



SCIENCE LIVE

A large Orion spacecraft is shown in space, with the word "NASA" written vertically in red on its side. In the background, the Earth and the Moon are visible against the blackness of space.

ARTEMIS

SCIENCE

RETURNS TO EARTH

1
00:00:03,410 --> 00:00:01,910
[Music]

2
00:00:17,730 --> 00:00:03,420
foreign

3
00:00:40,870 --> 00:00:27,380
[Music]

4
00:00:55,600 --> 00:00:40,880
foreign

5
00:01:59,350 --> 00:01:34,870
[Music]

6
00:01:59,360 --> 00:02:09,410
thank you

7
00:02:09,420 --> 00:02:12,970
yeah

8
00:02:19,010 --> 00:02:16,010
hello and welcome to another episode of

9
00:02:21,589 --> 00:02:19,020
NASA science live an opportunity for you

10
00:02:24,110 --> 00:02:21,599
to interact with our NASA experts ask

11
00:02:26,570 --> 00:02:24,120
your questions and have them answered in

12
00:02:29,869 --> 00:02:26,580
real time I'm your host Dr mumta

13
00:02:31,490 --> 00:02:29,879

nagaraja and today I am so excited that

14

00:02:33,770 --> 00:02:31,500

we are going to get to talk about the

15

00:02:36,050 --> 00:02:33,780

science on board NASA's Artemis 1

16

00:02:38,630 --> 00:02:36,060

Mission so if you have questions send

17

00:02:40,850 --> 00:02:38,640

them in using the hashtag Artemis on

18

00:02:43,309 --> 00:02:40,860

social media or drop a comment in the

19

00:02:46,130 --> 00:02:43,319

box wherever you're watching today

20

00:02:48,410 --> 00:02:46,140

so you might have seen the incredible

21

00:02:50,570 --> 00:02:48,420

launch of NASA's most powerful rocket

22

00:02:53,630 --> 00:02:50,580

from Kennedy Space Center on November

23

00:02:55,850 --> 00:02:53,640

16th since then the spacecraft onboard

24

00:02:58,610 --> 00:02:55,860

named Orion has completed two close

25

00:03:01,309 --> 00:02:58,620

flybys of the lunar surface and has

26

00:03:04,369 --> 00:03:01,319

flown farther than any other spacecraft

27

00:03:06,890 --> 00:03:04,379

built for humans yesterday it finished

28

00:03:09,530 --> 00:03:06,900

its return to Earth with a Splashdown in

29

00:03:11,690 --> 00:03:09,540

the Pacific Ocean Artemis 1 is a flight

30

00:03:13,790 --> 00:03:11,700

test to prove that the technology all

31

00:03:17,509 --> 00:03:13,800

works before we put humans on board

32

00:03:20,030 --> 00:03:17,519

Artemis too but there is a lot of

33

00:03:22,130 --> 00:03:20,040

science on board lucky for us and we are

34

00:03:23,750 --> 00:03:22,140

going to talk about that today and that

35

00:03:26,089 --> 00:03:23,760

science is going to help us learn how

36

00:03:28,490 --> 00:03:26,099

humans can thrive in deep space

37

00:03:30,470 --> 00:03:28,500

now some of the science had been has

38

00:03:32,750 --> 00:03:30,480

been deployed in the form of cubesats

39

00:03:34,190 --> 00:03:32,760

and if you've ever heard that phrase the

40

00:03:36,949 --> 00:03:34,200

best things come in small packages

41

00:03:39,229 --> 00:03:36,959

that's pretty much a cute set about the

42

00:03:42,229 --> 00:03:39,239

size of a shoe box fully functioning

43

00:03:44,630 --> 00:03:42,239

spacecraft and some of the science is

44

00:03:46,369 --> 00:03:44,640

nestled inside the Orion that splashed

45

00:03:48,710 --> 00:03:46,379

down yesterday in the Pacific Ocean

46

00:03:50,949 --> 00:03:48,720

let's learn more about the science on

47

00:03:54,350 --> 00:03:50,959

the Artemis One mission

48

00:03:56,990 --> 00:03:54,360

Artemis 1 is Paving the way for us to

49

00:03:59,930 --> 00:03:57,000

explore deeper and deeper into space I

50

00:04:03,110 --> 00:03:59,940

think Artemis one is significant on so

51
00:04:05,330 --> 00:04:03,120
many levels it is a new frontier to do

52
00:04:07,369 --> 00:04:05,340
science so the primary objective is to

53
00:04:09,470 --> 00:04:07,379
test the Orion spacecraft integrated

54
00:04:12,890 --> 00:04:09,480
with the space launch system and it is

55
00:04:14,570 --> 00:04:12,900
designed to to carry out the the boldest

56
00:04:16,250 --> 00:04:14,580
of the Bold missions but it's more than

57
00:04:18,650 --> 00:04:16,260
just learning how to travel in space

58
00:04:20,390 --> 00:04:18,660
we're taking a lot of cool science along

59
00:04:23,150 --> 00:04:20,400
with us on this first mission to the

60
00:04:25,189 --> 00:04:23,160
moon so as NASA plans to go back to the

61
00:04:27,350 --> 00:04:25,199
surface of the Moon and then on to Mars

62
00:04:29,450 --> 00:04:27,360
we want to spend more time there and

63
00:04:31,430 --> 00:04:29,460

that's riskier business so the more we

64

00:04:33,469 --> 00:04:31,440

learn about the moon itself and the

65

00:04:35,510 --> 00:04:33,479

environment where we'll be operating the

66

00:04:37,909 --> 00:04:35,520

better we can prepare we have 10

67

00:04:40,189 --> 00:04:37,919

cubesats we call secondary payloads

68

00:04:41,990 --> 00:04:40,199

which are small scientific spacecraft of

69

00:04:44,090 --> 00:04:42,000

their own that will each be conducting

70

00:04:46,370 --> 00:04:44,100

their own scientific Mission all of

71

00:04:49,310 --> 00:04:46,380

these payloads in some form or fashion

72

00:04:51,110 --> 00:04:49,320

will help us going forward they are

73

00:04:52,490 --> 00:04:51,120

going to be studying the Moon soon and

74

00:04:54,590 --> 00:04:52,500

they're going to help us understand what

75

00:04:56,930 --> 00:04:54,600

is the moon made out of what types of

76

00:04:59,090 --> 00:04:56,940

rocks what types of regolith what types

77

00:05:00,409 --> 00:04:59,100

of ice what's mixed in with water that

78

00:05:02,510 --> 00:05:00,419

might be present they're going to be

79

00:05:04,550 --> 00:05:02,520

studying the sun understanding and

80

00:05:06,590 --> 00:05:04,560

studying the space environment or the

81

00:05:09,290 --> 00:05:06,600

space weather some different propulsion

82

00:05:12,050 --> 00:05:09,300

systems these novel ideas will

83

00:05:14,030 --> 00:05:12,060

ultimately turn into the technology and

84

00:05:15,830 --> 00:05:14,040

the systems that we want to use going

85

00:05:17,810 --> 00:05:15,840

forward there's a lot of cool things

86

00:05:19,249 --> 00:05:17,820

going on between all these cubesats that

87

00:05:21,770 --> 00:05:19,259

make up our secondary payloads

88

00:05:23,629 --> 00:05:21,780

additionally inside the Orion we'll be

89

00:05:28,129 --> 00:05:23,639

flying an experiment to study space

90

00:05:32,090 --> 00:05:28,139

biology space biology is where we study

91

00:05:34,430 --> 00:05:32,100

the underlying changes that earth-based

92

00:05:37,189 --> 00:05:34,440

biological systems undergo when they're

93

00:05:39,409 --> 00:05:37,199

in space basically how does life respond

94

00:05:41,510 --> 00:05:39,419

to the space environment the level of

95

00:05:43,969 --> 00:05:41,520

ionizing radiation that you experience

96

00:05:46,610 --> 00:05:43,979

when you go beyond the Van Allen belt so

97

00:05:49,310 --> 00:05:46,620

you go beyond the protective magnetic

98

00:05:52,249 --> 00:05:49,320

sphere that we have around us you then

99

00:05:55,070 --> 00:05:52,259

get exposed to higher levels of ionizing

100

00:05:57,110 --> 00:05:55,080

radiation so we are flying several space

101
00:06:00,170 --> 00:05:57,120
biology experiments we will take a

102
00:06:03,350 --> 00:06:00,180
series of materials plant seeds fungi

103
00:06:05,390 --> 00:06:03,360
the yeast cell algae and right along the

104
00:06:07,909 --> 00:06:05,400
trip and then when it comes home we can

105
00:06:10,550 --> 00:06:07,919
analyze how they responded to that

106
00:06:13,189 --> 00:06:10,560
environment This research will help us

107
00:06:15,770 --> 00:06:13,199
thrive in space it will help us to go

108
00:06:17,629 --> 00:06:15,780
further and stay there longer so there

109
00:06:19,790 --> 00:06:17,639
you have it I hope you agree with me

110
00:06:22,790 --> 00:06:19,800
this is exciting the science will

111
00:06:25,129 --> 00:06:22,800
conduct on Artemis 1 lays the groundwork

112
00:06:26,870 --> 00:06:25,139
to ensure that we can safely conduct

113
00:06:29,390 --> 00:06:26,880

scientific activities at the Moon with

114

00:06:32,029 --> 00:06:29,400

our astronauts going forward this really

115

00:06:33,529 --> 00:06:32,039

is the stepping stone for us as we take

116

00:06:39,350 --> 00:06:33,539

that next giant leapman's base

117

00:06:44,090 --> 00:06:42,050

Artemis one is indeed Paving the way for

118

00:06:46,249 --> 00:06:44,100

us to explore deeper and deeper in space

119

00:06:48,350 --> 00:06:46,259

and with me today to tell you more about

120

00:06:50,809 --> 00:06:48,360

that and answer your questions are those

121

00:06:53,330 --> 00:06:50,819

two we just saw in the video I have Dr

122

00:06:55,550 --> 00:06:53,340

sharmila bachacharya NASA's senior

123

00:06:58,070 --> 00:06:55,560

program scientist for space biology and

124

00:07:00,590 --> 00:06:58,080

also a personal mentor of mine and Dr

125

00:07:03,050 --> 00:07:00,600

Jacob bleacher NASA's Chief exploration

126

00:07:05,809 --> 00:07:03,060

scientist sharmila and Jake thank you so

127

00:07:08,570 --> 00:07:05,819

much for being with us today

128

00:07:11,210 --> 00:07:08,580

thank you for inviting us Mamta it's a

129

00:07:13,670 --> 00:07:11,220

real pleasure to be here

130

00:07:15,770 --> 00:07:13,680

yeah really exciting times we have our

131

00:07:18,110 --> 00:07:15,780

Orion spacecraft home but the the work's

132

00:07:20,510 --> 00:07:18,120

just starting really exciting

133

00:07:22,189 --> 00:07:20,520

definitely so that leads me perfectly

134

00:07:24,350 --> 00:07:22,199

into my first question for each of you

135

00:07:26,689 --> 00:07:24,360

and sharmila I'll go to you first is

136

00:07:29,029 --> 00:07:26,699

there anything of particularly that's

137

00:07:31,610 --> 00:07:29,039

you're excited to learn about as we

138

00:07:34,550 --> 00:07:31,620

start getting some of this science back

139

00:07:37,610 --> 00:07:34,560

yeah absolutely you know Manta for me

140

00:07:40,510 --> 00:07:37,620

all of it you know there are for example

141

00:07:43,430 --> 00:07:40,520

on the package that came back yesterday

142

00:07:44,809 --> 00:07:43,440

uh on the Orion vehicle there are four

143

00:07:47,950 --> 00:07:44,819

experiments for space biology

144

00:07:51,830 --> 00:07:47,960

experiments on a diverse set of

145

00:07:55,490 --> 00:07:51,840

organisms you know fungus algae you know

146

00:07:57,950 --> 00:07:55,500

yeast cell and plant seeds and we have

147

00:08:00,529 --> 00:07:57,960

never exposed these systems to this

148

00:08:02,629 --> 00:08:00,539

unique environment in deep space so I'm

149

00:08:05,210 --> 00:08:02,639

just excited to see what we find and

150

00:08:07,610 --> 00:08:05,220

what we learn from all of it

151
00:08:09,710 --> 00:08:07,620
yeah you and I have this shared love of

152
00:08:12,409 --> 00:08:09,720
space biology because I too am a space

153
00:08:14,330 --> 00:08:12,419
biologist and I love that this we've

154
00:08:16,969 --> 00:08:14,340
never done this before I mean this is

155
00:08:19,309 --> 00:08:16,979
new and novel and yeah we're going to

156
00:08:21,290 --> 00:08:19,319
learn so much from it Jake is there

157
00:08:22,610 --> 00:08:21,300
anything particular that you're excited

158
00:08:25,969 --> 00:08:22,620
about

159
00:08:28,249 --> 00:08:25,979
well you know we are now on a path to

160
00:08:30,110 --> 00:08:28,259
with Artemis to send our astronauts to

161
00:08:32,209 --> 00:08:30,120
the South Pole of the Moon a place that

162
00:08:33,889 --> 00:08:32,219
no one's ever been before I mean it

163
00:08:36,589 --> 00:08:33,899

doesn't get any better than that right

164

00:08:38,510 --> 00:08:36,599

so learning what the spacecraft has to

165

00:08:40,909 --> 00:08:38,520

tell us about the trip it just took is

166

00:08:42,769 --> 00:08:40,919

is really exciting to me but I am a

167

00:08:43,790 --> 00:08:42,779

Scientist so I really am interested to

168

00:08:45,710 --> 00:08:43,800

know what

169

00:08:47,449 --> 00:08:45,720

all the cubesats are going to tell us

170

00:08:49,850 --> 00:08:47,459

they're they're out there flying through

171

00:08:52,610 --> 00:08:49,860

space right now uh talking to us giving

172

00:08:54,650 --> 00:08:52,620

us some data back uh learning about what

173

00:08:56,690 --> 00:08:54,660

the environment was like where we expect

174

00:08:59,090 --> 00:08:56,700

our astronauts to go when they ride on

175

00:09:01,130 --> 00:08:59,100

the Orion out around the moon in Artemis

176

00:09:04,070 --> 00:09:01,140

2 and then eventually to land on the

177

00:09:05,870 --> 00:09:04,080

moon in Artemis 3. uh you know it's just

178

00:09:07,790 --> 00:09:05,880

really hard to pick a winner here it's

179

00:09:10,130 --> 00:09:07,800

all exciting

180

00:09:12,110 --> 00:09:10,140

for sure but you lead me perfectly Jake

181

00:09:15,050 --> 00:09:12,120

into my next question so I'll start with

182

00:09:16,910 --> 00:09:15,060

you with yesterday's Splashdown what

183

00:09:19,190 --> 00:09:16,920

science has returned to Earth and what

184

00:09:22,070 --> 00:09:19,200

science has stayed in space

185

00:09:23,930 --> 00:09:22,080

yeah so first of all the most important

