Mars Sample Return: Planning Considerations for Searching for Biosignatures in Samples from Mars

1
00:00:05,110 --> 00:00:02,710
so uh good morning almost afternoon

2
00:00:06,950 --> 00:00:05,120
everyone thank you for coming today my

3
00:00:08,950 --> 00:00:06,960
name is brandi carrier and i'm going to

4
00:00:11,430 --> 00:00:08,960
be presenting um some of the advanced

5
00:00:13,830 --> 00:00:11,440
planning and planning considerations

6
00:00:15,270 --> 00:00:13,840
related to searching for biosignatures

7
00:00:17,830 --> 00:00:15,280
in the samples that we're hoping to

8
00:00:19,990 --> 00:00:17,840
return via mars sample return

9
00:00:22,470 --> 00:00:20,000
i'm presenting this on behalf of some of

10
00:00:23,750 --> 00:00:22,480
the msr campaign science leadership

11
00:00:25,990 --> 00:00:23,760
including

12
00:00:28,070 --> 00:00:26,000
michael meyer gerhard kaminik

13
00:00:30,470 --> 00:00:28,080

minnie wadwa who's here in the front row

14
00:00:32,950 --> 00:00:30,480
dave beatty fiona thiessen and lindsay

15
00:00:36,709 --> 00:00:32,960
hayes but i'm going to be handling the

16
00:00:42,229 --> 00:00:39,030
so just a little bit of an overview of

17
00:00:43,670 --> 00:00:42,239
the mars sample return campaign um can

18
00:00:44,470 --> 00:00:43,680
you guys everyone can see the slides

19
00:00:46,950 --> 00:00:44,480
okay

20
00:00:49,270 --> 00:00:46,960
um so as i'm sure you all know the mars

21
00:00:51,430 --> 00:00:49,280
sample return campaign is broken into uh

22
00:00:53,110 --> 00:00:51,440
several different kind of components the

23
00:00:56,069 --> 00:00:53,120
first component of course is the the

24
00:00:58,310 --> 00:00:56,079
mars 2020 sample collecting rover which

25
00:01:00,310 --> 00:00:58,320
is doing fantastic work right now on

26
00:01:03,110 --> 00:01:00,320
mars in jezreel crater

27
00:01:05,189 --> 00:01:03,120
um which to establish the geology of the

28
00:01:07,270 --> 00:01:05,199
samples to do the sample selection and

29
00:01:09,270 --> 00:01:07,280
acquisition documenting the sample

30
00:01:10,630 --> 00:01:09,280
context and using all their in-situ

31
00:01:12,070 --> 00:01:10,640
instruments to

32
00:01:13,750 --> 00:01:12,080
generate some advanced knowledge of the

33
00:01:16,550 --> 00:01:13,760
samples to be returned

34
00:01:18,870 --> 00:01:16,560
and then the mars sample return consists

35
00:01:21,270 --> 00:01:18,880
of the flight missions which will go to

36
00:01:23,190 --> 00:01:21,280
mars and retrieve the samples and return

37
00:01:25,670 --> 00:01:23,200
them to earth hopefully returning the

38
00:01:27,990 --> 00:01:25,680

samples in 2033.

39
00:01:29,830 --> 00:01:28,000
so it's a very complex series of

40
00:01:31,910 --> 00:01:29,840
missions there's of course going to be a

41
00:01:33,350 --> 00:01:31,920
sample retrieval aspect

42
00:01:34,630 --> 00:01:33,360
for which the architecture is kind of

43
00:01:36,390 --> 00:01:34,640
still in flux

44
00:01:38,950 --> 00:01:36,400
but the the samples some of the samples

45
00:01:40,630 --> 00:01:38,960
may be delivered by the mars 2020 rover

46
00:01:42,550 --> 00:01:40,640
directly to the

47
00:01:44,789 --> 00:01:42,560
sample retrieval lander and then the

48
00:01:46,469 --> 00:01:44,799
samples will be launched off mars via a

49
00:01:48,710 --> 00:01:46,479
mars ascent vehicle

50
00:01:51,350 --> 00:01:48,720
and released into orbit where they'll be

51
00:01:53,429 --> 00:01:51,360
intercepted by an earth return orbiter

52
00:01:55,749 --> 00:01:53,439
which has a capture containment and

53
00:01:57,830 --> 00:01:55,759
return system which essentially seals

54
00:01:59,830 --> 00:01:57,840
the samples inside

55
00:02:00,870 --> 00:01:59,840
two layers of containment which

56
00:02:03,270 --> 00:02:00,880
essentially

57
00:02:05,109 --> 00:02:03,280
breaks the chain of um

58
00:02:07,030 --> 00:02:05,119
the contact with uncontained mars

59
00:02:10,309 --> 00:02:07,040
material to protect the earth's bio

60
00:02:12,710 --> 00:02:10,319
biosphere and then the ero will transit

61
00:02:14,630 --> 00:02:12,720
back to earth and release an earth entry

62
00:02:16,869 --> 00:02:14,640
system into earth and then hopefully

63
00:02:19,110 --> 00:02:16,879

land somewhere in the utah desert as i

64
00:02:21,510 --> 00:02:19,120
mentioned in 2033.

