



1
00:00:07,829 --> 00:00:05,749
good afternoon and welcome to nasa's

2
00:00:11,030 --> 00:00:07,839
kennedy space center and the forward

3
00:00:15,110 --> 00:00:11,040
osmosis bag experiment demonstration

4
00:00:17,349 --> 00:00:15,120
joining us today are dr howard levine

5
00:00:19,750 --> 00:00:17,359
nasa project scientists

6
00:00:22,230 --> 00:00:19,760
and monica soler project engineer with

7
00:00:24,150 --> 00:00:22,240
kinetic north america

8
00:00:27,589 --> 00:00:24,160
we'll begin with some opening statements

9
00:00:30,470 --> 00:00:27,599
and then go into the demonstration

10
00:00:33,350 --> 00:00:30,480
so um we'd like to

11
00:00:35,590 --> 00:00:33,360
show to you a tech demo project that's

12
00:00:36,790 --> 00:00:35,600
flying on the shuttle atlantis this

13
00:00:39,110 --> 00:00:36,800

friday

14

00:00:40,790 --> 00:00:39,120

all right it's what we call the forward

15

00:00:43,750 --> 00:00:40,800

osmosis bag

16

00:00:45,910 --> 00:00:43,760

so think of it as a bag within a bag

17

00:00:48,310 --> 00:00:45,920

and the outer bag you can introduce

18

00:00:49,190 --> 00:00:48,320

dirty water or water that cannot be

19

00:00:51,110 --> 00:00:49,200

drunk

20

00:00:54,389 --> 00:00:51,120

by the astronauts

21

00:00:55,670 --> 00:00:54,399

on the interior the inner clean bag we

22

00:00:57,270 --> 00:00:55,680

introduce

23

00:01:00,229 --> 00:00:57,280

a high

24

00:01:01,029 --> 00:01:00,239

sugar solution concentrate

25

00:01:03,189 --> 00:01:01,039

and

26

00:01:05,429 --> 00:01:03,199

just by osmosis

27

00:01:08,469 --> 00:01:05,439

it cleans the water it pulls the water

28

00:01:11,510 --> 00:01:08,479

through a semi-permeable membrane

29

00:01:14,469 --> 00:01:11,520

selectively excludes

30

00:01:17,350 --> 00:01:14,479

elements compounds bacteria viral

31

00:01:20,550 --> 00:01:17,360

particles that are not desirable

32

00:01:22,789 --> 00:01:20,560

and you end up with a sports drink that

33

00:01:25,109 --> 00:01:22,799

maybe four to six hours later can be

34

00:01:26,950 --> 00:01:25,119

drunk by the crew members

35

00:01:29,510 --> 00:01:26,960

this technology was developed at ames

36

00:01:31,590 --> 00:01:29,520

research center and it was licensed to a

37

00:01:34,870 --> 00:01:31,600

company hydration

38

00:01:37,350 --> 00:01:34,880

corporation in in oregon

39

00:01:40,069 --> 00:01:37,360

and they went through the sbir small

40

00:01:42,950 --> 00:01:40,079

business innovative research program to

41

00:01:44,389 --> 00:01:42,960

commercialize it and they developed this

42

00:01:46,550 --> 00:01:44,399

product which

43

00:01:50,389 --> 00:01:46,560

is for hikers so that hikers out in the

44

00:01:52,469 --> 00:01:50,399

wild can put this into a stream and

45

00:01:54,550 --> 00:01:52,479

water that may not be suitable for

46

00:01:55,990 --> 00:01:54,560

parasites or suitable for parasites but

47

00:01:58,389 --> 00:01:56,000

not for drinking

48

00:02:00,550 --> 00:01:58,399

can be cleaned in this way

49

00:02:01,510 --> 00:02:00,560

there's also a version of this

50

00:02:03,190 --> 00:02:01,520

that is

51
00:02:04,389 --> 00:02:03,200
been modified for the department of

52
00:02:07,350 --> 00:02:04,399
defense

53
00:02:09,270 --> 00:02:07,360
for soldiers in the field

54
00:02:12,229 --> 00:02:09,280
the coast guard has also

55
00:02:14,949 --> 00:02:12,239
developed a version for salt water to

56
00:02:16,229 --> 00:02:14,959
make salt water drinkable

57
00:02:18,229 --> 00:02:16,239
so

58
00:02:21,430 --> 00:02:18,239
the

59
00:02:24,070 --> 00:02:21,440
project will be flying on friday we're

60
00:02:27,350 --> 00:02:24,080
going to be first we had to modify the

61
00:02:30,150 --> 00:02:27,360
bag so this commercial product is not

62
00:02:32,229 --> 00:02:30,160
flight rated as we say it's uh has

63
00:02:34,390 --> 00:02:32,239

materials that are don't meet the

64

00:02:36,470 --> 00:02:34,400

stringent flight requirements of the

65

00:02:39,350 --> 00:02:36,480

international space station

66

00:02:42,150 --> 00:02:39,360

so we created a flight version

67

00:02:44,390 --> 00:02:42,160

that has the proper materials

68

00:02:46,390 --> 00:02:44,400

and monica is going to go through a

69

00:02:49,270 --> 00:02:46,400

demonstration of how the crew members

70

00:02:51,350 --> 00:02:49,280

will load it up both the dirty side and

71

00:02:53,190 --> 00:02:51,360

the clean side

72

00:02:54,710 --> 00:02:53,200

and in the experiment

73

00:02:55,830 --> 00:02:54,720

we're going to be flying six of these

74

00:02:58,949 --> 00:02:55,840

bags

75

00:03:00,630 --> 00:02:58,959

three of which will be manually mixed by

76

00:03:02,470 --> 00:03:00,640

the crew

77

00:03:04,630 --> 00:03:02,480

and three of which will not be so we'll

78

00:03:08,149 --> 00:03:04,640

be seeing whether there's a requirement

79

00:03:09,030 --> 00:03:08,159

for them to be manually mixed or not

80

00:03:10,869 --> 00:03:09,040

okay

81

00:03:12,470 --> 00:03:10,879

so what we have here what will be flying

82

00:03:14,710 --> 00:03:12,480

on friday we're actually going to be

83

00:03:15,910 --> 00:03:14,720

flying seven of these forward osmosis

84

00:03:18,149 --> 00:03:15,920

kits

85

00:03:20,309 --> 00:03:18,159

they're made out of nomex and inside of

86

00:03:21,910 --> 00:03:20,319

the kit it's going to hold a forward

87

00:03:24,309 --> 00:03:21,920

osmosis bag

88

00:03:26,550 --> 00:03:24,319

an osmotic concentrate syringe

89

00:03:29,030 --> 00:03:26,560

