



1  
00:00:10,549 --> 00:00:08,870  
good morning and welcome to nasa's

2  
00:00:12,390 --> 00:00:10,559  
kennedy space center in florida where

3  
00:00:14,950 --> 00:00:12,400  
we're here today to talk with

4  
00:00:16,310 --> 00:00:14,960  
researchers and scientists who are

5  
00:00:18,310 --> 00:00:16,320  
excited because they are about to

6  
00:00:20,230 --> 00:00:18,320  
deliver some of their important research

7  
00:00:22,950 --> 00:00:20,240  
to the international space station

8  
00:00:25,750 --> 00:00:22,960  
aboard the spacex crs4 mission that's

9  
00:00:27,670 --> 00:00:25,760  
slated to launch on saturday morning i'd

10  
00:00:29,830 --> 00:00:27,680  
like to introduce our folks who are here

11  
00:00:31,269 --> 00:00:29,840  
to talk with you today to my left is

12  
00:00:35,110 --> 00:00:31,279  
dwayne ratliff

13  
00:00:36,709 --> 00:00:35,120

the chief operating officer for cases

14

00:00:38,950 --> 00:00:36,719

to his left

15

00:00:42,869 --> 00:00:38,960

mike yagli director of research and

16

00:00:45,190 --> 00:00:42,879

testing for cobra puma golf

17

00:00:50,310 --> 00:00:45,200

next dr eugene boland

18

00:00:55,189 --> 00:00:52,950

jason gilbert scientific

19

00:00:58,950 --> 00:00:55,199

associate for novartis institutes for

20

00:01:04,149 --> 00:01:01,590

and nikki werkheiser project manager for

21

00:01:06,149 --> 00:01:04,159

3d printing in xerog

22

00:01:07,750 --> 00:01:06,159

welcome everyone

23

00:01:09,830 --> 00:01:07,760

we kind of would like to encourage just

24

00:01:13,109 --> 00:01:09,840

an open discussion this morning

25

00:01:15,030 --> 00:01:13,119

we have a number of our news media folks

26

00:01:17,429 --> 00:01:15,040

in the room as well as social media

27

00:01:19,270 --> 00:01:17,439

attendees for the nasa social

28

00:01:20,789 --> 00:01:19,280

and uh just kind of would like to have a

29

00:01:22,870 --> 00:01:20,799

dialogue about everything that's going

30

00:01:24,230 --> 00:01:22,880

on and duane i wonder if

31

00:01:25,590 --> 00:01:24,240

we could start off with you and just

32

00:01:28,950 --> 00:01:25,600

give us a little bit of information

33

00:01:32,550 --> 00:01:28,960

about cases and and the exciting uh

34

00:01:34,310 --> 00:01:32,560

plans you have once we launch the spacex

35

00:01:35,510 --> 00:01:34,320

falcon 9 and dragon this weekend yeah

36

00:01:37,109 --> 00:01:35,520

sure mike thanks so this is a great

37

00:01:38,870 --> 00:01:37,119

opportunity to be here and this panel

38

00:01:40,069 --> 00:01:38,880

actually really does a great job of

39

00:01:42,069 --> 00:01:40,079

representing

40

00:01:43,670 --> 00:01:42,079

cases and its partnerships and its

41

00:01:46,469 --> 00:01:43,680

opportunities to create

42

00:01:49,590 --> 00:01:46,479

utilization of the iss from an r d

43

00:01:52,630 --> 00:01:49,600

perspective um cases as you know is the

44

00:01:54,870 --> 00:01:52,640

non-profit partner with nasa

45

00:01:56,789 --> 00:01:54,880

in collaboration with nasa we are

46

00:01:59,030 --> 00:01:56,799

engaged in utilizing the international

47

00:02:01,749 --> 00:01:59,040

space station the national laboratory if

48

00:02:04,149 --> 00:02:01,759

you will as the ideal r d platform in

49

00:02:07,350 --> 00:02:04,159

microgravity low earth orbit

50

00:02:09,109 --> 00:02:07,360

our our focus really is to utilize iss

51  
00:02:11,190 --> 00:02:09,119  
for research and development that will

52  
00:02:13,350 --> 00:02:11,200  
have applicability back here on earth

53  
00:02:14,869 --> 00:02:13,360  
and so that's kind of the the divergence

54  
00:02:17,589 --> 00:02:14,879  
if you will from where nasa and cases

55  
00:02:19,670 --> 00:02:17,599  
separates nasa is focusing its efforts

56  
00:02:21,589 --> 00:02:19,680  
on exploration and use of the iss for

57  
00:02:23,589 --> 00:02:21,599  
that research whereas cases is looking

58  
00:02:25,030 --> 00:02:23,599  
at how the research done on iss can be

59  
00:02:26,710 --> 00:02:25,040  
beneficial for

60  
00:02:29,830 --> 00:02:26,720  
folks back here on earth and so this

61  
00:02:32,150 --> 00:02:29,840  
panel really represents a good

62  
00:02:33,750 --> 00:02:32,160  
example of how we're doing that effort

63  
00:02:36,790 --> 00:02:33,760

we have representatives here today that

64

00:02:38,470 --> 00:02:36,800

are describing material science research

65

00:02:41,190 --> 00:02:38,480

um looking at drug studies in the

66

00:02:42,949 --> 00:02:41,200

biotech and life sciences areas as well

67

00:02:45,190 --> 00:02:42,959

as new technology development and

68

00:02:47,350 --> 00:02:45,200

enabling technology that will not only

69

00:02:51,350 --> 00:02:47,360

help the iss serve as a better research

70

00:02:52,630 --> 00:02:51,360

and development platform but the um

71

00:02:54,229 --> 00:02:52,640

the information and the knowledge that

72

00:02:55,509 --> 00:02:54,239

we gather from that may be helpful in

73

00:02:57,509 --> 00:02:55,519

applications that will be derived here

74

00:02:59,509 --> 00:02:57,519

on the ground and of course with uh with

75

00:03:02,309 --> 00:02:59,519

nikki she rounds it out representing our

76

00:03:04,390 --> 00:03:02,319

nasa collaboration

77

00:03:06,470 --> 00:03:04,400

okay mike i wanted to ask you uh the

78

00:03:09,190 --> 00:03:06,480

idea and the concept of using the iss

79

00:03:11,110 --> 00:03:09,200

for commercial use um is not you know

80

00:03:14,070 --> 00:03:11,120

completely unique but the the idea of

81

00:03:15,750 --> 00:03:14,080

sporting goods is uh is very very

82

00:03:18,470 --> 00:03:15,760

interesting and wondering if you could

83

00:03:21,110 --> 00:03:18,480

tell us a little bit about that yes

84

00:03:23,430 --> 00:03:21,120

so we've put together an experiment

85

00:03:24,470 --> 00:03:23,440

that's going to help us understand

86

00:03:27,030 --> 00:03:24,480

uh

87

00:03:29,110 --> 00:03:27,040

how plating in a microgravity

88

00:03:32,309 --> 00:03:29,120

environment will

89

00:03:34,949 --> 00:03:32,319

potentially improve crystalline growth

90

00:03:36,869 --> 00:03:34,959

adhesion durability

91

00:03:39,750 --> 00:03:36,879

all of those things are

92

00:03:41,910 --> 00:03:39,760

very critical in making honestly a very

93

00:03:44,229 --> 00:03:41,920

good golf club right because our job is

94

00:03:46,789 --> 00:03:44,239

to make it fun for players to play golf

95

00:03:49,030 --> 00:03:46,799

in order to do that we've got objects

96

00:03:50,390 --> 00:03:49,040

that literally are seeing seven thousand

97

00:03:51,589 --> 00:03:50,400

g's and

98

00:03:53,270 --> 00:03:51,599

some environments are even more

99

00:03:54,070 --> 00:03:53,280

stressful and straining than what you

100

00:03:55,910 --> 00:03:54,080

see

101  
00:03:59,429 --> 00:03:55,920  
in space and

102  
00:04:01,270 --> 00:03:59,439  
that research is very fundamental to

103  
00:04:04,149 --> 00:04:01,280  
being able to improve

104  
00:04:07,830 --> 00:04:04,159  
the durability potentially the adhesion

105  
00:04:10,789 --> 00:04:07,840  
characteristics of multi-materials

106  
00:04:13,350 --> 00:04:10,799  
the structural integrity of the of the

107  
00:04:14,710 --> 00:04:13,360  
surface so ultimately

108  
00:04:16,390 --> 00:04:14,720  
we'll get a very fundamental

109  
00:04:18,310 --> 00:04:16,400  
understanding of how

110  
00:04:21,270 --> 00:04:18,320  
the microgravity environment could

111  
00:04:23,590 --> 00:04:21,280  
improve a process that we use in making

112  
00:04:25,350 --> 00:04:23,600  
a golf club

113  
00:04:28,310 --> 00:04:25,360

all right thank you

114

00:04:30,710 --> 00:04:28,320

gene the the tech shot bone densitometer

115

00:04:32,230 --> 00:04:30,720

has real interesting uh applications as

116

00:04:33,030 --> 00:04:32,240

well can you tell us a little bit about

117

00:04:35,110 --> 00:04:33,040

what

118

00:04:37,909 --> 00:04:35,120

a little bit more about it

119

00:04:39,670 --> 00:04:37,919

absolutely so we've known for over 40

120

00:04:42,469 --> 00:04:39,680

years that

121

00:04:43,909 --> 00:04:42,479

you lose bone density in space

122

00:04:46,070 --> 00:04:43,919

but we've never been able to measure it

123

00:04:47,909 --> 00:04:46,080

in real time so this is going to provide

124

00:04:50,629 --> 00:04:47,919

a platform finally

125

00:04:53,270 --> 00:04:50,639

that's going to allow researchers to

126

00:04:55,749 --> 00:04:53,280

measure that bone loss in real time

127

00:04:57,749 --> 00:04:55,759

in collaboration with some outstanding

128

00:05:01,030 --> 00:04:57,759

researchers both in the commercial as

129

00:05:03,350 --> 00:05:01,040

well in the academic uh research fields

130

00:05:06,790 --> 00:05:03,360

and you know as a

131

00:05:10,469 --> 00:05:06,800

long-standing uh development or for nasa

132

00:05:12,070 --> 00:05:10,479

for hardware and uh since cases um start

133

00:05:14,390 --> 00:05:12,080

we've been an implementation partner for

134

00:05:16,150 --> 00:05:14,400

cases for developing hardware that uh we

135

00:05:17,670 --> 00:05:16,160

feel that uh you know our ability to

136

00:05:20,070 --> 00:05:17,680

develop world-class hardware for

137

00:05:21,350 --> 00:05:20,080

world-class researchers has a really

138

00:05:23,029 --> 00:05:21,360

kind of a

139

00:05:24,469 --> 00:05:23,039

hit and we feel that you know this being

140

00:05:25,909 --> 00:05:24,479

our first piece to the international

141

00:05:27,749 --> 00:05:25,919

space station

142

00:05:29,510 --> 00:05:27,759

kind of really marks puts a high water

143

00:05:32,469 --> 00:05:29,520

mark for tech shot and uh for some

144

00:05:35,430 --> 00:05:32,479

research moving forward

145

00:05:37,350 --> 00:05:35,440

okay thank you jason the uh

146

00:05:39,990 --> 00:05:37,360

for novartis this is a part of a

147

00:05:41,590 --> 00:05:40,000

potentially ongoing investigation and

148

00:05:43,189 --> 00:05:41,600

wondered if you could tell us a little

149

00:05:45,830 --> 00:05:43,199

bit more about

150

00:05:47,830 --> 00:05:45,840

the role of novartis sure um

151  
00:05:50,070 --> 00:05:47,840  
so i work for novartis institute of

152  
00:05:51,430 --> 00:05:50,080  
biomedical research in the kadena lab

153  
00:05:52,950 --> 00:05:51,440  
and for us

154  
00:05:54,870 --> 00:05:52,960  
it's all about muscle

155  
00:05:57,430 --> 00:05:54,880  
that's what we're concerned with muscle

156  
00:05:59,990 --> 00:05:57,440  
mass and muscle function and more

157  
00:06:01,830 --> 00:06:00,000  
specifically preserving muscle mass and

158  
00:06:02,629 --> 00:06:01,840  
muscle muscle function

159  
00:06:05,670 --> 00:06:02,639  
so

160  
00:06:07,510 --> 00:06:05,680  
we've got this great opportunity to

161  
00:06:09,430 --> 00:06:07,520  
send an experiment into a unique

162  