65
00:02:22,710 --> 00:02:21,520
now from a sample from a sample science

66
00:02:24,550 --> 00:02:22,720
standpoint one of the most important

67
00:02:26,949 --> 00:02:24,560
things in these flight missions is to

68
00:02:29,270 --> 00:02:26,959
maintain the integrity of the samples

69
00:02:30,710 --> 00:02:29,280
throughout all of these phases including

70
00:02:32,869 --> 00:02:30,720
things like not subjecting them to

71
00:02:34,390 --> 00:02:32,879
environmental extremes that would

72
00:02:35,830 --> 00:02:34,400
compromise our ability to do all the

73
00:02:37,110 --> 00:02:35,840
science we hope to do when the samples

74
00:02:38,710 --> 00:02:37,120
come back

75
00:02:40,790 --> 00:02:38,720
so today i'm actually going to focus

76
00:02:42,470 --> 00:02:40,800
mostly on what happens after the samples

77
00:02:43,509 --> 00:02:42,480
come back so

78
00:02:45,830 --> 00:02:43,519
right now we're in kind of a

79
00:02:48,630 --> 00:02:45,840
pre-formulation phase for a sample

80
00:02:50,470 --> 00:02:48,640
receiving project which will be the all

81
00:02:53,190 --> 00:02:50,480
of the earth earth-based infrastructure

82
00:02:55,350 --> 00:02:53,200
for the msr campaign including a sample

83
00:02:57,589 --> 00:02:55,360
receiving facility where the samples

84
00:02:59,430 --> 00:02:57,599
would be held in under bsl4 containment

85
00:03:01,589 --> 00:02:59,440
until they're either deemed safe for

86
00:03:02,790 --> 00:03:01,599
release or sterilized

87
00:03:04,390 --> 00:03:02,800
so of course we'll have to do a sample

88
00:03:06,550 --> 00:03:04,400

safety assessment

89
00:03:08,309 --> 00:03:06,560
a lot of curation-based activities like

90
00:03:10,149 --> 00:03:08,319
basic characterization and preliminary

91
00:03:12,710 --> 00:03:10,159
examination of the samples

92
00:03:14,550 --> 00:03:12,720
and then a lot of hopefully competed

93
00:03:16,309 --> 00:03:14,560
sample science investigations both

94
00:03:19,190 --> 00:03:16,319
inside and outside the sample receiving

95
00:03:20,630 --> 00:03:19,200
facility to kind of get all the science

96
00:03:24,390 --> 00:03:20,640
answers we're hoping to get with these

97
00:03:27,190 --> 00:03:25,910
so because this is an astrobiology

98
00:03:28,710 --> 00:03:27,200
conference i'm going to focus on kind of

99
00:03:29,910 --> 00:03:28,720
the planning considerations that we're

100
00:03:31,990 --> 00:03:29,920
thinking about

101
00:03:34,229 --> 00:03:32,000
that we need to do to optimize the

102
00:03:36,789 --> 00:03:34,239
sample analyses related to looking for

103
00:03:39,430 --> 00:03:36,799
biosignatures of extinct or extent life

104
00:03:41,509 --> 00:03:39,440
in the msr samples and so there's five

105
00:03:43,430 --> 00:03:41,519
main topics i'm gonna i'm gonna mention

106
00:03:44,869 --> 00:03:43,440
here um the first um being contamination

107
00:03:45,830 --> 00:03:44,879
control and knowledge for the samples

108
00:03:47,830 --> 00:03:45,840
which of course is going to be very

109
00:03:49,830 --> 00:03:47,840
important to distinguish between you

110
00:03:52,390 --> 00:03:49,840
know an actual mars biosignature and

111
00:03:54,309 --> 00:03:52,400
potential terrestrial contamination

112
00:03:55,990 --> 00:03:54,319
as i mentioned a moment ago avoiding

113
00:03:57,910 --> 00:03:56,000

environmental extremes that could alter

114
00:03:59,830 --> 00:03:57,920
or degrade potential biosignatures so

115
00:04:01,270 --> 00:03:59,840
things like avoiding elevated

116
00:04:03,429 --> 00:04:01,280
temperatures

117
00:04:05,509 --> 00:04:03,439
and

118
00:04:07,190 --> 00:04:05,519
avoiding high impact scenarios that

119
00:04:09,270 --> 00:04:07,200
could potentially pulverize the samples

120
00:04:12,070 --> 00:04:09,280
and impede our ability to look at you

121
00:04:14,630 --> 00:04:12,080
know stratigraphic context and molecular

122
00:04:15,990 --> 00:04:14,640
patterns in the samples and then the

123
00:04:17,430 --> 00:04:16,000
measurements and investigations that

124
00:04:19,749 --> 00:04:17,440
will be needed to complete the sample

125
00:04:21,430 --> 00:04:19,759
safety assessment and then of course

126
00:04:23,030 --> 00:04:21,440
also

127
00:04:25,110 --> 00:04:23,040
any other measurements of potential

128
00:04:27,189 --> 00:04:25,120
biosignatures determining whether they

129
00:04:28,710 --> 00:04:27,199
could be performed on sterilized samples

130
00:04:30,790 --> 00:04:28,720
outside biocontainment or whether they

131
00:04:32,710 --> 00:04:30,800
need to be planned for as part of the

132
00:04:34,790 --> 00:04:32,720
initial set of experiments inside the

133
00:04:36,390 --> 00:04:34,800
biocontainment facility

134
00:04:37,990 --> 00:04:36,400
and then another really complicated

135
00:04:40,150 --> 00:04:38,000
topic is is kind of planning for the

136
00:04:41,590 --> 00:04:40,160
sample investigation workflow that can

137
00:04:43,270 --> 00:04:41,600
accommodate the measurements i already

138
00:04:45,510 --> 00:04:43,280

mentioned as well as measurements that

139
00:04:46,629 --> 00:04:45,520
are are time sensitive so i'll touch on

140
00:04:49,030 --> 00:04:46,639
each of these things a little bit in the

141
00:04:54,390 --> 00:04:49,040
presentation and then open the floor for

142
00:04:58,629 --> 00:04:56,390
so for contamination control and

143
00:05:00,150 --> 00:04:58,639
knowledge um the mars 2020 rover had

144
00:05:02,469 --> 00:05:00,160
very stringent requirements on

145
00:05:04,629 --> 00:05:02,479
contamination as well as a comprehensive

146
00:05:07,749 --> 00:05:04,639
contamination knowledge program the

147
00:05:10,629 --> 00:05:07,759
overall goal is for the return samples

148
00:05:14,310 --> 00:05:10,639
to basically have less than 10 ppb of

149
00:05:15,430 --> 00:05:14,320
total organic carbon in each sample tube

150
00:05:17,510 --> 00:05:15,440
that represents terrestrial

151
00:05:19,830 --> 00:05:17,520
contamination and there were actually

152
00:05:21,909 --> 00:05:19,840
more stringent limits of i believe

153
00:05:23,510 --> 00:05:21,919
one ppb for several

154
00:05:24,790 --> 00:05:23,520
compounds that are designated tier one

155
00:05:29,350 --> 00:05:24,800
compounds

156
00:05:31,749 --> 00:05:29,360
be indicative of of past or present life

157
00:05:33,830 --> 00:05:31,759
so very very strict requirements

158
00:05:35,430 --> 00:05:33,840
and then the flight missions which are

159
00:05:37,350 --> 00:05:35,440
currently under development are also

160
00:05:39,830 --> 00:05:37,360
following a strict contamination control

161
00:05:41,749 --> 00:05:39,840
and knowledge plan to limit any organ

162
00:05:44,150 --> 00:05:41,759
any organic contamination that can enter

163
00:05:45,510 --> 00:05:44,160

a sealed sample tube while the samples

164
00:05:47,029 --> 00:05:45,520
are in the custody of the flight

165
00:05:48,150 --> 00:05:47,039
missions because as

166
00:05:50,310 --> 00:05:48,160
everyone in this room knows that

167
00:05:51,909 --> 00:05:50,320
contamination can really impede our

168
00:05:53,430 --> 00:05:51,919
abilities to make definitive

169
00:05:56,390 --> 00:05:53,440
measurements and conclusions when we do

170
00:05:59,189 --> 00:05:56,400
our scientific analyses

171
00:06:01,110 --> 00:05:59,199
for the sample receiving project we are

172
00:06:02,950 --> 00:06:01,120
currently working on developing those

173
00:06:05,110 --> 00:06:02,960
contamination control and knowledge

174
00:06:06,870 --> 00:06:05,120
requirements and an implementation plan

175
00:06:08,550 --> 00:06:06,880
for achieving those so one of the really

176
00:06:10,070 --> 00:06:08,560
complicated things about this sample

177
00:06:13,749 --> 00:06:10,080
receiving facility is not only does it

178
00:06:15,430 --> 00:06:13,759
need to be a bsl4 containment facility

179
00:06:16,710 --> 00:06:15,440
to prevent anything from getting out and

180
00:06:19,189 --> 00:06:16,720
potentially contaminating earth's

181
00:06:21,110 --> 00:06:19,199
biosphere but unlike traditional bsl-4

182
00:06:23,189 --> 00:06:21,120
facilities we also have to worry about

183
00:06:24,950 --> 00:06:23,199
contamination getting into the samples

184
00:06:26,550 --> 00:06:24,960
so there are a lot of potential

185
00:06:27,909 --> 00:06:26,560
implementations that could mitigate that

186
00:06:29,749 --> 00:06:27,919
things like double walled isolators

187
00:06:31,909 --> 00:06:29,759
where you have a positive flow

188
00:06:35,029 --> 00:06:31,919

and a negative flow both protecting the

189
00:06:37,510 --> 00:06:35,039
samples and the external environment so

190
00:06:39,510 --> 00:06:37,520
that is a activity that is ongoing and

191
00:06:41,670 --> 00:06:39,520
you know we plan to kind of come up with

192
00:06:45,590 --> 00:06:41,680
a draft implementation plan for that in

193
00:06:48,629 --> 00:06:47,590
okay so for sample environmental control

194
00:06:51,589 --> 00:06:48,639
um

195
00:06:53,670 --> 00:06:51,599
biosignal biosignature degradation will

196
00:06:55,029 --> 00:06:53,680
occur if the msr samples are exposed to

197
00:06:56,230 --> 00:06:55,039
temperatures that are significantly

198
00:06:58,309 --> 00:06:56,240
higher than they've seen in their

199
00:07:00,309 --> 00:06:58,319
natural history on mars and i believe

200
00:07:03,189 --> 00:07:00,319
mark seftin has a presentation on this

201
00:07:05,990 --> 00:07:03,199
tomorrow we had formed a temperature

202
00:07:08,150 --> 00:07:06,000
time tiger team um earlier this year and

203
00:07:10,230 --> 00:07:08,160
their final report is is about to come

204
00:07:12,629 --> 00:07:10,240
out very soon that looked at what are

205
00:07:14,790 --> 00:07:12,639
the consequences to the science we can

206
00:07:16,870 --> 00:07:14,800
do with the mars samples if the

207
00:07:19,270 --> 00:07:16,880
temperatures are exposed to temperatures

208
00:07:20,710 --> 00:07:19,280
above 30 degrees c for for varying

209
00:07:22,629 --> 00:07:20,720
periods of time and what are the

210
00:07:24,870 --> 00:07:22,639
implications of that for science and

211
00:07:27,830 --> 00:07:24,880
that information is used to

212
00:07:30,390 --> 00:07:27,840
evaluate any requests or waivers from

213
00:07:32,710 --> 00:07:30,400

the projects to exceed that plus 30c

214
00:07:34,390 --> 00:07:32,720
temperature so right now we have a

215
00:07:35,510 --> 00:07:34,400
maximum temperature requirement of plus

216
00:07:37,270 --> 00:07:35,520
30 c

217
00:07:39,510 --> 00:07:37,280
during the retrieval and transport of

218
00:07:40,790 --> 00:07:39,520
the samples to earth and we're very much

219
00:07:42,550 --> 00:07:40,800
hoping that we can we can meet that

220
00:07:44,309 --> 00:07:42,560
requirement we also have reason to

221
00:07:46,309 --> 00:07:44,319
believe that the samples will not have

222
00:07:49,029 --> 00:07:46,319
seen temperatures higher than that

223
00:07:50,710 --> 00:07:49,039
during the custody of mars 2020 or

224
00:07:52,550 --> 00:07:50,720
potentially while sitting in a depot on

225
00:07:53,990 --> 00:07:52,560
the martian surface

226
00:07:55,749 --> 00:07:54,000
and again for the sample receiving

227
00:07:58,230 --> 00:07:55,759
project it's a little bit easier to do

228
00:08:00,469 --> 00:07:58,240
thermal control in a in a building than

229
00:08:02,230 --> 00:08:00,479
it is on a flight mission so we expect

230
00:08:04,869 --> 00:08:02,240
there to be a similar thermal

231
00:08:06,869 --> 00:08:04,879
requirements for the msr samples and

232
00:08:08,070 --> 00:08:06,879
including the ability to potentially

233
00:08:10,469 --> 00:08:08,080
preserve

234
00:08:11,830 --> 00:08:10,479
select samples or sample splits at much

235
00:08:12,950 --> 00:08:11,840
colder temperatures if we think there

236
00:08:14,309 --> 00:08:12,960
are signs

237
00:08:19,670 --> 00:08:14,319
of

238
00:08:21,830 --> 00:08:19,680

or extinct life

239
00:08:24,230 --> 00:08:21,840
the other uh environmental consideration

240
00:08:25,670 --> 00:08:24,240
is impact and vibration as i mentioned a

241
00:08:27,909 --> 00:08:25,680
lot of the value of these samples comes

242
00:08:30,230 --> 00:08:27,919
from having sample cores where you can

243
00:08:31,430 --> 00:08:30,240
see the stratigraphic relationships of

244
00:08:33,430 --> 00:08:31,440
different minerals and different

245
00:08:35,670 --> 00:08:33,440
depositional layers to each other to

246
00:08:36,949 --> 00:08:35,680
kind of derive a history of habitability

247
00:08:39,670 --> 00:08:36,959
and potentially a history of

248
00:08:41,909 --> 00:08:39,680
biosignatures on mars as the samples

249
00:08:44,470 --> 00:08:41,919
were naturally deposited

250
00:08:46,790 --> 00:08:44,480
so there is a general goal for mars

251
00:08:48,790 --> 00:08:46,800
sample return as a whole including mars

252
00:08:51,430 --> 00:08:48,800
2020 and the flight missions to limit

253
00:08:53,110 --> 00:08:51,440
the overall fracturing of the samples so

254
00:08:54,230 --> 00:08:53,120
that greater than

255
00:08:56,150 --> 00:08:54,240
65

256
00:08:57,590 --> 00:08:56,160
of the samples are in pieces with the

257
00:09:00,150 --> 00:08:57,600
longest dimension

258
00:09:01,670 --> 00:09:00,160
um no shorter than 10 millimeters so

259
00:09:04,230 --> 00:09:01,680
that even if we do have fracturing we

260
00:09:05,670 --> 00:09:04,240
can hopefully you know reconstruct um

261
00:09:07,269 --> 00:09:05,680
well it's like a puzzle right putting

262
00:09:08,949 --> 00:09:07,279
the puzzle pieces back together but

263
00:09:10,790 --> 00:09:08,959

obviously the less fracturing we induce

264
00:09:12,150 --> 00:09:10,800
the better

265
00:09:13,670 --> 00:09:12,160
and currently there's an activity

266
00:09:15,910 --> 00:09:13,680
underway by the mars sample return

267
00:09:17,910 --> 00:09:15,920
program looking at their other different

268
00:09:19,509 --> 00:09:17,920
vibrational and impact

269
00:09:20,470 --> 00:09:19,519
environments throughout the entire

270
00:09:22,630 --> 00:09:20,480
course

271
00:09:24,949 --> 00:09:22,640
of the retrieval and delivery missions

272
00:09:29,110 --> 00:09:24,959
to ensure that we can preserve those

273
00:09:33,750 --> 00:09:31,430
