



ABSciCON 2017

MESA, ARIZONA

1
00:00:12,250 --> 00:00:06,150

you

2
00:00:17,730 --> 00:00:15,180

[Music]

3
00:00:19,420 --> 00:00:17,740

so welcome to our opening plenary on

4
00:00:22,120 --> 00:00:19,430

planetary protection

5
00:00:23,859 --> 00:00:22,130

so I'm Arielle on bar and on behalf of

6
00:00:25,269 --> 00:00:23,869

myself and Louise Proctor my partner in

7
00:00:26,670 --> 00:00:25,279

crime and organizing this session I want

8
00:00:29,620 --> 00:00:26,680

to welcome you and welcome you to

9
00:00:33,160 --> 00:00:29,630

greater Phoenix Arizona and it's really

10
00:00:34,180 --> 00:00:33,170

really exciting as a somebody who lives

11
00:00:35,710 --> 00:00:34,190

here and works here it's really exciting

12
00:00:37,270 --> 00:00:35,720

to see you all here so we're going to

13
00:00:39,040 --> 00:00:37,280

try to do something a little different

14

00:00:41,229 --> 00:00:39,050

this morning when you hear the words

15

00:00:43,090 --> 00:00:41,239

planetary protection you don't normally

16

00:00:44,860 --> 00:00:43,100

think of fun and entertaining and

17

00:00:46,930 --> 00:00:44,870

engaging but we're going to try to do

18

00:00:48,930 --> 00:00:46,940

something that is fun and entertaining

19

00:00:51,310 --> 00:00:48,940

and engaging and a little experimental

20

00:00:53,139 --> 00:00:51,320

so we'll see if this goes well but we

21

00:00:54,040 --> 00:00:53,149

think it's going to go pretty well why

22

00:00:55,780 --> 00:00:54,050

are we doing this so planetary

23

00:00:58,000 --> 00:00:55,790

protection it's never been more

24

00:00:59,889 --> 00:00:58,010

important to consider because emissions

25

00:01:02,080 --> 00:00:59,899

to Europa and maybe Enceladus hopefully

26
00:01:03,850 --> 00:01:02,090
Enceladus and ever more serious planning

27
00:01:06,370 --> 00:01:03,860
from our sample return because of the

28
00:01:08,380 --> 00:01:06,380
rise of private players like SpaceX who

29
00:01:10,060 --> 00:01:08,390
want to go to other worlds and because

30
00:01:12,310 --> 00:01:10,070
of ever-increasing public interest in

31
00:01:14,170 --> 00:01:12,320
life on other worlds world's planetary

32
00:01:15,639 --> 00:01:14,180
protection is something that's we're

33
00:01:19,240 --> 00:01:15,649
going to deal with more and more as we

34
00:01:20,440 --> 00:01:19,250
move forward as we talk about planter

35
00:01:22,719 --> 00:01:20,450
protection it's really easy to get lost

36
00:01:25,300 --> 00:01:22,729
in debates over technical requirements

37
00:01:28,120 --> 00:01:25,310
and history and policy and sometimes

38
00:01:30,340 --> 00:01:28,130

cost comes up as an issue too there's

39

00:01:32,890 --> 00:01:30,350

going to be plenty of opportunity to go

40

00:01:34,390 --> 00:01:32,900

into those kind of topics in the planner

41

00:01:36,280 --> 00:01:34,400

protection sessions that happen later

42

00:01:38,080 --> 00:01:36,290

today but this morning we want to sort

43

00:01:39,520 --> 00:01:38,090

of take a step back from all those weeds

44

00:01:40,870 --> 00:01:39,530

from all that detail it's all important

45

00:01:42,819 --> 00:01:40,880

but we won't take a step back from all

46

00:01:44,140 --> 00:01:42,829

that to stimulate a community

47

00:01:46,210 --> 00:01:44,150

conversation that we hope will live on

48

00:01:47,890 --> 00:01:46,220

beyond this session and beyond this week

49

00:01:50,230 --> 00:01:47,900

and maybe get people thinking a little

50

00:01:51,730 --> 00:01:50,240

differently about the topic about why

51
00:01:53,950 --> 00:01:51,740
planter protection matters in the first

52
00:01:56,200 --> 00:01:53,960
place why it's an issue that we all need

53
00:01:58,120 --> 00:01:56,210
to take seriously and to get us thinking

54
00:02:00,149 --> 00:01:58,130
of get us all thinking about why there's

55
00:02:02,350 --> 00:02:00,159
such diversity of opinion about it

56
00:02:04,480 --> 00:02:02,360
because that's really the source of a

57
00:02:06,490 --> 00:02:04,490
lot of the the tension to reflect that's

58
00:02:09,190 --> 00:02:06,500
a reflect attention a reflection of so

59
00:02:10,749 --> 00:02:09,200
much diversity of opinion so to do that

60
00:02:13,150 --> 00:02:10,759
instead of giving you a history lesson

61
00:02:15,250 --> 00:02:13,160
or a detailed lesson in plantarflexion

62
00:02:16,840 --> 00:02:15,260
policy or something like that we instead

63
00:02:19,000 --> 00:02:16,850

turn to someone who regularly deals with

64

00:02:20,710 --> 00:02:19,010

controversial issues like this issues

65

00:02:22,119 --> 00:02:20,720

that are on one level technical and

66

00:02:24,130 --> 00:02:22,129

regulatory but that underneath that

67

00:02:26,360 --> 00:02:24,140

surface are really about differences in

68

00:02:29,000 --> 00:02:26,370

values and differences in perception of

69

00:02:31,520 --> 00:02:29,010

risk and how that then translates into

70

00:02:34,039 --> 00:02:31,530

policy and action and so I'm pleased to

71

00:02:36,140 --> 00:02:34,049

introduce Andrew Maynard Andrew is not

72

00:02:37,520 --> 00:02:36,150

an astrobiologist he's a professor in

73

00:02:39,350 --> 00:02:37,530

ASU's school for the future of

74

00:02:41,809 --> 00:02:39,360

innovation Society trained as a

75

00:02:43,610 --> 00:02:41,819

physicist at University of Cambridge but

76

00:02:45,680 --> 00:02:43,620

now running the risk innovation

77

00:02:47,000 --> 00:02:45,690

laboratory at ASU so he's a professional

78

00:02:49,550 --> 00:02:47,010

at dealing with these sorts of

79

00:02:51,229 --> 00:02:49,560

challenging technical values Laden

80

00:02:54,520 --> 00:02:51,239

issues and he's going to lead us through

81

00:03:03,130 --> 00:02:54,530

a fun interactive and participatory

82

00:03:09,080 --> 00:03:06,229

well thank you thank you for turning out

83

00:03:12,339 --> 00:03:09,090

just half 8:30 in the morning for what

84

00:03:16,460 --> 00:03:12,349

Arielle said is an experiment and an

85

00:03:18,050 --> 00:03:16,470

experimental session here so actually

86

00:03:20,000 --> 00:03:18,060

let me just put up the first slide so

87

00:03:22,640 --> 00:03:20,010

you probably or hopefully got the email

88

00:03:24,649 --> 00:03:22,650

last night saying come prepared to

89

00:03:27,649 --> 00:03:24,659

interact with your phone with your

90

00:03:30,020 --> 00:03:27,659

computer with your tablet many of you

91

00:03:32,000 --> 00:03:30,030

probably also realize that ASU has got a

92

00:03:33,920 --> 00:03:32,010

problem with its email system in that

93

00:03:36,349 --> 00:03:33,930

what should have been a really short URL

94

00:03:37,759 --> 00:03:36,359

ended up being about 200 characters long

95

00:03:39,589 --> 00:03:37,769

and probably didn't work we'll get to

96

00:03:42,110 --> 00:03:39,599

that in a minute but this is going to be

97

00:03:44,270 --> 00:03:42,120

highly interactive and it's going to be

98

00:03:46,009 --> 00:03:44,280

a session where I hope I can get you

99

00:03:47,539 --> 00:03:46,019

thinking in slightly different ways

100

00:03:49,220 --> 00:03:47,549

about some of the challenges and

101

00:03:51,319 --> 00:03:49,230

opportunities around planetary

102

00:03:53,059 --> 00:03:51,329

protection we're not here to find

103

00:03:56,809 --> 00:03:53,069

solutions but we're here to start

104

00:03:58,339 --> 00:03:56,819

thinking differently and just an absurd

105

00:03:59,809 --> 00:03:58,349

Ariel's introduction so why am i

106

00:04:01,159 --> 00:03:59,819

standing here well one reason I think

107

00:04:03,500 --> 00:04:01,169

I'm standing here is that if I make a

108

00:04:06,020 --> 00:04:03,510

real mess of this I can run away an

109

00:04:08,720 --> 00:04:06,030

ariel can say it's not my fault so I'm

110

00:04:10,699 --> 00:04:08,730

the full guy here but I'm also somebody

111

00:04:13,390 --> 00:04:10,709

that has worked crossed many different

112

00:04:16,069 --> 00:04:13,400

domains I work for many years as a

113

00:04:18,680 --> 00:04:16,079

physicist a lab scientists working with

114

00:04:19,879 --> 00:04:18,690

aerosol dynamics but I've also worked on

115

00:04:22,189 --> 00:04:19,889

the policy side and science

116

00:04:24,260 --> 00:04:22,199

communication side around risk and

117

00:04:26,750 --> 00:04:24,270

decision making especially in areas

118

00:04:28,159 --> 00:04:26,760

where this huge uncertainty and that's

119

00:04:30,350 --> 00:04:28,169

the perspective that I want to bring

120

00:04:32,270 --> 00:04:30,360

today to try and get you thinking as I

121

00:04:34,730 --> 00:04:32,280

said slightly differently about

122

00:04:37,279 --> 00:04:34,740

planetary protection and how we can

123

00:04:39,020 --> 00:04:37,289

possibly move forward to achieve what

124

00:04:40,220 --> 00:04:39,030

are largely common goals in a very

125

00:04:43,700 --> 00:04:40,230

complex area

126

00:04:46,940 --> 00:04:43,710

okay so to start with I said if you have

127

00:04:48,290 --> 00:04:46,950

a phone or a laptop or a computer now is

128

00:04:50,060 --> 00:04:48,300

the time to take it out because the

129

00:04:52,220 --> 00:04:50,070

first bit here is going to be getting

130

00:04:53,570 --> 00:04:52,230

you used to exactly how we're going to

131

00:04:56,600 --> 00:04:53,580

run this we're going to be doing some

132

00:04:58,400 --> 00:04:56,610

real-time polling here and the first few

133

00:05:01,430 --> 00:04:58,410

polls and just to get you used to the

134

00:05:04,100 --> 00:05:01,440

session to the idea before we get to the

135

00:05:07,190 --> 00:05:04,110

serious stuff okay so you can join using

136

00:05:08,870 --> 00:05:07,200

text messaging SMS or you can join the

137

00:05:11,990 --> 00:05:08,880

webpage let me just show you what this

138

00:05:14,150 --> 00:05:12,000

looks like so if you want to get on to

139

00:05:17,480 --> 00:05:14,160

the website instead of that 200 plus

140

00:05:22,160 --> 00:05:17,490

count along web URL it's simply pull

141

00:05:24,530 --> 00:05:22,170

Evie comm slash apps icon if you go to

142

00:05:28,010 --> 00:05:24,540

that page it works well on your phones

143

00:05:30,590 --> 00:05:28,020

as well as on laptops you should come up

144

00:05:33,080 --> 00:05:30,600

with a page that says this poll hasn't

145

00:05:35,920 --> 00:05:33,090

started yet but you'll actually be in a

146

00:05:39,770 --> 00:05:35,930

session where you can begin to interact

147

00:05:41,990 --> 00:05:39,780

if you want to join otherwise by text

148

00:05:43,310 --> 00:05:42,000

this is this actually works really

149

00:05:46,820 --> 00:05:43,320

nicely but you've got to join the

150

00:05:48,320 --> 00:05:46,830

session so you need to text apps icon to

151

00:05:50,900 --> 00:05:48,330

this number three 76

152

00:05:53,030 --> 00:05:50,910

oh seven as soon as you've done that

153

00:05:54,380 --> 00:05:53,040

actually it'll take a few seconds you

154

00:05:56,810 --> 00:05:54,390

should get a message back saying you've

155

00:05:58,460 --> 00:05:56,820

joined the session and then once you're

156

00:06:01,760 --> 00:05:58,470

there every times the question on the

157

00:06:04,370 --> 00:06:01,770

screen you can just text your reply or

158

00:06:08,030 --> 00:06:04,380

your answer to that question you'll get

159

00:06:09,950 --> 00:06:08,040

the hang of this very quickly okay so

160

00:06:11,510 --> 00:06:09,960

we're just going to try this out to make

161

00:06:13,850 --> 00:06:11,520

sure that you're actually awake and

162

00:06:16,280 --> 00:06:13,860

there we go oh well people have already

163

00:06:18,770 --> 00:06:16,290

started coming in with this okay so this

164

00:06:21,530 --> 00:06:18,780

is the first simple question okay when

165

00:06:22,970 --> 00:06:21,540

you call Heart home and I love the fact

166

00:06:25,040 --> 00:06:22,980

that immediately you can see who this

167

00:06:27,530 --> 00:06:25,050

crowd is because earth is there right in

168

00:06:30,550 --> 00:06:27,540

the center where else is really

169

00:06:32,360 --> 00:06:30,560

interesting so either some people can't

170

00:06:37,280 --> 00:06:32,370

spell or there are some really

171

00:06:38,870 --> 00:06:37,290

interesting places here there's milk oh

172

00:06:40,940 --> 00:06:38,880

yeah so I should say and this is one of

173

00:06:42,800 --> 00:06:40,950

the reasons why we do this so one word

174

00:06:44,510 --> 00:06:42,810

answers only so you can see a milky

175

00:06:46,790 --> 00:06:44,520

there and then presumably there's a way

176
00:06:48,560 --> 00:06:46,800
somewhere else in there so if you really

177
00:06:49,910 --> 00:06:48,570
do want to put phrases in make sure you

178
00:06:51,560 --> 00:06:49,920
put dashes or something in between

179
00:06:52,730 --> 00:06:51,570
otherwise all the words will be

180
00:06:56,660 --> 00:06:52,740
separated out

181
00:06:58,970 --> 00:06:56,670
okay good so okay interesting that

182
00:07:00,620 --> 00:06:58,980
California comes a sort of close second

183
00:07:03,650 --> 00:07:00,630
behind Earth I'm not quite sure what

184
00:07:05,630 --> 00:07:03,660
that tells us okay good so you get the

185
00:07:08,120 --> 00:07:05,640
idea I'm going to move on from here on

186
00:07:10,010 --> 00:07:08,130
to the next one okay next question

187
00:07:13,430 --> 00:07:10,020
absolutely just a minute let me go yep

188
