

Science On Board CRS-15



NASA briefing about science launching to the Space Station,
including ECOSTRESS

Thursday, June 28 at 8 a.m. PT (11 a.m. ET, 1500 UTC)

[#AskNASA](#)
[#ECOSTRESS](#)



Jet Propulsion Laboratory
California Institute of Technology

1
00:00:06,230 --> 00:00:02,450
250 science and research investigations

2
00:00:07,369 --> 00:00:06,240
that will occur on expedition 56 today

3
00:00:08,600 --> 00:00:07,379
we're going to hear from some of the

4
00:00:10,879 --> 00:00:08,610
people that have worked to make this

5
00:00:13,430 --> 00:00:10,889
mission a success if you have any

6
00:00:16,310 --> 00:00:13,440
questions for us out there in TV land

7
00:00:19,580 --> 00:00:16,320
please reach out via twitter at hashtag

8
00:00:21,200 --> 00:00:19,590
ask NASA and to begin our program we're

9
00:00:23,300 --> 00:00:21,210
going to see a video from the Center for

10
00:00:26,710 --> 00:00:23,310
the Advancement of science at space

11
00:00:29,900 --> 00:00:26,720
often refer to as cases the National Lab

12
00:00:37,819 --> 00:00:29,910
is run by cases on the International

13
00:00:40,340 --> 00:00:37,829

Space Station this launch represents the

14

00:00:42,080 --> 00:00:40,350

15th resupply mission by SpaceX to the

15

00:00:43,430 --> 00:00:42,090

International Space Station this mission

16

00:00:44,840 --> 00:00:43,440

is truly packed with an incredible

17

00:00:47,900 --> 00:00:44,850

amount of research that has the capacity

18

00:00:49,100 --> 00:00:47,910

benefit life on Earth let's find out a

19

00:00:50,720 --> 00:00:49,110

little bit more about some of the

20

00:00:52,459 --> 00:00:50,730

payloads that are destined to the space

21

00:00:57,080 --> 00:00:52,469

station on this mission sponsored by the

22

00:01:01,280 --> 00:00:59,540

ngx is an innovative startup based in

23

00:01:03,710 --> 00:01:01,290

cambridge massachusetts looking to

24

00:01:05,780 --> 00:01:03,720

improve cancer patient care ngx has

25

00:01:07,550 --> 00:01:05,790

created a novel cancer therapy targeting

26

00:01:10,400 --> 00:01:07,560

a protein in the proliferation of

27

00:01:12,620 --> 00:01:10,410

endothelial cells which line the walls

28

00:01:14,360 --> 00:01:12,630

of blood vessels this project seeks to

29

00:01:16,760 --> 00:01:14,370

evaluate if these cells culture to

30

00:01:18,830 --> 00:01:16,770

microgravity represent a valid system to

31

00:01:23,120 --> 00:01:18,840

test the effects of vascular targeted

32

00:01:24,500 --> 00:01:23,130

cancer drugs on normal blood vessels the

33

00:01:27,260 --> 00:01:24,510

University of Florida has a rich history

34

00:01:28,820 --> 00:01:27,270

in plant biology research now a new

35

00:01:30,700 --> 00:01:28,830

University of Florida plant biology

36

00:01:32,780 --> 00:01:30,710

investigation seeks to develop

37

00:01:35,000 --> 00:01:32,790

electrochemical cells suitable for

38

00:01:36,920 --> 00:01:35,010

spaceflight to study instability under

39

00:01:38,690 --> 00:01:36,930

microgravity conditions the

40

00:01:41,030 --> 00:01:38,700

investigation could ultimately develop

41

00:01:42,890 --> 00:01:41,040

algae that can help sustain both a low

42

00:01:46,790 --> 00:01:42,900

Earth orbit space economy and long

43

00:01:48,200 --> 00:01:46,800

duration deep space missions the

44

00:01:50,150 --> 00:01:48,210

University of California Santa Barbara

45

00:01:52,370 --> 00:01:50,160

in association with the National Science

46

00:01:53,960 --> 00:01:52,380

Foundation is sending a project focused

47

00:01:57,070 --> 00:01:53,970

on the study of forces between particles

48

00:01:59,330 --> 00:01:57,080

they cluster together in microgravity

49

00:02:01,639 --> 00:01:59,340

investigators can observe how particles

50

00:02:03,620 --> 00:02:01,649

cluster over long timescales without

51
00:02:05,930 --> 00:02:03,630
gravitational settling which complicates

52
00:02:07,460 --> 00:02:05,940
measurements taken under this work has

53
00:02:08,719 --> 00:02:07,470
several important applications that will

54
00:02:10,820 --> 00:02:08,729
benefit life on Earth including

55
00:02:12,980 --> 00:02:10,830
ecosystem modeling deep water

56
00:02:16,040 --> 00:02:12,990
hydrocarbon exploration sequestration

57
00:02:19,400 --> 00:02:16,050
and mobilization of contaminants among

58
00:02:21,170 --> 00:02:19,410
others there are multiple student

59
00:02:23,300 --> 00:02:21,180
organizations supporting education

60
00:02:24,920 --> 00:02:23,310
investigations intended to stimulate and

61
00:02:26,990 --> 00:02:24,930
engage the next generation on this

62
00:02:28,580 --> 00:02:27,000
mission one such group is the student

63
00:02:30,559 --> 00:02:28,590

Space Flight experiments program in

64

00:02:31,730 --> 00:02:30,569

partnership with dream up and hardware

65

00:02:33,650 --> 00:02:31,740

developer NanoRacks

66

00:02:35,960 --> 00:02:33,660

this collection of students around the

67

00:02:39,750 --> 00:02:35,970

world will send over 30 separate student

68

00:02:43,420 --> 00:02:41,949

this is just a small portion of the

69

00:02:45,130 --> 00:02:43,430

incredible amount of research that it's

70

00:02:46,960 --> 00:02:45,140

destined for the space station as part

71

00:02:48,520 --> 00:02:46,970

of this mission to learn more about all

72

00:02:49,899 --> 00:02:48,530

the payloads on this mission or to learn

73

00:02:53,110 --> 00:02:49,909

how to become part of the space station

74

00:03:02,619 --> 00:02:53,120

research community visit ISS - cases

75

00:03:04,960 --> 00:03:02,629

ordered from NASA's Johnson Space Center

76
00:03:06,399 --> 00:03:04,970
please welcome David Brady the assistant

77
00:03:09,369 --> 00:03:06,409
program scientist for the International

78
00:03:11,349 --> 00:03:09,379
Space Station program and the deputy

79
00:03:16,270 --> 00:03:11,359
chief scientist from cases dr. Mike

80
00:03:18,220 --> 00:03:16,280
Roberts thanks Greg appreciate it hey

81
00:03:20,110 --> 00:03:18,230
I'm happy to hear you all see y'all here

82
00:03:21,369 --> 00:03:20,120
today it's wonderful to have a packed

83
00:03:23,589 --> 00:03:21,379
room even though I'm sorry we couldn't

84
00:03:25,629 --> 00:03:23,599
give you all seats but it's really neat

85
00:03:27,309 --> 00:03:25,639
to see the interest here I'm gonna talk

86
00:03:29,080 --> 00:03:27,319
a little bit about perspective I'm not

87
00:03:30,580 --> 00:03:29,090
gonna talk so much about the details of

88
00:03:32,080 --> 00:03:30,590

the research investigations I'm going to

89

00:03:34,030 --> 00:03:32,090

leave that to the investigators to talk

90

00:03:35,800 --> 00:03:34,040

about but I was thinking about my flight

91

00:03:37,179 --> 00:03:35,810

out here from Houston to Orlando some

92

00:03:39,789 --> 00:03:37,189

different things first of all how the

93

00:03:43,360 --> 00:03:39,799

human mind seeks to understand things

94

00:03:44,979 --> 00:03:43,370

how we seek to create new things and a

95

00:03:46,240 --> 00:03:44,989

lot of times we get that from a change

96

00:03:48,009 --> 00:03:46,250

of perspective or a change of

97

00:03:49,990 --> 00:03:48,019

environment and that's one of the things

98

00:03:51,400 --> 00:03:50,000

that the lab aboard the International

99

00:03:52,559 --> 00:03:51,410

Space Station provides is that we

100

00:03:54,729 --> 00:03:52,569

provide a unique environment

101
00:03:56,830 --> 00:03:54,739
specifically microgravity space

102
00:03:58,569 --> 00:03:56,840
radiation and for external payloads a

103
00:04:01,390 --> 00:03:58,579
vantage point and the external

104
00:04:02,649 --> 00:04:01,400
environment as well so some of the

105
00:04:04,869 --> 00:04:02,659
things I was thinking about coming out

106
00:04:07,300 --> 00:04:04,879
here with regards to the the folks we

107
00:04:08,409 --> 00:04:07,310
have here today is the first thing I was

108
00:04:10,899 --> 00:04:08,419
thinking is you know when I first

109
00:04:12,580 --> 00:04:10,909
started flying on an airliner telephones

110
00:04:15,039 --> 00:04:12,590
were things that hung off of walls and

111
00:04:16,330 --> 00:04:15,049
sat on tables and an address book and a

112
00:04:18,580 --> 00:04:16,340
calendar was something you pulled out a

113
00:04:20,170 --> 00:04:18,590

pin and you wrote in - and a camera you

114

00:04:22,029 --> 00:04:20,180

stuck film in it then you took it down

115

00:04:24,939 --> 00:04:22,039

to you know drugstore to get it get it

116

00:04:26,500 --> 00:04:24,949

to process but now we all have this

117

00:04:29,649 --> 00:04:26,510

little thing that you could rightfully

118

00:04:31,089 --> 00:04:29,659

call a mobile companion that we use in

119

00:04:33,610 --> 00:04:31,099

our everyday lives for all these

120

00:04:35,050 --> 00:04:33,620

functions and even more so I'm excited

121

00:04:36,939 --> 00:04:35,060

that today y'all are going to hear from

122

00:04:39,129 --> 00:04:36,949

some folks on the mobile companion

123

00:04:41,080 --> 00:04:39,139

investigation to talk about how we're

124

00:04:43,450 --> 00:04:41,090

going to take hardware and software and

125

00:04:45,070 --> 00:04:43,460

apply that to provide a mobile companion

126

00:04:47,200 --> 00:04:45,080

for our flight crews in order to make

127

00:04:49,209 --> 00:04:47,210

their lives safer make their work more

128

00:04:51,310 --> 00:04:49,219

efficient and hopefully in the future

129

00:04:53,170 --> 00:04:51,320

make their environment more pleasant as

130

00:04:54,880 --> 00:04:53,180

well so

131

00:04:56,980 --> 00:04:54,890

of course I'm working on my cellphone on

132

00:04:58,450 --> 00:04:56,990

the airliner and I'm up at 39,000 feet

133

00:05:00,940 --> 00:04:58,460

and I'm sitting there you know munching

134

00:05:02,800 --> 00:05:00,950

on my pretzel and you know pretzel is

135

00:05:04,810 --> 00:05:02,810

actually a really simple thing but

136

00:05:07,570 --> 00:05:04,820

there's a lot of science and engineering

137

00:05:09,280 --> 00:05:07,580

this little guy here I mean if you think

138

00:05:11,290 --> 00:05:09,290

about it there's a biology there's

139

00:05:14,170 --> 00:05:11,300

chemistry and there's physics in this

140

00:05:16,390 --> 00:05:14,180

because at some point someone had to say

141

00:05:18,430 --> 00:05:16,400

hey I think I'm gonna go grab that fruit

142

00:05:20,140 --> 00:05:18,440

off that plant in the field and I'm

143

00:05:22,690 --> 00:05:20,150

gonna haul it in and I'm gonna grind it

144

00:05:25,120 --> 00:05:22,700

up and then I'm gonna chemically mix it

145

00:05:26,650 --> 00:05:25,130

with some other substances and then I'm

146

00:05:28,570 --> 00:05:26,660

gonna apply heat to it and I'm gonna

147

00:05:30,240 --> 00:05:28,580

create something that's useful and tasty

148

00:05:32,380 --> 00:05:30,250

you know something that I like and so

149

00:05:34,120 --> 00:05:32,390

fortunately we've gotten smarter in

150

00:05:36,340 --> 00:05:34,130

nowadays it doesn't take us years and

151
00:05:38,320 --> 00:05:36,350
years and years to develop an item but

152
00:05:40,000 --> 00:05:38,330
what are the investigations you're gonna

153
00:05:42,670 --> 00:05:40,010
see today they're gonna use the unique

154
00:05:44,920 --> 00:05:42,680
microgravity environment onboard the

155
00:05:46,960 --> 00:05:44,930
space station in order to study the

156
00:05:48,040 --> 00:05:46,970
physics of nanotubes so chemical Gardens

157
00:05:50,950 --> 00:05:48,050
will be come in to talk to y'all about

158
00:05:52,990 --> 00:05:50,960
that a little bit later so again I'm on

159
00:05:54,460 --> 00:05:53,000
the airliner I'm up at 39,000 feet I'm

160
00:05:56,670 --> 00:05:54,470
working on my cell phone I'm eating my

161
00:05:59,050 --> 00:05:56,680
pretzels and I'm looking out the window

162
00:06:00,730 --> 00:05:59,060
looking out the window is not something

163
00:06:01,870 --> 00:06:00,740

I've done my entire business life

164

00:06:04,300 --> 00:06:01,880

because when I first started doing

165

00:06:05,920 --> 00:06:04,310

business travel my inclination was no I

166

00:06:08,440 --> 00:06:05,930

want to sit on the aisle and wear the

167

00:06:11,350 --> 00:06:08,450

snack tray is the trash can is you know

168

00:06:12,580 --> 00:06:11,360

the restrooms are and all that once my

169

00:06:14,560 --> 00:06:12,590

daughter started flying though she

170

00:06:15,490 --> 00:06:14,570

always wanted to sit by the window and I

171

00:06:16,960 --> 00:06:15,500

said why do you want to sit by the

172

00:06:19,810 --> 00:06:16,970

window and she says because of the

173

00:06:21,250 --> 00:06:19,820

awesome view so that's one of the things

174

00:06:22,750 --> 00:06:21,260

we provided with Space Station

175

00:06:25,000 --> 00:06:22,760

especially for our earth science and our

176
00:06:26,500 --> 00:06:25,010
space science folks is the awesome view

177
00:06:28,710 --> 00:06:26,510
of Earth and you're gonna hear from the

178
00:06:30,400 --> 00:06:28,720
Eco stress folks today about their

179
00:06:33,310 --> 00:06:30,410
investigation they're doing the research

180
00:06:34,930 --> 00:06:33,320
they're doing about water in plants so

181
00:06:37,960 --> 00:06:34,940
finally the other thing I like about

182
00:06:39,250 --> 00:06:37,970
flying between Houston Orlando as part

183
00:06:40,600 --> 00:06:39,260
of the awesome you'll meet my pretzels

184
00:06:42,550 --> 00:06:40,610
I'm looking working on my cell phone I'm

185
00:06:44,110 --> 00:06:42,560
looking out the window is when you fly

186
00:06:46,240 --> 00:06:44,120
right over the mouth of the Mississippi

187
00:06:48,490 --> 00:06:46,250
River and if you've never done that it's

188
00:06:50,350 --> 00:06:48,500

just amazing the amount of sediment the

189

00:06:53,020 --> 00:06:50,360

amount of effluent that's coming out of

190

00:06:54,550 --> 00:06:53,030

the mouth of the river and that is part

191

00:06:56,620 --> 00:06:54,560

of our ecological and geological

192

00:06:58,480 --> 00:06:56,630

processes and understanding that is

193

00:07:00,520 --> 00:06:58,490

really important but the problem is is

194

00:07:02,410 --> 00:07:00,530

that on earth all those sediments in a

195

00:07:03,940 --> 00:07:02,420

lab tend to settle really fast because

196

00:07:06,160 --> 00:07:03,950

of gravity so we're gonna have some

197

00:07:07,020 --> 00:07:06,170

folks here today from beak at sea s to

198

00:07:08,520 --> 00:07:07,030

talk to you a little bit

199

00:07:10,950 --> 00:07:08,530

about how they're using the unique

200

00:07:12,930 --> 00:07:10,960

environment onboard the space station in

201
00:07:14,430 --> 00:07:12,940
order to study those processes that they

202
00:07:16,830 --> 00:07:14,440
understand them better and be able to

203
00:07:18,270 --> 00:07:16,840
apply them back here on earth so last

204
00:07:20,220 --> 00:07:18,280
thing I want to mention is a shout-out

205
00:07:21,890 --> 00:07:20,230
to our robotics folks although they're

206
00:07:24,630 --> 00:07:21,900
technically not part of our research

207
00:07:26,220 --> 00:07:24,640
investigations the building of the space

208
00:07:28,020 --> 00:07:26,230
station the operating in the space

209
00:07:29,940 --> 00:07:28,030
station would not be possible without

210
00:07:32,010 --> 00:07:29,950
the robotics technology and I'm also

211
00:07:33,900 --> 00:07:32,020
very proud to say that that robotics

212
00:07:35,640 --> 00:07:33,910
technology has come home and has been

213
00:07:37,680 --> 00:07:35,650

adapted so that there are medical

214

00:07:39,390 --> 00:07:37,690

procedures that could not be done prior

215

00:07:41,400 --> 00:07:39,400

to this technology being developed and

216

00:07:43,140 --> 00:07:41,410

so it's making people's lives on Earth a

217

00:07:44,220 --> 00:07:43,150

lot better so along those lines I'm

218

00:07:47,070 --> 00:07:44,230

going to turn it over to Mike now to

219

00:07:48,420 --> 00:07:47,080

talk about the National Lab stuff thanks

220

00:07:50,280 --> 00:07:48,430

David it's difficult to pick up

221

00:07:53,580 --> 00:07:50,290

following pretzel logic but I'll do my

222

00:07:55,830 --> 00:07:53,590

best sir first of all welcome you saw

223

00:07:58,530 --> 00:07:55,840

the opening video with the lovely face

224

00:08:01,080 --> 00:07:58,540

of Patrick O'Neil talking about what

225

00:08:02,730 --> 00:08:01,090

cases is and I wanted to highlight just

226

00:08:04,560 --> 00:08:02,740

a couple of other experiments that are

227

00:08:07,020 --> 00:08:04,570

going up on that explain to you a little

228

00:08:09,780 --> 00:08:07,030

bit about the great excitement that I

229

00:08:11,730 --> 00:08:09,790

share with Dave in our partnership with

230

00:08:13,920 --> 00:08:11,740

NASA in managing the International Space

231

00:08:15,150 --> 00:08:13,930

Station National Lab so as Dave

232

00:08:16,560 --> 00:08:15,160

mentioned the International Space

233

00:08:18,930 --> 00:08:16,570

Station is many things to many different

234

00:08:20,940 --> 00:08:18,940

people but from the viewpoint of

235

00:08:22,920 --> 00:08:20,950

investigators and technology developers

236

00:08:25,620 --> 00:08:22,930

it offers opportunities unique

237

00:08:27,270 --> 00:08:25,630

opportunities that are one-of-a-kind off

238

00:08:29,700 --> 00:08:27,280

this world opportunities to test

239

00:08:31,680 --> 00:08:29,710

technology to demonstrate the validity

240

00:08:34,050 --> 00:08:31,690

of technologies and to do fundamental

241

00:08:35,850 --> 00:08:34,060

basic research that is of interest not

242

00:08:37,440 --> 00:08:35,860

only to NASA and the international

243

00:08:39,750 --> 00:08:37,450

partners who work in the space room all

244

00:08:41,610 --> 00:08:39,760

the time but to investigators who work

245

00:08:42,870 --> 00:08:41,620

here on earth so among those are

246

00:08:45,180 --> 00:08:42,880

experiments you'll hear more about later

247

00:08:47,730 --> 00:08:45,190

that are sponsored and funded by the

248

00:08:49,380 --> 00:08:47,740

National Science Foundation that are

249

00:08:52,079 --> 00:08:49,390

flying projects that are exploring the

250

00:08:53,640 --> 00:08:52,089

fundamental physics of materials in the

251
00:08:56,579 --> 00:08:53,650
space environment using the be ket's

252
00:08:58,110 --> 00:08:56,589
apparatus developed by implementation

253
00:09:00,930 --> 00:08:58,120
partners that have supported nasa for

254
00:09:02,610 --> 00:09:00,940
years there are a multitude of student

255
00:09:04,829 --> 00:09:02,620
Space Flight experiments that Patrick

256
00:09:06,990 --> 00:09:04,839
touched on that are leveraging the

257
00:09:09,990 --> 00:09:07,000
imagination of youngsters and their

258
00:09:12,390 --> 00:09:10,000
excitement about not only thinking about

259
00:09:15,210 --> 00:09:12,400
space but actually designing experiments

260
00:09:17,130 --> 00:09:15,220
and taking them from the drafting page

261
00:09:18,750 --> 00:09:17,140
all the way through to execution and

262
00:09:20,100 --> 00:09:18,760
then actually analyzing data from that

263
00:09:22,440 --> 00:09:20,110

spaceflight environment

264

00:09:24,450 --> 00:09:22,450

and you also learn about some companies

265

00:09:26,940 --> 00:09:24,460

that are supporting commercial research

266

00:09:28,980 --> 00:09:26,950

activities one of those is a commercial

267

00:09:31,260 --> 00:09:28,990

platform uses it's developed by Teledyne

268

00:09:33,840 --> 00:09:31,270

Brown engineering and will have its

269

00:09:36,030 --> 00:09:33,850

first payload hosted from DLR today so

270

00:09:38,880 --> 00:09:36,040

we are now seeing in the space

271

00:09:40,440 --> 00:09:38,890

environment this opportunity for sharing

272

00:09:42,150 --> 00:09:40,450

of space and for building new

273

00:09:45,030 --> 00:09:42,160

opportunities in that space environment

274

00:09:46,970 --> 00:09:45,040

by collaboration between federal funding

275

00:09:49,200 --> 00:09:46,980

agencies that are sponsoring research

276

00:09:51,030 --> 00:09:49,210

commercial companies that are sponsoring

277

00:09:53,100 --> 00:09:51,040

R&D activities that are of interest to

278

00:09:55,080 --> 00:09:53,110

their portfolio and the continued

279

00:09:56,880 --> 00:09:55,090

success of NASA in demonstrating the

280

00:09:59,220 --> 00:09:56,890

utility of having this orbiting

281

00:10:01,440 --> 00:09:59,230

laboratory operating in the harshness of

282

00:10:03,090 --> 00:10:01,450

space in microgravity all the time

283

00:10:05,310 --> 00:10:03,100

and with that I'd like to queue the

284

00:10:07,200 --> 00:10:05,320

video go into a little bit deeper about

285

00:10:08,820 --> 00:10:07,210

one of the commercial payloads that will

286

00:10:11,040 --> 00:10:08,830

be operating onboard the International

287

00:10:16,620 --> 00:10:11,050

Space Station sponsored by the ISS

288

00:10:20,150 --> 00:10:16,630

National Lab we're trying to make a

289

00:10:24,580 --> 00:10:20,160

therapy that can address 90% of cancers

290

00:10:27,079 --> 00:10:24,590

and make make cancer a non fatal disease

291

00:10:30,379 --> 00:10:27,089

[Music]

