1
00:00:00,000 --> 00:00:08,350
sun shield

2
00:00:13,850 --> 00:00:11,089
liftoff from a tropical rainforest to

3
00:00:16,070 --> 00:00:13,860
the Edge of Time itself James Webb

4
00:00:22,370 --> 00:00:16,080
begins a voyage back to the birth of the

5
00:00:25,790 --> 00:00:24,590
we do have confirmation of Observatory

6
00:00:28,370 --> 00:00:25,800
separation

7
00:00:30,290 --> 00:00:28,380
the James Webb Space Telescope amidst

8
00:00:31,250 --> 00:00:30,300
Applause here in the mission control

9
00:00:32,950 --> 00:00:31,260
center

10
00:00:35,750 --> 00:00:32,960
foreign

11
00:00:38,150 --> 00:00:35,760
from the upper stage camera on the

12
00:00:41,590 --> 00:00:38,160
Ariane 5 looking at the James Webb Space

13
00:00:44,180 --> 00:00:41,600

Telescope as it moves uh gently away

14
00:00:49,750 --> 00:00:44,190
from its launch vehicle

15
00:00:55,910 --> 00:00:53,689
yes go away ironically enough as we

16
00:00:58,250 --> 00:00:55,920
Marvel on this view from the upper stage

17
00:01:01,310 --> 00:00:58,260
camera this will be Humanity's last view

18
00:01:04,130 --> 00:01:01,320
of the James Webb Space Telescope as it

19
00:01:07,310 --> 00:01:04,140
moves to its workplace about a million

20
00:01:07,320 --> 00:01:10,929
[Music]

