
AbSciCon
2019

1
00:00:00,790 --> 00:00:07,320
[Music]

2
00:00:12,199 --> 00:00:09,250
[Applause]

3
00:00:14,959 --> 00:00:12,209
hello everyone my name is Peter I'm here

4
00:00:18,650 --> 00:00:14,969
to represent my colleagues both at JPL

5
00:00:20,780 --> 00:00:18,660
and at Goddard and at NASA Ames as

6
00:00:22,700 --> 00:00:20,790
Cynthia mentioned in an introduction for

7
00:00:24,529 --> 00:00:22,710
this particular mission opportunity the

8
00:00:27,620 --> 00:00:24,539
it's really important we're gonna

9
00:00:29,420 --> 00:00:27,630
succeed in this endeavor we really need

10
00:00:31,429 --> 00:00:29,430
to have integrated payloads to really

11
00:00:34,009 --> 00:00:31,439
work well together so we actually took

12
00:00:35,570 --> 00:00:34,019
upon ourselves before the IC to call to

13
00:00:37,820 --> 00:00:35,580

actually begin that process of

14
00:00:40,250 --> 00:00:37,830
integrating together what we believe is

15
00:00:42,350 --> 00:00:40,260
the most powerful instrument sweep for

16
00:00:43,910 --> 00:00:42,360
addressing the organic compositional

17
00:00:45,979 --> 00:00:43,920
measurements that are detailed in the

18
00:00:47,380 --> 00:00:45,989
science definition team report so I'm

19
00:00:50,060 --> 00:00:47,390
going to talk today I'm gonna give you a

20
00:00:51,979 --> 00:00:50,070
motivation for how that process went and

21
00:00:53,830 --> 00:00:51,989
then I'm going to tell you a focus on

22
00:00:55,939 --> 00:00:53,840
the stuff that we've done in JPL and

23
00:00:57,350 --> 00:00:55,949
here you've probably see if you're in

24
00:00:59,869 --> 00:00:57,360
this session presumably if you looked at

25
00:01:02,420 --> 00:00:59,879
this before but you can you can think of

26
00:01:04,520 --> 00:01:02,430
the organic chemical measurements as

27
00:01:07,310 --> 00:01:04,530
this means for looking at bio signatures

28
00:01:09,980 --> 00:01:07,320
and ordered structures and the report

29
00:01:12,020 --> 00:01:09,990
really prioritizes the first two and

30
00:01:13,460 --> 00:01:12,030
deep prioritizes isotopic measurements

31
00:01:16,400 --> 00:01:13,470
because you can get false positives in

32
00:01:17,570 --> 00:01:16,410
that way so right away emilie suite was

33
00:01:19,520 --> 00:01:17,580
designed to really focus on these two

34
00:01:21,800 --> 00:01:19,530
things and I'm gonna make some very

35
00:01:24,109 --> 00:01:21,810
simple points that may be self-evident

36
00:01:26,930 --> 00:01:24,119
but maybe not so the first thing that

37
00:01:29,240 --> 00:01:26,940
this idea of looking for bio signatures

38
00:01:31,010 --> 00:01:29,250

embedded in populations so again you can

39
00:01:33,440 --> 00:01:31,020
only identify these things if you look

40
00:01:35,089 --> 00:01:33,450
at an aggregate sum of a population of

41
00:01:35,870 --> 00:01:35,099
things and then compare one thing with

42
00:01:39,350 --> 00:01:35,880
respect to another

43
00:01:41,719 --> 00:01:39,360
so the sort of canonical distribution or

44
00:01:43,550 --> 00:01:41,729
the mention of this came a long time ago

45
00:01:45,320 --> 00:01:43,560
love glock wrote about this is not new

46
00:01:47,839 --> 00:01:45,330
and he always shows this distribution of

47
00:01:49,790 --> 00:01:47,849
alkanes abiotic ones on the top

48
00:01:51,290 --> 00:01:49,800
biotic ones on the bottom and again if

49
00:01:52,699 --> 00:01:51,300
you just measure any one of those you

50
00:01:54,889 --> 00:01:52,709
wouldn't be able to identify this bio

51
00:01:56,839 --> 00:01:54,899
signature another example you've heard

52
00:01:57,859 --> 00:01:56,849
much about I'm sure it is amino acid so

53
00:01:59,749 --> 00:01:57,869
again there's all there's other

54
00:02:00,949 --> 00:01:59,759
distributions of amino acids not if you

55
00:02:02,300 --> 00:02:00,959
just measure them it doesn't tell you

56
00:02:04,010 --> 00:02:02,310
