



1
00:00:00,790 --> 00:00:07,320

[Music]

2
00:00:11,720 --> 00:00:09,129

[Applause]

3
00:00:13,459 --> 00:00:11,730

hi everyone I'm Elizabeth had a meal I'm

4
00:00:15,410 --> 00:00:13,469

gonna present the work that's being done

5
00:00:18,499 --> 00:00:15,420

on Micah which is a microfluidic I see

6
00:00:22,010 --> 00:00:18,509

world chemistry analyzer this is a

7
00:00:23,510 --> 00:00:22,020

collaboration between a couple of

8
00:00:25,729 --> 00:00:23,520

different NASA centers NASA aims to

9
00:00:30,200 --> 00:00:25,739

propulsion labs Tufts University Tony

10
00:00:32,690 --> 00:00:30,210

Rico is the PI on it and so mica is

11
00:00:34,880 --> 00:00:32,700

basically a combination between the

12
00:00:37,790 --> 00:00:34,890

heritage of the Phoenix wet chemistry

13
00:00:40,430 --> 00:00:37,800

labs which flew and and did some

14
00:00:41,930 --> 00:00:40,440
experiments on Mars back in 2008 and the

15
00:00:43,880 --> 00:00:41,940
work that's been done with micro

16
00:00:45,880 --> 00:00:43,890
fluidics on small satellites through

17
00:00:50,330 --> 00:00:45,890
Ames and together we're combining these

18
00:00:52,400 --> 00:00:50,340
ya into a basically a smaller version of

19
00:00:54,920 --> 00:00:52,410
the Phoenix wet chemistry labs that

20
00:00:59,139 --> 00:00:54,930
would might be useful on Europa Lander

21
00:01:01,580 --> 00:00:59,149
potential mission so the Europa Lander

22
00:01:04,160 --> 00:01:01,590
science definition team report came out

23
00:01:05,359 --> 00:01:04,170
with of course several different key

24
00:01:08,840 --> 00:01:05,369
science goals that they were interested

25
00:01:10,999 --> 00:01:08,850
in and we believe that the the mic

26

00:01:14,899 --> 00:01:11,009

instrument that we're building well not

27

00:01:16,879 --> 00:01:14,909

necessarily obviously going to address

28

00:01:20,809 --> 00:01:16,889

these it does have a very important role

29

00:01:22,489 --> 00:01:20,819

in them in it and the primary

30

00:01:23,899 --> 00:01:22,499

measurements that Myka is going to make

31

00:01:25,010 --> 00:01:23,909

our inorganic measurements just a little

32

00:01:26,419 --> 00:01:25,020

bit different from what a lot of other

33

00:01:29,840 --> 00:01:26,429

people are talking about here today

34

00:01:31,940 --> 00:01:29,850

it's an electro chemistry array that

35

00:01:33,800 --> 00:01:31,950

uses ion selective electrodes cyclical

36

00:01:36,379 --> 00:01:33,810

cemetry and chrono potentiometry and

37

00:01:38,739 --> 00:01:36,389

where it fits in in this this science

38

00:01:41,300 --> 00:01:38,749

definition team report is looking at

39

00:01:43,429 --> 00:01:41,310

characterizing the inorganic environment

40

00:01:45,879 --> 00:01:43,439

characterizing the sort of sources for

41

00:01:48,499 --> 00:01:45,889

energy that might be fueling these

42

00:01:50,840 --> 00:01:48,509

potential life forms looking at the

43

00:01:53,239 --> 00:01:50,850

habitability of the surface and just

44

00:01:57,289 --> 00:01:53,249

characterizing the chemical matrix in

45

00:01:59,209 --> 00:01:57,299

which the measurements will be taken and

46

00:02:00,769 --> 00:01:59,219

so all of this sort of stems from the

47

00:02:02,870 --> 00:02:00,779

Phoenix lander and so for those of you

48

00:02:05,089 --> 00:02:02,880

who maybe don't think about the Phoenix

49

00:02:06,499 --> 00:02:05,099

lander as often as some of us do I want

50

00:02:08,210 --> 00:02:06,509

to remind you exactly what the wet

51
00:02:10,070 --> 00:02:08,220
chemistry labs are and why they're

52
00:02:14,540 --> 00:02:10,080
actually a really great stepping stone

53
00:02:16,250 --> 00:02:14,550
for the Europa Lander so in 2008 the

54
00:02:17,839 --> 00:02:16,260
Phoenix lander landed on the northern

55
00:02:20,119 --> 00:02:17,849
