
OSIRIS-REx
ASTEROID SAMPLE COLLECTION RECAP
AND FIRST IMAGES

1
00:06:32,400 --> 00:06:37,510
we are ready

2
00:06:40,950 --> 00:06:39,270
so what i'll do is just give a quick

3
00:06:43,430 --> 00:06:40,960
countdown for you all

4
00:06:45,270 --> 00:06:43,440
um then i'll be snuffing the music okay

5
00:06:47,590 --> 00:06:45,280
so in three

6
00:06:50,870 --> 00:06:48,629
all right

7
00:06:53,029 --> 00:06:50,880
hello everyone i'm nancy neal jones from

8
00:06:54,790 --> 00:06:53,039
the office of communications at nasa

9
00:06:56,629 --> 00:06:54,800
goddard space flight center

10
00:06:59,110 --> 00:06:56,639
i'm standing in the mission support area

11
00:07:01,430 --> 00:06:59,120
at lockheed martin space facility

12
00:07:03,589 --> 00:07:01,440
we are complying with local county

13
00:07:06,150 --> 00:07:03,599

guidelines and lockheed martin's social

14
00:07:08,629 --> 00:07:06,160
distancing policy of maintaining at

15
00:07:10,309 --> 00:07:08,639
least six feet when possible and by

16
00:07:11,430 --> 00:07:10,319
wearing mass

17
00:07:13,510 --> 00:07:11,440
yesterday

18
00:07:16,070 --> 00:07:13,520
nasa's first asteroid sample return

19
00:07:18,390 --> 00:07:16,080
mission osiris-rex successfully made

20
00:07:20,950 --> 00:07:18,400
contact with the surface of asteroid

21
00:07:24,469 --> 00:07:20,960
bennu to collect the pristine sample for

22
00:07:26,469 --> 00:07:24,479
delivery to earth in 2023

23
00:07:27,670 --> 00:07:26,479
to share some remarks with us and to

24
00:07:29,189 --> 00:07:27,680
tell us more about what happened

25
00:07:32,230 --> 00:07:29,199
yesterday and what's coming up for the

26
00:07:35,510 --> 00:07:32,240
mission we have with us today

27
00:07:37,189 --> 00:07:35,520
jim bridenstine nasa administrator nasa

28
00:07:38,629 --> 00:07:37,199
headquarters he'll be joining us by

29
00:07:40,070 --> 00:07:38,639
phone

30
00:07:42,309 --> 00:07:40,080
tommy zabukin

31
00:07:44,390 --> 00:07:42,319
associate administrator science mission

32
00:07:47,270 --> 00:07:44,400
directorate nasa headquarters

33
00:07:49,670 --> 00:07:47,280
he will also be joining us by phone

34
00:07:53,350 --> 00:07:49,680
dante loretta osiris-rex principal

35
00:07:56,550 --> 00:07:53,360
investigator university of arizona

36
00:07:58,869 --> 00:07:56,560
rich burns osiris-rex project manager

37
00:08:01,430 --> 00:07:58,879
nasa's goddard space flight center

38
00:08:04,790 --> 00:08:01,440

and sandy friend osiris-rex mission

39
00:08:06,629 --> 00:08:04,800
operations manager lockheed martin space

40
00:08:08,629 --> 00:08:06,639
we'll start with the administrator with

41
00:08:09,510 --> 00:08:08,639
administrator branding stein joining us

42
00:08:10,629 --> 00:08:09,520
from

43
00:08:12,790 --> 00:08:10,639
his phone

44
00:08:14,950 --> 00:08:12,800
administrator brian stein we'll turn it

45
00:08:17,270 --> 00:08:14,960
over to you

46
00:08:18,629 --> 00:08:17,280
well thank you it's uh it's it's an

47
00:08:21,790 --> 00:08:18,639
amazing day

48
00:08:25,110 --> 00:08:21,800
i just saw the first images there of

49
00:08:27,110 --> 00:08:25,120
osiris-rex touching down on bennu

50
00:08:29,110 --> 00:08:27,120
and it was every bit as beautiful as i

51
00:08:31,830 --> 00:08:29,120
thought it would be uh what what an

52
00:08:32,870 --> 00:08:31,840
amazing accomplishment by such amazing

53
00:08:35,190 --> 00:08:32,880
people

54
00:08:38,230 --> 00:08:35,200
uh at this time we think about

55
00:08:39,350 --> 00:08:38,240
the challenges of of getting osiris

56
00:08:41,029 --> 00:08:39,360
built and

57
00:08:42,949 --> 00:08:41,039
launched we think about

58
00:08:45,990 --> 00:08:42,959
you know this has been a project that

59
00:08:48,070 --> 00:08:46,000
nasa and the university of arizona and

60
00:08:50,870 --> 00:08:48,080
lockheed martin and all of our partners

61
00:08:53,110 --> 00:08:50,880
we've been collaborating on since 2011

62
00:08:55,190 --> 00:08:53,120
and i know arizona university of arizona

63
00:08:56,949 --> 00:08:55,200

was working on and even before that

64
00:08:59,030 --> 00:08:56,959
trying to get it approved

65
00:09:01,590 --> 00:08:59,040
and here we are in the year 2020 with

66
00:09:03,430 --> 00:09:01,600
this really stunning achievement and i

67
00:09:04,630 --> 00:09:03,440
just want to say congratulations to all

68
00:09:07,110 --> 00:09:04,640
of the teams

69
00:09:09,350 --> 00:09:07,120
the idea that this team

70
00:09:11,590 --> 00:09:09,360
broke the record for

71
00:09:13,430 --> 00:09:11,600
being able to orbit the smallest object

72
00:09:16,150 --> 00:09:13,440
that's ever been orbited before the idea

73
00:09:18,310 --> 00:09:16,160
that they were able to orbit an object

74
00:09:19,750 --> 00:09:18,320
closer than any object has ever been

75
00:09:21,350 --> 00:09:19,760
orbited before

76
00:09:23,829 --> 00:09:21,360
the idea that when we got there we

77
00:09:26,710 --> 00:09:23,839
learned so much about how rough the

78
00:09:29,190 --> 00:09:26,720
terrain was which was not anticipated

79
00:09:31,509 --> 00:09:29,200
how small of a landing area we actually

80
00:09:32,550 --> 00:09:31,519
had and then ultimately being able to

81
00:09:34,949 --> 00:09:32,560
use

82
00:09:37,030 --> 00:09:34,959
those extremely sophisticated precision

83
00:09:39,990 --> 00:09:37,040
navigation capability

84
00:09:42,790 --> 00:09:40,000
that way outperformed what anybody

85
00:09:44,389 --> 00:09:42,800
believed could be done of course i know

86
00:09:45,750 --> 00:09:44,399
the people who built it believed in it

87
00:09:49,030 --> 00:09:45,760
100

88
00:09:52,790 --> 00:09:49,040

but it was just uh it was an amazing day

89
00:09:55,590 --> 00:09:52,800
yesterday uh when we watched it land

90
00:09:58,230 --> 00:09:55,600
on a parking spot basically the the area

91
00:09:59,670 --> 00:09:58,240
was about the size of two parking spaces

92
00:10:03,590 --> 00:09:59,680
side by side

93
00:10:05,829 --> 00:10:03,600
uh and it landed just just uh just as as

94
00:10:08,230 --> 00:10:05,839
as it should have we didn't get five or

95
00:10:10,710 --> 00:10:08,240
ten minutes uh five or ten seconds on

96
00:10:12,310 --> 00:10:10,720
the surface we got 15 seconds

97
00:10:13,910 --> 00:10:12,320
uh and of course we're learning we're

98
00:10:15,829 --> 00:10:13,920
going to be learning more about uh how

99
00:10:16,630 --> 00:10:15,839
much sample we got and things like that

100
00:10:18,389 --> 00:10:16,640
but

101
00:10:20,870 --> 00:10:18,399
this one it went as well as could have

102
00:10:21,990 --> 00:10:20,880
gone uh i i said it yesterday i'll say

103
00:10:24,550 --> 00:10:22,000
it again

104
00:10:26,790 --> 00:10:24,560
the osiris of the osiris-rex mission

105
00:10:28,630 --> 00:10:26,800
outperformed in every way

106
00:10:31,269 --> 00:10:28,640
and so i just wanted to make sure that i

107
00:10:34,710 --> 00:10:31,279
congratulated the teams um

108
00:10:36,550 --> 00:10:34,720
and uh you guys all made not just the

109
00:10:38,389 --> 00:10:36,560
united states of america proud that you

110
00:10:40,949 --> 00:10:38,399
made humanity proud

111
00:10:42,790 --> 00:10:40,959
in your ability to to go way out into

112
00:10:44,949 --> 00:10:42,800
deep space and characterize this

113
00:10:46,870 --> 00:10:44,959

asteroid venue

114
00:10:48,470 --> 00:10:46,880
there's so so much more to do i want to

115
00:10:50,389 --> 00:10:48,480
be clear there's a lot left to do we've

116
00:10:53,509 --> 00:10:50,399
got to bring the sample home

117
00:10:55,350 --> 00:10:53,519
uh but at the same time uh this this in

118
00:10:57,670 --> 00:10:55,360
itself the touchdown

119
00:10:59,509 --> 00:10:57,680
the sample collection was an amazing

120
00:11:00,630 --> 00:10:59,519
achievement and i want to congratulate

121
00:11:05,110 --> 00:11:00,640
the team

122
00:11:10,949 --> 00:11:08,150
thank you sir um thanks administrator

123
00:11:13,829 --> 00:11:10,959
it's thomas sibling here and uh yes

124
00:11:16,389 --> 00:11:13,839
yesterday our team did an amazing thing

125
00:11:17,910 --> 00:11:16,399
a true first for nasa

126
00:11:19,990 --> 00:11:17,920
uh the mission of course has its

127
00:11:22,230 --> 00:11:20,000
senators in the early 2000s like you

128
00:11:24,870 --> 00:11:22,240
said you know rex finally had that an

129
00:11:27,430 --> 00:11:24,880
ultimate act of its amazing journey when

130
00:11:30,150 --> 00:11:27,440
it successfully touched the surface of

131
00:11:31,750 --> 00:11:30,160
to collect a sample

132
00:11:33,350 --> 00:11:31,760
we're going to hear about this but

133
00:11:35,430 --> 00:11:33,360
everything

134
00:11:38,230 --> 00:11:35,440
really went like it should and like we

135
00:11:40,550 --> 00:11:38,240
hoped yesterday the technology performed

136
00:11:42,710 --> 00:11:40,560
flawlessly and to command our great

137
00:11:44,069 --> 00:11:42,720
teams and to the spacecraft unfolded

138
00:11:45,910 --> 00:11:44,079

autonomously

139
00:11:48,230 --> 00:11:45,920
since the signal from the earth to all

140
00:11:50,230 --> 00:11:48,240
rex is 18 plus minutes and the

141
00:11:52,150 --> 00:11:50,240
spacecraft had to be pre-loaded and

142
00:11:52,870 --> 00:11:52,160
prepared for this amazing journey on its

143
00:11:54,230 --> 00:11:52,880
own

144
00:11:56,470 --> 00:11:54,240
i remember thinking on multiple

145
00:11:58,629 --> 00:11:56,480
locations down to yesterday and bridge

146
00:12:00,470 --> 00:11:58,639
you know wow if only the speed of light

147
00:12:03,030 --> 00:12:00,480
was a lot faster

148
00:12:05,110 --> 00:12:03,040
and it isn't of course so the spacecraft

149
00:12:07,910 --> 00:12:05,120
slowly approached the surface of tenno

150
00:12:11,030 --> 00:12:07,920
uh it's data getting more detailed

151
00:12:14,629 --> 00:12:11,040
and uh the risk going down decreasing as

152
00:12:16,470 --> 00:12:14,639
we got more and more uh information and

153
00:12:18,710 --> 00:12:16,480
uh approaching that target with an

154
00:12:19,750 --> 00:12:18,720
accuracy unprecedented in previous tests

155
00:12:21,509 --> 00:12:19,760
that then

156
00:12:24,230 --> 00:12:21,519
touch panel and we're going to hear

157
00:12:26,949 --> 00:12:24,240
about this grasp into the wreckage and

158
00:12:28,790 --> 00:12:26,959
stirred up a swirl of material probably

159
00:12:29,990 --> 00:12:28,800
unlike anything ben who had seen in

160
00:12:32,550 --> 00:12:30,000
quite a while

161
00:12:35,110 --> 00:12:32,560
and then as planned evaluating its

162
00:12:37,430 --> 00:12:35,120
surrounding the spacecraft backed away

163
00:12:39,750 --> 00:12:37,440

and is talking to its handlers on earth

164
00:12:42,389 --> 00:12:39,760
the team has a lot to work on to analyze

165
00:12:45,110 --> 00:12:42,399
them which is likely to be a sample and

166
00:12:46,629 --> 00:12:45,120
it appears that the spacecraft is safe

167
00:12:48,550 --> 00:12:46,639
and again i look forward to hearing the

168
00:12:50,389 --> 00:12:48,560
details here

169
00:12:52,470 --> 00:12:50,399
this is all the beginning of the process

170
00:12:54,710 --> 00:12:52,480
and we're nowhere near the end this

171
00:12:56,389 --> 00:12:54,720
morning in fact i thought of the analogy

172
00:12:59,110 --> 00:12:56,399
of fishing yes

173
00:13:01,590 --> 00:12:59,120
a line tied and the sinker dropped and

174
00:13:02,470 --> 00:13:01,600
we are excited but now we need to bring

175
00:13:04,710 --> 00:13:02,480
it in

176
00:13:07,269 --> 00:13:04,720
see where we caught the fish and then of

177
00:13:09,269 --> 00:13:07,279
course bring it home

178
00:13:11,829 --> 00:13:09,279
it was an honor and a joy to be with the

179
00:13:14,150 --> 00:13:11,839
mission control team yesterday and the

180
00:13:16,310 --> 00:13:14,160
leadership team at lockheed and we

181
00:13:18,470 --> 00:13:16,320
determined uh that the spacecraft had

182
00:13:20,150 --> 00:13:18,480
done exactly what it was designed for

183
00:13:22,629 --> 00:13:20,160
and apparently touch the surface and

184
00:13:24,870 --> 00:13:22,639
fire the gas bottle

185
00:13:25,590 --> 00:13:24,880
powers the collection mechanism attacks

186
00:13:27,990 --> 00:13:25,600
them

187
00:13:29,829 --> 00:13:28,000
and it's not safely on its way back from

188
00:13:31,750 --> 00:13:29,839

this hazardous environment it's always

189
00:13:34,790 --> 00:13:31,760
an amazing feeling to be with people

