37,730 --> 00:31:35,419
standby round robin we're ready for

712
00:31:40,730 --> 00:31:37,740
693.033 to

713
00:31:42,470 --> 00:31:40,740

um restore default torque limits

714

00:31:43,909 --> 00:31:42,480

the command line looks good you're going

715

00:31:49,250 --> 00:31:43,919

to execute

716

00:31:55,970 --> 00:31:50,950

and you're going to continue

717

00:32:00,350 --> 00:31:58,370

and earlier we had mentioned uh the

718

00:32:03,110 --> 00:32:00,360

position called Mom a submission

719

00:32:04,970 --> 00:32:03,120

operations manager and the elbow we're

720

00:32:08,930 --> 00:32:04,980

seeing in the top screen and that's Carl

721

00:32:20,870 --> 00:32:08,940

Starr who's the mama jwst

722

00:32:26,810 --> 00:32:23,389

when they do the small mirror move the

723

00:32:28,190 --> 00:32:26,820

small motor move on the mirror here in

724

00:32:28,850 --> 00:32:28,200

our uh

725

00:32:30,889 --> 00:32:28,860

um

726

00:32:33,049 --> 00:32:30,899

and our tool that we get to see on the

727

00:32:35,090 --> 00:32:33,059

screen the ovt The Observatory

728

00:32:37,250 --> 00:32:35,100

visualization tool we don't actually

729

00:32:39,950 --> 00:32:37,260

it's such a small move we won't see the

730

00:32:42,049 --> 00:32:39,960

tool actually uh change at all it won't

731

00:32:44,450 --> 00:32:42,059

be until the major move before we can

732

00:32:46,549 --> 00:32:44,460

actually see it on this tool

733

00:32:48,649 --> 00:32:46,559

and it looks like they're calculating

734

00:32:51,169 --> 00:32:48,659

that's going to be another 20 or more

735

00:32:52,850 --> 00:32:51,179

minutes until we actually see the full

736

00:33:04,370 --> 00:32:52,860

move take place

737

00:33:08,210 --> 00:33:06,590

we're sitting here now with worksheet uh

738

00:33:10,009 --> 00:33:08,220

watching the uh the mission operation

739

00:33:11,389 --> 00:33:10,019

manager and you'll also be seeing live

740

00:33:13,190 --> 00:33:11,399

coverage from the mock the mission

741

00:33:15,289 --> 00:33:13,200

operations center at the Space Telescope

742

00:33:18,470 --> 00:33:15,299

Science Institute in Baltimore Maryland

743

00:33:20,690 --> 00:33:18,480

I'm there as well although in a uh in an

744

00:33:22,310 --> 00:33:20,700

isolated conference room so I can speak

745

00:33:24,230 --> 00:33:22,320

to you unmasked

746

00:33:26,990 --> 00:33:24,240

of course we're operating under coveted

747

00:33:29,330 --> 00:33:27,000

protocols which has made a challenge but

748

00:33:31,070 --> 00:33:29,340

uh it's a happy and and festive day here

749

00:33:36,529 --> 00:33:31,080

and uh we are we're really looking

750

00:33:39,470 --> 00:33:38,149

later on in the program we'll have a

751

00:33:41,389 --> 00:33:39,480

chance to take some of your questions

752

00:33:43,909 --> 00:33:41,399

from social media and today we're asking

753

00:33:46,190 --> 00:33:43,919

you to use the hashtag unfold the

754

00:33:51,529 --> 00:33:46,200

universe so on hashtag unfold the

755

00:33:56,509 --> 00:33:53,570

we'll be stopping our commentaries with

756

00:33:58,130 --> 00:33:56,519

your commands so uh you know we may have

757

00:34:00,409 --> 00:33:58,140

a conversation but then we'll stop to

758

00:34:02,389 --> 00:34:00,419

hear how the commands are progressing as

759

00:34:04,490 --> 00:34:02,399

first they make a very small movement to

760

00:34:05,690 --> 00:34:04,500

make sure the wing is uh is moving

761

00:34:07,549 --> 00:34:05,700

correctly and all the motors are

762

00:34:10,069 --> 00:34:07,559

functioning correctly and then in about

763

00:34:11,510 --> 00:34:10,079

20 minutes from now you will see uh on

764

00:34:13,250 --> 00:34:11,520

the uh on the left hand side of your

765

00:34:15,470 --> 00:34:13,260

screen you will actually see the wing

766

00:34:18,710 --> 00:34:15,480

click into place and then after that

767

00:34:20,750 --> 00:34:18,720

there will be a couple hours of uh of

768

00:34:23,450 --> 00:34:20,760

latching it of making sure that this is

769

00:34:28,609 --> 00:34:23,460

fully in it's extended permanent

770

00:34:32,329 --> 00:34:30,409

I see Julie's got a big smile on her

771

00:34:37,369 --> 00:34:32,339

face which I I love to see because uh

772

00:34:37,379 --> 00:34:42,470

um

773

00:34:46,849 --> 00:34:45,290

Bill Oaks is the program manager and uh

774

00:34:49,250 --> 00:34:46,859

you'll uh you'll see him throughout this

775

00:34:50,569 --> 00:34:49,260

as Julie said in the he's sort of the

776

00:34:53,389 --> 00:34:50,579

the head of the mission everybody kind

777

00:34:55,069 --> 00:34:53,399

of reports to him at this point

778

00:34:57,589 --> 00:34:55,079

there's an interesting

779

00:34:59,569 --> 00:34:57,599

um uh teamwork between scientists and

780

00:35:00,770 --> 00:34:59,579

Engineers on a mission like this and

781

00:35:03,530 --> 00:35:00,780

actually Julie and I were talking about

782

00:35:04,670 --> 00:35:03,540

this earlier that uh you know I come

783

00:35:06,230 --> 00:35:04,680

from the background of being an

784

00:35:08,150 --> 00:35:06,240

astrophysicist and and when I think

785

00:35:09,950 --> 00:35:08,160

about web I mainly think of all of the

786

00:35:11,510 --> 00:35:09,960

incredible data and the questions the

787

00:35:13,130 --> 00:35:11,520

scientific questions that I I'm looking

788

00:35:15,410 --> 00:35:13,140

forward to being able to explore with

789

00:35:17,990 --> 00:35:15,420

the telescope uh Julie has a very

790

00:35:20,450 --> 00:35:18,000

different perspective Julie tell us a

791

00:35:22,670 --> 00:35:20,460

bit about your your position as the uh

792

00:35:25,510 --> 00:35:22,680

the deputy commissioning engineer tell

793

00:35:28,790 --> 00:35:25,520

us about what that what that job entails

794

00:35:30,109 --> 00:35:28,800

sure as the deputy commissioning

795

00:35:32,990 --> 00:35:30,119

engineer

796

00:35:35,690 --> 00:35:33,000

um I've worked to try to make sure all

797

00:35:38,390 --> 00:35:35,700

of the various pieces that it takes to

798

00:35:42,829 --> 00:35:38,400

commission the telescope come together

799

00:35:46,069 --> 00:35:42,839

um in a way that uh makes an engineering

800

00:35:48,109 --> 00:35:46,079

sense so there's a lot of people who uh

801
00:35:50,530 --> 00:35:48,119
have worked many many years to make sure

802
00:35:54,310 --> 00:35:50,540
that it comes together operationally

803
00:35:59,089 --> 00:35:54,320
working with how the commands are sent

804
00:36:01,130 --> 00:35:59,099
how the the control is done of the

805
00:36:03,530 --> 00:36:01,140
observatory making sure our

806
00:36:06,530 --> 00:36:03,540
Communications with the Ascend is is

807
00:36:07,550 --> 00:36:06,540
worked out and timed with all of our

808
00:36:10,490 --> 00:36:07,560
activities

809
00:36:12,770 --> 00:36:10,500
but I I deal with the

810
00:36:13,990 --> 00:36:12,780
um engineering aspect of that to make

811
00:36:18,530 --> 00:36:14,000
sure that

812
00:36:20,569 --> 00:36:18,540
if things are happening in a faster

813
00:36:23,750 --> 00:36:20,579

sense that will

814

00:36:25,970 --> 00:36:23,760

still be safe like our operations can be

815

00:36:28,430 --> 00:36:25,980

handled uh two days earlier or two days

816

00:36:30,650 --> 00:36:28,440

later should the timeline move one way

817

00:36:34,310 --> 00:36:30,660

or another from a hardware perspective

818

00:36:36,710 --> 00:36:34,320

uh so I I you know so many people are

819

00:36:38,210 --> 00:36:36,720

very interested in how the signs will

820

00:36:40,310 --> 00:36:38,220

work but I'm interested in how the parts

821

00:36:42,290 --> 00:36:40,320

of the telescope work themselves to make

822

00:36:45,530 --> 00:36:42,300

sure that they work together to actually

823

00:36:49,910 --> 00:36:47,990

thank you and uh you know that that's

824

00:36:51,349 --> 00:36:49,920

the the question of course about you

825

00:36:52,970 --> 00:36:51,359

know how you become an engineer or how

826

00:36:54,650 --> 00:36:52,980

you become a scientist

827

00:36:56,450 --> 00:36:54,660

um well what what is your background I

828

00:36:57,530 --> 00:36:56,460

mean what what do you have a degree in

829

00:36:59,210 --> 00:36:57,540

for example that led you to this

830

00:37:01,550 --> 00:36:59,220

particular job

831

00:37:03,829 --> 00:37:01,560

uh my actual degree both my

832

00:37:06,890 --> 00:37:03,839

undergraduate and I have a master's

833

00:37:10,670 --> 00:37:06,900

degree in mechanical engineering uh and

834

00:37:12,890 --> 00:37:10,680

basically I started off uh being

835

00:37:16,310 --> 00:37:12,900

interested in in how to design and build

836

00:37:17,950 --> 00:37:16,320

things uh as a kid I like to to build

837

00:37:20,990 --> 00:37:17,960

forts

838

00:37:24,050 --> 00:37:21,000

uh you know you name it I like to put it

839

00:37:26,210 --> 00:37:24,060

together so uh I went to school to be a

840

00:37:28,910 --> 00:37:26,220

mechanical engineer graduated from

841

00:37:31,430 --> 00:37:28,920

school my first uh company was a small

842

00:37:33,650 --> 00:37:31,440

it was a small company so it kind of got

843

00:37:35,390 --> 00:37:33,660

to do a little bit of everything so you

844

00:37:38,510 --> 00:37:35,400

kind of learned to be the Jill of all

845

00:37:41,390 --> 00:37:38,520

trades uh and from that I moved to NASA

846

00:37:43,550 --> 00:37:41,400

and uh got into into the testing

847

00:37:44,870 --> 00:37:43,560

department and was able to do actually a

848

00:37:47,390 --> 00:37:44,880

lot of the Hubble servicing missions

849

00:37:49,190 --> 00:37:47,400

from from the testing side to get those

850

00:37:50,569 --> 00:37:49,200

instruments and components that were

851
00:37:52,609 --> 00:37:50,579
being

852
00:37:54,950 --> 00:37:52,619
um sent to Hubble on the on the

853
00:37:57,710 --> 00:37:54,960
different servicing missions ready for

854
00:38:00,470 --> 00:37:57,720
those uh missions

855
00:38:04,370 --> 00:38:00,480
uh then eventually I moved over to jwst

856
00:38:06,290 --> 00:38:04,380
and I've been on jwst since 2003 and

857
00:38:08,569 --> 00:38:06,300
I've been a systems engineer on the

858
00:38:11,270 --> 00:38:08,579
instruments and then the payload and now

859
00:38:13,130 --> 00:38:11,280
onto the commissioning

860
00:38:15,109 --> 00:38:13,140
wonderful

861
00:38:17,329 --> 00:38:15,119
so we will pause our commentary when we

862
00:38:19,069 --> 00:38:17,339
see your commands from the uh the

863
00:38:20,390 --> 00:38:19,079

mission operations center but we do have

864

00:38:23,450 --> 00:38:20,400

time to take a few questions on social

865

00:38:24,950 --> 00:38:23,460

media so um whenever people ask

866

00:38:26,569 --> 00:38:24,960

questions like this I'm I'm touching

867

00:38:28,490 --> 00:38:26,579

wood right now it says it's as Nicholas

868

00:38:29,690 --> 00:38:28,500

on Twitter asks would the Observer store

869

00:38:31,609 --> 00:38:29,700

would the observatory still be

870

00:38:32,810 --> 00:38:31,619

operational if one or a few of the

871

00:38:34,849 --> 00:38:32,820

mirrors break

872

00:38:37,190 --> 00:38:34,859

is there anything out there that could

873

00:38:38,210 --> 00:38:37,200

break them so I mean so that there's

874

00:38:40,010 --> 00:38:38,220

maybe a couple of different ways to

875

00:38:41,510 --> 00:38:40,020

answer this I mean what what happens all

876

00:38:43,609 --> 00:38:41,520

of the mirrors will be aimed

877

00:38:45,290 --> 00:38:43,619

independently what happens if for

878

00:38:46,609 --> 00:38:45,300

example one of them doesn't aim

879

00:38:49,250 --> 00:38:46,619

correctly

880

00:38:50,690 --> 00:38:49,260

well the great thing about the the web

881

00:38:52,310 --> 00:38:50,700

telescope is with these independent

882

00:38:54,349 --> 00:38:52,320

mirrors is that

883

00:38:57,829 --> 00:38:54,359

um we can handle so many different

884

00:39:01,609 --> 00:38:57,839

scenarios like that uh for instance if

885

00:39:05,390 --> 00:39:01,619

um one of the mirrors either let's say a

886

00:39:08,210 --> 00:39:05,400

a piece of debris hits it or during its

887

00:39:10,430 --> 00:39:08,220

launch and Ascent phase uh some of the

888

00:39:13,670 --> 00:39:10,440

stresses were higher than predicted and

889

00:39:16,250 --> 00:39:13,680

and we had a problem that that broke a

890

00:39:17,990 --> 00:39:16,260

mirror or an actuator uh behind the

891

00:39:20,930 --> 00:39:18,000

mirror we could actually take that in

892

00:39:23,930 --> 00:39:20,940

your essentially out of the image

893

00:39:26,750 --> 00:39:23,940

by making it very much out of focus with

894

00:39:29,150 --> 00:39:26,760

the rest of the telescope and uh you

895

00:39:31,910 --> 00:39:29,160

know if anyone's ever experienced having

896

00:39:35,210 --> 00:39:31,920

a floater in their eye or or something

897

00:39:37,569 --> 00:39:35,220

uh like a scratch one on your eye you

898

00:39:40,190 --> 00:39:37,579

can you can realize how much you can see

899

00:39:43,569 --> 00:39:40,200

and it is completely unaffected by that

900

00:39:46,730 --> 00:39:43,579

so when something's not quite

901
00:39:49,370 --> 00:39:46,740
in sync with the rest of of the primary

902
00:39:51,589 --> 00:39:49,380
mirror there's there's different ways to

903
00:39:53,630 --> 00:39:51,599
take that impact out some of it's

904
00:39:55,730 --> 00:39:53,640
physically by moving the mirror out of

905
00:39:57,890 --> 00:39:55,740
its focus and some of it's digitally by

906
00:40:00,770 --> 00:39:57,900
knowing that there's a uh imperfection

907
00:40:03,589 --> 00:40:00,780
that's going to be in each and every

908
00:40:06,470 --> 00:40:03,599
um uh image that gets subtracted out

909
00:40:07,730 --> 00:40:06,480
digitally from those images

910
00:40:09,770 --> 00:40:07,740
thank you

911
00:40:11,030 --> 00:40:09,780
maybe another social media question for

912
00:40:12,589 --> 00:40:11,040
those of you that would like to uh

913
00:40:14,870 --> 00:40:12,599

actually have questions uh answered live

914

00:40:16,730 --> 00:40:14,880

on air with us use the hashtag unfold

915

00:40:18,349 --> 00:40:16,740

the universe so we'll be looking for

916

00:40:20,270 --> 00:40:18,359

hashtag unfold the universe take your

917

00:40:23,630 --> 00:40:20,280

questions on social media

918

00:40:25,190 --> 00:40:23,640

and so uh this actually kind of uh goes

919

00:40:27,290 --> 00:40:25,200

along with the second one so Michael on

920

00:40:29,390 --> 00:40:27,300

Facebook asks what protects the mirror

921

00:40:30,650 --> 00:40:29,400

from micrometeors and other fine space

922

00:40:32,710 --> 00:40:30,660

dust debris

923

00:40:35,410 --> 00:40:32,720

I think the answer is

924

00:40:38,390 --> 00:40:35,420

not much nothing

925

00:40:42,890 --> 00:40:38,400

what you see is what you get

926

00:40:46,190 --> 00:40:42,900

um the this this the sun shield

927

00:40:48,890 --> 00:40:46,200

um is facing the the Earth and the Sun

928

00:40:50,150 --> 00:40:48,900

so not only does it protect it a little

929

00:40:51,829 --> 00:40:50,160

bit from

930

00:40:55,250 --> 00:40:51,839

um

931

00:40:57,710 --> 00:40:55,260

from a little bit of possibly Duster or

932

00:40:59,990 --> 00:40:57,720

anything coming from the Sun but you

933

00:41:03,589 --> 00:41:00,000

know the heat of the sun is basically

934

00:41:05,450 --> 00:41:03,599

what it does if the sun shield itself

935

00:41:07,309 --> 00:41:05,460

you know this isn't quite the question

936

00:41:10,130 --> 00:41:07,319

he asked but if the sun shield itself

937

00:41:11,930 --> 00:41:10,140

got hit by a micrometeoroid

938

00:41:13,849 --> 00:41:11,940

um and got a little tear or a rip in it

939

00:41:17,390 --> 00:41:13,859

we have that's part of why we have five

940

00:41:20,450 --> 00:41:17,400

layers and we can tolerate so much

941

00:41:22,010 --> 00:41:20,460

um damage throughout time and it was

942

00:41:25,190 --> 00:41:22,020

part of our lifetime calculations to

943

00:41:27,290 --> 00:41:25,200

make sure based on

944

00:41:30,109 --> 00:41:27,300

um our little bit of knowledge that we

945

00:41:33,410 --> 00:41:30,119

have of other observatories at the L2

946

00:41:34,990 --> 00:41:33,420

point to make sure that the the

947

00:41:38,450 --> 00:41:35,000

environment there

948

00:41:40,910 --> 00:41:38,460

can be sustained by all of our Optics

949

00:41:44,930 --> 00:41:40,920

and all of our sun shield over the time

950

00:41:47,990 --> 00:41:46,730

and just to give you an update you're

951
00:41:49,730 --> 00:41:48,000
looking at live commissioning of the

952
00:41:51,589 --> 00:41:49,740
James Webb Space Telescope from what I

953
00:41:54,589 --> 00:41:51,599
understand uh there will be a call in

954
00:41:55,910 --> 00:41:54,599
about four minutes releasing the uh the

955
00:41:57,770 --> 00:41:55,920
larger mechanism and about four minutes

956
00:42:00,710 --> 00:41:57,780
after that we should be able to see the

957
00:42:02,510 --> 00:42:00,720
wings start to move so in uh now in a

958
00:42:03,770 --> 00:42:02,520
bit under 10 minutes we'll see the wing

959
00:42:06,109 --> 00:42:03,780
move

960
00:42:08,109 --> 00:42:06,119
in the first release at this time we're

961
00:42:12,170 --> 00:42:08,119
ready to continue with

962
00:42:17,089 --> 00:42:12,180
693.034 deu to operate frame six

963
00:42:17,099 --> 00:42:22,910

executed

964

00:42:30,349 --> 00:42:25,970

and you're going to continue

965

00:42:34,910 --> 00:42:32,809

when they do the small move this will

966

00:42:36,770 --> 00:42:34,920

verify for sure and for certain that all

967

00:42:39,050 --> 00:42:36,780

of those launch release mechanisms have

968

00:42:41,270 --> 00:42:39,060

released and that the mirror is free to

969

00:42:44,450 --> 00:42:41,280

move into its final position

970

00:42:48,470 --> 00:42:46,550

continuing our conversation I mean in

971

00:42:50,990 --> 00:42:48,480

some small impacts for micrometeorites

972

00:42:52,970 --> 00:42:51,000

will happen you know over the lifetime

973

00:42:55,130 --> 00:42:52,980

of the mission there there will be some

974

00:42:57,650 --> 00:42:55,140

damage to the uh the the the mirrors of

975

00:42:59,930 --> 00:42:57,660

the telescope I I remember

976
00:43:01,490 --> 00:42:59,940
um I The Goddard space flight center

977
00:43:03,290 --> 00:43:01,500
when they replaced some of the cameras

978
00:43:04,670 --> 00:43:03,300
on the Huddle Space Telescope they

979
00:43:07,010 --> 00:43:04,680
brought some of the old cameras back for

980
00:43:09,770 --> 00:43:07,020
an hour can they confirm operation

981
00:43:12,410 --> 00:43:09,780
framework and we're ready to continue

982
00:43:19,910 --> 00:43:12,420
with the small motor move

983
00:43:22,609 --> 00:43:20,870
the window

984
00:43:24,230 --> 00:43:22,619
that command line looks good you're

985
00:43:26,150 --> 00:43:24,240
going to execute

986
00:43:29,150 --> 00:43:26,160
I'll be back you see you have to go to

987
00:43:33,910 --> 00:43:29,160
skip executing

988
00:43:40,490 --> 00:43:37,190

there we go

989

00:43:48,170 --> 00:43:40,500

and stand by probably review parameter

990

00:43:53,630 --> 00:43:51,470

so we were talking about the the degree

991

00:43:54,950 --> 00:43:53,640

um also being at L2 is very useful

992

00:43:56,390 --> 00:43:54,960

parameters what good you're going to

993

00:44:03,109 --> 00:43:56,400

move the motor

994

00:44:07,849 --> 00:44:05,450

complete

995

00:44:20,329 --> 00:44:07,859

the above copies and you can queue up

996

00:44:20,339 --> 00:44:59,150

and The Meta status is moving

997

00:45:02,270 --> 00:45:01,370

I'm singing got it I remember the uh the

998

00:45:04,790 --> 00:45:02,280

camera is being brought back for

999

00:45:06,770 --> 00:45:04,800

analysis they were uh they were you know

1000

00:45:08,510 --> 00:45:06,780

analyzing every tiny tiny little crater

1001
00:45:10,670 --> 00:45:08,520
that was made by a little piece of dust

1002
00:45:12,650 --> 00:45:10,680
or a little piece of debris so but you

1003
00:45:14,150 --> 00:45:12,660
said that L2 for example is actually a

1004
00:45:16,069 --> 00:45:14,160
very nice place to be it's actually a

1005
00:45:17,990 --> 00:45:16,079
kind of a cleaner place when it comes to

1006
00:45:21,530 --> 00:45:18,000
space jump because is that correct yes

1007
00:45:24,650 --> 00:45:21,540
yes uh low earth orbit tumble is in is

1008
00:45:26,150 --> 00:45:24,660
is uh has a lot of space debris as

1009
00:45:27,730 --> 00:45:26,160
everybody has seen the move things

1010
00:45:30,710 --> 00:45:27,740
gravity

1011
00:45:32,930 --> 00:45:30,720
execute stop deploy

1012
00:45:35,569 --> 00:45:32,940
copy that since you have about your

1013
00:45:37,910 --> 00:45:35,579

suggests XK

1014

00:45:42,109 --> 00:45:37,920

and you're going to continue but we're

1015

00:45:42,119 --> 00:45:53,690

they're stopping the motor move now

1016

00:45:58,190 --> 00:45:56,569

and I see the matter of thought

1017

00:46:02,990 --> 00:45:58,200

that this time we're ready to continue

1018

00:46:06,170 --> 00:46:03,000

with uh 693.041 deu to stand by

1019

00:46:07,730 --> 00:46:06,180

but looks good you are good to execute

1020

00:46:11,329 --> 00:46:07,740

right there if you have the

1021

00:46:11,339 --> 00:46:25,190

and you're going to continue

1022

00:46:29,270 --> 00:46:27,050

once they've taken a moment to analyze

1023

00:46:31,250 --> 00:46:29,280

their Telemetry and then move on again

1024

00:46:33,349 --> 00:46:31,260

with the mirror moves uh they're going

1025

00:46:36,170 --> 00:46:33,359

to take the motor and they're going to

1026
00:46:37,309 --> 00:46:36,180
drive the mirror up against a hard stop

1027
00:46:38,990 --> 00:46:37,319
all

1028
00:46:40,790 --> 00:46:39,000
once they move it up against the hard

1029
00:46:42,470 --> 00:46:40,800
stop and they verify that they they're

1030
00:46:45,050 --> 00:46:42,480
happy with that position then they're

1031
00:46:46,430 --> 00:46:45,060
going to start moving some latch latches

1032
00:46:47,809 --> 00:46:46,440
into position

1033
00:46:49,370 --> 00:46:47,819
but when they move the latches into

1034
00:46:51,109 --> 00:46:49,380
position they'll kind of back off on

1035
00:46:53,270 --> 00:46:51,119
that deployment motor a little bit to

1036
00:46:54,490 --> 00:46:53,280
make sure that the latches are the ones

1037
00:46:57,589 --> 00:46:54,500
that

1038
00:46:59,710 --> 00:46:57,599

can confirm standby round robin at this

1039

00:47:03,290 --> 00:46:59,720

time we're ready to continue with

1040

00:47:04,970 --> 00:47:03,300

693.042 to restore the gainsmap

1041

00:47:07,010 --> 00:47:04,980

parameter to default

1042

00:47:08,450 --> 00:47:07,020

that command line looks good you are

1043

00:47:11,930 --> 00:47:08,460

going to continue

1044

00:47:11,940 --> 00:47:20,990

executing

1045

00:47:27,049 --> 00:47:23,210

sending some configuration commands to

1046

00:47:30,049 --> 00:47:28,730

so once again you're joining us for the

1047

00:47:31,549 --> 00:47:30,059

live commissioning of the James Webb

1048

00:47:35,329 --> 00:47:31,559

Space Telescope

1049

00:47:37,430 --> 00:47:35,339

the uh the starboard wing of the primary

1050

00:47:38,510 --> 00:47:37,440

mirror is being deployed today in just a

1051
00:47:40,490 --> 00:47:38,520
few minutes we should be able to

1052
00:47:41,809 --> 00:47:40,500
actually see it moving on the left-hand

1053
00:47:43,910 --> 00:47:41,819
side of your screen is a real-time

1054
00:47:46,069 --> 00:47:43,920
visualization based on Telemetry Based

1055
00:47:48,049 --> 00:47:46,079
on data from the telescope it's uh it's

1056
00:47:49,250 --> 00:47:48,059
generated by a computer this is not a

1057
00:47:51,470 --> 00:47:49,260
camera we do not have cameras

1058
00:47:52,670 --> 00:47:51,480
unfortunately on board web but this will

1059
00:47:55,069 --> 00:47:52,680
show us the configuration that's

1060
00:47:56,450 --> 00:47:55,079
actually in in real time and in just a

1061
00:47:59,089 --> 00:47:56,460
few minutes from now we will begin

1062
00:48:02,270 --> 00:47:59,099
actually bringing that side part of the

1063
00:48:04,490 --> 00:48:02,280

primary mirror around to form one large

1064

00:48:06,650 --> 00:48:04,500

mirror of 18 segments

1065

00:48:08,270 --> 00:48:06,660

segments that you see are colored gold

1066

00:48:10,130 --> 00:48:08,280

which we'll talk more about the mirrors

1067

00:48:12,349 --> 00:48:10,140

after we do this deployment we'll have

1068

00:48:13,910 --> 00:48:12,359

some time as the the telescope is

1069

00:48:16,910 --> 00:48:13,920

latched into its into its final

1070

00:48:19,250 --> 00:48:16,920

configuration but that uh that is uh

1071

00:48:21,470 --> 00:48:19,260

actual gold very very thin coating of

1072

00:48:23,450 --> 00:48:21,480

gold just a few hundred atoms thick

1073

00:48:24,770 --> 00:48:23,460

and uh

1074

00:48:26,089 --> 00:48:24,780

the telescope would actually look quite

1075

00:48:27,770 --> 00:48:26,099

a bit darker than you see in that

1076

00:48:29,809 --> 00:48:27,780

animation that the sun shield is

1077

00:48:31,730 --> 00:48:29,819

blocking out all of the light from the

1078

00:48:33,829 --> 00:48:31,740

sun and any reflected light from the

1079

00:48:35,390 --> 00:48:33,839

Earth and the moon and and so those

1080

00:48:39,650 --> 00:48:35,400

mirrors right now are exposed to the

1081

00:48:41,450 --> 00:48:39,660

dark cold space that will be uh doing

1082

00:48:49,609 --> 00:48:41,460

its primary science you know looking out

1083

00:48:57,230 --> 00:48:51,230

I understand the call to move is

1084

00:49:00,890 --> 00:48:59,089

and when the uh the mirror begins to

1085

00:49:03,950 --> 00:49:00,900

move we will just uh I'll sit back

1086

00:49:05,930 --> 00:49:03,960

together and enjoy watching that and uh

1087

00:49:08,690 --> 00:49:05,940

we'll come back with commentary uh after

1088

00:49:10,970 --> 00:49:08,700

that has completed and uh we have some

1089

00:49:13,430 --> 00:49:10,980

time as a latch telescope a couple of

1090

00:49:15,470 --> 00:49:13,440

hours uh into its final configuration so

1091

00:49:17,030 --> 00:49:15,480

we'll have different guests and experts

1092

00:49:25,670 --> 00:49:17,040

to uh to talk about what's going on when

1093

00:49:30,890 --> 00:49:27,950

I'm joined by Julie van kampen and she's

1094

00:49:46,430 --> 00:49:30,900

the deputy Observatory commissioning

1095

00:49:52,250 --> 00:49:48,890

rtcp is complete

1096

00:49:54,109 --> 00:49:52,260

because of and devops copies that looks

1097

00:49:56,170 --> 00:49:54,119

like that load completed successfully

1098

00:50:00,650 --> 00:49:56,180

we're ready to continue with

1099

00:50:03,349 --> 00:50:00,660

693.043 be to operate frame six

1100

00:50:05,030 --> 00:50:03,359

oh is that on the window and the command

1101
00:50:06,770 --> 00:50:05,040
line looks good you're going to execute

1102
00:50:11,329 --> 00:50:06,780
project

1103
00:50:16,790 --> 00:50:12,890
so they've just put that you're going to

1104
00:50:22,549 --> 00:50:19,370
the deployment motor back into its uh

1105
00:50:23,630 --> 00:50:22,559
operational state it was uh taken out of

1106
00:50:25,190 --> 00:50:23,640
operational state to do a

1107
00:50:27,049 --> 00:50:25,200
reconfiguration

1108
00:50:30,470 --> 00:50:27,059
and now it's ready to do the full move

1109
00:50:32,089 --> 00:50:30,480
once this this is done

1110
00:50:33,530 --> 00:50:32,099
we're coming to you live from Space

1111
00:50:34,849 --> 00:50:33,540
Telescope Science Institute in Baltimore

1112
00:50:37,069 --> 00:50:34,859
Maryland

1113
00:50:40,970 --> 00:50:37,079

this is happening in real time uh the

1114

00:50:50,270 --> 00:50:40,980

James Webb Space Telescope commissioning

1115

00:51:09,829 --> 00:50:51,770

you're looking at live coverage from the

1116

00:51:13,970 --> 00:51:11,930

command to deploy the wing is imminent

1117

00:51:15,770 --> 00:51:13,980

we're waiting for it any minute now and

1118

00:51:18,049 --> 00:51:15,780

then we will uh we'll watch on the uh

1119

00:51:19,790 --> 00:51:18,059

The Observatory visualization tool

1120

00:51:21,109 --> 00:51:19,800

to see that it'll just be a couple of

1121

00:51:22,970 --> 00:51:21,119

minutes something like four to five

1122

00:51:24,650 --> 00:51:22,980

minutes and then after that we will come

1123

00:51:26,390 --> 00:51:24,660

back with more more commentary about the

1124

00:51:27,650 --> 00:51:26,400

observatory and we'll talk to some of

1125

00:51:29,030 --> 00:51:27,660

the people that are some of the science

1126

00:51:30,589 --> 00:51:29,040

leads as well about some of the

1127

00:51:33,950 --> 00:51:30,599

scientific questions this Observatory

1128

00:51:41,030 --> 00:51:36,109

they've just given the campaign probably

1129

00:51:41,040 --> 00:51:46,010

I think

1130

00:51:51,049 --> 00:51:48,309

they're reviewing the parameters

1131

00:51:57,230 --> 00:51:51,059

parameters what goods you are going to

1132

00:52:08,809 --> 00:51:59,270

and this will move the mirrors into

1133

00:52:13,250 --> 00:52:11,329

the screen to the right shows us our

1134

00:52:16,910 --> 00:52:13,260

ground station

1135

00:52:19,130 --> 00:52:16,920

and the motor status is moving

1136

00:52:30,470 --> 00:52:19,140

doesn't see the mirrors move in the

1137

00:52:35,870 --> 00:52:32,270

it will take about four minutes for them

1138

00:52:40,549 --> 00:52:37,910

and a reminder this is real live footage

1139

00:52:42,829 --> 00:52:40,559

there's a three second time delay it

1140

00:52:46,250 --> 00:52:42,839

takes that long for light to travel at

1141

00:52:48,230 --> 00:52:46,260

186 000 miles per second

1142

00:52:55,490 --> 00:52:48,240

um the James Webb Space Telescope is now

1143

00:52:59,930 --> 00:52:58,609

I think you remember about this

1144

00:53:01,670 --> 00:52:59,940

go ahead

1145

00:53:04,069 --> 00:53:01,680

I was just going to say just remember

1146

00:53:06,349 --> 00:53:04,079

that this visualization is real this is

1147

00:53:08,150 --> 00:53:06,359

not pre-recorded it's based on actual

1148

00:53:12,290 --> 00:53:08,160

data coming to us from the telescope

1149

00:53:16,790 --> 00:53:14,030

and the important thing about the light

1150

00:53:18,890 --> 00:53:16,800

delay is not that the light takes that

1151
00:53:20,150 --> 00:53:18,900
long but the data which moves at the

1152
00:53:27,530 --> 00:53:20,160
speed of light

1153
00:53:33,109 --> 00:53:30,230
I know that was a question we had on

1154
00:53:36,710 --> 00:53:33,119
some of ourselves with the status we

1155
00:53:38,990 --> 00:53:36,720
have started our uh deployment into the

1156
00:53:44,150 --> 00:53:39,000
deployed hard stops and our current

1157
00:53:44,160 --> 00:53:50,809
Mount copy

1158
00:53:55,370 --> 00:53:52,910
that was another of our deployment

1159
00:53:56,870 --> 00:53:55,380
Engineers uh confirming that everything

1160
00:54:01,010 --> 00:53:56,880
looks good with our mission operations

1161
00:54:04,190 --> 00:54:03,049
it's exciting to actually see it moving

1162
00:54:05,630 --> 00:54:04,200
you know there it is on the

1163
00:54:07,609 --> 00:54:05,640

visualization tool it's getting closer

1164

00:54:11,510 --> 00:54:07,619

and closer

1165

00:54:19,430 --> 00:54:11,520

yep it's it's gonna be momentous when it

1166

00:54:23,870 --> 00:54:21,049

the first Wing was successfully deployed

1167

00:54:25,790 --> 00:54:23,880

yesterday and uh and now this is the the

1168

00:54:29,329 --> 00:54:25,800

final part the primary mirror being

1169

00:54:33,230 --> 00:54:31,490

Julie give us a sense of the scale uh

1170

00:54:35,390 --> 00:54:33,240

these mirror segments I mean I had the

1171

00:54:36,589 --> 00:54:35,400

honor of watching this being built a lot

1172

00:54:38,990 --> 00:54:36,599

of it at Goddard

1173

00:54:40,789 --> 00:54:39,000

um how big a cross for example is is one

1174

00:54:43,430 --> 00:54:40,799

of those hexagons

1175

00:54:47,510 --> 00:54:43,440

uh they're about a meter and a half

1176

00:54:49,849 --> 00:54:47,520

across uh from tip to tip uh the

1177

00:54:51,530 --> 00:54:49,859

the hexagons are quite large it's

1178

00:54:54,049 --> 00:54:51,540

amazing to actually be in the clean room

1179

00:54:56,089 --> 00:54:54,059

and look up to see the whole mirror

1180

00:54:59,030 --> 00:54:56,099

assembled towering above you there's no

1181

00:55:00,230 --> 00:54:59,040

amount of seeing it on photos that kind

1182

00:55:03,109 --> 00:55:00,240

of gives you the sense of actually

1183

00:55:04,430 --> 00:55:03,119

standing next to it in a playroom when

1184

00:55:07,549 --> 00:55:04,440

it was assembled

1185

00:55:10,609 --> 00:55:07,559

and as we talked about before and uh

1186

00:55:13,010 --> 00:55:10,619

once it's uh fully into position here

1187

00:55:14,630 --> 00:55:13,020

the final shape that our primary mirror

1188

00:55:20,410 --> 00:55:14,640

is going to be called a tri-contagon

1189

00:55:20,420 --> 00:55:25,609

and everything still looks really good

1190

00:55:25,619 --> 00:55:28,549

it's so full

1191

00:55:37,490 --> 00:55:32,089

will be concave you can sort of just see

1192

00:55:42,470 --> 00:55:40,250

they actually have simulated some some

1193

00:55:50,510 --> 00:55:42,480

stars and things in space that you can

1194

00:55:54,049 --> 00:55:52,549

also as the mirror comes forward and I'm

1195

00:55:55,970 --> 00:55:54,059

not sure that we can see it at this

1196

00:55:58,490 --> 00:55:55,980

angle but there's a thing called it's

1197

00:56:00,829 --> 00:55:58,500

called the bat wing and it's a it's a

1198

00:56:05,270 --> 00:56:00,839

shade that falls down behind the mirror

1199

00:56:08,510 --> 00:56:05,280

to help shade any light or heat that

1200

00:56:09,910 --> 00:56:08,520

might be coming up through the hole in

1201
00:56:13,490 --> 00:56:09,920
the sun shade

1202
00:56:15,770 --> 00:56:13,500
from keeping any of the back side of the

1203
00:56:18,170 --> 00:56:15,780
telescope warm there's one on each side

1204
00:56:23,289 --> 00:56:18,180
that comes down passively as the motor

1205
00:56:28,789 --> 00:56:26,210
the mirrors

1206
00:56:32,109 --> 00:56:28,799
are very small

1207
00:56:34,670 --> 00:56:32,119
I think it's on the order of severeign

1208
00:56:36,829 --> 00:56:34,680
Ops we have reached the end of

1209
00:56:38,569 --> 00:56:36,839
deployment and we are pre-loading into

1210
00:56:40,990 --> 00:56:38,579
the latch pads

1211
00:56:43,549 --> 00:56:41,000
all right

1212
00:56:46,930 --> 00:56:43,559
[Laughter]

1213
00:56:53,089 --> 00:56:46,940

you see people clapping yes

1214

00:56:57,470 --> 00:56:54,770

wow just look at that

1215

00:57:00,829 --> 00:56:57,480

the primary mirror is successfully

1216

00:57:02,870 --> 00:57:00,839

deployed this is a first we have made a

1217

00:57:04,730 --> 00:57:02,880

space Observatory that was the mirror

1218

00:57:06,890 --> 00:57:04,740

was so large that it had to be folded up

1219

00:57:09,490 --> 00:57:06,900

to fit inside the room I don't see at

1220

00:57:12,950 --> 00:57:09,500

this time we're ready to continue with

1221

00:57:14,750 --> 00:57:12,960

693.046 enable activate scs250

1222

00:57:17,530 --> 00:57:14,760

um 240 um

1223

00:57:20,870 --> 00:57:17,540

256.

