OUR FIRST ATTEMPT TO SAMPLE

ASTEROID BENNU

NASA SCIENCE LIVE

VIRTUAL EDITION

1
00:00:01,000 --> 00:00:11,030
[Music]

2
00:00:15,749 --> 00:00:13,509
for the first time nasa has touched the

3
00:00:18,230 --> 00:00:15,759
surface of asteroid venue to collect the

4
00:00:20,310 --> 00:00:18,240
agency's first ever asteroid sample

5
00:00:22,630 --> 00:00:20,320
which will one day shed new insights on

6
00:00:24,150 --> 00:00:22,640
the history of our solar system so

7
00:00:26,550 --> 00:00:24,160
what's next

8
00:00:28,550 --> 00:00:26,560
i'm your host lauren ward and hello if

9
00:00:31,509 --> 00:00:28,560
you haven't heard we made history

10
00:00:34,389 --> 00:00:31,519
yesterday so let's bring you up to speed

11
00:00:36,310 --> 00:00:34,399
at 6 12 p.m eastern time nasa attempted

12
00:00:38,869 --> 00:00:36,320
to collect a sample from a near-earth

13
00:00:42,150 --> 00:00:38,879

asteroid named bennu since arriving at

14
00:00:44,389 --> 00:00:42,160
bennu in 2018 our osiris-rex spacecraft

15
00:00:46,470 --> 00:00:44,399
has been orbiting the asteroid mapping

16
00:00:49,029 --> 00:00:46,480
it and studying it closely

17
00:00:51,590 --> 00:00:49,039
and yesterday the spacecraft descended

18
00:00:53,830 --> 00:00:51,600
on an asteroid surface and its robotic

19
00:00:56,229 --> 00:00:53,840
arm touched down for a few seconds to

20
00:00:57,430 --> 00:00:56,239
collect the sample of an asteroid's rock

21
00:01:01,189 --> 00:00:57,440
and dust

22
00:01:02,229 --> 00:01:01,199
spacecraft will safely enclose in a

23
00:01:04,229 --> 00:01:02,239
capsule

24
00:01:05,750 --> 00:01:04,239
could tell us more about the history of

25
00:01:08,469 --> 00:01:05,760
our solar system

26
00:01:10,310 --> 00:01:08,479
and that's why in 2023 the sample will

27
00:01:11,750 --> 00:01:10,320
have made its way back to earth so we

28
00:01:14,550 --> 00:01:11,760
can study it

29
00:01:16,710 --> 00:01:14,560
so the question is what happens next

30
00:01:19,830 --> 00:01:16,720
today we are joined by three experts

31
00:01:21,990 --> 00:01:19,840
danny dela justina osiris-rex lead image

32
00:01:25,429 --> 00:01:22,000
processing scientist at university of

33
00:01:27,670 --> 00:01:25,439
arizona jason dworkin osiris-rex project

34
00:01:30,550 --> 00:01:27,680
scientist at nasa goddard and beau

35
00:01:33,109 --> 00:01:30,560
beerhouse osiris-rex tag sam scientist

36
00:01:34,870 --> 00:01:33,119
at lockheed martin thank you so much for

37
00:01:37,030 --> 00:01:34,880
joining us you guys it has been a wild

38
00:01:38,950 --> 00:01:37,040

24 hours

39
00:01:41,670 --> 00:01:38,960
thanks lauren it's great to be here

40
00:01:44,149 --> 00:01:41,680
thank you we're so excited to have you

41
00:01:45,670 --> 00:01:44,159
so danny let's get into it i understand

42
00:01:48,069 --> 00:01:45,680
there's a new video taken by the

43
00:01:50,550 --> 00:01:48,079
spacecraft as it actually descended to

44
00:01:52,230 --> 00:01:50,560
the surface of asteroid bennu could you

45
00:01:54,469 --> 00:01:52,240
walk us through how that was even

46
00:01:56,709 --> 00:01:54,479
created

47
00:01:59,749 --> 00:01:56,719
sure lauren um so this is a video

48
00:02:02,230 --> 00:01:59,759
created from sam cam images and samcam

49
00:02:04,149 --> 00:02:02,240
is one of three cameras that was built

50
00:02:06,469 --> 00:02:04,159
by the university of arizona

51
00:02:10,309 --> 00:02:06,479
specifically to acquire scientific data

52
00:02:13,589 --> 00:02:10,319
of asteroid venue so what we see in the

53
00:02:16,070 --> 00:02:13,599
video is the taxi alarm it's extended

54
00:02:18,229 --> 00:02:16,080
out and tax sam is observing it as the

55
00:02:20,229 --> 00:02:18,239
spacecraft translates across the surface

56
00:02:22,630 --> 00:02:20,239
of venue arriving at nightingale the

57
00:02:24,550 --> 00:02:22,640
sample site and then you see right as we

58
00:02:26,470 --> 00:02:24,560
make contact with the surface and our

59
00:02:29,270 --> 00:02:26,480
nitrogen gas bottle fires to collect

60
00:02:31,350 --> 00:02:29,280
that sample there's a huge spray of

61
00:02:32,869 --> 00:02:31,360
material that's just lofted from the

62
00:02:34,949 --> 00:02:32,879
surface of bennu

63
00:02:37,110 --> 00:02:34,959

and this is a great sign it looks like

64
00:02:38,949 --> 00:02:37,120
we picked up a lot of material and that

65
00:02:41,910 --> 00:02:38,959
means that some of it likely made it

66
00:02:44,790 --> 00:02:41,920
into that sampling mechanism so

67
00:02:47,030 --> 00:02:44,800
we are really happy to see this result

68
00:02:49,509 --> 00:02:47,040
and the movie from sam cam is quite

69
00:02:52,229 --> 00:02:49,519
promising

70
00:02:53,670 --> 00:02:52,239
that is amazing and it's so astonishing

71
00:02:55,750 --> 00:02:53,680
that your team was actually able to put

72
00:02:57,509 --> 00:02:55,760
it together so quickly for our viewers

73
00:02:58,869 --> 00:02:57,519
at home these guys have been up all

74
00:03:00,949 --> 00:02:58,879
night

75
00:03:03,430 --> 00:03:00,959
so bo your team will use this video to

76
00:03:05,670 --> 00:03:03,440
assess the response of tag sam head to

77
00:03:07,030 --> 00:03:05,680
the surface um could you walk us through

78
00:03:09,830 --> 00:03:07,040
exactly what we're seeing in this

79
00:03:11,110 --> 00:03:09,840
amazing video

80
00:03:12,869 --> 00:03:11,120
absolutely

81
00:03:15,430 --> 00:03:12,879
so the first part of the video you'll

82
00:03:18,550 --> 00:03:15,440
see the tag sam heads centered in the

83
00:03:20,390 --> 00:03:18,560
sam cam image as dance

84
00:03:22,470 --> 00:03:20,400
and as the spacecraft descends towards

85
00:03:25,430 --> 00:03:22,480
the surface at a leisurely 10

86
00:03:27,589 --> 00:03:25,440
centimeters per second about 15 times

87
00:03:29,910 --> 00:03:27,599
slower than walking speed

88
00:03:32,710 --> 00:03:29,920

uh eventually the spacecraft senses

89
00:03:35,270 --> 00:03:32,720
contact with cert with the surface

90
00:03:36,550 --> 00:03:35,280
we sensed contact with an accelerometer

91
00:03:38,710 --> 00:03:36,560
on board

92