00:06:11,510 --> 00:06:09,440  
environment where

163  
00:06:13,350 --> 00:06:11,520

because of the microgravity muscle mass

164

00:06:15,189 --> 00:06:13,360

is directly affected

165

00:06:17,670 --> 00:06:15,199

so what we'll be doing is sending

166

00:06:19,990 --> 00:06:17,680

control samples up with normal

167

00:06:23,110 --> 00:06:20,000

functioning proteins and then sending up

168

00:06:24,469 --> 00:06:23,120

a knockout sample that has a murph

169

00:06:26,230 --> 00:06:24,479

protein

170

00:06:27,670 --> 00:06:26,240

knocked out and not functioning now

171

00:06:30,230 --> 00:06:27,680

murph is really cool it's a muscle ring

172

00:06:32,070 --> 00:06:30,240

finger protein and it labels

173

00:06:35,189 --> 00:06:32,080

other proteins for degradation and

174

00:06:37,510 --> 00:06:35,199

destruction so when mirth is active in a

175

00:06:39,990 --> 00:06:37,520

muscle that's in an environment that is

176

00:06:41,430 --> 00:06:40,000

set up to get smaller that's what murph

177

00:06:43,350 --> 00:06:41,440

does it labels proteins and they get

178

00:06:46,629 --> 00:06:43,360

destroyed so what we're really hoping to

179

00:06:48,950 --> 00:06:46,639

see is in the knockouts

180

00:06:51,430 --> 00:06:48,960

situation where the muscle is actually

181

00:06:53,590 --> 00:06:51,440

spared from this atrophy in space

182

00:06:55,510 --> 00:06:53,600

now why is muscle important well

183

00:06:56,309 --> 00:06:55,520

unfortunately we're all getting older

184

00:06:58,550 --> 00:06:56,319

and

185

00:07:01,350 --> 00:06:58,560

once you reach about 65 naturally muscle

186

00:07:03,589 --> 00:07:01,360

mass starts to decline and this is also

187

00:07:06,070 --> 00:07:03,599

made worse by sickness

188

00:07:08,150 --> 00:07:06,080

things like cancer cachexia or bed rest

189

00:07:09,909 --> 00:07:08,160

so for us maintaining a person's muscle

190

00:07:11,430 --> 00:07:09,919

mass is really important in these

191

00:07:13,589 --> 00:07:11,440

situations because it will lead to a

192

00:07:15,990 --> 00:07:13,599

better quality of life and maybe a

193

00:07:17,589 --> 00:07:16,000

faster recovery so we're really looking

194

00:07:19,990 --> 00:07:17,599

forward to this exciting opportunity to

195

00:07:22,070 --> 00:07:20,000

explore different methods and mechanisms

196

00:07:25,909 --> 00:07:22,080

behind muscle loss and how this could

197

00:07:28,790 --> 00:07:25,919

potentially help patients in the future

198

00:07:31,189 --> 00:07:28,800

okay nikki the the idea of 3d printing

199

00:07:32,230 --> 00:07:31,199

has really captivated many of us and the

200

00:07:34,309 --> 00:07:32,240

idea of sending it up to the

201  
00:07:36,950 --> 00:07:34,319  
international space station seems to

202  
00:07:38,309 --> 00:07:36,960  
have all kinds of uh potential and i

203  
00:07:40,469 --> 00:07:38,319  
know that this is sort of a

204  
00:07:42,550 --> 00:07:40,479  
demonstration the first time around but

205  
00:07:44,550 --> 00:07:42,560  
uh can you can you

206  
00:07:46,230 --> 00:07:44,560  
elaborate a little bit on the technology

207  
00:07:48,230 --> 00:07:46,240  
and i know you have a

208  
00:07:49,670 --> 00:07:48,240  
demonstration model with you and some of

209  
00:07:51,029 --> 00:07:49,680  
the tools as well if you could just

210  
00:07:53,749 --> 00:07:51,039  
share some information with us we would

211  
00:07:55,670 --> 00:07:53,759  
appreciate it absolutely i would love to

212  
00:07:58,309 --> 00:07:55,680  
actually 3d printing has captivated me

213  
00:08:00,629 --> 00:07:58,319

as well and it's especially important

214

00:08:02,390 --> 00:08:00,639

when we consider space travel human

215

00:08:04,550 --> 00:08:02,400

space exploration

216

00:08:06,150 --> 00:08:04,560

from day one the supply chain has been

217

00:08:07,909 --> 00:08:06,160

very constrained as you know we have to

218

00:08:10,150 --> 00:08:07,919

launch every single thing that we ever

219

00:08:12,550 --> 00:08:10,160

need from earth

220

00:08:14,070 --> 00:08:12,560

so being able to make what you need on

221

00:08:16,469 --> 00:08:14,080

orbit when you need it

222

00:08:18,950 --> 00:08:16,479

is a real game changer so our first um

223

00:08:20,950 --> 00:08:18,960

this is our baby this is our 3d printer

224

00:08:22,950 --> 00:08:20,960

technology demonstration and it is a

225

00:08:24,869 --> 00:08:22,960

partnership between nasa and the company

226

00:08:27,029 --> 00:08:24,879

made in space inc

227

00:08:29,670 --> 00:08:27,039

it's through a small business innovation

228

00:08:31,990 --> 00:08:29,680

reason research award and it's in my

229

00:08:32,949 --> 00:08:32,000

opinion been a very ideal collaboration

230

00:08:34,870 --> 00:08:32,959

between

231

00:08:36,389 --> 00:08:34,880

nasa and a small business

232

00:08:38,709 --> 00:08:36,399

the first printer that we're flying is

233

00:08:40,709 --> 00:08:38,719

actually a technology demonstration and

234

00:08:43,029 --> 00:08:40,719

we it's that simply because the space

235

00:08:44,949 --> 00:08:43,039

station is literally the only platform

236

00:08:47,670 --> 00:08:44,959

in the universe where we can print an

237

00:08:49,829 --> 00:08:47,680

entire part in microgravity

238

00:08:51,590 --> 00:08:49,839

made in space and nasa both have flown

239

00:08:53,910 --> 00:08:51,600

many parabolic or

240

00:08:55,350 --> 00:08:53,920

effectually known vomit comet flights

241

00:08:57,430 --> 00:08:55,360

where we've gotten a lot of data that

242

00:08:59,750 --> 00:08:57,440

shows that the the parts are equitable

243

00:09:01,670 --> 00:08:59,760

to those that we print on the ground

244

00:09:03,670 --> 00:09:01,680

however you can really only get 20 to 30

245

00:09:06,630 --> 00:09:03,680

second spurts of microgravity on those

246

00:09:08,630 --> 00:09:06,640

flights so being able to print an entire

247

00:09:10,949 --> 00:09:08,640

part which even our smaller parts may

248

00:09:12,310 --> 00:09:10,959

take 15 to 20 minutes space station is

249

00:09:14,310 --> 00:09:12,320

our only

250

00:09:16,310 --> 00:09:14,320

avenue for doing that that's why we call

251

00:09:18,949 --> 00:09:16,320

it a technology demonstration so the

252

00:09:21,190 --> 00:09:18,959

first phase will focus on the printer

253

00:09:23,269 --> 00:09:21,200

and the process but the second phase we

254

00:09:25,110 --> 00:09:23,279

do focus more on uh

255

00:09:27,269 --> 00:09:25,120

demonstrating the actual parts we print

256

00:09:29,670 --> 00:09:27,279

and their usefulness on space station

257

00:09:32,230 --> 00:09:29,680

for things like obviously science users

258

00:09:34,230 --> 00:09:32,240

science experiments and consumable

259

00:09:36,949 --> 00:09:34,240

laboratory equipment

260

00:09:39,350 --> 00:09:36,959

as well as crew tools we're working

261

00:09:40,230 --> 00:09:39,360

closely with the crew tools office

262

00:09:42,790 --> 00:09:40,240

even

263

00:09:44,550 --> 00:09:42,800

small satellite components and really

264

00:09:46,870 --> 00:09:44,560

the possibilities are endless and what i

265

00:09:48,710 --> 00:09:46,880

get most excited about are the things

266

00:09:50,790 --> 00:09:48,720

that we haven't even thought of yet

267

00:09:53,269 --> 00:09:50,800

because now when you can design a part

268

00:09:54,630 --> 00:09:53,279

to be printed in microgravity you don't

269

00:09:56,550 --> 00:09:54,640

have to worry about things like launch

270

00:09:58,710 --> 00:09:56,560

loads anymore which that has been so

271

00:10:00,870 --> 00:09:58,720

beaten into us from day one to design

272

00:10:02,630 --> 00:10:00,880

for surviving the the environment of

273

00:10:04,150 --> 00:10:02,640

launch so i think it's really going to

274

00:10:05,670 --> 00:10:04,160

open up that design space and the

275

00:10:07,670 --> 00:10:05,680

possibilities

276

00:10:09,350 --> 00:10:07,680

and i think when we we get that call

277

00:10:11,430 --> 00:10:09,360

that first call for the part that none

278

00:10:13,590 --> 00:10:11,440

of us even really even thought of

279

00:10:14,630 --> 00:10:13,600

out of all the brainstorming we've done

280

00:10:17,990 --> 00:10:14,640

i think that's going to be a very

281

00:10:19,990 --> 00:10:18,000

exciting day

282

00:10:21,350 --> 00:10:20,000

okay uh for for questions please feel

283

00:10:23,110 --> 00:10:21,360

free to raise your hands and we'll get

284

00:10:24,389 --> 00:10:23,120

the microphone to you since we're on tv

285

00:10:27,350 --> 00:10:24,399

and we want everybody to be able to

286

00:10:29,990 --> 00:10:27,360

participate um marcia dunn

287

00:10:30,710 --> 00:10:30,000

associated press on the printer how is

288

00:10:35,670 --> 00:10:30,720

the

289

00:10:37,750 --> 00:10:35,680

how did you have to make it safe

290

00:10:39,670 --> 00:10:37,760

for the astronauts to use and talk a

291

00:10:41,430 --> 00:10:39,680

little bit about when it all how often

292

00:10:43,670 --> 00:10:41,440

it will be used and how they're going to

293

00:10:46,230 --> 00:10:43,680

use it right so i'll take the first

294

00:10:48,389 --> 00:10:46,240

question first and uh

295

00:10:50,310 --> 00:10:48,399

as far as how the actual 3d printing

296

00:10:52,389 --> 00:10:50,320

process works and the extrusion of the

297

00:10:53,910 --> 00:10:52,399

plastic it is actually very analogous to

298

00:10:56,310 --> 00:10:53,920

what we do on the ground

299

00:10:57,670 --> 00:10:56,320

and what you you hit it head on with

300

00:10:59,350 --> 00:10:57,680

what we really had to think about and

301  
00:11:02,630 --> 00:10:59,360  
work with made in space

302  
00:11:05,030 --> 00:11:02,640  
is the safety design the design for easy

303  
00:11:06,230 --> 00:11:05,040  
operations and autonomy

304  
00:11:07,910 --> 00:11:06,240  
obviously

305  
00:11:09,750 --> 00:11:07,920  
surviving launch loads and going through

306  
00:11:11,110 --> 00:11:09,760  
the astringent flight certification

307  
00:11:12,710 --> 00:11:11,120  
process

308  
00:11:14,790 --> 00:11:12,720  
on the ground for example if you have to

309  
00:11:16,710 --> 00:11:14,800  
align your 3d printer

310  
00:11:18,389 --> 00:11:16,720  
you have to turn like thumb screws and

311  
00:11:19,829 --> 00:11:18,399  
visually align that that's very

312  
00:11:21,430 --> 00:11:19,839  
difficult in microgravity and we don't

313  
00:11:22,550 --> 00:11:21,440

want to use crew time for that so we

314

00:11:24,150 --> 00:11:22,560

don't have to worry about that on this

315

00:11:26,790 --> 00:11:24,160

printer it's been designed where the

316

00:11:28,630 --> 00:11:26,800

structure itself compensates

317

00:11:30,550 --> 00:11:28,640

we do have a backup way for doing that

318

00:11:32,230 --> 00:11:30,560

but it is that a backup

319

00:11:33,750 --> 00:11:32,240