190
00:13:37,110 --> 00:13:34,800
celebrating such a success for humanity

191
00:13:39,269 --> 00:13:37,120
as the administrators and one that took

192
00:13:40,629 --> 00:13:39,279
many thousands of people over many years

193
00:13:43,430 --> 00:13:40,639
to achieve

194
00:13:46,069 --> 00:13:43,440
i know from my uh emails and uh tech

195
00:13:47,990 --> 00:13:46,079
streams and social media to find this

196
00:13:49,829 --> 00:13:48,000
within the united states and around the

197
00:13:52,629 --> 00:13:49,839
world are ecstatic

198
00:13:54,870 --> 00:13:52,639
discoveries will make we will make about

199
00:13:57,430 --> 00:13:54,880
our solar system and our planet for

200
00:13:59,670 --> 00:13:57,440
materials that was around at the time of

201
00:14:01,430 --> 00:13:59,680
its formation will be immense and the

202
00:14:03,829 --> 00:14:01,440
questions that we have there or not

203
00:14:05,509 --> 00:14:03,839
these bodies could in fact exceed life

204
00:14:08,310 --> 00:14:05,519
on earth there's another tantalizing

205
00:14:10,230 --> 00:14:08,320
avenue we want to pursue and many more

206
00:14:12,230 --> 00:14:10,240
and it looks like many generations will

207
00:14:14,629 --> 00:14:12,240
have the chance to pursue these kind of

208
00:14:17,350 --> 00:14:14,639
questions and others from the pristine

209
00:14:19,509 --> 00:14:17,360
examples coming back to earth

210
00:14:21,430 --> 00:14:19,519
and countless discoveries and

211
00:14:23,110 --> 00:14:21,440
researchers will be uh happening as a

212
00:14:25,670 --> 00:14:23,120
result of that

213
00:14:27,350 --> 00:14:25,680

so dante loretta principal investigator

214
00:14:29,990 --> 00:14:27,360
i want to commend you and the entire

215
00:14:32,470 --> 00:14:30,000
team at the university of arizona uh the

216
00:14:34,870 --> 00:14:32,480
team at nasa goddard and rich uh ferns

217
00:14:37,030 --> 00:14:34,880
and others and lockheed martin with the

218
00:14:39,030 --> 00:14:37,040
people that we met there yesterday i

219
00:14:40,949 --> 00:14:39,040
also want to give a shout out again as

220
00:14:43,910 --> 00:14:40,959
our international partners on all wrecks

221
00:14:46,150 --> 00:14:43,920
and the canadian states and the japanese

222
00:14:48,069 --> 00:14:46,160
space agency who are our partners in

223
00:14:50,069 --> 00:14:48,079
ashrae exploration

224
00:14:51,910 --> 00:14:50,079
and i really look forward uh with

225
00:14:53,509 --> 00:14:51,920
everyone else to hear from downtown to

226
00:14:55,829 --> 00:14:53,519
team about the details that's how we

227
00:14:58,310 --> 00:14:55,839
pulled up this hold off this incredible

228
00:15:00,629 --> 00:14:58,320
mission and what's next most importantly

229
00:15:02,870 --> 00:15:00,639
i really look forward to him releasing

230
00:15:03,750 --> 00:15:02,880
what i believe will become an iconic

231
00:15:05,189 --> 00:15:03,760
image

232
00:15:09,110 --> 00:15:05,199
of the power and excitement of

233
00:15:11,590 --> 00:15:09,120
exploration one that inspires all of us

234
00:15:13,269 --> 00:15:11,600
back to you

235
00:15:15,750 --> 00:15:13,279
okay thank you thank you administrator

236
00:15:18,069 --> 00:15:15,760
bradenstein and dr zabuki we will now

237
00:15:20,230 --> 00:15:18,079
turn it over to donte loretta the

238
00:15:23,110 --> 00:15:20,240

principal investigator of the osiris-rex

239
00:15:24,870 --> 00:15:23,120
mission dante thank you nancy and thank

240
00:15:26,790 --> 00:15:24,880
you administrator bridenstine and dr

241
00:15:27,910 --> 00:15:26,800
zabukin for your words of support and

242
00:15:30,389 --> 00:15:27,920
encouragement

243
00:15:32,389 --> 00:15:30,399
uh it was great to have dr zabrukin and

244
00:15:34,150 --> 00:15:32,399
dr lori glaze and other representatives

245
00:15:36,310 --> 00:15:34,160
from headquarters here yesterday

246
00:15:38,310 --> 00:15:36,320
supporting and encouraging this team and

247
00:15:41,110 --> 00:15:38,320
we really appreciated administrator

248
00:15:42,710 --> 00:15:41,120
bridenstine's

249
00:15:45,110 --> 00:15:42,720
congratulations to the entire team

250
00:15:46,550 --> 00:15:45,120
yesterday it uplifted the team to an

251
00:15:48,710 --> 00:15:46,560
even higher level after an amazing

252
00:15:50,949 --> 00:15:48,720
accomplishment we really appreciate your

253
00:15:53,350 --> 00:15:50,959
joining the team in our celebration

254
00:15:54,949 --> 00:15:53,360
so yesterday was all about monitoring

255
00:15:57,350 --> 00:15:54,959
this real-time telemetry from the

256
00:15:59,910 --> 00:15:57,360
spacecraft as we watched the events

257
00:16:01,509 --> 00:15:59,920
unfold 200 million miles away

258
00:16:03,829 --> 00:16:01,519
and the question that came up over and

259
00:16:05,590 --> 00:16:03,839
over again in that live broadcast was

260
00:16:07,030 --> 00:16:05,600
when are we going to get the images back

261
00:16:08,629 --> 00:16:07,040
when are we going to know how the

262
00:16:10,389 --> 00:16:08,639
sampling event went

263
00:16:12,470 --> 00:16:10,399

i can tell you a lot of us were up

264
00:16:14,470 --> 00:16:12,480
really late last night

265
00:16:17,590 --> 00:16:14,480
we were watching the images come down

266
00:16:20,470 --> 00:16:17,600
one by one by about two am here local

267
00:16:22,949 --> 00:16:20,480
time in denver we got what was what i

268
00:16:25,430 --> 00:16:22,959
call the money shot where we saw tag

269
00:16:28,310 --> 00:16:25,440
sand contacting the surface and then the

270
00:16:30,710 --> 00:16:28,320
effect of injecting that high purity gas

271
00:16:32,470 --> 00:16:30,720
down into the asteroid regolith so i

272
00:16:34,150 --> 00:16:32,480
think without further ado

273
00:16:35,189 --> 00:16:34,160
let's just go and take a quick look at

274
00:16:37,509 --> 00:16:35,199
the data

275
00:16:39,350 --> 00:16:37,519
i'm going to show you a series of images

276
00:16:41,269 --> 00:16:39,360
taken by the sand cam

277
00:16:43,509 --> 00:16:41,279
this is about twice the frame rate so

278
00:16:44,629 --> 00:16:43,519
we're coming in a little bit faster here

279
00:16:46,470 --> 00:16:44,639
and i'm just going to let that play out

280
00:16:48,470 --> 00:16:46,480
i'm going to let you appreciate it one

281
00:16:50,069 --> 00:16:48,480
more time as we go through and then

282
00:16:53,110 --> 00:16:50,079
we've got some analysis that we can

283
00:16:59,990 --> 00:16:53,120
perform about what happened here

284
00:17:04,150 --> 00:17:01,590
i must have watched it about a hundred

285
00:17:05,990 --> 00:17:04,160
times last night before i finally got a

286
00:17:09,029 --> 00:17:06,000
little bit of shut eye

287
00:17:10,949 --> 00:17:09,039
and then i dreamed of a wonder world of

288
00:17:11,990 --> 00:17:10,959

bennu regolith particles floating all

289
00:17:13,669 --> 00:17:12,000
around me

290
00:17:14,789 --> 00:17:13,679
so just to remind you what we're looking

291
00:17:17,350 --> 00:17:14,799
at here

292
00:17:18,630 --> 00:17:17,360
this is a full scale model of the tag

293
00:17:20,309 --> 00:17:18,640
sam head

294
00:17:22,230 --> 00:17:20,319
and so this is what's at the end of that

295
00:17:24,789 --> 00:17:22,240
long robotic arm you can see it's about

296
00:17:27,270 --> 00:17:24,799
30 centimeters or about a foot in

297
00:17:29,110 --> 00:17:27,280
diameter and this is what we placed onto

298
00:17:31,110 --> 00:17:29,120
the surface of the asteroid

299
00:17:33,029 --> 00:17:31,120
it's at the end of the robotic arm and

300
00:17:35,430 --> 00:17:33,039
the high purity nitrogen gas feeds in

301
00:17:36,950 --> 00:17:35,440
here through a couple tubes and that

302
00:17:40,230 --> 00:17:36,960
actually comes out through this inner

303
00:17:42,070 --> 00:17:40,240
annulus and pushes everything up into

304
00:17:44,470 --> 00:17:42,080
the collection chamber

305
00:17:46,549 --> 00:17:44,480
let's take a another look at just a

306
00:17:48,549 --> 00:17:46,559
couple of the key images

307
00:17:51,430 --> 00:17:48,559
right before contact and right after

308
00:17:53,830 --> 00:17:51,440
contact before the gas is fired so

309
00:17:56,070 --> 00:17:53,840
there's a little over one second time

310
00:17:57,350 --> 00:17:56,080
difference between these two images and

311
00:17:59,029 --> 00:17:57,360
there's an enormous wealth of

312
00:18:00,549 --> 00:17:59,039
information about the asteroid surface

313
00:18:02,310 --> 00:18:00,559

contained in here

314
00:18:04,470 --> 00:18:02,320
so the first thing that you can see if

315
00:18:06,230 --> 00:18:04,480
you look at the area right above about

316
00:18:07,110 --> 00:18:06,240
the 12 o'clock position on the sample

317
00:18:08,870 --> 00:18:07,120
head

318
00:18:11,350 --> 00:18:08,880
we're making contact with a relatively

319
00:18:13,190 --> 00:18:11,360
large rock a little over 20 centimeters

320
00:18:16,390 --> 00:18:13,200
which we had considered a potential

321
00:18:18,630 --> 00:18:16,400
obstruction to sampling but literally we

322
00:18:21,270 --> 00:18:18,640
crushed it when the spacecraft made

323
00:18:22,470 --> 00:18:21,280
contact that rock appears to fragment

324
00:18:24,470 --> 00:18:22,480
and shatter

325
00:18:26,470 --> 00:18:24,480
which is great news because that means

326
00:18:28,549 --> 00:18:26,480
that ingestible material by tag sam is

327
00:18:30,230 --> 00:18:28,559
probably being created just by the

328
00:18:32,150 --> 00:18:30,240
motion of the spacecraft

329
00:18:34,070 --> 00:18:32,160
pushing into the surface if you look at

330
00:18:36,630 --> 00:18:34,080
a couple other areas around like this

331
00:18:38,789 --> 00:18:36,640
one here about 10 30 just off to the

332
00:18:41,110 --> 00:18:38,799
upper left of the tag sam head you can

333
00:18:43,750 --> 00:18:41,120
actually see motion

334
00:18:46,390 --> 00:18:43,760
in the regolith so it looks like we are

335
00:18:49,110 --> 00:18:46,400
pushing and exerting a force throughout

336
00:18:51,669 --> 00:18:49,120
this soil on the asteroid surface also

337
00:18:53,909 --> 00:18:51,679
good news for uh our potential for

338
00:18:55,750 --> 00:18:53,919

successful sample collection

339
00:18:57,430 --> 00:18:55,760
i want to point out another feature of

340
00:18:59,590 --> 00:18:57,440
the tag sam head that didn't get a lot

341
00:19:01,510 --> 00:18:59,600
of attention yesterday we talked a lot

342
00:19:03,909 --> 00:19:01,520
about the gas stimulation and driving

343
00:19:06,150 --> 00:19:03,919
bulk sample into this filter but as you

344
00:19:08,390 --> 00:19:06,160
can see in this 3d printed model of tag

345
00:19:09,590 --> 00:19:08,400
sam there's a whole series of circular

346
00:19:11,510 --> 00:19:09,600
disks

347
00:19:14,070 --> 00:19:11,520
on the flight hardware what's mounted in

348
00:19:16,230 --> 00:19:14,080
here are contact pads literally made out

349
00:19:17,750 --> 00:19:16,240
of stainless steel velcro and these are

350
00:19:20,310 --> 00:19:17,760
designed to pick up material on the

351
00:19:22,150 --> 00:19:20,320
order of a millimeter size and smaller

352
00:19:23,750 --> 00:19:22,160
so the fact that when the tag sam head

353
00:19:25,750 --> 00:19:23,760
is making contact with the asteroid

354
00:19:28,950 --> 00:19:25,760
surface and it's crushing what appears

355
00:19:30,710 --> 00:19:28,960
to be a very soft friable material is

356
00:19:32,310 --> 00:19:30,720
good news not only for the bulk sample

357
00:19:34,870 --> 00:19:32,320
collection because in our laboratory

358
00:19:36,230 --> 00:19:34,880
tests when the tag sam head penetrates

359
00:19:38,789 --> 00:19:36,240
and we're estimating about two

360
00:19:40,950 --> 00:19:38,799
centimeters of penetration at least

361
00:19:42,870 --> 00:19:40,960
during this event a lot of material gets

362
00:19:44,390 --> 00:19:42,880
forced up into the sample collector and

363
00:19:45,669 --> 00:19:44,400

of course by crushing you're going to

364
00:19:48,549 --> 00:19:45,679
drive a lot of material into these

365
00:19:50,150 --> 00:19:48,559
contact pads so right away bottom line

366
00:19:52,070 --> 00:19:50,160
is from analysis of the images that

367
00:19:54,310 --> 00:19:52,080
we've gotten down so far is that the

368
00:19:55,830 --> 00:19:54,320
sampling event went really well

369
00:19:57,510 --> 00:19:55,840
as good as we could have imagined it

370
00:19:59,590 --> 00:19:57,520