21
00:01:15,289 --> 00:01:13,190
quite a Christmas present for the

22
00:01:18,950 --> 00:01:15,299
world's astronomers as the James Webb

23
00:01:20,170 --> 00:01:18,960
Space Telescope begins its life heading

24
00:01:30,230 --> 00:01:20,180
towards deep space

25
00:01:36,410 --> 00:01:32,810
after yesterday's successful completion

26
00:01:37,969 --> 00:01:36,420
web Central deployment Mission

27
00:01:39,410 --> 00:01:37,979
controllers of the Space Telescope

28
00:01:41,690 --> 00:01:39,420
Science Institute in Baltimore Maryland

29
00:01:43,850 --> 00:01:41,700
are today ready to move on to the next

30
00:01:46,609 --> 00:01:43,860
major spacecraft Milestone the

31
00:01:48,050 --> 00:01:46,619
deployment of Webb's secondary mirror in

32
00:01:49,490 --> 00:01:48,060
just a few minutes the team will send a

33
00:01:52,010 --> 00:01:49,500
signal to release Webb's secondary

34
00:01:54,230 --> 00:01:52,020
mirror support system today's activities

35
00:01:56,749 --> 00:01:54,240
marked first in a series of deployments

36
00:02:02,709 --> 00:01:56,759
related to web's Optics those beautiful

37
00:02:07,850 --> 00:02:05,569
how exciting

38
00:02:10,070 --> 00:02:07,860

significant Milestone accomplished job

39
00:02:23,869 --> 00:02:10,080
well done sunshield team job well done

40
00:02:29,510 --> 00:02:26,330
that is on the window please check on

41
00:02:37,850 --> 00:02:32,089
and OC that looks good you're go to

42
00:02:41,210 --> 00:02:39,650
I'm your host Michelle Fowler and for

43
00:02:43,190 --> 00:02:41,220
the rest of this remarkable live stream

44
00:02:44,809 --> 00:02:43,200
we'll be dialed into the action as

45
00:02:46,790 --> 00:02:44,819
Mission managers proceed with setting up

46
00:02:48,589 --> 00:02:46,800
the web Observatory on its way to a

47
00:02:50,449 --> 00:02:48,599
parking orbit a million miles away from

48
00:02:52,729 --> 00:02:50,459
Earth joining me to share information

49
00:02:54,530 --> 00:02:52,739
and insights into this process is Julie

50
00:02:58,130 --> 00:02:54,540
van kampen the deputy commissioning

51
00:02:59,630 --> 00:02:58,140
manager for James Webb so welcome Julie

52
00:03:01,190 --> 00:02:59,640
thank you thank thank you for having me

53
00:03:03,530 --> 00:03:01,200
thank you Sean

54
00:03:04,850 --> 00:03:03,540
so as we listened for confirmation of

55
00:03:06,229 --> 00:03:04,860
the secondary mirror support structure

56
00:03:08,270 --> 00:03:06,239
release let me talk a little bit about

57
00:03:10,070 --> 00:03:08,280
how things are going to work today we're

58
00:03:12,229 --> 00:03:10,080
looking live at the mock the mission

59
00:03:13,910 --> 00:03:12,239
operations center at the Space Telescope

60
00:03:15,290 --> 00:03:13,920
Science Institute at the end of the

61
00:03:17,750 --> 00:03:15,300
campus of Johns Hopkins in Baltimore

62
00:03:18,890 --> 00:03:17,760
Maryland step is zero two zero

63
00:03:20,690 --> 00:03:18,900

and you'll notice that we are

64
00:03:22,309 --> 00:03:20,700
occasionally pausing to listen and

65
00:03:23,990 --> 00:03:22,319
that's because we are actually pausing

66
00:03:25,729 --> 00:03:24,000
to listen for the live updates from the

67
00:03:28,009 --> 00:03:25,739
mock about the secondary mirror

68
00:03:29,750 --> 00:03:28,019
deployment so as we are conversing if

69
00:03:30,770 --> 00:03:29,760
you if you see us pause we're both kind

70
00:03:32,270 --> 00:03:30,780
of you know wondering what's happening

71
00:03:34,850 --> 00:03:32,280
next we're listening for the command

72
00:03:37,070 --> 00:03:34,860
because we're you're actually live with

73
00:03:38,509 --> 00:03:37,080
us today for this incredible secondary

74
00:03:40,970 --> 00:03:38,519
mirror deployment

75
00:03:42,470 --> 00:03:40,980
so um so Julie as we listen for

76
00:03:44,330 --> 00:03:42,480
confirmation of the secondary mirror

77
00:03:46,550 --> 00:03:44,340
support structure release how are things

78
00:03:48,110 --> 00:03:46,560
looking today how are things going

79
00:03:50,690 --> 00:03:48,120
things are going really well today

80
00:03:52,610 --> 00:03:50,700
things have um

81
00:03:55,670 --> 00:03:52,620
worked incredibly well over the past 12

82
00:03:58,729 --> 00:03:55,680
days you know we've had moments of of uh

83
00:04:01,490 --> 00:03:58,739
excitement and uh lots of attention as

84
00:04:06,589 --> 00:04:01,500
we as we kind of wait to see how things

85
00:04:09,289 --> 00:04:06,599
uh work out but the rate or right on or

86
00:04:13,130 --> 00:04:09,299
slightly ahead of schedule it's it's uh

87
00:04:14,809 --> 00:04:13,140
it's from the moments where ariane's

88
00:04:18,110 --> 00:04:14,819

boss was able to put us right where we

89
00:04:19,909 --> 00:04:18,120
needed to in orbit it's been going great

90
00:04:21,949 --> 00:04:19,919
so um what is the first step in today's

91
00:04:24,050 --> 00:04:21,959
deployment and and and you know this

92
00:04:26,450 --> 00:04:24,060
involves something called neas these are

93
00:04:28,189 --> 00:04:26,460
not explosive actuators uh what is the

94
00:04:30,469 --> 00:04:28,199
team going to start that

95
00:04:32,570 --> 00:04:30,479
they should start that soon uh right now

96
00:04:34,310 --> 00:04:32,580
they're in the middle of checking out to

97
00:04:37,010 --> 00:04:34,320
make sure that the two Motors that they

98
00:04:39,110 --> 00:04:37,020
use uh when they do the deployments are

99
00:04:41,629 --> 00:04:39,120
are working they do an aliveness check

100
00:04:44,210 --> 00:04:41,639
they make sure everything's uh ready to

101
00:04:46,129 --> 00:04:44,220
go for it before they uh release the

102
00:04:48,830 --> 00:04:46,139
launch locks and then once they release

103
00:04:52,010 --> 00:04:48,840
the launch box they'll do a small move

104
00:04:55,550 --> 00:04:52,020
of the secondary support structure to to

105
00:04:57,170 --> 00:04:55,560
to bring it out a little bit more than a

106
00:04:58,610 --> 00:04:57,180
um check out all their Telemetry make

107
00:05:00,350 --> 00:04:58,620
sure that they're happy with how it's

108
00:05:01,490 --> 00:05:00,360
performing for the complete the full

109
00:05:05,150 --> 00:05:01,500
move

110
00:05:07,010 --> 00:05:05,160
sequence that they'll go through to

111
00:05:08,810 --> 00:05:07,020
launch to lock the mechanism into

112
00:05:11,870 --> 00:05:08,820
position

113
00:05:13,370 --> 00:05:11,880

or it's at the right

114
00:05:15,650 --> 00:05:13,380
um

115
00:05:18,170 --> 00:05:15,660
orientation to have the

116
00:05:19,969 --> 00:05:18,180
the mute captured into the the

117
00:05:22,790 --> 00:05:19,979
observatory's

118
00:05:25,550 --> 00:05:22,800
um away from sensing system and so that

119
00:05:28,310 --> 00:05:25,560
it can be aligned later on

120
00:05:30,230 --> 00:05:28,320
absolutely so um as our viewers are

121
00:05:32,749 --> 00:05:30,240
tuning in right now let's uh let's sort

122
00:05:34,430 --> 00:05:32,759
of go over what's uh happening to uh on

123
00:05:35,930 --> 00:05:34,440
the screen in front of them so as we

124
00:05:38,330 --> 00:05:35,940
mentioned we see some windows into the

125
00:05:40,670 --> 00:05:38,340
mock the mission operations center and

126
00:05:42,350 --> 00:05:40,680
uh that's uh as we said before on the

127
00:05:44,749 --> 00:05:42,360
Johns Hopkins campus at Baltimore

128
00:05:46,790 --> 00:05:44,759
Maryland and then on the left side of

129
00:05:48,710 --> 00:05:46,800
your screen you're seeing an animation

130
00:05:50,390 --> 00:05:48,720
but this isn't just any you know any

131
00:05:52,310 --> 00:05:50,400
random animation this is actually based

132
00:05:53,150 --> 00:05:52,320
on real data so Julie could you could

133
00:05:56,029 --> 00:05:53,160
you tell us a bit about what we're

134
00:05:58,850 --> 00:05:56,039
looking at as far as this animation here

135
00:06:02,809 --> 00:05:58,860
sure this is called our uh Observatory

136
00:06:04,070 --> 00:06:02,819
verify a visualization tool and it's a

137
00:06:07,909 --> 00:06:04,080
really

138
00:06:10,730 --> 00:06:07,919

um interesting uh work between 3D

139
00:06:12,890 --> 00:06:10,740
modeling and some Telemetry coming

140
00:06:14,749 --> 00:06:12,900
directly from the spacecraft and you'll

141
00:06:16,990 --> 00:06:14,759
be able to see this as we go through

142
00:06:20,809 --> 00:06:17,000
that there's some real-time Telemetry

143
00:06:24,230 --> 00:06:20,819
being fed into a model which then reacts

144
00:06:27,230 --> 00:06:24,240
as though the observatory is actually

145
00:06:31,870 --> 00:06:27,240
um doing those movements in space

146
00:06:34,189 --> 00:06:31,880
it's not a video or a model that's

147
00:06:37,790 --> 00:06:34,199
pre-programmed to do that it's actually

148
00:06:38,830 --> 00:06:37,800
receiving the Telemetry model to match

149
00:06:42,650 --> 00:06:38,840
that

150
00:06:43,969 --> 00:06:42,660
we are go to stop the DU motor

151
00:06:55,490 --> 00:06:43,979
so they're stopping the motor they're

152
00:06:59,150 --> 00:06:58,129
so Julia you were saying to me oh go

153
00:07:01,189 --> 00:06:59,160
ahead please

154
00:07:03,950 --> 00:07:01,199
I was going to say you hear them talking

155
00:07:06,469 --> 00:07:03,960
to each other in the control room uh

156
00:07:08,510 --> 00:07:06,479
each person has different call signals

157
00:07:10,430 --> 00:07:08,520
so you'll hear one person called OC

158
00:07:11,930 --> 00:07:10,440
that's the operation controller and

159
00:07:13,850 --> 00:07:11,940
you'll hear CC that's the command

160
00:07:16,309 --> 00:07:13,860
controller and the two of them work

161
00:07:20,050 --> 00:07:16,319
together make sure that all the commands

162
00:07:22,490 --> 00:07:20,060
that are set up to the observatory

163
00:07:24,469 --> 00:07:22,500

exactly what we want to do and configure

164
00:07:27,529 --> 00:07:24,479
it properly

165
00:07:34,850 --> 00:07:27,539
and I verify that command Q is in the

166
00:07:40,850 --> 00:07:37,550
so OC at this time we are go to proceed

167
00:07:43,990 --> 00:07:40,860
on to step 0 to 2 to disable the Adu

168
00:07:44,000 --> 00:07:47,570
on the window

169
00:07:50,930 --> 00:07:49,369
and OC that looks good you're a good

170
00:07:54,469 --> 00:07:50,940
execute

171
00:07:54,479 --> 00:08:12,469
and OC you have a go to continue

172
00:08:15,770 --> 00:08:14,450
so Julie can you talk a bit about uh the

173
00:08:17,529 --> 00:08:15,780
important thing that's happened today is

174
00:08:20,089 --> 00:08:17,539
the deployment of the secondary mirror

175
00:08:23,210 --> 00:08:20,099
and uh give us a little sense about

176
00:08:24,650 --> 00:08:23,220
about you know what this is and feel

177
00:08:25,909 --> 00:08:24,660
free to listen to the calls I know that

178
00:08:29,809 --> 00:08:25,919
you're doing this live with us as well

179
00:08:31,850 --> 00:08:29,819
and OC I have also confirmed that we are

180
00:08:34,070 --> 00:08:31,860
ready to perform the smsf latch motor

181
00:08:41,469 --> 00:08:34,080
aliveness so at this time we are going

182
00:08:46,009 --> 00:08:44,089
the deployment motor and now they're

183
00:08:47,630 --> 00:08:46,019
going to check the latch motor because

184
00:08:52,930 --> 00:08:47,640
they have two different Motors that have

185
00:08:57,530 --> 00:08:55,389
if you take a look at the uh

186
00:08:59,990 --> 00:08:57,540
visualization tool right now you'll see

187
00:09:02,290 --> 00:09:00,000
that the mirror does um

188
00:09:05,030 --> 00:09:02,300

does not look very functional

189
00:09:07,550 --> 00:09:05,040
pieces the two wings are folded back on

190
00:09:10,370 --> 00:09:07,560
the side and the secondary mirror is

191
00:09:12,889 --> 00:09:10,380
those two black lines going up to the

192
00:09:14,630 --> 00:09:12,899
top of the mirror and it's a little hard

193
00:09:17,150 --> 00:09:14,640
to see but the the mirror itself is

194
00:09:21,530 --> 00:09:17,160
actually perched on top of the telescope

195
00:09:23,449 --> 00:09:21,540
on those two long spindly legs what will

196
00:09:25,910 --> 00:09:23,459
happen is it will fold out and it will

197
00:09:27,769 --> 00:09:25,920
put it down into the center of the of

198
00:09:30,350 --> 00:09:27,779
the primary mirror where it can be a

199
00:09:32,930 --> 00:09:30,360
reflecting light back into the center of

200
00:09:35,449 --> 00:09:32,940
the telescope

201
00:09:39,290 --> 00:09:35,459
um telescope itself is a reflective

202
00:09:40,910 --> 00:09:39,300
telescope it's a three mirror

203
00:09:43,490 --> 00:09:40,920
anti-sigmat

204
00:09:44,870 --> 00:09:43,500
um so it the the light uh we'll talk

205
00:09:47,150 --> 00:09:44,880
about a little bit later about the light

206
00:09:54,110 --> 00:09:47,160
path and you'll see once it comes out

207
00:09:57,949 --> 00:09:55,970
I understand we have an animation that

208
00:09:59,269 --> 00:09:57,959
we can play now about the uh the

209
00:10:02,449 --> 00:09:59,279
secondary mirror and sort of how it will

210
00:10:04,250 --> 00:10:02,459
fold out so uh here we go you can if you

211
00:10:06,710 --> 00:10:04,260
can just tell us what's going on here

212
00:10:08,930 --> 00:10:06,720
yep so you can see the legs come out and

213
00:10:12,290 --> 00:10:08,940

the top leg has a hinge in the middle of

214
00:10:13,850 --> 00:10:12,300
it and it snaps into place and the the

215
00:10:16,250 --> 00:10:13,860
we're seeing the back of the mirror so

216
00:10:18,889 --> 00:10:16,260
it looks black but that

217
00:10:21,110 --> 00:10:18,899
um that's that round item in the center

218
00:10:22,670 --> 00:10:21,120
is the mirror and you can see it's held

219
00:10:24,949 --> 00:10:22,680
a certain diff distance away from the

220
00:10:30,050 --> 00:10:24,959
primary mirror

221
00:10:32,090 --> 00:10:30,060
secondary mirrors convex and it shoots

222
00:10:34,790 --> 00:10:32,100
the beam of light back down through the

223
00:10:35,870 --> 00:10:34,800
center those parameters look good we are

224
00:10:38,449 --> 00:10:35,880
go to continue with the motor

225
00:10:40,490 --> 00:10:38,459
instruments are packed into a box you

226
00:10:43,910 --> 00:10:40,500
can kind of see behind the telescope

227
00:10:46,310 --> 00:10:43,920
there's a there's a rectangular box with

228
00:10:47,569 --> 00:10:46,320
a with a sloped top to it that's where

229
00:10:49,550 --> 00:10:47,579
all the instruments are packed back

230
00:10:51,350 --> 00:10:49,560
there and they take the light in from

231
00:10:54,290 --> 00:10:51,360
the center of the telescope and

232
00:10:57,350 --> 00:10:54,300
and bring it down onto detectors for us

233
00:11:02,269 --> 00:10:57,360
and OC we do expect uh the yellow alarm

234
00:11:07,970 --> 00:11:05,930
so they're talking about um alarms right

235
00:11:10,190 --> 00:11:07,980
now on the loops and what they mean by

236
00:11:13,550 --> 00:11:10,200
that is as we

237
00:11:16,069 --> 00:11:13,560
um move through different uh checkouts

238
00:11:18,410 --> 00:11:16,079

uh there's Telemetry that comes into the

239
00:11:19,970 --> 00:11:18,420
mock and it gets processed into a ground

240
00:11:21,829 --> 00:11:19,980
system and that ground system looks at

241
00:11:25,190 --> 00:11:21,839
the Telemetry and it has a different

242
00:11:27,230 --> 00:11:25,200
parameters set up and uh to alert us

243
00:11:29,569 --> 00:11:27,240
when things are happening we've we've

244
00:11:31,910 --> 00:11:29,579
assigned uh you know essentially colored

245
00:11:33,949 --> 00:11:31,920
lights that come on it's on your digital

246
00:11:36,829 --> 00:11:33,959
screen they're not light bulbs

247
00:11:38,630 --> 00:11:36,839
um the so an alarm will come on

248
00:11:40,790 --> 00:11:38,640
someone's screen and say that this motor

249
00:11:43,730 --> 00:11:40,800
is doing something or this temperature

250
00:11:45,410 --> 00:11:43,740
sensor is doing something and some of

251
00:11:46,790 --> 00:11:45,420
them are meant to be in that state

252
00:11:49,430 --> 00:11:46,800
during different times and some of them

253
00:11:51,230 --> 00:11:49,440
are not so we watch them and we alert

254
00:11:55,610 --> 00:11:51,240
each other to our plan as to what we

255
00:11:59,870 --> 00:11:57,710
for those of you who are just joining us

256
00:12:01,370 --> 00:11:59,880
we are looking at a live coverage of the

257
00:12:03,530 --> 00:12:01,380
deployment of the secondary mirror for

258
00:12:05,870 --> 00:12:03,540
the James Webb Space Telescope you're

259
00:12:07,970 --> 00:12:05,880
looking at uh an animation that includes

260
00:12:09,889 --> 00:12:07,980
real-time Telemetry real-time data from

261
00:12:11,690 --> 00:12:09,899
the spacecraft as do the configuration

262
00:12:14,329 --> 00:12:11,700
that it's in what's going on complete

263
00:12:17,509 --> 00:12:14,339

standby for evaluation

264
00:12:18,829 --> 00:12:17,519
and you're listening to uh live commands

265
00:12:21,170 --> 00:12:18,839
coming from the mission operations

266
00:12:30,170 --> 00:12:21,180
center or mock at the Space Telescope

267
00:12:30,180 --> 00:12:35,230
foreign

268
00:12:40,310 --> 00:12:38,269
we have verified that the sync move was

269
00:12:43,129 --> 00:12:40,320
good and we are going to proceed with

270
00:12:44,629 --> 00:12:43,139
the launch lock releases for the smsf at

271
00:12:52,370 --> 00:12:44,639
this time we are going to proceed onto

272
00:12:56,810 --> 00:12:53,930
and we have an expertise

273
00:12:58,370 --> 00:12:56,820
the window yes please please go ahead be

274
00:13:01,670 --> 00:12:58,380
that command that looks good you are

275
00:13:04,490 --> 00:13:01,680
good execute copy excuse me I wanted to

276
00:13:05,870 --> 00:13:04,500
release the launch locks and OC or go to

277
00:13:09,230 --> 00:13:05,880
continue

278
00:13:11,870 --> 00:13:09,240
we're gonna hold here and listen to the

279
00:13:14,210 --> 00:13:11,880
commands this is a a very momentous uh

280
00:13:16,069 --> 00:13:14,220
event happening via extension getting

281
00:13:20,629 --> 00:13:16,079
ready to extend the secondary mirror

282
00:13:23,389 --> 00:13:22,190
we'll hold here just for a little while

283
00:13:45,170 --> 00:13:23,399
and we're going to listen to commands

284
00:13:45,180 --> 00:14:01,389
foreign

285
00:14:05,810 --> 00:14:03,829
thing I'll add is that we will have time

286
00:14:09,170 --> 00:14:05,820
we believe to take some questions from

287
00:14:10,550 --> 00:14:09,180
social media use the hashtag asknasa we

288
00:14:12,769 --> 00:14:10,560

will get to as many of those as we can

289
00:14:23,930 --> 00:14:12,779
we're on multiple platforms wherever you

290
00:14:23,940 --> 00:14:40,490
foreign

291
00:14:45,710 --> 00:14:43,189
devops copies and I can confirm all

292
00:14:49,189 --> 00:14:45,720
channels are safe so at this time we are

293
00:14:51,170 --> 00:14:49,199
going to proceed onto step 0 to 7.