00:07:16,670 --> 00:07:13,440

there's the next one okay let's try this

189

00:07:19,480 --> 00:07:16,680

how long till Elon Musk establishes musk

190

00:07:21,950 --> 00:07:19,490

Ville on Mars

191

00:07:25,280 --> 00:07:21,960

let's see how quickly the over my dead

192

00:07:29,210 --> 00:07:25,290

body comes up here actually it's

193

00:07:31,850 --> 00:07:29,220

surprising the consensus 20 years I'll

194

00:07:33,500 --> 00:07:31,860

give you a second longer there so I'm

195

00:07:34,880 --> 00:07:33,510

glad to see very few people think it's

196

00:07:36,170 --> 00:07:34,890

going to be in the next 10 years so

197

00:07:38,170 --> 00:07:36,180

though I think either must would like to

198

00:07:40,880 --> 00:07:38,180

think that maybe that's a possibility

199

00:07:43,480 --> 00:07:40,890

okay but interesting that this is

200

00:07:46,520 --> 00:07:43,490

something that seems to be a plausible

201
00:07:48,380 --> 00:07:46,530
future reality that within the next 20

202
00:07:50,980 --> 00:07:48,390
years maybe maybe a little bit longer

203
00:07:54,020 --> 00:07:50,990
we're going to see a private enterprise

204
00:07:59,510 --> 00:07:54,030
establishing some sort of Bayes base on

205
00:08:00,950 --> 00:07:59,520
Mars okay next one okay getting a little

206
00:08:02,690 --> 00:08:00,960
bit more relevant to this conference

207
00:08:06,100 --> 00:08:02,700
what's the likelihood will discover non

208
00:08:10,310 --> 00:08:06,110
liar earth life in the solar system

209
00:08:11,690 --> 00:08:10,320
there's a few dirty years there that's a

210
00:08:13,550 --> 00:08:11,700
few zeroes as well

211
00:08:15,550 --> 00:08:13,560
interesting so so the beauty of this and

212
00:08:18,320 --> 00:08:15,560
I should have said this is anonymous so

213
00:08:19,970 --> 00:08:18,330

you can actually express your real self

214

00:08:22,400 --> 00:08:19,980

here rather than the self you feel you

215

00:08:24,860 --> 00:08:22,410

have to express to your neighbors and

216

00:08:26,840 --> 00:08:24,870

get away with it but yes not

217

00:08:29,360 --> 00:08:26,850

surprisingly most of you think that this

218

00:08:31,730 --> 00:08:29,370

is a a possibility I'm interested in the

219

00:08:34,700 --> 00:08:31,740

zeroes are unlikely is here yeah that's

220

00:08:37,670 --> 00:08:34,710

a conversation for coffee I think okay

221

00:08:39,350 --> 00:08:37,680

moving on and what words capture the

222

00:08:42,920 --> 00:08:39,360

purpose and goal of space exploration

223

00:08:44,870 --> 00:08:42,930

again one-word answers or if you do have

224

00:08:48,290 --> 00:08:44,880

to have a phrase put dashes or something

225

00:08:56,630 --> 00:08:48,300

there here we go curiosity knowledge

226
00:08:58,430 --> 00:08:56,640
discovery great longevity wonder I love

227
00:09:00,470 --> 00:08:58,440
this because it really gives a beautiful

228
00:09:03,860 --> 00:09:00,480
snapshot of how people are thinking

229
00:09:05,940 --> 00:09:03,870
positively and in excited way about what

230
00:09:08,400 --> 00:09:05,950
the possibilities and what the purposes

231
00:09:10,050 --> 00:09:08,410
yeah not surprisingly curiosity and

232
00:09:12,420 --> 00:09:10,060
discovery they're out front

233
00:09:13,710 --> 00:09:12,430
knowledge philosophy cures is a really

234
00:09:19,440 --> 00:09:13,720
interesting one aliens

235
00:09:20,730 --> 00:09:19,450
adventure life ET i like ET and just

236
00:09:23,010 --> 00:09:20,740
give you a second with that because this

237
00:09:24,750 --> 00:09:23,020
really begins to sort of capture how

238
00:09:27,320 --> 00:09:24,760

you're thinking and where your

239

00:09:29,370 --> 00:09:27,330

aspirations and your goals are here

240

00:09:32,940 --> 00:09:29,380

survival is an interesting one as well

241

00:09:40,160 --> 00:09:32,950

actually and i love that we got a french

242

00:09:42,930 --> 00:09:40,170

curiosity as well in there okay then

243

00:09:47,820 --> 00:09:42,940

okay that's great i'm gonna move on to

244

00:09:50,250 --> 00:09:47,830

the next one okay now getting into risk

245

00:09:52,590 --> 00:09:50,260

so going from excitement to something a

246

00:10:01,830 --> 00:09:52,600

little more dour what comes to mind when

247

00:10:15,900 --> 00:10:01,840

you think I knew I could rely on this

248

00:10:21,890 --> 00:10:15,910

audience danger Trump there and it's not

249

00:10:24,240 --> 00:10:21,900

going away I'll give you a second longer

250

00:10:26,340 --> 00:10:24,250

just in case anybody wants to get rid of

251
00:10:28,410 --> 00:10:26,350
the Trump I don't think you will it's

252
00:10:30,120 --> 00:10:28,420
still oh well that's fun there as well

253
00:10:32,720 --> 00:10:30,130
I've gone now there was a little bit of

254
00:10:35,460 --> 00:10:32,730
fun right in the middle of Trump their

255
00:10:38,720 --> 00:10:35,470
failure reward uncertainty opportunity

256
00:10:41,400 --> 00:10:38,730
yeah so actually slightly more serious I

257
00:10:42,660 --> 00:10:41,410
you've got all the downsides of risk

258
00:10:47,610 --> 00:10:42,670
here but then you've got a few things

259
00:10:50,790 --> 00:10:47,620
like opportunity in there necessary what

260
00:10:52,440 --> 00:10:50,800
else got and bad things yeah but I

261
00:10:54,270 --> 00:10:52,450
believe there are one or two things

262
00:10:55,890 --> 00:10:54,280
there which aren't necessarily negative

263
00:10:57,600 --> 00:10:55,900

and this is going to be really important

264

00:10:59,370 --> 00:10:57,610

as we start thinking slightly

265

00:11:01,590 --> 00:10:59,380

differently about risk risk isn't always

266

00:11:03,900 --> 00:11:01,600

about the bad but it's about how you

267

00:11:06,000 --> 00:11:03,910

actually get to where you want to be but

268

00:11:07,449 --> 00:11:06,010

still danger Trump death or in the

269

00:11:11,499 --> 00:11:07,459

center

270

00:11:12,970 --> 00:11:11,509

okay and more serious still what comes

271

00:11:19,090 --> 00:11:12,980

to mind when you think of planetary

272

00:11:20,470 --> 00:11:19,100

protection management cost this is where

273

00:11:24,669 --> 00:11:20,480

it's really important that this is

274

00:11:27,749 --> 00:11:24,679

anonymous contamination yes as you would

275

00:11:32,769 --> 00:11:27,759

expect musk is there tedious difficult

276

00:11:35,669 --> 00:11:32,779

controversial problem over board wisdom

277

00:11:39,009 --> 00:11:35,679

non contamination yes sustainability

278

00:11:42,939 --> 00:11:39,019

pre-emptive strike the cafe is up there

279

00:11:45,189 --> 00:11:42,949

it has I give you second longer on that

280

00:11:47,230 --> 00:11:45,199

but this is the safety in contamination

281

00:11:50,230 --> 00:11:47,240

so this is really helpful to me because

282

00:11:51,970 --> 00:11:50,240

it gives me a sense of where the rooms

283

00:11:54,249 --> 00:11:51,980

thinking is when you begin to think

284

00:11:57,910 --> 00:11:54,259

instinctively about planetary protection

285

00:12:00,309 --> 00:11:57,920

and how you feel about it and very clear

286

00:12:03,129 --> 00:12:00,319

here there are these fears or these

287

00:12:05,439 --> 00:12:03,139

concerns or these these thinking around

288

00:12:06,819 --> 00:12:05,449

contamination and safety and then some

289

00:12:08,980 --> 00:12:06,829

of the other things that come in like

290

00:12:11,169 --> 00:12:08,990

the oh the word overboard for instance I

291

00:12:12,999 --> 00:12:11,179

think from what I understand of this

292

00:12:14,799 --> 00:12:13,009

area and the communities there are

293

00:12:16,389 --> 00:12:14,809

different ways of thinking about this

294

00:12:18,429 --> 00:12:16,399

and this is what makes it such an

295

00:12:20,470 --> 00:12:18,439

interesting complex sometimes

296

00:12:22,269 --> 00:12:20,480

controversial area but nevertheless very

297

00:12:25,239 --> 00:12:22,279

very important as that big word

298

00:12:27,789 --> 00:12:25,249

contamination says okay this is great so

299

00:12:29,889 --> 00:12:27,799

obviously the system is working at least

300

00:12:33,970 --> 00:12:29,899

it's working for at least 250 of you

301

00:12:36,309 --> 00:12:33,980

which i think is good enough so let's

302

00:12:38,650 --> 00:12:36,319

move on into a little bit of the meat of

303

00:12:40,299 --> 00:12:38,660

this so that was a great start it made

304

00:12:42,489 --> 00:12:40,309

sure that you understand how the system

305

00:12:44,350 --> 00:12:42,499

works has given me a sense of where your

306

00:12:45,999 --> 00:12:44,360

thinking is it's given you a sense of

307

00:12:48,100 --> 00:12:46,009

where your colleagues thinking is on

308

00:12:50,980 --> 00:12:48,110

some of these issues what I want to do

309

00:12:53,889 --> 00:12:50,990

now is I want to begin to work out how

310

00:12:55,960 --> 00:12:53,899

we can frame planetary protection in a

311

00:12:59,169 --> 00:12:55,970

way that actually opens up conversations

312

00:13:01,030 --> 00:12:59,179

and helps different communities work

313

00:13:03,730 --> 00:13:01,040

together to try and understand how to

314

00:13:05,499 --> 00:13:03,740

crack what is a really complex nut so

315

00:13:07,329 --> 00:13:05,509

that we can do what we set out to do

316

00:13:09,429 --> 00:13:07,339

when it comes to space exploration but

317

00:13:11,470 --> 00:13:09,439

to do that I thought I would start off

318

00:13:13,840 --> 00:13:11,480

by giving you what I called it a naive

319

00:13:16,030 --> 00:13:13,850

perspective on planetary protection here

320

00:13:18,699 --> 00:13:16,040

I should say if you haven't worked out

321

00:13:20,499 --> 00:13:18,709

I'm a Brit and the Brits when I use

322

00:13:20,800 --> 00:13:20,509

words like naive I actually don't really

323

00:13:23,019 --> 00:13:20,810

be

324

00:13:25,269 --> 00:13:23,029

no naive it's just the way that we sell

325

00:13:28,810 --> 00:13:25,279

deprecated so I'm not quite as naive as

326

00:13:30,550 --> 00:13:28,820

I might I might make out on the other

327

00:13:32,230 --> 00:13:30,560

hand if you think I'm speaking at

328

00:13:35,500 --> 00:13:32,240

absolute rubbish at least I can fall

329

00:13:38,079 --> 00:13:35,510

back and say I was just naive but let me

330

00:13:39,730 --> 00:13:38,089

at least explain to you what I think

331

00:13:43,180 --> 00:13:39,740

about when I think about planetary

332

00:13:45,460 --> 00:13:43,190

protection so this to me is what the

333

00:13:47,380 --> 00:13:45,470

nature of the challenges we're sitting

334

00:13:49,540 --> 00:13:47,390

here on earth and we're sitting in a

335

00:13:53,019 --> 00:13:49,550

solar system with all sorts of other

336

00:13:54,850 --> 00:13:53,029

entities and we have lots of biological

337

00:13:56,680 --> 00:13:54,860

stuff on earth that we worried about

338

00:13:58,180 --> 00:13:56,690

taking out into the solar system but

339

00:14:00,070 --> 00:13:58,190

we're also worried about the possibility

340

00:14:02,140 --> 00:14:00,080

of biological stuff being in the solar

341

00:14:05,290 --> 00:14:02,150

system and even beyond that we might

342

00:14:07,329 --> 00:14:05,300

bring back to earth so this to me is at

343

00:14:09,130 --> 00:14:07,339

the heart of discussions around

344

00:14:11,710 --> 00:14:09,140

planetary protection why is this

345

00:14:13,329 --> 00:14:11,720

important well many reasons but some of

346

00:14:15,370 --> 00:14:13,339

the big ones are obviously and you saw

347

00:14:16,660 --> 00:14:15,380

from the word cloud contamination we

348

00:14:18,550 --> 00:14:16,670

don't want to take stuff out from earth

349

00:14:21,430 --> 00:14:18,560

out into the solar system and

350

00:14:23,680 --> 00:14:21,440

contaminate other systems we've also got

351
00:14:26,290 --> 00:14:23,690
the problem of confounded science if we

352
00:14:28,180 --> 00:14:26,300
try to do science on non human or non

353
00:14:30,010 --> 00:14:28,190
earth life we really don't want to take

354
00:14:31,990 --> 00:14:30,020
our stuff out there and completely mess

355
00:14:33,760 --> 00:14:32,000
the whole enterprise up but obviously

356
00:14:35,680 --> 00:14:33,770
coming back the other way as well there

357
00:14:38,650 --> 00:14:35,690
are concerns about environmental harm if

358
00:14:40,960 --> 00:14:38,660
we bring biological stuff but did not

359
00:14:43,090 --> 00:14:40,970
orotate originated on earth back here

360
00:14:45,970 --> 00:14:43,100
but also the possibility of human harm

361
00:14:48,100 --> 00:14:45,980
as well and still that idea of

362
00:14:49,570 --> 00:14:48,110
confounded science that if we have

363
00:14:51,040 --> 00:14:49,580

contamination in the system whether

364

00:14:53,829 --> 00:14:51,050

we're going out of whether we're coming

365

00:14:57,190 --> 00:14:53,839

back it really messes up our ability to

366

00:14:59,470 --> 00:14:57,200

do good science so this is the framework

367

00:15:01,030 --> 00:14:59,480

that certainly I think about when I

368

00:15:02,920 --> 00:15:01,040

think about planetary protection but

369

00:15:04,900 --> 00:15:02,930

there are a lot of other contexts here

370

00:15:07,930 --> 00:15:04,910

which are important one of the context

371

00:15:09,550 --> 00:15:07,940

says why do we explore space in the

372

00:15:11,650 --> 00:15:09,560

first place why are we trying to get out

373

00:15:13,540 --> 00:15:11,660