00:03:41,350 --> 00:03:38,720
and that told the spacecraft to fire the

93
00:03:43,350 --> 00:03:41,360
gas bottle which then released gas under

94
00:03:46,229 --> 00:03:43,360
the knife or released nitrogen gas under

95
00:03:48,470 --> 00:03:46,239
the tax am head which mobilized material

96
00:03:51,270 --> 00:03:48,480
uh we hope into the tag stamp head as

97
00:03:53,270 --> 00:03:51,280
well as outside attack sandpad

98
00:03:55,270 --> 00:03:53,280
the two things that we're really

99
00:03:57,190 --> 00:03:55,280
examining in detail now that we have

100
00:03:58,309 --> 00:03:57,200
these incredible images

101
00:04:00,149 --> 00:03:58,319
is the

102
00:04:02,229 --> 00:04:00,159
response of the tag stem head to the

103
00:04:04,390 --> 00:04:02,239
surface and the response of the surface

104
00:04:06,710 --> 00:04:04,400
to the tag same head itself

105
00:04:08,869 --> 00:04:06,720
um so of course the surface is very

106
00:04:10,949 --> 00:04:08,879
interesting and very dynamic and that

107
00:04:13,429 --> 00:04:10,959
tells us that the material is probably

108
00:04:16,069 --> 00:04:13,439
very weak and doesn't have a lot of

109
00:04:18,469 --> 00:04:16,079
cohesion and so therefore is easily

110
00:04:21,349 --> 00:04:18,479
mobilized and potentially easily called

111
00:04:23,670 --> 00:04:21,359
easily collected inside the tag same pad

112
00:04:25,590 --> 00:04:23,680
the second piece of information we're

113
00:04:28,070 --> 00:04:25,600

trying to understand is the geometry of

114
00:04:29,670 --> 00:04:28,080
the tags and head against the surface

115
00:04:33,350 --> 00:04:29,680
so we want to know whether it was

116
00:04:36,629 --> 00:04:33,360
filtered or flush when it fired the gas

117
00:04:39,189 --> 00:04:36,639
signs preliminary signs suggest

118
00:04:41,909 --> 00:04:39,199
that it had a minor tilt at most which

119
00:04:44,150 --> 00:04:41,919
is very good for sample collection

120
00:04:46,390 --> 00:04:44,160
there's a great um

121
00:04:48,469 --> 00:04:46,400
image now you're seeing a pair of images

122
00:04:49,670 --> 00:04:48,479
of just before contact and just after

123
00:04:51,749 --> 00:04:49,680
contact

124
00:04:53,590 --> 00:04:51,759
and you can see the tag stand head

125
00:04:55,990 --> 00:04:53,600
coping just a little bit

126
00:04:58,870 --> 00:04:56,000
and in fact you can see surface material

127
00:05:00,390 --> 00:04:58,880
moving in response to the contact of the

128
00:05:01,830 --> 00:05:00,400
tag stand head

129
00:05:03,430 --> 00:05:01,840
and we thought that this might happen

130
00:05:05,830 --> 00:05:03,440
based on some of the experiments that we

131
00:05:07,189 --> 00:05:05,840
had done with reduced gravity flight

132
00:05:09,350 --> 00:05:07,199
and the final thing that we're doing is

133
00:05:11,270 --> 00:05:09,360
we're assessing the arm

134
00:05:12,710 --> 00:05:11,280
in the images as we back away just to

135
00:05:15,029 --> 00:05:12,720
make sure that there was no damage to

136
00:05:17,670 --> 00:05:15,039
the arm and so far that all looks great

137
00:05:22,310 --> 00:05:19,990
absolutely spectacular it is so

138
00:05:24,150 --> 00:05:22,320

interesting to watch osiris-rex descend

139
00:05:25,830 --> 00:05:24,160
on the surface to the surface of the

140
00:05:27,430 --> 00:05:25,840
asteroid venue especially when you

141
00:05:30,230 --> 00:05:27,440
consider that these images are coming

142
00:05:31,830 --> 00:05:30,240
from over 2 million miles away so

143
00:05:33,749 --> 00:05:31,840
fantastic

144
00:05:35,990 --> 00:05:33,759
jason the team will analyze the sample

145
00:05:37,909 --> 00:05:36,000
once it's delivered to earth but before

146
00:05:40,469 --> 00:05:37,919
then there is still a ton that has to

147
00:05:42,790 --> 00:05:40,479
happen can you explain how the sample

148
00:05:44,790 --> 00:05:42,800
will be handled from now until it lands

149
00:05:49,430 --> 00:05:44,800
on earth

150
00:05:51,510 --> 00:05:49,440
absolutely so the the next step is to

151
00:05:53,270 --> 00:05:51,520
take images of the

152
00:05:55,670 --> 00:05:53,280
material inside the the sample head

153
00:05:57,510 --> 00:05:55,680
inside of the tag sam head

154
00:05:59,590 --> 00:05:57,520
this weekend we'll be taking

155
00:06:02,629 --> 00:05:59,600
measurements of the

156
00:06:05,510 --> 00:06:02,639
mass of the of the material by extending

157
00:06:07,350 --> 00:06:05,520
the the tag stem arm and rotating the

158
00:06:09,350 --> 00:06:07,360
spacecraft slowly around and measuring

159
00:06:11,189 --> 00:06:09,360
the change in moment of inertia

160
00:06:12,790 --> 00:06:11,199
uh after that we will

161
00:06:14,309 --> 00:06:12,800
assess whether or not we think we have

162
00:06:17,189 --> 00:06:14,319
enough material

163
00:06:19,590 --> 00:06:17,199

uh and then

164
00:06:21,510 --> 00:06:19,600
if we do we can

165
00:06:24,950 --> 00:06:21,520
be opening up the uh the sampling trend

166
00:06:27,270 --> 00:06:24,960
capsule and stowing the material inside

167
00:06:29,350 --> 00:06:27,280
uh at this time we cut off the sample

168
00:06:30,469 --> 00:06:29,360
head close up the the assembly turn

169
00:06:33,029 --> 00:06:30,479
canister

170
00:06:35,990 --> 00:06:33,039
i can see happening right here

171
00:06:39,110 --> 00:06:36,000
then in march uh the spacecraft departs

172
00:06:40,870 --> 00:06:39,120
uh orbits around from bennu or uh

173
00:06:42,950 --> 00:06:40,880
and then heads to earth

174
00:06:44,629 --> 00:06:42,960
the temperature capsule is jettisoned

175
00:06:47,990 --> 00:06:44,639
from the spacecraft

176
00:06:49,670 --> 00:06:48,000
uh landing in the utah desert at utah

177
00:06:50,790 --> 00:06:49,680
testing training range outside salt lake

178
00:06:53,990 --> 00:06:50,800
city

179
00:06:56,230 --> 00:06:54,000
the morning of september 24 2023 the

180
00:06:57,909 --> 00:06:56,240
spacecraft diverts goes into orbit

181
00:07:01,270 --> 00:06:57,919
around the sun

182
00:07:02,950 --> 00:07:01,280
and the sample return capsule is

183
00:07:03,990 --> 00:07:02,960
uh collected by

184
00:07:11,909 --> 00:07:04,000
