
NASA
NASA
NASA

1
00:00:00,000 --> 00:00:03,830
[Applause]

2
00:00:07,909 --> 00:00:04,950
thank you

3
00:00:10,549 --> 00:00:07,919
good morning and welcome to reaching for

4
00:00:12,950 --> 00:00:10,559
the stars connecting to the future with

5
00:00:16,470 --> 00:00:12,960
nasa and hollywood

6
00:00:18,150 --> 00:00:16,480
you know nab show is the place for

7
00:00:21,109 --> 00:00:18,160
groundbreaking demonstrations of

8
00:00:23,349 --> 00:00:21,119
advanced media technology

9
00:00:24,950 --> 00:00:23,359
and today we are truly

10
00:00:26,550 --> 00:00:24,960
bringing you something that is out of

11
00:00:29,109 --> 00:00:26,560
this world

12
00:00:31,669 --> 00:00:29,119
you are here to witness and to be a part

13
00:00:33,270 --> 00:00:31,679

of an amazing collection

14
00:00:36,150 --> 00:00:33,280
of astronauts

15
00:00:38,470 --> 00:00:36,160
filmmakers and technology leaders that

16
00:00:41,990 --> 00:00:38,480
will take you behind the scenes of the

17
00:00:44,790 --> 00:00:42,000
advanced video and cloud workflows that

18
00:00:47,190 --> 00:00:44,800
power deep space research

19
00:00:49,750 --> 00:00:47,200
that ignite our imagination about the

20
00:00:51,189 --> 00:00:49,760
future in vast areas of science and

21
00:00:53,990 --> 00:00:51,199
storytelling

22
00:00:56,549 --> 00:00:54,000
and that create the foundation for the

23
00:00:59,510 --> 00:00:56,559
future of space commerce

24
00:01:01,270 --> 00:00:59,520
today you will be a part of the first

25
00:01:04,070 --> 00:01:01,280
ever live

26
00:01:06,149 --> 00:01:04,080
4k ultra high definition transmission

27
00:01:07,429 --> 00:01:06,159
from space and the international space

28
00:01:09,590 --> 00:01:07,439
station

29
00:01:13,429 --> 00:01:09,600
the first live discussion with

30
00:01:16,070 --> 00:01:13,439
astronauts in space at the nab show

31
00:01:19,030 --> 00:01:16,080
and an incredible gathering of

32
00:01:21,749 --> 00:01:19,040
scientists astronauts technologists and

33
00:01:25,030 --> 00:01:21,759
storytellers

34
00:01:27,510 --> 00:01:25,040
such an effort requires great teamwork

35
00:01:29,510 --> 00:01:27,520
and there was absolutely a fantastic

36
00:01:30,950 --> 00:01:29,520
collaboration between our teams here at

37
00:01:35,190 --> 00:01:30,960
nab

38
00:01:37,990 --> 00:01:35,200

amazon web services aws elemental

39
00:01:40,550 --> 00:01:38,000
nasa and christie

40
00:01:43,190 --> 00:01:40,560
we must also offer a special thanks to

41
00:01:45,590 --> 00:01:43,200
the military and government conference

42
00:01:47,990 --> 00:01:45,600
as they enabled dave mcqueen's

43
00:01:48,950 --> 00:01:48,000
participation today

44
00:01:50,789 --> 00:01:48,960
so

45
00:01:53,109 --> 00:01:50,799
as the saying goes

46
00:01:55,990 --> 00:01:53,119
what goes up

47
00:02:01,190 --> 00:01:56,000
must come down

48
00:02:04,389 --> 00:02:01,200
except

49
00:02:06,310 --> 00:02:04,399
when what goes up goes into outer space

50
00:02:08,869 --> 00:02:06,320
and that is what makes the first ever

51
00:02:11,350 --> 00:02:08,879
red camera to go to the international

52
00:02:13,750 --> 00:02:11,360
space station so special

53
00:02:16,150 --> 00:02:13,760
this camera was a vital tool used to

54
00:02:18,070 --> 00:02:16,160
further our scientific studies

55
00:02:19,430 --> 00:02:18,080
and the interests of nasa's space

56
00:02:22,470 --> 00:02:19,440
exploration

57
00:02:24,309 --> 00:02:22,480
it recently returned to earth so it did

58
00:02:26,229 --> 00:02:24,319
successfully come down

59
00:02:28,949 --> 00:02:26,239
and i'd like to invite

60
00:02:31,990 --> 00:02:28,959
dylan mathis and rodney grubb of nasa

61
00:02:34,309 --> 00:02:32,000
and jared land president of red to the

62
00:02:37,040 --> 00:02:34,319
stage to conduct a brief ceremony with

63
00:02:48,470 --> 00:02:37,050

this vital first uhd camera

64
00:02:51,830 --> 00:02:48,480
[Applause]

65
00:02:54,309 --> 00:02:51,840
in 2015 nasa and red collaborated to fly

66
00:02:55,670 --> 00:02:54,319
a red epic dragon to the international

67
00:02:57,589 --> 00:02:55,680
space station

68
00:03:01,190 --> 00:02:57,599
this camera has served us very well and

69
00:03:02,550 --> 00:03:01,200
has recently returned to earth after 437

70
00:03:04,790 --> 00:03:02,560
days in space

71
00:03:07,589 --> 00:03:04,800
and it was replaced by another red epic

72
00:03:09,430 --> 00:03:07,599
dragon as in it will help us to continue

73
00:03:10,550 --> 00:03:09,440
to probe deeper into the mysteries of

74
00:03:12,949 --> 00:03:10,560
space

75
00:03:14,869 --> 00:03:12,959
with rodney grubbs i'm dylan mathis as

76
00:03:16,550 --> 00:03:14,879
principal investigators

77
00:03:18,550 --> 00:03:16,560
for this project we would like to

78
00:03:27,110 --> 00:03:18,560
present to you the first camera back

79
00:03:29,589 --> 00:03:28,070
thank you

80
00:03:31,350 --> 00:03:29,599
i always feel like a hobbit standing

81
00:03:34,530 --> 00:03:31,360
next to jared

82
00:03:40,630 --> 00:03:34,540
thank you thank you

83
00:03:42,550 --> 00:03:40,640
[Applause]

84
00:03:45,350 --> 00:03:42,560
thank you again dylan rodney and jared

85
00:03:48,229 --> 00:03:45,360
that is very very cool stuff

86
00:03:51,190 --> 00:03:48,239
and now it is my pleasure to introduce

87
00:03:53,429 --> 00:03:51,200
carolyn giordina technology editor at

88
00:03:55,429 --> 00:03:53,439

the hollywood reporter to set the stage

89
00:03:57,830 --> 00:03:55,439
for the panel discussion

90
00:03:59,030 --> 00:03:57,840
including our first ever live ultra high

91
00:04:01,190 --> 00:03:59,040
definition

92
00:04:03,830 --> 00:04:01,200
conversation with the international

93
00:04:05,270 --> 00:04:03,840
space station commander peggy whitson

94
00:04:07,990 --> 00:04:05,280
who also

95
00:04:11,190 --> 00:04:08,000
just happens to be the u.s astronaut

96
00:04:20,550 --> 00:04:11,200
with the most cumulative time in space

97
00:04:24,790 --> 00:04:22,550
good morning

98
00:04:27,430 --> 00:04:24,800
for the next hour this panel will look

99
00:04:30,070 --> 00:04:27,440
at how nasa and hollywood use advanced

100
00:04:32,469 --> 00:04:30,080
technologies and inspire one another

101
00:04:33,749 --> 00:04:32,479
this includes technologies such as 4k

102
00:04:36,629 --> 00:04:33,759
and cloud

103
00:04:39,510 --> 00:04:36,639
today we will begin by demonstrating for

104
00:04:41,590 --> 00:04:39,520
the first time ever a live public 4k

105
00:04:42,870 --> 00:04:41,600
broadcast from the international space

106
00:04:45,270 --> 00:04:42,880
station

107
00:04:47,030 --> 00:04:45,280
and since this is a time since this is

108
00:04:49,270 --> 00:04:47,040
time sensitive due to the position of

109
00:04:52,710 --> 00:04:49,280
the iss i'm going to quickly hand this

110
00:04:55,030 --> 00:04:52,720
over to sam blackman ceo and co-founder

111
00:04:57,189 --> 00:04:55,040
of aws elemental

112
00:05:00,500 --> 00:04:57,199
for this segment of the session and then

113
00:05:07,990 --> 00:05:00,510

we'll continue with our panelists

114
00:05:09,510 --> 00:05:08,000
[Applause]

115
00:05:12,469 --> 00:05:09,520
who's excited

116
00:05:13,830 --> 00:05:12,479
first live 4k transmission from space

117
00:05:15,909 --> 00:05:13,840
ever

118
00:05:23,029 --> 00:05:15,919
let's get right to it johnson space

119
00:05:29,830 --> 00:05:24,840
coming

120
00:05:31,830 --> 00:05:29,840
[Applause]

121
00:05:48,469 --> 00:05:31,840
we should hear it in the room very

122
00:06:02,710 --> 00:05:52,170
yes we're ready for the event

123
00:06:07,430 --> 00:06:03,909
okay

124
00:06:09,189 --> 00:06:07,440
here we go hello commander fisher and

125
00:06:11,830 --> 00:06:09,199
colonel fish commander whitson and

126
00:06:14,550 --> 00:06:11,840
colonel fisher it is an honor for all of

127
00:06:16,870 --> 00:06:14,560
us and those online to join you and all

128
00:06:20,629 --> 00:06:16,880
of your colleagues at nasa in the first

129
00:06:22,710 --> 00:06:20,639
ever live 4k stream from space

130
00:06:31,189 --> 00:06:22,720
what is the iss position in orbit right

131
00:06:31,199 --> 00:06:37,510
11 seconds

132
00:06:42,230 --> 00:06:39,830
well we're just passing over baja

133
00:06:44,950 --> 00:06:42,240
california and we're heading in an arc

134
00:06:51,110 --> 00:06:44,960
over north america by the time we finish

135
00:06:55,990 --> 00:06:53,749
amazing amazing

136
00:06:59,350 --> 00:06:56,000
before we learn more about nasa's use of

137
00:07:01,189 --> 00:06:59,360
live 4k i'd like to share about peggy's

138
00:07:03,830 --> 00:07:01,199

exciting achievement that was recently

139
00:07:06,390 --> 00:07:03,840
made on the iss and in space

140
00:07:08,309 --> 00:07:06,400
peggy you've made eight spacewalks and

141
00:07:11,029 --> 00:07:08,319
you recently set the record for the most

142
00:07:18,950 --> 00:07:11,039
days in space by an american astronaut

143
00:07:18,960 --> 00:07:35,430
what inspired you to become an astronaut

144
00:07:39,909 --> 00:07:37,830
actually when i was growing up i saw the

145
00:07:41,749 --> 00:07:39,919
first men walk on the moon and i thought

146
00:07:44,150 --> 00:07:41,759
wow cool

147
00:07:46,230 --> 00:07:44,160
of course it didn't really become a goal

148
00:07:48,150 --> 00:07:46,240
of mine it was just a dream that when i

149
00:07:50,629 --> 00:07:48,160
graduated from high school the first

150
00:07:53,510 --> 00:07:50,639
female astronauts were selected and

151
00:07:54,309 --> 00:07:53,520
that's when it truly became a goal for

152
00:07:56,309 --> 00:07:54,319
me

153
00:07:58,390 --> 00:07:56,319
luckily i had no idea how hard it would

154
00:08:00,469 --> 00:07:58,400
be and i just worked really really hard

155
00:08:03,029 --> 00:08:00,479
and spent a lot of years getting there

156
00:08:05,670 --> 00:08:03,039
but and a lot of hard work but in the

157
00:08:08,230 --> 00:08:05,680
end i got lucky and

158
00:08:10,070 --> 00:08:08,240
some of that work paid off so it was

159
00:08:11,270 --> 00:08:10,080
it's been well worth the journey for

160
00:08:14,230 --> 00:08:11,280
sure

161
00:08:16,469 --> 00:08:14,240
well it's an inspiration to thousands of

162
00:08:18,790 --> 00:08:16,479
students in the united united states and

163
00:08:21,110 --> 00:08:18,800

the entire world so thank you so much

164
00:08:22,950 --> 00:08:21,120
now of course we're calling from the nab

165
00:08:25,110 --> 00:08:22,960
show here in las vegas where next

166
00:08:27,189 --> 00:08:25,120
generation broadcast and production

167
00:08:29,189 --> 00:08:27,199
technology comes to life are there any

168
00:08:45,350 --> 00:08:29,199
films about space that have truly

169
00:08:49,110 --> 00:08:47,190
well for me it was

170
00:08:51,430 --> 00:08:49,120
definitely the right stuff as a as a

171
00:08:53,750 --> 00:08:51,440
test pilot who you know edwards was my

172
00:08:55,829 --> 00:08:53,760
second home you know this start where

173
00:08:57,670 --> 00:08:55,839
he's like flying through the clouds and

174
00:08:59,509 --> 00:08:57,680
he's talking about there's a demon that

175
00:09:02,790 --> 00:08:59,519
lives on the mater

176
00:09:05,030 --> 00:09:02,800
and then the plane crashes it explodes

177
00:09:07,670 --> 00:09:05,040
it goes to color that's just so awesome

178
00:09:09,509 --> 00:09:07,680
and then also spaceballs because we're

179
00:09:12,389 --> 00:09:09,519
basically flying at ludicrous speed

180
00:09:24,550 --> 00:09:14,010
okay

181
00:09:28,630 --> 00:09:24,650
[Applause]