also that the parts that we know will

320

00:11:36,069 --> 00:11:33,760

eventually wear out and have to be

321

00:11:37,990 --> 00:11:36,079

exchanged we've made those very modular

322

00:11:39,190 --> 00:11:38,000

maiden spaces has worked hard to design

323

00:11:41,509 --> 00:11:39,200

that

324

00:11:44,150 --> 00:11:41,519

we worked very closely nasa and maiden

325

00:11:45,670 --> 00:11:44,160

space throughout the design process

326  
00:11:47,670 --> 00:11:45,680  
to ensure that when we went through the

327  
00:11:49,910 --> 00:11:47,680  
flight certification and the operations

328  
00:11:53,269 --> 00:11:49,920  
and the safety process that the design

329  
00:11:56,069 --> 00:11:53,279  
did pass and and through the very first

330  
00:11:57,509 --> 00:11:56,079  
run of safety in flight cert it passed

331  
00:11:59,269 --> 00:11:57,519  
successfully which

332  
00:12:00,630 --> 00:11:59,279  
for a brand new technology and brand new

333  
00:12:02,870 --> 00:12:00,640  
hardware

334  
00:12:04,870 --> 00:12:02,880  
is is is challenging so we're very proud

335  
00:12:06,790 --> 00:12:04,880  
of that

336  
00:12:08,629 --> 00:12:06,800  
also that autonomy so we'll be able to

337  
00:12:11,190 --> 00:12:08,639  
uplink the files from the ground

338  
00:12:12,870 --> 00:12:11,200

directly to the printer maidenspace has

339

00:12:15,190 --> 00:12:12,880

a laptop they can command from from

340

00:12:17,190 --> 00:12:15,200

their offices in california as well as

341

00:12:19,110 --> 00:12:17,200

we can command from the the control

342

00:12:21,590 --> 00:12:19,120

center in huntsville alabama directly to

343

00:12:23,269 --> 00:12:21,600

the printer so you can imagine how cool

344

00:12:25,829 --> 00:12:23,279

it will be and we'll be able to

345

00:12:28,389 --> 00:12:25,839

uplink or email a part to space instead

346

00:12:31,990 --> 00:12:28,399

of launching it and it's really a game

347

00:12:36,069 --> 00:12:33,990

so everything is enclosed though

348

00:12:38,550 --> 00:12:36,079

is is right this is always going to be

349

00:12:39,750 --> 00:12:38,560

sealed during operation um actually this

350

00:12:41,350 --> 00:12:39,760

this front door

351  
00:12:43,110 --> 00:12:41,360  
you can move the front door to remove

352  
00:12:44,550 --> 00:12:43,120  
the part remove the print the little

353  
00:12:45,829 --> 00:12:44,560  
print tray just slides out and the crew

354  
00:12:47,509 --> 00:12:45,839  
removes it

355  
00:12:48,710 --> 00:12:47,519  
and these these setup and the part

356  
00:12:51,190 --> 00:12:48,720  
remover are the only things that the

357  
00:12:52,949 --> 00:12:51,200  
crew has to do we're able to control the

358  
00:12:55,110 --> 00:12:52,959  
print and you'll notice the windows as

359  
00:12:56,870 --> 00:12:55,120  
well on the front and the side will have

360  
00:12:58,949 --> 00:12:56,880  
high definition cameras and we'll be

361  
00:13:00,470 --> 00:12:58,959  
watching live for the from the ground so

362  
00:13:02,389 --> 00:13:00,480  
that will provide immediate data

363  
00:13:04,829 --> 00:13:02,399

feedback we'll be able to see

364

00:13:05,910 --> 00:13:04,839

in very

365

00:13:08,069 --> 00:13:05,920

detailed uh

366

00:13:10,629 --> 00:13:08,079

visuals how the the plastic is being

367

00:13:12,550 --> 00:13:10,639

deposited layer by layer which will will

368

00:13:14,550 --> 00:13:12,560

give us some immediate science feedback

369

00:13:16,310 --> 00:13:14,560

in addition the very first parts that we

370

00:13:18,310 --> 00:13:16,320

print they may not look really exciting

371

00:13:20,389 --> 00:13:18,320

to the layman but they're exciting to us

372

00:13:23,509 --> 00:13:20,399

and we'll be doing all kinds of coupons

373

00:13:25,509 --> 00:13:23,519

uh tinsel flexure compression those very

374

00:13:27,750 --> 00:13:25,519

first parts we will also return to the

375

00:13:30,230 --> 00:13:27,760

ground and do detailed ground analysis

376

00:13:32,790 --> 00:13:30,240

and compared to the ground controls

377

00:13:34,230 --> 00:13:32,800

but but yes while it's being printed it

378

00:13:36,310 --> 00:13:34,240

remains sealed and then when done the

379

00:13:37,670 --> 00:13:36,320

crew just pops open that door removes

380

00:13:41,350 --> 00:13:37,680

the print tray and removes the part and

381

00:13:45,030 --> 00:13:42,790

i'd like to add just a little bit to

382

00:13:47,110 --> 00:13:45,040

that marcia cases is actually very very

383

00:13:48,629 --> 00:13:47,120

interested in what nasa is doing with

384

00:13:50,470 --> 00:13:48,639

this demonstration

385

00:13:52,230 --> 00:13:50,480

portion of this um we're hoping at the

386

00:13:54,069 --> 00:13:52,240

same time to maybe be able to to

387

00:13:56,710 --> 00:13:54,079

parallel with some of their efforts of

388

00:13:58,470 --> 00:13:56,720

ensuring that in fact you can add a

389

00:14:00,069 --> 00:13:58,480

manufacturer in space

390

00:14:01,670 --> 00:14:00,079

and then actually print parts we're

391

00:14:03,990 --> 00:14:01,680

we're also hopeful that we can start to

392

00:14:06,550 --> 00:14:04,000

look at how our customers may benefit

393

00:14:08,949 --> 00:14:06,560

from this as well we've noticed quickly

394

00:14:11,350 --> 00:14:08,959

there's really twofold opportunity here

395

00:14:14,150 --> 00:14:11,360

through the the safety processes and

396

00:14:15,829 --> 00:14:14,160

some of the technology design that was

397

00:14:17,350 --> 00:14:15,839

necessarily inherent

398

00:14:18,870 --> 00:14:17,360

in order for this to be manifested for

399

00:14:20,550 --> 00:14:18,880

flight there's actually applications

400

00:14:21,910 --> 00:14:20,560

that have been derived

401  
00:14:24,230 --> 00:14:21,920  
that can be applicable to the additive

402  
00:14:25,670 --> 00:14:24,240  
manufacturing process globally and on

403  
00:14:27,430 --> 00:14:25,680  
the ground and some of those things are

404  
00:14:29,430 --> 00:14:27,440  
considering are still under

405  
00:14:31,670 --> 00:14:29,440  
consideration and development

406  
00:14:33,509 --> 00:14:31,680  
but from our perspective

407  
00:14:36,629 --> 00:14:33,519  
if you consider cases

408  
00:14:39,269 --> 00:14:36,639  
first and foremost the supporter of an r

409  
00:14:40,710 --> 00:14:39,279  
d laboratory where in general

410  
00:14:43,430 --> 00:14:40,720  
science is being conducted there's

411  
00:14:45,269 --> 00:14:43,440  
really two things that are pretty much

412  
00:14:46,870 --> 00:14:45,279  
a given principle in any type of science

413  
00:14:48,230 --> 00:14:46,880

that you're doing one is that it's an

414

00:14:50,870 --> 00:14:48,240

iterative process

415

00:14:53,350 --> 00:14:50,880

and two you go through consumables it

416

00:14:56,470 --> 00:14:53,360

takes materials in order to conduct a

417

00:14:58,790 --> 00:14:56,480

series of experiments and by creating an

418

00:15:01,269 --> 00:14:58,800

additive manufacturing facility on orbit

419

00:15:03,269 --> 00:15:01,279

in our laboratory that in essence is a

420

00:15:04,710 --> 00:15:03,279

huge game changer for us because now we

421

00:15:06,230 --> 00:15:04,720

no longer have to wait for the next

422

00:15:08,470 --> 00:15:06,240

transportation

423

00:15:10,310 --> 00:15:08,480

opportunity up to space we know that

424

00:15:11,189 --> 00:15:10,320

science is iterative we know that for

425

00:15:12,389 --> 00:15:11,199

every

426

00:15:13,670 --> 00:15:12,399

question that's answered there are

427

00:15:15,670 --> 00:15:13,680

probably five new questions that are

428

00:15:17,829 --> 00:15:15,680

generated so to be able to continue the

429

00:15:19,350 --> 00:15:17,839

research without having to worry about

430

00:15:22,310 --> 00:15:19,360

the transportation logistics and

431

00:15:24,150 --> 00:15:22,320

consumables is a huge opportunity for

432

00:15:26,949 --> 00:15:24,160

for us as well as

433

00:15:28,550 --> 00:15:26,959

nasa so we're very um excited to be able

434

00:15:29,990 --> 00:15:28,560

to partner with them on this in the very

435

00:15:32,150 --> 00:15:30,000

near future as well i should have

436

00:15:34,230 --> 00:15:32,160

mentioned uh after this technology

437

00:15:35,910 --> 00:15:34,240

demonstration we will follow with a even

438

00:15:37,990 --> 00:15:35,920

more sophisticated printer um that will

439

00:15:39,910 --> 00:15:38,000

be a commercial printer that that made

440

00:15:41,750 --> 00:15:39,920

in space has designed

441

00:15:43,030 --> 00:15:41,760

nasa will become a customer of that

442

00:15:45,110 --> 00:15:43,040

printer

443

00:15:47,110 --> 00:15:45,120

so that a lot of work will take place

444

00:15:49,030 --> 00:15:47,120

through cases as well as

445

00:15:51,350 --> 00:15:49,040

from a nasa perspective

446

00:15:53,350 --> 00:15:51,360

for exploration missions the supplied

447

00:15:56,069 --> 00:15:53,360

model that we use currently is just not

448

00:15:58,870 --> 00:15:56,079

feasible and so so we're very interested

449

00:16:00,790 --> 00:15:58,880

in continuing to evolve this technology

450

00:16:02,389 --> 00:16:00,800

eventually having an integrated suite of

451  
00:16:03,990 --> 00:16:02,399  
capabilities from

452  
00:16:05,430 --> 00:16:04,000  
everything from additive or printable

453  
00:16:07,189 --> 00:16:05,440  
electronics

454  
00:16:09,430 --> 00:16:07,199  
to larger structures additive

455  
00:16:11,910 --> 00:16:09,440  
construction where you could

456  
00:16:13,990 --> 00:16:11,920  
even use the in-situ resources somewhere

457  
00:16:16,470 --> 00:16:14,000  
like mars to build radiation shielding

458  
00:16:19,189 --> 00:16:16,480  
habitats or landing pads

459  
00:16:21,350 --> 00:16:19,199  
so everything from the smallest tool to

460  
00:16:22,870 --> 00:16:21,360  
the habitat you live in eventually

461  
00:16:24,710 --> 00:16:22,880  
for exploration and everything you might

462  
00:16:26,470 --> 00:16:24,720  
need along the way

463  
00:16:30,150 --> 00:16:26,480

we hope to to establish through the

464

00:16:34,230 --> 00:16:32,470

ken kramer hi ken kramer universe today

465

00:16:35,749 --> 00:16:34,240

in america space two questions let me

466

00:16:37,749 --> 00:16:35,759

just follow up on the 3d printing are

467

00:16:38,790 --> 00:16:37,759

these examples of what you are going to

468

00:16:41,030 --> 00:16:38,800

be

469

00:16:43,430 --> 00:16:41,040

printing in space some of them are and

470

00:16:44,470 --> 00:16:43,440

some of them are just for fun but yes we

471

00:16:46,790 --> 00:16:44,480

definitely

472

00:16:48,150 --> 00:16:46,800

we're developing a utilization catalog

473

00:16:49,990 --> 00:16:48,160

that we'll be really focusing on i

474

00:16:51,590 --> 00:16:50,000

mentioned that phase one of the printer

475

00:16:52,710 --> 00:16:51,600

is to focus on the printer and the