forward osmosis sampling syringe and the

90

00:03:32,390 --> 00:03:29,040

input storage bag and each kit is going

91

00:03:34,550 --> 00:03:32,400

to have a letter identifier a b c d and

92

00:03:35,750 --> 00:03:34,560

so on for the crew member to associate

93

00:03:37,990 --> 00:03:35,760

with

94

00:03:39,589 --> 00:03:38,000

so as howard was saying we modified the

95

00:03:41,670 --> 00:03:39,599

commercially available off-the-shelf

96

00:03:44,149 --> 00:03:41,680

product and changed the materials from

97

00:03:47,830 --> 00:03:44,159

pvc to polyethylene for flammability

98

00:03:50,710 --> 00:03:47,840

purposes and we also change the ports

99

00:03:51,589 --> 00:03:50,720

to self-sealing quick disconnect ports

100

00:03:53,589 --> 00:03:51,599

for

101
00:03:55,589 --> 00:03:53,599
leakage purposes you can imagine trying

102
00:03:57,270 --> 00:03:55,599
to pour in some

103
00:03:59,350 --> 00:03:57,280
water into one of these big red ports in

104
00:04:01,270 --> 00:03:59,360
microgravity you'll have water flying

105
00:04:04,390 --> 00:04:01,280
everywhere

106
00:04:07,030 --> 00:04:04,400
we also have your standard 60 milliliter

107
00:04:09,350 --> 00:04:07,040
syringe which is going to hold fructose

108
00:04:11,589 --> 00:04:09,360
and glucose syrups and deionized water

109
00:04:13,670 --> 00:04:11,599
as howard had mentioned it's

110
00:04:15,990 --> 00:04:13,680
going to be injected into the inner

111
00:04:17,749 --> 00:04:16,000
chamber of the forward osmosis bag

112
00:04:19,270 --> 00:04:17,759
the sampling syringe is an identical

113
00:04:20,870 --> 00:04:19,280

version of the osmotic concentrate

114

00:04:23,350 --> 00:04:20,880

syringe which will be pulling the 60

115

00:04:25,749 --> 00:04:23,360

milliliter sample approximately six

116

00:04:28,629 --> 00:04:25,759

hours after each bag is induced and the

117

00:04:31,430 --> 00:04:28,639

input storage bag holds fit 500

118

00:04:34,230 --> 00:04:31,440

milliliters of potassium chloride and a

119

00:04:38,150 --> 00:04:34,240

methyl blue dye which is your typical

120

00:04:40,390 --> 00:04:38,160

food coloring over-the-counter dye

121

00:04:42,870 --> 00:04:40,400

and both of these items will be launched

122

00:04:44,629 --> 00:04:42,880

pre-loaded and all of the lab work is

123

00:04:47,110 --> 00:04:44,639

being done at the space life science lab

124

00:04:49,030 --> 00:04:47,120

here at kennedy space center

125

00:04:52,230 --> 00:04:49,040

so to begin the initiation the crew

126
00:04:54,550 --> 00:04:52,240
member is going to transfer

127
00:04:57,749 --> 00:04:54,560
all of the liquid from the input storage

128
00:05:00,790 --> 00:04:57,759
bag into the outer chamber

129
00:05:02,230 --> 00:05:00,800
of the forward osmosis bag

130
00:05:04,629 --> 00:05:02,240
using this

131
00:05:06,550 --> 00:05:04,639
forward osmosis pump syringe

132
00:05:15,830 --> 00:05:06,560
so i'm going to rotate this to make it a

133
00:05:20,070 --> 00:05:17,990
so the crew member will ensure that the

134
00:05:22,230 --> 00:05:20,080
check valve that we have here is in the

135
00:05:23,189 --> 00:05:22,240
off position towards the forward osmosis

136
00:05:25,749 --> 00:05:23,199
bag

137
00:05:28,629 --> 00:05:25,759
the velcro that we have on

138
00:05:30,070 --> 00:05:28,639

the input storage bag is used to assist

139

00:05:32,150 --> 00:05:30,080

the crew member

140

00:05:34,629 --> 00:05:32,160

in pushing all the liquid towards the

141

00:05:35,909 --> 00:05:34,639

outlet of the input storage bag so they

142

00:05:37,590 --> 00:05:35,919

can roll

143

00:05:40,070 --> 00:05:37,600

the bag just like that and they're able

144

00:05:42,870 --> 00:05:40,080

to get all the liquid towards the outlet

145

00:05:45,430 --> 00:05:42,880

and they'll be pulling

146

00:05:48,230 --> 00:05:45,440

liquid into the forward osmosis pump

147

00:05:50,070 --> 00:05:48,240

syringe just like this

148

00:05:52,950 --> 00:05:50,080

and then once they have it approximately

149

00:05:54,950 --> 00:05:52,960

full they're going to move the check

150

00:05:56,150 --> 00:05:54,960

valve in the off direction of the input

151
00:05:58,070 --> 00:05:56,160
storage bag

152
00:06:02,710 --> 00:05:58,080
and slowly inject

153
00:06:08,469 --> 00:06:05,749
with the dirty water

154
00:06:10,309 --> 00:06:08,479
now this cycle should take up to about

155
00:06:12,790 --> 00:06:10,319
eight times eight cycles for the crew

156
00:06:18,469 --> 00:06:12,800
member to get as much water as they can

157
00:06:29,990 --> 00:06:19,430
so

158
00:06:30,000 --> 00:06:35,590
using the velcro

159
00:06:35,600 --> 00:06:53,029
to pull the dirty solution

160
00:06:59,350 --> 00:06:56,230
now the purpose of the methyl blue dye

161
00:07:01,430 --> 00:06:59,360
is to wet the membrane it's to dye the

162
00:07:03,189 --> 00:07:01,440
membrane so when the forward osmosis

163
00:07:04,950 --> 00:07:03,199

bags are returned

164

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

for a post-flight analysis we're going

165

00:07:10,550 --> 00:07:07,039

to be able to dissect the forward

166

00:07:11,990 --> 00:07:10,560

osmosis bag and see how the liquid

167

00:07:14,469 --> 00:07:12,000

wetted the membrane whether or not it

168

00:07:21,830 --> 00:07:14,479

was a uniform wetting or if it was

169

00:07:21,840 --> 00:07:38,870

we'll do a couple more pools

170

00:07:42,469 --> 00:07:40,950

and then once

171

00:07:44,230 --> 00:07:42,479

they've gotten as much

172

00:07:46,150 --> 00:07:44,240