294
00:14:55,490 --> 00:14:51,180
for the

295
00:15:01,069 --> 00:14:59,210
and OC that script looks good you'll go

296
00:15:05,389 --> 00:15:01,079
to execute

297
00:15:30,230 --> 00:15:07,550
and OC you're going to continue and

298
00:15:35,030 --> 00:15:32,810
oh see I can confirm both ordinance

299
00:15:37,910 --> 00:15:35,040
cards are enabled your go to continue

300
00:16:10,850 --> 00:15:37,920
with ordinance Channel arms

301
00:16:16,249 --> 00:16:13,970
and ocg can confirm both ordinance

302
00:16:19,009 --> 00:16:16,259
channels are armed and the SCF is

303
00:16:22,550 --> 00:16:19,019
enabled altations alterations the next

304
00:16:25,189 --> 00:16:22,560
command will fire OTE lrm group three

305
00:16:29,170 --> 00:16:25,199
OC your go to fire

306
00:16:35,509 --> 00:16:32,449
any commentary yes thank you via their

307
00:16:37,850 --> 00:16:35,519
fire launch release mechanisms for the

308
00:16:40,670 --> 00:16:37,860
optical telescope elements that's the

309
00:16:44,090 --> 00:16:40,680
OTE lrm that they're talking about

310
00:16:46,430 --> 00:16:44,100
um and what these are are the uh pins

311
00:16:49,129 --> 00:16:46,440
essentially in a holder

312
00:16:51,350 --> 00:16:49,139
um that restrain the mechanism during

313
00:16:53,749 --> 00:16:51,360

launch to make sure that uh you know

314
00:16:55,490 --> 00:16:53,759
during the forces of and vibration that

315
00:16:58,910 --> 00:16:55,500
we see that everything stays in position

316
00:17:01,790 --> 00:16:58,920
and doesn't put undue strain onto the

317
00:17:04,490 --> 00:17:01,800
motors or the mechanisms themselves

318
00:17:06,470 --> 00:17:04,500
during that launch and at this point

319
00:17:14,630 --> 00:17:06,480
we're releasing them so that we can then

320
00:17:18,049 --> 00:17:16,189
so first we're going to release the

321
00:17:20,449 --> 00:17:18,059
mechanisms that keep this all in place

322
00:17:23,409 --> 00:17:20,459
and then when can we expect the uh the

323
00:17:26,689 --> 00:17:23,419
secondary arm to actually begin to move

324
00:17:29,630 --> 00:17:26,699
oh well it will the very first move will

325
00:17:31,970 --> 00:17:29,640
be extremely small uh so I am not sure

326
00:17:34,310 --> 00:17:31,980
that we will be able to discern it on

327
00:17:36,110 --> 00:17:34,320
the visualization tool

328
00:17:38,510 --> 00:17:36,120
um but definitely once we got into the

329
00:17:39,830 --> 00:17:38,520
full move we will we will be able to see

330
00:17:45,830 --> 00:17:39,840
that

331
00:17:47,930 --> 00:17:45,840
um and uh the the uh once once they

332
00:17:49,909 --> 00:17:47,940
release those mechanisms they'll want to

333
00:17:52,370 --> 00:17:49,919
take a moment and check out and make

334
00:17:53,990 --> 00:17:52,380
sure that everything is exactly what

335
00:17:56,870 --> 00:17:54,000
they want before they move on let's see

336
00:17:59,510 --> 00:17:56,880
I verify proc complete so at this time

337
00:18:04,070 --> 00:17:59,520
we are going to proceed onto step 0 to 8

338
00:18:05,690 --> 00:18:04,080

to release the OTE lrm group five and OC

339
00:18:11,450 --> 00:18:05,700
and here's that the script looks good

340
00:18:11,460 --> 00:18:16,190
next launch release cards

341
00:18:16,200 --> 00:18:29,570
stopping out to continue

342
00:18:34,310 --> 00:18:31,430
and at this time what they're doing is

343
00:18:36,789 --> 00:18:34,320
they're running scripts that are made

344
00:18:39,409 --> 00:18:36,799
and tested well in advance they're

345
00:18:40,970 --> 00:18:39,419
tested on simulators they're tested onto

346
00:18:44,090 --> 00:18:40,980
the real Hardware when we're doing

347
00:18:46,669 --> 00:18:44,100
ground test and they've gone through

348
00:18:48,529 --> 00:18:46,679
these scripts that send up commands to

349
00:18:51,169 --> 00:18:48,539
the spacecraft you can confirm both

350
00:18:52,610 --> 00:18:51,179
ordinance cards are enabled but you are

351
00:19:02,510 --> 00:18:52,620
go to continue with ordinance Channel

352
00:19:07,970 --> 00:19:05,630
and the operation controller

353
00:19:09,650 --> 00:19:07,980
um uh they as you can hear talk back and

354
00:19:12,590 --> 00:19:09,660
forth and very slowly walk through the

355
00:19:14,150 --> 00:19:12,600
script in the step and allowing the uh

356
00:19:18,049 --> 00:19:14,160
commands to be sent up to the spacecraft

357
00:19:21,890 --> 00:19:20,029
some things are checked automatically by

358
00:19:23,870 --> 00:19:21,900
the script and some things we wait for

359
00:19:26,870 --> 00:19:23,880
verification from the engineers on the

360
00:19:29,750 --> 00:19:26,880
ground before moving on

361
00:19:31,970 --> 00:19:29,760
we'll see I can confirm both Ordnance

362
00:19:34,730 --> 00:19:31,980
channels are armed and the SCS is

363
00:19:36,110 --> 00:19:34,740

enabled altations alterations the next

364
00:19:40,310 --> 00:19:36,120
command will fire

365
00:19:45,830 --> 00:19:40,320
OTE lrm group 5. go see your go to fire

366
00:19:50,029 --> 00:19:47,450
you're watching live coverage of the

367
00:19:52,010 --> 00:19:50,039
deployment of the secondary mirror an

368
00:19:53,810 --> 00:19:52,020
absolutely essential component of the

369
00:19:55,669 --> 00:19:53,820
James Webb Space Telescope

370
00:20:02,870 --> 00:19:55,679
we are getting ready to extend secondary

371
00:20:07,250 --> 00:20:05,149
and when they say go to fire what

372
00:20:09,590 --> 00:20:07,260
they're actually doing is

373
00:20:12,770 --> 00:20:09,600
um they're putting a current through a

374
00:20:19,070 --> 00:20:12,780
brake wire that releases a coiled wire

375
00:20:32,750 --> 00:20:19,080
that lets a a cone and uh cup assembly

376
00:20:37,370 --> 00:20:34,970
you'll hear commentary from uh myself

377
00:21:08,510 --> 00:20:37,380
Michelle Fowler I come to you from

378
00:21:14,750 --> 00:21:12,649
and OC I can verify plot complete

379
00:21:17,149 --> 00:21:14,760
at this time we are going to execute the

380
00:21:20,090 --> 00:21:17,159
0 to 9 to configure the deu to standby

381
00:21:21,590 --> 00:21:20,100
mode and OC that input looks good your

382
00:21:25,190 --> 00:21:21,600
go to execute

383
00:21:25,200 --> 00:21:30,169
and what they're doing now

384
00:21:39,710 --> 00:21:32,990
into standby while they get ready to do

385
00:21:43,370 --> 00:21:41,330
and of course the reason this is so

386
00:21:45,350 --> 00:21:43,380
dramatic you're looking at something

387
00:21:47,270 --> 00:21:45,360
very historic here this is the the

388
00:21:50,390 --> 00:21:47,280

largest space Observatory ever launched

389
00:21:52,909 --> 00:21:50,400
the James Webb Space Telescope and the

390
00:21:54,590 --> 00:21:52,919
uh um the the mirror assembly is so

391
00:21:56,870 --> 00:21:54,600
large it had to be folded up people

392
00:21:58,190 --> 00:21:56,880
often say like origami to fit into the

393
00:22:00,110 --> 00:21:58,200
rocket we'll talk more about that later

394
00:22:02,870 --> 00:22:00,120
when we have some time as they're

395
00:22:04,610 --> 00:22:02,880
verifying the uh uh the secondary mirror

396
00:22:06,950 --> 00:22:04,620
deployment and also latching complete

397
00:22:08,930 --> 00:22:06,960
and I can't confirm the DU is in standby

398
00:22:12,169 --> 00:22:08,940
mode but at this time we are going to

399
00:22:15,830 --> 00:22:12,179
proceed onto step zero three zero to uh

400
00:22:17,330 --> 00:22:15,840
execute the sap parameter upload

401
00:22:19,669 --> 00:22:17,340
I'll do that

402
00:22:22,250 --> 00:22:19,679
that is from the window

403
00:22:23,570 --> 00:22:22,260
and OC that looks good you're a good

404
00:22:28,490 --> 00:22:23,580
execute

405
00:22:32,270 --> 00:22:29,930
you're hearing commands from the mission

406
00:22:40,490 --> 00:22:32,280
operations center the mock and OC you

407
00:22:45,770 --> 00:22:43,130
yesterday saw the the tremendous success

408
00:22:48,590 --> 00:22:45,780
of the deployment of the giant heat

409
00:22:50,510 --> 00:22:48,600
shield to keep this a very cold infrared

410
00:22:52,789 --> 00:22:50,520
heat sensitive telescope there's a

411
00:22:54,409 --> 00:22:52,799
gigantic five-layered heat shield each

412
00:22:57,169 --> 00:22:54,419
layer is about the size of a tennis

413
00:22:59,570 --> 00:22:57,179

court and yesterday we were with you

414
00:23:01,850 --> 00:22:59,580
live for the uh the finale of that as

415
00:23:04,850 --> 00:23:01,860
the uh the final layer was deployed

416
00:23:07,370 --> 00:23:04,860
attention pulled tight it is now fully

417
00:23:10,549 --> 00:23:07,380
functional fully uh operational cooling

418
00:23:14,750 --> 00:23:13,190
the telescope components the mesh the

419
00:23:17,930 --> 00:23:14,760
mirror will always be pointed away from

420
00:23:19,669 --> 00:23:17,940
the Sun and as such exposed to the the

421
00:23:21,590 --> 00:23:19,679
cold vacuum of space will cool the

422
00:23:23,270 --> 00:23:21,600
temperatures close to -400 degrees

423
00:23:25,370 --> 00:23:23,280
Fahrenheit

424
00:23:28,610 --> 00:23:25,380
and that has has begun because the heat

425
00:23:32,210 --> 00:23:30,230
step UPS go ahead

426
00:23:34,010 --> 00:23:32,220
uh yeah it's just looking for you to

427
00:23:37,430 --> 00:23:34,020
confirm you've gotten Joy this far with

428
00:23:41,710 --> 00:23:39,169
that's affirmative we have been

429
00:23:44,149 --> 00:23:41,720
proceeding uh as expected

430
00:23:45,529 --> 00:23:44,159
thank you some of the Telemetry we've

431
00:23:46,970 --> 00:23:45,539
seen of like control rooms different so

432
00:23:48,289 --> 00:23:46,980
we didn't we didn't know what what you

433
00:23:58,430 --> 00:23:48,299
guys were all looking at but that's good

434
00:24:02,390 --> 00:24:00,289
that was the voice of our mission

435
00:24:06,950 --> 00:24:02,400
operations manager

436
00:24:12,769 --> 00:24:11,029
his uh his acronym obviously his mom so

437
00:24:15,130 --> 00:24:12,779
you'll hear people call to Mom and

438
00:24:17,330 --> 00:24:15,140

sometimes that's a little surprising

439
00:24:23,930 --> 00:24:17,340
but it stands for Mission operations

440
00:24:28,370 --> 00:24:26,269
and Julie you are the uh the deputy

441
00:24:30,350 --> 00:24:28,380
commissioning engineer and uh also you

442
00:24:32,450 --> 00:24:30,360
were the lead systems engineer for the

443
00:24:33,470 --> 00:24:32,460
uh the instrument package I believe uh

444
00:24:35,269 --> 00:24:33,480
maybe just just give us a little

445
00:24:38,269 --> 00:24:35,279
introduction again as to who you are and

446
00:24:39,529 --> 00:24:38,279
your your uh your role in this mission

447
00:24:40,370 --> 00:24:39,539
sure

448
00:24:44,510 --> 00:24:40,380
um

449
00:24:47,330 --> 00:24:44,520
so for uh commissioning there's there's

450
00:24:49,430 --> 00:24:47,340
it's breaking down into uh several parts

451
00:24:52,070 --> 00:24:49,440
like the parts that we've done over the

452
00:24:52,970 --> 00:24:52,080
last 12 days is really focused on

453
00:24:54,830 --> 00:24:52,980
um

454
00:24:58,549 --> 00:24:54,840
some of the spacecraft deployments

455
00:25:00,350 --> 00:24:58,559
getting the solar array out getting the

456
00:25:02,930 --> 00:25:00,360
communication system up and working

457
00:25:05,210 --> 00:25:02,940
getting the sun shield out and tensioned

458
00:25:07,850 --> 00:25:05,220
and it's all been very

459
00:25:13,010 --> 00:25:11,390
a lot of intensive work on the on this

460
00:25:15,769 --> 00:25:13,020
team that both the spacecraft and the

461
00:25:17,510 --> 00:25:15,779
sun shield and then today is kind of

462
00:25:20,750 --> 00:25:17,520
marks a transition point

463
00:25:24,049 --> 00:25:20,760

so today we we switch gears and we work

464
00:25:26,090 --> 00:25:24,059
more onto the on to the cold side on

465
00:25:27,710 --> 00:25:26,100
into the Optics and the optical

466
00:25:30,769 --> 00:25:27,720
telescope element and getting that

467
00:25:33,590 --> 00:25:30,779
deployed and set up for Optics and then

468
00:25:36,169 --> 00:25:33,600
the the final part of commissioning will

469
00:25:38,029 --> 00:25:36,179
be we switch gears again

470
00:25:41,090 --> 00:25:38,039
um we'll go into the science instruments

471
00:25:44,090 --> 00:25:41,100
and get them turned on and calibrated so

472
00:25:47,570 --> 00:25:44,100
so as our

473
00:25:50,090 --> 00:25:47,580
these different segments we have

474
00:25:52,010 --> 00:25:50,100
different people who kind of uh oversee

475
00:25:54,890 --> 00:25:52,020
from a technical Point what's going on

476
00:25:57,409 --> 00:25:54,900
and how things are going so my expertise

477
00:26:00,049 --> 00:25:57,419
is more towards the more towards the

478
00:26:03,950 --> 00:26:00,059
telescope itself and the instruments

479
00:26:06,590 --> 00:26:03,960
um and then the uh

480
00:26:09,710 --> 00:26:06,600
there's other people who have overseen

481
00:26:12,049 --> 00:26:09,720
up to this point and a little bit today

482
00:26:14,930 --> 00:26:12,059
I want to give a quick shout out for the

483
00:26:17,450 --> 00:26:14,940
people who built the telescope and

484
00:26:19,669 --> 00:26:17,460
assembled it and done it uh you know I

485
00:26:21,830 --> 00:26:19,679
wasn't directly involved with a lot of

486
00:26:24,110 --> 00:26:21,840
that but as you can see all those people

487
00:26:26,990 --> 00:26:24,120
are needed to be there in the control

488
00:26:29,930 --> 00:26:27,000

room watching the data be available if

489
00:26:32,330 --> 00:26:29,940
there's problems or questions so I I get

490
00:26:35,269 --> 00:26:32,340
to fill in today for the telescope

491
00:26:36,769 --> 00:26:35,279
um and to talk about this and uh you'll

492
00:26:39,350 --> 00:26:36,779
probably hear from some more people

493
00:26:41,930 --> 00:26:39,360
along the way Michelle as as different

494
00:26:45,289 --> 00:26:41,940
experts have more time and uh

495
00:26:46,669 --> 00:26:45,299
availability to talk to you

496
00:26:48,330 --> 00:26:46,679
well she'll be happy to have you here

497
00:26:53,090 --> 00:26:48,340
Julie

498
00:26:56,029 --> 00:26:54,470
we're looking at again we're looking at

499
00:26:57,470 --> 00:26:56,039
live coverage of the deployment at the

500
00:26:58,909 --> 00:26:57,480
secondary mirror for the James Webb

501
00:27:00,710 --> 00:26:58,919
Space Telescope that should be happening

502
00:27:03,890 --> 00:27:00,720
in a few minutes from now you're looking

503
00:27:05,510 --> 00:27:03,900
at a a real-time animation created by

504
00:27:13,130 --> 00:27:05,520
Telemetry that is data from the

505
00:27:22,909 --> 00:27:15,649
and then the other two windows are live

506
00:27:28,730 --> 00:27:25,850
and as they uh get ready here I can

507
00:27:30,470 --> 00:27:28,740
watch my screen and uh see what steps

508
00:27:33,230 --> 00:27:30,480
they're on they're they're moving

509
00:27:35,630 --> 00:27:33,240
forward through through their timeline

510
00:27:38,149 --> 00:27:35,640
um and they're getting ready to

511
00:27:40,789 --> 00:27:38,159
um do a couple of setup steps with their

512
00:27:42,950 --> 00:27:40,799
Motors and then they'll be moving on to

513
00:27:45,710 --> 00:27:42,960

doing their small mirror move to make

514
00:27:47,090 --> 00:27:45,720
sure that our uh

515
00:27:48,830 --> 00:27:47,100
the

516
00:27:51,889 --> 00:27:48,840
deployment motor

517
00:27:54,049 --> 00:27:51,899
just a few degrees actually 1.3 degrees

518
00:28:04,490 --> 00:27:54,059
out to make sure that everything looks

519
00:28:08,570 --> 00:28:06,889
as we're talking you'll occasionally see

520
00:28:10,130 --> 00:28:08,580
us pause as we listen to commands from

521
00:28:12,350 --> 00:28:10,140
the mission operations center

522
00:28:14,330 --> 00:28:12,360
but whenever we have a few minutes to uh

523
00:28:15,649 --> 00:28:14,340
to fill some time Julie one of the

524
00:28:17,389 --> 00:28:15,659
things that we talked about before was

525
00:28:19,909 --> 00:28:17,399
the fact that there are no actual

526
00:28:22,190 --> 00:28:19,919
cameras for us to see on web what the

527
00:28:23,870 --> 00:28:22,200
telescope is doing and that was

528
00:28:25,549 --> 00:28:23,880
something that was a deliberate decision

529
00:28:27,470 --> 00:28:25,559
it was it was definitely thought about

530
00:28:28,970 --> 00:28:27,480
but it there there are several things

531
00:28:30,649 --> 00:28:28,980
that make this very difficult to have

532
00:28:31,789 --> 00:28:30,659
cameras on this particular Mission I

533
00:28:33,649 --> 00:28:31,799
don't know if you'd like to go through

534
00:28:34,730 --> 00:28:33,659
some of that I uh I remember some of the

535
00:28:39,590 --> 00:28:34,740
reasons myself

536
00:28:41,090 --> 00:28:39,600
hey yeah sure you know we would in this

537
00:28:42,350 --> 00:28:41,100
day and age everything's caught on

538
00:28:44,389 --> 00:28:42,360

camera

539
00:28:47,870 --> 00:28:44,399
um but you know realize that James Webb

540
00:28:51,529 --> 00:28:47,880
has been designed over many many years

541
00:28:54,169 --> 00:28:51,539
um we did look uh at the possibility of

542
00:28:56,289 --> 00:28:54,179
adding some uh cameras that would give

543
00:28:59,990 --> 00:28:56,299
us some views some similar to this

544
00:29:02,269 --> 00:29:00,000
visualization tool however the um

545
00:29:04,490 --> 00:29:02,279
you know the the thing that the tool can

546
00:29:06,169 --> 00:29:04,500
do for us is is as you see right now the

547
00:29:07,850 --> 00:29:06,179
mirrors are bright and shiny as though

548
00:29:10,310 --> 00:29:07,860
there's light shining on it but the

549
00:29:11,870 --> 00:29:10,320
reality is out in space it's dark uh it

550
00:29:13,730 --> 00:29:11,880
would be like walking into a dark room

551
00:29:15,470 --> 00:29:13,740
and looking at the telescope

552
00:29:18,169 --> 00:29:15,480
it would be dark

553
00:29:22,310 --> 00:29:18,179
um so we would need some kind of light

554
00:29:24,590 --> 00:29:22,320
system on a camera system uh we would

555
00:29:28,610 --> 00:29:24,600
have problems if we wanted to do

556
00:29:31,070 --> 00:29:28,620
flash photography obviously are uh

557
00:29:32,810 --> 00:29:31,080
mirror is very sensitive our Optics

558
00:29:34,549 --> 00:29:32,820
inside are very sensitive and most

559
00:29:36,529 --> 00:29:34,559
importantly our detectors all the way

560
00:29:39,049 --> 00:29:36,539
deep inside of our instruments you know

561
00:29:43,010 --> 00:29:39,059
we even looked at how sensitive they are

562
00:29:45,470 --> 00:29:43,020
to Simply lights in the room if your

563
00:29:47,870 --> 00:29:45,480

fluorescent bulbs in the in the clean

564
00:29:49,250 --> 00:29:47,880
room over years would degrade our

565
00:29:52,370 --> 00:29:49,260
detectors we certainly don't want to be

566
00:29:54,049 --> 00:29:52,380
flashing them with a with a flash for a

567
00:29:58,010 --> 00:29:54,059
camera

568
00:30:00,769 --> 00:29:58,020
um the other thing is that as you can

569
00:30:02,450 --> 00:30:00,779
see in our visit our where's web now

570
00:30:05,450 --> 00:30:02,460
tool that we're getting colder and

571
00:30:07,789 --> 00:30:05,460
colder so uh a camera

572
00:30:08,990 --> 00:30:07,799
that you would that you would get

573
00:30:11,389 --> 00:30:09,000
that would work at those temperatures

574
00:30:14,450 --> 00:30:11,399
would have to be specially designed you

575
00:30:17,450 --> 00:30:14,460
know Plastics fall apart and they shrink

576
00:30:20,090 --> 00:30:17,460
and can crack uh glues don't hold

577
00:30:21,649 --> 00:30:20,100
together I mean to make something that

578
00:30:24,350 --> 00:30:21,659
would work at the cryogenic temperatures

579
00:30:27,130 --> 00:30:24,360
on the cold side of the of the sun

580
00:30:30,350 --> 00:30:27,140
shield would take a lot of

581
00:30:33,409 --> 00:30:30,360
engineering and design and then one

582
00:30:36,529 --> 00:30:33,419
other major issue is is that you know we

583
00:30:40,010 --> 00:30:36,539
would have to run cables and power out

584
00:30:43,730 --> 00:30:40,020
to these cameras and

585
00:30:45,649 --> 00:30:43,740
our our Power Balance especially on the

586
00:30:48,409 --> 00:30:45,659
cold side of the telescope is so

587
00:30:51,049 --> 00:30:48,419
delicate uh you know those would be

588
00:30:53,450 --> 00:30:51,059

essentially hot the heat leaks and we

589
00:30:55,190 --> 00:30:53,460
would not want to pick up the signature

590
00:30:58,789 --> 00:30:55,200
from those cables into the telescope

591
00:31:00,950 --> 00:30:58,799
Optics itself and take a risk I can

592
00:31:03,649 --> 00:31:00,960
verify if not complete and all loads

593
00:31:05,570 --> 00:31:03,659
executed successfully but this time we

594
00:31:07,549 --> 00:31:05,580
are going to proceed onto Step Zero

595
00:31:10,370 --> 00:31:07,559
through one to configure the deu to

596
00:31:13,250 --> 00:31:10,380
operate frame 14.

597
00:31:19,730 --> 00:31:13,260
so we would not want this

598
00:31:24,409 --> 00:31:22,549
or go to continue

599
00:31:26,090 --> 00:31:24,419
or thermally

600
00:31:28,549 --> 00:31:26,100
feel free to pause Julian if we can come

601
00:31:32,330 --> 00:31:28,559
back that's right yes

602
00:31:33,710 --> 00:31:32,340
uh and uh last of all you know if if the

603
00:31:35,930 --> 00:31:33,720
camera did fail we would certainly not

604
00:31:39,769 --> 00:31:35,940
want the the debris from the camera to

605
00:31:41,810 --> 00:31:39,779
to be moving around our telescope

606
00:31:43,610 --> 00:31:41,820
uh you know there's also two sides of

607
00:31:46,490 --> 00:31:43,620
the telescope this is the side we're

608
00:31:49,490 --> 00:31:46,500
working on today but um for the earlier

609
00:31:52,310 --> 00:31:49,500
deployments we would have had cameras uh

610
00:31:54,889 --> 00:31:52,320
preferably on the hot side but

611
00:31:57,830 --> 00:31:54,899
as you can see maybe in the video where

612
00:31:59,509 --> 00:31:57,840
the observatory is moving away from the

613
00:32:03,649 --> 00:31:59,519

upper stage of the rocket were very

614
00:32:06,289 --> 00:32:03,659
shiny so um I could verify Rock complete

615
00:32:18,169 --> 00:32:06,299
and the deu is an operate mode frame 14.