uh

185
00:07:13,749 --> 00:07:11,919
use of test and training range to make

186
00:07:16,629 --> 00:07:13,759
sure that the uh

187
00:07:17,589 --> 00:07:16,639
pyros and uh batteries are disarmed

188
00:07:20,070 --> 00:07:17,599

flown

189
00:07:20,790 --> 00:07:20,080
to houston to johnson space center where

190
00:07:34,390 --> 00:07:20,800
the

191
00:07:38,469 --> 00:07:36,550
that is fantastic and i want to rectify

192
00:07:41,589 --> 00:07:38,479
something i said before it's it's not

193
00:07:43,029 --> 00:07:41,599
two million miles it's 200 million miles

194
00:07:45,749 --> 00:07:43,039
away that is

195
00:07:48,390 --> 00:07:45,759
so much farther and more impressive than

196
00:07:50,550 --> 00:07:48,400
two million miles so um i understand

197
00:07:52,710 --> 00:07:50,560
that bennu was far more rocky than we

198
00:07:55,029 --> 00:07:52,720
expected making yesterday's maneuver

199
00:07:56,070 --> 00:07:55,039
more difficult than we had ever imagined

200
00:07:57,589 --> 00:07:56,080
um

201
00:08:00,550 --> 00:07:57,599
one thing that i think everybody is

202
00:08:03,110 --> 00:08:00,560
wondering is was that experience

203
00:08:04,550 --> 00:08:03,120
watching bennu you know do the tag was

204
00:08:08,230 --> 00:08:04,560
that nerve-wracking and i really want to

205
00:08:10,710 --> 00:08:08,240
hear from everybody starting with jason

206
00:08:13,830 --> 00:08:10,720
so i've been uh anticipating this moment

207
00:08:15,589 --> 00:08:13,840
since 2004 when i started working on the

208
00:08:19,350 --> 00:08:15,599
predecessor to the osiris-rex mission

209
00:08:20,309 --> 00:08:19,360
osiris uh it's been an amazing journey a

210
00:08:23,110 --> 00:08:20,319
lot of

211
00:08:26,869 --> 00:08:23,120
really talented scientists engineers

212
00:08:29,510 --> 00:08:26,879
managers technicians admins

213
00:08:32,230 --> 00:08:29,520

it's been an incredible journey and that

214
00:08:33,990 --> 00:08:32,240
these few seconds

215
00:08:35,909 --> 00:08:34,000
means so much

216
00:08:39,269 --> 00:08:35,919
and that the sample will be distributed

217
00:08:41,909 --> 00:08:39,279
as a legacy of this team that the world

218
00:08:43,990 --> 00:08:41,919
can enjoy that scientists uh not yet

219
00:08:46,150 --> 00:08:44,000
born using instrumentation not yet

220
00:08:49,670 --> 00:08:46,160
invented can answer questions that we

221
00:08:54,070 --> 00:08:51,829
wow what an amazing gift for the entire

222
00:08:57,190 --> 00:08:54,080
world uh danny i'd love to get your

223
00:09:01,829 --> 00:08:59,509
yeah well so i got my start on

224
00:09:04,790 --> 00:09:01,839
osiris-rex also on the precursor to the

225
00:09:07,430 --> 00:09:04,800
mission named osiris as an undergraduate

226
00:09:09,910 --> 00:09:07,440
student in the early 2000s

227
00:09:11,750 --> 00:09:09,920
and as we were leading up to this event

228
00:09:15,750 --> 00:09:11,760
um you know it occurred to me that i've

229
00:09:18,389 --> 00:09:15,760
been waiting for my life together

230
00:09:20,710 --> 00:09:18,399
um so i went into the event with a lot

231
00:09:24,150 --> 00:09:20,720
of cautious optimism

232
00:09:26,949 --> 00:09:24,160
um because this team is exceptional and

233
00:09:29,590 --> 00:09:26,959
i know we had done everything possible

234
00:09:31,670 --> 00:09:29,600
to minimize the risks associated with

235
00:09:34,150 --> 00:09:31,680
gathering the sample from venue um even

236
00:09:36,230 --> 00:09:34,160
though you mentioned lauren it was more

237
00:09:37,670 --> 00:09:36,240
challenging than we were expecting uh

238
00:09:40,150 --> 00:09:37,680

the surface was far

239
00:09:41,110 --> 00:09:40,160
here anticipated when we designed the

240
00:09:43,750 --> 00:09:41,120
mission

241
00:09:45,910 --> 00:09:43,760
uh so i felt confident that we had done

242
00:09:47,990 --> 00:09:45,920
everything in our control to achieve

243
00:09:49,269 --> 00:09:48,000
mission success and the rest was up to

244
00:09:50,470 --> 00:09:49,279
venue

245
00:09:53,190 --> 00:09:50,480
and and

246
00:09:55,269 --> 00:09:53,200
it turns out better complied um and it

247
00:09:57,750 --> 00:09:55,279
looks like we've

248
00:09:59,829 --> 00:09:57,760
we've achieved what we were hoping for

249
00:10:02,150 --> 00:09:59,839
but there's a little more work to go to

250
00:10:04,710 --> 00:10:02,160
to verify the amount of sample we

251
00:10:07,590 --> 00:10:04,720
collected

252
00:10:10,470 --> 00:10:07,600
bennu definitely did an outstanding job

253
00:10:12,310 --> 00:10:10,480
and it did exactly what we intended um

254
00:10:15,269 --> 00:10:12,320
bo what were you thinking during the tag

255
00:10:19,670 --> 00:10:17,750
i was thinking a lot of things and so

256
00:10:21,590 --> 00:10:19,680
many things that it's probably hard to

257
00:10:23,910 --> 00:10:21,600
to put in a small number of words in a

258
00:10:26,389 --> 00:10:23,920
short period of time

259
00:10:28,069 --> 00:10:26,399
of course incredibly exciting i've been

260
00:10:30,790 --> 00:10:28,079
waiting for this moment

261
00:10:33,910 --> 00:10:30,800
also since 2004 i started working on the

262
00:10:35,550 --> 00:10:33,920
mission in 2004

263
00:10:39,269 --> 00:10:35,560

have done

264
00:10:41,829 --> 00:10:39,279
890 collection tests with tag sam

265
00:10:44,150 --> 00:10:41,839
multiple reduced gravity flights

266
00:10:46,150 --> 00:10:44,160
and the team was incredibly well

267
00:10:49,350 --> 00:10:46,160
prepared we couldn't have done anything

268
00:10:50,470 --> 00:10:49,360
more we had rehearsed the tag uh twice

269
00:10:52,470 --> 00:10:50,480
before

270
00:10:55,110 --> 00:10:52,480
in real life with the spacecraft around

271
00:10:57,509 --> 00:10:55,120
venue and many many times before

272
00:11:00,230 --> 00:10:57,519
in simulations on our computers

273
00:11:02,550 --> 00:11:00,240
so we had a pretty good idea of what to

274
00:11:04,069 --> 00:11:02,560
expect and what could go wrong and how

275
00:11:05,350 --> 00:11:04,079
to handle things that they might have

276
00:11:07,829 --> 00:11:05,360
gone wrong

277