1224

00:57:23,809 --> 00:57:20,880

I am back that command line looks good

1225

00:57:28,789 --> 00:57:23,819

your go to execute don't be that

1226

00:57:32,510 --> 00:57:30,770

I think you can hear the relief in our

1227

00:57:40,970 --> 00:57:32,520

deployment Ops and you're going to

1228

00:57:45,530 --> 00:57:43,670

I it's I have to say it I I just feel

1229

00:57:47,510 --> 00:57:45,540

this kind of glow you know in my in my

1230

00:57:50,150 --> 00:57:47,520

my chest right now just seeing that that

1231

00:57:52,849 --> 00:57:50,160

mirror all deployed all together

1232

00:57:54,829 --> 00:57:52,859

the um the size of a mirror allows us to

1233

00:57:57,109 --> 00:57:54,839

collect uh more light from fainter

1234

00:57:58,970 --> 00:57:57,119

objects and a lot of cases that means

1235

00:58:01,970 --> 00:57:58,980

farther away objects that light took

1236

00:58:03,770 --> 00:58:01,980

many billions of years to travel to us a

1237

00:58:06,470 --> 00:58:03,780

chance to see the universe as it was

1238

00:58:08,030 --> 00:58:06,480

perhaps uh only a couple hundred million

1239

00:58:10,549 --> 00:58:08,040

years after the start after the big bang

1240

00:58:13,069 --> 00:58:10,559

the sensitivity of this mirror will

1241

00:58:15,710 --> 00:58:13,079

allow that and uh and the size of the

1242

00:58:17,870 --> 00:58:15,720

mirror also gives us a clearer uh higher

1243

00:58:20,329 --> 00:58:17,880

resolution able to see more detail in

1244

00:58:22,069 --> 00:58:20,339

space than ever before so this was

1245

00:58:23,809 --> 00:58:22,079

something that absolutely had to happen

1246

00:58:26,089 --> 00:58:23,819

you know we had to I had to unfold this

1247

00:58:28,849 --> 00:58:26,099

mirror the secondary focusing mirror had

1248

00:58:30,589 --> 00:58:28,859

to come out and uh and then a little bit

1249

00:58:32,630 --> 00:58:30,599

more than a week ago the the amazing sun

1250

00:58:34,789 --> 00:58:32,640

shield and there it is in front of us

1251
00:58:37,490 --> 00:58:34,799
you're looking at this uh this animation

1252
00:58:39,470 --> 00:58:37,500
this is not a pre-made animation this is

1253
00:58:42,410 --> 00:58:39,480
based on actual data coming from the

1254
00:58:44,030 --> 00:58:42,420
telescope to us right now we are live at

1255
00:58:47,510 --> 00:58:44,040
the Space Telescope Science Institute

1256
00:58:50,150 --> 00:58:47,520
and uh we have successfully unfolded the

1257
00:58:52,250 --> 00:58:50,160
the last part of the primary mirror

1258
00:58:53,630 --> 00:58:52,260
after this there is are still more

1259
00:58:55,430 --> 00:58:53,640
commissioning acts to come very

1260
00:58:57,309 --> 00:58:55,440
important ones for uh example focusing

1261
00:59:01,670 --> 00:58:57,319
okay

1262
00:59:03,950 --> 00:59:01,680
56 is active in the delayed state

1263
00:59:06,950 --> 00:59:03,960

and I've confirmed with the depth read

1264

00:59:10,250 --> 00:59:06,960

they're ready to begin this three-door

1265

00:59:12,730 --> 00:59:10,260

um latch off stow and latch to say

1266

00:59:15,770 --> 00:59:12,740

so we're ready to continue with

1267

00:59:18,530 --> 00:59:15,780

693.048 move one of 20.

1268

00:59:20,690 --> 00:59:18,540

popular Sunday window

1269

00:59:31,370 --> 00:59:20,700

and that proc looks good you are going

1270

00:59:36,710 --> 00:59:33,829

uh go through a mouthful of description

1271

00:59:38,329 --> 00:59:36,720

there of what happens next uh there

1272

00:59:41,210 --> 00:59:38,339

there's a

1273

00:59:44,390 --> 00:59:41,220

a hook latch and it's basically really

1274

00:59:47,150 --> 00:59:44,400

that it looks like a a big latch like

1275

00:59:50,510 --> 00:59:47,160

you would hook possibly on a bathroom

1276

00:59:53,750 --> 00:59:50,520

door or a tie down if you were if you

1277

00:59:55,910 --> 00:59:53,760

had tie down straps to hold some some uh

1278

00:59:57,710 --> 00:59:55,920

some packaging onto the back of a

1279

00:59:59,990 --> 00:59:57,720

vehicle

1280

01:00:00,950 --> 01:00:00,000

um it's a it's a it's a it's actually a

1281

01:00:03,950 --> 01:00:00,960

hook

1282

01:00:06,589 --> 01:00:03,960

um and you heard her call it three-door

1283

01:00:08,630 --> 01:00:06,599

and what that means is um it's

1284

01:00:10,670 --> 01:00:08,640

essentially it has a couple of different

1285

01:00:13,849 --> 01:00:10,680

degrees of motion that it can do okay

1286

01:00:18,950 --> 01:00:13,859

and by for perimeter review

1287

01:00:23,270 --> 01:00:20,990

each of each of the latches are a little

1288

01:00:25,490 --> 01:00:23,280

different in in which degrees of freedom

1289

01:00:27,950 --> 01:00:25,500

that they can move in and so the three

1290

01:00:29,270 --> 01:00:27,960

doors can see the parameters look good

1291

01:00:30,849 --> 01:00:29,280

you're going to continue with the motor

1292

01:00:35,510 --> 01:00:30,859

move

1293

01:00:35,520 --> 01:00:41,390

it's one of the types that we have

1294

01:00:45,109 --> 01:00:43,309

this latching procedure will take a

1295

01:00:46,730 --> 01:00:45,119

couple of hours we will be here through

1296

01:00:49,549 --> 01:00:46,740

the entirety of it we will be able to

1297

01:00:52,010 --> 01:00:49,559

tell you when it is complete uh and uh

1298

01:00:53,569 --> 01:00:52,020

we may pause our commentary uh now and

1299

01:00:55,190 --> 01:00:53,579

again that we'll have different guests

1300

01:00:56,750 --> 01:00:55,200

talking about aspects of the engineering

1301
01:00:59,150 --> 01:00:56,760
and science of the James Webb Space

1302
01:01:00,650 --> 01:00:59,160
Telescope through the next few hours and

1303
01:01:02,510 --> 01:01:00,660
uh this uh this procedure will take

1304
01:01:03,950 --> 01:01:02,520
quite a while but can you tell us a

1305
01:01:05,630 --> 01:01:03,960
little bit more about the latching but

1306
01:01:07,789 --> 01:01:05,640
we're going to be uh we're just saying

1307
01:01:10,609 --> 01:01:07,799
in the next few hours Julie

1308
01:01:13,069 --> 01:01:10,619
sure uh there's there's actually several

1309
01:01:15,230 --> 01:01:13,079
latches uh the next one that you'll hear

1310
01:01:17,569 --> 01:01:15,240
her talk about will be one of the two

1311
01:01:18,589 --> 01:01:17,579
doors uh and there's

1312
01:01:21,650 --> 01:01:18,599
um

1313
01:01:24,650 --> 01:01:21,660

there's there's four in total I believe

1314

01:01:26,329 --> 01:01:24,660

and each of these will will come into

1315

01:01:28,130 --> 01:01:26,339

position and then they'll very slowly

1316

01:01:29,450 --> 01:01:28,140

they want to make sure that they don't

1317

01:01:33,470 --> 01:01:29,460

do something that's called like over

1318

01:01:36,470 --> 01:01:33,480

constrained uh and as uh anyone who

1319

01:01:39,650 --> 01:01:36,480

understands how a mechanism might move

1320

01:01:41,750 --> 01:01:39,660

you can you can easily kind of get

1321

01:01:44,750 --> 01:01:41,760

yourself jammed into a position if you

1322

01:01:46,430 --> 01:01:44,760

uh try to tighten one thing before

1323

01:01:48,950 --> 01:01:46,440

you're completely aligned with another

1324

01:01:51,170 --> 01:01:48,960

almost like when you change your tire

1325

01:01:53,210 --> 01:01:51,180

you want to kind of do that star pattern

1326

01:01:55,069 --> 01:01:53,220

to wiggle it into the just the right

1327

01:01:56,510 --> 01:01:55,079

position to make sure it's flat you

1328

01:01:58,670 --> 01:01:56,520

don't want to tighten one of those bolts

1329

01:02:00,230 --> 01:01:58,680

before you before you get the others

1330

01:02:01,789 --> 01:02:00,240

snug and you want to tighten them up in

1331

01:02:03,349 --> 01:02:01,799

a pattern so they'll do the same thing

1332

01:02:06,710 --> 01:02:03,359

with these latches they'll make sure

1333

01:02:08,510 --> 01:02:06,720

that that they're done in a very precise

1334

01:02:10,730 --> 01:02:08,520

order that the different degrees of

1335

01:02:12,529 --> 01:02:10,740

freedoms of each of the latches are

1336

01:02:15,890 --> 01:02:12,539

coming into play in the order that they

1337

01:02:19,309 --> 01:02:15,900

had planned to make sure that they uh

1338

01:02:22,069 --> 01:02:19,319

get that mirror latched in and locked

1339

01:02:24,589 --> 01:02:22,079

down in the absolute best position so

1340

01:02:27,529 --> 01:02:24,599

that those mirrors are in range for what

1341

01:02:29,990 --> 01:02:27,539

they need to do for actually defining

1342

01:02:31,910 --> 01:02:30,000

the surface of that mirror with the

1343

01:02:36,230 --> 01:02:31,920

actuators and motions that will come

1344

01:02:39,289 --> 01:02:37,789

well Julie thank you so much for being

1345

01:02:40,970 --> 01:02:39,299

with us for this procedure uh we're

1346

01:02:43,250 --> 01:02:40,980

going to come back to you later on as

1347

01:02:45,230 --> 01:02:43,260

this happens at the moment we are going

1348

01:02:46,930 --> 01:02:45,240

to uh have one of our expert guests come

1349

01:02:49,870 --> 01:02:46,940

up here

1350

01:02:53,329 --> 01:02:49,880

we are ready to continue with

1351

01:02:54,950 --> 01:02:53,339

693.049 three door latch to save move

1352

01:03:03,589 --> 01:02:54,960

two of 20.

1353

01:03:07,670 --> 01:03:06,349

thank you for having me to continue

1354

01:03:13,730 --> 01:03:07,680

okay we'll come back to you later

1355

01:03:16,549 --> 01:03:15,230

the uh the next person we're going to be

1356

01:03:18,410 --> 01:03:16,559

talking to is the associate

1357

01:03:20,569 --> 01:03:18,420

administrator for science at Nasa Dr

1358

01:03:22,970 --> 01:03:20,579

Thomas circlekin Thomas it is wonderful

1359

01:03:24,950 --> 01:03:22,980

to see you how are you feeling to tell

1360

01:03:27,950 --> 01:03:24,960

me about what you just observed

1361

01:03:29,450 --> 01:03:27,960

oh I'm emotional about it that what an

1362

01:03:31,190 --> 01:03:29,460

amazing Milestone received that

1363

01:03:33,710 --> 01:03:31,200

beautiful pattern out there in the sky

1364

01:03:36,049 --> 01:03:33,720

now almost complete of course it needs

1365

01:03:38,289 --> 01:03:36,059

to latch but what an amazing Milestone

1366

01:03:42,529 --> 01:03:38,299

just ahead of it

1367

01:03:45,289 --> 01:03:42,539

178 out of 178 of these uh you know

1368

01:03:48,289 --> 01:03:45,299

actuators that uh that had to fire the

1369

01:03:50,750 --> 01:03:48,299

right way uh I'm just so amazed and they

1370

01:03:52,910 --> 01:03:50,760

know about this team

1371

01:03:54,170 --> 01:03:52,920

so one of the things that I've just sort

1372

01:03:55,670 --> 01:03:54,180

of I I haven't seen you for a while

1373

01:03:58,309 --> 01:03:55,680

without a mask you know they have a

1374

01:04:00,049 --> 01:03:58,319

solid isolated rooms and uh you're

1375

01:04:01,670 --> 01:04:00,059

you're always clean-shaven you're a

1376

01:04:05,329 --> 01:04:01,680

little bit different today is is there

1377

01:04:07,789 --> 01:04:05,339

is there some story behind that you

1378

01:04:10,309 --> 01:04:07,799

notice right so you know basically what

1379

01:04:12,170 --> 01:04:10,319

happened is after we launched frankly I

1380

01:04:13,670 --> 01:04:12,180

basically said I told my wife I'm not

1381

01:04:15,829 --> 01:04:13,680

going to shave until this entire

1382

01:04:17,390 --> 01:04:15,839

telescope is fully uh deployed this is

1383

01:04:19,609 --> 01:04:17,400

like my favorite sports team when

1384

01:04:22,190 --> 01:04:19,619

they're in the playoffs right you have

1385

01:04:23,870 --> 01:04:22,200

to be sure that you fully support them

1386

01:04:26,630 --> 01:04:23,880

so that's what I'm doing here I can't

1387

01:04:28,100 --> 01:04:26,640

wait to shave uh Michelle my wife says

1388

01:04:31,270 --> 01:04:28,110

like are they done soon

1389

01:04:33,589 --> 01:04:31,280

[Laughter]