186

00:09:26,090 --> 00:09:23,940

science from my perspective is what our

187

00:09:28,370 --> 00:09:26,100

Orion spacecraft has to tell us so it's

188

00:09:30,769 --> 00:09:28,380

splashed down uh just off the coast of

189

00:09:33,590 --> 00:09:30,779

San Diego uh and it's carrying with it

190

00:09:34,790 --> 00:09:33,600

just a wealth of data about flying in

191

00:09:37,509 --> 00:09:34,800

deep space

192

00:09:40,490 --> 00:09:37,519

um this spacecraft just took a trip

193

00:09:42,769 --> 00:09:40,500

1.4 million miles long to get back here

194

00:09:44,810 --> 00:09:42,779

to the Earth and it's it's basically

195

00:09:46,550 --> 00:09:44,820

gone on a trip that will be similar to

196

00:09:48,769 --> 00:09:46,560

where our astronauts will go and as

197

00:09:51,530 --> 00:09:48,779

sharmilla talked about it's in places

198

00:09:53,449 --> 00:09:51,540

where we haven't really studied uh what

199

00:09:55,370 --> 00:09:53,459

the space environment is like when it

200

00:09:58,009 --> 00:09:55,380

interacts with uh with life here from

201
00:10:00,410 --> 00:09:58,019
Earth uh so we we brought back some

202
00:10:02,990 --> 00:10:00,420
payloads that came along for the ride

203
00:10:05,449 --> 00:10:03,000
with Orion but we also sent out a series

204
00:10:08,570 --> 00:10:05,459
of these secondary cubesats we call them

205
00:10:11,210 --> 00:10:08,580
so you mentioned them the the shoebox

206
00:10:13,550 --> 00:10:11,220
size spacecraft each one of those is

207
00:10:15,650 --> 00:10:13,560
like its own you know science Mission

208
00:10:17,329 --> 00:10:15,660
out out in the space and some of them

209
00:10:18,650 --> 00:10:17,339
are looking at the moon some of them are

210
00:10:20,210 --> 00:10:18,660
learning about the space weather

211
00:10:22,310 --> 00:10:20,220
environment you know kind of that

212
00:10:24,530 --> 00:10:22,320
weather from the Sun that we'll uh we'll

213
00:10:26,449 --> 00:10:24,540

have to live in uh when we go out some

214

00:10:28,370 --> 00:10:26,459

are traveling out in different trips out

215

00:10:30,410 --> 00:10:28,380

into space to study different locations

216

00:10:31,970 --> 00:10:30,420

so we've got a series of those out in

217

00:10:33,769 --> 00:10:31,980

space right now and then we brought back

218

00:10:36,650 --> 00:10:33,779

the Orion and the Orion has some really

219

00:10:38,810 --> 00:10:36,660

cool science inside of it as well

220

00:10:40,610 --> 00:10:38,820

yeah so show Mila can you tell me more

221

00:10:43,130 --> 00:10:40,620

about some of those biology experiments

222

00:10:46,850 --> 00:10:43,140

did any of them come back to earth

223

00:10:49,850 --> 00:10:46,860

yes so so this is perfect because Jake's

224

00:10:51,829 --> 00:10:49,860

at the stage for the fact uh that some

225

00:10:53,509 --> 00:10:51,839

of the science went out as secondary

226

00:10:56,090 --> 00:10:53,519

payloads and then and then as you

227

00:10:58,370 --> 00:10:56,100

mentioned some of them came back so we

228

00:11:02,870 --> 00:10:58,380

actually have biology experiments on

229

00:11:04,610 --> 00:11:02,880

both so for the ones coming back then as

230

00:11:07,610 --> 00:11:04,620

we discussed earlier there are four

231

00:11:09,410 --> 00:11:07,620

experiments in what we call a sweet it's

232

00:11:10,910 --> 00:11:09,420

an instrument called bio experiment one

233

00:11:12,949 --> 00:11:10,920

which actually consists of four

234

00:11:15,829 --> 00:11:12,959

different experiments with four

235

00:11:18,829 --> 00:11:15,839

different living systems which will help

236

00:11:20,030 --> 00:11:18,839

us understand the effects of this

237

00:11:23,990 --> 00:11:20,040

environment of the deep space

238

00:11:27,410 --> 00:11:24,000

environment on a diverse number of

239

00:11:29,690 --> 00:11:27,420

biological systems and then we have the

240

00:11:32,090 --> 00:11:29,700

one Biology experiment in the cubesat

241

00:11:34,430 --> 00:11:32,100

that went as a free flyer and what's

242

00:11:36,550 --> 00:11:34,440

really cool about that one as well is

243

00:11:41,630 --> 00:11:36,560

that that one is going towards the Sun

244

00:11:44,090 --> 00:11:41,640

so that one is going far far away from

245

00:11:45,889 --> 00:11:44,100

you know where we are located hated and

246

00:11:47,329 --> 00:11:45,899

where we've been you know in low earth

247

00:11:50,569 --> 00:11:47,339

orbits and the International Space

248

00:11:53,090 --> 00:11:50,579

Station and this payload uses the yeast

249

00:11:56,509 --> 00:11:53,100

cell and it looks at it has a really

250

00:12:00,110 --> 00:11:56,519

nice way of doing science uh by looking

251

00:12:01,910 --> 00:12:00,120

at the changes on the cell called the

252

00:12:05,090 --> 00:12:01,920

yeast cell the same yeast cell that you

253

00:12:07,610 --> 00:12:05,100

use to make bread or beer and it will

254

00:12:10,730 --> 00:12:07,620

experience this environment things like

255

00:12:13,069 --> 00:12:10,740

radiation will affect its biology in

256

00:12:15,290 --> 00:12:13,079

such a way that we could measure that

257

00:12:18,170 --> 00:12:15,300

change by looking at growth and it'll

258

00:12:20,449 --> 00:12:18,180

send all that data back by Telemetry

259

00:12:23,389 --> 00:12:20,459

from deep space we never have to get

260

00:12:25,730 --> 00:12:23,399

that science back and so we will get all

261

00:12:29,630 --> 00:12:25,740

of the information over the next several

262

00:12:32,750 --> 00:12:29,640

months as those cells get activated by

263

00:12:34,850 --> 00:12:32,760

putting media into them feeding them

264

00:12:37,310 --> 00:12:34,860

and then watching them grow so that's

265

00:12:39,290 --> 00:12:37,320

one set and then the ones that came back

266

00:12:41,269 --> 00:12:39,300

to Earth as you mentioned month are the

267

00:12:44,449 --> 00:12:41,279

ones that splashed down yesterday in

268

00:12:47,030 --> 00:12:44,459

that amazing video that we just saw

269

00:12:49,970 --> 00:12:47,040

um what we're going to do is all of that

270

00:12:53,030 --> 00:12:49,980

science will actually be done in the

271

00:12:55,610 --> 00:12:53,040

researchers lab on Earth so we could get

272

00:12:57,889 --> 00:12:55,620

pretty complex with the kind of science

273

00:12:59,990 --> 00:12:57,899

analysis we're going to do because the

274

00:13:02,870 --> 00:13:00,000

researchers the principal investigators

275

00:13:04,430 --> 00:13:02,880

will actually the teams will get these

276

00:13:06,829 --> 00:13:04,440

experiments back in their Laboratories

277

00:13:10,009 --> 00:13:06,839

and then they can look at you know how

278

00:13:12,650 --> 00:13:10,019

do they grow how did they respond you

279

00:13:15,290 --> 00:13:12,660

know which specific genes are

280

00:13:16,970 --> 00:13:15,300

responsible for helping us thrive in

281

00:13:20,030 --> 00:13:16,980

this novel environment and when I say

282

00:13:23,930 --> 00:13:20,040

genes you know I know you know this uh

283

00:13:26,509 --> 00:13:23,940

really well Mamta but our DNA inside all

284

00:13:28,730 --> 00:13:26,519

of our cells uh consists of these

285

00:13:31,790 --> 00:13:28,740

elements they're like Words inside a

286

00:13:33,769 --> 00:13:31,800

sentence uh called genes and those genes

287

00:13:35,509 --> 00:13:33,779

are what are responsible able from

288

00:13:37,970 --> 00:13:35,519

making RNA and then the RNA makes

289

00:13:40,430 --> 00:13:37,980

protein and the proteins do all the work

290

00:13:42,470 --> 00:13:40,440

inside your cell so at the end of this

291

00:13:44,210 --> 00:13:42,480

experiment we'll get lots of valuable

292

00:13:47,449 --> 00:13:44,220

information about how these genes

293

00:13:49,910 --> 00:13:47,459

function in this unique environment

294

00:13:51,230 --> 00:13:49,920

sharmeila you led me perfectly into my

295

00:13:53,090 --> 00:13:51,240

next thought and that's what was going

296

00:13:54,650 --> 00:13:53,100

to happen to the science once it's come

297

00:13:57,470 --> 00:13:54,660

here so you told us about the biology

298

00:13:59,870 --> 00:13:57,480

ones Jake you mentioned you know one of

299

00:14:01,069 --> 00:13:59,880

the things you're interested in is all

300

00:14:03,710 --> 00:14:01,079

the signs we're going to get from the

301
00:14:05,090 --> 00:14:03,720
spacecraft itself so what how what are

302
00:14:06,650 --> 00:14:05,100
we going to learn from that and how are

303
00:14:08,990 --> 00:14:06,660
we going to learn from all of that

304
00:14:11,269 --> 00:14:09,000
different information we get back

305
00:14:13,190 --> 00:14:11,279
sure so the Orion's been talking to us

306
00:14:15,710 --> 00:14:13,200
throughout the entire trip that it took

307
00:14:17,389 --> 00:14:15,720
around the moon so we also have we

308
00:14:19,610 --> 00:14:17,399
already have a lot of that data back and

309
00:14:21,050 --> 00:14:19,620
we're starting to work through it

310
00:14:22,910 --> 00:14:21,060
um and so we're you know what's great

311
00:14:25,069 --> 00:14:22,920
about it is the mission went really well

312
00:14:27,350 --> 00:14:25,079
the spacecraft flew well the space

313
00:14:30,050 --> 00:14:27,360

launch system the big rocket part that

314

00:14:32,210 --> 00:14:30,060

that made the really spectacular uh made

315

00:14:34,730 --> 00:14:32,220

it basically made it like night time in

316

00:14:37,129 --> 00:14:34,740

the daytime when that thing launched uh

317

00:14:39,230 --> 00:14:37,139

you know we got a ton of data from that

318

00:14:42,530 --> 00:14:39,240

and the space launch system performed

319

00:14:44,210 --> 00:14:42,540

extremely well the Orion performed well

320

00:14:46,069 --> 00:14:44,220

uh we were able to get the mission

321

00:14:48,470 --> 00:14:46,079

complete we even were able to do some

322

00:14:50,210 --> 00:14:48,480

additional work along the way uh but you

323

00:14:52,370 --> 00:14:50,220

know one of the big parts for the

324

00:14:54,650 --> 00:14:52,380

mission was coming back to Earth coming

325

00:14:57,590 --> 00:14:54,660

into Earth that extremely fast speed

326

00:14:59,870 --> 00:14:57,600

almost 25 000 miles per hour and as the

327

00:15:01,550 --> 00:14:59,880

Orion comes into the Earth's atmosphere

328

00:15:02,930 --> 00:15:01,560

creates a lot of friction kind of like

329

00:15:05,449 --> 00:15:02,940

when you rub your hands together and

330

00:15:08,750 --> 00:15:05,459

they get warm but like a lot more than

331

00:15:11,509 --> 00:15:08,760

that so it gets really hot and so one of

332

00:15:13,730 --> 00:15:11,519

the big parts we had to study was um how

333

00:15:15,350 --> 00:15:13,740

to slow the Orion down because we got to

334

00:15:17,930 --> 00:15:15,360

protect our astronauts our friends who

335

00:15:20,090 --> 00:15:17,940

were riding inside so as the Orion comes

336

00:15:21,350 --> 00:15:20,100

into the atmosphere it heats up and so

337

00:15:24,470 --> 00:15:21,360

we're going to be able to actually look

338

00:15:26,870 --> 00:15:24,480

at the Orion now when we take it to uh

339

00:15:28,850 --> 00:15:26,880

back to Kennedy to uh to understand how

340

00:15:30,470 --> 00:15:28,860

well it performed and how well the job

341

00:15:32,509 --> 00:15:30,480

it did and then it had some parachutes

342

00:15:35,329 --> 00:15:32,519

that opened up that slowed it down for

343

00:15:37,430 --> 00:15:35,339

its eventual Splashdown uh looking at

344

00:15:38,750 --> 00:15:37,440

how it performed floating in the ocean

345

00:15:40,730 --> 00:15:38,760

for instance

346

00:15:42,350 --> 00:15:40,740

um so we have to be able to get to the

347

00:15:45,170 --> 00:15:42,360

Orion to help get our astronauts out of

348

00:15:46,910 --> 00:15:45,180

the plan once it's in the water so

349

00:15:49,030 --> 00:15:46,920

there's a whole bunch of steps that go

350

00:15:51,949 --> 00:15:49,040

on there that will work through the data

351

00:15:54,050 --> 00:15:51,959

analyze that data and it's all very

352

00:15:55,850 --> 00:15:54,060

important for us to have the confidence

353

00:15:58,550 --> 00:15:55,860

that we need to put our friends in there

354

00:16:00,769 --> 00:15:58,560

for Artemis 2 which will be another fly

355

00:16:02,629 --> 00:16:00,779

around the moon but with astronauts on

356

00:16:04,430 --> 00:16:02,639

board so we just it just gets more and

357

00:16:07,189 --> 00:16:04,440

more exciting each time

358

00:16:09,110 --> 00:16:07,199

yes it does and I studied aerospace

359

00:16:10,910 --> 00:16:09,120

engineering for my undergraduate degree

360

00:16:14,090 --> 00:16:10,920

so the aerospace that you just

361

00:16:17,870 --> 00:16:14,100

described is so fascinating to me I love

362

00:16:19,730 --> 00:16:17,880

that entire branch of science so my next

363

00:16:22,129 --> 00:16:19,740

question and sharmila I'll start with

364

00:16:24,290 --> 00:16:22,139

you there's cons a considerable number

365

00:16:26,030 --> 00:16:24,300

of experiments that we had on board that

366

00:16:29,090 --> 00:16:26,040

we're focusing on and you mentioned this

367

00:16:30,650 --> 00:16:29,100

before the effects of radiation why is