liquid out of the input storage bag as

173

00:07:48,309 --> 00:07:46,160

they possibly can

174

00:07:50,230 --> 00:07:48,319

they'll use a dry wipe which they

175

00:07:52,070 --> 00:07:50,240

already have up there just to make sure

176

00:07:55,189 --> 00:07:52,080

there's no

177

00:07:58,070 --> 00:07:55,199

spots that come out to disconnect the

178

00:08:00,230 --> 00:07:58,080

qd's from the input storage bag and the

179

00:08:02,550 --> 00:08:00,240

forward osmosis bag

180

00:08:04,469 --> 00:08:02,560

so as you can see all the liquid is on

181

00:08:05,749 --> 00:08:04,479

the outer chamber of the forward osmosis

182

00:08:06,710 --> 00:08:05,759

bag

183

00:08:08,710 --> 00:08:06,720

then we're going to they're going to

184

00:08:10,950 --> 00:08:08,720

come and grab the osmotic concentrate

185

00:08:12,950 --> 00:08:10,960

syringe and inject

186

00:08:15,270 --> 00:08:12,960

the osmotic concentrate

187

00:08:17,029 --> 00:08:15,280

to the inner chamber of the forward

188

00:08:18,710 --> 00:08:17,039

osmosis bag

189

00:08:20,950 --> 00:08:18,720

and the osmotic concentrate is the

190

00:08:23,110 --> 00:08:20,960

driver for the water to pass through the

191

00:08:24,710 --> 00:08:23,120

membrane so the higher concentrated

192

00:08:27,110 --> 00:08:24,720

liquid pulls the

193

00:08:29,189 --> 00:08:27,120

potable water through the membrane

194

00:08:32,550 --> 00:08:29,199

so once they're done with that they'll

195

00:08:34,230 --> 00:08:32,560

disconnect and as howard said

196

00:08:35,829 --> 00:08:34,240

three of the six bags are going to be

197

00:08:38,070 --> 00:08:35,839

hand manipulated

198

00:08:39,430 --> 00:08:38,080

so hand shaken for approximately two

199

00:08:41,670 --> 00:08:39,440

hours

200

00:08:43,350 --> 00:08:41,680

and this is just to compare whether or

201
00:08:45,030 --> 00:08:43,360
not mechanical

202
00:08:47,190 --> 00:08:45,040
mechanically inducing the bags will

203
00:08:50,070 --> 00:08:47,200
actually increase the flux weight of the

204
00:08:50,949 --> 00:08:50,080
water moving through the membrane or

205
00:08:52,550 --> 00:08:50,959
if

206
00:08:54,230 --> 00:08:52,560
two minutes approximately two minutes

207
00:08:55,590 --> 00:08:54,240
yeah

208
00:08:58,230 --> 00:08:55,600
so once they're complete with the

209
00:08:59,829 --> 00:08:58,240
initiation and the mixing of the bags

210
00:09:01,990 --> 00:08:59,839
and they're going to restow them back

211
00:09:04,870 --> 00:09:02,000
into this forward osmosis

212
00:09:07,990 --> 00:09:04,880
kits and back into the storage mid-deck

213
00:09:09,670 --> 00:09:08,000

locker and approximately six hours after

214

00:09:11,829 --> 00:09:09,680

this is done they're going to come back

215

00:09:13,269 --> 00:09:11,839

and they're going to

216

00:09:15,110 --> 00:09:13,279

remove

217

00:09:17,269 --> 00:09:15,120

a 60 milliliter sample from the inner

218

00:09:19,990 --> 00:09:17,279

chamber of the bag using this forward

219

00:09:21,509 --> 00:09:20,000

osmosis sampling syringe very similar to

220

00:09:22,949 --> 00:09:21,519

the way we did with the osmotic

221

00:09:23,750 --> 00:09:22,959

concentrate syringe they're just going

222

00:09:26,150 --> 00:09:23,760

to

223

00:09:28,389 --> 00:09:26,160

connect it and remove the 60 milliliter

224

00:09:30,470 --> 00:09:28,399

sample i won't remove a sample right now

225

00:09:31,910 --> 00:09:30,480

just because there's only been a couple

226

00:09:33,430 --> 00:09:31,920

minutes since i've actually initiated

227

00:09:35,030 --> 00:09:33,440

the bag so you probably won't see much

228

00:09:36,710 --> 00:09:35,040

of anything

229

00:09:39,030 --> 00:09:36,720

and then they're going to resto

230

00:09:41,750 --> 00:09:39,040

everything back into the ford osmosis

231

00:09:43,990 --> 00:09:41,760

kit and back into the locker for return

232

00:09:47,269 --> 00:09:44,000

all operations are going to occur within

233

00:09:48,710 --> 00:09:47,279

two days of landing and

234

00:09:51,030 --> 00:09:48,720

all the post flight analysis will be

235

00:09:55,910 --> 00:09:51,040

done here at the space life science lab

236

00:09:55,920 --> 00:09:58,389

and

237

00:10:04,230 --> 00:10:02,310

so the key part of the science is

238

00:10:07,269 --> 00:10:04,240

six hours later when the crew member

239

00:10:09,670 --> 00:10:07,279

goes and withdraws the 60 milliliter

240

00:10:11,430 --> 00:10:09,680

sample

241

00:10:13,829 --> 00:10:11,440

you saw that this

242

00:10:16,230 --> 00:10:13,839

uh osmotic concentrate

243

00:10:19,590 --> 00:10:16,240

is yellow okay it has a dye in it a

244

00:10:21,750 --> 00:10:19,600

fluorescein dye the sample that we

245

00:10:24,230 --> 00:10:21,760

collect will be diluted based on the

246

00:10:26,230 --> 00:10:24,240

water that's passed through the membrane

247

00:10:28,310 --> 00:10:26,240

all right so this is our microgravity

248

00:10:30,389 --> 00:10:28,320

sample this is the the most important

249

00:10:31,829 --> 00:10:30,399

sample of the whole experiment and we'll

250

00:10:34,630 --> 00:10:31,839

be able to run this through a

251
00:10:37,110 --> 00:10:34,640
spectrophotometer post flight and get an

252
00:10:38,949 --> 00:10:37,120
idea of the flux rate of the water

253
00:10:41,269 --> 00:10:38,959
passage through the semi-permeable

254
00:10:42,870 --> 00:10:41,279
membrane based on the dilution

255
00:10:45,829 --> 00:10:42,880
of this dye

256
00:10:47,590 --> 00:10:45,839
this other blue dye as monica said is to