292

00:10:35,269 --> 00:10:30,389

in the US over one-third of people go on

293

00:10:38,869 --> 00:10:35,279

to develop cancer in their lifetime my

294

00:10:41,629 --> 00:10:38,879

mother died of cancer and she died at

295

00:10:43,759 --> 00:10:41,639

age 33 when I was 10 years old wasn't

296

00:10:46,879 --> 00:10:43,769

able to do anything for her when she was

297

00:10:49,209 --> 00:10:46,889

alive but I can at least have made my

298

00:10:53,769 --> 00:10:49,219

contribution to all the future mothers

299

00:10:59,929 --> 00:10:56,299

microgravity is providing a good model

300

00:11:02,359 --> 00:10:59,939

for us to study hall drugs are targeting

301
00:11:05,029 --> 00:11:02,369
normal blood vessels and to test our

302
00:11:08,299 --> 00:11:05,039
cancer therapy this model our approach

303
00:11:10,639 --> 00:11:08,309
destroys both the tumor cells and the

304
00:11:14,179 --> 00:11:10,649
tumor blood vessels simultaneously and

305
00:11:16,489 --> 00:11:14,189
the whole tumor dies for lack of oxygen

306
00:11:18,589 --> 00:11:16,499
and nutrients we notice astronauts have

307
00:11:21,739 --> 00:11:18,599
more cardiovascular disease but less

308
00:11:23,749 --> 00:11:21,749
cancer and we notice endothelial cells

309
00:11:26,419 --> 00:11:23,759
which are the type of cells that make up

310
00:11:28,039 --> 00:11:26,429
blood vessels didn't grow in space so

311
00:11:29,719 --> 00:11:28,049
we're sending up a bunch of endothelial

312
00:11:31,669 --> 00:11:29,729
cells we're going to treat them with our

313
00:11:33,469 --> 00:11:31,679

drug and we want to see if and a few

314

00:11:37,519 --> 00:11:33,479

your cells in space are different than

315

00:11:40,219 --> 00:11:37,529

on the ground and justice mission is to

316

00:11:44,839 --> 00:11:40,229

cure cancer and microgravity may provide

317

00:11:46,849 --> 00:11:44,849

that opportunity is one of the to

318

00:11:49,519 --> 00:11:46,859

conclude ngx came to us through the mass

319

00:11:52,159 --> 00:11:49,529

challenge program so in partnership with

320

00:11:53,809 --> 00:11:52,169

Boeing casus and Boeing are able to

321

00:11:57,079 --> 00:11:53,819

offer opportunities for small

322

00:11:58,989 --> 00:11:57,089

entrepreneurial startups who have new

323

00:12:01,999 --> 00:11:58,999

ideas innovative new ways to develop

324

00:12:03,919 --> 00:12:02,009

therapies such as for cancer to develop

325

00:12:06,049 --> 00:12:03,929

new medical devices and other advances

326

00:12:07,969 --> 00:12:06,059

in technology that can directly utilize

327

00:12:10,069 --> 00:12:07,979

the international space station National

328

00:12:10,969 --> 00:12:10,079

Lab so we're excited for the launch

329

00:12:13,039 --> 00:12:10,979

tomorrow morning

330

00:12:14,479 --> 00:12:13,049

everybody I hope is anxious to get up at

331

00:12:18,829 --> 00:12:14,489

3:00 in the morning to get their spot

332

00:12:20,719 --> 00:12:18,839

and get started great so great overview

333

00:12:23,289 --> 00:12:20,729

gentlemen thank you so much does anybody

334

00:12:25,909 --> 00:12:23,299

have any questions for Mike or David

335

00:12:31,750 --> 00:12:25,919

please yeah wait for a microphone to

336

00:12:36,970 --> 00:12:33,820

Jim Siegel I'm with Space Flight Insider

337

00:12:40,840 --> 00:12:36,980

I'm interested in roughly how many

338

00:12:44,800 --> 00:12:40,850

discrete experiments or investigations

339

00:12:48,310 --> 00:12:44,810

are onboard this this flight both from

340

00:12:52,690 --> 00:12:48,320

the cases point of view and from the

341

00:12:53,980 --> 00:12:52,700

total manifest point of view I'll have

342

00:12:56,440 --> 00:12:53,990

to get back you with a total number

343

00:12:58,840 --> 00:12:56,450

because I focus mainly on the new ones

344

00:13:00,850 --> 00:12:58,850

but I know there's 27 new ones going up

345

00:13:04,060 --> 00:13:00,860

and I believe as mentioned before that

346

00:13:05,110 --> 00:13:04,070

those contribute to a total of over 300

347

00:13:13,090 --> 00:13:05,120

that will be operating during

348

00:13:16,690 --> 00:13:13,100

expeditions 55 and 56 and are both cases

349

00:13:19,480 --> 00:13:16,700

and and yes so for the ISS National Lab

350

00:13:25,660 --> 00:13:19,490

side there's 20 payloads that represent

351

00:13:27,850 --> 00:13:25,670

over 50 experiments have a question back

352

00:13:40,290 --> 00:13:27,860

here just one moment for the microphone

353

00:13:44,980 --> 00:13:43,150

can you talk about a couple of the

354

00:13:48,190 --> 00:13:44,990

student projects that are going up and

355

00:13:51,640 --> 00:13:50,290

so we're very excited about all the

356

00:13:53,920 --> 00:13:51,650

student projects that are going up so I

357

00:13:56,530 --> 00:13:53,930

don't want to pick on any one of them in

358

00:13:58,480 --> 00:13:56,540

particular but there are a few that are

359

00:13:59,950 --> 00:13:58,490

looking actually at kidney cells and the

360

00:14:02,200 --> 00:13:59,960

microgravity environment so you heard

361

00:14:04,269 --> 00:14:02,210

from Angie X and others that there's a

362

00:14:06,400 --> 00:14:04,279

lot of interest in removing gravity from

363

00:14:09,090 --> 00:14:06,410

the growth of cells that has advantages

364

00:14:11,829 --> 00:14:09,100

and disadvantages at a fundamental level

365

00:14:14,010 --> 00:14:11,839

some students are looking at simply ways

366

00:14:16,360 --> 00:14:14,020

to culture cells in that environment and

367

00:14:18,490 --> 00:14:16,370

monitoring their oxygen uptake and

368

00:14:20,380 --> 00:14:18,500

ability to metabolize in that

369

00:14:22,180 --> 00:14:20,390

environment so we have a variety

370

00:14:23,500 --> 00:14:22,190

experiments on this missions and others

371

00:14:26,230 --> 00:14:23,510

before those that have focused either on

372

00:14:28,030 --> 00:14:26,240

human cells in culture which is

373

00:14:30,670 --> 00:14:28,040

something that I wasn't able to do when

374

00:14:32,260 --> 00:14:30,680

I was in high school or plant cell

375

00:14:34,360 --> 00:14:32,270

culture we've had quite a few

376

00:14:36,100 --> 00:14:34,370

experiments that have focused on growth

377

00:14:39,910 --> 00:14:36,110

of algae and microalgae in that

378

00:14:41,769 --> 00:14:39,920

environment as well and the cost of

379

00:14:43,329 --> 00:14:41,779

admission for students to those is

380

00:14:46,150 --> 00:14:43,339

drastically down now through

381

00:14:48,820 --> 00:14:46,160

partnerships with dream up NanoRacks

382

00:14:50,980 --> 00:14:48,830

based hango there are a lot of companies

383

00:14:52,870 --> 00:14:50,990

now that are directly engaged with high

384

00:14:55,900 --> 00:14:52,880

schools to work with students and

385

00:14:57,820 --> 00:14:55,910

student mentors to develop projects and

386

00:14:59,620 --> 00:14:57,830

the price point for them getting in is

387

00:15:01,329 --> 00:14:59,630

now to the point where high school

388

00:15:04,090 --> 00:15:01,339

students working out of their basement

389

00:15:07,920 --> 00:15:04,100

can almost fund their own their own

390

00:15:10,120 --> 00:15:07,930

small lab to go up it's an exciting time

391

00:15:12,400 --> 00:15:10,130

anybody else have a question for micro

392

00:15:17,620 --> 00:15:12,410

David yes back here please wait for the

393

00:15:19,510 --> 00:15:17,630

microphone in terms of the projects that

394

00:15:22,449 --> 00:15:19,520

go up is there a combination between

395

00:15:25,780 --> 00:15:22,459

things that the space station wants to

396

00:15:28,840 --> 00:15:25,790

have happen and private industry wanting

397

00:15:31,210 --> 00:15:28,850

to or do have specific numbers of we

398

00:15:32,500 --> 00:15:31,220

have room for outside experiments and

399

00:15:35,019 --> 00:15:32,510

then specific things that you want to

400

00:15:37,120 --> 00:15:35,029

have happen the way the research is

401
00:15:39,910 --> 00:15:37,130
divided with regards to sponsorship is

402
00:15:42,280 --> 00:15:39,920
that among the American research it's

403
00:15:44,410 --> 00:15:42,290
split 50-50 between the national lab and

404
00:15:46,240 --> 00:15:44,420
NASA and then in addition to that we

405
00:15:49,269 --> 00:15:46,250
also have our international partners as

406
00:15:50,619 --> 00:15:49,279
well that participate

407
00:15:53,499 --> 00:15:50,629
in there folks that are looking to add

408
00:15:56,170 --> 00:15:53,509
new capabilities all the time so we want

409
00:15:58,389 --> 00:15:56,180
to continue to exceed the capacity of

410
00:16:00,189 --> 00:15:58,399
the International Space Station and see

411
00:16:01,449 --> 00:16:00,199
it grow and there are already companies

412
00:16:03,040 --> 00:16:01,459
that are coming up with innovative new

413
00:16:05,170 --> 00:16:03,050

ways to get even more science and

414

00:16:07,480 --> 00:16:05,180

technology they're more innovative ways

415

00:16:10,689 --> 00:16:07,490

to return samples back to earth quickly

416

00:16:13,030 --> 00:16:10,699

and ways to communicate data back

417

00:16:14,590 --> 00:16:13,040

between Earth and the International

418

00:16:17,309 --> 00:16:14,600

Space Station or more rapid manner so

419

00:16:19,480 --> 00:16:17,319

right now is the time to see that grow

420

00:16:27,600 --> 00:16:19,490

great we have time for just one more

421

00:16:33,900 --> 00:16:30,309

we hear a lot about the the Space

422

00:16:37,360 --> 00:16:33,910

Station program being wound down or

423

00:16:38,590 --> 00:16:37,370

defunded or shut down is there anything

424

00:16:41,889 --> 00:16:38,600

you could tell us about that and maybe

425

00:16:46,269 --> 00:16:41,899

what the next phase might be your future

426

00:16:48,639 --> 00:16:46,279

plans the the presidential budget that

427

00:16:51,879 --> 00:16:48,649

was offered up indicated that they would

428

00:16:54,129 --> 00:16:51,889

like to reduce it was proposed that we

429

00:16:56,910 --> 00:16:54,139

reduced the government portion of the

430

00:16:59,019 --> 00:16:56,920

support of space station in 2025 to zero

431

00:17:00,670 --> 00:16:59,029

there's a lot of folks looking at that

432

00:17:02,259 --> 00:17:00,680

right now to see exactly what that means

433

00:17:05,590 --> 00:17:02,269

because obviously you don't go from a

434

00:17:08,380 --> 00:17:05,600

budget of this much to zero but as part

435

00:17:10,659 --> 00:17:08,390

of implementing the the overall plan to

436

00:17:13,480 --> 00:17:10,669

to work with commercial companies that's

437

00:17:15,610 --> 00:17:13,490

always been part of our our charter yeah

438

00:17:16,899 --> 00:17:15,620

and from our perspective that the

439

00:17:19,299 --> 00:17:16,909

synergy advancement of Science in space

440

00:17:21,880 --> 00:17:19,309

we've seen growing and sustained

441

00:17:23,679 --> 00:17:21,890

interest from many different sectors of

442

00:17:25,600 --> 00:17:23,689

the commercial economy from material

443

00:17:27,159 --> 00:17:25,610

science developers through

444

00:17:29,320 --> 00:17:27,169

pharmaceutical companies who've made

445

00:17:31,330 --> 00:17:29,330

extensive use of the platform we're

446

00:17:32,830 --> 00:17:31,340

seeing increased engagement and funding

447

00:17:35,200 --> 00:17:32,840

opportunities provided by government

448

00:17:37,180 --> 00:17:35,210

agencies other than NASA so National

449

00:17:39,340 --> 00:17:37,190

Science Foundation National Institutes

450

00:17:41,049 --> 00:17:39,350

of Health Department of Defense are all

451

00:17:42,220 --> 00:17:41,059

funding research utilizing the

452

00:17:44,740 --> 00:17:42,230

International Space Station National

453

00:17:46,360 --> 00:17:44,750

Laboratory so although the funding

454

00:17:48,730 --> 00:17:46,370

structure is going to change at some

455

00:17:50,649 --> 00:17:48,740

point in the future we're very confident

456

00:17:51,970 --> 00:17:50,659

that as a platform the International

457

00:17:53,680 --> 00:17:51,980

Space Station is going to continue to

458

00:17:55,720 --> 00:17:53,690

operate for as long as people see

459

00:17:57,399 --> 00:17:55,730

utility in it and we're able to get

460

00:17:59,080 --> 00:17:57,409

science and technology development up

461

00:18:00,810 --> 00:17:59,090

there and back and the future is very

462

00:18:03,340 --> 00:18:00,820

bright for that

463

00:18:05,380 --> 00:18:03,350

okay well thank you David and Mike for

464

00:18:15,880 --> 00:18:05,390

sharing with us that that perspective

465

00:18:17,980 --> 00:18:15,890

for sure so thank you so much so so next

466

00:18:20,710 --> 00:18:17,990

to discuss the crew interactive mobile

467

00:18:23,980 --> 00:18:20,720

companion or Simon project is dr.