616
00:32:22,850 --> 00:32:19,970
of a background would be very difficult

617
00:32:25,370 --> 00:32:22,860
to you know it's a little bit of a like

618
00:32:27,289 --> 00:32:25,380
a Hall of Mirrors with the with the

619
00:32:30,710 --> 00:32:27,299
shiny surfaces

620
00:32:32,870 --> 00:32:30,720
you know what would you look at to to be

621
00:32:34,549 --> 00:32:32,880
able to distinguish what's going on so

622
00:32:36,470 --> 00:32:34,559
from an engineering perspective we we

623
00:32:38,930 --> 00:32:36,480
decided that it our Telemetry coming

624
00:32:41,930 --> 00:32:38,940
down was the most reliable thing that we

625
00:32:42,950 --> 00:32:41,940
have but when we did see the

626
00:32:45,830 --> 00:32:42,960
um

627
00:32:48,529 --> 00:32:45,840
the solar array deploy it from the

628
00:32:51,110 --> 00:32:48,539
camera from the uh upper stage that was

629
00:32:52,310 --> 00:32:51,120
really quite exciting for us yeah this

630
00:32:54,590 --> 00:32:52,320
was amazing so what you're looking at

631
00:32:56,509 --> 00:32:54,600
here on the screen is is the actual

632
00:32:58,850 --> 00:32:56,519
footage of the observatory uh leaving

633
00:33:00,529 --> 00:32:58,860
the area in five rocket uh you see the

634
00:33:03,769 --> 00:33:00,539
logo of the European Space Agency they

635
00:33:05,330 --> 00:33:03,779
were the providers of the area M5 and as

636
00:33:07,549 --> 00:33:05,340
the James Webb Space Telescope is

637
00:33:10,549 --> 00:33:07,559
they're flying off independently into

638
00:33:12,110 --> 00:33:10,559

space our last view of it uh one of the

639
00:33:14,149 --> 00:33:12,120
things we were able to see is the uh the

640
00:33:15,710 --> 00:33:14,159
the solar array deploying and so that

641
00:33:17,690 --> 00:33:15,720
was uh that was amazing I was not

642
00:33:20,029 --> 00:33:17,700
expecting that and uh there were so many

643
00:33:22,610 --> 00:33:20,039
cheers and so many Smiles as we uh as we

644
00:33:24,409 --> 00:33:22,620
saw that heading off into space uh Webb

645
00:33:26,269 --> 00:33:24,419
is going about a million miles away is

646
00:33:28,909 --> 00:33:26,279
going to a LaGrange point that is a

647
00:33:30,590 --> 00:33:28,919
point where the gravity of the uh the

648
00:33:33,470 --> 00:33:30,600
earth and the the Sun and the Moon

649
00:33:35,509 --> 00:33:33,480
balance it's a great place to actually

650
00:33:38,090 --> 00:33:35,519
uh to park a spacecraft and everything

651
00:33:40,130 --> 00:33:38,100
kind of balances and keeps you there

652
00:33:42,110 --> 00:33:40,140
the solar array that you see deploying

653
00:33:43,730 --> 00:33:42,120
right now if you look over at the Ed web

654
00:33:45,649 --> 00:33:43,740
going off into space you see the solar

655
00:33:47,630 --> 00:33:45,659
array deploying that was the first of

656
00:33:49,549 --> 00:33:47,640
its deployments that allowed the

657
00:33:51,590 --> 00:33:49,559
spacecraft to power itself up

658
00:33:53,509 --> 00:33:51,600
and we are now

659
00:33:55,490 --> 00:33:53,519
very very much involved in the rest of

660
00:33:57,830 --> 00:33:55,500
the deployments yesterday we had the

661
00:33:59,750 --> 00:33:57,840
incredible finale of the the giant

662
00:34:01,310 --> 00:33:59,760
sunscreen successfully deploying and

663
00:34:03,950 --> 00:34:01,320

today we are looking for the secondary

664
00:34:05,509 --> 00:34:03,960
mirror the focusing mirror to deploy

665
00:34:07,490 --> 00:34:05,519
there will be deployments and

666
00:34:09,470 --> 00:34:07,500
commissioning for quite a while the

667
00:34:11,930 --> 00:34:09,480
major ones will be completed all about

668
00:34:14,690 --> 00:34:11,940
29 days after launch

669
00:34:16,970 --> 00:34:14,700
nice uh nice little dramatic lens flare

670
00:34:17,990 --> 00:34:16,980
there from the uh the sunlight hitting

671
00:34:22,069 --> 00:34:18,000
the back of the James Webb Space

672
00:34:24,889 --> 00:34:23,930
so Michelle as I listen to what's going

673
00:34:26,930 --> 00:34:24,899
on here

674
00:34:28,909 --> 00:34:26,940
they're in the process of doing their

675
00:34:30,889 --> 00:34:28,919
small move which like I said I don't

676
00:34:33,409 --> 00:34:30,899
believe we'll be able to detect on the

677
00:34:36,950 --> 00:34:33,419
visualization Tool uh but they're

678
00:34:40,129 --> 00:34:36,960
waiting for confirmation from the uh

679
00:34:43,190 --> 00:34:40,139
deployment lead that the the move has

680
00:34:48,050 --> 00:34:45,290
so at this point all of the latching

681
00:34:49,369 --> 00:34:48,060
mechanisms have been uh released so that

682
00:34:51,589 --> 00:34:49,379
the the mirror has actually been

683
00:34:52,909 --> 00:34:51,599
released and now we're waiting for a

684
00:34:55,069 --> 00:34:52,919
small move you know to check and see

685
00:34:56,930 --> 00:34:55,079
that everything's all right and then uh

686
00:34:59,510 --> 00:34:56,940
later on the broadcast the uh the

687
00:35:00,530 --> 00:34:59,520
deployment of the secondary mirror and

688
00:35:02,510 --> 00:35:00,540

we will be with you through the

689
00:35:05,030 --> 00:35:02,520
deployment and then also through the

690
00:35:07,430 --> 00:35:05,040
latching as the secondary mirror is is

691
00:35:08,810 --> 00:35:07,440
latched solidly into place and we know

692
00:35:11,630 --> 00:35:08,820
that the secondary mirror has been

693
00:35:14,089 --> 00:35:11,640
successfully deployed

694
00:35:16,370 --> 00:35:14,099
we expect the uh the latching to take

695
00:35:17,690 --> 00:35:16,380
place uh Julie correct me if I'm wrong

696
00:35:20,150 --> 00:35:17,700
but I believe that will be about 45

697
00:35:22,670 --> 00:35:20,160
minutes after the deployment of the the

698
00:35:24,950 --> 00:35:22,680
mirror is that process will be complete

699
00:35:28,130 --> 00:35:24,960
yes

700
00:35:30,770 --> 00:35:28,140
yeah the latching has a has a couple of

701
00:35:32,210 --> 00:35:30,780
steps they move through it slowly they

702
00:35:35,450 --> 00:35:32,220
want to make sure that everything's in

703
00:35:38,150 --> 00:35:35,460
its precise position so that um

704
00:35:41,030 --> 00:35:38,160
once it's latched it's completely we do

705
00:35:43,030 --> 00:35:41,040
not come back and ever adjust this again

706
00:35:45,950 --> 00:35:43,040
oh they must have gotten confirmation

707
00:35:50,390 --> 00:35:45,960
that that the small move was successful

708
00:35:53,750 --> 00:35:51,890
but you're looking at is live footage

709
00:35:55,430 --> 00:35:53,760
this is happening right now at the mock

710
00:35:57,410 --> 00:35:55,440
the mission operations center

711
00:35:59,089 --> 00:35:57,420
you're looking at the the deployment of

712
00:36:00,950 --> 00:35:59,099
the secondary mirror of the James Webb

713
00:36:03,710 --> 00:36:00,960

Space Telescope an absolutely essential

714
00:36:08,990 --> 00:36:06,050
oh see that bots on Ops

715
00:36:10,790 --> 00:36:09,000
this is something go ahead

716
00:36:13,490 --> 00:36:10,800
that bleed has confirmed we have

717
00:36:16,370 --> 00:36:13,500
positive separation but we are going to

718
00:36:18,349 --> 00:36:16,380
proceed onto step zero three seven to

719
00:36:21,890 --> 00:36:18,359
stop the DU motor

720
00:36:23,810 --> 00:36:21,900
copy that that is on the window

721
00:36:27,170 --> 00:36:23,820
and OC that looks good you're going to

722
00:36:34,250 --> 00:36:27,180
execute okay excuse

723
00:36:38,210 --> 00:36:36,410
you can just hear the excitement and the

724
00:36:40,370 --> 00:36:38,220
voices of the people on the floor as

725
00:36:42,770 --> 00:36:40,380
they're announcing the success of this

726
00:36:45,410 --> 00:36:42,780
this first small move because

727
00:36:48,190 --> 00:36:45,420
this is you know once this small move is

728
00:36:50,870 --> 00:36:48,200
seen to be successful

729
00:36:53,270 --> 00:36:50,880
and I can confirm the DU motor has

730
00:36:56,270 --> 00:36:53,280
stopped but this time we are going to

731
00:36:59,390 --> 00:36:56,280
proceed onto step 038 to configure the

732
00:37:04,670 --> 00:36:59,400
deu to standby mode

733
00:37:08,569 --> 00:37:07,010
and OC the command line looks good

734
00:37:11,270 --> 00:37:08,579
you're good to execute

735
00:37:11,280 --> 00:37:27,609
and OC you are go to continue

736
00:37:32,270 --> 00:37:30,109
so now they'll go ahead and get ready to

737
00:37:35,150 --> 00:37:32,280
do the full deployment but the small

738
00:37:39,130 --> 00:37:35,160

move gave them so much confidence in in

739
00:37:43,490 --> 00:37:39,140
the uh the motor doing its job on the

740
00:37:46,370 --> 00:37:43,500
mechanisms working and and moving just

741
00:37:49,069 --> 00:37:46,380
as expected so they're coming into this

742
00:37:52,069 --> 00:37:49,079
next major deployment with a lot of

743
00:37:55,490 --> 00:37:53,690
as we were saying there are no live

744
00:37:57,730 --> 00:37:55,500
cameras on the web telescope for many

745
00:37:59,450 --> 00:37:57,740
good reasons

746
00:38:01,310 --> 00:37:59,460
standby mode

747
00:38:04,609 --> 00:38:01,320
so at this time we are going to proceed

748
00:38:11,210 --> 00:38:04,619
onto step 039 for the integral gain set

749
00:38:15,410 --> 00:38:14,329
and OC that looks good you're good to

750
00:38:22,849 --> 00:38:15,420
execute

751
00:38:22,859 --> 00:38:28,730
so people to continue

752
00:38:31,910 --> 00:38:30,170
but you're looking on the left hand side

753
00:38:34,069 --> 00:38:31,920
of your screen is the observatory

754
00:38:35,990 --> 00:38:34,079
visualization tool and actually we have

755
00:38:39,109 --> 00:38:36,000
a question from social media there is a

756
00:38:41,270 --> 00:38:39,119
devil on Twitch that says will this

757
00:38:43,190 --> 00:38:41,280
Observatory officials visualization tool

758
00:38:45,470 --> 00:38:43,200
be made available to the public

759
00:38:47,569 --> 00:38:45,480
and uh Julie I believe this is something

760
00:38:50,329 --> 00:38:47,579
people can can follow along with on some

761
00:38:53,270 --> 00:38:50,339
of the websites is that correct

762
00:38:55,390 --> 00:38:53,280
I think people are putting out uh

763
00:38:59,030 --> 00:38:55,400

information on the website and I think

764
00:39:01,430 --> 00:38:59,040
uh you can you can get different updates

765
00:39:03,710 --> 00:39:01,440
but I don't think the tool itself is

766
00:39:04,609 --> 00:39:03,720
available right if that's what they're

767
00:39:09,050 --> 00:39:04,619
asking

768
00:39:13,370 --> 00:39:11,329
you can go to the website where is web

769
00:39:15,170 --> 00:39:13,380
and there's lots of information as to

770
00:39:16,849 --> 00:39:15,180
where exactly web is on its path out to

771
00:39:18,950 --> 00:39:16,859
L2 the LaGrange point a million miles

772
00:39:20,870 --> 00:39:18,960
away from Earth as well as the

773
00:39:22,790 --> 00:39:20,880
temperature you can actually see in real

774
00:39:24,710 --> 00:39:22,800
time uh the different temperatures on

775
00:39:28,790 --> 00:39:24,720
the sun side of the telescope and the

776
00:39:28,800 --> 00:39:33,530
we were talking about sensitivity

777
00:39:37,430 --> 00:39:35,349
please go ahead Julie

778
00:39:39,470 --> 00:39:37,440
and we were talking about we were

779
00:39:41,810 --> 00:39:39,480
talking about the the uh different

780
00:39:44,390 --> 00:39:41,820
temperatures on the cold side of the sun

781
00:39:46,190 --> 00:39:44,400
shield here uh and you know even in our

782
00:39:48,710 --> 00:39:46,200
visualization tool here you can kind of

783
00:39:50,450 --> 00:39:48,720
get an idea anything that's down close

784
00:39:52,250 --> 00:39:50,460
to that sun shield is going to run a

785
00:39:54,230 --> 00:39:52,260
little bit warmer because there is there

786
00:39:56,270 --> 00:39:54,240
is some heat that comes through there is

787
00:39:59,569 --> 00:39:56,280
some heat that gets reflected up into it

788
00:40:02,329 --> 00:39:59,579

there's a uh essentially a hole through

789
00:40:04,550 --> 00:40:02,339
the center of the the sun shield that

790
00:40:06,410 --> 00:40:04,560
has all of the structure and cable

791
00:40:08,690 --> 00:40:06,420
running down to the hot side of the

792
00:40:11,089 --> 00:40:08,700
spacecraft devops copies and I can

793
00:40:13,370 --> 00:40:11,099
confirm the load was executed

794
00:40:15,530 --> 00:40:13,380
successfully at this time we are going

795
00:40:17,589 --> 00:40:15,540
to proceed onto step zero four zero to

796
00:40:20,809 --> 00:40:17,599
configure the deu to operate frame 14

797
00:40:22,609 --> 00:40:20,819
and OC that command line looks good we

798
00:40:25,250 --> 00:40:22,619
are go to execute

799
00:40:34,730 --> 00:40:25,260
they're getting ready

800
00:40:40,069 --> 00:40:37,250
um the we were talking about the

801
00:40:41,450 --> 00:40:40,079
temperatures of the items closer to the

802
00:40:43,370 --> 00:40:41,460
sun shield being warmer than the stuff

803
00:40:45,170 --> 00:40:43,380
away from the sun shield and as you can

804
00:40:47,809 --> 00:40:45,180
see the the secondary mirror itself

805
00:40:49,849 --> 00:40:47,819
being perched on top of the of the

806
00:40:52,490 --> 00:40:49,859
telescope at the moment is is one of our

807
00:40:53,690 --> 00:40:52,500
colder items even when it gets deployed

808
00:40:56,089 --> 00:40:53,700
out

809
00:40:57,950 --> 00:40:56,099
yeah oh there's a great picture you can

810
00:41:00,050 --> 00:40:57,960
see that the secondary mirror here is at

811
00:41:03,349 --> 00:41:00,060
the top of your screen on the dark side

812
00:41:05,210 --> 00:41:03,359
on the cold side and it does run

813
00:41:07,970 --> 00:41:05,220

it does not have its own radiator but it

814
00:41:13,849 --> 00:41:10,190
um the it's one of the colder items on

815
00:41:16,670 --> 00:41:13,859
on that side uh and this sun shield

816
00:41:18,109 --> 00:41:16,680
itself is basically what keeps it cold

817
00:41:22,670 --> 00:41:18,119
and the fact that it really doesn't

818
00:41:22,680 --> 00:41:31,370
here we go

819
00:41:37,190 --> 00:41:33,829
that bleed has confirmed we are ready to

820
00:41:38,809 --> 00:41:37,200
proceed with the smss deploy it's about

821
00:41:43,309 --> 00:41:38,819
this time we are going to proceed on

822
00:41:45,170 --> 00:41:43,319
step 042 for the smss motor move

823
00:41:46,910 --> 00:41:45,180
ment you're looking at live coverage the

824
00:41:48,109 --> 00:41:46,920
deployment of the secondary mirror an

825
00:41:49,970 --> 00:41:48,119
essential component for the James

826
00:41:56,329 --> 00:41:49,980
website that command line looks good

827
00:42:02,329 --> 00:41:59,690
and OC or go to continue rather go to

828
00:42:10,730 --> 00:42:05,750
and OC standby for verification

829
00:42:15,650 --> 00:42:13,130
Julie can you tell us what smss means

830
00:42:19,010 --> 00:42:15,660
the acronym that we're hearing

831
00:42:24,650 --> 00:42:19,020
sure that's uh those parameters look

832
00:42:29,150 --> 00:42:26,270
that's the secondary mirror support

833
00:42:32,510 --> 00:42:29,160
structure and it's a four bar linkage uh

834
00:42:35,510 --> 00:42:32,520
you'll see it kind of uh unfold here

835
00:42:39,170 --> 00:42:35,520
kind of almost looks a little uh like

836
00:42:42,349 --> 00:42:39,180
from a high tech movie but uh it will

837
00:42:46,309 --> 00:42:42,359
move in a linkage assembly out until the

838
00:42:49,010 --> 00:42:46,319

joint in the middle of the top leg

839
00:42:51,109 --> 00:42:49,020
that's into position

840
00:42:53,450 --> 00:42:51,119
so there's

841
00:42:55,970 --> 00:42:53,460
there's hinges at the bottom

842
00:42:58,130 --> 00:42:55,980
and there's a hinge at the mirror on the

843
00:43:00,410 --> 00:42:58,140
short leg and then there's a hinge in

844
00:43:02,210 --> 00:43:00,420
the center of the shorter leg and then a

845
00:43:04,190 --> 00:43:02,220
hinge at the top very top of the mirror

846
00:43:07,130 --> 00:43:04,200
and the two short legs fold into one

847
00:43:11,089 --> 00:43:08,870
one Coming Attraction for this broadcast

848
00:43:12,589 --> 00:43:11,099
is that once they extend the secondary

849
00:43:14,809 --> 00:43:12,599
mirror there'll be about a 45 minute

850
00:43:16,390 --> 00:43:14,819
period where they latch the mirror where

851
00:43:19,730 --> 00:43:16,400
they make sure that it's very strongly

852
00:43:21,109 --> 00:43:19,740
and solidly put together and during that

853
00:43:23,809 --> 00:43:21,119
45 minutes we'll be able to show you

854
00:43:25,309 --> 00:43:23,819
some uh some some footage of the actual

855
00:43:29,150 --> 00:43:25,319
testing and building of the secondary

856
00:43:30,770 --> 00:43:29,160
mirror it's surprisingly large that

857
00:43:32,809 --> 00:43:30,780
those Booms that are extending from it

858
00:43:35,030 --> 00:43:32,819
uh Julie you may know this offhanded if

859
00:43:36,470 --> 00:43:35,040
you don't when the booms are extended

860
00:43:38,809 --> 00:43:36,480
about how far away is the secondary

861
00:43:42,609 --> 00:43:38,819
mirror from the primary mirror

862
00:43:45,230 --> 00:43:42,619
oh I should have looked that up uh yeah

863
00:43:46,550 --> 00:43:45,240

the uh what one of the Privileges I had

864
00:43:48,530 --> 00:43:46,560
uh working at Goddard space flight

865
00:43:50,690 --> 00:43:48,540
center was was watching uh tests like

866
00:43:52,490 --> 00:43:50,700
this and I I did see the secondary

867
00:43:54,290 --> 00:43:52,500
mirror deployed and it was it was it was

868
00:43:56,750 --> 00:43:54,300
it was to me it seemed like it was

869
00:43:59,569 --> 00:43:56,760
perhaps nearly two stories away from the

870
00:44:01,910 --> 00:43:59,579
uh uh the primary mirror and uh it's uh

871
00:44:04,190 --> 00:44:01,920
it's a it's a spectacular thing to see

872
00:44:06,650 --> 00:44:04,200
and and like I said after after we have

873
00:44:08,930 --> 00:44:06,660
uh confirmation that this is that this

874
00:44:10,190 --> 00:44:08,940
event has concluded uh we will then be

875
00:44:13,569 --> 00:44:10,200
latching we'll have some about 45

876
00:44:16,069 --> 00:44:13,579
minutes to talk more about this

877
00:44:18,109 --> 00:44:16,079
uh this motor move takes about 11