plains of Mars and its mission was to

56
00:02:21,470 --> 00:02:20,129
assess the habitability of that site and

57
00:02:23,300 --> 00:02:21,480
it did that with

58
00:02:24,710 --> 00:02:23,310
different tools one of this was this

59
00:02:27,110 --> 00:02:24,720
microscopy electrochemistry and

60
00:02:29,479 --> 00:02:27,120
conductivity analyzer Mecca and what

61
00:02:31,970 --> 00:02:29,489
Mecca did was it had as part of it a

62
00:02:33,440 --> 00:02:31,980
series of four cells which were the wet

63
00:02:35,300 --> 00:02:33,450

chemistry labs and they were these

64

00:02:37,100 --> 00:02:35,310

electrochemical sensor arrays they

65

00:02:38,900 --> 00:02:37,110

included a suite of ion selective

66

00:02:41,530 --> 00:02:38,910

electrodes conductivity probes they

67

00:02:44,240 --> 00:02:41,540

sensed pH oxidation reduction potential

68

00:02:46,130 --> 00:02:44,250

and different oxidants in the soil and

69

00:02:48,289 --> 00:02:46,140

this was really the first time that on

70

00:02:51,020 --> 00:02:48,299

Mars we were able to characterize the

71

00:02:54,110 --> 00:02:51,030

the regul if in terms of these soluble

72

00:02:55,550 --> 00:02:54,120

species which was very important and in

73

00:02:57,289 --> 00:02:55,560

addition to having the success of

74

00:02:58,580 --> 00:02:57,299

actually measuring the primary cations

75

00:03:00,680 --> 00:02:58,590

that were in the soil and really giving

76
00:03:03,259 --> 00:03:00,690
us a context for that in measure pH for

77
00:03:05,809 --> 00:03:03,269
the first time and it detected

78
00:03:07,309 --> 00:03:05,819
perchlorate in the surface for the first

79
00:03:09,199 --> 00:03:07,319
time and this was a really really really

80
00:03:12,199 --> 00:03:09,209
important contribution to how we

81
00:03:13,339 --> 00:03:12,209
understand Mars so before this you know

82
00:03:15,020 --> 00:03:13,349
we had always expected there to be

83
00:03:16,250 --> 00:03:15,030
organic molecules and we'd go and we'd

84
00:03:19,190 --> 00:03:16,260
measure and they weren't there and we

85
00:03:20,809 --> 00:03:19,200
were all like what is happening and so

86
00:03:22,759 --> 00:03:20,819
when when Phoenix showed up and they

87
00:03:24,349 --> 00:03:22,769
actually measured what was in the soil

88
00:03:25,610 --> 00:03:24,359

they measured what was in the matrix of

89

00:03:27,800 --> 00:03:25,620

the sample that they were trying to

90

00:03:29,740 --> 00:03:27,810

detect these organics in they found this

91

00:03:31,729 --> 00:03:29,750

molecule called perchlorate and

92

00:03:32,900 --> 00:03:31,739

perchlorate is interesting because if

93

00:03:34,250 --> 00:03:32,910

you heat it up in the presence of

94

00:03:35,569 --> 00:03:34,260

organics which you get are a bunch of

95

00:03:37,809 --> 00:03:35,579

combusted organics and you don't

96

00:03:40,640 --> 00:03:37,819

actually see what you wanted to see so

97

00:03:42,530 --> 00:03:40,650

you know since then curiosity is then

98

00:03:44,629 --> 00:03:42,540

confirmed the presence of organic with

99

00:03:46,339 --> 00:03:44,639

this oxygen evolution peak so when

100

00:03:48,440 --> 00:03:46,349

perchlorate degrades when you heat it up

101
00:03:50,180 --> 00:03:48,450
it has this oxygen evolution peak and it

102
00:03:51,650 --> 00:03:50,190
explains why we were really for a long

103
00:03:53,300 --> 00:03:51,660
time only getting these very small

104
00:03:54,890 --> 00:03:53,310
chlorinated organics and it wasn't until

105
00:03:56,990 --> 00:03:54,900
very recently that we started to detect

106
00:03:58,430 --> 00:03:57,000
other things where we could search in

107
00:04:00,199 --> 00:03:58,440
environments that maybe perchlorate

108
00:04:01,759 --> 00:04:00,209
wasn't as abundant and what I'm trying

109
00:04:03,920 --> 00:04:01,769
to emphasize here is the importance of