476  
00:16:55,110 --> 00:16:52,720  
process

477  
00:16:56,790 --> 00:16:55,120  
phase two turns focus on the parts so

478  
00:16:59,269 --> 00:16:56,800  
we're working with payload developers

479  
00:17:00,710 --> 00:16:59,279  
working with the science community

480  
00:17:03,269 --> 00:17:00,720  
and the crew tools logistics and

481  
00:17:06,069 --> 00:17:03,279  
maintenance medical offices replacement

482  
00:17:07,189 --> 00:17:06,079  
hardware for exercise equipment

483  
00:17:09,669 --> 00:17:07,199  
and we've got placeholders in the

484  
00:17:11,829 --> 00:17:09,679  
catalog to explore all of those i will

485  
00:17:14,309 --> 00:17:11,839  
say um the key to this though is we want

486  
00:17:16,949 --> 00:17:14,319  
to be successful in understanding the

487  
00:17:19,669 --> 00:17:16,959  
foundation of the materials um in in

488  
00:17:21,990 --> 00:17:19,679

their in design optimization using

489

00:17:23,909 --> 00:17:22,000

additive manufacturing is really key to

490

00:17:25,590 --> 00:17:23,919

the success of this as much or more than

491

00:17:26,870 --> 00:17:25,600

even the actual technology of the

492

00:17:29,350 --> 00:17:26,880

printer itself

493

00:17:31,029 --> 00:17:29,360

so in conjunction we're also developing

494

00:17:33,590 --> 00:17:31,039

the material databases which i know

495

00:17:35,510 --> 00:17:33,600

doesn't sound as exciting and thrilling

496

00:17:37,029 --> 00:17:35,520

but it really is and

497

00:17:39,909 --> 00:17:37,039

knowing how to design the parts where

498

00:17:41,830 --> 00:17:39,919

they function appropriately is important

499

00:17:43,110 --> 00:17:41,840

so when we design a wrench for example

500

00:17:45,270 --> 00:17:43,120

it may not look like the wrench that you

501  
00:17:47,110 --> 00:17:45,280  
get at your local supply store it may be

502  
00:17:49,510 --> 00:17:47,120  
shorter and squatter and fatter but it

503  
00:17:51,669 --> 00:17:49,520  
will do its job

504  
00:17:53,190 --> 00:17:51,679  
okay my other question is for techshot

505  
00:17:55,110 --> 00:17:53,200  
please can you tell us a little bit more

506  
00:17:56,870 --> 00:17:55,120  
details you mentioned you're going to be

507  
00:17:58,870 --> 00:17:56,880  
collecting the data in real time will

508  
00:18:00,470 --> 00:17:58,880  
you be transmitting it and receiving

509  
00:18:02,789 --> 00:18:00,480  
this data in real time how many

510  
00:18:05,110 --> 00:18:02,799  
astronauts are involved and how regular

511  
00:18:06,630 --> 00:18:05,120  
will you be making these measurements

512  
00:18:08,710 --> 00:18:06,640  
thanks

513  
00:18:10,310 --> 00:18:08,720

so yes the uh

514

00:18:12,710 --> 00:18:10,320

the information can be uh can be

515

00:18:16,230 --> 00:18:12,720

downlinked so it's being collected on

516

00:18:19,350 --> 00:18:16,240

the express rack express rack laptop and

517

00:18:20,870 --> 00:18:19,360

can be downlinked in real time to

518

00:18:22,470 --> 00:18:20,880

to researchers

519

00:18:24,150 --> 00:18:22,480

and

520

00:18:26,150 --> 00:18:24,160

it's really up to

521

00:18:27,430 --> 00:18:26,160

up to the science community as to how

522

00:18:28,870 --> 00:18:27,440

often

523

00:18:30,710 --> 00:18:28,880

since

524

00:18:32,630 --> 00:18:30,720

right now we are the hardware developer

525

00:18:34,549 --> 00:18:32,640

we're not the we're not the science end

526

00:18:36,230 --> 00:18:34,559

user so that's going to be that's going

527

00:18:38,310 --> 00:18:36,240

to be determined by you know people like

528

00:18:39,350 --> 00:18:38,320

novartis who are going to be using the

529

00:18:41,190 --> 00:18:39,360

hardware

530

00:18:44,070 --> 00:18:41,200

um so i can't i can't necessarily answer

531

00:18:45,669 --> 00:18:44,080

the science question to uh how often the

532

00:18:48,070 --> 00:18:45,679

hardware is going to be used but it's

533

00:18:49,270 --> 00:18:48,080

going to be a permanent installation so

534

00:18:51,190 --> 00:18:49,280

um

535

00:18:53,990 --> 00:18:51,200

it must be some

536

00:18:56,710 --> 00:18:54,000

regular use of it right yeah there is um

537

00:18:59,430 --> 00:18:56,720

it's it's being part of is part of

538

00:19:02,310 --> 00:18:59,440

ames uh ruden research

539

00:19:04,150 --> 00:19:02,320

plan and again a scan is a scan for the

540

00:19:06,630 --> 00:19:04,160

hardware is approximately three minutes

541

00:19:08,070 --> 00:19:06,640

and can be used virtually indefinitely

542

00:19:16,549 --> 00:19:08,080

um

543

00:19:18,390 --> 00:19:16,559

expected endpoint of the station

544

00:19:20,710 --> 00:19:18,400

so we're uh we're planning uh fairly

545

00:19:25,110 --> 00:19:20,720

regular usage um

546

00:19:26,710 --> 00:19:25,120

um pure um periodic usage throughout the

547

00:19:28,070 --> 00:19:26,720

throughout the life so

548

00:19:29,510 --> 00:19:28,080

i would say

549

00:19:33,909 --> 00:19:29,520

at least

550

00:19:36,870 --> 00:19:35,990

i'd add to that this is really a new

551  
00:19:38,150 --> 00:19:36,880  
model

552  
00:19:38,950 --> 00:19:38,160  
that tech shot

553  
00:19:40,549 --> 00:19:38,960  
along with some of the other

554  
00:19:43,669 --> 00:19:40,559  
implementation partners over the the

555  
00:19:46,070 --> 00:19:43,679  
recent past are sort of delving into and

556  
00:19:47,190 --> 00:19:46,080  
that is they are providing a service on

557  
00:19:48,950 --> 00:19:47,200  
orbit

558  
00:19:51,990 --> 00:19:48,960  
that can be obtained

559  
00:19:53,909 --> 00:19:52,000  
by any end customer and as nikki pointed

560  
00:19:55,750 --> 00:19:53,919  
out with respect to 3d printing both

561  
00:19:57,029 --> 00:19:55,760  
nasa and cases will ultimately be

562  
00:19:58,390 --> 00:19:57,039  
customers of the service that they can

563  
00:20:01,190 --> 00:19:58,400

provide

564

00:20:03,510 --> 00:20:01,200

we really challenged techshot to

565

00:20:05,430 --> 00:20:03,520

determine if can you take a commercially

566

00:20:07,510 --> 00:20:05,440

available off-the-shelf

567

00:20:09,830 --> 00:20:07,520

piece of analytical equipment

568

00:20:12,630 --> 00:20:09,840

obviously harden it and make it safe for

569

00:20:14,950 --> 00:20:12,640

iss utilization but still keep it

570

00:20:16,390 --> 00:20:14,960

functionally as similar as possible to

571

00:20:18,630 --> 00:20:16,400

what our researchers on the ground are

572

00:20:21,430 --> 00:20:18,640

used to i think they really nailed all

573

00:20:24,230 --> 00:20:21,440

those requirements in doing so

574

00:20:26,230 --> 00:20:24,240

and i can't emphasize enough that using

575

00:20:27,830 --> 00:20:26,240

novartis as an example

576

00:20:29,190 --> 00:20:27,840

we know that microgravity really has a

577

00:20:30,390 --> 00:20:29,200

lot of opportunities in biomedical

578

00:20:32,630 --> 00:20:30,400

research

579

00:20:34,630 --> 00:20:32,640

in those areas primarily the area of

580

00:20:37,029 --> 00:20:34,640

bone loss and bone demineralization as

581

00:20:38,789 --> 00:20:37,039

well as muscle wasting or atrophy are

582

00:20:40,789 --> 00:20:38,799

two probably the ones that really bubble

583

00:20:42,390 --> 00:20:40,799

to the top as

584

00:20:45,830 --> 00:20:42,400

wanting to understand better the

585

00:20:47,669 --> 00:20:45,840

fundamental aspects of of those

586

00:20:50,390 --> 00:20:47,679

observations of microgravity but more

587

00:20:52,630 --> 00:20:50,400

specifically how we apply those to

588

00:20:53,909 --> 00:20:52,640

therapeutics and and perhaps even drug

589

00:20:57,270 --> 00:20:53,919

therapies so

590

00:20:58,549 --> 00:20:57,280

being able to actually analyze bone loss

591

00:21:01,350 --> 00:20:58,559

in real time

592

00:21:03,990 --> 00:21:01,360

in the laboratory without having to

593

00:21:05,669 --> 00:21:04,000

account for return to space and g-loads

594

00:21:07,669 --> 00:21:05,679

and how that may impact

595

00:21:09,270 --> 00:21:07,679

your sample is is again another game

596

00:21:12,310 --> 00:21:09,280

changer for us and it's huge and there's

597

00:21:13,830 --> 00:21:12,320

a lot of interest in the pharmaceutical

598

00:21:15,830 --> 00:21:13,840

areas that would like to continue to use

599

00:21:17,909 --> 00:21:15,840

that's going on in the future but as

600

00:21:19,909 --> 00:21:17,919

with any new technology there is a

601  
00:21:21,750 --> 00:21:19,919  
period of sort of demonstration

602  
00:21:23,350 --> 00:21:21,760  
that's what really this first element of

603  
00:21:25,830 --> 00:21:23,360  
this mission will be but we expect to be

604  
00:21:29,029 --> 00:21:25,840  
using it quite a bit

605  
00:21:34,549 --> 00:21:32,390  
uh matt coons from social media for 3d

606  
00:21:36,630 --> 00:21:34,559  
printing from an engineering perspective

607  
00:21:38,710 --> 00:21:36,640  
what material are you starting with and

608  
00:21:39,990 --> 00:21:38,720  
what sort of property changes do you

609  
00:21:41,590 --> 00:21:40,000  
expect to see

610  
00:21:44,070 --> 00:21:41,600  
so the material that we're starting with

611  
00:21:45,990 --> 00:21:44,080  
for the technology demonstration is abs

612  
00:21:48,630 --> 00:21:46,000  
plastic which is the same plastic that

613  
00:21:50,070 --> 00:21:48,640

the lego bricks are made out of so as

614

00:21:52,549 --> 00:21:50,080

you probably know we've flown quite a

615

00:21:54,870 --> 00:21:52,559

bit of abs through legos and through

616

00:21:57,430 --> 00:21:54,880

other parts and some of the cubesat

617

00:21:59,590 --> 00:21:57,440

components and structures have been abs

618

00:22:01,270 --> 00:21:59,600

the next printer we're looking at even

619

00:22:03,430 --> 00:22:01,280

stronger

620

00:22:04,950 --> 00:22:03,440

higher temperature plastics and there's

621

00:22:07,029 --> 00:22:04,960

several that we've been doing detailed

622

00:22:08,390 --> 00:22:07,039

ground studies on

623

00:22:10,630 --> 00:22:08,400

the abs

624

00:22:11,909 --> 00:22:10,640

there's still

625

00:22:13,590 --> 00:22:11,919

several things that we've been looking

626  
00:22:15,190 --> 00:22:13,600  
at that it will work quite well with and

627  
00:22:17,350 --> 00:22:15,200  
we're doing detailed ground

628  
00:22:19,669 --> 00:22:17,360  
studies and analysis as far as what will

629  
00:22:21,350 --> 00:22:19,679  
be different in microgravity

630  
00:22:23,029 --> 00:22:21,360  
there's no way to say for certainty i

631  
00:22:25,430 --> 00:22:23,039  
think that's probably the most exciting

632  
00:22:27,830 --> 00:22:25,440  
part about this is that

633  
00:22:29,750 --> 00:22:27,840  
we can't say with 100 certainty if it's

634  
00:22:32,310 --> 00:22:29,760  
going to be the same the parabolic

635  
00:22:34,710 --> 00:22:32,320  
flights have have led us to believe and

636  
00:22:36,390 --> 00:22:34,720  
we feel confident that it will be