468

00:18:26,380 --> 00:18:23,990

Christian Koresh program lead for from

469

00:18:38,320 --> 00:18:26,390

the German Aerospace Center and Phillip

470

00:18:41,320 --> 00:18:38,330

Julian project engineer from Airbus yes

471

00:18:43,500 --> 00:18:41,330

Simon Says thank you thank you for the

472

00:18:48,370 --> 00:18:43,510

honor being here to present our project

473

00:18:50,500 --> 00:18:48,380

so Simon was developed by Abbas and the

474

00:18:53,740 --> 00:18:50,510

artificial intelligence comes from IBM

475

00:18:57,250 --> 00:18:53,750

and we I'm from DLR we're yeah the

476
00:19:00,630 --> 00:18:57,260
payload owner so what is Simon Simon is

477
00:19:05,350 --> 00:19:00,640
a free-floating artificial intelligence

478
00:19:07,810 --> 00:19:05,360
his journey will begin tomorrow and when

479
00:19:10,120 --> 00:19:07,820
he will be activated this is kind of a

480
00:19:13,360 --> 00:19:10,130
historical moment so this will be the

481
00:19:16,330 --> 00:19:13,370
first operating artificial intelligence

482
00:19:19,810 --> 00:19:16,340
with a human machine interaction so

483
00:19:22,120 --> 00:19:19,820
maybe you can also start the video in

484
00:19:25,450 --> 00:19:22,130
the back so you get some impressions

485
00:19:28,210 --> 00:19:25,460
what's happened so far so we trained

486
00:19:31,750 --> 00:19:28,220
Simon he's especially trained to the

487
00:19:33,490 --> 00:19:31,760
German astronaut so these are some

488
00:19:35,169 --> 00:19:33,500

pictures from the turbo leak flight so

489

00:19:37,960 --> 00:19:35,179

we tested him already in weightlessness

490

00:19:41,200 --> 00:19:37,970

and this technology demonstration

491

00:19:42,430 --> 00:19:41,210

together with Airbus and IBM and it's a

492

00:19:45,010 --> 00:19:42,440

kind of yeah

493

00:19:47,020 --> 00:19:45,020

pioneer challenge so to implement an

494

00:19:48,909 --> 00:19:47,030

artificial intelligence in real time

495

00:19:52,480 --> 00:19:48,919

into the International Space Station

496

00:19:54,760 --> 00:19:52,490

that's a really tough challenge in terms

497

00:19:57,460 --> 00:19:54,770

of safety and security here you can see

498

00:19:59,980 --> 00:19:57,470

Alexander Gerst he trained with him his

499

00:20:02,760 --> 00:19:59,990

face recognition and his voice and

500

00:20:06,669 --> 00:20:02,770

things like this so we are very happy

501
00:20:10,030 --> 00:20:06,679
that Simon will be the first artificial

502
00:20:12,250 --> 00:20:10,040
intelligence in space and one of the

503
00:20:13,659 --> 00:20:12,260
main challenges so we are a team of

504
00:20:15,909 --> 00:20:13,669
about 50 people

505
00:20:20,249 --> 00:20:15,919
working on this for the last two years

506
00:20:22,749 --> 00:20:20,259
and usually in space you need to yeah

507
00:20:25,869 --> 00:20:22,759
five or ten years for a project like

508
00:20:29,169 --> 00:20:25,879
this with this complexity but we managed

509
00:20:31,599 --> 00:20:29,179
and made this challenge happen so we are

510
00:20:34,180 --> 00:20:31,609
very very happy and maybe my colleague

511
00:20:36,999 --> 00:20:34,190
can say some few words the technical

512
00:20:39,669 --> 00:20:37,009
just one point I want to figure out is

513
00:20:42,039 --> 00:20:39,679

that for us this is a piece of the

514

00:20:45,369 --> 00:20:42,049

future of human space flight I mean if

515

00:20:47,289 --> 00:20:45,379

you go out to the moon or to Mars so you

516

00:20:49,239 --> 00:20:47,299

cannot take all mankind and engineers

517

00:20:52,389 --> 00:20:49,249

with you so the astronauts they will be

518

00:20:54,999 --> 00:20:52,399

on their own so but with an artificial

519

00:20:57,699 --> 00:20:55,009

intelligence you have instant the all

520

00:21:00,129 --> 00:20:57,709

the knowledge of mankind and this is

521

00:21:03,099 --> 00:21:00,139

just the first technology demonstration

522

00:21:08,289 --> 00:21:03,109

for us but I guess it's one step into

523

00:21:09,699 --> 00:21:08,299

the future for exploration ok so what I

524

00:21:11,049 --> 00:21:09,709

want to do is I want to give you a short

525

00:21:13,539 --> 00:21:11,059

insight into what's actually happening

526
00:21:15,940 --> 00:21:13,549
happening on board of the International

527
00:21:18,039 --> 00:21:15,950
Space Station one Simon's up there so

528
00:21:19,629 --> 00:21:18,049
what what will happen basically is that

529
00:21:21,729 --> 00:21:19,639
Simon will be floating somewhere inside

530
00:21:24,129 --> 00:21:21,739
the Columbus module and Alex on a guest

531
00:21:27,039 --> 00:21:24,139
which Simon is tailored to Sam the free

532
00:21:29,560 --> 00:21:27,049
flyer will call Simon at a certain time

533
00:21:31,959 --> 00:21:29,570
then Simon with the help of a microphone

534
00:21:33,940 --> 00:21:31,969
array will acoustic acoustically know

535
00:21:36,039 --> 00:21:33,950
where Alexander gasps is speaking from

536
00:21:37,810 --> 00:21:36,049
Simon will orient to what Alexander

537
00:21:40,419 --> 00:21:37,820
guessed and then the orientation will

538
00:21:42,579 --> 00:21:40,429

switch towards the front camera with

539

00:21:44,619 --> 00:21:42,589

front camera we perform face detection

540

00:21:46,299 --> 00:21:44,629

so we detect all the faces that are

541

00:21:46,889 --> 00:21:46,309

inside the camera inside the picture of

542

00:21:48,909 --> 00:21:46,899

the camera

543

00:21:52,839 --> 00:21:48,919

afterwards we perform face recognition

544

00:21:55,389 --> 00:21:52,849

with the help of our IBM api's where we

545

00:21:57,060 --> 00:21:55,399

got great support from IBM then

546

00:21:58,690 --> 00:21:57,070

Alexander guess could say something like

547

00:22:00,609 --> 00:21:58,700

Simon could you please help me

548

00:22:02,049 --> 00:22:00,619

performing a certain certain experiment

549

00:22:04,269 --> 00:22:02,059

could be please help me with with the

550

00:22:06,430 --> 00:22:04,279

procedure then Simon will fly to bots

551

00:22:09,190 --> 00:22:06,440

Alexander guest with the help of 14

552

00:22:11,680 --> 00:22:09,200

impellers that are inside this sphere so

553

00:22:13,859 --> 00:22:11,690

we have four tubes for quite fast

554

00:22:16,839 --> 00:22:13,869

acceleration to the to the front and

555

00:22:18,039 --> 00:22:16,849

then Simon will fly towards Alex on a

556

00:22:22,329 --> 00:22:18,049

guest and they will already start the

557

00:22:24,849 --> 00:22:22,339

communication so Simon will then guide

558

00:22:27,250 --> 00:22:24,859

Alex on a guest through a procedure he

559

00:22:29,950 --> 00:22:27,260

will show on the screen on the front he

560

00:22:32,680 --> 00:22:29,960

so for example videos or or displays or

561

00:22:34,570 --> 00:22:32,690

pictures of the of the facility and then

562

00:22:36,910 --> 00:22:34,580

if Alexander guess has certain questions

563

00:22:38,050 --> 00:22:36,920

to that experiment is working on Simon

564

00:22:40,240 --> 00:22:38,060

is quite deep knowledge on that

565

00:22:42,130 --> 00:22:40,250

experiment so you can really get inside

566

00:22:45,490 --> 00:22:42,140

the experiment and you can ask questions

567

00:22:48,670 --> 00:22:45,500

that are beyond the procedure and also

568

00:22:50,950 --> 00:22:48,680

for example Alexander guest:can can then

569

00:22:53,290 --> 00:22:50,960

sign verbally certain steps from the

570

00:22:56,680 --> 00:22:53,300

procedure he can go one one step ahead

571

00:22:58,510 --> 00:22:56,690

one step back or he can he can do

572

00:23:01,510 --> 00:22:58,520

whatever you want basically with this

573

00:23:04,330 --> 00:23:01,520

one what else do we got here we got a

574

00:23:06,040 --> 00:23:04,340

microphone on the very on the back then

575

00:23:08,650 --> 00:23:06,050

we got an infrared camera on the front

576

00:23:10,420 --> 00:23:08,660

for example the whole hardware is

577

00:23:12,460 --> 00:23:10,430

electrically powered so we got two

578

00:23:17,050 --> 00:23:12,470

batteries in the back but it can also be

579

00:23:18,670 --> 00:23:17,060

powered hardwired then we got which it

580

00:23:20,650 --> 00:23:18,680

was quite important for Alexander guests

581

00:23:22,960 --> 00:23:20,660

who we did several training sessions

582

00:23:25,000 --> 00:23:22,970

with was that we had an actual an

583

00:23:27,460 --> 00:23:25,010

offline button if that partners

584

00:23:30,310 --> 00:23:27,470

activated that's on the back Thank You

585

00:23:32,620 --> 00:23:30,320

Christian once that button is activated

586

00:23:35,890 --> 00:23:32,630

Alex on the gas can be sure that nothing

587

00:23:37,780 --> 00:23:35,900

that he's actually saying by now is

588

00:23:41,020 --> 00:23:37,790

streamed down to earth so it's kind of

589

00:23:42,580 --> 00:23:41,030

private then and once it's okay for him

590

00:23:44,470 --> 00:23:42,590

that the information sent back to earth

591

00:23:46,270 --> 00:23:44,480

again it just deactivates the offline

592

00:23:50,020 --> 00:23:46,280

button and then it will be streamed down

593

00:23:56,370 --> 00:23:50,030

to the to the IBM server again and Simon

594

00:24:03,640 --> 00:24:00,820

the batteries we are very happy that the

595

00:24:05,500 --> 00:24:03,650

Astra B team supported or helped us so

596

00:24:08,080 --> 00:24:05,510

we couldn't qualify batteries and within

597

00:24:10,240 --> 00:24:08,090

our own project but we take batteries

598

00:24:12,250 --> 00:24:10,250

which they qualify for the International

599

00:24:15,130 --> 00:24:12,260

Space Station so without them and

600

00:24:17,260 --> 00:24:15,140

without them support so we this would be

601
00:24:20,470 --> 00:24:17,270
our showstopper the batteries so we are

602
00:24:23,170 --> 00:24:20,480
very happy so this is the kind of yeah

603
00:24:27,190 --> 00:24:23,180
space spirit we're doing here with NASA

604
00:24:28,690 --> 00:24:27,200
and all the other is a really great

605
00:24:30,850 --> 00:24:28,700
collaboration and it really works so

606
00:24:34,180 --> 00:24:30,860
people are very friendly helpful and

607
00:24:36,460 --> 00:24:34,190
yeah we thank for that very fast and

608
00:24:37,810 --> 00:24:36,470
project running less than two years we

609
00:24:40,540 --> 00:24:37,820
just didn't have the time for the

610
00:24:42,280 --> 00:24:40,550
battery certification so we were

611
00:24:45,640 --> 00:24:42,290
very thankful to get the batteries from

612
00:24:46,930 --> 00:24:45,650
this regime which is just and what I'm

613
00:24:49,900 --> 00:24:46,940

going to do is I'm going to introduce

614

00:24:52,150 --> 00:24:49,910

you to the IBM vice president for the AI

615

00:24:54,790 --> 00:24:52,160

portion of this project

616

00:24:55,720 --> 00:24:54,800

Brett Greenstein so we're going to take

617

00:24:58,060 --> 00:24:55,730

some questions

618

00:25:02,260 --> 00:24:58,070

I got a front row question right here

619

00:25:05,080 --> 00:25:02,270

please Chris K Bart with NASA space

620

00:25:06,970 --> 00:25:05,090

flight can you talk about how Simon

621

00:25:08,020 --> 00:25:06,980

connects to the cloud on the

622

00:25:09,640 --> 00:25:08,030

international space station

623

00:25:12,550 --> 00:25:09,650

does it have to does its operation if it

624

00:25:14,950 --> 00:25:12,560

be timed like for certain periods with

625

00:25:16,990 --> 00:25:14,960

connection through the network and since

626

00:25:18,850 --> 00:25:17,000

you had to UM print it to Alexander for

627

00:25:20,530 --> 00:25:18,860

this flight what happens to Simon when

628

00:25:23,140 --> 00:25:20,540

Alexander comes back to earth at the end

629

00:25:24,640 --> 00:25:23,150

of the year okay so you can probably

630

00:25:25,870 --> 00:25:24,650

talk better to the technical

631

00:25:27,670 --> 00:25:25,880

communications of the satellites of the

632

00:25:30,280 --> 00:25:27,680

earth but during the times when there is

633

00:25:31,720 --> 00:25:30,290

connectivity all the communications go

634

00:25:33,430 --> 00:25:31,730

back through the cloud so all the AI

635

00:25:35,350 --> 00:25:33,440

work is being processed at the cloud

636

00:25:37,480 --> 00:25:35,360

natural language all the training and

637

00:25:39,670 --> 00:25:37,490

tailoring we did happens in the cloud

638

00:25:41,670 --> 00:25:39,680

which also means we can enhance it from

639

00:25:44,560 --> 00:25:41,680

the earth anytime and make it smarter

640

00:25:48,220 --> 00:25:44,570

constantly to help Alexander and the

641

00:25:50,350 --> 00:25:48,230

team to use it it is tailored and tuned

642

00:25:52,570 --> 00:25:50,360

and trained to work with Alexander but

643

00:25:53,680 --> 00:25:52,580

it's a it's an open system it works with

644

00:25:56,260 --> 00:25:53,690

everybody who listens

645

00:25:57,940 --> 00:25:56,270

it was just specifically trained to help

646

00:25:59,080 --> 00:25:57,950

us some of the terminology and the way

647

00:26:00,670 --> 00:25:59,090

that he speaks to make it work even

648

00:26:03,220 --> 00:26:00,680

better for him so it works for everybody

649

00:26:08,830 --> 00:26:03,230

great think Kenya had a question just

650

00:26:11,290 --> 00:26:08,840

one moment for the microphone please hi

651
00:26:14,020 --> 00:26:11,300
Ken Kramer space up-close thanks for

652
00:26:17,890 --> 00:26:14,030
doing this session how difficult would

653
00:26:19,900 --> 00:26:17,900
it be for someone besides Kara to work

654
00:26:23,770 --> 00:26:19,910
with it since it's specifically for him

655
00:26:26,260 --> 00:26:23,780
and is it multilingual so it would work

656
00:26:28,150 --> 00:26:26,270
with anybody obviously it's tuned to

657
00:26:29,950 --> 00:26:28,160
language so this is designed to work in

658
00:26:31,900 --> 00:26:29,960
English works in English in understands

659
00:26:33,400 --> 00:26:31,910
Alexander in particular was helpful to

660
00:26:35,290 --> 00:26:33,410
train it to recognize him so that it

661
00:26:36,790 --> 00:26:35,300
will come to him when he speaks so that

662
00:26:39,130 --> 00:26:36,800
part is helpful but it'll work for all

663
00:26:41,920 --> 00:26:39,140

the astronauts now and on language

664

00:26:43,570 --> 00:26:41,930

support right now it's English but our

665

00:26:44,950 --> 00:26:43,580

Watson services support many languages

666

00:26:46,360 --> 00:26:44,960

so it can give you a few more

667

00:26:48,280 --> 00:26:46,370

informations what what does actually

668

00:26:49,690 --> 00:26:48,290

mean tailored to alexander guests we had

669

00:26:51,190 --> 00:26:49,700

several feminization sessions together

670

00:26:53,980 --> 00:26:51,200

with Alexander guest so he was able to

671

00:26:55,390 --> 00:26:53,990

choose for example the face that is this

672

00:26:57,250 --> 00:26:55,400

played on the screen once he's talking

673

00:26:59,410 --> 00:26:57,260

he had the yet being able to choose

674

00:27:01,360 --> 00:26:59,420

between a quite a simple smiley quite a

675

00:27:03,040 --> 00:27:01,370

closed face to the human face and he

676

00:27:05,470 --> 00:27:03,050

made his choice something quite in

677

00:27:08,620 --> 00:27:05,480

between for example it was also able to

678

00:27:10,660 --> 00:27:08,630

choose the voice that that the IBM that

679

00:27:13,330 --> 00:27:10,670

the language that actually comes out of

680

00:27:15,460 --> 00:27:13,340

Simon if it should be male or female for

681

00:27:17,890 --> 00:27:15,470

example or which which accidently should

682

00:27:19,840 --> 00:27:17,900

have and then it was also able to to

683

00:27:23,770 --> 00:27:19,850

influence the design slightly and to

684

00:27:25,540 --> 00:27:23,780

give his commands or to send us his

685

00:27:27,549 --> 00:27:25,550

commands in advance and we were able to

686

00:27:30,130 --> 00:27:27,559

train really the the word said Alexander

687

00:27:31,330 --> 00:27:30,140

guess 10 suits quite quite often and all

688

00:27:33,430 --> 00:27:31,340

the abbreviation for example that

689

00:27:35,590 --> 00:27:33,440

Alexander gets uses so it will work with

690

00:27:37,299 --> 00:27:35,600

everyone you can also work with with

691

00:27:40,299 --> 00:27:37,309

everyone in this room everyone is able

692

00:27:42,549 --> 00:27:40,309

to speak with it but Alexander guest is

693

00:27:45,190 --> 00:27:42,559

able to speak with it best that's great

694

00:27:48,610 --> 00:27:45,200

I think we have a social question don't

695

00:27:52,510 --> 00:27:48,620

we you would like to know how does Simon

696

00:27:55,590 --> 00:27:52,520

move in zero-gravity so we got 14

697

00:27:58,360 --> 00:27:55,600

impellers inside this sphere they are

698

00:28:01,060 --> 00:27:58,370

seven no sorry there are eight impellers

699

00:28:04,120 --> 00:28:01,070

in this direction so it is able to move

700

00:28:04,540 --> 00:28:04,130

quite fast to the front then we got four

701
00:28:06,820 --> 00:28:04,550
impellers

702
00:28:08,950 --> 00:28:06,830
in this direction so it's able to move

703
00:28:11,049 --> 00:28:08,960
quite well to the left and to the right

704
00:28:12,640 --> 00:28:11,059
and we got two impellers in to the up

705
00:28:14,680 --> 00:28:12,650
direction so it's able to stabilize and

706
00:28:16,390 --> 00:28:14,690
also just go to perform short movements

707
00:28:18,310 --> 00:28:16,400
we don't have any gyroscopes or anything

708
00:28:20,590 --> 00:28:18,320
in there it's just moving with the with

709
00:28:22,450 --> 00:28:20,600
the help of impellers so we suck in air

710
00:28:23,620 --> 00:28:22,460
on the back for example and then we push

711
00:28:27,900 --> 00:28:23,630
it out to the front and then we're

712
00:28:30,340 --> 00:28:27,910
flying backwards great question marcia

713
00:28:34,780 --> 00:28:30,350

why should an associated press have a

714

00:28:36,549 --> 00:28:34,790

couple questions would Simon be able if

715

00:28:40,840 --> 00:28:36,559

there was a breakdown on the space

716

00:28:45,130 --> 00:28:40,850

station could you could an astronaut

717

00:28:47,590 --> 00:28:45,140

help fix the broken toilet or or or if

718

00:28:49,720 --> 00:28:47,600

there was someone sick could there be

719

00:28:52,450 --> 00:28:49,730

some diagnosis medical things are there

720

00:28:54,880 --> 00:28:52,460

any implementations like that for the

721

00:28:56,980 --> 00:28:54,890

time being this is just a technology

722

00:28:59,830 --> 00:28:56,990

demonstration so we have just three

723

00:29:01,990 --> 00:28:59,840

hours of crew time so with commissioning

724

00:29:04,570 --> 00:29:02,000

then we do we'll do an educational

725

00:29:05,710 --> 00:29:04,580

experiment and we will do some skill

726
00:29:10,960 --> 00:29:05,720
training

727
00:29:13,269 --> 00:29:10,970
and he's not trained to all emergencies

728
00:29:18,070 --> 00:29:13,279
and all protocols for the space station

729
00:29:20,980 --> 00:29:18,080
so this is just the first step so maybe

730
00:29:23,919 --> 00:29:20,990
for a future operating system but this

731
00:29:26,200 --> 00:29:23,929
gonna take a while now we have time for

732
00:29:32,379 --> 00:29:26,210
just one more question I'll go back here

733
00:29:34,930 --> 00:29:32,389
this gentleman right here Thank You

734
00:29:36,869 --> 00:29:34,940
Chuck fields online coffee break um I

735
00:29:39,430 --> 00:29:36,879
assume when an astronaut is

736
00:29:42,220 --> 00:29:39,440
communicating with Simon he uses a waik

737
00:29:44,379 --> 00:29:42,230
word like Simon once he starts that does

738
00:29:48,430 --> 00:29:44,389

he use that word each time or is it more

739

00:29:51,759 --> 00:29:48,440

conversational like Google Play there is

740

00:29:53,470 --> 00:29:51,769

a certain mode that we have installed if

741

00:29:55,749 --> 00:29:53,480

it's activated the crew needs to say

742

00:29:56,799 --> 00:29:55,759

every time Simon so in case for example

743

00:29:58,960 --> 00:29:56,809

if the second roommate enters the

744

00:30:00,490 --> 00:29:58,970

Columbus module Sam shall not be

745

00:30:02,860 --> 00:30:00,500

supposed to listen to that kind of

746

00:30:05,740 --> 00:30:02,870

conversation all the time and and shall

747

00:30:07,990 --> 00:30:05,750

not disrupt that conversation that's why

748

00:30:09,970 --> 00:30:08,000

we implemented that feature so if you

749

00:30:11,710 --> 00:30:09,980

switch that mode on it will only react

750

00:30:13,690 --> 00:30:11,720

if you start a sentence with Simon

751

00:30:14,440 --> 00:30:13,700

what's going on Simon how are you Simon

752

00:30:16,749 --> 00:30:14,450

can you please help me

753

00:30:18,190 --> 00:30:16,759

if you switch off this mode then you can

754

00:30:19,389 --> 00:30:18,200

just talk freely to Simon and if we

755

00:30:21,249 --> 00:30:19,399

listen to everything that you're saying

756

00:30:23,080 --> 00:30:21,259

and you don't need any key words you can

757

00:30:25,659 --> 00:30:23,090

just speak to it freely as well as

758

00:30:27,129 --> 00:30:25,669

whatever you like to say and we and

759

00:30:28,119 --> 00:30:27,139

we've done a lot of work to make sure we

760

00:30:29,889 --> 00:30:28,129

pick up on sort of the way

761

00:30:31,840 --> 00:30:29,899

conversational cues work so you know

762

00:30:33,580 --> 00:30:31,850