257
00:10:49,430 --> 00:10:47,600
get an idea of the

258
00:10:51,430 --> 00:10:49,440
the distribution of the water in

259
00:10:53,990 --> 00:10:51,440
microgravity on the semi-permeable

260
00:10:57,990 --> 00:10:56,230
okay and now we'll take questions please

261
00:11:03,350 --> 00:10:58,000
state your name and affiliation and wait

262
00:11:07,910 --> 00:11:05,190
jim siegel celebration independent

263
00:11:10,630 --> 00:11:07,920

newspaper so so let me get this straight

264

00:11:13,030 --> 00:11:10,640

nobody's going to drink anything

265

00:11:15,829 --> 00:11:13,040

of that's been sampled here or

266

00:11:17,990 --> 00:11:15,839

experimented with on this

267

00:11:20,310 --> 00:11:18,000

on this flight correct that's correct

268

00:11:21,670 --> 00:11:20,320

and that so

269

00:11:23,590 --> 00:11:21,680

um could you

270

00:11:25,190 --> 00:11:23,600

describe a little bit about what this

271

00:11:26,870 --> 00:11:25,200

would replace

272

00:11:28,310 --> 00:11:26,880

if it was to be used on the space

273

00:11:30,790 --> 00:11:28,320

shuttle or the international space

274

00:11:34,470 --> 00:11:30,800

station in

275

00:11:36,310 --> 00:11:34,480

in a little bit of detail and how how

276
00:11:37,030 --> 00:11:36,320
large would something like that have to

277
00:11:38,550 --> 00:11:37,040
be

278
00:11:40,949 --> 00:11:38,560
on the space shuttle or the space

279
00:11:44,069 --> 00:11:40,959
station in order to do that

280
00:11:47,670 --> 00:11:44,079
so we think of this uh primarily as an

281
00:11:49,910 --> 00:11:47,680
emergency contingency water system

282
00:11:52,550 --> 00:11:49,920
so in the event that one of the normal

283
00:11:56,550 --> 00:11:52,560
physical chemical means of producing

284
00:12:00,710 --> 00:11:58,710
this could be used in an emergency

285
00:12:01,829 --> 00:12:00,720
situation it could also be used in the

286
00:12:05,590 --> 00:12:01,839
future

287
00:12:07,829 --> 00:12:05,600
as part of an eva extra vehicle activity

288
00:12:09,910 --> 00:12:07,839

suit

289

00:12:11,670 --> 00:12:09,920

some of you may be science fiction fans

290

00:12:14,230 --> 00:12:11,680

you may have you know read the dune

291

00:12:16,790 --> 00:12:14,240

series with the fremen on arrakis and

292

00:12:19,829 --> 00:12:16,800

they had still suits well this could be

293

00:12:21,590 --> 00:12:19,839

you know almost a first step towards

294

00:12:23,829 --> 00:12:21,600

recapturing

295

00:12:26,230 --> 00:12:23,839

the humidity from our sweat from our

296

00:12:29,509 --> 00:12:26,240

breath even from our urine

297

00:12:30,550 --> 00:12:29,519

and recycling it and making it drinkable

298

00:12:32,389 --> 00:12:30,560

so

299

00:12:34,629 --> 00:12:32,399

mostly i guess to answer your question

300

00:12:36,870 --> 00:12:34,639

as an emergency situation it's not meant

301
00:12:38,470 --> 00:12:36,880
to be a day-to-day water generation

302
00:12:40,949 --> 00:12:38,480
device

303
00:12:43,509 --> 00:12:40,959
but it could also be used when the crew

304
00:12:44,949 --> 00:12:43,519
comes back on on a capsule and they land

305
00:12:47,829 --> 00:12:44,959
in the ocean

306
00:12:50,150 --> 00:12:47,839
it could be filled with sea water and

307
00:12:52,710 --> 00:12:50,160
potable drinkable

308
00:12:54,550 --> 00:12:52,720
a sports drink kind of product could be

309
00:12:56,949 --> 00:12:54,560
made that way as well

310
00:12:59,670 --> 00:12:56,959
and just to add to that this is actually

311
00:13:01,509 --> 00:12:59,680
phase one of the forward osmosis bag so

312
00:13:03,509 --> 00:13:01,519
we're using this technology

313
00:13:04,790 --> 00:13:03,519

demonstration to demonstrate the

314

00:13:07,670 --> 00:13:04,800

technology of the membrane in

315

00:13:11,509 --> 00:13:07,680

microgravity so we've already been

316

00:13:12,790 --> 00:13:11,519

accepted as a sdto or xdto for a fob

317

00:13:14,310 --> 00:13:12,800

phase 2

318

00:13:17,110 --> 00:13:14,320

for so that we would be able to take

319

00:13:19,190 --> 00:13:17,120

more samples at an hourly interval

320

00:13:21,350 --> 00:13:19,200

and get a better curve of the flux rate

321

00:13:22,949 --> 00:13:21,360

as the water passes through the membrane

322

00:13:24,310 --> 00:13:22,959

so this is pretty much just

323

00:13:27,829 --> 00:13:24,320

demonstrating the technology of the

324

00:13:29,990 --> 00:13:27,839

membrane for this particular flight

325

00:13:32,550 --> 00:13:30,000

and and the key point there is that it's

326

00:13:36,150 --> 00:13:32,560

necessary to elevate the technology

327

00:13:38,230 --> 00:13:36,160

readiness level of this technology

328

00:13:40,069 --> 00:13:38,240

and demonstrate that it functions in a

329

00:13:41,670 --> 00:13:40,079

microgravity environment and that's

330

00:13:42,870 --> 00:13:41,680

really the main purpose of what we're

331

00:13:44,550 --> 00:13:42,880

trying to do

332

00:13:46,949 --> 00:13:44,560

and once we demonstrate that it does

333

00:13:49,110 --> 00:13:46,959

indeed function in microgravity as it

334

00:13:51,829 --> 00:13:49,120

does on earth

335

00:13:53,590 --> 00:13:51,839

then the program can take it and plan on

336

00:13:55,829 --> 00:13:53,600

using this technology in future

337

00:13:58,069 --> 00:13:55,839

endeavors

338

00:14:01,189 --> 00:13:58,079

okay

339

00:14:03,110 --> 00:14:01,199

ken you have a question yes

340

00:14:06,230 --> 00:14:03,120

uh hi ken framer from space flight

341

00:14:07,990 --> 00:14:06,240