there why we trying to do stuff and of

374

00:15:15,190 --> 00:15:13,550

course there are many reasons why we do

375

00:15:16,930 --> 00:15:15,200

that there's discovery there's new

376

00:15:19,210 --> 00:15:16,940

science that learning about ourselves

377

00:15:22,000 --> 00:15:19,220

and our place in the solar system the

378

00:15:25,210 --> 00:15:22,010

galaxy the universe there's exploration

379

00:15:26,560 --> 00:15:25,220

as part of that there's Fame there are

380

00:15:28,360 --> 00:15:26,570

one or two people that would like to

381

00:15:30,250 --> 00:15:28,370

make their names by going out there I'm

382

00:15:33,040 --> 00:15:30,260

not going to name anybody here

383

00:15:34,390 --> 00:15:33,050

there are economics believe it or not

384

00:15:36,640 --> 00:15:34,400

some people think that

385

00:15:38,830 --> 00:15:36,650

maybe one day there's going to be an

386

00:15:41,830 --> 00:15:38,840

economical advantage and profit from

387

00:15:44,170 --> 00:15:41,840

space exploration but then there are

388

00:15:46,180 --> 00:15:44,180

other things which make things even more

389

00:15:46,690 --> 00:15:46,190

complex and through the ethics of what

390

00:15:49,240 --> 00:15:46,700

we do

391

00:15:51,580 --> 00:15:49,250

the ethics not only of even should we go

392

00:15:53,680 --> 00:15:51,590

out to other bodies in the solar system

393

00:15:56,350 --> 00:15:53,690

but how we work out what is appropriate

394

00:15:58,210 --> 00:15:56,360

and what is not there are values

395

00:16:00,190 --> 00:15:58,220

associated with that the things that we

396

00:16:03,280 --> 00:16:00,200

individually and as different groups

397

00:16:05,980 --> 00:16:03,290

consider importance here and that leads

398

00:16:07,900 --> 00:16:05,990

to ideologies the things that drive what

399

00:16:10,210 --> 00:16:07,910

we think is right and what we think is

400

00:16:11,860 --> 00:16:10,220

wrong and these are necessarily right or

401

00:16:13,900 --> 00:16:11,870

wrong but they're different between

402

00:16:16,600 --> 00:16:13,910

different people different communities

403

00:16:18,640 --> 00:16:16,610

different organizations and then of

404

00:16:21,550 --> 00:16:18,650

course this policy there's what we've

405

00:16:24,430 --> 00:16:21,560

decided as communities as countries as a

406

00:16:26,590 --> 00:16:24,440

society as a whole in terms of what is

407

00:16:28,930 --> 00:16:26,600

appropriate and what is not and what the

408

00:16:30,280 --> 00:16:28,940

guidelines are for how we do the right

409

00:16:33,700 --> 00:16:30,290

things and of course wherever you've got

410

00:16:35,290 --> 00:16:33,710

policy you've got politics perhaps not

411

00:16:36,790 --> 00:16:35,300

surprising Trump came up and actually is

412

00:16:39,460 --> 00:16:36,800

quite a good thing that Trump came up

413

00:16:41,620 --> 00:16:39,470

because there's always politics involved

414

00:16:44,500 --> 00:16:41,630

with these messy decisions that involve

415

00:16:47,350 --> 00:16:44,510

people and profit and everything else

416

00:16:49,000 --> 00:16:47,360

which is not just pure science and then

417

00:16:51,310 --> 00:16:49,010

of course there's a massive amount of

418

00:16:53,620 --> 00:16:51,320

uncertainty from a risk perspective we

419

00:16:55,840 --> 00:16:53,630

really are in a space at the moment

420

00:16:58,030 --> 00:16:55,850

where we're grappling with things that

421

00:16:59,800 --> 00:16:58,040

we really have no idea what lies in the

422

00:17:02,500 --> 00:16:59,810

future we have very few ways of actually

423

00:17:04,360 --> 00:17:02,510

working out what we're likely to find at

424

00:17:05,920 --> 00:17:04,370

how we're likely to build resilience

425

00:17:08,320 --> 00:17:05,930

into our systems so if we find something

426
00:17:10,540 --> 00:17:08,330
new we can manage it and of course all

427
00:17:12,579 --> 00:17:10,550
that comes down to risk so in my head

428
00:17:14,710 --> 00:17:12,589
when I think of planetary protection I

429
00:17:17,620 --> 00:17:14,720
think of this really complex messy

430
00:17:19,930 --> 00:17:17,630
landscape which is summed up by simply

431
00:17:22,120 --> 00:17:19,940
saying it's wickedly complex there are

432
00:17:25,329 --> 00:17:22,130
no silver bullets here there are no easy

433
00:17:27,010 --> 00:17:25,339
solutions to moving forward to an

434
00:17:29,500 --> 00:17:27,020
approach to planetary protection that

435
00:17:31,810 --> 00:17:29,510
works and everybody is happy with and in

436
00:17:33,580 --> 00:17:31,820
fact in the social and policy sciences

437
00:17:35,200 --> 00:17:33,590
this is what we call a wicked problem

438
00:17:37,600 --> 00:17:35,210

some of you may be familiar with this

439

00:17:39,100 --> 00:17:37,610

term others not so it's typically not a

440

00:17:41,410 --> 00:17:39,110

problem that's used in science and

441

00:17:42,760 --> 00:17:41,420

engineering or a term that's used in

442

00:17:45,610 --> 00:17:42,770

science and engineering but a wicked

443

00:17:47,500 --> 00:17:45,620

problem is a problem without clearly

444

00:17:50,140 --> 00:17:47,510

defined solutions if I could

445

00:17:51,820 --> 00:17:50,150

worse than that a wicked problem is the

446

00:17:54,250 --> 00:17:51,830

sort of problem where as you try and

447

00:17:56,860 --> 00:17:54,260

develop and implement solutions the

448

00:17:59,020 --> 00:17:56,870

nature of the problem changes so you're

449

00:18:01,570 --> 00:17:59,030

always chasing after a moving target

450

00:18:03,430 --> 00:18:01,580

this makes wicked problems incredibly

451

00:18:05,050 --> 00:18:03,440

difficult but it doesn't mean that we

452

00:18:07,570 --> 00:18:05,060

don't address them it just means we need

453

00:18:09,940 --> 00:18:07,580

to be quite smart and sophisticated in

454

00:18:12,370 --> 00:18:09,950

how we begin to develop solutions and

455

00:18:15,250 --> 00:18:12,380

how we begin to change tack as the

456

00:18:17,260 --> 00:18:15,260

nature of the problem changes so this is

457

00:18:19,150 --> 00:18:17,270

part and parcel of one of the areas that

458

00:18:21,310 --> 00:18:19,160

I work in which is called risk

459

00:18:22,990 --> 00:18:21,320

innovation and I want to just spend a

460

00:18:25,000 --> 00:18:23,000

few minutes talking about what this is

461

00:18:27,730 --> 00:18:25,010

because I think it'll help frame the

462

00:18:30,490 --> 00:18:27,740

following discussion so risk innovation

463

00:18:31,870 --> 00:18:30,500

is if actually before I tell you what

464

00:18:34,930 --> 00:18:31,880

risk innovation is let me just ask this

465

00:18:36,790 --> 00:18:34,940

question because I can riff off this is

466

00:18:39,250 --> 00:18:36,800

this yeah we are it's going to kick in

467

00:18:42,160 --> 00:18:39,260

so when I mention the word innovation

468

00:18:46,630 --> 00:18:42,170

just cut up what first comes to mind in

469

00:18:49,780 --> 00:18:46,640

terms of words here new novel exciting

470

00:18:51,310 --> 00:18:49,790

scam I like that especially as you're

471

00:18:53,320 --> 00:18:51,320

being hosted by what is supposed to be

472

00:18:56,890 --> 00:18:53,330

the number one university for innovation

473

00:18:58,300 --> 00:18:56,900

in the country creativity yeah those

474

00:19:01,630 --> 00:18:58,310

that delay with that slightly

475

00:19:04,240 --> 00:19:01,640

embarrassed chuckle there corporatism

476
00:19:06,810 --> 00:19:04,250
exciting opportunity knowledge and usual

477
00:19:11,080 --> 00:19:06,820
ASU number one in thank you it's

478
00:19:13,240 --> 00:19:11,090
buzzword call yes leap else we have

479
00:19:19,780 --> 00:19:13,250
implementation musk again musk appears

480
00:19:21,490 --> 00:19:19,790
on all of these okay great so a lot of

481
00:19:23,620 --> 00:19:21,500
actually a lot of positive words there

482
00:19:26,470 --> 00:19:23,630
about innovation but this idea of

483
00:19:29,650 --> 00:19:26,480
creativity and you is there as well so

484
00:19:32,410 --> 00:19:29,660
the reason I ask this and to lead into

485
00:19:35,200 --> 00:19:32,420
this idea of risk innovation is when it

486
00:19:38,620 --> 00:19:35,210
comes to risk we tend not to be creative

487
00:19:40,330 --> 00:19:38,630
we tend not to think in new ways in fact

488
00:19:43,360 --> 00:19:40,340

most of the thinking about risk

489

00:19:46,360 --> 00:19:43,370

assessment risk analysis risk management

490

00:19:49,750 --> 00:19:46,370

no matter what field you look at is very

491

00:19:52,210 --> 00:19:49,760

very conservative and most of it this

492

00:19:54,280 --> 00:19:52,220

has worked well in a world which has

493

00:19:56,500 --> 00:19:54,290

been largely predictive we've been able

494

00:19:58,720 --> 00:19:56,510

to sort of work out how we come up with

495

00:20:00,580 --> 00:19:58,730

models for assessing risk in a world

496

00:20:03,610 --> 00:20:00,590

which is largely invariant

497

00:20:05,409 --> 00:20:03,620

these approaches to risk do not work in

498

00:20:09,310 --> 00:20:05,419

a world where things are changing

499

00:20:10,749 --> 00:20:09,320

rapidly and very uncertain so one of the

500

00:20:12,580 --> 00:20:10,759

things that we set out to do in my

501
00:20:15,549 --> 00:20:12,590
Center the risk Innovation Lab is to ask

502
00:20:17,619 --> 00:20:15,559
how can we bring the mindset of the

503
00:20:19,330 --> 00:20:17,629
innovator the entrepreneur to thinking

504
00:20:21,100 --> 00:20:19,340
about risk how can we bring creativity

505
00:20:23,350 --> 00:20:21,110
into the process of thinking about risk

506
00:20:25,509 --> 00:20:23,360
and see whether we can approach risk in

507
00:20:28,960 --> 00:20:25,519
new ways which actually help us find

508
00:20:30,549 --> 00:20:28,970
solutions to complex wicked problems and

509
00:20:32,440 --> 00:20:30,559
I'm not going to say too much about the

510
00:20:34,509 --> 00:20:32,450
actual work we're doing there but I am

511
00:20:36,249 --> 00:20:34,519
going to talk about three things that

512
00:20:39,249 --> 00:20:36,259
come out of this sort of thinking about

513
00:20:41,200 --> 00:20:39,259

risk there are three very very simple

514

00:20:43,659 --> 00:20:41,210

things but the first thing is this idea

515

00:20:45,669 --> 00:20:43,669

of thinking about risk as a medium to be

516

00:20:48,580 --> 00:20:45,679

traveled through not thinking about risk

517

00:20:50,769 --> 00:20:48,590

is something that's bad to be removed or

518

00:20:52,419 --> 00:20:50,779

something that has to be managed but

519

00:20:54,669 --> 00:20:52,429

thinking of risk that's something that's

520

00:20:57,220 --> 00:20:54,679

necessary so effectively something like

521

00:20:59,830 --> 00:20:57,230

this you're here at the moment you want

522

00:21:02,289 --> 00:20:59,840

to be somewhere else the only way you

523

00:21:06,539 --> 00:21:02,299

can get to where you want to be is to

524

00:21:09,399 --> 00:21:06,549

move through this medium of risk this is

525

00:21:11,230 --> 00:21:09,409

simple it's obvious but it's not how we

526

00:21:13,210 --> 00:21:11,240

usually think about risk because this

527

00:21:15,519 --> 00:21:13,220

says that there's always going to be

528

00:21:17,529 --> 00:21:15,529

risk in everything we do in fact one of

529

00:21:19,960 --> 00:21:17,539

the things I tell my students is the

530

00:21:22,869 --> 00:21:19,970

only way to get rid of risk altogether

531

00:21:24,549 --> 00:21:22,879

is to be dead and it's not a

532

00:21:27,159 --> 00:21:24,559

particularly good solution to any

533

00:21:29,470 --> 00:21:27,169

problem so somehow we've got to get into

534

00:21:31,600 --> 00:21:29,480

the mindset where we actually think

535

00:21:33,460 --> 00:21:31,610

about moving through the sea of risk and

536

00:21:34,930 --> 00:21:33,470

trying to work out which risks are the

537

00:21:36,700 --> 00:21:34,940

ones that we want to grapple with how

538

00:21:38,350 --> 00:21:36,710

are we going to trade-off those risks

539

00:21:40,600 --> 00:21:38,360

against the benefits that we're going to

540

00:21:43,859 --> 00:21:40,610

receive what we cannot afford to do is

541

00:21:46,119 --> 00:21:43,869

try and get risk rid of risk altogether

542

00:21:48,730 --> 00:21:46,129

so the second thing that comes out of

543

00:21:51,549 --> 00:21:48,740

this way of thinking is this idea of

544

00:21:53,830 --> 00:21:51,559

risk as being a threat to things of

545

00:21:56,200 --> 00:21:53,840

importance to people to groups into

546

00:21:58,659 --> 00:21:56,210

organizations so we usually think about

547

00:22:01,720 --> 00:21:58,669

risk as something that'll maybe harm the

548

00:22:04,299 --> 00:22:01,730

environment or harm individual people or

549

00:22:06,310 --> 00:22:04,309

communities possibly called death those

550

00:22:08,019 --> 00:22:06,320

that all possibly lead to financial ruin

551
00:22:11,320 --> 00:22:08,029
so those are three big areas we tend to

552
00:22:12,249 --> 00:22:11,330
think of risk in but risk goes way

553
00:22:14,410 --> 00:22:12,259
beyond that

554
00:22:17,770 --> 00:22:14,420
so risk can even come down to

555
00:22:20,350 --> 00:22:17,780
culture personality deeply held beliefs

556
00:22:22,930 --> 00:22:20,360
your sense of yourself your sense of

557
00:22:25,150 --> 00:22:22,940
identity these are things that deeply

558