when something's directed at Simon or

763

00:30:34,690 --> 00:30:33,590

something else and there's a lot of work

764

00:30:35,980 --> 00:30:34,700

to be done around conversational

765

00:30:37,869 --> 00:30:35,990

analytics to make it as natural as

766

00:30:48,230 --> 00:30:37,879

possible since multiple people are

767

00:30:52,620 --> 00:30:50,580

you're just one thing I want to add I

768

00:30:55,590 --> 00:30:52,630

mean it's a bit more as a smartphone

769

00:30:57,570 --> 00:30:55,600

which follows you so for for this

770

00:30:59,610 --> 00:30:57,580

approach we are doing it's what is

771

00:31:02,820 --> 00:30:59,620

really really important for us is the

772

00:31:05,600 --> 00:31:02,830

human-machine interaction so that the

773

00:31:08,850 --> 00:31:05,610

astronaut works together with an

774

00:31:11,490 --> 00:31:08,860

artificial intelligence as a team so

775

00:31:14,490 --> 00:31:11,500

human and machine they're both part of

776

00:31:17,340 --> 00:31:14,500

our experiment and we are very curious

777

00:31:22,470 --> 00:31:17,350

what what alexander guest will tell us

778

00:31:24,420 --> 00:31:22,480

after trying simon some great technology

779

00:31:25,680 --> 00:31:24,430

for sure christian philip brett thank

780

00:31:27,840 --> 00:31:25,690

you so much for joining us this morning

781

00:31:36,870 --> 00:31:27,850

and share a little bit about simon with

782

00:31:39,480 --> 00:31:36,880

us so thank you very much Chemical

783

00:31:41,700 --> 00:31:39,490

Gardens are structures that grow during

784

00:31:44,850 --> 00:31:41,710

the interaction of metal salt solutions

785

00:31:46,980 --> 00:31:44,860

with a select anions joining us today to

786

00:31:49,230 --> 00:31:46,990

share details about the chemical gardens

787

00:31:51,780 --> 00:31:49,240

science study our principal

788

00:31:53,850 --> 00:31:51,790

investigators dr. Richard Bruegel from

789

00:31:56,190 --> 00:31:53,860

NASA's Marshall Space Flight Center and

790

00:31:58,440 --> 00:31:56,200

dr. Oliver Steinbach from Florida State

791

00:32:00,120 --> 00:31:58,450

University thank you very much yeah

792

00:32:01,500 --> 00:32:00,130

we're we're having something completely

793

00:32:03,900 --> 00:32:01,510

different from you for you guys could

794

00:32:09,830 --> 00:32:03,910

have the first slide please

795

00:32:14,070 --> 00:32:11,010

okay

796

00:32:15,390 --> 00:32:14,080

awesome so we are studying chemical

797

00:32:16,980 --> 00:32:15,400

gardens and their inorganic

798

00:32:20,940 --> 00:32:16,990

precipitation structures that are

799

00:32:22,320 --> 00:32:20,950

looking extremely lifelike and they are

800

00:32:24,600 --> 00:32:22,330

bought in centimeter a couple of

801
00:32:27,540 --> 00:32:24,610
centimeters an inch high formed within

802
00:32:28,980 --> 00:32:27,550
you know a few minutes and he's as you

803
00:32:30,540 --> 00:32:28,990
can see has this tendency to grow

804
00:32:32,660 --> 00:32:30,550
upwards and this would be of course

805
00:32:35,520 --> 00:32:32,670
important next slide please

806
00:32:37,560 --> 00:32:35,530
so probably the older ones in the

807
00:32:38,460 --> 00:32:37,570
audience remember that may be the

808
00:32:40,350 --> 00:32:38,470
younger ones too

809
00:32:42,630 --> 00:32:40,360
these were little chemical toy

810
00:32:44,790 --> 00:32:42,640
demonstrations right and so it has a

811
00:32:47,160 --> 00:32:44,800
very long history it's actually order

812
00:32:49,470 --> 00:32:47,170
the history than this box even Isaac

813
00:32:54,320 --> 00:32:49,480

Newton already studied these systems and

814

00:32:56,790 --> 00:32:54,330

his alchemical studies next slide and

815

00:32:58,110 --> 00:32:56,800

here's another picture of them grown in

816

00:32:59,820 --> 00:32:58,120

the laboratory at Florida State

817

00:33:01,049 --> 00:32:59,830

University and

818

00:33:02,639 --> 00:33:01,059

you see that there's this different

819

00:33:03,960 --> 00:33:02,649

color so I want to quickly tell you what

820

00:33:06,180 --> 00:33:03,970

these structures are made of and how

821

00:33:08,310 --> 00:33:06,190

they are produced you have a clear

822

00:33:10,289 --> 00:33:08,320

liquid it's a basic solution of silicate

823

00:33:12,570 --> 00:33:10,299

and you drop a little tiny crystal in

824

00:33:14,820 --> 00:33:12,580

there and within seconds as crystal

825

00:33:16,769 --> 00:33:14,830

starts to dissolve reactions occur and

826

00:33:19,649 --> 00:33:16,779

the little membrane forms around the

827

00:33:21,630 --> 00:33:19,659

crystal and then water flows in the

828

00:33:24,060 --> 00:33:21,640

membrane birth and out of it comes a

829

00:33:25,950 --> 00:33:24,070

kind of buoyant jet of soil solution and

830

00:33:27,810 --> 00:33:25,960

around that jet you get these chemical

831

00:33:30,509 --> 00:33:27,820

gardens that grow so they are actually

832

00:33:32,879 --> 00:33:30,519

hollow tubes the water's maybe 10

833

00:33:34,710 --> 00:33:32,889

microns thick and in these experiments

834

00:33:39,090 --> 00:33:34,720

and the different colors are different

835

00:33:41,399 --> 00:33:39,100

materials silicates copper oxide copper

836

00:33:44,279 --> 00:33:41,409

hydroxides compounds like that some of

837

00:33:48,840 --> 00:33:44,289

which have catalytic activity okay next

838

00:33:51,450 --> 00:33:48,850

slide and so that brings me to the

839

00:33:52,980 --> 00:33:51,460

reason why would we study them okay so

840

00:33:54,539 --> 00:33:52,990

they're actually at least three good

841

00:33:56,879 --> 00:33:54,549

reasons why you want to study these

842

00:33:59,730 --> 00:33:56,889

systems and the microgravity photos from

843

00:34:03,360 --> 00:33:59,740

it so this was actually a movie playing

844

00:34:04,950 --> 00:34:03,370

there showing the growth the their

845

00:34:06,659 --> 00:34:04,960

natural structures that are very very

846

00:34:08,730 --> 00:34:06,669

similar so on the left you see

847

00:34:10,919 --> 00:34:08,740

hydrothermal vents is white and black

848

00:34:12,359 --> 00:34:10,929

smokers on the ocean floor and those

849

00:34:15,960 --> 00:34:12,369

from a chemical point of view those

850

00:34:17,159 --> 00:34:15,970

materials are very very similar and on

851
00:34:18,869 --> 00:34:17,169
the right hand side you have another

852
00:34:21,599 --> 00:34:18,879
natural phenomena they're briny kills

853
00:34:24,629 --> 00:34:21,609
they're actually happening under ice

854
00:34:26,669 --> 00:34:24,639
floating on the ocean and these gigantic

855
00:34:28,589 --> 00:34:26,679
ice tubes extent down to the ocean floor

856
00:34:30,270 --> 00:34:28,599
so they're also tubular structures from

857
00:34:31,770 --> 00:34:30,280
very different length scales more

858
00:34:35,970 --> 00:34:31,780
interesting for me are the ones on the

859
00:34:38,339 --> 00:34:35,980
Left these hydrothermal vents they're a

860
00:34:40,950 --> 00:34:38,349
possible place where life might have

861
00:34:42,659 --> 00:34:40,960
started on earth and I very quickly give

862
00:34:45,300 --> 00:34:42,669
you three good reasons why it might have

863
00:34:47,280 --> 00:34:45,310

happened there these materials have free

864

00:34:49,680 --> 00:34:47,290

energy available to them it's hot and

865

00:34:52,409 --> 00:34:49,690

you know different PHS on different

866

00:34:54,659 --> 00:34:52,419

sites so there's a energy source that

867

00:34:56,550 --> 00:34:54,669

life could have tapped into the

868

00:34:58,200 --> 00:34:56,560

materials are micro porous so they're

869

00:35:00,660 --> 00:34:58,210

tiny little pores where material can

870

00:35:02,970 --> 00:35:00,670

accumulate and you don't have to produce

871

00:35:04,800 --> 00:35:02,980

a lipid cell membrane the water

872

00:35:08,010 --> 00:35:04,810

structure is catalytically active so you

873

00:35:09,750 --> 00:35:08,020

initially don't need enzymes and there's

874

00:35:11,760 --> 00:35:09,760

some simple interesting compounds coming

875

00:35:13,230 --> 00:35:11,770

out of the ground when these things are

876

00:35:15,000 --> 00:35:13,240

operational so

877

00:35:16,790 --> 00:35:15,010

of interest for NASA's also that similar

878

00:35:21,270 --> 00:35:16,800

structures might exist on other moons

879

00:35:23,280 --> 00:35:21,280

and so we essentially produce these tiny

880

00:35:24,450 --> 00:35:23,290

versions in the laboratory to study them

881

00:35:28,050 --> 00:35:24,460

next slide please

882

00:35:30,810 --> 00:35:28,060

it's my last another motivation is to

883

00:35:33,330 --> 00:35:30,820

turn this into a new type of engineering

884

00:35:35,550 --> 00:35:33,340

it looks like a little toy but every

885

00:35:37,170 --> 00:35:35,560

good technology starts maybe as a toy

886

00:35:40,740 --> 00:35:37,180

when you look at the first transistor or

887

00:35:42,660 --> 00:35:40,750

so and so the idea is here to

888

00:35:44,580 --> 00:35:42,670

essentially grow tubular structures in a

889

00:35:46,590 --> 00:35:44,590

more organic lifelike way so the way I

890

00:35:48,450 --> 00:35:46,600

want to explain that is if life if

891

00:35:50,370 --> 00:35:48,460

biology wants to grow a finger it

892

00:35:53,550 --> 00:35:50,380

doesn't produce finger material extrude

893

00:35:56,370 --> 00:35:53,560

modes it it grows it in a programmed

894

00:35:57,930 --> 00:35:56,380

organic kind of way so we believe that

895

00:35:59,970 --> 00:35:57,940

this is something that you also can do

896

00:36:01,800 --> 00:35:59,980

with inorganic materials reactions and

897

00:36:05,030 --> 00:36:01,810

to turn this into a different type of

898

00:36:07,590 --> 00:36:05,040

technology so I hand it over to Richard

899

00:36:12,270 --> 00:36:07,600

thank you very much we're really pleased

900

00:36:13,859 --> 00:36:12,280

to be here that slide you just saw just

901
00:36:17,390 --> 00:36:13,869
to start out that is not the planet

902
00:36:21,390 --> 00:36:17,400
eater from the original Star Trek series

903
00:36:25,020 --> 00:36:21,400
it is a microfluidic tube that a flow

904
00:36:27,599 --> 00:36:25,030
rate does go through and that flow rate

905
00:36:31,980 --> 00:36:27,609
is dependent on two terms a buoyancy

906
00:36:34,260 --> 00:36:31,990
term and a pressure term we know that

907
00:36:35,640 --> 00:36:34,270
those work and we can determine the flow

908
00:36:37,740 --> 00:36:35,650
rates from that but we don't know the

909
00:36:40,740 --> 00:36:37,750
relative contributions from those two

910
00:36:43,080 --> 00:36:40,750
terms in microgravity the buoyancy term

911
00:36:45,109 --> 00:36:43,090
has a gravity factor in it and up there

912
00:36:48,030 --> 00:36:45,119
it's going to basically go to zero and

913
00:36:50,580 --> 00:36:48,040

when that happens we'll have nothing but

914

00:36:52,200 --> 00:36:50,590

the pressure term to make the structure

915

00:36:56,910 --> 00:36:52,210

and then when we bring them back down

916

00:37:00,480 --> 00:36:56,920

we'll be able to evaluate those and we

917

00:37:01,830 --> 00:37:00,490

can determine strictly from that to how

918

00:37:03,930 --> 00:37:01,840

these things are growing and we'll be

919

00:37:08,480 --> 00:37:03,940

able to sort out those two terms so the

920

00:37:14,460 --> 00:37:12,720

okay so as as professor Steinbach

921

00:37:16,470 --> 00:37:14,470

mentioned we can probably try to make

922

00:37:18,750 --> 00:37:16,480

some novel structures including micro

923

00:37:21,750 --> 00:37:18,760

fluidics this is some ground-based were

924

00:37:23,550 --> 00:37:21,760

research that Alex Blanchard the PhD

925

00:37:25,180 --> 00:37:23,560

graduate student from Florida State is

926

00:37:28,089 --> 00:37:25,190

working on at our lab in

927

00:37:31,420 --> 00:37:28,099

Marshall right now and through some

928

00:37:33,190 --> 00:37:31,430

clever experimental work we're trying to

929

00:37:36,040 --> 00:37:33,200

mimic what we might find in microgravity

930

00:37:38,140 --> 00:37:36,050

and we can see these sort of spiral

931

00:37:39,670 --> 00:37:38,150

structures here so we'll do some more

932

00:37:40,839 --> 00:37:39,680

work with this and we'll compare it to

933

00:37:44,339 --> 00:37:40,849

what we get from the microgravity

934

00:37:46,870 --> 00:37:44,349

experiments next please

935

00:37:50,890 --> 00:37:46,880

yeah the experiments themselves are

936

00:37:53,319 --> 00:37:50,900

really conceptually simple we're gonna

937

00:37:56,410 --> 00:37:53,329

conduct them on the space station in the

938

00:37:59,620 --> 00:37:56,420

glove bag that you see in the upper left

939

00:38:01,839 --> 00:37:59,630

hand corner there and this has been

940

00:38:03,880 --> 00:38:01,849

successful and and this experiment is

941

00:38:06,190 --> 00:38:03,890

has a lot of synergy with the

942

00:38:08,620 --> 00:38:06,200

microgravity investigation of cement

943

00:38:10,870 --> 00:38:08,630

solidification being directed by

944

00:38:14,109 --> 00:38:10,880

Professor Alexander a disc and graduate

945

00:38:16,359 --> 00:38:14,119

student Juliana Navis up at Penn State

946

00:38:18,190 --> 00:38:16,369

and we just completed some of those

947

00:38:20,410 --> 00:38:18,200

experiments in that similar glove bag

948

00:38:22,599 --> 00:38:20,420

very successfully on the experimental

949

00:38:25,480 --> 00:38:22,609

space station and this is basically how

950

00:38:27,550 --> 00:38:25,490

what they look like here we have a burst

951
00:38:30,309 --> 00:38:27,560
bag here with a weak seal in the center

952
00:38:32,140 --> 00:38:30,319
there's a Teflon insert with a wire on

953
00:38:34,540 --> 00:38:32,150
it to which we've attached the crystals

954
00:38:38,710 --> 00:38:34,550
in the bottom is the sodium silicate

955
00:38:40,510 --> 00:38:38,720
solution this will be put into the glove

956
00:38:42,250 --> 00:38:40,520
bag and it will be rolled up the seal

957
00:38:45,370 --> 00:38:42,260
will break and the solution will come in

958
00:38:48,300 --> 00:38:45,380
contact with the crystal and we'll see

959
00:38:51,780 --> 00:38:48,310
what the growth is when it comes back

960
00:38:57,849 --> 00:38:56,170
okay so we realize that we want to get a

961
00:39:00,339 --> 00:38:57,859
lot of science impact out of this also

962
00:39:03,280 --> 00:39:00,349
but it's important that we have some

963
00:39:06,309 --> 00:39:03,290

outreach and this is a picture of our co

964

00:39:09,220 --> 00:39:06,319

eyes on the left is Marshalls chief

965

00:39:13,599 --> 00:39:09,230

microscopist Elin Rabin Berg and on the

966

00:39:16,180 --> 00:39:13,609

right is pH D Oliver's a PhD soon Alex

967

00:39:20,589 --> 00:39:16,190

Blanchard and they're doing an outreach

968

00:39:22,870 --> 00:39:20,599

program here where NASA or Marshall

969

00:39:24,099 --> 00:39:22,880

doesn't NASA in the park vans were they

970

00:39:27,300 --> 00:39:24,109

highlight everything that goes on at

971

00:39:29,859 --> 00:39:27,310

Marshall and one of those events was

972

00:39:31,540 --> 00:39:29,869

we've set up this booth here and and a

973

00:39:33,880 --> 00:39:31,550

hundred and sixty school-aged children

974

00:39:36,790 --> 00:39:33,890

were introduced to chemistry and making

975

00:39:38,440 --> 00:39:36,800

their own chemical gardens and I just

976

00:39:41,130 --> 00:39:38,450

like to close by saying

977

00:39:43,930 --> 00:39:41,140

later on this summer both Alex and

978

00:39:46,569 --> 00:39:43,940

Juliana are going to be in Ellen's lab

979

00:39:48,220 --> 00:39:46,579

and I'm expecting some spirited

980

00:39:50,230 --> 00:39:48,230

discussions between the relative

981

00:39:52,180 --> 00:39:50,240

experiments and we're really hoping for

982

00:39:55,599 --> 00:39:52,190

a solid collaboration between the

983

00:39:57,670 --> 00:39:55,609

chemists and the cement scientists thank

984

00:39:59,290 --> 00:39:57,680

you very much that's great that's great

985

00:40:10,780 --> 00:39:59,300

do we have any questions from our

986

00:40:12,849 --> 00:40:10,790

audience I can clear my space up close

987

00:40:15,040 --> 00:40:12,859

you mentioned the black smokers it could

988

00:40:17,200 --> 00:40:15,050

be a potential origin of life huh talk a

989

00:40:19,660 --> 00:40:17,210

little bit more detail please how this

990

00:40:22,900 --> 00:40:19,670

work will inform us about the black

991

00:40:25,750 --> 00:40:22,910

smokers and very important for me is to

992

00:40:28,329 --> 00:40:25,760

understand it's not only the material

993

00:40:31,390 --> 00:40:28,339

itself it is a gradient the pH jump that

994

00:40:33,250 --> 00:40:31,400

occurs as you cross this membrane so the

995

00:40:36,069 --> 00:40:33,260

black smokers are often iron sulphides

996

00:40:39,940 --> 00:40:36,079

nickel oxides materials like that fairly

997

00:40:42,160 --> 00:40:39,950

hot actually maybe too hot and so we

998

00:40:44,950 --> 00:40:42,170

want to understand and create and study

999

00:40:46,359 --> 00:40:44,960

in the laboratory how these materials in

1000

00:40:48,010 --> 00:40:46,369

the presence of a steep pH or

1001
00:40:50,440 --> 00:40:48,020
temperature gradient can catalyze

1002
00:40:52,420 --> 00:40:50,450
certain reactions and you can do this

1003
00:40:54,190 --> 00:40:52,430
just more precisely in a controlled

1004
00:41:00,790 --> 00:40:54,200
systematic way in the lab than you could

1005
00:41:03,849 --> 00:41:00,800
in a true hydrothermal vent field so

1006
00:41:06,220 --> 00:41:03,859
that aspect is just essentially adding I

1007
00:41:07,599 --> 00:41:06,230
would say the microgravity experience

1008
00:41:09,579 --> 00:41:07,609
primarily contribute to the

1009
00:41:13,750 --> 00:41:09,589
understanding of how gravity conditions

1010
00:41:14,620 --> 00:41:13,760
affect the material and structures that

1011
00:41:16,540 --> 00:41:14,630
are being formed

1012
00:41:19,500 --> 00:41:16,550
but that only indirectly informs this

1013
00:41:22,180 --> 00:41:19,510

particular aspect of the investigations

1014

00:41:27,130 --> 00:41:22,190

and we're gonna go to Twitter for

1015

00:41:28,480 --> 00:41:27,140

another question mark would like to know

1016

00:41:30,190 --> 00:41:28,490

what would be some practical

1017

00:41:34,900 --> 00:41:30,200

applications of the chemical gardens

1018

00:41:36,520 --> 00:41:34,910

here on earth so not in the short-term

1019

00:41:38,290 --> 00:41:36,530

not in the short term but in the long

1020

00:41:40,180 --> 00:41:38,300

term you can think of it as essentially

1021

00:41:41,890 --> 00:41:40,190

the idea of taking a chemistry lab and

1022

00:41:44,230 --> 00:41:41,900

shrinking it down to a little tiny

1023

00:41:45,760 --> 00:41:44,240

microscopic object if you want to move

1024

00:41:47,890 --> 00:41:45,770

the chemicals around you need a little

1025

00:41:50,109 --> 00:41:47,900

plumbing network for this and we hope

1026

00:41:52,240 --> 00:41:50,119

that we can grow these plumbing networks

1027

00:41:53,980 --> 00:41:52,250

in a more intelligent way and

1028

00:41:56,350 --> 00:41:53,990

elegant wave with structures when we

1029

00:41:58,210 --> 00:41:56,360

control them and some particular aspects

1030

00:42:01,180 --> 00:41:58,220

would have little catalytic features or

1031

00:42:02,890 --> 00:42:01,190

analytical features so the one possible

1032

00:42:05,800 --> 00:42:02,900

application would be to shrink it down

1033

00:42:09,070 --> 00:42:05,810

the bigger idea is just to create micro

1034

00:42:10,990 --> 00:42:09,080

shapes in a very different not

1035

00:42:13,720 --> 00:42:11,000

sequential engineering step type of way

1036

00:42:17,260 --> 00:42:13,730

but really through programming and these

1037

00:42:19,300 --> 00:42:17,270

these structures are very sound you can

1038

00:42:21,370 --> 00:42:19,310

pour out the liquid and they style they

1039

00:42:23,920 --> 00:42:21,380

maintain their shape and you can heat

1040

00:42:26,710 --> 00:42:23,930

them up and cinturón and they have

1041

00:42:28,600 --> 00:42:26,720

potential uses as scaffolding for

1042

00:42:30,850 --> 00:42:28,610

biological applications and things like

1043

00:42:33,520 --> 00:42:30,860

that if we understand how better how

1044

00:42:36,910 --> 00:42:33,530

they grow better we're closer to

1045

00:42:38,650 --> 00:42:36,920

applying them okay great in the room do

1046

00:42:44,410 --> 00:42:38,660

we have any more questions from our

1047

00:42:45,970 --> 00:42:44,420

social crowd okay Richard Oliver thank

1048

00:42:54,340 --> 00:42:45,980

you for sharing with us thank you very

1049

00:42:57,160 --> 00:42:54,350

much next up is the ecosystem spaceborne

1050

00:42:59,560 --> 00:42:57,170

thermal radiometer experiment on space

1051
00:43:01,870 --> 00:42:59,570
station known as eco stress which

1052
00:43:03,640 --> 00:43:01,880
measures temperatures of plants and uses

1053
00:43:06,280 --> 00:43:03,650
that information to better understand

1054
00:43:09,400 --> 00:43:06,290
how much water plants need and how they

1055
00:43:11,800 --> 00:43:09,410
respond to stress joining us today from

1056
00:43:13,840 --> 00:43:11,810
NASA's Jet Propulsion Laboratory is dr.