182
00:09:34,230 --> 00:09:30,550
amazing all right we could watch that

183
00:09:36,470 --> 00:09:34,240
microphone spin for a long time

184
00:09:38,870 --> 00:09:36,480
so talking back to technology can you

185
00:09:46,770 --> 00:09:38,880
help us understand the role video plays

186
00:09:46,780 --> 00:09:53,829
[Laughter]

187
00:09:58,230 --> 00:09:56,550
well when we're traveling at 17 500

188
00:10:00,389 --> 00:09:58,240

miles an hour there's a lot of data

189
00:10:03,509 --> 00:10:00,399
going by even just looking at the earth

190
00:10:05,750 --> 00:10:03,519
below us and because we are

191
00:10:07,910 --> 00:10:05,760
traveling once around the world every 90

192
00:10:10,630 --> 00:10:07,920
minutes and then the earth is precessing

193
00:10:13,350 --> 00:10:10,640
underneath our orbit we get to see all

194
00:10:15,990 --> 00:10:13,360
over the world and and we're in

195
00:10:19,030 --> 00:10:16,000
different places each time we pass over

196
00:10:21,350 --> 00:10:19,040
a particular area and so it is amazing

197
00:10:23,509 --> 00:10:21,360
amount of data that allows us to capture

198
00:10:25,509 --> 00:10:23,519
some of that in high resolution but

199
00:10:28,470 --> 00:10:25,519
actually inside the space station we're

200
00:10:30,870 --> 00:10:28,480
also capturing a lot of data high data

201
00:10:33,350 --> 00:10:30,880
resolution uh for the scientific

202
00:10:35,110 --> 00:10:33,360
experiments inside the rags that we have

203
00:10:37,350 --> 00:10:35,120
around us we have

204
00:10:39,870 --> 00:10:37,360
many different types of experiments uh

205
00:10:42,150 --> 00:10:39,880
either cell cultures

206
00:10:43,829 --> 00:10:42,160
microbiological cultures protein

207
00:10:46,949 --> 00:10:43,839
crystallization

208
00:10:49,110 --> 00:10:46,959
we're doing a combustion experiment

209
00:10:51,110 --> 00:10:49,120
and lots of studies looking at different

210
00:10:52,870 --> 00:10:51,120
physical properties so

211
00:10:55,190 --> 00:10:52,880
it's very exciting and

212
00:10:58,829 --> 00:10:55,200
being able to capture a lot of data is

213
00:11:04,470 --> 00:11:01,829

scientifically what do live 4k and ultra

214
00:11:06,150 --> 00:11:04,480
hd help you do onboard the iss in terms

215
00:11:22,790 --> 00:11:06,160
of scientific research that you couldn't

216
00:11:26,310 --> 00:11:24,470
well i think uh

217
00:11:28,790 --> 00:11:26,320
peggy mentioned a lot a lot of the

218
00:11:31,670 --> 00:11:28,800
reasons you know with these new cameras

219
00:11:34,550 --> 00:11:31,680
and new technologies we're able to get

220
00:11:36,949 --> 00:11:34,560
higher resolution higher frame rates uh

221
00:11:40,069 --> 00:11:36,959
to capture different science for some of

222
00:11:42,310 --> 00:11:40,079
our experiments uh ultra slow motion

223
00:11:45,750 --> 00:11:42,320
for some of the effects that are very

224
00:11:48,550 --> 00:11:45,760
short-lived uh yet very important

225
00:11:51,110 --> 00:11:48,560
so there's a lot of uh science both on

226
00:11:53,350 --> 00:11:51,120
the station looking at the earth and i

227
00:11:57,190 --> 00:11:53,360
think even more importantly is the

228
00:11:59,110 --> 00:11:57,200
inspirational aspect because you know 4k

229
00:12:01,430 --> 00:11:59,120
and ultra high def

230
00:12:02,230 --> 00:12:01,440
uh actually make you feel like you're

231
00:12:03,990 --> 00:12:02,240
there

232
00:12:07,030 --> 00:12:04,000
i mean if you look really close you can

233
00:12:09,430 --> 00:12:07,040
probably see into my pores right now

234
00:12:11,430 --> 00:12:09,440
granted nobody wants to see there

235
00:12:13,670 --> 00:12:11,440
but everybody wants to see the earth

236
00:12:15,910 --> 00:12:13,680
from this vantage point and

237
00:12:18,069 --> 00:12:15,920
by looking down at the earth with this

238
00:12:20,069 --> 00:12:18,079

amazing new technology we're able to

239
00:12:22,550 --> 00:12:20,079
inspire an entire new generation of

240
00:12:24,389 --> 00:12:22,560
explorers so i think

241
00:12:27,990 --> 00:12:24,399
probably the biggest

242
00:12:29,430 --> 00:12:28,000
impact that these technologies will have

243
00:12:32,150 --> 00:12:29,440
is bringing

244
00:12:34,230 --> 00:12:32,160
everyone else on the planet to see these

245
00:12:37,750 --> 00:12:34,240
amazing sites that we get to see every

246
00:12:39,990 --> 00:12:37,760
day and inspire them to push beyond just

247
00:12:45,430 --> 00:12:40,000
living on earth

248
00:12:48,629 --> 00:12:46,629
all right so the moment i've been

249
00:13:05,190 --> 00:12:48,639
waiting for can you show us some

250
00:13:10,310 --> 00:13:08,069
actually we'd love to do that and so

251
00:13:12,150 --> 00:13:10,320
uh a lot of these are kind of things

252
00:13:14,230 --> 00:13:12,160
that might we do maybe to have a little

253
00:13:16,550 --> 00:13:14,240
bit of fun that just because you can do

254
00:13:18,470 --> 00:13:16,560
them in zero gravity so we're going to

255
00:13:19,910 --> 00:13:18,480
play a little ping pong but it's kind of

256
00:13:22,389 --> 00:13:19,920
space ping ping-pong because we're going

257
00:13:24,310 --> 00:13:22,399
to use a ball of water as our ball

258
00:13:26,069 --> 00:13:24,320
so jack's going to build a ball of water

259
00:13:28,150 --> 00:13:26,079
here with the uh

260
00:13:30,150 --> 00:13:28,160
using pushing water out of the straw of

261
00:13:31,430 --> 00:13:30,160
the drink bag he's got a little bowl of

262
00:13:33,590 --> 00:13:31,440
water

263
00:13:51,110 --> 00:13:33,600

and

264
00:13:51,120 --> 00:14:11,750
amazing

265
00:14:11,760 --> 00:14:16,510
oh

266
00:14:22,790 --> 00:14:20,790
[Applause]

267
00:14:26,470 --> 00:14:22,800
and

268
00:14:28,310 --> 00:14:26,480
another demonstration

269
00:14:30,790 --> 00:14:28,320
uh the next one i think we'll go after

270
00:14:33,269 --> 00:14:30,800
will be what we call uh actually it's

271
00:14:36,230 --> 00:14:33,279
going to be a ball of water but it's got

272
00:14:37,910 --> 00:14:36,240
a little additive uh put in it

273
00:14:40,310 --> 00:14:37,920
um we're going to add a little

274
00:14:41,750 --> 00:14:40,320
alka-seltzer to this bowl of water and

275
00:14:43,350 --> 00:14:41,760
let you see it

276
00:14:44,710 --> 00:14:43,360
and we're going to move up close so

277
00:14:46,710 --> 00:14:44,720
we'll get our

278
00:15:08,550 --> 00:14:46,720
focus up here a little closer so you can

279
00:15:08,560 --> 00:15:13,110
oh

280
00:15:31,670 --> 00:15:14,949
wow

281
00:15:31,680 --> 00:15:40,680
and a little food coloring added to that

282
00:15:40,690 --> 00:15:49,110
[Laughter]