1390

01:04:34,789 --> 01:04:33,599

so I mean did that actually gives us a

1391

01:04:37,069 --> 01:04:34,799

chance to talk a bit about what's coming

1392

01:04:38,150 --> 01:04:37,079

out next so you know about how long do

1393

01:04:39,430 --> 01:04:38,160

you think it's going to be until you

1394

01:04:42,529 --> 01:04:39,440

shave

1395

01:04:44,690 --> 01:04:42,539

well I I fully expect assuming that

1396

01:04:46,970 --> 01:04:44,700

everything goes well uh today I fully

1397

01:04:48,650 --> 01:04:46,980

expect to shave today and and I just

1398

01:04:51,710 --> 01:04:48,660

want you to know a lot you know this

1399

01:04:53,930 --> 01:04:51,720

team is basically uh on track within a

1400

01:04:56,210 --> 01:04:53,940

half a day or so of the fastest uh

1401

01:04:58,250 --> 01:04:56,220

schedule that we had to outline frankly

1402

01:05:01,130 --> 01:04:58,260

I sat there today with some of the

1403

01:05:05,829 --> 01:05:01,140

managers and said if you ask somebody uh

1404

01:05:12,950 --> 01:05:08,150

what would you have said I said it's

1405

01:05:15,109 --> 01:05:12,960

massively optimistic unrealistic I I

1406

01:05:17,270 --> 01:05:15,119

think this team is just incredible you

1407

01:05:18,710 --> 01:05:17,280

know back to my sports analogy you know

1408

01:05:20,870 --> 01:05:18,720

we're seeing that the team on the

1409

01:05:23,510 --> 01:05:20,880

playing field and it's just an awesome

1410

01:05:25,910 --> 01:05:23,520

team and frankly kind of over and above

1411

01:05:27,890 --> 01:05:25,920

all expectations that anybody might have

1412

01:05:29,690 --> 01:05:27,900

had

1413

01:05:31,069 --> 01:05:29,700

you're talking about the team you know

1414

01:05:32,750 --> 01:05:31,079

and all coming together but then there

1415

01:05:34,789 --> 01:05:32,760

are also some tremendous challenges that

1416

01:05:35,870 --> 01:05:34,799

this team has faced and you know I know

1417

01:05:37,010 --> 01:05:35,880

that that's something that you've been

1418

01:05:38,870 --> 01:05:37,020

you've been there with the team for

1419

01:05:40,789 --> 01:05:38,880

quite a while now can you give us a

1420

01:05:42,589 --> 01:05:40,799

sense about I mean not only did we have

1421

01:05:45,109 --> 01:05:42,599

covid you know where we were all trying

1422

01:05:46,370 --> 01:05:45,119

to do this and uh be isolated and be

1423

01:05:47,750 --> 01:05:46,380

careful for each other's safety and all

1424

01:05:49,490 --> 01:05:47,760

that but there were there were all kinds

1425

01:05:50,990 --> 01:05:49,500

of other challenges I mean tell us about

1426

01:05:53,150 --> 01:05:51,000

some of the things that you know in your

1427

01:05:55,910 --> 01:05:53,160

years on this Mission you were like wow

1428

01:05:58,130 --> 01:05:55,920

I'm amazed they overcame that

1429

01:06:00,049 --> 01:05:58,140

look um I just want to tell you first

1430

01:06:02,569 --> 01:06:00,059

Michelle I'm I'm uh you know very

1431

01:06:04,430 --> 01:06:02,579

humbled to be part of this uh team right

1432

01:06:06,529 --> 01:06:04,440

now and I know so many others who are

1433

01:06:08,150 --> 01:06:06,539

part of this team for decades before I

1434

01:06:09,170 --> 01:06:08,160

even showed up I've only been part of

1435

01:06:12,529 --> 01:06:09,180

this team

1436

01:06:15,289 --> 01:06:12,539

for uh five years and I'm honored uh to

1437

01:06:16,910 --> 01:06:15,299

be part of the team uh yes uh we've had

1438

01:06:19,490 --> 01:06:16,920

a number of challenges you know if you

1439

01:06:21,890 --> 01:06:19,500

uh of course look at everything that you

1440

01:06:24,230 --> 01:06:21,900

know go backwards uh anything with the

1441

01:06:26,150 --> 01:06:24,240

deployments uh uh some of the challenges

1442

01:06:28,490 --> 01:06:26,160

frankly that the team immediately uh

1443

01:06:30,190 --> 01:06:28,500

addressed uh they made it look easy even

1444

01:06:33,650 --> 01:06:30,200

though some of these challenges frankly

1445

01:06:36,170 --> 01:06:33,660

were tough uh you go back in time

1446

01:06:39,349 --> 01:06:36,180

and of course it's very hard to think

1447

01:06:41,329 --> 01:06:39,359

about uh the grit of this team that that

1448

01:06:44,450 --> 01:06:41,339

we're seeing without thinking of covet

1449

01:06:47,210 --> 01:06:44,460

right I mean uh what's really amazing uh

1450

01:06:49,370 --> 01:06:47,220

uh is how they overcame that right how

1451

01:06:51,770 --> 01:06:49,380

they did not you know they took every

1452

01:06:54,529 --> 01:06:51,780

excuse they could to stay on track right

1453

01:06:57,170 --> 01:06:54,539

that's it so often uh Michelle you know

1454

01:06:59,630 --> 01:06:57,180

uh we sometimes we see teams you know in

1455

01:07:01,309 --> 01:06:59,640

our private lives or even uh you know uh

1456

01:07:03,950 --> 01:07:01,319

elsewhere where where all of a sudden

1457

01:07:06,289 --> 01:07:03,960

you know people take excuses to do not

1458

01:07:09,710 --> 01:07:06,299

fulfill our goals this team found every

1459

01:07:12,529 --> 01:07:09,720

excuse to do so you go back in time and

1460

01:07:15,650 --> 01:07:12,539

you realize you know how hard it is to

1461

01:07:18,109 --> 01:07:15,660

be truly a single team and Michelle it's

1462

01:07:21,289 --> 01:07:18,119

not just the engineers it's our the good

1463

01:07:24,170 --> 01:07:21,299

people on uh on Capitol Hill who are uh

1464

01:07:26,510 --> 01:07:24,180

allocating the budgets uh uh the people

1465

01:07:28,849 --> 01:07:26,520

in the White House you know the all the

1466

01:07:30,650 --> 01:07:28,859

stakeholders there and I think what

1467

01:07:32,390 --> 01:07:30,660

correct Robinson and for me it's it's

1468

01:07:34,609 --> 01:07:32,400

just really important to say that name

1469

01:07:37,789 --> 01:07:34,619

on what he managed to do and kind of

1470

01:07:40,849 --> 01:07:37,799

overcame is really building a team from

1471

01:07:43,370 --> 01:07:40,859

the top all the way to the technician

1472

01:07:45,470 --> 01:07:43,380

the single team and of course that's why

1473

01:07:47,870 --> 01:07:45,480

that's why it's going so well right

1474

01:07:49,670 --> 01:07:47,880

because of you know unified teams you

1475

01:07:51,549 --> 01:07:49,680

know are a beautiful thing to watch and

1476

01:07:55,130 --> 01:07:51,559

yeah

1477

01:07:57,470 --> 01:07:55,140

for a couple minutes and into our move

1478

01:07:59,510 --> 01:07:57,480

to the safe position on the three-door

1479

01:08:02,390 --> 01:07:59,520

latch everything looks really good

1480

01:08:04,130 --> 01:08:02,400

strains are low and the strain offset

1481

01:08:06,470 --> 01:08:04,140

came in right where we wanted it so

1482

01:08:08,089 --> 01:08:06,480

we're looking good

1483

01:08:12,349 --> 01:08:08,099

mom copies that's awesome definitely

1484

01:08:16,010 --> 01:08:13,849

so as the associate administrator for

1485

01:08:18,050 --> 01:08:16,020

science at Nasa uh you know you are a

1486

01:08:20,390 --> 01:08:18,060

scientist and uh you know there's this

1487

01:08:21,950 --> 01:08:20,400

incredible scientific goals with this

1488

01:08:24,110 --> 01:08:21,960

Mission and like we said that this all

1489

01:08:25,550 --> 01:08:24,120

started from from questions you know we

1490

01:08:26,990 --> 01:08:25,560

launched the Hubble Space Telescope we

1491

01:08:29,149 --> 01:08:27,000

understood there was there was so many

1492

01:08:31,130 --> 01:08:29,159

more things to see even farther back in

1493

01:08:32,390 --> 01:08:31,140

time it could give me a sense about some

1494

01:08:34,309 --> 01:08:32,400

of the signs that you're most looking

1495

01:08:35,829 --> 01:08:34,319

forward to hoping that this Mission will

1496

01:08:38,269 --> 01:08:35,839

accomplish

1497

01:08:40,809 --> 01:08:38,279

how much time do you have Michelle right

1498

01:08:44,030 --> 01:08:40,819

I'm not gonna give you like a couple

1499

01:08:46,550 --> 01:08:44,040

but but you know I you know I've been

1500

01:08:48,349 --> 01:08:46,560

I've been doing a lot of reading and

1501

01:08:51,110 --> 01:08:48,359

thinking about this kind of early

1502

01:08:54,349 --> 01:08:51,120

universe and the galaxies and and for me

1503

01:08:57,289 --> 01:08:54,359

you know the the impact potential impact

1504

01:08:59,510 --> 01:08:57,299

of prime more Geo black holes uh in this

1505

01:09:02,149 --> 01:08:59,520

whole discussion really the relationship

1506

01:09:05,030 --> 01:09:02,159

of galaxies and black holes that are so

1507

01:09:06,709 --> 01:09:05,040

tight uh as we look at today's uh

1508

01:09:08,870 --> 01:09:06,719

galaxies kind of in our neighborhood

1509

01:09:11,090 --> 01:09:08,880

like how did that go there for me it

1510

01:09:13,490 --> 01:09:11,100

just boggles my mind you know to think

1511

01:09:15,289 --> 01:09:13,500

of these enormous structures in the

1512

01:09:17,209 --> 01:09:15,299

universe that are in the past I'm going

1513

01:09:18,590 --> 01:09:17,219

to give you a second example I'm

1514

01:09:19,370 --> 01:09:18,600

Michelle and you know of course it's

1515

01:09:21,769 --> 01:09:19,380

about

1516

01:09:24,769 --> 01:09:21,779

finding life elsewhere but I'm going to

1517

01:09:26,570 --> 01:09:24,779

focus on our own solar system we're

1518

01:09:28,910 --> 01:09:26,580

going to take observations make

1519

01:09:30,950 --> 01:09:28,920

observations for example of Europa you

1520

01:09:33,530 --> 01:09:30,960

know we did that with Hubble and there's

1521

01:09:35,149 --> 01:09:33,540

amazing papers out there from in nature

1522

01:09:38,329 --> 01:09:35,159

and science that says hey just

1523

01:09:41,570 --> 01:09:38,339

marginally we can see kind of emissions

1524

01:09:43,910 --> 01:09:41,580

of Europa that kind of are similar to

1525

01:09:46,849 --> 01:09:43,920

Enceladus for example where you know

1526

01:09:50,149 --> 01:09:46,859

water from these subsurface oceans are

1527

01:09:51,829 --> 01:09:50,159

coming out together with uh Organics uh

1528

01:09:53,149 --> 01:09:51,839

at then sellers the question is does

1529

01:09:53,990 --> 01:09:53,159

that happen with Europe and of course

1530

01:09:56,450 --> 01:09:54,000

we're

1531

01:10:00,649 --> 01:09:56,460

moving towards a launch of Clipper and

1532

01:10:02,689 --> 01:10:00,659

24 and we wanna make sure that if there

1533

01:10:04,490 --> 01:10:02,699

are such uh you know emission points

1534

01:10:06,290 --> 01:10:04,500

that we know that because we want to

1535

01:10:09,290 --> 01:10:06,300

take the measurements with that amazing

1536

01:10:11,450 --> 01:10:09,300

Mass spectrometer on uh Clipper a

1537

01:10:13,310 --> 01:10:11,460

similar type of discussions on Mars

1538

01:10:16,250 --> 01:10:13,320

where of course we're in the middle of

1539

01:10:18,050 --> 01:10:16,260

another huge Adventure trying to get the

1540

01:10:21,110 --> 01:10:18,060

samples back in the first round trip to

1541

01:10:23,209 --> 01:10:21,120

another planet and and for me again uh

1542

01:10:26,030 --> 01:10:23,219

observations of the Martian atmosphere

1543

01:10:28,910 --> 01:10:26,040

its composition and its dust components

1544

01:10:31,010 --> 01:10:28,920

are just so critical

1545

01:10:32,930 --> 01:10:31,020

this is something that I I think that

1546

01:10:35,030 --> 01:10:32,940

you know I really enjoyed seeing your

1547

01:10:37,910 --> 01:10:35,040

leadership on in the last years is is no

1548

01:10:40,010 --> 01:10:37,920

Mission stands alone you know we we have

1549

01:10:42,050 --> 01:10:40,020

missions each one supports the other

1550

01:10:43,850 --> 01:10:42,060

that it's not just this Mission then

1551

01:10:45,350 --> 01:10:43,860

that one there's a strategy that

1552

01:10:47,570 --> 01:10:45,360

everything works together so like you

1553

01:10:48,890 --> 01:10:47,580

said for exploring the solar system you

1554

01:10:50,750 --> 01:10:48,900

have something like the web telescope

1555

01:10:53,450 --> 01:10:50,760

which from a distance can see things

1556

01:10:55,189 --> 01:10:53,460

like like Mars Europa places like Titan

1557

01:10:57,470 --> 01:10:55,199

but but then we have missions that are

1558

01:11:00,189 --> 01:10:57,480

uh are poised to go there and explore

1559

01:11:03,169 --> 01:11:00,199

closer up as well

1560

01:11:05,570 --> 01:11:03,179

oh I I strongly believe that right and

1561

01:11:08,870 --> 01:11:05,580

it was so beautiful about nature and so

1562

01:11:10,850 --> 01:11:08,880

be amazing about the science program we

1563

01:11:12,770 --> 01:11:10,860

have at Nasa is data connectedness

1564

01:11:14,750 --> 01:11:12,780

between the different questions that are

1565

01:11:17,630 --> 01:11:14,760

there and and I to me that has always

1566

01:11:20,050 --> 01:11:17,640

been one of the most exciting parts of

1567

01:11:22,729 --> 01:11:20,060

uh studying nature is to see

1568

01:11:25,010 --> 01:11:22,739

relationships that were not innately

1569

01:11:27,530 --> 01:11:25,020

recognized there and I think the more we

1570

01:11:29,689 --> 01:11:27,540

learn about nature and especially in

1571

01:11:31,850 --> 01:11:29,699

astrophysics the more we see some of

1572

01:11:34,010 --> 01:11:31,860

these connections right what you know I

1573

01:11:36,229 --> 01:11:34,020

I'm always saying I'll I read some

1574

01:11:38,270 --> 01:11:36,239

papers not as many as I would like to uh

1575

01:11:39,790 --> 01:11:38,280

Michelle but but nonetheless I read some

1576

01:11:42,950 --> 01:11:39,800

of the papers I realized that

1577

01:11:45,229 --> 01:11:42,960

atmospheric models of exoplanets so

1578

01:11:54,910 --> 01:11:45,239

often are done by our good people and

1579

01:11:54,920 --> 01:11:59,770

haven't changed significantly

1580

01:12:04,010 --> 01:12:02,149

thank you

1581

01:12:05,570 --> 01:12:04,020

listening to the uh listening to assist

1582

01:12:06,950 --> 01:12:05,580

commands from the mock making sure we we

1583

01:12:08,990 --> 01:12:06,960

stay up to date on them

1584

01:12:10,729 --> 01:12:09,000

but uh but but you know absolutely I

1585

01:12:12,649 --> 01:12:10,739

mean you you mentioned the first stars

1586

01:12:14,030 --> 01:12:12,659

and uh there's probably plenty of people

1587

01:12:15,770 --> 01:12:14,040

in the audience that that don't really

1588

01:12:17,330 --> 01:12:15,780

know your background as the scientists I

1589

01:12:19,189 --> 01:12:17,340

mean maybe a little sense about your

1590

01:12:22,430 --> 01:12:19,199

scientific expertise and how you came to

1591

01:12:25,550 --> 01:12:22,440

be associate administrator of NASA

1592

01:12:27,530 --> 01:12:25,560

well so I I studied astrophysics and you

1593

01:12:30,050 --> 01:12:27,540

know uh uh you know I was really

1594

01:12:31,850 --> 01:12:30,060

inspired by some of these uh missions

1595

01:12:33,590 --> 01:12:31,860

frankly I remember when I was eight

1596

01:12:35,330 --> 01:12:33,600

years old I got this book about the

1597

01:12:38,209 --> 01:12:35,340

Voyager missions and some of these

1598

01:12:40,370 --> 01:12:38,219

telescope that Nancy Grace Roman right

1599

01:12:43,310 --> 01:12:40,380

uh it really started imagining that was

1600

01:12:45,830 --> 01:12:43,320

in the 70s uh when I got this book and

1601

01:12:47,870 --> 01:12:45,840

that inspired me out of the Little

1602

01:12:49,850 --> 01:12:47,880

Mountain Village in Switzerland to be

1603

01:12:52,250 --> 01:12:49,860

where I am right now I'm an

1604

01:12:54,470 --> 01:12:52,260

astrophysicist but I mostly focused uh

1605

01:12:56,450 --> 01:12:54,480

my work about the Sun and kind of the

1606

01:12:58,729 --> 01:12:56,460

inner solar system so I know how to do

1607

01:13:00,470 --> 01:12:58,739

mass spectrometers and I've worked with

1608

01:13:02,570 --> 01:13:00,480

teams and you know what I fell in love

1609

01:13:05,390 --> 01:13:02,580

with Michelle is really the ability of

1610

01:13:08,209 --> 01:13:05,400

working with amazing teams uh when I see

1611

01:13:10,550 --> 01:13:08,219

a team whether it's in athletics uh you

1612

01:13:13,189 --> 01:13:10,560

know or whether I see it in this control

1613

01:13:14,990 --> 01:13:13,199

room right there uh team that is truly

1614

01:13:18,530 --> 01:13:15,000

operating at their highest capability

1615

01:13:20,689 --> 01:13:18,540

I'm so excited to see it it's the most

1616

01:13:22,310 --> 01:13:20,699

beautiful thing but I'm also gives me so

1617

01:13:24,649 --> 01:13:22,320

much hope of all these other things

1618

01:13:26,149 --> 01:13:24,659

things we can do so so when I look at

1619

01:13:28,070 --> 01:13:26,159

astrophysics of course I think of the

1620

01:13:29,689 --> 01:13:28,080

classes and so many of the things that I

1621

01:13:31,910 --> 01:13:29,699

learned in the late 90s that are no

1622

01:13:34,910 --> 01:13:31,920

longer true and that's what science is

1623

01:13:36,890 --> 01:13:34,920

about because we learn all the time and

1624

01:13:39,530 --> 01:13:36,900

can you imagine even in five years from

1625

01:13:41,270 --> 01:13:39,540

now how classes everywhere around the

1626

01:13:43,910 --> 01:13:41,280

world will be affected by this very

1627

01:13:46,370 --> 01:13:43,920

amazing Observatory that's being set up

1628

01:13:49,310 --> 01:13:47,930

yeah there's going to be some very very

1629

01:13:50,930 --> 01:13:49,320

profound things I mean you were talking

1630

01:13:53,810 --> 01:13:50,940

about looking at some of the first

1631

01:13:55,610 --> 01:13:53,820

galaxies to form and this of course is

1632

01:13:57,050 --> 01:13:55,620

one of the reasons why we have an

1633

01:13:58,729 --> 01:13:57,060

infrared telescope which is different

1634

01:14:00,890 --> 01:13:58,739

from Hubble which was largely an

1635

01:14:02,870 --> 01:14:00,900

invisible light infrared actually allows

1636

01:14:04,610 --> 01:14:02,880

us to see and to some extent farther

1637

01:14:05,930 --> 01:14:04,620

back in time farther away in the

1638

01:14:07,970 --> 01:14:05,940

universe where the expansion of the

1639

01:14:09,770 --> 01:14:07,980

universe has actually stretched out the

1640

01:14:11,630 --> 01:14:09,780

light from visible light into the

1641

01:14:13,070 --> 01:14:11,640

infrared wavelengths and you mentioned

1642

01:14:15,229 --> 01:14:13,080

this close relationship between black

1643

01:14:17,030 --> 01:14:15,239

holes and galaxies I mean a lot of our

1644

01:14:18,830 --> 01:14:17,040

viewers out there probably don't realize

1645

01:14:20,510 --> 01:14:18,840

that we are orbiting around a giant

1646

01:14:22,490 --> 01:14:20,520

black hole right now at about half a

1647

01:14:23,750 --> 01:14:22,500

million miles an hour uh the giant black

1648

01:14:25,610 --> 01:14:23,760

hole in the middle of the the center of

1649

01:14:27,169 --> 01:14:25,620

the Galaxy and there seems to be some

1650

01:14:29,149 --> 01:14:27,179

relationship between how galaxies form

1651

01:14:31,370 --> 01:14:29,159

and how black holes form but there's

1652

01:14:34,430 --> 01:14:31,380

there's a real mystery about these big

1653

01:14:36,830 --> 01:14:34,440

black holes that we see so far away and

1654

01:14:38,450 --> 01:14:36,840

therefore so so far back in time maybe

1655

01:14:39,770 --> 01:14:38,460

give us a little more sense about this

1656

01:14:42,470 --> 01:14:39,780

is one of the things that as an

1657

01:14:45,229 --> 01:14:42,480

astrophysicist we look at we say I don't

1658

01:14:47,570 --> 01:14:45,239

understand how that happened

1659

01:14:49,970 --> 01:14:47,580

right it's it's truly a chicken and egg

1660

01:14:52,189 --> 01:14:49,980

problem right kind of right now it seems

1661

01:14:54,229 --> 01:14:52,199

to be the case that black horse and

1662

01:14:56,990 --> 01:14:54,239

galaxies really coexist right it's

1663

01:14:58,729 --> 01:14:57,000

actually really hard to find a Galaxy in

1664

01:15:00,770 --> 01:14:58,739

which there's no black hole there it

1665

01:15:03,350 --> 01:15:00,780

really seems that it's a really

1666

01:15:06,290 --> 01:15:03,360

important part of uh of the galactic

1667

01:15:08,810 --> 01:15:06,300

Evolution but how does that start is uh

1668

01:15:11,149 --> 01:15:08,820

is the black hole first what is the role

1669

01:15:12,169 --> 01:15:11,159

of the black holes uh uh you know from

1670

01:15:14,390 --> 01:15:12,179

the beginning you talked about the

1671

01:15:16,790 --> 01:15:14,400

interconnectedness uh Michelle we're

1672

01:15:20,510 --> 01:15:16,800

right now setting up a small telescope

1673

01:15:23,090 --> 01:15:20,520

we launched a few uh weeks ago uh XP you

1674

01:15:26,209 --> 01:15:23,100

know at the polarimetry Explorer uh that

1675

01:15:28,130 --> 01:15:26,219

uh and that and hopefully next week uh

1676

01:15:30,950 --> 01:15:28,140

we'll be able to give kind of first

1677

01:15:33,050 --> 01:15:30,960

slide of that kind of X-ray observation

1678

01:15:35,510 --> 01:15:33,060

kind of again providing new insights

1679

01:15:37,370 --> 01:15:35,520

about some of these uh kind of more

1680

01:15:39,050 --> 01:15:37,380

recent black calls kind of really trying

1681

01:15:41,930 --> 01:15:39,060

to understand what the mechanisms really

1682

01:15:43,970 --> 01:15:41,940

are and that that in that in those black

1683

01:15:46,189 --> 01:15:43,980

holes but also uh the environment around

1684

01:15:47,990 --> 01:15:46,199

it for example the roles of magnetic

1685

01:15:51,169 --> 01:15:48,000

fields that are so critical in so many

1686

01:15:55,790 --> 01:15:53,750

I know for me one of the things is

1687

01:15:57,050 --> 01:15:55,800

looking at the universe in the case of

1688

01:15:59,990 --> 01:15:57,060

Hubble we've

1689

01:16:01,850 --> 01:16:00,000

we met holes that are are gigantic they

1690

01:16:03,830 --> 01:16:01,860

are millions of times the mass of the

1691

01:16:06,229 --> 01:16:03,840

Sun and we're seeing them at a time when

1692

01:16:08,630 --> 01:16:06,239

the universe was only say you know 500

1693

01:16:10,550 --> 01:16:08,640

million years old and black holes you

1694

01:16:13,550 --> 01:16:10,560

know we tend to think of as being formed

1695

01:16:14,870 --> 01:16:13,560

by stars that die but you know when you

1696

01:16:17,510 --> 01:16:14,880

think about the universe being that

1697

01:16:20,630 --> 01:16:17,520

young you know how did such a huge black

1698

01:16:22,790 --> 01:16:20,640

hole form that quickly and as a as an

1699

01:16:24,350 --> 01:16:22,800

astrophysicist myself that studies stars

1700

01:16:26,450 --> 01:16:24,360

one of the things that I'm hoping web

1701

01:16:27,890 --> 01:16:26,460

will shed some light on is the fact that

1702

01:16:30,110 --> 01:16:27,900

the very first stars in the universe

1703

01:16:32,149 --> 01:16:30,120

might have been quite different than the

1704

01:16:33,110 --> 01:16:32,159

Stars today and maybe maybe that's

1705

01:16:35,330 --> 01:16:33,120

something you can give us a little bit

1706

01:16:37,310 --> 01:16:35,340

of an idea why why would the first Stars

1707

01:16:39,890 --> 01:16:37,320

be that much different from the Stars we

1708

01:16:41,990 --> 01:16:39,900

see around us right now

1709

01:16:43,970 --> 01:16:42,000

I think it's a really great question and

1710

01:16:46,790 --> 01:16:43,980

I think it's one of the most amazing

1711

01:16:49,310 --> 01:16:46,800

parts of uh really talking about how we

1712

01:16:51,590 --> 01:16:49,320

relate to our universe and that is that

1713

01:16:53,870 --> 01:16:51,600

of course when the universe starts uh at

1714

01:16:57,110 --> 01:16:53,880

the beginning that Adam's that form

1715

01:16:59,270 --> 01:16:57,120

really are much less rich in terms of

1716

01:17:02,510 --> 01:16:59,280

diversity than we have today you know on

1717

01:17:05,209 --> 01:17:02,520

my hands I have gold and platinum uh

1718

01:17:07,490 --> 01:17:05,219

rings that my wife gave me and uh we

1719

01:17:09,229 --> 01:17:07,500

know that those are not from the

1720

01:17:11,930 --> 01:17:09,239

beginning of the universe frankly they

1721

01:17:14,330 --> 01:17:11,940

come from neutron stars that are merging

1722

01:17:16,370 --> 01:17:14,340

that are much much later kind of after a

1723

01:17:18,590 --> 01:17:16,380

lifetime of a star so so when you look

1724

01:17:20,510 --> 01:17:18,600

at the first Stars you know like what

1725

01:17:24,470 --> 01:17:20,520

you have kind of the material you build

1726

01:17:26,630 --> 01:17:24,480

with is much lighter than stars that are

1727

01:17:29,510 --> 01:17:26,640

kind of that most of the stars that were

1728

01:17:31,850 --> 01:17:29,520

looking at night through a telescope

1729

01:17:34,430 --> 01:17:31,860

because those stars are Next Generation

1730

01:17:36,890 --> 01:17:34,440

stars in so many of the cases with much

1731

01:17:38,330 --> 01:17:36,900

heavier components that are there so the

1732

01:17:40,430 --> 01:17:38,340

question really is how do you build

1733

01:17:42,050 --> 01:17:40,440

those first stars and and for frankly

1734

01:17:43,729 --> 01:17:42,060

how do they then kick off that

1735

01:17:46,370 --> 01:17:43,739

evolutionary process there's a lot of

1736

01:17:47,990 --> 01:17:46,380

models and the data will of course

1737

01:17:50,030 --> 01:17:48,000

constrain these models that's what we

1738

01:17:52,250 --> 01:17:50,040

call learning right kind of it's say

1739

01:17:54,050 --> 01:17:52,260

this model is correct this model is not

1740

01:17:56,030 --> 01:17:54,060

correct and by the way there's some an

1741

01:17:58,310 --> 01:17:56,040

observation that none of the models

1742

01:18:00,050 --> 01:17:58,320

predicts which is the element of

1743

01:18:01,910 --> 01:18:00,060

surprise we can always bet on the

1744

01:18:03,890 --> 01:18:01,920

element of surprise Michelle frankly

1745

01:18:05,990 --> 01:18:03,900

often the surprising parts are the most

1746

01:18:07,729 --> 01:18:06,000

important ones

1747

01:18:09,410 --> 01:18:07,739

I sort of like that we're talking about

1748

01:18:11,090 --> 01:18:09,420

the history of chemical elements but in

1749

01:18:13,910 --> 01:18:11,100

there is always the element of surprise

1750

01:18:16,610 --> 01:18:13,920

yes the um you know the universe began

1751

01:18:18,290 --> 01:18:16,620

you know with hydrogen and helium you

1752

01:18:19,970 --> 01:18:18,300

know a tiny tiny little bit of a couple

1753

01:18:21,410 --> 01:18:19,980

other elements but as you mentioned

1754

01:18:22,970 --> 01:18:21,420

everything that really makes us up

1755

01:18:25,430 --> 01:18:22,980

things that make up a human body like

1756

01:18:27,110 --> 01:18:25,440

carbon or the calcium in our teeth or or

1757

01:18:30,050 --> 01:18:27,120

phosphorus or sulfur of the things that

1758

01:18:32,870 --> 01:18:30,060

we need for a DNA we have completed this

1759

01:18:34,610 --> 01:18:32,880

move of the three-door latch to save

1760

01:18:40,750 --> 01:18:34,620

so we're going to proceed with the

1761

01:18:45,590 --> 01:18:43,010

one of the things

1762

01:18:47,810 --> 01:18:45,600

hoping that the James Webb Observatory

1763

01:18:50,330 --> 01:18:47,820

will shed some light on is what the

1764

01:18:52,310 --> 01:18:50,340

universe was like before most of that

1765

01:18:54,350 --> 01:18:52,320

formed I mean really the origins of the

1766

01:18:56,030 --> 01:18:54,360

stuff that we are coming from but

1767

01:19:00,130 --> 01:18:56,040

there's another part of our origin too

1768

01:19:04,070 --> 01:19:00,140

you mentioned you know in five years

1769

01:19:06,290 --> 01:19:04,080

though that is the motor move 3 of 20

1770

01:19:07,610 --> 01:19:06,300

the command line looks good you're going

1771

01:19:13,070 --> 01:19:07,620

to execute

1772

01:19:20,810 --> 01:19:15,410

and you're going to continue I hope you

1773

01:19:24,709 --> 01:19:22,430

one of the things that I'm really

1774

01:19:26,570 --> 01:19:24,719

looking forward to is being able to uh

1775

01:19:29,270 --> 01:19:26,580

maybe in a few years from now point to a

1776

01:19:31,370 --> 01:19:29,280

star in this up in the sky and say that

1777

01:19:34,430 --> 01:19:31,380

there's a planet around that star that

1778

01:19:37,010 --> 01:19:34,440

has an environment similar to us here on

1779

01:19:38,990 --> 01:19:37,020

Earth maybe to take us through how how

1780

01:19:41,270 --> 01:19:39,000

will God do that how will I be able to

1781

01:19:43,430 --> 01:19:41,280

explore what the actual environments on

1782

01:19:46,669 --> 01:19:43,440

planets that far away around other stars

1783

01:19:49,310 --> 01:19:46,679

how will I be able to do that

1784

01:19:51,530 --> 01:19:49,320

so if you go back in time of the earth

1785

01:19:53,750 --> 01:19:51,540

of course long before we were here

1786

01:19:56,689 --> 01:19:53,760

uh the atmosphere of our planet was very

1787

01:19:57,790 --> 01:19:56,699

different and uh frankly the emergence

1788

01:20:00,110 --> 01:19:57,800

of Life

1789

01:20:03,410 --> 01:20:00,120

the atmosphere you can open that

1790

01:20:06,169 --> 01:20:03,420

Goldilocks song right now

1791

01:20:07,910 --> 01:20:06,179

the emergence of uh of life really

1792

01:20:09,830 --> 01:20:07,920

changed the atmosphere frankly there's a

1793

01:20:11,810 --> 01:20:09,840

number of uh papers out there that said

1794

01:20:14,209 --> 01:20:11,820

a large fraction of the nitrogen in our

1795

01:20:16,129 --> 01:20:14,219

atmosphere may very well be from the

1796

01:20:19,550 --> 01:20:16,139

emergence of life there's other of

1797

01:20:22,129 --> 01:20:19,560

course elements oxygen type of uh you

1798

01:20:24,410 --> 01:20:22,139

know ozone uh kind of elements like that

1799

01:20:27,350 --> 01:20:24,420

that really come of course are very much

1800

01:20:30,729 --> 01:20:27,360

part of that cycle of life that is here

1801

01:20:34,450 --> 01:20:30,739

so as we look at others monetary

1802

01:20:38,629 --> 01:20:34,460

what are the patterns there

1803

01:20:41,810 --> 01:20:38,639

are indicative of the presence both the

1804

01:20:44,149 --> 01:20:41,820

ability to have life there but even in

1805

01:20:46,729 --> 01:20:44,159

some cases kind of the the follow-up or

1806

01:20:48,709 --> 01:20:46,739

kind of the consistency with life uh

1807

01:20:50,689 --> 01:20:48,719

there is certainly from what we've

1808

01:20:53,570 --> 01:20:50,699

learned here but perhaps also other

1809

01:20:55,010 --> 01:20:53,580

versions that we yet have to

1810

01:20:57,530 --> 01:20:55,020

um well we have to learn of course

1811

01:20:59,810 --> 01:20:57,540

what's so hard about life is we have n

1812

01:21:02,450 --> 01:20:59,820

equals one we know only one life all

1813

01:21:04,430 --> 01:21:02,460

life on Earth is related and and you

1814

01:21:06,290 --> 01:21:04,440

know we learned a lot when went from one

1815

01:21:08,629 --> 01:21:06,300

solar system to many solar systems

1816

01:21:11,090 --> 01:21:08,639

Stellar systems you know frankly many of

1817

01:21:13,610 --> 01:21:11,100

the models crumbled within weeks of the

1818

01:21:17,090 --> 01:21:13,620

first observations that were published

1819

01:21:19,790 --> 01:21:17,100

in 1995 so when we look at life I'm sure

1820

01:21:23,330 --> 01:21:19,800

similar things will happen but for me

1821

01:21:26,629 --> 01:21:25,010

well that's absolutely wonderful so so

1822

01:21:28,490 --> 01:21:26,639

once again we're speaking to Dr Thomas

1823

01:21:30,290 --> 01:21:28,500

rebutin he's the associate administrator

1824

01:21:32,030 --> 01:21:30,300

for science at Nasa

1825

01:21:33,890 --> 01:21:32,040

um Thomas and our audience out there

1826

01:21:35,270 --> 01:21:33,900

we're going to take a short break we're

1827

01:21:37,370 --> 01:21:35,280

going to take a pause in the commentary

1828

01:21:39,590 --> 01:21:37,380

and we will be coming back at 11 o'clock

1829

01:21:41,450 --> 01:21:39,600

in the morning Eastern Standard Time to

1830

01:21:43,370 --> 01:21:41,460

resume our commentary but Thomas thank

1831

01:21:45,350 --> 01:21:43,380

you so much for joining us what an

1832

01:21:48,470 --> 01:21:45,360

exciting day as you said very emotional

1833

01:21:49,850 --> 01:21:48,480

and uh and and uh I'm just so pleased to

1834

01:21:52,070 --> 01:21:49,860

be able to be here

1835

01:21:53,570 --> 01:21:52,080

on the floor beneath you

1836

01:21:55,189 --> 01:21:53,580

so I'll wave to you from down in the

1837

01:21:57,590 --> 01:21:55,199

building

1838

01:21:59,870 --> 01:21:57,600

yeah I just do want to thank you for all

1839

01:22:01,490 --> 01:21:59,880

the amazing work you've been doing um

1840

01:22:03,770 --> 01:22:01,500

Michelle it's just been wonderful I've

1841

01:22:05,750 --> 01:22:03,780

watched you many times uh from different

1842

01:22:07,610 --> 01:22:05,760

locations I know you have exactly the

1843

01:22:09,290 --> 01:22:07,620

same passion I do about this amazing

1844

01:22:12,169 --> 01:22:09,300

science and you can't wait to get those

1845

01:22:13,669 --> 01:22:12,179

data back in just a few months time

1846

01:22:15,050 --> 01:22:13,679

absolutely

1847

01:22:16,430 --> 01:22:15,060

thank you so much for joining us and

1848

01:22:18,350 --> 01:22:16,440

we'll be back in our commentary just a

1849

01:22:22,930 --> 01:22:18,360

few minutes

1850

01:22:22,940 --> 01:22:36,830

yeah yeah

1851
01:22:40,610 --> 01:22:38,689
okay and I would see that motor move

1852
01:22:42,010 --> 01:22:40,620
completed successfully we're ready to

1853
01:22:45,470 --> 01:22:42,020
continue with

1854
01:22:48,890 --> 01:22:45,480
693.052 it's the door latch to safe mode

1855
01:22:52,610 --> 01:22:50,450
it's not just on the win

1856
01:22:54,770 --> 01:22:52,620
and that command line looks good you're

1857
01:22:57,350 --> 01:22:54,780
going to execute

1858
01:23:00,290 --> 01:22:57,360
okay excuse me go ahead and Mr good

1859
01:23:43,550 --> 01:23:02,750
and you're going to continue hope we go

1860
01:23:47,629 --> 01:23:45,770
and stand by while we review the

1861
01:23:57,790 --> 01:23:47,639
parameters

1862
01:23:57,800 --> 01:24:46,430
go to continue with the move to continue

1863
01:24:51,350 --> 01:24:48,709

and I see the mirror movies in progress

1864

01:24:53,990 --> 01:24:51,360

this will take about 14 minutes

1865

01:27:34,910 --> 01:24:54,000

coffee for two minutes well let's stand

1866

01:27:38,629 --> 01:27:37,370

for the depth lead on Ops with the

1867

01:27:42,470 --> 01:27:38,639

status

1868

01:27:45,590 --> 01:27:42,480

um we are on step four of 20 of latching

1869

01:27:47,990 --> 01:27:45,600

we're latching the two-door to the safe

1870

01:27:48,890 --> 01:27:48,000

position uh into it a couple of minutes

1871

01:27:51,470 --> 01:27:48,900

now

1872

01:27:55,490 --> 01:27:51,480

again strains look really good nice and

1873

01:28:01,070 --> 01:27:55,500

low and our strain offset is uh matched

1874

01:28:01,080 --> 01:31:33,530

excellent mom copies thank you

1875

01:31:38,390 --> 01:31:35,930

this is definitely done Ops we are

1876
01:31:41,270 --> 01:31:38,400
halfway through this uh latching to the

1877
01:31:46,430 --> 01:31:41,280
safe position on the two-door and

1878
01:31:46,440 --> 01:31:56,209
welcome back to our live commentary

1879
01:31:59,810 --> 01:31:57,950
if you're joining us right now you're

1880
01:32:01,129 --> 01:31:59,820
looking at live coverage of the

1881
01:32:03,290 --> 01:32:01,139
commissioning of the James Webb Space

1882
01:32:04,910 --> 01:32:03,300
Telescope I'm here at the Space

1883
01:32:05,930 --> 01:32:04,920
Telescope Science Institute in Baltimore

1884
01:32:07,850 --> 01:32:05,940
Maryland

1885
01:32:10,729 --> 01:32:07,860
and what you're seeing on the screen

1886
01:32:13,010 --> 01:32:10,739
above me is a live live footage from the