1057
00:43:16,180 --> 00:43:13,850
Simon Hook principal investigator and

1058
00:43:17,890 --> 00:43:16,190
from NASA's headquarters Earth Science

1059
00:43:21,550 --> 00:43:17,900
Division a program scientist woody

1060
00:43:22,630 --> 00:43:21,560
Turner well good morning everyone today

1061
00:43:25,330 --> 00:43:22,640
we're going to tell you a little bit

1062
00:43:27,160 --> 00:43:25,340
about eco stress and how eco stress fits

1063
00:43:30,130 --> 00:43:27,170

in the overall NASA earth science

1064

00:43:33,100 --> 00:43:30,140

program now eco stress stands for the

1065

00:43:35,320 --> 00:43:33,110

ecosystem spaceborne thermal radiometer

1066

00:43:37,450 --> 00:43:35,330

experiments on space station yes I

1067

00:43:39,340 --> 00:43:37,460

realize it's a bit of a mouthful it's

1068

00:43:42,250 --> 00:43:39,350

actually a thermal infrared radiometer

1069

00:43:44,590 --> 00:43:42,260

that measures the energy that's coming

1070

00:43:46,990 --> 00:43:44,600

off the surface and then translates that

1071

00:43:48,490 --> 00:43:47,000

energy into a temperature so it works a

1072

00:43:51,580 --> 00:43:48,500

lot like when you put your hand above a

1073

00:43:53,590 --> 00:43:51,590

stove and you can feel the heat and your

1074

00:43:55,510 --> 00:43:53,600

hand is a crude thermal infrared sensor

1075

00:43:57,460 --> 00:43:55,520

obviously this instruments a lot better

1076

00:43:59,320 --> 00:43:57,470

than that and that allows us to get the

1077

00:44:01,300 --> 00:43:59,330

surface temperature and once we've got

1078

00:44:03,820 --> 00:44:01,310

the surface temperature we can use that

1079

00:44:04,930 --> 00:44:03,830

to do all sorts of studies and what

1080

00:44:06,670 --> 00:44:04,940

we're going to do is

1081

00:44:12,700 --> 00:44:06,680

pants so if you can just have the first

1082

00:44:14,920 --> 00:44:12,710

slide so plants and drawing water

1083

00:44:17,920 --> 00:44:14,930

through their roots and then that water

1084

00:44:19,630 --> 00:44:17,930

gets expelled through small pores on the

1085

00:44:22,150 --> 00:44:19,640

underside of their leaves called stomata

1086

00:44:24,309 --> 00:44:22,160

and as this water gets expelled

1087

00:44:27,579 --> 00:44:24,319

it keeps the plants cool and these same

1088

00:44:31,300 --> 00:44:27,589

pores are used to drawing co2 and then

1089

00:44:33,730 --> 00:44:31,310

use it to make with photosynthesis to

1090

00:44:35,890 --> 00:44:33,740

make sugars and grow the plant now if

1091

00:44:37,960 --> 00:44:35,900

the plant has enough water it can stay

1092

00:44:40,960 --> 00:44:37,970

cool but if it doesn't then these

1093

00:44:43,720 --> 00:44:40,970

stomata closed and the plant temperature

1094

00:44:45,520 --> 00:44:43,730

goes up and eventually it starves and so

1095

00:44:46,839 --> 00:44:45,530

we can see this change in plant

1096

00:44:49,180 --> 00:44:46,849

temperature when we can use it as a

1097

00:44:52,990 --> 00:44:49,190

proxy for the amount of water that the

1098

00:44:54,880 --> 00:44:53,000

plant is actually using now this process

1099

00:44:56,500 --> 00:44:54,890

as I mentioned is called transpiration

1100

00:44:58,930 --> 00:44:56,510

from the plant but there's also

1101
00:45:00,460 --> 00:44:58,940
evaporation from the surface and the two

1102
00:45:03,220 --> 00:45:00,470
combined are called evapotranspiration

1103
00:45:05,470 --> 00:45:03,230
and that's what we'll be measuring from

1104
00:45:08,730 --> 00:45:05,480
the International Space Station so our

1105
00:45:13,990 --> 00:45:11,640
so as you can imagine evapotranspiration

1106
00:45:16,030 --> 00:45:14,000
varies throughout the day and this is

1107
00:45:17,500 --> 00:45:16,040
actually a plot and you can see it

1108
00:45:19,510 --> 00:45:17,510
starts in the morning and then it goes

1109
00:45:21,670 --> 00:45:19,520
to the end of the evening and you can

1110
00:45:23,230 --> 00:45:21,680
see how evapotranspiration increases and

1111
00:45:25,540 --> 00:45:23,240
then in the middle of the day it shuts

1112
00:45:27,700 --> 00:45:25,550
down when the stomata closed and then it

1113
00:45:29,859 --> 00:45:27,710

starts up again later in the day so

1114

00:45:32,349 --> 00:45:29,869

obviously what we want to do is be able

1115

00:45:32,740 --> 00:45:32,359

to see how this varies throughout the

1116

00:45:34,809 --> 00:45:32,750

day

1117

00:45:36,910 --> 00:45:34,819

now most satellites fly over at this

1118

00:45:39,280 --> 00:45:36,920

sort of same time every morning at about

1119

00:45:40,480 --> 00:45:39,290

10:30 so they don't really give us a

1120

00:45:42,220 --> 00:45:40,490

good indication of how this

1121

00:45:44,349 --> 00:45:42,230

evapotranspiration is varying throughout

1122

00:45:46,000 --> 00:45:44,359

the day but the International Space

1123

00:45:48,550 --> 00:45:46,010

Station is in what's called a processing

1124

00:45:50,829 --> 00:45:48,560

orbit and as a result it flies over at

1125

00:45:52,270 --> 00:45:50,839

different times of day and so we can use

1126

00:45:53,589 --> 00:45:52,280

the unique vantage point of the

1127

00:45:55,809 --> 00:45:53,599

International Space Station

1128

00:45:58,180 --> 00:45:55,819

to be able to see how this is varying

1129

00:46:00,069 --> 00:45:58,190

through throughout the day and there's a

1130

00:46:01,329 --> 00:46:00,079

picture estimator in the background

1131

00:46:02,430 --> 00:46:01,339

there so we'll have the next slide

1132

00:46:04,210 --> 00:46:02,440

please

1133

00:46:06,339 --> 00:46:04,220

now the other thing about

1134

00:46:08,920 --> 00:46:06,349

evapotranspiration is it's what's known

1135

00:46:11,349 --> 00:46:08,930

as a leading indicator so what that

1136

00:46:13,960 --> 00:46:11,359

means is we know what's going on before

1137

00:46:15,640 --> 00:46:13,970

it actually happened so we can see the

1138

00:46:18,279 --> 00:46:15,650

plants are stressed by looking at their

1139

00:46:20,499 --> 00:46:18,289

temperature before they actually

1140

00:46:22,419 --> 00:46:20,509

start to turn brown and die so this is

1141

00:46:25,539 --> 00:46:22,429

very useful now this is a picture of

1142

00:46:27,549 --> 00:46:25,549

evapotranspiration rates for the US

1143

00:46:30,069 --> 00:46:27,559

during one of the major droughts and you

1144

00:46:33,279 --> 00:46:30,079

can see the area that was being strongly

1145

00:46:36,699 --> 00:46:33,289

affected by the drought you know in this

1146

00:46:37,900 --> 00:46:36,709

image is the the red area so what we'll

1147

00:46:40,749 --> 00:46:37,910

be able to do is measure

1148

00:46:42,640 --> 00:46:40,759

evapotranspiration over the entire globe

1149

00:46:43,479 --> 00:46:42,650

now obviously a farmer could go out and

1150

00:46:45,189 --> 00:46:43,489

do this and measure the

1151
00:46:46,689 --> 00:46:45,199
evapotranspiration themselves but you

1152
00:46:49,059 --> 00:46:46,699
need a lot of farmers to be able to

1153
00:46:51,159 --> 00:46:49,069
cover the entire globe and so obviously

1154
00:46:52,839 --> 00:46:51,169
that's another big advantage with the

1155
00:46:54,329 --> 00:46:52,849
space station so I have the next slide

1156
00:46:56,979 --> 00:46:54,339
please

1157
00:46:59,109 --> 00:46:56,989
and this just illustrates that point I

1158
00:47:01,689 --> 00:46:59,119
was making earlier about the fact that

1159
00:47:04,479 --> 00:47:01,699
the International Space Station flies

1160
00:47:06,459 --> 00:47:04,489
over at different times and what you see

1161
00:47:08,289 --> 00:47:06,469
is if you look at say 10 o'clock there's

1162
00:47:11,380 --> 00:47:08,299
a bar chart and it shows that the

1163
00:47:13,839 --> 00:47:11,390

numbers about 24 and we have two

1164

00:47:16,089 --> 00:47:13,849

satellites that fly over but they say

1165

00:47:17,709 --> 00:47:16,099

fly over twice a month and they only fly

1166

00:47:20,949 --> 00:47:17,719

over at 10 o'clock

1167

00:47:23,199 --> 00:47:20,959

but with on the ISS will fly over 24

1168

00:47:25,239 --> 00:47:23,209

times at 10 o'clock at 11 o'clock at 12

1169

00:47:27,189 --> 00:47:25,249

o'clock and so on throughout the day and

1170

00:47:29,949 --> 00:47:27,199

we can use that now another big

1171

00:47:32,529 --> 00:47:29,959

advantage with eco stress is it has a

1172

00:47:35,079 --> 00:47:32,539

very wide swath and the way that that

1173

00:47:37,089 --> 00:47:35,089

works is it has a mirror and it looks

1174

00:47:39,579 --> 00:47:37,099

off to one side and then that mirror

1175

00:47:41,439 --> 00:47:39,589

scans across the surface as the station

1176

00:47:44,229 --> 00:47:41,449

is moving forward and we use that

1177

00:47:46,839 --> 00:47:44,239

scanning to build up a picture and then

1178

00:47:49,929 --> 00:47:46,849

turn that into a temperature so if we go

1179

00:47:51,370 --> 00:47:49,939

to the next slide please so this just

1180

00:47:53,229 --> 00:47:51,380

next slide just shows you where Eco

1181

00:47:55,419 --> 00:47:53,239

stress will go on the International

1182

00:47:57,549 --> 00:47:55,429

Space Station you can probably see it's

1183

00:48:00,309 --> 00:47:57,559

indicated by the arrow it's on the

1184

00:48:02,380 --> 00:48:00,319

leftmost side of the picture as I'm

1185

00:48:04,179 --> 00:48:02,390

looking at it and so what happens is

1186

00:48:06,249 --> 00:48:04,189

inside that box there's this mirror

1187

00:48:08,380 --> 00:48:06,259

that's rotating around it's looking at

1188

00:48:10,569 --> 00:48:08,390

its scanning across as the station is

1189

00:48:12,909 --> 00:48:10,579

moving forward and we're actually

1190

00:48:14,890 --> 00:48:12,919

building up the image so what I'd like

1191

00:48:17,499 --> 00:48:14,900

to do now is just sort of show you a

1192

00:48:22,029 --> 00:48:17,509

video of that emotion and we'll go to

1193

00:48:24,039 --> 00:48:22,039

the next slide please so what you can

1194

00:48:26,259 --> 00:48:24,049

see is the station moving along at the

1195

00:48:29,199 --> 00:48:26,269

very front on the left hand side in the

1196

00:48:31,990 --> 00:48:29,209

gray area is the journey F platform or

1197

00:48:35,260 --> 00:48:32,000

the Japanese external module experiment

1198

00:48:36,700 --> 00:48:35,270

facility and that is where eco stress is

1199

00:48:39,430 --> 00:48:36,710

going to go you can sort of see it's

1200

00:48:41,080 --> 00:48:39,440

highlighted there on the left and so

1201
00:48:43,300 --> 00:48:41,090
what will happen is this video will zoom

1202
00:48:44,860 --> 00:48:43,310
in and we're actually looking at Salton

1203
00:48:46,060 --> 00:48:44,870
Sea and you can see the green fields

1204
00:48:47,920 --> 00:48:46,070
this is what you'd see if you're looking

1205
00:48:49,480 --> 00:48:47,930
with your eye but eco stress will see

1206
00:48:51,670 --> 00:48:49,490
the temperature and you can see the

1207
00:48:53,260 --> 00:48:51,680
different areas the blue colder areas

1208
00:48:55,390 --> 00:48:53,270
and those are the areas that are being

1209
00:48:57,580 --> 00:48:55,400
watered are being irrigated so we can

1210
00:49:00,430 --> 00:48:57,590
use this information to help farmers to

1211
00:49:02,170 --> 00:49:00,440
understand what is going on in terms of

1212
00:49:04,870 --> 00:49:02,180
their crops and to get the maximum yield

1213
00:49:07,780 --> 00:49:04,880

from the amount of water that is

1214

00:49:09,730 --> 00:49:07,790

available but we can also use it to look

1215

00:49:11,770 --> 00:49:09,740

at other regions around the world that

1216

00:49:13,240 --> 00:49:11,780

are stressed and see how those regions

1217

00:49:15,610 --> 00:49:13,250

are changing so we can look at the major

1218

00:49:18,070 --> 00:49:15,620

biomes and we can see whether they're

1219

00:49:19,150 --> 00:49:18,080

transit whether plants are different

1220

00:49:23,010 --> 00:49:19,160

plants are coming in or they're

1221

00:49:25,630 --> 00:49:23,020

transitioning to different types of

1222

00:49:27,010 --> 00:49:25,640

environments so it's going to be a very

1223

00:49:28,630 --> 00:49:27,020

useful instrument from that point of

1224

00:49:30,040 --> 00:49:28,640

view and now I'd like to just hand it

1225

00:49:31,450 --> 00:49:30,050

over to woody and he'll tell us a little

1226

00:49:34,060 --> 00:49:31,460

bit more about how it fits in the

1227

00:49:36,400 --> 00:49:34,070

overall NASA program thank you very much

1228

00:49:38,410 --> 00:49:36,410

Simon this is just a fantastic mission

1229

00:49:40,960 --> 00:49:38,420

we have here first I want to step back

1230

00:49:43,020 --> 00:49:40,970

and talk a bit about why we care so much

1231

00:49:48,970 --> 00:49:43,030

about plants if I could get the first

1232

00:49:50,830 --> 00:49:48,980

next slide as you say please Simon

1233

00:49:53,800 --> 00:49:50,840

mentioned the process of photosynthesis

1234

00:49:57,220 --> 00:49:53,810

in that process plants take energy from

1235

00:49:59,230 --> 00:49:57,230

our star the Sun add water and carbon

1236

00:50:01,390 --> 00:49:59,240

dioxide and produce sugars now these

1237

00:50:03,160 --> 00:50:01,400

sugars are really key this plant primary

1238

00:50:05,680 --> 00:50:03,170

production these sugars are the basis

1239

00:50:08,850 --> 00:50:05,690

for the vast majority of food on this

1240

00:50:11,800 --> 00:50:08,860

planet in addition they produce oxygen

1241

00:50:13,870 --> 00:50:11,810

so plants are both feeding us and giving

1242

00:50:16,060 --> 00:50:13,880

an oxygen oxygenating our atmosphere so

1243

00:50:18,870 --> 00:50:16,070

that we can breathe major stuff thanks

1244

00:50:22,450 --> 00:50:18,880

to plants next slide please

1245

00:50:27,840 --> 00:50:22,460

this slide shows the active earth

1246

00:50:29,890 --> 00:50:27,850

science space missions of NASA and it

1247

00:50:31,780 --> 00:50:29,900

gives you the perspective that we're

1248

00:50:33,550 --> 00:50:31,790

looking at our planet as we look at

1249

00:50:35,200 --> 00:50:33,560

other planets in the solar system from

1250

00:50:38,380 --> 00:50:35,210

the vantage point of space it's a very

1251
00:50:39,850 --> 00:50:38,390
holistic top-down view and lets us get

1252
00:50:42,250 --> 00:50:39,860
an understanding of the whole earth

1253
00:50:44,410 --> 00:50:42,260
system and doing that now their system

1254
00:50:45,130 --> 00:50:44,420
is quite complex so we have a number of

1255
00:50:47,019 --> 00:50:45,140
number

1256
00:50:49,089 --> 00:50:47,029
systems looking at different components

1257
00:50:50,470 --> 00:50:49,099
of the Earth's system at the same trying

1258
00:50:52,150 --> 00:50:50,480
to try to give us the big picture and

1259
00:50:55,059 --> 00:50:52,160
understand it sort of soup-to-nuts the

1260
00:50:58,059 --> 00:50:55,069
atmosphere the ocean the lands and life

1261
00:51:00,130 --> 00:50:58,069
and how they all interact now

1262
00:51:02,710 --> 00:51:00,140
we've marked on this particular slide

1263
00:51:05,769 --> 00:51:02,720

those missions that are focused on the

1264

00:51:08,349 --> 00:51:05,779

water cycle with a water droplet those

1265

00:51:09,910 --> 00:51:08,359

focusing on carbon with a sea and I want

1266

00:51:12,309 --> 00:51:09,920

to focus on the water cycle in carbon

1267

00:51:15,490 --> 00:51:12,319

cycle as well as climate because these

1268

00:51:18,039 --> 00:51:15,500