368

00:16:33,230 --> 00:16:30,660

that so important as we set the stage

369

00:16:36,710 --> 00:16:33,240

for future Artemis missions

370

00:16:39,230 --> 00:16:36,720

yeah great question there so the reason

371

00:16:43,009 --> 00:16:39,240

that's important for us to to Really

372

00:16:46,189 --> 00:16:43,019

measure and to understand is that

373

00:16:48,530 --> 00:16:46,199

radiation is you know simply a reality I

374

00:16:50,030 --> 00:16:48,540

mean we're exposed to ionizing radiation

375

00:16:51,949 --> 00:16:50,040

on the surface of the Earth We're

376

00:16:55,069 --> 00:16:51,959

exposed to ionizing radiation on the

377

00:16:57,410 --> 00:16:55,079

International Space Station and will be

378

00:17:00,949 --> 00:16:57,420

exposed to a little bit more of that

379

00:17:03,170 --> 00:17:00,959

same sort of radiation when we go beyond

380

00:17:06,829 --> 00:17:03,180

the Van Allen belts as you heard in the

381

00:17:10,370 --> 00:17:06,839

the earlier uh video and so it becomes

382

00:17:12,350 --> 00:17:10,380

important to really understand what the

383

00:17:14,630 --> 00:17:12,360

biological effects as well as the other

384

00:17:17,289 --> 00:17:14,640

effects actually you know the effects on

385

00:17:20,150 --> 00:17:17,299

the electronics Etc of this radiation

386

00:17:22,189 --> 00:17:20,160

just so that we are well prepared you

387

00:17:24,289 --> 00:17:22,199

know we know what to take with us we

388

00:17:27,350 --> 00:17:24,299

know how to counter it we know what

389

00:17:29,990 --> 00:17:27,360

sorts of foods Etc might be able to to

390

00:17:34,669 --> 00:17:30,000

help protect us uh you know and and and

391

00:17:37,490 --> 00:17:34,679

again improve Us in terms of thriving in

392

00:17:39,169 --> 00:17:37,500

this deep space environment

393

00:17:40,549 --> 00:17:39,179

yeah that's great Jake do you have

394

00:17:42,230 --> 00:17:40,559

anything to add on that too because I

395

00:17:45,230 --> 00:17:42,240

know there's many different perspectives

396

00:17:47,510 --> 00:17:45,240

when we're looking at radiation

397

00:17:49,310 --> 00:17:47,520

yeah I think Familia said it right it's

398

00:17:51,409 --> 00:17:49,320

a reality that uh that's part of the

399

00:17:53,330 --> 00:17:51,419

environment right and just like here on

400

00:17:55,490 --> 00:17:53,340

Earth we have different types of weather

401
00:17:57,169 --> 00:17:55,500
on different days and so maybe some days

402
00:17:59,210 --> 00:17:57,179
the weather is not as great for what you

403
00:18:00,950 --> 00:17:59,220
want to do and you kind of plan around

404
00:18:03,590 --> 00:18:00,960
it and and that's what we're doing now

405
00:18:05,810 --> 00:18:03,600
is we're planning how to do these space

406
00:18:07,789 --> 00:18:05,820
missions in the future and so as we

407
00:18:10,310 --> 00:18:07,799
learn about what normal conditions are

408
00:18:11,630 --> 00:18:10,320
like is we learn what maybe non-normal

409
00:18:13,789 --> 00:18:11,640
conditions are like

410
00:18:15,950 --> 00:18:13,799
um we can understand what the spectrum

411
00:18:17,990 --> 00:18:15,960
of that space weather looks like so that

412
00:18:19,730 --> 00:18:18,000
we can prepare for it

413
00:18:21,230 --> 00:18:19,740

um you know I I used to do a lot of

414

00:18:23,330 --> 00:18:21,240

field work here on Earth I used to study

415

00:18:24,890 --> 00:18:23,340

volcanoes and we used to say you know

416

00:18:26,930 --> 00:18:24,900

it's not that there's bad weather

417

00:18:29,330 --> 00:18:26,940

there's just bad preparation and so

418

00:18:31,789 --> 00:18:29,340

that's what we do now is we prepare we

419

00:18:34,669 --> 00:18:31,799

learn by flying spacecraft like the

420

00:18:36,350 --> 00:18:34,679

Orion by flying the cubesats they're all

421

00:18:38,690 --> 00:18:36,360

teaching us about that environment that

422

00:18:40,970 --> 00:18:38,700

we have to prepare for so that when our

423

00:18:42,789 --> 00:18:40,980

astronaut friends go to the Moon we know

424

00:18:45,169 --> 00:18:42,799

as much as we can about it but you know

425

00:18:47,990 --> 00:18:45,179

exploration by definition is kind of

426

00:18:50,390 --> 00:18:48,000

going into the unexplored so we will

427

00:18:52,190 --> 00:18:50,400

always learn as we go and then we adapt

428

00:18:53,690 --> 00:18:52,200

to that and we plan for the next time we

429

00:18:56,750 --> 00:18:53,700

get a shot at it

430

00:18:59,510 --> 00:18:56,760

yeah yeah totally so even though there

431

00:19:01,669 --> 00:18:59,520

weren't any humans on Artemis 1 there

432

00:19:03,350 --> 00:19:01,679

were a few special passengers that will

433

00:19:04,669 --> 00:19:03,360

help pave the way for future missions

434

00:19:07,190 --> 00:19:04,679

let's take a look and learn more about

435

00:19:09,890 --> 00:19:07,200

these passengers

436

00:19:11,690 --> 00:19:09,900

inside the Orion spacecraft as we fly

437

00:19:13,310 --> 00:19:11,700

around the Moon we have some cool

438

00:19:15,110 --> 00:19:13,320

experiments going on to help us

439

00:19:16,789 --> 00:19:15,120

understand what the environment is like

440

00:19:18,710 --> 00:19:16,799

although there's no humans aboard

441

00:19:20,690 --> 00:19:18,720

Artemis one we do have a few special

442

00:19:22,850 --> 00:19:20,700

passengers aboard that will help us pave

443

00:19:24,710 --> 00:19:22,860

the way for future Artemis missions so

444

00:19:25,970 --> 00:19:24,720

there's basically three occupants riding

445

00:19:28,789 --> 00:19:25,980

you kind of think about it like three

446

00:19:31,850 --> 00:19:28,799

astronauts we have a moon again we will

447

00:19:33,470 --> 00:19:31,860

also have two torsos that are learning

448

00:19:35,029 --> 00:19:33,480

about the moon and learning about the

449

00:19:37,190 --> 00:19:35,039

environment for our astronauts before

450

00:19:39,590 --> 00:19:37,200

they go we have a mannequin on Artemis

451

00:19:41,210 --> 00:19:39,600

one we call them our moon again for

452

00:19:44,390 --> 00:19:41,220

short that Moon again is called

453

00:19:47,270 --> 00:19:44,400

Commander moonachin Campos the name is

454

00:19:48,830 --> 00:19:47,280

actually in homage to Arturo Campos who

455

00:19:51,409 --> 00:19:48,840

was an important person who helped bring

456

00:19:53,690 --> 00:19:51,419

the Apollo 13 capsule home the moon

457

00:19:56,630 --> 00:19:53,700

again will sit in the Commander's seat

458

00:19:58,909 --> 00:19:56,640

and it will wear a suit just like our

459

00:20:01,370 --> 00:19:58,919

astronauts will wear Moon compost is

460

00:20:04,010 --> 00:20:01,380

actually weighted to simulate an actual

461

00:20:05,510 --> 00:20:04,020

human aboard the Orion spacecraft that

462

00:20:08,090 --> 00:20:05,520

will help us understand what our

463

00:20:09,529 --> 00:20:08,100

astronauts will experience as they go to

464

00:20:11,870 --> 00:20:09,539

the moon and home the Orion Cruise

465

00:20:13,789 --> 00:20:11,880

survival system suit and the Orion sea

466

00:20:16,070 --> 00:20:13,799

were designed simultaneously to fit

467

00:20:19,430 --> 00:20:16,080

together as a seamless package the

468

00:20:21,830 --> 00:20:19,440

actual design of the suit was built into

469

00:20:24,350 --> 00:20:21,840

the Orion sea such that when they're in

470

00:20:26,150 --> 00:20:24,360

the suit in the seat is a true Cocoon of

471

00:20:27,830 --> 00:20:26,160

protection for them during this test

472

00:20:30,110 --> 00:20:27,840

flight the seat will actually be

473

00:20:31,669 --> 00:20:30,120

instrumented with accelerometers sensors

474

00:20:33,830 --> 00:20:31,679

that tell us how much the chair is

475

00:20:35,630 --> 00:20:33,840

shaking during launch and re-entry and

476

00:20:37,610 --> 00:20:35,640

how many g-forces or gravitational

477

00:20:39,650 --> 00:20:37,620

forces that experiences we expect

478

00:20:41,450 --> 00:20:39,660

Commander Munich and compost to have a

479

00:20:43,610 --> 00:20:41,460

very exciting ride on his way to orbit

480

00:20:45,650 --> 00:20:43,620

the thrill of launch the experience of

481

00:20:47,690 --> 00:20:45,660

weightlessness the excitement of Landing

482

00:20:49,490 --> 00:20:47,700

what we learn on Artemis 1 with our

483

00:20:51,169 --> 00:20:49,500

mannequins assistance will help us

484

00:20:52,970 --> 00:20:51,179

better understand how a human will

485

00:20:55,430 --> 00:20:52,980

actually behave in the sea both for

486

00:20:57,710 --> 00:20:55,440

landing and for launch to allow us to

487

00:21:00,110 --> 00:20:57,720

ensure their safety in addition to the

488

00:21:02,510 --> 00:21:00,120

Moon again we'll have two seats that

489

00:21:05,210 --> 00:21:02,520

have basically what's like a human dummy

490

00:21:07,070 --> 00:21:05,220

an upper torso that are detecting how

491

00:21:09,470 --> 00:21:07,080

much radiation they're experiencing it's

492

00:21:11,990 --> 00:21:09,480

called the matrushka Astra radiation

493

00:21:14,090 --> 00:21:12,000

experiment Mare Mare is an international

494

00:21:17,150 --> 00:21:14,100

collaboration with German Aerospace

495

00:21:20,210 --> 00:21:17,160

Center DLR and with Israel space agency

496

00:21:22,970 --> 00:21:20,220

the mara experiment consists of two

497

00:21:26,510 --> 00:21:22,980

anthropomorphic Phantoms called Helga

498

00:21:29,210 --> 00:21:26,520

and Zohar that are simulating a female

499

00:21:31,730 --> 00:21:29,220

body in a space radiation environment

500

00:21:34,730 --> 00:21:31,740

one of those will be wearing a safety

501
00:21:36,830 --> 00:21:34,740
vest the master radiation vest that we

502
00:21:38,690 --> 00:21:36,840
hope will help protect our astronauts

503
00:21:41,510 --> 00:21:38,700
from radiation each one of the two

504
00:21:44,510 --> 00:21:41,520
Phantoms will be equipped with about 20

505
00:21:46,909 --> 00:21:44,520
battery operated radiation instruments

506
00:21:48,950 --> 00:21:46,919
so between the two we'll be able to

507
00:21:50,990 --> 00:21:48,960
determine how well we can protect our

508
00:21:54,110 --> 00:21:51,000
astronauts from radiation events space

509
00:21:56,570 --> 00:21:54,120
radiation is a mix of high energy heavy

510
00:21:58,789 --> 00:21:56,580
charge particles that originate from the

511
00:22:02,330 --> 00:21:58,799
Sun to put things in perspective one

512
00:22:04,549 --> 00:22:02,340
year of Earth exposure to cosmic rays is

513
00:22:07,010 --> 00:22:04,559

equivalent with one day of space

514

00:22:10,010 --> 00:22:07,020

radiation exposure in deep space the

515

00:22:12,710 --> 00:22:10,020

purpose of the mara experiment is to

516

00:22:16,250 --> 00:22:12,720

learn more about the radiation exposure

517

00:22:18,289 --> 00:22:16,260

as well as the biological effects of

518

00:22:21,110 --> 00:22:18,299

different organs so basically it's like

519

00:22:23,270 --> 00:22:21,120

we have three occupants inside Orion

520

00:22:24,770 --> 00:22:23,280

that are learning about the moon and

521

00:22:26,930 --> 00:22:24,780

learning about the environment for our

522

00:22:29,210 --> 00:22:26,940

astronauts before they go going back to

523

00:22:31,430 --> 00:22:29,220

the Moon with new exploration goals and

524

00:22:33,409 --> 00:22:31,440

new technologies will help us gain

525

00:22:35,930 --> 00:22:33,419

better understanding of the challenges

526
00:22:38,390 --> 00:22:35,940
we encounter with deep space exploration

527
00:22:40,730 --> 00:22:38,400
we will have to develop new technology

528
00:22:42,830 --> 00:22:40,740
and solutions to meet really difficult

529
00:22:50,649 --> 00:22:42,840
challenges but that's what NASA does

530
00:22:55,669 --> 00:22:53,750
all right so Jake sharmila this is my

531
00:22:57,529 --> 00:22:55,679
favorite part of any NASA science live

532
00:22:59,870 --> 00:22:57,539
we're about to answer the questions that

533
00:23:02,270 --> 00:22:59,880
people have been sending in they want to

534
00:23:04,490 --> 00:23:02,280
know so much about Artemis so these are

535
00:23:07,850 --> 00:23:04,500
some good questions and I know many of

536
00:23:10,070 --> 00:23:07,860
you online have questions so if you want

537
00:23:11,930 --> 00:23:10,080
to use the hashtag Artemis on social

538
00:23:13,610 --> 00:23:11,940

media or drop a comment in the box

539

00:23:15,890 --> 00:23:13,620

wherever you're watching today we will

540

00:23:18,529 --> 00:23:15,900

get those questions and try to answer as

541

00:23:21,169 --> 00:23:18,539

many as we can so the first one I'm

542

00:23:24,710 --> 00:23:21,179

going to send to you Jake shaven Jenkins

543

00:23:26,810 --> 00:23:24,720

one on Twitter asks how will the outcome

544

00:23:28,730 --> 00:23:26,820

of the mannequin tests influence what

545

00:23:30,649 --> 00:23:28,740

changes are made for the next Artemis

546

00:23:32,570 --> 00:23:30,659

mission

547

00:23:34,789 --> 00:23:32,580

yeah that's that's what it's all about

548

00:23:36,230 --> 00:23:34,799

right they're out there to help us learn

549

00:23:38,330 --> 00:23:36,240

about the environment that our

550

00:23:40,370 --> 00:23:38,340

astronauts will travel through so as we

551