00:22:27,070 --> 00:22:25,160
motivate us as individuals and as humans

559
00:22:29,140 --> 00:22:27,080
and if we don't incorporate them into

560
00:22:31,930 --> 00:22:29,150
our thinking of risk we miss something

561
00:22:34,300 --> 00:22:31,940
really important so this idea of risk

562
00:22:36,730 --> 00:22:34,310
really expands from the individual

563
00:22:38,560 --> 00:22:36,740

thinking of what is it that is going to

564

00:22:41,050 --> 00:22:38,570

threaten somebody whether it's going to

565

00:22:43,150 --> 00:22:41,060

threaten their health their beliefs

566

00:22:45,970 --> 00:22:43,160

their sense of purpose and their

567

00:22:47,020 --> 00:22:45,980

identity to beyond their what is it

568

00:22:49,300 --> 00:22:47,030

there's going to threaten groups

569

00:22:51,070 --> 00:22:49,310

especially groups that have got deeply

570

00:22:53,070 --> 00:22:51,080

held ideas about what is right and what

571

00:22:55,720 --> 00:22:53,080

is wrong what is going to threaten

572

00:22:57,910 --> 00:22:55,730

institutions again institutions that may

573

00:22:58,780 --> 00:22:57,920

have vested interests in doing things in

574

00:23:00,880 --> 00:22:58,790

a certain way

575

00:23:03,370 --> 00:23:00,890

all of these are different aspects of

576

00:23:05,770 --> 00:23:03,380

risk and going back to our previous

577

00:23:08,920 --> 00:23:05,780

slide think about moving through a sea

578

00:23:11,200 --> 00:23:08,930

of risk you can't understand the nature

579

00:23:13,330 --> 00:23:11,210

that sea unless you begin to understand

580

00:23:15,430 --> 00:23:13,340

what is important to these different

581

00:23:17,920 --> 00:23:15,440

groups from individuals to organizations

582

00:23:21,550 --> 00:23:17,930

what they're going to fight for and how

583

00:23:22,990 --> 00:23:21,560

you navigate around that and then the

584

00:23:25,030 --> 00:23:23,000

third thing which leads on to this is

585

00:23:27,340 --> 00:23:25,040

the idea of risk as a complex landscape

586

00:23:29,230 --> 00:23:27,350

to be moved through to reach common

587

00:23:31,890 --> 00:23:29,240

goals so this begins to tie in with

588

00:23:34,600 --> 00:23:31,900

those first two points so this is a

589

00:23:35,980 --> 00:23:34,610

conceptualization of this and this is

590

00:23:37,720 --> 00:23:35,990

what I think about when I think about a

591

00:23:40,060 --> 00:23:37,730

risk landscape but it's only sort of my

592

00:23:41,590 --> 00:23:40,070

own mental model but again is the idea

593

00:23:42,970 --> 00:23:41,600

that you're in one place at the moment

594

00:23:44,830 --> 00:23:42,980

you want to be somewhere else in the

595

00:23:47,770 --> 00:23:44,840

future you want to be here on the map

596

00:23:50,200 --> 00:23:47,780

but to get between a and B you've got to

597

00:23:52,960 --> 00:23:50,210

navigate this really complex wickedly

598

00:23:56,950 --> 00:23:52,970

complex landscape that it's got things

599

00:23:58,660 --> 00:23:56,960

in such as health environment but it's

600

00:24:01,860 --> 00:23:58,670

also got things like public opinion in

601
00:24:04,180 --> 00:24:01,870
it politics policy mission objectives

602
00:24:05,950 --> 00:24:04,190
science and what people think is the

603
00:24:07,480 --> 00:24:05,960
right science versus the wrong science

604
00:24:10,660 --> 00:24:07,490
or how to do science or how not to do

605
00:24:12,430 --> 00:24:10,670
science the reason I put this up is if

606
00:24:14,740 --> 00:24:12,440
you begin to look at a wicked problem

607
00:24:16,480 --> 00:24:14,750
like planetary protection you've got to

608
00:24:19,540 --> 00:24:16,490
work out what the nature of this

609
00:24:21,100 --> 00:24:19,550
landscape is and what the tools are to

610
00:24:23,110 --> 00:24:21,110
help navigate through it and actually

611
00:24:25,720 --> 00:24:23,120
learn how to fill in that landscape as

612
00:24:27,700 --> 00:24:25,730
you go this is not just about protecting

613
00:24:28,230 --> 00:24:27,710

the environment or protecting human

614

00:24:30,240 --> 00:24:28,240

health

615

00:24:32,580 --> 00:24:30,250

or protecting the integrity of science

616

00:24:34,290 --> 00:24:32,590

it's working out what is important to

617

00:24:36,240 --> 00:24:34,300

different groups and how you can

618

00:24:40,650 --> 00:24:36,250

actually navigate around that to get to

619

00:24:42,870 --> 00:24:40,660

a set of common goals so with that I

620

00:24:44,340 --> 00:24:42,880

actually want to turn back to you and

621

00:24:46,049 --> 00:24:44,350

see whether I can get you doing a little

622

00:24:48,510 --> 00:24:46,059

bit of work here now I've given you the

623

00:24:50,400 --> 00:24:48,520

risk innovation primer and we're going

624

00:24:53,190 --> 00:24:50,410

to go through a series of questions here

625

00:24:55,680 --> 00:24:53,200

where I want to give get a sense from

626

00:24:57,810 --> 00:24:55,690

you of how you think about what's

627

00:24:59,220 --> 00:24:57,820

important to different groups of people

628

00:25:01,919 --> 00:24:59,230

and I'm going to start with a test

629

00:25:03,630 --> 00:25:01,929

question just so we get get a sense of

630

00:25:05,100 --> 00:25:03,640

how this is going to work so this is not

631

00:25:06,660 --> 00:25:05,110

an important question but at least it

632

00:25:10,880 --> 00:25:06,670

tells me whether you're on the same page

633

00:25:13,049 --> 00:25:10,890

as me so give this a second to kick in

634

00:25:14,940 --> 00:25:13,059

it's always really worries me every time

635

00:25:17,640 --> 00:25:14,950

this comes up I think has the system

636

00:25:19,530 --> 00:25:17,650

crashed here we go No so title one word

637

00:25:21,840 --> 00:25:19,540

that you think captures what's most

638

00:25:23,880 --> 00:25:21,850

important to kids when it comes to space

639

00:25:26,100 --> 00:25:23,890

exploration and I put one or two sort of

640

00:25:27,630 --> 00:25:26,110

seed words up there but put your own

641

00:25:29,280 --> 00:25:27,640

words up and I think you've already

642

00:25:30,510 --> 00:25:29,290

worked this out but if you see a word on

643

00:25:33,750 --> 00:25:30,520

the screen that you like you can always

644

00:25:36,210 --> 00:25:33,760

duplicate it okay great so adventure

645

00:25:38,910 --> 00:25:36,220

aliens rockets Buzz Lightyear dinosaurs

646

00:25:40,680 --> 00:25:38,920

astronauts possibility curiosity I love

647

00:25:45,500 --> 00:25:40,690

this one aunt Leigh I might keep this

648

00:25:51,740 --> 00:25:45,510

one shiny books hands-on ethics

649

00:25:55,290 --> 00:25:52,950

okay

650

00:25:57,870 --> 00:25:55,300

let's just give that a second aliens an

651
00:26:00,870 --> 00:25:57,880
adventure or yeah I actually love wow

652
00:26:04,710 --> 00:26:00,880
yeah I love this absolutely let's give

653
00:26:05,940 --> 00:26:04,720
that a second more okay good so you get

654
00:26:07,890 --> 00:26:05,950
the idea so we're going to go through a

655
00:26:10,710 --> 00:26:07,900
sequence of these I'm not going to give

656
00:26:13,080 --> 00:26:10,720
you the seed answers on the the

657
00:26:15,419 --> 00:26:13,090
following slides but in each one I want

658
00:26:19,169 --> 00:26:15,429
you to do the same thing I want you to

659
00:26:21,960 --> 00:26:19,179
give me your one-word response that you

660
00:26:24,810 --> 00:26:21,970
think captures what's most important to

661
00:26:27,120 --> 00:26:24,820
different groups the next one is going

662
00:26:29,160 --> 00:26:27,130
to be the public what one word you think

663
00:26:30,870 --> 00:26:29,170

captures what's most important to the

664

00:26:35,530 --> 00:26:30,880

public when it comes to space

665

00:26:37,360 --> 00:26:35,540

exploration money costs safe aliens

666

00:26:39,400 --> 00:26:37,370

so you can begin to see what we're doing

667

00:26:42,910 --> 00:26:39,410

here I'm trying to get you to put

668

00:26:45,520 --> 00:26:42,920

yourself in other people's shoes to

669

00:26:48,520 --> 00:26:45,530

understand what's important to them and

670

00:26:50,410 --> 00:26:48,530

what if that is threatened they're going

671

00:26:52,450 --> 00:26:50,420

to fight against so this is a way of

672

00:26:54,850 --> 00:26:52,460

thinking about risk in terms of thinking

673

00:26:57,130 --> 00:26:54,860

about what threats people are going to

674

00:26:59,340 --> 00:26:57,140

try and resist okay

675

00:27:02,590 --> 00:26:59,350

cost money aliens or practicality

676
00:27:04,840 --> 00:27:02,600
discovery and again the beauty of that

677
00:27:07,450 --> 00:27:04,850
is that I think that if you were to be

678
00:27:09,550 --> 00:27:07,460
identified with this and have your name

679
00:27:11,620 --> 00:27:09,560
associated water you put up there this

680
00:27:13,840 --> 00:27:11,630
would be a very different word cloud I

681
00:27:16,090 --> 00:27:13,850
would be surprised if money and cost

682
00:27:19,030 --> 00:27:16,100
came up in quite the same prominence as

683
00:27:20,380 --> 00:27:19,040
it does here but this is interesting USA

684
00:27:23,500 --> 00:27:20,390
number one Klingons

685
00:27:26,290 --> 00:27:23,510
yeah of course taxes I'm surprised taxes

686
00:27:28,060 --> 00:27:26,300
isn't bigger actually okay good but

687
00:27:30,250 --> 00:27:28,070
you're getting the idea and this idea

688
00:27:32,530 --> 00:27:30,260

the cost of money are important here is

689

00:27:34,150 --> 00:27:32,540

going to be critical where if you're

690

00:27:36,460 --> 00:27:34,160

part of the community that is trying to

691

00:27:39,190 --> 00:27:36,470

push space exploration you need to be

692

00:27:41,050 --> 00:27:39,200

cognizant of what members of the public

693

00:27:43,270 --> 00:27:41,060

are going to be thinking about in terms

694

00:27:48,190 --> 00:27:43,280

of how they weigh the value of that to

695

00:27:49,570 --> 00:27:48,200

them okay next one politicians type one

696

00:27:51,460 --> 00:27:49,580

word that you think captures what's most

697

00:27:53,980 --> 00:27:51,470

important to politicians when it comes

698

00:27:57,610 --> 00:27:53,990

to space exploration cost and resources

699

00:27:59,230 --> 00:27:57,620

mining money money going to be the

700

00:28:06,730 --> 00:27:59,240

answer to everything here I hope not

701
00:28:08,860 --> 00:28:06,740
pork yes Texas nationalism yep economic

702
00:28:10,510 --> 00:28:08,870
success election

703
00:28:15,660 --> 00:28:10,520
yeah re-election yeah and grab

704
00:28:22,110 --> 00:28:19,380
folks yep so you again you begin to get

705
00:28:24,030 --> 00:28:22,120
the idea that if you're in the science

706
00:28:26,280 --> 00:28:24,040
community and you're trying to push not

707
00:28:28,500 --> 00:28:26,290
only for certain approaches for space

708
00:28:30,690 --> 00:28:28,510
exploration but the inclusion of

709
00:28:33,080 --> 00:28:30,700
thinking about planetary protection here

710
00:28:35,670 --> 00:28:33,090
and you're talking to politicians

711
00:28:36,930 --> 00:28:35,680
they're going to be listening to you and

712
00:28:41,100 --> 00:28:36,940
they're going to be thinking reelection

713
00:28:43,650 --> 00:28:41,110

votes money cost and if you seem to be

714

00:28:44,880 --> 00:28:43,660

threatening any of those they're going

715

00:28:47,640 --> 00:28:44,890

to create barriers for you to achieve

716

00:28:49,680 --> 00:28:47,650

what you're trying to achieve so again

717

00:28:52,410 --> 00:28:49,690

it's important to understand what's

718

00:28:56,910 --> 00:28:52,420

important to them what is at risk to

719

00:28:58,890 --> 00:28:56,920

them okay next one the space industry so

720

00:29:00,630 --> 00:28:58,900

here I'm thinking about the commercial

721

00:29:02,760 --> 00:29:00,640

space industry I you can interpret this

722

00:29:05,010 --> 00:29:02,770

very largely but obviously you've got

723

00:29:06,110 --> 00:29:05,020

things I SpaceX blue origins and the

724

00:29:08,940 --> 00:29:06,120

rest of them

725

00:29:11,940 --> 00:29:08,950

okay profit money maybe not surprising

726

00:29:18,420 --> 00:29:11,950

the opportunity prestige jobs contracts

727

00:29:19,890 --> 00:29:18,430

publicity reputation the reputation one

728

00:29:22,800 --> 00:29:19,900

actually is an interesting one because

729

00:29:25,830 --> 00:29:22,810

of course these commercial companies are

730

00:29:27,930 --> 00:29:25,840

out there for profit but if their

731

00:29:30,570 --> 00:29:27,940

reputation is their brand this damage

732

00:29:34,170 --> 00:29:30,580

immediately their ability to create that

733

00:29:35,900 --> 00:29:34,180

profit disappears so you can begin to

734

00:29:38,540 --> 00:29:35,910

see these associations between things

735

00:29:44,640 --> 00:29:38,550

discovery is that good

736

00:29:46,260 --> 00:29:44,650

penis size I like to say that it had to

737

00:29:53,360 --> 00:29:46,270

come up with space exploration and

738

00:29:59,670 --> 00:29:53,370

Rockets dominance yeah okay great

739

00:30:01,440 --> 00:29:59,680

moving on okay now space engineers so

740

00:30:06,540 --> 00:30:01,450

now we're getting closer to this

741

00:30:10,250 --> 00:30:06,550

community here Fame a WoW fame success

742

00:30:15,630 --> 00:30:10,260

risk challenges technology yep

743

00:30:18,200 --> 00:30:15,640

so again and this is interesting to me

744

00:30:20,070 --> 00:30:18,210

[Laughter]