so once the samples arrive at the sample

274
00:09:36,389 --> 00:09:33,760
receiving facility and we start you know

275
00:09:37,910 --> 00:09:36,399
extracting them from the hardware and

276
00:09:39,110 --> 00:09:37,920
hopefully opening the tubes there will

277
00:09:41,030 --> 00:09:39,120
be a

278
00:09:43,269 --> 00:09:41,040
suite of curation activities

279
00:09:45,190 --> 00:09:43,279
for example ct scanning of the tubes

280
00:09:46,870 --> 00:09:45,200
before they're opened and things like

281
00:09:48,070 --> 00:09:46,880
that to get an idea of the context and

282
00:09:51,030 --> 00:09:48,080
how the pieces of the samples fit

283
00:09:52,710 --> 00:09:51,040
together and to identify the samples to

284
00:09:54,470 --> 00:09:52,720
potentially open first

285
00:09:57,269 --> 00:09:54,480
so as i mentioned due to planetary

286
00:09:58,870 --> 00:09:57,279
protection concerns

287
00:10:01,269 --> 00:09:58,880
all of the samples will have to stay

288
00:10:03,430 --> 00:10:01,279

under biosafety level 4 containment

289
00:10:05,910 --> 00:10:03,440
until they are deemed safe for release

290
00:10:08,389 --> 00:10:05,920
via a sample safety assessment

291
00:10:09,750 --> 00:10:08,399
or until they are sterilized

292
00:10:11,670 --> 00:10:09,760
now

293
00:10:14,069 --> 00:10:11,680
two of the most common ways to sterilize

294
00:10:15,269 --> 00:10:14,079
samples are with you know high heat

295
00:10:17,829 --> 00:10:15,279
or with

296
00:10:20,470 --> 00:10:17,839
radiation and both of those things would

297
00:10:23,190 --> 00:10:20,480
impact the preservation of biosignatures

298
00:10:24,630 --> 00:10:23,200
particularly organic biosignatures that

299
00:10:26,389 --> 00:10:24,640
we really want to look for in the

300
00:10:28,790 --> 00:10:26,399
samples

301
00:10:30,470 --> 00:10:28,800
so how do we actually prove that the

302
00:10:31,910 --> 00:10:30,480
samples are safe i'm sure as you can

303
00:10:33,750 --> 00:10:31,920
imagine this is this is a complicated

304
00:10:36,230 --> 00:10:33,760
question because essentially you have to

305
00:10:37,910 --> 00:10:36,240
disprove life rather than than prove

306
00:10:40,150 --> 00:10:37,920
life and it's very hard to prove a

307
00:10:42,470 --> 00:10:40,160
negative as i i'm sure you all know

308
00:10:44,870 --> 00:10:42,480
so um over the last few years the

309
00:10:47,030 --> 00:10:44,880
committee on space research or coast bar

310
00:10:48,630 --> 00:10:47,040
the sample safety assessment framework

311
00:10:50,550 --> 00:10:48,640
group

312
00:10:52,069 --> 00:10:50,560
has been working to kind of develop a

313
00:10:54,630 --> 00:10:52,079

framework for how to go about

314
00:10:56,710 --> 00:10:54,640
implementing a sample safety assessment

315
00:10:58,310 --> 00:10:56,720
for the msr samples

316
00:10:59,990 --> 00:10:58,320
so the objective of the safety

317
00:11:01,750 --> 00:11:00,000
assessment would be to evaluate whether

318
00:11:03,590 --> 00:11:01,760
the samples returned from mars could be

319
00:11:05,990 --> 00:11:03,600
harmful for earth's systems for the

320
00:11:07,910 --> 00:11:06,000
environment for the biosphere for

321
00:11:09,750 --> 00:11:07,920
geochemical cycles

322
00:11:11,829 --> 00:11:09,760
and so the scope of the sample safety

323
00:11:13,509 --> 00:11:11,839
assessment framework was to evaluate

324
00:11:15,670 --> 00:11:13,519
whether the presence of martian life can

325
00:11:18,069 --> 00:11:15,680
be definitively excluded

326
00:11:19,670 --> 00:11:18,079
in samples from mars to within a certain

327
00:11:21,750 --> 00:11:19,680
confidence ratio

328
00:11:24,790 --> 00:11:21,760
if the presence of marginalized can't be

329
00:11:27,030 --> 00:11:24,800
excluded via a series of investigations

330
00:11:29,190 --> 00:11:27,040
a holding critical review phase would be

331
00:11:30,790 --> 00:11:29,200
established to evaluate the risk

332
00:11:32,790 --> 00:11:30,800
management measures and decide on the

333
00:11:35,269 --> 00:11:32,800
next steps

334
00:11:36,550 --> 00:11:35,279
so um there's actually a paper put out

335
00:11:39,030 --> 00:11:36,560
by this working group that's going to be

336
00:11:40,630 --> 00:11:39,040
available online in astrobiology in the

337
00:11:41,990 --> 00:11:40,640
next week or so so you'll be able to

338
00:11:43,990 --> 00:11:42,000

look at more details at that point but

339
00:11:46,310 --> 00:11:44,000
i'll just go through a little bit of the

340
00:11:48,949 --> 00:11:46,320
of the report here

341
00:11:51,590 --> 00:11:48,959
so there's a few principles that provide

342
00:11:53,670 --> 00:11:51,600
the basis of this framework so first of

343
00:11:55,269 --> 00:11:53,680
all you the use of a hypothesis-driven

344
00:11:57,910 --> 00:11:55,279
approach in the development for life

345
00:11:59,910 --> 00:11:57,920
detection investigations so

346
00:12:01,030 --> 00:11:59,920
the measurements for science which

347
00:12:02,790 --> 00:12:01,040
basically starts from the null

348
00:12:04,949 --> 00:12:02,800
hypothesis that there are no that there

349
00:12:06,710 --> 00:12:04,959
is no life in the samples and the same

350
00:12:08,550 --> 00:12:06,720
sample safety assessment which starts

351
00:12:09,670 --> 00:12:08,560
from the positive hypothesis and

352
00:12:11,030 --> 00:12:09,680
attempts to

353
00:12:12,470 --> 00:12:11,040
disprove that there's life in the

354
00:12:14,949 --> 00:12:12,480
samples

355
00:12:16,230 --> 00:12:14,959
although these are two different

356
00:12:17,829 --> 00:12:16,240
regimes

357
00:12:18,870 --> 00:12:17,839
it relies on a lot of the same types of

358
00:12:21,350 --> 00:12:18,880
measurements and scientific

359
00:12:23,110 --> 00:12:21,360
investigations as we go forward

360
00:12:24,949 --> 00:12:23,120
so the sample safety assessment has to

361
00:12:27,110 --> 00:12:24,959
be data driven and it needs to be

362
00:12:29,509 --> 00:12:27,120
responsive to the results of different

363
00:12:31,750 --> 00:12:29,519

investigations as the as the results are

364
00:12:33,590 --> 00:12:31,760
derived

365
00:12:35,670 --> 00:12:33,600
so the main distinction between the

366
00:12:37,190 --> 00:12:35,680
scientific objective to search for life

367
00:12:38,710 --> 00:12:37,200
and the sample safety assessment is

368
00:12:40,710 --> 00:12:38,720
mainly the degree of rigor and

369
00:12:42,790 --> 00:12:40,720
supervision that will be applied so

370
00:12:44,629 --> 00:12:42,800
there'll be a much higher standard for

371
00:12:46,949 --> 00:12:44,639
evaluating whether the samples are

372
00:12:48,389 --> 00:12:46,959
actually safe than potentially there is

373
00:12:50,629 --> 00:12:48,399
in looking at you know science results

374
00:12:51,910 --> 00:12:50,639
for science sake and a lot of regulatory

375
00:12:54,470 --> 00:12:51,920
agencies will be involved here for

376
00:12:57,030 --> 00:12:54,480
example the the cdc and potentially the

377
00:13:00,389 --> 00:12:57,040
the epa and other governmental

378
00:13:04,389 --> 00:13:02,470
so there's a few major elements that

379
00:13:07,670 --> 00:13:04,399
drive the sample safety assessment

380
00:13:09,110 --> 00:13:07,680
framework the use of bayesian statistics

381
00:13:11,190 --> 00:13:09,120
with so you start with a starting

382
00:13:13,110 --> 00:13:11,200
hypothesis of you know what is the

383
00:13:15,670 --> 00:13:13,120
likelihood of there being life in the

384
00:13:17,670 --> 00:13:15,680
samples estimating the number of tests

385
00:13:20,069 --> 00:13:17,680
you will need for each sample tube how

386
00:13:22,069 --> 00:13:20,079
many subsamples you'll have to analyze

387
00:13:25,350 --> 00:13:22,079
and then a targeted sub sampling

388
00:13:27,030 --> 00:13:25,360

strategy which would be used to identify

389
00:13:29,990 --> 00:13:27,040
the pieces in the samples that have the

390
00:13:32,230 --> 00:13:30,000
highest priority for preserving evidence

391
00:13:33,829 --> 00:13:32,240
of well extant life which is really the

392
00:13:35,509 --> 00:13:33,839
question here although a lot of the

393
00:13:37,030 --> 00:13:35,519
investigations that you would do for

394
00:13:38,550 --> 00:13:37,040
extant life are similar to the ones you

395
00:13:41,189 --> 00:13:38,560
would do for extinct life

396
00:13:43,350 --> 00:13:41,199
and so this requires structural chemical

397
00:13:45,110 --> 00:13:43,360
and mineralogical information

398
00:13:46,949 --> 00:13:45,120
um to be collected during the test

399
00:13:48,949 --> 00:13:46,959
sequence and then there'll be a need to

400
00:13:50,790 --> 00:13:48,959
set up a decision framework which will

401
00:13:53,269 --> 00:13:50,800
include regulations for you know quality

402
00:13:55,590 --> 00:13:53,279
control what are the processes for data

403
00:13:58,389 --> 00:13:55,600
reduction what are the criteria for the

404
00:14:00,230 --> 00:13:58,399
various steps in the test sequence and

405
00:14:02,629 --> 00:14:00,240
then you know when do you pause and

406
00:14:04,949 --> 00:14:02,639
review if you have a positive detection

407
00:14:06,710 --> 00:14:04,959
or an uncertain detection

408
00:14:09,189 --> 00:14:06,720
so the main purpose as i mentioned of

409
00:14:11,110 --> 00:14:09,199
the test sequence is to exclude the

410
00:14:13,590 --> 00:14:11,120
presence of martian life specifically

411
00:14:15,910 --> 00:14:13,600
extent martian life

412
00:14:18,150 --> 00:14:15,920
so the sensitivity and specificity of

413
00:14:19,670 --> 00:14:18,160

the overall test sequence in each in

414
00:14:21,829 --> 00:14:19,680
each experiment that's done in the test

415
00:14:23,269 --> 00:14:21,839
sequence in influences the number of

416
00:14:25,670 --> 00:14:23,279
tests needed to

417
00:14:27,269 --> 00:14:25,680
achieve a certain level of assurance

418
00:14:30,069 --> 00:14:27,279
so and then once you've done all these

419
00:14:32,069 --> 00:14:30,079
tests of on n sub samples of a specific

420
00:14:33,750 --> 00:14:32,079
sample tube you have a result that you

421
00:14:35,829 --> 00:14:33,760
think is verified within a predefined

422
00:14:37,670 --> 00:14:35,839
level of assurance it's only valid for

423
00:14:39,030 --> 00:14:37,680
that one sample tube because as we know

424
00:14:39,990 --> 00:14:39,040
the samples are collected from from

425
00:14:41,910 --> 00:14:40,000
different places and they're

426
00:14:43,910 --> 00:14:41,920
representative of different periods in

427
00:14:46,310 --> 00:14:43,920
martian time and different environments

428
00:14:48,069 --> 00:14:46,320
which may or may not be more conducive

429
00:14:49,750 --> 00:14:48,079
to extent life

430
00:14:52,310 --> 00:14:49,760
but the results you get from one sample

431
00:14:54,310 --> 00:14:52,320
tube do inform the pre-test probability

432
00:14:56,550 --> 00:14:54,320
for other sample tubes

433
00:14:58,710 --> 00:14:56,560
so here's kind of an overview of the

434
00:15:01,750 --> 00:14:58,720
integrated test sequence that's being

435
00:15:03,750 --> 00:15:01,760
proposed by the sample safety assessment

436
00:15:06,069 --> 00:15:03,760
working group so you can see that there

437
00:15:07,350 --> 00:15:06,079
are basically nine steps here includes

438
00:15:09,110 --> 00:15:07,360

things like the three-dimensional

439
00:15:11,110 --> 00:15:09,120
structure of the samples

440
00:15:13,030 --> 00:15:11,120
analysis of the headspace gas from the

441
00:15:14,790 --> 00:15:13,040
sample tubes

442
00:15:17,030 --> 00:15:14,800
looking at the chemistry and mineralogy

443
00:15:19,030 --> 00:15:17,040
of the samples and then using refined

444
00:15:20,550 --> 00:15:19,040
subsampling to choose

445
00:15:23,509 --> 00:15:20,560
the subsamples that have the highest

446
00:15:25,750 --> 00:15:23,519
probability of preserving extant life

447
00:15:28,150 --> 00:15:25,760
based on the chemistry and mineralogy

448
00:15:31,030 --> 00:15:28,160
and then a suite of analyses related to

449
00:15:32,269 --> 00:15:31,040
looking for organic molecules molecular

450
00:15:34,949 --> 00:15:32,279
patterns

451
00:15:36,550 --> 00:15:34,959
macromolecules and these steps four

452
00:15:38,870 --> 00:15:36,560
through six all kind of feed into step

453
00:15:40,870 --> 00:15:38,880
seven which is to exclude life as we

454
00:15:42,150 --> 00:15:40,880
know it from the samples

455
00:15:43,910 --> 00:15:42,160
and then of course there needs to be

456
00:15:45,430 --> 00:15:43,920
another step which is step eight which

457
00:15:47,990 --> 00:15:45,440
uses other more

458
00:15:50,150 --> 00:15:48,000
agnostic uh life detection

459
00:15:52,710 --> 00:15:50,160
measurements to rule out life as we

460
00:15:54,790 --> 00:15:52,720
don't know it and then again a stop and

461
00:15:56,710 --> 00:15:54,800
a critical review phase to determine

462
00:15:58,870 --> 00:15:56,720
whether we have actually

463
00:16:02,150 --> 00:15:58,880

excluded martian life in the samples to

464
00:16:03,590 --> 00:16:02,160
a defined degree of assurance

465
00:16:05,189 --> 00:16:03,600
and then you can decide on the next

466
00:16:07,110 --> 00:16:05,199
steps is that sample that was in that

467
00:16:08,949 --> 00:16:07,120
sample tube is it is it safe to release

468
00:16:10,230 --> 00:16:08,959
to outside laboratories for further

469
00:16:13,189 --> 00:16:10,240
analysis

470
00:16:15,030 --> 00:16:13,199
are more analyses needed does the sample

471
00:16:17,030 --> 00:16:15,040
does the sample indicate that there is

472
00:16:18,230 --> 00:16:17,040
martian life in the in the sample tube

473
00:16:19,749 --> 00:16:18,240
in which case

474
00:16:21,110 --> 00:16:19,759
of course there's a whole other suite of

475
00:16:23,110 --> 00:16:21,120
experiments you want to do but you'd

476
00:16:24,470 --> 00:16:23,120
have to do them inside bio containment

477
00:16:25,910 --> 00:16:24,480
you probably wouldn't want to sterilize

478
00:16:28,310 --> 00:16:25,920
a sample that you think has margin life

479
00:16:30,310 --> 00:16:28,320
in it until you've fully analyzed

480
00:16:31,509 --> 00:16:30,320
anything that's in that tube so again

481
00:16:33,350 --> 00:16:31,519
these point to more things that would

482