really anything whether or not there's

57
00:02:05,749 --> 00:02:04,020
bio signature but there's these three

58
00:02:07,130 --> 00:02:05,759
different ones what types are present

59
00:02:09,080 --> 00:02:07,140
their relative abundances and of course

60
00:02:11,270 --> 00:02:09,090
their chirality so if you're gonna

61
00:02:13,070 --> 00:02:11,280
measure those distributions you need to

62
00:02:14,960 --> 00:02:13,080
do separation science that's the first

63
00:02:16,760 --> 00:02:14,970

first take home measure if you really

64
00:02:18,320 --> 00:02:16,770
want to address the science and the best

65
00:02:20,030 --> 00:02:18,330
possible way written in the Overlander

66
00:02:22,610 --> 00:02:20,040
report you have to do this thing where

67
00:02:24,050 --> 00:02:22,620
you take a sample you separate it apart

68
00:02:26,240 --> 00:02:24,060
and then you do these type of analyses

69
00:02:27,949 --> 00:02:26,250
so so you can do that if you take the

70
00:02:29,420 --> 00:02:27,959
sample there's you can't use solids

71
00:02:30,920 --> 00:02:29,430
because things are locked in place in a

72
00:02:33,020 --> 00:02:30,930
solid but you get to pick liquids gases

73
00:02:35,089 --> 00:02:33,030
or subcritical fluids and if you want to

74
00:02:37,850 --> 00:02:35,099
do that so that's an intrinsic thing

75
00:02:39,170 --> 00:02:37,860
that's part of the MLA suite second if

76
00:02:41,059 --> 00:02:39,180
you want to look for complexity the

77
00:02:42,410 --> 00:02:41,069
second type of complexity the complexity

78
00:02:45,470 --> 00:02:42,420
that's embedded in an individual

79
00:02:47,000 --> 00:02:45,480
molecule here are some examples of ones

80
00:02:49,280 --> 00:02:47,010
on earth we don't want to be limited to

81
00:02:51,380 --> 00:02:49,290
just look at molecules we know exists on

82
00:02:53,000 --> 00:02:51,390
earth and trust your biology you want to

83
00:02:55,370 --> 00:02:53,010
look at things like this and other

84
00:02:57,110 --> 00:02:55,380
complex ones the only really truly

85
00:02:59,210 --> 00:02:57,120
general-purpose method to do that as

86
00:03:01,039 --> 00:02:59,220
mass spectrometry so right away the

87
00:03:02,390 --> 00:03:01,049
first order you have to do those both of

88
00:03:05,479 --> 00:03:02,400

those things have to be included in your

89
00:03:07,960 --> 00:03:05,489
suite finally important point is they

90
00:03:10,430 --> 00:03:07,970
have to be very very sensitive so the

91
00:03:12,170 --> 00:03:10,440
measurement requirements here you know

92
00:03:14,900 --> 00:03:12,180
you you you got to be able to detect

93
00:03:17,420 --> 00:03:14,910
amino acids in in water floating around

94
00:03:18,830 --> 00:03:17,430
the Earth's South Pole or you shouldn't

95
00:03:20,839 --> 00:03:18,840
you shouldn't try this on another world

96
00:03:23,000 --> 00:03:20,849
especially not your so it needs to be

97
00:03:25,520 --> 00:03:23,010
very sensitive way to transfer your

98
00:03:27,349 --> 00:03:25,530
molecules into your detector system and

99
00:03:28,789 --> 00:03:27,359
then another thing that you can't kind

100
00:03:30,289 --> 00:03:28,799
of get lost if you just read the

101
00:03:31,849 --> 00:03:30,299
requirements like that is you really

102
00:03:33,379 --> 00:03:31,859
need to do this with a whole bunch of

103
00:03:35,150 --> 00:03:33,389
different molecules that are actually

104
00:03:37,069 --> 00:03:35,160
quite different and the differences

105
00:03:39,020 --> 00:03:37,079
between those molecules really inform

106
00:03:40,849 --> 00:03:39,030
how you build the instrument so of

107
00:03:43,220 --> 00:03:40,859
course we're looking going to an ocean

108
00:03:44,629 --> 00:03:43,230
world it's got water but so because

109
00:03:46,490 --> 00:03:44,639
things can dissolve in water but not

110
00:03:48,259 --> 00:03:46,500
everything dissolves in water if I go