00:23:42,710 --> 00:23:40,380

learn about uh for instance uh what

552

00:23:44,810 --> 00:23:42,720

helgar and zogar have to tell us Helga

553

00:23:46,789 --> 00:23:44,820

and Zohar have to tell us uh they're

554

00:23:48,289 --> 00:23:46,799

going to tell us about radiation and

555

00:23:50,750 --> 00:23:48,299

whether or not some of the materials

556

00:23:53,450 --> 00:23:50,760

that we design the Astro rat suit out of

557

00:23:55,610 --> 00:23:53,460

can help kind of minimize the amount of

558

00:23:57,590 --> 00:23:55,620

radiation that they're exposed to so

559

00:23:59,029 --> 00:23:57,600

that will probably influence maybe how

560

00:24:01,850 --> 00:23:59,039

we design

561

00:24:04,130 --> 00:24:01,860

um safety blankets or suits or something

562

00:24:05,750 --> 00:24:04,140

that they can wear so that if they're in

563

00:24:09,049 --> 00:24:05,760

a situation where they need to protect

564

00:24:11,270 --> 00:24:09,059

themselves they have something to use it

565

00:24:13,909 --> 00:24:11,280

could eventually influence how we design

566

00:24:16,730 --> 00:24:13,919

the outside of spacecraft

567

00:24:18,230 --> 00:24:16,740

um all of these types of lessons can

568

00:24:20,570 --> 00:24:18,240

help us learn about the next

569

00:24:23,330 --> 00:24:20,580

technological step we need to take

570

00:24:25,610 --> 00:24:23,340

so it's all important for us and

571

00:24:27,590 --> 00:24:25,620

Commander Campos he's teaching us a

572

00:24:30,049 --> 00:24:27,600

little bit about how the seat designs

573

00:24:32,029 --> 00:24:30,059

will work to kind of minimize just how

574

00:24:34,789 --> 00:24:32,039

much they're being shaken during their

575

00:24:36,590 --> 00:24:34,799

travel so that helps us understand the

576

00:24:38,330 --> 00:24:36,600

interior design of the spacecraft and

577

00:24:40,789 --> 00:24:38,340

how the suits are designed to interact

578

00:24:42,529 --> 00:24:40,799

with the with the spacecraft itself so

579

00:24:45,169 --> 00:24:42,539

together they just kind of help make the

580

00:24:46,610 --> 00:24:45,179

rod a little smoother and also just kind

581

00:24:49,549 --> 00:24:46,620

of help us make sure we've got them

582

00:24:51,049 --> 00:24:49,559

outfitted with the right gear to safely

583

00:24:53,450 --> 00:24:51,059

conduct emissions we'll ask our

584

00:24:55,490 --> 00:24:53,460

astronauts to do in the future

585

00:24:57,409 --> 00:24:55,500

yeah it's one of my favorite parts of

586

00:24:59,870 --> 00:24:57,419

the signs that went up on Artemis one is

587

00:25:02,810 --> 00:24:59,880

just having those dummies and all of the

588

00:25:05,330 --> 00:25:02,820

the collection of that what are those

589

00:25:07,070 --> 00:25:05,340

what are people gonna experience when

590

00:25:10,070 --> 00:25:07,080

they're in this rocket it is the most

591

00:25:12,830 --> 00:25:10,080

powerful rocket we have so I I find that

592

00:25:14,510 --> 00:25:12,840

so fascinating so let's say let's see um

593

00:25:16,070 --> 00:25:14,520

sharmila maybe you can take this one and

594

00:25:17,810 --> 00:25:16,080

if I send you a question and you think

595

00:25:19,669 --> 00:25:17,820

the other person should answer it feel

596

00:25:21,350 --> 00:25:19,679

free to toss it around I think we're

597

00:25:24,409 --> 00:25:21,360

we're pretty informal here on NASA

598

00:25:29,350 --> 00:25:24,419

science live so at lugalia and Daga on

599

00:25:32,810 --> 00:25:29,360

Twitter asks will capsule be reused

600

00:25:34,669 --> 00:25:32,820

uh actually I am going to hand that over

601
00:25:37,070 --> 00:25:34,679
to Jake I think that's that's a good

602
00:25:39,230 --> 00:25:37,080
question for Jake

603
00:25:41,149 --> 00:25:39,240
capsules are are designed to be able to

604
00:25:43,070 --> 00:25:41,159
be reused it's one um thing that we're

605
00:25:44,810 --> 00:25:43,080
doing with uh with the new systems is

606
00:25:46,850 --> 00:25:44,820
trying to be able to reuse them

607
00:25:49,190 --> 00:25:46,860
um and if it's not the entire capsule as

608
00:25:51,289 --> 00:25:49,200
we continue to um develop things in the

609
00:25:53,750 --> 00:25:51,299
future we certainly will learn from each

610
00:25:55,970 --> 00:25:53,760
one and develop new systems based off

611
00:25:57,590 --> 00:25:55,980
the knowledge that we gain from them but

612
00:26:00,470 --> 00:25:57,600
the intent is for us to be able to reuse

613
00:26:03,890 --> 00:26:00,480

those spacecraft when we go forward

614

00:26:05,390 --> 00:26:03,900

awesome thanks Jake yeah so sharmila I

615

00:26:07,490 --> 00:26:05,400

do think that you can you can tell us

616

00:26:08,690 --> 00:26:07,500

more about this one so Connor on Twitter

617

00:26:11,630 --> 00:26:08,700

asks

618

00:26:13,370 --> 00:26:11,640

what can we ex when can we expect to see

619

00:26:16,130 --> 00:26:13,380

all of the data and the science that's

620

00:26:18,110 --> 00:26:16,140

stored on the spacecraft and the and the

621

00:26:20,210 --> 00:26:18,120

science and what kind of data can we

622

00:26:22,430 --> 00:26:20,220

expect to see

623

00:26:24,470 --> 00:26:22,440

yeah great question Connor thanks for

624

00:26:26,450 --> 00:26:24,480

that so

625

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

um you know it'll depend as I mentioned

626
00:26:31,549 --> 00:26:29,039
for the science let's come back on Orion

627
00:26:33,470 --> 00:26:31,559
there are four different experiments so

628
00:26:35,149 --> 00:26:33,480
there's different analysis that's going

629
00:26:39,610 --> 00:26:35,159
to be done on each of those four

630
00:26:43,730 --> 00:26:39,620
different organisms typically though

631
00:26:46,250 --> 00:26:43,740
the analysis for most studies take about

632
00:26:48,769 --> 00:26:46,260
a year for when you get the samples back

633
00:26:51,649 --> 00:26:48,779
also don't forget that we have to do a

634
00:26:53,750 --> 00:26:51,659
gram control that matches the exact

635
00:26:56,570 --> 00:26:53,760
conditions that the space light samples

636
00:26:58,909 --> 00:26:56,580
went through and so usually we do that

637
00:27:01,250 --> 00:26:58,919
after Return of the flight samples

638
00:27:03,590 --> 00:27:01,260

because we have all kinds of sensors and

639

00:27:07,130 --> 00:27:03,600

detectors inside the experiment package

640

00:27:09,169 --> 00:27:07,140

which measures you know temperature uh

641

00:27:11,149 --> 00:27:09,179

you know humidity you know radiation

642

00:27:13,010 --> 00:27:11,159

levels there's other changes that are

643

00:27:15,830 --> 00:27:13,020

being measured and so you want to

644

00:27:17,870 --> 00:27:15,840

recreate as best as you can at least the

645

00:27:20,269 --> 00:27:17,880

temperature you know humidity gas

646

00:27:22,669 --> 00:27:20,279

composition these sorts of things and so

647

00:27:25,789 --> 00:27:22,679

those will be recreated in the ground

648

00:27:27,830 --> 00:27:25,799

control and then the ground control and

649

00:27:30,350 --> 00:27:27,840

the space flight samples will both be

650

00:27:32,930 --> 00:27:30,360

analyzed and compared to each other so

651
00:27:35,269 --> 00:27:32,940
that we can tell what the changes are so

652
00:27:36,470 --> 00:27:35,279
to give you a brief example you know for

653
00:27:39,409 --> 00:27:36,480
the seeds

654
00:27:42,110 --> 00:27:39,419
uh the researchers will look at you know

655
00:27:43,549 --> 00:27:42,120
the seeds that came back from space and

656
00:27:45,769 --> 00:27:43,559
that were exposed to this kind of

657
00:27:48,590 --> 00:27:45,779
elevated radiation environment how well

658
00:27:51,169 --> 00:27:48,600
did they germinate how robustly do they

659
00:27:53,570 --> 00:27:51,179
grow does the addition of these

660
00:27:56,630 --> 00:27:53,580
increased amino acid content does it

661
00:27:58,310 --> 00:27:56,640
help it survive better in space and then

662
00:28:00,470 --> 00:27:58,320
likewise for some of the others for the

663
00:28:02,510 --> 00:28:00,480

yeast cells you know we'll be looking at

664

00:28:04,490 --> 00:28:02,520

what are some of the genes that helped

665

00:28:06,950 --> 00:28:04,500

make those cells more robust in this

666

00:28:08,510 --> 00:28:06,960

environment for example

667

00:28:10,970 --> 00:28:08,520

yeah and I think sharmila what's

668

00:28:12,890 --> 00:28:10,980

important to note is science takes time

669

00:28:15,590 --> 00:28:12,900

to do and so when we get all of this

670

00:28:17,269 --> 00:28:15,600

information we and science has a rigor

671

00:28:19,370 --> 00:28:17,279

to it and the whole reason we have that

672

00:28:21,890 --> 00:28:19,380

rigor to it is so that we can be as

673

00:28:23,750 --> 00:28:21,900

accurate as possible when we interpret

674

00:28:26,690 --> 00:28:23,760

the data that we get but I think

675

00:28:29,210 --> 00:28:26,700

Connor's question also Jake um Can

676

00:28:30,890 --> 00:28:29,220

allude to the science and the data the

677

00:28:32,570 --> 00:28:30,900

information not the science but the data

678

00:28:34,850 --> 00:28:32,580

we're getting from the spacecraft itself

679

00:28:37,070 --> 00:28:34,860

so do you have any insight on when we'll

680

00:28:38,930 --> 00:28:37,080

be able to get that information and and

681

00:28:41,029 --> 00:28:38,940

be able to interpret it and improve the

682

00:28:43,130 --> 00:28:41,039

next Artemis missions

683

00:28:45,230 --> 00:28:43,140

sure I mean some of it's already here

684

00:28:47,210 --> 00:28:45,240

we've been talking to the Orion

685

00:28:49,370 --> 00:28:47,220

throughout its entire flight uh so

686

00:28:50,990 --> 00:28:49,380

Orion's been telling us a lot about how

687

00:28:53,390 --> 00:28:51,000

it handles in space

688

00:28:55,310 --> 00:28:53,400

um it had to make several different uh

689

00:28:58,190 --> 00:28:55,320

engine Burns in order to put it in just

690

00:29:00,350 --> 00:28:58,200

the right trajectory so you know one of

691

00:29:02,149 --> 00:29:00,360

the great things about the math involved

692

00:29:03,769 --> 00:29:02,159

in flying in space is you're trying to

693

00:29:05,750 --> 00:29:03,779

balance how fast you're going with

694

00:29:08,269 --> 00:29:05,760

gravitational pulls from things like the

695

00:29:10,430 --> 00:29:08,279

moon so as you go out around the Moon to

696

00:29:12,289 --> 00:29:10,440

stay on course that you want to keep you

697

00:29:14,450 --> 00:29:12,299

have to add a little bit of thrust to

698

00:29:16,730 --> 00:29:14,460

your vehicle so fire those engines off

699

00:29:19,610 --> 00:29:16,740

every one of those gave us more data

700

00:29:21,769 --> 00:29:19,620

about how the engines worked um how they

701
00:29:23,810 --> 00:29:21,779
performed how the vehicle responded to

702
00:29:26,090 --> 00:29:23,820
that amount of thrust that we gave it um

703
00:29:27,889 --> 00:29:26,100
and uh and again we it performed really

704
00:29:29,990 --> 00:29:27,899
well which is exciting to us because

705
00:29:31,490 --> 00:29:30,000
that means we're in pretty good shape to

706
00:29:34,250 --> 00:29:31,500
start planning for the next Artemis

707
00:29:37,070 --> 00:29:34,260
Mission RMS 2. so we're already learning

708
00:29:39,529 --> 00:29:37,080
about it but now with Orion back here on

709
00:29:41,450 --> 00:29:39,539
Earth safe and sound we can actually go

710
00:29:43,610 --> 00:29:41,460
and start to study the Orion itself so

711
00:29:45,289 --> 00:29:43,620
looking at things like how well did the

712
00:29:47,029 --> 00:29:45,299
heat shields perform

713
00:29:49,190 --> 00:29:47,039

um was there anything that didn't quite

714

00:29:51,350 --> 00:29:49,200

operate the way we thought it did so

715

00:29:52,850 --> 00:29:51,360

those those steps uh they'll take you

716

00:29:55,190 --> 00:29:52,860

know weeks months

717

00:29:57,769 --> 00:29:55,200

um even years I mean what's great about

718

00:29:59,750 --> 00:29:57,779

science is you you kind of do the study

719

00:30:01,730 --> 00:29:59,760

right you do the research but then it

720

00:30:04,250 --> 00:30:01,740

serves as a point of comparison for

721

00:30:07,310 --> 00:30:04,260

everything else that you learn so every

722

00:30:08,990 --> 00:30:07,320

time we fly a spacecraft in space we can

723

00:30:11,630 --> 00:30:09,000

compare it to what we learned from this

724

00:30:13,909 --> 00:30:11,640

Mission uh to help us better prepare for

725

00:30:16,310 --> 00:30:13,919

that next mission so it's starting now

726
00:30:18,289 --> 00:30:16,320
and and a lot of that work will be done

727
00:30:20,090 --> 00:30:18,299
over the next weeks to months but it

728
00:30:21,769 --> 00:30:20,100
never ends really it'll always be there

729
00:30:23,090 --> 00:30:21,779
to help us understand how to fly in

730
00:30:25,430 --> 00:30:23,100
space

731
00:30:27,769 --> 00:30:25,440
yeah I love that idea that you just

732
00:30:29,149 --> 00:30:27,779
expressed because science does build on

733
00:30:30,470 --> 00:30:29,159
top of each other as soon as you learn

734
00:30:32,570 --> 00:30:30,480
something you come up with another

735
00:30:34,490 --> 00:30:32,580
question and then you think well how

736
00:30:36,529 --> 00:30:34,500