00:16:35,030 --> 00:16:33,360
need to be done in a bio containment

483
00:16:36,790 --> 00:16:35,040
environment whereas if you think you've

484
00:16:39,110 --> 00:16:36,800
definitively ruled out life perhaps you

485
00:16:40,550 --> 00:16:39,120
could release that sample for you know

486
00:16:48,470 --> 00:16:40,560
all kinds of other measurements outside

487
00:16:52,870 --> 00:16:51,030
so in order to fully kind of scope what

488
00:16:54,230 --> 00:16:52,880

needs to be done in a sample receiving

489
00:16:55,670 --> 00:16:54,240
facility we need to think about all the

490
00:16:57,670 --> 00:16:55,680
possibilities

491
00:17:00,550 --> 00:16:57,680
you know if we can't to rule out extant

492
00:17:01,590 --> 00:17:00,560
life in a sample tube and we can only

493
00:17:02,870 --> 00:17:01,600
release samples that have been

494
00:17:04,549 --> 00:17:02,880
sterilized

495
00:17:06,069 --> 00:17:04,559
and we know we need to know what kind of

496
00:17:07,669 --> 00:17:06,079
measurements and investigations would be

497
00:17:10,949 --> 00:17:07,679
impacted by those

498
00:17:13,590 --> 00:17:10,959
sterilization processes so the msr

499
00:17:15,350 --> 00:17:13,600
science planning group 2

500
00:17:16,470 --> 00:17:15,360
has a report on this topic trying to

501
00:17:18,390 --> 00:17:16,480
identify

502
00:17:19,909 --> 00:17:18,400
all of the potential objectives of mars

503
00:17:21,590 --> 00:17:19,919
sample return all of the potential

504
00:17:24,150 --> 00:17:21,600
investigations we'd want to do

505
00:17:26,150 --> 00:17:24,160
starting from the international msr

506
00:17:28,150 --> 00:17:26,160
objectives and samples team study from

507
00:17:28,950 --> 00:17:28,160
2018

508
00:17:30,789 --> 00:17:28,960
and

509
00:17:33,430 --> 00:17:30,799
deriving

510
00:17:36,310 --> 00:17:33,440
which of these investigations would be

511
00:17:37,990 --> 00:17:36,320
degrade degraded or you know altered if

512
00:17:41,350 --> 00:17:38,000
we were to sterilize the samples using

513
00:17:43,669 --> 00:17:41,360

either uh thermal or gamma irradiation

514
00:17:45,190 --> 00:17:43,679
sterilization techniques

515
00:17:46,789 --> 00:17:45,200
and again this is this report also is

516
00:17:51,110 --> 00:17:46,799
available this one's already available

517
00:17:54,150 --> 00:17:53,190
so the challenge as i mentioned is that

518
00:17:56,070 --> 00:17:54,160
the samples are going to be held in

519
00:17:58,470 --> 00:17:56,080
biocontainment until they're deemed safe

520
00:18:00,950 --> 00:17:58,480
or are rendered safe via sterilization

521
00:18:02,549 --> 00:18:00,960
and we know that sterilization processes

522
00:18:04,230 --> 00:18:02,559
would permanently alter certain

523
00:18:05,590 --> 00:18:04,240
characteristics of the sample and a lot

524
00:18:07,350 --> 00:18:05,600
of those characteristics are things that

525
00:18:08,470 --> 00:18:07,360
have high value or high interest to

526
00:18:10,549 --> 00:18:08,480
science

527
00:18:12,390 --> 00:18:10,559
so if these measurements aren't planned

528
00:18:13,669 --> 00:18:12,400
to happen inside the sample receiving

529
00:18:17,110 --> 00:18:13,679
facility

530
00:18:19,590 --> 00:18:17,120
scientific inves information may be lost

531
00:18:21,590 --> 00:18:19,600
so the starting point here was to

532
00:18:23,430 --> 00:18:21,600
identify the sample attributes that

533
00:18:25,510 --> 00:18:23,440
would be vulnerable to alteration via

534
00:18:27,510 --> 00:18:25,520
either heat or gamma or radiation

535
00:18:30,070 --> 00:18:27,520
sterilization and of course this

536
00:18:32,390 --> 00:18:30,080
includes biosignatures of extant or

537
00:18:34,710 --> 00:18:32,400
extinct martian life

538
00:18:36,870 --> 00:18:34,720

potentially the

539
00:18:39,110 --> 00:18:36,880
composition of the sample head space gas

540
00:18:40,789 --> 00:18:39,120
which has evolved from the sample

541
00:18:43,190 --> 00:18:40,799
during transport

542
00:18:45,590 --> 00:18:43,200
indicators of paleo habitability and

543
00:18:48,230 --> 00:18:45,600
biosignature preservation potential and

544
00:18:50,549 --> 00:18:48,240
also properties of either volatile rich

545
00:18:53,909 --> 00:18:50,559
or amorphous materials which are very

546
00:18:56,230 --> 00:18:53,919
sensitive to elevated heat

547
00:18:57,190 --> 00:18:56,240
and then we also identified overlap

548
00:18:58,870 --> 00:18:57,200
between

549
00:19:00,710 --> 00:18:58,880
measurements that are time sensitive

550
00:19:03,510 --> 00:19:00,720
which i'll talk more about in the next

551
00:19:06,070 --> 00:19:03,520
module and then sterilization sensitive

552
00:19:07,669 --> 00:19:06,080
and then we we feel that we can plan to

553
00:19:09,669 --> 00:19:07,679
conduct anything that's quote unquote

554
00:19:11,430 --> 00:19:09,679
sterilization tolerant

555
00:19:13,110 --> 00:19:11,440
outside of the sample receiving facility

556
00:19:14,630 --> 00:19:13,120
so there are many measurements that

557
00:19:16,870 --> 00:19:14,640
aren't related to organics or bio

558
00:19:18,549 --> 00:19:16,880
signatures things like geochronology

559
00:19:21,110 --> 00:19:18,559
related measurements things that are

560
00:19:23,909 --> 00:19:21,120
much more tolerant to high heat so

561
00:19:25,830 --> 00:19:23,919
theoretically some samples or subsamples

562
00:19:27,830 --> 00:19:25,840
could be sterilized relatively quickly

563
00:19:29,909 --> 00:19:27,840

and released to outside laboratories to

564
00:19:31,270 --> 00:19:29,919
do these types of investigations so we

565
00:19:32,310 --> 00:19:31,280
didn't worry too much about those

566
00:19:34,390 --> 00:19:32,320
because we think that there's a good

567
00:19:35,909 --> 00:19:34,400
pathway to get those done

568
00:19:39,590 --> 00:19:35,919
and so one of the main findings here was

569
00:19:41,590 --> 00:19:39,600
that most aspects of msr science

570
00:19:43,830 --> 00:19:41,600
should be planned to be performed on

571
00:19:45,350 --> 00:19:43,840
samples deemed safe in uncontained

572
00:19:47,029 --> 00:19:45,360
laboratories so whether that's by

573
00:19:48,150 --> 00:19:47,039
sterilization or the sample safety

574
00:19:51,430 --> 00:19:48,160
assessment

575
00:19:53,029 --> 00:19:51,440
however other aspects of msr science

576
00:19:55,350 --> 00:19:53,039
would be both time sensitive and

577
00:19:57,270 --> 00:19:55,360
sterilization sensitive including and

578
00:19:59,430 --> 00:19:57,280
especially the search for life

579
00:20:01,190 --> 00:19:59,440
assessment of habitability and volatile

580
00:20:03,270 --> 00:20:01,200
exchange processes so these we need to

581
00:20:05,350 --> 00:20:03,280
plan for how to carry them out

582
00:20:08,549 --> 00:20:05,360
successfully inside a biocontainment

583
00:20:12,390 --> 00:20:10,470
so one of the kind of key strategies

584
00:20:14,230 --> 00:20:12,400
here you see this um this red box that

585
00:20:16,470 --> 00:20:14,240
says srf these are the things we think

586
00:20:18,070 --> 00:20:16,480
need to be need to happen within within

587
00:20:19,510 --> 00:20:18,080
the sample receiving facility we need to

588
00:20:21,029 --> 00:20:19,520

have the instruments and the

589
00:20:22,950 --> 00:20:21,039
capabilities and the infrastructure to

590
00:20:24,710 --> 00:20:22,960
do these so there's the curation related

591
00:20:26,549 --> 00:20:24,720
things that i mentioned so basically

592
00:20:28,789 --> 00:20:26,559
everything you need to do to develop a

593
00:20:29,830 --> 00:20:28,799
sample catalog and effectively allocate

594
00:20:31,270 --> 00:20:29,840
the right samples for the right

595
00:20:33,750 --> 00:20:31,280
investigations

596
00:20:35,909 --> 00:20:33,760
the sample safety assessment protocol

597
00:20:37,750 --> 00:20:35,919
any science that's time sensitive so

598
00:20:40,070 --> 00:20:37,760
basically things that start to change or

599
00:20:42,310 --> 00:20:40,080
we re-equilibrate once you um once you

600
00:20:44,149 --> 00:20:42,320
remove the the caps from the tubes

601
00:20:45,830 --> 00:20:44,159
and then any sterilization sensitive

602
00:20:47,750 --> 00:20:45,840
science that overlaps with those above

603
00:20:49,270 --> 00:20:47,760
three categories and then you have this

604
00:20:51,350 --> 00:20:49,280
decision point that you will that you

605
00:20:53,029 --> 00:20:51,360
reach after the sample safety assessment

606
00:20:55,430 --> 00:20:53,039
is it okay to release unsterilized

607
00:20:56,950 --> 00:20:55,440
samples if yes then you you've released

608
00:20:59,830 --> 00:20:56,960
the samples and you work on released

609
00:21:01,830 --> 00:20:59,840
unsterilized samples in uncontained labs

610
00:21:03,830 --> 00:21:01,840
you know all over the world

611
00:21:05,669 --> 00:21:03,840
if it's determined that

612
00:21:07,190 --> 00:21:05,679
we can't release unsterilized samples

613
00:21:09,270 --> 00:21:07,200

due to you know a positive or

614
00:21:10,950 --> 00:21:09,280
inconclusive result we could sterilize

615
00:21:12,630 --> 00:21:10,960
and release some samples in to

616
00:21:14,710 --> 00:21:12,640
uncontained laboratories for for things

617
00:21:16,310 --> 00:21:14,720
that are not sterilization sensitive but

618
00:21:19,430 --> 00:21:16,320
we would need to add contingency

619
00:21:21,590 --> 00:21:19,440
capability inside biocontainment somehow

620
00:21:23,909 --> 00:21:21,600
to do any other sterilization sensitive

621
00:21:26,230 --> 00:21:23,919
science and particularly if if signs of

622
00:21:27,270 --> 00:21:26,240
life are detected in the samples you can

623
00:21:28,310 --> 00:21:27,280
you can imagine a whole suite of

624
00:21:30,070 --> 00:21:28,320
experiments you would want to do to

625
00:21:32,390 --> 00:21:30,080
characterize that life and that would

626
00:21:37,669 --> 00:21:32,400
have to be done under biocontainment

627
00:21:41,830 --> 00:21:39,990
so this goes back to again how do you

628
00:21:43,430 --> 00:21:41,840
develop a sample workflow that makes

629
00:21:45,029 --> 00:21:43,440
sense that accommodates all of the

630
00:21:46,710 --> 00:21:45,039
measurements that i mentioned plus the

631
00:21:48,710 --> 00:21:46,720
time-sensitive measurements

632
00:21:50,710 --> 00:21:48,720
so you know as i just mentioned that

633
00:21:52,470 --> 00:21:50,720
well as i mentioned several times the

634
00:21:53,990 --> 00:21:52,480
samples will be held in the srf until

635
00:21:56,549 --> 00:21:54,000
they're deemed safe

636
00:21:57,750 --> 00:21:56,559
but once you break the sample tube seal

637
00:21:58,950 --> 00:21:57,760
you're going to get an equilibrium

638
00:22:00,549 --> 00:21:58,960

change that's going to cause

639
00:22:02,710 --> 00:22:00,559
irreversible changes over time

640
00:22:04,710 --> 00:22:02,720
particularly in volatile rich

641
00:22:06,549 --> 00:22:04,720
samples where you have an equilibrium

642
00:22:08,710 --> 00:22:06,559
between the martian atmosphere that's

643
00:22:11,110 --> 00:22:08,720
been in the sample tube for however many

644
00:22:12,710 --> 00:22:11,120
years since the samples have

645
00:22:14,630 --> 00:22:12,720
have been collected until the sample

646
00:22:16,789 --> 00:22:14,640
tube is open and then you'll potentially

647
00:22:19,270 --> 00:22:16,799
put that open sample tube under you know

648
00:22:20,549 --> 00:22:19,280
an inert atmosphere which tend to be

649
00:22:23,590 --> 00:22:20,559
pretty dry so you're going to drive

650
00:22:26,230 --> 00:22:23,600
dehydration reactions among other things

651
00:22:28,230 --> 00:22:26,240
so this group of the msr science

652
00:22:29,669 --> 00:22:28,240
planning group phase 2 which also has a

653
00:22:32,470 --> 00:22:29,679
full report available on the

654
00:22:34,390 --> 00:22:32,480
astrobiology website tried to identify

655
00:22:36,149 --> 00:22:34,400
what processes

656
00:22:38,149 --> 00:22:36,159
would contribute to degradation of

657
00:22:40,070 --> 00:22:38,159
important sample attributes at the time

658
00:22:41,350 --> 00:22:40,080
scales of several months or less which

659
00:22:43,350 --> 00:22:41,360
we estimate is the amount of time it

660
00:22:45,350 --> 00:22:43,360
would actually take to deem a sample

661
00:22:47,190 --> 00:22:45,360
safe and and send it to do analysis

662
00:22:49,350 --> 00:22:47,200
elsewhere and they identified things

663
00:22:50,630 --> 00:22:49,360

like degradation of organics which of

664
00:22:52,950 --> 00:22:50,640
course is a key driver for the

665
00:22:55,029 --> 00:22:52,960
astrobiological investigations

666
00:22:56,950 --> 00:22:55,039
modification of the headspace gas and

667
00:22:58,789 --> 00:22:56,960
mineral volatile exchange

668
00:23:01,430 --> 00:22:58,799
so we want to ensure that the sample

669
00:23:02,950 --> 00:23:01,440
receiving facility is capable of

670
00:23:05,190 --> 00:23:02,960
performing these measurements required

671
00:23:06,630 --> 00:23:05,200
to investigate those kind of attributes

672
00:23:09,909 --> 00:23:06,640
before they've been altered to the point

673
00:23:12,470 --> 00:23:09,919
where we lose valuable science

674
00:23:14,470 --> 00:23:12,480
so this working group tried to define

675
00:23:15,830 --> 00:23:14,480
that the time scales of the processes

676
00:23:17,590 --> 00:23:15,840
that would underpin these time

677
00:23:19,029 --> 00:23:17,600
sensitivity

678
00:23:21,029 --> 00:23:19,039
measurements and we know that we need to

679
00:23:22,789 --> 00:23:21,039
move quickly for some of these once the

680
00:23:23,830 --> 00:23:22,799
sample tubes are open so you can see

681
00:23:25,510 --> 00:23:23,840
that there's kind of four main

682
00:23:27,830 --> 00:23:25,520
categories here which is the degradation

683
00:23:29,909 --> 00:23:27,840
of organic material which can happen on

684
00:23:32,549 --> 00:23:29,919
the order of hours or days particularly

685
00:23:35,190 --> 00:23:32,559
if there's h2o or reactive oxygen

686
00:23:36,710 --> 00:23:35,200
species present in the samples

687
00:23:38,549 --> 00:23:36,720
and then the change in the sample

688
00:23:40,549 --> 00:23:38,559

headspace gas composition which is you

689
00:23:42,390 --> 00:23:40,559
know kind of dependent on how well we're

