1
00:00:15,030 --> 00:00:12,070
[Music]

2
00:00:26,810 --> 00:00:15,040
the next one

3
00:00:51,250 --> 00:00:35,510
[Music]

4
00:01:30,410 --> 00:00:52,310
thank you

5
00:01:35,810 --> 00:01:33,469
hello I'm Hayden Baggett a conference

6
00:01:37,789 --> 00:01:35,820
programmer at South by Southwest and I'm

7
00:01:38,870 --> 00:01:37,799
excited to welcome you to our day five

8
00:01:41,030 --> 00:01:38,880
Keynote

9
00:01:42,890 --> 00:01:41,040
before we get to today's keynote I've

10
00:01:45,109 --> 00:01:42,900
got some housekeeping notes

11
00:01:47,810 --> 00:01:45,119
we're running slido today

12
00:01:49,730 --> 00:01:47,820
through for our audience q a you can

13
00:01:52,010 --> 00:01:49,740

find this by opening the session listing

14
00:01:54,530 --> 00:01:52,020
in the South by Southwest Go app by

15
00:01:56,810 --> 00:01:54,540
clicking on the engage button

16
00:01:59,030 --> 00:01:56,820
on Wednesday our creative Industries

17
00:02:03,109 --> 00:01:59,040
Expo will be free and open to the public

18
00:02:08,510 --> 00:02:05,690
after years of planning and countless

19
00:02:11,990 --> 00:02:08,520
man-hours the James Webb Space Telescope

20
00:02:14,750 --> 00:02:12,000
was successfully deployed last year this

21
00:02:17,750 --> 00:02:14,760
Monumental achievement highlights

22
00:02:20,809 --> 00:02:17,760
that perseverance and collaboration are

23
00:02:23,330 --> 00:02:20,819
at the heart of what makes us human

24
00:02:26,330 --> 00:02:23,340
each year We Gather from all over the

25
00:02:28,610 --> 00:02:26,340
world to celebrate this core principle

26
00:02:31,550 --> 00:02:28,620
at South by Southwest

27
00:02:34,130 --> 00:02:31,560
with that in mind please join me in

28
00:02:40,030 --> 00:02:34,140
welcoming NASA's Laura bets to the stage

29
00:02:40,040 --> 00:02:49,610
thank you

30
00:02:55,850 --> 00:02:53,030
hey how's it going I'm Laura Betts and

31
00:02:57,770 --> 00:02:55,860
I'm incredibly excited to introduce you

32
00:03:00,890 --> 00:02:57,780
to our unfold the universe panel

33
00:03:02,809 --> 00:03:00,900
featuring scientists from NASA's James

34
00:03:05,210 --> 00:03:02,819
Webb Space Telescope

35
00:03:07,369 --> 00:03:05,220
with us today we have four

36
00:03:11,170 --> 00:03:07,379
astrophysicists from the team

37
00:03:14,910 --> 00:03:11,180
Macarena Garcia Marin Amber strong

38
00:03:22,190 --> 00:03:14,920

Stephanie Milam and Nicole colon

39
00:03:25,070 --> 00:03:22,200
[Applause]

40
00:03:27,830 --> 00:03:25,080
the James Webb Space Telescope is the

41
00:03:32,390 --> 00:03:27,840
largest and most complex Space Telescope

42
00:03:35,270 --> 00:03:32,400
ever built this is the result of 20 000

43
00:03:36,890 --> 00:03:35,280
people people from around the world

44
00:03:39,710 --> 00:03:36,900
working together

45
00:03:42,890 --> 00:03:39,720
Webb will solve mysteries of in our

46
00:03:45,589 --> 00:03:42,900
Solar System look Beyond Distant Worlds

47
00:03:48,170 --> 00:03:45,599
around other stars and probe the

48
00:03:51,410 --> 00:03:48,180
mysterious structures and origins of our

49
00:03:54,830 --> 00:03:51,420
universe and our place in it Webb is an

50
00:03:57,530 --> 00:03:54,840
international program led by NASA with

51
00:03:58,789 --> 00:03:57,540
its Partners Issa and the Canadian space

52
00:04:01,850 --> 00:03:58,799
agency

53
00:04:03,589 --> 00:04:01,860
this telescope is working better than

54
00:04:05,990 --> 00:04:03,599
ever expected

55
00:04:08,990 --> 00:04:06,000
following its successful launch in

56
00:04:12,289 --> 00:04:09,000
December 2021 and the start of science

57
00:04:14,890 --> 00:04:12,299
operations in July 2022.

58
00:04:18,650 --> 00:04:14,900
today we are sharing with you a

59
00:04:21,770 --> 00:04:18,660
never-before-seen image from Webb I'm so

60
00:04:24,230 --> 00:04:21,780
honored to be with the team that's going

61
00:04:25,730 --> 00:04:24,240
to share more about this image and what

62
00:04:27,530 --> 00:04:25,740
we've been learning from this powerful

63
00:04:29,870 --> 00:04:27,540

telescope

64
00:04:35,870 --> 00:04:29,880
here

65
00:04:39,890 --> 00:04:35,880
image that's come out from NASA's James

66
00:04:46,370 --> 00:04:43,850
the beautiful wolf Raye star

67
00:04:47,749 --> 00:04:46,380
Amber can you tell us a little bit more

68
00:04:49,790 --> 00:04:47,759
about this image

69
00:04:52,430 --> 00:04:49,800
sure I think anytime we're talking about

70
00:04:56,510 --> 00:04:52,440
astronomy It's always important to think

71
00:04:58,249 --> 00:04:56,520
of the concepts of context and scale you

72
00:04:59,510 --> 00:04:58,259
know those of of us that aren't used to

73
00:05:01,969 --> 00:04:59,520
thinking about these things every day

74
00:05:04,430 --> 00:05:01,979
and even those of us that are need to be

75
00:05:05,870 --> 00:05:04,440
reminded and so what we're seeing in

76
00:05:08,570 --> 00:05:05,880
this beautiful new image at the very

77
00:05:10,070 --> 00:05:08,580
center is a star the light from that

78
00:05:13,610 --> 00:05:10,080
star has been traveling through space

79
00:05:16,550 --> 00:05:13,620
for about 15 000 years 15 000 light

80
00:05:19,129 --> 00:05:16,560
years away until it hit the detectors on

81
00:05:21,050 --> 00:05:19,139
the telescope and the material that

82
00:05:25,249 --> 00:05:21,060
you're seeing around the central star

83
00:05:27,469 --> 00:05:25,259
that looks like dust is dust and so at

84
00:05:30,409 --> 00:05:27,479
the end of a star's life

85
00:05:32,270 --> 00:05:30,419
it they shed their outer material their

86
00:05:34,550 --> 00:05:32,280
outer layers out into the rest of the

87
00:05:36,110 --> 00:05:34,560
universe and I think this is one of the

88
00:05:39,110 --> 00:05:36,120

most beautiful Concepts in all of

89
00:05:42,170 --> 00:05:39,120
astronomy this is Carl Sagan's Stardust

90
00:05:44,330 --> 00:05:42,180
concept the fact that the iron in your

91
00:05:47,090 --> 00:05:44,340
blood and the calcium in your bones was

92
00:05:49,370 --> 00:05:47,100
literally forged inside of a star that

93
00:05:50,689 --> 00:05:49,380
exploded billions of years ago and

94
00:05:52,670 --> 00:05:50,699
that's what we're seeing in this new

95
00:05:55,370 --> 00:05:52,680
image that dust is spreading out into

96
00:05:57,110 --> 00:05:55,380
the cosmos and will eventually create

97
00:05:59,330 --> 00:05:57,120
planets

98
00:06:00,529 --> 00:05:59,340
and um this is this is how we got here

99
00:06:03,890 --> 00:06:00,539
in fact

100
00:06:05,570 --> 00:06:03,900
wow so beautiful Monica can you tell us

101
00:06:08,870 --> 00:06:05,580
a little bit more about why this is

102
00:06:11,090 --> 00:06:08,880
important sure so this Warfare Stars

103
00:06:12,590 --> 00:06:11,100
they are really big and bright and

104
00:06:14,990 --> 00:06:12,600
incredibly hot so they're really bold

105
00:06:17,570 --> 00:06:15,000
objects this one in particular is 30

106
00:06:19,490 --> 00:06:17,580
times the mass of our sun so it's very

107
00:06:21,830 --> 00:06:19,500
big and when they are we know that the

108
00:06:24,290 --> 00:06:21,840
stars that are this big they live fast

109
00:06:27,469 --> 00:06:24,300
they go through the you know different

110
00:06:29,270 --> 00:06:27,479
stages in very quick time and some of

111
00:06:32,270 --> 00:06:29,280
them only some of them end up being this

112
00:06:35,210 --> 00:06:32,280
Warfare to later on become a supernova

113
00:06:37,370 --> 00:06:35,220

so it's really uh unique that we can see

114
00:06:40,309 --> 00:06:37,380
and study this starts with least detail

115
00:06:43,370 --> 00:06:40,319
with jwst for the first time in the

116
00:06:45,110 --> 00:06:43,380
infrared so asunder was saying this stud

117
00:06:47,870 --> 00:06:45,120
has shared a lot of guys and we're

118
00:06:49,790 --> 00:06:47,880
talking 10 times worth our sun so it's

119
00:06:53,090 --> 00:06:49,800
really a lot of material going into

120
00:06:55,610 --> 00:06:53,100
space and as it goes away from the star

121
00:06:58,550 --> 00:06:55,620
of this glass cools down when it cools

122
00:07:00,529 --> 00:06:58,560
down it forms dust and that does when it

123
00:07:03,409 --> 00:07:00,539
gets colder it glows in the infrared

124
00:07:05,150 --> 00:07:03,419
which is exactly what James Webb looks

125
00:07:06,890 --> 00:07:05,160
at the in front of the lights so what is

126
00:07:08,629 --> 00:07:06,900
in front of the light it's it's

127
00:07:10,730 --> 00:07:08,639
it's a type of light we don't see with

128
00:07:12,469 --> 00:07:10,740
our eyes with our eyes we see visible we

129
00:07:15,230 --> 00:07:12,479
see the Reds the blues and the greens

130
00:07:16,969 --> 00:07:15,240
infrared is a light it's a the fraction

131
00:07:18,710 --> 00:07:16,979
of the light that is really sensitive to

132
00:07:21,469 --> 00:07:18,720
temperature everything that has a

133
00:07:24,290 --> 00:07:21,479
temperature from our bodies to a piece

134
00:07:27,170 --> 00:07:24,300
of ice emits in the infrared and so with

135
00:07:29,930 --> 00:07:27,180
it we can observe really in a very

136
00:07:31,309 --> 00:07:29,940
advantages we still adopted so we can

137
00:07:33,710 --> 00:07:31,319
there are three men about that

138
00:07:36,770 --> 00:07:33,720

disadvantages you can see through the

139
00:07:38,629 --> 00:07:36,780
dust and the gas and then really see for

140
00:07:40,969 --> 00:07:38,639
instance astral nurseries that are

141
00:07:43,490 --> 00:07:40,979
forming behind we can also see color of

142
00:07:45,710 --> 00:07:43,500
this I call dust and colder planets and

143
00:07:47,450 --> 00:07:45,720
we can look back in time and this is

144
00:07:49,610 --> 00:07:47,460
um one of the main reasons why we build

145
00:07:51,830 --> 00:07:49,620
well was to actually look at the very

146
00:07:53,809 --> 00:07:51,840
first soldiers of the universe so when

147
00:07:56,029 --> 00:07:53,819
those objects form about

148
00:07:58,909 --> 00:07:56,039
more than 13 billion years ago they

149
00:08:00,950 --> 00:07:58,919
needed light light is a wave and as it

150
00:08:03,770 --> 00:08:00,960
travels through the rivers through the

151
00:08:05,870 --> 00:08:03,780
expanded universe towards us it expands

152
00:08:08,390 --> 00:08:05,880
like literally like a slinky

153
00:08:10,490 --> 00:08:08,400
so it moves from the visible light to

154
00:08:12,350 --> 00:08:10,500
the infrared light and then wet can see

155
00:08:14,150 --> 00:08:12,360
it as we'll see for the first time with

156
00:08:15,890 --> 00:08:14,160
his details so we've never seen that

157
00:08:18,650 --> 00:08:15,900
before it's really exciting oh

158
00:08:21,409 --> 00:08:18,660
definitely thank you so much so this

159
00:08:23,029 --> 00:08:21,419
image is just one of many that we've

160
00:08:25,909 --> 00:08:23,039
seen since we've started science

161
00:08:28,430 --> 00:08:25,919
operations last July the web Mission has

162
00:08:30,110 --> 00:08:28,440
been so successful and has far exceeded

163
00:08:31,790 --> 00:08:30,120

our expectations

164
00:08:34,610 --> 00:08:31,800
let's take a look at some of these other

165
00:08:36,350 --> 00:08:34,620
stunning images starting with the solar

166
00:08:38,209 --> 00:08:36,360
system Stephanie

167
00:08:41,329 --> 00:08:38,219
can you tell us a little bit more about

168
00:08:43,370 --> 00:08:41,339
this image absolutely but before I get

169
00:08:46,640 --> 00:08:43,380
started I want to wish my dad a happy

170
00:08:55,610 --> 00:08:53,150
[Applause]