00:11:08,949 --> 00:11:07,839
the one thing we had not

278
00:11:12,150 --> 00:11:08,959
tested

279
00:11:14,389 --> 00:11:12,160
was the actual kagsam collection event

280
00:11:16,150 --> 00:11:14,399
at bennu so even though we have done

281
00:11:17,910 --> 00:11:16,160
hundreds of tests

282
00:11:19,670 --> 00:11:17,920
on the ground and on reduced gravity

283
00:11:21,190 --> 00:11:19,680
flights we had never

284
00:11:22,630 --> 00:11:21,200
done this sample collection event at

285
00:11:24,710 --> 00:11:22,640
bennu before

286
00:11:26,870 --> 00:11:24,720
so that was the last piece we hadn't

287
00:11:29,269 --> 00:11:26,880
done it's an important piece but as

288
00:11:31,910 --> 00:11:29,279

danny said uh fortunately bennett

289
00:11:33,829 --> 00:11:31,920
complied it's one of the three ways uh

290
00:11:37,110 --> 00:11:33,839
in which venue actually worked in our

291
00:11:38,949 --> 00:11:37,120
favor it was rockier than expected there

292
00:11:41,030 --> 00:11:38,959
were particles being ejected off the

293
00:11:44,069 --> 00:11:41,040
surface that we didn't expect

294
00:11:46,630 --> 00:11:44,079
but uh in this particular case um venus

295
00:11:47,430 --> 00:11:46,640
teams to have have fallen in our favor

296
00:11:49,670 --> 00:11:47,440
and

297
00:11:50,870 --> 00:11:49,680
after having worked 16 years on this

298
00:11:53,509 --> 00:11:50,880
program

299
00:11:56,230 --> 00:11:53,519
to have all of that time collapse down

300
00:11:59,670 --> 00:11:56,240
into just a few seconds it's a

301
00:12:02,389 --> 00:11:59,680
it's a weird surreal juxtaposition of

302
00:12:04,790 --> 00:12:02,399
time scales but i'm i'm incredibly happy

303
00:12:07,110 --> 00:12:04,800
and proud and excited for for everybody

304
00:12:09,350 --> 00:12:07,120
involved

305
00:12:12,310 --> 00:12:09,360
well this team is second to none and you

306
00:12:14,870 --> 00:12:12,320
guys were adaptable beyond any uh

307
00:12:18,150 --> 00:12:14,880
imaginable scope so it's it's worth

308
00:12:19,910 --> 00:12:18,160
being extremely proud about um so we've

309
00:12:22,230 --> 00:12:19,920
been able to study asteroids that have

310
00:12:24,949 --> 00:12:22,240
come through earth's atmosphere before

311
00:12:28,550 --> 00:12:24,959
danny what makes what is different about

312
00:12:33,269 --> 00:12:30,629
now that's a really good question lauren

313
00:12:35,269 --> 00:12:33,279

so you're right um we do have meteorites

314
00:12:37,590 --> 00:12:35,279
that come from asteroids in our sample

315
00:12:40,069 --> 00:12:37,600
collections on earth but you know those

316
00:12:42,550 --> 00:12:40,079
meteorites only represent the material

317
00:12:45,030 --> 00:12:42,560
that is strong enough to survive of what

318
00:12:46,230 --> 00:12:45,040
is a very warm entry through earth's

319
00:12:47,910 --> 00:12:46,240
atmosphere

320
00:12:49,110 --> 00:12:47,920
as well as an impact on the earth's

321
00:12:50,069 --> 00:12:49,120
surface

322
00:12:52,230 --> 00:12:50,079
and so

323
00:12:54,790 --> 00:12:52,240
the data that we've obtained so far from

324
00:12:57,030 --> 00:12:54,800
bennu using the osiris-rex spacecraft it

325
00:12:58,790 --> 00:12:57,040
indicates that the asteroid has

326
00:13:02,310 --> 00:12:58,800
water-bearing minerals

327
00:13:05,030 --> 00:13:02,320
and organic molecules um and this

328
00:13:07,190 --> 00:13:05,040
material might be pretty fragile and

329
00:13:09,269 --> 00:13:07,200
thus it wouldn't be represented in our

330
00:13:12,230 --> 00:13:09,279
meteorite collection you know it likely

331
00:13:15,509 --> 00:13:12,240
wouldn't survive that atmospheric entry

332
00:13:17,829 --> 00:13:15,519
onto earth's surface um but additionally

333
00:13:19,590 --> 00:13:17,839
by going to bennu to acquire a sample

334
00:13:22,069 --> 00:13:19,600
directly from its surface

335
00:13:24,949 --> 00:13:22,079
in a very controlled way putting it in a

336
00:13:26,949 --> 00:13:24,959
safe and clean sample return capsule

337
00:13:29,430 --> 00:13:26,959
we know that that material

338
00:13:31,430 --> 00:13:29,440

it's not going to be contaminated by you

339
00:13:33,269 --> 00:13:31,440
know the earth's surface in the same way

340
00:13:35,990 --> 00:13:33,279
that meteorites are

341
00:13:38,150 --> 00:13:36,000
and so it really offers an unprecedented

342
00:13:40,710 --> 00:13:38,160
opportunity to study

343
00:13:42,550 --> 00:13:40,720
material from an asteroid that we might

344
00:13:45,590 --> 00:13:42,560
not have in our meteorite collection and

345
00:13:49,030 --> 00:13:45,600
that is pristine and hasn't experienced

346
00:13:53,509 --> 00:13:51,750
fantastic um okay so let's get down to

347
00:13:55,910 --> 00:13:53,519
it the internet is buzzing with

348
00:13:58,310 --> 00:13:55,920
excitement around yesterday's events

349
00:14:00,550 --> 00:13:58,320
and many people have questions so let's

350
00:14:02,389 --> 00:14:00,560
take a few now if you're watching this

351
00:14:04,949 --> 00:14:02,399
and you have questions submit them

352
00:14:07,269 --> 00:14:04,959
online by using the hashtag to bennu and

353
00:14:08,629 --> 00:14:07,279
back or comment on the stream wherever

354
00:14:09,509 --> 00:14:08,639
you're watching this

355
00:14:12,550 --> 00:14:09,519
okay

356
00:14:14,629 --> 00:14:12,560
our first question is from anna too

357
00:14:16,949 --> 00:14:14,639
who is an eighth grader at mesa verde

358
00:14:19,110 --> 00:14:16,959
middle school and she asks

359
00:14:21,509 --> 00:14:19,120
is there a possibility that this sample

360
00:14:24,069 --> 00:14:21,519
can change the design of future bots

361
00:14:26,069 --> 00:14:24,079
made for the same purpose that is an

362
00:14:30,710 --> 00:14:26,079
engineer in the making

363
00:14:34,310 --> 00:14:31,750

we can

364
00:14:35,750 --> 00:14:34,320
uh try to answer that question it is an

365
00:14:38,470 --> 00:14:35,760
excellent question

366
00:14:39,509 --> 00:14:38,480
and uh we hope the answer is absolutely

367
00:14:41,829 --> 00:14:39,519
yes

368
00:14:43,030 --> 00:14:41,839
one of the major challenges we had for

369