690
00:23:44,549 --> 00:23:42,400
able to capture that gas when we're

691
00:23:46,070 --> 00:23:44,559
opening the tube um among other things

692
00:23:48,310 --> 00:23:46,080
but then there's volatiles that are

693
00:23:50,870 --> 00:23:48,320
bound to the samples so things that are

694
00:23:53,830 --> 00:23:50,880
like hydrated sulfates or perchlorates

695
00:23:56,310 --> 00:23:53,840
or clays can start to lose absorbed

696
00:23:58,230 --> 00:23:56,320
water or bound water again on the time

697
00:23:59,990 --> 00:23:58,240
scale of hours to days

698
00:24:01,830 --> 00:24:00,000
and the same thing with the hosts of

699
00:24:02,950 --> 00:24:01,840
these kind of solid phase

700
00:24:04,390 --> 00:24:02,960
volatiles

701
00:24:06,230 --> 00:24:04,400
and so everything you kind of see here

702
00:24:07,430 --> 00:24:06,240
under the hours today's categories are

703
00:24:09,190 --> 00:24:07,440
things we think we need to have the

704
00:24:12,390 --> 00:24:09,200
instrumentation to do those things

705
00:24:13,430 --> 00:24:12,400
inside the sample receiving facility

706
00:24:14,630 --> 00:24:13,440
so i've mentioned there's a lot of

707
00:24:16,870 --> 00:24:14,640
things that need to happen in the sample

708
00:24:18,870 --> 00:24:16,880
receiving facility so it's really

709
00:24:21,750 --> 00:24:18,880
complicated to kind of optimize that

710
00:24:23,190 --> 00:24:21,760
sample workflow and to identify

711
00:24:24,549 --> 00:24:23,200
what are the key objectives for the

712
00:24:25,990 --> 00:24:24,559
sample receiving facility so this is

713
00:24:28,070 --> 00:24:26,000

kind of a summary of the things that

714
00:24:30,470 --> 00:24:28,080
we've identified so of course we need to

715
00:24:32,310 --> 00:24:30,480
be able to receive the return spacecraft

716
00:24:34,390 --> 00:24:32,320
and carefully take it apart layer by

717
00:24:36,149 --> 00:24:34,400
layer while preserving the integrity of

718
00:24:38,070 --> 00:24:36,159
the samples

719
00:24:40,630 --> 00:24:38,080
provide an environment consisting of

720
00:24:42,789 --> 00:24:40,640
bsl4 containment and a very high level

721
00:24:44,470 --> 00:24:42,799
of cleanliness and contamination control

722
00:24:45,669 --> 00:24:44,480
as well as physical security you can

723
00:24:47,830 --> 00:24:45,679
imagine these samples are going to be

724
00:24:49,430 --> 00:24:47,840
very very valuable

725
00:24:52,149 --> 00:24:49,440
we need to put all the samples into a

726
00:24:54,549 --> 00:24:52,159
safe and stable state including the gas

727
00:24:57,029 --> 00:24:54,559
from inside the tubes any dust that's on

728
00:24:58,630 --> 00:24:57,039
the outside of the tubes and allow

729
00:25:00,230 --> 00:24:58,640
curation to complete the initial

730
00:25:01,750 --> 00:25:00,240
characterization of the sample so that

731
00:25:03,669 --> 00:25:01,760
the right pieces can be allocated for

732
00:25:05,990 --> 00:25:03,679
the right investigations

733
00:25:07,269 --> 00:25:06,000
and then enable all the specific science

734
00:25:08,710 --> 00:25:07,279
investigations that i mentioned

735
00:25:10,149 --> 00:25:08,720
previously including those needed for

736
00:25:11,190 --> 00:25:10,159
the sample safety assessment which is

737
00:25:13,350 --> 00:25:11,200
really key

738
00:25:15,350 --> 00:25:13,360

and then enable sample allocation and

739
00:25:17,350 --> 00:25:15,360
pristine sample storage

740
00:25:19,590 --> 00:25:17,360
and then

741
00:25:22,710 --> 00:25:19,600
supporting the transition to post srf

742
00:25:25,510 --> 00:25:22,720
activities so we imagine that the sample

743
00:25:27,350 --> 00:25:25,520
receiving project will have a set of

744
00:25:29,669 --> 00:25:27,360
objectives you know the primary science

745
00:25:31,590 --> 00:25:29,679
objectives of msr and those will be part

746
00:25:32,950 --> 00:25:31,600
of the project but as we know from

747
00:25:34,630 --> 00:25:32,960
looking at previous sample return

748
00:25:36,710 --> 00:25:34,640
missions there will be samples and we'll

749
00:25:38,390 --> 00:25:36,720
be working on them for decades to come

750
00:25:40,230 --> 00:25:38,400
but once there's a definitive end point

751
00:25:41,830 --> 00:25:40,240
for the project and the primary science

752
00:25:43,190 --> 00:25:41,840
objectives

753
00:25:44,870 --> 00:25:43,200
are achieved we'll kind of transition

754
00:25:46,149 --> 00:25:44,880
into a phase where hopefully all the

755
00:25:48,230 --> 00:25:46,159
samples have been

756
00:25:50,070 --> 00:25:48,240
deemed safe and they move to uncontained

757
00:25:51,669 --> 00:25:50,080
curation facilities and it would go

758
00:25:53,830 --> 00:25:51,679
through a kind of a

759
00:25:56,870 --> 00:25:53,840
the same kind of allocation and

760
00:26:01,269 --> 00:25:56,880
ongoing rna as we have for

761
00:26:05,190 --> 00:26:03,269
so this is kind of our our concept of

762
00:26:07,110 --> 00:26:05,200
operations which kind of summarizes um

763
00:26:09,350 --> 00:26:07,120

what i just said here you see the you

764
00:26:11,350 --> 00:26:09,360
know the return spacecraft arrives we

765
00:26:13,909 --> 00:26:11,360
have all of the sample dossiers and all

766
00:26:15,590 --> 00:26:13,919
of the data collected from mars 2020

767
00:26:17,190 --> 00:26:15,600
and everything in the red box is what

768
00:26:18,789 --> 00:26:17,200
happens inside this bio containment

769
00:26:21,350 --> 00:26:18,799
barrier including the spacecraft

770
00:26:22,710 --> 00:26:21,360
receiving and de-integration we extract

771
00:26:24,870 --> 00:26:22,720
the sample tubes from the from the

772
00:26:26,630 --> 00:26:24,880
flight hardware we

773
00:26:27,430 --> 00:26:26,640
wipe all the dust off the sample tubes

774
00:26:29,750 --> 00:26:27,440
because we're going to want to do

775
00:26:31,430 --> 00:26:29,760
science on that too we do the pre-basic

776
00:26:32,230 --> 00:26:31,440
characterization so any measurements we

777
00:26:33,990 --> 00:26:32,240
can do

778
00:26:35,350 --> 00:26:34,000
through a sample tube for example ct

779
00:26:37,669 --> 00:26:35,360
scanning

780
00:26:39,029 --> 00:26:37,679
potential bulk magnetic measurements

781
00:26:41,430 --> 00:26:39,039
and then we need to move these samples

782
00:26:43,269 --> 00:26:41,440
into basically pristine isolators with

783
00:26:45,830 --> 00:26:43,279
super high levels of contamination

784
00:26:48,470 --> 00:26:45,840
control where we can extract the head

785
00:26:50,310 --> 00:26:48,480
gas from the tubes open the tubes allow

786
00:26:52,789 --> 00:26:50,320
the basic characterization to be

787
00:26:54,549 --> 00:26:52,799
complete and then you can see that um

788
00:26:56,549 --> 00:26:54,559

the arrow pointing down from that green

789
00:26:59,110 --> 00:26:56,559
box is for unsterilized subsamples so

790
00:27:00,710 --> 00:26:59,120
there's preliminary examination there's

791
00:27:02,390 --> 00:27:00,720
the sample safety assessment the

792
00:27:05,350 --> 00:27:02,400
sterilization science and the time

793
00:27:06,710 --> 00:27:05,360
sensitive science and we envision that

794
00:27:08,710 --> 00:27:06,720
all of the science measurements that

795
00:27:11,269 --> 00:27:08,720
take place there will be competed

796
00:27:12,870 --> 00:27:11,279
science investigations uh done by people

797
00:27:15,669 --> 00:27:12,880
like yourselves who write proposals to

798
00:27:17,590 --> 00:27:15,679
be on this kind of sample receiving

799
00:27:18,789 --> 00:27:17,600
project science team and be the first

800
00:27:20,149 --> 00:27:18,799
people to do these measurements so

801
00:27:21,029 --> 00:27:20,159
that's how we envision that that

802
00:27:22,710 --> 00:27:21,039
happening

803
00:27:25,750 --> 00:27:22,720
and of course all of these results go

804
00:27:27,190 --> 00:27:25,760
into you know evolving a sample catalog

805
00:27:28,789 --> 00:27:27,200
that includes you know scientific

806
00:27:31,029 --> 00:27:28,799
publications

807
00:27:32,789 --> 00:27:31,039
all of the safety reports etc

808
00:27:34,870 --> 00:27:32,799
and you know then hopefully we can move

809
00:27:38,630 --> 00:27:34,880
to laboratories outside of containment

810
00:27:40,470 --> 00:27:38,640
and again all of this we hope comes to

811
00:27:42,070 --> 00:27:40,480
the realization of everything that we've

812
00:27:43,669 --> 00:27:42,080
all hoped that we'd be able to achieve

813
00:27:45,830 --> 00:27:43,679

with samples from mars at the end of

814
00:27:51,269 --> 00:27:45,840
this

815
00:27:53,269 --> 00:27:51,279
there's been some thinking about how do

816
00:27:55,669 --> 00:27:53,279
you optimize a workflow inside a sample

817
00:27:57,190 --> 00:27:55,679
receiving facility this is derived from

818
00:27:59,990 --> 00:27:57,200
the msr

819
00:28:01,590 --> 00:28:00,000
operational scenarios definition team

820
00:28:03,029 --> 00:28:01,600
whose report i believe is available on

821
00:28:04,950 --> 00:28:03,039
the mppag website but i'll have to

822
00:28:07,110 --> 00:28:04,960
double check that when i get home um

823
00:28:08,789 --> 00:28:07,120
this is just kind of a draft of where do

824
00:28:10,310 --> 00:28:08,799
you start and where do you go and how do

825
00:28:11,909 --> 00:28:10,320
you open all these layers and what kind

826
00:28:13,909 --> 00:28:11,919
of environments do you have to do each

827
00:28:16,389 --> 00:28:13,919
step in and what happens in a double

828
00:28:18,549 --> 00:28:16,399
walled isolator what potentially happens

829
00:28:20,470 --> 00:28:18,559
in a bsl4 suit lab

830
00:28:22,630 --> 00:28:20,480
what instruments can what measurements

831
00:28:25,190 --> 00:28:22,640
can be done through a port in an

832
00:28:27,590 --> 00:28:25,200
isolation chamber versus need to be done

833
00:28:30,070 --> 00:28:27,600
out on a bench and optimizing all of

834
00:28:31,350 --> 00:28:30,080
that is very much a work in progress and

835
00:28:33,110 --> 00:28:31,360
this is the reason we really need to

836
00:28:35,110 --> 00:28:33,120
start this planning early we need to

837
00:28:36,950 --> 00:28:35,120
know what this sample receiving facility

838
00:28:38,630 --> 00:28:36,960

capabilities are going to be and how do

839
00:28:41,990 --> 00:28:38,640
we optimize it to make sure we get the

840
00:28:46,470 --> 00:28:44,470
so uh looking ahead a lot of this is

841
00:28:48,549 --> 00:28:46,480
derived from the msr science planning

842
00:28:50,549 --> 00:28:48,559
group two reports and work that has

843
00:28:52,230 --> 00:28:50,559
happened subsequent to that so the first

844
00:28:55,510 --> 00:28:52,240
thing is to initiate you know a

845
00:28:57,669 --> 00:28:55,520
comprehensive msr science program

846
00:28:59,909 --> 00:28:57,679
so nasa and esa are are very much

847
00:29:01,510 --> 00:28:59,919
collaborating on this so

848
00:29:03,190 --> 00:29:01,520
currently they're working on finalizing

849
00:29:05,669 --> 00:29:03,200
the documented and signed agreements

850
00:29:07,830 --> 00:29:05,679
between nasa and esa to define the

851
00:29:10,149 --> 00:29:07,840
end-to-end science program including a

852
00:29:12,630 --> 00:29:10,159
science memorandum of understanding an

853
00:29:14,789 --> 00:29:12,640
msr joint science management plan

854
00:29:17,029 --> 00:29:14,799
and importantly to seek the necessary

855
00:29:18,789 --> 00:29:17,039
funding and authority to implement them

856
00:29:20,710 --> 00:29:18,799
so this plan is expected uh to be

857
00:29:21,830 --> 00:29:20,720
finalized in the next in the next couple

858
00:29:23,909 --> 00:29:21,840
months

859
00:29:26,710 --> 00:29:23,919
and then in addition to that um one of

860
00:29:29,909 --> 00:29:26,720
the recommendations of mspg2 was to

861
00:29:31,830 --> 00:29:29,919
establish an msr campaign science group

862
00:29:33,430 --> 00:29:31,840
which is a group of international

863
00:29:36,389 --> 00:29:33,440

scientists

864
00:29:38,470 --> 00:29:36,399
who can advise on all of the issues that

865
00:29:40,549 --> 00:29:38,480
i talked about previously planning for

866
00:29:42,470 --> 00:29:40,559
the sample receiving facility making

867
00:29:44,789 --> 00:29:42,480
sure we have the right requirements in

868
00:29:47,029 --> 00:29:44,799
terms of contamination control making

869
00:29:48,549 --> 00:29:47,039
sure we know what the specifications of

870
00:29:50,470 --> 00:29:48,559
the instruments that we need to you know

871
00:29:51,669 --> 00:29:50,480
put out proposals for for the srf need

872
00:29:53,430 --> 00:29:51,679
to be

873
00:29:55,830 --> 00:29:53,440
potentially run a science definition

874
00:29:57,830 --> 00:29:55,840
team do a science traceability matrix

875
00:29:59,990 --> 00:29:57,840
once we really know what the samples are

876
00:30:01,990 --> 00:30:00,000
we expect to be returned

877
00:30:03,669 --> 00:30:02,000
so the call for applications for the

878
00:30:06,230 --> 00:30:03,679
first phase of that group which will be

879
00:30:07,669 --> 00:30:06,240
recomputed every two years was issued i

880
00:30:09,110 --> 00:30:07,679
want to say april and we actually

881
00:30:11,190 --> 00:30:09,120
expected the selections for that to be

882
00:30:13,110 --> 00:30:11,200
announced in the next week or two so

883
00:30:14,149 --> 00:30:13,120
that's probably a group of around 15 to

884
00:30:16,149 --> 00:30:14,159
20

885
00:30:18,630 --> 00:30:16,159
external and scientists with some

886
00:30:21,590 --> 00:30:18,640
ex-officio members who are kind of a um

887
00:30:22,950 --> 00:30:21,600
an advisory group to the to the msr

888
00:30:24,549 --> 00:30:22,960

projects

889
00:30:26,230 --> 00:30:24,559
to make sure that the science community

890
00:30:27,909 --> 00:30:26,240
is being represented and the science is

891
00:30:30,149 --> 00:30:27,919
being protected

892
00:30:32,149 --> 00:30:30,159
um and as i mentioned the next phase in

893
00:30:33,750 --> 00:30:32,159
msr after the flight missions is this

894
00:30:35,990 --> 00:30:33,760
sample receiving project which is kind

895
00:30:37,029 --> 00:30:36,000
of currently in a informal pre-phase a

896
00:30:39,029 --> 00:30:37,039
state

897
00:30:41,190 --> 00:30:39,039
so we need to formalize the organ