111
00:03:50,000 --> 00:03:48,269
jump in a swimming pool I don't dissolve

112
00:03:51,920 --> 00:03:50,010
completely and disappear there's parts

113
00:03:53,960 --> 00:03:51,930

of me that are not dissolvable in water

114
00:03:56,420 --> 00:03:53,970
and they're also very interesting and

115
00:03:57,740 --> 00:03:56,430
those things of course are described in

116
00:04:00,140 --> 00:03:57,750
the ladder of life detection will be a

117
00:04:02,180 --> 00:04:00,150
really interesting rollout this evening

118
00:04:03,470 --> 00:04:02,190
that we should I encourage you all to 10

119
00:04:05,059 --> 00:04:03,480
I'm really looking forward to myself and

120
00:04:07,220 --> 00:04:05,069
there's a variety of different ways that

121
00:04:09,500 --> 00:04:07,230
you can you can represent all these

122
00:04:11,809 --> 00:04:09,510
different types of molecules and their

123
00:04:13,220 --> 00:04:11,819
information content so to first order

124
00:04:14,659 --> 00:04:13,230
then let you get these four things you

125
00:04:15,949 --> 00:04:14,669
know you if you want to do this right

126
00:04:16,909 --> 00:04:15,959
you got to have analyzed a whole bunch

127
00:04:19,310 --> 00:04:16,919
of different molecules with different

128
00:04:21,860 --> 00:04:19,320
properties you got to do separation

129
00:04:23,360 --> 00:04:21,870
science on multiple fluid phases you got

130
00:04:25,550 --> 00:04:23,370
to do mass spec and it has to be really

131
00:04:27,589 --> 00:04:25,560
sensitive so let's talk about now let's

132
00:04:28,850 --> 00:04:27,599
you're gonna pick something so here's

133
00:04:31,339 --> 00:04:28,860
the way that we've come up of

134
00:04:33,500 --> 00:04:31,349
representing all the different sort of

135
00:04:35,540 --> 00:04:33,510
molecular animals in the zoo okay you

136
00:04:36,680 --> 00:04:35,550
can we move chosen these two axes it

137
00:04:38,660 --> 00:04:36,690
gets a nice scatter plot

138
00:04:40,250 --> 00:04:38,670

of different properties and all of the

139
00:04:42,260 --> 00:04:40,260
things you find in the ladder of life

140
00:04:44,510 --> 00:04:42,270
the axes you see on the bottom here and

141
00:04:46,430 --> 00:04:44,520
the x axis is solubility in water so

142
00:04:49,610 --> 00:04:46,440
things insoluble on the Left highly

143
00:04:51,170 --> 00:04:49,620
soluble on the right on your y-axis you

144
00:04:53,180 --> 00:04:51,180
see a heat of vaporization that's how

145
00:04:55,700 --> 00:04:53,190
much energy you have to put into the

146
00:04:58,340 --> 00:04:55,710
system to cause it to vaporize and if

147
00:04:59,630 --> 00:04:58,350
you want to probe that really well so we

148
00:05:01,640 --> 00:04:59,640
went there's a lot of instrument

149
00:05:03,440 --> 00:05:01,650
concepts being worked at at JPL and at

150
00:05:05,480 --> 00:05:03,450
Goddard and it aims and we had all kinds

151
00:05:06,950 --> 00:05:05,490
of things to consider and we just wanted

152
00:05:08,390 --> 00:05:06,960
to maximize the coverage so what we

153
00:05:09,710 --> 00:05:08,400
wanted to do first of all this is a very

154
00:05:11,930 --> 00:05:09,720
risky mission we're gonna choose the

155
00:05:13,880 --> 00:05:11,940
most mature techniques that can address

156
00:05:16,730 --> 00:05:13,890
and do the maximum coverage of this

157
00:05:19,100 --> 00:05:16,740
phase space so if you're gonna use a gas

158
00:05:20,540 --> 00:05:19,110
phase thing your molecules that you're

159
00:05:21,950 --> 00:05:20,550
gonna put on here they have to survive

160
00:05:25,130 --> 00:05:21,960
that heat you got to get them in the gas

161
00:05:27,020 --> 00:05:25,140
phase without destroying them so this is

162
00:05:29,450 --> 00:05:27,030
what we've chosen the techniques if you

163
00:05:32,120 --> 00:05:29,460

went to genogram roads planet of the

164
00:05:33,890 --> 00:05:32,130