would and i think the chances that

371
00:20:01,270 --> 00:19:59,600
there's material inside the tag sam head

372
00:20:02,950 --> 00:20:01,280
have gone wayne way up based on the

373
00:20:04,710 --> 00:20:02,960
analysis of these images we're going to

374
00:20:07,350 --> 00:20:04,720
take a look at just one more sequence

375
00:20:10,470 --> 00:20:07,360
now after the event when the gas bottle

376
00:20:12,950 --> 00:20:10,480
gets fired uh you can see that particles

377
00:20:15,270 --> 00:20:12,960
are flying all over the place we really

378
00:20:16,870 --> 00:20:15,280
did kind of make a mess on the surface

379
00:20:19,190 --> 00:20:16,880
of this asteroid but it's a good mass

380
00:20:21,669 --> 00:20:19,200
it's the kind of mess we were hoping for

381
00:20:23,590 --> 00:20:21,679
lots of material has been mobilized

382
00:20:25,669 --> 00:20:23,600
giving us additional confidence that we

383
00:20:27,590 --> 00:20:25,679
actually push material up into the

384
00:20:30,149 --> 00:20:27,600
sampler head and just a little bit of

385
00:20:33,590 --> 00:20:30,159
the timeline here we made

386
00:20:35,990 --> 00:20:33,600
contact about one second went by the gas

387
00:20:38,310 --> 00:20:36,000
bottle fired uh the gas was blown down

388
00:20:39,909 --> 00:20:38,320

for about five seconds which is as much

389
00:20:42,149 --> 00:20:39,919
time as we were hoping to get to collect

390
00:20:44,149 --> 00:20:42,159
that material so the system seems to

391
00:20:46,710 --> 00:20:44,159
have performed normally the surf

392
00:20:49,270 --> 00:20:46,720
nominally the surface of bennu behaved

393
00:20:51,110 --> 00:20:49,280
very well and so everything that we can

394
00:20:52,549 --> 00:20:51,120
see from these initial images indicates

395
00:20:54,230 --> 00:20:52,559
sampling success

396
00:20:56,310 --> 00:20:54,240
we still have some work to do we're

397
00:20:58,870 --> 00:20:56,320
going to go through our entire procedure

398
00:21:00,549 --> 00:20:58,880
including we'll hear from sandy later in

399
00:21:02,950 --> 00:21:00,559
the day about the additional activities

400
00:21:04,870 --> 00:21:02,960
for sample verification so in case you

401
00:21:07,430 --> 00:21:04,880
can't tell i'm pretty excited about all

402
00:21:08,310 --> 00:21:07,440
of this this is great news

403
00:21:09,750 --> 00:21:08,320
and

404
00:21:11,350 --> 00:21:09,760
i'm going to turn it over to rich to

405
00:21:12,950 --> 00:21:11,360
talk about the spacecraft performance

406
00:21:15,270 --> 00:21:12,960
from here

407
00:21:17,990 --> 00:21:15,280
thanks very much dante i'm happy to be

408
00:21:19,909 --> 00:21:18,000
here we're all super excited to uh

409
00:21:22,310 --> 00:21:19,919
to be sharing all this information from

410
00:21:25,029 --> 00:21:22,320
with you and i'm going to try to set

411
00:21:27,350 --> 00:21:25,039
some context for the movie that that

412
00:21:29,190 --> 00:21:27,360
dante showed with showing you exactly

413
00:21:31,430 --> 00:21:29,200

what happened during the last stages of

414
00:21:33,750 --> 00:21:31,440
tag and uh

415
00:21:35,990 --> 00:21:33,760
orienting you with uh

416
00:21:37,190 --> 00:21:36,000
what our sample site look nightingale

417
00:21:39,990 --> 00:21:37,200
look like

418
00:21:41,909 --> 00:21:40,000
so let's begin with the animation this

419
00:21:44,390 --> 00:21:41,919
is the final descent stages this is the

420
00:21:46,390 --> 00:21:44,400
same perspective you see in the images

421
00:21:49,590 --> 00:21:46,400
this is an animation of course

422
00:21:51,430 --> 00:21:49,600
so we'll transfer to an uh a perspective

423
00:21:53,750 --> 00:21:51,440
that's near the surface so you see just

424
00:21:56,390 --> 00:21:53,760
how rugged the terrain is here

425
00:21:58,390 --> 00:21:56,400
and then at contact you'll see the

426
00:22:00,070 --> 00:21:58,400
sample collection head make contact with

427
00:22:01,830 --> 00:22:00,080
the surface

428
00:22:03,590 --> 00:22:01,840
regolith gets disturbed and then the

429
00:22:06,070 --> 00:22:03,600
nitrogen bottle gets fired and more

430
00:22:09,110 --> 00:22:06,080
regolith gets disturbed the

431
00:22:11,350 --> 00:22:09,120
cutaway of the tax ham or the sample

432
00:22:12,390 --> 00:22:11,360
collection head shows the airflow of the

433
00:22:14,230 --> 00:22:12,400
nitrogen

434
00:22:16,070 --> 00:22:14,240
and the back away maneuver from the

435
00:22:18,710 --> 00:22:16,080
surface

436
00:22:21,029 --> 00:22:18,720
so that that completes where we're uh

437
00:22:23,029 --> 00:22:21,039
that that maneuver completed the

438
00:22:25,909 --> 00:22:23,039

uh sequence we're safely away from the

439
00:22:28,870 --> 00:22:25,919
surface right now i'll turn now to

440
00:22:31,029 --> 00:22:28,880
orientation of the the sample collection

441
00:22:33,590 --> 00:22:31,039
site nightingale and we'll show a

442
00:22:36,950 --> 00:22:33,600
graphic to describe that

443
00:22:39,350 --> 00:22:36,960
so you see on the upper right is a image

444
00:22:41,669 --> 00:22:39,360
from our reconnaissance c

445
00:22:43,990 --> 00:22:41,679
the resolution in that image is about

446
00:22:47,350 --> 00:22:44,000
four millimeters per pixel

447
00:22:49,430 --> 00:22:47,360
the yellow circle in that image is the

448
00:22:51,830 --> 00:22:49,440
uh dimension of our sample collection

449
00:22:53,510 --> 00:22:51,840
head so it gives you a a sense of the

450
00:22:56,149 --> 00:22:53,520
rocks the material that was under the

451
00:22:58,230 --> 00:22:56,159
collection head at the time of uh

452
00:23:01,190 --> 00:22:58,240
contact and then the bottom right is

453
00:23:04,310 --> 00:23:01,200
just the uh snapshot of the sample

454
00:23:06,470 --> 00:23:04,320
collection head just before contact

455
00:23:09,110 --> 00:23:06,480
on the left hand side of this graphic is

456
00:23:12,390 --> 00:23:09,120
the nightingale site

457
00:23:15,270 --> 00:23:12,400
and annotated on that uh on that graphic

458
00:23:17,510 --> 00:23:15,280
is our estimated point of contact

459
00:23:19,110 --> 00:23:17,520
which is less than a meter away from the

460
00:23:20,710 --> 00:23:19,120
center of the site

461
00:23:23,590 --> 00:23:20,720
i'll emphasize that because we're over

462
00:23:26,310 --> 00:23:23,600
over 320

463
00:23:27,669 --> 00:23:26,320

million kilometers away from earth at

464
00:23:29,990 --> 00:23:27,679
this point

465
00:23:32,310 --> 00:23:30,000
and we touched this asteroid within a

466
00:23:33,110 --> 00:23:32,320
meter of where we intended to

467
00:23:35,029 --> 00:23:33,120
so

468
00:23:36,630 --> 00:23:35,039
that's extraordinary and a real credit

469
00:23:38,230 --> 00:23:36,640
to our team

470
00:23:40,149 --> 00:23:38,240
our navigators

471
00:23:41,750 --> 00:23:40,159
the folks here at lockheed and the

472
00:23:43,750 --> 00:23:41,760
science team who all had to come

473
00:23:45,990 --> 00:23:43,760
together to

474
00:23:48,950 --> 00:23:46,000
to enable that to happen to allow the

475
00:23:51,029 --> 00:23:48,960
navigation system to work

476
00:23:53,350 --> 00:23:51,039
as administrator bridenstine said

477
00:23:55,350 --> 00:23:53,360
outperforming our requirements our

478
00:23:56,230 --> 00:23:55,360
initial requirements to work to land

479
00:23:59,190 --> 00:23:56,240
within

480
00:24:02,549 --> 00:23:59,200
25 meters of a specified site we landed

481
00:24:04,630 --> 00:24:02,559
within a meter so incredible there and

482
00:24:06,710 --> 00:24:04,640
also the rugged terrain you saw from the

483
00:24:08,630 --> 00:24:06,720
perspective near the surface

484
00:24:11,350 --> 00:24:08,640
of of the site

485
00:24:13,909 --> 00:24:11,360
extraordinarily rugged terrain the site

486
00:24:16,070 --> 00:24:13,919
the the sample site nightingale is

487
00:24:18,070 --> 00:24:16,080
actually one of the smoother areas but

488
00:24:19,269 --> 00:24:18,080

quite small compared to that 25 meter

489
00:24:20,789 --> 00:24:19,279
requirement

490
00:24:23,350 --> 00:24:20,799
now we'll talk a little bit about where

491
00:24:24,789 --> 00:24:23,360
the spacecraft is presently we'll start

492
00:24:26,789 --> 00:24:24,799
an animation that begins with the

493
00:24:27,990 --> 00:24:26,799
backway maneuver you see the thrusters

494
00:24:30,710 --> 00:24:28,000
firing

495
00:24:32,950 --> 00:24:30,720
this is a 40 centimeter per second uh

496
00:24:35,350 --> 00:24:32,960
maneuver which may not sound like much

497
00:24:37,830 --> 00:24:35,360
but you see the uh spacecraft going away

498
00:24:39,990 --> 00:24:37,840
quickly from venue and out of orbit

499
00:24:42,710 --> 00:24:40,000
this graphic shows the uh

500
00:24:45,190 --> 00:24:42,720
the orbit we left from and then we're on

501
00:24:47,190 --> 00:24:45,200
a hyperbolic trajectory safely drifting

502
00:24:49,590 --> 00:24:47,200
away from bennu

503
00:24:50,950 --> 00:24:49,600
we will actually arrest that drift away

504
00:24:53,590 --> 00:24:50,960
on friday

505
00:24:56,310 --> 00:24:53,600
at about 80 kilometers distance from

506
00:24:58,390 --> 00:24:56,320
bennett so all the mess that dante

507
00:25:00,310 --> 00:24:58,400
described that we made

508
00:25:02,630 --> 00:25:00,320
we're safely away from all that debris

509
00:25:03,830 --> 00:25:02,640
field at the at the present moment

510
00:25:06,710 --> 00:25:03,840
and i'm going to turn it over to my

511
00:25:07,830 --> 00:25:06,720
colleague sandy friend from lockheed

512
00:25:09,029 --> 00:25:07,840
thank you rich

513
00:25:11,669 --> 00:25:09,039

i'm going to talk a little bit about the

514
00:25:13,190 --> 00:25:11,679
spacecraft performance yesterday and

515
00:25:14,950 --> 00:25:13,200
what is coming up

516
00:25:17,750 --> 00:25:14,960
so the spacecraft performance was

517
00:25:19,590 --> 00:25:17,760
phenomenal all throughout the tag event

518
00:25:21,269 --> 00:25:19,600
performing just as planned natural

519
00:25:23,830 --> 00:25:21,279
feature tracking matching all of its

520
00:25:25,590 --> 00:25:23,840
features as we slowly descended

521
00:25:27,750 --> 00:25:25,600
you've heard and seen from the images

522
00:25:29,909 --> 00:25:27,760
that we made contact fired the gas

523
00:25:31,990 --> 00:25:29,919
bottle just as planned and we hope to

524
00:25:33,990 --> 00:25:32,000
have a lot of regolith captured in there

525
00:25:36,230 --> 00:25:34,000
before we backed away

526
00:25:38,149 --> 00:25:36,240
we did start downlinking our tag data

527
00:25:40,630 --> 00:25:38,159
yesterday and we were fortunate to

528
00:25:41,909 --> 00:25:40,640
maintain communication throughout the

529
00:25:43,909 --> 00:25:41,919
contact

530
00:25:45,190 --> 00:25:43,919
and our 40-bit telemetry

531
00:25:47,029 --> 00:25:45,200
last night we were able to go to a

532
00:25:48,789 --> 00:25:47,039
higher data rate and get down some of

533
00:25:51,350 --> 00:25:48,799
our recorded data including that

534
00:25:52,470 --> 00:25:51,360
phenomenal set of images that dante just

535
00:25:55,110 --> 00:25:52,480
showed

536
00:25:57,110 --> 00:25:55,120
all of our spacecraft subsystems are

537
00:25:59,269 --> 00:25:57,120
reporting nominal performance at this

538
00:26:01,269 --> 00:25:59,279

time we're not working any issues

539
00:26:03,110 --> 00:26:01,279
we did see a number of additional bright

540
00:26:04,789 --> 00:26:03,120
objects in our star tracker not

541
00:26:07,110 --> 00:26:04,799
unexpected seeing what came off the

542
00:26:08,149 --> 00:26:07,120
surface of bennu and that has all now

543
00:26:09,590 --> 00:26:08,159
cleared

544
00:26:11,269 --> 00:26:09,600
so coming up we have a series of

545
00:26:13,269 --> 00:26:11,279
spacecraft activities that's going to

546
00:26:15,190 --> 00:26:13,279
help inform us on how much sample we've

547
00:26:18,549 --> 00:26:15,200
collected and give us a little more

548
00:26:20,070 --> 00:26:18,559
insight into the spacecraft subsystems

549
00:26:22,390 --> 00:26:20,080
our first event will actually happen

550
00:26:25,269 --> 00:26:22,400
tomorrow and we've got an animation

551
00:26:27,590 --> 00:26:25,279
showing what sample imaging looks like

552
00:26:30,710 --> 00:26:27,600
so we're able to articulate our arm and

553
00:26:33,190 --> 00:26:30,720
the tag sam head over our sam cam

554
00:26:35,190 --> 00:26:33,200
which will take a series of images

555
00:26:38,070 --> 00:26:35,200