898
00:30:43,190 --> 00:30:41,200
organizational structure and funding for

899
00:30:46,070 --> 00:30:43,200
that process which will be led by

900
00:30:48,870 --> 00:30:46,080
johnson space center on behalf of esa

901
00:30:50,789 --> 00:30:48,880
and nasa's mars exploration program

902
00:30:54,389 --> 00:30:50,799
this project is expected to proceed to

903
00:30:56,630 --> 00:30:54,399
phase a in fy 23 so we are working to

904
00:30:58,630 --> 00:30:56,640
get that underway

905
00:31:01,029 --> 00:30:58,640
additionally we really need to make sure

906
00:31:04,230 --> 00:31:01,039
that we have funding for research and

907
00:31:06,710 --> 00:31:04,240
development and rna activities to plan

908
00:31:08,870 --> 00:31:06,720
for the analysis of these msr samples so

909
00:31:10,789 --> 00:31:08,880
we need to utilize or augment existing

910
00:31:13,269 --> 00:31:10,799
funding mechanisms or find new

911
00:31:15,190 --> 00:31:13,279
mechanisms to support you know short and

912
00:31:16,870 --> 00:31:15,200
medium-term studies

913
00:31:18,950 --> 00:31:16,880

required to carry out the msr science

914
00:31:21,110 --> 00:31:18,960
program so this would include things

915
00:31:23,110 --> 00:31:21,120
like you know an analog program to kind

916
00:31:25,590 --> 00:31:23,120
of determine what are acceptable

917
00:31:27,590 --> 00:31:25,600
sterilization techniques for a

918
00:31:29,029 --> 00:31:27,600
geological sample rather than just a

919
00:31:30,870 --> 00:31:29,039
surface because that's something that

920
00:31:32,630 --> 00:31:30,880
you know still needs more study making

921
00:31:34,710 --> 00:31:32,640
sure that any proposed sterilization

922
00:31:37,110 --> 00:31:34,720
technique goes through all of the

923
00:31:39,669 --> 00:31:37,120
reviews and processes it needs to be

924
00:31:43,269 --> 00:31:39,679
accepted by the regulatory agencies

925
00:31:45,830 --> 00:31:43,279
optimizing what kind of measurements

926
00:31:47,430 --> 00:31:45,840
can minimize the use of sample mass i

927
00:31:49,350 --> 00:31:47,440
mean we have a very limited amount of

928
00:31:51,509 --> 00:31:49,360
sample being returned from mars we want

929
00:31:53,269 --> 00:31:51,519
to make sure we make the most of it so

930
00:31:55,110 --> 00:31:53,279
there's a lot of kind of optimization

931
00:31:57,029 --> 00:31:55,120
experiments that need to be done in

932
00:31:58,389 --> 00:31:57,039
addition to technical development for

933
00:32:00,630 --> 00:31:58,399
things like um

934
00:32:02,149 --> 00:32:00,640
isolation chambers that provide bsl for

935
00:32:04,070 --> 00:32:02,159
containment but that can be moved from

936
00:32:05,029 --> 00:32:04,080
instrument to instrument and potentially

937
00:32:07,269 --> 00:32:05,039
even to

938
00:32:09,590 --> 00:32:07,279

you know instruments outside of a bsl4

939
00:32:11,830 --> 00:32:09,600
facility and making sure that those are

940
00:32:14,149 --> 00:32:11,840
at a technology readiness level that's

941
00:32:16,389 --> 00:32:14,159
acceptable to to regulatory agencies for

942
00:32:18,870 --> 00:32:16,399
for pp reasons

943
00:32:21,509 --> 00:32:18,880
and then of course to continue to refine

944
00:32:22,950 --> 00:32:21,519
the the requirements for the srf um for

945
00:32:25,509 --> 00:32:22,960
the sample receiving facility for the

946
00:32:27,830 --> 00:32:25,519
environmental conditions the cleanliness

947
00:32:28,789 --> 00:32:27,840
and to translate this into a curation

948
00:32:30,630 --> 00:32:28,799
plan

949
00:32:32,230 --> 00:32:30,640
the overall concept for the facility

950
00:32:34,310 --> 00:32:32,240
budget and schedule

951
00:32:36,630 --> 00:32:34,320
the the idea hopefully is that we would

952
00:32:39,029 --> 00:32:36,640
contin start having a

953
00:32:42,389 --> 00:32:39,039
site-specific design for the sample

954
00:32:44,070 --> 00:32:42,399
receiving facility in fy 25 to be able

955
00:32:47,029 --> 00:32:44,080
to start construction and get this done

956
00:32:48,630 --> 00:32:47,039
before the samples arrive

957
00:32:49,909 --> 00:32:48,640
so as i mentioned some of the you know

958
00:32:52,470 --> 00:32:49,919
the ongoing activities that are coming

959
00:32:54,710 --> 00:32:52,480
up soon again the the finalization of

960
00:32:57,669 --> 00:32:54,720
the science management plan um this will

961
00:32:59,590 --> 00:32:57,679
you know include content related to the

962
00:33:02,070 --> 00:32:59,600
the science and sample management

963
00:33:03,830 --> 00:33:02,080

structure uh including identifying all

964
00:33:05,430 --> 00:33:03,840
the ways that the science community can

965
00:33:07,430 --> 00:33:05,440
be involved in the planning and

966
00:33:08,870 --> 00:33:07,440
implementation of msr science because

967
00:33:10,870 --> 00:33:08,880
this is this is the whole point this is

968
00:33:13,509 --> 00:33:10,880
why we're doing msr is to do this

969
00:33:15,590 --> 00:33:13,519
science when the samples come back

970
00:33:16,870 --> 00:33:15,600
again how the the science data is going

971
00:33:19,430 --> 00:33:16,880
to be handled what are going to be the

972
00:33:22,070 --> 00:33:19,440
publication and communication policies

973
00:33:24,310 --> 00:33:22,080
and so this is based on kind of five

974
00:33:25,990 --> 00:33:24,320
guiding principles

975
00:33:27,430 --> 00:33:26,000
which include you know scientific

976
00:33:28,950 --> 00:33:27,440
maximization

977
00:33:31,029 --> 00:33:28,960
you know accessibility to the

978
00:33:34,710 --> 00:33:31,039
international science community

979
00:33:38,230 --> 00:33:37,029
the principle that although the samples

980
00:33:40,950 --> 00:33:38,240
may be in different locations at

981
00:33:42,710 --> 00:33:40,960
different times um including in the long

982
00:33:44,230 --> 00:33:42,720
term some may be in an esa curation

983
00:33:46,070 --> 00:33:44,240
facility and some may be in a nasa

984
00:33:48,389 --> 00:33:46,080
curation facility but this really needs

985
00:33:50,310 --> 00:33:48,399
to be managed as one collection so if

986
00:33:51,590 --> 00:33:50,320
someone is you know proposing to do an

987
00:33:53,909 --> 00:33:51,600
analysis

988
00:33:55,590 --> 00:33:53,919

of an msr sample we're really looking at

989
00:33:57,430 --> 00:33:55,600
the whole collection to find the best

990
00:33:59,909 --> 00:33:57,440
you know the best piece

991
00:34:02,149 --> 00:33:59,919
for that specific analysis

992
00:34:04,950 --> 00:34:02,159
and then of course return on investment

993
00:34:06,310 --> 00:34:04,960
for the uh the partners who are

994
00:34:11,829 --> 00:34:06,320
making the investment and actually

995
00:34:14,950 --> 00:34:13,669
i already mentioned the campaign science

996
00:34:18,069 --> 00:34:14,960
group so this group is going to be

997
00:34:20,310 --> 00:34:18,079
co-chaired by the nasa and esa msr lead

998
00:34:23,270 --> 00:34:20,320
scientists those positions currently

999
00:34:25,750 --> 00:34:23,280
being held by michael meyer for for nasa

1000
00:34:27,909 --> 00:34:25,760
and by gerhard kaminik for issa

1001
00:34:29,750 --> 00:34:27,919
and so this group again will assist

1002
00:34:31,909 --> 00:34:29,760
these lead scientists in the execution

1003
00:34:32,950 --> 00:34:31,919
of the science management plan to really

1004
00:34:34,470 --> 00:34:32,960
ensure

1005
00:34:36,069 --> 00:34:34,480
that we're maximizing the science

1006
00:34:38,149 --> 00:34:36,079
potential of msr

1007
00:34:40,230 --> 00:34:38,159
by establishing the processes for

1008
00:34:41,589 --> 00:34:40,240
decision making and establishing

1009
00:34:43,349 --> 00:34:41,599
maintaining the process whereby the

1010
00:34:45,030 --> 00:34:43,359
science community is involved in return

1011
00:34:47,510 --> 00:34:45,040
sample science and again this group will

1012
00:34:49,349 --> 00:34:47,520
function in an advisory capacity

1013
00:34:50,950 --> 00:34:49,359

we actually received about 80

1014
00:34:52,389 --> 00:34:50,960
applications from the international

1015
00:34:53,270 --> 00:34:52,399
science community and as i mentioned

1016
00:34:54,869 --> 00:34:53,280
these

1017
00:34:57,190 --> 00:34:54,879
selections are expected

1018
00:35:00,069 --> 00:34:57,200
by june 2022 but hopefully in the next

1019
00:35:01,430 --> 00:35:00,079
in the next week or so

1020
00:35:03,510 --> 00:35:01,440
again i mentioned that the sample

1021
00:35:05,750 --> 00:35:03,520
receiving project would be managed by

1022
00:35:07,750 --> 00:35:05,760
johnson space center in coordination

1023
00:35:09,349 --> 00:35:07,760
with esa and with nasa's mars

1024
00:35:11,670 --> 00:35:09,359
exploration program

1025
00:35:13,510 --> 00:35:11,680
so the sample receiving project again is

1026
00:35:15,510 --> 00:35:13,520
meant to encompass all of the non-flight

1027
00:35:17,270 --> 00:35:15,520
aspects of the campaign beginning once

1028
00:35:18,790 --> 00:35:17,280
the samples have touched down on earth

1029
00:35:21,670 --> 00:35:18,800
and ending when the primary science

1030
00:35:23,190 --> 00:35:21,680
objectives are met so there are draft

1031
00:35:25,270 --> 00:35:23,200
objectives that i've written here for

1032
00:35:27,589 --> 00:35:25,280
this project not finalized until we you

1033
00:35:28,870 --> 00:35:27,599
know move into a you know a pre-project

1034
00:35:31,109 --> 00:35:28,880
review

1035
00:35:34,390 --> 00:35:31,119
a lot of it is very similar to the you

1036
00:35:36,230 --> 00:35:34,400
know the objectives for the facility

1037
00:35:38,150 --> 00:35:36,240
except

1038
00:35:40,069 --> 00:35:38,160

that we need to you know conduct these

1039
00:35:41,750 --> 00:35:40,079
these science investigations inside and

1040
00:35:43,109 --> 00:35:41,760
outside the srf and make sure that

1041
00:35:45,190 --> 00:35:43,119
there's funding

1042
00:35:47,349 --> 00:35:45,200
and that this project won't end until

1043
00:35:49,270 --> 00:35:47,359
those science objectives are met and

1044
00:35:51,270 --> 00:35:49,280
then to provide and enable long-term

1045
00:35:53,670 --> 00:35:51,280
curation

1046
00:35:56,630 --> 00:35:53,680
and i think that's that's the end so i'm

1047
00:36:12,069 --> 00:35:56,640
happy to take any questions or comments

1048
00:36:12,079 --> 00:36:19,910
can we turn those on

1049
00:36:23,910 --> 00:36:20,950
hello

1050
00:36:26,470 --> 00:36:23,920
can you hear me yeah um hi brandi navida

1051
00:36:28,150 --> 00:36:26,480
nas tufts university massachusetts i

1052
00:36:30,790 --> 00:36:28,160
just want to say that was really really

1053
00:36:31,829 --> 00:36:30,800
uh interesting thank you i had one quick

1054
00:36:34,630 --> 00:36:31,839
question

1055
00:36:35,910 --> 00:36:34,640
so when you talked about sterilization

1056
00:36:38,310 --> 00:36:35,920
of samples

1057
00:36:39,510 --> 00:36:38,320
if you thought about the i mean you

1058
00:36:41,430 --> 00:36:39,520
already know but the presence of

1059
00:36:43,190 --> 00:36:41,440
perchlorate in those samples would they

1060
00:36:44,950 --> 00:36:43,200
not destroy the things you're looking

1061
00:36:46,470 --> 00:36:44,960
for yeah so that was one of the factors

1062
00:36:47,910 --> 00:36:46,480
that was taken into account in terms of

1063
00:36:49,910 --> 00:36:47,920

looking at what's sterilization

1064
00:36:51,910 --> 00:36:49,920
sensitive i mean we

1065
00:36:54,470 --> 00:36:51,920
you said you're from tufts university

1066
00:36:55,990 --> 00:36:54,480
how can i come talk to you

1067
00:36:57,430 --> 00:36:56,000
sorry that's that's also where i went to

1068
00:37:00,310 --> 00:36:57,440
grad school and looking at perchlorate

1069
00:37:01,990 --> 00:37:00,320
in the samples so uh in the phoenix

1070
00:37:03,270 --> 00:37:02,000
samples so yeah so that's certainly

1071
00:37:04,630 --> 00:37:03,280
something that was taken into account

1072
00:37:06,790 --> 00:37:04,640
and looking at what's sterilization

1073
00:37:08,550 --> 00:37:06,800
sensitive and also in terms of looking

1074
00:37:09,990 --> 00:37:08,560
at you know what is

1075
00:37:11,589 --> 00:37:10,000
sensitive to elevated temperatures over

1076
00:37:13,589 --> 00:37:11,599
time is is the presence of not only

1077
00:37:15,510 --> 00:37:13,599
perchlorates but other oxychlorines that

1078
00:37:18,230 --> 00:37:15,520
may be reactive as well as you know

1079
00:37:19,430 --> 00:37:18,240
things like oh radicals superoxides

1080
00:37:21,349 --> 00:37:19,440
because of course those things kind of

1081
00:37:22,710 --> 00:37:21,359
reduce the temperature at which you're

1082
00:37:24,550 --> 00:37:22,720
you know worried about

1083
00:37:25,829 --> 00:37:24,560
the temperature and time at which you're

1084
00:37:27,829 --> 00:37:25,839
worried about degradation so yeah that

1085
00:37:30,150 --> 00:37:27,839
was definitely uh taken into account

1086
00:37:33,510 --> 00:37:30,160
okay thank you

1087
00:37:35,190 --> 00:37:33,520
hi brandi hey ellie

1088
00:37:37,109 --> 00:37:35,200

i'm actually wondering about four years

1089
00:37:39,349 --> 00:37:37,119
before when you're doing your safety

1090
00:37:41,109 --> 00:37:39,359
assessment of the sample how much sample

1091
00:37:42,790 --> 00:37:41,119
processing can you actually do during

1092
00:37:44,550 --> 00:37:42,800
that process for example are we allowed

1093
00:37:46,950 --> 00:37:44,560
to like flatten the surface for like a

1094
00:37:48,550 --> 00:37:46,960
non-destructive spectroscopy technique

1095
00:37:50,790 --> 00:37:48,560
or does it have to be remain completely

1096
00:37:51,990 --> 00:37:50,800
intact and can't do things like take a

1097
00:37:54,230 --> 00:37:52,000
slice or things like that because it

1098
00:37:55,829 --> 00:37:54,240
seems like i'm thinking through various

1099
00:37:57,430 --> 00:37:55,839
techniques and it seems hard to do that

1100
00:37:59,430 --> 00:37:57,440
on like a non

1101
00:38:01,990 --> 00:37:59,440
yeah and surface or things like that

1102
00:38:04,470 --> 00:38:02,000
it's it's hard to see in this thing here

1103
00:38:05,750 --> 00:38:04,480
but you know i will refer read to this

1104
00:38:07,750 --> 00:38:05,760
paper which like i said will hopefully

1105