what about this and it just continues

737
00:30:39,289 --> 00:30:36,539
and it just loops and that's how we end

738
00:30:41,810 --> 00:30:39,299

up with this huge body of knowledge I I

739

00:30:44,149 --> 00:30:41,820

love that thought Jake so I think this

740

00:30:46,190 --> 00:30:44,159

one can go to both of you so I'd love to

741

00:30:49,730 --> 00:30:46,200

hear your thoughts on

742

00:30:51,350 --> 00:30:49,740

um Humberto Silva on YouTube and I'm

743

00:30:53,690 --> 00:30:51,360

sorry if I did not say your name

744

00:30:55,669 --> 00:30:53,700

correctly wants to know what is the

745

00:30:57,230 --> 00:30:55,679

principal difference between Apollo and

746

00:31:00,490 --> 00:30:57,240

the Artemis missions

747

00:31:03,289 --> 00:31:00,500

sharmila let's start with you

748

00:31:06,110 --> 00:31:03,299

yeah so you know one of the things with

749

00:31:08,269 --> 00:31:06,120

the art with the Apollo missions is it

750

00:31:10,850 --> 00:31:08,279

was still in the early days you know

751
00:31:13,490 --> 00:31:10,860
that was when we were first uh you know

752
00:31:15,649 --> 00:31:13,500
heading back you know outside of our own

753
00:31:18,049 --> 00:31:15,659
comfort zone so to speak and heading

754
00:31:20,090 --> 00:31:18,059
towards the moon and then getting to the

755
00:31:24,710 --> 00:31:20,100
surface of the Moon so there was so much

756
00:31:28,010 --> 00:31:24,720
unknown that we really had to focus then

757
00:31:31,909 --> 00:31:28,020
on you know getting there keeping our

758
00:31:34,789 --> 00:31:31,919
astronauts safe and so on so uh there

759
00:31:37,430 --> 00:31:34,799
wasn't as much of this very carefully

760
00:31:39,470 --> 00:31:37,440
controlled science that we are now

761
00:31:43,010 --> 00:31:39,480
setting up on the Artemis series of

762
00:31:45,649 --> 00:31:43,020
missions where you know we've sort of uh

763
00:31:47,389 --> 00:31:45,659

uh you know and and Jake I'm sure we'll

764

00:31:49,549 --> 00:31:47,399

further elaborate on this you know we

765

00:31:52,010 --> 00:31:49,559

have the Technologies now

766

00:31:55,010 --> 00:31:52,020

um as as you've seen Anonymous once to

767

00:31:56,810 --> 00:31:55,020

get there and get back safely so now we

768

00:31:58,730 --> 00:31:56,820

really need to use these platforms to

769

00:32:00,769 --> 00:31:58,740

understand the science so that we can be

770

00:32:03,049 --> 00:32:00,779

better prepared for our future Mission

771

00:32:06,490 --> 00:32:03,059

to Mars for example which is going to be

772

00:32:10,850 --> 00:32:06,500

further than any you know human has been

773

00:32:12,230 --> 00:32:10,860

uh you know ever uh and and so I think

774

00:32:14,210 --> 00:32:12,240

for me at least from the science

775

00:32:17,630 --> 00:32:14,220

perspective that's one major difference

776

00:32:20,090 --> 00:32:17,640

but Jake you know uh please add you know

777

00:32:23,690 --> 00:32:20,100

other perspectives as well

778

00:32:26,029 --> 00:32:23,700

yeah so both Apollo and Artemis

779

00:32:28,490 --> 00:32:26,039

um the intention is to put astronauts on

780

00:32:31,070 --> 00:32:28,500

the moon but there are some significant

781

00:32:33,169 --> 00:32:31,080

differences so Apollo was a series of

782

00:32:35,690 --> 00:32:33,179

missions that went to near the equator

783

00:32:37,310 --> 00:32:35,700

of the Moon and all on the near side of

784

00:32:40,610 --> 00:32:37,320

the moon so the side of the moon that

785

00:32:42,470 --> 00:32:40,620

continually faces the Earth so all of

786

00:32:44,149 --> 00:32:42,480

those Landings were kind of like right

787

00:32:46,549 --> 00:32:44,159

in the middle of the Moon as you would

788

00:32:48,769 --> 00:32:46,559

see it when you look at it uh the in the

789

00:32:51,470 --> 00:32:48,779

night sky where we want to go with

790

00:32:53,389 --> 00:32:51,480

Artemis is to the South Pole of the Moon

791

00:32:56,029 --> 00:32:53,399

and the reason we want to go to the

792

00:32:58,370 --> 00:32:56,039

South Pole is we've learned so much

793

00:33:01,370 --> 00:32:58,380

since Apollo and what we've learned is

794

00:33:03,409 --> 00:33:01,380

that in some cases there are craters at

795

00:33:05,029 --> 00:33:03,419

the poles that never see sunlight we

796

00:33:07,730 --> 00:33:05,039

refer to them as being permanently

797

00:33:10,010 --> 00:33:07,740

shadowed and because of their permanent

798

00:33:11,810 --> 00:33:10,020

Shadows they don't interact with the sun

799

00:33:13,669 --> 00:33:11,820

and so

800

00:33:16,610 --> 00:33:13,679

um materials that we call volatile

801
00:33:18,409 --> 00:33:16,620
elements volatile molecules that means

802
00:33:20,389 --> 00:33:18,419
that if they see the sun they become

803
00:33:22,909 --> 00:33:20,399
volatilized they turn to gas and they're

804
00:33:25,250 --> 00:33:22,919
lost these volatiles in these places

805
00:33:27,529 --> 00:33:25,260
that never see the sun they just kind of

806
00:33:29,930 --> 00:33:27,539
get stuck there and so over the whole

807
00:33:32,029 --> 00:33:29,940
history of the solar system these

808
00:33:34,370 --> 00:33:32,039
volatiles have collected in these cold

809
00:33:36,289 --> 00:33:34,380
traps these permanent shadows and so

810
00:33:39,110 --> 00:33:36,299
what that means is we think there's

811
00:33:42,470 --> 00:33:39,120
actually big deposits of ice there

812
00:33:44,630 --> 00:33:42,480
ice is really important to us

813
00:33:46,730 --> 00:33:44,640

um life needs water and if there's

814

00:33:48,590 --> 00:33:46,740

already water on the moon it's a

815

00:33:50,810 --> 00:33:48,600

resource we can use if you think about

816

00:33:53,330 --> 00:33:50,820

taking a trip here on Earth you can't

817

00:33:55,789 --> 00:33:53,340

possibly take everything with you every

818

00:33:58,549 --> 00:33:55,799

time you leave your house you depend on

819

00:34:01,250 --> 00:33:58,559

the fact that a place you go to is going

820

00:34:03,169 --> 00:34:01,260

to have a water fountain right so we are

821

00:34:03,889 --> 00:34:03,179

looking for that water fountain on the

822

00:34:06,409 --> 00:34:03,899

moon

823

00:34:08,389 --> 00:34:06,419

and we can use that water maybe for

824

00:34:11,030 --> 00:34:08,399

ourselves but we can break it down into

825

00:34:13,250 --> 00:34:11,040

hydrogen and oxygen maybe even make

826

00:34:15,409 --> 00:34:13,260

things like fuel or use the the oxygen

827

00:34:17,510 --> 00:34:15,419

to breathe so it's it is really

828

00:34:20,290 --> 00:34:17,520

different like but but it's all part of

829

00:34:23,329 --> 00:34:20,300

an arc or a trajectory of exploration

830

00:34:24,710 --> 00:34:23,339

it's not that Apollo and Artemis are

831

00:34:26,570 --> 00:34:24,720

different than each other it's just a

832

00:34:29,329 --> 00:34:26,580

different stage of learning how to

833

00:34:31,430 --> 00:34:29,339

explore deep space so Apollo did those

834

00:34:34,129 --> 00:34:31,440

first trips to the moon and we learned

835

00:34:36,230 --> 00:34:34,139

so much from Apollo uh since then we've

836

00:34:38,629 --> 00:34:36,240

been sending orbiters and Landers to the

837

00:34:40,909 --> 00:34:38,639

Moon from various countries around the

838

00:34:42,290 --> 00:34:40,919

globe learning about the moon and that's

839

00:34:44,930 --> 00:34:42,300

how we learned that that water is

840

00:34:47,389 --> 00:34:44,940

actually there and so now we're in this

841

00:34:49,909 --> 00:34:47,399

position for Artemis which is just

842

00:34:51,829 --> 00:34:49,919

wonderful where we can go and start to

843

00:34:53,810 --> 00:34:51,839

actually spend more time on the surface

844

00:34:55,669 --> 00:34:53,820

of the Moon and get to the point where

845

00:34:57,950 --> 00:34:55,679

we actually have reusable infrastructure

846

00:35:00,650 --> 00:34:57,960

if we can take something along like a

847

00:35:03,349 --> 00:35:00,660

small vehicle that we can drive around

848

00:35:05,450 --> 00:35:03,359

the late Apollo missions took one on

849

00:35:07,310 --> 00:35:05,460

each land but if we can take one and

850

00:35:08,930 --> 00:35:07,320

just reuse it then we don't have to

851
00:35:10,430 --> 00:35:08,940
bring one on each time and that leaves

852
00:35:12,470 --> 00:35:10,440
more space for us to bring other things

853
00:35:14,030 --> 00:35:12,480
like more science experiments or to take

854
00:35:15,230 --> 00:35:14,040
more rocks home or samples from the

855
00:35:17,329 --> 00:35:15,240
lunar surface

856
00:35:19,310 --> 00:35:17,339
so you know they're different but

857
00:35:21,770 --> 00:35:19,320
they're building on each other they're

858
00:35:24,109 --> 00:35:21,780
learning Artemis is learning from Apollo

859
00:35:26,270 --> 00:35:24,119
all the other spacecraft that have been

860
00:35:28,370 --> 00:35:26,280
there since Apollo to put us in this

861
00:35:30,069 --> 00:35:28,380
just great chance to go explore the

862
00:35:33,050 --> 00:35:30,079
unknown

863
00:35:34,849 --> 00:35:33,060

and I think you touched on them a little

864

00:35:37,310 --> 00:35:34,859

bit Jake but also one of the great

865

00:35:39,370 --> 00:35:37,320

differences between the two is Artemis

866

00:35:42,349 --> 00:35:39,380

is really an international Cooperative

867

00:35:45,109 --> 00:35:42,359

effort also we have lots of Partners

868

00:35:48,410 --> 00:35:45,119

around the world who are super excited

869

00:35:51,410 --> 00:35:48,420

to help the US explore the moon again I

870

00:35:54,230 --> 00:35:51,420

find that really great fascinating

871

00:35:55,250 --> 00:35:54,240

yeah this is it you know we talk about

872

00:36:04,790 --> 00:35:55,260

this

873

00:36:07,790 --> 00:36:04,800

uh and and we're going together uh just

874

00:36:10,970 --> 00:36:07,800

just on this light uh the European Space

875

00:36:13,430 --> 00:36:10,980

Agency provided um an element of Orion

876

00:36:16,609 --> 00:36:13,440

that helped helped us uh steer it and

877

00:36:19,010 --> 00:36:16,619

fly through space the service module

878

00:36:21,589 --> 00:36:19,020

um so a piece of that mission came from

879

00:36:24,050 --> 00:36:21,599

several other countries um over in

880

00:36:25,490 --> 00:36:24,060

Europe and several of the payloads the

881

00:36:27,349 --> 00:36:25,500

secondary payloads we talk about those

882

00:36:30,650 --> 00:36:27,359

cubesats that will not were provided by

883

00:36:32,530 --> 00:36:30,660

other countries uh so you know the all

884

00:36:35,210 --> 00:36:32,540

of it is learning how to work together

885

00:36:37,670 --> 00:36:35,220

uh be partners

886

00:36:39,829 --> 00:36:37,680

um what's also neat about it is it's not

887

00:36:41,390 --> 00:36:39,839

just International we're partnering with

888

00:36:44,210 --> 00:36:41,400

companies who are building the

889

00:36:46,069 --> 00:36:44,220

spacecraft for us now so the SLS the

890

00:36:48,109 --> 00:36:46,079

space launch system which is the rocket

891

00:36:49,250 --> 00:36:48,119

and the Orion crew capsule those were

892

00:36:50,690 --> 00:36:49,260

NASA

893

00:36:52,849 --> 00:36:50,700

um spacecraft built with some of our

894

00:36:55,430 --> 00:36:52,859

contractors but many of the future

895

00:36:56,870 --> 00:36:55,440

elements the Landers the vehicles on the

896

00:36:59,089 --> 00:36:56,880

surface they're going to be coming from

897

00:37:01,130 --> 00:36:59,099

companies that that we all know and know

898

00:37:02,870 --> 00:37:01,140

the names of that are that are going to

899

00:37:04,970 --> 00:37:02,880

be building those for us and so it just

900

00:37:06,710 --> 00:37:04,980

really is this wonderful like I

901
00:37:08,690 --> 00:37:06,720
described being at the Artemis one

902
00:37:10,970 --> 00:37:08,700
launch it's just this like comforting

903
00:37:13,190 --> 00:37:10,980
supportive environment where you know

904
00:37:15,349 --> 00:37:13,200
just people from all around the globe

905
00:37:17,030 --> 00:37:15,359
were paying attention and excited to see

906
00:37:19,370 --> 00:37:17,040
what was happening

907
00:37:20,810 --> 00:37:19,380
there's something so poetic about what

908
00:37:22,790 --> 00:37:20,820
you just said you said we are going

909
00:37:24,950 --> 00:37:22,800
together I don't know there's just

910
00:37:26,870 --> 00:37:24,960
something very heartwarming about that

911
00:37:29,270 --> 00:37:26,880
that it's all humankind

912
00:37:32,210 --> 00:37:29,280
so sharmila I got a question for you

913
00:37:34,250 --> 00:37:32,220

here at Karina yeah on Twitter asks why

914

00:37:36,109 --> 00:37:34,260

did they use yeast and bacteria in their

915

00:37:39,530 --> 00:37:36,119

experiments

916

00:37:42,650 --> 00:37:39,540

yeah another excellent question so you

917

00:37:46,970 --> 00:37:42,660

know because as we've been discussing uh

918

00:37:49,790 --> 00:37:46,980

Artemis one is is the start you know a

919

00:37:52,370 --> 00:37:49,800

renewal of a program you know within

920

00:37:56,109 --> 00:37:52,380

NASA to help us continue to explore

921

00:38:00,290 --> 00:37:56,119

these these new places so as a result

922

00:38:02,569 --> 00:38:00,300

the primary goal of this Vision was to