00:14:45,430 --> 00:14:43,040
this mission

370
00:14:48,310 --> 00:14:45,440
was trying to design a sample collection

371
00:14:49,910 --> 00:14:48,320
device for material that we didn't know

372
00:14:52,310 --> 00:14:49,920
what it was like we didn't know what the

373
00:14:54,389 --> 00:14:52,320
mechanical property might be we didn't

374
00:14:57,030 --> 00:14:54,399
have a good understanding of what really

375
00:14:59,110 --> 00:14:57,040
the size distribution of the particles

376
00:15:02,230 --> 00:14:59,120
might be and and by that i mean how many

377
00:15:03,670 --> 00:15:02,240
there are of any particular size

378
00:15:05,189 --> 00:15:03,680
we didn't know if the material was

379
00:15:07,269 --> 00:15:05,199
strong or weak

380
00:15:09,670 --> 00:15:07,279
and uh now that we've done this sample

381
00:15:11,509 --> 00:15:09,680
collection event at venu all of the data

382
00:15:13,829 --> 00:15:11,519
that we've collected

383
00:15:16,150 --> 00:15:13,839
both during this peg event now but as

384
00:15:17,670 --> 00:15:16,160
well as examining the sample itself when

385
00:15:19,670 --> 00:15:17,680
it comes back to earth

386
00:15:21,670 --> 00:15:19,680
we'll actually be able to make direct

387
00:15:23,030 --> 00:15:21,680
measurements of the strength of this

388
00:15:25,110 --> 00:15:23,040

material

389
00:15:27,829 --> 00:15:25,120
how electrically conductive is this

390
00:15:29,910 --> 00:15:27,839
material how magnetic is it and these

391
00:15:32,710 --> 00:15:29,920
will inform ways that we can design

392
00:15:35,030 --> 00:15:32,720
systems in the future to interact with

393
00:15:36,310 --> 00:15:35,040
other asteroids for for future missions

394
00:15:40,629 --> 00:15:36,320
so

395
00:15:43,829 --> 00:15:40,639
great question

396
00:15:46,389 --> 00:15:43,839
so speaking of material molly on twitter

397
00:15:49,110 --> 00:15:46,399
sorry molly on twitch asks why did the

398
00:15:51,269 --> 00:15:49,120
rocks on bennu crumble so easily are

399
00:15:53,269 --> 00:15:51,279
they very loose uh or was there an

400
00:15:59,829 --> 00:15:53,279
impact was it because of the impact of

401
00:16:03,269 --> 00:16:01,990
danny you talked about that a little bit

402
00:16:06,629 --> 00:16:03,279
sure

403
00:16:09,269 --> 00:16:06,639
yeah i can i can uh explain that so um

404
00:16:11,350 --> 00:16:09,279
in all of the indications that we had

405
00:16:13,269 --> 00:16:11,360
from um the

406
00:16:15,509 --> 00:16:13,279
instruments on board the osiris-rex

407
00:16:17,430 --> 00:16:15,519
spacecraft were

408
00:16:19,910 --> 00:16:17,440
telling us that boulders on venue are

409
00:16:22,949 --> 00:16:19,920
exceptionally weak um so even though the

410
00:16:25,670 --> 00:16:22,959
surface looks really rocky and jagged

411
00:16:29,110 --> 00:16:25,680
we think that these boulders are

412
00:16:32,069 --> 00:16:29,120
almost like balls of mud and likely

413
00:16:34,790 --> 00:16:32,079

crumble very very easily under

414
00:16:37,269 --> 00:16:34,800
even small forces so while we weren't

415
00:16:40,069 --> 00:16:37,279
necessarily expecting the tag sam head

416
00:16:42,069 --> 00:16:40,079
to uh crumble rocks on the surface of

417
00:16:44,230 --> 00:16:42,079
bennu when it was designed

418
00:16:48,629 --> 00:16:44,240
we think that might be what took place

419
00:16:52,870 --> 00:16:50,790
wow yeah i am that question too that is

420
00:16:55,990 --> 00:16:52,880
a uh a lot of debris it looks like but

421
00:16:57,910 --> 00:16:56,000
all very safe so joe on twitter asks

422
00:17:00,470 --> 00:16:57,920
will the spin to measure the mass

423
00:17:04,789 --> 00:17:00,480
collected cause a loss of material

424
00:17:09,029 --> 00:17:07,669
uh so the the spin is is very slow

425
00:17:11,029 --> 00:17:09,039
actually bo he looks like you're about

426
00:17:16,829 --> 00:17:11,039
to say something uh you're more expert

427
00:17:22,949 --> 00:17:20,710
am uh sure okay yeah jason's making an

428
00:17:24,230 --> 00:17:22,959
excellent point so that the spin is very

429
00:17:27,110 --> 00:17:24,240
very slow

430
00:17:29,270 --> 00:17:27,120
it's a very gentle movement and um the

431
00:17:31,510 --> 00:17:29,280
way that the collection device is

432
00:17:34,070 --> 00:17:31,520
designed is there's actually

433
00:17:36,390 --> 00:17:34,080
um basically a flap that prevents

434
00:17:38,870 --> 00:17:36,400
material from leaving the collection

435
00:17:39,909 --> 00:17:38,880
device after it's been sampled

436
00:17:41,909 --> 00:17:39,919
so

437
00:17:44,789 --> 00:17:41,919
it the material can go in when we

438
00:17:49,510 --> 00:17:44,799

collect it but it can't come out after

439
00:17:54,789 --> 00:17:51,510
okay there you have it

440
00:17:56,070 --> 00:17:54,799
okay so nathaniel on twitter asks

441
00:17:58,070 --> 00:17:56,080
it was mentioned that there was a

442
00:18:00,710 --> 00:17:58,080
possible carbonate that there's possibly

443
00:18:03,110 --> 00:18:00,720
carbonate on bennu if this is the case

444
00:18:05,669 --> 00:18:03,120
um is there any hypothesis on how the

445
00:18:10,950 --> 00:18:05,679
carbonate was formed um any papers

446
00:18:16,230 --> 00:18:13,990
sure i can answer that

447
00:18:18,789 --> 00:18:16,240
yeah so um there is actually a paper

448
00:18:21,990 --> 00:18:18,799
that just recently came out

449
00:18:23,990 --> 00:18:22,000
by our colleague hannah kaplan

450
00:18:25,990 --> 00:18:24,000
who is a scientist on the team who

451
00:18:28,470 --> 00:18:26,000
analyzed the composition of these

452
00:18:30,390 --> 00:18:28,480
carbonates and so i would encourage you

453
00:18:31,909 --> 00:18:30,400
to check out her

454
00:18:34,390 --> 00:18:31,919
her publication

455
00:18:37,830 --> 00:18:34,400
but our leading hypothesis for how these

456
00:18:40,070 --> 00:18:37,840
carbonates formed on bennu's parent body

457
00:18:41,669 --> 00:18:40,080
actually

458
00:18:44,470 --> 00:18:41,679
is that there was a large-scale

459
00:18:46,630 --> 00:18:44,480
hydrothermal system um so there was

460
00:18:49,830 --> 00:18:46,640
water flowing in the interior of the