283
00:15:53,269 --> 00:15:50,470
and of course all these things are

284
00:15:55,269 --> 00:15:53,279
happening because of the

285
00:15:57,350 --> 00:15:55,279
surface tension plays such a big role

286
00:15:58,389 --> 00:15:57,360
and it's not impacted

287
00:16:00,550 --> 00:15:58,399
in

288
00:16:03,749 --> 00:16:00,560

zero gravity

289
00:16:06,710 --> 00:16:03,759
by the forces it is on earth so that's a

290
00:16:09,110 --> 00:16:06,720
really fun way to demonstrate that

291
00:16:10,949 --> 00:16:09,120
another really interesting thing is

292
00:16:12,069 --> 00:16:10,959
something called thin films and you can

293
00:16:14,310 --> 00:16:12,079
do them

294
00:16:37,350 --> 00:16:14,320
also here in zero gravity but we're

295
00:16:42,150 --> 00:16:39,590
okay so i've got a little bit of water

296
00:16:44,710 --> 00:16:42,160
in this plastic bag

297
00:16:50,069 --> 00:16:44,720
and i'm pulling out oops it broke

298
00:16:50,079 --> 00:16:57,670
let that microphone go

299
00:17:02,389 --> 00:17:00,230
that is a benefit to pr's in space you

300
00:17:16,390 --> 00:17:02,399
really don't have to hold your mic

301
00:17:24,069 --> 00:17:21,350
so i have a very thin film of water here

302
00:17:45,270 --> 00:17:24,079
okay and jack's got a little bit of food

303
00:17:45,280 --> 00:17:49,270
it's amazing

304
00:17:53,190 --> 00:17:50,630
peggy jack i don't know if you can hear

305
00:17:53,990 --> 00:17:53,200
the oohs and oz in the audience here but

306
00:18:00,310 --> 00:17:54,000
it's

307
00:18:00,320 --> 00:18:04,630
wow

308
00:18:10,630 --> 00:18:06,870
it's just so it's mind-blowing to be

309
00:18:13,750 --> 00:18:11,510
wow

310
00:18:15,590 --> 00:18:13,760
how do you imagine the future of nasa in

311
00:18:17,909 --> 00:18:15,600
terms of where advanced imaging

312
00:18:34,950 --> 00:18:17,919
technologies will take you next

313
00:18:39,190 --> 00:18:37,110

actually i think uh

314
00:18:41,110 --> 00:18:39,200
advanced technologies

315
00:18:43,430 --> 00:18:41,120
are going to be required to go to mars

316
00:18:46,470 --> 00:18:43,440
and especially advanced imaging

317
00:18:49,430 --> 00:18:46,480
obviously it's important to us

318
00:18:51,669 --> 00:18:49,440
to better understand where we're headed

319
00:18:54,710 --> 00:18:51,679
uh it minimizes the risk if we better

320
00:18:56,870 --> 00:18:54,720
understand that in advance and so

321
00:18:58,310 --> 00:18:56,880
all the studies all the imaging studies

322
00:19:00,549 --> 00:18:58,320
from different

323
00:19:02,390 --> 00:19:00,559
uh rovers and

324
00:19:04,150 --> 00:19:02,400
missions that we send to mars before we

325
00:19:06,470 --> 00:19:04,160
actually arrive are going to be critical

326
00:19:14,870 --> 00:19:06,480
to a lot of the decision process

327
00:19:18,070 --> 00:19:15,669
just

328
00:19:18,950 --> 00:19:18,080
so fascinating okay

329
00:19:21,190 --> 00:19:18,960
well

330
00:19:22,950 --> 00:19:21,200
commander whitson colonel fisher this

331
00:19:25,669 --> 00:19:22,960
has been one of the most remarkable

332
00:19:27,510 --> 00:19:25,679
exchanges i have ever had

333
00:19:29,590 --> 00:19:27,520
your insights are fascinating and

334
00:19:31,350 --> 00:19:29,600
inspiring thank you so much for taking

335
00:19:33,909 --> 00:19:31,360
the time to share them with us and the

336
00:19:35,909 --> 00:19:33,919
entire nab audience and thousands and

337
00:19:37,190 --> 00:19:35,919
thousands online

338
00:19:39,510 --> 00:19:37,200

congratulations on all your

339
00:19:42,390 --> 00:19:39,520
accomplishments and we look forward to a

340
00:19:44,470 --> 00:19:42,400
lot of live 4k uhd from the space

341
00:19:46,140 --> 00:19:44,480
station for years to come

342
00:20:02,950 --> 00:19:46,150
thank you

343
00:20:02,960 --> 00:20:06,950
hello

344
00:20:06,960 --> 00:20:09,590
wow

345
00:20:22,070 --> 00:20:11,510
think about the special this is houston

346
00:20:26,070 --> 00:20:23,990
thank you so much one more round of

347
00:20:28,070 --> 00:20:26,080
applause

348
00:20:30,470 --> 00:20:28,080
thank you to all of the participants at

349
00:20:32,549 --> 00:20:30,480
the las vegas convention center station

350
00:20:35,510 --> 00:20:32,559
please stand by we are now resuming

351
00:20:36,230 --> 00:20:35,520
operational audio communication so

352
00:20:38,470 --> 00:20:36,240
the

353
00:20:39,590 --> 00:20:38,480
number of technologies that goes into

354
00:20:41,990 --> 00:20:39,600
making

355
00:20:44,390 --> 00:20:42,000
an exchange like that possible

356
00:20:47,510 --> 00:20:44,400
seeing how the teams from nasa

357
00:20:49,750 --> 00:20:47,520
and aws elemental have worked together

358
00:20:52,149 --> 00:20:49,760
over the past month the amount of

359
00:20:54,310 --> 00:20:52,159
technology from those networks coming

360
00:20:57,750 --> 00:20:54,320
down from the space station from 4k

361
00:21:00,549 --> 00:20:57,760
encoders from distribution over cdns to

362
00:21:02,390 --> 00:21:00,559
thin film displays all around the world

363
00:21:04,070 --> 00:21:02,400

it all builds on itself to make

364
00:21:07,029 --> 00:21:04,080
something like this possible

365
00:21:09,029 --> 00:21:07,039
and i know i'm deeply honored to be here

366
00:21:10,870 --> 00:21:09,039
today and be a part of it and i want to

367
00:21:13,110 --> 00:21:10,880
thank everyone here so much for taking

368
00:21:15,190 --> 00:21:13,120
the time to come and see history in the

369
00:21:21,029 --> 00:21:15,200
making here at nab

370
00:21:26,789 --> 00:21:24,070
all right next up to explain how this

371
00:21:28,390 --> 00:21:26,799
magic actually works can carolyn come

372
00:21:30,230 --> 00:21:28,400
back up to the stage please along with

373
00:21:32,470 --> 00:21:30,240
the panel that's going to be explaining

374
00:22:02,870 --> 00:21:32,480
all the amazing technology to us

375
00:22:07,510 --> 00:22:04,789
so let's just take another moment to

376
00:22:09,190 --> 00:22:07,520
congratulate nasa

377
00:22:12,549 --> 00:22:09,200
services aw

378
00:22:16,900 --> 00:22:12,559
mental and nab on that amazing first

379
00:22:16,910 --> 00:22:21,430
[Music]