are three key elements of our system and

1269

00:51:19,630 --> 00:51:18,049

they're an eco stress sits right at the

1270

00:51:21,099 --> 00:51:19,640

intersection of those those three

1271

00:51:24,210 --> 00:51:21,109

elements the carbon cycle water cycle

1272

00:51:28,059 --> 00:51:24,220

and climate of course we water and

1273

00:51:30,910 --> 00:51:28,069

carbon or key to all life and climate is

1274

00:51:33,730 --> 00:51:30,920

a huge driver of the physical chemical

1275

00:51:35,950 --> 00:51:33,740

and biological elements of our system as

1276
00:51:38,710 --> 00:51:35,960
a specially prime mover for what's going

1277
00:51:40,750 --> 00:51:38,720
on on this on this planet and eco stress

1278
00:51:42,519 --> 00:51:40,760
captures how those three interacts

1279
00:51:47,400 --> 00:51:42,529
essentially the dance of those three key

1280
00:51:49,749 --> 00:51:47,410
elements it's a great integrator and and

1281
00:51:52,499 --> 00:51:49,759
fantastic now I will have you noticed

1282
00:51:55,630 --> 00:51:52,509
that on the water side of the equation

1283
00:51:58,180 --> 00:51:55,640
many of those those those current

1284
00:52:00,519 --> 00:51:58,190
missions are focusing on the supply side

1285
00:52:03,849 --> 00:52:00,529
of the water cycle in other words where

1286
00:52:05,259 --> 00:52:03,859
the water comes from precipitation where

1287
00:52:07,720 --> 00:52:05,269
it is where it's located on the surface

1288
00:52:10,930 --> 00:52:07,730

either at the surface or in the soil or

1289

00:52:13,900 --> 00:52:10,940

perhaps even deep underground eco stress

1290

00:52:15,579 --> 00:52:13,910

its thermal channels are looking at the

1291

00:52:17,109 --> 00:52:15,589

demand for water by plants we're

1292

00:52:19,599 --> 00:52:17,119

capturing the demand side there -

1293

00:52:21,599 --> 00:52:19,609

another key component of eco stress next

1294

00:52:25,150 --> 00:52:21,609

slide please

1295

00:52:26,970 --> 00:52:25,160

and the point of this slide is to say

1296

00:52:29,859 --> 00:52:26,980

that in addition to doing great science

1297

00:52:31,450 --> 00:52:29,869

eco stress is also an applications

1298

00:52:34,150 --> 00:52:31,460

mission even though it's only going to

1299

00:52:37,420 --> 00:52:34,160

be there for a year to your year two

1300

00:52:39,190 --> 00:52:37,430

years relatively short time and during

1301

00:52:41,559 --> 00:52:39,200

that time it will help folks making

1302

00:52:45,220 --> 00:52:41,569

real-time decisions in several areas one

1303

00:52:46,900 --> 00:52:45,230

agriculture farmers need to know where

1304

00:52:49,029 --> 00:52:46,910

to apply water and when to use the water

1305

00:52:52,120 --> 00:52:49,039

most efficiently obviously water

1306

00:52:53,980 --> 00:52:52,130

managers need to know where to use water

1307

00:52:56,289 --> 00:52:53,990

again the minimal amount of water

1308

00:52:58,900 --> 00:52:56,299

necessary at a time of increasing water

1309

00:53:00,880 --> 00:52:58,910

scarcity and also because it's a

1310

00:53:03,069 --> 00:53:00,890

temperature sensor has temperature

1311

00:53:05,109 --> 00:53:03,079

channels on it it will help us

1312

00:53:07,690 --> 00:53:05,119

understand some major natural hazards

1313

00:53:09,910 --> 00:53:07,700

such as droughts and also hot spots from

1314

00:53:11,279 --> 00:53:09,920

fires and volcanoes and then finally

1315

00:53:13,630 --> 00:53:11,289

it's going to give us the big picture

1316

00:53:15,010 --> 00:53:13,640

for all natural resource manager

1317

00:53:16,690 --> 00:53:15,020

stressful natural resource managers to

1318

00:53:18,520 --> 00:53:16,700

help how their systems are doing how the

1319

00:53:19,870 --> 00:53:18,530

Rican systems are doing are they

1320

00:53:22,120 --> 00:53:19,880

stressed or not and for that of course

1321

00:53:24,390 --> 00:53:22,130

it all starts and ends with the plants

1322

00:53:26,740 --> 00:53:24,400

thanks

1323

00:53:33,910 --> 00:53:26,750

so does anybody have any questions for

1324

00:53:36,190 --> 00:53:33,920

Simon or woody thanks Jim Siegel Space

1325

00:53:39,010 --> 00:53:36,200

Flight Insider I'm particularly

1326

00:53:42,400 --> 00:53:39,020

intrigued by it how this can be applied

1327

00:53:46,900 --> 00:53:42,410

to say the average farmer down on earth

1328

00:53:49,870 --> 00:53:46,910

so my understanding was that you have

1329

00:53:51,730 --> 00:53:49,880

echo stress up in the ISS and it can

1330

00:53:55,960 --> 00:53:51,740

look down and look for hotspots and I

1331

00:53:57,760 --> 00:53:55,970

presume that will tell farmers whether

1332

00:53:59,559 --> 00:53:57,770

to increase or decrease the amount of

1333

00:54:04,450 --> 00:53:59,569

water that they're giving their plants

1334

00:54:07,779 --> 00:54:04,460

is that true first yes it's it's true

1335

00:54:10,029 --> 00:54:07,789

basically what will happen is that we

1336

00:54:12,279 --> 00:54:10,039

have partners on the mission from the US

1337

00:54:14,319 --> 00:54:12,289

Department of Agriculture and those

1338

00:54:15,910 --> 00:54:14,329

partners will get the data and work with

1339

00:54:18,279 --> 00:54:15,920

the data that we make publicly available

1340

00:54:20,109 --> 00:54:18,289

to everyone and then they will use that

1341

00:54:23,740 --> 00:54:20,119

to produce products which the farmers

1342

00:54:25,569 --> 00:54:23,750

can then use to look at how much

1343

00:54:28,089 --> 00:54:25,579

evapotranspiration is taking place

1344

00:54:30,549 --> 00:54:28,099

within their fields one of the great

1345

00:54:33,250 --> 00:54:30,559

things about eco stress is it allows us

1346

00:54:35,740 --> 00:54:33,260

to take very detailed pictures and so

1347

00:54:37,690 --> 00:54:35,750

you know we can see variations in

1348

00:54:39,789 --> 00:54:37,700

temperature within a field and so we can

1349

00:54:42,700 --> 00:54:39,799

see the people can see how much water to

1350

00:54:47,740 --> 00:54:42,710

put on the different parts thing I mean

1351

00:54:49,420 --> 00:54:47,750

I can call up somebody and say it's an

1352

00:54:52,690 --> 00:54:49,430

experimental mission that we're trying

1353

00:54:54,849 --> 00:54:52,700

out for one year but what we hope to do

1354

00:54:57,160 --> 00:54:54,859

is in a few months get the products out

1355

00:54:59,260 --> 00:54:57,170

so people can start using them and then

1356

00:55:01,569 --> 00:54:59,270

we should be able to update them more

1357

00:55:03,010 --> 00:55:01,579

frequently say weekly because from a

1358

00:55:05,230 --> 00:55:03,020

farmers point of view you want to know

1359

00:55:06,640 --> 00:55:05,240

how this is changing over a relatively

1360

00:55:08,500 --> 00:55:06,650

short period but it's not in the matter

1361

00:55:11,710 --> 00:55:08,510

of hours it's more in the matter of days

1362

00:55:13,720 --> 00:55:11,720

longer term after eco stress is

1363

00:55:15,790 --> 00:55:13,730

decommissioned or whatever on the on the

1364

00:55:18,130 --> 00:55:15,800

international space station then what

1365

00:55:20,680 --> 00:55:18,140

happens does another piece of equipment

1366

00:55:23,230 --> 00:55:20,690

go up there well we'd certainly like

1367

00:55:24,940 --> 00:55:23,240

that but you know nASA has to decide

1368

00:55:27,370 --> 00:55:24,950

what the next missions are going to be

1369

00:55:28,960 --> 00:55:27,380

and what we hope that is that eco stress

1370

00:55:31,240 --> 00:55:28,970

will just show you how valuable a

1371

00:55:32,620 --> 00:55:31,250

measurement this is and then it will

1372

00:55:34,060 --> 00:55:32,630

continue to make those measurements in

1373

00:55:35,589 --> 00:55:34,070

the future thank you there's something

1374

00:55:37,150 --> 00:55:35,599

called the National Academy puts out

1375

00:55:40,330 --> 00:55:37,160

something called a decade old survey

1376

00:55:42,010 --> 00:55:40,340

which recommends to NASA what types of

1377

00:55:43,660 --> 00:55:42,020

missions they should be flying and we

1378

00:55:46,210 --> 00:55:43,670

just had one come out of the inning of

1379

00:55:47,650 --> 00:55:46,220

this year from the National Academy and

1380

00:55:48,700 --> 00:55:47,660

one of the one of the missions they're

1381

00:55:50,859 --> 00:55:48,710

interested in looking at is a

1382

00:55:53,680 --> 00:55:50,869

multispectral or hyperspectral perhaps

1383

00:55:56,800 --> 00:55:53,690

the thermal instrument and so stay tuned

1384

00:56:04,290 --> 00:55:56,810

there may well be a eco stress follow-on

1385

00:56:10,800 --> 00:56:08,500

Daniel Spinola to blow honey tease my

1386

00:56:13,660 --> 00:56:10,810

question is actually on the flip side of

1387

00:56:15,849 --> 00:56:13,670

that which are looking at and just

1388

00:56:18,130 --> 00:56:15,859

wondering if you look at the other side

1389

00:56:19,930 --> 00:56:18,140

of things where you know where I'm from

1390

00:56:22,900 --> 00:56:19,940

right now there's a lot of landslides

1391

00:56:24,849 --> 00:56:22,910

from too much water and so is there a

1392

00:56:28,630 --> 00:56:24,859

look at the stress of maybe too much

1393

00:56:31,930 --> 00:56:28,640

water on plants in this mission as well

1394

00:56:34,060 --> 00:56:31,940

so we're not doing that in this mission

1395

00:56:35,560 --> 00:56:34,070

but the important thing is that when you

1396

00:56:36,730 --> 00:56:35,570

measure the surface temperature just

1397

00:56:38,349 --> 00:56:36,740

like when you go to the doctors and you

1398

00:56:41,740 --> 00:56:38,359

takes your temperature it's indicative

1399

00:56:43,420 --> 00:56:41,750

of all sorts of ailments and information

1400

00:56:45,520 --> 00:56:43,430

if you look at the surface temperature

1401

00:56:47,650 --> 00:56:45,530

you can see other patterns so you may be

1402

00:56:50,230 --> 00:56:47,660

able to see some patterns that are

1403

00:56:52,180 --> 00:56:50,240

associated with changes of soap that

1404

00:56:54,130 --> 00:56:52,190

might indicate a landslide or something

1405

00:56:57,130 --> 00:56:54,140

like that so these kinds of data have

1406

00:56:59,380 --> 00:56:57,140

been used in the past to to look at

1407

00:57:00,880 --> 00:56:59,390

landslides because you know with a

1408

00:57:02,140 --> 00:57:00,890

temperature measurement you can use it

1409

00:57:04,390 --> 00:57:02,150

to look at all and side you can look at

1410

00:57:06,370 --> 00:57:04,400

a volcano say the volcanoes in Hawaii

1411

00:57:08,380 --> 00:57:06,380

you know you can use it to look at heat

1412

00:57:10,420 --> 00:57:08,390

waves in cities so it's a very versatile

1413

00:57:12,490 --> 00:57:10,430

measurement so you can use it for those

1414

00:57:14,020 --> 00:57:12,500

kinds of things but we're not intending

1415

00:57:17,020 --> 00:57:14,030

to do it with eco stress which is

1416

00:57:19,800 --> 00:57:17,030

focused just on the plant there are a

1417

00:57:24,510 --> 00:57:22,530

I'm cross with Tesla Rotti I had a

1418

00:57:26,130 --> 00:57:24,520

question about the thermal camera could

1419

00:57:29,250 --> 00:57:26,140

you tell us the make and model of the

1420

00:57:30,870 --> 00:57:29,260

thermal camera and also how do you

1421

00:57:33,590 --> 00:57:30,880

ignore the weather the temperature of

1422

00:57:35,610 --> 00:57:33,600

the clouds and rain storms and is this a

1423

00:57:38,190 --> 00:57:35,620

subscription service that you plan on

1424

00:57:40,050 --> 00:57:38,200

providing to farmers so that they don't

1425

00:57:43,350 --> 00:57:40,060

fly drones around equipped with a FLIR

1426

00:57:45,600 --> 00:57:43,360

camera on their own fields that's so

1427

00:57:47,970 --> 00:57:45,610

that was three question questions so

1428

00:57:50,100 --> 00:57:47,980

I'll do my best to get through them so

1429

00:57:52,680 --> 00:57:50,110

the first one in terms of the instrument

1430

00:57:54,510 --> 00:57:52,690

the instrument was designed develops

1431

00:57:56,070 --> 00:57:54,520

built by JPL the Jet Propulsion

1432

00:57:58,980 --> 00:57:56,080

Laboratory which is one of the NASA

1433

00:58:01,020 --> 00:57:58,990

centers so it's a it's a unique custom

1434

00:58:05,190 --> 00:58:01,030

one-of-a-kind instrument that's the

1435

00:58:08,790 --> 00:58:05,200

first thing now well the second two

1436

00:58:11,130 --> 00:58:08,800

questions the subscription service

1437

00:58:13,680 --> 00:58:11,140

question so NASA makes all its data

1438

00:58:17,540 --> 00:58:13,690

freely available and so anyone can go

1439

00:58:19,590 --> 00:58:17,550

and download the data from eco stress

1440

00:58:23,370 --> 00:58:19,600

you know once we've done the initial

1441

00:58:24,600 --> 00:58:23,380

processing so you know anyone can get

1442

00:58:26,670 --> 00:58:24,610

access to the data and that's always

1443

00:58:31,380 --> 00:58:26,680

been a a NASA policy and a very

1444

00:58:35,370 --> 00:58:31,390

important policy for research yes we

1445

00:58:38,190 --> 00:58:35,380

don't see through clouds so we rely on

1446

00:58:39,720 --> 00:58:38,200

the way there being clear and of course

1447

00:58:41,490 --> 00:58:39,730

that's important because what that tells

1448

00:58:43,440 --> 00:58:41,500

you is that you want something that goes

1449

00:58:45,480 --> 00:58:43,450

over fairly frequently so you can see

1450

00:58:47,490 --> 00:58:45,490

between the clouds or when there aren't

1451

00:58:49,170 --> 00:58:47,500

clouds there and so one of the

1452

00:58:51,390 --> 00:58:49,180

advantages of this instrument is because

1453

00:58:53,610 --> 00:58:51,400

it has such a wide swath we get to see

1454

00:58:55,560 --> 00:58:53,620

every few days the other instruments

1455

00:58:57,840 --> 00:58:55,570

don't go over until every two weeks so

1456

00:58:59,550 --> 00:58:57,850

if they if they hit a cloudy cloudy day

1457

00:59:01,590 --> 00:58:59,560

then they don't get to go over for a

1458

00:59:04,230 --> 00:59:01,600

whole month where is because we go over

1459

00:59:05,880 --> 00:59:04,240

fairly frequently we can get

1460

00:59:08,490 --> 00:59:05,890

opportunities to see when it's not

1461

00:59:12,420 --> 00:59:08,500

clouded okay we have time for this one

1462

00:59:14,190 --> 00:59:12,430

more question yeah and you mentioned

1463

00:59:16,290 --> 00:59:14,200

that field of view what what is that

1464

00:59:18,390 --> 00:59:16,300

field of view in miles or kilometers on

1465

00:59:21,240 --> 00:59:18,400

the ground that it can see 400

1466

00:59:23,070 --> 00:59:21,250

kilometers on the ground so it is really

1467

00:59:26,250 --> 00:59:23,080

a wide field of view is plus or minus 25

1468

00:59:28,770 --> 00:59:26,260

degrees there's a lot of information at

1469

00:59:31,170 --> 00:59:28,780

eco stress JPL nasa.gov about the

1470

00:59:33,319 --> 00:59:31,180

instruments and the characteristics but

1471

00:59:35,630 --> 00:59:33,329

it is a very wide field that

1472

00:59:38,620 --> 00:59:35,640

field of view and so you know that's

1473

00:59:41,719 --> 00:59:38,630

what allows us to look so frequently

1474

00:59:43,789 --> 00:59:41,729

well let's thank Simon and woody for

1475

00:59:45,380 --> 00:59:43,799

sharing with us the Eco stress program

1476

00:59:48,609 --> 00:59:45,390

thank you

1477

00:59:52,160 --> 00:59:48,619

[Applause]