923

00:38:05,270 --> 00:38:02,579

make sure that we got the Rockets and

924

00:38:08,990 --> 00:38:05,280

the Orion crew capsule and all of this

925

00:38:11,630 --> 00:38:09,000

working safely and effectively so the

926
00:38:15,050 --> 00:38:11,640
science that came along came along for

927
00:38:19,150 --> 00:38:15,060
the ride you know NASA is you know as

928
00:38:22,130 --> 00:38:19,160
you know you know is is a very heavily

929
00:38:24,349 --> 00:38:22,140
science based and you know science

930
00:38:27,349 --> 00:38:24,359
interested organization

931
00:38:29,930 --> 00:38:27,359
and so we didn't want to to lose that

932
00:38:32,329 --> 00:38:29,940
opportunity to do valuable signs but at

933
00:38:34,910 --> 00:38:32,339
the same time we didn't want to risk the

934
00:38:37,069 --> 00:38:34,920
primary goal of this Mission which was

935
00:38:39,530 --> 00:38:37,079
to ensure that we could get back to

936
00:38:41,810 --> 00:38:39,540
these new environments safely so

937
00:38:44,329 --> 00:38:41,820
therefore the experiments that we

938
00:38:46,730 --> 00:38:44,339

selected to go on these first mission

939

00:38:50,150 --> 00:38:46,740

and the same is actually true for the

940

00:38:53,270 --> 00:38:50,160

next mission uh is you know these are

941

00:38:56,329 --> 00:38:53,280

more robust organisms they're very good

942

00:38:58,730 --> 00:38:56,339

biological models though for doing uh

943

00:39:01,430 --> 00:38:58,740

biology research on Earth

944

00:39:03,950 --> 00:39:01,440

in fact these have been workhorses that

945

00:39:06,470 --> 00:39:03,960

have been used on Earth for many decades

946

00:39:09,829 --> 00:39:06,480

now and help us understand fundamental

947

00:39:12,050 --> 00:39:09,839

biology about how you know genes uh you

948

00:39:14,450 --> 00:39:12,060

know within the DNA get transcribed and

949

00:39:17,329 --> 00:39:14,460

make RNA and make protein you know all

950

00:39:20,210 --> 00:39:17,339

of this was initially worked out in

951
00:39:23,690 --> 00:39:20,220
systems like the yeast cells and

952
00:39:27,650 --> 00:39:23,700
bacterial cells and so on and so uh you

953
00:39:29,569 --> 00:39:27,660
know the the the intent was to find

954
00:39:31,970 --> 00:39:29,579
something that's scientifically very

955
00:39:34,849 --> 00:39:31,980
important but at the same time very

956
00:39:36,650 --> 00:39:34,859
robust so to give you an example you

957
00:39:40,130 --> 00:39:36,660
know for some of the experiments we had

958
00:39:41,810 --> 00:39:40,140
to load them weeks ahead of and in some

959
00:39:44,750 --> 00:39:41,820
cases actually for some of the free

960
00:39:48,109 --> 00:39:44,760
Flyers we had to load the biology months

961
00:39:51,470 --> 00:39:48,119
before Artemis one actually launched so

962
00:39:53,450 --> 00:39:51,480
we couldn't really fly experiments that

963
00:39:56,089 --> 00:39:53,460

needed you know a lot of tender loving

964

00:39:59,050 --> 00:39:56,099

care for themselves because we were not

965

00:40:02,450 --> 00:39:59,060

going to be able to access those

966

00:40:04,849 --> 00:40:02,460

payloads or those experiments still you

967

00:40:08,150 --> 00:40:04,859

know uh many weeks or many months before

968

00:40:10,250 --> 00:40:08,160

launch and so the art here

969

00:40:12,829 --> 00:40:10,260

was to pick things that would give us

970

00:40:15,589 --> 00:40:12,839

very good science but at the same time

971

00:40:17,750 --> 00:40:15,599

would be able to withstand some of the

972

00:40:21,170 --> 00:40:17,760

engineering requirements you know which

973

00:40:23,150 --> 00:40:21,180

required us to do testing on various

974

00:40:26,030 --> 00:40:23,160

components of the rocket and the crew

975

00:40:28,069 --> 00:40:26,040

crew capsule uh before we can do our

976

00:40:31,790 --> 00:40:28,079

science and so so that's what went

977

00:40:34,069 --> 00:40:31,800

behind the thought of how to pick what

978

00:40:36,050 --> 00:40:34,079

kind of science we do

979

00:40:37,069 --> 00:40:36,060

yeah and I think you touched on it for

980

00:40:39,109 --> 00:40:37,079

Karina

981

00:40:42,230 --> 00:40:39,119

um a lot of what we know about the human

982

00:40:44,630 --> 00:40:42,240

body today if you traced it back we

983

00:40:47,089 --> 00:40:44,640

started learning about it in bacteria or

984

00:40:49,490 --> 00:40:47,099

Yeast or similar organisms so we'll be

985

00:40:51,170 --> 00:40:49,500

able to learn so much from these even

986

00:40:53,870 --> 00:40:51,180

though they're you know they seem like

987

00:40:55,910 --> 00:40:53,880

they would be too small or ineffective

988

00:40:58,609 --> 00:40:55,920

they're actually really great organisms

989

00:40:59,990 --> 00:40:58,619

for us to learn more about fundamental

990

00:41:01,730 --> 00:41:00,000

biology

991

00:41:04,069 --> 00:41:01,740

um so and I think that's exactly right

992

00:41:06,530 --> 00:41:04,079

sharmila so as we mentioned before

993

00:41:09,589 --> 00:41:06,540

Artemis one has a few hitchhikers on

994

00:41:11,569 --> 00:41:09,599

board the idea of these small secondary

995

00:41:14,210 --> 00:41:11,579

payloads is to make the most of the

996

00:41:16,790 --> 00:41:14,220

space launch rocket system this the

997

00:41:18,349 --> 00:41:16,800

space launch system rocket sorry and you

998

00:41:21,109 --> 00:41:18,359

it did not sound right coming out there

999

00:41:23,810 --> 00:41:21,119

these shoebox size Cube sets are not

1000

00:41:25,730 --> 00:41:23,820

related to the primary Mission but each

1001
00:41:27,410 --> 00:41:25,740
one will carry out different science and

1002
00:41:30,770 --> 00:41:27,420
technology demonstrations like you heard

1003
00:41:33,349 --> 00:41:30,780
Jake talk about before so from searching

1004
00:41:35,770 --> 00:41:33,359
for water ice and mapping the lunar

1005
00:41:38,390 --> 00:41:35,780
surface to technology demonstrations

1006
00:41:40,609 --> 00:41:38,400
these cubesats allow us to learn how to

1007
00:41:43,069 --> 00:41:40,619
reduce risk and improve our systems

1008
00:41:45,290 --> 00:41:43,079
overall for future missions to learn

1009
00:41:47,829 --> 00:41:45,300
more about the cubesats on Artemis 1 and

1010
00:41:51,890 --> 00:41:47,839
their missions visit

1011
00:41:53,810 --> 00:41:51,900
go.nasa.gov Artemis science now let's

1012
00:41:56,150 --> 00:41:53,820
take more of the questions that you have

1013
00:41:57,530 --> 00:41:56,160

and sharmila and Jake I've been taking a

1014

00:41:59,589 --> 00:41:57,540

peek at them and they're getting even

1015

00:42:01,970 --> 00:41:59,599

better and better such intelligent

1016

00:42:06,710 --> 00:42:01,980

insightful questions from our audience

1017

00:42:08,569 --> 00:42:06,720

today let's see so JJ on YouTube asks he

1018

00:42:10,970 --> 00:42:08,579

says I have two related questions for

1019

00:42:16,010 --> 00:42:10,980

you what are the moon again Phantoms

1020

00:42:17,630 --> 00:42:16,020

made out of and at love vengem I think

1021

00:42:20,569 --> 00:42:17,640

and sorry about these names if I get

1022

00:42:22,430 --> 00:42:20,579

them wrong on Twitter wants to know why

1023

00:42:25,010 --> 00:42:22,440

is it so important for us to study

1024

00:42:27,290 --> 00:42:25,020

radiation of the female body so Jacob

1025

00:42:29,569 --> 00:42:27,300

we'll start with you

1026

00:42:31,790 --> 00:42:29,579

well the the reason it's important to

1027

00:42:34,190 --> 00:42:31,800

study it we have sent people to the Moon

1028

00:42:36,589 --> 00:42:34,200

uh but all of the astronauts that went

1029

00:42:39,050 --> 00:42:36,599

to the moon were men so it's really

1030

00:42:41,210 --> 00:42:39,060

important for us to collect some data to

1031

00:42:43,130 --> 00:42:41,220

begin filling in uh that lack of

1032

00:42:44,810 --> 00:42:43,140

information that we have for what

1033

00:42:46,730 --> 00:42:44,820

happens to the female body when we

1034

00:42:48,950 --> 00:42:46,740

travel through deep space

1035

00:42:52,130 --> 00:42:48,960

um so that's one of the reasons that uh

1036

00:42:55,250 --> 00:42:52,140

the the uh Helga and Zohar were designed

1037

00:42:57,710 --> 00:42:55,260

to mimic a female body so we can collect

1038

00:42:59,750 --> 00:42:57,720

some of that data as for what it's made

1039

00:43:02,750 --> 00:42:59,760

out of it's made of material to

1040

00:43:04,970 --> 00:43:02,760

replicate some of the DNA that um that

1041

00:43:07,430 --> 00:43:04,980

makes up a female body as opposed to a

1042

00:43:09,829 --> 00:43:07,440

male body and so together

1043

00:43:11,930 --> 00:43:09,839

uh going out there one wearing a

1044

00:43:14,450 --> 00:43:11,940

protective vest and one not wearing the

1045

00:43:16,790 --> 00:43:14,460

best they can begin to look at what is

1046

00:43:18,770 --> 00:43:16,800

the uh what is the result if you have

1047

00:43:21,230 --> 00:43:18,780

none of that protection versus having

1048

00:43:23,809 --> 00:43:21,240

some of that protection there so again

1049

00:43:26,809 --> 00:43:23,819

we have some data from our Apollo

1050

00:43:28,849 --> 00:43:26,819

Astronauts that tells us about how the

1051
00:43:30,950 --> 00:43:28,859
male body responded to that deep space

1052
00:43:33,589 --> 00:43:30,960
environment and now we've collected some

1053
00:43:35,329 --> 00:43:33,599
of that information with Artemis one to

1054
00:43:37,309 --> 00:43:35,339
help fill out and have a more robust

1055
00:43:40,069 --> 00:43:37,319
understanding that actually represents

1056
00:43:42,170 --> 00:43:40,079
our astronaut um the the breadth of our

1057
00:43:44,150 --> 00:43:42,180
astronauts today

1058
00:43:46,550 --> 00:43:44,160
I'm so glad they asked those questions

1059
00:43:48,349 --> 00:43:46,560
because I didn't even think about why we

1060
00:43:49,790 --> 00:43:48,359
were modeling and had these female

1061
00:43:51,589 --> 00:43:49,800
mannequins on board but that makes

1062
00:43:55,730 --> 00:43:51,599
perfect sense now that you say it Jake

1063
00:43:58,550 --> 00:43:55,740

all right so for you sharmila at Simone

1064

00:44:01,010 --> 00:43:58,560

Joe Moore on Facebook asks us with the

1065

00:44:03,589 --> 00:44:01,020

bio experiments are we also looking at

1066

00:44:06,890 --> 00:44:03,599

how we might need to bio adapt and not

1067

00:44:14,030 --> 00:44:11,030

yeah another great question Simone so

1068

00:44:15,410 --> 00:44:14,040

um yes adaptation is definitely you know

1069

00:44:17,990 --> 00:44:15,420

especially as we're going to do

1070

00:44:19,670 --> 00:44:18,000

long-term space exploration in the

1071

00:44:21,470 --> 00:44:19,680

future you know going to Mars and back

1072

00:44:23,630 --> 00:44:21,480

is going to be something like a two to

1073

00:44:26,030 --> 00:44:23,640

three year round trip and then you know

1074

00:44:29,329 --> 00:44:26,040

couple with that you know time to stay

1075

00:44:32,510 --> 00:44:29,339

on Mars so we are increasingly going to

1076
00:44:35,750 --> 00:44:32,520
have to look at uh spending more time

1077
00:44:37,730 --> 00:44:35,760
there so yes some of the studies are

1078
00:44:38,870 --> 00:44:37,740
definitely going to begin to look at

1079
00:44:41,630 --> 00:44:38,880
that

1080
00:44:44,329 --> 00:44:41,640
but you remember this was a relatively

1081
00:44:46,849 --> 00:44:44,339
short duration trip uh because again we

1082
00:44:48,829 --> 00:44:46,859
wanted the capsule back having said that

1083
00:44:50,270 --> 00:44:48,839
you know sent to an experiment that I

1084
00:44:53,569 --> 00:44:50,280
mentioned that is going towards the

1085
00:44:56,329 --> 00:44:53,579
heliocentric orbit uh that one for

1086
00:44:59,750 --> 00:44:56,339
example uh you know is going to look at

1087
00:45:02,030 --> 00:44:59,760
long-term longer term exposure and so

1088
00:45:03,410 --> 00:45:02,040

we're going to look at almost six months

1089

00:45:06,109 --> 00:45:03,420

or more you know as long as we can get

1090

00:45:08,750 --> 00:45:06,119

the data back we will continue to do

1091

00:45:11,329 --> 00:45:08,760

that research and so you're absolutely

1092

00:45:13,910 --> 00:45:11,339

right some of the changes that we will

1093

00:45:16,550 --> 00:45:13,920

be looking at are the the immediate

1094

00:45:18,470 --> 00:45:16,560

changes and therefore you know what can

1095

00:45:20,750 --> 00:45:18,480

you do you know what can you learn from

1096

00:45:22,309 --> 00:45:20,760

some of that but then some of the data

1097

00:45:24,890 --> 00:45:22,319

will actually Point towards the

1098

00:45:27,530 --> 00:45:24,900

long-term changes which will hint more

1099

00:45:29,990 --> 00:45:27,540

towards you know how do you acclimate uh

1100

00:45:32,510 --> 00:45:30,000

and over many generations of cell growth

1101

00:45:34,670 --> 00:45:32,520

you know how do you actually adapt to

1102

00:45:37,849 --> 00:45:34,680

these environments so yes great question

1103

00:45:39,890 --> 00:45:37,859

yes that those are definitely along the

1104

00:45:42,109 --> 00:45:39,900

lines of what we're are interested in

1105

00:45:44,870 --> 00:45:42,119

for the science

1106

00:45:46,730 --> 00:45:44,880

that's great thanks shamila okay Jake