plenary session this morning these are

165
00:05:35,690 --> 00:05:33,900
the techniques that were used to

166
00:05:38,330 --> 00:05:35,700
discover all the organic molecules you

167
00:05:39,800 --> 00:05:38,340
talked about on Mars okay these are this

168
00:05:41,930 --> 00:05:39,810
is a core part of the instrument with

169
00:05:43,670 --> 00:05:41,940
the same people building the same

170
00:05:46,250 --> 00:05:43,680
heritage hardware to deliver that

171
00:05:47,960 --> 00:05:46,260
science if you want to analyze things as

172
00:05:50,120 --> 00:05:47,970
a liquid the other stuff here that's

173
00:05:51,500 --> 00:05:50,130
extremely interesting of course then you

174
00:05:52,760 --> 00:05:51,510
have to be able to do it does all these

175
00:05:54,830 --> 00:05:52,770
things that a liquid and you do

176
00:05:56,540 --> 00:05:54,840
separation science that way so we've

177
00:05:58,070 --> 00:05:56,550
selected these other techniques to

178
00:05:59,390 --> 00:05:58,080
address all these different things and

179
00:06:01,490 --> 00:05:59,400
we're going to do liquid based

180
00:06:02,720 --> 00:06:01,500
separation science with a bunch of

181
00:06:04,670 --> 00:06:02,730
different detectors which I'm going to

182
00:06:06,530 --> 00:06:04,680
tell you about in the morning so we

183
00:06:08,450 --> 00:06:06,540
choose the highest TRL hardware with the

184
00:06:09,950 --> 00:06:08,460
lowest development risk risk there's

185
00:06:11,270 --> 00:06:09,960
obviously things there super exciting

186
00:06:13,070 --> 00:06:11,280
that it's but it's really hard to

187
00:06:14,570 --> 00:06:13,080
imagine actually implementing them on a

188
00:06:16,940 --> 00:06:14,580

mission and they have to be able to

189
00:06:18,050 --> 00:06:16,950
achieve this science so NASA Goddard is

190
00:06:20,270 --> 00:06:18,060
going to be delivering the mass

191
00:06:22,040 --> 00:06:20,280
spectrometry and most critically the

192
00:06:23,540 --> 00:06:22,050
mission experience these are the people

193
00:06:25,159 --> 00:06:23,550
that have actually done separation

194
00:06:27,710 --> 00:06:25,169
science and discovered organics and

195
00:06:29,330 --> 00:06:27,720
other planetary surfaces here at our

196
00:06:30,920 --> 00:06:29,340
team at JPL is going to do the liquid

197
00:06:32,300 --> 00:06:30,930
extraction so taking the sample getting

198
00:06:34,370 --> 00:06:32,310
into the liquid phase from whatever

199
00:06:35,659 --> 00:06:34,380
mineral our liquid is present and then

200
00:06:38,510 --> 00:06:35,669
doing the separation science and

201
00:06:40,430 --> 00:06:38,520
detection and NASA Ames has their only

202
00:06:41,720 --> 00:06:40,440
entity that's done Space Flight

203
00:06:43,370 --> 00:06:41,730
microfluidic so they're gonna deliver

204
00:06:45,380 --> 00:06:43,380
that portion and of course honeybee

205
00:06:47,870 --> 00:06:45,390
robotics is involved in all parts of

206
00:06:50,330 --> 00:06:47,880
that so you put this whole thing

207
00:06:52,480 --> 00:06:50,340
together we call it Emily

208
00:06:55,760 --> 00:06:52,490
we'll give a post or will as the PI of

209
00:06:57,650 --> 00:06:55,770
an ICT project on this topic

210
00:06:59,270 --> 00:06:57,660
she gave a poster last night and

211
00:07:02,210 --> 00:06:59,280
describing the whole thing and if you

212
00:07:03,230 --> 00:07:02,220
can speak with him if you can find him

213
00:07:04,790 --> 00:07:03,240

after this here's just a quick

214
00:07:05,840 --> 00:07:04,800
representation of the different

215
00:07:08,210 --> 00:07:05,850
techniques I'm not going to go into

216
00:07:10,510 --> 00:07:08,220
detail I already kind of told you what

217
00:07:12,560 --> 00:07:10,520
the different things we've chosen are

218
00:07:16,010 --> 00:07:12,570
I'll tell you a little bit about the

219
00:07:17,930 --> 00:07:16,020
liquid stuff now so the oceans component