1887
01:32:14,870 --> 01:32:13,020
mock Mission operations center for the

1888
01:32:17,810 --> 01:32:14,880

James Webb Space Telescope and then to

1889

01:32:20,810 --> 01:32:17,820

my left is an observatory visualization

1890

01:32:22,970 --> 01:32:20,820

tool which is showing you real-time data

1891

01:32:25,129 --> 01:32:22,980

Telemetry as they say from the James

1892

01:32:27,229 --> 01:32:25,139

Webb Space Telescope which is now over

1893

01:32:29,750 --> 01:32:27,239

600 000 miles away from us on its way

1894

01:32:32,570 --> 01:32:29,760

out to uh and orbit about A Million

1895

01:32:33,350 --> 01:32:32,580

Miles Away past the moon L2 the LaGrange

1896

01:32:35,689 --> 01:32:33,360

point

1897

01:32:38,990 --> 01:32:35,699

and just a few minutes ago we

1898

01:32:41,209 --> 01:32:39,000

successfully deployed the uh the final

1899

01:32:43,910 --> 01:32:41,219

part of the primary mirror the side Wing

1900

01:32:46,729 --> 01:32:43,920

So this has been a a wonderful morning

1901

01:32:49,370 --> 01:32:46,739

so far here in Baltimore we still have a

1902

01:33:21,590 --> 01:32:49,380

few hours oh as they latch this primary

1903

01:38:08,930 --> 01:33:53,870

foreign

1904

01:38:13,729 --> 01:38:11,090

so there's a step lead on Ops with the

1905

01:38:17,209 --> 01:38:13,739

status we've just completed the two-door

1906

01:38:20,270 --> 01:38:17,219

move to Safe position uh so now we're in

1907

01:38:26,870 --> 01:38:20,280

a position to stop the deployment motor

1908

01:38:26,880 --> 01:38:34,729

possible

1909

01:38:39,470 --> 01:38:37,790

let's see there's the step up sign up so

1910

01:38:41,870 --> 01:38:39,480

um per depth lead that murder myth

1911

01:38:43,330 --> 01:38:41,880

completed successfully we are going to

1912

01:38:48,109 --> 01:38:43,340

continue at

1913

01:38:51,890 --> 01:38:48,119

693.054 to determinate scf-256

1914

01:38:56,270 --> 01:38:53,510

that command line looks good you're

1915

01:38:57,350 --> 01:38:56,280

going to execute poppy you see how

1916

01:39:03,830 --> 01:38:57,360

devoted

1917

01:39:10,070 --> 01:39:05,750

you're going to terminate

1918

01:39:53,330 --> 01:39:11,810

you have to go

1919

01:39:57,709 --> 01:39:56,149

is complete

1920

01:40:00,169 --> 01:39:57,719

possible

1921

01:40:03,530 --> 01:40:00,179

and I see this with step UPS you are

1922

01:40:06,350 --> 01:40:03,540

going to disable scsid 256

1923

01:40:08,149 --> 01:40:06,360

that's 55. the command line looks good

1924

01:40:16,850 --> 01:40:08,159

you're going to execute

1925

01:40:20,810 --> 01:40:19,370

and you're going to disable so we go to

1926

01:40:45,050 --> 01:40:20,820

disable

1927

01:40:45,060 --> 01:40:49,570

rtcp is complete okay

1928

01:40:55,669 --> 01:40:53,270

k-n-o-c-u-r go to execute the deu stop

1929

01:40:57,229 --> 01:40:55,679

deploy at five six

1930

01:40:59,689 --> 01:40:57,239

that command line looks good you're

1931

01:41:03,950 --> 01:40:59,699

going to execute copy that do you see

1932

01:41:07,310 --> 01:41:05,689

and you're going to continue

1933

01:41:28,970 --> 01:41:07,320

hope you go to continue

1934

01:41:34,430 --> 01:41:31,550

rtcp is complete

1935

01:41:36,590 --> 01:41:34,440

you'll see devops can confirm that the

1936

01:41:39,649 --> 01:41:36,600

motor is stopped we're ready for two

1937

01:41:42,530 --> 01:41:39,659

nine six nine three zero five seven d EU

1938

01:41:45,770 --> 01:41:44,149

and the command line looks good you're

1939

01:41:52,070 --> 01:41:45,780

going to execute

1940

01:42:34,189 --> 01:41:53,870

you're gonna continue

1941

01:42:39,790 --> 01:42:36,709

the devops can confirm standby round

1942

01:42:45,970 --> 01:42:39,800

robin I see we're ready for step

1943

01:42:55,490 --> 01:42:48,530

and that proc looks good you're going to

1944

01:42:55,500 --> 01:43:20,990

is you're going to continue

1945

01:43:24,169 --> 01:43:22,910

the time we'll have some chance to uh to

1946

01:43:26,270 --> 01:43:24,179

recap some of the story of the James

1947

01:43:27,890 --> 01:43:26,280

Webb Space Telescope as well as talk to

1948

01:43:30,109 --> 01:43:27,900

some of the expert scientists engineers

1949

01:43:31,970 --> 01:43:30,119

that are working on that so if you're

1950

01:43:34,010 --> 01:43:31,980

just joining us you can also talk to us

1951

01:43:37,010 --> 01:43:34,020

on social media we ask that you use the

1952

01:43:38,750 --> 01:43:37,020

hashtag unfold the universe so hashtag

1953

01:43:41,570 --> 01:43:38,760

unfold the universe and we'll get to as

1954

01:43:43,609 --> 01:43:41,580

many as those questions as possible

1955

01:43:45,709 --> 01:43:43,619

so this has really been a momentous day

1956

01:43:47,689 --> 01:43:45,719

everybody is very happy with how things

1957

01:43:49,129 --> 01:43:47,699

have proceeded I think that it's a

1958

01:43:51,169 --> 01:43:49,139

really nice chance to kind of go back

1959

01:43:52,609 --> 01:43:51,179

and talk a bit about the larger story of

1960

01:43:54,649 --> 01:43:52,619

how the James Webb spells Space

1961

01:43:57,290 --> 01:43:54,659

Telescope got to where it is today over

1962

01:43:59,270 --> 01:43:57,300

600 000 miles out in space headed toward

1963

01:44:01,010 --> 01:43:59,280

a LaGrange point a balance between the

1964

01:44:03,350 --> 01:44:01,020

Sun and the Earth's gravity where it

1965

01:44:04,850 --> 01:44:03,360

will uh hopefully have many years ahead

1966

01:44:07,310 --> 01:44:04,860

of it observing the early universe

1967

01:44:09,830 --> 01:44:07,320

exoplanets and all things like that

1968

01:44:12,050 --> 01:44:09,840

so the uh that this telescope has

1969

01:44:15,050 --> 01:44:12,060

actually been uh in development for many

1970

01:44:17,030 --> 01:44:15,060

many years a lot of people say that 1995

1971

01:44:18,830 --> 01:44:17,040

was the time when it began when we

1972

01:44:20,570 --> 01:44:18,840

started planning for this Observatory

1973

01:44:22,669 --> 01:44:20,580

and what you're seeing now is some

1974

01:44:25,250 --> 01:44:22,679

footage of actually putting together the

1975

01:44:26,629 --> 01:44:25,260

primary mirror uh much of this work but

1976

01:44:28,430 --> 01:44:26,639

building the primary mirror and the

1977

01:44:30,109 --> 01:44:28,440

observatory and testing it was done at

1978

01:44:31,910 --> 01:44:30,119

Goddard space flight center these are

1979

01:44:33,649 --> 01:44:31,920

acoustic and vibration tests which were

1980

01:44:35,750 --> 01:44:33,659

necessary to make sure the telescope

1981

01:44:38,629 --> 01:44:35,760

could withstand the pressures of launch

1982

01:44:40,490 --> 01:44:38,639

so there's our acoustic test chamber and

1983

01:44:43,430 --> 01:44:40,500

you can see there there the telescope is

1984

01:44:45,590 --> 01:44:43,440

wrapped keep it clean this is a vacuum

1985

01:44:47,629 --> 01:44:45,600

test that was done at the Johnson Space

1986

01:44:49,790 --> 01:44:47,639

Center in Houston this is what we call

1987

01:44:52,370 --> 01:44:49,800

chamber a this is the largest vacuum

1988

01:44:54,530 --> 01:44:52,380

chamber that NASA has and this was made

1989

01:44:56,750 --> 01:44:54,540

during the Apollo era it was actually

1990

01:44:58,310 --> 01:44:56,760

large enough to fit full command modules

1991

01:45:01,010 --> 01:44:58,320

of the Apollo mission in there to test

1992

01:45:02,990 --> 01:45:01,020

so what you're seeing now on the screen

1993

01:45:04,310 --> 01:45:03,000

in front of you right now is live

1994

01:45:06,229 --> 01:45:04,320

footage from the mock the vision

1995

01:45:08,450 --> 01:45:06,239

operations center that's right above me

1996

01:45:10,910 --> 01:45:08,460

as I'm speaking to you and to the left

1997

01:45:13,129 --> 01:45:10,920

is our Observatory visualization tool

1998

01:45:15,470 --> 01:45:13,139

this is a computer-generated image but

1999

01:45:16,669 --> 01:45:15,480

this is a live image generated by data

2000

01:45:19,070 --> 01:45:16,679

that's actually coming from the

2001
01:45:21,470 --> 01:45:19,080
telescope as we speak so what happened

2002
01:45:23,629 --> 01:45:21,480
just a few minutes ago was the the

2003
01:45:27,050 --> 01:45:23,639
starboard side of the primary mirror the

2004
01:45:28,550 --> 01:45:27,060
mirror Wing was released into place and

2005
01:45:31,010 --> 01:45:28,560
uh and that's an incredible

2006
01:45:34,490 --> 01:45:31,020
accomplishment the the mirror is now

2007
01:45:39,550 --> 01:45:34,500
fully unable and uh that's uh for all of

2008
01:45:46,609 --> 01:45:41,990
incredible Joy Joy command line Looks

2009
01:45:49,850 --> 01:45:48,350
you'll hear me pause as I listen to

2010
01:45:51,109 --> 01:45:49,860
what's happening in the control room uh

2011
01:45:57,410 --> 01:45:51,119
they are just making sure that all the

2012
01:46:00,709 --> 01:45:59,149
and as I mentioned this procedure will

2013
01:46:02,570 --> 01:46:00,719

go on for a couple more hours we will

2014

01:46:03,830 --> 01:46:02,580

stay with it through the entire thing so

2015

01:46:05,330 --> 01:46:03,840

that at the end we'll be able to tell

2016

01:46:08,030 --> 01:46:05,340

you that the mirror has been safely

2017

01:46:09,590 --> 01:46:08,040

latched into its final position and that

2018

01:46:11,209 --> 01:46:09,600

will mark the end of some major

2019

01:46:13,070 --> 01:46:11,219

commissioning efforts of the James Webb

2020

01:46:16,250 --> 01:46:13,080

Space Telescope there is more to come

2021

01:46:17,990 --> 01:46:16,260

this is not the last phase after this we

2022

01:46:19,970 --> 01:46:18,000

will be focusing the primary mirror

2023

01:46:21,410 --> 01:46:19,980

which is made of 18 independent segments

2024

01:46:23,030 --> 01:46:21,420

and then there will be Again Begin

2025

01:46:23,930 --> 01:46:23,040

commissioning of the science instruments

2026

01:46:26,450 --> 01:46:23,940

as well

2027

01:46:28,129 --> 01:46:26,460

so I think right now it's also a chance

2028

01:46:29,629 --> 01:46:28,139

to sort of talk about the journey that

2029

01:46:32,149 --> 01:46:29,639

Webb has been on

2030

01:46:33,890 --> 01:46:32,159

um this is a portable clean room the web

2031

01:46:36,649 --> 01:46:33,900

telescope of course had to be kept under

2032

01:46:39,590 --> 01:46:36,659

very very clean circumstances and that

2033

01:46:40,970 --> 01:46:39,600

left California on a special ship that

2034

01:46:43,250 --> 01:46:40,980

is actually designed to take a lot of

2035

01:46:45,649 --> 01:46:43,260

these uh specialized space spacecraft

2036

01:46:47,870 --> 01:46:45,659

cargo to the launch sites that the

2037

01:46:49,550 --> 01:46:47,880

European Space Agency runs in Peru

2038

01:46:51,410 --> 01:46:49,560

French Guiana this is in South America

2039

01:46:52,609 --> 01:46:51,420

and here you're seeing footage of that

2040

01:46:55,550 --> 01:46:52,619

portable clean room with the web

2041

01:46:58,430 --> 01:46:55,560

Observatory inside uh being taken off

2042

01:47:00,109 --> 01:46:58,440

the ship and being loaded onto the the

2043

01:47:02,450 --> 01:47:00,119

place where it will go up on an area in

2044

01:47:04,850 --> 01:47:02,460

five rocket so that's part of the

2045

01:47:06,530 --> 01:47:04,860

Journey of web and here you see uh

2046

01:47:08,510 --> 01:47:06,540

actually uh opening up that portable

2047

01:47:10,850 --> 01:47:08,520

clean room web is in its stowed

2048

01:47:12,290 --> 01:47:10,860

configuration folded up this is one of

2049

01:47:14,810 --> 01:47:12,300

the reasons it's been so exciting the

2050

01:47:15,950 --> 01:47:14,820

last couple of days this Observatory for

2051

01:47:18,169 --> 01:47:15,960

the first time we've launched an

2052

01:47:20,870 --> 01:47:18,179

observatory that was so big the mirror

2053

01:47:22,729 --> 01:47:20,880

had to be folded up and uh as people

2054

01:47:24,229 --> 01:47:22,739

often compared it to origami folding the

2055

01:47:26,870 --> 01:47:24,239

physical scope so it could fit inside

2056

01:47:41,330 --> 01:47:26,880

the fairing of the uh of the Ariane 5

2057

01:47:49,450 --> 01:47:45,530

and oh see you are going to continue to

2058

01:47:49,460 --> 01:47:55,010

is possible

2059

01:48:02,510 --> 01:47:56,810

as they continue the latching procedure

2060

01:48:06,649 --> 01:48:04,729

uh this was a Christmas present for all

2061

01:48:07,910 --> 01:48:06,659

of us this was about 7 30 in the morning

2062

01:48:10,310 --> 01:48:07,920

Eastern Standard Time in the United

2063

01:48:13,070 --> 01:48:10,320

States and there you see the launch of

2064

01:48:15,530 --> 01:48:13,080

the Ariane 5 rocket it was an absolutely

2065

01:48:18,169 --> 01:48:15,540

perfect launch uh they were able to get

2066

01:48:19,970 --> 01:48:18,179

enough energy from the launch itself to

2067

01:48:21,649 --> 01:48:19,980

uh to save some of the fuel on the web

2068

01:48:22,310 --> 01:48:21,659

telescope which we hope will extend its

2069

01:48:24,590 --> 01:48:22,320

life

2070

01:48:26,209 --> 01:48:24,600

and here you see some of the uh the

2071

01:48:28,070 --> 01:48:26,219

people at admission control and French

2072

01:48:29,870 --> 01:48:28,080

Guiana cheering after the successful

2073

01:48:32,330 --> 01:48:29,880

launch and what you're looking at here

2074

01:48:34,070 --> 01:48:32,340

is an animation of the observatory going

2075

01:48:35,990 --> 01:48:34,080

away from the rocket this is not an

2076

01:48:38,090 --> 01:48:36,000

anime animation this one here is the

2077

01:48:39,590 --> 01:48:38,100

actual footage there was a camera on

2078

01:48:42,830 --> 01:48:39,600

the rocket itself and here we see the

2079

01:48:45,290 --> 01:48:42,840

web telescope coming off the Ariane 5 uh

2080

01:48:47,810 --> 01:48:45,300

second stage on its way out to the

2081

01:48:49,310 --> 01:48:47,820

LaGrange boy L2 that's about a million

2082

01:48:51,590 --> 01:48:49,320

miles away from Earth it's on the other

2083

01:48:53,629 --> 01:48:51,600

side of the moon it's a wonderful

2084

01:48:55,129 --> 01:48:53,639

environment for an infrared telescope

2085

01:48:56,810 --> 01:48:55,139

that needs to be very cold

2086

01:48:58,430 --> 01:48:56,820

here you're actually seeing again this

2087

01:49:00,530 --> 01:48:58,440

is real footage from the camera you're

2088

01:49:03,410 --> 01:49:00,540

seeing that the solar uh the solar

2089

01:49:05,090 --> 01:49:03,420

panels unfold this was the very first of

2090

01:49:06,950 --> 01:49:05,100

the uh the actual unfoldings that had to

2091

01:49:09,290 --> 01:49:06,960

occur because now the telescope was able

2092

01:49:11,810 --> 01:49:09,300

to power itself up using uh using

2093

01:49:13,729 --> 01:49:11,820

radiation from the Sun and then after

2094

01:49:16,010 --> 01:49:13,739

that of course came the amazing oh

2095

01:49:18,229 --> 01:49:16,020

there's everybody celebrating uh people

2096

01:49:20,390 --> 01:49:18,239

of course put in huge amounts of time uh

2097

01:49:22,250 --> 01:49:20,400

they uh they were here over the holidays

2098

01:49:23,570 --> 01:49:22,260

uh all of us have been working uh

2099

01:49:25,669 --> 01:49:23,580

straight through Christmas and New

2100

01:49:26,990 --> 01:49:25,679

Year's of course it's been wonderfully

2101

01:49:29,270 --> 01:49:27,000

joyful but there are a lot of families

2102

01:49:31,070 --> 01:49:29,280

back at home that uh I'm sure missed us

2103

01:49:32,870 --> 01:49:31,080

as well uh here's the animation of some

2104

01:49:34,790 --> 01:49:32,880

of the major commissioning points that

2105

01:49:36,890 --> 01:49:34,800

we've actually accomplished so the uh

2106

01:49:38,930 --> 01:49:36,900

the the the solar array was unfurled and

2107

01:49:40,370 --> 01:49:38,940

also the antenna that allows the web to

2108

01:49:42,950 --> 01:49:40,380

communicate with the uh with the Earth

2109

01:49:45,770 --> 01:49:42,960

uh now you see the web moving up from

2110

01:49:49,910 --> 01:49:45,780

the sun shield which is now beginning to

2111

01:49:52,010 --> 01:49:49,920

unfold this is a five layer kept on sun

2112

01:49:54,109 --> 01:49:52,020

shield it's a material that's very much

2113

01:49:56,930 --> 01:49:54,119

like mylar it's a very thin very strong

2114

01:49:58,850 --> 01:49:56,940

material in this case it actually has

2115

01:50:01,370 --> 01:49:58,860

some silicon in it to make it more

2116

01:50:02,870 --> 01:50:01,380

reflective and also uh put together in

2117

01:50:04,550 --> 01:50:02,880

in small segments so that it's very

2118

01:50:06,290 --> 01:50:04,560

strong and can withstand any sort of

2119

01:50:08,089 --> 01:50:06,300

small impacts from micro meteorites

2120

01:50:09,229 --> 01:50:08,099

which we micrometeorites which we do

2121

01:50:12,350 --> 01:50:09,239

expect over the course of the mission

2122

01:50:14,810 --> 01:50:12,360

and now that incredible sun shield is

2123

01:50:17,870 --> 01:50:14,820

fully extended the secondary mirror came

2124

01:50:19,810 --> 01:50:17,880

out a few days ago yesterday we saw the

2125

01:50:22,070 --> 01:50:19,820

first of the Wings

2126
01:50:24,530 --> 01:50:22,080
and today we're just kind of leaving the

2127
01:50:26,510 --> 01:50:24,540
second part

2128
01:50:28,550 --> 01:50:26,520
so now that we've gone through a little

2129
01:50:30,709 --> 01:50:28,560
bit of an update as to uh what this

2130
01:50:32,990 --> 01:50:30,719
tremendous Journey that this Observatory

2131
01:50:35,149 --> 01:50:33,000
has been on it's my pleasure to talk to

2132
01:50:37,250 --> 01:50:35,159
me Feinberg who is one of the senior

2133
01:50:38,689 --> 01:50:37,260
Engineers on the web telescope and he's

2134
01:50:40,370 --> 01:50:38,699
going to talk to us a bit more about

2135
01:50:42,649 --> 01:50:40,380
some of these mirrors of some of the

2136
01:50:45,169 --> 01:50:42,659
technology in web so so for one thing

2137
01:50:47,030 --> 01:50:45,179
Lee wonderful to see you uh I uh we're

2138
01:50:48,609 --> 01:50:47,040

all isolated from each other so that we

2139

01:50:52,750 --> 01:50:48,619

can okay

2140

01:50:58,850 --> 01:50:56,149

Michelle we are ready to continue to

2141

01:51:02,990 --> 01:50:58,860

begin the three-door cup latch to

2142

01:51:09,129 --> 01:51:04,790

so as we said

2143

01:51:20,589 --> 01:51:11,209

in our conversation you'll probably

2144

01:51:23,270 --> 01:51:22,310

I'm sorry can you say that again

2145

01:51:24,950 --> 01:51:23,280

Michelle

2146

01:51:26,450 --> 01:51:24,960

where you're sitting can you hear those

2147

01:51:29,330 --> 01:51:26,460

calls from the mock

2148

01:51:31,910 --> 01:51:29,340

uh I can hear yeah I can hear them yes

2149

01:51:34,010 --> 01:51:31,920

okay right excellent

2150

01:51:35,930 --> 01:51:34,020

so for one thing you know but before we

2151
01:51:37,189 --> 01:51:35,940
we launch right into the technical to

2152
01:51:39,950 --> 01:51:37,199
tell me a bit about how you're feeling

2153
01:51:42,709 --> 01:51:39,960
right now we're human beings first

2154
01:51:44,149 --> 01:51:42,719
yeah well I feel I feel good

2155
01:51:45,530 --> 01:51:44,159
um you know I feel like the the

2156
01:51:47,810 --> 01:51:45,540
mechanical and the deployment teams

2157
01:51:49,729 --> 01:51:47,820
really have done a phenomenal job

2158
01:51:52,129 --> 01:51:49,739
um you know the the optical team

2159
01:51:54,410 --> 01:51:52,139
actually is just about to get started so

2160
01:51:56,930 --> 01:51:54,420
it's sort of a transition time

2161
01:51:58,430 --> 01:51:56,940
um but it but to see a full primary

2162
01:52:00,410 --> 01:51:58,440
mirror this is something we've really

2163
01:52:02,750 --> 01:52:00,420

been thinking about for a long time and

2164

01:52:05,330 --> 01:52:02,760

uh it's it's just a great it's a great

2165

01:52:07,609 --> 01:52:05,340

thing to to see and and to be ready to

2166

01:52:09,770 --> 01:52:07,619

start aligning those mirrors

2167

01:52:11,149 --> 01:52:09,780

absolutely well let's talk a bit about

2168

01:52:12,290 --> 01:52:11,159

those mirrors I mean that's uh that's

2169

01:52:14,390 --> 01:52:12,300

sort of the expertise that you bring

2170

01:52:16,129 --> 01:52:14,400

with us so to begin with

2171

01:52:17,570 --> 01:52:16,139

these are very different mirrors than

2172

01:52:19,310 --> 01:52:17,580

most people are used to in their in

2173

01:52:21,290 --> 01:52:19,320

their regular life and in in many many

2174

01:52:23,030 --> 01:52:21,300

ways obviously incredibly specialized

2175

01:52:24,950 --> 01:52:23,040

and tell us about some of the ways these

2176
01:52:26,750 --> 01:52:24,960
mirrors are are just completely unique

2177
01:52:29,450 --> 01:52:26,760
and very different

2178
01:52:31,250 --> 01:52:29,460
yeah well let me start by just saying

2179
01:52:32,930 --> 01:52:31,260
you know when we when we started this a

2180
01:52:34,250 --> 01:52:32,940
couple decades ago

2181
01:52:35,750 --> 01:52:34,260
um you know we knew from the very

2182
01:52:37,850 --> 01:52:35,760
beginning that one of the hardest parts

2183
01:52:40,010 --> 01:52:37,860
of of making the observatory was going

2184
01:52:41,149 --> 01:52:40,020
to be the nurse and in fact if you go

2185
01:52:43,970 --> 01:52:41,159
all the way back to the first project

2186
01:52:45,589 --> 01:52:43,980
manager Bernie Siri he used to have this

2187
01:52:47,149 --> 01:52:45,599
chart that would show that you know one

2188
01:52:49,070 --> 01:52:47,159

of the key goals was to make a mirror

2189

01:52:51,050 --> 01:52:49,080

that could be lighter than the Hubble

2190

01:52:53,390 --> 01:52:51,060

nerve by about 10 times per unit area

2191

01:52:54,890 --> 01:52:53,400

and it had to work at incredibly cold

2192

01:52:57,350 --> 01:52:54,900

temperatures minus 400 degrees

2193

01:52:59,390 --> 01:52:57,360

Fahrenheit and it had to have a quality

2194

01:53:01,310 --> 01:52:59,400

of the mirror that was approaching the

2195

01:53:03,470 --> 01:53:01,320

quality of like visible mirrors like the

2196

01:53:05,750 --> 01:53:03,480

Hubble Space Telescope kind of image

2197

01:53:07,129 --> 01:53:05,760

quality and so these were you know a set

2198

01:53:08,510 --> 01:53:07,139

of challenges that were extremely

2199

01:53:10,010 --> 01:53:08,520

difficult there were some people who

2200

01:53:12,589 --> 01:53:10,020

thought we couldn't even make mirrors

2201

01:53:15,589 --> 01:53:12,599

that were this light and this quality

2202

01:53:17,330 --> 01:53:15,599

um so so actually it was it was a pretty

2203

01:53:18,589 --> 01:53:17,340

um collaborative effort we actually

2204

01:53:21,169 --> 01:53:18,599

worked with

2205

01:53:23,930 --> 01:53:21,179

um other other government agencies

2206

01:53:25,669 --> 01:53:23,940

including the Department of Defense it

2207

01:53:28,450 --> 01:53:25,679

was a collaboration to invest in

2208

01:53:31,729 --> 01:53:28,460

multiple different Technologies

2209

01:53:34,070 --> 01:53:31,739

one of which was actually a technology

2210

01:53:35,510 --> 01:53:34,080

in which the Mirror Has a bed of nails

2211

01:53:37,669 --> 01:53:35,520

under it a whole series of little tiny

2212

01:53:40,430 --> 01:53:37,679

actuators but one of them was a

2213

01:53:42,050 --> 01:53:40,440

brillianter and the beryllium that was

2214

01:53:43,910 --> 01:53:42,060

developed for web it was actually a new

2215

01:53:46,850 --> 01:53:43,920

form of beryllium it was they called it

2216

01:53:48,530 --> 01:53:46,860

an optical grade beryllium and it was it

2217

01:53:50,450 --> 01:53:48,540

was developed by a company it was called

2218

01:53:53,089 --> 01:53:50,460

brush Wellman that then later became a

2219

01:53:55,370 --> 01:53:53,099

Tyrion but this Optical grade brilliant

2220

01:53:56,689 --> 01:53:55,380

was supposed to be more uniform it was

2221

01:53:59,570 --> 01:53:56,699

going to have better properties for

2222

01:54:01,370 --> 01:53:59,580

being a telescope and um the key though

2223

01:54:04,129 --> 01:54:01,380

was could you build large mirrors that

2224

01:54:06,410 --> 01:54:04,139

are about almost 1.3 1.4 meters in

2225

01:54:07,910 --> 01:54:06,420

diameter these are segments

2226

01:54:08,990 --> 01:54:07,920

um that are incredibly lightweight so

2227

01:54:11,390 --> 01:54:09,000

you have to be able to machine the

2228

01:54:13,430 --> 01:54:11,400

mirrors from the back uh to lightweight

2229

01:54:16,010 --> 01:54:13,440

them and so it was really it was a

2230

01:54:18,709 --> 01:54:16,020

several year technology development

2231

01:54:21,350 --> 01:54:18,719

um it took it really took uh groups from

2232

01:54:23,810 --> 01:54:21,360

all over the United States the Machining

2233

01:54:25,970 --> 01:54:23,820

was done in Alabama and the polishing

2234

01:54:27,470 --> 01:54:25,980

was done in California and

2235

01:54:29,330 --> 01:54:27,480

um here actually you could see some of

2236

01:54:31,669 --> 01:54:29,340

the the beryllium billets that were made

2237

01:54:34,430 --> 01:54:31,679

in in Ohio

2238

01:54:36,890 --> 01:54:34,440

um so so so we developed the technology

2239

01:54:38,689 --> 01:54:36,900

and there was a mirror that was almost

2240

01:54:40,490 --> 01:54:38,699

the full size of what the ultimate

2241

01:54:43,189 --> 01:54:40,500

segments looked like that was we called

2242

01:54:44,570 --> 01:54:43,199

it a prototype mirror and here you could

2243

01:54:46,189 --> 01:54:44,580

see the light waiting of the of the

2244

01:54:48,530 --> 01:54:46,199

mirror from the back and and so that was

2245

01:54:50,030 --> 01:54:48,540

the first phase was just making a single

2246

01:54:52,609 --> 01:54:50,040

mirror that could meet our requirements

2247

01:54:55,250 --> 01:54:52,619

including a coating a gold coating that

2248

01:54:56,930 --> 01:54:55,260

would uh reflect the infrared light and

2249

01:54:59,030 --> 01:54:56,940

so um it was it was a large team effort

2250

01:55:02,149 --> 01:54:59,040

ball Aerospace and build Colorado kind

2251
01:55:03,410 --> 01:55:02,159
of LED that team and uh and that mirror

2252
01:55:07,250 --> 01:55:03,420
actually was competing with other

2253
01:55:08,629 --> 01:55:07,260
mirrors we had a very intense process by

2254
01:55:10,330 --> 01:55:08,639
which we selected which whatever

2255
01:55:12,709 --> 01:55:10,340
technology we would use but beryllium

2256
01:55:14,030 --> 01:55:12,719
won out because of its Superior

2257
01:55:14,930 --> 01:55:14,040
qualities at these very cold

2258
01:55:16,729 --> 01:55:14,940
temperatures

2259
01:55:18,470 --> 01:55:16,739
and that's really the key beryllium has

2260
01:55:20,330 --> 01:55:18,480
this amazing property that when you take

2261
01:55:22,669 --> 01:55:20,340
it to these very cold temperatures it's

2262
01:55:23,870 --> 01:55:22,679
incredibly stable there's there's a

2263
01:55:26,330 --> 01:55:23,880

there's a material property called

2264

01:55:28,850 --> 01:55:26,340

coefficient of thermal expansion and for

2265

01:55:30,709 --> 01:55:28,860

beryllium that material property is like

2266

01:55:32,629 --> 01:55:30,719

as perfect as could be at these very

2267

01:55:34,129 --> 01:55:32,639

cold temperatures and that really was

2268

01:55:36,050 --> 01:55:34,139

one of the key reasons we selected

2269

01:55:37,850 --> 01:55:36,060

brilliant along with the fact I mean one

2270

01:55:40,430 --> 01:55:37,860

of the big benefits is it's extremely

2271

01:55:41,689 --> 01:55:40,440

light and if you look at how large the

2272

01:55:43,850 --> 01:55:41,699

telescope is you know six and a half

2273

01:55:45,709 --> 01:55:43,860

meter diameter if we didn't make mirrors

2274

01:55:47,510 --> 01:55:45,719

this light we would not be able to lift

2275

01:55:49,910 --> 01:55:47,520

them with a rocket so it was it was a

2276

01:55:51,830 --> 01:55:49,920

long effort we then had to manufacture

2277

01:55:55,010 --> 01:55:51,840

the mirrors but but that's that's what

2278

01:55:57,109 --> 01:55:55,020

led to the mirrors have confirmed the

2279

01:55:58,550 --> 01:55:57,119

story actually goes you know even

2280

01:56:00,350 --> 01:55:58,560

farther back than that I mean so so

2281

01:56:02,290 --> 01:56:00,360

where was the beryllium mind I mean

2282

01:56:04,370 --> 01:56:02,300

you're saying this sort of a new type

2283

01:56:06,109 --> 01:56:04,380

where did it start where did the

2284

01:56:09,410 --> 01:56:06,119

brilliant come out of the ground

2285

01:56:12,830 --> 01:56:09,420

well so it's actually mined in Utah

2286

01:56:13,970 --> 01:56:12,840

um and and uh and you know it's mined in

2287

01:56:16,490 --> 01:56:13,980

sort of these

2288

01:56:19,070 --> 01:56:16,500

chunks and rocks that eventually will

2289

01:56:20,089 --> 01:56:19,080

get ground up and eventually made into a

2290

01:56:22,129 --> 01:56:20,099

powder form

2291

01:56:24,410 --> 01:56:22,139

and that was one of the things that they

2292

01:56:26,689 --> 01:56:24,420

were able to do was make a finer powder

2293

01:56:29,810 --> 01:56:26,699

a powder that has more spherical

2294

01:56:31,790 --> 01:56:29,820

qualities and um and then once you get

2295

01:56:34,370 --> 01:56:31,800

that powder and this was what brush

2296

01:56:36,530 --> 01:56:34,380

Wellman did in in Ohio just outside of

2297

01:56:38,209 --> 01:56:36,540

Cleveland once you get that powder you

2298

01:56:41,450 --> 01:56:38,219

can actually do a process that's called

2299

01:56:43,669 --> 01:56:41,460

hipping It's Hot isostatic pressure it's

2300

01:56:46,070 --> 01:56:43,679

a process that puts heat and pressure on

2301

01:56:48,350 --> 01:56:46,080

the beryllium and forms a Billet a

2302

01:56:50,270 --> 01:56:48,360

beryllium a block of beryllium that we

2303

01:56:53,209 --> 01:56:50,280

would slice like an Oreo cookie into two

2304

01:56:55,129 --> 01:56:53,219

mirror blanks and that's how we got sort

2305

01:56:57,890 --> 01:56:55,139

of the large blanks that would make up

2306

01:57:00,050 --> 01:56:57,900

what we would ultimately then machine

2307

01:57:03,350 --> 01:57:00,060

and so that so the first step was to go

2308

01:57:05,390 --> 01:57:03,360

from Utah to Ohio and then and then they

2309

01:57:07,669 --> 01:57:05,400

would be sent out to the uh Coleman

2310

01:57:08,810 --> 01:57:07,679

Alabama where the Machine Shop was that

2311

01:57:10,790 --> 01:57:08,820

would lightweight the mirror and they

2312

01:57:12,410 --> 01:57:10,800

would also put on the front surface they

2313

01:57:14,870 --> 01:57:12,420

would they would literally machine a

2314

01:57:17,209 --> 01:57:14,880

surface that was approximately the

2315

01:57:18,430 --> 01:57:17,219

surface we needed for each mirror

2316

01:57:20,750 --> 01:57:18,440

um but that was only the beginning

2317

01:57:22,609 --> 01:57:20,760

because the next phase was you had to

2318

01:57:23,750 --> 01:57:22,619

grind and polish the mirror and that you

2319

01:57:25,129 --> 01:57:23,760

know you know typically when you make a

2320

01:57:27,109 --> 01:57:25,139

mirror it's a polishing that's the

2321

01:57:29,330 --> 01:57:27,119

hardest part and actually the hardest

2322

01:57:31,790 --> 01:57:29,340

part of that process is testing the

2323

01:57:33,890 --> 01:57:31,800

mirror and one of the key things we had

2324

01:57:35,930 --> 01:57:33,900

to figure out was how do you test

2325

01:57:37,030 --> 01:57:35,940

mirrors that are inside of a cryogenic

2326

01:57:39,530 --> 01:57:37,040

chamber

2327

01:57:41,930 --> 01:57:39,540

the level that we needed and nobody had

2328

01:57:44,270 --> 01:57:41,940

done that before and we also needed to

2329

01:57:45,169 --> 01:57:44,280

make sure that all 18 mirrors matched

2330

01:57:47,390 --> 01:57:45,179

each other

2331

01:57:49,070 --> 01:57:47,400

so that you know if you make wonder and

2332

01:57:51,530 --> 01:57:49,080

then you made a second mirror and you

2333

01:57:52,910 --> 01:57:51,540

and you and you you align them relative

2334

01:57:54,830 --> 01:57:52,920

to each other they need to have the same

2335

01:57:56,149 --> 01:57:54,840

curvature and that actually turned out

2336

01:57:59,330 --> 01:57:56,159

to be one of the more difficult problems

2337

01:58:01,250 --> 01:57:59,340

so we had to develop uh methods you know

2338

01:58:03,709 --> 01:58:01,260

for testing mirrors and then for

2339

01:58:05,270 --> 01:58:03,719

polishing the mirrors when you when you

2340

01:58:06,709 --> 01:58:05,280

cool the mirror down at minus 400

2341

01:58:08,089 --> 01:58:06,719

degrees Fahrenheit it will literally

2342

01:58:10,490 --> 01:58:08,099

deform

2343

01:58:13,370 --> 01:58:10,500

um because things shrink but they shrink

2344

01:58:15,169 --> 01:58:13,380

in a way that's not perfect and so when

2345

01:58:16,790 --> 01:58:15,179

you when we made these mirrors what we

2346

01:58:18,649 --> 01:58:16,800

did is we would put them inside of a

2347

01:58:20,330 --> 01:58:18,659

chamber that would cool them down we

2348

01:58:22,910 --> 01:58:20,340

would test them with devices that are

2349

01:58:24,890 --> 01:58:22,920

outside of the chamber and once we know

2350

01:58:27,530 --> 01:58:24,900

how they deform we would warm the mirror

2351
01:58:29,089 --> 01:58:27,540
back up send it back to the place that

2352
01:58:31,490 --> 01:58:29,099
polished the mirror and we would polish

2353
01:58:34,729 --> 01:58:31,500
the inverse of the way they deformed

2354
01:58:35,689 --> 01:58:34,739
that process we call cryopolishing and

2355
01:58:37,729 --> 01:58:35,699
and here you can actually see the

2356
01:58:38,870 --> 01:58:37,739
mirrors going into the chamber this is

2357
01:58:40,609 --> 01:58:38,880
actually at the Marshall space flight

2358
01:58:43,250 --> 01:58:40,619
center it's a chamber that was used for

2359
01:58:45,649 --> 01:58:43,260
the X for the Chandra Space Telescope

2360
01:58:47,510 --> 01:58:45,659
was converted for testing these mirrors

2361
01:58:50,450 --> 01:58:47,520
we put a special liquid helium shroud

2362
01:58:52,729 --> 01:58:50,460
inside of it and we also developed new

2363
01:58:54,290 --> 01:58:52,739

test equipment that could work in the

2364

01:58:55,790 --> 01:58:54,300

presence of all the vibration that we

2365

01:58:58,850 --> 01:58:55,800

would get inside of a vacuum chamber so

2366

01:59:00,950 --> 01:58:58,860

so we did all that work we we polished

2367

01:59:03,410 --> 01:59:00,960

the mirrors with the inverse to deal

2368

01:59:04,550 --> 01:59:03,420

with these cool down effects and we also

2369

01:59:05,990 --> 01:59:04,560

had to deal with the fact that these

2370

01:59:07,970 --> 01:59:06,000

very lightweight mirrors to form under

2371

01:59:09,589 --> 01:59:07,980

Gravity you know right now is actually

2372

01:59:11,870 --> 01:59:09,599

the first time these mirrors have ever

2373

01:59:13,669 --> 01:59:11,880

been in microgravity but on the ground

2374

01:59:15,410 --> 01:59:13,679

there was always a gravity and literally

2375

01:59:17,450 --> 01:59:15,420

the mirrors are so light that the

2376

01:59:19,850 --> 01:59:17,460

gravity would deform the mirror so we

2377

01:59:21,350 --> 01:59:19,860

not only had to polish the them for the

2378

01:59:24,290 --> 01:59:21,360

cool down but we also had to polish them

2379

01:59:25,970 --> 01:59:24,300

for the effects of gravity and uh and

2380

01:59:27,589 --> 01:59:25,980

deal with the effects of gravity and so

2381

01:59:29,030 --> 01:59:27,599

we had to combine all that with the fact

2382

01:59:30,830 --> 01:59:29,040

that we had 18 mirrors that all had to

2383

01:59:32,810 --> 01:59:30,840

match each other so it was it was a

2384

01:59:35,030 --> 01:59:32,820

challenging process the whole the whole

2385

01:59:37,910 --> 01:59:35,040

effort from technology development to

2386

01:59:40,970 --> 01:59:37,920

manufacturing was about a decade from

2387

01:59:42,950 --> 01:59:40,980

about 2000 to 2010.