171
00:08:57,470 --> 00:08:55,620
Jupiter this is actually the Jupiter

172
00:08:59,750 --> 00:08:57,480
system and it is one of my favorite

173
00:09:03,110 --> 00:08:59,760
images that we've released because it's

174
00:09:04,610 --> 00:09:03,120
a lot closer to home for all of us we

175
00:09:06,350 --> 00:09:04,620
will be observing the solar system with

176
00:09:08,150 --> 00:09:06,360
the James Webb Space Telescope and have

177
00:09:09,829 --> 00:09:08,160
been doing so and this was our first

178
00:09:11,570 --> 00:09:09,839
science image that we released of

179
00:09:14,870 --> 00:09:11,580
Jupiter in its system

180
00:09:17,630 --> 00:09:14,880
what is so fantastic about this image is

181
00:09:19,790 --> 00:09:17,640
in order to image something as big and

182
00:09:23,329 --> 00:09:19,800
bright as Jupiter but also in the same

183
00:09:25,610 --> 00:09:23,339
image capture the faint rings tiny

184
00:09:27,889 --> 00:09:25,620
satellites and all the intricate details

185
00:09:31,910 --> 00:09:27,899
of this planet means that we had to have

186
00:09:34,550 --> 00:09:31,920
a factor of 10 000 in contrast so

187
00:09:36,590 --> 00:09:34,560
something 10 000 brighter than like

188
00:09:38,990 --> 00:09:36,600

Jupiter compared to its own rings and

189
00:09:41,750 --> 00:09:39,000
satellites so it really shows the

190
00:09:44,210 --> 00:09:41,760
capability of jwst in observing things

191
00:09:46,550 --> 00:09:44,220
in our solar system everything from the

192
00:09:49,070 --> 00:09:46,560
Aurora on the boat on either pole of

193
00:09:51,470 --> 00:09:49,080
this of this planet the Great Red Spot

194
00:09:53,990 --> 00:09:51,480
which is white in this image because of

195
00:09:56,449 --> 00:09:54,000
the colors that we chose to depict it

196
00:09:58,910 --> 00:09:56,459
and all the Fantastic detail of the

197
00:10:00,350 --> 00:09:58,920
weather in in the atmosphere of Jupiter

198
00:10:02,509 --> 00:10:00,360
we're going to be observing everything

199
00:10:05,810 --> 00:10:02,519
in our solar system the jwst can point

200
00:10:08,509 --> 00:10:05,820
to from near-earth asteroids comets

201
00:10:10,310 --> 00:10:08,519
Interstellar objects all of the planets

202
00:10:12,470 --> 00:10:10,320
and their satellites to the farthest

203
00:10:14,840 --> 00:10:12,480
reaches of our solar system including

204
00:10:16,269 --> 00:10:14,850
our favorite minor planet Pluto

205
00:10:18,829 --> 00:10:16,279
[Laughter]