380
00:22:25,029 --> 00:22:23,029
we'll talk more about that in a few

381
00:22:28,310 --> 00:22:25,039
minutes but first let me introduce our

382
00:22:30,390 --> 00:22:28,320
panelists seated next to me is dr dave

383
00:22:33,669 --> 00:22:30,400
mcqueeny who's vice president of

384
00:22:36,470 --> 00:22:33,679
corporate technology at ibm

385
00:22:38,470 --> 00:22:36,480
next is filmmaker bernie mcdade former

386
00:22:41,669 --> 00:22:38,480
head of content at discovery science

387
00:22:43,029 --> 00:22:41,679
channel and since then she founded bua

388
00:22:45,190 --> 00:22:43,039

entertainment which is a creative

389
00:22:46,630 --> 00:22:45,200
consultancy specializing in virtual

390
00:22:49,029 --> 00:22:46,640
reality

391
00:22:53,190 --> 00:22:49,039
we are thrilled to welcome u.s nasa

392
00:22:55,510 --> 00:22:53,200
astronaut dr tracy caldwell

393
00:22:59,270 --> 00:22:55,520
dr dyson flew aboard the space shuttle

394
00:23:02,149 --> 00:22:59,280
endeavour on a long-haul iss mission and

395
00:23:09,350 --> 00:23:02,159
is a veteran of three spacewalks

396
00:23:14,870 --> 00:23:11,909
and she's logged more than 188 days in

397
00:23:18,870 --> 00:23:15,909
oops

398
00:23:22,070 --> 00:23:18,880
also with us this morning is kwaja shams

399
00:23:26,390 --> 00:23:22,080
vice president of engineering at aws

400
00:23:28,630 --> 00:23:26,400
elemental and also veteran of nasa's jet

401
00:23:30,789 --> 00:23:28,640
propulsion laboratory

402
00:23:33,510 --> 00:23:30,799
and last but not least we have rodney

403
00:23:35,909 --> 00:23:33,520
grubbs who is the nasa imaging experts

404
00:23:37,990 --> 00:23:35,919
program manager and chairs the nasa

405
00:23:45,190 --> 00:23:38,000
digital television working group so

406
00:23:51,269 --> 00:23:48,149
so as each of you watched that inspiring

407
00:23:53,430 --> 00:23:51,279
4k live stream just moments ago

408
00:23:58,789 --> 00:23:53,440
what was going through your minds what

409
00:24:03,350 --> 00:24:01,430
in the first moon landing 600 million

410
00:24:05,029 --> 00:24:03,360
people watched that landing on the

411
00:24:07,669 --> 00:24:05,039
grainy black and white

412
00:24:08,549 --> 00:24:07,679
television just i'll start again

413
00:24:10,950 --> 00:24:08,559

when the

414
00:24:12,870 --> 00:24:10,960
600 million people watch the first moon

415
00:24:14,470 --> 00:24:12,880
landing on a grainy black and white

416
00:24:17,029 --> 00:24:14,480
television and when i see this

417
00:24:18,470 --> 00:24:17,039
incredible technology just imagine what

418
00:24:20,310 --> 00:24:18,480
your children and your children's

419
00:24:21,750 --> 00:24:20,320
children are going to how they're going

420
00:24:23,990 --> 00:24:21,760
to experience

421
00:24:26,070 --> 00:24:24,000
further space exploration as we move

422
00:24:27,590 --> 00:24:26,080
forward and how that's going to inspire

423
00:24:29,669 --> 00:24:27,600
them and i think that's pretty

424
00:24:31,830 --> 00:24:29,679
incredible because you heard peggy say

425
00:24:33,430 --> 00:24:31,840
herself it was seeing that moon landing

426
00:24:35,350 --> 00:24:33,440
that made her determined to become an

427
00:24:37,830 --> 00:24:35,360
astronaut at a time when nasa didn't

428
00:24:40,470 --> 00:24:37,840
consider female astronauts and i think

429
00:24:41,430 --> 00:24:40,480
that's an incredible thing

430
00:24:43,430 --> 00:24:41,440
yeah and

431
00:24:46,470 --> 00:24:43,440
i i would say that

432
00:24:48,390 --> 00:24:46,480
when jack made his comment about

433
00:24:50,549 --> 00:24:48,400
these higher resolutions enabling

434
00:24:52,549 --> 00:24:50,559
everyone on earth potentially to be

435
00:24:53,830 --> 00:24:52,559
there on the iss with them i mean

436
00:24:56,070 --> 00:24:53,840
they're up there because of the

437
00:24:57,750 --> 00:24:56,080
resources of you know not just one

438
00:25:00,710 --> 00:24:57,760

country but many countries and the

439
00:25:02,789 --> 00:25:00,720
ability for technology to let any of us

440
00:25:03,430 --> 00:25:02,799
be immersed there and to be inspired by

441
00:25:07,110 --> 00:25:03,440
it

442
00:25:08,630 --> 00:25:07,120
impressive and that was what jack's

443
00:25:10,149 --> 00:25:08,640
comment was on the video i thought that

444
00:25:11,669 --> 00:25:10,159
was perfect

445
00:25:13,190 --> 00:25:11,679
dr dyson

446
00:25:15,590 --> 00:25:13,200
well i think it just means astronauts

447
00:25:20,070 --> 00:25:15,600
have to step up their game because

448
00:25:24,390 --> 00:25:22,310
so we've really got to be

449
00:25:27,909 --> 00:25:24,400
i think

450
00:25:28,870 --> 00:25:27,919
it was important that peggy and jack

451
00:25:30,870 --> 00:25:28,880
actually

452
00:25:33,669 --> 00:25:30,880
rehearse a little bit before

453
00:25:35,750 --> 00:25:33,679
performing those demonstrations but in

454
00:25:37,110 --> 00:25:35,760
the same vein when we're making

455
00:25:38,789 --> 00:25:37,120
a video for

456
00:25:41,669 --> 00:25:38,799
scientists on the ground to analyze

457
00:25:44,230 --> 00:25:41,679
their data we really got to we we get a

458
00:25:45,830 --> 00:25:44,240
lot of data but we also need to be as

459
00:25:48,549 --> 00:25:45,840
astronauts um

460
00:25:50,630 --> 00:25:48,559
technically savvy and uh also

461
00:25:52,789 --> 00:25:50,640
uh careful with how we set these things

462
00:25:54,390 --> 00:25:52,799
up just to make sure we get we the data

463
00:25:57,350 --> 00:25:54,400

that we collect is the data that they

464
00:25:59,350 --> 00:25:57,360
need because you do see everything

465
00:26:00,950 --> 00:25:59,360
and are you also a ping pong pro

466
00:26:05,029 --> 00:26:00,960
yes yeah you definitely gotta practice

467
00:26:09,430 --> 00:26:07,510
he cheated that's right just a little

468
00:26:12,070 --> 00:26:09,440
question rodney i know this was enormous

469
00:26:13,909 --> 00:26:12,080
effort to put together can you maybe um

470
00:26:16,230 --> 00:26:13,919
just tell us a little bit about behind

471
00:26:17,990 --> 00:26:16,240
the scenes to get here and then what you

472
00:26:19,669 --> 00:26:18,000
thought when you watched it well my

473
00:26:24,230 --> 00:26:19,679
thought was

474
00:26:24,240 --> 00:26:27,510
um

475
00:26:30,630 --> 00:26:28,870
so

476
00:26:32,470 --> 00:26:30,640
we we've already seen in the last five

477
00:26:34,390 --> 00:26:32,480
minutes doing live television isn't easy

478
00:26:36,630 --> 00:26:34,400
try doing it in uh

479
00:26:38,870 --> 00:26:36,640
with brand new equipment and so forth so

480
00:26:40,390 --> 00:26:38,880
uh we've got a great team and seeing

481
00:26:42,149 --> 00:26:40,400
everything come together

482
00:26:44,230 --> 00:26:42,159
uh three months ago we drew all this

483
00:26:45,750 --> 00:26:44,240
stuff on a white board in houston texas

484
00:26:47,510 --> 00:26:45,760
and i took a picture of it and sent it

485
00:26:48,470 --> 00:26:47,520
to some very smart people and here we

486
00:26:50,149 --> 00:26:48,480
are

487
00:26:51,990 --> 00:26:50,159
wow

488
00:26:54,549 --> 00:26:52,000

what was the most challenging aspect of

489
00:26:56,870 --> 00:26:54,559
the effort well as a technologist i was

490
00:26:59,110 --> 00:26:56,880
inspired by the fact that we now have

491
00:27:01,510 --> 00:26:59,120
you know this technical feat of 4k video

492
00:27:03,909 --> 00:27:01,520
coming from space but as i watched the

493
00:27:06,149 --> 00:27:03,919
video i learned that i found my own

494
00:27:08,230 --> 00:27:06,159
passion for space reinvigorated and i

495
00:27:10,630 --> 00:27:08,240
realized that the video is just a

496
00:27:12,310 --> 00:27:10,640
vehicle it's the content that i'm most

497
00:27:15,350 --> 00:27:12,320
excited about when you see space ping

498
00:27:17,269 --> 00:27:15,360
pong happen and you see how it inspires

499
00:27:19,110 --> 00:27:17,279
the younger generation to

500
00:27:21,269 --> 00:27:19,120
you know just wonder a little bit more

501
00:27:23,909 --> 00:27:21,279
about what really goes on in space and

502
00:27:25,190 --> 00:27:23,919
aspire to get to space faster i think

503
00:27:26,870 --> 00:27:25,200
that's what i'm most excited about and

504
00:27:28,549 --> 00:27:26,880
that's what goes on to my mind when i

505
00:27:30,230 --> 00:27:28,559
watch a video like that

506
00:27:32,870 --> 00:27:30,240
yes okay

507
00:27:35,269 --> 00:27:32,880
so um now ibm has actually been involved

508
00:27:37,510 --> 00:27:35,279
with nasa since the beginning and as

509
00:27:40,549 --> 00:27:37,520
many of you probably saw in the film

510
00:27:43,269 --> 00:27:40,559
hidden figures um ibm's computing power

511
00:27:45,350 --> 00:27:43,279
and the innovators behind it have played

512
00:27:47,510 --> 00:27:45,360
a big part um

513
00:27:48,630 --> 00:27:47,520

dave what inspires continuing

514
00:27:51,430 --> 00:27:48,640
development

515
00:27:53,430 --> 00:27:51,440
of cutting-edge computing systems

516
00:27:55,430 --> 00:27:53,440
well you know in in the movie hidden

517
00:27:57,029 --> 00:27:55,440
figures the the techies in the audience

518
00:27:59,269 --> 00:27:57,039
will probably remember a discussion

519
00:28:02,230 --> 00:27:59,279
about you know the the orbital physics

520
00:28:04,549 --> 00:28:02,240
of an elliptical orbit of a spacecraft

521
00:28:06,310 --> 00:28:04,559
orbiting transitioning to a parabolic

522
00:28:08,070 --> 00:28:06,320
orbit or kind of a trajectory through

523
00:28:09,750 --> 00:28:08,080
the atmosphere and at the time they

524
00:28:10,950 --> 00:28:09,760
didn't have a closed form mathematical

525
00:28:13,909 --> 00:28:10,960
solution to that and so they had to

526
00:28:17,190 --> 00:28:13,919
model that numerically and at the time

527
00:28:18,630 --> 00:28:17,200
a computer was a job title not a machine

528
00:28:20,950 --> 00:28:18,640
right it was the human

529
00:28:23,350 --> 00:28:20,960
folks in that movie uh that we were so

530
00:28:25,190 --> 00:28:23,360
inspired by and and it was that

531
00:28:27,430 --> 00:28:25,200
connection of those humans to the

532
00:28:28,549 --> 00:28:27,440
mission and you remember the astronauts

533
00:28:30,149 --> 00:28:28,559
in the film

534
00:28:32,470 --> 00:28:30,159
they placed their trust in those

535
00:28:33,750 --> 00:28:32,480
computers those human computers they

536
00:28:35,350 --> 00:28:33,760
knew

537
00:28:37,029 --> 00:28:35,360
if they say it's right then we're

538
00:28:38,630 --> 00:28:37,039

willing to bet our life on it so that

539
00:28:40,950 --> 00:28:38,640
that connection between humans and

540
00:28:42,630 --> 00:28:40,960
technology goes back that far and i've

541
00:28:44,950 --> 00:28:42,640
talked to some of the ibmers who worked

542
00:28:46,870 --> 00:28:44,960
on the mercury and apollo program

543
00:28:48,470 --> 00:28:46,880
homer r is someone i met

544
00:28:49,830 --> 00:28:48,480
recently at an event we had marking an

545
00:28:52,149 --> 00:28:49,840
anniversary

546
00:28:54,710 --> 00:28:52,159
and he told me at the time as much as we

547
00:28:56,310 --> 00:28:54,720
needed you know rockets and ballistic

548
00:28:58,549 --> 00:28:56,320
trajectory mathematics and everything

549
00:29:00,470 --> 00:28:58,559
else we needed compute power those those

550
00:29:02,310 --> 00:29:00,480
programs didn't work without

551
00:29:04,230 --> 00:29:02,320
compute power and so the ibm folks that

552
00:29:07,029 --> 00:29:04,240
worked on those missions knew

553
00:29:09,029 --> 00:29:07,039
that their innovations beyond anything

554
00:29:10,870 --> 00:29:09,039
they had done before were literally

555
00:29:12,630 --> 00:29:10,880
going to be necessary to bring a

556
00:29:14,789 --> 00:29:12,640
spacecraft back from orbit or to get a

557
00:29:16,789 --> 00:29:14,799
spacecraft uh to the moon and so there

558
00:29:18,950 --> 00:29:16,799
was again that that inspiration of the

559
00:29:21,110 --> 00:29:18,960
technical challenge and the power of the

560
00:29:22,710 --> 00:29:21,120
human and the computer we saw it again

561
00:29:24,310 --> 00:29:22,720
when we played chess against gary

562
00:29:26,470 --> 00:29:24,320
kasparov with the deep blue chess

563
00:29:28,310 --> 00:29:26,480

machine and at the time

564
00:29:30,310 --> 00:29:28,320
we knew that computers were capable of

565
00:29:31,909 --> 00:29:30,320
much more than just adding up ledgers

566
00:29:33,909 --> 00:29:31,919
and doing payroll we knew that computing

567
00:29:34,870 --> 00:29:33,919
could could impact the front office of

568
00:29:36,549 --> 00:29:34,880
business

569
00:29:38,149 --> 00:29:36,559
and we looked for a way to demonstrate

570
00:29:40,710 --> 00:29:38,159
that to everyone and so we played chess

571
00:29:43,350 --> 00:29:40,720
against gary kasparov and again it

572
00:29:45,190 --> 00:29:43,360
inspired people at a level that totally

573
00:29:46,950 --> 00:29:45,200
surprised us

574
00:29:49,029 --> 00:29:46,960
we did it again with the watson

575
00:29:50,789 --> 00:29:49,039
technology we put it on tv

576
00:29:52,470 --> 00:29:50,799
playing jeopardy where we said you know

577
00:29:54,149 --> 00:29:52,480
computing is now not just at a point

578
00:29:56,230 --> 00:29:54,159