637  
00:22:40,950 --> 00:22:36,400  
but we won't know that for sure until we

638  
00:22:44,310 --> 00:22:42,549

yeah jamestown with spaceflight insider

639

00:22:46,310 --> 00:22:44,320

um obviously techshot the hardware is

640

00:22:48,549 --> 00:22:46,320

getting delivered now um and you're

641

00:22:51,110 --> 00:22:48,559

testing do you know when the first live

642

00:22:52,470 --> 00:22:51,120

specimen the small rodents or whatnot

643

00:22:53,590 --> 00:22:52,480

will be

644

00:22:56,149 --> 00:22:53,600

you know set up the station for the

645

00:22:57,669 --> 00:22:56,159

testing yeah so so the bone detectometer

646

00:23:00,470 --> 00:22:57,679

is part of a much larger project that

647

00:23:01,750 --> 00:23:00,480

both nasa and cases are collaborating on

648

00:23:03,350 --> 00:23:01,760

um and there will be more discussion i

649

00:23:05,590 --> 00:23:03,360

think later this afternoon and another

650

00:23:08,230 --> 00:23:05,600

briefing on on some of the uh model

651  
00:23:10,149 --> 00:23:08,240  
organisms that will be used but i think

652  
00:23:11,510 --> 00:23:10,159  
a general statement would be that on

653  
00:23:13,750 --> 00:23:11,520  
this flight will be not only the

654  
00:23:15,430 --> 00:23:13,760  
delivery of the densitometer but also

655  
00:23:18,310 --> 00:23:15,440  
the organisms

656  
00:23:20,549 --> 00:23:18,320  
i believe the novartis study for

657  
00:23:22,870 --> 00:23:20,559  
cases and some of the nasa studies

658  
00:23:25,750 --> 00:23:22,880  
require a 20 to 30 day period of

659  
00:23:27,190 --> 00:23:25,760  
microgravity exposure and then at that

660  
00:23:29,350 --> 00:23:27,200  
point there will be the endpoint

661  
00:23:30,710 --> 00:23:29,360  
analyses that will take place which at

662  
00:23:34,630 --> 00:23:30,720  
that point that's when the densitometer

663  
00:23:40,230 --> 00:23:37,350

okay and in the back over here yes good

664

00:23:42,230 --> 00:23:40,240

morning chi ravilla from social media i

665

00:23:44,870 --> 00:23:42,240

also kind of had a question on the same

666

00:23:46,549 --> 00:23:44,880

line with the kind of interested in the

667

00:23:47,909 --> 00:23:46,559

bone density studies that are going to

668

00:23:50,390 --> 00:23:47,919

be performed

669

00:23:52,549 --> 00:23:50,400

um and kind of was interested if you

670

00:23:55,510 --> 00:23:52,559

could elaborate a little bit more over

671

00:23:58,149 --> 00:23:55,520

how the handshake takes place between

672

00:24:01,029 --> 00:23:58,159

what you learn in space and then how do

673

00:24:02,230 --> 00:24:01,039

you actually go go and apply on earth

674

00:24:04,630 --> 00:24:02,240

what you're going to be learning in

675

00:24:07,029 --> 00:24:04,640

space how that that you know process of

676

00:24:08,390 --> 00:24:07,039

transfer takes place

677

00:24:11,269 --> 00:24:08,400

well that's a great question let me try

678

00:24:13,269 --> 00:24:11,279

to kind of generally answer that um the

679

00:24:14,710 --> 00:24:13,279

one thing to really emphasize is that

680

00:24:17,029 --> 00:24:14,720

the iss

681

00:24:19,909 --> 00:24:17,039

is now that it's open and completely

682

00:24:23,950 --> 00:24:19,919

available for science utilization really

683

00:24:28,390 --> 00:24:26,630

multi-duration studies in microgravity

684

00:24:29,909 --> 00:24:28,400

take place

685

00:24:32,390 --> 00:24:29,919

yes there have been organism studies

686

00:24:34,230 --> 00:24:32,400

with respect to microgravity exposure

687

00:24:36,390 --> 00:24:34,240

and how that impacts bone loss how that

688

00:24:39,110 --> 00:24:36,400

impacts muscle wasting in the past but

689

00:24:40,390 --> 00:24:39,120

if you'll recall the the the at the most

690

00:24:42,070 --> 00:24:40,400

those exposures were as long as a

691

00:24:43,350 --> 00:24:42,080

shuttle sortie

692

00:24:44,870 --> 00:24:43,360

was

693

00:24:47,110 --> 00:24:44,880

so this really marks the first time that

694

00:24:48,950 --> 00:24:47,120

we can go many days many weeks and

695

00:24:50,630 --> 00:24:48,960

perhaps out into months

696

00:24:52,710 --> 00:24:50,640

to really clearly understand what are

697

00:24:54,149 --> 00:24:52,720

the impacts how does microgravity

698

00:24:55,350 --> 00:24:54,159

provide an ideal platform for

699

00:24:56,630 --> 00:24:55,360

understanding these physiological

700

00:24:58,390 --> 00:24:56,640

consequences

701  
00:25:00,630 --> 00:24:58,400  
so we're probably still on the very

702  
00:25:02,390 --> 00:25:00,640  
front leading edge of answering some of

703  
00:25:05,269 --> 00:25:02,400  
the basic questions that will

704  
00:25:06,710 --> 00:25:05,279  
will lead to application however at the

705  
00:25:08,230 --> 00:25:06,720  
same time you have companies like

706  
00:25:09,590 --> 00:25:08,240  
novartis and other commercial

707  
00:25:12,470 --> 00:25:09,600  
pharmaceutical

708  
00:25:14,390 --> 00:25:12,480  
interests that see this as opportunistic

709  
00:25:16,549 --> 00:25:14,400  
one because a lot of the basic science

710  
00:25:18,390 --> 00:25:16,559  
hasn't been answered and if they can

711  
00:25:19,669 --> 00:25:18,400  
sort of have the the first end look at

712  
00:25:22,470 --> 00:25:19,679  
it if you will

713  
00:25:24,310 --> 00:25:22,480

and perhaps create intellectual property

714

00:25:25,909 --> 00:25:24,320

or other information that may be of use

715

00:25:28,549 --> 00:25:25,919

to them that helps them get to market

716

00:25:30,149 --> 00:25:28,559

sooner so how does the handshake take

717

00:25:31,830 --> 00:25:30,159

place

718

00:25:33,830 --> 00:25:31,840

cases

719

00:25:35,909 --> 00:25:33,840

tries to make it as simple as possible

720

00:25:37,590 --> 00:25:35,919

so we have entered into a user agreement

721

00:25:38,549 --> 00:25:37,600

with novartis

722

00:25:40,789 --> 00:25:38,559

for this

723

00:25:42,549 --> 00:25:40,799

portion of the research we have

724

00:25:44,710 --> 00:25:42,559

helped them with funding so they've

725

00:25:46,310 --> 00:25:44,720

provided a lot of their their cash as

726

00:25:47,990 --> 00:25:46,320

well as in-kind support we've helped

727

00:25:50,230 --> 00:25:48,000

with a little bit of funding but from

728

00:25:52,950 --> 00:25:50,240

that partnership we're basically

729

00:25:54,630 --> 00:25:52,960

opening the national laboratory for use

730

00:25:56,549 --> 00:25:54,640

so they can come in they'll conduct the

731

00:25:58,789 --> 00:25:56,559

research they'll go home and can

732

00:26:01,350 --> 00:25:58,799

complete their post-flight analytics if

733

00:26:02,789 --> 00:26:01,360

you will and from that um they now have

734

00:26:04,789 --> 00:26:02,799

ownership of the intellectual property

735

00:26:06,310 --> 00:26:04,799

and the data they've created

736

00:26:08,070 --> 00:26:06,320

and if i can expand just a little bit on

737

00:26:09,990 --> 00:26:08,080

that dwayne from kind of a nuts and

738

00:26:12,549 --> 00:26:10,000

bolts perspective

739

00:26:15,029 --> 00:26:12,559

when cases and nasa approached techshot

740

00:26:16,870 --> 00:26:15,039

and kind of challenged us to do this

741

00:26:19,669 --> 00:26:16,880

we kind of scoured the

742

00:26:21,510 --> 00:26:19,679

scar the research arena and we found

743

00:26:23,830 --> 00:26:21,520

what was state of the art

744

00:26:24,710 --> 00:26:23,840

and we have the same software platform

745

00:26:26,070 --> 00:26:24,720

so

746

00:26:28,230 --> 00:26:26,080

you know what was state of the art for

747

00:26:30,950 --> 00:26:28,240

ground research for looking at um for

748

00:26:33,269 --> 00:26:30,960

looking at bone loss and muscle loss in

749

00:26:34,710 --> 00:26:33,279

the laboratory that these uh that you

750

00:26:37,190 --> 00:26:34,720

know the the top researchers in the

751  
00:26:38,470 --> 00:26:37,200  
countries in the country were using

752  
00:26:40,710 --> 00:26:38,480  
they're going to see the exact same

753  
00:26:42,789 --> 00:26:40,720  
result the exact same screens the exact

754  
00:26:44,630 --> 00:26:42,799  
same user interface

755  
00:26:45,990 --> 00:26:44,640  
on station with the results that they're

756  
00:26:47,190 --> 00:26:46,000  
seeing in their laboratory so they're

757  
00:26:49,029 --> 00:26:47,200  
going to be able to make one-to-one

758  
00:26:51,029 --> 00:26:49,039  
comparisons that was you know that was

759  
00:26:52,870 --> 00:26:51,039  
critical to us to be able to present

760  
00:26:54,789 --> 00:26:52,880  
that to the user community so they're

761  
00:26:56,789 --> 00:26:54,799  
not going to have to learn a new user

762  
00:26:58,470 --> 00:26:56,799  
interface and knew it in anything else

763  
00:27:00,149 --> 00:26:58,480

so we wanted to make sure that looks

764

00:27:02,630 --> 00:27:00,159

seamless whether it was on station or in

765

00:27:04,710 --> 00:27:02,640

their laboratory

766

00:27:06,710 --> 00:27:04,720

i have a question to uh just in general

767

00:27:08,630 --> 00:27:06,720

duane you know if you if you step back

768

00:27:10,470 --> 00:27:08,640

and you look at the diverse

769

00:27:12,230 --> 00:27:10,480

amount of payloads that we're talking

770

00:27:14,789 --> 00:27:12,240

about today and uh

771

00:27:16,950 --> 00:27:14,799

really really neat things um

772

00:27:18,950 --> 00:27:16,960

as far as the uh development of the

773

00:27:21,190 --> 00:27:18,960

internet of the international space

774

00:27:23,510 --> 00:27:21,200

station and the national lab portion and

775

00:27:27,430 --> 00:27:23,520

what cases is doing where do you really

776

00:27:28,630 --> 00:27:27,440

uh see the the the payload um

777

00:27:31,029 --> 00:27:28,640

market you know

778

00:27:33,430 --> 00:27:31,039

moving where do you see things uh you

779

00:27:34,950 --> 00:27:33,440

know successful in the near term and you

780

00:27:36,710 --> 00:27:34,960

know in the

781

00:27:39,510 --> 00:27:36,720

far term i guess that's a really great

782

00:27:41,190 --> 00:27:39,520

question and and i will say that um

783

00:27:43,830 --> 00:27:41,200

within the three years that we've been

784

00:27:45,269 --> 00:27:43,840

operating and clearly not ignoring all

785

00:27:48,549 --> 00:27:45,279

the work that has been done within nasa

786

00:27:50,950 --> 00:27:48,559

and research over um many decades there

787

00:27:53,669 --> 00:27:50,960

are three areas that seem to really sort

788

00:27:56,230 --> 00:27:53,679

of become emerging where there is a true

789

00:27:58,710 --> 00:27:56,240

value uh being described with respect to

790

00:28:00,149 --> 00:27:58,720

this being an ideal research platform um

791

00:28:01,590 --> 00:28:00,159

and i'll say we've been able to

792

00:28:02,710 --> 00:28:01,600

demonstrate this

793

00:28:04,950 --> 00:28:02,720

since

794

00:28:07,510 --> 00:28:04,960