220
00:07:19,790 --> 00:07:17,940
uses electrophoresis this is really if

221
00:07:21,950 --> 00:07:19,800
you just use Occam's razor and you're

222
00:07:23,120 --> 00:07:21,960
like okay I accept Peter I accept the

223
00:07:24,980 --> 00:07:23,130
fact you're gonna have to do this

224
00:07:27,320 --> 00:07:24,990
separation science on liquids how're we

225
00:07:28,220 --> 00:07:27,330
gonna do it the very simplest thing the

226
00:07:29,960 --> 00:07:28,230
way you can do it is to use

227
00:07:31,910 --> 00:07:29,970
electrophoresis you just you basically

228
00:07:33,920 --> 00:07:31,920
rely upon the fact that in the little

229
00:07:35,630 --> 00:07:33,930
hollow glass tube if you apply voltages

230
00:07:37,280 --> 00:07:35,640
things move at different speeds it's the

231
00:07:39,680 --> 00:07:37,290
minimum number of elements it looks like

232
00:07:41,960 --> 00:07:39,690
a fiber-optic cable and all the pieces

233
00:07:44,870 --> 00:07:41,970
are all spaceflight compatible you can

234
00:07:46,160 --> 00:07:44,880
build this stuff it's the the additional

235
00:07:47,930 --> 00:07:46,170
benefit of course it has all these

236
00:07:49,790 --> 00:07:47,940
things that are you want for a space

237
00:07:52,280 --> 00:07:49,800
flight mission and including the

238
00:07:53,780 --> 00:07:52,290

sensitivity and efficiency and it works

239
00:07:55,250 --> 00:07:53,790
as I said by different things move at

240
00:07:57,260 --> 00:07:55,260
different speeds and then the beauty of

241
00:07:59,030 --> 00:07:57,270
course is you can acouple it to these

242
00:08:00,950 --> 00:07:59,040
different detectors and the different

243
00:08:02,450 --> 00:08:00,960
detectors were the different regions in

244
00:08:03,560 --> 00:08:02,460
that phase space so there's different

245
00:08:06,170 --> 00:08:03,570
ones that are better for different

246
00:08:08,330 --> 00:08:06,180
things so I'm gonna go into a little bit

247
00:08:10,160 --> 00:08:08,340
of detail tell you some things that have

248
00:08:12,110 --> 00:08:10,170
happened at JPL that enabled us to get

249
00:08:15,200 --> 00:08:12,120
to the place we are now - you know

250
00:08:16,670 --> 00:08:15,210
incredibly proposed to do this I hope

251
00:08:18,740 --> 00:08:16,680
that many of you were able to attend

252
00:08:21,320 --> 00:08:18,750
Jessica Kramer's talk on Tuesday she

253
00:08:22,880 --> 00:08:21,330
described how at JPL we've pushed the

254
00:08:25,190 --> 00:08:22,890
envelope and now have developed the most

255
00:08:27,980 --> 00:08:25,200
capable method for doing this amino acid

256
00:08:29,650 --> 00:08:27,990
analysis on spaceflight missions and her

257
00:08:32,210 --> 00:08:29,660
work of course was designed to

258
00:08:34,250 --> 00:08:32,220
simultaneously make measurements of all

259
00:08:36,110 --> 00:08:34,260
different types of amino acids and

260
00:08:37,490 --> 00:08:36,120
different chirality z' and to do it in a

261
00:08:39,680 --> 00:08:37,500
really sensitive way and the take-home

262
00:08:40,940 --> 00:08:39,690
messages all amino acids are different

263
00:08:42,740 --> 00:08:40,950

and if you want to analyze them all you

264
00:08:45,440 --> 00:08:42,750
really have to do a lot of work to tease

265
00:08:46,700 --> 00:08:45,450
them all apart and since the time of the

266
00:08:47,750 --> 00:08:46,710
publication that you see here she's

267
00:08:49,910 --> 00:08:47,760
actually pushed the limit of detection

268
00:08:52,490 --> 00:08:49,920
down to one nano molar for most of the

269
00:08:55,550 --> 00:08:52,500
species so we meet all the requirements

270
00:08:57,740 --> 00:08:55,560
for amino acids let's talk about

271
00:08:59,510 --> 00:08:57,750
hardware so we we of course we have a

272
00:09:02,210 --> 00:08:59,520
whole bunch of different variants on how

273
00:09:03,860 --> 00:09:02,220
we do this at JPL we designed this of