2388

01:59:44,750 --> 01:59:42,960

it's absolutely incredible and and what

2389

01:59:46,970 --> 01:59:44,760

you just said the whole idea is you get

2390

01:59:48,649 --> 01:59:46,980

these 18 mirrors and they all they all

2391

01:59:51,229 --> 01:59:48,659

have to work together as one single

2392

01:59:52,129 --> 01:59:51,239

mirror and and that's a big part of the

2393

01:59:53,810 --> 01:59:52,139

commissioning that's actually going to

2394

01:59:55,490 --> 01:59:53,820

be happening you know in a couple of you

2395

01:59:56,810 --> 01:59:55,500

know in the future now but let's talk

2396

01:59:58,850 --> 01:59:56,820

about some of those that there's

2397

02:00:01,010 --> 01:59:58,860

actuators on the back right that can

2398

02:00:03,890 --> 02:00:01,020

control each of these mirror segments

2399

02:00:05,750 --> 02:00:03,900

individually yeah you know it's funny

2400

02:00:07,430 --> 02:00:05,760

because a lot of people see pictures of

2401
02:00:10,189 --> 02:00:07,440
the web Space Telescope and they see the

2402
02:00:13,070 --> 02:00:10,199
front and it's gold and it looks amazing

2403
02:00:14,990 --> 02:00:13,080
but for an engineer uh it's really the

2404
02:00:17,390 --> 02:00:15,000
back of the mirror that is where all the

2405
02:00:19,550 --> 02:00:17,400
engineering goes in and in fact you know

2406
02:00:21,350 --> 02:00:19,560
maybe if we could freeze uh the picture

2407
02:00:22,729 --> 02:00:21,360
in about a second

2408
02:00:24,770 --> 02:00:22,739
um if you look at the back of the mirror

2409
02:00:26,149 --> 02:00:24,780
that's where all the engineering is the

2410
02:00:27,890 --> 02:00:26,159
you know the first part was the light

2411
02:00:29,750 --> 02:00:27,900
weighting and the rip structure and how

2412
02:00:32,750 --> 02:00:29,760
you do that so that the mirror is strong

2413
02:00:34,550 --> 02:00:32,760

enough to take to to launch but then you

2414

02:00:37,070 --> 02:00:34,560

also have to be able to to connect

2415

02:00:38,570 --> 02:00:37,080

actuators to the mirror and each primary

2416

02:00:41,330 --> 02:00:38,580

mirror segment actually has seven

2417

02:00:43,490 --> 02:00:41,340

different actuators there's there's

2418

02:00:46,550 --> 02:00:43,500

three pairs of actuators that you can

2419

02:00:49,070 --> 02:00:46,560

see in this video that are we call them

2420

02:00:52,370 --> 02:00:49,080

bipods that literally allow the mirror

2421

02:00:54,530 --> 02:00:52,380

to tip and tilt and move around in six

2422

02:00:56,330 --> 02:00:54,540

different degrees of freedom and then we

2423

02:00:58,550 --> 02:00:56,340

have also one actuator at the center of

2424

02:00:59,810 --> 02:00:58,560

the mirror which allows us to change the

2425

02:01:01,430 --> 02:00:59,820

curvature

2426

02:01:03,310 --> 02:01:01,440

and so each of the primary mirror

2427

02:01:06,589 --> 02:01:03,320

segments actually has seven actuators

2428

02:01:07,910 --> 02:01:06,599

and it wasn't obvious exactly how to

2429

02:01:10,490 --> 02:01:07,920

design those from the beginning in fact

2430

02:01:12,410 --> 02:01:10,500

the very first design only had three

2431

02:01:14,870 --> 02:01:12,420

actuators plus a central actuator so

2432

02:01:17,089 --> 02:01:14,880

four total and as time went on we

2433

02:01:18,709 --> 02:01:17,099

understood better you know how we needed

2434

02:01:20,510 --> 02:01:18,719

to move the mirrors in order to make a

2435

02:01:23,209 --> 02:01:20,520

perfect primary mirror over the full

2436

02:01:25,629 --> 02:01:23,219

primary and we also needed to understand

2437

02:01:27,970 --> 02:01:25,639

how to mount those actuators

2438

02:01:30,350 --> 02:01:27,980

the actuators themselves are actually

2439

02:01:31,790 --> 02:01:30,360

you know an amazing achievement

2440

02:01:34,070 --> 02:01:31,800

themselves they were they were designed

2441

02:01:35,990 --> 02:01:34,080

by ball Aerospace using these special

2442

02:01:39,169 --> 02:01:36,000

little gear Motors that can move the

2443

02:01:40,790 --> 02:01:39,179

mirrors in steps that are so small

2444

02:01:43,189 --> 02:01:40,800

they're just a fraction of a human hair

2445

02:01:46,010 --> 02:01:43,199

in fact the smallest step that we can

2446

02:01:48,229 --> 02:01:46,020

move is about 120 000 of a human hair

2447

02:01:50,330 --> 02:01:48,239

and that is so that we can move the

2448

02:01:53,270 --> 02:01:50,340

mirrors into position so that all 18

2449

02:01:55,310 --> 02:01:53,280

mirrors together are will be aligned to

2450

02:01:56,570 --> 02:01:55,320

less than a wavelength of light if you

2451
02:01:58,669 --> 02:01:56,580
were to kind of go across the whole

2452
02:02:00,950 --> 02:01:58,679
surface and so we needed an actuator

2453
02:02:02,930 --> 02:02:00,960
that could move in these tiny steps but

2454
02:02:05,689 --> 02:02:02,940
do it at minus 400 degrees Fahrenheit

2455
02:02:07,430 --> 02:02:05,699
and that's a lot of complexity and

2456
02:02:09,169 --> 02:02:07,440
challenges and then at the same time

2457
02:02:10,790 --> 02:02:09,179
these actuators have to survive launch

2458
02:02:12,109 --> 02:02:10,800
and they you know so they have to be

2459
02:02:15,350 --> 02:02:12,119
able to deal with you know vibrations

2460
02:02:17,030 --> 02:02:15,360
large vibrations and get the mirrors

2461
02:02:19,850 --> 02:02:17,040
into the right position initially

2462
02:02:21,310 --> 02:02:19,860
because when we launch the mirrors we

2463
02:02:23,810 --> 02:02:21,320

actually have them in a special position

2464

02:02:25,729 --> 02:02:23,820

that is designed for launching them

2465

02:02:27,109 --> 02:02:25,739

where the mirrors are up against we call

2466

02:02:30,709 --> 02:02:27,119

it a hard stop so they're in a nice

2467

02:02:32,270 --> 02:02:30,719

secure way secure position but actually

2468

02:02:34,870 --> 02:02:32,280

in the coming week we're going to deploy

2469

02:02:36,770 --> 02:02:34,880

the mirrors about a half inch forward

2470

02:02:38,870 --> 02:02:36,780

to this point where we can start

2471

02:02:40,609 --> 02:02:38,880

aligning them so these so these motors

2472

02:02:41,750 --> 02:02:40,619

had to be able to get you forward by

2473

02:02:43,609 --> 02:02:41,760

about a half an inch and then move in

2474

02:02:46,550 --> 02:02:43,619

these very small steps and so that's

2475

02:02:48,410 --> 02:02:46,560

there's a lot of different challenges it

2476
02:02:50,390 --> 02:02:48,420
took a huge team of people across the

2477
02:02:52,790 --> 02:02:50,400
country there's there's companies that

2478
02:02:54,589 --> 02:02:52,800
develop the motors and in Florida a

2479
02:02:57,169 --> 02:02:54,599
company that developed the bearings in

2480
02:02:58,430 --> 02:02:57,179
New Hampshire I mean all over you know

2481
02:03:00,350 --> 02:02:58,440
while web is an international

2482
02:03:02,570 --> 02:03:00,360
collaboration

2483
02:03:05,629 --> 02:03:02,580
the the telescope itself was actually

2484
02:03:07,970 --> 02:03:05,639
built within the United States but you

2485
02:03:10,310 --> 02:03:07,980
know maybe 20 or 30 States made major

2486
02:03:12,470 --> 02:03:10,320
contributions just to the primary mayor

2487
02:03:14,270 --> 02:03:12,480
itself that's how that's how significant

2488
02:03:16,070 --> 02:03:14,280

an effort it was and that's how much

2489

02:03:17,330 --> 02:03:16,080

coordination it took the team from

2490

02:03:20,450 --> 02:03:17,340

Northrop Grumman the team from ball

2491

02:03:22,310 --> 02:03:20,460

Aerospace uh the teams from L3 Harris

2492

02:03:23,629 --> 02:03:22,320

and ATK that all worked on this primary

2493

02:03:25,070 --> 02:03:23,639

mirror they had to work with all these

2494

02:03:27,550 --> 02:03:25,080

subcontractors from all over the United

2495

02:03:29,930 --> 02:03:27,560

States to make all these pieces

2496

02:03:31,370 --> 02:03:29,940

in fact I actually believe we have a map

2497

02:03:32,990 --> 02:03:31,380

that we could show the different

2498

02:03:35,390 --> 02:03:33,000

collaborators you know all over the

2499

02:03:36,350 --> 02:03:35,400

United States uh the primary mirror I

2500

02:03:37,970 --> 02:03:36,360

think they're gonna they're gonna run

2501

02:03:40,250 --> 02:03:37,980

that yes here we are

2502

02:03:42,890 --> 02:03:40,260

okay yeah

2503

02:03:45,530 --> 02:03:42,900

um yeah I mean it's it's literally you

2504

02:03:48,470 --> 02:03:45,540

know all over the country and obviously

2505

02:03:51,530 --> 02:03:48,480

the people who kind of worked on this

2506

02:03:53,810 --> 02:03:51,540

got a lot of frequent flyer mileage

2507

02:03:55,250 --> 02:03:53,820

um but yeah I mean it was it was a team

2508

02:03:56,990 --> 02:03:55,260

effort and we we had three different

2509

02:03:59,149 --> 02:03:57,000

NASA centers early in the program

2510

02:04:01,370 --> 02:03:59,159

working on this um you know I I come

2511

02:04:03,530 --> 02:04:01,380

from Goddard which was the lead for the

2512

02:04:05,390 --> 02:04:03,540

The Observatory and the telescope where

2513

02:04:06,649 --> 02:04:05,400

it was all integrated but we had uh the

2514

02:04:08,870 --> 02:04:06,659

folks from Marshall space flight center

2515

02:04:10,430 --> 02:04:08,880

who had a lot of uh you know who helped

2516

02:04:12,890 --> 02:04:10,440

us with the testing and the mirror

2517

02:04:14,390 --> 02:04:12,900

technology we had JPL involved in the in

2518

02:04:15,350 --> 02:04:14,400

the algorithms

2519

02:04:17,510 --> 02:04:15,360

um and then there was this large

2520

02:04:19,370 --> 02:04:17,520

contractor team led by Northrop Grumman

2521

02:04:21,410 --> 02:04:19,380

but with companies all over the country

2522

02:04:23,450 --> 02:04:21,420

and for the mirrors it really was ball

2523

02:04:26,209 --> 02:04:23,460

Aerospace that was the lead so it really

2524

02:04:27,770 --> 02:04:26,219

took a large collaborative effort and

2525

02:04:30,229 --> 02:04:27,780

one of the really neat things about it

2526

02:04:32,089 --> 02:04:30,239

was when you work on something like like

2527

02:04:34,910 --> 02:04:32,099

the James Webb Space Telescope that is

2528

02:04:37,010 --> 02:04:34,920

so incredible important capabilities

2529

02:04:38,689 --> 02:04:37,020

it's not hard to get people to want to

2530

02:04:40,970 --> 02:04:38,699

work on it you get you get the most

2531

02:04:42,890 --> 02:04:40,980

incredible people and they're so

2532

02:04:45,290 --> 02:04:42,900

dedicated because they know how exciting

2533

02:04:47,450 --> 02:04:45,300

it is and so and and they all you know

2534

02:04:49,129 --> 02:04:47,460

everyone worked really collaboratively I

2535

02:04:51,229 --> 02:04:49,139

know a lot of the folks who worked on

2536

02:04:53,930 --> 02:04:51,239

this you know from the people who were

2537

02:04:56,149 --> 02:04:53,940

you know ground the nerves people put

2538

02:04:57,910 --> 02:04:56,159

the motors together we know they're all

2539

02:04:59,990 --> 02:04:57,920

following you know a lot of them

2540

02:05:01,490 --> 02:05:00,000

a lot of them haven't even been on the

2541

02:05:03,290 --> 02:05:01,500

program for over 10 years but they're

2542

02:05:05,930 --> 02:05:03,300

following every little step in detail

2543

02:05:07,669 --> 02:05:05,940

with a lot of Pride and and I will tell

2544

02:05:09,530 --> 02:05:07,679

you that for you know you see a few

2545

02:05:12,169 --> 02:05:09,540

folks on television that you're watching

2546

02:05:13,250 --> 02:05:12,179

in the mission operations center but for

2547

02:05:16,609 --> 02:05:13,260

every one of those people there's

2548

02:05:18,229 --> 02:05:16,619

probably you know hundreds of people who

2549

02:05:20,089 --> 02:05:18,239

led up to that point who are all

2550

02:05:22,550 --> 02:05:20,099

watching with pride and that's what it

2551

02:05:25,189 --> 02:05:22,560

took to get to this point

2552

02:05:26,450 --> 02:05:25,199

yeah it's amazing I mean you talk about

2553

02:05:27,950 --> 02:05:26,460

every step of the way you know I

2554

02:05:30,350 --> 02:05:27,960

remember at one point uh they were

2555

02:05:32,810 --> 02:05:30,360

flying uh parts of the primary for

2556

02:05:35,270 --> 02:05:32,820

testing on the C5 which is a gigantic

2557

02:05:37,250 --> 02:05:35,280

aircraft that has this huge Hollow

2558

02:05:39,290 --> 02:05:37,260

interior that you can take very very

2559

02:05:40,910 --> 02:05:39,300

large objects and I got a chance to talk

2560

02:05:42,530 --> 02:05:40,920

to the flight crew and you know and and

2561

02:05:44,510 --> 02:05:42,540

these these young men who were actually

2562

02:05:46,490 --> 02:05:44,520

in charge of flying the airplane were so

2563

02:05:48,050 --> 02:05:46,500

excited to be flying the James Webb

2564

02:05:50,930 --> 02:05:48,060

Space Telescope they just thought that

2565

02:05:52,550 --> 02:05:50,940

was a wonderful thing to do so we talked

2566

02:05:54,229 --> 02:05:52,560

a bit about well we talked a bit about

2567

02:05:55,970 --> 02:05:54,239

about building and testing the primary

2568

02:05:57,770 --> 02:05:55,980

mirrors and then the idea that these

2569

02:06:00,169 --> 02:05:57,780

segments like you said that they have to

2570

02:06:01,609 --> 02:06:00,179

function in in zero gravity which is

2571

02:06:03,470 --> 02:06:01,619

something that you can't do on Earth you

2572

02:06:05,750 --> 02:06:03,480

need to make sure you you compensate for

2573

02:06:07,910 --> 02:06:05,760

that and also at the low temperature but

2574

02:06:09,649 --> 02:06:07,920

what comes next in commissioning is is

2575

02:06:11,629 --> 02:06:09,659

something pretty incredible and that is

2576

02:06:13,790 --> 02:06:11,639

getting all of these 18 segments to work

2577

02:06:15,229 --> 02:06:13,800

together and maybe you can step us

2578

02:06:17,330 --> 02:06:15,239

through a little bit about what you know

2579

02:06:18,709 --> 02:06:17,340

what comes next you know with a little

2580

02:06:20,270 --> 02:06:18,719

bit of a timeline and what we're going

2581

02:06:21,790 --> 02:06:20,280

to do to actually make this thing into

2582

02:06:24,890 --> 02:06:21,800

one big mirror

2583

02:06:27,109 --> 02:06:24,900

yeah well um so first of all in just a

2584

02:06:28,430 --> 02:06:27,119

few days we're going to start

2585

02:06:29,530 --> 02:06:28,440

um exercising all the little Motors

2586

02:06:33,709 --> 02:06:29,540

there's actually

2587

02:06:35,569 --> 02:06:33,719

132 we call them actuators total on the

2588

02:06:37,129 --> 02:06:35,579

telescope um there's seven on each of

2589

02:06:39,109 --> 02:06:37,139

the primary mirror segments and there's

2590

02:06:40,250 --> 02:06:39,119

six on the secondary mirror and so the

2591

02:06:42,530 --> 02:06:40,260

first thing we're going to do is what we

2592

02:06:43,910 --> 02:06:42,540

call mirror deployment that's a that's

2593

02:06:45,350 --> 02:06:43,920

about a week and a half to two week

2594

02:06:46,609 --> 02:06:45,360

operation

2595

02:06:48,709 --> 02:06:46,619

um so that'll be starting actually as

2596

02:06:50,629 --> 02:06:48,719

early as this Tuesday and that's just to

2597

02:06:52,729 --> 02:06:50,639

get the mirrors at a point where we can

2598

02:06:55,370 --> 02:06:52,739

start tipping and tilting them in order

2599

02:06:57,350 --> 02:06:55,380

to align them but um after that we'll

2600

02:06:59,089 --> 02:06:57,360

wait a little bit we wait about a week

2601

02:07:00,890 --> 02:06:59,099

are a little over a week for the

2602

02:07:02,750 --> 02:07:00,900

instruments to get cold enough so that

2603

02:07:04,490 --> 02:07:02,760

we can get images so so we can't

2604

02:07:06,649 --> 02:07:04,500

actually start we can't get first light

2605

02:07:08,270 --> 02:07:06,659

until the instruments are cold enough

2606

02:07:11,089 --> 02:07:08,280

this is one of the things about being an

2607

02:07:12,770 --> 02:07:11,099

infrared Observatory uh is you need very

2608

02:07:14,990 --> 02:07:12,780

cold detectors so we've got to wait for

2609

02:07:16,370 --> 02:07:15,000

the instruments to get cold but once

2610

02:07:17,990 --> 02:07:16,380

that happens the very first thing we're

2611

02:07:19,310 --> 02:07:18,000

going to do is we'll look at a bright

2612

02:07:27,470 --> 02:07:19,320

star

2613

02:07:29,149 --> 02:07:27,480

are really blurry okay and it's not

2614

02:07:33,910 --> 02:07:29,159

going to look real pretty

2615

02:07:39,229 --> 02:07:37,069

yeah yeah so you can see light will come

2616

02:07:41,030 --> 02:07:39,239

into the 18 mirrors and they'll they'll

2617

02:07:42,770 --> 02:07:41,040

behave like 18 separate telescopes

2618

02:07:44,209 --> 02:07:42,780

because they're not aligned yet so each

2619

02:07:46,370 --> 02:07:44,219

mirror actually forms a telescope

2620

02:07:48,229 --> 02:07:46,380

between the primary mirror segment and

2621

02:07:50,330 --> 02:07:48,239

the secondary mirror and that makes a

2622

02:07:52,069 --> 02:07:50,340

series of spots and one of the first

2623

02:07:54,410 --> 02:07:52,079

things we're going to do is find all 18

2624

02:07:56,030 --> 02:07:54,420

segments with those spots and then

2625

02:07:57,950 --> 02:07:56,040

ultimately what we need to do is get

2626

02:08:00,169 --> 02:07:57,960

those spots on top of each other so so

2627

02:08:02,270 --> 02:08:00,179

we'll align the spots we'll line those

2628

02:08:04,609 --> 02:08:02,280

primary mirror segments well enough that

2629

02:08:06,229 --> 02:08:04,619

we have nice spots that we can form on

2630

02:08:07,609 --> 02:08:06,239

top of each other we call that the

2631

02:08:09,649 --> 02:08:07,619

forming on top of each other image

2632

02:08:11,089 --> 02:08:09,659

stacking but it is a little bit of a

2633

02:08:13,010 --> 02:08:11,099

long process because we have to take

2634

02:08:15,290 --> 02:08:13,020

images we have to figure out how to move

2635

02:08:17,930 --> 02:08:15,300

the mirrors we actually have a special

2636

02:08:19,970 --> 02:08:17,940

wavefront room here at Space Telescope

2637

02:08:23,089 --> 02:08:19,980

Science Institute and we'll have it team

2638

02:08:24,410 --> 02:08:23,099

of real experts from Bull aerospace and

2639

02:08:26,270 --> 02:08:24,420

from Space Telescope Science Institute

2640

02:08:28,669 --> 02:08:26,280

from Goddard that all will work together

2641

02:08:30,830 --> 02:08:28,679

and they'll get the images they'll

2642

02:08:33,050 --> 02:08:30,840

analyze them using software that they've

2643

02:08:35,330 --> 02:08:33,060

rehearsed all of this with they've done

2644

02:08:37,609 --> 02:08:35,340

simulations of all this and we've tested

2645

02:08:39,410 --> 02:08:37,619

a lot of this with a testbed telescope

2646

02:08:42,050 --> 02:08:39,420

that was built up and they will go

2647

02:08:44,450 --> 02:08:42,060

through and they'll get those 18 images

2648

02:08:46,129 --> 02:08:44,460

on top of each other and at that point

2649

02:08:48,950 --> 02:08:46,139

we're ready to get into what we call

2650

02:08:51,410 --> 02:08:48,960

phasing and phasing is a little bit like

2651
02:08:52,850 --> 02:08:51,420
if you think of sort of oceans I'm sorry

2652
02:08:55,550 --> 02:08:52,860
if you think of waves in an ocean

2653
02:08:57,169 --> 02:08:55,560
imagine you have different Surfers and

2654
02:08:59,689 --> 02:08:57,179
they're each surfing on a different wave

2655
02:09:02,270 --> 02:08:59,699
what we need is for all of those Surfers

2656
02:09:04,129 --> 02:09:02,280
to be on the same wave and so we need

2657
02:09:07,189 --> 02:09:04,139
all of those mirrors to be essentially

2658
02:09:09,589 --> 02:09:07,199
on the same wave wave of light light

2659
02:09:11,510 --> 02:09:09,599
travels in electromagnetic waves and we

2660
02:09:13,550 --> 02:09:11,520
need them all to be on the same wave of

2661
02:09:15,589 --> 02:09:13,560
light otherwise we will get images that

2662
02:09:16,850 --> 02:09:15,599
are kind of confusing

2663
02:09:18,229 --> 02:09:16,860

um and so we'll go through a process

2664

02:09:21,229 --> 02:09:18,239

first we go through a process called

2665

02:09:23,209 --> 02:09:21,239

course phasing where we'll get

2666

02:09:25,310 --> 02:09:23,219

every you know all the waves all the

2667

02:09:27,530 --> 02:09:25,320

mirrors lined up to maybe one or two

2668

02:09:29,990 --> 02:09:27,540

waves so imagine the Surfers are almost

2669

02:09:31,850 --> 02:09:30,000

all in the same wave but not quite and

2670

02:09:34,030 --> 02:09:31,860

then we'll go through fine phasing and

2671

02:09:36,709 --> 02:09:34,040

fine phasing is the very final sequence

2672

02:09:38,030 --> 02:09:36,719

we actually use special algorithms that

2673

02:09:39,830 --> 02:09:38,040

were developed

2674

02:09:42,169 --> 02:09:39,840

primarily actually if you go all the way

2675

02:09:44,270 --> 02:09:42,179

back to when Hubble Space Telescope had

2676
02:09:46,250 --> 02:09:44,280
its blurry problem you know that the

2677
02:09:47,750 --> 02:09:46,260
sphere collaboration problem there were

2678
02:09:49,310 --> 02:09:47,760
algorithms that were developed to figure

2679
02:09:51,589 --> 02:09:49,320
out the prescription of Hubble so that

2680
02:09:54,229 --> 02:09:51,599
we could repair Hubble and those same

2681
02:09:56,089 --> 02:09:54,239
algorithms are actually being applied

2682
02:09:57,830 --> 02:09:56,099
here to align

2683
02:09:59,629 --> 02:09:57,840
the primary mirror in this very final

2684
02:10:01,609 --> 02:09:59,639
stage it's almost like you have a blurry

2685
02:10:03,530 --> 02:10:01,619
primary mirror and so we'll take images

2686
02:10:05,629 --> 02:10:03,540
in the main science camera the near

2687
02:10:06,830 --> 02:10:05,639
infrared camera but we'll take them

2688
02:10:08,510 --> 02:10:06,840

through Focus you know we'll take

2689

02:10:10,490 --> 02:10:08,520

different it's almost like you move the

2690

02:10:12,709 --> 02:10:10,500

focus on your camera so we'll take a

2691

02:10:14,270 --> 02:10:12,719

series of images and then we'll run them

2692

02:10:15,890 --> 02:10:14,280

through these special algorithms that

2693

02:10:17,390 --> 02:10:15,900

we've developed we've we started what

2694

02:10:19,430 --> 02:10:17,400

with what we did on how about we've

2695

02:10:21,229 --> 02:10:19,440

adapted them for the fact that this is a

2696

02:10:23,270 --> 02:10:21,239

segmented telescope but that's what's

2697

02:10:26,209 --> 02:10:23,280

going to allow us to align this mirror

2698

02:10:28,850 --> 02:10:26,219

perfectly and eventually we're going to

2699

02:10:30,109 --> 02:10:28,860

get an image of a single star so a star

2700

02:10:33,410 --> 02:10:30,119

will come in

2701
02:10:34,910 --> 02:10:33,420
very early on and maybe you know a

2702
02:10:37,010 --> 02:10:34,920
couple weeks three weeks or so it'll

2703
02:10:38,689 --> 02:10:37,020
look like 18 separate images but we

2704
02:10:41,689 --> 02:10:38,699
think by sometime in March we'll

2705
02:10:44,149 --> 02:10:41,699
actually have a star form a single image

2706
02:10:46,430 --> 02:10:44,159
and that's kind of the first goal

2707
02:10:47,810 --> 02:10:46,440
um of of the alignment process and then

2708
02:10:49,430 --> 02:10:47,820
from there really what we're doing is

2709
02:10:51,950 --> 02:10:49,440
we're aligning the secondary mirror to

2710
02:10:53,450 --> 02:10:51,960
give us uh image an image of a star that

2711
02:10:55,310 --> 02:10:53,460
works in all the four instruments you

2712
02:10:57,229 --> 02:10:55,320
know over the full field that takes

2713
02:10:59,030 --> 02:10:57,239

about another month and a month and a

2714

02:11:01,069 --> 02:10:59,040

half so that so the whole process is

2715

02:11:03,589 --> 02:11:01,079

about three and a half months we call it

2716

02:11:05,149 --> 02:11:03,599

wave front sensing and control but

2717

02:11:06,890 --> 02:11:05,159

really what it is is it's aligning all

2718

02:11:09,350 --> 02:11:06,900

these mirrors to act like a perfect

2719

02:11:11,510 --> 02:11:09,360

telescope and um and at the end of all

2720

02:11:13,430 --> 02:11:11,520

that we'll be able to hand off a

2721

02:11:15,109 --> 02:11:13,440

telescope some of the science instrument

2722

02:11:16,370 --> 02:11:15,119

teams who will be finishing up the

2723

02:11:18,290 --> 02:11:16,380

collaboration

2724

02:11:21,050 --> 02:11:18,300

um and then get on with some of the

2725

02:11:24,709 --> 02:11:22,850

well that's absolutely incredible and

2726

02:11:25,850 --> 02:11:24,719

that's probably a nice place for us to

2727

02:11:28,069 --> 02:11:25,860

break because we're going to bring on

2728

02:11:30,350 --> 02:11:28,079

one of those uh scientists that is

2729

02:11:32,450 --> 02:11:30,360

waiting to use uh web uh so again we're

2730

02:11:33,830 --> 02:11:32,460

talking to Lee Feinberg uh one of the

2731

02:11:35,569 --> 02:11:33,840

senior Engineers on the James Webb Space

2732

02:11:38,750 --> 02:11:35,579

Telescope it's such a pleasure to have

2733

02:11:41,030 --> 02:11:38,760

you here Lee congratulations thank you

2734

02:11:42,530 --> 02:11:41,040

and uh the rest of the day goes very

2735

02:11:45,530 --> 02:11:42,540

well for you

2736

02:11:47,330 --> 02:11:45,540

yeah thank you very much

2737

02:11:48,890 --> 02:11:47,340

so for those of you that are joining us

2738

02:11:50,149 --> 02:11:48,900

you're watching live coverage of the

2739

02:11:52,310 --> 02:11:50,159

commissioning of the James Webb Space

2740

02:11:53,930 --> 02:11:52,320

Telescope we are all here at the Space

2741

02:11:56,689 --> 02:11:53,940

Telescope Science Institute in Baltimore

2742

02:11:58,790 --> 02:11:56,699

Maryland and I'm Michelle Fowler I'm

2743

02:12:00,050 --> 02:11:58,800

from Goddard space flight center and if

2744

02:12:01,490 --> 02:12:00,060

you'd like to join us later on we'll

2745

02:12:03,250 --> 02:12:01,500

probably have some time for social media

2746

02:12:05,330 --> 02:12:03,260

questions so you can use the hashtag

2747

02:12:08,270 --> 02:12:05,340

unfold the universe so once again

2748

02:12:09,770 --> 02:12:08,280

hashtag unfold the universe and that

2749

02:12:11,350 --> 02:12:09,780

will allow us to to see your questions

2750

02:12:13,430 --> 02:12:11,360

and answers

2751

02:12:16,189 --> 02:12:13,440

so the next person that I'm going to

2752

02:12:17,930 --> 02:12:16,199

talk to is Dr Antonella Nota and

2753

02:12:19,609 --> 02:12:17,940

Antonella works here at the Space

2754

02:12:21,169 --> 02:12:19,619

Telescope Science Institute she's the

2755

02:12:23,990 --> 02:12:21,179

representative for the European Space

2756

02:12:26,810 --> 02:12:24,000

Agency so Antonella first off

2757

02:12:28,490 --> 02:12:26,820

many congratulations it's been a

2758

02:12:29,629 --> 02:12:28,500

wonderful morning so far how are you

2759

02:12:32,450 --> 02:12:29,639

doing

2760

02:12:35,810 --> 02:12:32,460

it is amazing it has been an amazing

2761

02:12:39,470 --> 02:12:35,820

morning and the team made it look so

2762

02:12:41,629 --> 02:12:39,480

easy I we know how many years of

2763

02:12:43,910 --> 02:12:41,639

preparation that were behind the moves

2764

02:12:46,609 --> 02:12:43,920

this morning but it just looks so

2765

02:12:49,010 --> 02:12:46,619

amazingly easy I'm so delighted to

2766

02:12:52,069 --> 02:12:49,020

represent the European Space Agency at

2767

02:12:56,330 --> 02:12:52,079

this time and this is the moment we have

2768

02:12:59,569 --> 02:12:56,340

been waiting for for so long so we are

2769

02:13:01,609 --> 02:12:59,579

ready to move to the next step

2770

02:13:02,990 --> 02:13:01,619

it's incredible so for those of you that

2771

02:13:05,589 --> 02:13:03,000

may have just joined us today that we

2772

02:13:08,930 --> 02:13:05,599

deployed the uh the the second and final

2773

02:13:10,669 --> 02:13:08,940

uh to the primary mirror and uh that was

2774

02:13:12,589 --> 02:13:10,679

a major commissioning exercise there are

2775

02:13:14,089 --> 02:13:12,599

there are definitely things to come but

2776

02:13:16,490 --> 02:13:14,099

yeah this is you know what's been

2777

02:13:18,109 --> 02:13:16,500

accomplished is absolutely the story and

2778

02:13:20,290 --> 02:13:18,119

really incredible

2779

02:13:23,750 --> 02:13:20,300

um you're looking at live coverage

2780

02:13:24,890 --> 02:13:23,760

Center yeah command line and that looks

2781

02:13:26,270 --> 02:13:24,900

good too occasionally you'll hear me

2782

02:13:29,270 --> 02:13:26,280

pause because we're listening to the

2783

02:13:31,790 --> 02:13:29,280

commands so uh that's all fine

2784

02:13:34,310 --> 02:13:31,800

and uh in between commands we'll have a

2785

02:13:37,250 --> 02:13:34,320

chance to talk to Antonella so um

2786

02:13:39,350 --> 02:13:37,260

Antonella you are an an astrophysicist

2787

02:13:41,209 --> 02:13:39,360

an astronomer and uh tell us a bit about

2788

02:13:42,290 --> 02:13:41,219

some of the major science goals that

2789

02:13:44,209 --> 02:13:42,300

you're looking forward to but maybe

2790

02:13:46,370 --> 02:13:44,219

maybe before we do that we should back

2791

02:13:48,589 --> 02:13:46,380

up a little bit and talk about infrared

2792

02:13:51,410 --> 02:13:48,599

well why is web an infrared telescope

2793

02:13:54,950 --> 02:13:51,420

and and why is that so important

2794

02:13:57,890 --> 02:13:54,960

it's easy for us because it's

2795

02:14:00,470 --> 02:13:57,900

um the sources that web wants to look at

2796

02:14:02,810 --> 02:14:00,480

and meet indeed for example when we look

2797

02:14:05,510 --> 02:14:02,820

at the distant Universe we're all

2798

02:14:08,330 --> 02:14:05,520

familiar with the Hubble they feel that

2799

02:14:14,390 --> 02:14:08,340

the Hubble took several years ago and we

2800

02:14:20,089 --> 02:14:16,550

the big guy just at the very beginning

2801
02:14:23,450 --> 02:14:20,099
Hubble with the 2.4 meter could push us

2802
02:14:26,270 --> 02:14:23,460
to see that Horizon web will go way past

2803
02:14:29,589 --> 02:14:26,280
and look at the first few Millionaires

2804
02:14:33,530 --> 02:14:29,599
and see those galaxies that are small

2805
02:14:35,689 --> 02:14:33,540
irregular compact we want to know how

2806
02:14:40,430 --> 02:14:35,699
those galaxies became the Milky Way

2807
02:14:42,770 --> 02:14:40,440
after that and those galaxies emit in

2808
02:14:46,129 --> 02:14:42,780
the infrared here you see a beautiful

2809
02:14:49,729 --> 02:14:46,139
fly through the um the hubbledy field

2810
02:14:52,370 --> 02:14:49,739
and it's amazing that in the size of a

2811
02:14:54,950 --> 02:14:52,380
pencil we could see thousands and

2812
02:14:59,089 --> 02:14:54,960
thousands of galaxies including some

2813
02:15:01,850 --> 02:14:59,099

very very old as I said as old as 400

2814

02:15:03,189 --> 02:15:01,860

million years after the big bang so

2815

02:15:06,169 --> 02:15:03,199

we're talking

2816

02:15:08,810 --> 02:15:06,179

13.2 billion years old and those

2817

02:15:10,910 --> 02:15:08,820

galaxies look very different from today

2818

02:15:13,790 --> 02:15:10,920

and so I think the challenge for the

2819

02:15:17,390 --> 02:15:13,800

astronomers is to understand how they

2820

02:15:20,209 --> 02:15:17,400

evolve from how we look at them then and

2821

02:15:20,870 --> 02:15:20,219

how we see them today and where we'll do

2822

02:15:24,709 --> 02:15:20,880

that

2823

02:15:27,350 --> 02:15:24,719

web will also make be able to actually

2824

02:15:29,890 --> 02:15:27,360

individually take Spectra of these

2825

02:15:32,569 --> 02:15:29,900

galaxies because it has powerful

2826

02:15:34,490 --> 02:15:32,579

spectrograph on board including for

2827

02:15:37,010 --> 02:15:34,500

example near spec the word for

2828

02:15:40,129 --> 02:15:37,020

spectrograph provided by the European

2829

02:15:43,430 --> 02:15:40,139

space agency and near spec will be able

2830

02:15:46,729 --> 02:15:43,440

to actually take Spectra and and for all

2831

02:15:49,669 --> 02:15:46,739

of you who are watching Spectra are when

2832

02:15:51,589 --> 02:15:49,679

the light of an astronomical Target gets

2833

02:15:52,450 --> 02:15:51,599

split into its component like for

2834

02:15:55,010 --> 02:15:52,460

example

2835

02:15:58,430 --> 02:15:55,020

raindrop let's do after a thunderstorm

2836

02:16:00,770 --> 02:15:58,440

and you see a rainbow so why Spectra are

2837

02:16:04,490 --> 02:16:00,780

important because Factor telestronomer

2838

02:16:07,069 --> 02:16:04,500

what the object is made of images tell

2839

02:16:09,530 --> 02:16:07,079

us how objects look like but we really

2840

02:16:12,229 --> 02:16:09,540

want to know the physical chemical

2841

02:16:15,290 --> 02:16:12,239

composition the elements that are there

2842

02:16:19,250 --> 02:16:15,300

and for that we inspect and because

2843

02:16:22,010 --> 02:16:19,260

web will be so powerful 100 times more

2844

02:16:23,930 --> 02:16:22,020

powerful than web with do believe that

2845

02:16:26,990 --> 02:16:23,940

we'll be able to expect that all these

2846

02:16:29,390 --> 02:16:27,000

faint objects that we see at the edge of

2847

02:16:31,669 --> 02:16:29,400

our observable universe we are ready to

2848

02:16:32,870 --> 02:16:31,679

continue with it's absolutely incredible

2849

02:16:33,950 --> 02:16:32,880

for those of you that might not be

2850

02:16:35,209 --> 02:16:33,960

familiar with the Hubble Deep Field

2851
02:16:37,190 --> 02:16:35,219
which was the image that we had started

2852
02:16:39,589 --> 02:16:37,200
with there when Antonella says the size

2853
02:16:41,990 --> 02:16:39,599
of a pencil it's looking down the narrow

2854
02:16:44,209 --> 02:16:42,000
part and so that tiny little bit of the

2855
02:16:46,790 --> 02:16:44,219
sky anywhere you look in the sky there

2856
02:16:50,089 --> 02:16:46,800
are many thousands very very far away

2857
02:16:52,009 --> 02:16:50,099
from us so um again and for our viewers

2858
02:16:53,870 --> 02:16:52,019
we often get a lot of questions about

2859
02:16:55,969 --> 02:16:53,880
how is it that we're able to look back

2860
02:16:57,230 --> 02:16:55,979
in time a lot of people I've actually

2861
02:16:59,870 --> 02:16:57,240
gotten questions on social media

2862
02:17:01,490 --> 02:16:59,880
recently about what direction do you

2863
02:17:02,929 --> 02:17:01,500

need to look to see that far back in

2864

02:17:04,610 --> 02:17:02,939

time maybe you could give us just a

2865

02:17:06,709 --> 02:17:04,620

little bit of an astronomy lesson about

2866

02:17:07,910 --> 02:17:06,719

how is it that we can view the normal

2867

02:17:11,030 --> 02:17:07,920

universe

2868

02:17:14,450 --> 02:17:11,040

yes you look anywhere because wherever

2869

02:17:16,549 --> 02:17:14,460

you look your eyesight basically looks

2870

02:17:18,830 --> 02:17:16,559

as far as you can go and the farthest

2871

02:17:21,469 --> 02:17:18,840

you go you go the farthest you go back

2872

02:17:24,650 --> 02:17:21,479

in time so as I was saying this very

2873

02:17:27,770 --> 02:17:24,660

faint Galaxy that we see in the Hubble

2874

02:17:31,429 --> 02:17:27,780

the field I've traveled for the light

2875

02:17:34,849 --> 02:17:31,439

for those galaxies has traveled for 13.2

2876

02:17:38,030 --> 02:17:34,859

billion years so we see them today as

2877

02:17:40,849 --> 02:17:38,040

they were 13 billion years ago and this

2878

02:17:43,610 --> 02:17:40,859

is the powerful of this amazing

2879

02:17:45,589 --> 02:17:43,620

telescope who can actually look at the

2880

02:17:47,990 --> 02:17:45,599

beginning of the formation of the

2881

02:17:50,389 --> 02:17:48,000

universe because one of the things that

2882

02:17:53,270 --> 02:17:50,399

uh rev will do you know it will be

2883

02:17:56,389 --> 02:17:53,280

focusing on Origins what is the origin

2884

02:17:59,270 --> 02:17:56,399

of our universe as well as other origin

2885

02:18:02,150 --> 02:17:59,280

things like how stars form what's the

2886

02:18:05,629 --> 02:18:02,160

origin of stars so you can see the web

2887

02:18:08,330 --> 02:18:05,639

is going to look we hope in the up to

2888

02:18:10,849 --> 02:18:08,340

the first hundred or two hundred million

2889

02:18:12,830 --> 02:18:10,859

years after the big time if we are

2890

02:18:15,049 --> 02:18:12,840

really lucky we might even see the first

2891

02:18:18,230 --> 02:18:15,059

star Thomas was talking about first star

2892

02:18:21,290 --> 02:18:18,240

earlier on that's a challenge but this

2893

02:18:23,389 --> 02:18:21,300

is one maybe of the surprises that the

2894

02:18:26,330 --> 02:18:23,399

web will bring us together with many

2895

02:18:28,009 --> 02:18:26,340

others I'm sure

2896

02:18:30,169 --> 02:18:28,019

you know I've also gotten questions

2897

02:18:32,270 --> 02:18:30,179

about who gets to use web you know I

2898

02:18:33,410 --> 02:18:32,280

mean how is it you know one of the

2899

02:18:34,969 --> 02:18:33,420

questions that I actually got on social

2900

02:18:36,650 --> 02:18:34,979

media is you know the only people from

2901

02:18:39,110 --> 02:18:36,660

NASA get to use web and that's that's

2902

02:18:40,549 --> 02:18:39,120

very much not the case are you you work

2903

02:18:41,750 --> 02:18:40,559

at the Space Telescope Science Institute

2904

02:18:42,950 --> 02:18:41,760

where a lot of this happens it could

2905

02:18:46,070 --> 02:18:42,960

give us a sense

2906

02:18:49,250 --> 02:18:46,080

how how is time on web allocated

2907

02:18:52,669 --> 02:18:49,260

absolutely so the entire worldwide

2908

02:18:55,849 --> 02:18:52,679

Community can can use web to observe

2909

02:18:58,190 --> 02:18:55,859

they just need to have a good idea and a

2910

02:19:00,830 --> 02:18:58,200

laptop and an internet connection and

2911

02:19:03,290 --> 02:19:00,840

they can submit their proposal and their

2912

02:19:06,230 --> 02:19:03,300

proposal they will say I want to use

2913

02:19:09,410 --> 02:19:06,240

these instruments to make this amazing

2914

02:19:12,349 --> 02:19:09,420

Discovery will be evaluated by a group

2915

02:19:16,610 --> 02:19:12,359

of peers experts in the various Fields

2916

02:19:19,070 --> 02:19:16,620

And if that idea is compelling that idea

2917

02:19:21,650 --> 02:19:19,080

will be scheduled on the telescope and

2918

02:19:24,889 --> 02:19:21,660

as we speak we have already a first year

2919

02:19:27,410 --> 02:19:24,899

already scheduled of observations that

2920

02:19:29,629 --> 02:19:27,420

have been given out to the community to

2921

02:19:32,030 --> 02:19:29,639

the instrument Builders who have the

2922

02:19:34,969 --> 02:19:32,040

right to get the fruit of our hard work

2923

02:19:38,469 --> 02:19:34,979

over so many years and the early release

2924

02:19:40,910 --> 02:19:38,479

signs scientists

2925

02:19:47,330 --> 02:19:40,920

definitely it's ready to begin with the

2926
02:19:47,340 --> 02:20:11,050
foreign

2927
02:20:17,030 --> 02:20:14,389
for for doing such an amazing amazing

2928
02:20:20,330 --> 02:20:17,040
world you know for astronomers this is

2929
02:20:22,849 --> 02:20:20,340
the biggest gift that we can get and

2930
02:20:25,070 --> 02:20:22,859
we're just looking forward to see what

2931
02:20:27,889 --> 02:20:25,080
level it has but I was saying the early

2932
02:20:30,650 --> 02:20:27,899
release science this is something that

2933
02:20:33,469 --> 02:20:30,660
the director of Staci use some of his

2934
02:20:36,889 --> 02:20:33,479
precious directory with rational hours

2935
02:20:39,830 --> 02:20:36,899
to actually tell the community submit

2936
02:20:42,590 --> 02:20:39,840
proposals for approximately a couple of

2937
02:20:44,809 --> 02:20:42,600
hundred hours and they will be evaluated

2938
02:20:47,510 --> 02:20:44,819

with this travel there will be done

2939

02:20:49,790 --> 02:20:47,520

right away the observation will become

2940

02:20:52,190 --> 02:20:49,800

public they will go in their time they

2941

02:20:54,530 --> 02:20:52,200

will be made available to all because

2942

02:20:56,889 --> 02:20:54,540

this observation will show the

2943

02:20:59,510 --> 02:20:56,899

capability of this very powerful

2944

02:21:01,610 --> 02:20:59,520

Observatory so there are a number of

2945

02:21:03,770 --> 02:21:01,620

programs some of Which Europeans that

2946

02:21:06,349 --> 02:21:03,780

are going to execute in the very very

2947

02:21:10,389 --> 02:21:06,359

first few months and those are the ones

2948

02:21:12,969 --> 02:21:10,399

that will show the work or how actually

2949

02:21:16,190 --> 02:21:12,979

web performs

2950

02:21:19,190 --> 02:21:16,200

before that we will have the early

2951

02:21:22,070 --> 02:21:19,200

release observations and those are

2952

02:21:26,090 --> 02:21:22,080

really the ones that I'm waiting for to

2953

02:21:28,910 --> 02:21:26,100

see this is super secret list of targets

2954

02:21:31,250 --> 02:21:28,920

I don't know you know what targets will

2955

02:21:34,969 --> 02:21:31,260

be but I know one thing that they will

2956

02:21:37,990 --> 02:21:34,979

be absolutely spectacular and they will

2957

02:21:41,950 --> 02:21:38,000

be shown to the world

2958

02:21:43,969 --> 02:21:41,960

200 days after launch at the end of the

2959

02:21:48,290 --> 02:21:43,979

commissioning instrument commissioning

2960

02:21:50,510 --> 02:21:48,300

but I hold your brand because it will

2961

02:21:52,429 --> 02:21:50,520

they will be just I've been working at

2962

02:21:54,170 --> 02:21:52,439

the uh so we've talked a bit about the

2963

02:21:56,389 --> 02:21:54,180

early universe and I know that another

2964

02:21:58,130 --> 02:21:56,399

you know primary science goal of web has

2965

02:21:59,630 --> 02:21:58,140

to do with exoplanets we mentioned that

2966

02:22:00,889 --> 02:21:59,640

a little bit with Thomas but I think

2967

02:22:03,770 --> 02:22:00,899

maybe you could take us a bit more

2968

02:22:05,750 --> 02:22:03,780

through how does web actually analyze

2969

02:22:07,450 --> 02:22:05,760

yeah the atmospheres of planets around

2970

02:22:10,130 --> 02:22:07,460

other stars

2971

02:22:12,650 --> 02:22:10,140

absolutely so this is a technique that

2972

02:22:14,110 --> 02:22:12,660

Hubble had already pioneered and I want

2973

02:22:16,910 --> 02:22:14,120

just to to

2974

02:22:18,710 --> 02:22:16,920

tell the community who is listening you

2975

02:22:22,070 --> 02:22:18,720

know when Harbor was launch we didn't

2976

02:22:25,250 --> 02:22:22,080

know exoplanets now we know that every

2977

02:22:27,889 --> 02:22:25,260

Star is exoplanet around so this

2978

02:22:31,670 --> 02:22:27,899

technique allows to study the atmosphere

2979

02:22:35,450 --> 02:22:31,680

of the exoplanet as they move in front

2980

02:22:38,510 --> 02:22:35,460

of their hostiles and by doing that we

2981

02:22:40,429 --> 02:22:38,520

can see but via spectroscopy will

2982

02:22:43,070 --> 02:22:40,439

actually the components of that

2983

02:22:45,290 --> 02:22:43,080

atmosphere and so you can see here the

2984

02:22:48,349 --> 02:22:45,300

planet basically moving in front of the

2985

02:22:51,790 --> 02:22:48,359

star the lights did and the in the

2986

02:22:54,710 --> 02:22:51,800

infrared we can see uh important

2987

02:22:57,410 --> 02:22:54,720

component elements that are the building

2988

02:23:01,870 --> 02:22:57,420

block We Believe of life in the future

2989

02:23:05,210 --> 02:23:01,880

so water vapor uh carbon dioxide

2990

02:23:08,210 --> 02:23:05,220

oxygen all the complex molecules based

2991

02:23:11,210 --> 02:23:08,220

on oxygen why we're looking for these

2992

02:23:14,150 --> 02:23:11,220

molecules because the ultimate goal is

2993

02:23:16,849 --> 02:23:14,160

to see if there is life out there so we

2994

02:23:19,370 --> 02:23:16,859

start looking at the building blocks and