878
00:44:21,130 --> 00:44:18,119
minutes and we'll give uh periodic

879
00:44:26,210 --> 00:44:23,630
here you can see the Telemetry coming in

880
00:44:28,069 --> 00:44:26,220
at the top of the screen that the the

881
00:44:30,050 --> 00:44:28,079
visualization tool is using to

882
00:44:32,750 --> 00:44:30,060
recalculate the position of these this

883
00:44:35,750 --> 00:44:32,760
mechanism and it's a little hard to see

884
00:44:37,490 --> 00:44:35,760
with the black background on with the

885
00:44:38,990 --> 00:44:37,500
black tubes but you can if you look

886
00:44:42,290 --> 00:44:39,000
carefully at the top you can start to

887
00:44:44,210 --> 00:44:42,300
see the mechanism start to unfold

888
00:44:46,370 --> 00:44:44,220

this is this is tremendously exciting to

889
00:44:48,170 --> 00:44:46,380
me so you know as this Observatory is on

890
00:44:50,150 --> 00:44:48,180
its way to its uh it's it's a resting

891
00:44:52,910 --> 00:44:50,160
point A Million Miles Away this this

892
00:44:55,430 --> 00:44:52,920
huge secondary mirror configuration is

893
00:44:57,470 --> 00:44:55,440
is now deploying and I can I can see

894
00:44:59,809 --> 00:44:57,480
that the the bars are changing on our

895
00:45:02,089 --> 00:44:59,819
Observatory visualization tool which is

896
00:45:04,490 --> 00:45:02,099
based on real live data from The

897
00:45:11,569 --> 00:45:04,500
Observatory and the uh the secondary

898
00:45:15,589 --> 00:45:13,490
this procedure will take about 11

899
00:45:18,109 --> 00:45:15,599
minutes about 10 minutes from now we

900
00:45:37,250 --> 00:45:18,119
should uh see the the secondary mirror

901
00:45:41,089 --> 00:45:39,050
the last few days I've seen some of the

902
00:45:43,609 --> 00:45:41,099
most dramatic deployments uh from the

903
00:45:46,970 --> 00:45:43,619
the web Observatory yesterday of course

904
00:45:48,770 --> 00:45:46,980
the uh spectacular finale of deploying

905
00:45:51,650 --> 00:45:48,780
the giant heat shield

906
00:45:53,750 --> 00:45:51,660
and today the secondary mirror and as

907
00:45:55,970 --> 00:45:53,760
you can see the secondary mirror is now

908
00:45:57,530 --> 00:45:55,980
moving away from the primary mirror I

909
00:45:59,450 --> 00:45:57,540
understand it's a little bit dark in the

910
00:46:01,130 --> 00:45:59,460
animation sort of black bars on the

911
00:46:02,630 --> 00:46:01,140
black background but we can see the

912
00:46:14,930 --> 00:46:02,640
movement we can see that this is

913
00:46:19,609 --> 00:46:16,849

so the

914
00:46:23,150 --> 00:46:19,619
um mechanism that's actually lifting and

915
00:46:24,770 --> 00:46:23,160
and uh rotating this position is at the

916
00:46:28,010 --> 00:46:24,780
top of the mirror there

917
00:46:30,589 --> 00:46:28,020
uh is is where the motor is located that

918
00:46:32,630 --> 00:46:30,599
actually does the deployment

919
00:46:35,510 --> 00:46:32,640
um in

920
00:46:37,849 --> 00:46:35,520
we have a photograph on the screen

921
00:46:40,790 --> 00:46:37,859
of our mission operation manager Carl

922
00:46:46,790 --> 00:46:44,690
he's up in the in the top camera shop

923
00:46:49,550 --> 00:46:46,800
so as you can see it's a bright sunny

924
00:46:51,950 --> 00:46:49,560
day in Baltimore which makes it a little

925
00:46:54,710 --> 00:46:51,960
hard to see people in the room in the

926
00:46:57,109 --> 00:46:54,720
flight control room in the top uh box

927
00:46:59,270 --> 00:46:57,119
there but um

928
00:47:03,950 --> 00:46:59,280
oh it's great to have it's great to have

929
00:47:07,730 --> 00:47:05,990
Carl Starr is the you'll hear the

930
00:47:11,990 --> 00:47:07,740
acronym the mom the mission operations

931
00:47:15,770 --> 00:47:14,030
and you are looking at live coverage at

932
00:47:17,690 --> 00:47:15,780
the deployment of the secondary lead on

933
00:47:19,250 --> 00:47:17,700
Ops with the status we're about halfway

934
00:47:22,370 --> 00:47:19,260
through the deployment currents are

935
00:47:23,870 --> 00:47:22,380
looking really good lower than we saw in

936
00:47:26,450 --> 00:47:23,880
the ground testing

937
00:47:28,370 --> 00:47:26,460
and everything's looking nominal so

938
00:47:30,650 --> 00:47:28,380

we've got about five more minutes to

939
00:47:33,290 --> 00:47:30,660
five or six more minutes to get to the

940
00:47:33,300 --> 00:47:42,109
oh right of that thank you for that day

941
00:47:49,430 --> 00:47:44,210
is it nice to be when our Observatory

942
00:47:53,809 --> 00:47:51,950
you see this giant boom taking the

943
00:48:01,609 --> 00:47:53,819
secondary mirror the focusing mechanism

944
00:48:05,870 --> 00:48:03,589
the primary mirror are those gold

945
00:48:07,910 --> 00:48:05,880
segments that you see there are 18 gold

946
00:48:10,609 --> 00:48:07,920
segments

947
00:48:12,589 --> 00:48:10,619
and after we have uh confirmation that

948
00:48:14,150 --> 00:48:12,599
the mirror has been deployed we'll have

949
00:48:15,589 --> 00:48:14,160
some time to look at how those will be

950
00:48:17,390 --> 00:48:15,599
focused that will be another major

951
00:48:29,089 --> 00:48:17,400
commissioning activity for the James

952
00:48:33,349 --> 00:48:31,069
this is the largest and most sensitive

953
00:48:35,690 --> 00:48:33,359
space Observatory ever flown it had to

954
00:48:38,390 --> 00:48:35,700
be actually folded up to fit inside a

955
00:48:40,150 --> 00:48:38,400
rocket this is something that is uh

956
00:48:42,650 --> 00:48:40,160
historic we have not done this before

957
00:48:43,609 --> 00:48:42,660
where things need to be unfolded to this

958
00:48:45,829 --> 00:48:43,619
extent

959
00:48:49,010 --> 00:48:45,839
so this is uh this is very dramatic

960
00:48:50,809 --> 00:48:49,020
there are people all over the world

961
00:48:52,910 --> 00:48:50,819
so happy that things so far are going

962
00:48:55,190 --> 00:48:52,920
well and uh and wishing for a successful

963
00:48:56,930 --> 00:48:55,200

deployment

964
00:48:58,790 --> 00:48:56,940
I know that I have friends of mine

965
00:49:03,170 --> 00:48:58,800
who've worked on the the web telescopes

966
00:49:07,609 --> 00:49:05,690
so this is many many decades of people's

967
00:49:09,170 --> 00:49:07,619
work and life all happening right in

968
00:49:27,049 --> 00:49:09,180
front of you live as we watch that

969
00:49:31,190 --> 00:49:29,569
and some of the things that are unique

970
00:49:35,270 --> 00:49:31,200
about this

971
00:49:38,089 --> 00:49:35,280
is the operation of these

972
00:49:39,650 --> 00:49:38,099
joints in space and at such a cold

973
00:49:42,650 --> 00:49:39,660
temperature

974
00:49:45,890 --> 00:49:42,660
I do have a few heaters that we warm up

975
00:49:48,650 --> 00:49:45,900
the motors and some of the the mechanism

976
00:49:51,230 --> 00:49:48,660
components but for the most part the

977
00:49:53,390 --> 00:49:51,240
joints have uh to work in the cold

978
00:49:56,809 --> 00:49:53,400
environment of the space which takes

979
00:49:58,430 --> 00:49:56,819
special design and special Coatings and

980
00:49:59,990 --> 00:49:58,440
as you can see they also are quite close

981
00:50:13,150 --> 00:50:00,000
to our mirrors we have to be careful

982
00:50:17,630 --> 00:50:15,109
thank you

983
00:50:19,250 --> 00:50:17,640
to do this deployment in zero gravity

984
00:50:23,150 --> 00:50:19,260
every other time that we've done the

985
00:50:26,329 --> 00:50:23,160
deployment in uh in a clean room we've

986
00:50:27,890 --> 00:50:26,339
had to to have gravity considerations

987
00:50:31,430 --> 00:50:27,900
so this is the first time doing it in

988
00:50:35,270 --> 00:50:32,750

we were talking about that yesterday

989
00:50:36,710 --> 00:50:35,280
with the non-explosive actuators all of

990
00:50:38,930 --> 00:50:36,720
these little pins that need to release

991
00:50:41,930 --> 00:50:38,940
to unfold different parts of the uh the

992
00:50:44,390 --> 00:50:41,940
telescope and again those were you know

993
00:50:46,190 --> 00:50:44,400
those those were all tested uh on the

994
00:50:47,750 --> 00:50:46,200
Earth where you weren't not you were not

995
00:50:48,770 --> 00:50:47,760
not in zero gravity they needed to work

996
00:50:50,750 --> 00:50:48,780
in space

997
00:50:52,130 --> 00:50:50,760
I don't know about you but every time I

998
00:50:54,530 --> 00:50:52,140
see that mirror move a little bit

999
00:50:56,270 --> 00:50:54,540
farther in our visualization tool I'm

1000
00:50:57,770 --> 00:50:56,280
getting more and more excited my heart

1001
00:51:00,109 --> 00:50:57,780
is starting to be faster and faster

1002
00:51:01,849 --> 00:51:00,119
there's for me there's a tremendous

1003
00:51:03,589 --> 00:51:01,859
amount of Joy I mean I have this the

1004
00:51:04,430 --> 00:51:03,599
smile like have my face from ear to ear

1005
00:51:06,589 --> 00:51:04,440
right now

1006
00:51:08,930 --> 00:51:06,599
as I uh as I see this this absolutely

1007
00:51:11,030 --> 00:51:08,940
essential component of the James Webb

1008
00:51:13,309 --> 00:51:11,040
Observatory via the secondary mirror the

1009
00:51:15,589 --> 00:51:13,319
focusing mechanism deployed

1010
00:51:17,329 --> 00:51:15,599
yes without this without this mirror in

1011
00:51:24,410 --> 00:51:17,339
its right position we do not get light

1012
00:51:28,250 --> 00:51:26,329
and all of those actuators all of those

1013
00:51:30,470 --> 00:51:28,260

pins that needed to uh release in order

1014
00:51:31,849 --> 00:51:30,480
to unfold this um Julie can you can you

1015
00:51:34,010 --> 00:51:31,859
give me an idea I believe there's

1016
00:51:35,870 --> 00:51:34,020
there's over is are there over 300 of

1017
00:51:38,510 --> 00:51:35,880
those

1018
00:51:40,549 --> 00:51:38,520
yeah there's different kinds and

1019
00:51:42,230 --> 00:51:40,559
different types around so it's kind of

1020
00:51:43,309 --> 00:51:42,240
every time you'll read something that

1021
00:51:45,349 --> 00:51:43,319
will tell you a slightly different

1022
00:51:47,210 --> 00:51:45,359
number but it all depends on what

1023
00:51:50,510 --> 00:51:47,220
category they count them in

1024
00:51:51,950 --> 00:51:50,520
um and for this this what we watched

1025
00:51:55,250 --> 00:51:51,960
today there was three different ones

1026
00:51:57,530 --> 00:51:55,260
that we released so there's so much of

1027
00:52:00,109 --> 00:51:57,540
that now behind us there was a lot of

1028
00:52:02,089 --> 00:52:00,119
work over the years to make sure that

1029
00:52:04,309 --> 00:52:02,099
these devices worked and then all the

1030
00:52:06,530 --> 00:52:04,319
different configurations that we needed

1031
00:52:07,670 --> 00:52:06,540
them in and the different sizes to make

1032
00:52:09,589 --> 00:52:07,680
sure that they all work and they all

1033
00:52:12,230 --> 00:52:09,599
work reliably they're very much like a

1034
00:52:14,750 --> 00:52:12,240
parachute they're they're very sensitive

1035
00:52:16,309 --> 00:52:14,760
to how they're wrapped and how they're

1036
00:52:18,170 --> 00:52:16,319
handled

1037
00:52:19,910 --> 00:52:18,180
um you know you get one chance to do it

1038
00:52:21,770 --> 00:52:19,920

right and if you test it and it works

1039
00:52:23,510 --> 00:52:21,780
that doesn't mean that you've done the

1040
00:52:25,609 --> 00:52:23,520
next one right so you have to package

1041
00:52:27,829 --> 00:52:25,619
each one just perfectly and we're coming

1042
00:52:31,010 --> 00:52:27,839
very close to being fully deployed as

1043
00:52:33,290 --> 00:52:31,020
you can see the the top of the um

1044
00:52:35,089 --> 00:52:33,300
of the mechanism the two bars there

1045
00:52:37,670 --> 00:52:35,099
coming closer and closer

1046
00:52:39,589 --> 00:52:37,680
to their final position of being in line

1047
00:52:41,390 --> 00:52:39,599
with each other

1048
00:52:44,390 --> 00:52:41,400
and you can from this orientation you

1049
00:52:46,309 --> 00:52:44,400
can now see uh that the at the mirror

1050
00:52:48,349 --> 00:52:46,319
side of the secondary

1051
00:52:54,530 --> 00:52:48,359
has the gold coating on it too in the

1052
00:53:00,049 --> 00:52:57,230
well the web Observatory is a very large

1053
00:53:02,210 --> 00:53:00,059
mirror it's a tiny amount of gold I I

1054
00:53:03,650 --> 00:53:02,220
believe it's just a couple gold rings

1055
00:53:06,650 --> 00:53:03,660
worth of gold across the whole thing

1056
00:53:08,990 --> 00:53:06,660
just a couple hundred atoms thick on on

1057
00:53:11,089 --> 00:53:09,000
the surfaces gold was chosen because it

1058
00:53:13,250 --> 00:53:11,099
is it is wonderfully reflective in the

1059
00:53:15,829 --> 00:53:13,260
infrared this is a heat sensitive

1060
00:53:18,589 --> 00:53:15,839
telescope infrared light and also gold

1061
00:53:20,630 --> 00:53:18,599
is very stable and and doesn't uh unlike

1062
00:53:22,370 --> 00:53:20,640
something like silver doesn't react

1063
00:53:24,650 --> 00:53:22,380

chemically very much so it's a very good

1064
00:53:26,829 --> 00:53:24,660
thing to use when nobody can go out

1065
00:53:30,230 --> 00:53:26,839
there to uh to clean your mirrors it's

1066
00:53:32,630 --> 00:53:30,240
all on its own

1067
00:53:35,270 --> 00:53:32,640
so as the

1068
00:53:37,370 --> 00:53:35,280
as the mechanism continues to unfold

1069
00:53:39,770 --> 00:53:37,380
here the motor will drive it into a hard

1070
00:53:43,549 --> 00:53:39,780
stop and from that then they will start

1071
00:53:45,410 --> 00:53:43,559
working on the latching procedure

1072
00:53:47,270 --> 00:53:45,420
so we will first wait for confirmation

1073
00:53:49,069 --> 00:53:47,280
that the mirror is fully deployed and

1074
00:53:50,809 --> 00:53:49,079
then after that as they go through the

1075
00:53:52,910 --> 00:53:50,819
latching procedure we'll have some time

1076
00:53:54,530 --> 00:53:52,920
to uh to talk to our host a bit about

1077
00:53:58,130 --> 00:53:54,540
the the testing in the building with the

1078
00:54:01,250 --> 00:53:59,809
we already have a lot of questions

1079
00:54:03,109 --> 00:54:01,260
coming in through social media we should

1080
00:54:03,950 --> 00:54:03,119
have time to get to some of them but if

1081
00:54:07,250 --> 00:54:03,960
you'd like to have your question

1082
00:54:09,710 --> 00:54:07,260
answered just go to hashtag and we have

1083
00:54:11,990 --> 00:54:09,720
uh deployed into the heart stops so

1084
00:54:17,450 --> 00:54:12,000
we'll move into capturing the latches

1085
00:54:22,970 --> 00:54:19,450
all right as you heard that one

1086
00:54:25,490 --> 00:54:22,980
completely into the hard stop

1087
00:54:27,589 --> 00:54:25,500
and they'll take a little bit of time to

1088
00:54:28,970 --> 00:54:27,599

take them to uh take a look at their

1089
00:54:31,549 --> 00:54:28,980
telemetry

1090
00:54:35,569 --> 00:54:31,559
put the motor into a standby mode and

1091
00:54:38,410 --> 00:54:35,579
then move into the latching sequences

1092
00:54:41,150 --> 00:54:38,420
so Julia at this point the mirror

1093
00:54:42,410 --> 00:54:41,160
at this point I'm sorry I misspoke they

1094
00:54:43,730 --> 00:54:42,420
will actually keep the tension on the

1095
00:54:50,390 --> 00:54:43,740
motor at this point while they do the

1096
00:54:54,770 --> 00:54:52,670
so as they are starting latching uh I

1097
00:54:56,630 --> 00:54:54,780
think so at this point the the mirror

1098
00:54:57,950 --> 00:54:56,640
mechanism has been fully deployed is is

1099
00:55:02,170 --> 00:54:57,960
that correctly

1100
00:55:06,470 --> 00:55:04,549
while they do the latching I have

1101
00:55:09,230 --> 00:55:06,480
confirmed the deathly that we are ready

1102
00:55:10,849 --> 00:55:09,240
to proceed with the Adu left moves at

1103
00:55:12,650 --> 00:55:10,859
this time we are going to proceed onto

1104
00:55:16,069 --> 00:55:12,660
step zero four four

1105
00:55:19,130 --> 00:55:16,079
to enable scs-256.

1106
00:55:21,770 --> 00:55:19,140
copy that that is on the window

1107
00:55:22,789 --> 00:55:21,780
and OC that looks good you are go to

1108
00:55:26,270 --> 00:55:22,799
execute

1109
00:55:30,970 --> 00:55:28,970
and you heard the term edu that's uh the

1110
00:55:36,010 --> 00:55:30,980
motor that drives the actuator

1111
00:55:45,349 --> 00:55:36,020
do a table activate fgf 257.

1112
00:55:48,289 --> 00:55:47,030
. so thank you again for joining us uh

1113
00:55:49,609 --> 00:55:48,299

you're looking at the uh the live

1114
00:55:51,770 --> 00:55:49,619
coverage of the commissioning of the

1115
00:55:53,990 --> 00:55:51,780
James Webb Space Telescope uh today the

1116
00:55:56,870 --> 00:55:54,000
main task is deploying and now latching

1117
00:55:58,910 --> 00:55:56,880
the secondary mirror assembly and uh

1118
00:56:00,470 --> 00:55:58,920
that is a absolutely essential for the

1119
00:56:03,170 --> 00:56:00,480
telescope to operate and to be able to

1120
00:56:05,450 --> 00:56:03,180
focus light onto its gigantic primary

1121
00:56:07,549 --> 00:56:05,460
mirror and over on the left side of the

1122
00:56:09,589 --> 00:56:07,559
screen you're seeing a visualization

1123
00:56:12,109 --> 00:56:09,599
produced by real-time data from the

1124
00:56:14,450 --> 00:56:12,119
telescope and then above us you see uh

1125
00:56:15,890 --> 00:56:14,460
live footage from the mission control of

1126
00:56:18,530 --> 00:56:15,900
the the mock the mission operations

1127
00:56:22,609 --> 00:56:18,540
center in the Johns Hopkins University

1128
00:56:26,450 --> 00:56:22,619
yeah complete and 256 is enabled and

1129
00:56:39,829 --> 00:56:26,460
activated in slot 2.

1130
00:56:44,750 --> 00:56:42,530
CEO latching that's going to come out

1131
00:56:47,750 --> 00:56:44,760
and OC I have confirmed with dep lead

1132
00:56:50,089 --> 00:56:47,760
that we are ready to perform the first

1133
00:56:53,089 --> 00:56:50,099
latch off Stow move so at this time

1134
00:56:58,130 --> 00:56:53,099
we're going to proceed onto step 046

1135
00:57:03,289 --> 00:57:00,109
copy that

1136
00:57:04,370 --> 00:57:03,299
and OC that looks good you are go to

1137
00:57:06,650 --> 00:57:04,380
execute

1138
00:57:09,349 --> 00:57:06,660

Roger excuse

1139
00:57:20,450 --> 00:57:09,359
[Music]