we're hoping that we can see lots of

556
00:26:39,990 --> 00:26:38,080
sample entrained inside the sampler head

557
00:26:42,950 --> 00:26:40,000
we'll also be able to see evidence of

558
00:26:45,510 --> 00:26:42,960
sample on those contact pads any dust

559
00:26:48,390 --> 00:26:45,520
that may be on the arm or the sampler

560
00:26:50,390 --> 00:26:48,400
head so that'll be the first activity to

561
00:26:53,510 --> 00:26:50,400
help us determine just how much sample

562
00:26:55,590 --> 00:26:53,520
we've collected then our second activity

563
00:26:58,230 --> 00:26:55,600

is our sample mass measurement and we

564
00:27:00,630 --> 00:26:58,240
have a second animation showing that

565
00:27:02,870 --> 00:27:00,640
we'll extend the arm and spin the

566
00:27:05,430 --> 00:27:02,880
spacecraft now we've done this activity

567
00:27:07,590 --> 00:27:05,440
before so we've got a pre tag and this

568
00:27:09,669 --> 00:27:07,600
will be our post tag that way we can

569
00:27:11,430 --> 00:27:09,679
compare the moment of inertia which will

570
00:27:14,070 --> 00:27:11,440
help us determine how much mass is

571
00:27:16,390 --> 00:27:14,080
actually in the sampler head

572
00:27:18,230 --> 00:27:16,400
we do also have a spacecraft checkout

573
00:27:19,830 --> 00:27:18,240
plans early next week where we'll get an

574
00:27:21,430 --> 00:27:19,840
opportunity to do some engineering

575
00:27:23,830 --> 00:27:21,440
checkouts of some of our redundant

576
00:27:25,830 --> 00:27:23,840
components as we continue to trend the

577
00:27:27,669 --> 00:27:25,840
spacecraft which looks just absolutely

578
00:27:28,870 --> 00:27:27,679
amazing after what we put it through

579
00:27:31,190 --> 00:27:28,880
yesterday

580
00:27:33,830 --> 00:27:31,200
i'm going to turn it back over to nancy

581
00:27:36,149 --> 00:27:33,840
okay thank you sandy we're now ready to

582
00:27:37,909 --> 00:27:36,159
take questions from the media by phone

583
00:27:41,029 --> 00:27:37,919
operator please patch through our first

584
00:27:45,350 --> 00:27:43,029
thank you we will now begin the question

585
00:27:48,389 --> 00:27:45,360
and answer session if you would like to

586
00:27:51,669 --> 00:27:48,399
ask a question please press star one

587
00:27:54,070 --> 00:27:51,679
i meet your phone and record your name

588
00:27:56,870 --> 00:27:54,080

your name and your associated press is

589
00:27:58,470 --> 00:27:56,880
required to introduce your question to

590
00:27:59,669 --> 00:27:58,480
withdraw your question please press

591
00:28:01,750 --> 00:27:59,679
start to

592
00:28:04,710 --> 00:28:01,760
again to ask a question please press

593
00:28:09,269 --> 00:28:04,720
star one the first question comes from

594
00:28:12,549 --> 00:28:09,279
marsha dunn from associated print

595
00:28:16,310 --> 00:28:14,310
congratulations

596
00:28:18,549 --> 00:28:16,320
i heard that mr breidenstein say that

597
00:28:19,590 --> 00:28:18,559
contact was actually 15 seconds which is

598
00:28:22,070 --> 00:28:19,600
a little

599
00:28:25,110 --> 00:28:22,080
longer than anticipated um i guess

600
00:28:27,430 --> 00:28:25,120
that's a good thing uh right and when do

601
00:28:30,549 --> 00:28:27,440
you think might be the soonest that you

602
00:28:33,269 --> 00:28:30,559
can declare success and

603
00:28:34,950 --> 00:28:33,279
have at least a pretty good hunch that

604
00:28:36,789 --> 00:28:34,960
you've got what you were going after

605
00:28:39,830 --> 00:28:36,799
thank you

606
00:28:43,430 --> 00:28:39,840
a great question i'll tell you the 15

607
00:28:46,310 --> 00:28:43,440
seconds i got in open media reports

608
00:28:48,549 --> 00:28:46,320
so i'll let probably the experts uh tell

609
00:28:51,190 --> 00:28:48,559
us exactly what what they know occurred

610
00:28:52,710 --> 00:28:51,200
if uh dante if you'd like to take that i

611
00:28:54,870 --> 00:28:52,720
think i'll let sandy answer that she's

612
00:28:56,870 --> 00:28:54,880
our spacecraft engineer and analyze the

613
00:28:58,870 --> 00:28:56,880

telemetry that gives us that information

614
00:29:01,269 --> 00:28:58,880
yes our preliminary analysis of the

615
00:29:04,470 --> 00:29:01,279
telemetry shows that we were in contact

616
00:29:06,470 --> 00:29:04,480
with the surface for about six seconds

617
00:29:08,230 --> 00:29:06,480
and our collection time about five

618
00:29:10,149 --> 00:29:08,240
seconds it takes just about a second

619
00:29:12,630 --> 00:29:10,159
after we make contact before that gas

620
00:29:14,549 --> 00:29:12,640
bottle is fired which is that one second

621
00:29:17,510 --> 00:29:14,559
difference

622
00:29:21,669 --> 00:29:17,520
so i i i read an article and it says 15

623
00:29:23,830 --> 00:29:21,679
so i guess i was raw marsha i apologize

624
00:29:25,669 --> 00:29:23,840
oh that's quite all right and when do

625
00:29:27,110 --> 00:29:25,679
you think the soonest might be that

626
00:29:29,669 --> 00:29:27,120
you'll have

627
00:29:33,510 --> 00:29:29,679
if not an exact measurement a pretty

628
00:29:37,990 --> 00:29:33,520
good idea that you uh that you can uh

629
00:29:45,669 --> 00:29:41,590
uh yeah so we're continuing oh go ahead

630
00:29:49,029 --> 00:29:47,510
yeah so we're continuing to analyze of

631
00:29:50,549 --> 00:29:49,039
all the engineering data that we have on

632
00:29:52,389 --> 00:29:50,559
the ground so that we can better

633
00:29:54,149 --> 00:29:52,399
correlate all the data sets together and

634
00:29:55,990 --> 00:29:54,159
get an exact timeline of everything that

635
00:29:57,669 --> 00:29:56,000
happened here on the surface

636
00:29:59,190 --> 00:29:57,679
how fast the bottle pressure went down

637
00:30:01,750 --> 00:29:59,200
and all of that is is being looked at

638
00:30:03,750 --> 00:30:01,760

very closely here as we look to analyze

639
00:30:05,190 --> 00:30:03,760
the sample we've collected so hoping to

640
00:30:07,190 --> 00:30:05,200
have good solid timelines here in the

641
00:30:09,909 --> 00:30:07,200
next few days and i think the sample

642
00:30:11,269 --> 00:30:09,919
mass measurement is planned for saturday

643
00:30:13,110 --> 00:30:11,279
yes that's when the spacecraft will

644
00:30:15,590 --> 00:30:13,120
execute that maneuver and the team needs

645
00:30:18,230 --> 00:30:15,600
some time to analyze that information

646
00:30:21,110 --> 00:30:18,240
uh and so uh sandy remind me when do we

647
00:30:23,110 --> 00:30:21,120
expect the final report from gnc on that

648
00:30:25,590 --> 00:30:23,120
value yes we are expecting a final

649
00:30:28,149 --> 00:30:25,600
sample mass measurement report on monday

650
00:30:31,350 --> 00:30:29,590
operator we're ready for the next

651
00:30:33,110 --> 00:30:31,360
question

652
00:30:36,710 --> 00:30:33,120
thank you

653
00:30:39,190 --> 00:30:36,720
sarik malik of space.com your line is

654
00:30:43,990 --> 00:30:41,830
hello uh thank you so much for uh for

655
00:30:47,510 --> 00:30:44,000
the update here and uh congratulations

656
00:30:49,830 --> 00:30:47,520
it appears uh so far on um the sampling

657
00:30:52,070 --> 00:30:49,840
my question is for dante uh i'm just

658
00:30:55,590 --> 00:30:52,080
curious you know it's been a long road

659
00:30:57,750 --> 00:30:55,600
reaching venue with osiris-rex uh and

660
00:30:59,750 --> 00:30:57,760
and you know very

661
00:31:01,590 --> 00:30:59,760
unexpected circumstances to try to

662
00:31:04,070 --> 00:31:01,600
actually collect samples of the

663
00:31:07,830 --> 00:31:04,080

asteroids last night and i'm wondering

664
00:31:10,230 --> 00:31:07,840
kind of what you and and the team

665
00:31:11,909 --> 00:31:10,240
are feeling or were feeling when you saw

666
00:31:14,470 --> 00:31:11,919
those images come down

667
00:31:16,710 --> 00:31:14,480
uh after you know making lots of

668
00:31:19,190 --> 00:31:16,720
precautions uh for you know the ongoing

669
00:31:20,470 --> 00:31:19,200
pandemic or uh you know every other

670
00:31:21,590 --> 00:31:20,480
challenge situation that we're facing

671
00:31:23,509 --> 00:31:21,600
right now

672
00:31:26,549 --> 00:31:23,519
i'm just curious kind of what that tone

673
00:31:28,630 --> 00:31:26,559
was like when you saw those images there

674
00:31:31,029 --> 00:31:28,640
of course that's a great question so we

675
00:31:33,590 --> 00:31:31,039
stayed here at the msa at lockheed

676
00:31:35,909 --> 00:31:33,600
martin fairly late last night

677
00:31:37,830 --> 00:31:35,919
i stuck around to get to the point where

678
00:31:39,029 --> 00:31:37,840
we made the high gain antenna contact

679
00:31:41,110 --> 00:31:39,039
with the spacecraft and we started to

680
00:31:42,630 --> 00:31:41,120
get the initial telemetry back down and

681
00:31:44,950 --> 00:31:42,640
we actually had a spacecraft status

682
00:31:47,830 --> 00:31:44,960
meeting about 9 30 p.m here local denver

683
00:31:51,269 --> 00:31:47,840
time i got back to my apartment here in

684
00:31:52,789 --> 00:31:51,279
denver around 11 o'clock last night

685
00:31:54,389 --> 00:31:52,799
and i couldn't sleep as you could

686
00:31:56,389 --> 00:31:54,399
imagine i knew we were expecting those

687
00:31:59,509 --> 00:31:56,399
images around 2 a.m

688
00:32:01,830 --> 00:31:59,519

so i got on to the chat we have a chat

689
00:32:03,909 --> 00:32:01,840
feature with our science team

690
00:32:05,190 --> 00:32:03,919
and actually the images get processed

691
00:32:07,590 --> 00:32:05,200
through the science processing and

692
00:32:09,990 --> 00:32:07,600
operation center in tucson arizona so

693
00:32:10,950 --> 00:32:10,000
our imaging scientists at u of a were

694
00:32:13,190 --> 00:32:10,960
busy

695
00:32:15,110 --> 00:32:13,200
downloading and analyzing the images and

696
00:32:17,509 --> 00:32:15,120
the science team was analyzing them in

697
00:32:19,509 --> 00:32:17,519
real time through the chat feature and

698
00:32:22,070 --> 00:32:19,519
we were producing the animated gifs

699
00:32:24,950 --> 00:32:22,080
looking at various aspects and timing in

700
00:32:27,830 --> 00:32:24,960
the sequences and as you can imagine the

701
00:32:30,389 --> 00:32:27,840
chat was filled with emojis and wows and

702
00:32:32,710 --> 00:32:30,399
all kinds of celebratory remarks uh

703
00:32:35,110 --> 00:32:32,720
science it never sleeps in these kinds

704
00:32:37,669 --> 00:32:35,120
of conditions so we immediately started

705
00:32:39,990 --> 00:32:37,679
assessing how far the tag sam had

706
00:32:42,950 --> 00:32:40,000
penetrated into the surface

707
00:32:44,789 --> 00:32:42,960
overall the the mood was uh jubilant

708
00:32:47,430 --> 00:32:44,799
because everything looked better than we

709
00:32:49,190 --> 00:32:47,440
expected and i could say the best piece

710
00:32:51,509 --> 00:32:49,200
of information we got was that that tag

711
00:32:54,149 --> 00:32:51,519
sam head looks like it pushed down into

712
00:32:55,909 --> 00:32:54,159
the asteroid surface uh when with all

713
00:32:58,149 --> 00:32:55,919

the laboratory testing that the team at

714
00:33:00,549 --> 00:32:58,159
lockheed martin did here to assess tag

715
00:33:03,509 --> 00:33:00,559
sam performance some of the best test

716
00:33:05,669 --> 00:33:03,519
results occurred when tag sam gets down

717
00:33:07,990 --> 00:33:05,679
underneath the surface just a little bit

718
00:33:10,710 --> 00:33:08,000
and is able to fire the nitrogen gas

719
00:33:12,389 --> 00:33:10,720
with regolith all around it so

720
00:33:13,990 --> 00:33:12,399
i know we're going to hear in another

721
00:33:16,549 --> 00:33:14,000
event later today from our tag sam

722
00:33:18,710 --> 00:33:16,559
scientist beau beerhouse so

723
00:33:19,590 --> 00:33:18,720
you can look forward to that i know he

724
00:33:25,509 --> 00:33:19,600
is

725
00:33:27,830 --> 00:33:25,519
devices performed and that spread

726
00:33:29,750 --> 00:33:27,840
throughout the entire science team

727
00:33:31,430 --> 00:33:29,760
the only thing i'm looking forward to

728
00:33:33,190 --> 00:33:31,440
is maybe being able to sleep tonight

729
00:33:35,590 --> 00:33:33,200
knowing that we had a job really well

730
00:33:35,600 --> 00:33:40,789
thank you dante operating next question

731
00:33:48,630 --> 00:33:44,230
thank you stephen clark of space flight

732
00:33:55,509 --> 00:33:52,789
hi congratulations on the success um my

733
00:33:56,710 --> 00:33:55,519
question is for dante uh are you at any