206
00:10:21,710 --> 00:10:18,839
so lots and more to come

207
00:10:24,230 --> 00:10:21,720
thank you and Nicole we've also been

208
00:10:27,350 --> 00:10:24,240
able to learn more about exoplanets or

209
00:10:29,389 --> 00:10:27,360
planets outside of our solar system can

210
00:10:31,550 --> 00:10:29,399
you tell us a little bit more how Webb

211
00:10:33,170 --> 00:10:31,560
is studying exoplanets and really what

212
00:10:36,050 --> 00:10:33,180
we've learned so far

213
00:10:37,910 --> 00:10:36,060

yeah absolutely I I wish we had as

214
00:10:40,310 --> 00:10:37,920
beautiful pictures of Jupiter as we did

215
00:10:43,610 --> 00:10:40,320
of these Distant Worlds but they're very

216
00:10:45,470 --> 00:10:43,620
far away uh so we have to be kind of

217
00:10:48,490 --> 00:10:45,480
creative in the techniques that we used

218
00:10:52,069 --> 00:10:48,500
to study these distant exoplanets and so

219
00:10:54,470 --> 00:10:52,079
jwst is you know a provider of these

220
00:10:55,610 --> 00:10:54,480
amazing images but it also is really

221
00:10:58,430 --> 00:10:55,620
great at doing something called

222
00:11:00,590 --> 00:10:58,440
spectroscopy so all that really means is

223
00:11:02,569 --> 00:11:00,600
we're taking the rainbow of light and

224
00:11:04,610 --> 00:11:02,579
breaking it down so we can measure the

225
00:11:07,670 --> 00:11:04,620
chemical Fingerprints of of objects in

226
00:11:09,410 --> 00:11:07,680
the universe and so with exoplanets one

227
00:11:11,690 --> 00:11:09,420
way we can study them and study their

228
00:11:13,490 --> 00:11:11,700
atmospheres is by looking at ones that

229
00:11:16,250 --> 00:11:13,500
pass in front of their star

230
00:11:19,970 --> 00:11:16,260
and then when that happens as shown in

231
00:11:23,150 --> 00:11:19,980
the animation uh what we can see is star

232
00:11:25,970 --> 00:11:23,160
light blocked by the planet plus its

233
00:11:27,650 --> 00:11:25,980
atmosphere so we can break down what

234
00:11:30,769 --> 00:11:27,660
light gets filtered by the planet

235
00:11:34,190 --> 00:11:30,779
atmosphere to reveal what the atmosphere

236
00:11:35,569 --> 00:11:34,200
is made of and so using this technique

237
00:11:38,810 --> 00:11:35,579
we've already made some great

238
00:11:40,490 --> 00:11:38,820

discoveries with jwst so this is real

239
00:11:42,590 --> 00:11:40,500
data that you're seeing here again it's

240
00:11:44,870 --> 00:11:42,600
not a pretty image the the background

241
00:11:47,750 --> 00:11:44,880
illustration is just an illustration of

242
00:11:50,690 --> 00:11:47,760
of a giant gaseous Jupiter sized Planet

243
00:11:53,949 --> 00:11:50,700
but just 700 light years away

244
00:11:56,870 --> 00:11:53,959
um you know just 700. so it's pretty far

245
00:11:59,810 --> 00:11:56,880
but the really neat thing about this is

246
00:12:02,810 --> 00:11:59,820
we see this massive bump in the data and

247
00:12:04,730 --> 00:12:02,820
what that is revealing is that the

248
00:12:06,650 --> 00:12:04,740
planet plus its atmosphere is blocking

249
00:12:08,990 --> 00:12:06,660
extra light from the Star and that tells

250
00:12:11,810 --> 00:12:09,000
us this whopping signal is carbon

251
00:12:13,430 --> 00:12:11,820
dioxide in that exoplanet atmosphere and

252
00:12:14,930 --> 00:12:13,440
the reason this is so groundbreaking is

253
00:12:17,569 --> 00:12:14,940
because it's the first definitive

254
00:12:19,610 --> 00:12:17,579
detection of carbon dioxide outside the

255
00:12:21,590 --> 00:12:19,620
solar system we know about Jupiter and

256
00:12:23,630 --> 00:12:21,600
Saturn and all these planets and we can

257
00:12:24,949 --> 00:12:23,640
tell their atmospheres but now we need

258
00:12:26,690 --> 00:12:24,959
to learn about all these other worlds

259
00:12:28,130 --> 00:12:26,700
because there are over 5000 of them out

260
00:12:30,769 --> 00:12:28,140
there

261
00:12:32,210 --> 00:12:30,779
files and another thing I've been really

262
00:12:34,850 --> 00:12:32,220
excited about is what we've been

263
00:12:36,470 --> 00:12:34,860

learning with galaxies Maca can you tell

264
00:12:39,170 --> 00:12:36,480
me a little bit more about that of

265
00:12:41,389 --> 00:12:39,180
course so all planets and stars they

266
00:12:43,009 --> 00:12:41,399
sort of live in neighborhoods and those

267
00:12:44,930 --> 00:12:43,019
neighbors who have galaxies so I like to

268
00:12:47,030 --> 00:12:44,940
think of a glasses as the building

269
00:12:49,129 --> 00:12:47,040
blocks of our universe there are many of

270
00:12:51,110 --> 00:12:49,139
them and this beautiful image shows a

271
00:12:52,970 --> 00:12:51,120
group of galaxies that are sort of

272
00:12:54,410 --> 00:12:52,980
having a cosmic dance I like to think

273
00:12:57,050 --> 00:12:54,420
about it so they are interacting with

274
00:12:58,250 --> 00:12:57,060
each other as they get close and as you

275
00:13:00,230 --> 00:12:58,260
can see here

276
00:13:02,150 --> 00:13:00,240
the gravitational pull and the

277
00:13:04,970 --> 00:13:02,160
neighborhood so they get so close that

278
00:13:06,650 --> 00:13:04,980
it's a very slow and a very intense

279
00:13:08,509 --> 00:13:06,660
process and really the stores the Galaxy

280
00:13:11,690 --> 00:13:08,519
creates plumes creates beautiful

281
00:13:14,389 --> 00:13:11,700
structures but it also does create new

282
00:13:16,610 --> 00:13:14,399
stars and it really creates that

283
00:13:17,810 --> 00:13:16,620
possibility of having from two different

284
00:13:20,090 --> 00:13:17,820
galaxies

285
00:13:22,069 --> 00:13:20,100
a new Galaxy that could be maybe a big

286
00:13:24,110 --> 00:13:22,079
elliptical so by the end of this process

287
00:13:25,329 --> 00:13:24,120
you will either have a completely new

288
00:13:27,769 --> 00:13:25,339

Galaxy

289
00:13:30,170 --> 00:13:27,779
another galaxy that can go away and

290
00:13:32,629 --> 00:13:30,180
essentially really understand how they

291
00:13:34,250 --> 00:13:32,639
form an evolve and at the center of each

292
00:13:36,230 --> 00:13:34,260
of these galaxies we have a super

293
00:13:38,389 --> 00:13:36,240
massive black hole which is also a very

294
00:13:40,250 --> 00:13:38,399
I mean it's very interesting

295
00:13:43,069 --> 00:13:40,260
um to me because supermassive black

296
00:13:45,110 --> 00:13:43,079
holes we really don't know yet how they

297
00:13:48,290 --> 00:13:45,120
are formed there's a lot of Discovery

298
00:13:49,670 --> 00:13:48,300
Space in there and interaction is a very

299
00:13:52,370 --> 00:13:49,680
important part of Galaxy Evolution

300
00:13:54,949 --> 00:13:52,380
because we think all galaxies undergo

301
00:13:57,650 --> 00:13:54,959
one of these processes at least once in

302
00:14:00,650 --> 00:13:57,660
their life so it's really driven the

303
00:14:03,009 --> 00:14:00,660
universe we see today so yeah it's one

304
00:14:05,329 --> 00:14:03,019
of my favorites essentially thank you

305
00:14:07,370 --> 00:14:05,339
unveiled by President Biden in the

306
00:14:09,590 --> 00:14:07,380
summer we've been able to see Webb's

307
00:14:10,970 --> 00:14:09,600
Deep Field Amber can you tell us a

308
00:14:14,509 --> 00:14:10,980
little bit more about that

309
00:14:16,629 --> 00:14:14,519
sure and again scale is really important

310
00:14:19,790 --> 00:14:16,639
for these deep filled images

311
00:14:22,310 --> 00:14:19,800
so and just to make a sort of hinted at

312
00:14:24,530 --> 00:14:22,320
it but to sort of take us all back to

313
00:14:27,590 --> 00:14:24,540

middle school science class right our

314
00:14:29,449 --> 00:14:27,600
sun and our planets um are part of the

315
00:14:31,790 --> 00:14:29,459
Milky Way galaxy which has a couple

316
00:14:34,730 --> 00:14:31,800
hundred billion stars just in our Milky

317
00:14:36,530 --> 00:14:34,740
Way galaxy and so what we're seeing in

318
00:14:39,530 --> 00:14:36,540
this image almost every single point of

319
00:14:42,470 --> 00:14:39,540
light here is itself an individual

320
00:14:44,870 --> 00:14:42,480
Galaxy filled with hundreds of billions

321
00:14:47,030 --> 00:14:44,880
of stars and so you might think okay

322
00:14:50,090 --> 00:14:47,040
well this must be like the whole sky but

323
00:14:52,610 --> 00:14:50,100
actually it's not so the size of this

324
00:14:54,650 --> 00:14:52,620
image on the sky would be about the size

325
00:14:57,290 --> 00:14:54,660
of a grain of sand if you held it out at

326
00:15:00,050 --> 00:14:57,300
arm's length so it's a very tiny piece

327
00:15:03,530 --> 00:15:00,060
of sky and in this tiny piece of Sky we

328
00:15:05,810 --> 00:15:03,540
see 10 000 galaxies so it sort of starts

329
00:15:07,730 --> 00:15:05,820
to give you a sense of the Scale of the

330
00:15:09,590 --> 00:15:07,740
Universe and in fact I think that's one

331
00:15:12,650 --> 00:15:09,600
of the the most beautiful things that

332
00:15:15,230 --> 00:15:12,660
these space telescopes have in US is a

333
00:15:17,030 --> 00:15:15,240
sense of the the absolute enormity of

334
00:15:19,430 --> 00:15:17,040
the universe

335
00:15:23,689 --> 00:15:19,440
thank you and this project is the result

336
00:15:27,230 --> 00:15:23,699
of two decades of hard work 14 countries

337
00:15:29,269 --> 00:15:27,240
working together and 29 States

338
00:15:31,730 --> 00:15:29,279

tell us a little bit more about the

339
00:15:37,310 --> 00:15:31,740
journey to get here for web and what is

340
00:15:42,230 --> 00:15:39,590
it's groundbreaking you really need many

341
00:15:43,790 --> 00:15:42,240
many years so it took decades to

342
00:15:45,829 --> 00:15:43,800
you know

343
00:15:47,750 --> 00:15:45,839
decades three different agencies many

344
00:15:49,430 --> 00:15:47,760
different countries thousands of people

345
00:15:50,930 --> 00:15:49,440
with you know putting their minds on

346
00:15:55,250 --> 00:15:50,940
brain and Ingenuity to make this

347
00:15:57,050 --> 00:15:55,260
possible so from the original scientific

348
00:15:58,850 --> 00:15:57,060
reason which is exactly what Amber was

349
00:16:00,889 --> 00:15:58,860
now describing let's look at the first

350
00:16:04,210 --> 00:16:00,899
galaxies that were formed so from that

351
00:16:07,550 --> 00:16:04,220
initial concept to design build

352
00:16:09,889 --> 00:16:07,560
Implement integration and testing and by

353
00:16:11,269 --> 00:16:09,899
the way one of our most important

354
00:16:14,569 --> 00:16:11,279
testing companies who stand in Houston

355
00:16:17,269 --> 00:16:14,579
here around the corner in 2017 so it's

356
00:16:18,889 --> 00:16:17,279
really nice to be back it's really nice

357
00:16:20,750 --> 00:16:18,899
to be in the area

358
00:16:22,670 --> 00:16:20,760
um and here in this video it's a

359
00:16:25,189 --> 00:16:22,680
celebration of I mean you seeking

360
00:16:27,290 --> 00:16:25,199
moments like lunch you see moments like

361
00:16:31,430 --> 00:16:27,300
integration this is in Corolla the

362
00:16:33,710 --> 00:16:31,440
French Guyana and this was all thanks to

363
00:16:35,750 --> 00:16:33,720

the work of the team and it really shows

364
00:16:37,850 --> 00:16:35,760
how when we work together

365
00:16:39,710 --> 00:16:37,860
we put together our minds and Brands as

366
00:16:42,530 --> 00:16:39,720
a matter which nationality which agency

367
00:16:45,889 --> 00:16:42,540
it really shows how we can achieve

368
00:16:47,930 --> 00:16:45,899
essentially the unachievable and really

369
00:16:50,030 --> 00:16:47,940
May groundbreaking science and history

370
00:16:52,370 --> 00:16:50,040
in this case

371
00:16:54,230 --> 00:16:52,380
and as a result of all that web is

372
00:16:56,329 --> 00:16:54,240
working better than expected it's

373
00:16:57,530 --> 00:16:56,339
already starting to change our views of

374
00:16:59,990 --> 00:16:57,540
the universe

375
00:17:03,230 --> 00:17:00,000
why and how do you think web is really

376
00:17:04,610 --> 00:17:03,240
contributing to these discoveries

377
00:17:06,890 --> 00:17:04,620
Amber

378
00:17:09,350 --> 00:17:06,900
well we've already talked a little bit

379
00:17:11,870 --> 00:17:09,360
about about some of the the sort of big

380
00:17:14,870 --> 00:17:11,880
questions that that we hope that that

381
00:17:17,150 --> 00:17:14,880
jrc will answer and to go back to the

382
00:17:19,610 --> 00:17:17,160
Deep Field you know one of the primary

383
00:17:22,370 --> 00:17:19,620
reasons we built the telescope the way

384
00:17:24,829 --> 00:17:22,380
we did was to be able to look back in

385
00:17:27,049 --> 00:17:24,839
time and see those that very first epic

386
00:17:28,730 --> 00:17:27,059
of galaxies that were born in the Big

387
00:17:30,710 --> 00:17:28,740
Bang right after the big bang so we're

388
00:17:33,830 --> 00:17:30,720

talking about looking back in time over

389
00:17:35,510 --> 00:17:33,840
13 and a half billion years to see a

390
00:17:36,409 --> 00:17:35,520
part of space that we've never seen

391
00:17:39,049 --> 00:17:36,419
before

392
00:17:41,690 --> 00:17:39,059
and one of the really interesting things

393
00:17:43,310 --> 00:17:41,700
that's happened you know we didn't know

394
00:17:45,110 --> 00:17:43,320
what we would see right where this is

395
00:17:48,049 --> 00:17:45,120
Uncharted Territory in terms of space

396
00:17:49,909 --> 00:17:48,059
we've never seen it before and we hoped

397
00:17:51,289 --> 00:17:49,919
that we would be able to see galaxies in

398
00:17:54,049 --> 00:17:51,299
that part of space but we really didn't

399
00:17:56,570 --> 00:17:54,059
know because we'd never looked and so

400
00:17:59,270 --> 00:17:56,580
these first few months of data are

401
00:18:01,130 --> 00:17:59,280
showing us that galaxies we are

402
00:18:03,409 --> 00:18:01,140
detecting galaxies in that part of space

403
00:18:05,750 --> 00:18:03,419
which is great news

404
00:18:07,370 --> 00:18:05,760
um but the surprising thing is is that

405
00:18:10,130 --> 00:18:07,380
the galaxies that we're finding in the

406
00:18:14,029 --> 00:18:10,140
very very early Universe are much bigger

407
00:18:17,390 --> 00:18:14,039
and much brighter than we expected and

408
00:18:19,190 --> 00:18:17,400
we don't really understand why yet so we

409
00:18:21,049 --> 00:18:19,200
had theories of the early universe that

410
00:18:23,930 --> 00:18:21,059
told us how we thought galaxies should

411
00:18:25,430 --> 00:18:23,940
grow very early on and it turns out that

412
00:18:27,350 --> 00:18:25,440
our observations don't match the

413
00:18:28,850 --> 00:18:27,360

theories so and we don't know yet we

414
00:18:30,710 --> 00:18:28,860
don't know what's going on and this is a

415
00:18:32,510 --> 00:18:30,720
really fun place to be in science is

416
00:18:34,010 --> 00:18:32,520
where we're really trying to figure it

417
00:18:36,169 --> 00:18:34,020
out and make our theories match the

418
00:18:39,289 --> 00:18:36,179
observations so I think that's one of

419
00:18:40,909 --> 00:18:39,299
the most for me I study galaxies and how

420
00:18:43,310 --> 00:18:40,919
how stars and black holes grow in

421
00:18:45,350 --> 00:18:43,320
galaxies so so this is my favorite topic

422
00:18:47,029 --> 00:18:45,360
but I think one of the most surprising

423
00:18:48,710 --> 00:18:47,039
things that we've already discovered in

424
00:18:51,169 --> 00:18:48,720
just the first few months of operations

425
00:18:53,810 --> 00:18:51,179
is the fact that these galaxies you know

426
00:18:55,490 --> 00:18:53,820
grew really fast and really big so it's

427
00:18:56,630 --> 00:18:55,500
it's really interesting we don't know

428
00:18:59,330 --> 00:18:56,640
why

429
00:19:02,270 --> 00:18:59,340
thanks and for you Nicole

430
00:19:05,270 --> 00:19:02,280
yeah you know with uh exoplanets again

431
00:19:08,390 --> 00:19:05,280
we've talked about the first detection

432
00:19:11,029 --> 00:19:08,400
of carbon dioxide outside our solar

433
00:19:13,909 --> 00:19:11,039
system but going beyond that we've

434
00:19:17,570 --> 00:19:13,919
already seen that jwst data is is just

435
00:19:20,090 --> 00:19:17,580
so good it's so precise that we are able

436
00:19:21,950 --> 00:19:20,100
to detect additional molecules in these

437
00:19:24,650 --> 00:19:21,960
distant exoplanet atmospheres that we've

438
00:19:26,510 --> 00:19:24,660

never really expected to see one of

439
00:19:28,789 --> 00:19:26,520
those is sulfur dioxide which is

440
00:19:30,529 --> 00:19:28,799
actually created the same way Earth's

441
00:19:33,770 --> 00:19:30,539
ozone layer is created it's a

442
00:19:35,330 --> 00:19:33,780
photochemical process and there's these

443
00:19:37,669 --> 00:19:35,340
reactions these chemical reactions

444
00:19:39,350 --> 00:19:37,679
happening in the atmosphere is that we

445
00:19:41,330 --> 00:19:39,360
just literally didn't think we'd be able

446
00:19:42,710 --> 00:19:41,340
to see them with jwst even though we

447
00:19:44,810 --> 00:19:42,720
knew it would be great telescope you

448
00:19:47,750 --> 00:19:44,820
know it was still just that much better

449
00:19:50,270 --> 00:19:47,760
than expected and we're so excited I

450
00:19:52,610 --> 00:19:50,280
mean even these initial detections that

451
00:19:54,710 --> 00:19:52,620
we're making they're already rewriting

452
00:19:57,590 --> 00:19:54,720
the textbooks for our understanding of

453
00:20:00,890 --> 00:19:57,600
the composition like going from galaxies

454
00:20:02,870 --> 00:20:00,900
and formation time scales to exoplanet

455
00:20:05,750 --> 00:20:02,880
information and solar system you know in

456
00:20:08,150 --> 00:20:05,760
every scale we are rewriting textbooks

457
00:20:10,370 --> 00:20:08,160
like every day

458
00:20:12,650 --> 00:20:10,380
and I'm curious

459
00:20:14,930 --> 00:20:12,660
what was it like what was the feeling

460
00:20:16,610 --> 00:20:14,940
that you had when you saw that first web

461
00:20:19,250 --> 00:20:16,620
image

462
00:20:21,529 --> 00:20:19,260
Stephanie so uh for me

463
00:20:23,690 --> 00:20:21,539

um one of the first images that I I got

464
00:20:27,710 --> 00:20:23,700
to see was obviously the Karina nebula

465
00:20:29,630 --> 00:20:27,720
and this is just um one of the most the

466
00:20:31,669 --> 00:20:29,640
most breathtaking image I would argue

467
00:20:34,330 --> 00:20:31,679
that we've had to date

468
00:20:37,430 --> 00:20:34,340
um we can argue about that later

469
00:20:40,310 --> 00:20:37,440
uh but it's just it's spectacular in

470
00:20:43,070 --> 00:20:40,320
every form and it's artistic it is it is

471
00:20:45,169 --> 00:20:43,080
beautiful but it's also just bursting

472
00:20:47,510 --> 00:20:45,179
with science and Discovery

473
00:20:50,270 --> 00:20:47,520
um also if it's not your background of

474
00:20:52,190 --> 00:20:50,280
your phone or your computer screen

475
00:20:55,370 --> 00:20:52,200
um you clearly have not been paying

476
00:20:58,669 --> 00:20:56,390
um

477
00:21:01,010 --> 00:20:58,679
so what we're learning about even when

478
00:21:01,789 --> 00:21:01,020
this first image came in so beyond its

479
00:21:04,010 --> 00:21:01,799
beauty

480
00:21:05,570 --> 00:21:04,020
um I had to take a moment I had to pause

481
00:21:07,970 --> 00:21:05,580
because

482
00:21:10,010 --> 00:21:07,980
already I could see the Discovery Space

483
00:21:12,110 --> 00:21:10,020
just coming out of this the science

484
00:21:13,789 --> 00:21:12,120
there we were told we weren't allowed to

485
00:21:16,070 --> 00:21:13,799
science the images that were being

486
00:21:18,590 --> 00:21:16,080
released in the first uh the first set

487
00:21:20,330 --> 00:21:18,600
of images and it was so hard to sit

488
00:21:22,070 --> 00:21:20,340

there and keep your mouth shut about all

489
00:21:24,770 --> 00:21:22,080
the things that we can see already the

490
00:21:26,450 --> 00:21:24,780
Discovery Space the new the new ways

491
00:21:28,730 --> 00:21:26,460
that we can see Star formation and plan

492
00:21:32,450 --> 00:21:28,740
information happening it's like

493
00:21:33,770 --> 00:21:32,460
happening in this picture and it was it

494
00:21:36,830 --> 00:21:33,780
was an emotional experience the

495
00:21:38,810 --> 00:21:36,840
culmination of you know the multiple

496
00:21:41,270 --> 00:21:38,820
Decades of people working together to

497
00:21:44,330 --> 00:21:41,280
build this telescope the six months of

498
00:21:46,850 --> 00:21:44,340
day in and day out commissioning waiting

499
00:21:48,649 --> 00:21:46,860
for these images to be released

500
00:21:50,750 --> 00:21:48,659
um it was a lot of energy and it was

501
00:21:53,390 --> 00:21:50,760
just a lot of relief and it was a lot of

502
00:21:56,510 --> 00:21:53,400
excitement so um I'm just excited for

503
00:21:56,520 --> 00:22:00,890
anyone else any thoughts you had

504
00:22:05,090 --> 00:22:02,930
[Laughter]