magazine um describe a little bit uh the

342

00:14:11,590 --> 00:14:08,000

shuttle astronauts will do this not the

343

00:14:13,430 --> 00:14:11,600

iss astronauts and when you do um bring

344

00:14:15,590 --> 00:14:13,440

it up as an emergency situation yeah

345

00:14:17,910 --> 00:14:15,600

that's what i was wondering um how many

346

00:14:20,710 --> 00:14:17,920

bags would you bring up and has anything

347

00:14:22,470 --> 00:14:20,720

like this been flown before thank you

348

00:14:25,670 --> 00:14:22,480

uh well i'll take the first couple of

349

00:14:27,990 --> 00:14:25,680

questions yes this is a sortie mission

350

00:14:30,389 --> 00:14:28,000

so a sorority payload meaning that it

351
00:14:32,550 --> 00:14:30,399
will be launched and returned from on

352
00:14:34,069 --> 00:14:32,560
the shuttle it will not cross over onto

353
00:14:36,389 --> 00:14:34,079
the space station so we have one of the

354
00:14:39,509 --> 00:14:36,399
u.s crew members actually rex walheim

355
00:14:43,750 --> 00:14:39,519
will be conducting the experiment two

356
00:14:48,069 --> 00:14:46,150
what was the second question

357
00:14:49,430 --> 00:14:48,079
has any thing been flown like this

358
00:14:51,030 --> 00:14:49,440
before

359
00:14:52,310 --> 00:14:51,040
and how many units would you bring up to

360
00:14:53,350 --> 00:14:52,320
the iss

361
00:14:57,030 --> 00:14:53,360
so

362
00:14:58,710 --> 00:14:57,040
no this has not been flown before

363
00:14:59,670 --> 00:14:58,720

and the number that would be brought up

364

00:15:01,670 --> 00:14:59,680

uh

365

00:15:02,710 --> 00:15:01,680

really that's a programmatic decision

366

00:15:04,790 --> 00:15:02,720

but

367

00:15:07,350 --> 00:15:04,800

uh if you think of it we spend quite a

368

00:15:09,269 --> 00:15:07,360

bit of money uh bringing water up to the

369

00:15:11,990 --> 00:15:09,279

international space station

370

00:15:13,829 --> 00:15:12,000

uh they're a contingency water container

371

00:15:18,310 --> 00:15:13,839

bags that are brought up they contain

372

00:15:20,389 --> 00:15:18,320

about 43 liters of water they're stowed

373

00:15:23,110 --> 00:15:20,399

they have a certain lifetime after which

374

00:15:26,550 --> 00:15:23,120

they're no longer rated for drinking

375

00:15:30,389 --> 00:15:26,560

these could be used to recertify

376

00:15:32,230 --> 00:15:30,399

those expired waters as a potable drink

377

00:15:34,790 --> 00:15:32,240

again it doesn't produce water but it

378

00:15:38,629 --> 00:15:34,800

produces a sports drink kind of a

379

00:15:43,110 --> 00:15:40,389

and as an example for the

380

00:15:45,910 --> 00:15:43,120

post splashdown i believe each astronaut

381

00:15:47,110 --> 00:15:45,920

gets two gallons of water as they're

382

00:15:49,509 --> 00:15:47,120

waiting for

383

00:15:51,030 --> 00:15:49,519

a boat to come and pick them up and so

384

00:15:54,150 --> 00:15:51,040

if you're able to

385

00:15:56,069 --> 00:15:54,160

just send each a pouch per astronaut

386

00:15:58,069 --> 00:15:56,079

you're reducing mass

387

00:15:59,829 --> 00:15:58,079

and volume that's going to be on the

388

00:16:02,230 --> 00:15:59,839

orbiter when they're returning

389

00:16:03,430 --> 00:16:02,240

and each bag is able to be used up to 10

390

00:16:05,749 --> 00:16:03,440

times

391

00:16:08,230 --> 00:16:05,759

so you're able to recycle the bag up to

392

00:16:09,189 --> 00:16:08,240

10 times so let me let me elaborate a

393

00:16:11,509 --> 00:16:09,199

little bit

394

00:16:12,710 --> 00:16:11,519

so you saw that

395

00:16:13,910 --> 00:16:12,720

each bag

396

00:16:16,629 --> 00:16:13,920

can

397

00:16:19,430 --> 00:16:16,639

purify let's say a liter of water over

398

00:16:21,269 --> 00:16:19,440

the course of four to six hours

399

00:16:24,870 --> 00:16:21,279

over the course of one day that would be

400

00:16:27,509 --> 00:16:24,880

four uses and most for most applications

401
00:16:28,790 --> 00:16:27,519
the bags could be used up to 10 days in

402
00:16:31,590 --> 00:16:28,800
duration

403
00:16:34,550 --> 00:16:31,600
so 10 days you know using the maximum

404
00:16:36,069 --> 00:16:34,560
rate four times a day would be 40 times

405
00:16:39,350 --> 00:16:36,079
it's all dependent on what you're

406
00:16:41,590 --> 00:16:39,360
introducing into them but up to 40 times

407
00:16:44,710 --> 00:16:41,600
the bags could be used and if you think

408
00:16:46,790 --> 00:16:44,720
of that that's 40 liters of a drinkable

409
00:16:49,350 --> 00:16:46,800
solution

410
00:16:52,150 --> 00:16:49,360
40 liters about 4 liters to a gallon

411
00:16:54,790 --> 00:16:52,160
that's about 10 gallons

412
00:16:57,110 --> 00:16:54,800
each gallon of water is about a little

413
00:16:59,509 --> 00:16:57,120

bit more than 8 pounds

414

00:17:00,710 --> 00:16:59,519

so and if you think about

415

00:17:03,030 --> 00:17:00,720

10 000

416

00:17:04,870 --> 00:17:03,040

per pound for for launch costs that's a

417

00:17:08,630 --> 00:17:04,880

conservative figure

418

00:17:13,029 --> 00:17:11,029

just one last quick question

419

00:17:16,630 --> 00:17:13,039

can they be built larger

420

00:17:22,309 --> 00:17:19,270

this is really uh you know an individual

421

00:17:25,750 --> 00:17:22,319

size unit you know developed mostly for

422

00:17:28,710 --> 00:17:25,760

you know commercial applications

423

00:17:30,549 --> 00:17:28,720

okay right here

424

00:17:32,789 --> 00:17:30,559

uh jim siegel from the celebration

425

00:17:34,870 --> 00:17:32,799