110
00:04:05,569 --> 00:04:03,930
measuring even this inorganic matrix

111
00:04:07,220 --> 00:04:05,579
before you start doing these incredibly

112
00:04:09,140 --> 00:04:07,230
complicated awesome techniques that can

113
00:04:10,490 --> 00:04:09,150

maybe detect really low levels of

114

00:04:12,559 --> 00:04:10,500

organics and all of that but if you

115

00:04:14,990 --> 00:04:12,569

don't understand your chemical matrix at

116

00:04:16,759 --> 00:04:15,000

the base level then you could be missing

117

00:04:20,199 --> 00:04:16,769

something very obvious and now you've

118

00:04:23,629 --> 00:04:20,209

wasted all of this time and energy - and

119

00:04:25,370 --> 00:04:23,639

- because you just simply didn't test

120

00:04:27,770 --> 00:04:25,380

your your your matrix and this is really

121

00:04:30,050 --> 00:04:27,780

a first step in any basic laboratory

122

00:04:34,110 --> 00:04:30,060

analysis you know test your pH test

123

00:04:36,240 --> 00:04:34,120

what's in there and so we know that we

124

00:04:38,129 --> 00:04:36,250

did a really excellent job on Mars but

125

00:04:39,780 --> 00:04:38,139

there are different challenges for going

126
00:04:42,900 --> 00:04:39,790
forward on Europa and so we've been

127
00:04:43,980 --> 00:04:42,910
developing these sensors to test them to

128
00:04:45,870 --> 00:04:43,990
make sure that they will be robust

129
00:04:47,670 --> 00:04:45,880
enough to handle the environments that

130
00:04:49,950 --> 00:04:47,680
we expect on Europa and the first of

131
00:04:51,960 --> 00:04:49,960
those tests was the radiation dose so

132
00:04:53,460 --> 00:04:51,970
the radiation on Europa is much larger

133
00:04:55,020 --> 00:04:53,470
than the radiation on Mars and so we've

134
00:04:58,260 --> 00:04:55,030
been testing at this 300 killer ad

135
00:05:00,900 --> 00:04:58,270
totalized an ionization dose because the

136
00:05:02,670 --> 00:05:00,910
molecules that do sort of the heavy

137
00:05:04,500 --> 00:05:02,680
lifting and ion selective electrode are

138
00:05:06,180 --> 00:05:04,510

actually small organic molecules and so

139

00:05:07,260 --> 00:05:06,190

one of our concerns was that if they

140

00:05:09,200 --> 00:05:07,270

couldn't handle the higher radiation

141

00:05:11,730 --> 00:05:09,210

that there would be a problem and so we

142

00:05:14,189 --> 00:05:11,740

did some measurements we calibrated them

143

00:05:16,080 --> 00:05:14,199

and we compared them before and after

144

00:05:17,400 --> 00:05:16,090

this 300 kilo rad total radiation dose

145

00:05:19,529 --> 00:05:17,410

and we found that at least for the ones

146

00:05:20,760 --> 00:05:19,539

that we've tested so far there doesn't

147

00:05:22,890 --> 00:05:20,770

really seem to be a loss of performance

148

00:05:26,700 --> 00:05:22,900

so it looks like that high radiation

149

00:05:28,140 --> 00:05:26,710

environment doesn't seem to be going to

150

00:05:30,900 --> 00:05:28,150

be too much of a problem for at least

151

00:05:32,070 --> 00:05:30,910

these potentially these organic

152

00:05:34,770 --> 00:05:32,080

molecules that we put in our our

153

00:05:36,870 --> 00:05:34,780

membranes the second is the lifetime so

154

00:05:38,790 --> 00:05:36,880

Mars is a lot closer than Europa and so

155

00:05:41,430 --> 00:05:38,800

if we're looking at a 10-year flight

156

00:05:42,839 --> 00:05:41,440

mission we just wanted to make sure that

157

00:05:44,520 --> 00:05:42,849

these electrodes would still function

158

00:05:46,050 --> 00:05:44,530

when we got there and this was one of

159

00:05:47,610 --> 00:05:46,060

the great things about using a heritage

160

00:05:49,890 --> 00:05:47,620

technology is we actually had an

161

00:05:52,350 --> 00:05:49,900

original flight spare beaker that back

162

00:05:54,540 --> 00:05:52,360