505
00:22:07,310 --> 00:22:05,100
very similarly so

506
00:22:09,529 --> 00:22:07,320
um for me my first image was

507
00:22:10,970 --> 00:22:09,539
um when we were you know launched I

508
00:22:12,470 --> 00:22:10,980
started to switch on the instruments

509
00:22:14,630 --> 00:22:12,480
which on the detectors and you start to

510
00:22:16,190 --> 00:22:14,640
get this first engineering images that

511
00:22:18,710 --> 00:22:16,200
obviously are not as beautiful as this

512
00:22:20,630 --> 00:22:18,720
one but they already indicated how well

513
00:22:21,470 --> 00:22:20,640

everything was working and then at some

514
00:22:23,690 --> 00:22:21,480
point

515
00:22:25,190 --> 00:22:23,700
um there was all the work of making all

516
00:22:26,810 --> 00:22:25,200
the mirrors assignment the mirrors to

517
00:22:28,669 --> 00:22:26,820
work as a single one and I'm sure you

518
00:22:31,310 --> 00:22:28,679
also that first

519
00:22:34,250 --> 00:22:31,320
sort of um again engineering image

520
00:22:36,350 --> 00:22:34,260
showing a very bright sharp star in the

521
00:22:37,970 --> 00:22:36,360
center which was like it is working so

522
00:22:39,890 --> 00:22:37,980
well and it's really going Beyond

523
00:22:42,350 --> 00:22:39,900
expectations but also you could see

524
00:22:44,930 --> 00:22:42,360
around all these little tiny galaxies

525
00:22:47,049 --> 00:22:44,940
that personally I didn't expect to be so

526
00:22:50,149 --> 00:22:47,059
many of them

527
00:22:51,890 --> 00:22:50,159
photobombing galaxies and really it's

528
00:22:53,630 --> 00:22:51,900
it's all about

529
00:22:55,130 --> 00:22:53,640
often we were thinking like a

530
00:22:57,590 --> 00:22:55,140
preparation for commissioning oh we need

531
00:22:59,510 --> 00:22:57,600
to serve an isolated Galaxy to do this

532
00:23:01,970 --> 00:22:59,520
or that there are no I saw that they got

533
00:23:04,549 --> 00:23:01,980
isolated starts with web everything is

534
00:23:06,409 --> 00:23:04,559
surrounded by galaxies and by more

535
00:23:08,690 --> 00:23:06,419
um you know sources that are there we

536
00:23:10,130 --> 00:23:08,700
need to to explore so it was a great

537
00:23:11,930 --> 00:23:10,140
experience and of course a combination

538
00:23:13,730 --> 00:23:11,940

of Stephanie was saying was this

539
00:23:16,370 --> 00:23:13,740
beautiful set of images that was

540
00:23:19,190 --> 00:23:16,380
released for the public to enjoy and to

541
00:23:20,570 --> 00:23:19,200
really see why it was worth it but also

542
00:23:23,090 --> 00:23:20,580
for the community the scientific

543
00:23:25,370 --> 00:23:23,100
Community to really dig into data and

544
00:23:27,049 --> 00:23:25,380
start making science and start taking

545
00:23:28,909 --> 00:23:27,059
advantage and learning about a new

546
00:23:31,730 --> 00:23:28,919
Mission and your telescope that we

547
00:23:33,169 --> 00:23:31,740
launched this year so um yeah it was

548
00:23:34,970 --> 00:23:33,179
very good

549
00:23:36,049 --> 00:23:34,980
and Nicole how did that moment make you

550
00:23:38,390 --> 00:23:36,059
feel

551
00:23:40,549 --> 00:23:38,400
I mean it's similar to you know what's

552
00:23:42,770 --> 00:23:40,559
been said it's literally these pictures

553
00:23:44,510 --> 00:23:42,780
are full of just unimagined detail you

554
00:23:46,730 --> 00:23:44,520
know if you download the high-res

555
00:23:48,590 --> 00:23:46,740
versions you can zoom and scroll for

556
00:23:51,590 --> 00:23:48,600
days you know and discover new features

557
00:23:53,510 --> 00:23:51,600
and it's incredible to know that

558
00:23:55,070 --> 00:23:53,520
in these first images alone you know

559
00:23:56,450 --> 00:23:55,080
it's only the beginning and we're

560
00:23:59,210 --> 00:23:56,460
already seeing

561
00:24:02,029 --> 00:23:59,220
evidence of new stars forming galaxies

562
00:24:05,029 --> 00:24:02,039
everywhere baby planets that could be

563
00:24:07,130 --> 00:24:05,039

forming and it was just unreal and you

564
00:24:08,750 --> 00:24:07,140
know very humbling that you know we all

565
00:24:11,330 --> 00:24:08,760
did get to take part in this amazing

566
00:24:14,270 --> 00:24:11,340
journey to help get those images out to

567
00:24:15,890 --> 00:24:14,280
the public last summer and we were all

568
00:24:18,890 --> 00:24:15,900
involved in the six-month commissioning

569
00:24:20,510 --> 00:24:18,900
like around the clock work as well just

570
00:24:22,490 --> 00:24:20,520
to get these ready

571
00:24:25,549 --> 00:24:22,500
um it was so it was a lot of hard work

572
00:24:27,890 --> 00:24:25,559
but it was so worth it and you know it's

573
00:24:29,570 --> 00:24:27,900
just yeah you almost have no words to

574
00:24:31,669 --> 00:24:29,580
describe

575
00:24:33,470 --> 00:24:31,679
and then Amber how like what was going

576
00:24:36,649 --> 00:24:33,480
through your head during that moment

577
00:24:38,570 --> 00:24:36,659
yeah I mean similarly I think one of the

578
00:24:40,789 --> 00:24:38,580
most fun Parts was just being the part

579
00:24:43,130 --> 00:24:40,799
of the like behind the scenes team that

580
00:24:45,590 --> 00:24:43,140
was was getting the telescope ready for

581
00:24:47,210 --> 00:24:45,600
you know for its public debut but you

582
00:24:49,190 --> 00:24:47,220
know we got to see um the the

583
00:24:51,289 --> 00:24:49,200
engineering images that came came

584
00:24:53,450 --> 00:24:51,299
through during that six-month

585
00:24:55,370 --> 00:24:53,460
commissioning period which was a very

586
00:24:57,890 --> 00:24:55,380
intense time of getting a telescope

587
00:24:59,570 --> 00:24:57,900
ready for operations and so for me being

588
00:25:01,310 --> 00:24:59,580

part of you know being part of that team

589
00:25:03,289 --> 00:25:01,320
that was working together to get the

590
00:25:04,669 --> 00:25:03,299
telescope working was was really

591
00:25:07,130 --> 00:25:04,679
incredible and then yeah when we

592
00:25:09,289 --> 00:25:07,140
released these first images

593
00:25:10,850 --> 00:25:09,299
um it's just you know from a scientific

594
00:25:12,830 --> 00:25:10,860
standpoint like Stephanie was saying you

595
00:25:14,390 --> 00:25:12,840
know you could see the richness you

596
00:25:16,610 --> 00:25:14,400
could see the detail the things we'd

597
00:25:18,830 --> 00:25:16,620
never seen before but on a more human

598
00:25:20,990 --> 00:25:18,840
level I think for me it was good to just

599
00:25:23,510 --> 00:25:21,000
like to sort of Step Back From My

600
00:25:25,250 --> 00:25:23,520
scientist Persona and just take in the

601
00:25:28,250 --> 00:25:25,260
beauty of these images you know they're

602
00:25:30,769 --> 00:25:28,260
beautiful on a deep human level and so

603
00:25:32,810 --> 00:25:30,779
for me it was it was it was emotional

604
00:25:35,029 --> 00:25:32,820
you know I I think a lot of us were like

605
00:25:37,549 --> 00:25:35,039
we all cried we saw the images the first

606
00:25:40,610 --> 00:25:37,559
time you know they're they're um

607
00:25:43,010 --> 00:25:40,620
you know undoubtedly very beautiful

608
00:25:44,990 --> 00:25:43,020
tell me a little bit more of some of the

609
00:25:46,370 --> 00:25:45,000
other new discoveries that we've been

610
00:25:49,850 --> 00:25:46,380
seeing

611
00:25:52,310 --> 00:25:49,860
so um Beyond you know the the farthest

612
00:25:55,250 --> 00:25:52,320
galaxies and you know planets around

613
00:25:57,769 --> 00:25:55,260

other stars and exploring our solar

614
00:26:00,230 --> 00:25:57,779
system one area that we're really

615
00:26:03,110 --> 00:26:00,240
um getting a lot of new information and

616
00:26:05,690 --> 00:26:03,120
already a lot of science out of is the

617
00:26:07,549 --> 00:26:05,700
birth of stars so understanding star

618
00:26:10,010 --> 00:26:07,559
formation in a way that we've never

619
00:26:11,930 --> 00:26:10,020
really had access to we don't know how

620
00:26:14,690 --> 00:26:11,940
massive stars are formed we don't know

621
00:26:17,029 --> 00:26:14,700
how small stars or binary Stars we don't

622
00:26:19,130 --> 00:26:17,039
know how all these complex new planetary

623
00:26:22,370 --> 00:26:19,140
systems we're now seeing how they're

624
00:26:24,710 --> 00:26:22,380
formed and when we look inside these

625
00:26:26,690 --> 00:26:24,720
giant clouds of gas and dust we're

626
00:26:28,789 --> 00:26:26,700
seeing that Dynamic actually happening

627
00:26:30,950 --> 00:26:28,799
we can study the chemistry we can study

628
00:26:32,870 --> 00:26:30,960
the physics and again it's just with

629
00:26:35,330 --> 00:26:32,880
this whole new sensitivity and detail

630
00:26:36,710 --> 00:26:35,340
that we've never had before not only are

631
00:26:39,470 --> 00:26:36,720
we studying star formation in our own

632
00:26:40,850 --> 00:26:39,480
Galaxy but even in other galaxies

633
00:26:42,710 --> 00:26:40,860
um so even what we're seeing here in the

634
00:26:44,450 --> 00:26:42,720
cartwheel image we're seeing these

635
00:26:46,370 --> 00:26:44,460
galaxies are colliding but it's also

636
00:26:49,850 --> 00:26:46,380
triggering all kinds of new stars to be

637
00:26:51,470 --> 00:26:49,860
born and formed and we're getting this

638
00:26:53,690 --> 00:26:51,480

detail now that we used to only have on

639
00:26:55,730 --> 00:26:53,700
our own Galactic understanding now

640
00:26:58,669 --> 00:26:55,740
expanding into these other galaxies

641
00:27:00,830 --> 00:26:58,679
Across the Universe and it's just really

642
00:27:03,710 --> 00:27:00,840
an exciting time to be part of that

643
00:27:06,230 --> 00:27:03,720
field and understand how our son was

644
00:27:08,810 --> 00:27:06,240
born and how the solar system was was

645
00:27:10,909 --> 00:27:08,820
formed and this is giving us that first

646
00:27:13,970 --> 00:27:10,919
real glimpse of it

647
00:27:16,130 --> 00:27:13,980
and when it comes to galaxies like what

648
00:27:20,390 --> 00:27:16,140
more are we learning here

649
00:27:22,250 --> 00:27:20,400
well with jwdc the thing is that maybe

650
00:27:25,250 --> 00:27:22,260
this is like the cartwheel that you can

651
00:27:27,470 --> 00:27:25,260
see now on the screen they are close

652
00:27:29,029 --> 00:27:27,480
so you could think well is it

653
00:27:30,769 --> 00:27:29,039
quote-unquote worth or serving it with

654
00:27:32,870 --> 00:27:30,779
web and the answer is absolutely yes

655
00:27:36,769 --> 00:27:32,880
because we are seeing it so much detail

656
00:27:38,570 --> 00:27:36,779
and in-depth study so in this case for

657
00:27:41,210 --> 00:27:38,580
instance you see how this galaxy has

658
00:27:43,430 --> 00:27:41,220
this very strange shape uh like a whale

659
00:27:45,970 --> 00:27:43,440
and this is because it did undergo many

660
00:27:48,230 --> 00:27:45,980
years ago a very strong and fast

661
00:27:50,510 --> 00:27:48,240
Collision essentially with a smaller

662
00:27:52,730 --> 00:27:50,520
Galaxy that sort of went through and

663
00:27:55,250 --> 00:27:52,740

created that those spokes that were

664
00:27:57,769 --> 00:27:55,260
originally the spiral arms of the first

665
00:28:00,230 --> 00:27:57,779
Galaxy so what we can see is studying

666
00:28:02,810 --> 00:28:00,240
galaxies is we do have at hand the

667
00:28:05,269 --> 00:28:02,820
perfect laboratory to study with jwst

668
00:28:08,390 --> 00:28:05,279
how galaxies

669
00:28:10,190 --> 00:28:08,400
form evolve and and essentially how to

670
00:28:12,230 --> 00:28:10,200
start form inside you have to put

671
00:28:13,909 --> 00:28:12,240
together all that information from the

672
00:28:16,310 --> 00:28:13,919
detail studies from the solar system

673
00:28:18,110 --> 00:28:16,320
from you know from the solar system to

674
00:28:21,230 --> 00:28:18,120
the nearby

675
00:28:23,390 --> 00:28:21,240