274
00:09:05,480 --> 00:09:03,870
the plug in place of the

275
00:09:07,280 --> 00:09:05,490
interfaces are straightforward between

276
00:09:09,440 --> 00:09:07,290
all of them but generally speaking you

277
00:09:11,570 --> 00:09:09,450
got to be able to take some piece of a

278
00:09:13,340 --> 00:09:11,580
sample and put it in convert it to a

279
00:09:15,920 --> 00:09:13,350
liquid and then manipulate it and do the

280
00:09:18,680 --> 00:09:15,930
separation and detection so if you

281
00:09:20,690 --> 00:09:18,690
attended the talks on Tuesday you would

282
00:09:23,960 --> 00:09:20,700
have seen about the microchip branch so

283
00:09:26,030 --> 00:09:23,970
Fernando Mora has brought the chemical

284
00:09:27,860 --> 00:09:26,040
laptop instrument to this really high

285
00:09:30,950 --> 00:09:27,870
level of fidelity now where we can just

286
00:09:32,810 --> 00:09:30,960
simply add a sample a liquid sample to

287
00:09:35,590 --> 00:09:32,820
this unit and press Start and it will

288
00:09:37,900 --> 00:09:35,600

completely in an automated sense run and

289
00:09:41,060 --> 00:09:37,910
perform these type of analyses

290
00:09:43,130 --> 00:09:41,070
Florian Kael has developed this portable

291
00:09:45,829 --> 00:09:43,140
extractor which works in a similar way

292
00:09:47,150 --> 00:09:45,839
if you can deliver some dirt to the top

293
00:09:49,120 --> 00:09:47,160
of the instrument and you can press

294
00:09:52,190 --> 00:09:49,130
Start it will in an automated way

295
00:09:54,860 --> 00:09:52,200
completely do the extraction so you can

296
00:09:56,810 --> 00:09:54,870
actually liberate biomolecules from the

297
00:10:00,140 --> 00:09:56,820
samples and then of course you can just

298
00:10:02,090 --> 00:10:00,150
feed the extractor directly into the

299
00:10:03,530 --> 00:10:02,100
analyzer without doing any other tricks

300
00:10:05,510 --> 00:10:03,540
you don't need to do salt you don't need

301
00:10:07,250 --> 00:10:05,520
to concentrate you don't need to do any

302
00:10:08,840 --> 00:10:07,260
there's no hidden behind the curtain

303
00:10:12,320 --> 00:10:08,850
stuff that happens it just passes it

304
00:10:15,320 --> 00:10:12,330
straight in so here you can see a trace

305
00:10:16,850 --> 00:10:15,330
on the the upper-left that's what what

306
00:10:19,250 --> 00:10:16,860
the data looks like when you perform

307
00:10:21,530 --> 00:10:19,260
this on material that's sitting on these

308
00:10:23,449 --> 00:10:21,540
driest dentists of Hills than Atacama

309
00:10:24,800 --> 00:10:23,459
Desert and you can see all these

310
00:10:26,600 --> 00:10:24,810
different little peaks there are

311
00:10:28,820 --> 00:10:26,610
actually different amino acids and we're

312
00:10:30,740 --> 00:10:28,830
able to do make chiral measurements of

313
00:10:32,420 --> 00:10:30,750

alanine leucine and valine at the sub

314
00:10:34,370 --> 00:10:32,430
parts per billion level so that's a big

315
00:10:35,570 --> 00:10:34,380
deal so the next thing we're gonna do in

316
00:10:37,460 --> 00:10:35,580
September is we're going to take both of

317
00:10:40,490 --> 00:10:37,470
them and mount them together on the air

318
00:10:42,769 --> 00:10:40,500
Ed's Rover that K Rex are over and we're

319
00:10:44,810 --> 00:10:42,779
gonna do this and completely automated

320
00:10:46,579 --> 00:10:44,820
sense so I I couldn't resist the saying

321
00:10:48,710 --> 00:10:46,589
this I'm sure you guys many of you have

322
00:10:50,240 --> 00:10:48,720
seen these talks over the years this if

323
00:10:52,160 --> 00:10:50,250
you are familiar at all with the URI

324
00:10:53,810 --> 00:10:52,170
instrument this is really the first time

325
00:10:57,110 --> 00:10:53,820
we will ever have demonstrated this

326
00:10:58,640 --> 00:10:57,120
end-to-end validation of the URI like

327
00:11:00,230 --> 00:10:58,650