2995

02:23:22,250 --> 02:23:19,380

the humble has already moved the field

2996

02:23:24,410 --> 02:23:22,260

forward but it's a small telescope we do

2997

02:23:27,110 --> 02:23:24,420

believe that being a hundred times more

2998

02:23:30,110 --> 02:23:27,120

sensitive web will just revolutionize

2999

02:23:33,170 --> 02:23:30,120

this field so our knowledge of exoplanet

3000

02:23:36,530 --> 02:23:33,180

composition will be just spectacular and

3001

02:23:39,590 --> 02:23:36,540

maybe we will find another Earth out

3002

02:23:42,969 --> 02:23:39,600

there that's the big you know uh award

3003

02:23:45,230 --> 02:23:42,979

for for this work

3004

02:23:47,330 --> 02:23:45,240

absolutely wonderful Antonella thank you

3005

02:23:49,910 --> 02:23:47,340

so much for joining us I hope the the

3006

02:23:51,530 --> 02:23:49,920

day continues to be joyful and exciting

3007

02:23:53,330 --> 02:23:51,540

and uh and after this we all get a bit

3008

02:23:55,309 --> 02:23:53,340

of a break so I thank you again for

3009

02:23:57,590 --> 02:23:55,319

joining us that's uh that's Dr Antonella

3010

02:23:59,030 --> 02:23:57,600

Nota the uh the Europeans uh the

3011

02:24:00,290 --> 02:23:59,040

European Space Agency representative

3012

02:24:02,150 --> 02:24:00,300

here at the Space Telescope Science

3013

02:24:09,110 --> 02:24:02,160

Institute thank you so much thank you

3014

02:24:14,389 --> 02:24:10,910

so the next uh person we're going to be

3015

02:24:15,590 --> 02:24:14,399

talking to is uh is Joe uh spofera and

3016

02:24:17,150 --> 02:24:15,600

uh he will tell us a little bit more

3017

02:24:18,830 --> 02:24:17,160

about some of the engineering aspects of

3018

02:24:20,150 --> 02:24:18,840

the web telescope for those of you that

3019

02:24:22,130 --> 02:24:20,160

are just joining us you're looking at

3020

02:24:23,929 --> 02:24:22,140

live commissioning of the James Webb

3021

02:24:25,490 --> 02:24:23,939

Space Telescope I'm here at the Space

3022

02:24:28,070 --> 02:24:25,500

Telescope Science Institute in Baltimore

3023

02:24:29,510 --> 02:24:28,080

Maryland I'm Michelle Thaller and Joe

3024

02:24:30,530 --> 02:24:29,520

thank you so much for for joining us

3025

02:24:33,050 --> 02:24:30,540

today

3026

02:24:34,550 --> 02:24:33,060

um so to begin with please introduce

3027

02:24:36,830 --> 02:24:34,560

yourself and tell us a bit about your

3028

02:24:39,410 --> 02:24:36,840

role on the web telescope

3029

02:24:41,210 --> 02:24:39,420

uh yeah so yeah you mentioned my name's

3030

02:24:42,469 --> 02:24:41,220

Joseph so

3031

02:24:44,570 --> 02:24:42,479

um I've been working on the web

3032

02:24:47,570 --> 02:24:44,580

telescope for 16 and a half years now

3033

02:24:50,330 --> 02:24:47,580

with Northrop Grumman uh currently the

3034

02:24:52,429 --> 02:24:50,340

program Dynamics lead uh for Northrop as

3035

02:24:54,590 --> 02:24:52,439

well as doing a lot of lead

3036

02:24:56,690 --> 02:24:54,600

responsibilities for deployments with

3037

02:24:57,710 --> 02:24:56,700

the team that we have uh both what we've

3038

02:25:01,370 --> 02:24:57,720

done on the ground and what we're doing

3039

02:25:02,929 --> 02:25:01,380

today here at the mock for on orbit

3040

02:25:04,790 --> 02:25:02,939

and how's how's the morning gone for you

3041

02:25:06,170 --> 02:25:04,800

are you are you as excited as everybody

3042

02:25:07,010 --> 02:25:06,180

else and happy that things have gone

3043

02:25:09,650 --> 02:25:07,020

well

3044

02:25:10,969 --> 02:25:09,660

yeah it's it's been going fantastic it

3045

02:25:12,230 --> 02:25:10,979

really has for the last two weeks as

3046

02:25:14,570 --> 02:25:12,240

well kind of everything we could have

3047

02:25:17,389 --> 02:25:14,580

hoped for uh with all the operations

3048

02:25:19,910 --> 02:25:17,399

have really gone quite nominal and quite

3049

02:25:23,510 --> 02:25:19,920

to our expectations so it's been a great

3050

02:25:27,110 --> 02:25:25,550

so uh I guess one of the things that we

3051
02:25:29,030 --> 02:25:27,120
have that we can show our audience are

3052
02:25:30,830 --> 02:25:29,040
some footage from the tests that came

3053
02:25:32,630 --> 02:25:30,840
before the launch of the James Webb

3054
02:25:34,849 --> 02:25:32,640
Space Telescope different tests in the

3055
02:25:36,349 --> 02:25:34,859
clean room so I believe we're gonna

3056
02:25:38,450 --> 02:25:36,359
roll some video and you can tell me what

3057
02:25:41,090 --> 02:25:38,460
we're seeing here please Joe

3058
02:25:42,590 --> 02:25:41,100
yeah so this is uh actually the wing

3059
02:25:44,809 --> 02:25:42,600
we're deploying today so that was the

3060
02:25:46,370 --> 02:25:44,819
ground deployment test for that Wing the

3061
02:25:48,410 --> 02:25:46,380
the last time through

3062
02:25:50,150 --> 02:25:48,420
uh and actually if we end up deploying

3063
02:25:51,950 --> 02:25:50,160

both when deployed this is our our

3064

02:25:53,510 --> 02:25:51,960

pre-observatory environment deployment

3065

02:25:55,910 --> 02:25:53,520

was the last time that both wings were

3066

02:25:57,889 --> 02:25:55,920

deployed at the same time on the ground

3067

02:26:00,110 --> 02:25:57,899

uh so you can kind of see the the

3068

02:26:02,450 --> 02:26:00,120

operations that went through there with

3069

02:26:05,809 --> 02:26:02,460

all of the individuals in the high Bay

3070

02:26:07,309 --> 02:26:05,819

Performing their jobs getting through so

3071

02:26:09,349 --> 02:26:07,319

um down on the left there watching that

3072

02:26:11,570 --> 02:26:09,359

Wing deployment uh that's Paul Reynolds

3073

02:26:13,250 --> 02:26:11,580

who's downstairs right now uh as the

3074

02:26:15,950 --> 02:26:13,260

deputy doing the deployment kind of

3075

02:26:17,330 --> 02:26:15,960

watching for what's going on both like

3076

02:26:19,309 --> 02:26:17,340

he would have on the floor there doing

3077

02:26:20,809 --> 02:26:19,319

uh observing the deployment looking to

3078

02:26:22,670 --> 02:26:20,819

see any interaction seeing what's

3079

02:26:24,790 --> 02:26:22,680

happening and uh he's down there right

3080

02:26:27,590 --> 02:26:24,800

now today with the rest of the mock team

3081

02:26:29,030 --> 02:26:27,600

doing that deployment watching for the

3082

02:26:32,690 --> 02:26:29,040

Telemetry to make sure we see what we

3083

02:26:35,809 --> 02:26:34,309

and actually in this footage you can see

3084

02:26:38,210 --> 02:26:35,819

that there's sort of this this black

3085

02:26:39,889 --> 02:26:38,220

border on the outside of the mirror and

3086

02:26:42,290 --> 02:26:39,899

and that's for a very specific purpose

3087

02:26:43,610 --> 02:26:42,300

maybe you can tell us a bit about that

3088

02:26:45,410 --> 02:26:43,620

uh you're speaking about the black

3089

02:26:47,150 --> 02:26:45,420

quarter on the very outsides of all the

3090

02:26:50,990 --> 02:26:47,160

mirrors yes that's right yeah that's

3091

02:26:52,429 --> 02:26:51,000

there for uh the frill section that goes

3092

02:26:54,110 --> 02:26:52,439

around the outside the fixed frill

3093

02:26:57,170 --> 02:26:54,120

outside of the the mirrors themselves

3094

02:26:59,090 --> 02:26:57,180

for uh thermal purposes so that you kind

3095

02:27:01,969 --> 02:26:59,100

of have this deep black right next to

3096

02:27:07,010 --> 02:27:01,979

the mirrors that would not pick up the

3097

02:27:10,429 --> 02:27:08,570

and then of course uh those beautiful

3098

02:27:11,750 --> 02:27:10,439

that beautiful gold coating and that

3099

02:27:13,250 --> 02:27:11,760

that's something that we get a lot of

3100

02:27:16,490 --> 02:27:13,260

questions about as to why why the

3101
02:27:18,349 --> 02:27:16,500
mirrors are are coated with gold uh can

3102
02:27:19,730 --> 02:27:18,359
you give us an explanation for that

3103
02:27:21,889 --> 02:27:19,740
please

3104
02:27:23,230 --> 02:27:21,899
uh I'm probably not the best person to

3105
02:27:26,389 --> 02:27:23,240
give you the explanations

3106
02:27:27,889 --> 02:27:26,399
the best material that was determined by

3107
02:27:29,809 --> 02:27:27,899
you know a number of scientists and

3108
02:27:31,670 --> 02:27:29,819
Engineers to to give us the best

3109
02:27:33,130 --> 02:27:31,680
performance for the Optics and for

3110
02:27:35,450 --> 02:27:33,140
taking data

3111
02:27:37,309 --> 02:27:35,460
when you see the deployment of the tests

3112
02:27:38,990 --> 02:27:37,319
that were done the thing that amazes me

3113
02:27:40,969 --> 02:27:39,000

is that all this was done here on Earth

3114

02:27:43,070 --> 02:27:40,979

there was no way to take this up into

3115

02:27:44,510 --> 02:27:43,080

space and test it in space and of course

3116

02:27:46,730 --> 02:27:44,520

in space you don't have the influence of

3117

02:27:48,650 --> 02:27:46,740

gravity whereas here on Earth you do how

3118

02:27:51,349 --> 02:27:48,660

do you design a test that you know that

3119

02:27:52,730 --> 02:27:51,359

it's it's going to work in zero gravity

3120

02:27:54,349 --> 02:27:52,740

you know how do you design to take that

3121

02:27:55,670 --> 02:27:54,359

into account when you're testing here on

3122

02:27:58,370 --> 02:27:55,680

Earth

3123

02:27:59,750 --> 02:27:58,380

right so the key thing there is uh we

3124

02:28:02,210 --> 02:27:59,760

have to have a very good understanding

3125

02:28:03,710 --> 02:28:02,220

of the loads that we want to see in the

3126
02:28:05,510 --> 02:28:03,720
deployment and the loads that we want to

3127
02:28:07,969 --> 02:28:05,520
kind of counteract or counterbalance in

3128
02:28:10,610 --> 02:28:07,979
the gravity field so we do want to try

3129
02:28:11,750 --> 02:28:10,620
to maintain the the resistances that

3130
02:28:13,150 --> 02:28:11,760
we're trying to characterize or

3131
02:28:16,070 --> 02:28:13,160
understand so there are certain

3132
02:28:17,570 --> 02:28:16,080
harnessing or insulation that provides a

3133
02:28:18,830 --> 02:28:17,580
drag or resistance in the deployment we

3134
02:28:20,630 --> 02:28:18,840
still want to capture that in the test

3135
02:28:22,610 --> 02:28:20,640
so we can characterize it understand it

3136
02:28:24,469 --> 02:28:22,620
on the ground but you do need to

3137
02:28:25,610 --> 02:28:24,479
counteract the gravity you need to take

3138
02:28:27,410 --> 02:28:25,620

away the fact that there's weight

3139

02:28:29,750 --> 02:28:27,420

reacting on hinges and different

3140

02:28:32,389 --> 02:28:29,760

locations in the Deployable Hardware so

3141

02:28:34,730 --> 02:28:32,399

uh there is an offload system that we

3142

02:28:37,070 --> 02:28:34,740

use for that and it was visible a little

3143

02:28:38,990 --> 02:28:37,080

bit in the video that you did show and I

3144

02:28:41,090 --> 02:28:39,000

don't know if going back to that or not

3145

02:28:43,190 --> 02:28:41,100

but uh in the case of the Wings there

3146

02:28:45,469 --> 02:28:43,200

was an overhead system and actually you

3147

02:28:48,110 --> 02:28:45,479

can see it right here so there's a cable

3148

02:28:49,490 --> 02:28:48,120

going up from the wing itself uh from

3149

02:28:52,070 --> 02:28:49,500

some Hardware attached on the back so

3150

02:28:54,469 --> 02:28:52,080

that we can attach basically through the

3151
02:28:56,990 --> 02:28:54,479
CG of the wing and you can see the cable

3152
02:28:58,910 --> 02:28:57,000
running up to the crane structure to

3153
02:29:00,830 --> 02:28:58,920
what looks sort of like a balanced beam

3154
02:29:03,170 --> 02:29:00,840
or a teeter-totter that's up there and

3155
02:29:05,750 --> 02:29:03,180
that cable that the beam that's up there

3156
02:29:08,030 --> 02:29:05,760
can pivot and rotate and the rotation

3157
02:29:10,190 --> 02:29:08,040
points aligned to the rotation axis of

3158
02:29:11,870 --> 02:29:10,200
the wing so that you get a one-to-one

3159
02:29:14,510 --> 02:29:11,880
rotation there as the wing is turning

3160
02:29:16,790 --> 02:29:14,520
it's turning the hardware up above in

3161
02:29:19,670 --> 02:29:16,800
the crane area and at the opposite end

3162
02:29:21,230 --> 02:29:19,680
of that rotating arm is also a weight to

3163
02:29:24,230 --> 02:29:21,240

kind of balance that out so you get a

3164

02:29:25,969 --> 02:29:24,240

load or attention in that cable that's

3165

02:29:28,309 --> 02:29:25,979

effectively equivalent to what the wing

3166

02:29:30,770 --> 02:29:28,319

weighs so that now as you're rotating

3167

02:29:32,750 --> 02:29:30,780

the hinges that you have in this system

3168

02:29:35,090 --> 02:29:32,760

don't actually see the weight of the

3169

02:29:37,730 --> 02:29:35,100

wing they're nearly weightless you know

3170

02:29:40,130 --> 02:29:37,740

as as best as we can on the grounds that

3171

02:29:42,170 --> 02:29:40,140

you can instead try to capture just the

3172

02:29:43,849 --> 02:29:42,180

loads of the nominal flight deployment

3173

02:29:45,230 --> 02:29:43,859

which would be like I mentioned

3174

02:29:46,730 --> 02:29:45,240

something like a harness or some

3175

02:29:49,130 --> 02:29:46,740

insulation

3176

02:29:50,630 --> 02:29:49,140

or some you know very low nominal drag

3177

02:29:53,750 --> 02:29:50,640

that you get from driving at the one

3178

02:29:57,349 --> 02:29:56,210

really wonderful

3179

02:29:59,150 --> 02:29:57,359

so it's

3180

02:30:00,830 --> 02:29:59,160

a pleasure having you here Joe you know

3181

02:30:02,450 --> 02:30:00,840

congratulations again on everything

3182

02:30:03,950 --> 02:30:02,460

that's happened this morning and the

3183

02:30:05,330 --> 02:30:03,960

continued commissioning of the sales

3184

02:30:08,090 --> 02:30:05,340

book is coming up

3185

02:30:10,730 --> 02:30:08,100

so uh we'll we'll let you go thank you

3186

02:30:13,010 --> 02:30:10,740

so much for taking us to consistent

3187

02:30:14,990 --> 02:30:13,020

thank you very good to have you here

3188

02:30:16,250 --> 02:30:15,000

so for uh those people in the audience

3189

02:30:17,929 --> 02:30:16,260

that are just joining us you're looking

3190

02:30:20,030 --> 02:30:17,939

at live commissioning of the James Webb

3191

02:30:22,969 --> 02:30:20,040

Space Telescope today we have successful

3192

02:30:25,130 --> 02:30:22,979

deployed yeah uh with the second wing of

3193

02:30:27,290 --> 02:30:25,140

the primary mirror we now have the whole

3194

02:30:29,389 --> 02:30:27,300

primary mirror together and we are

3195

02:30:31,670 --> 02:30:29,399

currently uh involved in latching that

3196

02:30:33,349 --> 02:30:31,680

into its final place so that that

3197

02:30:34,849 --> 02:30:33,359

procedurally good happening for a couple

3198

02:30:37,130 --> 02:30:34,859

more hours and we'll be here to the end

3199

02:30:38,570 --> 02:30:37,140

of it uh right now however uh we will

3200

02:30:40,490 --> 02:30:38,580

probably take a short break in our

3201
02:30:41,990 --> 02:30:40,500
commentary and when we come back we will

3202
02:30:43,790 --> 02:30:42,000
talk to some more experts on the the

3203
02:30:45,410 --> 02:30:43,800
James Webb Space Telescope you'll be

3204
02:30:47,030 --> 02:30:45,420
seeing more live coverage from the mock

3205
02:30:48,889 --> 02:30:47,040
the mission operations center here at

3206
02:30:51,230 --> 02:30:48,899
the Space Telescope Science Institute in

3207
02:30:52,610 --> 02:30:51,240
Baltimore Maryland and I'll be here to

3208
02:30:55,010 --> 02:30:52,620
take more of your questions on social

3209
02:30:56,870 --> 02:30:55,020
media once again you can use the hashtag

3210
02:30:58,849 --> 02:30:56,880
unfold the universe and we'll get to

3211
02:31:00,170 --> 02:30:58,859
some questions after the break so thank

3212
02:31:02,990 --> 02:31:00,180
you very much and we'll we'll see you

3213
02:31:12,849 --> 02:31:05,770

hmm

3214

02:31:12,859 --> 02:31:16,670

in progress

3215

02:31:30,950 --> 02:31:19,190

and the mirror may just complete

3216

02:31:30,960 --> 02:31:33,469

um

3217

02:31:39,170 --> 02:31:35,690

okay and OC

3218

02:31:40,490 --> 02:31:39,180

um definitely have confirmed that um I

3219

02:31:44,150 --> 02:31:40,500

just look good we're ready to continue

3220

02:31:50,030 --> 02:31:44,160

with the three door latched oh

3221

02:31:50,040 --> 02:31:53,510

standby

3222

02:31:53,520 --> 02:32:14,889

anyway

3223

02:32:38,630 --> 02:32:34,750

thank you

3224

02:32:43,610 --> 02:32:38,640

um you could just steal one off one of

3225

02:32:43,620 --> 02:33:00,110

self-cent matters

3226

02:33:04,450 --> 02:33:02,330

hello Julie

3227

02:33:08,929 --> 02:33:04,460

hello

3228

02:33:15,650 --> 02:33:12,650

we're currently in our final steps of

3229

02:33:19,070 --> 02:33:15,660

the first latching of the three degree

3230

02:33:21,110 --> 02:33:19,080

of Freedom uh latch this is bringing it

3231

02:33:23,929 --> 02:33:21,120

up to its full load

3232

02:33:26,570 --> 02:33:23,939

uh they've been as you've been talking

3233

02:33:28,849 --> 02:33:26,580

with your other guests you can hear that

3234

02:33:30,230 --> 02:33:28,859

they've been talking through all the

3235

02:33:32,929 --> 02:33:30,240

steps as they move through all the

3236

02:33:35,330 --> 02:33:32,939

different levels of load on the on the

3237

02:33:37,969 --> 02:33:35,340

latches and they're coming up on what

3238

02:33:39,590 --> 02:33:37,979

they call the three-door latch and it's

3239

02:33:42,830 --> 02:33:39,600

going to be

3240

02:33:47,270 --> 02:33:42,840

um uh loaded up to its final and uh

3241

02:33:51,170 --> 02:33:49,010

as they've been going through they've

3242

02:33:53,450 --> 02:33:51,180

been checking out their system checking

3243

02:33:55,070 --> 02:33:53,460

out their Motors making sure that each

3244

02:33:58,010 --> 02:33:55,080

step of the way that everything's good

3245

02:34:01,370 --> 02:33:58,020

they're in their final checkouts now and

3246

02:34:02,990 --> 02:34:01,380

this first complete latch is a is a big

3247

02:34:05,150 --> 02:34:03,000

milestone

3248

02:34:07,130 --> 02:34:05,160

excellent for those of you who've just

3249

02:34:08,929 --> 02:34:07,140

joined us uh that's uh Julie van kempen

3250

02:34:10,309 --> 02:34:08,939

she is the the deputy commissioning

3251
02:34:12,110 --> 02:34:10,319
engineer for the James Webb Space

3252
02:34:14,630 --> 02:34:12,120
Telescope and I am Michelle Fowler

3253
02:34:16,070 --> 02:34:14,640
you're we're joining you from uh the

3254
02:34:17,450 --> 02:34:16,080
Space Telescope Science Institute today

3255
02:34:19,849 --> 02:34:17,460
in Baltimore Maryland

3256
02:34:22,250 --> 02:34:19,859
and uh earlier in the day we

3257
02:34:24,290 --> 02:34:22,260
successfully deployed the wing the final

3258
02:34:25,429 --> 02:34:24,300
wing of the primary mirror and what's

3259
02:34:27,230 --> 02:34:25,439
going to be happening for the next

3260
02:34:30,290 --> 02:34:27,240
couple of hours is latching that into

3261
02:34:32,570 --> 02:34:30,300
place now uh during our broadcast you'll

3262
02:34:34,610 --> 02:34:32,580
probably see us pause as we listen to

3263
02:34:37,250 --> 02:34:34,620

commentary from the mock or the mission

3264

02:34:39,110 --> 02:34:37,260

operations center here so if we're

3265

02:34:41,510 --> 02:34:39,120

causing vid conversation we will start

3266

02:34:43,849 --> 02:34:41,520

right back up as soon as we get the call

3267

02:34:45,349 --> 02:34:43,859

and of course we're operating under some

3268

02:34:47,990 --> 02:34:45,359

very interesting circumstances today

3269

02:34:50,210 --> 02:34:48,000

because of the uh the The covid Surge we

3270

02:34:51,710 --> 02:34:50,220

were all isolated I'm downstairs in a

3271

02:34:53,990 --> 02:34:51,720

conference room so I can speak to you

3272

02:34:56,690 --> 02:34:54,000

without a mask on and Julie is in a room

3273

02:34:58,610 --> 02:34:56,700

upstairs so we're all isolated from each

3274

02:35:00,050 --> 02:34:58,620

other to keep each other safe you'll

3275

02:35:03,410 --> 02:35:00,060

notice that everybody is masked inside

3276

02:35:04,849 --> 02:35:03,420

the control room uh we had a uh a large

3277

02:35:06,110 --> 02:35:04,859

and beautiful set at Goddard space

3278

02:35:07,910 --> 02:35:06,120

flight center that we were going to do

3279

02:35:09,950 --> 02:35:07,920

perhaps a much more polished and

3280

02:35:11,929 --> 02:35:09,960

professional looking broadcast but in a

3281

02:35:13,849 --> 02:35:11,939

way this is kind of wonderful because it

3282

02:35:16,309 --> 02:35:13,859

was so important for us to bring you all

3283

02:35:18,110 --> 02:35:16,319

along on this very historic day this is

3284

02:35:20,389 --> 02:35:18,120

the the largest most complex space

3285

02:35:22,309 --> 02:35:20,399

Observatory ever built it's built to

3286

02:35:24,950 --> 02:35:22,319

answer some incredible questions about

3287

02:35:27,469 --> 02:35:24,960

the origins of stars and galaxies and

3288

02:35:29,090 --> 02:35:27,479

planets the origins of us uh the

3289

02:35:30,770 --> 02:35:29,100

possibility of there being environments

3290

02:35:33,650 --> 02:35:30,780

like the Earth on planets around other

3291

02:35:36,410 --> 02:35:33,660

stars and many many things in between

3292

02:35:38,330 --> 02:35:36,420

so the the rocket was launched carrying

3293

02:35:40,670 --> 02:35:38,340

the James Webb Space Telescope on

3294

02:35:43,370 --> 02:35:40,680

December 25th from French Guiana from

3295

02:35:46,130 --> 02:35:43,380

Peru that's in South America it's now

3296

02:35:48,290 --> 02:35:46,140

traveled more than 600 000 miles on its

3297

02:35:50,750 --> 02:35:48,300

way out to its final resting place at L2

3298

02:35:52,610 --> 02:35:50,760

L2 is a LaGrange point which is a

3299

02:35:54,110 --> 02:35:52,620

balance point between the gravity of the

3300

02:35:56,270 --> 02:35:54,120

Earth and the Sun that's a wonderful

3301

02:35:59,030 --> 02:35:56,280

stable place to put in Observatory web

3302

02:36:01,610 --> 02:35:59,040

is on it's way out there right now but

3303

02:36:03,770 --> 02:36:01,620

as it does so it is unfolding it's the

3304

02:36:05,929 --> 02:36:03,780

observatory is so large had to be folded

3305

02:36:07,910 --> 02:36:05,939

up to fit inside the rocket and that's

3306

02:36:09,349 --> 02:36:07,920

uh that's a unique thing about web that

3307

02:36:11,389 --> 02:36:09,359

has not been attempted before this

3308

02:36:13,370 --> 02:36:11,399

degree of unfolding and commissioning

3309

02:36:15,710 --> 02:36:13,380

and that's why we wanted to bring this

3310

02:36:18,230 --> 02:36:15,720

to you live because this is a live

3311

02:36:20,929 --> 02:36:18,240

broadcast based on an actual engineering

3312

02:36:22,969 --> 02:36:20,939

event the schedule is not known uh to

3313

02:36:25,130 --> 02:36:22,979

the minute the engineers will call out

3314

02:36:27,050 --> 02:36:25,140

the commands you know as they see fit

3315

02:36:30,650 --> 02:36:27,060

and at the pace that they want to go at

3316

02:36:33,590 --> 02:36:30,660

so this is a a broadcast that is not

3317

02:36:35,510 --> 02:36:33,600

only live but sort of you know very much

3318

02:36:37,730 --> 02:36:35,520

of the moment as we wait to see which

3319

02:36:39,950 --> 02:36:37,740

commands come in and how long they

3320

02:36:42,050 --> 02:36:39,960

decide to take from each step but but

3321

02:36:43,790 --> 02:36:42,060

Julie I I think you can um you can

3322

02:36:45,349 --> 02:36:43,800

reiterate everybody that things are

3323

02:36:48,650 --> 02:36:45,359

going very well this morning so far

3324

02:36:55,190 --> 02:36:51,950

yes so far our

3325

02:36:58,250 --> 02:36:55,200

actual motion of the mirrors segments as

3326

02:37:00,469 --> 02:36:58,260

they folded from being back alongside of

3327

02:37:02,870 --> 02:37:00,479

the structure to its final position as

3328

02:37:06,050 --> 02:37:02,880

you see it now in our visualization Tool

3329

02:37:08,870 --> 02:37:06,060

uh went extremely well uh the the motors

3330

02:37:11,570 --> 02:37:08,880

work perfectly the uh the launch

3331

02:37:13,070 --> 02:37:11,580

releases before that went perfectly and

3332

02:37:15,530 --> 02:37:13,080

uh now they're in the process of

3333

02:37:18,770 --> 02:37:15,540

latching into their final position so

3334

02:37:21,530 --> 02:37:18,780

that those mirrors are are aligned and

3335

02:37:26,389 --> 02:37:21,540

ready for the next steps which Leanne

3336

02:37:29,090 --> 02:37:27,710

so I'm just looking at some of the

3337

02:37:30,290 --> 02:37:29,100

social media questions that are coming

3338

02:37:31,490 --> 02:37:30,300

in and there's there's a lot of

3339

02:37:33,770 --> 02:37:31,500

different ones on the mirrors actually

3340

02:37:35,990 --> 02:37:33,780

this is probably one that we can answer

3341

02:37:38,090 --> 02:37:36,000

um so it's uh it's uh Jemison on Twitter

3342

02:37:40,429 --> 02:37:38,100

States my eight-year-old son wants to

3343

02:37:42,410 --> 02:37:40,439

know why the mirror is a set of hexagons

3344

02:37:44,210 --> 02:37:42,420

why why was that why was that shape

3345

02:37:46,010 --> 02:37:44,220

chosen for the mirror Julie you can

3346

02:37:48,590 --> 02:37:46,020

probably answer that one

3347

02:37:51,349 --> 02:37:48,600

as chores as you can kind of see in the

3348

02:37:54,590 --> 02:37:51,359

picture the hexagon shape uh packs in

3349

02:37:56,990 --> 02:37:54,600

nicely into a circle uh you know uh most

3350

02:38:00,050 --> 02:37:57,000

most telescopes you can

3351
02:38:02,870 --> 02:38:00,060
buy in the store or anywhere that you've

3352
02:38:06,530 --> 02:38:02,880
seen typically in in movies or whatnot

3353
02:38:08,090 --> 02:38:06,540
is um has a round mirror it gives you

3354
02:38:11,990 --> 02:38:08,100
the the best

3355
02:38:14,809 --> 02:38:12,000
um amount of light collected per per use

3356
02:38:16,090 --> 02:38:14,819
it it gives you a nice usable beam the

3357
02:38:18,469 --> 02:38:16,100
hexagon

3358
02:38:21,230 --> 02:38:18,479
approximated that very closely it has a

3359
02:38:24,530 --> 02:38:21,240
nice packing shape you can see how it um

3360
02:38:27,590 --> 02:38:24,540
fits in around the Optics that that kind

3361
02:38:30,050 --> 02:38:27,600
of poke out that nose in the middle is

3362
02:38:32,630 --> 02:38:30,060
um is called the AFT Optics it's the

3363
02:38:33,889 --> 02:38:32,640

Optics that kind of fold the beam a

3364

02:38:37,070 --> 02:38:33,899

couple times before it sends it back

3365

02:38:39,469 --> 02:38:37,080

into the science instruments the

3366

02:38:43,670 --> 02:38:39,479

the outside shape of the mirror itself

3367

02:38:47,929 --> 02:38:43,680

it doesn't matter as much of each of the

3368

02:38:50,210 --> 02:38:47,939

uh edges of those those mirrors are very

3369

02:38:52,910 --> 02:38:50,220

carefully handled to make sure that they

3370

02:38:56,090 --> 02:38:52,920

don't have glints off the edges uh and

3371

02:38:59,210 --> 02:38:56,100

to make sure that the uh the the edges

3372

02:39:01,250 --> 02:38:59,220

are perfectly uh handled with how the

3373

02:39:04,130 --> 02:39:01,260

gold coating reaches the edges of those

3374

02:39:04,849 --> 02:39:04,140

so the the

3375

02:39:07,250 --> 02:39:04,859

um

3376

02:39:09,410 --> 02:39:07,260

the hexagon gave us a great shape for

3377

02:39:11,690 --> 02:39:09,420

handling the mirror in its movement the

3378

02:39:15,050 --> 02:39:11,700

way that Lee had described and it gave

3379

02:39:17,870 --> 02:39:15,060

us the best approximation of round

3380

02:39:19,010 --> 02:39:17,880

okay and it's worth mentioning we've got

3381

02:39:20,630 --> 02:39:19,020

a couple different questions about the

3382

02:39:22,250 --> 02:39:20,640

gold coating that we're just going to

3383

02:39:25,010 --> 02:39:22,260

pause see what they're saying in the

3384

02:39:30,410 --> 02:39:28,070

go ahead this is

3385

02:39:31,969 --> 02:39:30,420

um so at this time I can really confirm

3386

02:39:34,910 --> 02:39:31,979

that definitely just ready to begin the

3387

02:39:39,290 --> 02:39:34,920

three door a couple hatch to full and

3388

02:39:44,150 --> 02:39:42,230

copia and that command line looks good

3389

02:39:46,130 --> 02:39:44,160

you're going to execute

3390

02:39:50,570 --> 02:39:46,140

talking

3391

02:39:52,969 --> 02:39:50,580

to see how they go to Circuit executed

3392

02:39:56,809 --> 02:39:52,979

and you're going to continue

3393

02:39:56,819 --> 02:40:07,610

nice to see you smile there Julie

3394

02:40:11,450 --> 02:40:09,530

not at all

3395

02:40:13,250 --> 02:40:11,460

let's say we're actually right now in

3396

02:40:15,230 --> 02:40:13,260

the latching procedure this will take a

3397

02:40:17,030 --> 02:40:15,240

couple of hours as the uh the mirror was

3398

02:40:19,490 --> 02:40:17,040

moved this morning and now it's being

3399

02:40:20,690 --> 02:40:19,500

latched into its its final place

3400

02:40:23,030 --> 02:40:20,700

that there are a couple different

3401

02:40:25,490 --> 02:40:23,040

questions on how we design things to

3402

02:40:28,550 --> 02:40:25,500

operate at this you know very very low

3403

02:40:29,450 --> 02:40:28,560

uh temperature in fact um I mean this

3404

02:40:31,190 --> 02:40:29,460

may be something that you as a

3405

02:40:33,170 --> 02:40:31,200

mechanical engineer so so Jerry from

3406

02:40:34,730 --> 02:40:33,180

Twitter asked what kind of lubricants

3407

02:40:36,769 --> 02:40:34,740

are required for the bearings or the

3408

02:40:38,690 --> 02:40:36,779

wing segments and mirrors or there or

3409

02:40:39,950 --> 02:40:38,700

are they electrically heated in the way

3410

02:40:42,469 --> 02:40:39,960

that they can actually you know move

3411

02:40:44,389 --> 02:40:42,479

around at these very low temperatures

3412

02:40:46,670 --> 02:40:44,399

like you said I mean not much more than

3413

02:40:48,590 --> 02:40:46,680

you know 100 degrees above absolute zero

3414

02:40:50,510 --> 02:40:48,600

can you give us a sense about about how

3415

02:40:52,550 --> 02:40:50,520

you design an actuator to actually move

3416

02:40:56,170 --> 02:40:52,560

and function you know things to actually

3417

02:40:59,030 --> 02:40:56,180

swing around that when they're that cold

3418

02:41:01,190 --> 02:40:59,040

that's a great question and it's been

3419

02:41:04,570 --> 02:41:01,200

one of our major challenges

3420

02:41:12,830 --> 02:41:04,580

um as you heard a little bit about that

3421

02:41:17,809 --> 02:41:16,429

that the uh

3422

02:41:19,910 --> 02:41:17,819

the

3423

02:41:21,469 --> 02:41:19,920

uh

3424

02:41:25,570 --> 02:41:21,479

I'm sorry I lost my chain of thought

3425

02:41:32,330 --> 02:41:28,730

but uh when Lee was talking about the

3426

02:41:34,370 --> 02:41:32,340

the ears swinging into position

3427

02:41:36,950 --> 02:41:34,380

um they have a particular type of Lube

3428

02:41:39,110 --> 02:41:36,960

on it we did heat these particular ones

3429

02:41:42,170 --> 02:41:39,120

up because they are what is called a wet

3430

02:41:44,809 --> 02:41:42,180

Lube um which means that we want them to

3431

02:41:46,250 --> 02:41:44,819

be at a special temperature many many of

3432

02:41:48,110 --> 02:41:46,260

our other actuators are the ones that

3433

02:41:50,690 --> 02:41:48,120

they was talking about that on the backs

3434

02:41:53,269 --> 02:41:50,700

of the mirrors and lots of other places

3435

02:41:55,610 --> 02:41:53,279

throughout the telescope

3436

02:41:58,550 --> 02:41:55,620

uh called what is a

3437

02:42:01,429 --> 02:41:58,560

a dry lube and most of the time the dry

3438

02:42:04,130 --> 02:42:01,439

lube that's used is a molybden uh

3439

02:42:07,070 --> 02:42:04,140

disulfide and it's this um it's

3440

02:42:08,690 --> 02:42:07,080

essentially a very very soft material

3441

02:42:12,830 --> 02:42:08,700

that um

3442

02:42:15,410 --> 02:42:12,840

is uh is is not uh

3443

02:42:17,570 --> 02:42:15,420

a liquid at all it's actually a solid

3444

02:42:20,450 --> 02:42:17,580

material that gets coated onto the

3445

02:42:22,190 --> 02:42:20,460

surface of a of a joint and the the

3446

02:42:26,510 --> 02:42:22,200

surface of the joint kind of smears

3447

02:42:27,950 --> 02:42:26,520

across that soft metal and and uh has a

3448

02:42:31,969 --> 02:42:27,960

very low friction

3449

02:42:35,570 --> 02:42:31,979

it's interesting uh because we're using

3450

02:42:37,910 --> 02:42:35,580

it at such low temperatures and

3451
02:42:39,410 --> 02:42:37,920
um as as we've talked about before there

3452
02:42:41,809 --> 02:42:39,420
was such a long period of time in

3453
02:42:43,309 --> 02:42:41,819
designing and building web so one of the

3454
02:42:46,250 --> 02:42:43,319
major things that we had to go through

3455
02:42:49,309 --> 02:42:46,260
was a lifetime test and in our lifetime

3456
02:42:53,090 --> 02:42:49,319
tests it's very difficult to simulate

3457
02:42:56,630 --> 02:42:53,100
exactly how long you're going to be in

3458
02:42:58,490 --> 02:42:56,640
and testing the ground so if you want to

3459
02:43:03,050 --> 02:42:58,500
say that your mechanism is going to be

3460
02:43:06,650 --> 02:43:03,060
good you know from the day we coat our

3461
02:43:08,750 --> 02:43:06,660
um our our joint to the day that we're

3462
02:43:11,210 --> 02:43:08,760
finished using it on orbit and maybe

3463
02:43:13,910 --> 02:43:11,220

that's a period of of 10 years maybe

3464

02:43:16,730 --> 02:43:13,920

that's a period of 20 years maybe we've

3465

02:43:18,769 --> 02:43:16,740

got you know lots of fuel and we we get

3466

02:43:20,750 --> 02:43:18,779

to do it for 30 years how do you get to

3467

02:43:22,269 --> 02:43:20,760

qualify that

3468

02:43:25,370 --> 02:43:22,279

um

3469

02:43:32,750 --> 02:43:25,380

transition to Mattress in an hour and 10

3470

02:43:37,969 --> 02:43:35,030

in a way might be actually the simplest

3471

02:43:39,889 --> 02:43:37,979

part of it uh it's steady state it's

3472

02:43:42,349 --> 02:43:39,899

always uh set steady state temperature

3473

02:43:45,050 --> 02:43:42,359

it's always a cryogenic temperature it

3474

02:43:47,570 --> 02:43:45,060

doesn't come back to error uh it's never

3475

02:43:51,290 --> 02:43:47,580

exposed to oxygen again oxygen is one of

3476

02:43:54,710 --> 02:43:51,300

the things that can degrade surfaces it

3477

02:43:57,650 --> 02:43:54,720

oxidizes creates little little uh chunky

3478

02:43:59,269 --> 02:43:57,660

pieces of oxidation so once we're in

3479

02:44:00,769 --> 02:43:59,279

orbit like we're pretty good with this

3480

02:44:04,250 --> 02:44:00,779

the

3481

02:44:06,469 --> 02:44:04,260

out well how many times are we going to

3482

02:44:07,849 --> 02:44:06,479

move this mechanism in air how many

3483

02:44:09,170 --> 02:44:07,859

times we're going to use it in vacuum

3484

02:44:11,150 --> 02:44:09,180

how many times we're going to use it at

3485

02:44:14,030 --> 02:44:11,160

cryogenic temperatures all through our

3486

02:44:14,990 --> 02:44:14,040

testing Lifetime and then put on top of

3487

02:44:17,809 --> 02:44:15,000

that

3488

02:44:20,090 --> 02:44:17,819

how long is it going to be used in space

3489

02:44:22,190 --> 02:44:20,100

in those conditions and will it have

3490

02:44:24,710 --> 02:44:22,200

enough life of that joint

3491

02:44:26,750 --> 02:44:24,720

so that was a great question

3492

02:44:29,510 --> 02:44:26,760

yeah absolutely I mean I mean this is

3493

02:44:30,710 --> 02:44:29,520

part of this idea of cryoengineering you

3494

02:44:32,929 --> 02:44:30,720

know but making things that are going to

3495

02:44:34,790 --> 02:44:32,939

be work and work for a long time and

3496

02:44:36,950 --> 02:44:34,800

work reliably under these sorts of

3497

02:44:38,090 --> 02:44:36,960

temperatures and and actually there

3498

02:44:39,650 --> 02:44:38,100

there are you know there are more

3499

02:44:41,870 --> 02:44:39,660

questions coming in from social media

3500

02:44:43,670 --> 02:44:41,880

about you know like for example uh

3501

02:44:45,290 --> 02:44:43,680

Dorian on Twitch said how did you manage

3502

02:44:47,389 --> 02:44:45,300

to test the focusing of the mirrors on

3503

02:44:48,830 --> 02:44:47,399

Earth with all the deformations so we've

3504

02:44:51,710 --> 02:44:48,840

mentioned that it's you know it's not

3505

02:44:53,870 --> 02:44:51,720

just uh you know one of the deformations

3506

02:44:55,670 --> 02:44:53,880

is caused by gravity versus no gravity

3507

02:44:57,469 --> 02:44:55,680

but there's also the deformations caused

3508

02:44:58,969 --> 02:44:57,479

by temperature and and this is something

3509

02:45:01,250 --> 02:44:58,979

that you know I've had the pleasure of

3510

02:45:03,710 --> 02:45:01,260

being able to watch for the last years

3511

02:45:05,929 --> 02:45:03,720

is all of the different stages of

3512

02:45:07,370 --> 02:45:05,939

testing of this uh maybe you can talk a

3513

02:45:09,050 --> 02:45:07,380

bit about some of the cryo tests that

3514

02:45:10,670 --> 02:45:09,060

this uh that this telescope had to go

3515

02:45:12,170 --> 02:45:10,680

through

3516

02:45:15,170 --> 02:45:12,180

sure

3517

02:45:17,929 --> 02:45:15,180

um you know the way NASA approaches this

3518

02:45:20,870 --> 02:45:17,939

and all the contractors that work for us

3519

02:45:22,849 --> 02:45:20,880

and and uh Isa too and their nominal

3520

02:45:25,250 --> 02:45:22,859

test program is you start at like the

3521

02:45:28,070 --> 02:45:25,260

very most basic level uh you saw some of

3522

02:45:30,950 --> 02:45:28,080

the the pictures of the mirrors being uh

3523

02:45:32,389 --> 02:45:30,960

uh built and assembled and Lee talked a

3524

02:45:35,210 --> 02:45:32,399

little bit about their manufacturer

3525

02:45:37,730 --> 02:45:35,220

along the way well that happens with

3526

02:45:41,510 --> 02:45:37,740

every component is you start at like the

3527

02:45:44,929 --> 02:45:41,520

component level like the piece parts and

3528

02:45:47,450 --> 02:45:44,939

you um you started testing them and

3529

02:45:49,250 --> 02:45:47,460

understanding them and even at cryogenic

3530

02:45:52,010 --> 02:45:49,260

temperatures you might start off with

3531

02:45:55,070 --> 02:45:52,020

just doing cryo Cycles to make sure that

3532

02:46:06,110 --> 02:45:55,080

those standby

3533

02:46:10,809 --> 02:46:08,450

so there's positive conversations we

3534

02:46:12,950 --> 02:46:10,819

listen to the Box yes

3535

02:46:15,170 --> 02:46:12,960

sometimes I get more conversation about

3536

02:46:17,570 --> 02:46:15,180

you and from the deaf lead um if happy

3537

02:46:20,510 --> 02:46:17,580

with the two-door latch to fall already

3538

02:46:22,670 --> 02:46:20,520

continue with the three door

3539

02:46:24,469 --> 02:46:22,680

oh sorry we're he was happy with the

3540

02:46:26,269 --> 02:46:24,479

three door latch to full we're ready to

3541

02:46:30,530 --> 02:46:26,279

continue with the two-door latch to full

3542

02:46:34,610 --> 02:46:30,540

and that is motor move 14 of 20.

3543

02:46:40,670 --> 02:46:37,010

and that command line looks good you are

3544

02:46:43,790 --> 02:46:40,680

going to execute okay

3545

02:46:50,150 --> 02:46:45,429

and you're gonna continue

3546

02:46:55,190 --> 02:46:52,010

so just to wrap up our conversation on

3547

02:46:58,969 --> 02:46:55,200

on cryo testing like some materials like

3548

02:47:01,370 --> 02:46:58,979

specifically are are carbon tube

3549

02:47:03,050 --> 02:47:01,380

material that you you could see in our

3550

02:47:05,090 --> 02:47:03,060

current visualization with the tubes

3551
02:47:06,889 --> 02:47:05,100
that hang the secondary mirror out in

3552
02:47:10,070 --> 02:47:06,899
front of us are all of our backplane

3553
02:47:13,510 --> 02:47:10,080
materials they're made of a carbon

3554
02:47:16,990 --> 02:47:13,520
structure that has a cyanate uh

3555
02:47:21,070 --> 02:47:19,250
polymer that binds all those carbons

3556
02:47:24,469 --> 02:47:21,080
together and that's like a special

3557
02:47:26,870 --> 02:47:24,479
polymer that's designed for high

3558
02:47:30,650 --> 02:47:26,880
stability at cryogenic temperatures but

3559
02:47:33,830 --> 02:47:30,660
in order to deal with that parameters

3560
02:47:37,130 --> 02:47:33,840
and know it at a higher temperature

3561
02:47:39,290 --> 02:47:37,140
you have to go through a Cycles to kind

3562
02:47:41,389 --> 02:47:39,300
of cryo stress relieve it and the

3563
02:47:43,910 --> 02:47:41,399

mirrors had the same thing so there's

3564

02:47:46,010 --> 02:47:43,920

lots of stuff that we do early on to to

3565

02:47:47,170 --> 02:47:46,020

help these materials deal with that cry

3566

02:47:49,610 --> 02:47:47,180

death

3567

02:47:56,929 --> 02:47:49,620

cryogenic temperature

3568

02:48:03,889 --> 02:48:00,730

project so they're in their final stages

3569

02:48:06,230 --> 02:48:03,899

of uh moving each of these latches into

3570

02:48:08,630 --> 02:48:06,240

their full position so they get their

3571

02:48:11,809 --> 02:48:08,640

full load on them and this will this

3572

02:48:14,090 --> 02:48:11,819

will um be the be the final thing that

3573

02:48:16,730 --> 02:48:14,100

holds that mirror down we did this with

3574

02:48:18,530 --> 02:48:16,740

the other side yesterday once it's in

3575

02:48:20,990 --> 02:48:18,540

its final position we've never touched

3576

02:48:22,730 --> 02:48:21,000

these latches again every motion from

3577

02:48:24,710 --> 02:48:22,740

that point forward is happening at the

3578

02:48:26,990 --> 02:48:24,720

mechanism level that's behind each of

3579

02:48:29,809 --> 02:48:27,000

the mirrors and not at the frame and the

3580

02:48:33,230 --> 02:48:29,819

structure uh behind it that we're

3581

02:48:34,910 --> 02:48:33,240

latching into position today

3582

02:48:36,290 --> 02:48:34,920

well Julie thank you so much for joining

3583

02:48:37,250 --> 02:48:36,300

us hopefully we I think we'll have a

3584

02:48:39,830 --> 02:48:37,260

chance to talk to you a little bit later

3585

02:48:41,330 --> 02:48:39,840

in the broadcast uh for those of you

3586

02:48:43,309 --> 02:48:41,340

that are just joining us you're watching

3587

02:48:46,510 --> 02:48:43,319

the live commissioning of the James Webb

3588

02:48:49,610 --> 02:48:46,520

Space Telescope okay and uh

3589

02:48:51,590 --> 02:48:49,620

be advised at this time we have just

3590

02:48:53,450 --> 02:48:51,600

about uh just a little more than an hour

3591

02:48:56,690 --> 02:48:53,460

before we begin our activities to hand

3592

02:49:00,050 --> 02:48:56,700

over from BSN Canberra to DSN Madrid

3593

02:49:01,969 --> 02:49:00,060

that will start at 18 15 when we will

3594

02:49:04,130 --> 02:49:01,979

lose coverage on the Madrid backup

3595

02:49:07,190 --> 02:49:04,140

station or remember a backup station

3596

02:49:09,650 --> 02:49:07,200

excuse me pss36 we will have command and

3597

02:49:11,389 --> 02:49:09,660

Telemetry through Canberra Prime dss34

3598

02:49:14,570 --> 02:49:11,399

for another five minutes

3599

02:49:16,550 --> 02:49:14,580

at 1820 Canberra Prime will bring down

3600

02:49:18,769 --> 02:49:16,560

their Uplink and we will have single

3601
02:49:22,550 --> 02:49:18,779
antenna Telemetry only at Canberra for

3602
02:49:25,730 --> 02:49:22,560
another five minutes at 1825 Canberra

3603
02:49:28,130 --> 02:49:25,740
will end their track Madrid Prime dss54

3604
02:49:30,110 --> 02:49:28,140
will start their track

3605
02:49:33,710 --> 02:49:30,120
then bring up the Uplink as soon as they

3606
02:49:40,250 --> 02:49:37,490
and at 18 35 minutes later our Madrid

3607
02:49:42,830 --> 02:49:40,260
backup station dss56 will acquire the

3608
02:49:46,429 --> 02:49:42,840
downlines so to reiterate we will lose

3609
02:49:48,170 --> 02:49:46,439
back up to Lem at 1815 lose command at

3610
02:49:51,769 --> 02:49:48,180
18 20.