um in our galaxy and then extrapolate

676
00:28:24,710 --> 00:28:23,400
those two galaxies and then you have to

677
00:28:27,169 --> 00:28:24,720
put together

678
00:28:29,210 --> 00:28:27,179
and the environment how do forming a

679
00:28:31,430 --> 00:28:29,220
Stars affects environment it creates

680
00:28:33,049 --> 00:28:31,440
filaments it creates newer Stars they

681
00:28:36,470 --> 00:28:33,059
evolve into supernovas we're going to

682
00:28:38,570 --> 00:28:36,480
start studying we do a study materials

683
00:28:41,330 --> 00:28:38,580
that are essential for the formation of

684
00:28:42,769 --> 00:28:41,340
both stars and planets and at the core

685
00:28:45,289 --> 00:28:42,779
of the galaxies we do have the super

686
00:28:47,029 --> 00:28:45,299
massive black holes that they have a

687
00:28:51,070 --> 00:28:47,039
very intimate interplay with their

688
00:28:53,990 --> 00:28:51,080

environment and in many cases they are

689
00:28:56,750 --> 00:28:54,000
they shine so bright that it literally

690
00:28:58,730 --> 00:28:56,760
outshines the whole embassador emission

691
00:29:02,510 --> 00:28:58,740
of the Galaxy so there are many

692
00:29:04,549 --> 00:29:02,520
advantages to to study galaxies because

693
00:29:07,549 --> 00:29:04,559
when you understand your local galaxies

694
00:29:10,669 --> 00:29:07,559
you can then say okay now let's see if

695
00:29:12,649 --> 00:29:10,679
this model we have in mind fits to older

696
00:29:15,110 --> 00:29:12,659
galaxies in time so it's really putting

697
00:29:16,789 --> 00:29:15,120
together many pieces of the puzzle with

698
00:29:17,810 --> 00:29:16,799
digital never seen before in the

699
00:29:19,909 --> 00:29:17,820
infrared

700
00:29:23,149 --> 00:29:19,919
absolutely and one thing that really

701
00:29:26,149 --> 00:29:23,159
strikes me with these images is how much

702
00:29:27,889 --> 00:29:26,159
they Inspire us all to wander really

703
00:29:29,930 --> 00:29:27,899
there's an explorer at the heart of

704
00:29:31,730 --> 00:29:29,940
everyone and these images have allowed

705
00:29:35,389 --> 00:29:31,740
us to really explore the unknown

706
00:29:37,909 --> 00:29:35,399
together uh why do you feel like this is

707
00:29:39,529 --> 00:29:37,919
so important Amber and why is this so

708
00:29:42,049 --> 00:29:39,539
inspirational

709
00:29:45,730 --> 00:29:42,059
well I think one of the main reasons

710
00:29:50,029 --> 00:29:45,740
that's important is that jrst shows us

711
00:29:53,269 --> 00:29:50,039
that we can do you know very difficult

712
00:29:55,250 --> 00:29:53,279
big bold you know almost impossible

713
00:29:57,830 --> 00:29:55,260

things when we're all working together

714
00:30:00,830 --> 00:29:57,840
for something good and I think astronomy

715
00:30:03,409 --> 00:30:00,840
is good you know I think in a in a real

716
00:30:06,350 --> 00:30:03,419
sense you know we're we're living in a

717
00:30:09,830 --> 00:30:06,360
difficult time right now as a world as a

718
00:30:10,730 --> 00:30:09,840
species and for me last summer I feel

719
00:30:14,330 --> 00:30:10,740
like

720
00:30:16,190 --> 00:30:14,340
this breath of fresh air it was

721
00:30:18,169 --> 00:30:16,200
something good and I think that these

722
00:30:21,470 --> 00:30:18,179
telescopes are something good that we

723
00:30:23,210 --> 00:30:21,480
that we can do for the world and as as

724
00:30:25,070 --> 00:30:23,220
far as inspiration goes you know one of

725
00:30:27,350 --> 00:30:25,080
the things I love most about astronomy

726
00:30:29,029 --> 00:30:27,360
in general is that astronomy gets to the

727
00:30:31,430 --> 00:30:29,039
heart of our big questions you know

728
00:30:33,769 --> 00:30:31,440
where do we come from and how do we get

729
00:30:35,930 --> 00:30:33,779
here and are we alone you know those big

730
00:30:37,430 --> 00:30:35,940
questions that are more than just Arcane

731
00:30:39,049 --> 00:30:37,440
science questions there are questions

732
00:30:41,149 --> 00:30:39,059
that get to the heart of what it means

733
00:30:43,490 --> 00:30:41,159
to be human and I think all of us have

734
00:30:45,649 --> 00:30:43,500
the common experience of of looking up

735
00:30:47,810 --> 00:30:45,659
at a dark night sky and it's just sort

736
00:30:49,549 --> 00:30:47,820
of intuitively asking those big

737
00:30:51,470 --> 00:30:49,559
questions and I think these telescopes

738
00:30:54,230 --> 00:30:51,480

help help push us forward and

739
00:30:56,389 --> 00:30:54,240
understanding more about our world you

740
00:30:58,010 --> 00:30:56,399
know it's a fundamental part of being a

741
00:31:01,010 --> 00:30:58,020
human being is to explore and discover

742
00:31:03,470 --> 00:31:01,020
and they help us with that

743
00:31:05,750 --> 00:31:03,480
and building the mission launching it

744
00:31:07,970 --> 00:31:05,760
and commissioning it has been a hugely

745
00:31:11,330 --> 00:31:07,980
International project

746
00:31:13,070 --> 00:31:11,340
this is such a feat how's that been for

747
00:31:14,630 --> 00:31:13,080
you to collaborate to make this happen

748
00:31:16,909 --> 00:31:14,640
Paka

749
00:31:19,190 --> 00:31:16,919
for me it's been the best part of

750
00:31:22,850 --> 00:31:19,200
experience so my whole career has been

751
00:31:25,010 --> 00:31:22,860
based on on what essentially working in

752
00:31:27,590 --> 00:31:25,020
different places different capacities

753
00:31:29,810 --> 00:31:27,600
but all the way through

754
00:31:31,789 --> 00:31:29,820
for me the best part of it was getting

755
00:31:33,769 --> 00:31:31,799
together with the team working the

756
00:31:36,110 --> 00:31:33,779
problem seeing what to do next and

757
00:31:38,630 --> 00:31:36,120
really planning to to have this amazing

758
00:31:41,029 --> 00:31:38,640
telescope we have out and when I go

759
00:31:43,610 --> 00:31:41,039
Amber essentially this really shows how

760
00:31:45,230 --> 00:31:43,620
we are all at our best when you put you

761
00:31:47,269 --> 00:31:45,240
know all our brains and all our effort

762
00:31:50,090 --> 00:31:47,279
together to do something this is

763
00:31:52,310 --> 00:31:50,100

spectacular so it's been

764
00:31:53,810 --> 00:31:52,320
it's been a gift personally to to be

765
00:31:54,950 --> 00:31:53,820
able to be part of this team and to

766
00:31:57,710 --> 00:31:54,960
enjoy it

767
00:31:59,810 --> 00:31:57,720
thanks Stephanie what's been the most

768
00:32:01,310 --> 00:31:59,820
rewarding part of this awe-inspiring

769
00:32:04,130 --> 00:32:01,320
project for you

770
00:32:07,010 --> 00:32:04,140
there's so many to choose from

771
00:32:09,289 --> 00:32:07,020
um I think it's probably been the most

772
00:32:11,570 --> 00:32:09,299
rewarding getting to work part of as

773
00:32:13,909 --> 00:32:11,580
part of this huge team I mean 20 000

774
00:32:15,350 --> 00:32:13,919
people over two decades

775
00:32:17,750 --> 00:32:15,360
um I've been on the project just barely

776
00:32:19,789 --> 00:32:17,760
over 10 years and what I've learned from

777
00:32:23,210 --> 00:32:19,799
those that individuals that have been

778
00:32:24,769 --> 00:32:23,220
working on this for almost 30 years uh I

779
00:32:28,370 --> 00:32:24,779
gained so much information inside

780
00:32:30,889 --> 00:32:28,380
knowledge and it has been fantastic to

781
00:32:32,630 --> 00:32:30,899
be part of this huge team and watch how

782
00:32:36,169 --> 00:32:32,640
they've worked together work through our

783
00:32:38,389 --> 00:32:36,179
issues our challenge is and deliver the

784
00:32:39,830 --> 00:32:38,399
best infrared Space Telescope that we

785
00:32:41,690 --> 00:32:39,840
ever had

786
00:32:44,990 --> 00:32:41,700
thanks now let's go back to those

787
00:32:48,289 --> 00:32:45,000
challenges so to get to this point you

788
00:32:50,690 --> 00:32:48,299

probably faced a lot of challenges and I

789
00:32:52,730 --> 00:32:50,700
just am curious were there any role

790
00:32:54,649 --> 00:32:52,740
models that you felt helped you get to

791
00:32:56,630 --> 00:32:54,659
this point

792
00:33:00,590 --> 00:32:56,640
Nicole

793
00:33:02,330 --> 00:33:00,600
yeah I mean there's well I'll start by

794
00:33:03,710 --> 00:33:02,340
saying I mean my parents are huge role

795
00:33:05,570 --> 00:33:03,720
models they are not scientists they're

796
00:33:09,110 --> 00:33:05,580
not involved with the James Webb Space

797
00:33:10,730 --> 00:33:09,120
Telescope but they always had have had

798
00:33:13,130 --> 00:33:10,740
and still have you know an amazing work

799
00:33:15,049 --> 00:33:13,140
ethic and that is part of it like you

800
00:33:17,450 --> 00:33:15,059
know perseverance basically to get

801
00:33:19,490 --> 00:33:17,460
through challenges and I mean I can

802
00:33:21,529 --> 00:33:19,500
speak to my personal experience I mean

803
00:33:23,630 --> 00:33:21,539
the project yeah it had a lot of

804
00:33:25,850 --> 00:33:23,640
challenges over time but I was

805
00:33:28,850 --> 00:33:25,860
relatively new to the project adjoining

806
00:33:30,350 --> 00:33:28,860
in late 2019 and you know if you might

807
00:33:33,169 --> 00:33:30,360
recall what happened a few months later

808
00:33:36,350 --> 00:33:33,179
a pandemic started and you know it was

809
00:33:39,230 --> 00:33:36,360
hard to get caught up in all of those um

810
00:33:41,269 --> 00:33:39,240
with the Decades of experience you know

811
00:33:44,149 --> 00:33:41,279
it was very humbling

812
00:33:45,710 --> 00:33:44,159
um and a great challenge but still an

813
00:33:47,750 --> 00:33:45,720

exciting challenge like you know Amber

814
00:33:50,389 --> 00:33:47,760
was saying it's worth it like to be able

815
00:33:53,389 --> 00:33:50,399
to share and to get this telescope out

816
00:33:56,509 --> 00:33:53,399
to share the universe with the world

817
00:33:58,130 --> 00:33:56,519
um and so a lot of you know nobody said

818
00:33:59,690 --> 00:33:58,140
anything in particular to me I guess I

819
00:34:02,330 --> 00:33:59,700
mean I was say our team is very

820
00:34:04,549 --> 00:34:02,340
supportive overall so it was really

821
00:34:06,950 --> 00:34:04,559
great to be able to work with you know

822
00:34:09,169 --> 00:34:06,960
be one of 20 000 people working on the

823
00:34:12,230 --> 00:34:09,179
project and even playing a tiny role to

824
00:34:14,030 --> 00:34:12,240
help get this mission where it is today

825
00:34:16,490 --> 00:34:14,040
um but you know I definitely have my

826
00:34:19,970 --> 00:34:16,500
parents to thank over the years they

827
00:34:22,369 --> 00:34:19,980
never gave up on me or my siblings and

828
00:34:24,649 --> 00:34:22,379
that really helped push us along I mean

829
00:34:27,589 --> 00:34:24,659
you know just to add one more thing you

830
00:34:29,329 --> 00:34:27,599
know I never did the best in school like

831
00:34:32,089 --> 00:34:29,339
I didn't have the greatest grades at

832
00:34:33,470 --> 00:34:32,099
times I had professors say they were

833
00:34:35,270 --> 00:34:33,480
literally disappointed in me and I'm

834
00:34:37,550 --> 00:34:35,280
like but you know what I can do it right

835
00:34:40,010 --> 00:34:37,560
if I I knew I wanted to work at Nasa one

836
00:34:43,310 --> 00:34:40,020
day I was going to make it happen and so

837
00:34:45,230 --> 00:34:43,320
it's all about perseverance um and

838
00:34:47,089 --> 00:34:45,240

overcoming these major challenges so for

839
00:34:48,530 --> 00:34:47,099
me personally but also I think that's a

840
00:34:50,510 --> 00:34:48,540
good theme for the project as a whole

841
00:34:52,909 --> 00:34:50,520
you know everybody working together to

842
00:34:54,530 --> 00:34:52,919
get through various obstacles that we

843
00:34:57,430 --> 00:34:54,540
had including launching during a

844
00:35:04,910 --> 00:35:02,870
[Applause]