experiment which is super old you know

328
00:11:03,260 --> 00:11:00,240
Jeff beta started talking about this in

329
00:11:05,510 --> 00:11:03,270
the 90s these ideas were new over a

330
00:11:07,370 --> 00:11:05,520
decade ago there was a brief time when

331
00:11:10,400 --> 00:11:07,380
we're actually contemplated for

332
00:11:12,710 --> 00:11:10,410
inclusion on the ExoMars payload and now

333
00:11:14,420 --> 00:11:12,720
we're finally making that dream true

334
00:11:15,300 --> 00:11:14,430
we're finally doing the things that we

335
00:11:17,670 --> 00:11:15,310
should have been able

336
00:11:19,410 --> 00:11:17,680
accomplish a decade or so ago so so we

337
00:11:20,790 --> 00:11:19,420
take all that information and informs us

338
00:11:23,280 --> 00:11:20,800

okay what are we gonna do on a Europa

339
00:11:24,390 --> 00:11:23,290
mission and what we we've decided you

340
00:11:27,750 --> 00:11:24,400
know we got to pick one of these two

341
00:11:30,150 --> 00:11:27,760
branches and what we have decided is we

342
00:11:32,010 --> 00:11:30,160
need to pick this branch the branch

343
00:11:34,380 --> 00:11:32,020
where we use hollow glass capillaries

344
00:11:37,320 --> 00:11:34,390
and not microchips and the reason for

345
00:11:39,660 --> 00:11:37,330
that is this is the way to couple to

346
00:11:41,100 --> 00:11:39,670
mass spectrometry so we has it for

347
00:11:43,620 --> 00:11:41,110
reasons I mentioned before you really

348
00:11:45,660 --> 00:11:43,630
need to do that in particularly think in

349
00:11:47,010 --> 00:11:45,670
terms of agnostic biosignatures you want

350
00:11:48,690 --> 00:11:47,020
to discover unknown unknowns that

351
00:11:49,670 --> 00:11:48,700
dissolve in water this is the way you're

352
00:11:52,500 --> 00:11:49,680
going to do it

353
00:11:55,320 --> 00:11:52,510
so the real hard part then is trying to

354
00:11:57,240 --> 00:11:55,330
couple your separation into a mass

355
00:11:58,650 --> 00:11:57,250
spectrometer that's the real missing

356
00:12:00,630 --> 00:11:58,660
piece of the puzzle and for that we've

357
00:12:02,730 --> 00:12:00,640
partnered with the one commercial vendor

358
00:12:04,890 --> 00:12:02,740
sy X corporation used to be Beckman

359
00:12:06,990 --> 00:12:04,900
Coulter they're the one entity that's

360
00:12:09,150 --> 00:12:07,000
that's managed to actually commercialize

361
00:12:11,400 --> 00:12:09,160
and make this incredibly delicate and

362
00:12:13,260 --> 00:12:11,410
challenging piece of hardware so here's

363
00:12:14,820 --> 00:12:13,270

some data that you can see they have

364
00:12:16,350 --> 00:12:14,830
these little sprayers and the beauty is

365
00:12:18,180 --> 00:12:16,360
that little sprayer is actually

366
00:12:21,030 --> 00:12:18,190
integrated directly into our glass

367
00:12:22,680 --> 00:12:21,040
capillary it is part of the capillary so

368
00:12:24,360 --> 00:12:22,690
it just use that and just spray directly

369
00:12:26,460 --> 00:12:24,370
into a mass spectrometer and you can see

370
00:12:29,180 --> 00:12:26,470
some data here this is amino acids and

371
00:12:31,590 --> 00:12:29,190
peptides and nucleotides and nucleobases

372
00:12:33,150 --> 00:12:31,600
you put together the ocean suite you

373
00:12:34,560 --> 00:12:33,160
have something that looks like this

374
00:12:36,000 --> 00:12:34,570
you've got your fluid comes in you get

375
00:12:38,070 --> 00:12:36,010
the capillary and then all these three

376
00:12:41,880 --> 00:12:38,080
detectors can be used they can assay the

377
00:12:43,620 --> 00:12:41,890
same stuff flowing down the tube we

378
00:12:45,960 --> 00:12:43,630
realized that was the way to go

379
00:12:48,270 --> 00:12:45,970
Constantine started as a postdoc and

380
00:12:52,110 --> 00:12:48,280
actually built this this is an

381
00:12:53,670 --> 00:12:52,120
incredibly unbelievable achievement as a

382