independent newspaper again

426

00:17:37,590 --> 00:17:34,880

i think you mentioned that that is that

427

00:17:38,710 --> 00:17:37,600

is commercially available now

428

00:17:41,590 --> 00:17:38,720

and

429

00:17:44,070 --> 00:17:41,600

so two questions one if someone wanted

430

00:17:45,590 --> 00:17:44,080

to buy that today how would they do it

431

00:17:48,150 --> 00:17:45,600

is there a website or something like

432

00:17:51,029 --> 00:17:48,160

that and secondly

433

00:17:52,789 --> 00:17:51,039

the forward osmosis bag

434

00:17:55,909 --> 00:17:52,799

i assume you've done some testing here

435

00:17:59,350 --> 00:17:55,919

on earth before you're doing this so has

436

00:18:02,310 --> 00:18:00,390

drunk from

437

00:18:06,230 --> 00:18:02,320

drunk the liquid that came out of that

438

00:18:11,190 --> 00:18:08,789

um well to answer your first question

439

00:18:13,990 --> 00:18:11,200

yes these are available

440

00:18:16,150 --> 00:18:14,000

as are the cpac and the hydro pack the

441

00:18:17,830 --> 00:18:16,160

hydro pack has actually been used for

442

00:18:20,310 --> 00:18:17,840

hurricane and earthquake relief

443

00:18:22,630 --> 00:18:20,320

hydration technologies has sent these

444

00:18:23,350 --> 00:18:22,640

over to haiti for

445

00:18:26,150 --> 00:18:23,360

for

446

00:18:29,909 --> 00:18:26,160

earthquake relief and yes their website

447

00:18:31,470 --> 00:18:29,919

is hti water.com

448

00:18:34,230 --> 00:18:31,480

t i

449

00:18:37,190 --> 00:18:34,240

water.com and you're able to purchase

450

00:18:39,430 --> 00:18:37,200

all of their products on their website

451
00:18:41,590 --> 00:18:39,440
and your follow-up question

452
00:18:44,310 --> 00:18:41,600
yes in order to

453
00:18:46,470 --> 00:18:44,320
manifest a payload we have to go through

454
00:18:49,029 --> 00:18:46,480
a whole payload integration process

455
00:18:50,950 --> 00:18:49,039
where we first we verify the science on

456
00:18:53,830 --> 00:18:50,960
using a science verification test where

457
00:18:56,070 --> 00:18:53,840
we kind of use a prototype

458
00:18:58,390 --> 00:18:56,080
component of the hardware but just to

459
00:19:00,630 --> 00:18:58,400
verify that the science would work and

460
00:19:03,590 --> 00:19:00,640
we do it in our orbiter environmental

461
00:19:05,190 --> 00:19:03,600
simulator chamber which actually follows

462
00:19:06,630 --> 00:19:05,200
one of the temperature profiles of the

463
00:19:09,750 --> 00:19:06,640

shuttle

464

00:19:12,150 --> 00:19:09,760

and then once we verify that the science

465

00:19:14,310 --> 00:19:12,160

works then we move on and prepare for a

466

00:19:16,789 --> 00:19:14,320

payload verification test which is where

467

00:19:19,029 --> 00:19:16,799

we actually use the flight hardware

468

00:19:20,789 --> 00:19:19,039

and the science to verify that

469

00:19:22,070 --> 00:19:20,799

everything will work

470

00:19:23,110 --> 00:19:22,080

properly

471

00:19:25,029 --> 00:19:23,120

and

472

00:19:27,990 --> 00:19:25,039

no nobody has

473

00:19:31,190 --> 00:19:28,000

to my knowledge has a drink anything yet

474

00:19:32,230 --> 00:19:31,200

but we are able to

475

00:19:34,070 --> 00:19:32,240

produce

476
00:19:35,270 --> 00:19:34,080
the nutrients i believe you can change

477
00:19:37,590 --> 00:19:35,280
the nutrients and the osmotic

478
00:19:39,430 --> 00:19:37,600
concentrate to fit any kind of nutrient

479
00:19:41,430 --> 00:19:39,440
profile that the crew members would need

480
00:19:43,430 --> 00:19:41,440
to nourish themselves

481
00:19:44,390 --> 00:19:43,440
and get it fda approved

482
00:19:47,270 --> 00:19:44,400
but

483
00:19:50,070 --> 00:19:47,280
we did have some japanese

484
00:19:52,070 --> 00:19:50,080
a tv team from japan and they drank it a

485
00:19:53,350 --> 00:19:52,080
little bit we advised them not to but

486
00:19:55,430 --> 00:19:53,360
they did

487
00:19:58,470 --> 00:19:55,440
and uh and i saw a guy outside you know

488
00:20:00,230 --> 00:19:58,480

he's still walking around yeah yeah yeah

489

00:20:02,549 --> 00:20:00,240

and they said it just tasted like a

490

00:20:03,909 --> 00:20:02,559

sweet gatorade sports drink and the

491

00:20:07,270 --> 00:20:03,919

commercial product if you were to

492

00:20:09,669 --> 00:20:07,280

purchase it also the drinkable product

493

00:20:11,909 --> 00:20:09,679

would be a lemon lime orange you can get

494

00:20:14,149 --> 00:20:11,919

any flavor that you want pretty much it

495

00:20:16,310 --> 00:20:14,159

just tastes like a sweet sports drink

496

00:20:18,710 --> 00:20:16,320

but as part of our verification

497

00:20:21,270 --> 00:20:18,720

pre-flight test we did verify we

498

00:20:24,149 --> 00:20:21,280

introduced for instance known

499

00:20:27,390 --> 00:20:24,159

concentrations of bacteria on the dirty

500

00:20:33,350 --> 00:20:27,400

side and we confirmed the manufacturer's

501
00:20:36,789 --> 00:20:34,470
rejection

502
00:20:38,310 --> 00:20:36,799
of the bacteria by the semi-permeable

503
00:20:39,630 --> 00:20:38,320
membrane

504
00:20:44,070 --> 00:20:39,640
there's also

505
00:20:45,750 --> 00:20:44,080
99.99 rejection of viral particles

506
00:20:51,669 --> 00:20:45,760
uh

507
00:20:52,870 --> 00:20:51,679
cysts of different types

508
00:20:55,590 --> 00:20:52,880
and

509
00:20:58,310 --> 00:20:55,600
the great thing about forward osmosis it

510
00:20:59,990 --> 00:20:58,320
you don't need any electrical mechanical

511
00:21:03,110 --> 00:21:00,000
any kind of equipment to use it the