845
00:35:08,690 --> 00:35:04,920
for you Amber

846
00:35:11,450 --> 00:35:08,700
yeah some challenges I mean yeah um I I

847
00:35:13,609 --> 00:35:11,460
grew up in rural Arkansas and so I was

848
00:35:16,190 --> 00:35:13,619
not surrounded by a lot of scientists um

849
00:35:18,349 --> 00:35:16,200
but similar to Nicole my parents were

850
00:35:20,450 --> 00:35:18,359
huge supporters my mom was always like

851
00:35:21,710 --> 00:35:20,460
my biggest cheerleader

852
00:35:23,510 --> 00:35:21,720
um but yeah there were definitely

853
00:35:25,069 --> 00:35:23,520
challenges to growing up you know in a

854
00:35:27,710 --> 00:35:25,079
place where there wasn't a lot of you

855
00:35:30,050 --> 00:35:27,720
know actual you know real life scientist

856
00:35:32,750 --> 00:35:30,060
Role Models but parents were supportive

857
00:35:34,910 --> 00:35:32,760
and you know I grew up uh during the

858
00:35:36,230 --> 00:35:34,920
shuttle program at Nasa

859
00:35:38,030 --> 00:35:36,240
um and I was in the fifth grade when

860
00:35:39,770 --> 00:35:38,040
Hubble launched and you know all of that

861
00:35:42,290 --> 00:35:39,780
stuff happening at Nasa in my childhood

862
00:35:45,710 --> 00:35:42,300
made me really want you know want to be

863
00:35:47,329 --> 00:35:45,720

a part of it and a a definite upside of

864
00:35:49,130 --> 00:35:47,339
growing up where I did was the sky was

865
00:35:51,890 --> 00:35:49,140
dark beautiful and dark and that's how I

866
00:35:55,310 --> 00:35:51,900
got into astronomy to begin with

867
00:35:57,170 --> 00:35:55,320
um and so uh yeah similarly to Nicole I

868
00:35:58,910 --> 00:35:57,180
I had my own challenges you know getting

869
00:36:01,970 --> 00:35:58,920
through school

870
00:36:03,770 --> 00:36:01,980
um I I felt my big physics test to get

871
00:36:05,750 --> 00:36:03,780
my PhD the first time I had to take it

872
00:36:08,030 --> 00:36:05,760
again you know we have all these silly

873
00:36:10,550 --> 00:36:08,040
mantras like failures not an option but

874
00:36:12,530 --> 00:36:10,560
you know that's not true

875
00:36:15,410 --> 00:36:12,540
um you know failure happens when you're

876
00:36:17,150 --> 00:36:15,420
doing hard things you're gonna have

877
00:36:18,950 --> 00:36:17,160
moments of failure and I think that's

878
00:36:21,050 --> 00:36:18,960
true personally it's definitely been

879
00:36:23,329 --> 00:36:21,060
true in this project you know we had

880
00:36:25,370 --> 00:36:23,339
engineering setbacks um but we we

881
00:36:28,190 --> 00:36:25,380
figured them out we persevered them

882
00:36:29,690 --> 00:36:28,200
exactly in four different ways and

883
00:36:31,550 --> 00:36:29,700
probably by talking to each other would

884
00:36:33,470 --> 00:36:31,560
find like a perfect solution for that so

885
00:36:36,050 --> 00:36:33,480
it's really it's great

886
00:36:38,390 --> 00:36:36,060
problem solving and collaboration thank

887
00:36:41,569 --> 00:36:38,400
you and what are you most looking

888
00:36:44,450 --> 00:36:41,579

forward to Stephanie

889
00:36:46,190 --> 00:36:44,460
uh the unknown unknown

890
00:36:49,190 --> 00:36:46,200
um every time we look at one of these

891
00:36:51,950 --> 00:36:49,200
fantastic new images Spectra or

892
00:36:53,690 --> 00:36:51,960
otherwise we're we're seeing things that

893
00:36:55,430 --> 00:36:53,700
we've never seen before and that's

894
00:36:57,470 --> 00:36:55,440
bringing out the Curiosity and the

895
00:36:59,690 --> 00:36:57,480
challenges that we have as scientists to

896
00:37:02,089 --> 00:36:59,700
say why did that happen how did that

897
00:37:04,609 --> 00:37:02,099
happen what's making that happen what's

898
00:37:06,530 --> 00:37:04,619
the evolution of this process and what

899
00:37:08,569 --> 00:37:06,540
can we learn from it and every time we

900
00:37:09,829 --> 00:37:08,579
do that and we've been doing this for

901
00:37:12,290 --> 00:37:09,839
you know

902
00:37:15,109 --> 00:37:12,300
hundreds of years as astronomers as

903
00:37:16,670 --> 00:37:15,119
scientists as as humans every time we

904
00:37:19,790 --> 00:37:16,680
look and we have a curiosity about

905
00:37:22,250 --> 00:37:19,800
something we look harder and I think

906
00:37:24,290 --> 00:37:22,260
this first year first couple of years of

907
00:37:26,630 --> 00:37:24,300
science with jwst is going to open the

908
00:37:28,910 --> 00:37:26,640
door to huge new questions and

909
00:37:31,609 --> 00:37:28,920
challenges that we have ahead of us on

910
00:37:33,530 --> 00:37:31,619
you know the evolution of the Galaxy

911
00:37:35,630 --> 00:37:33,540
um whether or not there could be life on

912
00:37:37,190 --> 00:37:35,640
another planet whether there's life in

913
00:37:38,569 --> 00:37:37,200

the solar system

914
00:37:40,430 --> 00:37:38,579
um all of these things are challenges

915
00:37:41,990 --> 00:37:40,440
that are put forward to us and we're

916
00:37:43,430 --> 00:37:42,000
doing the best that we can and but

917
00:37:45,170 --> 00:37:43,440
sometimes we think that we can do it

918
00:37:47,750 --> 00:37:45,180
better so we build bigger and better

919
00:37:49,970 --> 00:37:47,760
telescopes we build we collaborate with

920
00:37:51,589 --> 00:37:49,980
International Teams because sometimes

921
00:37:55,250 --> 00:37:51,599
these projects are bigger than just one

922
00:37:57,290 --> 00:37:55,260
person and I think the new discoveries

923
00:37:59,630 --> 00:37:57,300
the unknown unknowns is what I'm the

924
00:38:01,250 --> 00:37:59,640
most excited about with web would you

925
00:38:04,490 --> 00:38:01,260
like to add to that Nicole

926
00:38:06,770 --> 00:38:04,500
yeah it's been what less than a year you

927
00:38:09,109 --> 00:38:06,780
know of Science and every image every

928
00:38:10,790 --> 00:38:09,119
spectrum that we're getting it's just

929
00:38:12,230 --> 00:38:10,800
changing the way we view the universe

930
00:38:16,310 --> 00:38:12,240
because it's a really new information

931
00:38:18,710 --> 00:38:16,320
and a lot of what I study or involves

932
00:38:21,109 --> 00:38:18,720
exoplanets these Distant Worlds outside

933
00:38:23,150 --> 00:38:21,119
the solar system and you know a lot of

934
00:38:25,370 --> 00:38:23,160
what I've talked about today I mentioned

935
00:38:27,710 --> 00:38:25,380
today was these gas giant like

936
00:38:30,530 --> 00:38:27,720
jupiter-sized planets that we've been

937
00:38:32,329 --> 00:38:30,540
studying but there are many smaller

938
00:38:35,030 --> 00:38:32,339

rocky planets that we are looking to

939
00:38:38,510 --> 00:38:35,040
study with jwst it's already studying

940
00:38:40,430 --> 00:38:38,520
some of these and I'm excited to see you

941
00:38:42,230 --> 00:38:40,440
know what we learn about those planets

942
00:38:43,910 --> 00:38:42,240
that are around the same size as our own

943
00:38:46,069 --> 00:38:43,920
you know they might not always be the

944
00:38:46,970 --> 00:38:46,079
same temperature you know they might not

945
00:38:50,470 --> 00:38:46,980
have

946
00:38:54,710 --> 00:38:50,480
surfaces with liquid oceans and all that

947
00:38:56,630 --> 00:38:54,720
but we expect to still learn about their

948
00:38:58,250 --> 00:38:56,640
overall atmosphere and you know is there

949
00:39:00,430 --> 00:38:58,260
water in the atmosphere is there carbon

950
00:39:03,589 --> 00:39:00,440
dioxide is there anything familiar to us

951
00:39:06,290 --> 00:39:03,599
that we can connect to and relate to to

952
00:39:08,510 --> 00:39:06,300
help us understand better of you know

953
00:39:11,510 --> 00:39:08,520
is there other life out there you know

954
00:39:13,250 --> 00:39:11,520
what can jwst reveal and it's also

955
00:39:15,890 --> 00:39:13,260
helping set the stage for for future

956
00:39:18,410 --> 00:39:15,900
NASA goals as well

957
00:39:20,450 --> 00:39:18,420
and this telescope really belongs to the

958
00:39:23,630 --> 00:39:20,460
world could you tell me a little bit

959
00:39:25,670 --> 00:39:23,640
more Amber about who's using this and

960
00:39:27,770 --> 00:39:25,680
like how this is for everyone

961
00:39:29,810 --> 00:39:27,780
yeah I think you mentioned Laura in your

962
00:39:31,609 --> 00:39:29,820
in your introduction that this telescope

963
00:39:34,310 --> 00:39:31,619

was the result of 14 different countries

964
00:39:35,990 --> 00:39:34,320
working together uh so Engineers from

965
00:39:38,329 --> 00:39:36,000
you know all over the world built it in

966
00:39:40,190 --> 00:39:38,339
an even larger number of astronomers

967
00:39:42,890 --> 00:39:40,200
from all over the world are already

968
00:39:45,050 --> 00:39:42,900
using its data but I think you know

969
00:39:47,089 --> 00:39:45,060
beyond the engineers and the scientists

970
00:39:49,970 --> 00:39:47,099
that actively use the telescope and

971
00:39:52,250 --> 00:39:49,980
built the telescope it really is for all

972
00:39:55,069 --> 00:39:52,260
of us I think astronomy is for all of us

973
00:39:56,870 --> 00:39:55,079
and and these these beautiful images

974
00:39:58,790 --> 00:39:56,880
um they're all by the way available

975
00:40:00,589 --> 00:39:58,800
freely available online you can go

976
00:40:02,870 --> 00:40:00,599
download all of them

977
00:40:05,089 --> 00:40:02,880
um and I think it really does does show

978
00:40:08,089 --> 00:40:05,099
that that these these beautiful images

979
00:40:09,710 --> 00:40:08,099
in astronomy are here to inspire us so

980
00:40:10,970 --> 00:40:09,720
to think outside of ourselves and to

981
00:40:13,910 --> 00:40:10,980
think bigger

982
00:40:15,890 --> 00:40:13,920
thank you so much I really am so

983
00:40:17,990 --> 00:40:15,900
appreciative of you all being here today

984
00:40:19,010 --> 00:40:18,000
and now we're going to take some

985
00:40:21,650 --> 00:40:19,020
questions

986
00:40:23,990 --> 00:40:21,660
so here we go

987
00:40:26,870 --> 00:40:24,000
oh this is a great question

988
00:40:35,030 --> 00:40:26,880

is there extraterrestrial intelligent

989
00:40:38,650 --> 00:40:37,490
uh do you want me to this I can go for

990
00:40:41,210 --> 00:40:38,660
it I'm sorry

991
00:40:44,690 --> 00:40:41,220
okay I was just yeah talking about you

992
00:40:47,089 --> 00:40:44,700
know the potential for for jwst to at

993
00:40:49,069 --> 00:40:47,099
least study Rocky you know earth-sized

994
00:40:51,290 --> 00:40:49,079
planets um

995
00:40:53,329 --> 00:40:51,300
but is there actually extraterrestrial

996
00:40:55,849 --> 00:40:53,339
intelligent life there could be life is

997
00:41:00,860 --> 00:40:55,859
it intelligent you know is there

998
00:41:04,510 --> 00:41:02,140
[Applause]

999
00:41:07,370 --> 00:41:04,520
[Laughter]