1478

00:59:54,079 --> 00:59:52,170

next the be Katz CS investigation will

1479

00:59:55,910 --> 00:59:54,089

study forces between particles that

1480

00:59:58,789 --> 00:59:55,920

cluster together in sediment

1481

01:00:01,190 --> 00:59:58,799

please welcome dr. paulo Lizotte so

1482

01:00:02,870 --> 01:00:01,200

fidgets the principal investigator from

1483

01:00:05,420 --> 01:00:02,880

the University of California Santa

1484

01:00:07,609 --> 01:00:05,430

Barbara and the director of the National

1485

01:00:09,829 --> 01:00:07,619

Science Foundation Division of chemical

1486

01:00:14,589 --> 01:00:09,839

bioengineering environmental and

1487

01:00:18,789 --> 01:00:17,180

director of Seebeck which is the long

1488

01:00:20,809 --> 01:00:18,799

winded

1489

01:00:22,459 --> 01:00:20,819

division that was just mentioned that's

1490

01:00:23,930 --> 01:00:22,469

in the engineering Directorate at the

1491

01:00:26,359 --> 01:00:23,940

National Science Foundation so I'm very

1492

01:00:28,640 --> 01:00:26,369

excited today to talk about our very

1493

01:00:30,739 --> 01:00:28,650

first launch in the engineering

1494

01:00:33,049 --> 01:00:30,749

Directorate which is Paulo's experiment

1495

01:00:35,930 --> 01:00:33,059

so I got a very short prepared statement

1496

01:00:38,390 --> 01:00:35,940

and then Paula Wolfe it's really his

1497

01:00:39,739 --> 01:00:38,400

show today he'll give his talk and then

1498

01:00:43,189 --> 01:00:39,749

I'll be happy to take questions

1499

01:00:44,959 --> 01:00:43,199

afterwards the NSF is a federal agency

1500

01:00:46,599 --> 01:00:44,969

that invests in fundamental research and

1501
01:00:49,519 --> 01:00:46,609
education across science and engineering

1502
01:00:51,829 --> 01:00:49,529
for nearly seven decades NSF has shaped

1503
01:00:53,239 --> 01:00:51,839
the nation scientific enterprise by

1504
01:00:55,130 --> 01:00:53,249
funding innovative research at

1505
01:00:56,719 --> 01:00:55,140
universities and colleges and our

1506
01:00:59,299 --> 01:00:56,729
research facilities around the world

1507
01:01:01,279 --> 01:00:59,309
tomorrow we're launching our very first

1508
01:01:02,930 --> 01:01:01,289
engineering experiment to be performed

1509
01:01:05,299 --> 01:01:02,940
in the microgravity environment at the

1510
01:01:08,599 --> 01:01:05,309
International Space Station National Lab

1511
01:01:10,699 --> 01:01:08,609
thanks to our partnership with cases our

1512
01:01:12,670 --> 01:01:10,709
collaboration with the cases focuses on

1513
01:01:15,109 --> 01:01:12,680

research problems in fluid dynamics

1514

01:01:16,640 --> 01:01:15,119

combustion and tissue engineering and

1515

01:01:18,650 --> 01:01:16,650

this will advance scientific

1516

01:01:20,930 --> 01:01:18,660

understanding lead to future benefits to

1517

01:01:22,999 --> 01:01:20,940

life on Earth so now I'm very pleased to

1518

01:01:24,680 --> 01:01:23,009

introduce Paolo he's the first

1519

01:01:26,420 --> 01:01:24,690

investigator that's sending an

1520

01:01:28,759 --> 01:01:26,430

experiment up he's an assistant

1521

01:01:30,170 --> 01:01:28,769

professor of mechanical engineering at

1522

01:01:35,739 --> 01:01:30,180

the University of California Santa

1523

01:01:38,029 --> 01:01:35,749

Barbara professor Liu Gatto fidgets

1524

01:01:40,039 --> 01:01:38,039

investigates theoretical experimental

1525

01:01:41,749 --> 01:01:40,049

and computational fluid dynamics with

1526

01:01:44,839 --> 01:01:41,759

the eye towards energy production and

1527

01:01:46,970 --> 01:01:44,849

conservation NSF is pleased to find as a

1528

01:01:49,609 --> 01:01:46,980

new project his group's new project

1529

01:01:51,620 --> 01:01:49,619

say on the launch tomorrow that examines

1530

01:01:53,930 --> 01:01:51,630

fundamental dynamics of sediments which

1531

01:01:56,830 --> 01:01:53,940

has implications for lakes rivers and

1532

01:02:00,770 --> 01:01:56,840

oceans around the world so thank you

1533

01:02:03,170 --> 01:02:00,780

thank you so what we're gonna do is

1534

01:02:06,530 --> 01:02:03,180

we're gonna send some sediment toward

1535

01:02:08,240 --> 01:02:06,540

the International Space Station and what

1536

01:02:12,290 --> 01:02:08,250

we're interested in is looking at what

1537

01:02:14,660 --> 01:02:12,300

we call cohesive forces in sediment now

1538

01:02:19,310 --> 01:02:14,670

sediment is made up of clay as well as

1539

01:02:21,260 --> 01:02:19,320

silt and sand and by cohesive forces we

1540

01:02:23,240 --> 01:02:21,270

really mean what makes a sediment

1541

01:02:25,670 --> 01:02:23,250

essentially sticky if you imagine taking

1542

01:02:26,530 --> 01:02:25,680

a handful of mud has some stickiness to

1543

01:02:29,240 --> 01:02:26,540

it

1544

01:02:31,670 --> 01:02:29,250

now these cohesive forces are very

1545

01:02:34,190 --> 01:02:31,680

important to have sediment gets

1546

01:02:37,340 --> 01:02:34,200

transported in the environment and in

1547

01:02:39,440 --> 01:02:37,350

engineering systems however they're very

1548

01:02:41,660 --> 01:02:39,450

weak if you compare them to the force of

1549

01:02:43,760 --> 01:02:41,670

gravity and that means that it can be

1550

01:02:47,410 --> 01:02:43,770

very hard to study them accurately here

1551
01:02:51,859 --> 01:02:47,420
on earth now if we can look at the first

1552
01:02:53,710 --> 01:02:51,869
slide please so this is a picture taking

1553
01:02:57,109 --> 01:02:53,720
with a scanning electron microscope of

1554
01:02:58,940 --> 01:02:57,119
clay and clay is essentially what gives

1555
01:03:01,010 --> 01:02:58,950
you the smallest particles in sediment

1556
01:03:04,700 --> 01:03:01,020
they're a thousandth of a millimeter or

1557
01:03:06,620 --> 01:03:04,710
less across and they're so small that if

1558
01:03:08,599 --> 01:03:06,630
they get close enough to each other they

1559
01:03:11,200 --> 01:03:08,609
can essentially stick to each other

1560
01:03:15,349 --> 01:03:11,210
through what they're essentially

1561
01:03:17,380 --> 01:03:15,359
electrical kind of forces now these

1562
01:03:20,240 --> 01:03:17,390
forces are what we call cohesive forces

1563
01:03:23,000 --> 01:03:20,250

and they depend in some very complicated

1564

01:03:25,160 --> 01:03:23,010

ways on what kind of minerals you have

1565

01:03:26,960 --> 01:03:25,170

in there whether you have any salt in

1566

01:03:30,770 --> 01:03:26,970

there and whether you have maybe any

1567

01:03:33,220 --> 01:03:30,780

man-made contaminants now if we look at

1568

01:03:36,380 --> 01:03:33,230

the next slide please

1569

01:03:38,000 --> 01:03:36,390

so for example if you put clay in salt

1570

01:03:40,460 --> 01:03:38,010

water it is something you can see you

1571

01:03:44,150 --> 01:03:40,470

can get these aggregates which are order

1572

01:03:45,859 --> 01:03:44,160

of 10 microns across and in currents can

1573

01:03:49,040 --> 01:03:45,869

come together and make even larger

1574

01:03:51,740 --> 01:03:49,050

aggregates it is have a huge impact on

1575

01:03:54,440 --> 01:03:51,750

how sediment is transported in the

1576

01:03:57,530 --> 01:03:54,450

environment so for example you can think

1577

01:04:00,890 --> 01:03:57,540

of a river that carries sediment into

1578

01:04:03,140 --> 01:04:00,900

the ocean the cement particles

1579

01:04:06,289 --> 01:04:03,150

will typically come together and make

1580

01:04:09,849 --> 01:04:06,299

aggregates these aggregates will then

1581

01:04:13,009 --> 01:04:09,859

sink more than a hundred times faster

1582

01:04:18,489 --> 01:04:13,019

than the original primary particles

1583

01:04:21,470 --> 01:04:18,499

would have now if the particles do not

1584

01:04:24,859 --> 01:04:21,480

aggregate then they will settle much

1585

01:04:27,470 --> 01:04:24,869

more slowly in a water column which for

1586

01:04:29,779 --> 01:04:27,480

example we mean that light will have a

1587

01:04:34,009 --> 01:04:29,789

very hard time entering the water column

1588

01:04:35,660 --> 01:04:34,019

and so you'll then have that algae for

1589

01:04:38,870 --> 01:04:35,670

example we have a hard time growing and

1590

01:04:42,739 --> 01:04:38,880

that can undercut the food supply in

1591

01:04:45,289 --> 01:04:42,749

your ecosystem so you can ask well how

1592

01:04:49,880 --> 01:04:45,299

do I make an experiment involving

1593

01:04:52,309 --> 01:04:49,890

cohesive sediment well you ideally would

1594

01:04:54,799 --> 01:04:52,319

like to put some sediment in a small

1595

01:04:58,519 --> 01:04:54,809

container and then stir it until you

1596

01:05:00,890 --> 01:04:58,529

break up these aggregates and then you

1597

01:05:02,839 --> 01:05:00,900

like to look as these aggregates form

1598

01:05:04,700 --> 01:05:02,849

again and then from this aggregation

1599

01:05:08,479 --> 01:05:04,710

motion you can deduce back what the

1600

01:05:10,819 --> 01:05:08,489

forces are now that's fine in the ocean

1601
01:05:14,499 --> 01:05:10,829
where you have hundreds of feet where

1602
01:05:17,059 --> 01:05:14,509
the sediment can fall as it aggregates

1603
01:05:19,359 --> 01:05:17,069
however in the lab your sediment could

1604
01:05:22,160 --> 01:05:19,369
quickly reach the bottom of your

1605
01:05:24,769 --> 01:05:22,170
container and so you can only look at

1606
01:05:27,410 --> 01:05:24,779
aggregate over very short timescales in

1607
01:05:29,120 --> 01:05:27,420
the land so that's why we're going to do

1608
01:05:30,890 --> 01:05:29,130
an experiment on the space station

1609
01:05:34,009 --> 01:05:30,900
because you can essentially turn off the

1610
01:05:38,809 --> 01:05:34,019
effects of gravity could we have the

1611
01:05:41,450 --> 01:05:38,819
next slide please so we're sending an

1612
01:05:42,979 --> 01:05:41,460
array of ten small containers that have

1613
01:05:45,950 --> 01:05:42,989

different kinds of minerals in them

1614

01:05:47,569 --> 01:05:45,960

that's the sort of black plate you see

1615

01:05:49,849 --> 01:05:47,579

there in the middle with ten little

1616

01:05:52,160 --> 01:05:49,859

containers on the left you'd have a

1617

01:05:56,479 --> 01:05:52,170

flash which will shine a light through

1618

01:05:58,609 --> 01:05:56,489

the containers and then any aggregates

1619

01:06:01,460 --> 01:05:58,619

will essentially show up as dark or

1620

01:06:03,849 --> 01:06:01,470

darker spots in the images that are

1621

01:06:06,049 --> 01:06:03,859

taken by a camera there on the right and

1622

01:06:09,140 --> 01:06:06,059

here we are fortunately that we get to

1623

01:06:11,450 --> 01:06:09,150

essentially use again a previous set up

1624

01:06:14,660 --> 01:06:11,460

called the B cat which had been used for

1625

01:06:16,880 --> 01:06:14,670

other kinds of colloids predominantly

1626

01:06:19,960 --> 01:06:16,890

man-made engineered coloreds but here

1627

01:06:23,180 --> 01:06:19,970

we're gonna send a natural convoy to the

1628

01:06:25,610 --> 01:06:23,190

space station and I mentioned the

1629

01:06:27,350 --> 01:06:25,620

application involving a river flows and

1630

01:06:30,200 --> 01:06:27,360

estuaries but there are many other

1631

01:06:33,020 --> 01:06:30,210

applications for example where their

1632

01:06:34,940 --> 01:06:33,030

sediment behaves cohesively is very

1633

01:06:38,000 --> 01:06:34,950

important to the transport of any

1634

01:06:40,730 --> 01:06:38,010

contaminants or pollutants that stick to

1635

01:06:42,550 --> 01:06:40,740

the sediment they're also very important

1636

01:06:46,790 --> 01:06:42,560

to the process that give rise to

1637

01:06:48,680 --> 01:06:46,800

ultimately hydrocarbon reservoirs and so

1638

01:06:53,630 --> 01:06:48,690

that can help us for example more

1639

01:06:59,810 --> 01:06:53,640

efficiently map such reservoirs now if I

1640

01:07:03,260 --> 01:06:59,820

can have the final slide please so to

1641

01:07:05,840 --> 01:07:03,270

then the use models from the ISIS

1642

01:07:08,240 --> 01:07:05,850

experiments which we can use for the

1643

01:07:10,550 --> 01:07:08,250

benefit of life on earth what we're

1644

01:07:14,120 --> 01:07:10,560

gonna do is with my colleague Eckert my

1645

01:07:14,480 --> 01:07:14,130

Berg and his group also at UC Santa

1646

01:07:16,340 --> 01:07:14,490

Barbara

1647

01:07:19,700 --> 01:07:16,350

we're gonna run supercomputer

1648

01:07:22,310 --> 01:07:19,710

simulations of these cohesive sediment

1649

01:07:23,870 --> 01:07:22,320

here you you have sediment settling

1650

01:07:27,920 --> 01:07:23,880

under the effect of gravity with

1651

01:07:31,040 --> 01:07:27,930

different degrees of strength for the

1652

01:07:32,570 --> 01:07:31,050

cohesive forces of course we can also

1653

01:07:33,770 --> 01:07:32,580

turn off gravity and then mirror what

1654

01:07:37,240 --> 01:07:33,780

we're going to get on the space station

1655

01:07:40,330 --> 01:07:37,250

and by comparing the simulations to them

1656

01:07:42,770 --> 01:07:40,340

ISS experiments we can then did use

1657

01:07:45,230 --> 01:07:42,780

models for how sediment gets transported

1658

01:07:50,280 --> 01:07:45,240

which then we can use for the benefit of

1659

01:07:50,290 --> 01:07:54,530

so do we have any questions for Paulo

1660

01:08:03,120 --> 01:08:00,990

sir Jim Siegel with fast Space Flight

1661

01:08:05,240 --> 01:08:03,130

Insider could you back up a little bit

1662

01:08:07,980 --> 01:08:05,250

and maybe talk a bigger picture about

1663

01:08:11,280 --> 01:08:07,990

why this is important to life here on

1664

01:08:13,650 --> 01:08:11,290

earth I'm not familiar myself with the

1665

01:08:16,289 --> 01:08:13,660

importance of sediment or how it how it

1666

01:08:18,840 --> 01:08:16,299

affects life or plant growth or whatever

1667

01:08:20,910 --> 01:08:18,850

so what's what's the problem that this

1668

01:08:25,530 --> 01:08:20,920

is trying to solve and how is this going

1669

01:08:29,099 --> 01:08:25,540

to help solve it so for example one way

1670

01:08:32,789 --> 01:08:29,109

that hydrocarbon deposits can form is by

1671

01:08:33,630 --> 01:08:32,799

having this particular kind of what

1672

01:08:36,900 --> 01:08:33,640

they're essentially underwater

1673

01:08:40,050 --> 01:08:36,910

avalanches of sediment form these are

1674

01:08:42,690 --> 01:08:40,060

called turbidity currents and once they

1675

01:08:47,539 --> 01:08:42,700

form a deposit over time that can lead

1676

01:08:49,680 --> 01:08:47,549

to a hydrocarbon reservoir now the

1677

01:08:50,309 --> 01:08:49,690

process of understanding the geology of

1678

01:08:52,019 --> 01:08:50,319

something like that

1679

01:08:54,420 --> 01:08:52,029

has a lot to do with essentially

1680

01:08:55,079 --> 01:08:54,430

understanding their history the fluid

1681

01:08:57,570 --> 01:08:55,089

mechanics

1682

01:08:59,640 --> 01:08:57,580

that led to the formation of this of the

1683

01:09:04,650 --> 01:08:59,650

structure that then we see today and

1684

01:09:06,269 --> 01:09:04,660

then we can through these models we can

1685

01:09:08,370 --> 01:09:06,279

for example develop criteria for the

1686

01:09:10,050 --> 01:09:08,380

initiation of these underwater

1687

01:09:12,480 --> 01:09:10,060

avalanches and then how they will

1688

01:09:14,099 --> 01:09:12,490

actually propagate and and what

1689

01:09:18,660 --> 01:09:14,109

structure the deposit will ultimately

1690

01:09:21,059 --> 01:09:18,670

have and so for example in practice that

1691

01:09:25,019 --> 01:09:21,069

could mean that you'll be able to much

1692

01:09:26,999 --> 01:09:25,029

more quickly infer what the morphology

1693

01:09:30,599 --> 01:09:27,009

of the deposit is so you'd have to drill

1694

01:09:32,280 --> 01:09:30,609

fewer exploratory wells when you drill a

1695

01:09:34,380 --> 01:09:32,290

well it can be the of the cost of the

1696

01:09:40,200 --> 01:09:34,390

order of tens of millions of dollars or

1697

01:09:43,470 --> 01:09:40,210

more and drilling fewer wells is say the

1698

01:09:47,099 --> 01:09:43,480

money in also saving environmental risk

1699

01:10:02,939 --> 01:09:48,870

doesn't anybody else have a question for

1700

01:10:05,520 --> 01:10:02,949

Paulo or Richard back here please what a

1701

01:10:08,209 --> 01:10:05,530

potential future application of your

1702

01:10:10,919 --> 01:10:08,219

results be to actually introduce

1703

01:10:12,720 --> 01:10:10,929

something to cause an aggregate in a

1704

01:10:15,840 --> 01:10:12,730

water supply where the sunlight was not

1705

01:10:19,020 --> 01:10:15,850

creating algae yes that's very good

1706

01:10:21,600 --> 01:10:19,030

that's very good example you already use

1707

01:10:22,979 --> 01:10:21,610

for example for water treatment so this

1708

01:10:25,350 --> 01:10:22,989

is an engineering application there are

1709

01:10:28,560 --> 01:10:25,360

ages that are added called flocculants

1710

01:10:32,030 --> 01:10:28,570

to help undesirable substances settle

1711

01:10:35,010 --> 01:10:32,040

quickly this will essentially give as a

1712

01:10:37,709 --> 01:10:35,020

general treatment of how these kind of

1713

01:10:44,300 --> 01:10:37,719

agents could work in an environmental

1714

01:10:53,669 --> 01:10:52,470

please hi John Taylor with geekify um

1715

01:10:55,830 --> 01:10:53,679

can you tell us more about the samples

1716

01:10:57,510 --> 01:10:55,840

that you selected why the sizes the

1717

01:11:00,540 --> 01:10:57,520

sediment types a little bit more about

1718

01:11:04,050 --> 01:11:00,550

the materials themselves so there was a

1719

01:11:08,310 --> 01:11:04,060

big part of our experiments that we ran

1720

01:11:10,410 --> 01:11:08,320

here on earth before sending the samples

1721

01:11:12,000 --> 01:11:10,420

up as I mentioned here the setup we were

1722

01:11:13,859 --> 01:11:12,010

lucky enough to be able to use a game

1723

01:11:15,770 --> 01:11:13,869

one that was already in place so that

1724

01:11:19,109 --> 01:11:15,780

was the main challenge to choose what

1725

01:11:21,359 --> 01:11:19,119

what samples to send this is essentially

1726

01:11:24,620 --> 01:11:21,369

what we found was the area that was

1727

01:11:28,530 --> 01:11:24,630

likely to give us the strongest payoff

1728

01:11:29,729 --> 01:11:28,540

in terms of the science there are many

1729

01:11:30,780 --> 01:11:29,739

different things we want investigate the

1730

01:11:34,560 --> 01:11:30,790

effects of the minerals the effects of

1731

01:11:35,760 --> 01:11:34,570

the salt we were fortunate that we

1732

01:11:37,530 --> 01:11:35,770

seemed to have made quite out of

1733

01:11:40,530 --> 01:11:37,540

progress on the effect of the salinity

1734

01:11:42,000 --> 01:11:40,540

for example I read you on earth and so

1735

01:11:44,640 --> 01:11:42,010

we're going to primarily focus on the

1736

01:11:48,359 --> 01:11:44,650

effect of the different minerals for

1737

01:11:49,979 --> 01:11:48,369

this mission ok well let's thank Paulo

1738

01:11:52,940 --> 01:11:49,989

and Richard for sharing a little bit

1739

01:12:00,120 --> 01:11:57,510

and sometimes refer to as the new hand

1740

01:12:02,100 --> 01:12:00,130

our final speaker today comes to us from

1741

01:12:04,140 --> 01:12:02,110

the Canadian Space Agency and will share

1742

01:12:07,230 --> 01:12:04,150

with us the updates to the new latching

1743

01:12:09,960 --> 01:12:07,240

end effector on Canada arm to the

1744

01:12:12,810 --> 01:12:09,970

Canadian robot arm aboard the ISS please

1745

01:12:16,680 --> 01:12:12,820

welcome CAD pol Walski Canadian ISS

1746

01:12:18,060 --> 01:12:16,690

program manager thanks Rick so I'm here

1747

01:12:19,650 --> 01:12:18,070

to talk to you about actually a number

1748

01:12:21,330 --> 01:12:19,660

of Canadian interests that we have in

1749

01:12:23,520 --> 01:12:21,340

this mission so I'm going to talk a

1750

01:12:24,840 --> 01:12:23,530

little bit about science I'll talk about

1751

01:12:27,180 --> 01:12:24,850

our next crew flight that we're gonna

1752

01:12:28,470 --> 01:12:27,190

have a Canadian crew member I'll talk a

1753

01:12:30,270 --> 01:12:28,480

little bit about the operations the

1754

01:12:32,820 --> 01:12:30,280

space the robotics operations that we're

1755

01:12:33,930 --> 01:12:32,830

required to support SpaceX 15 and then

1756

01:12:36,420 --> 01:12:33,940

I'll finish up with talking about the

1757

01:12:39,060 --> 01:12:36,430

latching end effector so on the science

1758

01:12:41,300 --> 01:12:39,070

side of things Canadian science is

1759

01:12:45,150 --> 01:12:41,310

highly focused on humans human health

1760

01:12:46,290 --> 01:12:45,160

sciences and at crew performance so we

1761

01:12:47,940 --> 01:12:46,300

have a number of experiments that are

1762

01:12:51,150 --> 01:12:47,950

going on on the station that was go over

1763

01:12:53,430 --> 01:12:51,160

on a long-term multiple crew members

1764

01:12:55,860 --> 01:12:53,440

multiple samples one of the things that

1765

01:12:58,200 --> 01:12:55,870

we like about the SpaceX vehicle is it

1766

01:13:00,720 --> 01:12:58,210

has the ability to return stuff back to

1767

01:13:02,460 --> 01:13:00,730

the ground so coming back on spacex 15

1768

01:13:04,260 --> 01:13:02,470

we're gonna have some of the blood and

1769

01:13:05,460 --> 01:13:04,270

plasma samples that will coming back

1770

01:13:06,840 --> 01:13:05,470

from those experiments that's gonna be

1771

01:13:10,800 --> 01:13:06,850

very valuable to us and supporting our

1772

01:13:12,960 --> 01:13:10,810

science and you know our focus on human

1773

01:13:15,420 --> 01:13:12,970

health sciences is basically very

1774

01:13:17,940 --> 01:13:15,430

portable to our applications on earth we

1775

01:13:19,170 --> 01:13:17,950

like to look at things like the vascular

1776

01:13:21,510 --> 01:13:19,180