3611
02:49:54,290 --> 02:49:51,779
get command back at 1825 and get back up

3612
02:49:56,090 --> 02:49:54,300
to Lem back at 18 30. uh there will be

3613
02:49:57,769 --> 02:49:56,100

continuous Telemetry despite the

3614

02:49:59,630 --> 02:49:57,779

five-minute command outage except for a

3615

02:50:01,730 --> 02:49:59,640

few interruptions I will call them out

3616

02:50:06,530 --> 02:50:01,740

before they occur

3617

02:50:10,070 --> 02:50:07,790

once again thank you for joining us

3618

02:50:13,250 --> 02:50:11,750

all right so we're listening to uh live

3619

02:50:14,750 --> 02:50:13,260

commands from the mission operations

3620

02:50:16,910 --> 02:50:14,760

center at the Space Telescope Science

3621

02:50:18,469 --> 02:50:16,920

Institute in Baltimore Maryland I'm

3622

02:50:19,610 --> 02:50:18,479

Michelle Thaller for anybody just

3623

02:50:22,610 --> 02:50:19,620

joining us you're watching live

3624

02:50:24,170 --> 02:50:22,620

commissioning we'll see you guys at this

3625

02:50:26,389 --> 02:50:24,180

time you have one hour of command

3626
02:50:29,330 --> 02:50:26,399
remaining on DSM Canberra

3627
02:50:30,769 --> 02:50:29,340
copia would you would you hear them

3628
02:50:33,530 --> 02:50:30,779
talking about is something called the

3629
02:50:34,790 --> 02:50:33,540
deep space Network the DSI the way that

3630
02:50:38,269 --> 02:50:34,800
web

3631
02:50:40,790 --> 02:50:38,279
Earth is that there are several large uh

3632
02:50:42,830 --> 02:50:40,800
antennas radio dishes around the world

3633
02:50:44,389 --> 02:50:42,840
and of course as the Earth turns

3634
02:50:45,830 --> 02:50:44,399
different ones different different

3635
02:50:47,630 --> 02:50:45,840
different dishes come into view and out

3636
02:50:49,910 --> 02:50:47,640
of view of the web telescope the web

3637
02:50:51,710 --> 02:50:49,920
telescope itself is now uh more than

3638
02:50:54,710 --> 02:50:51,720

twice as far away as the moon it's about

3639

02:50:57,230 --> 02:50:54,720

600 000 miles away today and it's going

3640

02:50:59,210 --> 02:50:57,240

out to about a million miles away a

3641

02:51:00,769 --> 02:50:59,220

point called L2 the LaGrange point a

3642

02:51:02,510 --> 02:51:00,779

balance between the gravity of Earth and

3643

02:51:04,730 --> 02:51:02,520

the Earth and the Sun a wonderful place

3644

02:51:06,230 --> 02:51:04,740

to park a telescope for the long and

3645

02:51:08,510 --> 02:51:06,240

hopefully very successful Mission ahead

3646

02:51:11,210 --> 02:51:08,520

of it it's been an absolutely incredible

3647

02:51:13,849 --> 02:51:11,220

journey uh the uh the James Webb Space

3648

02:51:16,309 --> 02:51:13,859

Telescope launched on December 25th from

3649

02:51:18,110 --> 02:51:16,319

French Guiana from Coro this is the main

3650

02:51:19,670 --> 02:51:18,120

launch site of the European Space Agency

3651
02:51:21,950 --> 02:51:19,680
one of the major Partners in the James

3652
02:51:23,510 --> 02:51:21,960
Webb Space Telescope other major

3653
02:51:26,990 --> 02:51:23,520
Partners include the Canadian space

3654
02:51:28,610 --> 02:51:27,000
agency and of course NASA and uh the uh

3655
02:51:31,610 --> 02:51:28,620
the telescope has been on an incredible

3656
02:51:33,050 --> 02:51:31,620
journey I have been honored to have been

3657
02:51:34,550 --> 02:51:33,060
working in government at least in there

3658
02:51:36,410 --> 02:51:34,560
while much of it was built so I was able

3659
02:51:38,570 --> 02:51:36,420
to see some of the testing and something

3660
02:51:40,910 --> 02:51:38,580
of the primary mirror as well as the

3661
02:51:42,590 --> 02:51:40,920
instrument package and and then it was

3662
02:51:45,469 --> 02:51:42,600
shipped to north of Grumman in

3663
02:51:48,530 --> 02:51:45,479

California where it was uh actually put

3664

02:51:50,090 --> 02:51:48,540

onto the um uh the the actual spacecraft

3665

02:51:52,130 --> 02:51:50,100

and you see here some of the the

3666

02:51:53,870 --> 02:51:52,140

integration you see that large primary

3667

02:51:56,690 --> 02:51:53,880

mirror and that's exactly what happened

3668

02:51:58,250 --> 02:51:56,700

earlier today is that the final Wing was

3669

02:52:00,349 --> 02:51:58,260

deployed so we now have the full

3670

02:52:02,150 --> 02:52:00,359

complete mirror uh deployed and it's now

3671

02:52:03,830 --> 02:52:02,160

being lashed into place what you see

3672

02:52:06,710 --> 02:52:03,840

here is the testing of the incredible

3673

02:52:09,230 --> 02:52:06,720

sun shield this is a five layer shield

3674

02:52:11,690 --> 02:52:09,240

made of Captain a very light a very

3675

02:52:13,550 --> 02:52:11,700

strong material each one of those layers

3676

02:52:15,230 --> 02:52:13,560

makes the layer above it a little bit

3677

02:52:16,730 --> 02:52:15,240

colder until you finally get up to the

3678

02:52:19,250 --> 02:52:16,740

telescope that has an operating

3679

02:52:22,190 --> 02:52:19,260

temperature of under 400 Degrees my

3680

02:52:24,769 --> 02:52:22,200

under minus 400 degrees Fahrenheit so uh

3681

02:52:26,450 --> 02:52:24,779

just an incredible Marvel that was Julie

3682

02:52:28,010 --> 02:52:26,460

van kampen who was talking to us a bit

3683

02:52:29,570 --> 02:52:28,020

about some of the testing that was

3684

02:52:31,250 --> 02:52:29,580

required to make sure that different

3685

02:52:33,050 --> 02:52:31,260

components actually worked at that

3686

02:52:35,090 --> 02:52:33,060

incredible temperature

3687

02:52:37,490 --> 02:52:35,100

so here you see a beautiful picture of

3688

02:52:40,190 --> 02:52:37,500

that large primary mirror the mirror

3689

02:52:42,349 --> 02:52:40,200

segments are each each one of those

3690

02:52:44,690 --> 02:52:42,359

mirror segments is a bit over a meter uh

3691

02:52:46,790 --> 02:52:44,700

in in length so the mirror itself is

3692

02:52:48,349 --> 02:52:46,800

about a little bit over a little bit

3693

02:52:50,269 --> 02:52:48,359

over seven meters about seven and a half

3694

02:52:52,730 --> 02:52:50,279

meters across which is absolutely

3695

02:52:54,889 --> 02:52:52,740

incredible a long journey to get it here

3696

02:52:56,750 --> 02:52:54,899

from Goddard space flight center uh the

3697

02:52:59,090 --> 02:52:56,760

different universities where instruments

3698

02:53:00,950 --> 02:52:59,100

were built to uh north of Grumman where

3699

02:53:03,050 --> 02:53:00,960

it was all put together and and finally

3700

02:53:05,570 --> 02:53:03,060

tested and then put on a boat through

3701

02:53:07,550 --> 02:53:05,580

the Panama Canal and to uh to Kuro and

3702

02:53:16,010 --> 02:53:07,560

then the European space agency's launch

3703

02:53:20,150 --> 02:53:18,290

you'll uh you'll hear me pausing in the

3704

02:53:22,130 --> 02:53:20,160

commentary just so we can listen to what

3705

02:53:23,990 --> 02:53:22,140

the commands are currently they are

3706

02:53:27,110 --> 02:53:24,000

latching the telescope into its final

3707

02:53:30,650 --> 02:53:27,120

place and uh it's been an amazing

3708

02:53:33,110 --> 02:53:30,660

continue with the matter move

3709

02:53:34,910 --> 02:53:33,120

to continue

3710

02:53:36,889 --> 02:53:34,920

Roger the first thing that happened

3711

02:53:38,990 --> 02:53:36,899

about a week ago was the deployment of

3712

02:53:41,269 --> 02:53:39,000

the sun shield that was a very dramatic

3713

02:53:43,910 --> 02:53:41,279

and incredible and then came the the

3714

02:53:46,250 --> 02:53:43,920

secondary mirror the secondary mirror is

3715

02:53:47,630 --> 02:53:46,260

on a large boom that has to come out in

3716

02:53:49,730 --> 02:53:47,640

front of the primary mirrors the

3717

02:53:51,349 --> 02:53:49,740

focusing mirror the light from all of

3718

02:53:53,330 --> 02:53:51,359

those wonderful gold coated mirror

3719

02:53:55,370 --> 02:53:53,340

segments they're all focused up to the

3720

02:53:56,929 --> 02:53:55,380

secondary mirror which then directs the

3721

02:53:58,849 --> 02:53:56,939

light down into the instrument packages

3722

02:54:00,290 --> 02:53:58,859

and you can see here some of the major

3723

02:54:02,090 --> 02:54:00,300

deployments that Webb has been through

3724

02:54:04,070 --> 02:54:02,100

the very first deployment which we

3725

02:54:06,349 --> 02:54:04,080

actually saw on cameras from the rocket

3726

02:54:08,510 --> 02:54:06,359

was the uh the the solar panels to power

3727

02:54:10,910 --> 02:54:08,520

up the spacecraft and here you see that

3728

02:54:13,010 --> 02:54:10,920

incredible sun shield uh being unfolded

3729

02:54:15,290 --> 02:54:13,020

so there are the front and back

3730

02:54:16,969 --> 02:54:15,300

components of the sun shield web was

3731

02:54:18,950 --> 02:54:16,979

then lifted away from the sun shield

3732

02:54:21,110 --> 02:54:18,960

where it will be isolated and cold

3733

02:54:23,630 --> 02:54:21,120

operating temperatures like I said near

3734

02:54:27,050 --> 02:54:23,640

minus 400 degrees Fahrenheit

3735

02:54:28,670 --> 02:54:27,060

and uh that was a a baffled actually uh

3736

02:54:30,590 --> 02:54:28,680

that was put up to help it helped steady

3737

02:54:32,450 --> 02:54:30,600

itself in the solar wind a wind of

3738

02:54:34,429 --> 02:54:32,460

particles from the Sun and now we're

3739

02:54:35,510 --> 02:54:34,439

going to see the deployment of the sun

3740

02:54:37,670 --> 02:54:35,520

shield

3741

02:54:39,469 --> 02:54:37,680

this of course is a computer animation

3742

02:54:40,490 --> 02:54:39,479

we did not have any cameras on web

3743

02:54:41,990 --> 02:54:40,500

itself

3744

02:54:44,690 --> 02:54:42,000

but uh one of the things that we've been

3745

02:54:47,690 --> 02:54:44,700

able to do today is uh see live

3746

02:54:48,889 --> 02:54:47,700

visualizations from data from Telemetry

3747

02:54:50,510 --> 02:54:48,899

that's been coming down from the

3748

02:54:52,370 --> 02:54:50,520

telescopes

3749

02:54:54,889 --> 02:54:52,380

so the telescope has been sending us

3750

02:54:57,110 --> 02:54:54,899

signals as to what configuration it's in

3751

02:54:59,030 --> 02:54:57,120

and we've been following that this

3752

02:55:00,650 --> 02:54:59,040

morning and of course that was one here

3753

02:55:02,510 --> 02:55:00,660

you see that secondary mirror coming out

3754

02:55:05,389 --> 02:55:02,520

on those long long booms

3755

02:55:07,849 --> 02:55:05,399

and then uh yesterday you'll see the

3756

02:55:09,710 --> 02:55:07,859

next thing that happens is is one of

3757

02:55:11,929 --> 02:55:09,720

these uh these mirror segments was

3758

02:55:14,870 --> 02:55:11,939

clicked into place that was the activity

3759

02:55:17,030 --> 02:55:14,880

yesterday and this morning the final uh

3760

02:55:18,650 --> 02:55:17,040

the final wing of the primary mirror is

3761

02:55:21,170 --> 02:55:18,660

in place

3762

02:55:23,809 --> 02:55:21,180

so we have a a very special guest uh

3763

02:55:26,210 --> 02:55:23,819

joining us uh next we have Greg Robinson

3764

02:55:27,889 --> 02:55:26,220

and uh there are a few different people

3765

02:55:29,269 --> 02:55:27,899

including Tom Mister bookend who had

3766

02:55:35,530 --> 02:55:29,279

mentioned Greg earlier in the broadcast

3767

02:55:40,670 --> 02:55:38,150

uh definitely have confirmed that the

3768

02:55:43,670 --> 02:55:40,680

latch off stove performed as expected

3769

02:55:49,690 --> 02:55:43,680

he's ready to continue to the top one

3770

02:55:54,650 --> 02:55:51,469

10x1 please

3771

02:56:04,730 --> 02:55:56,570

and Greg will continue with you as soon

3772

02:56:09,490 --> 02:56:06,769

thank you

3773

02:56:12,889 --> 02:56:09,500

I think we're good to go welcome Greg

3774

02:56:13,910 --> 02:56:12,899

Michelle glad to be here oh what what

3775

02:56:16,190 --> 02:56:13,920

wonderful to have you here

3776

02:56:18,230 --> 02:56:16,200

congratulations on this this very

3777

02:56:20,030 --> 02:56:18,240

successful and exciting morning how are

3778

02:56:22,370 --> 02:56:20,040

you feeling right now

3779

02:56:24,769 --> 02:56:22,380

I'm feeling pretty good uh this is

3780

02:56:27,830 --> 02:56:24,779

certainly a huge milestone to complete

3781

02:56:29,630 --> 02:56:27,840

the all of the deployments uh as you

3782

02:56:31,490 --> 02:56:29,640

know this was the stage where we thought

3783

02:56:33,650 --> 02:56:31,500

we had the most risk in the mission

3784

02:56:36,230 --> 02:56:33,660

still have a long ways to go

3785

02:56:37,969 --> 02:56:36,240

uh but certainly uh it's great to have

3786

02:56:41,870 --> 02:56:37,979

this part behind us

3787

02:56:46,309 --> 02:56:44,330

so uh tell us a bit about your role on

3788

02:56:48,950 --> 02:56:46,319

on the James Webb Space Telescope I know

3789

02:56:50,570 --> 02:56:48,960

no you you are at NASA headquarters and

3790

02:56:52,190 --> 02:56:50,580

and what what has been your role for the

3791

02:56:54,469 --> 02:56:52,200

larger mission

3792

02:56:57,530 --> 02:56:54,479

so I've been on the program four years

3793

02:57:00,349 --> 02:56:57,540

so I'm the baby uh my role as program

3794

02:57:04,490 --> 02:57:00,359

director is to provide oversight to the

3795

02:57:06,469 --> 02:57:04,500

project uh execution uh leadership going

3796

02:57:08,570 --> 02:57:06,479

up to the administrative level to what

3797

02:57:10,130 --> 02:57:08,580

we call the non-floor and external

3798

02:57:14,389 --> 02:57:10,140

without stakeholders

3799

02:57:18,530 --> 02:57:16,849

and uh people time and time again have

3800

02:57:20,269 --> 02:57:18,540

commented on what a wonderful team this

3801

02:57:22,190 --> 02:57:20,279

is you know can you give us some

3802

02:57:23,570 --> 02:57:22,200

observations and maybe maybe some

3803

02:57:25,010 --> 02:57:23,580

personal stories about just how well

3804

02:57:25,969 --> 02:57:25,020

this team has worked together and

3805

02:57:29,210 --> 02:57:25,979

there's some very challenging

3806

02:57:31,670 --> 02:57:29,220

circumstances stand by

3807

02:57:33,710 --> 02:57:31,680

Cinema

3808

02:57:35,750 --> 02:57:33,720

yeah this is certainly an amazing team

3809

02:57:37,550 --> 02:57:35,760

honestly I will interview this

3810

02:57:40,010 --> 02:57:37,560

parameters and they look good we are

3811

02:57:41,870 --> 02:57:40,020

going to continue with the better move

3812

02:57:44,389 --> 02:57:41,880

topical to continue

3813

02:57:46,610 --> 02:57:44,399

Roger

3814

02:57:49,990 --> 02:57:46,620

I'd love to hear the voices because that

3815

02:57:52,790 --> 02:57:50,000

means we're making creepy progress

3816

02:57:54,769 --> 02:57:52,800

yeah so uh you know a very large team

3817

02:57:57,950 --> 02:57:54,779

across the globe if you've mentioned

3818

02:57:59,630 --> 02:57:57,960

that and certainly a lot of you look at

3819

02:58:02,870 --> 02:57:59,640

leaders at different locations at

3820

02:58:05,210 --> 02:58:02,880

Goddard at Northrop Institute here and

3821

02:58:08,210 --> 02:58:05,220

across the entire industrial base in the

3822

02:58:10,550 --> 02:58:08,220

U.S and across the globe a really good

3823

02:58:13,130 --> 02:58:10,560

team uh certainly at headquarters uh at

3824

02:58:15,230 --> 02:58:13,140

Bond level and Thomas the administrator

3825

02:58:16,730 --> 02:58:15,240

we've had tremendous support engagement

3826
02:58:19,130 --> 02:58:16,740
and focus

3827
02:58:21,530 --> 02:58:19,140
and so um

3828
02:58:22,670 --> 02:58:21,540
and the two it's kind of kind of funny

3829
02:58:25,309 --> 02:58:22,680
uh

3830
02:58:28,730 --> 02:58:25,319
going into the market how committed

3831
02:58:37,250 --> 02:58:28,740
people no idea which badges

3832
02:58:40,730 --> 02:58:38,870
I think this is often something that

3833
02:58:44,210 --> 02:58:40,740
surprises people about large missions

3834
02:58:46,130 --> 02:58:44,220
and it's not just a single take about 14

3835
02:58:58,190 --> 02:58:46,140
minutes

3836
02:59:00,710 --> 02:58:59,330
for those of you joining us for

3837
02:59:02,690 --> 02:59:00,720
listening to live commentary from the

3838
02:59:04,370 --> 02:59:02,700

mock the mission operations center and

3839

02:59:05,630 --> 02:59:04,380

they are latching in place the uh the

3840

02:59:07,670 --> 02:59:05,640

wing of the primary mirror that was

3841

02:59:09,050 --> 02:59:07,680

deployed earlier today that process is

3842

02:59:10,610 --> 02:59:09,060

going to take a few hours and we will be

3843

02:59:11,990 --> 02:59:10,620

here through the whole thing so at the

3844

02:59:13,610 --> 02:59:12,000

end of it we'll be able to say that that

3845

02:59:15,290 --> 02:59:13,620

procedure has been completed

3846

02:59:16,550 --> 02:59:15,300

successfully but Greg we were just

3847

02:59:18,830 --> 02:59:16,560

talking about that a lot of people don't

3848

02:59:20,330 --> 02:59:18,840

realize that that you know pretty much

3849

02:59:21,349 --> 02:59:20,340

you know all of the large missions that

3850

02:59:23,510 --> 02:59:21,359

they may have heard of and everything

3851
02:59:25,010 --> 02:59:23,520
from Mars rovers to the Hubble Space

3852
02:59:26,929 --> 02:59:25,020
Telescope and now the web telescope

3853
02:59:28,730 --> 02:59:26,939
these are international collaborations

3854
02:59:30,950 --> 02:59:28,740
and not just that collaborations between

3855
02:59:33,050 --> 02:59:30,960
industrial Partners government Partners

3856
02:59:34,610 --> 02:59:33,060
University Partners all of that maybe

3857
02:59:36,290 --> 02:59:34,620
you can give us a sense of just the the

3858
02:59:38,870 --> 02:59:36,300
range of partners that went into

3859
02:59:40,610 --> 02:59:38,880
something like the web mission

3860
02:59:42,530 --> 02:59:40,620
so the partnership but certainly

3861
02:59:44,150 --> 02:59:42,540
internationally includes the European

3862
02:59:48,050 --> 02:59:44,160
space agency and the Canadian space

3863
02:59:49,309 --> 02:59:48,060

agency really uh great Partners uh

3864

02:59:52,070 --> 02:59:49,319

they're partnering with us on many

3865

02:59:54,469 --> 02:59:52,080

missions and and they've brought a lot

3866

02:59:56,269 --> 02:59:54,479

to have instruments and there you have

3867

02:59:58,990 --> 02:59:56,279

five launch vehicle and we really

3868

03:00:02,570 --> 02:59:59,000

appreciate uh of course in the U.S

3869

03:00:05,030 --> 03:00:02,580

states 14 countries across the globe

3870

03:00:08,450 --> 03:00:05,040

saw a tremendous amount of support and

3871

03:00:10,490 --> 03:00:08,460

engagement that excellent development to

3872

03:00:13,370 --> 03:00:10,500

get web to this point and further along

3873

03:00:15,110 --> 03:00:13,380

in the operations so it's been a huge

3874

03:00:17,630 --> 03:00:15,120

team

3875

03:00:19,070 --> 03:00:17,640

um and and the industrial basis is

3876
03:00:21,050 --> 03:00:19,080
almost Limitless

3877
03:00:23,030 --> 03:00:21,060
if I try to name all of the the

3878
03:00:24,830 --> 03:00:23,040
companies and institutes and

3879
03:00:26,690 --> 03:00:24,840
universities I'd probably be here until

3880
03:00:28,429 --> 03:00:26,700
late today

3881
03:00:30,410 --> 03:00:28,439
um and and over the life of the

3882
03:00:33,290 --> 03:00:30,420
development more than 10 000 people have

3883
03:00:34,910 --> 03:00:33,300
actually touched web and externally we

3884
03:00:37,790 --> 03:00:34,920
we talk a lot when we go to schools and

3885
03:00:40,309 --> 03:00:37,800
things about technical careers many

3886
03:00:43,730 --> 03:00:40,319
people have touched Webb uh made it

3887
03:00:44,990 --> 03:00:43,740
possible including book Affairs and

3888
03:00:47,750 --> 03:00:45,000

finance

3889

03:00:50,269 --> 03:00:47,760

all types of disciplines of course they

3890

03:00:52,550 --> 03:00:50,279

have a lift thinking was done technical

3891

03:00:55,730 --> 03:00:52,560

teams

3892

03:00:59,750 --> 03:00:57,830

your careers so what what you know what

3893

03:01:02,030 --> 03:00:59,760

was your education and how did how did

3894

03:01:05,330 --> 03:01:02,040

your career bring you to this point

3895

03:01:07,910 --> 03:01:05,340

see so I'm I'm a double e

3896

03:01:10,130 --> 03:01:07,920

um and I started my career in industry

3897

03:01:13,370 --> 03:01:10,140

and then many years ago seemed so long

3898

03:01:15,590 --> 03:01:13,380

ago uh I got a space flight center I've

3899

03:01:19,610 --> 03:01:15,600

had many leadership roles

3900

03:01:21,170 --> 03:01:19,620

at Goddard uh at headquarters I was

3901
03:01:23,389 --> 03:01:21,180
Deputy out of the Glenn Research Center

3902
03:01:25,190 --> 03:01:23,399
for a couple years and prior to this

3903
03:01:29,630 --> 03:01:25,200
role I was uh

3904
03:01:32,150 --> 03:01:29,640
paid an SMD for programs which consists

3905
03:01:34,070 --> 03:01:32,160
of oversight of all of the

3906
03:01:36,469 --> 03:01:34,080
smms I think at the time they were

3907
03:01:38,870 --> 03:01:36,479
between 110 and 114

3908
03:01:41,389 --> 03:01:38,880
and then um

3909
03:01:43,969 --> 03:01:41,399
four years ago someone Twisted both of

3910
03:01:46,070 --> 03:01:43,979
my arms and said let's go look at this

3911
03:01:48,710 --> 03:01:46,080
thing over the goal line and and I think

3912
03:01:51,590 --> 03:01:48,720
we're pretty close

3913
03:01:53,389 --> 03:01:51,600

and just of course you know that NASA

3914

03:01:55,550 --> 03:01:53,399

loves acronyms SMD stands for the

3915

03:01:56,510 --> 03:01:55,560

science Mission directorate and as Greg

3916

03:01:58,730 --> 03:01:56,520

was saying the science Mission

3917

03:02:00,290 --> 03:01:58,740

directorate now has it's it's over a

3918

03:02:01,910 --> 03:02:00,300

hundred of course it changes week to

3919

03:02:03,469 --> 03:02:01,920

week as different missions launch and

3920

03:02:05,630 --> 03:02:03,479

different missions uh come to the end of

3921

03:02:08,150 --> 03:02:05,640

their lifetime but uh over over a

3922

03:02:10,790 --> 03:02:08,160

hundred uh missions all being science

3923

03:02:12,590 --> 03:02:10,800

Mission directorate at Nasa and again uh

3924

03:02:15,349 --> 03:02:12,600

perhaps uh perhaps those of you who

3925

03:02:18,370 --> 03:02:15,359

don't know what a double e is Greg what

3926

03:02:22,309 --> 03:02:20,570

electrical engineer

3927

03:02:25,130 --> 03:02:22,319

absolutely

3928

03:02:26,690 --> 03:02:25,140

so this you know the the wonderful

3929

03:02:28,130 --> 03:02:26,700

groundwork that you've laid with these

3930

03:02:30,469 --> 03:02:28,140

Partnerships you know and working

3931

03:02:31,910 --> 03:02:30,479

together you know I mean how does how

3932

03:02:34,370 --> 03:02:31,920

would this Mission shape the future of

3933

03:02:36,710 --> 03:02:34,380

astrophysics at NASA

3934

03:02:39,290 --> 03:02:36,720

so you've probably heard from some of us

3935

03:02:41,630 --> 03:02:39,300

you hear from boy uh so from uh what I

3936

03:02:46,070 --> 03:02:41,640

would call a Layman standpoint uh

3937

03:02:49,010 --> 03:02:46,080

certainly for NASA it's huge it adds to

3938

03:02:51,410 --> 03:02:49,020

the history of what NASA can do uh very

3939

03:02:54,050 --> 03:02:51,420

complex large missions

3940

03:02:56,269 --> 03:02:54,060

really open the doors for for many

3941

03:02:57,670 --> 03:02:56,279

discoveries and of course you've heard

3942

03:02:59,809 --> 03:02:57,680

all of the

3943

03:03:03,230 --> 03:02:59,819

Discovery certainly searching for with

3944

03:03:04,849 --> 03:03:03,240

web including looking back 13 and a half

3945

03:03:07,610 --> 03:03:04,859

plus billion years

3946

03:03:09,710 --> 03:03:07,620

between there and uh looking at having a

3947

03:03:13,309 --> 03:03:09,720

little habitability of

3948

03:03:15,950 --> 03:03:13,319

exoplanets and also studying within our

3949

03:03:19,190 --> 03:03:15,960

solar system so it's going to do a lot

3950

03:03:21,590 --> 03:03:19,200

a lot better than anything we have today

3951

03:03:23,929 --> 03:03:21,600

so certainly to that but from a

3952

03:03:25,969 --> 03:03:23,939

programmatic standpoint it further shows

3953

03:03:27,950 --> 03:03:25,979

uh with an asset within the broader

3954

03:03:31,010 --> 03:03:27,960

community of stakeholders and across the

3955

03:03:33,290 --> 03:03:31,020

globe uh what what NASA is capable of

3956

03:03:35,090 --> 03:03:33,300

doing and and

3957

03:03:36,769 --> 03:03:35,100

we can actually do a lot more when we

3958

03:03:40,910 --> 03:03:36,779

have excellent Partnerships like we have

3959

03:03:42,530 --> 03:03:40,920

today with our two primary partners

3960

03:03:44,510 --> 03:03:42,540

well Greg thank you so much for joining

3961

03:03:46,910 --> 03:03:44,520

us you know again congratulations on a

3962

03:03:48,590 --> 03:03:46,920

wonderful uh morning but congratulations

3963

03:03:51,170 --> 03:03:48,600

on the excellent leadership that you've

3964

03:03:52,790 --> 03:03:51,180

uh you've led into this program and

3965

03:03:54,769 --> 03:03:52,800

we're going to take a short break now

3966

03:03:56,510 --> 03:03:54,779

we're going to keep these images up in

3967

03:03:57,950 --> 03:03:56,520

front of you uh there there you see Greg

3968

03:03:59,809 --> 03:03:57,960

and me and then we take when we take a

3969

03:04:01,490 --> 03:03:59,819

break you'll see uh continuous images

3970

03:04:03,170 --> 03:04:01,500

from the mock the mission operations

3971

03:04:05,210 --> 03:04:03,180

center at the Space Telescope Science

3972

03:04:06,889 --> 03:04:05,220

Institute and also our Observatory

3973

03:04:09,410 --> 03:04:06,899

visualization tool which you see on the

3974

03:04:11,210 --> 03:04:09,420

left this is a computer generated image

3975

03:04:13,130 --> 03:04:11,220

but it's based on real-time data coming

3976
03:04:14,450 --> 03:04:13,140
down from the observatory so we're going

3977
03:04:16,190 --> 03:04:14,460
to take a short break and we'll be back

3978
03:04:17,929 --> 03:04:16,200
in just a little while to continue our

3979
03:10:38,929 --> 03:04:17,939
live commentary and the commissioning of

3980
03:10:38,939 --> 03:10:45,469
693.085

3981
03:10:45,479 --> 03:11:47,630
we still have three more minutes to go

3982
03:11:47,640 --> 03:11:52,130
and I see that better match complete

3983
03:11:52,140 --> 03:12:12,050
also copy

3984
03:12:16,969 --> 03:12:14,929
our gcp is complete

3985
03:12:19,190 --> 03:12:16,979
and Dropbox copy

3986
03:12:22,190 --> 03:12:19,200
and OC we're ready to continue with

3987
03:12:26,330 --> 03:12:22,200
693.086

3988
03:12:28,190 --> 03:12:26,340

pop one door latch to full 17 of 20.

3989

03:12:29,590 --> 03:12:28,200

the command line looks good you're good

3990

03:12:34,670 --> 03:12:29,600

to execute

3991

03:12:34,680 --> 03:12:38,150

and you're going to continue

3992

03:13:20,630 --> 03:12:39,830

so we go to continue

3993

03:13:30,110 --> 03:13:23,809

and standby for parameter review

3994

03:13:33,469 --> 03:13:32,330

and I see those parameters look good

3995

03:13:34,370 --> 03:13:33,479

you're going to continue with the motor

3996

03:13:36,889 --> 03:13:34,380

move

3997

03:14:19,969 --> 03:13:36,899

but we go to continue with the model

3998

03:14:19,979 --> 03:14:24,290

and the motor move has been progress

3999

03:14:24,300 --> 03:15:55,490

how to copy

4000

03:16:01,610 --> 03:15:58,670

all the Stations of the ROMs with

4001
03:16:08,030 --> 03:16:01,620
47 minutes to get alert and Plantation

4002
03:16:13,729 --> 03:16:10,969
and uh oh see this is gsion Ops be

4003
03:16:17,030 --> 03:16:13,739
advised in 32 minutes will be the end of

4004
03:16:47,450 --> 03:16:17,040
our Command coverage at DSN Canberra

4005
03:17:29,150 --> 03:16:49,670
and I see we're about halfway on this

4006
03:17:29,160 --> 03:19:09,590
cool

4007
03:19:09,600 --> 03:19:16,849
station three four Mississippi

4008
03:19:16,859 --> 03:19:31,269
completely

4009
03:19:38,030 --> 03:19:34,610
hey I see this is

4010
03:19:40,490 --> 03:19:38,040
um the motor moves complete of 17 of 20.

4011
03:19:42,190 --> 03:19:40,500
we're ready to continue

4012
03:19:46,250 --> 03:19:42,200
um with

4013
03:19:48,110 --> 03:19:46,260

693.088 bottom one door lash off so 18

4014

03:19:51,590 --> 03:19:48,120
of 20.

4015

03:19:53,330 --> 03:19:51,600
yeah copy that it's on the window

4016

03:19:56,269 --> 03:19:53,340
and that product looks good you're going

4017

03:19:59,990 --> 03:19:56,279
to execute puppy to see how they go to

4018

03:20:43,670 --> 03:20:02,150
and you're going to continue

4019

03:20:43,680 --> 03:20:47,570
let's stand by for parameter review

4020

03:20:47,580 --> 03:20:59,809
traffic up with standing one

4021

03:21:02,809 --> 03:21:01,790
and the overseas parameters are good

4022

03:21:04,670 --> 03:21:02,819
you're going to continue with the

4023

03:21:06,390 --> 03:21:04,680
measurement I'll be able to continue

4024

03:21:18,110 --> 03:21:06,400
with more remote

4025

03:21:18,120 --> 03:21:32,229
all right

4026
03:21:37,490 --> 03:21:34,490
I don't want to just turn your mic game

4027
03:21:37,500 --> 03:21:41,809
free

4028
03:21:45,590 --> 03:21:44,090
hello and welcome back to live coverage

4029
03:21:47,750 --> 03:21:45,600
of the commissioning of the James Webb

4030
03:21:51,170 --> 03:21:47,760
Space Telescope I'm Michelle Thaller I'm

4031
03:21:53,030 --> 03:21:51,180
joining you here Science Institute

4032
03:21:54,710 --> 03:21:53,040
and you're listening to a live

4033
03:21:56,389 --> 03:21:54,720
commentary

4034
03:21:57,769 --> 03:21:56,399
you'll notice that I'm positing because

4035
03:21:59,450 --> 03:21:57,779
there are different commands coming in

4036
03:22:01,309 --> 03:21:59,460
from the mission operations center or

4037
03:22:04,190 --> 03:22:01,319
the mock uh what has happened this

4038
03:22:06,590 --> 03:22:04,200

morning is we have deployed the final

4039

03:22:08,690 --> 03:22:06,600

part of the primary mirror this giant

4040

03:22:10,729 --> 03:22:08,700

gold coated mirror of the James Webb

4041

03:22:13,010 --> 03:22:10,739

Space Telescope there were two wings

4042

03:22:14,090 --> 03:22:13,020

that had to be deployed into place for

4043

03:22:16,370 --> 03:22:14,100

the whole primary mirror to be

4044

03:22:18,650 --> 03:22:16,380

functioning that has happened and was

4045

03:22:20,750 --> 03:22:18,660

happening now is latching these are

4046

03:22:23,450 --> 03:22:20,760

latches that will secure the mirror into

4047

03:22:25,309 --> 03:22:23,460

its final configuration and you'll hear

4048

03:22:27,170 --> 03:22:25,319

commands going on I'll pause the

4049

03:22:28,729 --> 03:22:27,180

commentary when uh when I hear different

4050

03:22:31,490 --> 03:22:28,739

commands coming in from the mission

4051

03:22:33,769 --> 03:22:31,500

operations center

4052

03:22:35,510 --> 03:22:33,779

so it's been an incredible morning an

4053

03:22:40,490 --> 03:22:35,520

incredible journey for all of us on the

4054

03:22:45,650 --> 03:22:43,670

and uh is now on its way out to its

4055

03:22:48,050 --> 03:22:45,660

final uh its final location its final

4056

03:22:53,809 --> 03:22:48,060

parking orbit at L2 a LaGrange point

4057

03:22:58,429 --> 03:22:56,450

of course coverage is a live event and

4058

03:23:01,790 --> 03:22:58,439

this schedule is set by the engineering

4059

03:23:04,309 --> 03:23:01,800

so we don't know exactly what time this

4060

03:23:06,590 --> 03:23:04,319

will end the idea is that we will be

4061

03:23:08,630 --> 03:23:06,600

here through the lectures

4062

03:23:11,469 --> 03:23:08,640

that looks like that proc's complete and

4063

03:23:14,870 --> 03:23:11,479

we are ready to continue with

4064

03:23:17,750 --> 03:23:14,880

693.089 bottom one door latch to Safe

4065

03:23:19,610 --> 03:23:17,760

move 19 of 20. manned line looks good

4066

03:23:25,250 --> 03:23:19,620

you're going to execute

4067

03:23:30,650 --> 03:23:26,870

and you're going to continue

4068

03:23:34,610 --> 03:23:32,690

so by the end of the broadcast we will

4069

03:23:36,830 --> 03:23:34,620

have uh the final confirmation that

4070

03:23:39,349 --> 03:23:36,840

everything is latched into place and

4071

03:23:41,990 --> 03:23:39,359

this has been an amazing couple days of

4072

03:23:43,250 --> 03:23:42,000

the the major installations required for

4073

03:23:45,950 --> 03:23:43,260

the functioning of the James Webb Space

4074

03:23:49,370 --> 03:23:45,960

Telescope it's not the end we still have

4075

03:23:50,510 --> 03:23:49,380

plenty left to do so uh um we will the

4076

03:23:52,490 --> 03:23:50,520

next thing after this is that the

4077

03:23:54,290 --> 03:23:52,500

telescope will have to cool down and

4078

03:23:56,630 --> 03:23:54,300

then we will begin commissioning the

4079

03:23:58,729 --> 03:23:56,640

primary mirror which is in 18 separate

4080

03:24:00,710 --> 03:23:58,739

segments each of those segments can be

4081

03:24:03,710 --> 03:24:00,720

individually moved to focus this into

4082

03:24:05,809 --> 03:24:03,720

one large functioning telescope

4083

03:24:09,170 --> 03:24:05,819

and I believe with me I'm going to have

4084

03:24:15,650 --> 03:24:09,180

Julie van kampen Julie is the Deputy uh

4085

03:24:18,830 --> 03:24:17,330

and so what you'll see on your screen is

4086

03:24:20,929 --> 03:24:18,840

you'll see a Julie and I on the bottom

4087

03:24:23,030 --> 03:24:20,939

here above us his live coverage from the

4088

03:24:25,190 --> 03:24:23,040

mock and oh at the moment it's just us

4089

03:24:27,290 --> 03:24:25,200

and then there'll also be data coming in

4090

03:24:28,849 --> 03:24:27,300

on an observatory visualization tool to

4091

03:24:31,070 --> 03:24:28,859

show us what the observatory is doing at

4092

03:24:32,870 --> 03:24:31,080

the moment so um Julie we have a few

4093

03:24:33,889 --> 03:24:32,880

moments and I know that one of the

4094

03:24:36,769 --> 03:24:33,899

things we're getting lots of questions

4095

03:24:38,150 --> 03:24:36,779

about are careers in science and we have

4096

03:24:40,190 --> 03:24:38,160

two sort of different people to

4097

03:24:43,490 --> 03:24:40,200

represent engineering and the science

4098

03:24:45,410 --> 03:24:43,500

aspect of working for NASA so um how

4099

03:24:46,790 --> 03:24:45,420

about uh how about if you start out tell

4100

03:24:48,469 --> 03:24:46,800

us a bit about careers in science and

4101
03:24:50,290 --> 03:24:48,479
how you came to be in the position that

4102
03:24:54,229 --> 03:24:50,300
you're in now Julie

4103
03:24:55,969 --> 03:24:54,239
oh well going through

4104
03:24:57,650 --> 03:24:55,979
um you know everybody that you've talked

4105
03:24:59,330 --> 03:24:57,660
to today has talked to you've asked the

4106
03:25:01,490 --> 03:24:59,340
same question and gone through the how

4107
03:25:03,349 --> 03:25:01,500
they've become uh careers in science and

4108
03:25:05,809 --> 03:25:03,359
and I think it's it's really interesting

4109
03:25:07,550 --> 03:25:05,819
to hear how everybody kind of like

4110
03:25:08,929 --> 03:25:07,560
everybody kind of goes back to like how

4111
03:25:10,250 --> 03:25:08,939
they got started and then they talk

4112
03:25:10,849 --> 03:25:10,260
about

4113
03:25:12,469 --> 03:25:10,859

um

4114

03:25:14,990 --> 03:25:12,479

you know kind of where they went through

4115

03:25:17,630 --> 03:25:15,000

their career but I think uh a couple

4116

03:25:19,070 --> 03:25:17,640

people have said uh a couple of really

4117

03:25:20,690 --> 03:25:19,080

important things and you even mentioned

4118

03:25:23,990 --> 03:25:20,700

it once when you were talking about the

4119

03:25:27,469 --> 03:25:24,000

the pilots that flew the plane to bring

4120

03:25:29,630 --> 03:25:27,479

the uh the telescope to a particular

4121

03:25:32,090 --> 03:25:29,640

place or portions of the telescope to a

4122

03:25:34,490 --> 03:25:32,100

particular place what's

4123

03:25:35,750 --> 03:25:34,500

always been

4124

03:25:37,849 --> 03:25:35,760

um

4125

03:25:39,710 --> 03:25:37,859

something that I knew that I wanted to

4126
03:25:41,570 --> 03:25:39,720
do and I didn't necessarily know I

4127
03:25:43,010 --> 03:25:41,580
wanted to be an engineer and I didn't

4128
03:25:45,290 --> 03:25:43,020
necessarily know that I wanted to work

4129
03:25:47,330 --> 03:25:45,300
for NASA but what I did know is that I

4130
03:25:49,969 --> 03:25:47,340
wanted to do something that I really

4131
03:25:51,349 --> 03:25:49,979
cared about and I think

4132
03:25:52,969 --> 03:25:51,359
um you know as you've gone through your

4133
03:25:55,610 --> 03:25:52,979
program today you've you've seen

4134
03:25:57,830 --> 03:25:55,620
technicians working in the clean room

4135
03:26:00,050 --> 03:25:57,840
um you've seen machinists you've seen

4136
03:26:01,729 --> 03:26:00,060
people who had to work in coding

4137
03:26:03,290 --> 03:26:01,739
departments

4138
03:26:06,229 --> 03:26:03,300

um you've talked to lots of engineers in

4139

03:26:09,290 --> 03:26:06,239

science uh scientists

4140

03:26:12,469 --> 03:26:09,300

and the thing that that everyone

4141

03:26:14,150 --> 03:26:12,479

um has in common and Greg had mentioned

4142

03:26:16,490 --> 03:26:14,160

how many people over the years had

4143

03:26:18,769 --> 03:26:16,500

really kind of touched jwst throughout

4144

03:26:21,410 --> 03:26:18,779

its life and whether you're a lawyer or

4145

03:26:24,650 --> 03:26:21,420

you're a finance or whether you're in

4146

03:26:25,670 --> 03:26:24,660

the immediate Department here today

4147

03:26:27,650 --> 03:26:25,680

um

4148

03:26:30,830 --> 03:26:27,660

you have to be really excited about what

4149

03:26:33,530 --> 03:26:30,840

you do it almost doesn't matter what it

4150

03:26:35,630 --> 03:26:33,540

is that you do or where you wind up or

4151
03:26:39,349 --> 03:26:35,640
what path that you take to do there as

4152
03:26:41,750 --> 03:26:39,359
long as you find it so compelling that

4153
03:26:42,950 --> 03:26:41,760
you want to get up today and that's what

4154
03:26:44,870 --> 03:26:42,960
you want to do

4155
03:26:47,269 --> 03:26:44,880
and that's and that's

4156
03:26:49,190 --> 03:26:47,279
um you know when people say well what

4157
03:26:51,229 --> 03:26:49,200
should I do what should I study it

4158
03:26:54,110 --> 03:26:51,239
almost really doesn't

4159
03:26:55,910 --> 03:26:54,120
um matter in particular what you pick as

4160
03:26:59,450 --> 03:26:55,920
long as you were really interested in it

4161
03:27:01,309 --> 03:26:59,460
and as long as you find your path to be

4162
03:27:03,229 --> 03:27:01,319
the most exciting thing of your life you

4163
03:27:06,290 --> 03:27:03,239

spend so much of your life doing it you

4164

03:27:09,710 --> 03:27:08,510

I I couldn't agree more Julie I mean

4165

03:27:10,910 --> 03:27:09,720

there's a few things there that you

4166

03:27:13,070 --> 03:27:10,920

touched on that I think are really

4167

03:27:15,050 --> 03:27:13,080

important you know one is the range of

4168

03:27:17,269 --> 03:27:15,060

people that can work for an organization

4169

03:27:19,550 --> 03:27:17,279

like NASA or our partner organizations

4170

03:27:22,010 --> 03:27:19,560

either universities or in the the

4171

03:27:23,450 --> 03:27:22,020

Aerospace industry you know I mean I I

4172

03:27:24,950 --> 03:27:23,460

don't just work with other scientists

4173

03:27:26,450 --> 03:27:24,960

like you mentioned you know when you

4174

03:27:28,429 --> 03:27:26,460

have all of the different nations and

4175

03:27:29,990 --> 03:27:28,439

all the different companies involved you

4176
03:27:32,210 --> 03:27:30,000
know you have lawyers you have people

4177
03:27:33,590 --> 03:27:32,220
that are experts in finances

4178
03:27:35,330 --> 03:27:33,600
um you have all of the people that are

4179
03:27:36,650 --> 03:27:35,340
generating the incredible animations

4180
03:27:38,030 --> 03:27:36,660
that we're seeing you know in the

4181
03:27:40,130 --> 03:27:38,040
computer scientists and the graphics

4182
03:27:41,990 --> 03:27:40,140
people and the visualizers the people

4183
03:27:44,030 --> 03:27:42,000
that can make this uh these beautiful

4184
03:27:46,010 --> 03:27:44,040
images that we see the people that will

4185
03:27:48,530 --> 03:27:46,020
eventually work on the images that come

4186
03:27:51,889 --> 03:27:48,540
down from web there there are so many

4187
03:27:54,229 --> 03:27:51,899
different ways to work at Nasa and you

4188
03:27:56,809 --> 03:27:54,239

know I mean for me it really was a dream

4189

03:27:58,670 --> 03:27:56,819

early on to work at Nasa that's because

4190

03:28:01,790 --> 03:27:58,680

I couldn't get these questions out of my

4191

03:28:04,070 --> 03:28:01,800

head about space I remember we opened

4192

03:28:06,229 --> 03:28:04,080

the program today with uh a little bit

4193

03:28:08,030 --> 03:28:06,239

of a voiceover from Carl Sagan who was a

4194

03:28:10,070 --> 03:28:08,040

a famous scientist when I was growing up

4195

03:28:13,490 --> 03:28:10,080

and when I was 10 years old he had his

4196

03:28:16,490 --> 03:28:13,500

program Cosmos that was back in 1980 and

4197

03:28:18,889 --> 03:28:16,500

I I was so taken with the questions and

4198

03:28:20,630 --> 03:28:18,899

the drama of the universe that even

4199

03:28:22,429 --> 03:28:20,640

though by the time I got to college I

4200

03:28:24,469 --> 03:28:22,439

didn't necessarily find the physics and

4201

03:28:27,290 --> 03:28:24,479

math classes easy I didn't get the best

4202

03:28:29,990 --> 03:28:27,300

grades but I could not stop thinking

4203

03:28:31,729 --> 03:28:30,000

about this and when people sometimes

4204

03:28:33,650 --> 03:28:31,739

your parents will say to me you know how

4205

03:28:36,349 --> 03:28:33,660

can I encourage my child to be a

4206

03:28:38,090 --> 03:28:36,359

scientist and and just like you said

4207

03:28:39,830 --> 03:28:38,100

I'm not so concerned about people

4208

03:28:41,330 --> 03:28:39,840

becoming scientists necessarily or

4209

03:28:44,330 --> 03:28:41,340

Engineers I'm concerned about them

4210

03:28:47,210 --> 03:28:44,340

following their own curiosity and and

4211

03:28:49,849 --> 03:28:47,220

then life becomes a jewelry yeah I mean

4212

03:28:51,710 --> 03:28:49,859

I I am so privileged to work with people

4213

03:28:53,870 --> 03:28:51,720

like you and people that we're seeing

4214

03:28:55,550 --> 03:28:53,880

today in the films and the footage live

4215

03:28:58,490 --> 03:28:55,560

here at the Space Telescope Science

4216

03:28:59,929 --> 03:28:58,500

Institute the the amazing thing is the

4217

03:29:02,090 --> 03:28:59,939

people that we work with and the passion

4218

03:29:06,410 --> 03:29:02,100

that we share

4219

03:29:10,250 --> 03:29:08,809

right so um I believe what we're going

4220

03:29:11,929 --> 03:29:10,260

to do now is talk a bit about the

4221

03:29:13,610 --> 03:29:11,939

science of web so we've just talked

4222

03:29:15,050 --> 03:29:13,620

about all of the passion and all of the

4223

03:29:17,570 --> 03:29:15,060

questions that we answered with the web

4224

03:29:19,130 --> 03:29:17,580

telescope and uh being an astronomer

4225

03:29:21,710 --> 03:29:19,140

like I said this is a particularly

4226

03:29:23,809 --> 03:29:21,720

exciting time for me I am personally

4227

03:29:25,250 --> 03:29:23,819

very very much looking forward to the

4228

03:29:28,550 --> 03:29:25,260

data that the web telescope is coming

4229

03:29:29,870 --> 03:29:28,560

back so um I I believe there are a

4230

03:29:31,550 --> 03:29:29,880

couple different animations we can run

4231

03:29:33,710 --> 03:29:31,560

while we talk about the science first of

4232

03:29:36,830 --> 03:29:33,720

all let me talk about why the web

4233

03:29:38,330 --> 03:29:36,840

telescope is an infrared telescope and

4234

03:29:40,010 --> 03:29:38,340

this is something that's different from

4235

03:29:42,110 --> 03:29:40,020

our eyes our eyes are not sensitive to

4236

03:29:44,210 --> 03:29:42,120

this color so infrared is a type of

4237

03:29:46,370 --> 03:29:44,220

light that is a lower energy light than

4238

03:29:47,870 --> 03:29:46,380

the eye the light that our eye sees what

4239

03:29:50,210 --> 03:29:47,880

you see here is the electromagnetic

4240

03:29:52,969 --> 03:29:50,220

spectrum but that's a word a term for

4241

03:29:55,309 --> 03:29:52,979

all of the type of light that exists and

4242

03:29:57,229 --> 03:29:55,319

our eyes are only sensitive to a tiny

4243

03:29:58,790 --> 03:29:57,239

bit of that so you know the

4244

03:30:00,410 --> 03:29:58,800

electromagnetic spectrum includes things

4245

03:30:02,570 --> 03:30:00,420

like gamma rays and x-rays and

4246

03:30:04,429 --> 03:30:02,580

UltraViolet that's over to the left of

4247

03:30:06,769 --> 03:30:04,439

your screen and those are types of

4248

03:30:09,170 --> 03:30:06,779

lights that are just too high energy for

4249

03:30:10,010 --> 03:30:09,180

our eyes to detect and then as you go on

4250

03:30:11,450 --> 03:30:10,020

to the other parts of the

4251
03:30:13,490 --> 03:30:11,460
electromagnetic spectrum you have things

4252
03:30:15,349 --> 03:30:13,500
like infrared light which we commonly

4253
03:30:18,530 --> 03:30:15,359
think of as heat light or also

4254
03:30:20,750 --> 03:30:18,540
microwaves and radio these are all parts

4255
03:30:22,429 --> 03:30:20,760
of light just things that we are not

4256
03:30:24,050 --> 03:30:22,439
sensitive to and there have been

4257
03:30:25,610 --> 03:30:24,060
telescopes before that have looked a

4258
03:30:27,170 --> 03:30:25,620
little bit in space into these different

4259
03:30:29,269 --> 03:30:27,180
types of light the Hubble Space

4260
03:30:30,349 --> 03:30:29,279
Telescope saw a little bit and still

4261
03:30:33,349 --> 03:30:30,359
does see a little bit into the

4262
03:30:35,570 --> 03:30:33,359
ultraviolet and the infrared and the

4263
03:30:38,030 --> 03:30:35,580

Spitzer Space Telescope was a mission

4264

03:30:40,550 --> 03:30:38,040

that that launched uh that I was part of

4265

03:30:42,469 --> 03:30:40,560

all the way back in 1998 I started

4266

03:30:44,570 --> 03:30:42,479

working on the specific Space Telescope

4267

03:30:46,729 --> 03:30:44,580

Mission and you can see that James Webb

4268

03:30:49,550 --> 03:30:46,739

was designed to look at this particular

4269

03:30:51,769 --> 03:30:49,560

wavelength of light infrared light and

4270

03:30:54,530 --> 03:30:51,779

infrared light has several incredible

4271

03:30:56,090 --> 03:30:54,540

advantages to it this is a famous image

4272

03:30:57,830 --> 03:30:56,100

from the Hubble Space Telescope in

4273

03:30:59,690 --> 03:30:57,840

visible light the type of light that our

4274

03:31:02,389 --> 03:30:59,700

eye sees of something called The Pillars

4275

03:31:05,030 --> 03:31:02,399

of Creation these are giant clouds of

4276
03:31:07,729 --> 03:31:05,040
dust and gas they are there are hundreds

4277
03:31:09,349 --> 03:31:07,739
of billions of miles across and this

4278
03:31:12,110 --> 03:31:09,359
image that you see here in infrared

4279
03:31:13,670 --> 03:31:12,120
that's a real image so this is an image

4280
03:31:15,229 --> 03:31:13,680
taken by the Hubble Space Telescope

4281
03:31:17,870 --> 03:31:15,239
looking a little bit into the infrared

4282
03:31:20,510 --> 03:31:17,880
our eyes can't see this it's invisible

4283
03:31:22,849 --> 03:31:20,520
to our eyes but all of those stars that

4284
03:31:25,729 --> 03:31:22,859
you're seeing there are really there the

4285
03:31:27,710 --> 03:31:25,739
light was obscured by dust visible light

4286
03:31:29,809 --> 03:31:27,720
that our eye sees is very easily

4287
03:31:31,250 --> 03:31:29,819
obscured by dust and some of the more

4288
03:31:33,830 --> 03:31:31,260

interesting things in the universe

4289

03:31:36,290 --> 03:31:33,840

actually happen inside these big clouds

4290

03:31:38,330 --> 03:31:36,300

and dust and gas this is a visualization

4291

03:31:40,969 --> 03:31:38,340

again produced by our amazing animators

4292

03:31:43,849 --> 03:31:40,979

based on real Hubble observations of the

4293

03:31:46,550 --> 03:31:43,859

Orion Nebula the Orion Nebula is one of

4294

03:31:48,769 --> 03:31:46,560

the largest places close to us in our

4295

03:31:51,889 --> 03:31:48,779

galaxy where new stars and planetary

4296

03:31:54,229 --> 03:31:51,899

systems are forming by the thousands and

4297

03:31:57,229 --> 03:31:54,239

inside this Cloud we see all of these

4298

03:31:59,090 --> 03:31:57,239

young Stars young planetary systems uh

4299

03:32:01,250 --> 03:31:59,100

normally much of this cloud is obscured

4300

03:32:03,650 --> 03:32:01,260

from us the dust is so thick we can't

4301
03:32:04,969 --> 03:32:03,660
see it uh but in infrared we can see

4302
03:32:07,250 --> 03:32:04,979
right through that dust and we can

4303
03:32:09,110 --> 03:32:07,260
actually you'll really have a chance to

4304
03:32:11,929 --> 03:32:09,120
witness the birth of stars and planets

4305
03:32:14,090 --> 03:32:11,939
themselves so infrared has this very

4306
03:32:16,210 --> 03:32:14,100
specific property of being able to see

4307
03:32:19,130 --> 03:32:16,220
places we can't see with visible light

4308
03:32:20,929 --> 03:32:19,140
and this is also something that comes in

4309
03:32:23,809 --> 03:32:20,939
handy with seeing the very early

4310
03:32:26,210 --> 03:32:23,819
universe the farther away you look out

4311
03:32:28,550 --> 03:32:26,220
into space the longer that light has

4312
03:32:30,889 --> 03:32:28,560
taken time to travel to us light travels

4313
03:32:33,769 --> 03:32:30,899

at 186 000 miles per second that's very

4314

03:32:36,290 --> 03:32:33,779

fast but it is a finite speed the Hubble

4315

03:32:38,330 --> 03:32:36,300

Space Telescope could see uh so far away

4316

03:32:41,030 --> 03:32:38,340

that the light was coming to us about

4317

03:32:43,010 --> 03:32:41,040

500 million years after the big bang but

4318

03:32:45,530 --> 03:32:43,020

Webb can see farther still

4319

03:32:47,690 --> 03:32:45,540

Webb can actually look so far away that

4320

03:32:49,969 --> 03:32:47,700

it's looking back to a time where the

4321

03:32:51,950 --> 03:32:49,979

light left when the universe was only a

4322

03:32:54,290 --> 03:32:51,960

couple hundred million years old that's

4323

03:32:56,929 --> 03:32:54,300

amazing that's actually the time when

4324

03:32:59,210 --> 03:32:56,939

the very first galaxies were forming and

4325

03:33:01,309 --> 03:32:59,220

this is a visualization based on on

4326

03:33:03,349 --> 03:33:01,319

physics based on how we think the early

4327

03:33:05,990 --> 03:33:03,359

Universe came together what you're

4328

03:33:08,150 --> 03:33:06,000

seeing here are young galaxies a galaxy

4329

03:33:10,610 --> 03:33:08,160

is a family of hundreds of billions of

4330

03:33:12,769 --> 03:33:10,620

stars and in the early Universe there

4331

03:33:15,050 --> 03:33:12,779

were many smaller galaxies that began to

4332

03:33:17,450 --> 03:33:15,060

combine into the large galaxies we see

4333

03:33:19,969 --> 03:33:17,460

today like our own Milky Way galaxy our

4334

03:33:22,010 --> 03:33:19,979

own Milky Way galaxy today has half a

4335

03:33:23,929 --> 03:33:22,020

trillion Stars more than 500 billion

4336

03:33:26,510 --> 03:33:23,939

stars it's a hundred thousand light

4337

03:33:29,090 --> 03:33:26,520

years across from end to end but we're

4338

03:33:31,550 --> 03:33:29,100

also part of a cluster of galaxies and

4339

03:33:33,349 --> 03:33:31,560

galaxies seem to Cluster together based

4340

03:33:35,510 --> 03:33:33,359

on something called dark matter that was

4341

03:33:37,190 --> 03:33:35,520

present in the early Universe web is

4342

03:33:39,349 --> 03:33:37,200

going to be probing this mysterious form

4343

03:33:41,929 --> 03:33:39,359

of matter and trying to understand how

4344

03:33:43,910 --> 03:33:41,939

it led to the formation of galaxies and

4345

03:33:45,590 --> 03:33:43,920

of course the Stars the planets and

4346

03:33:47,210 --> 03:33:45,600

everything else that we see today

4347

03:33:49,070 --> 03:33:47,220

what you're looking at right now are

4348

03:33:51,290 --> 03:33:49,080

some beautiful pictures of galaxies from

4349

03:33:52,670 --> 03:33:51,300

the Hubble telescope another thing that

4350

03:33:54,170 --> 03:33:52,680

we're really proud about with the web

4351
03:33:56,389 --> 03:33:54,180
telescope and really looking forward to

4352
03:33:59,030 --> 03:33:56,399
is we think we will have the ability to

4353
03:34:02,570 --> 03:33:59,040
understand what exoplanets are like

4354
03:34:04,010 --> 03:34:02,580
so exoplanets are our wonderful objects

4355
03:34:07,370 --> 03:34:04,020
that are planets going around other

4356
03:34:09,110 --> 03:34:07,380
stars so far we can measure the mass of

4357
03:34:10,969 --> 03:34:09,120
these planets so we can measure their

4358
03:34:12,950 --> 03:34:10,979
density but we really have no

4359
03:34:15,050 --> 03:34:12,960
understanding of their environments do

4360
03:34:16,670 --> 03:34:15,060
they have atmospheres like the Earth are

4361
03:34:19,610 --> 03:34:16,680
there things like water vapor present

4362
03:34:21,710 --> 03:34:19,620
carbon monoxide carbon dioxide the way

4363
03:34:24,530 --> 03:34:21,720

we find that is we watch the planet

4364

03:34:26,210 --> 03:34:24,540

actually we call transit in front of its

4365

03:34:28,370 --> 03:34:26,220

star actually make a tiny little solar

4366

03:34:30,650 --> 03:34:28,380

eclipse and when that happens The

4367

03:34:32,870 --> 03:34:30,660

Starlight shines through the atmosphere

4368

03:34:34,490 --> 03:34:32,880

of that planet and some of it goes right

4369

03:34:36,710 --> 03:34:34,500

on through the atmosphere and continues

4370

03:34:38,990 --> 03:34:36,720

toward us and the web telescope can pick

4371

03:34:41,510 --> 03:34:39,000

up that radiation and actually analyze

4372

03:34:43,309 --> 03:34:41,520

what's inside that that atmosphere the

4373

03:34:45,170 --> 03:34:43,319

reason we're able to do that is that

4374

03:34:47,570 --> 03:34:45,180

every different chemical like for

4375

03:34:49,969 --> 03:34:47,580

example oxygen carbon dioxide water

4376

03:34:52,010 --> 03:34:49,979

vapor methane all of these have very

4377

03:34:54,590 --> 03:34:52,020

specific wavelengths of light that are

4378

03:34:56,570 --> 03:34:54,600

absorbed and because of that with the

4379

03:34:59,510 --> 03:34:56,580

light we can tell what that atmosphere

4380

03:35:01,130 --> 03:34:59,520

is actually made of made of so so it's

4381

03:35:02,809 --> 03:35:01,140

it's a wonderful chance to give you a

4382

03:35:05,030 --> 03:35:02,819

little bit of a recap of some of the

4383

03:35:08,150 --> 03:35:05,040

major science goals of the web telescope

4384

03:35:09,290 --> 03:35:08,160

and uh I guess at the moment we are

4385

03:35:11,690 --> 03:35:09,300

getting ready for some of the more

4386

03:35:13,550 --> 03:35:11,700

significant calls we're going to take a

4387

03:35:14,809 --> 03:35:13,560

small break right now as we get ready

4388

03:35:17,870 --> 03:35:14,819

for some of the final latching

4389

03:35:19,790 --> 03:35:17,880

procedures uh so here again I'm joined

4390

03:35:22,010 --> 03:35:19,800

by by Julie van kampen we will be back

4391

03:35:23,929 --> 03:35:22,020

later we are going to be uh taking a

4392

03:35:26,570 --> 03:35:23,939

short break as we get ready for some of

4393

03:35:29,269 --> 03:35:26,580

the the finale of the latching

4394

03:35:31,250 --> 03:35:29,279

procedures coming up

4395

03:35:32,570 --> 03:35:31,260

you're watching live coverage of the

4396

03:35:39,290 --> 03:35:32,580

commissioning of the James Webb Space

4397

03:35:44,110 --> 03:35:41,410

yeah

4398

03:35:45,769 --> 03:35:44,120

they started at

4399

03:37:38,389 --> 03:35:45,779

54.