1140
00:57:24,770 --> 00:57:22,789
the latches on this that they're

1141
00:57:27,530 --> 00:57:24,780
discussing now

1142
00:57:30,109 --> 00:57:27,540
um is a is a hook latch kind of like uh

1143
00:57:33,770 --> 00:57:30,119
you would have on the possibly a

1144
00:57:37,370 --> 00:57:33,780
bathroom door uh that is

1145
00:57:39,890 --> 00:57:37,380
but obviously very highly specialized

1146
00:57:41,569 --> 00:57:39,900
for this operation and it will the

1147
00:57:45,349 --> 00:57:41,579
deployment motor

1148
00:57:49,490 --> 00:57:45,359
the Actuator motor will come in and put

1149
00:57:52,130 --> 00:57:49,500
that latch on top of a hard stop and

1150
00:57:54,670 --> 00:57:52,140
then the motor will pull down to to put

1151
00:57:57,109 --> 00:57:54,680
a preload into there

1152
00:58:00,049 --> 00:57:57,119
and then the deployment motor will

1153
00:58:03,410 --> 00:58:00,059
release its its push off against the

1154
00:58:07,730 --> 00:58:05,510
so as we look at the live coverage of

1155
00:58:09,589 --> 00:58:07,740
this event we are going to occasionally

1156
00:58:10,910 --> 00:58:09,599
stop conversation to listen to comments

1157
00:58:13,849 --> 00:58:10,920
from the mock the mission Operation

1158
00:58:16,010 --> 00:58:13,859
Center but as we are now awaiting the

1159
00:58:18,170 --> 00:58:16,020
latch procedure which will take about 45

1160
00:58:19,849 --> 00:58:18,180
minutes we're told we have a time to

1161
00:58:21,230 --> 00:58:19,859
look at some of the the actual

1162
00:58:24,349 --> 00:58:21,240
instrumentation as it was built and

1163
00:58:25,670 --> 00:58:24,359

tested at Goddard space flight center so

1164
00:58:28,190 --> 00:58:25,680
um I believe we're going to be looking

1165
00:58:30,170 --> 00:58:28,200
at some footage of the delivery of the

1166
00:58:31,789 --> 00:58:30,180
secondary mirror support structure and

1167
00:58:32,930 --> 00:58:31,799
here we have the secondary mirror Julie

1168
00:58:35,270 --> 00:58:32,940
can you tell us what we're looking at in

1169
00:58:38,630 --> 00:58:35,280
this side in this footage we have

1170
00:58:41,569 --> 00:58:38,640
sure so as you can kind of see here that

1171
00:58:45,289 --> 00:58:41,579
uh silver stainless piece is a is a

1172
00:58:48,049 --> 00:58:45,299
cover and then the mirror itself is on a

1173
00:58:51,109 --> 00:58:48,059
dolly with wheels and we have engineers

1174
00:58:53,630 --> 00:58:51,119
and technicians in what we call lovingly

1175
00:58:55,130 --> 00:58:53,640
as bunny suits in a clean room and this

1176
00:58:57,470 --> 00:58:55,140
is I believe at Goddard space flight

1177
00:58:59,930 --> 00:58:57,480
center uh doing the initial inspection

1178
00:59:02,390 --> 00:58:59,940
as they open up the shipping container

1179
00:59:06,410 --> 00:59:02,400
of the mirror and now here it looks like

1180
00:59:08,569 --> 00:59:06,420
we have the mirror up on to the crane

1181
00:59:09,589 --> 00:59:08,579
and the mechanism to move it up into

1182
00:59:11,210 --> 00:59:09,599
position

1183
00:59:13,190 --> 00:59:11,220
where we're going to then do the

1184
00:59:15,530 --> 00:59:13,200
installation and here's the people at

1185
00:59:18,530 --> 00:59:15,540
Goddard watching from The Observatory

1186
00:59:20,450 --> 00:59:18,540
area as the whole uh assembly takes

1187
00:59:22,309 --> 00:59:20,460
place

1188
00:59:24,410 --> 00:59:22,319

and this is the structure that we were

1189
00:59:26,030 --> 00:59:24,420
just seeing deployed you can see it kind

1190
00:59:28,010 --> 00:59:26,040
of across the middle of your screen the

1191
00:59:30,410 --> 00:59:28,020
big booms and this kind of gives you a

1192
00:59:32,690 --> 00:59:30,420
perspective of how large in diameter

1193
00:59:34,309 --> 00:59:32,700
those booms are you know they're they're

1194
00:59:37,430 --> 00:59:34,319
uh

1195
00:59:39,950 --> 00:59:37,440
quite substantial they look so small in

1196
00:59:43,430 --> 00:59:39,960
relative to the telescope but here you

1197
00:59:45,589 --> 00:59:43,440
can see as we as we deploy it here we do

1198
00:59:46,730 --> 00:59:45,599
it in a horizontal orientation and

1199
00:59:48,890 --> 00:59:46,740
they're white there because they have

1200
00:59:50,569 --> 00:59:48,900
some plastic uh protective coatings on

1201
00:59:53,270 --> 00:59:50,579
it

1202
00:59:54,650 --> 00:59:53,280
uh kind of like you would uh get

1203
00:59:56,690 --> 00:59:54,660
something shipped in the mail it's a

1204
00:59:58,069 --> 00:59:56,700
frapped in plastic bubble wrap oh

1205
01:00:00,109 --> 00:59:58,079
somebody's got their hand on the camera

1206
01:00:02,450 --> 01:00:00,119
there we go

1207
01:00:07,730 --> 01:00:05,930
and so uh you saw two pictures of of or

1208
01:00:11,329 --> 01:00:07,740
actually three different videos of it

1209
01:00:14,150 --> 01:00:11,339
being deployed one was as it was being

1210
01:00:15,589 --> 01:00:14,160
assembled at Goddard in in the clean

1211
01:00:17,750 --> 01:00:15,599
room and that one was done in a vertical

1212
01:00:20,270 --> 01:00:17,760
orientation and then the other two tests

1213
01:00:21,410 --> 01:00:20,280

were done in a horizontal orientation uh

1214
01:00:23,569 --> 01:00:21,420
the one that was done in vertical

1215
01:00:25,730 --> 01:00:23,579
orientation

1216
01:00:28,849 --> 01:00:25,740
you can see from the from the top of the

1217
01:00:30,410 --> 01:00:28,859
picture and it's a a little goes by

1218
01:00:32,630 --> 01:00:30,420
quickly but you can see we did some

1219
01:00:35,630 --> 01:00:32,640
gravity offloading and then in the

1220
01:00:37,730 --> 01:00:35,640
horizontal uh orientation the gravity

1221
01:00:39,289 --> 01:00:37,740
offloading was a little different but

1222
01:00:43,910 --> 01:00:39,299
testing it in the different orientations

1223
01:00:47,630 --> 01:00:45,829
yeah

1224
01:00:49,370 --> 01:00:47,640
uh this motor move has completed

1225
01:00:51,770 --> 01:00:49,380
successfully and depth lead has

1226
01:00:57,289 --> 01:00:51,780
confirmed we are go to proceed with the

1227
01:01:03,289 --> 01:01:00,710
focused on the window and OC that looks

1228
01:01:06,589 --> 01:01:03,299
good your go to execute advisor

1229
01:01:06,599 --> 01:01:16,309
and OC or go to continue

1230
01:01:19,609 --> 01:01:18,230
so we had a question from Darren on

1231
01:01:22,010 --> 01:01:19,619
Twitter that asked if the secondary

1232
01:01:24,890 --> 01:01:22,020
mirror was uh coated with gold the same

1233
01:01:27,230 --> 01:01:24,900
as the primary mirror and uh and and yes

1234
01:01:28,670 --> 01:01:27,240
uh we uh they they both are coated with

1235
01:01:31,270 --> 01:01:28,680
gold because of their that wonderful

1236
01:01:33,950 --> 01:01:31,280
reflective property in the infrared

1237
01:01:35,690 --> 01:01:33,960
so um Julie one of the things that we're

1238
01:01:37,430 --> 01:01:35,700

going on right now is latching so you

1239
01:01:38,990 --> 01:01:37,440
know now that the secondary mirror has

1240
01:01:40,609 --> 01:01:39,000
been fully extended they're they're

1241
01:01:42,109 --> 01:01:40,619
latching it into place

1242
01:01:43,609 --> 01:01:42,119
um I believe we have an animation about

1243
01:01:47,089 --> 01:01:43,619
the latching and what's going on right

1244
01:01:49,609 --> 01:01:47,099
now so if our uh there we go we could

1245
01:01:52,430 --> 01:01:49,619
maybe talk to this animation

1246
01:01:55,010 --> 01:01:52,440
sure so you can see the the bottom two

1247
01:01:58,190 --> 01:01:55,020
booms are fixed

1248
01:02:00,230 --> 01:01:58,200
um and the top one has a has a joint in

1249
01:02:02,390 --> 01:02:00,240
the center and that latch is right there

1250
01:02:04,789 --> 01:02:02,400
at that Center joint

1251
01:02:06,529 --> 01:02:04,799
um and as you come in close they don't

1252
01:02:09,470 --> 01:02:06,539
have the details of the latch itself

1253
01:02:11,809 --> 01:02:09,480
it's kind of buried in that structure

1254
01:02:15,670 --> 01:02:11,819
um but right in there there's a hook

1255
01:02:19,430 --> 01:02:15,680
latch that comes over to essentially a

1256
01:02:21,410 --> 01:02:19,440
a hard stop and then it can can pull on

1257
01:02:24,230 --> 01:02:21,420
that hard stop almost like a tie down

1258
01:02:28,130 --> 01:02:24,240
type Flash

1259
01:02:32,870 --> 01:02:30,349
and we were talking a bit you were

1260
01:02:34,250 --> 01:02:32,880
talking a bit about testing oh sorry we

1261
01:02:36,049 --> 01:02:34,260
were talking about testing and how this

1262
01:02:37,609 --> 01:02:36,059
uh you know it has to malfunction in

1263
01:02:38,990 --> 01:02:37,619

zero gravity when before we were looking

1264
01:02:41,029 --> 01:02:39,000
at footage that being tested on Earth

1265
01:02:42,049 --> 01:02:41,039
and actually we um we even had a

1266
01:02:43,910 --> 01:02:42,059
question that from somebody called

1267
01:02:45,289 --> 01:02:43,920
pocket moon on Twitter it says how much

1268
01:02:47,750 --> 01:02:45,299
do the engineers have to account for

1269
01:02:49,010 --> 01:02:47,760
operating 0g versus 1G what were some of

1270
01:02:50,750 --> 01:02:49,020
the things that during the testing that

1271
01:02:52,430 --> 01:02:50,760
how is it that you had confidence this

1272
01:02:54,829 --> 01:02:52,440
works in zero gravity when we can only

1273
01:02:58,069 --> 01:02:54,839
test it in gravity

1274
01:03:01,789 --> 01:02:58,079
well the the nice thing about gravity

1275
01:03:04,370 --> 01:03:01,799
um is it it's in one orientation so if

1276
01:03:06,770 --> 01:03:04,380
you want to account for it you can kind

1277
01:03:09,890 --> 01:03:06,780
of um do things in multiple orientations

1278
01:03:11,750 --> 01:03:09,900
and take the average and figure out how

1279
01:03:13,010 --> 01:03:11,760
to subtract it out so as you can see

1280
01:03:15,230 --> 01:03:13,020
here we did tests in different

1281
01:03:16,789 --> 01:03:15,240
directions we did testing to the left we

1282
01:03:17,990 --> 01:03:16,799
did testing to the right we did testing

1283
01:03:18,970 --> 01:03:18,000
upright

1284
01:03:21,770 --> 01:03:18,980
um

1285
01:03:23,109 --> 01:03:21,780
what's happening and exactly how gravity

1286
01:03:25,910 --> 01:03:23,119
impacts us

1287
01:03:28,130 --> 01:03:25,920
and uh take that into account same thing

1288
01:03:32,029 --> 01:03:28,140

with thermal uh there's a lot of thermal

1289
01:03:33,529 --> 01:03:32,039
impacts we want to make sure that uh you

1290
01:03:35,390 --> 01:03:33,539
know we're testing it as you can see

1291
01:03:36,950 --> 01:03:35,400
right there in the clean room but in

1292
01:03:38,930 --> 01:03:36,960
space we're going to be much much older

1293
01:03:40,849 --> 01:03:38,940
so we want to make sure that that mirror

1294
01:03:43,730 --> 01:03:40,859
is in the right position when we were

1295
01:03:46,130 --> 01:03:43,740
both in zero gravity and cold so we did

1296
01:03:48,710 --> 01:03:46,140
a lot of measurements both at ambient

1297
01:03:50,089 --> 01:03:48,720
and cryogenic temperatures to make sure

1298
01:03:52,190 --> 01:03:50,099
that when we account for both of those

1299
01:03:54,650 --> 01:03:52,200
effects together that we wind up in this

1300
01:03:56,450 --> 01:03:54,660
in the right spot

1301
01:03:58,490 --> 01:03:56,460
and that's a really amazing thing to uh

1302
01:04:00,349 --> 01:03:58,500
to think about that this telescope's

1303
01:04:02,809 --> 01:04:00,359
operating temperature is nearly 400

1304
01:04:04,130 --> 01:04:02,819
degrees below zero fahrenheit and so you

1305
01:04:05,750 --> 01:04:04,140
know I'm sure that you know people are

1306
01:04:08,329 --> 01:04:05,760
familiar a little in their daily life

1307
01:04:11,690 --> 01:04:08,339
that objects change properties when they

1308
01:04:13,430 --> 01:04:11,700
are very cold or very warm so the mirror

1309
01:04:16,069 --> 01:04:13,440
itself is actually not the correct

1310
01:04:17,569 --> 01:04:16,079
curvature each mirror segments until we

1311
01:04:20,210 --> 01:04:17,579
come down to the operating temperature

1312
01:04:21,410 --> 01:04:20,220
of the telescope so this is something

1313
01:04:23,569 --> 01:04:21,420

that from the beginning of the very

1314
01:04:25,490 --> 01:04:23,579
moment it was designed we knew that

1315
01:04:26,930 --> 01:04:25,500
building it and testing it on Earth we

1316
01:04:28,010 --> 01:04:26,940
had to be very careful to make sure that

1317
01:04:31,370 --> 01:04:28,020
everything worked in its real

1318
01:04:33,170 --> 01:04:31,380
environment in space and uh Julie the um

1319
01:04:34,849 --> 01:04:33,180
we actually have some footage I believe

1320
01:04:37,010 --> 01:04:34,859
we can talk about the light path and why

1321
01:04:38,809 --> 01:04:37,020
the secondary mirror is important so as

1322
01:04:40,609 --> 01:04:38,819
we said this is absolutely essential the

1323
01:04:42,829 --> 01:04:40,619
extension of this this focusing mirror

1324
01:04:45,370 --> 01:04:42,839
so I believe we have uh some animation

1325
01:04:48,109 --> 01:04:45,380
if you could talk to Miss Julie

1326
01:04:50,089 --> 01:04:48,119
yeah so here you can see like a rather

1327
01:04:52,849 --> 01:04:50,099
large beam of light coming in from space

1328
01:04:54,710 --> 01:04:52,859
it hits the primary mirror it reflects

1329
01:04:58,010 --> 01:04:54,720
all reflects off of that the primary

1330
01:05:00,529 --> 01:04:58,020
mirror is um concave and it reflects

1331
01:05:03,170 --> 01:05:00,539
back and if you run that again you'll

1332
01:05:05,210 --> 01:05:03,180
see that it the beam is shaped and

1333
01:05:07,730 --> 01:05:05,220
reflect back to the secondary which is

1334
01:05:09,890 --> 01:05:07,740
convex and then pushes it down through

1335
01:05:11,809 --> 01:05:09,900
the center of the telescope here

1336
01:05:13,250 --> 01:05:11,819
um and that is called our aft Optics and

1337
01:05:15,109 --> 01:05:13,260
it looks like a little nose in the

1338
01:05:18,289 --> 01:05:15,119

middle of this telescope and it actually

1339
01:05:20,510 --> 01:05:18,299
has a couple more uh Optical features in

1340
01:05:22,670 --> 01:05:20,520
it it has a mask that you can see that

1341
01:05:24,470 --> 01:05:22,680
the that the light crisscrosses right as

1342
01:05:28,309 --> 01:05:24,480
it goes through that mask and then it

1343
01:05:31,010 --> 01:05:28,319
has a mirror in the back uh that you can

1344
01:05:34,250 --> 01:05:31,020
kind of almost see a re-image of what

1345
01:05:36,349 --> 01:05:34,260
the telescope uh pupil looks like on

1346
01:05:37,910 --> 01:05:36,359
that the pupil is the outside of the

1347
01:05:42,289 --> 01:05:37,920
telescope

1348
01:05:44,690 --> 01:05:42,299
shaped when it's fully

1349
01:05:47,029 --> 01:05:44,700
that the wings are fully deployed and

1350
01:05:49,010 --> 01:05:47,039
that mirror has that same pattern on it

1351
01:05:51,289 --> 01:05:49,020
and then it

1352
01:05:52,789 --> 01:05:51,299
comes back and it hits a tertiary mirror

1353
01:05:56,029 --> 01:05:52,799
which then reflects it backwards into

1354
01:05:59,569 --> 01:05:56,039
the into the cameras that live behind

1355
01:06:06,049 --> 01:06:01,490
um

1356
01:06:08,270 --> 01:06:06,059
the primary mirror and this will allow

1357
01:06:10,250 --> 01:06:08,280
the light to actually go into the uh the

1358
01:06:13,970 --> 01:06:10,260
telescope yes

1359
01:06:19,250 --> 01:06:13,980
yes so you know just like your telescope

1360
01:06:21,529 --> 01:06:19,260
on the ground uh there's essentially a

1361
01:06:23,329 --> 01:06:21,539
somehow to capture the light since we we

1362
01:06:24,710 --> 01:06:23,339
don't go up there and look through the

1363
01:06:27,650 --> 01:06:24,720

telescope ourselves we need to have

1364
01:06:30,829 --> 01:06:27,660
cameras behind the telescope which take

1365
01:06:34,730 --> 01:06:30,839
all the images for us so

1366
01:06:37,670 --> 01:06:35,930
um

1367
01:06:39,349 --> 01:06:37,680
it would be unfortunate to have like

1368
01:06:41,150 --> 01:06:39,359
this entire telescope and just have one

1369
01:06:43,970 --> 01:06:41,160
camera available so what happens behind

1370
01:06:45,950 --> 01:06:43,980
that is the is the light beam gets

1371
01:06:48,650 --> 01:06:45,960
distributed between the four different

1372
01:06:51,890 --> 01:06:48,660
instruments so each instrument gets a

1373
01:06:55,849 --> 01:06:51,900
portion of that beam and then uses their

1374
01:06:57,950 --> 01:06:55,859
own internal Optics to shape and control

1375