734
00:33:59,110 --> 00:33:56,720
point in the next few days or a few

735
00:34:02,389 --> 00:33:59,120
weeks expecting to get any images

736
00:34:04,149 --> 00:34:02,399
inside the tank stamp to see

737
00:34:05,269 --> 00:34:04,159
maybe an image of the sample that you

738
00:34:08,310 --> 00:34:05,279

collected

739
00:34:09,990 --> 00:34:08,320
and i was wondering also if you have any

740
00:34:13,109 --> 00:34:10,000
estimate of the error bars that you'll

741
00:34:15,589 --> 00:34:13,119
have on your mass estimate um from the

742
00:34:18,470 --> 00:34:15,599
spin maneuver this weekend thanks

743
00:34:20,310 --> 00:34:18,480
yeah thank you stephen um absolutely so

744
00:34:23,109 --> 00:34:20,320
i think the next major flight activity

745
00:34:25,750 --> 00:34:23,119
for the spacecraft is using the sam cam

746
00:34:27,589 --> 00:34:25,760
to image the tag sam head

747
00:34:29,270 --> 00:34:27,599
sandy showed an animation of what that

748
00:34:30,710 --> 00:34:29,280
sequence looks like just a little bit

749
00:34:32,310 --> 00:34:30,720
earlier

750
00:34:33,510 --> 00:34:32,320
we will be able to look at the base

751
00:34:36,230 --> 00:34:33,520
plate we'll be able to look at those

752
00:34:38,470 --> 00:34:36,240
contact pads based on what i've seen so

753
00:34:40,230 --> 00:34:38,480
far with the asteroid surface crushing

754
00:34:42,470 --> 00:34:40,240
underneath the tag sam head i'm

755
00:34:44,869 --> 00:34:42,480
anticipating that we see contact pads

756
00:34:46,389 --> 00:34:44,879
coated in dark black asteroid regolith

757
00:34:49,589 --> 00:34:46,399
but of course we need those images down

758
00:34:51,349 --> 00:34:49,599
to verify that we hope to be able to see

759
00:34:52,869 --> 00:34:51,359
inside the tag sam head but that's not

760
00:34:55,109 --> 00:34:52,879
guaranteed

761
00:34:57,589 --> 00:34:55,119
for one thing the tag sam head may be so

762
00:34:59,349 --> 00:34:57,599
full of regolith that no light is able

763
00:35:00,870 --> 00:34:59,359

to penetrate inside that i'm going to

764
00:35:02,550 --> 00:35:00,880
take that as a win

765
00:35:03,990 --> 00:35:02,560
but it does require just the right

766
00:35:06,790 --> 00:35:04,000
lighting conditions

767
00:35:09,270 --> 00:35:06,800
for us to see inside that tag same head

768
00:35:10,790 --> 00:35:09,280
and we don't require that to take place

769
00:35:12,150 --> 00:35:10,800
but those images will be acquired

770
00:35:14,310 --> 00:35:12,160
tomorrow

771
00:35:16,230 --> 00:35:14,320
downlinked over the next day or so and

772
00:35:18,630 --> 00:35:16,240
obviously we'll be analyzing those

773
00:35:22,710 --> 00:35:18,640
intently um remind me what the second

774
00:35:26,790 --> 00:35:24,870
yeah just how precise is this moment of

775
00:35:28,950 --> 00:35:26,800
inertia measurement going to be in in

776
00:35:31,990 --> 00:35:28,960
terms of estimating how much mass

777
00:35:34,870 --> 00:35:32,000
how much sample you collected thank you

778
00:35:37,670 --> 00:35:34,880
so the mission requirement is to bring

779
00:35:39,430 --> 00:35:37,680
back 60 grams of regolith

780
00:35:40,230 --> 00:35:39,440
and we have done a lot of work with this

781
00:35:41,990 --> 00:35:40,240
team

782
00:35:44,230 --> 00:35:42,000
to determine what the precision on that

783
00:35:45,670 --> 00:35:44,240
measurement is and in fact we rehearsed

784
00:35:47,589 --> 00:35:45,680
it during the checkpoint rehearsal in

785
00:35:50,150 --> 00:35:47,599
the match point rehearsal

786
00:35:53,750 --> 00:35:50,160
right now we're carrying a three sigma

787
00:35:55,270 --> 00:35:53,760
uncertainty of about 20 grams on that

788
00:35:57,109 --> 00:35:55,280

measurement so

789
00:35:59,349 --> 00:35:57,119
we've actually worked through this with

790
00:36:01,750 --> 00:35:59,359
our stakeholders at nasa headquarters

791
00:36:04,790 --> 00:36:01,760
and 80 grams is kind of the magic number

792
00:36:07,349 --> 00:36:04,800
if we see smm coming in at 80 grams or

793
00:36:09,910 --> 00:36:07,359
higher we have a 90 percent confidence

794
00:36:11,589 --> 00:36:09,920
of having collected 60 grams of regolith

795
00:36:14,150 --> 00:36:11,599
so that's a key number that i'm looking

796
00:36:16,710 --> 00:36:14,160
for uh if it's below that uh it's a

797
00:36:19,670 --> 00:36:16,720
conversation that we have with the team

798
00:36:21,589 --> 00:36:19,680
with nasa headquarters dr zurbukin to

799
00:36:24,310 --> 00:36:21,599
decide what we think the best path uh

800
00:36:26,310 --> 00:36:24,320
forward is but 20 grand three sigma is

801
00:36:29,589 --> 00:36:26,320
the number that uh we have agreed to

802
00:36:29,599 --> 00:36:35,109
thank you operator next question

803
00:36:42,550 --> 00:36:37,910
craig smith of k

804
00:36:46,390 --> 00:36:45,270
thank you a question for for dante

805
00:36:47,910 --> 00:36:46,400
um

806
00:36:49,589 --> 00:36:47,920
how is the

807
00:36:51,349 --> 00:36:49,599
how is it decided just which

808
00:36:52,950 --> 00:36:51,359
organizations in which share of the

809
00:36:55,990 --> 00:36:52,960
collected material

810
00:36:58,230 --> 00:36:56,000
how what share do you expect university

811
00:37:00,550 --> 00:36:58,240
of arizona to get and please give us an

812
00:37:03,270 --> 00:37:00,560
idea of i guess the uh

813
00:37:06,230 --> 00:37:03,280

the researchers who are

814
00:37:08,310 --> 00:37:06,240
lined up to get a look at that maturity

815
00:37:11,349 --> 00:37:08,320
thanks craig great to hear from you uh

816
00:37:13,430 --> 00:37:11,359
so first the sample belongs to nasa and

817
00:37:16,870 --> 00:37:13,440
really to the american taxpayers

818
00:37:19,030 --> 00:37:16,880
uh so the only transfer of sample that's

819
00:37:21,670 --> 00:37:19,040
been authorized is that four percent

820
00:37:23,430 --> 00:37:21,680
goes to the canadian space agency that's

821
00:37:25,190 --> 00:37:23,440
by mass

822
00:37:27,829 --> 00:37:25,200
and then half a percent goes to the

823
00:37:29,430 --> 00:37:27,839
japanese space agency uh

824
00:37:31,030 --> 00:37:29,440
in to reciprocate for their

825
00:37:33,670 --> 00:37:31,040
contributions to the success of this

826
00:37:36,630 --> 00:37:33,680
mission the science team which is what i

827
00:37:39,510 --> 00:37:36,640
lead will be allocated 25

828
00:37:41,109 --> 00:37:39,520
of the return mass and also 25 of the

829
00:37:43,430 --> 00:37:41,119
contact pads

830
00:37:45,670 --> 00:37:43,440
for our scientific analysis but in all

831
00:37:47,750 --> 00:37:45,680
cases that material still belongs to the

832
00:37:48,790 --> 00:37:47,760
agency and is under the control of nasa

833
00:37:51,030 --> 00:37:48,800
and it's

834
00:37:53,510 --> 00:37:51,040
allocated to me and to the science team

835
00:37:56,069 --> 00:37:53,520
through what's called a loan agreement

836
00:37:58,710 --> 00:37:56,079
but all that aside we're basically

837
00:38:00,710 --> 00:37:58,720
planning right now on analyzing 25

838
00:38:02,870 --> 00:38:00,720

percent of the return mass

839
00:38:03,589 --> 00:38:02,880
and a lot of my activity lately has been

840
00:38:15,750 --> 00:38:03,599
in

841
00:38:17,750 --> 00:38:15,760
course the university of arizona will be

842
00:38:20,230 --> 00:38:17,760
a central organization in the analysis

843
00:38:22,230 --> 00:38:20,240
of the return material we've got new

844
00:38:24,470 --> 00:38:22,240
laboratories that we've installed over

845
00:38:26,710 --> 00:38:24,480
the last couple years a new instrument

846
00:38:27,910 --> 00:38:26,720
being developed right now

847
00:38:29,670 --> 00:38:27,920
that we're really looking forward to

848
00:38:31,829 --> 00:38:29,680
analyzing that material with

849
00:38:33,190 --> 00:38:31,839
but the science team really spans the

850
00:38:34,790 --> 00:38:33,200
entire globe

851
00:38:36,710 --> 00:38:34,800
we've got key organizations in the

852
00:38:39,109 --> 00:38:36,720
united states like nasa's goddard space

853
00:38:40,390 --> 00:38:39,119
flight center johnson space center that

854
00:38:42,550 --> 00:38:40,400
are going to play central roles in the

855
00:38:44,790 --> 00:38:42,560
sample analysis program and then we've

856
00:38:47,190 --> 00:38:44,800
got team members in canada in japan and

857
00:38:48,870 --> 00:38:47,200
australia throughout europe uh that are

858
00:38:50,790 --> 00:38:48,880
going to be involved in the program as

859
00:38:52,790 --> 00:38:50,800
well and we'll be able to talk about

860
00:38:55,030 --> 00:38:52,800
that and roll that plan out over the

861
00:38:57,270 --> 00:38:55,040
next year or so as we finalize the

862
00:38:59,510 --> 00:38:57,280
details on that but i can tell you based

863
00:39:01,670 --> 00:38:59,520

on what i've seen today uh we're looking

864
00:39:02,950 --> 00:39:01,680
at hopefully a lot of material and a lot

865
00:39:04,550 --> 00:39:02,960
of great science coming out of the

866
00:39:06,630 --> 00:39:04,560
sample analysis phase of those irish

867
00:39:07,990 --> 00:39:06,640
wrecks

868
00:39:09,990 --> 00:39:08,000
thank you great thank you

869
00:39:15,349 --> 00:39:10,000
congratulations

870
00:39:20,630 --> 00:39:19,109
leo in wright of irish tv your line is

871
00:39:22,790 --> 00:39:20,640
open

872
00:39:24,390 --> 00:39:22,800
uh thanks very much for doing this and

873
00:39:27,109 --> 00:39:24,400
congratulations

874
00:39:30,069 --> 00:39:27,119
a couple of questions one for uh rich

875
00:39:33,430 --> 00:39:30,079
burns uh you you mentioned uh the

876
00:39:35,589 --> 00:39:33,440
possibility of maybe less of a sample

877
00:39:38,230 --> 00:39:35,599
than you would hope for now i realize

878
00:39:39,990 --> 00:39:38,240
this is unlikely but if you found that

879
00:39:41,270 --> 00:39:40,000
you had less of a sample than you

880
00:39:44,230 --> 00:39:41,280
expected

881
00:39:46,390 --> 00:39:44,240
is there a plan b can you go back or is

882
00:39:49,829 --> 00:39:46,400
uh or is that it

883
00:39:51,670 --> 00:39:49,839
um and also for dr loretta

884
00:39:54,390 --> 00:39:51,680
can can you talk a little bit about the

885
00:39:57,910 --> 00:39:54,400
rocks that we saw you mentioned that the

886
00:39:59,829 --> 00:39:57,920
the rocks seem to fragment very easily

887
00:40:02,390 --> 00:39:59,839
what can you say about the nature of

888
00:40:04,790 --> 00:40:02,400

these rocks and whether for instance if

889
00:40:09,990 --> 00:40:04,800
i pick one up would i be able to crumble

890
00:40:14,630 --> 00:40:11,670
very much for that question uh it's a

891
00:40:17,270 --> 00:40:14,640
great one uh if we if we for some reason

892
00:40:19,430 --> 00:40:17,280
decided not to stow this sample uh if we

893
00:40:21,430 --> 00:40:19,440
determined this the mass was not

894
00:40:23,270 --> 00:40:21,440
sufficient that we wanted to go back we

895
00:40:25,190 --> 00:40:23,280
can in fact go back

896
00:40:27,349 --> 00:40:25,200
we have three nitrogen bottles which

897
00:40:28,470 --> 00:40:27,359
allows us to touch the surface three

898
00:40:30,790 --> 00:40:28,480
times

899
00:40:32,069 --> 00:40:30,800
of course we've disturbed as you saw in

900
00:40:33,589 --> 00:40:32,079
the in the

901
00:40:36,790 --> 00:40:33,599
animation are not the animation but the

902
00:40:39,109 --> 00:40:36,800
images that dante showed we've disturbed

903
00:40:40,309 --> 00:40:39,119
the surface of nightingale in a radical

904
00:40:42,470 --> 00:40:40,319
way

905
00:40:44,150 --> 00:40:42,480
so we won't be going back to

906
00:40:45,190 --> 00:40:44,160
nightingale at least for our second

907
00:40:47,109 --> 00:40:45,200
attempt

908
00:40:49,349 --> 00:40:47,119
we would go to our backup site which is

909
00:40:51,670 --> 00:40:49,359
called osprey which is a near equatorial

910
00:40:54,630 --> 00:40:51,680
site and we're prepared to do that in

911
00:40:56,309 --> 00:40:54,640
the in the mid-january time frame

912
00:40:57,589 --> 00:40:56,319
i'll turn it over to dante for answer

913
00:41:00,470 --> 00:40:57,599

the second question

914
00:41:02,069 --> 00:41:00,480
yeah the rocks on the asteroid surface

915
00:41:04,150 --> 00:41:02,079
uh have turned out to be fascinating

916
00:41:06,150 --> 00:41:04,160
scientifically and the team has done an

917
00:41:07,990 --> 00:41:06,160
amazing job processing all of the remote

918
00:41:10,069 --> 00:41:08,000
sensing data that we've acquired