745

00:30:24,990 --> 00:30:20,080

somebody's worked out how to put the

746

00:30:26,190 --> 00:30:25,000

emojis up I'm impressed but I assumed

747

00:30:27,870 --> 00:30:26,200

the rocket was actually part of

748

00:30:29,789 --> 00:30:27,880

something else okay so maybe this is

749

00:30:41,340 --> 00:30:29,799

just a replacement for a phrase on the

750

00:30:43,020 --> 00:30:41,350

other side so this is all about

751

00:30:47,190 --> 00:30:43,030

innovation I'm so glad to see we've got

752

00:30:55,440 --> 00:30:47,200

an innovative cloud here but you can

753

00:30:57,570 --> 00:30:55,450

begin to understand so when we come to

754

00:30:59,460 --> 00:30:57,580

the Q&A session and the comment session

755

00:31:01,860 --> 00:30:59,470

with the person that please put the poop

756

00:31:06,149 --> 00:31:01,870

emoji up come and explain exactly what

757

00:31:07,860 --> 00:31:06,159

the relevance is okay great so now we

758

00:31:10,289 --> 00:31:07,870

know what's really important to space

759

00:31:11,940 --> 00:31:10,299

engineers which is subverting the system

760

00:31:16,919 --> 00:31:11,950

and hacking it and having a bit of farm

761

00:31:18,289 --> 00:31:16,929

strength okay how are NASA of course

762

00:31:20,520 --> 00:31:18,299

this is the doubt

763

00:31:22,080 --> 00:31:20,530

this is the downside of it being

764

00:31:26,490 --> 00:31:22,090

anonymous well maybe not the downside

765

00:31:28,200 --> 00:31:26,500

funding success discovery great and as

766

00:31:30,510 --> 00:31:28,210

you can see again going through these

767

00:31:32,460 --> 00:31:30,520

different groups different organizations

768

00:31:35,310 --> 00:31:32,470

have got not only different priorities

769

00:31:36,360 --> 00:31:35,320

but different things that are important

770

00:31:38,490 --> 00:31:36,370

enough to them that if they're

771

00:31:42,799 --> 00:31:38,500

threatened they will see that as a risk

772

00:31:47,340 --> 00:31:42,809

and a risk to be managed and avoided yep

773

00:31:49,529 --> 00:31:47,350

lots of planet lots of money funding and

774

00:31:51,120 --> 00:31:49,539

discovery still front and center good

775

00:31:55,230 --> 00:31:51,130

and glad somebody has absolutely got

776

00:31:58,460 --> 00:31:55,240

NASA's mission yes space invaders and

777

00:32:01,260 --> 00:31:58,470

aliens mission yeah mission missions yep

778

00:32:02,850 --> 00:32:01,270

public opinion I'm surprised public

779

00:32:05,159 --> 00:32:02,860

opinion isn't bigger actually because

780

00:32:12,029 --> 00:32:05,169

NASA as an agency depends so critically

781

00:32:16,830 --> 00:32:12,039

on public support good ok two more of

782

00:32:18,510 --> 00:32:16,840

these to go so scientists add slowly in

783

00:32:20,130 --> 00:32:18,520

your mind you should be picking up a

784

00:32:22,260 --> 00:32:20,140

picture of where the commonalities are

785

00:32:23,789 --> 00:32:22,270

between these different groups and where

786

00:32:24,899 --> 00:32:23,799

the point of departure are because of

787

00:32:27,360 --> 00:32:24,909

course where there are points of

788

00:32:29,010 --> 00:32:27,370

commonality not only are the common

789

00:32:30,060 --> 00:32:29,020

goals but there are common ways of

790

00:32:32,790 --> 00:32:30,070

actually working to get

791

00:32:34,590 --> 00:32:32,800

towards those goals okay gain knowledge

792

00:32:36,270 --> 00:32:34,600

discovery discovery as one that actually

793

00:32:39,440 --> 00:32:36,280

comes up quite frequently here not

794

00:32:42,510 --> 00:32:39,450

surprisingly knowledge grants wonder

795

00:32:43,800 --> 00:32:42,520

dubious I was just about to say quite a

796

00:32:46,200 --> 00:32:43,810

lot of this looks like sort of what a

797

00:32:50,220 --> 00:32:46,210

kids excited about or what's important

798

00:32:56,220 --> 00:32:50,230

for kids not surprisingly facts grants

799

00:33:01,530 --> 00:32:56,230

learning dangerous dangerous great okay

800

00:33:03,060 --> 00:33:01,540

and final one bring it home what one

801
00:33:05,340 --> 00:33:03,070
word you think captures what's most

802
00:33:08,450 --> 00:33:05,350
important to astrobiologists when it

803
00:33:12,090 --> 00:33:08,460
comes to space exploration life aliens

804
00:33:22,290 --> 00:33:12,100
fame again okay hands up who wants fame

805
00:33:24,450 --> 00:33:22,300
no validation give that a second okay

806
00:33:26,010 --> 00:33:24,460
this is great so now so what is

807
00:33:29,420 --> 00:33:26,020
interesting here now you have a

808
00:33:31,680 --> 00:33:29,430
divergence because this I'm assuming

809
00:33:33,300 --> 00:33:31,690
represents a large part of the people

810
00:33:35,400 --> 00:33:33,310
that are in this room and what's

811
00:33:37,800 --> 00:33:35,410
important to you life is front and

812
00:33:40,110 --> 00:33:37,810
center there that didn't really come up

813
00:33:41,970 --> 00:33:40,120

in any of the other groups now that

814

00:33:43,080 --> 00:33:41,980

doesn't mean that life is not important

815

00:33:45,300 --> 00:33:43,090

to the other groups because I'm getting

816

00:33:47,520 --> 00:33:45,310

you to try and put yourself in their

817

00:33:50,100 --> 00:33:47,530

shoes and you may get things right you

818

00:33:52,200 --> 00:33:50,110

may not but clearly there is this

819

00:33:54,420 --> 00:33:52,210

disconnect here in terms of what is

820

00:33:56,490 --> 00:33:54,430

really important and where the risk

821

00:34:00,210 --> 00:33:56,500

might lie in terms of what is threatened

822

00:34:01,890 --> 00:34:00,220

and just that self-awareness is really

823

00:34:04,380 --> 00:34:01,900

helpful in trying to understand how to

824

00:34:08,580 --> 00:34:04,390

approach a complex issue like planetary

825

00:34:10,200 --> 00:34:08,590

protection and work out what your role

826

00:34:12,750 --> 00:34:10,210

is here what's important to you what's

827

00:34:14,820 --> 00:34:12,760

important to you to protect and how you

828

00:34:16,860 --> 00:34:14,830

can build up alliances with other groups

829

00:34:18,420 --> 00:34:16,870

based on what's important to them and

830

00:34:20,130 --> 00:34:18,430

how you can avoid getting yourself in a

831

00:34:22,920 --> 00:34:20,140

real mess because you don't realize

832

00:34:24,480 --> 00:34:22,930

what's important to them okay life and

833

00:34:29,700 --> 00:34:24,490

aliens still they're cool I like the

834

00:34:31,080 --> 00:34:29,710

call okay notoriety great and we can

835

00:34:32,810 --> 00:34:31,090

probably I actually have to check that

836

00:34:35,070 --> 00:34:32,820

Steve we can actually probably send

837

00:34:36,120 --> 00:34:35,080

shots of these word clouds around that

838

00:34:38,330 --> 00:34:36,130

people are interested afterwards

839

00:34:41,280 --> 00:34:38,340

actually think they tell us quite a lot

840

00:34:43,560 --> 00:34:41,290

I'll check them first

841

00:34:46,800 --> 00:34:43,570

okay so that's good so we've been

842

00:34:48,240 --> 00:34:46,810

through a process where I've given you a

843

00:34:50,909 --> 00:34:48,250

bit of an idea of how to think

844

00:34:52,740 --> 00:34:50,919

differently about risk think about

845

00:34:53,970 --> 00:34:52,750

planetary protection in terms of a

846

00:34:56,220 --> 00:34:53,980

wicked problem

847

00:34:59,190 --> 00:34:56,230

a wicked challenge that is really hard

848

00:35:00,750 --> 00:34:59,200

to get our teeth into and it involves

849

00:35:02,850 --> 00:35:00,760

many different stakeholders many

850

00:35:04,380 --> 00:35:02,860

different constituencies all of them

851
00:35:06,030 --> 00:35:04,390
with different priorities different

852
00:35:08,370 --> 00:35:06,040
things that are so important to them

853
00:35:10,920 --> 00:35:08,380
that if they're threatened they would

854
00:35:14,790 --> 00:35:10,930
consider that a threat to be eliminated

855
00:35:17,400 --> 00:35:14,800
or managed what I want to do now is work

856
00:35:20,370 --> 00:35:17,410
out how you move from those broad mushy

857
00:35:21,990 --> 00:35:20,380
concepts to understanding how we can

858
00:35:24,840 --> 00:35:22,000
make sense of that within this

859
00:35:27,330 --> 00:35:24,850
particular community so we're going to

860
00:35:29,460 --> 00:35:27,340
open it this up to a discussion and

861
00:35:31,680 --> 00:35:29,470
comment we've got actually a decent

862
00:35:32,940 --> 00:35:31,690
amount of time here there are some house

863
00:35:34,740 --> 00:35:32,950

rules here and I'm going to have a

864

00:35:38,910 --> 00:35:34,750

couple of seed questions to kick things

865

00:35:40,890 --> 00:35:38,920

off here the house rules are stick to

866

00:35:44,280 --> 00:35:40,900

the question when the question up on the

867

00:35:46,380 --> 00:35:44,290

screen be brief and constructive please

868

00:35:47,730 --> 00:35:46,390

do not hog the microphone do not be one

869

00:35:49,830 --> 00:35:47,740

of these people that feels you have to

870

00:35:51,840 --> 00:35:49,840

deliver your thesis at the microphone

871

00:35:53,490 --> 00:35:51,850

because there I'm sure there going to be

872

00:35:56,060 --> 00:35:53,500

other people that want to say something

873

00:35:59,040 --> 00:35:56,070

and but I want this to be a positive

874

00:36:01,710 --> 00:35:59,050

forward-looking discussion about how

875

00:36:04,230 --> 00:36:01,720

this community can move forward with

876

00:36:06,690 --> 00:36:04,240

planetary protection given all of the

877

00:36:09,840 --> 00:36:06,700

different ideas and concerns and

878

00:36:11,490 --> 00:36:09,850

problems and opportunities not to solve

879

00:36:13,080 --> 00:36:11,500

problems because we cannot will not

880

00:36:15,060 --> 00:36:13,090

solve problems here and in fact you

881

00:36:16,470 --> 00:36:15,070

cannot solve problems like this just by

882

00:36:20,100 --> 00:36:16,480

groupthink you actually have to have

883

00:36:22,260 --> 00:36:20,110

expertise in the mix but we can have a

884

00:36:23,970 --> 00:36:22,270

conversation around what is important

885

00:36:25,530 --> 00:36:23,980

what are common goals and how do we

886

00:36:26,010 --> 00:36:25,540

actually move together to achieve these

887

00:36:27,480 --> 00:36:26,020

goals

888

00:36:30,000 --> 00:36:27,490

rather than completely stymieing

889

00:36:32,040 --> 00:36:30,010

ourselves so let me just start with the

890

00:36:34,620 --> 00:36:32,050

first question and as this is coming up

891

00:36:36,450 --> 00:36:34,630

there are microphones in the aisle so if

892

00:36:38,790 --> 00:36:36,460

you do have something to say so there's

893

00:36:40,440 --> 00:36:38,800

comments questions questions to the

894

00:36:42,540 --> 00:36:40,450

audience answers to questions please

895

00:36:44,730 --> 00:36:42,550

come up to the mic and introduce

896

00:36:47,280 --> 00:36:44,740

yourself before you launch into what is

897

00:36:49,110 --> 00:36:47,290

hopefully not your thesis statement okay

898

00:36:51,660 --> 00:36:49,120

so just to kick things off what's your

899

00:36:53,970 --> 00:36:51,670

biggest fear if we don't manage forward

900

00:36:56,339 --> 00:36:53,980

contamination effectively

901
00:36:57,809 --> 00:36:56,349
and maybe not surprisingly compromised

902
00:36:58,289 --> 00:36:57,819
science I'm going to leave that out for

903
00:37:01,140 --> 00:36:58,299
a bit

904
00:37:04,020 --> 00:37:01,150
and ask you to actually come up to the

905
00:37:07,349 --> 00:37:04,030
microphone and just begin talking about

906
00:37:10,109 --> 00:37:07,359
where your confuse our here why you have

907
00:37:13,140 --> 00:37:10,119
those fears what you think the nature of

908
00:37:14,190 --> 00:37:13,150
the problem or the challenges here it's

909
00:37:15,630 --> 00:37:14,200
always difficult getting the first

910
00:37:17,730 --> 00:37:15,640
person to come up and speak this is

911
00:37:22,589 --> 00:37:17,740
where as a lecturer I'm so tempted to

912
00:37:23,849 --> 00:37:22,599
sort of point and say you but I won't so

913
00:37:26,460 --> 00:37:23,859

we have microphones here

914

00:37:28,349 --> 00:37:26,470

oh yeah and yes thank you so if you just

915

00:37:29,309 --> 00:37:28,359

let us know who you are so at least I

916

00:37:32,549 --> 00:37:29,319

know who you are

917

00:37:36,059 --> 00:37:32,559

Helen hands ma don't you think climate

918

00:37:39,030 --> 00:37:36,069

change is an incredibly larger risk now

919

00:37:42,359 --> 00:37:39,040

on earth rather than the remote problem

920

00:37:46,589 --> 00:37:42,369

of contamination at this moment in time

921

00:37:48,780 --> 00:37:46,599

and space so I so I'm not going to give

922

00:37:50,130 --> 00:37:48,790

you an answer because I'm not the Oracle

923

00:37:51,780 --> 00:37:50,140

on this but so thank you for the

924

00:37:55,230 --> 00:37:51,790

question I would love for other people

925

00:37:56,970 --> 00:37:55,240

to respond to that interesting that I

926
00:37:59,490 --> 00:37:56,980
can't remember seeing climate change

927
00:38:01,109 --> 00:37:59,500
coming up as prominently here but what

928
00:38:03,450 --> 00:38:01,119
is so important about the question is

929
00:38:05,400 --> 00:38:03,460
that it raises the issue that different

930
00:38:09,539 --> 00:38:05,410
people have different priorities and

931
00:38:12,120 --> 00:38:09,549
very clearly climate change and society

932
00:38:14,339 --> 00:38:12,130
on earth not only society on earth but

933
00:38:16,500 --> 00:38:14,349
how we actually deal with disparities

934
00:38:19,230 --> 00:38:16,510
between different sections of society is

935
00:38:21,539 --> 00:38:19,240
clearly a critical a critical issue and

936
00:38:23,940 --> 00:38:21,549
a critical risk so then how do you

937
00:38:26,180 --> 00:38:23,950
balance something that is clearly so

938
00:38:28,710 --> 00:38:26,190