where it can do front office business

579
00:29:57,590 --> 00:29:56,240
stuff computing is a point where it can

580
00:29:59,750 --> 00:29:57,600
start to have a

581
00:30:01,590 --> 00:29:59,760
a small understanding of human language

582
00:30:03,669 --> 00:30:01,600
you know most of our clients 80 of their

583
00:30:05,909 --> 00:30:03,679
data is unstructured and they get not

584
00:30:07,590 --> 00:30:05,919
enough use from it so that was a way of

585
00:30:09,350 --> 00:30:07,600
showing people here's a way that we can

586
00:30:12,230 --> 00:30:09,360
teach computers the knowledge of a human

587
00:30:14,149 --> 00:30:12,240
expert at a at a modest level and

588
00:30:15,990 --> 00:30:14,159

actually take this vast

589
00:30:18,149 --> 00:30:16,000
array of data that's under utilize and

590
00:30:19,510 --> 00:30:18,159
start not only getting insights but to

591
00:30:21,669 --> 00:30:19,520
interact between the human and the

592
00:30:23,269 --> 00:30:21,679
computer in the humans language rather

593
00:30:25,590 --> 00:30:23,279
than the computer's language so we call

594
00:30:27,590 --> 00:30:25,600
that cognitive computing and it's that

595
00:30:28,789 --> 00:30:27,600
inspiration of that jeopardy match has

596
00:30:31,269 --> 00:30:28,799
led to

597
00:30:32,789 --> 00:30:31,279
dozens and dozens of very interesting

598
00:30:34,950 --> 00:30:32,799
real world applications of this

599
00:30:36,789 --> 00:30:34,960
technology it's opened up

600
00:30:39,269 --> 00:30:36,799
all kinds of vistas for for future

601
00:30:41,190 --> 00:30:39,279
innovation and the last comment i would

602
00:30:43,190 --> 00:30:41,200
make is now that we've learned to use

603
00:30:45,830 --> 00:30:43,200
all this formerly dark data now that

604
00:30:48,710 --> 00:30:45,840
we've learned to impart some human

605
00:30:50,389 --> 00:30:48,720
intelligence uh to a machine to augment

606
00:30:51,909 --> 00:30:50,399
a human's expertise

607
00:30:53,750 --> 00:30:51,919
and to converse with the human at a

608
00:30:56,230 --> 00:30:53,760
natural human level with these cognitive

609
00:30:59,430 --> 00:30:56,240
technologies we now find ourselves

610
00:31:00,789 --> 00:30:59,440
wanting even more compute power and so

611
00:31:02,549 --> 00:31:00,799
one of the other things that we've done

612
00:31:04,389 --> 00:31:02,559
recently is we've taken one of the

613
00:31:06,389 --> 00:31:04,399

world's first quantum computers or just

614
00:31:08,789 --> 00:31:06,399
a five qubit quantum computer and

615
00:31:11,750 --> 00:31:08,799
literally put it up on the web so that

616
00:31:13,669 --> 00:31:11,760
anyone on the planet can submit programs

617
00:31:15,509 --> 00:31:13,679
to run on that and we've had hundreds of

618
00:31:17,669 --> 00:31:15,519
thousands of programs submitted from

619
00:31:19,590 --> 00:31:17,679
people all over the world some original

620
00:31:20,389 --> 00:31:19,600
scientific papers written as a result of

621
00:31:22,710 --> 00:31:20,399
these

622
00:31:25,029 --> 00:31:22,720
early inquiries and it represents the

623
00:31:26,630 --> 00:31:25,039
next enormous shift in compute power

624
00:31:27,909 --> 00:31:26,640
because instead of building computers

625
00:31:29,350 --> 00:31:27,919
out of atoms

626
00:31:31,750 --> 00:31:29,360
we'll actually use the properties of

627
00:31:33,350 --> 00:31:31,760
those atoms to do computation so kind of

628
00:31:35,669 --> 00:31:33,360
turning the tables

629
00:31:36,950 --> 00:31:35,679
on nature and and the inspiration that

630
00:31:38,630 --> 00:31:36,960
happens when the humans and the

631
00:31:41,350 --> 00:31:38,640
technology interact that way is i think

632
00:31:44,710 --> 00:31:41,360
what propels everything forward

633
00:31:45,590 --> 00:31:44,720
fascinating we're going to move to kwaja

634
00:31:47,669 --> 00:31:45,600
so

635
00:31:49,590 --> 00:31:47,679
as we we go in that direction um

636
00:31:53,029 --> 00:31:49,600
substantial engineering challengers are

637
00:31:55,430 --> 00:31:53,039
involved in bringing 4k to the screen

638
00:31:57,509 --> 00:31:55,440

space to our screens can you talk a

639
00:32:00,230 --> 00:31:57,519
little bit about those challenges sure

640
00:32:01,909 --> 00:32:00,240
um we got to participate in some of the

641
00:32:03,509 --> 00:32:01,919
challenges that people at nasa are

642
00:32:05,269 --> 00:32:03,519
dealing with on a daily basis so we got

643
00:32:06,710 --> 00:32:05,279
a little glimpse into that as we work

644
00:32:09,269 --> 00:32:06,720
through this when you're sending

645
00:32:10,070 --> 00:32:09,279
equipment into space it has to conform

646
00:32:13,590 --> 00:32:10,080
to

647
00:32:16,549 --> 00:32:13,600
because the deeper in space you go the

648
00:32:18,230 --> 00:32:16,559
harder it becomes to replenish hardware

649
00:32:19,430 --> 00:32:18,240
when you're sending equipment into space

650
00:32:21,190 --> 00:32:19,440
you have a tight power and heat

651
00:32:22,549 --> 00:32:21,200
dissipation budget and you want to make

652
00:32:23,750 --> 00:32:22,559
sure that you're remaining under tight

653
00:32:26,470 --> 00:32:23,760
constraints because you don't have an

654
00:32:29,750 --> 00:32:26,480
infinite amount of resources

655
00:32:33,430 --> 00:32:29,760
and it has to be durable so that um you

656
00:32:35,830 --> 00:32:33,440
know it can uh it can work through uh

657
00:32:37,750 --> 00:32:35,840
harsh radiations and other exposed

658
00:32:39,350 --> 00:32:37,760
elements that you have in space so

659
00:32:41,509 --> 00:32:39,360
that's just one part of getting

660
00:32:43,110 --> 00:32:41,519
something that is up and ready to be

661
00:32:44,310 --> 00:32:43,120
transported into space and can continue

662
00:32:46,230 --> 00:32:44,320
working

663
00:32:47,909 --> 00:32:46,240

after that the challenges are getting

664
00:32:50,230 --> 00:32:47,919
the data back from the space station

665
00:32:52,310 --> 00:32:50,240
down to earth and fortunately nasa has

666
00:32:54,230 --> 00:32:52,320
spent decades perfecting that technology

667
00:32:55,509 --> 00:32:54,240
making sure that we have the maximum

668
00:32:57,750 --> 00:32:55,519
amount of bandwidth that we can possibly

669
00:32:59,590 --> 00:32:57,760
get minimum amount of latency highest

670
00:33:01,190 --> 00:32:59,600
possible resilience because that's our

671
00:33:03,269 --> 00:33:01,200
lifeline to the station and we want to

672
00:33:04,710 --> 00:33:03,279
make sure that we can get that data

673
00:33:06,549 --> 00:33:04,720
since that pipeline has already been

674
00:33:09,750 --> 00:33:06,559
built we were able to just stand on

675
00:33:12,310 --> 00:33:09,760
their shoulders of nasa and get the 4k

676
00:33:14,389 --> 00:33:12,320
video stream down to earth so that's the

677
00:33:16,310 --> 00:33:14,399
first mile problem that nasa made really

678
00:33:18,149 --> 00:33:16,320
really easy or they you guys made it

679
00:33:19,750 --> 00:33:18,159
look really really easy for us

680
00:33:21,430 --> 00:33:19,760
then there's the middle mile and then

681
00:33:22,870 --> 00:33:21,440
the last mile the middle mile is making

682
00:33:24,549 --> 00:33:22,880
sure that for a live event you want to

683
00:33:26,549 --> 00:33:24,559
make sure that you have highly resilient

684
00:33:28,710 --> 00:33:26,559
infrastructure because you know there's

685
00:33:30,230 --> 00:33:28,720
a lot of people tuned in watching at the

686
00:33:32,549 --> 00:33:30,240
same time and you don't want to do

687
00:33:34,630 --> 00:33:32,559
anything to compromise their experience

688
00:33:36,549 --> 00:33:34,640

you want to make sure that

689
00:33:38,389 --> 00:33:36,559
you know you have the highest possible

690
00:33:39,509 --> 00:33:38,399
quality video quality in the stream

691
00:33:41,430 --> 00:33:39,519
that's being processed you want to make

692
00:33:43,190 --> 00:33:41,440
sure there's no disruptions you want to

693
00:33:44,789 --> 00:33:43,200
make sure that despite the fact that

694
00:33:46,789 --> 00:33:44,799
there are viewers at home that have

695
00:33:49,669 --> 00:33:46,799
varying internet bandwidth they can

696
00:33:51,430 --> 00:33:49,679
still get the maximum possible

697
00:33:54,230 --> 00:33:51,440
number of pixels on their screen so they

698
00:33:56,630 --> 00:33:54,240
can see and experience this content in

699
00:33:58,630 --> 00:33:56,640
the highest possible resolution

700
00:34:00,230 --> 00:33:58,640
so to deal with some of those challenges

701
00:34:02,630 --> 00:34:00,240
you know we provision each of these

702
00:34:05,350 --> 00:34:02,640
things inside you know a an elastic

703
00:34:06,789 --> 00:34:05,360
cloud inside of aws we you know to make

704
00:34:08,310 --> 00:34:06,799
sure that they're resilient we try to

705
00:34:09,909 --> 00:34:08,320
keep these things and running in

706
00:34:11,990 --> 00:34:09,919
multiple data centers we place the

707
00:34:13,829 --> 00:34:12,000
content across our edge points of

708
00:34:16,470 --> 00:34:13,839
presence in cloudfront to make sure that

709
00:34:18,629 --> 00:34:16,480
the data is becoming closer and closer

710
00:34:20,550 --> 00:34:18,639
to the end user so that we can maximize

711
00:34:22,149 --> 00:34:20,560
the bandwidth and minimize the latency

712
00:34:24,869 --> 00:34:22,159
and give them the ultimate possible

713
00:34:26,550 --> 00:34:24,879

immersive experience to view the space

714
00:34:29,430 --> 00:34:26,560
station

715
00:34:31,430 --> 00:34:29,440
fantastic okay now bernie you produce

716
00:34:33,510 --> 00:34:31,440
science documentaries as well as tv and

717
00:34:36,149 --> 00:34:33,520
features what impacted new technologies

718
00:34:38,950 --> 00:34:36,159
like 4k and virtual reality have on the

719
00:34:41,510 --> 00:34:38,960
sorts of stories that you can tell now

720
00:34:43,349 --> 00:34:41,520
well i would say the advent of 4k and

721
00:34:45,190 --> 00:34:43,359
virtual reality is probably the most

722
00:34:46,829 --> 00:34:45,200
exciting time to be in storytelling

723
00:34:48,869 --> 00:34:46,839
since we transitioned from radio to

724
00:34:51,109 --> 00:34:48,879
television not that i remember that

725
00:34:53,190 --> 00:34:51,119
personally

726
00:34:55,349 --> 00:34:53,200
and you know right now we buy a ticket

727
00:34:57,430 --> 00:34:55,359
to go to the cinema to watch a story

728
00:34:59,109 --> 00:34:57,440
unfold in front of us and this

729
00:35:01,910 --> 00:34:59,119
technology is going to allow us very

730
00:35:04,630 --> 00:35:01,920
shortly to go to a cinema and be in that

731
00:35:07,829 --> 00:35:04,640
story that's unfolding in front of us

732
00:35:09,510 --> 00:35:07,839
and i think the gifts of um 4k and vr

733
00:35:12,390 --> 00:35:09,520
are twofold

734
00:35:14,870 --> 00:35:12,400
firstly it democratizes experience and

735
00:35:17,030 --> 00:35:14,880
it also promotes empathy and what i mean

736
00:35:19,589 --> 00:35:17,040
by democratizing experience is that

737
00:35:21,990 --> 00:35:19,599
regardless of your age size physical

738
00:35:24,870 --> 00:35:22,000

ability we can take you on a journey to

739
00:35:25,829 --> 00:35:24,880
discover this world and beyond the other

740
00:35:28,230 --> 00:35:25,839
worlds

741
00:35:29,750 --> 00:35:28,240
and you know so pretty soon i won't have

742
00:35:31,510 --> 00:35:29,760
to go through the rigorous training and

743
00:35:33,670 --> 00:35:31,520
be as smart as tracy is to be an

744
00:35:35,510 --> 00:35:33,680
astronaut i can just pop my goggles on

745
00:35:38,310 --> 00:35:35,520
and how marvelous is that

746
00:35:40,790 --> 00:35:38,320
and so i think that's a real advantage

747
00:35:42,870 --> 00:35:40,800
and of course with empathy

748
00:35:45,349 --> 00:35:42,880
and i think particularly in the current

749
00:35:46,230 --> 00:35:45,359
political climate it would certainly

750
00:35:47,829 --> 00:35:46,240
help

751
00:35:50,310 --> 00:35:47,839
to allow people to step into someone

752
00:35:53,829 --> 00:35:50,320
else's skin for a while and see what

753
00:35:55,750 --> 00:35:53,839
their experience is on a daily basis um

754
00:35:57,829 --> 00:35:55,760
you know so as we forge forward into the

755
00:36:00,630 --> 00:35:57,839
future and hopefully to colonize other

756
00:36:03,670 --> 00:36:00,640
planets perhaps if we come together as a

757
00:36:07,190 --> 00:36:03,680
population on this planet first then vr

758
00:36:09,510 --> 00:36:07,200
and 4k can play a role in that

759
00:36:13,670 --> 00:36:09,520
okay

760
00:36:15,670 --> 00:36:13,680
dr dyson what role does uh

761
00:36:18,150 --> 00:36:15,680
live 4k cloud

762
00:36:20,150 --> 00:36:18,160
play in your work gathering diagnostics

763
00:36:22,069 --> 00:36:20,160

and experiments

764
00:36:23,750 --> 00:36:22,079
i think on orbit

765
00:36:25,109 --> 00:36:23,760
it's becoming

766
00:36:28,150 --> 00:36:25,119
more and more

767
00:36:30,790 --> 00:36:28,160
useful as it is important because

768
00:36:32,470 --> 00:36:30,800
as the station grows in terms of the

769
00:36:33,910 --> 00:36:32,480
investigations the scientific

770
00:36:35,990 --> 00:36:33,920
investigations

771
00:36:37,589 --> 00:36:36,000
we astronauts have

772