1107

00:45:48,950 --> 00:45:46,740

I've got a great question for you it

1108

00:45:51,650 --> 00:45:48,960

sounds like a lot of people online are

1109

00:45:53,870 --> 00:45:51,660

asking about Snoopy so Jake do you know

1110

00:45:56,150 --> 00:45:53,880

how he's doing and can you explain his

1111

00:45:58,730 --> 00:45:56,160

role on the mission

1112

00:46:01,490 --> 00:45:58,740

yeah so Snoopy's long been associated

1113

00:46:04,309 --> 00:46:01,500

with our our astronaut flights

1114

00:46:06,470 --> 00:46:04,319

um it's uh he's always been a part of

1115

00:46:09,650 --> 00:46:06,480

that I think he's just kind of a a

1116

00:46:11,450 --> 00:46:09,660

recognized part of human nature uh you

1117

00:46:13,609 --> 00:46:11,460

know he's always flying around on his

1118

00:46:15,470 --> 00:46:13,619

dog house and he leads the way for

1119

00:46:18,829 --> 00:46:15,480

exploring and so he's always

1120

00:46:22,130 --> 00:46:18,839

participated with NASA and his specific

1121

00:46:24,589 --> 00:46:22,140

job on the mission uh for Artemis one is

1122

00:46:26,990 --> 00:46:24,599

to help us understand when we're out of

1123

00:46:29,270 --> 00:46:27,000

that gravitational field so when you see

1124

00:46:32,450 --> 00:46:29,280

Snoopy starting to kind of float up

1125

00:46:34,609 --> 00:46:32,460

around you know that you now are no

1126

00:46:36,950 --> 00:46:34,619

longer in that gravitational field and

1127

00:46:40,130 --> 00:46:36,960

in fact when you look at any NASA launch

1128

00:46:42,050 --> 00:46:40,140

with crew they have one of these gravity

1129

00:46:45,349 --> 00:46:42,060

indicators as well and sometimes they

1130

00:46:47,569 --> 00:46:45,359

bring along a Memento that means more to

1131

00:46:49,609 --> 00:46:47,579

them but on this flight this important

1132

00:46:52,069 --> 00:46:49,619

flight Artemis wants soupy's the The

1133

00:46:53,930 --> 00:46:52,079

Ride Along for us so Snoopy came home in

1134

00:46:56,150 --> 00:46:53,940

the Orion splashed down in the Pacific

1135

00:46:59,089 --> 00:46:56,160

Ocean probably has some really awesome

1136

00:47:00,710 --> 00:46:59,099

stories to tell us but for sure has been

1137

00:47:02,870 --> 00:47:00,720

telling us what the gravitational field

1138

00:47:04,390 --> 00:47:02,880

is like during uh during the armist one

1139

00:47:07,609 --> 00:47:04,400

mission

1140

00:47:10,370 --> 00:47:07,619

I love that Jake oh my goodness Snoopy

1141

00:47:12,410 --> 00:47:10,380

is beloved in our culture for sure let's

1142

00:47:14,089 --> 00:47:12,420

see so a viewer on Twitter asks and

1143

00:47:16,069 --> 00:47:14,099

sharmila I'm going to start I'm going to

1144

00:47:18,349 --> 00:47:16,079

hand this one to you will there be

1145

00:47:19,790 --> 00:47:18,359

something like the DNA sequencer that is

1146

00:47:22,069 --> 00:47:19,800

used by the astronauts on the

1147

00:47:24,650 --> 00:47:22,079

International Space Station and if used

1148

00:47:26,569 --> 00:47:24,660

on the Orion for Artemis 2 and 3 could

1149

00:47:29,390 --> 00:47:26,579

it determine radiation damage to

1150

00:47:31,910 --> 00:47:29,400

microbes on board Orion I told you these

1151

00:47:34,130 --> 00:47:31,920

questions are getting tougher and

1152

00:47:37,430 --> 00:47:34,140

they're awesome yes

1153

00:47:40,970 --> 00:47:37,440

yes fabulous question and so the answer

1154

00:47:44,089 --> 00:47:40,980

is absolutely yes so you know over time

1155

00:47:46,730 --> 00:47:44,099

we are in fact exactly going to be doing

1156

00:47:49,069 --> 00:47:46,740

what you suggest which is we're going to

1157

00:47:51,710 --> 00:47:49,079

be taking up more and more of the tools

1158

00:47:54,470 --> 00:47:51,720

that we use on the International Space

1159

00:47:57,230 --> 00:47:54,480

Station for example which really help us

1160

00:47:58,730 --> 00:47:57,240

to do our science so we can do it you

1161

00:48:01,609 --> 00:47:58,740

know on the surface of the Moon for

1162

00:48:04,309 --> 00:48:01,619

example having said that let me also

1163

00:48:07,910 --> 00:48:04,319

tell you that one of the experiments on

1164

00:48:09,890 --> 00:48:07,920

that bio experiment One Suite uh one of

1165

00:48:13,010 --> 00:48:09,900

them is specifically going to look at

1166

00:48:16,069 --> 00:48:13,020

what we call omix changes which covers

1167

00:48:18,349 --> 00:48:16,079

exactly what you're asking which is you

1168

00:48:20,050 --> 00:48:18,359

you know if you sequence the RNA for

1169

00:48:23,870 --> 00:48:20,060

example and you look at what is called

1170

00:48:26,870 --> 00:48:23,880

transcriptomics it gives you a sense of

1171

00:48:29,870 --> 00:48:26,880

how the DNA and those genes inside the

1172

00:48:32,990 --> 00:48:29,880

DNA how do they respond in this novel

1173

00:48:34,849 --> 00:48:33,000

environment and so we are going to do

1174

00:48:37,490 --> 00:48:34,859

that for example we're going to get that

1175

00:48:40,010 --> 00:48:37,500

information but it is going to be done

1176

00:48:41,870 --> 00:48:40,020

on the samples that have come back to

1177

00:48:44,510 --> 00:48:41,880

earth this time you know because bio

1178

00:48:46,609 --> 00:48:44,520

experiment one is coming back has come

1179

00:48:49,130 --> 00:48:46,619

back and most of the science is going to

1180

00:48:52,309 --> 00:48:49,140

be down on on the ground

1181

00:48:56,150 --> 00:48:52,319

um so but but again that you know what

1182

00:48:58,490 --> 00:48:56,160

you say that is real time sequencing in

1183

00:49:01,329 --> 00:48:58,500

space you know on samples that are

1184

00:49:03,829 --> 00:49:01,339

flying in space can absolutely be done

1185

00:49:06,170 --> 00:49:03,839

and definitely is something that we're

1186

00:49:09,109 --> 00:49:06,180

going to do and the other advantage of

1187

00:49:11,230 --> 00:49:09,119

doing what you suggest is that many of

1188

00:49:14,450 --> 00:49:11,240

these operations are usually automated

1189

00:49:17,210 --> 00:49:14,460

and so the more automated we can make it

1190

00:49:20,270 --> 00:49:17,220

the easier it will be for us to do the

1191

00:49:23,089 --> 00:49:20,280

signs in future on the lunar surface so

1192

00:49:25,550 --> 00:49:23,099

absolutely yes yeah great question and

1193

00:49:28,670 --> 00:49:25,560

uh totally on the on the right track for

1194

00:49:31,130 --> 00:49:28,680

what we're interested in doing

1195

00:49:34,370 --> 00:49:31,140

I agree that was a great question from

1196

00:49:38,210 --> 00:49:34,380

our Twitter audience let's see Jake this

1197

00:49:41,210 --> 00:49:38,220

one is from electro Electro Boy 8128 on

1198

00:49:43,309 --> 00:49:41,220

YouTube he asks when will Artemis 2

1199

00:49:46,250 --> 00:49:43,319

launch

1200

00:49:48,109 --> 00:49:46,260

yeah so Artemis 2 uh if everything

1201
00:49:49,970 --> 00:49:48,119
continues to go well for us we're

1202
00:49:53,390 --> 00:49:49,980
expecting to be able to launch Artemis 2

1203
00:49:54,829 --> 00:49:53,400
in uh the year 2024. so we need a little

1204
00:49:57,650 --> 00:49:54,839
bit of time to just make sure we

1205
00:49:59,990 --> 00:49:57,660
understand uh exactly how uh Orion

1206
00:50:01,670 --> 00:50:00,000
performed in the SLS the space launch

1207
00:50:03,290 --> 00:50:01,680
system performed

1208
00:50:05,390 --> 00:50:03,300
um as we pull all that information

1209
00:50:07,790 --> 00:50:05,400
together we'll begin planning that that

1210
00:50:10,130 --> 00:50:07,800
next Artemis launch so Artemis 2 in the

1211
00:50:12,349 --> 00:50:10,140
year 2024 we'll have our astronaut

1212
00:50:13,970 --> 00:50:12,359
friends on board and it's going to do

1213
00:50:15,950 --> 00:50:13,980

something similar we'll fly out around

1214

00:50:18,890 --> 00:50:15,960

the moon and it will teach us again

1215

00:50:21,230 --> 00:50:18,900

about how um how to fly out in that deep

1216

00:50:23,510 --> 00:50:21,240

space environment what that environment

1217

00:50:25,790 --> 00:50:23,520

is like but this time it'll be super

1218

00:50:27,349 --> 00:50:25,800

cool with the astronauts on board you

1219

00:50:29,510 --> 00:50:27,359

know they all have to bring along stuff

1220

00:50:31,490 --> 00:50:29,520

like water and food and clothing so

1221

00:50:33,470 --> 00:50:31,500

we're gonna really start to load up the

1222

00:50:35,569 --> 00:50:33,480

Orion and see how it handles when it's

1223

00:50:37,490 --> 00:50:35,579

carrying more of the mass that it can so

1224

00:50:39,710 --> 00:50:37,500

like you think about driving your car

1225

00:50:41,089 --> 00:50:39,720

maybe the school or to work you probably

1226

00:50:42,589 --> 00:50:41,099

don't load it up but if you're going

1227

00:50:45,050 --> 00:50:42,599

like across the country to visit

1228

00:50:47,930 --> 00:50:45,060

somebody you really pack all your stuff

1229

00:50:49,790 --> 00:50:47,940

in there and so ultimately Orion will

1230

00:50:52,609 --> 00:50:49,800

need to do that on its flights to the

1231

00:50:54,829 --> 00:50:52,619

moon and we have to learn like the prior

1232

00:50:57,349 --> 00:50:54,839

question about uh the types of science

1233

00:50:59,870 --> 00:50:57,359

we might carry so we need to learn how

1234

00:51:01,670 --> 00:50:59,880

much mass we can carry along with us and

1235

00:51:04,370 --> 00:51:01,680

as we learn how well the vehicle

1236

00:51:06,950 --> 00:51:04,380

performs through these test flights that

1237

00:51:08,690 --> 00:51:06,960

will teach us how to pack it how much we

1238

00:51:11,569 --> 00:51:08,700

can put in there how much science we can

1239

00:51:13,849 --> 00:51:11,579

take along and it's all part of this

1240

00:51:15,410 --> 00:51:13,859

whole process of learning as we go and

1241

00:51:17,390 --> 00:51:15,420

learning with each flight and learning

1242

00:51:19,370 --> 00:51:17,400

from the science that we take along that

1243

00:51:22,549 --> 00:51:19,380

puts us in a position to do next flight

1244

00:51:25,190 --> 00:51:22,559

so 2024 is our goal for uh for flying

1245

00:51:27,950 --> 00:51:25,200

that Orion with some astronauts inside

1246

00:51:30,770 --> 00:51:27,960

yeah and all three of us are parents and

1247

00:51:34,190 --> 00:51:30,780

I get a bunch of our audience too it is

1248

00:51:36,710 --> 00:51:34,200

too and we all know that 2024 might seem

1249

00:51:38,750 --> 00:51:36,720

like it's a long way away but when you

1250

00:51:41,150 --> 00:51:38,760

think about it it's like right around

1251

00:51:43,609 --> 00:51:41,160

the corner so it's really not that far

1252

00:51:45,589 --> 00:51:43,619

away I start measuring things in terms

1253

00:51:49,250 --> 00:51:45,599

of how tall my children get overnight so

1254

00:51:50,650 --> 00:51:49,260

I know 2024 is not that far away let's

1255

00:51:53,930 --> 00:51:50,660

see

1256

00:51:55,790 --> 00:51:53,940

Humberto Silva on YouTube asks and this

1257

00:51:58,010 --> 00:51:55,800

is for both of you Jake or sharmila will

1258

00:52:02,210 --> 00:51:58,020

start with you what is the most

1259

00:52:09,710 --> 00:52:06,950

ooh great question so so one of the

1260

00:52:12,470 --> 00:52:09,720

things that that Jake alluded to in the

1261

00:52:14,450 --> 00:52:12,480

pre previous question was that this one

1262

00:52:17,150 --> 00:52:14,460

doesn't have crew on it right because

1263

00:52:19,010 --> 00:52:17,160

this is the test flight sort of valid

1264

00:52:21,650 --> 00:52:19,020

all the systems work and everything is

1265

00:52:25,430 --> 00:52:21,660

nominal before we put crew in there so

1266

00:52:27,829 --> 00:52:25,440

one of the things that this made uh you

1267

00:52:30,890 --> 00:52:27,839

know made it a bit of a challenge if you

1268

00:52:32,569 --> 00:52:30,900

please for doing science is that you

1269

00:52:34,490 --> 00:52:32,579

know unlike on the International Space

1270

00:52:36,410 --> 00:52:34,500

Station or in the space shuttle in the

1271

00:52:39,170 --> 00:52:36,420

past or on the mirror space station

1272

00:52:42,950 --> 00:52:39,180

where you always had astronauts or

1273

00:52:45,650 --> 00:52:42,960

cosmonauts or people there uh the crew

1274

00:52:48,829 --> 00:52:45,660

was helping us do science right they

1275

00:52:51,109 --> 00:52:48,839

were our you know research assistants

1276

00:52:53,510 --> 00:52:51,119

and our technicians doing the research

1277

00:52:56,809 --> 00:52:53,520

that we needed done this one though

1278

00:52:59,510 --> 00:52:56,819

didn't have that assistance so we had to

1279

00:53:02,569 --> 00:52:59,520

figure out ways in which you could

1280

00:53:06,109 --> 00:53:02,579

either automate the experiments like we

1281

00:53:07,910 --> 00:53:06,119

did for by a sentinel one or where you

1282

00:53:10,250 --> 00:53:07,920

would do the bulk of the very

1283

00:53:12,230 --> 00:53:10,260

complicated analysis after you get it

1284

00:53:14,210 --> 00:53:12,240

back which is what we're doing for Bio

1285

00:53:17,569 --> 00:53:14,220

experiment one so I would say that would

1286

00:53:20,089 --> 00:53:17,579

be one of the you know challenges uh you

1287

00:53:22,309 --> 00:53:20,099