01:06:59,750 --> 01:06:57,960
that beam and filter that beam in

1376
01:07:03,230 --> 01:06:59,760
different ways before it hits the

1377
01:07:05,569 --> 01:07:03,240
detector of those instruments which then

1378
01:07:07,849 --> 01:07:05,579
the science data comes down to you

1379
01:07:08,569 --> 01:07:07,859
oh and here's one of

1380
01:07:13,670 --> 01:07:08,579
um

1381
01:07:16,010 --> 01:07:13,680
of see that it's a it's on some spindly

1382
01:07:20,150 --> 01:07:16,020
legs the stuff that's putting itself out

1383
01:07:21,770 --> 01:07:20,160
to the right and the left is uh his legs

1384
01:07:25,789 --> 01:07:21,780
and here's the beam of light that comes

1385
01:07:28,309 --> 01:07:25,799
in and is folded into the instrument and

1386
01:07:30,549 --> 01:07:28,319
then it is folded again and then once

1387
01:07:33,710 --> 01:07:30,559
again it's folded this is our near Speck

1388
01:07:36,349 --> 01:07:33,720

and then it comes through a wall and

1389
01:07:38,930 --> 01:07:36,359
it's into now into the Optics and into

1390
01:07:41,809 --> 01:07:38,940
the camera into the back you can see the

1391
01:07:43,250 --> 01:07:41,819
filter wheel spinning there

1392
01:07:46,490 --> 01:07:43,260
actually I'm not sure that this isn't

1393
01:07:49,430 --> 01:07:48,170
these are different instruments that are

1394
01:07:51,770 --> 01:07:49,440
in the uh the ice and the instrument

1395
01:07:54,430 --> 01:07:51,780
package uh some of the most

1396
01:07:54,440 --> 01:07:57,589
yes yes

1397
01:08:02,510 --> 01:07:59,930
this is Murray okay

1398
01:08:06,529 --> 01:08:02,520
which is which is very similar

1399
01:08:14,890 --> 01:08:09,710
it's four Optics there

1400
01:08:20,209 --> 01:08:17,809
from Sally Sparks on Twitter who asks um

1401
01:08:21,470 --> 01:08:20,219
how you how are the steps verified we've

1402
01:08:23,209 --> 01:08:21,480
been we've been listening to the mock

1403
01:08:25,189 --> 01:08:23,219
today the mission operations center and

1404
01:08:27,229 --> 01:08:25,199
you know they say so this is verified

1405
01:08:29,749 --> 01:08:27,239
the engines are on how are we getting

1406
01:08:32,269 --> 01:08:29,759
that information

1407
01:08:35,630 --> 01:08:32,279
so we get uh Telemetry

1408
01:08:39,050 --> 01:08:35,640
um what we have on the on the telescope

1409
01:08:42,470 --> 01:08:39,060
is a whole series of sensors of

1410
01:08:44,390 --> 01:08:42,480
different kinds we have uh sensors that

1411
01:08:46,550 --> 01:08:44,400
are position sensors we have sensors

1412
01:08:48,709 --> 01:08:46,560
that are current sensors we have sensors

1413
01:08:51,410 --> 01:08:48,719

that are temperature sensors

1414
01:08:53,570 --> 01:08:51,420
um uh and all that Telemetry gets fed in

1415
01:08:55,070 --> 01:08:53,580
through the computers and then brought

1416
01:08:57,950 --> 01:08:55,080
down through the the communication

1417
01:09:00,229 --> 01:08:57,960
system into a crown station get sent

1418
01:09:03,169 --> 01:09:00,239
over to our operations center here in

1419
01:09:06,229 --> 01:09:03,179
Baltimore at the um

1420
01:09:08,749 --> 01:09:06,239
uh comes out on our computer screens and

1421
01:09:11,090 --> 01:09:08,759
uh as you if you remember looking at the

1422
01:09:12,829 --> 01:09:11,100
mock a lot of those screens are you have

1423
01:09:13,789 --> 01:09:12,839
four screens there and there's all

1424
01:09:14,329 --> 01:09:13,799
different

1425
01:09:16,729 --> 01:09:14,339
um

1426
01:09:18,649 --> 01:09:16,739
information each of those Engineers are

1427
01:09:20,990 --> 01:09:18,659
looking at a different aspect of what's

1428
01:09:22,910 --> 01:09:21,000
going on so they'll each have different

1429
01:09:25,189 --> 01:09:22,920
pieces of information and Telemetry

1430
01:09:27,050 --> 01:09:25,199
coming up that they're checking out and

1431
01:09:29,209 --> 01:09:27,060
they can take a look at that and they

1432
01:09:31,430 --> 01:09:29,219
can look at the

1433
01:09:33,229 --> 01:09:31,440
at the status

1434
01:09:38,870 --> 01:09:33,239
um and the Telemetry coming back to get

1435
01:09:41,689 --> 01:09:40,490
so for our audience joining us you're

1436
01:09:43,189 --> 01:09:41,699
looking at live coverage of the

1437
01:09:45,110 --> 01:09:43,199
deployment of the secondary mirror of

1438
01:09:47,870 --> 01:09:45,120

the James Webb Space Telescope

1439
01:09:49,910 --> 01:09:47,880
this is a second day of very dramatic

1440
01:09:52,249 --> 01:09:49,920
and successful deployments yesterday saw

1441
01:09:54,050 --> 01:09:52,259
the uh the full installation of the

1442
01:09:58,910 --> 01:09:54,060
giant heat shield and today we have the

1443
01:10:02,090 --> 01:10:00,410
the secondary mirror has been fully

1444
01:10:05,090 --> 01:10:02,100
deployed and at this point they are now

1445
01:10:11,090 --> 01:10:08,090
so we actually have a question from

1446
01:10:13,430 --> 01:10:11,100
um uh Manuel on Twitter that says why is

1447
01:10:15,110 --> 01:10:13,440
web built to see in specific and longer

1448
01:10:16,850 --> 01:10:15,120
wavelengths in the Hubble and why didn't

1449
01:10:19,310 --> 01:10:16,860
you mount shorter wavelength lenses like

1450
01:10:20,689 --> 01:10:19,320
UV x-rays Etc so this this might give me

1451
01:10:22,729 --> 01:10:20,699
a little chance to talk about some of

1452
01:10:24,530 --> 01:10:22,739
the science behind web and also why it's

1453
01:10:27,649 --> 01:10:24,540
an infrared Observatory

1454
01:10:29,090 --> 01:10:27,659
so um to answer the question

1455
01:10:31,250 --> 01:10:29,100
um different wavelengths of light

1456
01:10:33,110 --> 01:10:31,260
require very different observatories

1457
01:10:34,370 --> 01:10:33,120
basically is no way to build one

1458
01:10:36,290 --> 01:10:34,380
telescope that can capture all the

1459
01:10:38,870 --> 01:10:36,300
wavelengths of light and you see here

1460
01:10:41,450 --> 01:10:38,880
that infrared light is the color of

1461
01:10:44,270 --> 01:10:41,460
light that is a bit redder that our eyes

1462
01:10:45,649 --> 01:10:44,280
detect you see that there is an area of

1463
01:10:47,930 --> 01:10:45,659

this what we call the electromagnetic

1464
01:10:49,430 --> 01:10:47,940
spectrum the electromagnetic spectrum is

1465
01:10:52,250 --> 01:10:49,440
simply a name for all of the different

1466
01:10:54,709 --> 01:10:52,260
forms that light takes and our eyes are

1467
01:10:56,510 --> 01:10:54,719
only sensitive to a very small range of

1468
01:10:58,850 --> 01:10:56,520
that which we call rather obviously

1469
01:11:01,130 --> 01:10:58,860
visible light there are higher energy

1470
01:11:04,130 --> 01:11:01,140
forms of light that are basically too

1471
01:11:07,070 --> 01:11:04,140
blue too high energy the UV light gamma

1472
01:11:09,410 --> 01:11:07,080
rays and x-rays and NASA does operate

1473
01:11:11,149 --> 01:11:09,420
telescopes that see in all these

1474
01:11:12,890 --> 01:11:11,159
different wavelengths but you need very

1475
01:11:15,530 --> 01:11:12,900
very different kinds of instruments and

1476
01:11:17,870 --> 01:11:15,540
different kinds of mirrors for example

1477
01:11:19,729 --> 01:11:17,880
we have the Chandra x-ray Observatory

1478
01:11:22,070 --> 01:11:19,739
upright right now that sees an x-rays

1479
01:11:25,189 --> 01:11:22,080
x-rays are a very high energy type of

1480
01:11:26,630 --> 01:11:25,199
light and uh as you sort of know you

1481
01:11:28,610 --> 01:11:26,640
know colloquially from the doctor's

1482
01:11:31,070 --> 01:11:28,620
offices x-rays go right through your

1483
01:11:32,930 --> 01:11:31,080
body and x-rays of course would go right

1484
01:11:34,790 --> 01:11:32,940
through most detectors and mirrors who

1485
01:11:37,130 --> 01:11:34,800
need very specialized detectors

1486
01:11:40,189 --> 01:11:37,140
infrared light is lower energy light and

1487
01:11:42,830 --> 01:11:40,199
we we often experience this as humans as

1488
01:11:45,770 --> 01:11:42,840

a form of heat heat light infrared light

1489
01:11:48,590 --> 01:11:45,780
infrared radiation the the reason we we

1490
01:11:50,630 --> 01:11:48,600
sort of associated it with heat is that

1491
01:11:52,610 --> 01:11:50,640
objects that are the temperature of a

1492
01:11:54,890 --> 01:11:52,620
human body uh you know and the

1493
01:11:57,649 --> 01:11:54,900
temperature for example of a planet like

1494
01:11:59,450 --> 01:11:57,659
Earth they naturally glow in these lower

1495
01:12:01,669 --> 01:11:59,460
energy types of light

1496
01:12:03,649 --> 01:12:01,679
so the sun is so hot you know the

1497
01:12:05,390 --> 01:12:03,659
surface temperature of the Sun about 10

1498
01:12:08,450 --> 01:12:05,400
000 degrees it's hot enough to actually

1499
01:12:10,850 --> 01:12:08,460
glow and uh that produces visible light

1500
01:12:12,709 --> 01:12:10,860
but objects that are just warm really

1501
01:12:15,470 --> 01:12:12,719
have any temperature at all they are

1502
01:12:17,450 --> 01:12:15,480
glowing in infrared light and uh we've

1503
01:12:19,130 --> 01:12:17,460
had many successful infrared telescopes

1504
01:12:20,930 --> 01:12:19,140
the Hubble Space Telescope did see a

1505
01:12:23,270 --> 01:12:20,940
little bit into the infrared and we see

1506
01:12:25,450 --> 01:12:23,280
here an image taken by Hubble in visible

1507
01:12:28,250 --> 01:12:25,460
light of the famous Pillars of Creation

1508
01:12:31,010 --> 01:12:28,260
these are dust clouds that are many

1509
01:12:33,290 --> 01:12:31,020
hundreds of billions of miles across and

1510
01:12:35,870 --> 01:12:33,300
they are forming new stars and solar

1511
01:12:37,250 --> 01:12:35,880
systems inside them and you see here the

1512
01:12:38,750 --> 01:12:37,260
optical light but if we switch to

1513
01:12:40,370 --> 01:12:38,760

infrared light

1514
01:12:42,050 --> 01:12:40,380
um Hubble had an instrument called Nick

1515
01:12:44,870 --> 01:12:42,060
Moss that saw a little bit into the

1516
01:12:47,570 --> 01:12:44,880
infrared this is these are both actual

1517
01:12:49,790 --> 01:12:47,580
images these are both real data but this

1518
01:12:52,970 --> 01:12:49,800
infrared image is one their eyes do not

1519
01:12:54,410 --> 01:12:52,980
see the information has been translated

1520
01:12:56,030 --> 01:12:54,420
into colors that we can actually

1521
01:12:58,370 --> 01:12:56,040
interpret and then and we make this

1522
01:13:00,290 --> 01:12:58,380
image with but all of those stars that

1523
01:13:01,970 --> 01:13:00,300
you see in this image were really there

1524
01:13:03,890 --> 01:13:01,980
in the visible light image just not

1525
01:13:06,290 --> 01:13:03,900
visible in the kind of light that our

1526
01:13:08,930 --> 01:13:06,300
eye sees infrared light has the ability

1527
01:13:11,270 --> 01:13:08,940
to pass through dust and a lot of

1528
01:13:12,950 --> 01:13:11,280
obscuring material and there are some

1529
01:13:15,350 --> 01:13:12,960
really fascinating things that happen

1530
01:13:17,090 --> 01:13:15,360
inside these giant dust clouds so we

1531
01:13:19,430 --> 01:13:17,100
mentioned the formation of stars and

1532
01:13:22,010 --> 01:13:19,440
planets and this is one of the most

1533
01:13:23,689 --> 01:13:22,020
active regions of star formation in our

1534
01:13:25,669 --> 01:13:23,699
part of the Galaxy this is the Orion

1535
01:13:28,010 --> 01:13:25,679
Nebula the urine nebula is actually

1536
01:13:30,050 --> 01:13:28,020
visible as a faint smudge below the belt

1537
01:13:32,149 --> 01:13:30,060
of Orion in what we call the sword of

1538
01:13:34,130 --> 01:13:32,159

Orion there are sort of three stars that

1539
01:13:36,290 --> 01:13:34,140
hang down from the belt of Orion this is

1540
01:13:38,209 --> 01:13:36,300
the middle quote unquote star it's not a

1541
01:13:40,550 --> 01:13:38,219
star actually it's a collection of many

1542
01:13:42,890 --> 01:13:40,560
hundreds of young stars and planetary

1543
01:13:45,890 --> 01:13:42,900
systems that are forming inside a vast

1544
01:13:47,930 --> 01:13:45,900
cloud of dust and gas and while we can

1545
01:13:50,149 --> 01:13:47,940
see inside the nebula a little bit where

1546
01:13:53,149 --> 01:13:50,159
the Orion Nebula is visible to us it's a

1547
01:13:55,550 --> 01:13:53,159
much larger complex and we can see

1548
01:13:57,290 --> 01:13:55,560
through that that dust using infrared we

1549
01:13:58,790 --> 01:13:57,300
mentioned the Miri instrument and also

1550
01:14:00,530 --> 01:13:58,800
spectroscopes this is one of the things

1551
01:14:03,350 --> 01:14:00,540
that's a very powerful way to analyze

1552
01:14:05,810 --> 01:14:03,360
light so what a what a spectroscope does

1553
01:14:08,930 --> 01:14:05,820
a spectrograph I should say is is

1554
01:14:10,910 --> 01:14:08,940
actually less light through a prism and

1555
01:14:12,470 --> 01:14:10,920
break it up into the components of the

1556
01:14:15,050 --> 01:14:12,480
rainbow all the different colors of the

1557
01:14:17,870 --> 01:14:15,060
rainbow now we can actually tell really

1558
01:14:20,270 --> 01:14:17,880
exciting things from measuring very very

1559
01:14:22,250 --> 01:14:20,280
carefully how much color comes from each

1560
01:14:23,870 --> 01:14:22,260
uh how much how much light comes in each

1561
01:14:26,450 --> 01:14:23,880
color of the rainbow that's called

1562
01:14:28,189 --> 01:14:26,460
spectroscopy and spectroscopy allows you

1563
01:14:29,870 --> 01:14:28,199

to do things like discover what the

1564
01:14:31,189 --> 01:14:29,880
components are made of and here we see

1565
01:14:33,530 --> 01:14:31,199
so here we see a beam of white light

1566
01:14:35,990 --> 01:14:33,540
again it's being passed through in this

1567
01:14:37,550 --> 01:14:36,000
case a prism on a telescope it's usually

1568
01:14:39,410 --> 01:14:37,560
a grading that does the same thing it

1569
01:14:41,689 --> 01:14:39,420
spreads it into a rainbow and the graph

1570
01:14:43,790 --> 01:14:41,699
shows you how much light is coming in

1571
01:14:46,430 --> 01:14:43,800
different colors wherever you see this

1572
01:14:48,890 --> 01:14:46,440
kind of squiggly line go down that means

1573
01:14:50,990 --> 01:14:48,900
less light in that color the reason

1574
01:14:53,209 --> 01:14:51,000
that's interesting is that every

1575
01:14:56,149 --> 01:14:53,219
chemical in the universe basically every

1576
01:14:57,950 --> 01:14:56,159
atom every molecule has a fingerprint of

1577
01:15:00,050 --> 01:14:57,960
light that that specific molecule

1578
01:15:02,270 --> 01:15:00,060
absorbs and that's how we're able to

1579
01:15:03,709 --> 01:15:02,280
tell you what stars are made of what

1580
01:15:05,209 --> 01:15:03,719
about planets that are around other

1581
01:15:06,649 --> 01:15:05,219
stars you know what the composition of

1582
01:15:08,570 --> 01:15:06,659
their atmospheres may be

1583
01:15:10,490 --> 01:15:08,580
this is one of the big deals about the

1584
01:15:13,010 --> 01:15:10,500
web Observatory one of the major goals

1585
01:15:14,570 --> 01:15:13,020
is to see do planets around other stars

1586
01:15:17,630 --> 01:15:14,580
have environments like the Earth with

1587
01:15:18,950 --> 01:15:17,640
water vapor carbon dioxide oxygen and

1588
01:15:21,050 --> 01:15:18,960

the way web is going to determine that

1589
01:15:23,870 --> 01:15:21,060
is by watching that planet move in front

1590
01:15:26,030 --> 01:15:23,880
of the star and the star light behind it

1591
01:15:26,930 --> 01:15:26,040
will pass through the atmosphere of that

1592
01:15:29,450 --> 01:15:26,940
planet

1593
01:15:31,430 --> 01:15:29,460
and as that does different components

1594
01:15:33,770 --> 01:15:31,440
will be absorbed because we know the

1595
01:15:36,229 --> 01:15:33,780
absorption characteristics of all of

1596
01:15:38,390 --> 01:15:36,239
these different chemicals Like Oxygen

1597
01:15:40,130 --> 01:15:38,400
like water vapor and as that Light

1598
01:15:41,870 --> 01:15:40,140
reaches the James Webb Space Telescope

1599
01:15:43,669 --> 01:15:41,880
we'll be able to say all right there's a

1600
01:15:46,189 --> 01:15:43,679
planet going around that star in the sky

1601
01:15:47,450 --> 01:15:46,199
that has an atmosphere very much like

1602
01:15:49,550 --> 01:15:47,460
the Earth and these are some of the

1603
01:15:52,189 --> 01:15:49,560
signals that we're looking for another

1604
01:15:54,169 --> 01:15:52,199
reason infrared is so important is that

1605
01:15:56,270 --> 01:15:54,179
some of the most important signiful

1606
01:15:58,130 --> 01:15:56,280