00:36:39,349 --> 00:36:37,599
fewer fewer

773
00:36:41,910 --> 00:36:39,359
opportunities to

774
00:36:43,670 --> 00:36:41,920
really dive into the actual details of

775
00:36:46,710 --> 00:36:43,680
the science that we're setting up and

776
00:36:49,670 --> 00:36:46,720
helping to produce data so having 4k and

777
00:36:51,990 --> 00:36:49,680
the cloud the ability to bring this

778
00:36:54,710 --> 00:36:52,000
work down in high definition allows the

779
00:36:57,349 --> 00:36:54,720
investigator to really do their job and

780
00:36:59,750 --> 00:36:57,359
to be able to see the detail that we

781
00:37:01,510 --> 00:36:59,760
perhaps would miss in trying to relay

782
00:37:03,430 --> 00:37:01,520
this information to them otherwise and

783
00:37:05,030 --> 00:37:03,440
so i think

784
00:37:07,109 --> 00:37:05,040
the greater we

785
00:37:08,470 --> 00:37:07,119
the greater our capability in bringing

786
00:37:10,069 --> 00:37:08,480
down definition

787
00:37:12,950 --> 00:37:10,079
in these scientific experiments in

788
00:37:14,710 --> 00:37:12,960

particular the um the greater ability

789
00:37:16,390 --> 00:37:14,720
that the researchers have on the ground

790
00:37:17,510 --> 00:37:16,400
to use the data that we're collecting

791
00:37:19,270 --> 00:37:17,520
for them

792
00:37:20,310 --> 00:37:19,280
um are there any specific examples that

793
00:37:22,790 --> 00:37:20,320
you think of something that you're

794
00:37:25,670 --> 00:37:22,800
working on right now and using this um

795
00:37:28,470 --> 00:37:25,680
well so when i was up on orbit we had an

796
00:37:30,310 --> 00:37:28,480
experiment called uh cfe and it was

797
00:37:31,430 --> 00:37:30,320
critical fluid

798
00:37:35,190 --> 00:37:31,440
dynamics

799
00:37:36,470 --> 00:37:35,200
and using shapes of vessels to propel

800
00:37:38,470 --> 00:37:36,480
liquids

801
00:37:40,710 --> 00:37:38,480
from point a to point b and it has its

802
00:37:43,510 --> 00:37:40,720
application in fuel tank design for

803
00:37:46,310 --> 00:37:43,520
spacecraft where you could um you could

804
00:37:47,670 --> 00:37:46,320
propel fluid without any kind of moving

805
00:37:49,750 --> 00:37:47,680
parts which is very important when

806
00:37:51,829 --> 00:37:49,760
you're trying to reduce mass on a

807
00:37:53,670 --> 00:37:51,839
spacecraft and

808
00:37:56,069 --> 00:37:53,680
but one of the most important components

809
00:37:58,310 --> 00:37:56,079
of setting up this experiment is the

810
00:38:00,470 --> 00:37:58,320
video camera and if you were to walk

811
00:38:02,230 --> 00:38:00,480
into mission control during one of these

812
00:38:05,589 --> 00:38:02,240
experiments you would see

813
00:38:07,510 --> 00:38:05,599

very huge um apparatus which was

814
00:38:10,310 --> 00:38:07,520
actually really this big but it's blown

815
00:38:11,670 --> 00:38:10,320
up huge on the screen and a timer and

816
00:38:13,109 --> 00:38:11,680
then you would hear the principal

817
00:38:15,430 --> 00:38:13,119
investigator in the background with all

818
00:38:17,910 --> 00:38:15,440
his oohs and oz and and excitement over

819
00:38:20,790 --> 00:38:17,920
what he's seen through the video and so

820
00:38:22,710 --> 00:38:20,800
i can only imagine 4k what that would be

821
00:38:24,390 --> 00:38:22,720
telling and that's that's even without

822
00:38:26,630 --> 00:38:24,400
all of the timing data and the

823
00:38:28,710 --> 00:38:26,640
dimensional data but just what he's

824
00:38:30,950 --> 00:38:28,720
watching through the video

825
00:38:33,750 --> 00:38:30,960
and is being

826
00:38:35,510 --> 00:38:33,760
transmitted to him in in a level of

827
00:38:37,190 --> 00:38:35,520
information as well as inspiration

828
00:38:38,710 --> 00:38:37,200
that's just one example

829
00:38:41,670 --> 00:38:38,720
it's fantastic

830
00:38:43,750 --> 00:38:41,680
um now rodney nasa has achieved this

831
00:38:46,390 --> 00:38:43,760
technology first today with the live

832
00:38:47,829 --> 00:38:46,400
stream in 4k from space what lies ahead

833
00:38:49,990 --> 00:38:47,839
can you talk a little bit about the role

834
00:38:52,470 --> 00:38:50,000
that live 4k and the cloud uh will play

835
00:38:53,829 --> 00:38:52,480
as humans move farther from earth and

836
00:38:55,990 --> 00:38:53,839
toward mars

837
00:38:58,310 --> 00:38:56,000
right so there's a lot of components to

838
00:39:00,870 --> 00:38:58,320

imaging from space right so

839
00:39:03,109 --> 00:39:00,880
uh part of it is the compression so we

840
00:39:04,390 --> 00:39:03,119
used h.265 compression today for the

841
00:39:06,710 --> 00:39:04,400
first time

842
00:39:07,990 --> 00:39:06,720
and uh bandwidth is very precious even

843
00:39:10,069 --> 00:39:08,000
though we've increased the amount of

844
00:39:11,910 --> 00:39:10,079
bandwidth we get from the station as we

845
00:39:13,750 --> 00:39:11,920
start moving further out

846
00:39:15,750 --> 00:39:13,760
and start putting human presence around

847
00:39:18,230 --> 00:39:15,760
the moon and then start talking to go to

848
00:39:19,829 --> 00:39:18,240
mars that amount of bandwidth that we

849
00:39:21,670 --> 00:39:19,839
can get back from the spacecraft gets

850
00:39:24,950 --> 00:39:21,680
smaller and smaller

851
00:39:27,109 --> 00:39:24,960
so if as a technologist and somebody

852
00:39:29,430 --> 00:39:27,119
interested in having compelling content

853
00:39:31,430 --> 00:39:29,440
for filmmakers

854
00:39:33,750 --> 00:39:31,440
we need to uh if we're going to do 4k

855
00:39:36,710 --> 00:39:33,760
when we go back to the moon

856
00:39:38,470 --> 00:39:36,720
or the moon area the cis lunar space

857
00:39:41,589 --> 00:39:38,480
i've got to fit that into a smaller pipe

858
00:39:43,510 --> 00:39:41,599
so the compression was really important

859
00:39:44,310 --> 00:39:43,520
better pixels more pixels

860
00:39:46,870 --> 00:39:44,320
and

861
00:39:50,069 --> 00:39:46,880
being able to

862
00:39:51,190 --> 00:39:50,079
down select a frame or a segment inside

863
00:39:52,150 --> 00:39:51,200

a larger

864
00:39:53,510 --> 00:39:52,160
space

865
00:39:55,510 --> 00:39:53,520
in the image

866
00:39:57,990 --> 00:39:55,520
is also very very valuable so as we go

867
00:39:59,349 --> 00:39:58,000
from 4k to 8k

868
00:40:00,710 --> 00:39:59,359
maybe someday

869
00:40:02,550 --> 00:40:00,720
sooner and maybe

870
00:40:04,230 --> 00:40:02,560
than people might think

871
00:40:06,870 --> 00:40:04,240
what that actually lets us do is shoot a

872
00:40:08,790 --> 00:40:06,880
very wide field of view and still have

873
00:40:11,109 --> 00:40:08,800
extremely high resolution in a smaller

874
00:40:13,589 --> 00:40:11,119
part of it so there are a lot of aspects

875
00:40:14,870 --> 00:40:13,599
of doing demonstrations like this

876
00:40:15,990 --> 00:40:14,880
that are going to get us ready for the

877
00:40:18,069 --> 00:40:16,000
kinds of things that we're going to be

878
00:40:19,190 --> 00:40:18,079
doing hopefully in the not so distant

879
00:40:21,430 --> 00:40:19,200
future

880
00:40:24,230 --> 00:40:21,440
so from from here what are some of the

881
00:40:25,750 --> 00:40:24,240
next demonstrations and tests and things

882
00:40:27,190 --> 00:40:25,760
that you'll be working on well one of

883
00:40:29,349 --> 00:40:27,200
the things that

884
00:40:30,870 --> 00:40:29,359
we've talked a little bit about vr one

885
00:40:33,349 --> 00:40:30,880
of the things that we're interested in

886
00:40:35,349 --> 00:40:33,359
vr technology for is

887
00:40:37,349 --> 00:40:35,359
right now on the space station on the

888
00:40:40,309 --> 00:40:37,359

outside of the space station

889
00:40:41,750 --> 00:40:40,319
we have pan tilt cameras um these these

890
00:40:44,470 --> 00:40:41,760
units were built

891
00:40:46,309 --> 00:40:44,480
over 20 years ago and they're very very

892
00:40:47,430 --> 00:40:46,319
heavy and very clunky

893
00:40:49,349 --> 00:40:47,440
and

894
00:40:51,270 --> 00:40:49,359
everything you take in space is precious

895
00:40:53,910 --> 00:40:51,280
every pound that you take is precious

896
00:40:56,710 --> 00:40:53,920
and so simplification and making things

897
00:40:58,950 --> 00:40:56,720
smaller would really pay off uh

898
00:41:01,510 --> 00:40:58,960
particularly if you're in cis lunar

899
00:41:04,069 --> 00:41:01,520
space and you've got

900
00:41:06,950 --> 00:41:04,079
proximity operations of a spacecraft

901
00:41:09,670 --> 00:41:06,960
approaching for example so if i can get

902
00:41:11,910 --> 00:41:09,680
the functionality of pan tilt and zoom

903
00:41:13,829 --> 00:41:11,920
by over sampling and having a vr camera

904
00:41:15,910 --> 00:41:13,839
with no moving parts i've solved a whole

905
00:41:19,190 --> 00:41:15,920
bunch of problems for us we don't have

906
00:41:21,349 --> 00:41:19,200
to launch this big complex device that's

907
00:41:23,430 --> 00:41:21,359
heavy that points the camera around and

908
00:41:25,510 --> 00:41:23,440
what if there's something going on in

909
00:41:28,150 --> 00:41:25,520
front and something going on in the back

910
00:41:31,190 --> 00:41:28,160
uh with something like that we would be

911
00:41:32,790 --> 00:41:31,200
able to get a lot of detail and have

912
00:41:34,630 --> 00:41:32,800
operators on the ground looking at

913
00:41:36,870 --> 00:41:34,640

everything around them with no moving

914
00:41:38,710 --> 00:41:36,880
parts

915
00:41:40,790 --> 00:41:38,720
so can you elaborate a little bit on

916
00:41:43,190 --> 00:41:40,800
what's what what's up there right now

917
00:41:45,109 --> 00:41:43,200
and what are you using or well the most

918
00:41:47,270 --> 00:41:45,119
advanced motion imagery camera is the

919
00:41:49,270 --> 00:41:47,280
one we just saw used right there the red

920
00:41:52,150 --> 00:41:49,280
epic dragon right

921
00:41:55,829 --> 00:41:52,160
day-to-day cameras are routine um

922
00:41:57,670 --> 00:41:55,839
hd cameras we have a canon 305

923
00:42:00,150 --> 00:41:57,680
these kinds of demonstrations

924
00:42:03,030 --> 00:42:00,160
usually result in more and more

925
00:42:04,470 --> 00:42:03,040
of the next thing right and so uh the

926
00:42:06,710 --> 00:42:04,480
natural progression would be more and

927
00:42:09,270 --> 00:42:06,720
more uhd 4k

928
00:42:11,589 --> 00:42:09,280
and use of h.265 so we can get even more

929
00:42:13,430 --> 00:42:11,599
streams down to the ground

930
00:42:14,790 --> 00:42:13,440
we have a few things that we're trying

931
00:42:16,950 --> 00:42:14,800
to do in the next few years you're going

932
00:42:18,710 --> 00:42:16,960
to start seeing the space station used

933
00:42:20,870 --> 00:42:18,720
as a laboratory to get us ready for

934
00:42:23,430 --> 00:42:20,880
these technologies as we start getting

935
00:42:25,270 --> 00:42:23,440
ready to move to cisco interspace and i

936
00:42:27,750 --> 00:42:25,280
could just jump in there so i don't know

937
00:42:29,829 --> 00:42:27,760
if everybody's aware but nasa is a huge

938
00:42:31,910 --> 00:42:29,839

partner in the filmmaking business and

939
00:42:33,670 --> 00:42:31,920
they're huge collaborators and

940
00:42:36,710 --> 00:42:33,680
oftentimes they will supply

941
00:42:39,109 --> 00:42:36,720
exceptionally high level high quality

942
00:42:41,510 --> 00:42:39,119
footage for films i made a series called

943
00:42:44,069 --> 00:42:41,520
secret space escapes and frankly the

944
00:42:45,910 --> 00:42:44,079
nasa footage was hd and it was the

945
00:42:48,069 --> 00:42:45,920
highest quality we had from the

946
00:42:50,550 --> 00:42:48,079
international space station which is

947
00:42:52,309 --> 00:42:50,560
pretty incredible so when rodney told me

948
00:42:55,109 --> 00:42:52,319
that they were looking into putting

949
00:42:57,190 --> 00:42:55,119
virtual reality cameras on the iss i

950
00:42:59,910 --> 00:42:57,200
think that's an enormous resource for

951
00:43:02,390 --> 00:42:59,920
film producers too and of course in turn

952
00:43:05,109 --> 00:43:02,400
that's how you inspire people

953
00:43:07,829 --> 00:43:05,119
to move forward and you know whether to

954
00:43:10,790 --> 00:43:07,839
become scientists or just to be you know

955
00:43:13,430 --> 00:43:10,800
donate to the scientific cause um so

956
00:43:15,510 --> 00:43:13,440
it's all you know hugely positive i love

957
00:43:17,349 --> 00:43:15,520
the author of the little prince said if

958
00:43:20,550 --> 00:43:17,359
you want to if you want to be an

959
00:43:22,630 --> 00:43:20,560
explorer on the great sea don't uh don't

960
00:43:24,710 --> 00:43:22,640
divide people up to collect wood and buy

961
00:43:27,270 --> 00:43:24,720
a ship inspire them to yearn for the

962
00:43:29,589 --> 00:43:27,280
open ocean and i think that's why

963
00:43:31,910 --> 00:43:29,599

scientists and filmmakers are such a

964
00:43:32,790 --> 00:43:31,920
kind of symbiotic relationship and we

965
00:43:34,309 --> 00:43:32,800
kind of

966
00:43:35,430 --> 00:43:34,319
feed each other what was the name of the

967
00:43:40,150 --> 00:43:35,440
circle

968
00:43:41,290 --> 00:43:40,160
yesterday and i said well no one's

969
00:43:42,870 --> 00:43:41,300
invited me

970
00:43:44,230 --> 00:43:42,880
[Laughter]