critical with something we're doing off

939

00:38:31,349 --> 00:38:28,720

how do you make those trade-offs between

940

00:38:34,049 --> 00:38:31,359

where we focus our attention and how we

941

00:38:37,260 --> 00:38:34,059

make decisions I would love for people's

942

00:38:38,849 --> 00:38:37,270

thoughts on that but in the meantime do

943

00:38:41,039 --> 00:38:38,859

you want my thought on that or do you

944

00:38:42,780 --> 00:38:41,049

want what I was going to say as well so

945

00:38:44,640 --> 00:38:42,790

actually both will do but I should let

946

00:38:46,319 --> 00:38:44,650

you say what you want to think okay I

947

00:38:47,819 --> 00:38:46,329

think that we learn a lot about climate

948

00:38:49,799 --> 00:38:47,829

change on Earth by exploring other

949

00:38:51,359 --> 00:38:49,809

planets is my short response to that

950

00:38:54,120 --> 00:38:51,369

it's not one or the other I think

951
00:38:56,069 --> 00:38:54,130
science is integrated in a way that you

952
00:38:58,319 --> 00:38:56,079
can address a lot of questions at the

953
00:39:00,510 --> 00:38:58,329
same time what I wanted to say about

954
00:39:02,789 --> 00:39:00,520
forward contamination being this big

955
00:39:05,039 --> 00:39:02,799
issue for astrobiologists is that a lot

956
00:39:06,630 --> 00:39:05,049
of the public desire for space

957
00:39:09,359 --> 00:39:06,640
exploration is to send you

958
00:39:11,609 --> 00:39:09,369
and if we send humans anywhere we will

959
00:39:14,579 --> 00:39:11,619
contaminate the planet because we are

960
00:39:16,259 --> 00:39:14,589
dead if we're sterile and so there's a

961
00:39:18,529 --> 00:39:16,269
huge conflict between trying to

962
00:39:21,479 --> 00:39:18,539
understand microbial life anywhere and

963
00:39:24,930 --> 00:39:21,489

human exploration in particular yeah

964

00:39:27,150 --> 00:39:24,940

thank you and I'd love to get comments

965

00:39:30,989 --> 00:39:27,160

on that as well so certainly from my

966

00:39:33,690 --> 00:39:30,999

perspective that is a really big value

967

00:39:36,960 --> 00:39:33,700

disconnect I talk about risk you've got

968

00:39:40,440 --> 00:39:36,970

the people that are really dedicated to

969

00:39:42,299 --> 00:39:40,450

getting humans on other bodies see

970

00:39:44,130 --> 00:39:42,309

people that don't like that idea because

971

00:39:46,140 --> 00:39:44,140

in contamination is a risk to their

972

00:39:49,529 --> 00:39:46,150

mission on the other hand if your

973

00:39:52,979 --> 00:39:49,539

interest is in alien life or the

974

00:39:56,160 --> 00:39:52,989

evolution of life or lifelike systems in

975

00:39:58,499 --> 00:39:56,170

other systems the idea of putting humans

976
00:40:00,390 --> 00:39:58,509
on to another body is a risk to what you

977
00:40:02,249 --> 00:40:00,400
think is incredibly important so how do

978
00:40:05,220 --> 00:40:02,259
we begin to find the common ground

979
00:40:07,620 --> 00:40:05,230
between those yeah I don't think that

980
00:40:10,470 --> 00:40:07,630
there's a conflict between sending

981
00:40:12,900 --> 00:40:10,480
humans and understanding life before you

982
00:40:14,489 --> 00:40:12,910
send humans and the issue of course has

983
00:40:17,940 --> 00:40:14,499
to do with whether or not the humans are

984
00:40:20,130 --> 00:40:17,950
going into a minefield of a another

985
00:40:22,769 --> 00:40:20,140
biosphere or whether or not there's

986
00:40:26,099 --> 00:40:22,779
actually the potential for humans to

987
00:40:27,390 --> 00:40:26,109
benefit from the lack of life but if

988
00:40:29,880 --> 00:40:27,400

you're going to look for something like

989

00:40:32,160 --> 00:40:29,890

a mars aquifer it would be tragic to

990

00:40:34,410 --> 00:40:32,170

find that there was one there but some

991

00:40:38,579 --> 00:40:34,420

earth microbe turned it into some kind

992

00:40:41,430 --> 00:40:38,589

of a mineral and you know you lose that

993

00:40:42,660 --> 00:40:41,440

so I think both are possible but you

994

00:40:44,309 --> 00:40:42,670

know especially if you want to get into

995

00:40:47,670 --> 00:40:44,319

terraforming I mean you're going to

996

00:40:49,680 --> 00:40:47,680

start making the planet change a lot but

997

00:40:51,359 --> 00:40:49,690

you don't want to be stopped by the

998

00:40:54,390 --> 00:40:51,369

microbes you took with you inadvertently

999

00:40:56,370 --> 00:40:54,400

right right like we should be a choice

1000

00:40:59,009 --> 00:40:56,380

right of course one of the challenges

1001
00:41:01,440 --> 00:40:59,019
here is with really speculating out into

1002
00:41:02,940 --> 00:41:01,450
the future and we see this with risk in

1003
00:41:04,739 --> 00:41:02,950
so many different areas we're at the

1004
00:41:06,630 --> 00:41:04,749
cutting edge how do you make decisions

1005
00:41:08,729 --> 00:41:06,640
on things that you don't know whether

1006
00:41:10,079 --> 00:41:08,739
they're going to happen or not and one

1007
00:41:11,759 --> 00:41:10,089
thing we do know is the last thing you

1008
00:41:13,229 --> 00:41:11,769
can do is do nothing because you're

1009
00:41:14,370 --> 00:41:13,239
scared of the future so then the

1010
00:41:16,529 --> 00:41:14,380
question is how do you make those

1011
00:41:17,579 --> 00:41:16,539
informed decisions but also something we

1012
00:41:19,360 --> 00:41:17,589
might want to come back to in the

1013
00:41:20,950 --> 00:41:19,370

conversation because this is a calm

1014

00:41:22,960 --> 00:41:20,960

sation that were having around

1015

00:41:25,240 --> 00:41:22,970

cutting-edge emerging technologies is

1016

00:41:27,790 --> 00:41:25,250

how do you build resilience into your

1017

00:41:29,890 --> 00:41:27,800

systems so when something goes wrong and

1018

00:41:31,330 --> 00:41:29,900

I can guarantee if you're actually

1019

00:41:33,340 --> 00:41:31,340

moving forward something will go wrong

1020

00:41:36,040 --> 00:41:33,350

if something when something goes wrong

1021

00:41:37,240 --> 00:41:36,050

how do you have enough resilience in the

1022

00:41:40,660 --> 00:41:37,250

system so you can respond to that

1023

00:41:42,010 --> 00:41:40,670

rapidly and change course rapidly yes if

1024

00:41:43,510 --> 00:41:42,020

you can say who you are please

1025

00:41:45,190 --> 00:41:43,520

I'm Linda Billings I'm a social

1026

00:41:47,200 --> 00:41:45,200

scientist working in the astrobiology

1027

00:41:49,720 --> 00:41:47,210

community and when I look at compromised

1028

00:41:51,130 --> 00:41:49,730

science as the biggest fear I can

1029

00:41:53,350 --> 00:41:51,140

understand that but it's a social

1030

00:41:55,390 --> 00:41:53,360

scientist I would think that if NASA

1031

00:41:58,510 --> 00:41:55,400

were to spend five billion dollars on a

1032

00:42:00,250 --> 00:41:58,520

life detection mission to Mars and over

1033

00:42:02,020 --> 00:42:00,260

the course of analysis of the data its

1034

00:42:03,640 --> 00:42:02,030

discovered that the life we've

1035

00:42:05,710 --> 00:42:03,650

discovered on Mars is actually earth

1036

00:42:09,870 --> 00:42:05,720

life then loss of public trust would

1037

00:42:13,090 --> 00:42:09,880

really shoot up yeah thank you

1038

00:42:14,920 --> 00:42:13,100

next I think that climate change is a

1039

00:42:17,290 --> 00:42:14,930

reason why we should be more cautious

1040

00:42:18,340 --> 00:42:17,300

about planetary protection because when

1041

00:42:20,320 --> 00:42:18,350

you look at the anthropogenic climate

1042

00:42:21,610 --> 00:42:20,330

change in human based problems like

1043

00:42:23,500 --> 00:42:21,620

that's a reason why we need to be more

1044

00:42:25,060 --> 00:42:23,510

careful with when we're exploring other

1045

00:42:26,830 --> 00:42:25,070

planets and how colonization

1046

00:42:29,020 --> 00:42:26,840

historically even from country to

1047

00:42:31,450 --> 00:42:29,030

country has backfired in our faces like

1048

00:42:34,120 --> 00:42:31,460

even like on this land Native Americans

1049

00:42:35,410 --> 00:42:34,130

were oftentimes murdered from diseases

1050

00:42:37,090 --> 00:42:35,420

and that kind of thing which is a reason

1051

00:42:40,660 --> 00:42:37,100

why we should be careful and like

1052

00:42:43,180 --> 00:42:40,670

rethink our ethics and certainly I to me

1053

00:42:45,610 --> 00:42:43,190

that's a very strong narrative and I

1054

00:42:47,620 --> 00:42:45,620

can't think of any one good example

1055

00:42:51,310 --> 00:42:47,630

where colonization has been uniformly

1056

00:42:53,620 --> 00:42:51,320

good as a species it's been a history of

1057

00:42:55,150 --> 00:42:53,630

bad ideas bad mistakes that somehow

1058

00:42:57,280 --> 00:42:55,160

we've managed to bumble through and

1059

00:42:59,470 --> 00:42:57,290

actually make some sort of progress for

1060

00:43:01,510 --> 00:42:59,480

some people afterwards yeah so we don't

1061

00:43:03,310 --> 00:43:01,520

have a great track record here Margaret

1062

00:43:05,530 --> 00:43:03,320

race and SETI Institute and I work on

1063

00:43:07,030 --> 00:43:05,540

planetary protection I agree with

1064

00:43:08,800 --> 00:43:07,040

everything that's been said so far and I

1065

00:43:09,910 --> 00:43:08,810

think one of the difficulties I see in

1066

00:43:13,300 --> 00:43:09,920

dealing with different audiences

1067

00:43:15,970 --> 00:43:13,310

different balance questions is the

1068

00:43:18,250 --> 00:43:15,980

problem of time we in the astrobiology

1069

00:43:20,800 --> 00:43:18,260

community go from years to decades

1070

00:43:23,140 --> 00:43:20,810

decades to centuries no problem and then

1071

00:43:25,270 --> 00:43:23,150

centuries to millennia and then big time

1072

00:43:26,860 --> 00:43:25,280

and when we talk about things are

1073

00:43:28,690 --> 00:43:26,870

constantly mixing them up and when we're

1074

00:43:30,280 --> 00:43:28,700

talking about trying to solve problem

1075

00:43:32,020 --> 00:43:30,290

for forward contamination or make a

1076

00:43:33,670 --> 00:43:32,030

right policy

1077

00:43:35,530 --> 00:43:33,680

how time gets left out of it and we're

1078

00:43:37,240 --> 00:43:35,540

so comfortable with dealing with this

1079

00:43:38,800 --> 00:43:37,250

full range of time that we often don't

1080

00:43:41,380 --> 00:43:38,810

even stop and think about what we mean

1081

00:43:43,870 --> 00:43:41,390

ourselves great thank you

1082

00:43:45,520 --> 00:43:43,880

yeah we I would like to actually come

1083

00:43:47,800 --> 00:43:45,530

back to that issue of time and

1084

00:43:50,650 --> 00:43:47,810

timescales and decision making processes

1085

00:43:52,720 --> 00:43:50,660

yeah I'd say - oh sorry thank you yet

1086

00:43:54,760 --> 00:43:52,730

just two seconds thank you right thank

1087

00:43:56,320 --> 00:43:54,770

you I guess

1088

00:43:58,030 --> 00:43:56,330

the whole question about forward

1089

00:44:01,270 --> 00:43:58,040

contamination from a boils down the

1090

00:44:03,310 --> 00:44:01,280

question of up compromising science in

1091

00:44:05,020 --> 00:44:03,320

the context of actually identifying

1092

00:44:08,410 --> 00:44:05,030

whether life does exist elsewhere

1093

00:44:11,080 --> 00:44:08,420

whether it is rich second genesis and so

1094

00:44:14,380 --> 00:44:11,090

on and the big problem in my mind is

1095

00:44:17,440 --> 00:44:14,390

that it's likely that if life does exist

1096

00:44:20,410 --> 00:44:17,450

elsewhere it may well be existent in

1097

00:44:22,360 --> 00:44:20,420

niches rather than widespread on the

1098

00:44:25,060 --> 00:44:22,370

surface where for example humans might

1099

00:44:29,170 --> 00:44:25,070

first go so if we for example with

1100

00:44:31,780 --> 00:44:29,180

curiosity at Mars and Mars 2020 and so

1101

00:44:33,370 --> 00:44:31,790

on shows that Mars is sterile on the

1102

00:44:35,650 --> 00:44:33,380

surface it does not mean that it is

1103

00:44:37,810 --> 00:44:35,660

sterile and the subsurface steeps deep

1104

00:44:40,990 --> 00:44:37,820

subsurface so we have to be very

1105

00:44:43,690 --> 00:44:41,000

cautious about exploration of such

1106

00:44:46,120 --> 00:44:43,700

bodies and forward contamination which

1107

00:44:47,860 --> 00:44:46,130

could in fact prejudice downstream

1108

00:44:50,380 --> 00:44:47,870

science very far in the future where we

1109

00:44:53,470 --> 00:44:50,390

go deep and look for other lights and

1110

00:44:55,330 --> 00:44:53,480

other nations racial thank you so just

1111

00:44:58,090 --> 00:44:55,340

another C question if I get to this

1112

00:45:00,040 --> 00:44:58,100

gentleman and I'm playing devil's

1113

00:45:03,340 --> 00:45:00,050

advocate here because I don't believe in

1114

00:45:05,820 --> 00:45:03,350

this this argument myself but how do you

1115

00:45:08,710 --> 00:45:05,830

deal with the people that argue that

1116

00:45:10,420 --> 00:45:08,720

this is very self-indulgence of

1117

00:45:12,040 --> 00:45:10,430

scientists saying you've got to leave

1118

00:45:13,810 --> 00:45:12,050

space to us because we're the only

1119

00:45:14,920 --> 00:45:13,820

people that know how to work here and

1120

00:45:18,130 --> 00:45:14,930

not make a mess of it

1121

00:45:20,380 --> 00:45:18,140

so if you want to mine asteroids if you

1122

00:45:22,200 --> 00:45:20,390

want to colonize Mars whatever you

1123

00:45:25,270 --> 00:45:22,210

should keep your hands off because earth

1124

00:45:26,710 --> 00:45:25,280

scientists have the first choice here

1125

00:45:29,530 --> 00:45:26,720

and we're the people that know how to do

1126

00:45:31,000 --> 00:45:29,540

this so I'm channeling conversations

1127

00:45:33,160 --> 00:45:31,010

that I've heard as I said I don't

1128

00:45:35,920 --> 00:45:33,170

believe this but how do you counter

1129

00:45:38,200 --> 00:45:35,930