461
00:18:53,029 --> 00:18:49,840
asteroid that percolated through cracks

462
00:18:56,310 --> 00:18:53,039
in rocks and um eventually precipitated

463
00:18:58,549 --> 00:18:56,320

carbonate and this is really exciting

464
00:19:02,150 --> 00:18:58,559
because it indicates that venue's parent

465
00:19:04,150 --> 00:19:02,160
body was a it was a water world um and

466
00:19:06,630 --> 00:19:04,160
so benny was is what we call a rubble

467
00:19:09,190 --> 00:19:06,640
pile asteroid and we think it

468
00:19:12,310 --> 00:19:09,200
accumulated from the fragments of a

469
00:19:15,270 --> 00:19:12,320
giant impact on its parent body

470
00:19:17,350 --> 00:19:15,280
and so by studying venue we start to get

471
00:19:19,270 --> 00:19:17,360
pieces and clues about what took place

472
00:19:21,750 --> 00:19:19,280
on this water world in the early solar

473
00:19:24,390 --> 00:19:21,760
system before it was catastrophically

474
00:19:27,029 --> 00:19:24,400
disrupted

475
00:19:30,310 --> 00:19:27,039
and speaking of um

476
00:19:32,310 --> 00:19:30,320
speaking of that jl on periscope asks

477
00:19:34,870 --> 00:19:32,320
did you find any fault lines during your

478
00:19:40,710 --> 00:19:34,880
scan or is this asteroid pretty much

479
00:19:44,310 --> 00:19:42,549
jason do you want to get that

480
00:19:47,669 --> 00:19:44,320
well i was going to say this is post

481
00:19:50,630 --> 00:19:47,679
expertise but i can answer for him uh so

482
00:19:51,350 --> 00:19:50,640
there are are uh limits or lines that

483
00:19:54,950 --> 00:19:51,360
run

484
00:19:55,909 --> 00:19:54,960
around bennu in some spots

485
00:19:58,630 --> 00:19:55,919
but

486
00:20:00,950 --> 00:19:58,640
there's macro porosity there are holes

487
00:20:02,549 --> 00:20:00,960
empty spaces inside bennu based on the

488
00:20:05,110 --> 00:20:02,559

gravity

489
00:20:06,789 --> 00:20:05,120
model that we've developed from

490
00:20:10,149 --> 00:20:06,799
watching those particles fly around

491
00:20:13,350 --> 00:20:10,159
bennu and from our close observations uh

492
00:20:15,830 --> 00:20:13,360
so it is not a solid rock it's it's

493
00:20:17,750 --> 00:20:15,840
very fluffy and that's also consistent

494
00:20:20,710 --> 00:20:17,760
with the crumbliness of the surface that

495
00:20:22,230 --> 00:20:20,720
we saw

496
00:20:23,990 --> 00:20:22,240
so it looks like we have a lot of people

497
00:20:27,110 --> 00:20:24,000
really interested on how they can see

498
00:20:28,310 --> 00:20:27,120
these photos eventually um dutch steam

499
00:20:29,830 --> 00:20:28,320
machine

500
00:20:32,070 --> 00:20:29,840
on youtube app

501
00:20:34,070 --> 00:20:32,080
i would love to enhance and

502
00:20:35,669 --> 00:20:34,080
look at these photos once they arrive is

503
00:20:41,510 --> 00:20:35,679
there a website to download the raw

504
00:20:45,909 --> 00:20:44,549
yeah so i can i get this question um as

505
00:20:47,110 --> 00:20:45,919
the image processing lead for the

506
00:20:49,270 --> 00:20:47,120
mission so

507
00:20:51,270 --> 00:20:49,280
many of the images that were recently

508
00:20:53,110 --> 00:20:51,280
acquired um

509
00:20:55,750 --> 00:20:53,120
for the sampling event itself are going

510
00:20:58,950 --> 00:20:55,760
to be available on the osiris-rex

511
00:21:01,830 --> 00:20:58,960
website which is asteroidmission.org

512
00:21:03,830 --> 00:21:01,840
and then uh data as it becomes

513
00:21:05,590 --> 00:21:03,840

publicly available is released to nasa's

514
00:21:07,190 --> 00:21:05,600
planetary data system

515
00:21:10,390 --> 00:21:07,200
and that's where you can access all of

516
00:21:12,470 --> 00:21:10,400
the raw images that haven't undergone

517
00:21:14,549 --> 00:21:12,480
any processing

518
00:21:16,710 --> 00:21:14,559
and that is available as a resource to

519
00:21:18,310 --> 00:21:16,720
the entire world to access the

520
00:21:20,789 --> 00:21:18,320
incredible data we've acquired with the

521
00:21:22,710 --> 00:21:20,799
osiris-rex mission

522
00:21:25,029 --> 00:21:22,720
absolutely we've got one interesting

523
00:21:27,909 --> 00:21:25,039
question here was the impact to the

524
00:21:31,909 --> 00:21:27,919
asteroid so strong or strong enough to

525
00:21:36,950 --> 00:21:34,950
uh the the contact was uh imparted a

526
00:21:39,750 --> 00:21:36,960
very small force relative to the size of

527
00:21:42,390 --> 00:21:39,760
the asteroid so the the the motion of

528
00:21:43,830 --> 00:21:42,400
the asteroid would be imperceptibly

529
00:21:44,710 --> 00:21:43,840
small

530
00:21:48,950 --> 00:21:44,720
the

531
00:21:50,230 --> 00:21:48,960
um

532
00:21:52,470 --> 00:21:50,240
of uh of a

533
00:21:56,310 --> 00:21:52,480
fan of a suv

534
00:21:59,830 --> 00:21:56,320
and uh touched it uh briefly uh and the

535
00:22:03,190 --> 00:21:59,840
the asteroid is the size of uh of a hill

536
00:22:04,870 --> 00:22:03,200
so uh dropping a car on the hill is not

537
00:22:07,190 --> 00:22:04,880
going to move the hill so

538
00:22:11,590 --> 00:22:08,789

all right good to know

539
00:22:13,669 --> 00:22:11,600
okay this is a great name out of cheese

540
00:22:15,830 --> 00:22:13,679
on periscope asks

541
00:22:17,909 --> 00:22:15,840
what do you hope to actually learn from

542
00:22:19,909 --> 00:22:17,919
this sample collection what are the

543
00:22:22,310 --> 00:22:19,919
implications

544
00:22:24,390 --> 00:22:22,320
oh i'd like to take this um so i'm on

545
00:22:27,029 --> 00:22:24,400
the sample analysis team

546
00:22:29,029 --> 00:22:27,039
and um this is what i've been waiting

547
00:22:30,149 --> 00:22:29,039
for is to look at the samples so we have

548
00:22:33,350 --> 00:22:30,159
um

549
00:22:35,830 --> 00:22:33,360
uh over 50 hypotheses we want to test

550
00:22:37,830 --> 00:22:35,840
uh one of many of them involve

551
00:22:40,310 --> 00:22:37,840
understanding verifying the observations

552
00:22:42,870 --> 00:22:40,320
we've made on the asteroids i am

553
00:22:45,270 --> 00:22:42,880
personally interested in the origin of

554
00:22:46,789 --> 00:22:45,280
organic compounds in the early solar