we started operations ourselves we've

795

00:28:09,269 --> 00:28:07,520

issued over 10 million dollars in grants

796

00:28:12,149 --> 00:28:09,279

in areas of research

797

00:28:14,950 --> 00:28:12,159

and we've manifested 115 payloads as

798

00:28:17,590 --> 00:28:14,960

national lab payloads in those areas

799

00:28:18,870 --> 00:28:17,600

biomedical research and

800

00:28:20,230 --> 00:28:18,880

biotech

801  
00:28:22,630 --> 00:28:20,240  
analysis

802  
00:28:24,870 --> 00:28:22,640  
development seem to be really the

803  
00:28:26,630 --> 00:28:24,880  
biggest emerging market or vertical and

804  
00:28:28,870 --> 00:28:26,640  
we have obviously placed a lot of focus

805  
00:28:30,789 --> 00:28:28,880  
on continuing to demonstrate that so

806  
00:28:32,870 --> 00:28:30,799  
that we will now have an application

807  
00:28:34,230 --> 00:28:32,880  
going forward

808  
00:28:35,269 --> 00:28:34,240  
second to that though interestingly

809  
00:28:37,430 --> 00:28:35,279  
enough

810  
00:28:40,389 --> 00:28:37,440  
mike and cobra puma golf represent the

811  
00:28:42,070 --> 00:28:40,399  
area of material science that largely

812  
00:28:43,750 --> 00:28:42,080  
is not well understood

813  
00:28:45,269 --> 00:28:43,760

nor has it been capitalized with respect

814

00:28:48,070 --> 00:28:45,279

to how do the physical aspects of

815

00:28:51,110 --> 00:28:48,080

microgravity impact materials um from

816

00:28:53,510 --> 00:28:51,120

design duration uh sustainment and and

817

00:28:54,470 --> 00:28:53,520

and ultimately um impact here on on the

818

00:28:56,149 --> 00:28:54,480

ground

819

00:28:57,190 --> 00:28:56,159

cobra puma golf is a great example of

820

00:28:58,870 --> 00:28:57,200

that but there's a lot of other

821

00:29:00,549 --> 00:28:58,880

companies that are also interested in

822

00:29:02,310 --> 00:29:00,559

materials research

823

00:29:04,070 --> 00:29:02,320

for the sake of application and

824

00:29:05,269 --> 00:29:04,080

development for for product in the

825

00:29:06,789 --> 00:29:05,279

future

826

00:29:08,789 --> 00:29:06,799

the third area actually kind of goes

827

00:29:11,350 --> 00:29:08,799

outside and

828

00:29:13,990 --> 00:29:11,360

it looks at the iss as a unique

829

00:29:15,510 --> 00:29:14,000

observation platform for earth sensing

830

00:29:17,750 --> 00:29:15,520

and and um

831

00:29:20,310 --> 00:29:17,760

and observation and when you compare

832

00:29:22,950 --> 00:29:20,320

that to say geosynchronous satellites

833

00:29:24,630 --> 00:29:22,960

which um largely are what we rely on for

834

00:29:26,950 --> 00:29:24,640

earth observation and sensing and

835

00:29:29,750 --> 00:29:26,960

communication and what have you um iss

836

00:29:31,510 --> 00:29:29,760

has advantages it's it's not a 100

837

00:29:33,430 --> 00:29:31,520

solution to a lot of things but it

838

00:29:35,269 --> 00:29:33,440

certainly is a lot easier to get to

839

00:29:38,149 --> 00:29:35,279

and a lot more affordable to get to

840

00:29:39,590 --> 00:29:38,159

thanks to uh the cases model and and the

841

00:29:42,070 --> 00:29:39,600

cooperative agreement that we that we

842

00:29:45,269 --> 00:29:42,080

have with nasa so i think over the next

843

00:29:47,430 --> 00:29:45,279

uh 18 to 24 months we'll see a lot um

844

00:29:49,669 --> 00:29:47,440

increased interest in in the earth

845

00:29:51,830 --> 00:29:49,679

sensing and remote uh

846

00:29:53,190 --> 00:29:51,840

observations opportunities as well

847

00:29:54,549 --> 00:29:53,200

okay thank you

848

00:29:56,230 --> 00:29:54,559

uh we had a question in the front row

849

00:29:57,590 --> 00:29:56,240

here yes aaron hayworth from space

850

00:29:59,110 --> 00:29:57,600

flight insider this is a question for

851  
00:30:00,870 --> 00:29:59,120  
mike yagli i was wondering if you could

852  
00:30:02,549 --> 00:30:00,880  
tell us a little bit more about sort of

853  
00:30:04,149 --> 00:30:02,559  
what materials research you're planning

854  
00:30:05,909 --> 00:30:04,159  
and i guess what benefits we're going to

855  
00:30:07,430 --> 00:30:05,919  
see back here on earth from what the

856  
00:30:10,710 --> 00:30:07,440  
research you're doing is is going to pay

857  
00:30:13,830 --> 00:30:10,720  
off in yes so the materials themselves

858  
00:30:15,990 --> 00:30:13,840  
it's a it's an aluminum uh substructure

859  
00:30:18,710 --> 00:30:16,000  
and then a silver

860  
00:30:21,590 --> 00:30:18,720  
electroplating over top of it and the

861  
00:30:24,230 --> 00:30:21,600  
experiment is to understand the impact

862  
00:30:25,110 --> 00:30:24,240  
of microgravity on the crystalline

863  
00:30:26,710 --> 00:30:25,120

growth

864

00:30:29,029 --> 00:30:26,720

of the material that's being deposited

865

00:30:31,750 --> 00:30:29,039

that'd be the silver and then the

866

00:30:33,590 --> 00:30:31,760

subsequent durability improvement

867

00:30:35,430 --> 00:30:33,600

structural improvement that can be

868

00:30:36,630 --> 00:30:35,440

gained from that and

869

00:30:38,950 --> 00:30:36,640

from a

870

00:30:40,630 --> 00:30:38,960

structural standpoint you have the

871

00:30:43,190 --> 00:30:40,640

improvement of

872

00:30:46,389 --> 00:30:43,200

the the actual plating that's put on the

873

00:30:48,789 --> 00:30:46,399

material itself and then there's some

874

00:30:51,190 --> 00:30:48,799

so the durability of that

875

00:30:52,149 --> 00:30:51,200

plating the durability of the structure

876

00:30:54,870 --> 00:30:52,159

the

877

00:30:57,350 --> 00:30:54,880

improvement or potential enhancement of

878

00:31:00,149 --> 00:30:57,360

joining dissimilar materials because

879

00:31:01,909 --> 00:31:00,159

there's plating and or other prepping

880

00:31:04,549 --> 00:31:01,919

processes that need to be done in order

881

00:31:07,510 --> 00:31:04,559

to to join things like titanium to

882

00:31:10,310 --> 00:31:07,520

carbon composite or titanium to steel

883

00:31:13,029 --> 00:31:10,320

so in a in a golf club you've got a very

884

00:31:14,470 --> 00:31:13,039

complex structure that undergoes a ton

885

00:31:17,029 --> 00:31:14,480

of loads i was shocked when i got in the

886

00:31:18,950 --> 00:31:17,039

industry because i came from aerospace

887

00:31:20,630 --> 00:31:18,960

and thinking you know in golf you know

888

00:31:22,230 --> 00:31:20,640

how much sciences are in golf and i was

889

00:31:24,149 --> 00:31:22,240

shocked at how many rocket scientists

890

00:31:26,149 --> 00:31:24,159

how many engineers how many technicians

891

00:31:28,870 --> 00:31:26,159

how many materials scientists are

892

00:31:30,470 --> 00:31:28,880

dedicating their work to you know making

893

00:31:32,710 --> 00:31:30,480

better structures happens to be a golf

894

00:31:34,230 --> 00:31:32,720

club it's a it's pretty serious science

895

00:31:35,190 --> 00:31:34,240

i was very impressed

896

00:31:36,230 --> 00:31:35,200

so

897

00:31:40,789 --> 00:31:36,240

those

898

00:31:42,789 --> 00:31:40,799

durability structural

899

00:31:44,870 --> 00:31:42,799

also potentially

900

00:31:46,389 --> 00:31:44,880

galvanic corrosion could be prevented

901  
00:31:48,950 --> 00:31:46,399  
because you've got dissimilar materials

902  
00:31:50,789 --> 00:31:48,960  
that are joined and you need to have a

903  
00:31:53,909 --> 00:31:50,799  
good barrier between similar to similar

904  
00:31:55,350 --> 00:31:53,919  
materials so all of that would apply to

905  
00:31:58,149 --> 00:31:55,360  
of course the golf clubs that we're

906  
00:32:00,149 --> 00:31:58,159  
looking at and any other structures that

907  
00:32:02,310 --> 00:32:00,159  
are built that way i mean things that

908  
00:32:05,110 --> 00:32:02,320  
are put in space are built with similar

909  
00:32:07,110 --> 00:32:05,120  
materials and have similar

910  
00:32:09,110 --> 00:32:07,120  
challenges in terms of the manufacturing

911  
00:32:12,230 --> 00:32:09,120  
and the assembly and the use of those

912  
00:32:13,190 --> 00:32:12,240  
structures uh automobiles airplanes i

913  
00:32:15,750 --> 00:32:13,200

mean

914

00:32:17,669 --> 00:32:15,760

there's a lot of commonality between the

915

00:32:20,470 --> 00:32:17,679

materials and structures in a golf club

916

00:32:22,389 --> 00:32:20,480

and many other things in life so

917

00:32:24,870 --> 00:32:22,399

and and i would also point to

918

00:32:26,950 --> 00:32:24,880

the rapid prototyping that's being done

919

00:32:28,789 --> 00:32:26,960

at some point

920

00:32:31,590 --> 00:32:28,799

somebody's going to want to put either a

921

00:32:33,350 --> 00:32:31,600

plating on top of that for connectivity

922

00:32:34,630 --> 00:32:33,360

right or structural improvement or

923

00:32:35,430 --> 00:32:34,640

durability

924

00:32:37,750 --> 00:32:35,440

so

925

00:32:39,590 --> 00:32:37,760

being able to plate in space in a

926  
00:32:41,909 --> 00:32:39,600  
microgravity environment is going to be

927  
00:32:43,350 --> 00:32:41,919  
important for those rapid prototype

928  
00:32:44,549 --> 00:32:43,360  
pieces that are made they won't be rapid

929  
00:32:47,029 --> 00:32:44,559  
prototypes at that point they're going

930  
00:32:49,269 --> 00:32:47,039  
to be things that we use in space

931  
00:32:50,870 --> 00:32:49,279  
so the enhancement of that product will

932  
00:32:54,630 --> 00:32:50,880  
be critical also so there's many

933  
00:33:00,630 --> 00:32:57,110  
james

934  
00:33:02,710 --> 00:33:00,640  
for explaining kind of the science

935  
00:33:04,549 --> 00:33:02,720  
elements of the golf club which was part

936  
00:33:06,789 --> 00:33:04,559  
of my question but um

937  
00:33:08,950 --> 00:33:06,799  
duane i was curious if you know

938  
00:33:12,310 --> 00:33:08,960

on your end was there any concern at all

939

00:33:13,830 --> 00:33:12,320

about perception that

940

00:33:15,509 --> 00:33:13,840

you know working on a golf club wouldn't

941

00:33:17,909 --> 00:33:15,519

necessarily be the

942

00:33:19,350 --> 00:33:17,919

most serious use of a 100 billion dollar

943

00:33:21,590 --> 00:33:19,360

laboratory

944

00:33:23,830 --> 00:33:21,600

or on the flip side is this maybe like

945

00:33:25,669 --> 00:33:23,840

one of the best opportunities yet to

946

00:33:28,870 --> 00:33:25,679

wake up the average person to the fact

947

00:33:33,269 --> 00:33:28,880

that we even have a space station

948

00:33:38,549 --> 00:33:33,279

and and mike most curious whatever

949

00:33:41,590 --> 00:33:39,909

will it will it be

950

00:33:43,110 --> 00:33:41,600

uh valuable to you guys do you intend to

951  
00:33:44,710 --> 00:33:43,120  
use um

952  
00:33:46,470 --> 00:33:44,720  
from a marketing standpoint the fact

953  
00:33:48,070 --> 00:33:46,480  
that you've been in space and

954  
00:33:49,830 --> 00:33:48,080  
and done this kind of work up on on the