signals of this absorption take place in

1607
01:15:59,689 --> 01:15:58,140
the infrared if you'd like to know for

1608
01:16:02,270 --> 01:15:59,699
example if there's water vapor if

1609
01:16:03,890 --> 01:16:02,280
there's oxygen not only that we should

1610
01:16:05,450 --> 01:16:03,900
be able to have some idea of the

1611
01:16:08,030 --> 01:16:05,460
temperature of the atmosphere and maybe

1612
01:16:10,850 --> 01:16:08,040
the density of the atmosphere and so the

1613
01:16:12,530 --> 01:16:10,860

hope is that once web is operational and

1614
01:16:14,750 --> 01:16:12,540
looking at exoplanets plants around

1615
01:16:16,610 --> 01:16:14,760
other stars we'll be able to say that

1616
01:16:19,189 --> 01:16:16,620
planet has an atmosphere very much like

1617
01:16:21,649 --> 01:16:19,199
the Earth and perhaps even might even

1618
01:16:24,350 --> 01:16:21,659
have biomarkers the the signals of

1619
01:16:25,970 --> 01:16:24,360
vegetation that's less likely the first

1620
01:16:27,649 --> 01:16:25,980
thing we'll be looking for is just to

1621
01:16:30,229 --> 01:16:27,659
find atmospheres that are like the Earth

1622
01:16:33,470 --> 01:16:30,239
these are animations scientific

1623
01:16:35,750 --> 01:16:33,480
visualizations made of exoplanets of

1624
01:16:37,370 --> 01:16:35,760
course exoplanets are so far away we

1625
01:16:40,370 --> 01:16:37,380
can't yet see whether they have oceans

1626
01:16:42,950 --> 01:16:40,380
or atmospheres but these are based on

1627
01:16:45,649 --> 01:16:42,960
scientific data around a star called

1628
01:16:47,330 --> 01:16:45,659
trappist-1 trappist-1 is a star that we

1629
01:16:49,850 --> 01:16:47,340
we're looking at with the James Webb

1630
01:16:53,030 --> 01:16:49,860
Space Telescope Trappist one we now know

1631
01:16:55,010 --> 01:16:53,040
has at least seven planets and of those

1632
01:16:56,990 --> 01:16:55,020
seven earth-sized planets that were

1633
01:16:58,490 --> 01:16:57,000
detected there are several of them that

1634
01:17:00,410 --> 01:16:58,500
are about the right distance from the

1635
01:17:02,750 --> 01:17:00,420
Star and have temperatures similar to

1636
01:17:04,669 --> 01:17:02,760
the Earth and uh that's all we know

1637
01:17:06,229 --> 01:17:04,679
right now is we know the rough size of

1638
01:17:08,149 --> 01:17:06,239

these planets we know that they're dense

1639
01:17:10,189 --> 01:17:08,159
they are rocky planets like the Earth

1640
01:17:11,510 --> 01:17:10,199
and Mars and Venus in our inner solar

1641
01:17:12,649 --> 01:17:11,520
system but we do not have any

1642
01:17:14,810 --> 01:17:12,659
information yet about what their

1643
01:17:16,790 --> 01:17:14,820
atmospheres are like and hopefully that

1644
01:17:18,649 --> 01:17:16,800
will change when the web telescope is

1645
01:17:21,050 --> 01:17:18,659
able to uh to send us back information

1646
01:17:30,229 --> 01:17:21,060
about these exoplanets that's one of the

1647
01:17:34,130 --> 01:17:31,850
you see here some of the uh the

1648
01:17:35,990 --> 01:17:34,140
exoplanets uh again imagined by our

1649
01:17:38,270 --> 01:17:36,000
scientific visualizers we don't have

1650
01:17:40,070 --> 01:17:38,280
this data yet but but hopefully in the

1651
01:17:42,530 --> 01:17:40,080
next decades we'll be able to tell you a

1652
01:17:46,850 --> 01:17:42,540
little bit about uh this is uh this is

1653
01:17:50,570 --> 01:17:48,950
the way that we find exoplanets is by

1654
01:17:52,250 --> 01:17:50,580
watching planets transit in front of

1655
01:17:54,350 --> 01:17:52,260
their Sun they block out a little bit of

1656
01:17:56,149 --> 01:17:54,360
the Starlight but basically a tiny

1657
01:17:58,910 --> 01:17:56,159
little solar eclipse as these planets

1658
01:18:00,350 --> 01:17:58,920
move in front and as the planets move in

1659
01:18:02,209 --> 01:18:00,360
front uh with the James Webb Space

1660
01:18:03,709 --> 01:18:02,219
Telescope we should also have the

1661
01:18:06,290 --> 01:18:03,719
opportunity to watch the background

1662
01:18:08,870 --> 01:18:06,300
Starlight of their of their parent star

1663
01:18:10,910 --> 01:18:08,880

shine through their atmospheres and when

1664
01:18:13,270 --> 01:18:10,920
that happens during a Transit Webb will

1665
01:18:15,350 --> 01:18:13,280
have the power to analyze the chemistry

1666
01:18:16,790 --> 01:18:15,360
possibly the temperature and the density

1667
01:18:18,530 --> 01:18:16,800
of these atmospheres and determine

1668
01:18:20,030 --> 01:18:18,540
whether any of these planets have

1669
01:18:21,530 --> 01:18:20,040
atmospheres that are friendly to light

1670
01:18:23,930 --> 01:18:21,540
and that's what you see here in this

1671
01:18:25,970 --> 01:18:23,940
diagram you see a an exoplanet in this

1672
01:18:28,550 --> 01:18:25,980
animation moving in front of its star

1673
01:18:30,709 --> 01:18:28,560
according to our our peel to view and

1674
01:18:32,149 --> 01:18:30,719
different layers of the atmosphere will

1675
01:18:33,590 --> 01:18:32,159
actually absorb different things

1676
01:18:35,209 --> 01:18:33,600
different wavelengths of light in the

1677
01:18:37,430 --> 01:18:35,219
infrared and so we'll be able to

1678
01:18:39,350 --> 01:18:37,440
actually explore what the environments

1679
01:18:41,930 --> 01:18:39,360
of these planets are like even from this

1680
01:18:45,890 --> 01:18:44,090
right well let's go back to the mission

1681
01:18:48,410 --> 01:18:45,900
operations center Let's uh let's find

1682
01:18:52,130 --> 01:18:48,420
out what's going on all stations

1683
01:18:55,310 --> 01:18:53,030
Monaco

1684
01:18:58,310 --> 01:18:55,320
I'm gonna listen to the PM right now all

1685
01:19:00,290 --> 01:18:58,320
stations plus 2 P.M

1686
01:19:01,970 --> 01:19:00,300
thanks Carl hey I just want to take a

1687
01:19:05,270 --> 01:19:01,980
moment to congratulate everyone another

1688
01:19:07,189 --> 01:19:05,280

Banner Day for jdbst in particular the

1689
01:19:09,410 --> 01:19:07,199
secondary mirror deployment folks you

1690
01:19:10,850 --> 01:19:09,420
guys did a heck of a job this is

1691
01:19:13,669 --> 01:19:10,860
unbelievable

1692
01:19:15,410 --> 01:19:13,679
we are now at a point where I looked up

1693
01:19:17,270 --> 01:19:15,420
before we're about 600 000 miles from

1694
01:19:22,669 --> 01:19:17,280
Earth and we actually have a telescope

1695
01:19:22,679 --> 01:19:28,850
that was Bill Oaks our program manager

1696
01:19:32,810 --> 01:19:30,470
congratulating everyone on the

1697
01:19:36,110 --> 01:19:32,820
operations Loop

1698
01:19:37,790 --> 01:19:36,120
you're seeing some high fives there

1699
01:19:40,130 --> 01:19:37,800
and what they've done while we were off

1700
01:19:42,830 --> 01:19:40,140
talking about exoplanets is they

1701
01:19:45,350 --> 01:19:42,840
confirmed that the latch had latched and

1702
01:19:46,850 --> 01:19:45,360
took off the tension from the deployment

1703
01:19:48,649 --> 01:19:46,860
motor

1704
01:19:52,669 --> 01:19:48,659
um they will continue to do a little bit

1705
01:19:58,310 --> 01:19:55,310
but this is a major deployment and it is

1706
01:20:03,290 --> 01:20:01,310
this is tremendously go ahead

1707
01:20:06,350 --> 01:20:03,300
uh throughout this time we are ready to

1708
01:20:08,990 --> 01:20:06,360
proceed whenever you are

1709
01:20:14,330 --> 01:20:09,000
tell me that quickly they have to stop

1710
01:20:19,490 --> 01:20:16,729
devops copies OC we are going to proceed

1711
01:20:20,990 --> 01:20:19,500
with step 053 to command the DU to stand

1712
01:20:22,189 --> 01:20:21,000
by and that looks good you're a good

1713
01:20:26,570 --> 01:20:22,199

execute

1714
01:20:36,350 --> 01:20:29,570
and OC or go to continue I'll be going

1715
01:20:39,530 --> 01:20:37,910
so you'll hear us talking you'll

1716
01:20:41,149 --> 01:20:39,540
occasionally hear us pause as we listen

1717
01:20:42,649 --> 01:20:41,159
to uh commentary from the mission

1718
01:20:45,290 --> 01:20:42,659
operations center

1719
01:20:47,270 --> 01:20:45,300
so Julie um I mean after today's you

1720
01:20:49,129 --> 01:20:47,280
know wonderful and successful deployment

1721
01:20:50,270 --> 01:20:49,139
of this secondary mirror

1722
01:20:53,090 --> 01:20:50,280
um a little bit of a look ahead to

1723
01:20:54,830 --> 01:20:53,100
what's happening next and uh tomorrow I

1724
01:20:56,629 --> 01:20:54,840
believe we have another uh significant

1725
01:20:58,010 --> 01:20:56,639
deployment the after radiate radiator

1726
01:20:59,629 --> 01:20:58,020
will deploy can you tell us a little bit

1727
01:21:02,030 --> 01:20:59,639
about that

1728
01:21:03,649 --> 01:21:02,040
sure I think oh here's our animation so

1729
01:21:05,390 --> 01:21:03,659
this is on the back side of the

1730
01:21:07,490 --> 01:21:05,400
telescope on actually behind the

1731
01:21:08,870 --> 01:21:07,500
instruments and you can see right there

1732
01:21:10,970 --> 01:21:08,880
on the one side of the screen was

1733
01:21:13,370 --> 01:21:10,980
actually the uh the mirror is deploying

1734
01:21:16,910 --> 01:21:13,380
out of the way but the the this is a

1735
01:21:19,310 --> 01:21:16,920
radiator that takes some heat from the

1736
01:21:20,930 --> 01:21:19,320
um electronics and all the different

1737
01:21:23,590 --> 01:21:20,940
things that still have to operate on the

1738
01:21:26,930 --> 01:21:23,600

cold side of the telescope and and

1739
01:21:29,689 --> 01:21:26,940
directs that heat out into deep space to

1740
01:21:31,070 --> 01:21:29,699
to dump that power out where it doesn't

1741
01:21:32,810 --> 01:21:31,080
reflect around and get back into the

1742
01:21:34,430 --> 01:21:32,820
telescope

1743
01:21:36,110 --> 01:21:34,440
these instruments are designed to

1744
01:21:38,510 --> 01:21:36,120
operate at very cold temperatures and

1745
01:21:40,010 --> 01:21:38,520
after that we actually now have the

1746
01:21:41,810 --> 01:21:40,020
deployment of the wings of the uh the

1747
01:21:43,790 --> 01:21:41,820
main mirror so what will be happening in

1748
01:21:45,229 --> 01:21:43,800
the next few days as you see here is

1749
01:21:46,790 --> 01:21:45,239
that the two sides of the mirror the

1750
01:21:48,709 --> 01:21:46,800
mirror had to be folded up to fit inside

1751
01:21:50,390 --> 01:21:48,719
the rocket this is the largest space

1752
01:21:52,070 --> 01:21:50,400
Observatory ever built and had to be

1753
01:21:53,510 --> 01:21:52,080
folded up to fit inside a rocket we are

1754
01:21:56,270 --> 01:21:53,520
now deploying it

1755
01:21:57,830 --> 01:21:56,280
and I believe we have footage of the the

1756
01:22:00,770 --> 01:21:57,840
test of the mirrors in the clean room

1757
01:22:02,930 --> 01:22:00,780
where it was assembled so uh if we if we

1758
01:22:04,610 --> 01:22:02,940
have that footage to run

1759
01:22:06,470 --> 01:22:04,620
Julie you could maybe comment on what's

1760
01:22:08,090 --> 01:22:06,480
going on here

1761
01:22:09,649 --> 01:22:08,100
well this is back to the secondary

1762
01:22:11,510 --> 01:22:09,659
deployment

1763
01:22:12,830 --> 01:22:11,520

we're doing here again the secondary

1764
01:22:14,330 --> 01:22:12,840
deployment in a different gravity

1765
01:22:16,310 --> 01:22:14,340
orientation

1766
01:22:18,530 --> 01:22:16,320
and then one last time

1767
01:22:21,709 --> 01:22:18,540
uh in different views you can see the

1768
01:22:23,149 --> 01:22:21,719
mirror here's the wing coming out

1769
01:22:28,430 --> 01:22:23,159
um and as you see this you can see that

1770
01:22:30,050 --> 01:22:28,440
there's like a a black uh uh we call it

1771
01:22:31,910 --> 01:22:30,060
the frill around the outside of the

1772
01:22:34,550 --> 01:22:31,920
mirrors it's kind of like an Elizabethan

1773
01:22:37,310 --> 01:22:34,560
collar and what that does is it actually

1774
01:22:39,830 --> 01:22:37,320
prevents Starlight from behind the

1775
01:22:41,090 --> 01:22:39,840
telescope from passing close to the

1776
01:22:43,129 --> 01:22:41,100
telescope and actually hitting the

1777
01:22:46,070 --> 01:22:43,139
secondary mirror and working its way

1778
01:22:48,169 --> 01:22:46,080
into the Optus itself so that's actually

1779
01:22:51,110 --> 01:22:48,179
soft structure it's a it's a

1780
01:22:54,470 --> 01:22:51,120
blanket-like material made out of kapton

1781
01:22:57,410 --> 01:22:54,480
um that's a real low reflectivity and it

1782
01:22:58,669 --> 01:22:57,420
keeps the light from from uh poking its

1783
01:23:01,550 --> 01:22:58,679
head around the

1784
01:23:03,770 --> 01:23:01,560
back side of the of the mirrors and

1785
01:23:05,629 --> 01:23:03,780
making its way in and here you can see a

1786
01:23:07,430 --> 01:23:05,639
technician or an engineer taking a close

1787
01:23:08,870 --> 01:23:07,440
look as we close to make sure

1788
01:23:10,729 --> 01:23:08,880

everything's happening just perfectly

1789
01:23:12,830 --> 01:23:10,739
and behind that you can see people on

1790
01:23:15,050 --> 01:23:12,840
things we call diving boards we had to

1791
01:23:17,330 --> 01:23:15,060
do a lot of work high up in the sky to

1792
01:23:18,830 --> 01:23:17,340
to the telescope is so big you couldn't

1793
01:23:20,930 --> 01:23:18,840
be standing on the ground and doing the

1794
01:23:26,149 --> 01:23:20,940
work on it so our technicians got good

1795
01:23:28,129 --> 01:23:26,159
at being up high on on cranes and on

1796
01:23:29,570 --> 01:23:28,139
diving boards we call them and you could

1797
01:23:31,610 --> 01:23:29,580
see that they had fall protection to

1798
01:23:43,930 --> 01:23:31,620
make sure that that they didn't follow

1799
01:23:43,940 --> 01:23:49,209
frame 14.

1800
01:23:56,450 --> 01:23:52,850
3 that looks good you're a go to execute

1801
01:24:00,410 --> 01:23:58,490
you have to wear masks because of covid

1802
01:24:02,390 --> 01:24:00,420
but that's nothing compared to working

1803
01:24:04,930 --> 01:24:02,400
in those suits all day in the clean room

1804
01:24:07,669 --> 01:24:04,940
so uh

1805
01:24:09,350 --> 01:24:07,679
so my kudos to all the people who work

1806
01:24:11,390 --> 01:24:09,360
so hard all that time to put it together

1807
01:24:13,550 --> 01:24:11,400
we we shouldn't complain at all wearing

1808
01:24:16,430 --> 01:24:13,560
our Copic masks

1809
01:24:17,390 --> 01:24:16,440
right well so to to wrap up today's

1810
01:24:19,370 --> 01:24:17,400
broadcast

1811
01:24:21,169 --> 01:24:19,380
um we have had a live coverage of the

1812
01:24:22,669 --> 01:24:21,179
successful deployment of the secondary

1813
01:24:24,590 --> 01:24:22,679

mirror the focusing structure of the

1814
01:24:26,390 --> 01:24:24,600
James Webb Space Telescope this is an

1815
01:24:28,790 --> 01:24:26,400
absolutely essential component of the

1816
01:24:31,010 --> 01:24:28,800
observatory and I am smiling and I was

1817
01:24:33,350 --> 01:24:31,020
very excited to see this happen uh

1818
01:24:34,850 --> 01:24:33,360
joining me has been Julie Van Camp She

1819
01:24:37,669 --> 01:24:34,860
is the uh the deputy commissioning

1820
01:24:39,290 --> 01:24:37,679
engineer uh and also the uh the main

1821
01:24:42,530 --> 01:24:39,300
system engineer for the the instrument

1822
01:24:44,750 --> 01:24:42,540
package a very historic day so

1823
01:24:47,290 --> 01:24:44,760
um this uh this particular Observatory

1824
01:24:50,450 --> 01:24:47,300
will take about 29 days

1825
01:24:52,129 --> 01:24:50,460
after that it will cool down and we'll

1826
01:24:53,750 --> 01:24:52,139
actually have to wait a few months for

1827
01:24:55,610 --> 01:24:53,760
the uh the first images because of

1828
01:25:00,770 --> 01:24:55,620
cooling down but so far everything has

1829
01:25:06,830 --> 01:25:03,590
and OC that input looks good or go to

1830
01:25:06,840 --> 01:25:11,090
okay that's executing

1831
01:25:11,100 --> 01:25:18,169
and does he or go to continue

1832
01:25:28,070 --> 01:25:21,290
and OC standby for verification

1833
01:25:46,729 --> 01:25:31,669
e

1834
01:25:46,739 --> 01:25:58,010
okay

1835
01:25:58,020 --> 01:26:08,689
[Music]

1836
01:26:13,030 --> 01:26:10,570
foreign

1837
01:26:33,170 --> 01:26:13,040
[Music]

1838
01:26:33,180 --> 01:26:39,290

[Applause]

1839
01:26:39,300 --> 01:26:53,090
foreign

1840
01:26:57,350 --> 01:26:55,850
it's all about Flames fluids and

1841
01:26:59,990 --> 01:26:57,360
materials research aboard the

1842
01:27:02,209 --> 01:27:00,000
International Space Station hi I'm NASA

1843
01:27:04,729 --> 01:27:02,219
astronaut Tracy Dyson welcome to station