971
00:43:46,710 --> 00:43:44,240
you know i picked i want to pick up on

972
00:43:48,470 --> 00:43:46,720
something you said about the the the

973
00:43:50,550 --> 00:43:48,480
latency problem and the premium on

974
00:43:52,390 --> 00:43:50,560
bandwidth we saw a really interesting

975
00:43:55,589 --> 00:43:52,400
example of the 11 second delay up and

976
00:43:56,870 --> 00:43:55,599
down to the iss and if i look at you

977
00:43:58,550 --> 00:43:56,880
know one of the

978
00:44:00,150 --> 00:43:58,560
computing revolutions happening today

979
00:44:01,910 --> 00:44:00,160
that's often called the internet of

980
00:44:03,750 --> 00:44:01,920
things so taking these sensors that are

981
00:44:05,829 --> 00:44:03,760
deployed in a lot of the physical world

982
00:44:07,109 --> 00:44:05,839
and bringing back a digital image of the

983
00:44:09,670 --> 00:44:07,119
physical world that we can then

984
00:44:12,230 --> 00:44:09,680
manipulate you run into an interesting

985
00:44:14,710 --> 00:44:12,240
conundrum because computing power

986
00:44:16,870 --> 00:44:14,720
growing like this data volumes growing

987
00:44:19,750 --> 00:44:16,880
like this almost by definition coming

988
00:44:21,670 --> 00:44:19,760

from the edge but then communications

989
00:44:24,230 --> 00:44:21,680
bandwidth growing more slowly even

990
00:44:25,990 --> 00:44:24,240
terrestrially so the innovations that

991
00:44:27,990 --> 00:44:26,000
nasa is going to be forced to make to

992
00:44:29,829 --> 00:44:28,000
support space flight

993
00:44:32,550 --> 00:44:29,839
about more autonomous computing at the

994
00:44:34,950 --> 00:44:32,560
far end skinnier communication pipes

995
00:44:37,190 --> 00:44:34,960
there will be another revolution in the

996
00:44:40,470 --> 00:44:37,200
compute industry that is likely to be

997
00:44:42,390 --> 00:44:40,480
led by the folks from nasa just as you

998
00:44:44,309 --> 00:44:42,400
know in many ways the original computing

999
00:44:46,150 --> 00:44:44,319
revolution was led by programs like

1000
00:44:47,829 --> 00:44:46,160
mercury and apollo

1001
00:44:50,309 --> 00:44:47,839
the big difference though to our

1002
00:44:51,829 --> 00:44:50,319
advantage is in the apollo era nasa had

1003
00:44:55,510 --> 00:44:51,839
to invent it

1004
00:44:57,349 --> 00:44:55,520
now uh we can leverage technologists and

1005
00:44:58,790 --> 00:44:57,359
things like what we've seen and talked

1006
00:45:00,630 --> 00:44:58,800
about here

1007
00:45:02,390 --> 00:45:00,640
and maybe give you a hint or two of

1008
00:45:03,750 --> 00:45:02,400
that's really cool but could you do a

1009
00:45:06,309 --> 00:45:03,760
little bit of this and a little bit of

1010
00:45:08,069 --> 00:45:06,319
that and and uh you know seeing all this

1011
00:45:09,829 --> 00:45:08,079
commercial off the shelf technology pull

1012
00:45:11,589 --> 00:45:09,839
off what we just did we didn't have to

1013
00:45:14,710 --> 00:45:11,599

invent anything we were just able to

1014
00:45:16,230 --> 00:45:14,720
leverage what you folks build and design

1015
00:45:17,910 --> 00:45:16,240
and take advantage of but your mission

1016
00:45:19,589 --> 00:45:17,920
inspires and just the way bernie was

1017
00:45:21,990 --> 00:45:19,599
talking about your mission compels

1018
00:45:24,470 --> 00:45:22,000
people to gather the wood for the ships

1019
00:45:26,390 --> 00:45:24,480
in a way like no other institution i've

1020
00:45:28,390 --> 00:45:26,400
ever seen

1021
00:45:30,790 --> 00:45:28,400
i want to also re-emphasize one of the

1022
00:45:33,030 --> 00:45:30,800
points he made earlier around the higher

1023
00:45:34,950 --> 00:45:33,040
resolution and the role that it plays as

1024
00:45:37,510 --> 00:45:34,960
you go deeper and deeper into space the

1025
00:45:39,589 --> 00:45:37,520
longevity of your hardware becomes more

1026
00:45:40,790 --> 00:45:39,599
and more crucial right to get to mars

1027
00:45:42,790 --> 00:45:40,800
you know it's a

1028
00:45:43,750 --> 00:45:42,800
nine months to 24 month journey

1029
00:45:46,710 --> 00:45:43,760
depending on where you are on the

1030
00:45:48,150 --> 00:45:46,720
planetary rotations it is really hard to

1031
00:45:49,990 --> 00:45:48,160
think about hardware that you have to

1032
00:45:52,790 --> 00:45:50,000
replace even lubricating these moving

1033
00:45:54,710 --> 00:45:52,800
parts is so much more difficult and if

1034
00:45:56,309 --> 00:45:54,720
you can take away that need to have

1035
00:45:58,069 --> 00:45:56,319
moving parts if you can have that

1036
00:45:59,670 --> 00:45:58,079
perspective one you have increased the

1037
00:46:02,069 --> 00:45:59,680
longevity two

1038
00:46:03,589 --> 00:46:02,079

what you have done is you may not know

1039
00:46:05,990 --> 00:46:03,599
what you're actually looking for until

1040
00:46:08,710 --> 00:46:06,000
later and having that wider field of

1041
00:46:10,230 --> 00:46:08,720
view allows you to go back and take a

1042
00:46:11,510 --> 00:46:10,240
look at some side effects or something

1043
00:46:12,870 --> 00:46:11,520
else that might have been interesting

1044
00:46:14,790 --> 00:46:12,880
that you didn't think it was interesting

1045
00:46:16,950 --> 00:46:14,800
at the time that you captured it but

1046
00:46:18,870 --> 00:46:16,960
what video does is it allows you to

1047
00:46:20,390 --> 00:46:18,880
capture these moments into perpetuity so

1048
00:46:22,550 --> 00:46:20,400
that when you become interested you can

1049
00:46:25,750 --> 00:46:22,560
go back look at the data again to your

1050
00:46:28,069 --> 00:46:25,760
point and learn from it again so

1051
00:46:29,990 --> 00:46:28,079
yeah i just i i feel inspired to mention

1052
00:46:33,109 --> 00:46:30,000
this though i'm

1053
00:46:36,150 --> 00:46:33,119
i don't know the uh the conclusion but

1054
00:46:37,990 --> 00:46:36,160
on spacewalks uh you know we have

1055
00:46:39,990 --> 00:46:38,000
two cameras on our helmet and then

1056
00:46:42,069 --> 00:46:40,000
whatever external cameras that we have

1057
00:46:43,430 --> 00:46:42,079
looking that can look at the position

1058
00:46:46,069 --> 00:46:43,440
where the astronauts are during the

1059
00:46:48,309 --> 00:46:46,079
spacewalk and that gives us in mission

1060
00:46:50,069 --> 00:46:48,319
control an idea of what's going on

1061
00:46:52,150 --> 00:46:50,079
during a spacewalk and it wasn't until

1062
00:46:55,030 --> 00:46:52,160
recently that i believe it was terry

1063
00:46:57,990 --> 00:46:55,040

virts that took a gopro camera out

1064
00:47:00,870 --> 00:46:58,000
on a recent spacewalk and

1065
00:47:03,430 --> 00:47:00,880
how that opened up everyone's eyes to

1066
00:47:05,910 --> 00:47:03,440
the um the reality of what actually goes

1067
00:47:08,390 --> 00:47:05,920
on i mean we got a step closer to what

1068
00:47:10,470 --> 00:47:08,400
we actually see through our visor when

1069
00:47:12,470 --> 00:47:10,480
we're out in the vacuum of space

1070
00:47:14,150 --> 00:47:12,480
and i think with 4k

1071
00:47:16,069 --> 00:47:14,160
and the considerations that we have to

1072
00:47:18,710 --> 00:47:16,079
make in order to put things in space

1073
00:47:21,030 --> 00:47:18,720
that bring back such incredible images

1074
00:47:24,790 --> 00:47:21,040
miniaturizing it and making it durable

1075
00:47:27,270 --> 00:47:24,800
for the extremes of outer space the the

1076
00:47:30,710 --> 00:47:27,280
temperature extremes the the atomic

1077
00:47:31,750 --> 00:47:30,720
oxygen the vacuum of space and then just

1078
00:47:36,870 --> 00:47:31,760
the

1079
00:47:42,069 --> 00:47:36,880
working around hardware to be able to

1080
00:47:45,030 --> 00:47:42,079
capture um the magnificence of being in

1081
00:47:47,270 --> 00:47:45,040
literally in outer space i would i just

1082
00:47:49,270 --> 00:47:47,280
can't wait to see when we're able to

1083
00:47:51,109 --> 00:47:49,280
pull all of that together to bring it

1084
00:47:52,790 --> 00:47:51,119
from the inside of the space station to

1085
00:47:55,030 --> 00:47:52,800
the outside

1086
00:47:57,030 --> 00:47:55,040
what are some of the ways that

1087
00:48:00,309 --> 00:47:57,040
viewers can currently watch what's

1088
00:48:02,950 --> 00:48:00,319

happening on nasa tv and life

1089
00:48:04,069 --> 00:48:02,960
well i know that we run live streaming

1090
00:48:07,109 --> 00:48:04,079
video

1091
00:48:08,790 --> 00:48:07,119
from what we say dpc to dpc uh daily

1092
00:48:10,470 --> 00:48:08,800
planning conference to daily planning

1093
00:48:12,470 --> 00:48:10,480
conference so the beginning of an

1094
00:48:15,190 --> 00:48:12,480
astronauts day to the end of it there's

1095
00:48:16,870 --> 00:48:15,200
live streaming video from one of the um

1096
00:48:18,470 --> 00:48:16,880
cameras in the module depending on

1097
00:48:20,870 --> 00:48:18,480
what's going on that day

1098
00:48:22,069 --> 00:48:20,880
right there's uh there's an external hd

1099
00:48:24,230 --> 00:48:22,079
camera

1100
00:48:26,309 --> 00:48:24,240
system called hdev

1101
00:48:29,030 --> 00:48:26,319
uh my colleague carlos sitting in the

1102
00:48:30,710 --> 00:48:29,040
audience uh is uh the principal

1103
00:48:32,069 --> 00:48:30,720
investigator for that those are four

1104
00:48:34,470 --> 00:48:32,079
cameras that are sitting on the outside

1105
00:48:37,510 --> 00:48:34,480
of the station always looking down

1106
00:48:40,309 --> 00:48:37,520
and you can look that up and

1107
00:48:42,309 --> 00:48:40,319
when it has a signal you can see that 24

1108
00:48:43,589 --> 00:48:42,319
7 365 when it doesn't have a signal of

1109
00:48:45,109 --> 00:48:43,599
course it'll just say we'll be right

1110
00:48:47,589 --> 00:48:45,119
back basically

1111
00:48:49,670 --> 00:48:47,599
once we get a signal and we're starting

1112
00:48:50,630 --> 00:48:49,680
to put hdtv cameras out on the space

1113
00:48:52,309 --> 00:48:50,640

station

1114
00:48:54,069 --> 00:48:52,319
um you know the the international space

1115
00:48:56,710 --> 00:48:54,079
station was designed and built before

1116
00:48:58,630 --> 00:48:56,720
anybody even dreamed of hdtv and so

1117
00:49:00,470 --> 00:48:58,640
we've had to sort of retrofit some of

1118
00:49:01,510 --> 00:49:00,480
these systems and the communications

1119
00:49:03,190 --> 00:49:01,520
that are

1120
00:49:05,910 --> 00:49:03,200
on board the station to make all these

1121
00:49:07,910 --> 00:49:05,920