512
00:21:05,590 --> 00:21:03,120
membrane works on its own and

513
00:21:07,990 --> 00:21:05,600

it's low mass low volume no power

514

00:21:11,350 --> 00:21:08,000

required so it's a very ideal space

515

00:21:15,750 --> 00:21:13,750

okay we have a question right here sure

516

00:21:18,230 --> 00:21:15,760

pete crosstain harbor productions in

517

00:21:20,549 --> 00:21:18,240

studio city california um two questions

518

00:21:22,549 --> 00:21:20,559

here one we visited briefly here i

519

00:21:23,750 --> 00:21:22,559

believe you said about 80 percent you

520

00:21:26,950 --> 00:21:23,760

can recover

521

00:21:29,430 --> 00:21:26,960

and uh then the second question is

522

00:21:30,390 --> 00:21:29,440

will further testing uh be necessary or

523

00:21:33,430 --> 00:21:30,400

you

524

00:21:35,990 --> 00:21:33,440

expect that this will be ready to

525

00:21:37,430 --> 00:21:36,000

fly on a operational basis following the

526
00:21:41,029 --> 00:21:37,440
end of

527
00:21:45,430 --> 00:21:42,630
we don't think that there's an immediate

528
00:21:47,830 --> 00:21:45,440
need for this on station

529
00:21:50,070 --> 00:21:47,840
the program could fly them as is the

530
00:21:51,669 --> 00:21:50,080
flight rated versions

531
00:21:54,630 --> 00:21:51,679
what we're trying to do is to get

532
00:21:57,110 --> 00:21:54,640
follow-up flights to further define the

533
00:21:58,549 --> 00:21:57,120
the characteristics of the bag in a more

534
00:22:00,310 --> 00:21:58,559
precise way

535
00:22:02,310 --> 00:22:00,320
we view this first flight as really

536
00:22:05,350 --> 00:22:02,320
getting over the barrier of elevating

537
00:22:06,549 --> 00:22:05,360
the technology relevance level and to

538
00:22:08,230 --> 00:22:06,559

demonstrate that it works in

539

00:22:09,909 --> 00:22:08,240

microgravity

540

00:22:11,830 --> 00:22:09,919

but we could do quite a bit more in

541

00:22:12,950 --> 00:22:11,840

terms of studying the flux rates in a

542

00:22:15,990 --> 00:22:12,960

more

543

00:22:17,990 --> 00:22:16,000

scientifically rigorous fashion

544

00:22:20,310 --> 00:22:18,000

but

545

00:22:23,029 --> 00:22:20,320

there could be some that are flown at

546

00:22:25,990 --> 00:22:23,039

any time after this demonstration

547

00:22:30,149 --> 00:22:26,000

we're not aware of the program wanting

548

00:22:30,159 --> 00:22:34,950

are there any further questions

549

00:22:34,960 --> 00:22:51,270

okay right here

550

00:22:55,270 --> 00:22:52,710

well just to

551
00:22:56,470 --> 00:22:55,280
further go on about the hurricane relief

552
00:22:59,270 --> 00:22:56,480
i actually have

553
00:23:00,870 --> 00:22:59,280
their htis product the hydro pack in my

554
00:23:02,310 --> 00:23:00,880
hurricane relief

555
00:23:05,270 --> 00:23:02,320
package at home

556
00:23:07,510 --> 00:23:05,280
and it's very it's similar to capri sun

557
00:23:09,909 --> 00:23:07,520
but the sugar is already pre-loaded into

558
00:23:12,470 --> 00:23:09,919
the a pouch and you can just have a

559
00:23:14,630 --> 00:23:12,480
bucket of rain run off or any kind of

560
00:23:16,870 --> 00:23:14,640
runoff water and stick the pouch

561
00:23:18,710 --> 00:23:16,880
in the bucket and after about four to

562
00:23:20,230 --> 00:23:18,720
six hours of activation then you can

563
00:23:21,669 --> 00:23:20,240

just stick a straw in it and drink it

564

00:23:22,390 --> 00:23:21,679

like a capri sun

565

00:23:25,350 --> 00:23:22,400

so

566

00:23:27,590 --> 00:23:25,360

um it is available for anybody to use

567

00:23:29,510 --> 00:23:27,600

for any kind of hurricane relief or

568

00:23:37,110 --> 00:23:29,520

earthquake relief or everyday use

569

00:23:40,470 --> 00:23:39,029

well it may not be

570

00:23:44,230 --> 00:23:40,480

the way that you would want to go for

571

00:23:46,630 --> 00:23:44,240

the primary generation of water uh there

572

00:23:48,470 --> 00:23:46,640

are alternative implementations of the

573

00:23:51,350 --> 00:23:48,480

technology that aren't so much bags

574

00:23:53,669 --> 00:23:51,360

within a bag but pumping devices that

575

00:23:56,630 --> 00:23:53,679

you can pump water through it and the

576

00:23:59,269 --> 00:23:56,640

water that comes out is cleaner than

577

00:24:00,870 --> 00:23:59,279

what was introduced so there's other

578

00:24:02,870 --> 00:24:00,880

implementations that i think would be

579

00:24:04,470 --> 00:24:02,880

more relevant for that but but based on

580

00:24:06,789 --> 00:24:04,480

the same technology

581

00:24:08,789 --> 00:24:06,799

and hydration technologies actually does

582

00:24:10,549 --> 00:24:08,799

do a lot of work

583

00:24:12,549 --> 00:24:10,559

in third world countries they go over

584

00:24:15,029 --> 00:24:12,559

and they actually try to implement some

585

00:24:17,669 --> 00:24:15,039

water recycling systems using these uh

586

00:24:20,390 --> 00:24:17,679

the forward osmosis technology so that

587

00:24:22,310 --> 00:24:20,400

they do currently go overseas into third

588

00:24:24,549 --> 00:24:22,320

world countries and help them implement

589

00:24:25,830 --> 00:24:24,559

into little cities and villages which

590

00:24:29,190 --> 00:24:25,840

you can find further information on

591

00:24:30,230 --> 00:24:29,200

their website but they do okay we have a

592

00:24:33,350 --> 00:24:30,240

follow-up

593

00:24:37,590 --> 00:24:35,269

uh jim siegel again from the celebration

594

00:24:40,149 --> 00:24:37,600

independent newspaper my readers are

595

00:24:43,269 --> 00:24:40,159