arguments like that just a seed for

1130

00:45:41,440 --> 00:45:38,210

further questions yes my name is Keith

1131

00:45:44,170 --> 00:45:41,450

Cowen I'm editor of gasps watch calm I'm

1132

00:45:45,610 --> 00:45:44,180

here covering this meeting so I also run

1133

00:45:46,600 --> 00:45:45,620

astrobiology calm

1134

00:45:49,330 --> 00:45:46,610

I'm sitting here a little perplexed

1135

00:45:51,700 --> 00:45:49,340

because with my phone here I can tweet

1136

00:45:54,660 --> 00:45:51,710

to 400,000 people about this including

1137

00:45:56,680 --> 00:45:54,670

add astrobiology what and I know the UK

1138

00:45:58,150 --> 00:45:56,690

tabloids are waiting to see what I tweet

1139

00:45:59,740 --> 00:45:58,160

so they can write about a face eating

1140

00:46:01,660 --> 00:45:59,750

Martians you can go to any other

1141

00:46:04,900 --> 00:46:01,670

audience to get A's and B's go up and

1142

00:46:06,910 --> 00:46:04,910

down here I would just offer that if you

1143

00:46:09,460 --> 00:46:06,920

feel your audience isn't understanding

1144

00:46:12,010 --> 00:46:09,470

you you have the wrong communicators and

1145

00:46:13,750 --> 00:46:12,020

if parents can tell kids wash your hands

1146

00:46:15,750 --> 00:46:13,760

before dinner put the lid back on this

1147

00:46:17,920 --> 00:46:15,760

thing I mean basic aspects of

1148

00:46:18,700 --> 00:46:17,930

microbiology are not that difficult to

1149

00:46:20,590 --> 00:46:18,710

grasp

1150

00:46:22,420 --> 00:46:20,600

so again if whatever audience you're

1151

00:46:26,110 --> 00:46:22,430

worried about today is not getting your

1152

00:46:28,360 --> 00:46:26,120

message you need new messages and maybe

1153

00:46:29,770 --> 00:46:28,370

that should be like I was at one of the

1154

00:46:33,100 --> 00:46:29,780

original meetings with Linda and some of

1155

00:46:34,420 --> 00:46:33,110

the others back in the sixth 1996-97 we

1156

00:46:36,400 --> 00:46:34,430

had a whole group about the whole notion

1157

00:46:38,740 --> 00:46:36,410

of just explaining this to people yeah

1158

00:46:41,020 --> 00:46:38,750

and I quite frankly don't see enough of

1159

00:46:43,870 --> 00:46:41,030

that these days and you guys may know

1160

00:46:45,820 --> 00:46:43,880

the topic but he may not be he didn't

1161

00:46:48,250 --> 00:46:45,830

take that class in college talk to the

1162

00:46:50,710 --> 00:46:48,260

public so actually I let me just add to

1163

00:46:53,230 --> 00:46:50,720

that so one of the many hats I wear is

1164

00:46:55,750 --> 00:46:53,240

actually as a science communicator both

1165

00:46:57,750 --> 00:46:55,760

somebody who teaches and does it and one

1166

00:47:00,100 --> 00:46:57,760

of the fundamental principles there is

1167

00:47:01,600 --> 00:47:00,110

focus on your audience not only focused

1168

00:47:03,760 --> 00:47:01,610

on the audience but actually have

1169

00:47:05,380 --> 00:47:03,770

audience centric communication so you're

1170

00:47:07,510 --> 00:47:05,390

absolutely right and this ties in not

1171

00:47:10,150 --> 00:47:07,520

only with public trust but a whole range

1172

00:47:12,940 --> 00:47:10,160

of other things we can't sit here and

1173

00:47:15,070 --> 00:47:12,950

say we have the answers if you don't get

1174

00:47:16,720 --> 00:47:15,080

it you've got something wrong we've got

1175

00:47:18,970 --> 00:47:16,730

to think about how you actually build

1176

00:47:22,450 --> 00:47:18,980

those bridges and there is no one single

1177

00:47:23,860 --> 00:47:22,460

message thank you yes great I'm going to

1178

00:47:25,780 --> 00:47:23,870

go over here and then back here hi

1179

00:47:29,350 --> 00:47:25,790

name's Andrew sugar at the University of

1180

00:47:30,970 --> 00:47:29,360

Florida and as a preamble I work in the

1181

00:47:34,120 --> 00:47:30,980

field of planetary protection so I've

1182

00:47:35,770 --> 00:47:34,130

received funds in the past and expect

1183

00:47:38,550 --> 00:47:35,780

and hope to receive funds in the future

1184

00:47:41,620 --> 00:47:38,560

just to be fully full disclosure here

1185

00:47:44,760 --> 00:47:41,630

the cot the concept I want to convey is

1186

00:47:46,990 --> 00:47:44,770

is the term contamination because

1187

00:47:48,760 --> 00:47:47,000

contamination you can have contamination

1188

00:47:52,120 --> 00:47:48,770

and you can have contamination I mean it

1189

00:47:54,400 --> 00:47:52,130

there's a scale there and it's not one

1190

00:47:57,040 --> 00:47:54,410

bacterium that is dispersed under the

1191

00:47:59,050 --> 00:47:57,050

terrain that I'm most worried about it

1192

00:47:59,510 --> 00:47:59,060

would be contamination that is able to

1193

00:48:02,420 --> 00:47:59,520

establish

1194

00:48:05,330 --> 00:48:02,430

itself be dispersed around the planet

1195

00:48:07,820 --> 00:48:05,340

and move well beyond the immediate

1196

00:48:10,340 --> 00:48:07,830

landing site or the immediate wheel

1197

00:48:13,550 --> 00:48:10,350

track of a rover that I think is the

1198

00:48:16,660 --> 00:48:13,560

issue so we could transfer small numbers

1199

00:48:19,490 --> 00:48:16,670

of viable bacteria onto the surface and

1200

00:48:21,740 --> 00:48:19,500

that wheel track for example is the only

1201
00:48:23,810 --> 00:48:21,750
thing that gets contaminated as an

1202
00:48:26,330 --> 00:48:23,820
example so there's small contamination

1203
00:48:29,960 --> 00:48:26,340
big-10 option and the second concept is

1204
00:48:32,090 --> 00:48:29,970
that the surface of Mars is has a very

1205
00:48:35,150 --> 00:48:32,100
wide range of biocidal conditions

1206
00:48:38,240 --> 00:48:35,160
biocidal factors 15 to 20 have then

1207
00:48:41,120 --> 00:48:38,250
published through numbers of papers so

1208
00:48:44,330 --> 00:48:41,130
what really is the concern is if we have

1209
00:48:47,180 --> 00:48:44,340
back communities or assemblages from

1210
00:48:49,880 --> 00:48:47,190
earth transported to Mars they're able

1211
00:48:52,460 --> 00:48:49,890
to survive those collection of 20

1212
00:48:54,760 --> 00:48:52,470
biocidal conditions be dispersed into

1213
00:48:57,860 --> 00:48:54,770

niches that then become established I

1214

00:49:00,590 --> 00:48:57,870

just wanted to emphasize this small

1215

00:49:02,750 --> 00:49:00,600

contamination big contamination yeah no

1216

00:49:04,640 --> 00:49:02,760

I really appreciate that and of course

1217

00:49:07,160 --> 00:49:04,650

as part of that I mean the reason I set

1218

00:49:08,840 --> 00:49:07,170

it up this way is contamination is a

1219

00:49:10,880 --> 00:49:08,850

different type of problem from

1220

00:49:13,400 --> 00:49:10,890

compromised science because

1221

00:49:16,370 --> 00:49:13,410

contamination usually comes to how is

1222

00:49:18,350 --> 00:49:16,380

that presence of earth-based biological

1223

00:49:20,810 --> 00:49:18,360

stuff going to compromise my mission

1224

00:49:23,210 --> 00:49:20,820

which may be nothing to do with finding

1225

00:49:25,400 --> 00:49:23,220

alien life where as compromised science

1226

00:49:27,170 --> 00:49:25,410

is all about how do you prevent

1227

00:49:29,090 --> 00:49:27,180

something getting into the experiment

1228

00:49:30,890 --> 00:49:29,100

which is going to completely nullify in

1229

00:49:33,070 --> 00:49:30,900

the experiment the other thing actually

1230

00:49:36,980 --> 00:49:33,080

would struck me from those comments is

1231

00:49:38,480 --> 00:49:36,990

in the world of psychology and decision

1232

00:49:41,270 --> 00:49:38,490

analysis and how people actually make

1233

00:49:43,940 --> 00:49:41,280

sense of information one of the tools we

1234

00:49:45,470 --> 00:49:43,950

use is the idea of mental Maps the idea

1235

00:49:47,300 --> 00:49:45,480

of understanding how people actually

1236

00:49:50,840 --> 00:49:47,310

process information to make sense of the

1237

00:49:52,370 --> 00:49:50,850

world and this applies very very well to

1238

00:49:54,350 --> 00:49:52,380

looking at contamination some are like

1239

00:49:57,110 --> 00:49:54,360

Mars or somewhere like another body

1240

00:49:58,880 --> 00:49:57,120

where if you're not deeply steeped in

1241

00:50:02,270 --> 00:49:58,890

the science it's easy to jump to

1242

00:50:04,700 --> 00:50:02,280

conclusions that misrepresent the

1243

00:50:06,590 --> 00:50:04,710

science and where you can even go as far

1244

00:50:08,660 --> 00:50:06,600

as assuming that life is likely to

1245

00:50:10,280 --> 00:50:08,670

propagate on another body in the same

1246

00:50:11,270 --> 00:50:10,290

way as it would propagate in different

1247

00:50:13,130 --> 00:50:11,280

ecosystems on

1248

00:50:15,260 --> 00:50:13,140

and one of the critical things to do

1249

00:50:16,880 --> 00:50:15,270

here is make sure we have ways of both

1250

00:50:18,770 --> 00:50:16,890

understanding where there are

1251
00:50:21,530 --> 00:50:18,780
misconceptions in people's mental models

1252
00:50:24,590 --> 00:50:21,540
and understanding how to use the science

1253
00:50:27,260 --> 00:50:24,600
to reveal how things are actually likely

1254
00:50:29,630 --> 00:50:27,270
to work rather than how thing how things

1255
00:50:31,880 --> 00:50:29,640
have people think things are going to

1256
00:50:33,320 --> 00:50:31,890
work and that's a critical that's a

1257
00:50:35,270 --> 00:50:33,330
critical leap it actually comes back to

1258
00:50:37,730 --> 00:50:35,280
communication because we need to help

1259
00:50:40,490 --> 00:50:37,740
people understand the reality of science

1260
00:50:43,100 --> 00:50:40,500
of Earth and we need to work out where

1261
00:50:44,450 --> 00:50:43,110
people's misconceptions are here I'm

1262
00:50:48,140 --> 00:50:44,460
going to go here then we're going to go

1263
00:50:50,510 --> 00:50:48,150

over hi Stewart Butler

1264

00:50:53,360 --> 00:50:50,520

I appreciate this last point because

1265

00:50:57,520 --> 00:50:53,370

it's intuitively when you think about it

1266

00:51:01,790 --> 00:50:59,810

microorganisms from Earth given the

1267

00:51:03,950 --> 00:51:01,800

extreme nature of exoplanet environments

1268

00:51:05,510 --> 00:51:03,960

it seems generically unlikely that they

1269

00:51:08,380 --> 00:51:05,520

would be able to grow exponentially in

1270

00:51:11,690 --> 00:51:08,390

an exoplanet tree environment however

1271

00:51:13,430 --> 00:51:11,700

backwood contamination intuitively seems

1272

00:51:15,470 --> 00:51:13,440

like it could be more of a risk if we

1273

00:51:18,140 --> 00:51:15,480

start mining asteroids for example and

1274

00:51:20,450 --> 00:51:18,150

there's some super super extremophiles

1275

00:51:22,910 --> 00:51:20,460

that somehow managed to make a living

1276

00:51:25,160 --> 00:51:22,920

there and that gets back to earth and

1277

00:51:28,010 --> 00:51:25,170

suddenly it has a real easy time making

1278

00:51:30,410 --> 00:51:28,020

a living in the less extreme conditions

1279

00:51:33,020 --> 00:51:30,420

on earth that seems intuitively more

1280

00:51:35,210 --> 00:51:33,030

natural a candidate for spreading

1281

00:51:38,540 --> 00:51:35,220

exponentially in sort of invading so I

1282

00:51:40,370 --> 00:51:38,550

guess backward contamination could

1283

00:51:42,980 --> 00:51:40,380

become a concern in the future as well

1284

00:51:44,120 --> 00:51:42,990

and perfect segue because I'm going to

1285

00:51:46,370 --> 00:51:44,130

go on to the next question which is

1286

00:51:49,160 --> 00:51:46,380

about backward contamination but just

1287

00:51:51,680 --> 00:51:49,170

before I leave this slide remember this

1288

00:51:53,870 --> 00:51:51,690

because the compromised science reflects

1289

00:51:55,220 --> 00:51:53,880

this community and it's important to

1290

00:51:57,590 --> 00:51:55,230

realize there's actually quite a lot of

1291

00:51:59,540 --> 00:51:57,600

consensus here about what is important

1292

00:52:01,580 --> 00:51:59,550

here but it's also important to realize

1293

00:52:03,080 --> 00:52:01,590

that there is some diversity in

1294

00:52:06,290 --> 00:52:03,090

perspective here within this room as

1295

00:52:09,050 --> 00:52:06,300

well and it's always relevant to

1296

00:52:11,930 --> 00:52:09,060

understand the value and the validity of

1297

00:52:14,120 --> 00:52:11,940

that diversity of opinion okay so while

1298

00:52:16,610 --> 00:52:14,130

we keep on taking these let's get on to

1299

00:52:20,690 --> 00:52:16,620

or segue into a backward contamination

1300

00:52:24,920 --> 00:52:20,700

Sir Paul Mooney we're all descendant of

1301

00:52:32,849 --> 00:52:30,480

yes that that as far as colonization of

1302

00:52:35,970 --> 00:52:32,859

space you know America we left the

1303

00:52:39,630 --> 00:52:35,980

plaque on the moon with Apollo 11 we

1304

00:52:41,700 --> 00:52:39,640

come in peace for all mankind and that

1305

00:52:44,490 --> 00:52:41,710

should stand as a marker for a future

1306

00:52:46,080 --> 00:52:44,500

right right so the one thing I would say

1307

00:52:49,170 --> 00:52:46,090

I thank you for your point which is

1308

00:52:50,820 --> 00:52:49,180

really important but there's obviously

1309

00:52:53,099 --> 00:52:50,830

difference between saying we come in

1310

00:52:54,810 --> 00:52:53,109

peace and actually not leaving a dirty

1311

00:52:58,109 --> 00:52:54,820

great footprint which we can't erase

1312

00:52:59,760 --> 00:52:58,119

afterwards hello my name is Vladimir

1313

00:53:02,070 --> 00:52:59,770

Putin NASA Goddard Space Flight Center

1314

00:53:04,230 --> 00:53:02,080

and I want to come in not just a

1315

00:53:06,030 --> 00:53:04,240

contamination but an evolution of

1316

00:53:08,520 --> 00:53:06,040

contamination the point is that if we

1317

00:53:11,220 --> 00:53:08,530

bring a bacteria from other world to

1318

00:53:13,349 --> 00:53:11,230