00:12:56,550 --> 00:12:53,680
postdoc to do this in such a short time

383
00:12:59,130 --> 00:12:56,560
so we now have a brand new element a new

384
00:13:01,950 --> 00:12:59,140
techno instrument actually that that can

385
00:13:03,930 --> 00:13:01,960
achieve this and isolate the high

386
00:13:05,550 --> 00:13:03,940
voltages and inject samples we here's

387
00:13:07,680 --> 00:13:05,560
some data you can see it's highly

388
00:13:09,329 --> 00:13:07,690

reproducible this is using the system

389
00:13:11,040 --> 00:13:09,339
and calibrating it doing conductivity

390
00:13:12,480 --> 00:13:11,050
measurements that's what the data looks

391
00:13:14,070 --> 00:13:12,490
like in the green bars this is how

392
00:13:15,990 --> 00:13:14,080
reproducible so we can just set it up

393
00:13:17,730 --> 00:13:16,000
and just run it over and over and over

394
00:13:20,670 --> 00:13:17,740
and over again and it works the same

395
00:13:22,079 --> 00:13:20,680
each time we've now taken that as well

396
00:13:24,510 --> 00:13:22,089
and sprayed it into a mass spectrometer

397
00:13:25,650 --> 00:13:24,520
we get a little portable system that so

398
00:13:27,120 --> 00:13:25,660
we can mount the whole thing together

399
00:13:29,129 --> 00:13:27,130
and it's you know something you can

400
00:13:30,569 --> 00:13:29,139
carry and here's the first demonstration

401
00:13:35,340 --> 00:13:30,579
you see all these different amino acids

402
00:13:37,379 --> 00:13:35,350
I think have a min and a half and no

403
00:13:38,879 --> 00:13:37,389
okay would plot this is that you can

404
00:13:42,629 --> 00:13:38,889
overlay all this onto the Europa Lander

405
00:13:44,340 --> 00:13:42,639
science trace traceability we basically

406
00:13:46,379 --> 00:13:44,350
hit all of the different things we're

407
00:13:48,419 --> 00:13:46,389
doing all all this work that we're

408
00:13:49,919 --> 00:13:48,429
describing here we're doing it with TRL

409
00:13:51,449 --> 00:13:49,929
advancement in mind we're actually doing

410
00:13:52,979 --> 00:13:51,459
the way that the flight system

411
00:13:54,840 --> 00:13:52,989
development should be done we've had a

412
00:13:56,369 --> 00:13:54,850
few posters on that and and we've also

413
00:13:58,109 --> 00:13:56,379

studied that so the weakest elements

414
00:14:00,629 --> 00:13:58,119
with respect to radiation show that they

415
00:14:03,929 --> 00:14:00,639
tolerate that we're using this and field

416
00:14:05,609 --> 00:14:03,939
work not just in the Atacama Desert and

417
00:14:07,590 --> 00:14:05,619
then as a parting message I just want to

418
00:14:09,659 --> 00:14:07,600
say that you know we this Emily is

419
00:14:11,669 --> 00:14:09,669
intended to maximize the science return

420
00:14:13,439 --> 00:14:11,679
of Europa Lander mission and the chances

421
00:14:15,749 --> 00:14:13,449
of identifying life its if it's there

422
00:14:17,609 --> 00:14:15,759
and we're doing this the right way we're

423
00:14:19,109 --> 00:14:17,619
using flight project practices all the

424
00:14:20,909 --> 00:14:19,119
way at the early stages of development

425
00:14:23,400 --> 00:14:20,919
as I said we've already got undergone

426
00:14:25,229 --> 00:14:23,410
this process of integration and the

427
00:14:26,759 --> 00:14:25,239
guiding principle we're making these

428
00:14:28,289 --> 00:14:26,769
decisions now that we've decided what

429
00:14:29,999 --> 00:14:28,299
we're going to do is to minimize risk

430
00:14:32,009 --> 00:14:30,009
when we take that into account every day

431
00:14:33,720 --> 00:14:32,019
when we show up to work so I thank you

432
00:14:34,979 --> 00:14:33,730
very much for your time there's a we've

433
00:14:36,059 --> 00:14:34,989
got a whole bunch of presentations

434
00:14:37,949 --> 00:14:36,069
there's a lot of people from Jay bill

435
00:14:39,910 --> 00:14:37,959
here please come talk to any lesya any