555
00:22:49,669 --> 00:22:46,799
system that may be contributing to

556
00:22:51,510 --> 00:22:49,679
origin of life and so looking at

557
00:22:53,510 --> 00:22:51,520
the ancient chemistry like the amino

558
00:22:54,950 --> 00:22:53,520
acids their chirality their left versus

559
00:22:56,070 --> 00:22:54,960
right-handedness

560
00:22:59,990 --> 00:22:56,080
uh

561
00:23:03,909 --> 00:23:02,070
we need hours to discuss it in fact we

562
00:23:07,270 --> 00:23:03,919
have weekly meetings we discuss it for

563
00:23:11,350 --> 00:23:09,510

it sounds like big questions and really

564
00:23:13,750 --> 00:23:11,360
big implications too

565
00:23:15,669 --> 00:23:13,760
um so we're here ion

566
00:23:18,230 --> 00:23:15,679
yes absolutely and we're so glad that

567
00:23:20,630 --> 00:23:18,240
you're doing this work um ion on youth

568
00:23:22,870 --> 00:23:20,640
youtube asks how fast was the spacecraft

569
00:23:24,710 --> 00:23:22,880
going to collect the sample and how can

570
00:23:28,630 --> 00:23:24,720
we guarantee we got a good sample that

571
00:23:31,750 --> 00:23:30,630
i'll take that one

572
00:23:34,070 --> 00:23:31,760
we

573
00:23:36,310 --> 00:23:34,080
are just getting our telemetry back

574
00:23:38,230 --> 00:23:36,320
from the tag event we had a high gain

575
00:23:39,110 --> 00:23:38,240
pass over last night and through this

576
00:23:41,190 --> 00:23:39,120
morning

577
00:23:42,549 --> 00:23:41,200
we've got just a treasure trove of data

578
00:23:45,029 --> 00:23:42,559
that we're digging through now to

579
00:23:47,830 --> 00:23:45,039
understand the spacecraft performance

580
00:23:49,590 --> 00:23:47,840
one of those pieces of data is the

581
00:23:51,909 --> 00:23:49,600
contact velocity

582
00:23:54,789 --> 00:23:51,919
and we came down right around our

583
00:23:57,909 --> 00:23:54,799
expected 10 centimeters per second

584
00:24:01,669 --> 00:23:57,919
and for reference walking speed is about

585
00:24:02,630 --> 00:24:01,679
15 times faster than 10 centimeters per

586
00:24:05,110 --> 00:24:02,640
second

587
00:24:08,630 --> 00:24:05,120
so we really were coming down at a very

588
00:24:09,990 --> 00:24:08,640

very gentle slow uh pace and that was on

589
00:24:12,230 --> 00:24:10,000
purpose

590
00:24:14,390 --> 00:24:12,240
and then in terms of um how much

591
00:24:15,510 --> 00:24:14,400
material we collected and how well we

592
00:24:17,510 --> 00:24:15,520
know that

593
00:24:18,390 --> 00:24:17,520
uh the official

594
00:24:20,630 --> 00:24:18,400
mission

595
00:24:22,470 --> 00:24:20,640
process for estimating the sample mass

596
00:24:25,110 --> 00:24:22,480
is going to happen later this week

597
00:24:26,710 --> 00:24:25,120
actually on saturday and it's the sample

598
00:24:28,710 --> 00:24:26,720
mass measurement technique that we

599
00:24:30,950 --> 00:24:28,720
discussed a little bit before

600
00:24:33,110 --> 00:24:30,960
and that's where the spacecraft

601
00:24:36,070 --> 00:24:33,120
stretches out its arm

602
00:24:39,590 --> 00:24:36,080
and spins slowly around

603
00:24:42,390 --> 00:24:39,600
and it does that after tag we did that

604
00:24:45,110 --> 00:24:42,400
once before tag as well where we didn't

605
00:24:47,990 --> 00:24:45,120
have any sample inside the tag sam

606
00:24:50,710 --> 00:24:48,000
device and we'll do it again after tag

607
00:24:51,990 --> 00:24:50,720
with sample in the tag sam device and

608
00:24:54,549 --> 00:24:52,000
the difference in the measurement

609
00:24:56,310 --> 00:24:54,559
between those two spoons should give it

610
00:24:58,310 --> 00:24:56,320
information about how much mass we

611
00:25:01,190 --> 00:24:58,320
actually collected

612
00:25:03,269 --> 00:25:01,200
we have other indirect techniques for

613
00:25:04,549 --> 00:25:03,279

evaluating how much sample we might have

614
00:25:05,990 --> 00:25:04,559
collected

615
00:25:08,070 --> 00:25:06,000
in particular

616
00:25:10,070 --> 00:25:08,080
using the sam cam which is the same

617
00:25:11,669 --> 00:25:10,080
image or the same camera that we use to

618
00:25:14,549 --> 00:25:11,679
collect the images

619
00:25:17,350 --> 00:25:14,559
of the tag event itself we can reorient

620
00:25:19,190 --> 00:25:17,360
the tag sam head to actually be facing

621
00:25:21,430 --> 00:25:19,200
with the bottom into

622
00:25:23,669 --> 00:25:21,440
the field of view of the sam cam so we

623
00:25:26,870 --> 00:25:23,679
can look directly into the tag sam

624
00:25:29,190 --> 00:25:26,880
device itself and we hope to have direct

625
00:25:30,710 --> 00:25:29,200
measurement of the material inside

626
00:25:33,510 --> 00:25:30,720
tagsam

627
00:25:36,470 --> 00:25:33,520
by virtue of looking inside it but

628
00:25:38,390 --> 00:25:36,480
that can only uh show us some just

629
00:25:39,909 --> 00:25:38,400
because of limitations of the geometry

630
00:25:42,549 --> 00:25:39,919
we can't see the entire collection

631
00:25:44,070 --> 00:25:42,559
volume inside the device itself

632
00:25:46,390 --> 00:25:44,080
so while that will give us some

633
00:25:48,070 --> 00:25:46,400
information it's not the most accurate

634
00:25:52,549 --> 00:25:48,080
measurement so we really are waiting for

635
00:25:55,990 --> 00:25:54,310
saturday seems like such a long time

636
00:25:57,350 --> 00:25:56,000
from now

637
00:25:58,789 --> 00:25:57,360
okay moving right along we've got so

638
00:26:00,710 --> 00:25:58,799

many questions thank you all for

639
00:26:03,510 --> 00:26:00,720
submitting your questions sam on

640
00:26:06,549 --> 00:26:03,520
facebook asks um how fast would the

641
00:26:08,950 --> 00:26:06,559
material be ejected um and is that

642
00:26:10,470 --> 00:26:08,960
capable of damaging osiris-rex at all so

643
00:26:13,510 --> 00:26:10,480
i guess maybe you know when the material

644
00:26:17,909 --> 00:26:13,520
was um uh you know impacted could that

645
00:26:23,909 --> 00:26:20,789
i'll i'll take that one again um

646
00:26:26,470 --> 00:26:23,919
i actually led up a study to

647
00:26:28,549 --> 00:26:26,480
address that very specific question

648