things work uh it wasn't so long ago

1122
00:49:10,230 --> 00:49:07,920
that doing internet protocol anything on

1123
00:49:11,510 --> 00:49:10,240
the station was uh very very difficult

1124
00:49:13,270 --> 00:49:11,520
and impossible

1125
00:49:14,630 --> 00:49:13,280
and so now

1126
00:49:16,390 --> 00:49:14,640
that we basically have an internet in

1127
00:49:18,790 --> 00:49:16,400
space and we even have wi-fi on the

1128
00:49:20,870 --> 00:49:18,800
outside of the space station now for

1129
00:49:23,349 --> 00:49:20,880
people like me i get pretty excited

1130
00:49:25,030 --> 00:49:23,359
about that because it means maybe on a

1131
00:49:27,030 --> 00:49:25,040
future space walk somebody can leave a

1132
00:49:28,549 --> 00:49:27,040
camera sitting out there in a spot we

1133
00:49:30,390 --> 00:49:28,559
haven't seen before and we can

1134
00:49:32,950 --> 00:49:30,400
occasionally see that point of view as

1135
00:49:35,430 --> 00:49:32,960
well but uh nasa television is up on

1136
00:49:36,790 --> 00:49:35,440
satellite and it's streamed

1137
00:49:38,549 --> 00:49:36,800
all the time

1138
00:49:39,910 --> 00:49:38,559

there's lots of different ways of seeing

1139
00:49:42,309 --> 00:49:39,920
what's going on

1140
00:49:43,670 --> 00:49:42,319
nasa's charter says in its charter

1141
00:49:45,510 --> 00:49:43,680
everything that we do

1142
00:49:47,190 --> 00:49:45,520
is owned by the american taxpayer and

1143
00:49:49,910 --> 00:49:47,200
we're to make it available to them in

1144
00:49:52,309 --> 00:49:49,920
the most practical way we possibly can

1145
00:49:53,990 --> 00:49:52,319
and a lot of us work very hard to do

1146
00:49:57,349 --> 00:49:54,000
just that

1147
00:49:59,510 --> 00:49:57,359
and also social media has propelled nasa

1148
00:50:02,309 --> 00:49:59,520
into people's lives in a way we've never

1149
00:50:04,230 --> 00:50:02,319
seen before this century so it's almost

1150
00:50:06,870 --> 00:50:04,240
um they're really leveraging their

1151
00:50:08,470 --> 00:50:06,880
advantage of this incredible imagery

1152
00:50:11,109 --> 00:50:08,480
that they have and then of course the

1153
00:50:12,549 --> 00:50:11,119
advantage of sharing and all that so

1154
00:50:15,030 --> 00:50:12,559
it's it's almost that they're moving

1155
00:50:17,510 --> 00:50:15,040
from a brand their lifestyle

1156
00:50:18,790 --> 00:50:17,520
so if you are interested in nasa i would

1157
00:50:20,390 --> 00:50:18,800
encourage you to sign up for their

1158
00:50:22,069 --> 00:50:20,400
twitter account instagram account

1159
00:50:24,710 --> 00:50:22,079
because it's pretty cool thanks for the

1160
00:50:28,230 --> 00:50:26,710
start winding down but um one thing i

1161
00:50:29,270 --> 00:50:28,240
did want to make sure we talked about

1162
00:50:32,710 --> 00:50:29,280
since

1163
00:50:35,109 --> 00:50:32,720

uh nasa hollywood is um dr dyson you

1164
00:50:36,710 --> 00:50:35,119
were consultant on

1165
00:50:38,390 --> 00:50:36,720
the market can you tell us a little bit

1166
00:50:41,510 --> 00:50:38,400
about that experience

1167
00:50:43,510 --> 00:50:41,520
yes um i've had the honor and privilege

1168
00:50:46,150 --> 00:50:43,520
of working with jessica chastain on her

1169
00:50:46,870 --> 00:50:46,160
role as commander melissa lewis she it

1170
00:50:50,150 --> 00:50:46,880
was

1171
00:50:52,390 --> 00:50:50,160
all her doing um she asked if she could

1172
00:50:53,670 --> 00:50:52,400
go to space camp and ridley rigged it up

1173
00:50:56,549 --> 00:50:53,680
so that she could

1174
00:50:58,390 --> 00:50:56,559
visit both jpl and johnson space center

1175
00:51:00,790 --> 00:50:58,400
and she wanted to meet with a female

1176
00:51:03,829 --> 00:51:00,800
commander type and i was the lucky one

1177
00:51:06,950 --> 00:51:03,839
that got to spend a day with her

1178
00:51:09,829 --> 00:51:06,960
in our training facility and

1179
00:51:12,150 --> 00:51:09,839
to sum it up she's she's a researcher

1180
00:51:15,030 --> 00:51:12,160
jessica is and she takes any role that

1181
00:51:16,950 --> 00:51:15,040
she uh is given very seriously

1182
00:51:18,710 --> 00:51:16,960
she by nature she told me that she's

1183
00:51:19,990 --> 00:51:18,720
she's more of an emotional person and

1184
00:51:22,710 --> 00:51:20,000
what she really wanted to do is

1185
00:51:26,870 --> 00:51:22,720
dramatize her her character but what she

1186
00:51:29,990 --> 00:51:26,880
walked away with was um this sense of

1187
00:51:33,190 --> 00:51:30,000
the the intensity of the work that we do

1188
00:51:34,790 --> 00:51:33,200

as as astronauts so i felt in some ways

1189
00:51:37,750 --> 00:51:34,800
bad that she had to suppress her inner

1190
00:51:39,430 --> 00:51:37,760
being but i was admiring her all the all

1191
00:51:41,750 --> 00:51:39,440
the more because of

1192
00:51:43,910 --> 00:51:41,760
the character that she portrayed i felt

1193
00:51:46,069 --> 00:51:43,920
not only um

1194
00:51:48,150 --> 00:51:46,079
honored the work that we do but she it

1195
00:51:50,549 --> 00:51:48,160
was also very important to her to

1196
00:51:52,150 --> 00:51:50,559
understand the technical aspect of it as

1197
00:51:54,549 --> 00:51:52,160
well as the human side of it and that's

1198
00:51:56,390 --> 00:51:54,559
what i think that the media in hollywood

1199
00:51:59,589 --> 00:51:56,400
in particular

1200
00:52:01,910 --> 00:51:59,599
does um in great favor to nasa because

1201
00:52:04,790 --> 00:52:01,920
nasa's really busy with the the geeky

1202
00:52:06,950 --> 00:52:04,800
side of things and we're not always

1203
00:52:09,430 --> 00:52:06,960
at the top of our priority list how to

1204
00:52:11,270 --> 00:52:09,440
express it to the rest of the world

1205
00:52:13,109 --> 00:52:11,280
something that they that they own and it

1206
00:52:13,910 --> 00:52:13,119
belongs to them but

1207
00:52:18,150 --> 00:52:13,920
through

1208
00:52:19,670 --> 00:52:18,160
they do a very good job of cash

1209
00:52:22,630 --> 00:52:19,680
capturing the human side of it and in

1210
00:52:24,309 --> 00:52:22,640
fact um to jessica she asked me as many

1211
00:52:25,589 --> 00:52:24,319
questions about the technical side of it

1212
00:52:27,510 --> 00:52:25,599
what does it take to be a commander

1213
00:52:29,109 --> 00:52:27,520

what's your role of a commander on the

1214
00:52:31,270 --> 00:52:29,119
space station both

1215
00:52:33,030 --> 00:52:31,280
every day and when the bad things happen

1216
00:52:35,109 --> 00:52:33,040
she got really into the details but then

1217
00:52:37,030 --> 00:52:35,119
she noticed i was wearing a wedding ring

1218
00:52:39,190 --> 00:52:37,040
and she said did you did you wear that

1219
00:52:40,870 --> 00:52:39,200
during your mission and i said every day

1220
00:52:42,470 --> 00:52:40,880
and so she said that's great i want to

1221
00:52:44,150 --> 00:52:42,480
incorporate that and it was very

1222
00:52:46,630 --> 00:52:44,160
important to her to capture the human

1223
00:52:48,470 --> 00:52:46,640
side of it and she did that in more ways

1224
00:52:50,470 --> 00:52:48,480
than just what you saw on the screen but

1225
00:52:52,630 --> 00:52:50,480
in pulling all of her cast mates

1226
00:52:54,470 --> 00:52:52,640
together during the filming

1227
00:52:56,870 --> 00:52:54,480
she really brought to life

1228
00:52:59,510 --> 00:52:56,880
crew camaraderie and what really binds

1229
00:53:01,829 --> 00:52:59,520
the mission together are the people both

1230
00:53:05,670 --> 00:53:01,839
up in space and on the ground and in

1231
00:53:08,069 --> 00:53:05,680
between so i think a big tribute to

1232
00:53:10,390 --> 00:53:08,079
hollywood and jessica in particular

1233
00:53:12,549 --> 00:53:10,400
well we're we're out of time but i just

1234
00:53:14,790 --> 00:53:12,559
like if one of you

1235
00:53:18,230 --> 00:53:14,800
comment on what

1236
00:53:25,349 --> 00:53:18,240
space and storytelling

1237
00:53:27,589 --> 00:53:26,470
spoken

1238
00:53:35,349 --> 00:53:27,599

what

1239
00:53:36,390 --> 00:53:35,359
just ah stem i'm sorry yes so um

1240
00:53:39,270 --> 00:53:36,400
you know

1241
00:53:42,069 --> 00:53:39,280
if you go to the public and you ask them

1242
00:53:43,270 --> 00:53:42,079
a question about space or nasa in

1243
00:53:45,510 --> 00:53:43,280
general

1244
00:53:47,670 --> 00:53:45,520
almost always the answer that you will

1245
00:53:49,349 --> 00:53:47,680
get from them is actually a description

1246
00:53:51,750 --> 00:53:49,359
of imagery

1247
00:53:54,630 --> 00:53:51,760
and so if you think back to

1248
00:53:57,190 --> 00:53:54,640
what it meant when

1249
00:53:59,829 --> 00:53:57,200
we got a picture back of our pale little

1250
00:54:02,150 --> 00:53:59,839
blue dot as as the apollo 8 spacecraft

1251
00:54:04,470 --> 00:54:02,160
went around the moon and they had that

1252
00:54:05,910 --> 00:54:04,480
earth rise and they grabbed they said oh

1253
00:54:09,349 --> 00:54:05,920
my god look at that just grab the

1254
00:54:12,390 --> 00:54:09,359
picture and took those photographs

1255
00:54:14,950 --> 00:54:12,400
how many people have were inspired by

1256
00:54:16,790 --> 00:54:14,960
just an image like that uh i want to be

1257
00:54:19,030 --> 00:54:16,800
a scientist i want to be an engineer

1258
00:54:20,950 --> 00:54:19,040
look how fragile that blue dot is just

1259
00:54:23,589 --> 00:54:20,960
from that photograph or those images and

1260
00:54:25,589 --> 00:54:23,599
so i think we forget sometimes when

1261
00:54:27,829 --> 00:54:25,599
we're being geeky

1262
00:54:29,510 --> 00:54:27,839
just how something simple like a

1263
00:54:31,670 --> 00:54:29,520

demonstration like what we just saw

1264
00:54:33,270 --> 00:54:31,680
there's no telling how many people may

1265
00:54:34,549 --> 00:54:33,280
have seen that young people and said you

1266
00:54:35,910 --> 00:54:34,559
know instead of

1267
00:54:37,030 --> 00:54:35,920
doing what i thought i was going to do

1268
00:54:39,430 --> 00:54:37,040
maybe i'll

1269
00:54:40,870 --> 00:54:39,440
pay more attention in math class

1270
00:54:43,510 --> 00:54:40,880
or learn a little more about physics

1271
00:54:45,829 --> 00:54:43,520
because that was cool

1272
00:54:47,270 --> 00:54:45,839
yes absolutely okay so again we are out

1273
00:54:49,990 --> 00:54:47,280
of time please join me in thanking our

1274
00:54:52,710 --> 00:54:50,000
speeches and also in congratulating nasa