919
00:41:13,430 --> 00:41:10,079
starting in late 2018 and throughout

920
00:41:15,270 --> 00:41:13,440
2019 i can answer the question that

921
00:41:18,390 --> 00:41:15,280
first of all the surface seems to be

922
00:41:21,270 --> 00:41:18,400
dominated by two distinct rock types we

923
00:41:23,270 --> 00:41:21,280
see a very dark kind of hummucky rock

924
00:41:26,230 --> 00:41:23,280
which looks like the one that we crushed

925
00:41:28,470 --> 00:41:26,240
underneath it and from recent analysis

926
00:41:30,470 --> 00:41:28,480
uh using the thermal data how the rock

927
00:41:32,710 --> 00:41:30,480
heats up and cools off we actually

928
00:41:34,630 --> 00:41:32,720
inferred that these rocks might be very

929
00:41:36,710 --> 00:41:34,640
weak compared to what we're used to

930
00:41:38,630 --> 00:41:36,720
dealing with here on earth and most

931
00:41:40,790 --> 00:41:38,640
exciting i think for me as a sample

932
00:41:42,470 --> 00:41:40,800
scientist very weak compared to the

933
00:41:44,309 --> 00:41:42,480
meteorites that are currently in our

934
00:41:46,550 --> 00:41:44,319
collections here on earth

935
00:41:48,710 --> 00:41:46,560
so i think what we've seen is that our

936
00:41:51,430 --> 00:41:48,720
meteorites are possibly a biased sample

937
00:41:53,349 --> 00:41:51,440
that they're only the most uh sturdy and

938
00:41:55,030 --> 00:41:53,359

strong material that survives passage

939
00:41:56,630 --> 00:41:55,040
through the earth's atmosphere and it

940
00:41:58,710 --> 00:41:56,640
looks like the material that dominates

941
00:42:01,109 --> 00:41:58,720
the surface of bennu might be much more

942
00:42:03,190 --> 00:42:01,119
fragile and friable and with this

943
00:42:05,589 --> 00:42:03,200
interaction of tag sam with the asteroid

944
00:42:07,270 --> 00:42:05,599
surface that seems to be playing out i

945
00:42:09,430 --> 00:42:07,280
can tell you the science team is already

946
00:42:10,950 --> 00:42:09,440
excited uh about the possibility of

947
00:42:13,109 --> 00:42:10,960
getting a direct strength measurement

948
00:42:14,790 --> 00:42:13,119
through detailed analysis of this image

949
00:42:16,230 --> 00:42:14,800
sequence especially this these two

950
00:42:18,550 --> 00:42:16,240
images right before and right after

951
00:42:21,349 --> 00:42:18,560
contact the second kind of rock that

952
00:42:23,430 --> 00:42:21,359
we've seen on bennu is a little brighter

953
00:42:25,430 --> 00:42:23,440
it tends to be shot through with bright

954
00:42:27,829 --> 00:42:25,440
white veins or white inclusions that

955
00:42:29,430 --> 00:42:27,839
we've identified as a mineral carbonate

956
00:42:32,069 --> 00:42:29,440
this is a mineral people are probably

957
00:42:34,230 --> 00:42:32,079
familiar with it forms a kind of white

958
00:42:35,750 --> 00:42:34,240
crud around your faucets and sinks if

959
00:42:37,990 --> 00:42:35,760
you live in an area with hard water it's

960
00:42:39,829 --> 00:42:38,000
basically an evaporite and those rocks

961
00:42:41,589 --> 00:42:39,839
seem to be a little stronger probably

962
00:42:43,270 --> 00:42:41,599
because of that material that has

963
00:42:45,030 --> 00:42:43,280

cemented them together

964
00:42:46,470 --> 00:42:45,040
we do see maybe some hints that there

965
00:42:48,390 --> 00:42:46,480
was some of that brighter material

966
00:42:50,309 --> 00:42:48,400
smaller fragments of it underneath the

967
00:42:52,069 --> 00:42:50,319
tag sam head but the team is going in

968
00:42:53,990 --> 00:42:52,079
for detailed analysis to determine if

969
00:42:55,910 --> 00:42:54,000
that's in fact the case and then i'll

970
00:42:57,349 --> 00:42:55,920
just said mineralogically we've done a

971
00:42:59,510 --> 00:42:57,359
pretty good job understanding what these

972
00:43:02,390 --> 00:42:59,520
rocks are made out of they're definitely

973
00:43:05,109 --> 00:43:02,400
dominated by hydrated minerals that is

974
00:43:06,550 --> 00:43:05,119
clays that have water contained in their

975
00:43:08,470 --> 00:43:06,560
crystal structure

976
00:43:10,829 --> 00:43:08,480
that's very exciting scientifically

977
00:43:13,430 --> 00:43:10,839
we've also seen an iron oxide called

978
00:43:15,510 --> 00:43:13,440
magnetite abundant organic material

979
00:43:17,190 --> 00:43:15,520
particularly carbon hydrogen bonded

980
00:43:19,190 --> 00:43:17,200
material which is really what this

981
00:43:20,870 --> 00:43:19,200
mission is all about bringing back home

982
00:43:24,069 --> 00:43:20,880
and then that carbonate material that i

983
00:43:31,750 --> 00:43:25,190
thank you

984
00:43:39,349 --> 00:43:36,230
um nova pbs carolina's open

985
00:43:42,230 --> 00:43:39,359
hi everyone um firstly congratulations

986
00:43:44,710 --> 00:43:42,240
this is just super exciting and i know

987
00:43:47,190 --> 00:43:44,720
that we're all to use your point earlier

988
00:43:49,910 --> 00:43:47,200

over the asteroid for all of you guys

989
00:43:52,630 --> 00:43:49,920
and if i'm wondering from the images

990
00:43:54,470 --> 00:43:52,640
that you have currently i know during

991
00:43:56,230 --> 00:43:54,480
monday's press conferences there's a lot

992
00:43:57,430 --> 00:43:56,240
of conversation about

993
00:43:58,390 --> 00:43:57,440
diversity

994
00:44:00,309 --> 00:43:58,400
in

995
00:44:02,790 --> 00:44:00,319
regard to the size of

996
00:44:05,030 --> 00:44:02,800
the sample pieces as well as the

997
00:44:06,790 --> 00:44:05,040
material and everything so

998
00:44:08,390 --> 00:44:06,800
is there any clue from the images that

999
00:44:10,470 --> 00:44:08,400
you have currently that we have a good

1000
00:44:12,309 --> 00:44:10,480
diversity of really small pieces and

1001
00:44:14,550 --> 00:44:12,319
maybe pieces closer to that two

1002
00:44:16,309 --> 00:44:14,560
centimeter mark and maybe of different

1003
00:44:18,470 --> 00:44:16,319
types of material as well

1004
00:44:20,150 --> 00:44:18,480
um i guess that's for dante or really

1005
00:44:23,349 --> 00:44:20,160
anyone just an answer

1006
00:44:25,990 --> 00:44:23,359
yeah i'll take that um i could say just

1007
00:44:28,390 --> 00:44:26,000
within the past hour or so i got the

1008
00:44:30,230 --> 00:44:28,400
analysis from my image processing team

1009
00:44:32,870 --> 00:44:30,240
about the exact location where we think

1010
00:44:34,710 --> 00:44:32,880
the tag sam had made contact uh so i

1011
00:44:36,230 --> 00:44:34,720
haven't had time to process that

1012
00:44:38,470 --> 00:44:36,240
information i know that team is busy

1013
00:44:40,950 --> 00:44:38,480

analyzing that but from that quick look

1014
00:44:43,510 --> 00:44:40,960
assessment it does appear that we made

1015
00:44:45,829 --> 00:44:43,520
contact with an area that had already

1016
00:44:48,390 --> 00:44:45,839
been mapped out and verified to contain

1017
00:44:50,470 --> 00:44:48,400
abundant sampleable material rich

1018
00:44:52,790 --> 00:44:50,480
mentioned the imaging resolution during

1019
00:44:54,630 --> 00:44:52,800
the recon c characterization of

1020
00:44:57,270 --> 00:44:54,640
nightingale where we got down to that

1021
00:44:59,589 --> 00:44:57,280
four millimeter per pixel scale uh so

1022
00:45:00,790 --> 00:44:59,599
that this region does look uh really

1023
00:45:03,190 --> 00:45:00,800
sampleable

1024
00:45:04,870 --> 00:45:03,200
uh lots of small particles and then the

1025
00:45:06,630 --> 00:45:04,880
fact that the material just crushed

1026
00:45:09,030 --> 00:45:06,640
underneath the tag sam is just going to

1027
00:45:10,870 --> 00:45:09,040
add more smaller particles for us to

1028
00:45:12,950 --> 00:45:10,880
collect but i don't want to answer the

1029
00:45:14,950 --> 00:45:12,960
question just yet about the diversity of

1030
00:45:16,470 --> 00:45:14,960
the rock types there because the team is

1031
00:45:17,990 --> 00:45:16,480
still processing that

1032
00:45:22,150 --> 00:45:18,000
right up to the beginning of this this

1033
00:45:22,160 --> 00:45:26,150
operator next question

1034
00:45:26,160 --> 00:45:30,230
thank you

1035
00:45:41,270 --> 00:45:34,790
and

1036
00:45:45,670 --> 00:45:43,510
uh thank you um i wonder if you could

1037
00:45:47,430 --> 00:45:45,680
explain a little bit more about how you

1038
00:45:49,270 --> 00:45:47,440

will measure how much sample you've

1039
00:45:53,430 --> 00:45:49,280
collected besides the possibility of

1040
00:45:57,670 --> 00:45:55,349
yeah so we've got a sample mass

1041
00:45:59,750 --> 00:45:57,680
measurement activity so we've been

1042
00:46:01,430 --> 00:45:59,760
practicing this as i think dante rich

1043
00:46:03,270 --> 00:46:01,440
mentioned around our checkpoint and our

1044
00:46:05,030 --> 00:46:03,280
match point burns

1045
00:46:07,589 --> 00:46:05,040
or activities where we can extend the

1046
00:46:09,589 --> 00:46:07,599
arm and rotate the spacecraft and we can

1047
00:46:12,150 --> 00:46:09,599
measure the moment of inertia and by

1048
00:46:13,990 --> 00:46:12,160
doing that before tag and doing that

1049
00:46:15,349 --> 00:46:14,000
same activity after tag we can take the

1050
00:46:16,790 --> 00:46:15,359
difference in those measurements to

1051
00:46:19,270 --> 00:46:16,800
estimate the mass

1052
00:46:21,190 --> 00:46:19,280
so we did perform our pre-tag sample

1053
00:46:23,670 --> 00:46:21,200
mass measurement activity about 10 days

1054
00:46:25,349 --> 00:46:23,680
ago and we'll do our post tag one this

1055
00:46:26,950 --> 00:46:25,359
saturday and we'll be able to take those

1056
00:46:28,550 --> 00:46:26,960
two measurements and look at the

1057
00:46:30,630 --> 00:46:28,560
difference of them to get that estimate

1058
00:46:34,309 --> 00:46:30,640
of how much mass we believe is inside of

1059
00:46:34,319 --> 00:46:37,990
operator next question

1060
00:46:43,270 --> 00:46:40,150
thank you

1061
00:46:45,829 --> 00:46:43,280
chuck fields of your space journey your

1062
00:46:48,069 --> 00:46:45,839
line is open

1063
00:46:49,510 --> 00:46:48,079

i thank you everyone um for taking my

1064
00:46:51,829 --> 00:46:49,520
call and just congratulations to the

1065
00:46:53,670 --> 00:46:51,839
entire team i'm just wondering what are

1066
00:46:56,150 --> 00:46:53,680
the reasons for waiting until january

1067
00:46:58,230 --> 00:46:56,160
for a second collection attempt and if

1068
00:47:00,390 --> 00:46:58,240
the third attempt is required have you

1069
00:47:04,390 --> 00:47:00,400
determined when will that take place and

1070
00:47:09,190 --> 00:47:07,910
so uh yeah great question uh the the

1071
00:47:11,589 --> 00:47:09,200
reason that were

1072
00:47:13,829 --> 00:47:11,599
we would do a second attempt at

1073
00:47:17,030 --> 00:47:13,839
osprey in january as you saw we're

1074
00:47:19,190 --> 00:47:17,040
backing away from the asteroid right now

1075
00:47:21,349 --> 00:47:19,200
and i mentioned that

1076
00:47:24,470 --> 00:47:21,359
we'd be about 80 kilometers when we make

1077
00:47:26,870 --> 00:47:24,480
a maneuver to arrest that drift away on

1078
00:47:29,589 --> 00:47:26,880
friday that will put us on a trajectory

1079
00:47:32,150 --> 00:47:29,599
that goes to a to a waypoint where we

1080
00:47:34,710 --> 00:47:32,160
can re-enter orbit you see the orbit in

1081
00:47:37,910 --> 00:47:34,720
that animation that was just shown is a

1082
00:47:38,790 --> 00:47:37,920
tenuous uh as a tenuous trick for to get

1083
00:47:41,430 --> 00:47:38,800
into

1084
00:47:43,510 --> 00:47:41,440
uh then it was only 500 meters

1085
00:47:45,829 --> 00:47:43,520
in diameter so its gravity feel is

1086
00:47:49,190 --> 00:47:45,839
extraordinarily weak just getting into

1087
00:47:51,750 --> 00:47:49,200
orbit takes weeks of maneuvering to get

1088
00:47:53,910 --> 00:47:51,760

to get there and we want and we also

1089
00:47:56,549 --> 00:47:53,920
have to phase the orbit appropriately so

1090
00:47:59,030 --> 00:47:56,559
we depart for the next sample collection

1091
00:48:01,270 --> 00:47:59,040
attempt at the right latitude

1092
00:48:03,990 --> 00:48:01,280
uh all that takes weeks of planning and

1093
00:48:05,430 --> 00:48:04,000
preparation uh we also have to prepare

1094
00:48:08,150 --> 00:48:05,440
the spacecraft

1095
00:48:11,430 --> 00:48:08,160
to to tag at a different site

1096
00:48:13,589 --> 00:48:11,440
which involves uh

1097
00:48:15,829 --> 00:48:13,599
generating the spacecraft commands