interested in the the spin-off benefits

596

00:24:46,070 --> 00:24:43,279

of of space exploration onto what's

597

00:24:47,190 --> 00:24:46,080

going on on earth today so in this case

598

00:24:48,390 --> 00:24:47,200

we have

599

00:24:50,710 --> 00:24:48,400

existing

600

00:24:53,510 --> 00:24:50,720

earthbound technology being applied to

601
00:24:56,310 --> 00:24:53,520
space so can you see

602
00:24:58,789 --> 00:24:56,320
some learnings coming back to

603
00:25:01,750 --> 00:24:58,799
earthbound applications from the

604
00:25:06,630 --> 00:25:01,760
experiment that's going to be done here

605
00:25:10,630 --> 00:25:08,789
technology refining the technology or

606
00:25:11,350 --> 00:25:10,640
something like that

607
00:25:13,190 --> 00:25:11,360
well

608
00:25:15,430 --> 00:25:13,200
there has been quite a bit of research

609
00:25:17,830 --> 00:25:15,440
that's been done on earth

610
00:25:20,149 --> 00:25:17,840
that has gone into optimizing the design

611
00:25:22,310 --> 00:25:20,159
for earth-based applications

612
00:25:23,909 --> 00:25:22,320
it's conceivable that we may learn

613
00:25:25,909 --> 00:25:23,919

something and part of the reason we're

614

00:25:27,830 --> 00:25:25,919

flying is to see

615

00:25:29,510 --> 00:25:27,840

how does the membrane operate in

616

00:25:33,110 --> 00:25:29,520

microgravity

617

00:25:36,310 --> 00:25:33,120

without convection-based buoyancy

618

00:25:38,149 --> 00:25:36,320

without some physical concentration

619

00:25:40,630 --> 00:25:38,159

mechanisms

620

00:25:42,710 --> 00:25:40,640

that are occurring on earth or at

621

00:25:44,789 --> 00:25:42,720

decreased levels so it's possible that

622

00:25:47,990 --> 00:25:44,799

the fundamental knowledge that's

623

00:25:49,430 --> 00:25:48,000

generated by this spaceflight experiment

624

00:25:52,070 --> 00:25:49,440

which will be done

625

00:25:53,269 --> 00:25:52,080

in microgravity as opposed to on 1g

626
00:25:55,350 --> 00:25:53,279
might

627
00:25:57,830 --> 00:25:55,360
produce some enlightenment

628
00:26:01,430 --> 00:25:57,840
that could be used in earth-based

629
00:26:05,990 --> 00:26:04,310
okay any further questions

630
00:26:07,990 --> 00:26:06,000
one more here

631
00:26:09,830 --> 00:26:08,000
hi ken kramer space flight magazine can

632
00:26:12,070 --> 00:26:09,840
you talk about um what's the total

633
00:26:13,990 --> 00:26:12,080
weight it seems seems pretty light and

634
00:26:16,149 --> 00:26:14,000
has this possibly been tested in the in

635
00:26:18,390 --> 00:26:16,159
these uh short-term sub-orbital flights

636
00:26:20,149 --> 00:26:18,400
at all where you get microgravity for a

637
00:26:21,990 --> 00:26:20,159
few minutes

638
00:26:25,510 --> 00:26:22,000

so i believe each of these bags is on

639

00:26:27,909 --> 00:26:25,520

the order of 300 grams okay

640

00:26:29,909 --> 00:26:27,919

so relatively lightweight

641

00:26:31,430 --> 00:26:29,919

the problem with doing the

642

00:26:34,230 --> 00:26:31,440

the earth base

643

00:26:35,510 --> 00:26:34,240

microgravity analogs and and there's two

644

00:26:38,310 --> 00:26:35,520

of those that i think you're referring

645

00:26:40,310 --> 00:26:38,320

to one is the the parabolic flight

646

00:26:42,870 --> 00:26:40,320

series

647

00:26:44,870 --> 00:26:42,880

in which you get on the order of 20 25

648

00:26:46,870 --> 00:26:44,880

seconds of microgravity interspersed

649

00:26:48,310 --> 00:26:46,880

with 2g and 1g

650

00:26:50,149 --> 00:26:48,320

that would be very difficult because

651
00:26:52,710 --> 00:26:50,159
it's not long enough

652
00:26:55,190 --> 00:26:52,720
to get significant results

653
00:26:57,590 --> 00:26:55,200
the other category which is the the new

654
00:26:59,669 --> 00:26:57,600
emerging suborbital industry that we're

655
00:27:01,750 --> 00:26:59,679
all looking forward to

656
00:27:03,750 --> 00:27:01,760
there you can get somewhere between our

657
00:27:07,029 --> 00:27:03,760
other promises to get somewhere between

658
00:27:10,230 --> 00:27:07,039
two and five minutes of microgravity

659
00:27:12,070 --> 00:27:10,240
it's still probably short for this

660
00:27:15,110 --> 00:27:12,080
implementation

661
00:27:17,590 --> 00:27:15,120
but usually what you do is you design

662
00:27:19,350 --> 00:27:17,600
a different sized

663
00:27:21,510 --> 00:27:19,360

bag or whatever your hardware is that

664

00:27:24,149 --> 00:27:21,520

you're testing so that you could get

665

00:27:26,549 --> 00:27:24,159

significant results so it wouldn't be

666

00:27:27,510 --> 00:27:26,559

these size bags but we could scale them

667

00:27:29,110 --> 00:27:27,520

down

668

00:27:31,350 --> 00:27:29,120

so that we could get some interesting

669

00:27:35,669 --> 00:27:31,360

results from from those

670

00:27:40,230 --> 00:27:37,669

the whole payload weighs approximately

671

00:27:43,909 --> 00:27:40,240

6.3 uh kilos

672

00:27:46,310 --> 00:27:43,919

so about what 12-14 pounds

673

00:27:52,070 --> 00:27:46,320

and it's going to fill up approximately

674

00:27:57,590 --> 00:27:53,590

so we will be sharing with another

675

00:28:01,190 --> 00:27:59,110

okay well this will conclude our

676

00:28:03,350 --> 00:28:01,200

demonstration and

677

00:28:06,630 --> 00:28:03,360

our next televised event will be the

678

00:28:08,789 --> 00:28:06,640

nasa aeronautics research update at 8 15

679

00:28:11,590 --> 00:28:08,799

a.m tomorrow morning for more

680

00:28:15,029 --> 00:28:11,600

information on the sts-135 mission and