in 2007 they sealed up put in a freezer

163

00:05:56,159 --> 00:05:54,550

and forgot about for 10 years and then

164

00:05:58,529 --> 00:05:56,169

we said well would this work if we got

165

00:06:00,210 --> 00:05:58,539

to Europa in 10 years it was very easy

166

00:06:01,920 --> 00:06:00,220

to test we just opened up the beaker and

167

00:06:03,960 --> 00:06:01,930

we did the calibration again and you can

168

00:06:05,939 --> 00:06:03,970

see before and after the the calibration

169

00:06:07,439 --> 00:06:05,949

the sensitivity hasn't really changed

170

00:06:09,210 --> 00:06:07,449

over time so they definitely do have a

171

00:06:11,909 --> 00:06:09,220

demonstrated actual 10-year

172

00:06:15,659 --> 00:06:11,919

survivability which was pretty exciting

173

00:06:17,400 --> 00:06:15,669

for us to learn and then the next thing

174

00:06:19,230 --> 00:06:17,410

that we wanted to know is you know the

175

00:06:21,750 --> 00:06:19,240

original wickel beakers use 25

176

00:06:24,150 --> 00:06:21,760

milliliters of water and that's a that's

177

00:06:25,350 --> 00:06:24,160

a lot of water for Europa and so we

178

00:06:27,270 --> 00:06:25,360

wanted to make sure that these would

179

00:06:29,850 --> 00:06:27,280

still function if we reduce that sample

180

00:06:31,950 --> 00:06:29,860

volume down to the micro liter level so

181

00:06:34,230 --> 00:06:31,960

we took the original form factor of the

182

00:06:36,629 --> 00:06:34,240

Wicklow electrodes and we put them into

183

00:06:40,409 --> 00:06:36,639

a sort of microfluidic channel so this

184

00:06:43,560 --> 00:06:40,419

is 14 electrodes in a total channel

185

00:06:44,700 --> 00:06:43,570

volume of 100 microliters and we tested

186

00:06:46,620 --> 00:06:44,710

to see whether or not the performance

187

00:06:47,480 --> 00:06:46,630

change going from a beaker with a large

188

00:06:48,950 --> 00:06:47,490

volume to

189

00:06:51,020 --> 00:06:48,960

this manifold with a small volume and as

190

00:06:53,480 --> 00:06:51,030

you can tell the performance actually

191

00:06:56,390 --> 00:06:53,490

stays pretty good and novita had a

192

00:06:57,830 --> 00:06:56,400

poster on what was that Monday about

193

00:06:59,659 --> 00:06:57,840

that I'm sure it's still up if you are

194

00:07:00,950 --> 00:06:59,669

interested or you can find her and chat

195

00:07:03,290 --> 00:07:00,960

about it and she's been doing more work

196

00:07:05,420 --> 00:07:03,300

testing the different components to make

197

00:07:09,320 --> 00:07:05,430

sure that these manifolds still still

198

00:07:10,520 --> 00:07:09,330

hold up and there were you know going

199

00:07:13,249 --> 00:07:10,530

forward it's nice to know that these

200

00:07:14,689 --> 00:07:13,259

heritage kind of electrodes actually do

201
00:07:16,100 --> 00:07:14,699
function and they would be useful on

202
00:07:17,480 --> 00:07:16,110
Europe and we could still get the same

203
00:07:19,730 --> 00:07:17,490
kind of excellent science return that we

204
00:07:20,960 --> 00:07:19,740
got from Phoenix using them but we

205
00:07:22,640 --> 00:07:20,970
wanted to make sure that we weren't

206
00:07:23,570 --> 00:07:22,650
missing anything so it's been a while

207
00:07:25,790 --> 00:07:23,580
since Phoenix and there have been

208
00:07:27,499 --> 00:07:25,800
amazing technology advances since then

209
00:07:29,390 --> 00:07:27,509
and so we sort of started looking at

210
00:07:30,920 --> 00:07:29,400
what the next generation of these ion

211
00:07:32,570 --> 00:07:30,930
selective electrodes looks like and so

212
00:07:35,059 --> 00:07:32,580
we started comparing the heritage local

213
00:07:36,860 --> 00:07:35,069

ones which are here to the Salt contact

214

00:07:38,659 --> 00:07:36,870

ones to see if there would be a benefit

215