know again in a way I wouldn't even call

1288

00:53:23,690 --> 00:53:22,319

it the challenge because because the

1289

00:53:25,849 --> 00:53:23,700

more you're forced to think of

1290

00:53:27,829 --> 00:53:25,859

innovative ways and different ways to do

1291

00:53:30,349 --> 00:53:27,839

science the more you come up with

1292

00:53:32,569 --> 00:53:30,359

intriguing you know novel ways to to

1293

00:53:34,730 --> 00:53:32,579

look at the same thing

1294

00:53:37,250 --> 00:53:34,740

um so I think you know in spite of all

1295

00:53:39,770 --> 00:53:37,260

of that we've we've managed to get quite

1296

00:53:42,530 --> 00:53:39,780

a nice collection of science experiments

1297

00:53:44,630 --> 00:53:42,540

on board but certainly that was was

1298

00:53:47,210 --> 00:53:44,640

something we had to contend with as we

1299

00:53:50,150 --> 00:53:47,220

were doing our planning

1300

00:53:52,430 --> 00:53:50,160

Ah that's great Jake what do you think

1301
00:53:53,630 --> 00:53:52,440
what is the most difficult thing on this

1302
00:53:56,210 --> 00:53:53,640
mission

1303
00:53:58,609 --> 00:53:56,220
well I think the one thing I want to do

1304
00:54:00,710 --> 00:53:58,619
is give a big huge shout out to all of

1305
00:54:01,609 --> 00:54:00,720
our engineering teams that worked on

1306
00:54:04,549 --> 00:54:01,619
this

1307
00:54:06,890 --> 00:54:04,559
um I think you can you can see a launch

1308
00:54:08,990 --> 00:54:06,900
and you can see a spacecraft splash down

1309
00:54:10,970 --> 00:54:09,000
in the ocean and you know you might

1310
00:54:13,430 --> 00:54:10,980
think a few people worked on that right

1311
00:54:15,349 --> 00:54:13,440
but the number of people that worked on

1312
00:54:17,930 --> 00:54:15,359
this and they're divided up into teams

1313
00:54:20,329 --> 00:54:17,940

who work on specific steps along the

1314

00:54:22,010 --> 00:54:20,339

process I think if you talk to any one

1315

00:54:23,870 --> 00:54:22,020

of them they would say whatever the part

1316

00:54:25,370 --> 00:54:23,880

was they worked on was probably the

1317

00:54:27,890 --> 00:54:25,380

hardest part and they're not wrong

1318

00:54:30,589 --> 00:54:27,900

because all of the steps have to work

1319

00:54:32,569 --> 00:54:30,599

seamlessly together to make a mission

1320

00:54:34,130 --> 00:54:32,579

like this work and I don't just mean the

1321

00:54:36,410 --> 00:54:34,140

engineers that work on the spacecraft I

1322

00:54:38,270 --> 00:54:36,420

mean Engineers that built the cubesats

1323

00:54:40,430 --> 00:54:38,280

that built the payloads like shamila was

1324

00:54:42,770 --> 00:54:40,440

talking about that road inside Orion

1325

00:54:44,870 --> 00:54:42,780

you know the tremendous amount of work

1326
00:54:45,829 --> 00:54:44,880
that went into making this Mission a

1327
00:54:48,950 --> 00:54:45,839
success

1328
00:54:51,650 --> 00:54:48,960
um there's not enough credit to hand out

1329
00:54:53,150 --> 00:54:51,660
um but the so many steps assembling the

1330
00:54:55,130 --> 00:54:53,160
whole vehicle inside the Vehicle

1331
00:54:57,410 --> 00:54:55,140
Assembly Building you know stacking

1332
00:55:00,290 --> 00:54:57,420
these pieces of the rocket together and

1333
00:55:02,329 --> 00:55:00,300
then putting the Orion on top uh rolling

1334
00:55:04,670 --> 00:55:02,339
it out to the launch pad the launch

1335
00:55:06,190 --> 00:55:04,680
obviously is a spectacular moment where

1336
00:55:08,750 --> 00:55:06,200
a whole bunch of things got to go right

1337
00:55:10,010 --> 00:55:08,760
uh but you know once it got up into

1338
00:55:11,750 --> 00:55:10,020

orbit

1339

00:55:14,630 --> 00:55:11,760

um you know getting the solar array

1340

00:55:16,790 --> 00:55:14,640

deployed moving the cubesats out

1341

00:55:18,770 --> 00:55:16,800

deploying the cubesats you know every

1342

00:55:20,750 --> 00:55:18,780

one of those steps taking Orion there

1343

00:55:22,790 --> 00:55:20,760

were a bunch of I mentioned already a

1344

00:55:25,370 --> 00:55:22,800

bunch of engine Burns we had to do to

1345

00:55:27,290 --> 00:55:25,380

keep it in the right trajectory every

1346

00:55:31,190 --> 00:55:27,300

one of those has to go well

1347

00:55:33,710 --> 00:55:31,200

um and you know for it's when you are

1348

00:55:35,930 --> 00:55:33,720

watching this and working inside NASA

1349

00:55:37,549 --> 00:55:35,940

you see these handoffs right it's like

1350

00:55:39,230 --> 00:55:37,559

we complete a step and now this

1351
00:55:40,670 --> 00:55:39,240
engineering team's nervous because they

1352
00:55:42,109 --> 00:55:40,680
got the next thing and then this

1353
00:55:44,089 --> 00:55:42,119
engineering team is nervous because

1354
00:55:46,270 --> 00:55:44,099
they've got the next thing in every

1355
00:55:48,890 --> 00:55:46,280
single one of them just nailed it so um

1356
00:55:51,109 --> 00:55:48,900
you know every step is hard space flight

1357
00:55:53,329 --> 00:55:51,119
is is it's a tough business you know but

1358
00:55:55,670 --> 00:55:53,339
we learn and we've learned from all the

1359
00:55:57,710 --> 00:55:55,680
predecessors I like to say you know the

1360
00:55:59,750 --> 00:55:57,720
uh the Isaac Newton phrase you know we

1361
00:56:01,910 --> 00:55:59,760
stand on the shoulder at Giants and it

1362
00:56:03,829 --> 00:56:01,920
certainly is true here

1363
00:56:05,930 --> 00:56:03,839

um and you know each one of these groups

1364

00:56:07,970 --> 00:56:05,940

just uh their step performed

1365

00:56:11,329 --> 00:56:07,980

phenomenally and puts us in a position

1366

00:56:14,030 --> 00:56:11,339

to uh to send astronauts to the Moon

1367

00:56:16,670 --> 00:56:14,040

yeah and as President Kennedy said we do

1368

00:56:18,770 --> 00:56:16,680

it because it's hard this is what drives

1369

00:56:21,410 --> 00:56:18,780

us challenges right Humanity's greatest

1370

00:56:23,390 --> 00:56:21,420

challenges that's what drives us all

1371

00:56:26,329 --> 00:56:23,400

right so let's see Travis Ramirez on

1372

00:56:28,609 --> 00:56:26,339

YouTube asks if you could go back and

1373

00:56:31,309 --> 00:56:28,619

add one thing to the Artemis One mission

1374

00:56:37,450 --> 00:56:31,319

what would it be sure Milo will start

1375

00:56:41,690 --> 00:56:40,250

yeah that's that's really making us

1376

00:56:45,410 --> 00:56:41,700

think here

1377

00:56:46,970 --> 00:56:45,420

what is the one thing that we would add

1378

00:56:49,130 --> 00:56:46,980

well if you want me to give you a moment

1379

00:56:51,230 --> 00:56:49,140

to thanks for Mila I can I can give you

1380

00:56:53,750 --> 00:56:51,240

an answer now that I know the mission

1381

00:56:56,030 --> 00:56:53,760

went so well and everything performed

1382

00:56:58,250 --> 00:56:56,040

phenomenally the one thing I'd add was a

1383

00:57:00,430 --> 00:56:58,260

piece of astronauts uh but we didn't

1384

00:57:02,569 --> 00:57:00,440

know that when we started

1385

00:57:07,930 --> 00:57:02,579

it was a test

1386

00:57:07,940 --> 00:57:12,730

knowing that the ride went well you know

1387

00:57:17,150 --> 00:57:16,069

that's an excellent question uh answer

1388

00:57:19,549 --> 00:57:17,160

Jake

1389

00:57:22,370 --> 00:57:19,559

um yeah you know I'll tell you you know

1390

00:57:25,190 --> 00:57:22,380

I would have said that let's add more

1391

00:57:26,569 --> 00:57:25,200

let's add science but you know we added

1392

00:57:30,349 --> 00:57:26,579

a lot of science

1393

00:57:32,930 --> 00:57:30,359

so you know we also had these mannequins

1394

00:57:34,910 --> 00:57:32,940

as Jake talked about which is so

1395

00:57:37,549 --> 00:57:34,920

valuable it's going to we really need

1396

00:57:40,849 --> 00:57:37,559

that information as we get prepared for

1397

00:57:43,790 --> 00:57:40,859

the next crude Mission so you know

1398

00:57:45,589 --> 00:57:43,800

Snoopy we can't do without Snoopy you

1399

00:57:48,109 --> 00:57:45,599

know so Snoopy was in there check check

1400

00:57:49,490 --> 00:57:48,119

check so really I can't think of

1401
00:57:51,170 --> 00:57:49,500
anything

1402
00:57:52,809 --> 00:57:51,180
um further that I would have done or

1403
00:57:56,450 --> 00:57:52,819
something I would have done differently

1404
00:57:59,270 --> 00:57:56,460
than than how this was done so as Jake

1405
00:58:02,089 --> 00:57:59,280
said you know hats off to the whole team

1406
00:58:04,790 --> 00:58:02,099
for thinking through this Mission so

1407
00:58:10,030 --> 00:58:04,800
carefully and really being able to check

1408
00:58:14,390 --> 00:58:12,410
I think one thing I would love to have

1409
00:58:16,549 --> 00:58:14,400
been able to do is just have everybody

1410
00:58:19,849 --> 00:58:16,559
be able to watch the launch

1411
00:58:23,089 --> 00:58:19,859
um you know and so Artemis is going to

1412
00:58:25,250 --> 00:58:23,099
be a series of launches and so I hope

1413
00:58:26,990 --> 00:58:25,260

that everybody out there that you know

1414

00:58:28,430 --> 00:58:27,000

is interested in this stuff gets a

1415

00:58:30,890 --> 00:58:28,440

chance to see one of these launches

1416

00:58:32,569 --> 00:58:30,900

whether it's from far away I mean you

1417

00:58:35,750 --> 00:58:32,579

you could see this one from pretty far

1418

00:58:38,390 --> 00:58:35,760

away uh but you know it's just it's an

1419

00:58:40,490 --> 00:58:38,400

amazing event to see something like this

1420

00:58:42,170 --> 00:58:40,500

um to launch a vehicle and it will be

1421

00:58:44,870 --> 00:58:42,180

even more so when we know our friends

1422

00:58:46,549 --> 00:58:44,880

are going along for the ride so

1423

00:58:48,829 --> 00:58:46,559

um I hope hope everybody gets a chance

1424

00:58:51,410 --> 00:58:48,839

to be involved in Artemis there will be

1425

00:58:52,789 --> 00:58:51,420

many opportunities going forward so

1426
00:58:54,890 --> 00:58:52,799
that's one thing I would definitely like

1427
00:58:57,349 --> 00:58:54,900
to like to see

1428
00:58:59,150 --> 00:58:57,359
well I think this is the perfect way to

1429
00:59:01,250 --> 00:58:59,160
wrap up our show that's all the time we

1430
00:59:02,930 --> 00:59:01,260
have left today I completely agree that

1431
00:59:04,970 --> 00:59:02,940
it was so successful we had so much

1432
00:59:07,490 --> 00:59:04,980
science on board all we were missing

1433
00:59:10,970 --> 00:59:07,500
were astronauts that is the perfect way

1434
00:59:13,970 --> 00:59:10,980
best lead into Artemis 2 coming in 2024.

1435
00:59:15,650 --> 00:59:13,980
so sharmila Jake thank you so much for

1436
00:59:17,450 --> 00:59:15,660
being with us today answering all of

1437
00:59:19,370 --> 00:59:17,460
these questions the super creative

1438
00:59:21,589 --> 00:59:19,380

intelligent insightful questions that

1439

00:59:24,170 --> 00:59:21,599

our audience asked today

1440

00:59:26,870 --> 00:59:24,180

yes thank you all so much for the

1441

00:59:28,430 --> 00:59:26,880

questions thank you for hosting uh it

1442

00:59:29,870 --> 00:59:28,440

was a real pleasure being here today

1443

00:59:32,210 --> 00:59:29,880

thanks

1444

00:59:33,650 --> 00:59:32,220

again uh you know I hope I didn't sound

1445

00:59:35,809 --> 00:59:33,660

too excited it's really hard to control

1446

00:59:38,089 --> 00:59:35,819

right now uh with so much cool stuff

1447

00:59:39,829 --> 00:59:38,099

going on but uh you know I just want to

1448

00:59:41,990 --> 00:59:39,839

say to all the especially the younger

1449

00:59:44,270 --> 00:59:42,000

folks out there early career Engineers

1450

00:59:45,950 --> 00:59:44,280

scientists technologists and all the

1451

00:59:47,990 --> 00:59:45,960

kids out there you know stay curious

1452

00:59:49,549 --> 00:59:48,000

stay excited about this stuff I mean

1453

00:59:50,870 --> 00:59:49,559

we're doing this for you you're the ones

1454

00:59:53,450 --> 00:59:50,880

who are going to take this and go

1455

00:59:55,430 --> 00:59:53,460

explore the stars in the solar system so

1456

00:59:57,530 --> 00:59:55,440

we're taking these first baby steps for

1457

01:00:00,650 --> 00:59:57,540

you I hope you're coming along after us

1458

01:00:03,650 --> 01:00:00,660

and and really take it take it out there

1459

01:00:05,630 --> 01:00:03,660

Jake we love your excitement that is the

1460

01:00:08,289 --> 01:00:05,640

perfect way to end our show so if you

1461

01:00:10,789 --> 01:00:08,299

want to learn more visit nasa.gov

1462

01:00:13,250 --> 01:00:10,799

artemis1 and to stay updated on the

1463

01:00:15,950 --> 01:00:13,260

program and Artemis you can follow at

1464

01:00:19,309 --> 01:00:15,960

Nasa Artemis on Facebook Twitter and

1465

01:00:21,049 --> 01:00:19,319

Instagram and if today's show piqued

1466

01:00:23,510 --> 01:00:21,059

your interest in Jake and sharmila left

1467

01:00:25,370 --> 01:00:23,520

you wanting to know more there is a spot

1468

01:00:28,370 --> 01:00:25,380

for you for science too you can follow

1469

01:00:30,829 --> 01:00:28,380

at Nasa spaceside on Twitter for the

1470

01:00:33,109 --> 01:00:30,839

latest experiments and results thank you

1471

01:00:37,250 --> 01:00:33,119

so much for joining us asking the best

1472

01:01:09,230 --> 01:00:41,289

[Music]