1000
00:41:09,650 --> 00:41:07,380
I guess it depends on you know the the

1001
00:41:11,750 --> 00:41:09,660
how you Define intelligent but I think

1002
00:41:14,210 --> 00:41:11,760
uh I want to believe too I guess is the

1003
00:41:16,550 --> 00:41:14,220
bottom line I there's so many there's

1004
00:41:18,890 --> 00:41:16,560
billions of stars out there which means

1005
00:41:20,930 --> 00:41:18,900
there are billions of planets so you

1006
00:41:23,750 --> 00:41:20,940
know and it's more serious answer I

1007
00:41:25,970 --> 00:41:23,760
think there just has to be you know

1008
00:41:28,790 --> 00:41:25,980
otherwise again a Carl Sagan quote like

1009
00:41:32,390 --> 00:41:28,800
it's a waste of space if humans are the

1010
00:41:35,450 --> 00:41:32,400
only intelligent life in the universe

1011
00:41:38,630 --> 00:41:35,460
thank you another question how long does

1012
00:41:40,849 --> 00:41:38,640
it take to plan position and take a

1013
00:41:42,109 --> 00:41:40,859

single photo Peter Dwyer thanks for that

1014
00:41:45,170 --> 00:41:42,119
question

1015
00:41:45,890 --> 00:41:45,180
yeah thanks well

1016
00:41:48,650 --> 00:41:45,900
um

1017
00:41:51,410 --> 00:41:48,660
like everything it depends typically all

1018
00:41:53,810 --> 00:41:51,420
the data that is taking in a year all

1019
00:41:55,550 --> 00:41:53,820
the Santa Fe programs are prepared by

1020
00:41:56,930 --> 00:41:55,560
the you know scientific Community they

1021
00:42:00,050 --> 00:41:56,940
send their proposals and they get

1022
00:42:01,490 --> 00:42:00,060
approved so that preparation takes place

1023
00:42:03,710 --> 00:42:01,500
perhaps

1024
00:42:06,650 --> 00:42:03,720
a year or more than the observation is

1025
00:42:08,870 --> 00:42:06,660
taking so when it's approved it goes

1026
00:42:10,250 --> 00:42:08,880
into the scheduling and say your

1027
00:42:13,010 --> 00:42:10,260
observation is going to happen tomorrow

1028
00:42:15,050 --> 00:42:13,020
so depending on the object and depending

1029
00:42:18,770 --> 00:42:15,060
on how bright or how faint it is it can

1030
00:42:20,450 --> 00:42:18,780
take any time from you know one hour to

1031
00:42:22,430 --> 00:42:20,460
tens of hours it really depends what

1032
00:42:24,050 --> 00:42:22,440
you're seeing if you are interested in

1033
00:42:27,050 --> 00:42:24,060
services and targets like Stephanie

1034
00:42:29,030 --> 00:42:27,060
it'll take typically half an hour to get

1035
00:42:32,770 --> 00:42:29,040
to your target from you know when when

1036
00:42:35,750 --> 00:42:32,780
it's planned and very little time to get

1037
00:42:38,270 --> 00:42:35,760
a very sharp image but the sort of the

1038
00:42:40,069 --> 00:42:38,280

and then you have to if the source is

1039
00:42:42,890 --> 00:42:40,079
very big you have to you know do many

1040
00:42:44,990 --> 00:42:42,900
shots and do like a mosaic but yeah it's

1041
00:42:46,250 --> 00:42:45,000
um it's a very sensitive telescope but

1042
00:42:47,089 --> 00:42:46,260
it really depends on what you're looking

1043
00:42:49,609 --> 00:42:47,099
at

1044
00:42:51,349 --> 00:42:49,619
I think one of the um just to add on to

1045
00:42:53,390 --> 00:42:51,359
that one of the awesome things about

1046
00:42:55,790 --> 00:42:53,400
this telescope is how sensitive it is

1047
00:42:57,470 --> 00:42:55,800
how efficient it is so you know we we

1048
00:42:59,329 --> 00:42:57,480
have these beautiful deep fields from

1049
00:43:00,950 --> 00:42:59,339
Hubble um like the Hubble Ultra Deep

1050
00:43:02,809 --> 00:43:00,960
Field and if you look at those images

1051
00:43:04,550 --> 00:43:02,819
from Hubble which are beautiful and

1052
00:43:07,670 --> 00:43:04,560
taught us incredible things about the

1053
00:43:10,910 --> 00:43:07,680
universe they took days you know 14 20

1054
00:43:13,069 --> 00:43:10,920
days of observing and we saw on that

1055
00:43:14,990 --> 00:43:13,079
very first image that we released uh

1056
00:43:17,329 --> 00:43:15,000
last summer of the Deep Field that we

1057
00:43:20,329 --> 00:43:17,339
got an image that was even deeper in the

1058
00:43:22,790 --> 00:43:20,339
infrared in just hours of time and so

1059
00:43:25,550 --> 00:43:22,800
really the the the power of this

1060
00:43:27,589 --> 00:43:25,560
telescope is how efficient it is in its

1061
00:43:29,990 --> 00:43:27,599
observational capabilities

1062
00:43:31,309 --> 00:43:30,000
thanks we have another question from

1063
00:43:33,829 --> 00:43:31,319

Colleen Berg

1064
00:43:36,170 --> 00:43:33,839
what do you mean by the colors we choose

1065
00:43:40,250 --> 00:43:36,180
to depict can you expand on that process

1066
00:43:43,970 --> 00:43:40,260
and why don't we see it as it is

1067
00:43:45,890 --> 00:43:43,980
um I can take this one so uh as was

1068
00:43:48,589 --> 00:43:45,900
explained we have an infrared telescope

1069
00:43:50,390 --> 00:43:48,599
but not a telescope that operates at

1070
00:43:51,829 --> 00:43:50,400
wavelengths of light that you can see so

1071
00:43:55,809 --> 00:43:51,839
visible light the way the Hubble

1072
00:43:58,730 --> 00:43:55,819
telescope does so in order for us to

1073
00:44:01,069 --> 00:43:58,740
understand and study any of these given

1074
00:44:02,750 --> 00:44:01,079
objects at these longer wavelengths of

1075
00:44:06,530 --> 00:44:02,760
Light which our eyes are not sensitive

1076
00:44:09,170 --> 00:44:06,540
to we hone in on colors and we label

1077
00:44:12,829 --> 00:44:09,180
those colors as to define a given

1078
00:44:15,170 --> 00:44:12,839
physical process or chemical process so

1079
00:44:17,210 --> 00:44:15,180
that we can study those details in ways

1080
00:44:19,130 --> 00:44:17,220
that our eyes can actually see because

1081
00:44:21,230 --> 00:44:19,140
when these images come in they're

1082
00:44:24,530 --> 00:44:21,240
they're black and white it's it's a

1083
00:44:27,349 --> 00:44:24,540
series of you know ones and zeros lots

1084
00:44:30,650 --> 00:44:27,359
lots of pixels and we take a picture

1085
00:44:32,510 --> 00:44:30,660
with a given filter and we take another

1086
00:44:35,150 --> 00:44:32,520
picture of the same spot with another

1087
00:44:39,170 --> 00:44:35,160
filter and we just color one filter

1088
00:44:40,970 --> 00:44:39,180

green one filter red one filter blue and

1089
00:44:42,609 --> 00:44:40,980
each of those filters are telling us

1090
00:44:45,950 --> 00:44:42,619
something different about that object

1091
00:44:48,230 --> 00:44:45,960
and we just give them those colors based

1092
00:44:50,690 --> 00:44:48,240
on we try to follow the same color

1093
00:44:53,210 --> 00:44:50,700
coordination as visible light so longer

1094
00:44:54,950 --> 00:44:53,220
wavelengths we tend to color more red

1095
00:44:57,829 --> 00:44:54,960
shorter wavelengths we tend to color

1096
00:44:59,930 --> 00:44:57,839
more blue but it doesn't necessarily

1097
00:45:02,510 --> 00:44:59,940
have to be that way it's just a way that

1098
00:45:04,730 --> 00:45:02,520
we try to standardize when we make these

1099
00:45:06,230 --> 00:45:04,740
beautiful images that you see here but

1100
00:45:07,490 --> 00:45:06,240
if I was looking at an object in the

1101
00:45:09,710 --> 00:45:07,500
solar system I might choose different

1102
00:45:11,630 --> 00:45:09,720
colors just to highlight certain types

1103
00:45:14,569 --> 00:45:11,640
of phenomena that are happening in in

1104
00:45:16,790 --> 00:45:14,579
Jupiter's atmosphere for example I could

1105
00:45:19,430 --> 00:45:16,800
totally label the great red spot as red

1106
00:45:20,930 --> 00:45:19,440
in that image but there's other things

1107
00:45:23,270 --> 00:45:20,940
there's other Dynamic processes

1108
00:45:25,250 --> 00:45:23,280
happening in Jupiter for example that we

1109
00:45:26,809 --> 00:45:25,260
wanted to emphasize and that's why those

1110
00:45:28,069 --> 00:45:26,819
filters were chosen and those colors

1111
00:45:31,569 --> 00:45:28,079
were chosen

1112
00:45:34,849 --> 00:45:31,579
thanks and another question very similar

1113
00:45:38,990 --> 00:45:34,859

from high nutrient how does the team

1114
00:45:45,609 --> 00:45:40,910
anybody

1115
00:45:49,609 --> 00:45:45,619
yeah so the team doesn't understand

1116
00:45:51,710 --> 00:45:49,619
this is a telescope for the world so the

1117
00:45:53,450 --> 00:45:51,720
way it works right now after we did

1118
00:45:56,870 --> 00:45:53,460
commissioning and then the team decided

1119
00:45:58,970 --> 00:45:56,880
because it was all about you know the

1120
00:46:01,309 --> 00:45:58,980
setting the instruments and and really

1121
00:46:03,470 --> 00:46:01,319
demonstrating good to the science but

1122
00:46:05,270 --> 00:46:03,480
now for science for science operations

1123
00:46:07,309 --> 00:46:05,280
the way it works that once a year

1124
00:46:09,589 --> 00:46:07,319
typically there is a call for proposals

1125
00:46:10,970 --> 00:46:09,599
and the entire scientific Community is

1126
00:46:13,730 --> 00:46:10,980
invited to

1127
00:46:15,349 --> 00:46:13,740
send their ideas you could send you know

1128
00:46:17,210 --> 00:46:15,359
I want to use this instrument I will

1129
00:46:19,190 --> 00:46:17,220
serve this Target and this is the

1130
00:46:21,290 --> 00:46:19,200
science I want to achieve and then all

1131
00:46:23,290 --> 00:46:21,300
those proposals and this year it was

1132
00:46:28,390 --> 00:46:23,300
closed recently and we received like

1133
00:46:33,349 --> 00:46:31,250
so this will be revealed by several

1134
00:46:35,270 --> 00:46:33,359
panels of experts in all the different

1135
00:46:36,890 --> 00:46:35,280
scientific topics and it's an

1136
00:46:39,650 --> 00:46:36,900
interesting process because it is double

1137
00:46:41,809 --> 00:46:39,660
blind so the reviewer doesn't know who

1138
00:46:43,730 --> 00:46:41,819

is submitting the proposal or which team

1139
00:46:46,430 --> 00:46:43,740
is submitting it which is really great

1140
00:46:48,650 --> 00:46:46,440
because it removes a lot of biases so

1141
00:46:51,530 --> 00:46:48,660
the panels aside and they rank the

1142
00:46:52,849 --> 00:46:51,540
proposals and you know that top ones are

1143
00:46:55,370 --> 00:46:52,859
the ones that make it into the schedule

1144
00:46:58,309 --> 00:46:55,380
but it's all Merit based and

1145
00:46:59,990 --> 00:46:58,319
scientifically interesting proposals

1146
00:47:02,150 --> 00:47:00,000
um other ones that are chosen

1147
00:47:03,530 --> 00:47:02,160
and I think even one of the awesome

1148
00:47:04,910 --> 00:47:03,540
things about these telescopes that I

1149
00:47:06,890 --> 00:47:04,920
think a lot of people don't maybe don't

1150
00:47:08,630 --> 00:47:06,900
realize is that so yeah an astronomers

1151
00:47:11,089 --> 00:47:08,640
say they were one of the lucky ones that

1152
00:47:11,870 --> 00:47:11,099
got their awesome proposal awarded and

1153
00:47:13,849 --> 00:47:11,880
so

1154
00:47:15,770 --> 00:47:13,859
um it depends on the program but

1155
00:47:18,109 --> 00:47:15,780
typically that astronomer and their team

1156
00:47:20,270 --> 00:47:18,119
will get a year with the data then after

1157
00:47:22,430 --> 00:47:20,280
a year the data is public to everybody

1158
00:47:23,930 --> 00:47:22,440
absolutely and a lot of the programs

1159
00:47:27,410 --> 00:47:23,940
especially during this first year of

1160
00:47:29,870 --> 00:47:27,420
operations have no proprietary period so

1161
00:47:32,270 --> 00:47:29,880
that means as soon as the data is is is

1162
00:47:34,490 --> 00:47:32,280
you know downloaded the telescope and in

1163
00:47:36,290 --> 00:47:34,500

in the world it's in the world for

1164
00:47:38,630 --> 00:47:36,300
everybody anyone can use it and a lot of

1165
00:47:40,730 --> 00:47:38,640
the early teens have made the choice and

1166
00:47:42,470 --> 00:47:40,740
the solar system team decided you know

1167
00:47:44,210 --> 00:47:42,480
we could keep this data but we're going

1168
00:47:46,910 --> 00:47:44,220
to make it public for everyone so we can

1169
00:47:48,530 --> 00:47:46,920
learn as much as as we can about about

1170
00:47:50,450 --> 00:47:48,540
the telescope how it's operating and

1171
00:47:52,430 --> 00:47:50,460
about the science and so and that's

1172
00:47:54,290 --> 00:47:52,440
another sense in in which these

1173
00:47:55,190 --> 00:47:54,300
telescopes really are for the entire

1174
00:47:59,450 --> 00:47:55,200
world

1175
00:48:01,430 --> 00:47:59,460
thanks and Carly free has a question any

1176
00:48:04,970 --> 00:48:01,440
clues as to what space is telling us

1177
00:48:09,170 --> 00:48:06,950
yeah that's a broader question I mean it

1178
00:48:10,550 --> 00:48:09,180
could be Jameson specific

1179
00:48:12,950 --> 00:48:10,560
um it's but that's a really good

1180
00:48:14,630 --> 00:48:12,960
question I mean there's different ways

1181
00:48:16,910 --> 00:48:14,640
that we're studying

1182
00:48:19,550 --> 00:48:16,920
um planets including everything in our

1183
00:48:21,290 --> 00:48:19,560
solar system as well as asteroids comets

1184
00:48:24,589 --> 00:48:21,300
like the building blocks of our solar

1185
00:48:27,530 --> 00:48:24,599
system and then we're studying over 5

1186
00:48:30,650 --> 00:48:27,540
000 exoplanets that are

1187
00:48:34,130 --> 00:48:30,660
ranging anything from similar in size to

1188
00:48:36,109 --> 00:48:34,140

Earth to Jupiter size so we have a great

1189
00:48:39,710 --> 00:48:36,119
sample that continues to increase as

1190
00:48:42,970 --> 00:48:39,720
we're studying uh exoplanets and you

1191
00:48:46,790 --> 00:48:42,980
know what we do want to do is compare

1192
00:48:48,829 --> 00:48:46,800
those systems and say do they have any

1193
00:48:51,470 --> 00:48:48,839
similarities to Earth you know what is

1194
00:48:54,710 --> 00:48:51,480
their relation I mean Earth is

1195
00:48:56,930 --> 00:48:54,720
um like a middle-aged star Earth our

1196
00:48:59,990 --> 00:48:56,940
sign is a middle-aged star so Earth is a

1197
00:49:01,370 --> 00:49:00,000
middle-aged Planet if you will and we

1198
00:49:03,530 --> 00:49:01,380
are studying

1199
00:49:07,010 --> 00:49:03,540
um planets that are around younger stars

1200
00:49:09,470 --> 00:49:07,020
and around some older stars too so I

1201
00:49:11,870 --> 00:49:09,480
think we're still very much in the early

1202
00:49:14,750 --> 00:49:11,880
days of you know deciphering all the

1203
00:49:16,430 --> 00:49:14,760
exoplanet data to see okay could any of

1204
00:49:20,030 --> 00:49:16,440
them be you know like a future earth

1205
00:49:22,790 --> 00:49:20,040
right and but I will say Mars is a great

1206
00:49:24,349 --> 00:49:22,800
example of you know closer to home that

1207
00:49:26,390 --> 00:49:24,359
maybe Stephanie you want to elaborate on

1208
00:49:28,190 --> 00:49:26,400
is a potential way that Earth could

1209
00:49:31,190 --> 00:49:28,200
evolve in the future

1210
00:49:34,010 --> 00:49:31,200
yeah I can add a few thoughts on that as

1211
00:49:35,690 --> 00:49:34,020
well um so our Earth has looked very

1212
00:49:38,690 --> 00:49:35,700
different so if we had the James Webb

1213
00:49:40,490 --> 00:49:38,700

Space Telescope when the sun was was

1214
00:49:42,050 --> 00:49:40,500
formed and the planets were formed in

1215
00:49:43,910 --> 00:49:42,060
our solar system

1216
00:49:46,130 --> 00:49:43,920
um if we were looking at our solar

1217
00:49:49,510 --> 00:49:46,140
system the Earth

1218
00:49:51,770 --> 00:49:49,520
back then in the early the early days

1219
00:49:54,050 --> 00:49:51,780
looked very very different from what it

1220
00:49:56,030 --> 00:49:54,060
looks like today and it has evolved and

1221
00:49:58,370 --> 00:49:56,040
changed dramatically during the

1222
00:50:00,170 --> 00:49:58,380
evolution of our solar system you can

1223
00:50:02,089 --> 00:50:00,180
think about the heavy bombardment era

1224
00:50:04,370 --> 00:50:02,099
where everything just kind of got blown

1225
00:50:06,349 --> 00:50:04,380
off of the surface of the Earth

1226
00:50:09,290 --> 00:50:06,359
um even before you know the first signs

1227
00:50:12,290 --> 00:50:09,300
of life we had very different atmosphere

1228
00:50:14,450 --> 00:50:12,300
so while Nicole's studying planets

1229
00:50:16,370 --> 00:50:14,460
around other stars and studying their

1230
00:50:18,170 --> 00:50:16,380
atmospheres who's to say that that

1231
00:50:20,030 --> 00:50:18,180
planet's not going to evolve to

1232
00:50:22,790 --> 00:50:20,040
something like what earth looks like

1233
00:50:26,089 --> 00:50:22,800