00:07:40,820 --> 00:07:38,669

and maybe sacrificing a little TRL to

216

00:07:42,980 --> 00:07:40,830

get some benefit later on or whether or

217

00:07:44,420 --> 00:07:42,990

not it's it's better just to stick with

218

00:07:46,399 --> 00:07:44,430

the Heritage and so what we're mainly

219

00:07:49,700 --> 00:07:46,409

comparing here is the original heritage

220

00:07:51,050 --> 00:07:49,710

design it uses a hydrogel inner filling

221

00:07:53,180 --> 00:07:51,060

solution in order to do its main

222

00:07:55,100 --> 00:07:53,190

transduction from an ionic signal to an

223

00:07:57,170 --> 00:07:55,110

electronic one and while we know it can

224

00:07:58,909 --> 00:07:57,180

survive ten years of storage and we've

225

00:08:00,529 --> 00:07:58,919

done some dry storage testing which also

226

00:08:02,450 --> 00:08:00,539

kind of confirms that we can bring them

227

00:08:03,589 --> 00:08:02,460

back to life after drawing them out we

228

00:08:05,689 --> 00:08:03,599

wanted to know whether or not there

229

00:08:06,830 --> 00:08:05,699

would be benefit in eliminating that one

230

00:08:08,810 --> 00:08:06,840

of the benefits to eliminating that

231

00:08:10,370 --> 00:08:08,820

aside from just potentially adding a

232

00:08:12,260 --> 00:08:10,380

stability and survivability would be

233

00:08:14,300 --> 00:08:12,270

that we can reduce the size so this six

234

00:08:16,760 --> 00:08:14,310

millimeter size is kind of the limit if

235

00:08:17,839 --> 00:08:16,770

you're using that hydrogel but with by

236

00:08:19,700 --> 00:08:17,849

getting rid of it and using a

237

00:08:23,120 --> 00:08:19,710

carbon-based material which uses a

238

00:08:24,499 --> 00:08:23,130

capacitive transduction mechanism

239

00:08:26,390 --> 00:08:24,509

instead of a redox based one we're able

240

00:08:28,010 --> 00:08:26,400

to get it down to two millimeters so we

241

00:08:30,230 --> 00:08:28,020

could possibly fit more of them into a

242

00:08:32,839 --> 00:08:30,240

smaller array and we've been developing

243

00:08:34,430 --> 00:08:32,849

these well really there's been a lot of

244

00:08:36,889 --> 00:08:34,440

iterations of developing these solid

245

00:08:38,389 --> 00:08:36,899

contact ones since since the original

246

00:08:39,829 --> 00:08:38,399

Phoenix mission and this is sort of the

247

00:08:43,010 --> 00:08:39,839

most recent one so we have this two

248

00:08:46,160 --> 00:08:43,020

millimeter diameter using a graphene

249

00:08:47,930 --> 00:08:46,170

oxide carbon nanotube based transduction

250

00:08:50,120 --> 00:08:47,940

level and we've sort of are currently

251
00:08:52,850 --> 00:08:50,130
testing it in this small form-factor

252
00:08:54,889 --> 00:08:52,860
microfluidic array that includes

253
00:08:57,079 --> 00:08:54,899
calibration reservoirs and things of

254
00:08:58,579 --> 00:08:57,089
that nature and conductivity in testing

255
00:09:01,140 --> 00:08:58,589
it in this manner to see how it performs

256
00:09:03,120 --> 00:09:01,150
and so far it's performing just as well

257
00:09:04,890 --> 00:09:03,130
the original heritage ones which is

258
00:09:07,710 --> 00:09:04,900
which is excellent

259
00:09:09,990 --> 00:09:07,720
we were also wanted to address some of

260
00:09:11,730 --> 00:09:10,000
the some of the ions that we didn't

261
00:09:16,230 --> 00:09:11,740
actually measure when we were on Phoenix

262
00:09:18,150 --> 00:09:16,240
so ICS are really excellent at cations

263
00:09:20,490 --> 00:09:18,160

and then things get a little fuzzier

264

00:09:21,780 --> 00:09:20,500

when you go to anions and so what we

265

00:09:23,550 --> 00:09:21,790

were able to tech perchlorate to there

266

00:09:24,960 --> 00:09:23,560

are interferences and detecting becau

267

00:09:26,220 --> 00:09:24,970

right meant we couldn't detect a nitrate