00:38:09,510 --> 00:38:07,760
be out in the next week or so but a lot

1106
00:38:11,510 --> 00:38:09,520
of the identified measurements and

1107
00:38:13,270 --> 00:38:11,520
analyses are on process samples whether

1108
00:38:15,109 --> 00:38:13,280
it be you know a powdered sample of

1109
00:38:17,829 --> 00:38:15,119
which you've done bulk organic

1110
00:38:19,829 --> 00:38:17,839
extraction or the ability to you know do

1111
00:38:21,349 --> 00:38:19,839
thin sections or thick sections so those

1112
00:38:22,950 --> 00:38:21,359
are other you know i maybe should have

1113
00:38:24,790 --> 00:38:22,960

had a couple slides about the kind of

1114
00:38:26,630 --> 00:38:24,800
curation and sample processing needs

1115
00:38:29,270 --> 00:38:26,640
inside the srf because you know some

1116
00:38:30,790 --> 00:38:29,280
things need a flat surface

1117
00:38:33,670 --> 00:38:30,800
during the safety protocol we can

1118
00:38:38,310 --> 00:38:36,230
yeah so again this goes into how do you

1119
00:38:40,870 --> 00:38:38,320
safely do that does everything can you

1120
00:38:42,069 --> 00:38:40,880
do you know rock polishing inside an

1121
00:38:43,910 --> 00:38:42,079
isolator

1122
00:38:47,030 --> 00:38:43,920
and then you know put it through a port

1123
00:38:48,310 --> 00:38:47,040
into a small container those are again

1124
00:38:50,870 --> 00:38:48,320
this is why we need to optimize that

1125
00:38:52,550 --> 00:38:50,880
workflow but we do want we do anticipate

1126
00:38:55,829 --> 00:38:52,560
being able to do you know a kind of

1127
00:38:57,670 --> 00:38:55,839
complex sample processing um even during

1128
00:39:01,109 --> 00:38:57,680
the sample safety assessment

1129
00:39:03,670 --> 00:39:01,119
cool thank you thanks

1130
00:39:05,750 --> 00:39:03,680
hi i'm carlos cruz arsene from nasa

1131
00:39:07,829 --> 00:39:05,760
garden i was wondering uh for the ride

1132
00:39:09,430 --> 00:39:07,839
back home from mars to earth

1133
00:39:12,230 --> 00:39:09,440
will the radiation on the right back

1134
00:39:13,190 --> 00:39:12,240
foam affect the samples at all

1135
00:39:15,670 --> 00:39:13,200
you're standing next to a very

1136
00:39:17,589 --> 00:39:15,680
appropriate person um

1137
00:39:19,030 --> 00:39:17,599
no so the the kind of radiation

1138
00:39:21,270 --> 00:39:19,040

environment that's expected during

1139
00:39:23,109 --> 00:39:21,280
during the transit is actually kind of a

1140
00:39:24,550 --> 00:39:23,119
very small dosage of radiation compared

1141
00:39:25,510 --> 00:39:24,560
to what the samples will have already

1142
00:39:27,030 --> 00:39:25,520
seen

1143
00:39:28,550 --> 00:39:27,040
on the martian surface over you know

1144
00:39:31,750 --> 00:39:28,560
millions of years

1145
00:39:31,760 --> 00:39:35,670
hope

1146
00:39:40,230 --> 00:39:38,950
hi chad fazoreski from georgia tech so

1147
00:39:42,150 --> 00:39:40,240
i'm wondering about what sort of

1148
00:39:43,750 --> 00:39:42,160
technology development is required for

1149
00:39:46,069 --> 00:39:43,760
manipulation once it gets back on the

1150
00:39:47,030 --> 00:39:46,079
ground and i imagine there will be

1151
00:39:48,870 --> 00:39:47,040
um

1152
00:39:50,950 --> 00:39:48,880
when it comes to uncasing uh the device

1153
00:39:52,870 --> 00:39:50,960
that'll be specific technologies

1154
00:39:55,670 --> 00:39:52,880
that will be designed when the device

1155
00:39:56,630 --> 00:39:55,680
itself is but also for manipulation of

1156
00:39:59,990 --> 00:39:56,640
uh

1157
00:40:02,390 --> 00:40:00,000
of the samples at small scales and um

1158
00:40:03,990 --> 00:40:02,400
uh you know for for the requirements

1159
00:40:07,910 --> 00:40:04,000
that i guess are very unique to these

1160
00:40:10,230 --> 00:40:07,920
samples so are there any plans for

1161
00:40:14,790 --> 00:40:10,240
uh funding uh technology development

1162
00:40:16,630 --> 00:40:14,800
opportunities uh specifically for that

1163
00:40:18,069 --> 00:40:16,640

yes yes there are so this is something

1164
00:40:19,349 --> 00:40:18,079
that you know you know johnson space

1165
00:40:22,309 --> 00:40:19,359
center has been working into their you

1166
00:40:24,470 --> 00:40:22,319
know long-term kind of technology r d

1167
00:40:27,030 --> 00:40:24,480
program for the srf is yeah what can be

1168
00:40:28,790 --> 00:40:27,040
done potentially remotely with micro

1169
00:40:30,630 --> 00:40:28,800
manipulators um

1170
00:40:32,470 --> 00:40:30,640
and even for for opening the spacecraft

1171
00:40:34,150 --> 00:40:32,480
we started talking about well what if

1172
00:40:36,470 --> 00:40:34,160
you needed to take apart this the

1173
00:40:38,309 --> 00:40:36,480
hardware inside an isolator robotically

1174
00:40:39,990 --> 00:40:38,319
and so there's you know been a drive to

1175
00:40:41,589 --> 00:40:40,000
simplify that process there's a lot of

1176
00:40:42,950 --> 00:40:41,599
pieces which

1177
00:40:43,990 --> 00:40:42,960
we can take apart with a screwdriver

1178
00:40:45,510 --> 00:40:44,000
which you know that kind of thing is

1179
00:40:46,790 --> 00:40:45,520
easy but then of course there's you know

1180
00:40:48,550 --> 00:40:46,800
things that are

1181
00:40:50,470 --> 00:40:48,560
hermetically sealed and need a little

1182
00:40:52,790 --> 00:40:50,480
bit more um and then how do you do that

1183
00:40:55,670 --> 00:40:52,800
without introducing contamination

1184
00:40:57,910 --> 00:40:55,680
if you have you know lubricated motors

1185
00:41:00,069 --> 00:40:57,920
or you know micro manipulators so that

1186
00:41:01,910 --> 00:41:00,079
that is a long-term you know technology

1187
00:41:05,430 --> 00:41:01,920
development thing that needs to be done

1188
00:41:08,870 --> 00:41:07,270

the cost-benefit analysis of doing

1189
00:41:11,670 --> 00:41:08,880
things remotely versus having everyone

1190
00:41:13,750 --> 00:41:11,680
in a suit all the time um so yeah that

1191
00:41:14,790 --> 00:41:13,760
is a long-term thing and i do anticipate

1192
00:41:16,069 --> 00:41:14,800
there being

1193
00:41:17,829 --> 00:41:16,079
um

1194
00:41:19,270 --> 00:41:17,839
opportunities to to do those kind of

1195
00:41:21,349 --> 00:41:19,280
tech development projects and to

1196
00:41:24,069 --> 00:41:21,359
optimize that kind of thing right yeah

1197
00:41:27,910 --> 00:41:24,079
just briefly has have any uh objectives

1198
00:41:29,829 --> 00:41:27,920
for uh timelines for that been set

1199
00:41:31,030 --> 00:41:29,839
no

1200
00:41:32,630 --> 00:41:31,040
stay tuned

1201
00:41:33,670 --> 00:41:32,640
like i said we're working on getting

1202
00:41:34,950 --> 00:41:33,680
this um

1203
00:41:36,470 --> 00:41:34,960
you know this campaign science group

1204
00:41:39,510 --> 00:41:36,480
together and we anticipate that that

1205
00:41:42,069 --> 00:41:39,520
group is going to suggest a a technology

1206
00:41:43,829 --> 00:41:42,079
an r d roadmap um and to try to

1207
00:41:46,150 --> 00:41:43,839
prioritize which things need to be known

1208
00:41:47,750 --> 00:41:46,160
earlier versus later and and how best to

1209
00:41:49,109 --> 00:41:47,760
allocate funding for those things so

1210
00:41:50,470 --> 00:41:49,119
that if there are things like you

1211
00:41:52,550 --> 00:41:50,480
mentioned that are kind of needed to

1212
00:41:54,069 --> 00:41:52,560
plan you know how to design a sample

1213
00:41:55,670 --> 00:41:54,079

receiving facility you know those may

1214
00:41:57,670 --> 00:41:55,680
need to be done earlier versus some of

1215
00:42:00,069 --> 00:41:57,680
the analog experiments but that's still

1216
00:42:01,990 --> 00:42:00,079
very much kind of tbd okay thank you

1217
00:42:04,630 --> 00:42:02,000
very much

1218
00:42:06,230 --> 00:42:04,640
hey brandi uh aaron rigberg nasa johnson

1219
00:42:07,589 --> 00:42:06,240
i wonder if you could talk a little bit

1220
00:42:10,390 --> 00:42:07,599
about what

1221
00:42:11,910 --> 00:42:10,400
nasa needs from the scientific community

1222
00:42:13,589 --> 00:42:11,920
in terms of

1223
00:42:16,790 --> 00:42:13,599
science communication

1224
00:42:20,069 --> 00:42:16,800
about this mission uh so that we

1225
00:42:23,670 --> 00:42:20,079
avoid you know fears about

1226
00:42:24,630 --> 00:42:23,680
mars cobid or andromeda strain style

1227
00:42:26,630 --> 00:42:24,640
like

1228
00:42:28,309 --> 00:42:26,640
i i mean i think everybody in here is

1229
00:42:30,150 --> 00:42:28,319
excited about bringing wire samples back

1230
00:42:32,309 --> 00:42:30,160
but there are people that are going to

1231
00:42:34,309 --> 00:42:32,319
be worried about this yeah so that

1232
00:42:35,510 --> 00:42:34,319
that's that's a really good point so i i

1233
00:42:43,030 --> 00:42:35,520
think that

1234
00:42:44,309 --> 00:42:43,040
you're asked a question about msr and

1235
00:42:46,230 --> 00:42:44,319
particularly in terms of you know

1236
00:42:48,950 --> 00:42:46,240
biosafety i think you know i think the

1237
00:42:51,030 --> 00:42:48,960
idea is that we do not expect there to

1238
00:42:53,270 --> 00:42:51,040

be extent life in the near surface of

1239
00:42:54,309 --> 00:42:53,280
mars for for many reasons which most of

1240
00:42:56,309 --> 00:42:54,319
you in this room are probably familiar

1241
00:42:59,190 --> 00:42:56,319
with this is basically being done out of

1242
00:43:01,430 --> 00:42:59,200
an abundance of caution and to really

1243
00:43:03,030 --> 00:43:01,440
ensure because we have to go by you know

1244
00:43:04,870 --> 00:43:03,040
the coast bar planetary protection

1245
00:43:06,470 --> 00:43:04,880
policies to really make sure that

1246
00:43:09,349 --> 00:43:06,480
there's no chance that we're going to

1247
00:43:11,190 --> 00:43:09,359
contaminate earth's biosphere

1248
00:43:13,030 --> 00:43:11,200
and i think that's the key point and you

1249
00:43:15,750 --> 00:43:13,040
know potentially you know attending you

1250
00:43:17,829 --> 00:43:15,760
know nepa public hearings and you know

1251
00:43:20,550 --> 00:43:17,839
if you're asked for a statement on msr

1252
00:43:22,470 --> 00:43:20,560
you know make sure that yes

1253
00:43:25,270 --> 00:43:22,480
i'm going to be careful what i say here

1254
00:43:30,550 --> 00:43:27,430
no but you know like wouldn't it be cool

1255
00:43:32,150 --> 00:43:30,560
if there was life in the samples but

1256
00:43:34,150 --> 00:43:32,160
but i mean i think we all think that

1257
00:43:36,309 --> 00:43:34,160
that's really really highly unlikely and

1258
00:43:38,309 --> 00:43:36,319
this is really a risk mitigation

1259
00:43:41,990 --> 00:43:38,319
and public perception problem more than

1260
00:43:45,589 --> 00:43:43,910
oh sure i was i was just going to

1261
00:43:47,910 --> 00:43:45,599
address the previous question yeah

1262
00:43:50,309 --> 00:43:47,920
please do hopefully as well um

1263
00:43:51,510 --> 00:43:50,319

mini wagwa arizona state

1264
00:43:53,270 --> 00:43:51,520
um

1265
00:43:54,470 --> 00:43:53,280
that's an important point that brandy

1266
00:43:57,030 --> 00:43:54,480
just brought up that you know i think

1267
00:43:59,270 --> 00:43:57,040
the likelihood of finding extent light

1268
00:44:00,309 --> 00:43:59,280
we believe it's going to be very very

1269
00:44:02,870 --> 00:44:00,319
low

1270
00:44:03,670 --> 00:44:02,880
the other thing to also point out is

1271
00:44:06,230 --> 00:44:03,680
that

1272
00:44:08,550 --> 00:44:06,240
we have been

1273
00:44:11,990 --> 00:44:08,560
earth has been impacted by martian

1274
00:44:13,750 --> 00:44:12,000
materials over geologic time for

1275
00:44:16,550 --> 00:44:13,760
you know we've got a lot of that

1276
00:44:18,470 --> 00:44:16,560
material around and many of those rocks

1277
00:44:19,670 --> 00:44:18,480
presumably came from

1278
00:44:22,150 --> 00:44:19,680
um

1279
00:44:23,190 --> 00:44:22,160
deep deeper portions of mars than what

1280
00:44:24,230 --> 00:44:23,200
we're going to be sampling on the

1281
00:44:25,829 --> 00:44:24,240
surface

1282
00:44:29,190 --> 00:44:25,839
and you know

1283
00:44:30,710 --> 00:44:29,200
that's not been a catastrophic event for

1284
00:44:32,550 --> 00:44:30,720
for earth and so i think that that's

1285
00:44:34,230 --> 00:44:32,560
another important point to to

1286
00:44:35,910 --> 00:44:34,240
communicate as when you're able to do

1287
00:44:37,510 --> 00:44:35,920
that yeah that's a key point that you

1288
00:44:39,589 --> 00:44:37,520

know none of the martian meteorites that

1289
00:44:41,670 --> 00:44:39,599
we know have impacted earth have caused

1290
00:44:46,630 --> 00:44:41,680
any problems um i can't see online

1291
00:44:46,640 --> 00:44:54,550
okay

1292
00:44:58,390 --> 00:44:56,309
yeah dave that's certainly the intent

1293
00:45:01,190 --> 00:44:58,400
that we would want to capture the gas

1294
00:45:02,550 --> 00:45:01,200
behind any kind of inequality you know

1295
00:45:04,870 --> 00:45:02,560
seal

1296
00:45:06,230 --> 00:45:04,880
which may um include the the secondary

1297
00:45:08,790 --> 00:45:06,240
containment vessel and the primary

1298
00:45:11,109 --> 00:45:08,800
containment vessel um we expect that the

1299
00:45:13,750 --> 00:45:11,119
the orbiting sample container itself is

1300
00:45:15,510 --> 00:45:13,760
vented um but there may be gas we can

1301
00:45:16,870 --> 00:45:15,520
capture from behind the the primary

1302
00:45:18,710 --> 00:45:16,880
containment vessel

1303
00:45:22,069 --> 00:45:18,720
which will be sealed you know in mars

1304
00:45:23,430 --> 00:45:22,079
orbit um but we think the

1305
00:45:24,390 --> 00:45:23,440
the highest you know amount of gas we're

1306
00:45:26,069 --> 00:45:24,400
going to get is from those that from

1307
00:45:28,309 --> 00:45:26,079
inside the sample tubes so that includes

1308
00:45:30,309 --> 00:45:28,319
both the headspace gas and you know

1309
00:45:32,309 --> 00:45:30,319
atmospheric sample tubes or basically

1310
00:45:34,550 --> 00:45:32,319
sample tubes that mars 2020 has sealed

1311
00:45:38,390 --> 00:45:34,560
while empty to kind of uh deliver

1312
00:45:43,750 --> 00:45:40,550
hi annalise meyer mit what's

1313
00:45:44,950 --> 00:45:43,760

oceanographic um i was wondering for

1314
00:45:47,190 --> 00:45:44,960
[Music]