today we're getting these instantaneous

1234
00:50:28,730 --> 00:50:26,099
snapshots of of things that happened

1235
00:50:31,190 --> 00:50:28,740
billions of years ago sometimes or

1236
00:50:33,589 --> 00:50:31,200
hundreds of thousands of years ago so

1237
00:50:36,710 --> 00:50:33,599
who knows what they are today in real

1238
00:50:38,210 --> 00:50:36,720

time we can look at our history we can

1239
00:50:40,250 --> 00:50:38,220
look at other planets in our solar

1240
00:50:43,130 --> 00:50:40,260
system and see how they've been affected

1241
00:50:45,849 --> 00:50:43,140
impacted by their own Evolution Mars

1242
00:50:49,250 --> 00:50:45,859
being a fantastic example once having

1243
00:50:51,530 --> 00:50:49,260
huge oceans and lakes we see that with

1244
00:50:53,990 --> 00:50:51,540
the the rocks on Mars we see you know

1245
00:50:56,809 --> 00:50:54,000
riverbed like rocks that are rounded

1246
00:50:59,210 --> 00:50:56,819
from processing of liquid water flowing

1247
00:51:00,890 --> 00:50:59,220
on the surface these are things that

1248
00:51:02,930 --> 00:51:00,900
give us all the clues of how our planet

1249
00:51:05,089 --> 00:51:02,940
might actually evolve and if we don't

1250
00:51:08,089 --> 00:51:05,099
take care of it we might have a lot more

1251
00:51:11,930 --> 00:51:08,099
detrimental effects sooner than later

1252
00:51:13,670 --> 00:51:11,940
thanks and Louise percini asks how can

1253
00:51:15,530 --> 00:51:13,680
James Webb help us Advance the

1254
00:51:18,829 --> 00:51:15,540
understanding of Cutting Edge Mysteries

1255
00:51:20,589 --> 00:51:18,839
like dark matter Dark Energy

1256
00:51:22,730 --> 00:51:20,599
Etc

1257
00:51:25,549 --> 00:51:22,740
uh yeah so Louise knows it's

1258
00:51:28,549 --> 00:51:25,559
astrophysics good job

1259
00:51:29,750 --> 00:51:28,559
um so so yeah I guess again to zoom out

1260
00:51:33,890 --> 00:51:29,760
so

1261
00:51:37,309 --> 00:51:33,900
we think that about 75 of the

1262
00:51:39,530 --> 00:51:37,319
um whole energy matter content of the

1263
00:51:43,849 --> 00:51:39,540

universe is this mysterious thing that

1264
00:51:45,950 --> 00:51:43,859
we call dark energy and another 20 is

1265
00:51:48,049 --> 00:51:45,960
this other mysterious stuff called Dark

1266
00:51:49,490 --> 00:51:48,059
Matter so you're noticing a trend here

1267
00:51:51,710 --> 00:51:49,500
right when astronomers don't know what

1268
00:51:54,710 --> 00:51:51,720
something is we label it dark

1269
00:51:56,089 --> 00:51:54,720
um and so uh but it's a it's astounding

1270
00:51:57,589 --> 00:51:56,099
so all of these things we've been

1271
00:51:59,510 --> 00:51:57,599
discussing today you know the the

1272
00:52:01,730 --> 00:51:59,520
hundreds of billions of galaxies and the

1273
00:52:04,069 --> 00:52:01,740
trillions of stars and countless planets

1274
00:52:07,190 --> 00:52:04,079
all of that only makes up about five

1275
00:52:09,530 --> 00:52:07,200
percent of the whole universe and the

1276
00:52:12,770 --> 00:52:09,540
rest the other 95 percent

1277
00:52:14,870 --> 00:52:12,780
we don't know what it is uh and so there

1278
00:52:16,910 --> 00:52:14,880
are ways that jrst is going to help us

1279
00:52:18,650 --> 00:52:16,920
in learning about specifically about

1280
00:52:20,870 --> 00:52:18,660
dark matter because you can sort of

1281
00:52:22,549 --> 00:52:20,880
think of dark matter as the scaffolding

1282
00:52:24,530 --> 00:52:22,559
of the universe it's it's the

1283
00:52:27,530 --> 00:52:24,540
scaffolding on which the galaxies sit

1284
00:52:31,190 --> 00:52:27,540
and so by studying how how galaxies

1285
00:52:34,010 --> 00:52:31,200
evolve uh over time were able to learn

1286
00:52:35,450 --> 00:52:34,020
more about how dark matter behaves and

1287
00:52:37,309 --> 00:52:35,460
so in that sense of studying how

1288
00:52:40,609 --> 00:52:37,319

galaxies change over time we can learn

1289
00:52:42,710 --> 00:52:40,619
more about Dark Matter Dark Energy we

1290
00:52:44,690 --> 00:52:42,720
can we can also study Dark Energy with

1291
00:52:46,790 --> 00:52:44,700
jdris t in some of the similar ways

1292
00:52:48,950 --> 00:52:46,800
we've done so with Hubble but we're

1293
00:52:51,290 --> 00:52:48,960
actually building another telescope

1294
00:52:53,510 --> 00:52:51,300
um that's going to launch in 2027 called

1295
00:52:55,190 --> 00:52:53,520
the Nancy Grace Roman Space Telescope

1296
00:52:57,530 --> 00:52:55,200
and we're already building it already

1297
00:52:58,970 --> 00:52:57,540
testing it things are going great and

1298
00:53:01,190 --> 00:52:58,980
that particular telescope is

1299
00:53:03,170 --> 00:53:01,200
specifically designed to study Dark

1300
00:53:05,690 --> 00:53:03,180
Energy so we should be learning a lot

1301
00:53:07,130 --> 00:53:05,700
more about Dark Energy later on down the

1302
00:53:08,630 --> 00:53:07,140
road with the Nancy Grace Roman Space

1303
00:53:11,990 --> 00:53:08,640
Telescope

1304
00:53:16,430 --> 00:53:12,000
thanks and David frager asks what is the

1305
00:53:22,790 --> 00:53:18,890
Stephanie sure

1306
00:53:25,970 --> 00:53:22,800
um so we we built this telescope with a

1307
00:53:29,030 --> 00:53:25,980
requirement so NASA had to deliver a

1308
00:53:30,109 --> 00:53:29,040
space infrared telescope that worked for

1309
00:53:32,930 --> 00:53:30,119
five years

1310
00:53:35,450 --> 00:53:32,940
we also were told that we had to carry

1311
00:53:38,630 --> 00:53:35,460
about 10 years worth of fuel

1312
00:53:40,609 --> 00:53:38,640
um we do have a fuel limited Mission as

1313
00:53:43,130 --> 00:53:40,619

we were launching that was our our plan

1314
00:53:44,750 --> 00:53:43,140
was once we ran out of fuel to maintain

1315
00:53:46,790 --> 00:53:44,760
where we are

1316
00:53:48,589 --> 00:53:46,800
um a million miles away from Earth and

1317
00:53:51,170 --> 00:53:48,599
to unload momentum

1318
00:53:54,109 --> 00:53:51,180
um that would be the end of mission uh

1319
00:53:57,049 --> 00:53:54,119
fortunately because of our fantastic

1320
00:53:59,230 --> 00:53:57,059
colleagues who helped us launch our

1321
00:54:00,849 --> 00:53:59,240
telescope into space on an Arion 5

1322
00:54:05,150 --> 00:54:00,859
rocket

1323
00:54:07,490 --> 00:54:05,160
we had such a nominal launch

1324
00:54:09,530 --> 00:54:07,500
nominal just doesn't say the words it

1325
00:54:11,510 --> 00:54:09,540
was absolutely Flawless our launch was

1326
00:54:13,790 --> 00:54:11,520
so perfect you could not see the error

1327
00:54:15,890 --> 00:54:13,800
bars and what we hope to do versus what

1328
00:54:18,230 --> 00:54:15,900
we actually did

1329
00:54:20,390 --> 00:54:18,240
um and even in our first images that we

1330
00:54:22,250 --> 00:54:20,400
had of the telescope once it detached

1331
00:54:23,450 --> 00:54:22,260
from the spacecraft and started drifting

1332
00:54:25,430 --> 00:54:23,460
on its Journey

1333
00:54:28,010 --> 00:54:25,440
we saw our first deployment happen we

1334
00:54:30,530 --> 00:54:28,020
saw the solar array unfold which meant

1335
00:54:32,569 --> 00:54:30,540
the launch was so perfect we didn't even

1336
00:54:35,089 --> 00:54:32,579
have to tweak which way the telescope

1337
00:54:37,309 --> 00:54:35,099
was pointing it was already pointing in

1338
00:54:39,470 --> 00:54:37,319

the right direction already going on its

1339
00:54:41,450 --> 00:54:39,480
journey and it automatically started

1340
00:54:42,910 --> 00:54:41,460
deploying itself because I knew that

1341
00:54:45,829 --> 00:54:42,920
everything was perfect

1342
00:54:48,170 --> 00:54:45,839
so wear calculations after our launch

1343
00:54:49,370 --> 00:54:48,180
after our insertion into the orbit that

1344
00:54:52,309 --> 00:54:49,380
we're in

1345
00:54:54,710 --> 00:54:52,319
um gave us estimates of 20 years of

1346
00:55:00,410 --> 00:54:54,720
science Mission lifetime which is

1347
00:55:04,069 --> 00:55:02,030
thank you

1348
00:55:06,950 --> 00:55:04,079
fingers crossed all the instruments work

1349
00:55:08,930 --> 00:55:06,960
that long fingers crossed you know we

1350
00:55:11,329 --> 00:55:08,940
don't have any other major setbacks with

1351
00:55:13,130 --> 00:55:11,339
the observatory I mean we have a giant

1352
00:55:16,370 --> 00:55:13,140
sunshield that's made out of basically

1353
00:55:18,349 --> 00:55:16,380
happy birthday balloons so you know we

1354
00:55:19,790 --> 00:55:18,359
are a little fragile

1355
00:55:21,530 --> 00:55:19,800
um but we're doing the best we can to

1356
00:55:23,089 --> 00:55:21,540
maintain and operate our telescope in a

1357
00:55:24,950 --> 00:55:23,099
safe way so that we will have science

1358
00:55:29,630 --> 00:55:24,960
for many decades so

1359
00:55:31,730 --> 00:55:29,640
thanks and Anonymous asks what's been

1360
00:55:33,589 --> 00:55:31,740
the most wow moment in each of your

1361
00:55:36,230 --> 00:55:33,599
careers so far

1362
00:55:41,370 --> 00:55:36,240
PS love seeing an all-woman panel for a

1363
00:55:50,210 --> 00:55:47,329

[Applause]

1364
00:55:52,370 --> 00:55:50,220
I mean I could start by saying this is

1365
00:55:56,210 --> 00:55:52,380
the most wow moment

1366
00:55:59,030 --> 00:55:56,220
you know it's no honestly I think

1367
00:56:01,910 --> 00:55:59,040
um it's hard because working at Nasa is

1368
00:56:03,829 --> 00:56:01,920
just a lot of fun and we do get a lot of

1369
00:56:05,990 --> 00:56:03,839
wow moments like I'm very grateful for

1370
00:56:07,910 --> 00:56:06,000
that in the sense that we get to work on

1371
00:56:10,549 --> 00:56:07,920
all kinds of really amazing space

1372
00:56:12,950 --> 00:56:10,559
missions and get them out to the public

1373
00:56:15,349 --> 00:56:12,960
so that we can you know share these

1374
00:56:17,510 --> 00:56:15,359
incredible data with you and explore the

1375
00:56:19,730 --> 00:56:17,520
universe together so

1376
00:56:20,809 --> 00:56:19,740
in a way almost every day is a wow

1377
00:56:22,250 --> 00:56:20,819
moment

1378
00:56:25,490 --> 00:56:22,260
um when we're working on these missions

1379
00:56:27,530 --> 00:56:25,500
but I so that's not really you know one

1380
00:56:30,349 --> 00:56:27,540
single moment but I feel like there's so

1381
00:56:32,270 --> 00:56:30,359
many it's hard to pick one

1382
00:56:34,329 --> 00:56:32,280
anybody else want to add anything

1383
00:56:37,250 --> 00:56:34,339
I can pick one no

1384
00:56:39,770 --> 00:56:37,260
so for me my one moment was definitely

1385
00:56:42,109 --> 00:56:39,780
the day of launch like there was so much

1386
00:56:44,030 --> 00:56:42,119
at the stake you know so many years so

1387
00:56:46,490 --> 00:56:44,040
much effort has put into that so many

1388
00:56:49,490 --> 00:56:46,500

dreams and hopes into that mission that

1389
00:56:52,190 --> 00:56:49,500
it was really fantastic to see it so

1390
00:56:53,870 --> 00:56:52,200
nominal and boring quote unquote it was

1391
00:56:56,390 --> 00:56:53,880
perfect that it was a very enjoyable

1392
00:56:58,010 --> 00:56:56,400
moment and and I really treasured that

1393
00:57:01,250 --> 00:56:58,020
and then of course everything after it

1394
00:57:03,349 --> 00:57:01,260
Nicole is right we are lucky and there

1395
00:57:05,049 --> 00:57:03,359
are many great moments but for me

1396
00:57:08,030 --> 00:57:05,059
personally the day of launch was

1397
00:57:10,730 --> 00:57:08,040
fantastic it's really I think we have

1398
00:57:13,549 --> 00:57:10,740
time for a couple more questions owl

1399
00:57:15,410 --> 00:57:13,559
Conde writes NASA science is rewriting

1400
00:57:18,290 --> 00:57:15,420
science books at an increasing and

1401
00:57:20,390 --> 00:57:18,300
accelerating great a good problem is the

1402
00:57:23,510 --> 00:57:20,400
agency exploring new ways to disseminate

1403
00:57:29,750 --> 00:57:27,230
and um sure yeah I mean NASA really

1404
00:57:31,870 --> 00:57:29,760
takes seriously I think it's role to

1405
00:57:34,309 --> 00:57:31,880
explain what we're doing to the public

1406
00:57:35,870 --> 00:57:34,319
uh and I think you know all of us that

1407
00:57:38,329 --> 00:57:35,880
are involved in these missions really

1408
00:57:40,190 --> 00:57:38,339
try hard to to do that I mean this is a

1409
00:57:41,930 --> 00:57:40,200
good example

1410
00:57:43,849 --> 00:57:41,940
um of one of the ways that we try to do

1411
00:57:47,210 --> 00:57:43,859
that but yeah the agency is always

1412
00:57:48,890 --> 00:57:47,220
trying to think of of new ways to you

1413
00:57:51,470 --> 00:57:48,900

know to get to get our information and

1414
00:57:52,490 --> 00:57:51,480
our data out out to the rest of the

1415
00:57:54,430 --> 00:57:52,500
world

1416
00:57:56,450 --> 00:57:54,440
um you know I think I think it's it's

1417
00:57:59,390 --> 00:57:56,460
forward-looking in a lot of ways you

1418
00:58:01,069 --> 00:57:59,400
know NASA was one of the first maybe the

1419
00:58:03,109 --> 00:58:01,079
first government agency to really

1420
00:58:04,970 --> 00:58:03,119
Embrace social media

1421
00:58:07,309 --> 00:58:04,980
um and so I think I think that there's a

1422
00:58:10,069 --> 00:58:07,319
lot that our Communications teams uh do

1423
00:58:12,470 --> 00:58:10,079
which Laura is a part of thank you Laura

1424
00:58:14,630 --> 00:58:12,480
um that you know our Communications

1425
00:58:17,270 --> 00:58:14,640
teams are fantastic and work really

1426
00:58:19,549 --> 00:58:17,280
really hard at making sure that we can

1427
00:58:21,710 --> 00:58:19,559
make the science understandable and get

1428
00:58:26,750 --> 00:58:21,720
it out to the world

1429
00:58:33,109 --> 00:58:29,150
if you go no new question

1430
00:58:43,150 --> 00:58:33,119
uh what kinds of discoveries are we

1431
00:58:48,349 --> 00:58:46,430
uh so I can say we have a lot of

1432
00:58:50,150 --> 00:58:48,359
fantastic work that's coming out from

1433
00:58:52,670 --> 00:58:50,160
the the telescope

1434
00:58:54,289 --> 00:58:52,680
um now that we're just sort of almost

1435
00:58:56,930 --> 00:58:54,299
finished with our first year of science

1436
00:58:59,030 --> 00:58:56,940
operations the science Community is

1437
00:59:01,809 --> 00:58:59,040
really working hard on analyzing their

1438
00:59:04,609 --> 00:59:01,819

own data and putting it into scientific

1439
00:59:07,430 --> 00:59:04,619
peer-reviewed publication the way that

1440
00:59:08,630 --> 00:59:07,440
we are supposed to do and we get paid to

1441
00:59:11,450 --> 00:59:08,640
do

1442
00:59:13,789 --> 00:59:11,460
um and so that is now finally coming out

1443
00:59:17,450 --> 00:59:13,799
and is coming to fruition so lots of

1444
00:59:19,309 --> 00:59:17,460
science is coming out in the literature

1445
00:59:23,030 --> 00:59:19,319
um that's come from the James Webb Space

1446
00:59:25,190 --> 00:59:23,040
Telescope we have a queue of how many

1447
00:59:28,010 --> 00:59:25,200
press releases for future Publications

1448
00:59:30,230 --> 00:59:28,020
that are that are coming out so

1449
00:59:32,630 --> 00:59:30,240
um it is very exciting time

1450
00:59:35,030 --> 00:59:32,640
um Amber and I get a lot of the behind

1451
00:59:36,589 --> 00:59:35,040
the scenes looks at some of those things

1452
00:59:39,770 --> 00:59:36,599
um and just seeing the new science and

1453
00:59:42,109 --> 00:59:39,780
the new discoveries on the horizon

1454
00:59:44,569 --> 00:59:42,119
um just stay tuned I mean every week we

1455
00:59:47,569 --> 00:59:44,579
release something so uh just follow us

1456
00:59:50,030 --> 00:59:47,579
and I'm sure you'll you'll be astounded

1457
00:59:52,069 --> 00:59:50,040
and I want to thank you all so much for

1458
00:59:54,380 --> 00:59:52,079
being here today and for everyone

1459
01:00:05,049 --> 00:59:54,390
following along

1460
01:00:05,059 --> 01:00:10,250
and thank you

1461
01:00:14,150 --> 01:00:11,650
[Applause]

1462
01:00:16,730 --> 01:00:14,160
and if you want to follow along more for

1463
01:00:19,730 --> 01:00:16,740

more updates on NASA's James Webb Space

1464
01:00:22,050 --> 01:00:19,740
Telescope check out our social media at

1465
01:00:25,990 --> 01:00:22,060
Nasa web thank you so much

1466
01:00:34,569 --> 01:00:26,000
[Applause]

1467
01:00:41,690 --> 01:00:38,109
we are going

1468
01:00:44,510 --> 01:00:41,700
the history of this agency is marked

1469
01:00:45,849 --> 01:00:44,520
with broken barriers once viewed as

1470
01:00:50,089 --> 01:00:45,859
impossible

1471
01:00:52,970 --> 01:00:50,099
with science fiction turned reality with

1472
01:00:55,010 --> 01:00:52,980
innovations that have spun Industries