00:26:30,630 --> 00:26:28,559
because we knew that was a possibility

649
00:26:33,190 --> 00:26:30,640
when we were designing the mission

650
00:26:36,950 --> 00:26:33,200
so we actually did a very exhaustive

651
00:26:39,350 --> 00:26:36,960
study to look at the speeds and

652
00:26:40,870 --> 00:26:39,360
masses of material that we might pick

653
00:26:43,669 --> 00:26:40,880
off the surface

654
00:26:45,590 --> 00:26:43,679
and the short answer is no we don't feel

655
00:26:46,630 --> 00:26:45,600
like there's any risk to the spacecraft

656
00:26:48,710 --> 00:26:46,640
at all

657
00:26:50,070 --> 00:26:48,720
otherwise we would have chosen a

658
00:26:51,110 --> 00:26:50,080
different technique to collect the

659
00:26:54,950 --> 00:26:51,120
sample

660
00:26:57,269 --> 00:26:54,960
so there are some speeds of potentially

661
00:26:59,190 --> 00:26:57,279
10 meters per second or 15 meters per

662
00:27:00,310 --> 00:26:59,200
second of material coming off the

663
00:27:03,430 --> 00:27:00,320

surface

664
00:27:04,870 --> 00:27:03,440
um but that is not fast enough to damage

665
00:27:07,750 --> 00:27:04,880
any of the equipment onboard the

666
00:27:09,830 --> 00:27:07,760
spacecraft

667
00:27:13,269 --> 00:27:09,840
well thank goodness for that

668
00:27:15,269 --> 00:27:13,279
all right fami amy from facebook asks is

669
00:27:16,950 --> 00:27:15,279
there any analytical data sent back to

670
00:27:21,029 --> 00:27:16,960
earth regarding the sample or do we

671
00:27:22,710 --> 00:27:21,039
really have to wait until 2023

672
00:27:26,310 --> 00:27:22,720
you really have to wait

673
00:27:29,029 --> 00:27:26,320
uh part of designing a mission is you

674
00:27:31,029 --> 00:27:29,039
need to design for what you require

675
00:27:32,549 --> 00:27:31,039
and so it would be fun to add a whole

676
00:27:35,110 --> 00:27:32,559
bunch of instruments to interrogate the

677
00:27:36,549 --> 00:27:35,120
samples to give us a quick look

678
00:27:37,909 --> 00:27:36,559
that would be not as good as what we

679
00:27:39,269 --> 00:27:37,919
have on the earth which the whole reason

680
00:27:40,310 --> 00:27:39,279
we're bringing it back

681
00:27:42,549 --> 00:27:40,320
but that

682
00:27:44,870 --> 00:27:42,559
that costs a lot of money and costs a

683
00:27:46,789 --> 00:27:44,880
lot of time and space and mass

684
00:27:47,990 --> 00:27:46,799
and it's better to invest that time in

685
00:27:50,389 --> 00:27:48,000
having

686
00:27:53,110 --> 00:27:50,399
the the fantastic camera and

687
00:27:54,470 --> 00:27:53,120
spectrometer and lidar suites that that

688
00:27:56,870 --> 00:27:54,480

took the data we could compare the

689
00:27:59,430 --> 00:27:56,880
sample and get back on earth and having

690
00:28:01,430 --> 00:27:59,440
uh the the talented uh

691
00:28:03,830 --> 00:28:01,440
team to be able to to solve these

692
00:28:07,350 --> 00:28:03,840
problems that we had on board uh and

693
00:28:09,590 --> 00:28:07,360
that's been literally throughout us

694
00:28:12,149 --> 00:28:09,600
yeah can i add to that

695
00:28:14,470 --> 00:28:12,159
yes of course please

696
00:28:16,470 --> 00:28:14,480
yeah i think uh so jason is right we

697
00:28:17,669 --> 00:28:16,480
won't be able to directly interrogate

698
00:28:19,510 --> 00:28:17,679
the sample

699
00:28:22,389 --> 00:28:19,520
using anything onboard the spacecraft

700
00:28:24,870 --> 00:28:22,399
but i think it's important to

701
00:28:27,350 --> 00:28:24,880
to note that we gathered a lot of data

702
00:28:28,549 --> 00:28:27,360
of the sample site before we collected

703
00:28:31,269 --> 00:28:28,559
that sample

704
00:28:33,269 --> 00:28:31,279
so we do have some great indications

705
00:28:35,510 --> 00:28:33,279
that where we gathered a sample from on

706
00:28:38,070 --> 00:28:35,520
bennu is relatively young it looks like

707
00:28:40,950 --> 00:28:38,080
it has a color that's reddish and that

708
00:28:42,710 --> 00:28:40,960
might indicate a more recent exposure

709
00:28:45,350 --> 00:28:42,720
age and

710
00:28:47,990 --> 00:28:45,360
there was also evidence of the presence

711
00:28:49,990 --> 00:28:48,000
of organic molecules and carbonates

712
00:28:52,630 --> 00:28:50,000
around the sample sites so we believe it

713
00:28:54,710 --> 00:28:52,640

will have some carbon-bearing material

714
00:28:57,110 --> 00:28:54,720
so while that isn't you know data

715
00:28:59,269 --> 00:28:57,120
directly taken of the sample itself it

716
00:29:01,110 --> 00:28:59,279
gives us it allows us to make some

717
00:29:03,190 --> 00:29:01,120
inferences about what the sample will

718
00:29:05,110 --> 00:29:03,200
look like and they are all very

719
00:29:08,630 --> 00:29:05,120
promising

720
00:29:10,310 --> 00:29:08,640
oh love to hear it that sounds great um

721
00:29:12,470 --> 00:29:10,320
and that is all the time we have for

722
00:29:14,149 --> 00:29:12,480
today thank you so much for joining us

723
00:29:16,630 --> 00:29:14,159
danny jason and bo we know you're busy

724
00:29:18,950 --> 00:29:16,640
and we've loved having you

725
00:29:20,870 --> 00:29:18,960
thanks lauren thank you thank you

726
00:29:22,870 --> 00:29:20,880
great to be here and thank you for

727
00:29:25,350 --> 00:29:22,880
joining us at home we've loved having

728
00:29:28,070 --> 00:29:25,360
you too for more updates on osiris-rex

729
00:29:30,630 --> 00:29:28,080
journey back to earth visit nasa.gov

730
00:29:32,789 --> 00:29:30,640
backslash osiris-rex or follow at

731
00:29:34,789 --> 00:29:32,799
osiris-rex on twitter facebook and

732
00:29:36,470 --> 00:29:34,799
instagram check back with us in the

733
00:29:38,149 --> 00:29:36,480
first week of november when we hope to

734
00:29:40,870 --> 00:29:38,159
make an announcement

735
00:29:42,950 --> 00:29:40,880
um especially regarding whether or not

736
00:29:44,870 --> 00:29:42,960
sufficient sample was collected so

737
00:29:47,029 --> 00:29:44,880
that's very exciting check us check

738
00:29:49,269 --> 00:29:47,039

check that out be sure to check that out

739
00:29:51,029 --> 00:29:49,279
um until next time i'm lauren ward