1315
00:45:50,390 --> 00:45:47,200
should samples be deemed unsafe to

1316
00:45:51,829 --> 00:45:50,400
release and sterilization sensitive

1317
00:45:53,190 --> 00:45:51,839
uh science

1318
00:45:55,589 --> 00:45:53,200
um

1319
00:45:57,910 --> 00:45:55,599
should should labs looking to perform

1320
00:46:00,390 --> 00:45:57,920
sterilization sensitive science

1321
00:46:02,550 --> 00:46:00,400
count on being able to work within the

1322
00:46:05,270 --> 00:46:02,560
srf or is that going to be limited to

1323
00:46:06,710 --> 00:46:05,280
nasa affiliates and especially um

1324
00:46:07,750 --> 00:46:06,720
involving the international science

1325
00:46:09,430 --> 00:46:07,760
community because i know you mentioned

1326
00:46:10,550 --> 00:46:09,440
the security concerns yeah so like i

1327
00:46:12,230 --> 00:46:10,560
said one of the you know one of our

1328
00:46:14,550 --> 00:46:12,240
guiding principles here is is

1329
00:46:17,109 --> 00:46:14,560
accessibility to the sample so even for

1330
00:46:19,109 --> 00:46:17,119
completed investigations inside the srf

1331
00:46:20,710 --> 00:46:19,119
you know those would need to be open to

1332
00:46:21,750 --> 00:46:20,720
the international you know science

1333
00:46:24,790 --> 00:46:21,760
community

1334
00:46:26,630 --> 00:46:24,800
the mspg2 sterilization sensitive

1335
00:46:27,670 --> 00:46:26,640
study identified

1336
00:46:28,870 --> 00:46:27,680
a number of instruments and

1337
00:46:30,710 --> 00:46:28,880
investigations that they think would

1338
00:46:31,829 --> 00:46:30,720

need to be present inside the srf and

1339
00:46:34,069 --> 00:46:31,839
you know we expect most of the

1340
00:46:35,670 --> 00:46:34,079
opportunities to do those to be competed

1341
00:46:37,109 --> 00:46:35,680
but they did identify some things that

1342
00:46:39,030 --> 00:46:37,119
you know aren't time sensitive and

1343
00:46:41,589 --> 00:46:39,040
perhaps aren't necessary for the sample

1344
00:46:43,589 --> 00:46:41,599
safety assessment and so we can kind of

1345
00:46:45,750 --> 00:46:43,599
hope that we get unsterilized samples

1346
00:46:48,630 --> 00:46:45,760
out later but if we don't you can see

1347
00:46:50,309 --> 00:46:48,640
this kind of um red box on the lower

1348
00:46:52,230 --> 00:46:50,319
right hand corner where we would need to

1349
00:46:54,470 --> 00:46:52,240
add contingency capability so that may

1350
00:46:56,470 --> 00:46:54,480
not be inside the original srf it may be

1351
00:46:58,150 --> 00:46:56,480
a new modular building

1352
00:47:00,150 --> 00:46:58,160
that can be um

1353
00:47:02,069 --> 00:47:00,160
that can add additional capabilities if

1354
00:47:03,670 --> 00:47:02,079
we find more things and but yeah i do

1355
00:47:05,670 --> 00:47:03,680
expect that all of those kind of science

1356
00:47:07,510 --> 00:47:05,680
investigation opportunities would be

1357
00:47:09,349 --> 00:47:07,520
open you know to our international you

1358
00:47:11,589 --> 00:47:09,359
know partners and would go through a

1359
00:47:15,430 --> 00:47:11,599
competition process that that's fair

1360
00:47:19,190 --> 00:47:17,829
hey brandi andrew gangadeen granberg

1361
00:47:21,270 --> 00:47:19,200
institute of science first of all that

1362
00:47:23,670 --> 00:47:21,280
was very well communicated so thank you

1363
00:47:25,910 --> 00:47:23,680

i'm wondering so when these are being

1364
00:47:27,109 --> 00:47:25,920
sent out or considered for analyses you

1365
00:47:28,710 --> 00:47:27,119
know there's seemingly an infinite

1366
00:47:31,190 --> 00:47:28,720
number of analyses you can do on these

1367
00:47:33,589 --> 00:47:31,200
samples but um some of them might be

1368
00:47:35,190 --> 00:47:33,599
prohibitive of future analyses so for

1369
00:47:36,470 --> 00:47:35,200
instance if you

1370
00:47:37,829 --> 00:47:36,480
made thin sections of the sample is

1371
00:47:39,910 --> 00:47:37,839
great but then if you send it off to

1372
00:47:41,270 --> 00:47:39,920
someone to do raman spectroscopy it

1373
00:47:42,950 --> 00:47:41,280
might make a little divot in the sample

1374
00:47:45,270 --> 00:47:42,960
that prevents you know effective sims

1375
00:47:47,910 --> 00:47:45,280
analyses next so is there a you know

1376
00:47:49,510 --> 00:47:47,920
planned list of desired an analytical

1377
00:47:50,470 --> 00:47:49,520
order for these samples that's being

1378
00:47:51,910 --> 00:47:50,480
developed

1379
00:47:53,510 --> 00:47:51,920
yeah and that's so that's a little bit

1380
00:47:55,030 --> 00:47:53,520
of part of the sample you know workflow

1381
00:47:56,390 --> 00:47:55,040
planning but i think one of the other

1382
00:47:57,990 --> 00:47:56,400
things that you know might be really

1383
00:47:59,750 --> 00:47:58,000
beneficial is you know when the

1384
00:48:01,349 --> 00:47:59,760
proposals are being written to do these

1385
00:48:03,030 --> 00:48:01,359
analyses particularly for things where

1386
00:48:05,349 --> 00:48:03,040
samples would be sent out is you know

1387
00:48:07,270 --> 00:48:05,359
for consortia you know studies that

1388
00:48:09,349 --> 00:48:07,280

propose a sequence of analyses that

1389
00:48:11,190 --> 00:48:09,359
could be done on on one sample to kind

1390
00:48:13,430 --> 00:48:11,200
of maximize the use on this sample i

1391
00:48:15,270 --> 00:48:13,440
mean as you may or may not know you know

1392
00:48:17,829 --> 00:48:15,280
once a sample is kind of released from

1393
00:48:19,829 --> 00:48:17,839
you know the custody of curation you

1394
00:48:21,349 --> 00:48:19,839
know you don't really know what happened

1395
00:48:22,390 --> 00:48:21,359
to it or what kind of contamination it

1396
00:48:24,230 --> 00:48:22,400
went through so it's always going to be

1397
00:48:26,790 --> 00:48:24,240
considered you know obviously a

1398
00:48:27,910 --> 00:48:26,800
non-pristine you know kind of less

1399
00:48:29,030 --> 00:48:27,920
anything you find in that sample

1400
00:48:30,710 --> 00:48:29,040
subsequently you're probably going to

1401
00:48:32,790 --> 00:48:30,720
assume is some kind of contamination

1402
00:48:35,589 --> 00:48:32,800
because you haven't been watching that

1403
00:48:37,270 --> 00:48:35,599
sample the entire time um so yeah i

1404
00:48:38,870 --> 00:48:37,280
think in terms of maximizing sample mass

1405
00:48:40,710 --> 00:48:38,880
you want to look at you know the

1406
00:48:42,870 --> 00:48:40,720
sequencing the thing so that you start

1407
00:48:44,150 --> 00:48:42,880
with the least destructive analyses and

1408
00:48:46,309 --> 00:48:44,160
then you progress

1409
00:48:48,870 --> 00:48:46,319
to more and more destructive yeah

1410
00:48:50,390 --> 00:48:48,880
thanks

1411
00:48:52,630 --> 00:48:50,400
this is back to the

1412
00:48:54,549 --> 00:48:52,640
question about the hair space of gas in

1413
00:48:57,190 --> 00:48:54,559

the hair space it might be worth to have

1414
00:49:00,549 --> 00:48:57,200
a procedure when you remove it prior to

1415
00:49:03,030 --> 00:49:00,559
sterilization of the sample because

1416
00:49:05,510 --> 00:49:03,040
if there is like co2 in that tube

1417
00:49:07,349 --> 00:49:05,520
with a sample and blasted with gamma

1418
00:49:10,950 --> 00:49:07,359
the rate of degradation can increase

1419
00:49:11,910 --> 00:49:10,960
significantly so i appear yes yeah so

1420
00:49:17,670 --> 00:49:11,920
yeah

1421
00:49:19,510 --> 00:49:17,680
um you would puncture that you know hook

1422
00:49:20,790 --> 00:49:19,520
well and again this is very preliminary

1423
00:49:22,150 --> 00:49:20,800
stuff right but that you would hook the

1424
00:49:24,069 --> 00:49:22,160
sample tube up to some kind of gas

1425
00:49:26,230 --> 00:49:24,079
manifold to puncture the tube and

1426
00:49:28,630 --> 00:49:26,240
extract the headspace gas before you

1427
00:49:30,790 --> 00:49:28,640
extract the solid sample and then you

1428
00:49:31,990 --> 00:49:30,800
would hold that gas and then you could

1429
00:49:34,069 --> 00:49:32,000
do things that are sterilization

1430
00:49:36,069 --> 00:49:34,079
sensitive on that gas potentially even

1431
00:49:38,710 --> 00:49:36,079
then sterilize subsamples of gas to go

1432
00:49:40,150 --> 00:49:38,720
to you know stable isotope laboratories

1433
00:49:41,670 --> 00:49:40,160
and things like that but you would

1434
00:49:43,510 --> 00:49:41,680
definitely want to open the sample tubes

1435
00:49:47,349 --> 00:49:43,520
and extract that gas before you

1436
00:49:51,030 --> 00:49:49,270
hi there i'm tristan caro from cu

1437
00:49:52,710 --> 00:49:51,040
boulder um these are really exciting

1438
00:49:54,630 --> 00:49:52,720

developments and i am excited for the

1439
00:49:56,309 --> 00:49:54,640
publications that are coming down the

1440
00:49:58,069 --> 00:49:56,319
road i'm curious though if you could

1441
00:49:59,990 --> 00:49:58,079
elaborate on the sort of quantitative

1442
00:50:02,630 --> 00:50:00,000
thresholding that you're thinking of

1443
00:50:04,630 --> 00:50:02,640
using for the uh

1444
00:50:05,990 --> 00:50:04,640
the whole flow chart that you showed and

1445
00:50:07,510 --> 00:50:06,000
specifically like

1446
00:50:10,710 --> 00:50:07,520
what sort of

1447
00:50:12,549 --> 00:50:10,720
biomarkers are being considered for like

1448
00:50:14,470 --> 00:50:12,559
that that's sort of i think you use

1449
00:50:15,910 --> 00:50:14,480
bayesian thresholding or you mentioned

1450
00:50:17,910 --> 00:50:15,920
that a little bit you mean like for the

1451
00:50:19,349 --> 00:50:17,920
sample safety assessment exactly yeah

1452
00:50:21,670 --> 00:50:19,359
i'm gonna i'm gonna defer that question

1453
00:50:23,510 --> 00:50:21,680
until the report comes out but i i will

1454
00:50:25,510 --> 00:50:23,520
say that um and i believe that there is

1455
00:50:27,589 --> 00:50:25,520
a notional uh number here on this chart

1456
00:50:29,670 --> 00:50:27,599
so this is for example 1 times 10 to the

1457
00:50:31,109 --> 00:50:29,680
minus 6. so this is kind of the number

1458
00:50:33,270 --> 00:50:31,119
that the flight missions have been using

1459
00:50:34,790 --> 00:50:33,280
is they need to they want to assure that

1460
00:50:36,549 --> 00:50:34,800
they have less than a one in a million

1461
00:50:39,190 --> 00:50:36,559
chance of releasing

1462
00:50:40,790 --> 00:50:39,200
a single unsterilized martian particle

1463
00:50:42,870 --> 00:50:40,800

into the martian biosphere so i think

1464
00:50:44,069 --> 00:50:42,880
that's like a a reasonable kind of uh

1465
00:50:45,589 --> 00:50:44,079
starting point as you want to make sure

1466
00:50:48,230 --> 00:50:45,599
it's you know less than a one in a

1467
00:50:50,549 --> 00:50:48,240
million chance um but again i and feel

1468
00:50:51,829 --> 00:50:50,559
free to follow up with me um about that

1469
00:50:53,670 --> 00:50:51,839
and i can i can send you the report once

1470
00:50:55,670 --> 00:50:53,680
it's finalized we had a little

1471
00:50:56,950 --> 00:50:55,680
publishing uh snafu that's held it up

1472
00:50:58,870 --> 00:50:56,960
but we do expect the paper to be

1473
00:51:02,069 --> 00:50:58,880
available in in the next week or so

1474
00:51:06,470 --> 00:51:04,309
yeah thank you for your talk this made

1475
00:51:09,430 --> 00:51:06,480
it really uh put everything all in one

1476
00:51:12,230 --> 00:51:09,440
place which i find helpful um i'm donnie

1477
00:51:15,270 --> 00:51:12,240
blazer from asu uh i had a question

1478
00:51:16,309 --> 00:51:15,280
about um absorbed or mineral hosted

1479
00:51:17,829 --> 00:51:16,319
water

1480
00:51:21,109 --> 00:51:17,839
if that was going to be a part of the

1481
00:51:22,390 --> 00:51:21,119
gas phase analysis in in in the workflow

1482
00:51:24,230 --> 00:51:22,400
or or

1483
00:51:26,549 --> 00:51:24,240
do we have plans for that

1484
00:51:29,750 --> 00:51:26,559
yes i i i would say that the answer to

1485
00:51:31,109 --> 00:51:29,760
that is yes so we have a kind of um

1486
00:51:33,270 --> 00:51:31,119
and again i'll point you to the the

1487
00:51:34,790 --> 00:51:33,280
mspg2 reports both the sterilization

1488
00:51:36,790 --> 00:51:34,800

sensitive report and the time-sensitive

1489
00:51:37,750 --> 00:51:36,800
report and if anybody actually needs me

1490
00:51:41,430 --> 00:51:37,760
to

1491
00:51:43,109 --> 00:51:41,440
please come see me afterwards and i can

1492
00:51:44,710 --> 00:51:43,119
do that um

1493
00:51:46,390 --> 00:51:44,720
where there is a list of you know

1494
00:51:48,549 --> 00:51:46,400
potential things you would want to

1495
00:51:50,470 --> 00:51:48,559
measure both in the gas and in the solid

1496
00:51:52,710 --> 00:51:50,480
samples of course you know the

1497
00:51:54,470 --> 00:51:52,720
the specific um

1498
00:51:57,910 --> 00:51:54,480
methods to do those measurements and

1499
00:52:01,190 --> 00:51:57,920
stuff are still to be defined but yes

1500
00:52:04,069 --> 00:52:02,710
hi there uh

1501
00:52:06,790 --> 00:52:04,079
haley literal from university of

1502
00:52:08,390 --> 00:52:06,800
arkansas i was just wondering um

1503
00:52:10,230 --> 00:52:08,400
after you've analyzed the samples for

1504
00:52:12,470 --> 00:52:10,240
carbon-based life forms do you have a

1505
00:52:14,390 --> 00:52:12,480
strategy for analyzing those samples for

1506
00:52:15,910 --> 00:52:14,400
non-carbon-based life forms and what is

1507
00:52:17,270 --> 00:52:15,920
the protocol for that

1508
00:52:18,950 --> 00:52:17,280
yeah again i'm gonna i'm gonna i'm gonna

1509
00:52:20,549 --> 00:52:18,960
point you to the report and actually i'm

1510
00:52:22,630 --> 00:52:20,559
not actually a co-author on this one so

1511
00:52:25,190 --> 00:52:22,640
i'm gonna point you to the report but

1512
00:52:27,349 --> 00:52:25,200
there is a section where you can see

1513
00:52:29,030 --> 00:52:27,359

so basically everything that's based on

1514
00:52:30,950 --> 00:52:29,040
carbon and life as we know it is up to

1515
00:52:32,390 --> 00:52:30,960
this uh step seven but then there is a

1516
00:52:35,030 --> 00:52:32,400
there is a step eight here and there's a

1517
00:52:36,790 --> 00:52:35,040
little bit more uh information in the

1518
00:52:38,710 --> 00:52:36,800
sample safety assessment framework

1519
00:52:40,790 --> 00:52:38,720
report once it comes out about how how

1520
00:52:43,109 --> 00:52:40,800
they envision looking for you know life

1521
00:52:45,349 --> 00:52:43,119
that's not as we know it basically more

1522
00:52:48,309 --> 00:52:45,359
agnostic life detection uh techniques

1523
00:52:48,319 --> 00:52:53,190
all right is there anything else online

1524
00:52:57,109 --> 00:52:55,270
okay well i guess