268

00:09:29,610 --> 00:09:26,230

and so we've been developing techniques

269

00:09:31,170 --> 00:09:29,620

using the same types of electronics and

270

00:09:32,430 --> 00:09:31,180

electrodes that were in the original one

271

00:09:33,780 --> 00:09:32,440

we've been just sort of developing

272

00:09:35,760 --> 00:09:33,790

methods that would allow us to tailor

273

00:09:38,190 --> 00:09:35,770

that to detect other things and so

274

00:09:39,990 --> 00:09:38,200

here's an example of some CV which was

275

00:09:42,300 --> 00:09:40,000

on board the original Phoenix I'm using

276

00:09:44,280 --> 00:09:42,310

a silver electrode to detect nitrate you

277

00:09:45,570 --> 00:09:44,290

can see that the peak here varies with

278

00:09:47,940 --> 00:09:45,580

concentration and you can actually

279

00:09:49,620 --> 00:09:47,950

measure your nitrate based on that and

280

00:09:51,810 --> 00:09:49,630

we did a similar thing with sulfate and

281

00:09:54,150 --> 00:09:51,820

the led electrode where you can see that

282

00:09:56,460 --> 00:09:54,160

we can vary the concentration and get

283

00:09:58,470 --> 00:09:56,470

some potentially quantifying information

284

00:10:02,390 --> 00:09:58,480

about these these anions that might be

285

00:10:04,440 --> 00:10:02,400

swamped by other signals in the IOC's

286

00:10:05,790 --> 00:10:04,450

and so we've taken all of these

287

00:10:09,240 --> 00:10:05,800

wonderful developments for the the

288

00:10:10,650 --> 00:10:09,250

wickel heritage electrochemistry array

289

00:10:12,150 --> 00:10:10,660

and we're sort of coupling it with the

290

00:10:13,580 --> 00:10:12,160

knowledge at NASA Ames with their

291

00:10:17,610 --> 00:10:13,590

microfluidic so they've been doing these

292

00:10:20,130 --> 00:10:17,620

small satellite microfluidic devices for

293

00:10:22,800 --> 00:10:20,140

years and I'm not going to talk too much

294

00:10:25,410 --> 00:10:22,810

about that because someone else can talk

295

00:10:27,510 --> 00:10:25,420

about it later if they feel like it but

296

00:10:29,670 --> 00:10:27,520

we sort of brought these together and

297

00:10:31,620 --> 00:10:29,680

and put it in this splice which was

298

00:10:33,180 --> 00:10:31,630

talked about I was funded under cold

299

00:10:36,660 --> 00:10:33,190

tech funding I think Leslie talked about

300

00:10:37,560 --> 00:10:36,670

it on Tuesday I believe and this was

301

00:10:38,880 --> 00:10:37,570

sort of built and it has these

302

00:10:42,930 --> 00:10:38,890

connections where I can integrate with

303

00:10:44,460 --> 00:10:42,940

this this these at this M wickel are

304

00:10:45,720 --> 00:10:44,470

these these sort of microfluidic wickel

305

00:10:47,390 --> 00:10:45,730

devices that we've been building so

306

00:10:49,950 --> 00:10:47,400

we've been sort of testing it like that

307

00:10:51,270 --> 00:10:49,960

for a while and then this all comes

308

00:10:52,830 --> 00:10:51,280

together eventually in all of this

309

00:10:54,930 --> 00:10:52,840

knowledge and experience in this sort of

310

00:10:56,220 --> 00:10:54,940

heritage and high TRL work that we've

311

00:10:58,410 --> 00:10:56,230

been doing comes together in these

312

00:11:00,960 --> 00:10:58,420

actual proposed mica systems so we have

313

00:11:02,520 --> 00:11:00,970

a sealing door and a sample handling

314

00:11:06,030 --> 00:11:02,530

that's being developed by honeybee

315

00:11:07,320 --> 00:11:06,040

that'll allow us to have the meet the

316

00:11:08,850 --> 00:11:07,330

requirements that we need for that we

317

00:11:10,800 --> 00:11:08,860

have our calibrations our water

318

00:11:12,329 --> 00:11:10,810

reservoir our electrochemical sensor

319

00:11:14,129 --> 00:11:12,339

right here if here is Siri

320

00:11:16,170 --> 00:11:14,139