1098
00:48:18,630 --> 00:48:15,839
testing them and so forth so that that

1099
00:48:20,950 --> 00:48:18,640
runs out the timeline to january

1100
00:48:23,589 --> 00:48:20,960
and then the third sample

1101
00:48:26,549 --> 00:48:23,599
attempt would be uh

1102
00:48:28,069 --> 00:48:26,559
to be determined uh date most likely in

1103
00:48:30,150 --> 00:48:28,079
march

1104
00:48:32,950 --> 00:48:30,160
when we'd be attempting a third attempt

1105
00:48:34,710 --> 00:48:32,960
but it largely depends on what happens

1106
00:48:37,990 --> 00:48:34,720
at osprey

1107
00:48:40,069 --> 00:48:38,000
if we were to go to osprey in january

1108
00:48:41,589 --> 00:48:40,079
and wave off abort

1109
00:48:44,390 --> 00:48:41,599
for some reason and not touch the

1110
00:48:45,829 --> 00:48:44,400
surface and not disturb osprey as we've

1111
00:48:47,510 --> 00:48:45,839
seen

1112
00:48:48,390 --> 00:48:47,520
the the dramatic disturbance of

1113
00:48:50,710 --> 00:48:48,400

nightingale

1114
00:48:52,870 --> 00:48:50,720
we go back to osprey

1115
00:48:55,430 --> 00:48:52,880
if we did disturb osprey that's a

1116
00:48:57,670 --> 00:48:55,440
contingency that we would have to either

1117
00:48:59,430 --> 00:48:57,680
uh perform more reconnaissance over one

1118
00:49:01,589 --> 00:48:59,440
of the two

1119
00:49:03,510 --> 00:49:01,599
nightingale or osprey or follow some

1120
00:49:05,910 --> 00:49:03,520
other path

1121
00:49:07,990 --> 00:49:05,920
and the reason i'm saying that is we use

1122
00:49:09,190 --> 00:49:08,000
optical navigation to get down to the

1123
00:49:10,870 --> 00:49:09,200
surface so

1124
00:49:12,549 --> 00:49:10,880
much as you're driving to

1125
00:49:15,109 --> 00:49:12,559
some location your local town and you

1126
00:49:16,870 --> 00:49:15,119
know where you are where gas station is

1127
00:49:18,950 --> 00:49:16,880
or supermarket

1128
00:49:21,510 --> 00:49:18,960
the spacecraft knows where it is by

1129
00:49:23,990 --> 00:49:21,520
features on the surface so groups of

1130
00:49:26,230 --> 00:49:24,000
rocks that cast shadows or just clusters

1131
00:49:28,790 --> 00:49:26,240
of rocks that have distinctive features

1132
00:49:30,390 --> 00:49:28,800
are recognized by the spacecraft in its

1133
00:49:32,390 --> 00:49:30,400
imagery as it descends

1134
00:49:34,069 --> 00:49:32,400
and it knows where to go it knows to

1135
00:49:36,630 --> 00:49:34,079
take the right turn at the supermarket

1136
00:49:39,430 --> 00:49:36,640
to get to the center of the site so

1137
00:49:41,990 --> 00:49:39,440
once we disturb all those features

1138
00:49:43,829 --> 00:49:42,000

that means we're going to need to take

1139
00:49:45,670 --> 00:49:43,839
more images and build a new set of

1140
00:49:47,349 --> 00:49:45,680
feature catalogs to

1141
00:49:49,510 --> 00:49:47,359
teach the spacecraft where the grocery

1142
00:49:50,309 --> 00:49:49,520
store is

1143
00:49:52,790 --> 00:49:50,319
great

1144
00:49:56,309 --> 00:49:52,800
thank you rich operator next question

1145
00:50:03,109 --> 00:49:59,750
joshua ortega of course i need your line

1146
00:50:06,390 --> 00:50:04,549
thank you for having me and uh

1147
00:50:08,790 --> 00:50:06,400
congratulations to everybody involved in

1148
00:50:10,549 --> 00:50:08,800
this mission um

1149
00:50:13,430 --> 00:50:10,559
what was one of the biggest discoveries

1150
00:50:15,910 --> 00:50:13,440
that uh that you made in making contact

1151
00:50:17,829 --> 00:50:15,920
with the asteroid venue

1152
00:50:20,309 --> 00:50:17,839
that you didn't that you didn't expect

1153
00:50:22,549 --> 00:50:20,319
and my second question is

1154
00:50:24,710 --> 00:50:22,559
what is the future applicability of

1155
00:50:30,870 --> 00:50:24,720
future projects with some of the

1156
00:50:35,030 --> 00:50:32,630
i guess i'll take the discovery question

1157
00:50:37,270 --> 00:50:35,040
i could say we've had the data down for

1158
00:50:40,710 --> 00:50:37,280
just a little over 13 hours so the

1159
00:50:42,390 --> 00:50:40,720
discoveries are still uh to come

1160
00:50:45,030 --> 00:50:42,400
really we're you know what i was looking

1161
00:50:46,710 --> 00:50:45,040
at yes this morning two o'clock here

1162
00:50:48,950 --> 00:50:46,720
denver time after being up through a

1163
00:50:51,109 --> 00:50:48,960

very exciting event was how does it look

1164
00:50:52,470 --> 00:50:51,119
in terms of getting the sample

1165
00:50:53,750 --> 00:50:52,480
so the science is something that we're

1166
00:50:54,630 --> 00:50:53,760
going to think of down the road a little

1167
00:50:56,630 --> 00:50:54,640
bit

1168
00:50:59,670 --> 00:50:56,640
but i can tell you that

1169
00:51:01,750 --> 00:50:59,680
i i was hopeful that the surface was

1170
00:51:04,549 --> 00:51:01,760
going to be soft and crushable

1171
00:51:06,230 --> 00:51:04,559
and that was confirmed by our contact

1172
00:51:07,990 --> 00:51:06,240
with the tag same analysis of the images

1173
00:51:09,589 --> 00:51:08,000
that we've seen here so far so that is

1174
00:51:11,589 --> 00:51:09,599
really good news

1175
00:51:13,109 --> 00:51:11,599
so i'm pretty focused on sampling

1176
00:51:15,109 --> 00:51:13,119
success right now

1177
00:51:17,510 --> 00:51:15,119
i i will tell you the science team is

1178
00:51:19,990 --> 00:51:17,520
busy in a couple of different areas they

1179
00:51:22,630 --> 00:51:20,000
are working through a detailed analysis

1180
00:51:25,030 --> 00:51:22,640
of this entire image sequence along with

1181
00:51:27,430 --> 00:51:25,040
additional data from the spacecraft uh

1182
00:51:29,430 --> 00:51:27,440
guidance navigation and control team

1183
00:51:31,270 --> 00:51:29,440
about exactly what happened when the

1184
00:51:34,069 --> 00:51:31,280
spacecraft was in contact for those six

1185
00:51:36,069 --> 00:51:34,079
seconds uh that'll tell us a lot about

1186
00:51:37,829 --> 00:51:36,079
tag sam performance and there's also

1187
00:51:40,710 --> 00:51:37,839
follow on science that we'll be able to

1188
00:51:43,270 --> 00:51:40,720

do with that information but um right

1189
00:51:45,589 --> 00:51:43,280
now i would say the big discovery is

1190
00:51:47,750 --> 00:51:45,599
that it looked really sampleable uh that

1191
00:51:49,589 --> 00:51:47,760
the tag same had pushed into the surface

1192
00:51:51,750 --> 00:51:49,599
and that it was in a very good position

1193
00:51:52,870 --> 00:51:51,760
when that gas fired to collect a lot of

1194
00:51:54,309 --> 00:51:52,880
material

1195
00:51:55,910 --> 00:51:54,319
so we still have all the confirmation

1196
00:51:57,750 --> 00:51:55,920
activities that sandy walked us through

1197
00:52:00,230 --> 00:51:57,760
earlier in the briefing to verify all

1198
00:52:01,910 --> 00:52:00,240
that but the trend right now is that we

1199
00:52:03,190 --> 00:52:01,920
we have sample and that we were

1200
00:52:05,829 --> 00:52:03,200
successful here

1201
00:52:07,589 --> 00:52:05,839
based on analysis of this image this set

1202
00:52:09,990 --> 00:52:07,599
of images yeah i'd love to speak to the

1203
00:52:11,910 --> 00:52:10,000
second part of that question if possible

1204
00:52:14,549 --> 00:52:11,920
um yeah so

1205
00:52:16,790 --> 00:52:14,559
the question was what technologies uh on

1206
00:52:19,829 --> 00:52:16,800
board this on the for the spacecraft can

1207
00:52:21,030 --> 00:52:19,839
enable future future missions

1208
00:52:24,069 --> 00:52:21,040
and

1209
00:52:26,150 --> 00:52:24,079
i think one of the most amazing

1210
00:52:28,069 --> 00:52:26,160
technologies is the optical navigation

1211
00:52:29,829 --> 00:52:28,079
system i talked about what we call

1212
00:52:32,549 --> 00:52:29,839
natural feature tracking

1213
00:52:34,390 --> 00:52:32,559

and it has an actually an amazing story

1214
00:52:37,510 --> 00:52:34,400
uh the spacecraft is actually was

1215
00:52:40,870 --> 00:52:37,520
originally designed to use a a lidar to

1216
00:52:44,390 --> 00:52:40,880
measure the altitude uh to the surface

1217
00:52:47,030 --> 00:52:44,400
as as its primary uh sensor to to do the

1218
00:52:47,829 --> 00:52:47,040
navigation to the surface

1219
00:52:49,589 --> 00:52:47,839
but

1220
00:52:51,589 --> 00:52:49,599
natural feature tracking or optical

1221
00:52:54,790 --> 00:52:51,599
navigation was added around the critical

1222
00:52:57,349 --> 00:52:54,800
design review time period

1223
00:52:59,670 --> 00:52:57,359
in order to have a backup solution

1224
00:53:02,309 --> 00:52:59,680
and what as i mentioned what it does is

1225
00:53:04,150 --> 00:53:02,319
recognize features on the surface of the

1226
00:53:06,549 --> 00:53:04,160
of the asteroid and then

1227
00:53:08,950 --> 00:53:06,559
update its own sense of its position so

1228
00:53:12,069 --> 00:53:08,960
it knows where to go in the future

1229
00:53:15,190 --> 00:53:12,079
now uh this uh this technology being

1230
00:53:17,109 --> 00:53:15,200
added late in the game was was done by

1231
00:53:19,190 --> 00:53:17,119
our colleagues at lockheed martin and it

1232
00:53:21,349 --> 00:53:19,200
was an amazing accomplishment of

1233
00:53:22,710 --> 00:53:21,359
amazing engineering accomplishment

1234
00:53:25,030 --> 00:53:22,720
and one of the

1235
00:53:27,990 --> 00:53:25,040
most amazing performances

1236
00:53:30,870 --> 00:53:28,000
of the system yesterday was just how

1237
00:53:32,790 --> 00:53:30,880
well that system performed relative to

1238
00:53:35,270 --> 00:53:32,800

our simulations of it

1239
00:53:38,230 --> 00:53:35,280
optical navigation systems are notorious

1240
00:53:40,870 --> 00:53:38,240
for not performing as expected and this

1241
00:53:42,470 --> 00:53:40,880
one performed exactly as expected and

1242
00:53:44,309 --> 00:53:42,480
allowed us to hit that center of the

1243
00:53:46,150 --> 00:53:44,319
target within a meter

1244
00:53:48,950 --> 00:53:46,160
so our colleagues at lockheed martin

1245
00:53:50,069 --> 00:53:48,960
deserve a lot of credit for that

1246
00:53:51,829 --> 00:53:50,079
and

1247
00:53:53,510 --> 00:53:51,839
how that gets applied in the future is

1248
00:53:55,829 --> 00:53:53,520
it will allow

1249
00:53:58,870 --> 00:53:55,839
for autonomous navigation for other deep

1250
00:54:02,549 --> 00:53:58,880
space missions to small bodies or not

1251
00:54:04,309 --> 00:54:02,559
for landing or cir or navigation around

1252
00:54:06,390 --> 00:54:04,319
uh hazardous or non-hazardous

1253
00:54:08,470 --> 00:54:06,400
environments so i don't know if sandy do

1254
00:54:11,030 --> 00:54:08,480
you want to follow on to that at all

1255
00:54:13,349 --> 00:54:11,040
yeah definitely um i would have for sure

1256
00:54:15,349 --> 00:54:13,359
pointed out natural feature tracking as

1257
00:54:17,430 --> 00:54:15,359
a capability that i can see useful in

1258
00:54:19,430 --> 00:54:17,440
the future i'll also point out that tag

1259
00:54:20,630 --> 00:54:19,440
sam is new technology flying onboard the

1260
00:54:22,390 --> 00:54:20,640
spacecraft

1261
00:54:24,470 --> 00:54:22,400
and you can see that going forward after

1262
00:54:27,270 --> 00:54:24,480
future sample collection sample return

1263
00:54:32,230 --> 00:54:29,670

and one more quick question for the nasa

1264
00:54:33,510 --> 00:54:32,240
representatives uh what is this

1265
00:54:35,270 --> 00:54:33,520
is this the first time working with the

1266
00:54:37,270 --> 00:54:35,280
university of arizona and what does this

1267
00:54:39,990 --> 00:54:37,280
say

1268
00:54:42,630 --> 00:54:40,000
about about the school and future

1269
00:54:46,470 --> 00:54:42,640
projects with the school as well

1270
00:54:48,150 --> 00:54:46,480
uh and thomas here um um head of science

1271
00:54:50,630 --> 00:54:48,160
i know this is not the first time i

1272
00:54:53,670 --> 00:54:50,640
think of the university of

1273
00:54:55,670 --> 00:54:53,680
uh here it's sauna and it's a kind of uh

1274
00:54:58,390 --> 00:54:55,680
partner university off the street so to

1275
00:55:00,710 --> 00:54:58,400
say arizona state to really be kind of

1276
00:55:02,789 --> 00:55:00,720
meccas of planetary science uh and

1277
00:55:03,990 --> 00:55:02,799
exploration the university of arizona

1278
00:55:05,750 --> 00:55:04,000
has

1279
00:55:07,910 --> 00:55:05,760
had the principal investigator of

1280
00:55:09,670 --> 00:55:07,920
multiple missions and continues to

1281