955  
00:33:51,430 --> 00:33:49,840  
space station is that something where

956  
00:33:53,590 --> 00:33:51,440  
you guys expect to

957  
00:33:55,590 --> 00:33:53,600  
generate you know commercial value just

958  
00:33:56,310 --> 00:33:55,600  
by being up there

959  
00:33:58,389 --> 00:33:56,320  
so

960  
00:33:59,669 --> 00:33:58,399  
i i honestly i'm hoping that whatever

961  
00:34:01,830 --> 00:33:59,679  
comes out of this will straighten out my

962  
00:34:03,350 --> 00:34:01,840  
slice so i guess uh

963  
00:34:05,350 --> 00:34:03,360

i'm a little biased

964

00:34:06,630 --> 00:34:05,360

in the research

965

00:34:08,869 --> 00:34:06,640

um but

966

00:34:10,149 --> 00:34:08,879

no i first and foremost

967

00:34:11,190 --> 00:34:10,159

i think the way we need to look at this

968

00:34:16,869 --> 00:34:11,200

is

969

00:34:19,829 --> 00:34:16,879

industrial research and development on

970

00:34:21,270 --> 00:34:19,839

materials that is clearly targeted for

971

00:34:22,710 --> 00:34:21,280

the improvement of products that will go

972

00:34:25,589 --> 00:34:22,720

into the marketplace

973

00:34:27,030 --> 00:34:25,599

and and honestly this is one example um

974

00:34:29,190 --> 00:34:27,040

probably one of the best examples to

975

00:34:31,109 --> 00:34:29,200

date that i can think of really

976  
00:34:33,109 --> 00:34:31,119  
illustrates the mission of cases and

977  
00:34:36,069 --> 00:34:33,119  
that is looking at how

978  
00:34:37,990 --> 00:34:36,079  
r d in a national laboratory has

979  
00:34:39,270 --> 00:34:38,000  
terrestrial impact direct

980  
00:34:41,030 --> 00:34:39,280  
there's no questions about it what

981  
00:34:42,710 --> 00:34:41,040  
they're doing they're spending their own

982  
00:34:44,149 --> 00:34:42,720  
capital and their own money to do

983  
00:34:46,710 --> 00:34:44,159  
industrial research and development that

984  
00:34:47,750 --> 00:34:46,720  
will tie into their product enhancement

985  
00:34:50,230 --> 00:34:47,760  
and will need to be sold on the

986  
00:34:52,790 --> 00:34:50,240  
marketplace um this is a for-profit

987  
00:34:54,310 --> 00:34:52,800  
company and um we're really excited that

988  
00:34:55,750 --> 00:34:54,320

this research may translate into a

989

00:34:58,390 --> 00:34:55,760

product maybe it will be a golf club

990

00:35:00,150 --> 00:34:58,400

maybe it'll be something else um but yet

991

00:35:02,870 --> 00:35:00,160

james you're absolutely right this is

992

00:35:04,310 --> 00:35:02,880

also a great opportunity for us as part

993

00:35:05,990 --> 00:35:04,320

of our other mission within cases to

994

00:35:08,150 --> 00:35:06,000

conduct the outreach and advocacy and

995

00:35:10,069 --> 00:35:08,160

awareness of the iss and the iss

996

00:35:12,390 --> 00:35:10,079

national laboratory and what better

997

00:35:14,470 --> 00:35:12,400

story to tell that there is a

998

00:35:17,589 --> 00:35:14,480

recreational

999

00:35:20,550 --> 00:35:17,599

company um who is investing

1000

00:35:23,750 --> 00:35:20,560

their own r d dollars in hopes of

1001  
00:35:25,190 --> 00:35:23,760  
improving their products and yes we will

1002  
00:35:27,030 --> 00:35:25,200  
probably both capitalize on the brand

1003  
00:35:28,790 --> 00:35:27,040  
that may be created as a secondary

1004  
00:35:30,550 --> 00:35:28,800  
result of the significant research

1005  
00:35:31,589 --> 00:35:30,560  
that's taken place

1006  
00:35:32,310 --> 00:35:31,599  
yeah

1007  
00:35:35,270 --> 00:35:32,320  
and

1008  
00:35:37,270 --> 00:35:35,280  
your question on marketing uh

1009  
00:35:39,430 --> 00:35:37,280  
i can tell you we've got in our building

1010  
00:35:40,790 --> 00:35:39,440  
probably 30 to 40 people totally

1011  
00:35:42,870 --> 00:35:40,800  
dedicated to

1012  
00:35:45,109 --> 00:35:42,880  
you know the science and the

1013  
00:35:46,550 --> 00:35:45,119

manufacturing the engineering the design

1014

00:35:48,630 --> 00:35:46,560

of the product and you've got a handful

1015

00:35:50,310 --> 00:35:48,640

of marketing people and and they've got

1016

00:35:52,870 --> 00:35:50,320

to figure out at times how to make what

1017

00:35:54,390 --> 00:35:52,880

we do more interesting i mean it's very

1018

00:35:56,390 --> 00:35:54,400

interesting to engineers and scientists

1019

00:35:58,710 --> 00:35:56,400

right we we love what we're doing the

1020

00:36:00,230 --> 00:35:58,720

average golfer it might escape them a

1021

00:36:01,829 --> 00:36:00,240

little bit because like dwayne said he

1022

00:36:03,349 --> 00:36:01,839

just wants to reduce the slice well

1023

00:36:05,190 --> 00:36:03,359

there's a ton of science that goes into

1024

00:36:06,870 --> 00:36:05,200

doing that and so when the marketing

1025

00:36:08,630 --> 00:36:06,880

people see it and they say so we'll

1026  
00:36:10,950 --> 00:36:08,640  
actually be able to say we've done some

1027  
00:36:12,310 --> 00:36:10,960  
research that was significant and

1028  
00:36:13,910 --> 00:36:12,320  
again i'm going to emphasize its

1029  
00:36:15,670 --> 00:36:13,920  
research right that's the whole point of

1030  
00:36:17,510 --> 00:36:15,680  
this it is research we don't know if

1031  
00:36:18,790 --> 00:36:17,520  
we're going to see an improvement a

1032  
00:36:21,030 --> 00:36:18,800  
degradation

1033  
00:36:22,870 --> 00:36:21,040  
we're assuming not assuming we know

1034  
00:36:24,870 --> 00:36:22,880  
we'll see a change

1035  
00:36:26,790 --> 00:36:24,880  
the hypothesis we'll see is we'll see an

1036  
00:36:28,470 --> 00:36:26,800  
improvement and back to the marketing

1037  
00:36:30,390 --> 00:36:28,480  
guys you know being able to say hey we

1038  
00:36:33,109 --> 00:36:30,400

did some research that we couldn't do

1039

00:36:35,430 --> 00:36:33,119

here on earth that help us make a better

1040

00:36:37,670 --> 00:36:35,440

material that happens to be used in a

1041

00:36:40,230 --> 00:36:37,680

golf club you know they can't think of

1042

00:36:42,710 --> 00:36:40,240

anything better in order to you know

1043

00:36:45,430 --> 00:36:42,720

excite someone and get them interested

1044

00:36:47,270 --> 00:36:45,440

into something that you know it looks

1045

00:36:49,109 --> 00:36:47,280

like you know it's a metal object

1046

00:36:50,870 --> 00:36:49,119

sitting there right

1047

00:36:52,630 --> 00:36:50,880

there's so much science that goes into

1048

00:36:53,990 --> 00:36:52,640

it and our job is to you know make it a

1049

00:36:55,589 --> 00:36:54,000

great golf club and then some people

1050

00:36:57,510 --> 00:36:55,599

have to you know talk about it and get

1051  
00:36:59,829 --> 00:36:57,520  
people interested in it so they're

1052  
00:37:02,630 --> 00:36:59,839  
highly interested in leveraging the made

1053  
00:37:04,069 --> 00:37:02,640  
in space portion of this and that's a

1054  
00:37:05,750 --> 00:37:04,079  
good point i think

1055  
00:37:07,589 --> 00:37:05,760  
we actually want to capitalize on the

1056  
00:37:09,750 --> 00:37:07,599  
brand awareness that this can create

1057  
00:37:11,430 --> 00:37:09,760  
again for our our own personal interests

1058  
00:37:13,510 --> 00:37:11,440  
which is um creating awareness of the

1059  
00:37:15,109 --> 00:37:13,520  
iss but also promoting

1060  
00:37:17,510 --> 00:37:15,119  
what can come from utilization of the

1061  
00:37:19,990 --> 00:37:17,520  
iss and so cases has invested in

1062  
00:37:22,150 --> 00:37:20,000  
trademarking a brand which is spaces and

1063  
00:37:24,150 --> 00:37:22,160

as mike mentions and we're hopeful that

1064

00:37:25,670 --> 00:37:24,160  
as a result of this research and

1065

00:37:26,790 --> 00:37:25,680  
ultimately that technology being

1066

00:37:28,470 --> 00:37:26,800  
deployed

1067

00:37:29,990 --> 00:37:28,480  
into a product that's sold on the market

1068

00:37:31,589 --> 00:37:30,000  
that that brand

1069

00:37:36,150 --> 00:37:31,599  
will be a part of that and that we will

1070

00:37:40,069 --> 00:37:37,430  
ken did you have another question yeah

1071

00:37:42,470 --> 00:37:40,079  
hi ken kramer for america's space for uh

1072

00:37:44,870 --> 00:37:42,480  
novartis i'm wondering if is this your

1073

00:37:46,390 --> 00:37:44,880  
first experiment on the iss or do you

1074

00:37:49,109 --> 00:37:46,400  
have others what are your plans for the

1075

00:37:51,750 --> 00:37:49,119  
future and and your research will help

1076

00:37:54,069 --> 00:37:51,760

um not just people on the ground but you

1077

00:37:55,910 --> 00:37:54,079

expect it to have applicability to the

1078

00:37:57,829 --> 00:37:55,920

astronauts and perhaps long duration

1079

00:38:00,550 --> 00:37:57,839

space flight thanks

1080

00:38:02,390 --> 00:38:00,560

absolutely so um this is my first

1081

00:38:04,069 --> 00:38:02,400

involvement in an experiment i can't

1082

00:38:05,670 --> 00:38:04,079

speaking to whether or not we've conducted

1083

00:38:09,349 --> 00:38:05,680

others but for our muscle group this is

1084

00:38:12,550 --> 00:38:09,359

absolutely the first first one for us

1085

00:38:15,190 --> 00:38:12,560

and in terms of applications for space

1086

00:38:17,589 --> 00:38:15,200

travel i think

1087

00:38:19,349 --> 00:38:17,599

really we're really excited about

1088

00:38:21,510 --> 00:38:19,359

the opportunity to

1089

00:38:23,109 --> 00:38:21,520

be in an environment where muscle

1090

00:38:24,630 --> 00:38:23,119

atrophy occurs

1091

00:38:27,349 --> 00:38:24,640

i spend a lot of my time in the lab

1092

00:38:30,230 --> 00:38:27,359

creating artificially muscle atrophy so

1093

00:38:31,510 --> 00:38:30,240

to be able to get data from a

1094

00:38:34,470 --> 00:38:31,520

research

1095

00:38:36,230 --> 00:38:34,480

station that that happens naturally it's

1096

00:38:37,910 --> 00:38:36,240

kind of it's very exciting for us

1097

00:38:39,109 --> 00:38:37,920

because it will really lead to some sort

1098

00:38:41,190 --> 00:38:39,119

of future

1099

00:38:42,790 --> 00:38:41,200

understandings that maybe perhaps

1100

00:38:45,990 --> 00:38:42,800

through our artificial creation on earth

1101  
00:38:47,349 --> 00:38:46,000  
we don't necessarily catch or observe

1102  
00:38:49,430 --> 00:38:47,359  
but i do see

1103  
00:38:50,390 --> 00:38:49,440  
sort of not just a patient benefit on

1104  
00:38:53,109 --> 00:38:50,400  
earth but

1105  
00:38:54,390 --> 00:38:53,119  
for long term space man space flight

1106  
00:38:55,270 --> 00:38:54,400  
it's definitely going to be something

1107  
00:38:57,349 --> 00:38:55,280  
that

1108  
00:38:58,550 --> 00:38:57,359  
you know muscle loss and bone loss will

1109  
00:39:00,310 --> 00:38:58,560  
definitely need to be something that's

1110  
00:39:01,990 --> 00:39:00,320  
addressed and hopefully you know this is

1111  
00:39:04,390 --> 00:39:02,000  
the first step in starting to answer