pumps and valves all of them and all of

321

00:11:19,410 --> 00:11:16,180

these are meant to fit into a design

322

00:11:22,350 --> 00:11:19,420

that is about you know 10 centimeters by

323

00:11:23,639 --> 00:11:22,360

17 by 11 and a half and it's basically

324

00:11:27,329 --> 00:11:23,649

going to fit into one of these smaller

325

00:11:30,329 --> 00:11:27,339

sections of the the proposed Europa

326

00:11:32,519 --> 00:11:30,339

Lander and so this is the current CAD

327

00:11:34,049 --> 00:11:32,529

design that we're working up and we're

328

00:11:35,519 --> 00:11:34,059

actually getting printed a I don't want

329

00:11:37,710 --> 00:11:35,529

to say as we speak but sometime in the

330

00:11:39,929 --> 00:11:37,720

not-too-distant future for integration

331

00:11:41,429 --> 00:11:39,939

and testing of all of these final are

332

00:11:43,829 --> 00:11:41,439

these these initial designs that we've

333

00:11:44,910 --> 00:11:43,839

been we've been doing and so with that I

334

00:11:46,379 --> 00:11:44,920

just want to run through these

335

00:11:48,360 --> 00:11:46,389

conclusions real quick so we have these

336

00:11:50,309 --> 00:11:48,370

electrochemistry measurements that are

337

00:11:52,199 --> 00:11:50,319

really well-suited to to address things

338

00:11:53,699 --> 00:11:52,209

like habitability and sample site

339

00:11:55,049 --> 00:11:53,709

characterization which is incredibly

340

00:11:56,730 --> 00:11:55,059

important when you're going to a place

341

00:11:58,679 --> 00:11:56,740

for the first time to do sort of

342

00:12:00,660 --> 00:11:58,689

complicated measurements and it really

343

00:12:04,379 --> 00:12:00,670

incorporates a lot of really high TRL

344

00:12:05,549 --> 00:12:04,389

Flight heritage devices which makes it

345

00:12:07,350 --> 00:12:05,559

what makes it a really promising

346

00:12:09,210 --> 00:12:07,360

technology and has been built off of

347

00:12:10,530 --> 00:12:09,220

funding from cold techs and things like

348

00:12:11,639 --> 00:12:10,540

that that have been basically bringing

349

00:12:14,340 --> 00:12:11,649

all of this together

350

00:12:15,840 --> 00:12:14,350

since the start of it and that we're at

351
00:12:17,549 --> 00:12:15,850
the stage where we're about to actually

352
00:12:36,569 --> 00:12:17,559
integrate all of these things and test

353
00:12:41,090 --> 00:12:36,579
them finally so in question I was really

354
00:12:42,210 --> 00:12:41,100
intrigued by your use of the the Phoenix

355
00:12:43,319 --> 00:12:42,220
parts

356
00:12:47,150 --> 00:12:43,329
was there anything else that you

357
00:12:49,679 --> 00:12:47,160
cannibalized that stood the test of time

358
00:12:51,269 --> 00:12:49,689
well yeah so the spare flake because you

359
00:12:52,710 --> 00:12:51,279
know it's it's funny that box sits in

360
00:12:53,939 --> 00:12:52,720
the freezer for a while and it takes up

361
00:12:55,679 --> 00:12:53,949
a lot of space and then it comes very

362
00:12:57,439 --> 00:12:55,689
useful I'm in that respect if there's

363
00:12:59,460 --> 00:12:57,449

anything else from them that we're using

364

00:13:01,559 --> 00:12:59,470

specifically from Phoenix I'm not sure

365

00:13:03,239 --> 00:13:01,569

because that was really optimized for

366

00:13:04,889 --> 00:13:03,249

taking soil and mixing it with water

367

00:13:06,360 --> 00:13:04,899

right and here we're expecting to be

368

00:13:07,919 --> 00:13:06,370

able to sort of maybe melt our sample

369

00:13:10,499 --> 00:13:07,929

and we don't need to do as much in the

370

00:13:12,030 --> 00:13:10,509

mixing so from there we have a few a few

371

00:13:16,390 --> 00:13:12,040

tweaks which is a micro fluidics part of

372

00:13:18,319 --> 00:13:16,400

it but yeah cool nice work

373

00:13:18,520 --> 00:13:18,329

[Music]