disease those kind of things that affect

1777

01:13:22,680 --> 01:13:21,520

our society we also look at it from a

1778

01:13:24,120 --> 01:13:22,690

crew performance point of view because

1779

01:13:27,270 --> 01:13:24,130

when we go to Mars and you'll notice

1780

01:13:28,830 --> 01:13:27,280

that I said when not if when we go to

1781

01:13:30,450 --> 01:13:28,840

Mars we want to be able to optimize crew

1782

01:13:32,100 --> 01:13:30,460

performance and be able to have crew on

1783

01:13:34,350 --> 01:13:32,110

board that are gonna be able to best do

1784

01:13:37,910 --> 01:13:34,360

those missions so that's the science

1785

01:13:41,430 --> 01:13:37,920

side of things from a crew point of view

1786

01:13:44,640 --> 01:13:41,440

coming up in December we'll be launching

1787

01:13:47,480 --> 01:13:44,650

on expedition 58 59 David saint-jacques

1788

01:13:49,830 --> 01:13:47,490

so that is going to be our third

1789

01:13:52,320 --> 01:13:49,840

long-duration spaceflight opportunity

1790

01:13:55,260 --> 01:13:52,330

for Canada so that's gonna be a pretty

1791

01:13:58,140 --> 01:13:55,270

big deal for us one of the things that

1792

01:13:59,730 --> 01:13:58,150

connects his mission to SpaceX 15 is

1793

01:14:01,200 --> 01:13:59,740

he's actually gonna be launching some of

1794

01:14:03,960 --> 01:14:01,210

his requested food items are gonna be

1795

01:14:05,250 --> 01:14:03,970

going up on SpaceX 15 so we actually got

1796

01:14:06,720 --> 01:14:05,260

I think on on this

1797

01:14:08,069 --> 01:14:06,730

ts a Twitter account last night we got a

1798

01:14:10,950 --> 01:14:08,079

question about whether maple syrup was

1799

01:14:12,419 --> 01:14:10,960

flying up so I don't think it's actually

1800

01:14:14,549 --> 01:14:12,429

flying up on this flight it might be

1801
01:14:17,339 --> 01:14:14,559
flying up on a subsequent flight however

1802
01:14:20,370 --> 01:14:17,349
there is maple smoked salmon crab

1803
01:14:22,439 --> 01:14:20,380
lobster so I don't think dove it is a

1804
01:14:24,899 --> 01:14:22,449
big red meat guy I think he likes his

1805
01:14:26,339 --> 01:14:24,909
fish so that's going up on SpaceX 15 so

1806
01:14:28,609 --> 01:14:26,349
we're looking forward to that mission

1807
01:14:31,109 --> 01:14:28,619
coming that's gonna be a big deal for us

1808
01:14:33,720 --> 01:14:31,119
next I wanted to talk about some of the

1809
01:14:34,890 --> 01:14:33,730
robotics operations so SpaceX 15 is

1810
01:14:36,149 --> 01:14:34,900
going to be a vehicle that flies up the

1811
01:14:38,580 --> 01:14:36,159
station it doesn't actually talk to the

1812
01:14:41,000 --> 01:14:38,590
space station so what we do is we do a

1813
01:14:42,979 --> 01:14:41,010

free flyer capture using the canadarm2

1814

01:14:45,839 --> 01:14:42,989

using canadarm2

1815

01:14:50,100 --> 01:14:45,849

this is actually going to be our 30th

1816

01:14:52,350 --> 01:14:50,110

vehicle that we capture and basically

1817

01:14:55,020 --> 01:14:52,360

the the Dragon capsule will fly up close

1818

01:14:57,419 --> 01:14:55,030

to station get to about 10 meters about

1819

01:14:58,439 --> 01:14:57,429

30 feet and then with a crew member on

1820

01:15:00,509 --> 01:14:58,449

board will actually reach out with

1821

01:15:03,270 --> 01:15:00,519

Canada arm to grapple the vehicle while

1822

01:15:05,370 --> 01:15:03,280

flying at you know 25,000 kilometers per

1823

01:15:06,419 --> 01:15:05,380

hour and then secure the vehicle and

1824

01:15:07,740 --> 01:15:06,429

then we'll maneuver that vehicle and

1825

01:15:09,600 --> 01:15:07,750

berth it to the station and then we can

1826

01:15:11,279 --> 01:15:09,610

start the process of unloading it so

1827

01:15:13,020 --> 01:15:11,289

that's one important part of it but also

1828

01:15:15,270 --> 01:15:13,030

we then continue the operations with our

1829

01:15:16,799 --> 01:15:15,280

other robotic system which is dexter the

1830

01:15:18,689 --> 01:15:16,809

two-armed robot that we do maintenance

1831

01:15:20,250 --> 01:15:18,699

on the space station with and then we

1832

01:15:21,839 --> 01:15:20,260

actually go in and unload the payloads

1833

01:15:23,939 --> 01:15:21,849

that are in the trunk of the vehicle and

1834

01:15:25,140 --> 01:15:23,949

then we bring those onto onto station

1835

01:15:27,120 --> 01:15:25,150

move them around different parts of

1836

01:15:28,859 --> 01:15:27,130

station shuffle all those payloads

1837

01:15:29,850 --> 01:15:28,869

around and then at the end of the day we

1838

01:15:31,799 --> 01:15:29,860

have to bring at the end of the mission

1839

01:15:33,060 --> 01:15:31,809

we have to bring payloads that are now

1840

01:15:34,620 --> 01:15:33,070

going to be de manifested from the

1841

01:15:36,569 --> 01:15:34,630

station and gonna be returned for

1842

01:15:38,100 --> 01:15:36,579

destructive reentry into that trunk and

1843

01:15:41,669 --> 01:15:38,110

basically reload the trunk so they can

1844

01:15:43,109 --> 01:15:41,679

go back into the atmosphere so that's

1845

01:15:44,520 --> 01:15:43,119

the operations side of things so space

1846

01:15:45,959 --> 01:15:44,530

or space robotics that plays a pretty

1847

01:15:48,450 --> 01:15:45,969

critical role in terms of supporting

1848

01:15:50,129 --> 01:15:48,460

these missions we're also going to when

1849

01:15:51,750 --> 01:15:50,139

we release that vehicle I think this

1850

01:15:54,149 --> 01:15:51,760

time around we're going to our plan is

1851

01:15:56,549 --> 01:15:54,159

gonna be our third planned ground

1852

01:15:59,009 --> 01:15:56,559

control release of a vehicle so this is

1853

01:16:00,930 --> 01:15:59,019

a relatively new thing for us we tried

1854

01:16:03,089 --> 01:16:00,940

that back on SpaceX 13 but we're very

1855

01:16:04,890 --> 01:16:03,099

well made that nominal for SpaceX 14 and

1856

01:16:06,149 --> 01:16:04,900

now subsequent SpaceX flights will be

1857

01:16:09,569 --> 01:16:06,159

looking at the other vehicles that we

1858

01:16:11,279 --> 01:16:09,579

capture as well to do that it's just a

1859

01:16:13,229 --> 01:16:11,289

point about how we continue to push

1860

01:16:15,299 --> 01:16:13,239

forward and evolve and continue to look

1861

01:16:17,490 --> 01:16:15,309

at how we do robotics operations and how

1862

01:16:18,839 --> 01:16:17,500

we can do things more efficiently and as

1863

01:16:20,520 --> 01:16:18,849

we do that we're actually

1864

01:16:24,029 --> 01:16:20,530

bringing up crew time and then that crew

1865

01:16:25,560 --> 01:16:24,039

time is then applied to science so the

1866

01:16:28,349 --> 01:16:25,570

last thing I wanted to mention was our

1867

01:16:30,239 --> 01:16:28,359

latching end effector so you know

1868

01:16:32,639 --> 01:16:30,249

certainly not last but certainly not

1869

01:16:35,520 --> 01:16:32,649

least the latching end effector is

1870

01:16:38,310 --> 01:16:35,530

really or the Lee is the business end of

1871

01:16:39,839 --> 01:16:38,320

the canadarm2 so on the canadarm2 we

1872

01:16:42,839 --> 01:16:39,849

actually have one of these latching in

1873

01:16:45,060 --> 01:16:42,849

effectors on each end of the arm now

1874

01:16:49,080 --> 01:16:45,070

that allows us to grapple payloads it

1875

01:16:50,520 --> 01:16:49,090

allows us to capture vehicles it also

1876

01:16:53,159 --> 01:16:50,530

allows us to connect the different

1877

01:16:55,049 --> 01:16:53,169

attachment points on the station and it

1878

01:16:57,389 --> 01:16:55,059

allows us to make a structural power

1879

01:16:59,219 --> 01:16:57,399

data and video connection there so we

1880

01:17:00,540 --> 01:16:59,229

think that we can then effectively use

1881

01:17:02,310 --> 01:17:00,550

the other end of the arm as the base

1882

01:17:04,500 --> 01:17:02,320

that allows the arm to be able to walk

1883

01:17:06,089 --> 01:17:04,510

around the station so clearly a latching

1884

01:17:07,919 --> 01:17:06,099

end effector is very important to us and

1885

01:17:09,299 --> 01:17:07,929

because they're so important so critical

1886

01:17:10,619 --> 01:17:09,309

to how we use the system and because

1887

01:17:12,750 --> 01:17:10,629

we're so mobile and what we need to do

1888

01:17:14,339 --> 01:17:12,760

with their system we've put a lot of

1889

01:17:16,049 --> 01:17:14,349

wear and tear on that system now we've

1890

01:17:18,149 --> 01:17:16,059

had a very good run with the canadarm2

1891

01:17:20,580 --> 01:17:18,159

in terms of nearly 17 years of

1892

01:17:22,679 --> 01:17:20,590

operations without any real major issues

1893

01:17:24,659 --> 01:17:22,689

however we did get to that point where

1894

01:17:26,669 --> 01:17:24,669

it's like when you you know if you if

1895

01:17:27,899 --> 01:17:26,679

you meet a trades person and you and you

1896

01:17:29,759 --> 01:17:27,909

shake their hands you kind of realize

1897

01:17:33,389 --> 01:17:29,769

that their hands kind of go through a

1898

01:17:35,310 --> 01:17:33,399

lot of hardship so after about 17 years

1899

01:17:36,629 --> 01:17:35,320

of operations we were starting to notice

1900

01:17:38,159 --> 01:17:36,639

that we were having a little bit of a

1901

01:17:40,739 --> 01:17:38,169

trouble with our hands getting a little

1902

01:17:42,540 --> 01:17:40,749

bit arthritic if you will so we had

1903

01:17:43,979 --> 01:17:42,550

planned to start changing out one of the

1904

01:17:48,060 --> 01:17:43,989

latching end effectors on the canadarm2

1905

01:17:50,009 --> 01:17:48,070

and actually back last fall in 2017 we

1906

01:17:52,529 --> 01:17:50,019

happen to have a failure on the other

1907

01:17:53,429 --> 01:17:52,539

one so luckily we have spares on

1908

01:17:56,009 --> 01:17:53,439

available on-orbit

1909

01:17:57,509 --> 01:17:56,019

did two spacewalks back in October

1910

01:17:59,489 --> 01:17:57,519

changed out one of the latching end

1911

01:18:00,989 --> 01:17:59,499

effectors on the canadarm2 and then in

1912

01:18:03,089 --> 01:18:00,999

February we actually made the decision

1913

01:18:05,399 --> 01:18:03,099

to change the other one so the good news

1914

01:18:06,989 --> 01:18:05,409

with that is that canadarm2 has two

1915

01:18:07,979 --> 01:18:06,999

perfectly functional latching and

1916

01:18:08,790 --> 01:18:07,989

effectors everything is working very

1917

01:18:11,129 --> 01:18:08,800

well there

1918

01:18:12,719 --> 01:18:11,139

that went exceptionally well for us now

1919

01:18:14,609 --> 01:18:12,729

the trick is is we want to launch this

1920

01:18:16,549 --> 01:18:14,619

new latching end effector and put that

1921

01:18:18,779 --> 01:18:16,559

on station to have an available spare

1922

01:18:20,339 --> 01:18:18,789

because we do the assembly the

1923

01:18:21,750 --> 01:18:20,349

maintenance operations because we do the

1924

01:18:24,479 --> 01:18:21,760

resupply of the station with the space

1925

01:18:25,830 --> 01:18:24,489

robotics and it's a critical system we

1926

01:18:27,449 --> 01:18:25,840

always want to be able to protect for

1927

01:18:28,859 --> 01:18:27,459

failure so if we get anything any kind

1928

01:18:30,540 --> 01:18:28,869

of random failure or any kind of issue

1929

01:18:31,760 --> 01:18:30,550

that pops up we want to have that

1930

01:18:34,100 --> 01:18:31,770

available spare

1931

01:18:36,380 --> 01:18:34,110

orbit and and ready for us to swap that

1932

01:18:40,250 --> 01:18:36,390

in if we need it and I guess the last

1933

01:18:41,750 --> 01:18:40,260

point I'll make is SpaceX 15 is also

1934

01:18:43,610 --> 01:18:41,760

going to be critical for us and remember

1935

01:18:44,930 --> 01:18:43,620

I said that we like SpaceX or we like

1936

01:18:46,400 --> 01:18:44,940

the dragon vehicles because we can get

1937

01:18:48,470 --> 01:18:46,410

stuff back out down on the ground

1938

01:18:51,530 --> 01:18:48,480

well the failed latching end effector

1939

01:18:52,880 --> 01:18:51,540

that we changed out back in October we

1940

01:18:54,740 --> 01:18:52,890

actually brought that inside the space

1941

01:18:56,240 --> 01:18:54,750

station and we are going to be able to

1942

01:18:57,680 --> 01:18:56,250

squeeze that into this into the Dragon

1943

01:19:00,110 --> 01:18:57,690

capsule and then return that to earth

1944

01:19:01,940 --> 01:19:00,120

we'll get that back back down on the

1945

01:19:04,700 --> 01:19:01,950

ground we'll fly that back up to Ontario

1946

01:19:06,320 --> 01:19:04,710

Canada our prime contractor will put an

1947

01:19:08,540 --> 01:19:06,330

air comput they're capable hand hands

1948

01:19:09,740 --> 01:19:08,550

MacDonald Dettwiler associates they're

1949

01:19:11,720 --> 01:19:09,750

gonna refurbish that latching end

1950

01:19:13,460 --> 01:19:11,730

effector and then basically with that

1951

01:19:15,590 --> 01:19:13,470

we'll have an available subsequent

1952

01:19:17,990 --> 01:19:15,600

available spare that we can use and that

1953

01:19:23,900 --> 01:19:18,000

allows us to plan for going to 2024 and

1954

01:19:30,440 --> 01:19:23,910

hopefully beyond that does anybody have

1955

01:19:32,120 --> 01:19:30,450

any questions for Ken here please when

1956

01:19:34,010 --> 01:19:32,130

you talked about the ground control

1957

01:19:35,990 --> 01:19:34,020

release that started on Cirrus 13 was

1958

01:19:37,310 --> 01:19:36,000

there anything on the arm side any

1959

01:19:38,960 --> 01:19:37,320

software or anything from the arm

1960

01:19:41,240 --> 01:19:38,970

perspective that had to change or was

1961

01:19:45,710 --> 01:19:41,250

that all station ground communication

1962

01:19:48,320 --> 01:19:45,720

side it's a little bit of both so I mean

1963

01:19:50,390 --> 01:19:48,330

in general we have actually we

1964

01:19:51,800 --> 01:19:50,400
architected the entire mobile servicing

1965

01:19:52,610 --> 01:19:51,810
system so all of our robotics suite

1966

01:19:54,650 --> 01:19:52,620
that's on the station

1967

01:19:55,970 --> 01:19:54,660
we've probably changed just about

1968

01:19:57,650 --> 01:19:55,980
everything about it in terms of how we

1969

01:20:00,020 --> 01:19:57,660
operate and occur and the code that we

1970

01:20:01,280 --> 01:20:00,030
use to do that one of the big changes

1971

01:20:02,870 --> 01:20:01,290
that we did was to implement ground

1972

01:20:04,580 --> 01:20:02,880
control the original design of the

1973

01:20:07,790 --> 01:20:04,590
system the original concept it was all

1974

01:20:10,130 --> 01:20:07,800
going to be crew operated once we got

1975

01:20:11,690 --> 01:20:10,140
into doing that and we saw what the

1976

01:20:13,430 --> 01:20:11,700

potentials were we actually changed the

1977

01:20:14,960 --> 01:20:13,440

software and how we use the system and

1978

01:20:16,370 --> 01:20:14,970

then started to implement ground control

1979

01:20:17,780 --> 01:20:16,380

with that we have to put in all the

1980

01:20:19,070 --> 01:20:17,790

different safety protocols so it's a

1981

01:20:20,960 --> 01:20:19,080

combination of changes to the software

1982

01:20:22,610 --> 01:20:20,970

changes to how we actually do the

1983

01:20:23,990 --> 01:20:22,620

commanding from the ground and then of

1984

01:20:25,580 --> 01:20:24,000

course the communications infrastructure

1985

01:20:26,990 --> 01:20:25,590

and how we do that to be able to put

1986

01:20:28,610 --> 01:20:27,000

that together so it's really a

1987

01:20:30,500 --> 01:20:28,620

combination of all those pieces that

1988

01:20:35,270 --> 01:20:30,510

allow us to be able to do things like a

1989

01:20:41,540 --> 01:20:39,410

I think I forgot to call my graphics I

1990

01:20:43,220 --> 01:20:41,550

think I have one slide up there with the

1991

01:20:44,720 --> 01:20:43,230

latching end effector sure we can bring

1992

01:20:50,540 --> 01:20:44,730

that up you bring that up over looking

1993

01:20:52,339 --> 01:20:50,550

for questions some of those graphics did

1994

01:21:01,520 --> 01:20:52,349

come up while you were speaking oh good

1995

01:21:03,229 --> 01:21:01,530

I'm glad people were thinking so you

1996

01:21:05,839 --> 01:21:03,239

mentioned some of the food that's going

1997

01:21:08,209 --> 01:21:05,849

up on this mission for for the astronaut

1998

01:21:11,750 --> 01:21:08,219

in December I'm kind of curious about

1999

01:21:14,540 --> 01:21:11,760

the the form that some of some of that

2000

01:21:19,669 --> 01:21:14,550

food takes is it freeze-dried or is it

2001

01:21:20,839 --> 01:21:19,679

in a pouch that's warmed up or I think

2002

01:21:22,819 --> 01:21:20,849

you pretty much hit the answer there

2003

01:21:25,100 --> 01:21:22,829

it's usually dehydrated sometimes

2004

01:21:27,979 --> 01:21:25,110

freeze-dried almost always contains

2005

01:21:29,330 --> 01:21:27,989

individually contained and packaged they

2006

01:21:30,589 --> 01:21:29,340

portion it out in a couple different

2007

01:21:33,200 --> 01:21:30,599

ways so sometimes it's resealable

2008

01:21:36,080 --> 01:21:33,210

usually I think it's one-off one-off

2009

01:21:37,129 --> 01:21:36,090

portions thank you okay we have time for

2010

01:21:41,810 --> 01:21:37,139

this one more question

2011

01:21:43,640 --> 01:21:41,820

go back question so you mentioned

2012

01:21:45,169 --> 01:21:43,650

robotics and focused a lot on canadarm2

2013

01:21:46,549 --> 01:21:45,179

but I think I'd be remiss if I didn't

2014

01:21:49,370 --> 01:21:46,559

ask how is Dexter doing

2015

01:21:51,500 --> 01:21:49,380

Dexter's actually doing quite well we

2016

01:21:53,359 --> 01:21:51,510

launched extra in 2008 so we we don't

2017

01:21:55,939 --> 01:21:53,369

have we don't yet have the same concerns

2018

01:21:57,319 --> 01:21:55,949

about its latching end effector one

2019

01:21:58,609 --> 01:21:57,329

thing I mentioned you know I said we've

2020

01:22:00,859 --> 01:21:58,619

got a latching end effector on each on

2021

01:22:02,089 --> 01:22:00,869

either end of the canadarm2 we've also

2022

01:22:03,589 --> 01:22:02,099

got a latching end effector on our

2023

01:22:04,700 --> 01:22:03,599

mobile based system that travels up and

2024

01:22:06,470 --> 01:22:04,710

down the main thrust of the space

2025

01:22:08,419 --> 01:22:06,480

station and we've got a latching end

2026

01:22:10,040 --> 01:22:08,429

effector on Dexter

2027

01:22:12,229 --> 01:22:10,050

so Dexter's latching end effector is

2028

01:22:14,270 --> 01:22:12,239

doing quite well we do expect that you

2029

01:22:14,810 --> 01:22:14,280

know as we use that system quite a bit

2030

01:22:16,250 --> 01:22:14,820

as well

2031

01:22:17,870 --> 01:22:16,260

we'll get to the point where we'll have

2032

01:22:19,520 --> 01:22:17,880

enough cycles on it that we'll start to

2033

01:22:21,470 --> 01:22:19,530

really kind of closely follow the

2034

01:22:23,029 --> 01:22:21,480

performance there and look at how things

2035

01:22:24,589 --> 01:22:23,039

are performance from performing from a

2036

01:22:25,760 --> 01:22:24,599

friction point of view and such which

2037

01:22:29,270 --> 01:22:25,770

are kind of the indicators that we were

2038

01:22:32,149 --> 01:22:29,280

following with the canadarm2 these other

2039

01:22:34,100 --> 01:22:32,159

than that we've had some minor issues

2040

01:22:36,080 --> 01:22:34,110

with the hands on Dexter Dexter uses

2041

01:22:38,450 --> 01:22:36,090

smaller hands because it does much more

2042

01:22:40,430 --> 01:22:38,460

precise and dexterous work in terms of

2043

01:22:42,290 --> 01:22:40,440

operating with the avionics and computer

2044

01:22:44,689 --> 01:22:42,300

boxes and batteries and such on the

2045

01:22:46,549 --> 01:22:44,699

outside of the space station but it's

2046

01:22:49,250 --> 01:22:46,559

actually doing very very well

2047

01:22:51,050 --> 01:22:49,260

overall I would dare say that

2048

01:22:53,360 --> 01:22:51,060

we've gotten exceptional performance out

2049

01:22:55,190 --> 01:22:53,370

of our space robotics just because 17

2050

01:22:57,140 --> 01:22:55,200

years into the game for a system that

2051
01:22:59,920 --> 01:22:57,150
was designed for you know a ten year

2052
01:23:02,780 --> 01:22:59,930
operational life 15 years on orbit and

2053
01:23:04,130 --> 01:23:02,790
with issue the very few issues that

2054
01:23:06,530 --> 01:23:04,140
we've had I think our biggest problems

2055
01:23:08,570 --> 01:23:06,540
is really about cameras we've changed a

2056
01:23:10,880 --> 01:23:08,580
number of cameras we've got new cameras

2057
01:23:12,590 --> 01:23:10,890
in the works and those are actually very

2058
01:23:14,479 --> 01:23:12,600
nice because we can actually change them

2059
01:23:16,880 --> 01:23:14,489
out robotically so that's a case where

2060
01:23:19,190 --> 01:23:16,890
you're using our own robots to fix our

2061
01:23:22,100 --> 01:23:19,200
own robots so it works actually it's

2062
01:23:23,780 --> 01:23:22,110
it's kind of the ideal scenario well

2063
01:23:30,890 --> 01:23:23,790

thank you Ken for sharing with us today

2064

01:23:33,140 --> 01:23:30,900

and we really appreciate it so this

2065

01:23:35,120 --> 01:23:33,150

concludes our what's onboard briefing I

2066

01:23:36,770 --> 01:23:35,130

would like to thank all of you for being

2067

01:23:38,900 --> 01:23:36,780

here and also for all our presenters who

2068

01:23:41,000 --> 01:23:38,910

shared with you their impact on our

2069

01:23:44,960 --> 01:23:41,010

mission if you'd like to follow the

2070

01:23:48,170 --> 01:23:44,970

launch activities please go to WWN assay

2071

01:23:51,530 --> 01:23:48,180

gov backslash space X for all launch

2072

01:23:54,260 --> 01:23:51,540

activities and coming up next at 12:45

2073

01:23:55,820 --> 01:23:54,270

p.m. Eastern Daylight Time on NASA TV

2074

01:23:58,250 --> 01:23:55,830

we'll be having our pre-launch news