1112  
00:39:06,150 --> 00:39:04,400  
some of those questions

1113  
00:39:07,990 --> 00:39:06,160

marcia

1114

00:39:09,430 --> 00:39:08,000

press with a golf and a printer question

1115

00:39:10,950 --> 00:39:09,440

um could you explain what are the

1116

00:39:12,230 --> 00:39:10,960

samples that you're flying how big are

1117

00:39:14,710 --> 00:39:12,240

they how many

1118

00:39:15,990 --> 00:39:14,720

um and do they come back on this dragon

1119

00:39:17,589 --> 00:39:16,000

and the same for the printer how long

1120

00:39:20,470 --> 00:39:17,599

will your printer stay up and when does

1121

00:39:22,150 --> 00:39:20,480

the next version go up

1122

00:39:24,390 --> 00:39:22,160

so that the parts that we're going to

1123

00:39:26,470 --> 00:39:24,400

fly will be there'll be 20 of them and

1124

00:39:28,310 --> 00:39:26,480

they're roughly about

1125

00:39:29,829 --> 00:39:28,320

say 50 millimeters in diameter about 10

1126

00:39:31,990 --> 00:39:29,839

millimeters tall

1127

00:39:34,390 --> 00:39:32,000

and they'll be in two separate

1128

00:39:36,710 --> 00:39:34,400

experiments so we're doing two separate

1129

00:39:39,670 --> 00:39:36,720

plating durations and those parts will

1130

00:39:41,430 --> 00:39:39,680

be coming down um on a subsequent flight

1131

00:39:43,430 --> 00:39:41,440

they will not come back on the on the

1132

00:39:46,069 --> 00:39:43,440

same capsule to come back on a

1133

00:39:48,310 --> 00:39:46,079

subsequent flight

1134

00:39:50,870 --> 00:39:48,320

for the 3d printer we have no plans

1135

00:39:53,030 --> 00:39:50,880

actually to return the printer itself

1136

00:39:55,030 --> 00:39:53,040

for the first initial parts it is

1137

00:39:56,550 --> 00:39:55,040

absolutely time critical

1138

00:39:58,630 --> 00:39:56,560

that we get those back as soon as

1139

00:40:00,390 --> 00:39:58,640

possible and the reason why is i

1140

00:40:02,150 --> 00:40:00,400

mentioned earlier those very first

1141

00:40:03,829 --> 00:40:02,160

initial coupons

1142

00:40:06,310 --> 00:40:03,839

even though we'll get some some

1143

00:40:07,910 --> 00:40:06,320

preliminary feedback from the video

1144

00:40:09,190 --> 00:40:07,920

we really need to test those on the

1145

00:40:11,030 --> 00:40:09,200

ground and compare them to the ground

1146

00:40:12,950 --> 00:40:11,040

controls and we have a test matrix for

1147

00:40:15,190 --> 00:40:12,960

doing just that and the sooner we get

1148

00:40:16,950 --> 00:40:15,200

those back we can close out the final

1149

00:40:19,109 --> 00:40:16,960

design of the additive manufacturing

1150

00:40:21,190 --> 00:40:19,119

facility the commercial facility

1151

00:40:22,550 --> 00:40:21,200

that will follow

1152

00:40:24,390 --> 00:40:22,560

so we're hoping to get those back on the

1153

00:40:27,109 --> 00:40:24,400

first available

1154

00:40:29,109 --> 00:40:27,119

flight home spacex 5 would probably be

1155

00:40:30,390 --> 00:40:29,119

the first opportunity as far as the

1156

00:40:32,710 --> 00:40:30,400

printer

1157

00:40:34,310 --> 00:40:32,720

up

1158

00:40:36,710 --> 00:40:34,320

we're looking at the possibility of

1159

00:40:38,150 --> 00:40:36,720

leaving the tech demo on orbit because

1160

00:40:40,390 --> 00:40:38,160

we'll want to continue testing other

1161

00:40:42,630 --> 00:40:40,400

materials maybe

1162

00:40:46,069 --> 00:40:42,640

we might tweak the way we handle some of

1163

00:40:47,910 --> 00:40:46,079

our operations or some of our modularity

1164

00:40:49,190 --> 00:40:47,920

we're looking at ways to do in-space

1165

00:40:51,030 --> 00:40:49,200

metals

1166

00:40:54,150 --> 00:40:51,040

we're also looking at ways that we can

1167

00:40:57,510 --> 00:40:54,160

use a regular simulant a lunar or

1168

00:40:59,030 --> 00:40:57,520

martian simulant to 3d print and and

1169

00:41:00,710 --> 00:40:59,040

just like with the plastic there's no

1170

00:41:03,030 --> 00:41:00,720

other place to do that besides space

1171

00:41:05,109 --> 00:41:03,040

station so leaving the technology

1172

00:41:06,790 --> 00:41:05,119

demonstration on board to do just that

1173

00:41:09,270 --> 00:41:06,800

to continue demonstrating different

1174

00:41:13,430 --> 00:41:09,280

technologies would be ideal um in in

1175

00:41:16,710 --> 00:41:14,950

when do you think it's the earliest that

1176

00:41:20,870 --> 00:41:16,720

you're the next version of the printer

1177

00:41:22,150 --> 00:41:20,880

and 2015 is the goal mid to late

1178

00:41:23,829 --> 00:41:22,160

obviously we still have to go through

1179

00:41:24,790 --> 00:41:23,839

the same flight certification maiden

1180

00:41:27,430 --> 00:41:24,800

space will be going through the same

1181

00:41:31,349 --> 00:41:27,440

flight certification and safety protocol

1182

00:41:34,390 --> 00:41:32,710

okay

1183

00:41:36,309 --> 00:41:34,400

we have time for one final question here

1184

00:41:38,309 --> 00:41:36,319

in the front

1185

00:41:39,750 --> 00:41:38,319

hey this is megan again with space.com i

1186

00:41:42,230 --> 00:41:39,760

just have a follow-up question about the

1187

00:41:43,750 --> 00:41:42,240

3d printing um so when the coupons come

1188

00:41:45,349 --> 00:41:43,760

back to the ground how will you test

1189

00:41:46,470 --> 00:41:45,359

them what kinds of changes are you going

1190

00:41:49,190 --> 00:41:46,480

to look for

1191

00:41:53,109 --> 00:41:49,200

so we actually have a a b basis test

1192

00:41:54,390 --> 00:41:53,119

matrix um we use the astm standards

1193

00:41:56,309 --> 00:41:54,400

and we have our ground controls that

1194

00:41:57,910 --> 00:41:56,319

were printed on the exact same printer

1195

00:41:59,510 --> 00:41:57,920

before flight

1196

00:42:01,750 --> 00:41:59,520

so we have our added manufacturing

1197

00:42:04,069 --> 00:42:01,760

facility there at marshall space flight

1198

00:42:06,470 --> 00:42:04,079

center the labs they've actually been

1199

00:42:08,390 --> 00:42:06,480

been doing this since about 1999 when

1200

00:42:10,630 --> 00:42:08,400

our principal investigator ken cooper

1201  
00:42:12,390 --> 00:42:10,640  
first flew a parabolic flight and so

1202  
00:42:13,750 --> 00:42:12,400  
they have a very detailed protocol and

1203  
00:42:15,030 --> 00:42:13,760  
test matrix

1204  
00:42:16,470 --> 00:42:15,040  
but it's the things that you might

1205  
00:42:18,710 --> 00:42:16,480  
imagine to see if there are any material

1206  
00:42:20,230 --> 00:42:18,720  
characterization changes we're

1207  
00:42:22,390 --> 00:42:20,240  
particularly interested in the

1208  
00:42:24,470 --> 00:42:22,400  
mechanical properties obviously

1209  
00:42:26,630 --> 00:42:24,480  
to be able to use this material for

1210  
00:42:30,790 --> 00:42:26,640  
various utilization capabilities of

1211  
00:42:34,390 --> 00:42:32,790  
duane do uh you or any anyone else on

1212  
00:42:35,670 --> 00:42:34,400  
the panel have any uh closing remarks

1213  
00:42:38,230 --> 00:42:35,680

before we

1214

00:42:40,069 --> 00:42:38,240

yeah we have been waiting for this

1215

00:42:42,550 --> 00:42:40,079

flight for quite some time and we're

1216

00:42:44,470 --> 00:42:42,560

very excited for spacex for as i

1217

00:42:45,510 --> 00:42:44,480

mentioned when we opened up this this

1218

00:42:47,510 --> 00:42:45,520

afternoon

1219

00:42:49,829 --> 00:42:47,520

this morning actually um this panel

1220

00:42:51,349 --> 00:42:49,839

actually represents uh the diversity of

1221

00:42:53,510 --> 00:42:51,359

the research that we have uh going on

1222

00:42:54,550 --> 00:42:53,520

but i'll also mention very quickly that

1223

00:42:56,870 --> 00:42:54,560

um

1224

00:42:59,349 --> 00:42:56,880

in support of our earlier mission on

1225

00:43:01,190 --> 00:42:59,359

spacex 3 where we delivered

1226

00:43:03,829 --> 00:43:01,200

six protein crystallization experiments

1227

00:43:05,430 --> 00:43:03,839

we have two additional ones that will be

1228

00:43:08,230 --> 00:43:05,440

delivered on this flight one is with the

1229

00:43:10,069 --> 00:43:08,240

broad institute out of mit they are

1230

00:43:12,470 --> 00:43:10,079

working on a new platform that has been

1231

00:43:14,309 --> 00:43:12,480

developed by nanoracks and emerald bio

1232

00:43:16,069 --> 00:43:14,319

again it represents commercially

1233

00:43:18,150 --> 00:43:16,079

available off-the-shelf state-of-the-art

1234

00:43:20,230 --> 00:43:18,160

technology that's used in ground labs

1235

00:43:22,470 --> 00:43:20,240

and we're looking to to conduct some

1236

00:43:24,630 --> 00:43:22,480

proprietary protein crystal studies on

1237

00:43:26,950 --> 00:43:24,640

that we also have a follow-on study from

1238

00:43:28,870 --> 00:43:26,960

one of our original investigators and

1239

00:43:30,150 --> 00:43:28,880

when spacex 4 returns we have three of

1240

00:43:31,829 --> 00:43:30,160

our customers coming back from that

1241

00:43:33,670 --> 00:43:31,839

spacex 3

1242

00:43:35,670 --> 00:43:33,680

launch we also have the veterans

1243

00:43:38,470 --> 00:43:35,680

administration as a

1244

00:43:41,510 --> 00:43:38,480

customer looking at some

1245

00:43:43,430 --> 00:43:41,520

drug studies on model organisms and so

1246

00:43:45,430 --> 00:43:43,440

that is part of our other government

1247

00:43:46,309 --> 00:43:45,440

agency support that we are

1248

00:43:47,270 --> 00:43:46,319

also

1249

00:43:48,790 --> 00:43:47,280

under

1250

00:43:50,470 --> 00:43:48,800

the cooperative agreement where we're

1251

00:43:52,069 --> 00:43:50,480

required to support

1252

00:43:53,750 --> 00:43:52,079

so we have a lot of opportunities going

1253

00:43:56,150 --> 00:43:53,760

up on this one we're really excited for

1254

00:43:57,430 --> 00:43:56,160

it so uh we can't wait for uh launch on

1255

00:43:59,349 --> 00:43:57,440

saturday

1256

00:44:01,589 --> 00:43:59,359

yeah it's going to be exciting i think

1257

00:44:03,270 --> 00:44:01,599

you can see everybody is excited we have

1258

00:44:05,589 --> 00:44:03,280

uh we also have a video that we're going

1259

00:44:07,109 --> 00:44:05,599

to play uh when we're done here that

1260

00:44:08,150 --> 00:44:07,119

talks a little bit more about cases and

1261

00:44:11,990 --> 00:44:08,160

some of the

1262

00:44:13,910 --> 00:44:12,000

investigations that you brought forth

1263

00:44:15,589 --> 00:44:13,920

so we look forward to that as well

1264

00:44:17,990 --> 00:44:15,599

coming up at 11 o'clock we'll have a

1265

00:44:19,510 --> 00:44:18,000

briefing today on model organisms and

1266

00:44:21,510 --> 00:44:19,520

you can keep track of all of the

1267

00:44:24,309 --> 00:44:21,520

research and everything that's leading

1268

00:44:26,630 --> 00:44:24,319

toward the launch of the spacex crs4

1269

00:44:30,230 --> 00:44:26,640

launch which currently is slated for 2