earth because we have deep biosphere the

1319

00:53:16,680 --> 00:53:13,359

biosphere means that biological

1320

00:53:18,540 --> 00:53:16,690

equilibrium said the old biological

1321

00:53:20,880 --> 00:53:18,550

niches are taken they're going to kill

1322

00:53:23,190 --> 00:53:20,890

this bacteria so I don't understand the

1323

00:53:24,630 --> 00:53:23,200

contamination that cells imagine that we

1324

00:53:27,420 --> 00:53:24,640

have a biosphere on Mars

1325

00:53:29,460 --> 00:53:27,430

subsurface biosphere we bring a bacteria

1326

00:53:32,130 --> 00:53:29,470

and they just matter of time might be

1327

00:53:34,380 --> 00:53:32,140

they might be a month but if life

1328

00:53:36,690 --> 00:53:34,390

prosper on Mars they will kill bacteria

1329

00:53:39,060 --> 00:53:36,700

myth so I don't understand contamination

1330

00:53:41,160 --> 00:53:39,070

so I actually like people to dig into

1331

00:53:43,310 --> 00:53:41,170

that a little bit more because this is

1332

00:53:46,200 --> 00:53:43,320

where I can see tremendous uncertainty

1333

00:53:49,079 --> 00:53:46,210

especially from those that are deeply

1334

00:53:51,210 --> 00:53:49,089

familiar with the biology of extreme

1335

00:53:55,680 --> 00:53:51,220

especially extremophiles but also the

1336

00:53:57,930 --> 00:53:55,690

nature of either modified DNA or non DNA

1337

00:54:00,450 --> 00:53:57,940

based life because it seems like there's

1338

00:54:02,099 --> 00:54:00,460

a huge divergence of opinion as to where

1339

00:54:03,599 --> 00:54:02,109

the alien life would actually be able to

1340

00:54:06,960 --> 00:54:03,609

survive on earth because you don't have

1341

00:54:08,339 --> 00:54:06,970

those those niches or whether it would

1342

00:54:10,140 --> 00:54:08,349

dominate like an invasive species

1343

00:54:12,930 --> 00:54:10,150

because it has advantages that others

1344

00:54:15,089 --> 00:54:12,940

don't have I don't really get a sense of

1345

00:54:18,930 --> 00:54:15,099

where there is good science consensus

1346

00:54:22,859 --> 00:54:18,940

here but prove me wrong let's get it I

1347

00:54:25,050 --> 00:54:22,869

just want to point out that people

1348

00:54:26,790 --> 00:54:25,060

didn't realize that kudzu would take

1349

00:54:28,589 --> 00:54:26,800

over the entire South people didn't

1350

00:54:30,660 --> 00:54:28,599

realize that honeysuckle would take over

1351

00:54:33,300 --> 00:54:30,670

the north people didn't realize that all

1352

00:54:35,460 --> 00:54:33,310

the diseases that were brought by the

1353

00:54:38,489 --> 00:54:35,470

original colonizers

1354

00:54:40,349 --> 00:54:38,499

European colonizers of North America

1355

00:54:44,069 --> 00:54:40,359

would bring diseases that would kill the

1356

00:54:46,259 --> 00:54:44,079

native people here it's sort of I don't

1357

00:54:48,690 --> 00:54:46,269

like this argument that well we think

1358

00:54:51,180 --> 00:54:48,700

that the niches are taken up or we think

1359

00:54:53,489 --> 00:54:51,190

that the environment is too sterile and

1360

00:54:55,589 --> 00:54:53,499

Mars things can't grow there I think

1361

00:54:57,059 --> 00:54:55,599

that we need to understand that

1362

00:55:00,720 --> 00:54:57,069

sometimes scientists don't know things

1363

00:55:01,979 --> 00:55:00,730

and when we don't know we need to we

1364

00:55:04,019 --> 00:55:01,989

need to be careful because we could

1365

00:55:04,650 --> 00:55:04,029

really ruin something yeah and we've

1366

00:55:06,989 --> 00:55:04,660

done it before

1367

00:55:14,729 --> 00:55:06,999

and we might do it again so can I put

1368

00:55:16,499 --> 00:55:14,739

you on the spot and keep you up I just

1369

00:55:19,529 --> 00:55:16,509

want to ask a follow-up question to that

1370

00:55:22,470 --> 00:55:19,539

so I again you look through the history

1371

00:55:25,229 --> 00:55:22,480

of humanity and that has been a legacy

1372

00:55:26,370 --> 00:55:25,239

that we do things out of ignorance even

1373

00:55:28,829 --> 00:55:26,380

though we think we're pretty smart at

1374

00:55:30,989 --> 00:55:28,839

the time and we spend the next sort of

1375

00:55:33,210 --> 00:55:30,999

years decades centuries millennia

1376
00:55:35,999 --> 00:55:33,220
sometimes mopping up the mess afterwards

1377
00:55:37,319 --> 00:55:36,009
but we have done things and some would

1378
00:55:40,920 --> 00:55:37,329
say we've actually progressed as a

1379
00:55:44,249 --> 00:55:40,930
society probably because of our mistakes

1380
00:55:46,739 --> 00:55:44,259
so how do we then find that line between

1381
00:55:48,749 --> 00:55:46,749
not doing anything because we know that

1382
00:55:50,970 --> 00:55:48,759
we're going to mess up or doing

1383
00:55:53,460 --> 00:55:50,980
something because that's the human

1384
00:55:55,859 --> 00:55:53,470
imperative anyway and I think that's a

1385
00:55:58,529 --> 00:55:55,869
question of our goal so if we're going

1386
00:56:00,299 --> 00:55:58,539
to Mars looking for Martian life if

1387
00:56:02,549 --> 00:56:00,309
we're looking for a second genesis of

1388
00:56:03,779 --> 00:56:02,559

life then we have to be very careful

1389

00:56:05,400 --> 00:56:03,789

that we don't bring any of our own

1390

00:56:07,349 --> 00:56:05,410

species there even if we think there's

1391

00:56:09,569 --> 00:56:07,359

no chance of them surviving however if

1392

00:56:11,339 --> 00:56:09,579

our goal is to terraform Mars make it

1393

00:56:13,859 --> 00:56:11,349

more like earth and make it so that we

1394

00:56:15,950 --> 00:56:13,869

can live there then I think we need to

1395

00:56:18,839 --> 00:56:15,960

basically assume that we're going to

1396

00:56:20,039 --> 00:56:18,849

we're going to be bringing our organisms

1397

00:56:22,229 --> 00:56:20,049

there we're going to make that like

1398

00:56:23,609 --> 00:56:22,239

Earth and then that's our goal we need

1399

00:56:25,019 --> 00:56:23,619

to know what our goal is I think that's

1400

00:56:26,339 --> 00:56:25,029

the most important part about it

1401

00:56:28,109 --> 00:56:26,349

thank you which i think is really

1402

00:56:29,579 --> 00:56:28,119

important and also knowing what other

1403

00:56:31,380 --> 00:56:29,589

people's goals are and how you can

1404

00:56:34,380 --> 00:56:31,390

actually find that that point of

1405

00:56:37,380 --> 00:56:34,390

convergence yes my travisano University

1406

00:56:39,029 --> 00:56:37,390

of Minnesota so following up on that

1407

00:56:40,829 --> 00:56:39,039

last one so there's been a lot of

1408

00:56:42,809 --> 00:56:40,839

efforts to investigate what the

1409

00:56:45,299 --> 00:56:42,819

properties are of invasive species here

1410

00:56:47,680 --> 00:56:45,309

on earth moving them around and by and

1411

00:56:49,299 --> 00:56:47,690

large we have no general consensus

1412

00:56:51,130 --> 00:56:49,309

so that the ecologist and evolutionary

1413

00:56:54,430 --> 00:56:51,140

biologists are really challenged by it

1414

00:56:56,140 --> 00:56:54,440

what you typically see is for for things

1415

00:56:58,930 --> 00:56:56,150

that have their own primary productivity

1416

00:57:01,599 --> 00:56:58,940

to make make energy from from the Sun is

1417

00:57:04,059 --> 00:57:01,609

that they don't get eaten so they escape

1418

00:57:06,730 --> 00:57:04,069

and they're quite happy to not be eaten

1419

00:57:08,349 --> 00:57:06,740

and the things that eat things are don't

1420

00:57:09,940 --> 00:57:08,359

have it just go berserk and eat

1421

00:57:12,370 --> 00:57:09,950

everything so those are those are the

1422

00:57:14,650 --> 00:57:12,380

properties of the of the contamination

1423

00:57:17,079 --> 00:57:14,660

that have frequently been problematic

1424

00:57:18,549 --> 00:57:17,089

great thank you so this is going to be

1425

00:57:20,680 --> 00:57:18,559

the last question because I have one

1426

00:57:23,380 --> 00:57:20,690

final slide we need to wrap up please

1427

00:57:26,799 --> 00:57:23,390

Lukas make Lukas mix from Harvard I

1428

00:57:29,020 --> 00:57:26,809

would say both from a risk perspective

1429

00:57:31,059 --> 00:57:29,030

and from a science perspective one of

1430

00:57:34,510 --> 00:57:31,069

the things we try and do is avoid

1431

00:57:35,950 --> 00:57:34,520

confounding variables so to my mind one

1432

00:57:38,799 --> 00:57:35,960

of the benefits of planetary protection

1433

00:57:41,020 --> 00:57:38,809

is that we save the Mars questions for

1434

00:57:42,849 --> 00:57:41,030

Mars and the earth science questions for

1435

00:57:44,890 --> 00:57:42,859

Earth because we know when the two will

1436

00:57:47,410 --> 00:57:44,900

interact it will be a less predictable

1437

00:57:48,880 --> 00:57:47,420

system than it currently is great okay

1438

00:57:51,370 --> 00:57:48,890

thank you that's a nice place to finish

1439

00:57:53,319 --> 00:57:51,380

so just try and leave this slide again I

1440

00:57:55,870 --> 00:57:53,329

think this is important just for getting

1441

00:58:00,630 --> 00:57:55,880

the feel of where opinion is here it's

1442

00:58:02,950 --> 00:58:00,640

not necessarily the ultimate opinion or

1443

00:58:05,079 --> 00:58:02,960

representing different groups but the

1444

00:58:07,599 --> 00:58:05,089

fact that environmental impacts is

1445

00:58:09,970 --> 00:58:07,609

clearly important here followed by human

1446

00:58:11,140 --> 00:58:09,980

health impact but also loss of public

1447

00:58:13,390 --> 00:58:11,150

that should save lots of public trust

1448

00:58:16,350 --> 00:58:13,400

not loss of public which would be

1449

00:58:21,700 --> 00:58:20,050

but but but the fact that it's there is

1450

00:58:24,190 --> 00:58:21,710

important but I also think it's

1451

00:58:27,160 --> 00:58:24,200

important to understand why loss of

1452

00:58:29,980 --> 00:58:27,170

public trust is relevant here and it's a

1453

00:58:32,410 --> 00:58:29,990

complex question but it's partly down to

1454

00:58:34,570 --> 00:58:32,420

the legitimacy of what different

1455

00:58:36,130 --> 00:58:34,580

organizations what different groups will

1456

00:58:37,900 --> 00:58:36,140

different individuals do here because

1457

00:58:40,540 --> 00:58:37,910

ultimately everything needs to come down

1458

00:58:43,000 --> 00:58:40,550

to the legitimacy that society places on

1459

00:58:46,690 --> 00:58:43,010

it but also it's down to the fact that

1460

00:58:49,930 --> 00:58:46,700

we're all part of this society that has

1461

00:58:52,540 --> 00:58:49,940

a stake in what we do in the solar

1462

00:58:54,640 --> 00:58:52,550

system and beyond so whether you agree

1463

00:58:56,140 --> 00:58:54,650

with people or don't or whether people

1464

00:58:57,580 --> 00:58:56,150

understand the science or don't or

1465

00:58:59,410 --> 00:58:57,590

whether they understand the politics or

1466

00:59:00,600 --> 00:58:59,420

the policy or the broader conditions and

1467

00:59:03,310 --> 00:59:00,610

situations

1468

00:59:05,560 --> 00:59:03,320

everybody has got some state some voice

1469

00:59:07,600 --> 00:59:05,570

in this and so it's really important

1470

00:59:09,340 --> 00:59:07,610

that we actually engage with different

1471

00:59:11,500 --> 00:59:09,350

members and sectors of the public

1472

00:59:14,290 --> 00:59:11,510

different institutions and organizations

1473

00:59:15,610 --> 00:59:14,300

if progress is going to be made so I

1474

00:59:17,470 --> 00:59:15,620

just want to wrap up but I want to wrap

1475

00:59:18,610 --> 00:59:17,480

up by going back to this question that I

1476

00:59:19,870 --> 00:59:18,620

asked you earlier again because I'm

1477

00:59:22,240 --> 00:59:19,880

intrigued to see whether there's any

1478

00:59:23,350 --> 00:59:22,250

difference so final question again what

1479

00:59:25,630 --> 00:59:23,360

comes to mind when you think of

1480

00:59:30,090 --> 00:59:25,640

planetary protection I'll give you a

1481

00:59:36,970 --> 00:59:30,100

second to respond to that glass of wine

1482

00:59:38,260 --> 00:59:36,980

spot-on so the big thing is I go back

1483

00:59:40,120 --> 00:59:38,270

through these that will be different is

1484

00:59:41,140 --> 00:59:40,130

that we've learned how to use emojis at

1485

00:59:43,870 --> 00:59:41,150

this point and we didn't know that

1486

00:59:45,250 --> 00:59:43,880

before so if you're doing that I just

1487

00:59:46,860 --> 00:59:45,260

want to wrap up by saying first of all

1488

00:59:49,900 --> 00:59:46,870

thank you for indulging me

1489

00:59:52,120 --> 00:59:49,910

it's not always easy when you have

1490

00:59:55,300 --> 00:59:52,130

somebody that isn't a deep expert in a

1491

00:59:57,460 --> 00:59:55,310

in an area come to talk but I hope that

1492

00:59:59,800 --> 00:59:57,470

this has actually stimulated some of

1493

01:00:02,290 --> 00:59:59,810

your thinking and especially stimulated

1494

01:00:04,240 --> 01:00:02,300

conversations not about people bulken

1495

01:00:05,740 --> 01:00:04,250

izing themselves into their technical

1496

01:00:07,810 --> 01:00:05,750

areas of expertise when it comes to

1497

01:00:10,420 --> 01:00:07,820

primary protection but having broader

1498

01:00:12,910 --> 01:00:10,430

conversations about what is important

1499

01:00:16,150 --> 01:00:12,920

here to you what is important to others

1500

01:00:18,730 --> 01:00:16,160

and how as communities and as a society

1501

01:00:21,520 --> 01:00:18,740

we can actually move forwards so we

1502

01:00:23,260 --> 01:00:21,530

actually do think seriously about the

1503

01:00:25,540 --> 01:00:23,270

issues around planetary protection at

1504

01:00:27,670 --> 01:00:25,550

the same time not stymieing what we

1505

01:00:28,569 --> 01:00:27,680

think is important in terms of space

1506

01:00:30,080 --> 01:00:28,579

exploration