4400

03:37:38,399 --> 03:37:41,750

faster

4401
03:37:41,760 --> 03:38:27,969
complete

4402
03:38:32,689 --> 03:38:30,830
oh stations be advised we have 10

4403
03:38:34,189 --> 03:38:32,699
minutes of command coverage remaining on

4404
03:38:56,349 --> 03:38:34,199
DSN Canberra

4405
03:39:00,650 --> 03:38:58,269
prayers

4406
03:39:02,229 --> 03:39:00,660
thank you that's not completed we're

4407
03:39:07,269 --> 03:39:02,239
ready for

4408
03:39:16,189 --> 03:39:09,889
the command line looks good you will go

4409
03:39:40,490 --> 03:39:17,929
and you're going to continue

4410
03:39:44,330 --> 03:39:42,110
e at the Space Telescope Science

4411
03:39:47,809 --> 03:39:44,340
Institute in Baltimore Maryland and I'm

4412
03:39:49,429 --> 03:39:47,819
joined by uh Julian campus she is the uh

4413
03:39:51,950 --> 03:39:49,439

the deputy commissioning engineer for

4414

03:39:53,570 --> 03:39:51,960

the James Webb Space Telescope we had a

4415

03:39:55,670 --> 03:39:53,580

wonderfully active and successful

4416

03:39:57,889 --> 03:39:55,680

morning where the second wing of the

4417

03:40:00,229 --> 03:39:57,899

primary mirror was deployed and we are

4418

03:40:03,110 --> 03:40:00,239

now in these weasels of latching that

4419

03:40:05,870 --> 03:40:04,610

Julie can you give us a little bit of an

4420

03:40:07,010 --> 03:40:05,880

update as to what's going on right now

4421

03:40:08,950 --> 03:40:07,020

and some of the commands that we're

4422

03:40:14,030 --> 03:40:08,960

hearing coming along

4423

03:40:18,830 --> 03:40:15,769

they're getting ready to send the very

4424

03:40:21,710 --> 03:40:18,840

last move command uh to latch the the

4425

03:40:23,929 --> 03:40:21,720

bottom latch of the mirrors that were

4426

03:40:25,550 --> 03:40:23,939

deployed today the uh the wing that was

4427

03:40:26,510 --> 03:40:25,560

deployed today with the three mirrors on

4428

03:40:28,910 --> 03:40:26,520

it

4429

03:40:31,490 --> 03:40:28,920

um this last command uh will take a few

4430

03:40:36,290 --> 03:40:31,500

minutes and it will pull the the latch

4431

03:40:38,689 --> 03:40:36,300

into its final uh full load and uh we

4432

03:40:40,670 --> 03:40:38,699

will hear them talk and and as they give

4433

03:40:43,910 --> 03:40:40,680

that last command and then finally

4434

03:40:47,150 --> 03:40:43,920

they'll verify that the uh the command

4435

03:40:50,809 --> 03:40:47,160

was successful in the voters uh brought

4436

03:40:52,370 --> 03:40:50,819

it to full uh load and you can see

4437

03:40:54,710 --> 03:40:52,380

everybody here in the in the room is

4438

03:40:57,290 --> 03:40:54,720

ready to see that last and final stage

4439

03:40:58,910 --> 03:40:57,300

this is the very last move of our

4440

03:41:02,870 --> 03:40:58,920

deployment sequence

4441

03:41:06,469 --> 03:41:02,880

for the structural deployments for jwst

4442

03:41:07,729 --> 03:41:06,479

just incredible it's been an amazing a

4443

03:41:11,269 --> 03:41:07,739

little bit more than a week now it

4444

03:41:13,729 --> 03:41:11,279

launched on December 25th and uh then

4445

03:41:16,070 --> 03:41:13,739

the uh the amazing Sun field was the

4446

03:41:17,750 --> 03:41:16,080

philosophy began to cool of going down

4447

03:41:20,929 --> 03:41:17,760

to an operating temperature of close to

4448

03:41:23,630 --> 03:41:20,939

minus 400 degrees Fahrenheit

4449

03:41:26,150 --> 03:41:23,640

and uh after that we had the deployment

4450

03:41:28,790 --> 03:41:26,160

of the secondary focusing mirror then

4451
03:41:31,670 --> 03:41:28,800
yesterday saw the deployment of the

4452
03:41:33,349 --> 03:41:31,680
first wing of the primary mirror and uh

4453
03:41:35,389 --> 03:41:33,359
then today that the second one and now

4454
03:41:38,090 --> 03:41:35,399
we are finishing up latching that into

4455
03:41:40,189 --> 03:41:38,100
its final stable configuration those

4456
03:41:41,990 --> 03:41:40,199
latches will not be touched again the

4457
03:41:44,269 --> 03:41:42,000
mirror will be in its file configuration

4458
03:41:45,469 --> 03:41:44,279
but that's not the end uh in the weeks

4459
03:41:47,269 --> 03:41:45,479
to come there are some pretty uh

4460
03:41:49,309 --> 03:41:47,279
important things coming up and maybe

4461
03:41:50,510 --> 03:41:49,319
Julie as we as we're waiting for this

4462
03:41:52,429 --> 03:41:50,520
final conference give us a sense about

4463
03:41:54,469 --> 03:41:52,439

what's coming up next for the uh the

4464

03:41:58,070 --> 03:41:54,479

commissioning of web

4465

03:42:00,650 --> 03:41:58,080

yeah uh over the next several weeks as

4466

03:42:03,769 --> 03:42:00,660

you uh talked with Lou Feinberg earlier

4467

03:42:05,929 --> 03:42:03,779

today we'll be taking the mirrors off of

4468

03:42:07,670 --> 03:42:05,939

their launch position and they're

4469

03:42:09,830 --> 03:42:07,680

they're up against hard stops we'll be

4470

03:42:11,269 --> 03:42:09,840

moving them a half an inch forward uh

4471

03:42:13,969 --> 03:42:11,279

once they're all a half an inch forward

4472

03:42:16,610 --> 03:42:13,979

then we'll start the steps involved in

4473

03:42:19,910 --> 03:42:16,620

actually turning our mirror into a a

4474

03:42:21,950 --> 03:42:19,920

nice clean image a one smooth mirror

4475

03:42:24,830 --> 03:42:21,960

we'll we'll first figure out which

4476

03:42:27,590 --> 03:42:24,840

mirror is which uh for the

4477

03:42:29,389 --> 03:42:27,600

um images that we see off of the sky and

4478

03:42:31,189 --> 03:42:29,399

then we'll bring all those into one

4479

03:42:34,429 --> 03:42:31,199

image and then we'll start to actually

4480

03:42:36,349 --> 03:42:34,439

change the mirror to make sure it's uh

4481

03:42:38,210 --> 03:42:36,359

all in one shape

4482

03:42:40,130 --> 03:42:38,220

um we'll also move the secondary mirror

4483

03:42:42,889 --> 03:42:40,140

which is a couple of days ago we

4484

03:42:44,450 --> 03:42:42,899

deployed the secondary structure

4485

03:42:47,590 --> 03:42:44,460

you can see people starting to get

4486

03:42:51,410 --> 03:42:49,849

yeah they can just kind of see the

4487

03:42:53,450 --> 03:42:51,420

tension there

4488

03:42:57,530 --> 03:42:53,460

um we'll bring the secondary mirror off

4489

03:42:59,510 --> 03:42:57,540

off of its hard stops too and and uh I

4490

03:43:01,729 --> 03:42:59,520

move that forward and back and do a

4491

03:43:04,070 --> 03:43:01,739

final Focus adjust of the telescope

4492

03:43:06,170 --> 03:43:04,080

during that time all of our instruments

4493

03:43:08,870 --> 03:43:06,180

are cooling down and being powered on

4494

03:43:12,170 --> 03:43:08,880

and checked out for the first time we'll

4495

03:43:13,969 --> 03:43:12,180

we'll move our filter wheels and all of

4496

03:43:16,370 --> 03:43:13,979

our mechanisms with inside the

4497

03:43:17,689 --> 03:43:16,380

instruments we'll uh check out our

4498

03:43:19,309 --> 03:43:17,699

detectors and make sure they're

4499

03:43:22,189 --> 03:43:19,319

operating at their their proper

4500

03:43:26,330 --> 03:43:22,199

temperatures and then

4501
03:43:32,929 --> 03:43:30,050
and uh the uh final thing that we'll do

4502
03:43:35,570 --> 03:43:32,939
is we'll start taking images and

4503
03:43:38,330 --> 03:43:35,580
calibrate those instruments uh we'll

4504
03:43:40,130 --> 03:43:38,340
make sure that everything is is set to

4505
03:43:42,050 --> 03:43:40,140
go and ready to start our early science

4506
03:43:46,910 --> 03:43:42,060
operations which you heard several of

4507
03:43:50,929 --> 03:43:48,769
there's a question that we get a lot on

4508
03:43:52,550 --> 03:43:50,939
on social media it might be kind of fun

4509
03:43:54,710 --> 03:43:52,560
to take the time and like I said we will

4510
03:43:55,910 --> 03:43:54,720
break our commentary when we see that

4511
03:43:58,429 --> 03:43:55,920
the command has come through for that

4512
03:44:00,349 --> 03:43:58,439
final latch but Kelly on Facebook asks

4513
03:44:01,610 --> 03:44:00,359

how do infrared signals taken by the

4514

03:44:03,410 --> 03:44:01,620

James Webb Space Telescope get

4515

03:44:04,910 --> 03:44:03,420

translated into pictures are the

4516

03:44:07,250 --> 03:44:04,920

pictures we will get the same as if we

4517

03:44:10,429 --> 03:44:07,260

looked at it up close at this time we

4518

03:44:12,650 --> 03:44:10,439

have a nominal Los on dss36 our backup

4519

03:44:14,450 --> 03:44:12,660

antenna at Canberra we will continue to

4520

03:44:16,429 --> 03:44:14,460

have Telemetry on the prime antenna for

4521

03:44:20,090 --> 03:44:16,439

another 10 minutes

4522

03:44:21,950 --> 03:44:20,100

demand coverage will end in four minutes

4523

03:44:23,870 --> 03:44:21,960

as the Earth rotates there are different

4524

03:44:25,570 --> 03:44:23,880

uh antennas that the James Webb Space

4525

03:44:28,389 --> 03:44:25,580

Telescope is using to download its

4526

03:44:40,910 --> 03:44:28,399

Telemetry to tell us

4527

03:44:46,070 --> 03:44:43,729

my command button I see that on the

4528

03:44:49,490 --> 03:44:46,080

ground Cecil

4529

03:44:51,830 --> 03:44:49,500

that keyword looks good CC

4530

03:44:57,769 --> 03:44:51,840

next game

4531

03:45:03,889 --> 03:44:59,269

confirmation that the mirror has been

4532

03:45:06,050 --> 03:45:03,899

lasted on Ops uh we've only had 5 000

4533

03:45:08,389 --> 03:45:06,060

steps remaining in our final latch

4534

03:45:15,849 --> 03:45:08,399

reload move

4535

03:45:15,859 --> 03:45:21,769

multiculties three thousand

4536

03:45:21,779 --> 03:45:50,510

foreign

4537

03:45:54,889 --> 03:45:53,090

and we have a fully deployed jwsp

4538

03:45:57,030 --> 03:45:54,899

Observatory

4539

03:45:57,050 --> 03:45:57,040

all right

4540

03:45:59,150 --> 03:45:57,060

[Music]

4541

03:46:03,769 --> 03:45:59,160

[Applause]

4542

03:46:08,150 --> 03:46:05,389

thousands of people around the world

4543

03:46:09,530 --> 03:46:08,160

have worked on this and you see here the

4544

03:46:11,380 --> 03:46:09,540

people at the Space Telescope Science

4545

03:46:16,910 --> 03:46:11,390

Institute in Baltimore Maryland

4546

03:46:18,050 --> 03:46:16,920

[Applause]

4547

03:46:20,510 --> 03:46:18,060

hopefully we'll get a little bit of

4548

03:46:22,070 --> 03:46:20,520

audio from that room too

4549

03:46:23,570 --> 03:46:22,080

even if we don't we can see the Joy on

4550

03:46:25,429 --> 03:46:23,580

their faces

4551
03:46:29,170 --> 03:46:25,439
everybody of course being very careful

4552
03:46:33,469 --> 03:46:32,030
I'm joining you from an isolated room so

4553
03:46:35,809 --> 03:46:33,479
I can talk to you without a mask on

4554
03:46:48,010 --> 03:46:35,819
everybody else is wearing their masks

4555
03:46:52,729 --> 03:46:50,809
even though I'm a floor below the

4556
03:46:55,490 --> 03:46:52,739
control room I can hear people cheering

4557
03:46:58,150 --> 03:46:55,500
in the background

4558
03:47:01,010 --> 03:46:58,160
[Applause]

4559
03:47:04,030 --> 03:47:01,020
stand by for the project manager stand

4560
03:47:04,040 --> 03:47:07,670
I think

4561
03:47:12,830 --> 03:47:09,849
it's okay

4562
03:47:15,670 --> 03:47:12,840
yeah I just want to thank everyone and

4563
03:47:18,229 --> 03:47:15,680

congratulate them on stage mirror move

4564

03:47:20,150 --> 03:47:18,239

the last two weeks have been totally

4565

03:47:22,490 --> 03:47:20,160

amazing

4566

03:47:24,950 --> 03:47:22,500

thousands of people have worked on jvst

4567

03:47:26,630 --> 03:47:24,960

at this point to get get us here

4568

03:47:29,450 --> 03:47:26,640

but I have a couple of special shout

4569

03:47:32,330 --> 03:47:29,460

outs one to the deployment team

4570

03:47:34,250 --> 03:47:32,340

you guys have done a phenomenal job over

4571

03:47:37,670 --> 03:47:34,260

the last two weeks but also over the

4572

03:47:39,309 --> 03:47:37,680

last probably 15 20 years to get it to

4573

03:47:42,950 --> 03:47:39,319

this point

4574

03:47:45,650 --> 03:47:42,960

I do want to also thank the Northrop int

4575

03:47:47,630 --> 03:47:45,660

team and The Goddard folks who

4576

03:47:51,110 --> 03:47:47,640

participated in the actual stowing of

4577

03:47:54,170 --> 03:47:51,120

the observatory about a year ago

4578

03:47:56,389 --> 03:47:54,180

if they hadn't done it perfectly these

4579

03:47:58,490 --> 03:47:56,399

last two weeks would not have gone as

4580

03:48:01,670 --> 03:47:58,500

well as they have

4581

03:48:04,429 --> 03:48:01,680

finally on a personal note

4582

03:48:06,469 --> 03:48:04,439

I will tell you guys every single day I

4583

03:48:08,150 --> 03:48:06,479

am honored and humbled to be associated

4584

03:48:11,689 --> 03:48:08,160

with this team

4585

03:48:11,699 --> 03:48:23,630

go jwc

4586

03:48:27,469 --> 03:48:25,849

I'll take you to be advised in just a

4587

03:48:29,570 --> 03:48:27,479

few seconds station three four will

4588

03:48:31,070 --> 03:48:29,580

bring down the Uplink we will see a

4589

03:48:43,490 --> 03:48:31,080

brief lot of telemetry at that time

4590

03:48:49,790 --> 03:48:46,969

you can hear me also uh I'm Thomas and

4591

03:48:51,590 --> 03:48:49,800

I'm the head of Science and NASA and I I

4592

03:48:55,550 --> 03:48:51,600

want to tell you

4593

03:48:57,889 --> 03:48:55,560

just how excited and uh emotional I am

4594

03:49:00,590 --> 03:48:57,899

right now we have

4595

03:49:02,689 --> 03:49:00,600

a deployed telescope on orbit a

4596

03:49:04,790 --> 03:49:02,699

magnificent telescope likes of which the

4597

03:49:07,250 --> 03:49:04,800

world has never seen so how does it feel

4598

03:49:10,230 --> 03:49:07,260

to make history everybody you just said

4599

03:49:15,530 --> 03:49:12,889

[Applause]

4600

03:49:16,910 --> 03:49:15,540

we're coming from the other side of the

4601
03:49:19,490 --> 03:49:16,920
time

4602
03:49:20,570 --> 03:49:19,500
that most of you would offend with your

4603
03:49:24,410 --> 03:49:20,580
families

4604
03:49:28,429 --> 03:49:24,420
and uh with a time that frankly even the

4605
03:49:30,889 --> 03:49:28,439
last year where most of you worked way

4606
03:49:33,170 --> 03:49:30,899
harder than perhaps you ever worked in

4607
03:49:36,050 --> 03:49:33,180
your life and I just want to tell you

4608
03:49:37,330 --> 03:49:36,060
how much I personally and we as an

4609
03:49:41,389 --> 03:49:37,340
entire team

4610
03:49:44,210 --> 03:49:41,399
appreciate your sacrifice uh that you've

4611
03:49:47,210 --> 03:49:44,220
given and also your family uh your

4612
03:49:50,269 --> 03:49:47,220
families to sacrifice Thanksgiving to

4613
03:49:52,450 --> 03:49:50,279

this amazing history making amazing uh

4614

03:49:55,189 --> 03:49:52,460

telescopes

4615

03:49:56,650 --> 03:49:55,199

you know what work cannot pay you back

4616

03:49:59,809 --> 03:49:56,660

just

4617

03:50:02,269 --> 03:49:59,819

know how deeply we appreciate and How

4618

03:50:07,070 --> 03:50:02,279

Deeply we value everything you've done

4619

03:50:09,769 --> 03:50:07,080

uh bill I have been fun to watch you and

4620

03:50:12,110 --> 03:50:09,779

uh I start working together with Craig

4621

03:50:15,050 --> 03:50:12,120

and all the other leaders kind of really

4622

03:50:17,450 --> 03:50:15,060

building an amazing team I think of it

4623

03:50:19,550 --> 03:50:17,460

as a championship team you never know

4624

03:50:21,229 --> 03:50:19,560

how great the team is until you see him

4625

03:50:25,849 --> 03:50:21,239

out there on a field

4626

03:50:28,189 --> 03:50:25,859

I love what I see I love we all love

4627

03:50:30,889 --> 03:50:28,199

what we see it truly an excellent team

4628

03:50:32,809 --> 03:50:30,899

and uh you've shown the whole world you

4629

03:50:34,670 --> 03:50:32,819

cannot believe how many letters and

4630

03:50:38,510 --> 03:50:34,680

emails I've gotten from around the world

4631

03:50:40,849 --> 03:50:38,520

kind of congratulating uh our entire

4632

03:50:42,650 --> 03:50:40,859

agency our entire country our entire

4633

03:50:46,550 --> 03:50:42,660

team the international team for this

4634

03:50:48,170 --> 03:50:46,560

work of course the NASA Goddard is uh

4635

03:50:50,750 --> 03:50:48,180

leading a little bit to so many of the

4636

03:50:52,010 --> 03:50:50,760

team members here thanks to each and

4637

03:50:55,070 --> 03:50:52,020

every one of you

4638

03:50:57,710 --> 03:50:55,080

uh north of ramen I have been fun to get

4639

03:51:00,229 --> 03:50:57,720

to know you and be with you on this

4640

03:51:02,030 --> 03:51:00,239

journey I'm only for five years on this

4641

03:51:06,110 --> 03:51:02,040

journey many of you have been here for

4642

03:51:08,630 --> 03:51:06,120

20 or more uh years and some of us you

4643

03:51:10,189 --> 03:51:08,640

are not even right now here anymore or

4644

03:51:13,429 --> 03:51:10,199

because there are other projects or some

4645

03:51:15,950 --> 03:51:13,439

have retired or not no longer with us we

4646

03:51:18,170 --> 03:51:15,960

think of them also in each one of them

4647

03:51:20,150 --> 03:51:18,180

please help Science Institute what a

4648

03:51:22,130 --> 03:51:20,160

great place to be here looking out at

4649

03:51:25,130 --> 03:51:22,140

the trees that we think of the deep

4650

03:51:27,290 --> 03:51:25,140

space and uh you know being a single

4651
03:51:29,090 --> 03:51:27,300
team here and that of course uh the

4652
03:51:31,910 --> 03:51:29,100
partner that's going to add a lot here

4653
03:51:35,030 --> 03:51:31,920
are going forward and

4654
03:51:37,729 --> 03:51:35,040
roll a small Aerospace as we're starting

4655
03:51:38,929 --> 03:51:37,739
to work out with this entire team uh

4656
03:51:41,389 --> 03:51:38,939
going forward

4657
03:51:43,550 --> 03:51:41,399
so what I'd like to do is quickly just

4658
03:51:56,530 --> 03:51:43,560
uh introduce somebody else and frankly I

4659
03:52:02,229 --> 03:52:00,170
I actually have not received more texts

4660
03:52:04,450 --> 03:52:02,239
from anybody else

4661
03:52:08,150 --> 03:52:04,460
except my kids

4662
03:52:12,769 --> 03:52:08,160
uh uh in the last few months and weeks

4663
03:52:17,090 --> 03:52:15,170

work and his partnership and friendship

4664

03:52:19,729 --> 03:52:17,100

as we go forward so I wanted to see what

4665

03:52:21,189 --> 03:52:19,739

he wants to add a couple sentences uh

4666

03:52:26,290 --> 03:52:21,199

you tell me whether it's going to work

4667

03:52:32,929 --> 03:52:29,210

you but he is just talking about how

4668

03:52:34,370 --> 03:52:32,939

much of an honor is to uh to be part of

4669

03:52:36,769 --> 03:52:34,380

this incredible mission

4670

03:52:38,330 --> 03:52:36,779

and uh I think they're uh

4671

03:52:41,330 --> 03:52:38,340

they need to be working on his his audio

4672

03:52:43,729 --> 03:52:41,340

right now it it's something that you

4673

03:52:45,469 --> 03:52:43,739

hear a lot for people at Nasa about how

4674

03:52:47,210 --> 03:52:45,479

privileged we are to work in this group

4675

03:52:48,469 --> 03:52:47,220

it's something that you hear a lot of

4676
03:52:51,410 --> 03:52:48,479
people say that I I have to really

4677
03:52:53,809 --> 03:52:51,420
reiterate just how much we feel this it

4678
03:52:57,050 --> 03:52:53,819
is a tremendous honor and privilege to

4679
03:53:00,170 --> 03:52:57,060
work on something large and to have a

4680
03:53:01,309 --> 03:53:00,180
goal that you know I believe you know is

4681
03:53:04,130 --> 03:53:01,319
Noble

4682
03:53:05,929 --> 03:53:04,140
we are trying to advance knowledge there

4683
03:53:07,910 --> 03:53:05,939
are risks we have never deployed an

4684
03:53:10,250 --> 03:53:07,920
observatory like this before

4685
03:53:12,170 --> 03:53:10,260
tens of thousands of people are actually

4686
03:53:13,670 --> 03:53:12,180
waiting around the world for this to

4687
03:53:16,250 --> 03:53:13,680
work who have worked on this who have

4688
03:53:21,769 --> 03:53:16,260

given years of their life as as Thomas

4689

03:53:30,170 --> 03:53:23,510

so I think with that we're going to uh

4690

03:53:37,370 --> 03:53:33,530

I hear some Applause in the background

4691

03:53:39,769 --> 03:53:37,380

okay so the uh the final guest we have

4692

03:53:43,189 --> 03:53:39,779

is a head of NASA the administrator of

4693

03:53:46,130 --> 03:53:43,199

NASA Bill Nelson uh Bill comes from uh a

4694

03:53:47,510 --> 03:53:46,140

huge amount of experience a former

4695

03:53:50,990 --> 03:53:47,520

Senator and I might also mention a

4696

03:53:53,389 --> 03:53:51,000

former astronaut uh Billy it is an

4697

03:53:59,450 --> 03:53:53,399

honored to have you here please give us

4698

03:54:01,780 --> 03:54:00,830

and unfortunately I think you may have

4699

03:54:03,710 --> 03:54:01,790

to unmute bill

4700

03:54:12,229 --> 03:54:03,720

[Laughter]

4701
03:54:16,189 --> 03:54:14,510
I am unmuted

4702
03:54:19,910 --> 03:54:16,199
there you go

4703
03:54:22,729 --> 03:54:19,920
okay I want to uh

4704
03:54:24,889 --> 03:54:22,739
say again what Thomas just said and what

4705
03:54:29,349 --> 03:54:24,899
Bill Oakes just said

4706
03:54:32,450 --> 03:54:29,359
uh it's an incredible team

4707
03:54:35,210 --> 03:54:32,460
uh NASA

4708
03:54:38,990 --> 03:54:35,220
is a place where

4709
03:54:42,610 --> 03:54:39,000
The Impossible becomes possible

4710
03:54:45,170 --> 03:54:42,620
and that's why so many people have

4711
03:54:49,010 --> 03:54:45,180
stayed with NASA over the years that's

4712
03:54:51,710 --> 03:54:49,020
why nine years in a row NASA has been

4713
03:54:53,809 --> 03:54:51,720

voted as the best place to work in the

4714

03:54:55,429 --> 03:54:53,819

entire federal government nine years in

4715

03:54:58,490 --> 03:54:55,439

a row

4716

03:55:03,710 --> 03:54:58,500

uh we bring in and we value our interns

4717

03:55:07,849 --> 03:55:03,720

from college and we bring them in and

4718

03:55:10,610 --> 03:55:07,859

30 percent of them end up having a a

4719

03:55:12,650 --> 03:55:10,620

career at NASA

4720

03:55:15,490 --> 03:55:12,660

and then we have these incredible

4721

03:55:18,950 --> 03:55:15,500

Partners outside of NASA

4722

03:55:21,290 --> 03:55:18,960

that Thomas has mentioned just just take

4723

03:55:24,170 --> 03:55:21,300

the Aerospace company Northrop Grumman

4724

03:55:26,269 --> 03:55:24,180

that oversaw all this take the people

4725

03:55:30,110 --> 03:55:26,279

that Goddard take the people at the

4726

03:55:34,429 --> 03:55:30,120

Space Telescope Institute

4727

03:55:38,990 --> 03:55:34,439

this is uh just incredible input think

4728

03:55:41,689 --> 03:55:39,000

about the delivery in packaging of that

4729

03:55:43,790 --> 03:55:41,699

telescope when it was put on the ship

4730

03:55:48,010 --> 03:55:43,800

and they had to have special security

4731

03:55:51,410 --> 03:55:48,020

going through the Panama Canal

4732

03:55:54,050 --> 03:55:51,420

and then of course area in space I mean

4733

03:55:57,830 --> 03:55:54,060

right on the money

4734

03:56:00,050 --> 03:55:57,840

and our International Partners which are

4735

03:56:02,630 --> 03:56:00,060

are so important to us

4736

03:56:05,150 --> 03:56:02,640

in this particular mission

4737

03:56:07,610 --> 03:56:05,160

uh the Canadian space agency the

4738

03:56:11,450 --> 03:56:07,620

European Space Agency

4739

03:56:15,729 --> 03:56:11,460

but in NASA at large you know we've got

4740

03:56:18,530 --> 03:56:15,739

over 30 to 50 partners for example

4741

03:56:21,429 --> 03:56:18,540

International involved in the

4742

03:56:24,710 --> 03:56:21,439

International Space Station and look

4743

03:56:27,050 --> 03:56:24,720

look at the politics on Earth where it's

4744

03:56:30,830 --> 03:56:27,060

so rough between Russia

4745

03:56:34,309 --> 03:56:30,840

and the United States right to today

4746

03:56:38,090 --> 03:56:34,319

over terrestrial matters and yet what's

4747

03:56:42,229 --> 03:56:39,950

we're cooperating and we've been

4748

03:56:47,090 --> 03:56:42,239

cooperating in the civilian Space

4749

03:56:52,969 --> 03:56:50,809

when an American spacecraft and a Soviet

4750

03:56:55,729 --> 03:56:52,979

spacecraft Rendezvous and docked and the

4751
03:56:58,490 --> 03:56:55,739
crews lived together for nine days

4752
03:57:01,550 --> 03:56:58,500
and that has continued all the way up to

4753
03:57:04,490 --> 03:57:01,560
today where they the Russians have

4754
03:57:07,010 --> 03:57:04,500
helped us build and operate the

4755
03:57:09,950 --> 03:57:07,020
International Space Station so I give

4756
03:57:12,170 --> 03:57:09,960
you the examples because when people put

4757
03:57:14,570 --> 03:57:12,180
their mind to it

4758
03:57:17,389 --> 03:57:14,580
and start cooperating and working

4759
03:57:20,570 --> 03:57:17,399
together as a team

4760
03:57:23,150 --> 03:57:20,580
as we say at Nasa they

4761
03:57:27,410 --> 03:57:23,160
impossible becomes possible

4762
03:57:31,189 --> 03:57:27,420
and here is another example of that

4763
03:57:34,250 --> 03:57:31,199

so how can I thank you enough

4764

03:57:36,370 --> 03:57:34,260

uh how can I thank the support that

4765

03:57:40,250 --> 03:57:36,380

we've gotten from the White House

4766

03:57:43,250 --> 03:57:40,260

President Biden specifically

4767

03:57:46,370 --> 03:57:43,260

uh is watching this Mission the vice

4768

03:57:49,070 --> 03:57:46,380

president Kamala Harris same thing

4769

03:57:51,290 --> 03:57:49,080

our partners in the house and the Senate

4770

03:57:53,090 --> 03:57:51,300

my old colleagues that I love to

4771

03:57:54,769 --> 03:57:53,100

continue to harass

4772

03:57:57,050 --> 03:57:54,779

uh

4773

03:57:59,150 --> 03:57:57,060

and yet they have supported this I want

4774

03:58:03,170 --> 03:57:59,160

to single out one person

4775

03:58:06,050 --> 03:58:03,180

because James Webb is long overdue and

4776
03:58:07,849 --> 03:58:06,060
it's uh way over budget on the original

4777
03:58:11,510 --> 03:58:07,859
budget

4778
03:58:15,110 --> 03:58:11,520
but James Webb was kept alive in large

4779
03:58:18,650 --> 03:58:15,120
part by Senator Barbara mikulski of

4780
03:58:21,050 --> 03:58:18,660
Maryland now retired I've called her

4781
03:58:24,229 --> 03:58:21,060
personally to thank her

4782
03:58:27,469 --> 03:58:24,239
and indeed this is a proud day for her

4783
03:58:29,510 --> 03:58:27,479
too because when it was needed for

4784
03:58:31,729 --> 03:58:29,520
additional preparations

4785
03:58:34,309 --> 03:58:31,739
she was there

4786
03:58:35,929 --> 03:58:34,319
so what a great day now we got a long

4787
03:58:39,889 --> 03:58:35,939
way to go

4788
03:58:41,450 --> 03:58:39,899

uh we we got to get out there to day 29

4789

03:58:43,510 --> 03:58:41,460

and that the

4790

03:58:45,889 --> 03:58:43,520

those uh

4791

03:58:49,370 --> 03:58:45,899

thrusters have got to work to get us

4792

03:58:52,370 --> 03:58:49,380

into that orbit around L2

4793

03:58:53,929 --> 03:58:52,380

a lot of other mechanisms to work and

4794

03:58:56,990 --> 03:58:53,939

then it's going to take us about six

4795

03:59:01,370 --> 03:58:57,000

months to start receiving those pictures

4796

03:59:05,090 --> 03:59:01,380

but when we do as you have had Michelle

4797

03:59:08,929 --> 03:59:05,100

explain to you oh

4798

03:59:11,990 --> 03:59:08,939

The Horizon is not the limit

4799

03:59:16,250 --> 03:59:12,000

we're going to have all kind of new out

4800

03:59:18,410 --> 03:59:16,260

knowledge about who we are what we are

4801
03:59:21,530 --> 03:59:18,420
where we came from

4802
03:59:22,790 --> 03:59:21,540
are there others out there

4803
03:59:26,630 --> 03:59:22,800
uh

4804
03:59:29,630 --> 03:59:26,640
did any wonder why it's such a privilege

4805
03:59:31,750 --> 03:59:29,640
to be involved in NASA

4806
03:59:36,290 --> 03:59:31,760
so

4807
03:59:37,729 --> 03:59:36,300
just like Thomas I'm emotional too

4808
03:59:45,170 --> 03:59:37,739
thank you

4809
03:59:48,650 --> 03:59:45,180
have you here with us and yes it's a

4810
03:59:50,030 --> 03:59:48,660
very emotional day for all of us

4811
03:59:51,889 --> 03:59:50,040
ah

4812
03:59:54,050 --> 03:59:51,899
absolutely incredible

4813
03:59:56,150 --> 03:59:54,060

so on behalf of everybody here at the

4814

03:59:58,070 --> 03:59:56,160

Space Telescope Science Institute this

4815

03:59:59,870 --> 03:59:58,080

will actually begin the conclusion of

4816

04:00:02,510 --> 03:59:59,880

our broadcast it has been an amazing

4817

04:00:05,030 --> 04:00:02,520

couple of weeks actually first the

4818

04:00:06,950 --> 04:00:05,040

run-up to the launch then the launch uh

4819

04:00:09,590 --> 04:00:06,960

the successful deployment of the

4820

04:00:10,910 --> 04:00:09,600

observatory and we look forward now to a

4821

04:00:12,950 --> 04:00:10,920

few more months

4822

04:00:16,130 --> 04:00:12,960

and until we release those those first

4823

04:00:18,769 --> 04:00:16,140

images and they proved to be amazing

4824

04:00:21,349 --> 04:00:18,779

it's we're all all of it because we're

4825

04:00:23,090 --> 04:00:21,359

all just so happy to be here

4826
04:00:25,969 --> 04:00:23,100
again what we were saying before that

4827
04:00:29,090 --> 04:00:25,979
it's easy you keep hearing it again this

4828
04:00:31,429 --> 04:00:29,100
team of people as much as I love science

4829
04:00:33,590 --> 04:00:31,439
I've been fascinated all my life the

4830
04:00:36,170 --> 04:00:33,600
best part about working at Nasa are the

4831
04:00:38,870 --> 04:00:36,180
people around us none of this is

4832
04:00:40,910 --> 04:00:38,880
possible without everybody listening

4833
04:00:43,189 --> 04:00:40,920
here today people that are members of

4834
04:00:45,050 --> 04:00:43,199
countries all over the world people who

4835
04:00:46,929 --> 04:00:45,060
can support science through their tax

4836
04:00:49,130 --> 04:00:46,939
money people you know at universities

4837
04:00:51,229 --> 04:00:49,140
seriously everywhere in every country

4838
04:00:53,090 --> 04:00:51,239

that there is we are all in this

4839

04:00:55,250 --> 04:00:53,100

together and this is something amazing

4840

04:00:57,050 --> 04:00:55,260

that we have just begun this new journey

4841

04:00:59,150 --> 04:00:57,060

to have an entirely new view of the

4842

04:01:01,189 --> 04:00:59,160

universe it's been an honor to be with

4843

04:01:03,530 --> 04:01:01,199

you through this part of commissioning I

4844

04:01:05,269 --> 04:01:03,540

hope to be here on as this continues uh

4845

04:01:07,010 --> 04:01:05,279

so this is Michelle Thaller wishing you

4846

04:01:23,090 --> 04:01:07,020

a very good day from the Space Telescope