00:55:11,589 --> 00:55:09,680
compete very well

1282
00:55:12,710 --> 00:55:11,599
in many different

1283
00:55:14,789 --> 00:55:12,720
areas

1284
00:55:16,630 --> 00:55:14,799
and uh and really especially in

1285
00:55:19,910 --> 00:55:16,640
planetary science at the university of

1286
00:55:21,750 --> 00:55:19,920
arizona is one of the top leaders in the

1287
00:55:23,349 --> 00:55:21,760
whole country

1288
00:55:24,710 --> 00:55:23,359

what did you say about arizona state

1289
00:55:26,950 --> 00:55:24,720
university as well

1290
00:55:29,270 --> 00:55:26,960
university arizona state university

1291
00:55:31,430 --> 00:55:29,280
frankly is uh if you just lined up kind

1292
00:55:33,589 --> 00:55:31,440
of the top universities and planetary

1293
00:55:35,829 --> 00:55:33,599
science uh oaks university of arizona

1294
00:55:37,030 --> 00:55:35,839
the arizona state ranked in the top uh

1295
00:55:39,589 --> 00:55:37,040
in the top

1296
00:55:42,630 --> 00:55:39,599
uh you know part of of such a ranking

1297
00:55:44,309 --> 00:55:42,640
list so arizona state also at this

1298
00:55:46,710 --> 00:55:44,319
moment in time for example has a

1299
00:55:49,109 --> 00:55:46,720
principal investigator of a discovery uh

1300
00:55:50,710 --> 00:55:49,119
mission called psyche there's uh

1301
00:55:53,190 --> 00:55:50,720
instruments are being built there for

1302
00:55:55,750 --> 00:55:53,200
other missions so also arizona state is

1303
00:55:58,390 --> 00:55:55,760
a really a critical partner for nasa in

1304
00:56:00,870 --> 00:55:58,400
it in this and uh and also other

1305
00:56:02,150 --> 00:56:00,880
disciplines

1306
00:56:04,950 --> 00:56:02,160
thank you thank you very much for your

1307
00:56:04,960 --> 00:56:09,670
thank you operator next question

1308
00:56:14,390 --> 00:56:11,190
mark said

1309
00:56:16,309 --> 00:56:14,400
me magazine your line is open

1310
00:56:19,030 --> 00:56:16,319
hi thanks very much for taking my

1311
00:56:20,710 --> 00:56:19,040
question and congratulations to everyone

1312
00:56:23,109 --> 00:56:20,720
uh i just had a couple of questions on

1313
00:56:25,990 --> 00:56:23,119

the series of images that was released

1314
00:56:28,549 --> 00:56:26,000
and the really impressive rubble cloud

1315
00:56:30,309 --> 00:56:28,559
that this kicked up i just wondered if

1316
00:56:32,150 --> 00:56:30,319
you're able to green anything

1317
00:56:34,950 --> 00:56:32,160
scientifically about the surface

1318
00:56:37,030 --> 00:56:34,960
material from the dynamics of that cloud

1319
00:56:39,349 --> 00:56:37,040
and the locking particles that make it

1320
00:56:41,190 --> 00:56:39,359
up and then uh obviously you expect it

1321
00:56:42,950 --> 00:56:41,200
to make a mess but what kind of

1322
00:56:44,710 --> 00:56:42,960
safeguards or system checks are in place

1323
00:56:46,549 --> 00:56:44,720
to make sure that the craft wasn't

1324
00:56:48,390 --> 00:56:46,559
damaged by that

1325
00:56:51,510 --> 00:56:48,400
and then finally i was just curious what

1326
00:56:53,109 --> 00:56:51,520
is the time step between those images so

1327
00:56:54,549 --> 00:56:53,119
what's the effective frame rate of that

1328
00:56:55,990 --> 00:56:54,559
video

1329
00:56:57,430 --> 00:56:56,000
so i'll answer the imaging questions

1330
00:57:00,230 --> 00:56:57,440
i'll hand it over to sandy for the

1331
00:57:02,150 --> 00:57:00,240
safety assessment of the spacecraft uh

1332
00:57:05,589 --> 00:57:02,160
so right to your final question those

1333
00:57:07,190 --> 00:57:05,599
images are about 1.25 seconds apart

1334
00:57:09,109 --> 00:57:07,200
so the first version i showed which was

1335
00:57:11,190 --> 00:57:09,119
the larger image sequence was sped up by

1336
00:57:13,349 --> 00:57:11,200
uh by quite a bit relative that frame

1337
00:57:15,750 --> 00:57:13,359
rate

1338
00:57:19,190 --> 00:57:15,760

in terms of the debris cloud absolutely

1339
00:57:21,589 --> 00:57:19,200
uh it actually is kind of uh impressive

1340
00:57:23,510 --> 00:57:21,599
uh the the fragments that we see flying

1341
00:57:24,630 --> 00:57:23,520
around there's there's some pretty large

1342
00:57:26,069 --> 00:57:24,640
particles

1343
00:57:27,829 --> 00:57:26,079
one of the things the science team has

1344
00:57:30,069 --> 00:57:27,839
already started doing is tracking the

1345
00:57:32,390 --> 00:57:30,079
trajectories of the particles

1346
00:57:34,390 --> 00:57:32,400
as we see them mobilizing across the

1347
00:57:35,829 --> 00:57:34,400
images here they're going by pretty fast

1348
00:57:37,349 --> 00:57:35,839
right now but obviously we're slowing

1349
00:57:39,349 --> 00:57:37,359
those down

1350
00:57:41,750 --> 00:57:39,359
identifying individual particles there's

1351
00:57:43,430 --> 00:57:41,760
other images too that we collected with

1352
00:57:45,109 --> 00:57:43,440
a different camera called the navcam the

1353
00:57:46,549 --> 00:57:45,119
one that was used for the natural

1354
00:57:48,230 --> 00:57:46,559
feature tracking

1355
00:57:49,589 --> 00:57:48,240
i was getting a quick look at those

1356
00:57:51,829 --> 00:57:49,599
right before the media conference those

1357
00:57:53,750 --> 00:57:51,839
are fresh off the spacecraft so we're

1358
00:57:55,270 --> 00:57:53,760
still processing those and analyzing

1359
00:57:57,430 --> 00:57:55,280
those and those will be released a

1360
00:57:59,349 --> 00:57:57,440
little later on this week but those give

1361
00:58:01,510 --> 00:57:59,359
us a wider field of view as well so

1362
00:58:03,510 --> 00:58:01,520
we're kind of getting this great a point

1363
00:58:05,510 --> 00:58:03,520

of view of the sam cam contacting the

1364
00:58:07,349 --> 00:58:05,520
asteroid surface and all the particle

1365
00:58:09,270 --> 00:58:07,359
debris that we see and then we have the

1366
00:58:11,270 --> 00:58:09,280
nav cam 2 which is off pointed a little

1367
00:58:13,829 --> 00:58:11,280
bit in a wider field of view so it's

1368
00:58:15,750 --> 00:58:13,839
going to be a nice image pair

1369
00:58:17,670 --> 00:58:15,760
and i think the final thing to point out

1370
00:58:19,510 --> 00:58:17,680
is that the initial ejection of

1371
00:58:21,910 --> 00:58:19,520
particles actually comes from the tag

1372
00:58:24,069 --> 00:58:21,920
same gas as it was blown down through

1373
00:58:25,510 --> 00:58:24,079
that sample collector head

1374
00:58:27,349 --> 00:58:25,520
but you got to remember we were only in

1375
00:58:29,670 --> 00:58:27,359
contact with that asteroid for six

1376
00:58:31,750 --> 00:58:29,680
seconds after that point the back away

1377
00:58:34,069 --> 00:58:31,760
thrusters fired and those kicked up a

1378
00:58:36,470 --> 00:58:34,079
second set of cloud and debris

1379
00:58:38,870 --> 00:58:36,480
so we're still disentangling uh that

1380
00:58:40,870 --> 00:58:38,880
whole history what was liberated by tag

1381
00:58:43,670 --> 00:58:40,880
sam what was uh kicked up by the backway

1382
00:58:46,230 --> 00:58:43,680
thrusters and the navcam images are

1383
00:58:48,549 --> 00:58:46,240
pretty fresh right now on the ground so

1384
00:58:50,069 --> 00:58:48,559
we got a quick look at those uh they're

1385
00:58:51,589 --> 00:58:50,079
very impressive just to get everybody

1386
00:58:53,270 --> 00:58:51,599
excited uh but we're not ready to

1387
00:58:55,109 --> 00:58:53,280
release those because we haven't really

1388
00:58:56,390 --> 00:58:55,119

had a chance to process them ourselves

1389
00:58:58,470 --> 00:58:56,400
quite yet

1390
00:59:00,069 --> 00:58:58,480
uh i'll hand over to sandy about the

1391
00:59:01,990 --> 00:59:00,079
safety assessment

1392
00:59:03,990 --> 00:59:02,000
yeah so the spacecraft was designed for

1393
00:59:05,109 --> 00:59:04,000
this we knew when we made contact that

1394
00:59:07,430 --> 00:59:05,119
we were going to stir up a lot of

1395
00:59:09,670 --> 00:59:07,440
regolith there was a large back scatter

1396
00:59:11,109 --> 00:59:09,680
study done during development to make

1397
00:59:13,750 --> 00:59:11,119
sure that we would keep the spacecraft

1398
00:59:15,589 --> 00:59:13,760
safe now just by monitoring this

1399
00:59:17,670 --> 00:59:15,599
spacecraft over the last you know close

1400
00:59:19,589 --> 00:59:17,680
to 24 hours now we've been able to see a

1401
00:59:22,230 --> 00:59:19,599
number of components

1402
00:59:24,069 --> 00:59:22,240
and we're trending as our subsystems do

1403
00:59:25,750 --> 00:59:24,079
throughout making sure that things are

1404
00:59:27,589 --> 00:59:25,760
going as planned

1405
00:59:29,829 --> 00:59:27,599
and they're not seeing any any changes

1406
00:59:31,670 --> 00:59:29,839
in their measurements and now on next

1407
00:59:33,589 --> 00:59:31,680
week early next week i believe monday

1408
00:59:34,789 --> 00:59:33,599
we'll be doing a spacecraft checkout

1409
00:59:37,030 --> 00:59:34,799
where we'll get a chance to take some

1410
00:59:38,630 --> 00:59:37,040
star camera images on both of our

1411
00:59:40,230 --> 00:59:38,640
primary tracker and our redundant

1412
00:59:41,430 --> 00:59:40,240
tracker and we'll get to do some other

1413
00:59:43,349 --> 00:59:41,440

engineering

1414
00:59:45,030 --> 00:59:43,359
activities to better inform us if we've

1415
00:59:47,670 --> 00:59:45,040
had any sort of degradation on the

1416
00:59:53,990 --> 00:59:47,680
vehicle

1417
00:59:58,789 --> 00:59:56,549
lisa grossman of science new york is

1418
01:00:00,950 --> 00:59:58,799
open

1419
01:00:04,230 --> 01:00:00,960
hi thanks for taking my question um i

1420
01:00:05,829 --> 01:00:04,240
was wondering if you knew if any of the

1421
01:00:08,630 --> 01:00:05,839
regulars that got disturbed any of the

1422
01:00:11,349 --> 01:00:08,640
stuff that got uh tossed up into space

1423
01:00:14,150 --> 01:00:11,359
around the new would end up at earth and

1424
01:00:16,870 --> 01:00:14,160
if maybe you just created a new new year

1425
01:00:20,710 --> 01:00:19,030
hi lisa i'll answer that one uh you i

1426
01:00:22,390 --> 01:00:20,720
think you read my mind i certainly have

1427
01:00:24,549 --> 01:00:22,400
been thinking about that

1428
01:00:25,990 --> 01:00:24,559
uh we have thought about that as as i

1429
01:00:27,750 --> 01:00:26,000
mentioned yesterday and we've talked

1430
01:00:31,030 --> 01:00:27,760
about for quite a while on the mission

1431
01:00:33,030 --> 01:00:31,040
bennu is already kicking particles off

1432
01:00:35,750 --> 01:00:33,040
the surface and one of the things that

1433
01:00:37,829 --> 01:00:35,760
we are doing is monitoring for a meteor

1434
01:00:39,190 --> 01:00:37,839
shower which would have would occur in

1435
01:00:40,710 --> 01:00:39,200
the southern hemisphere in the third

1436
01:00:42,710 --> 01:00:40,720
week of september

1437
01:00:44,150 --> 01:00:42,720
which is when benny's orbit crosses that

1438
01:00:46,789 --> 01:00:44,160

of the earth's orbit

1439
01:00:48,390 --> 01:00:46,799
we actually had data just that we just

1440
01:00:50,470 --> 01:00:48,400
recently received from that meteor

1441
01:00:53,030 --> 01:00:50,480
campaign and we're still processing that

1442
01:00:55,589 --> 01:00:53,040
to see if there's maybe a small signal

1443
01:00:56,789 --> 01:00:55,599
but maybe not of bennu natural venue

1444
01:00:57,589 --> 01:00:56,799
meteors

1445
01:00:59,750 --> 01:00:57,599
so

1446
01:01:01,270 --> 01:00:59,760
that idea is already in place that kind

1447
01:01:02,470 --> 01:01:01,280
of study is something that we're already

1448
01:01:04,390 --> 01:01:02,480
pursuing

1449
01:01:05,670 --> 01:01:04,400
so i'm going to go back to that team

1450
01:01:07,829 --> 01:01:05,680
that's responsible for that

1451
01:01:10,390 --> 01:01:07,839
investigation with your exact question i

1452
01:01:12,150 --> 01:01:10,400
haven't had a chance to ask him that i

1453
01:01:15,030 --> 01:01:12,160
didn't dare to hope that we would kick

1454
01:01:15,829 --> 01:01:15,040
up as much debris as we're seeing here

1455
01:01:17,910 --> 01:01:15,839
so

1456
01:01:19,750 --> 01:01:17,920
i'm not sure but it's definitely a

1457
01:01:21,750 --> 01:01:19,760
question i've asked myself and we've got

1458
01:01:23,430 --> 01:01:21,760
team members who are thinking about that

1459
01:01:25,589 --> 01:01:23,440
based on bennu's natural particle

1460
01:01:28,549 --> 01:01:25,599
ejection events so it is a natural line

1461
01:01:29,990 --> 01:01:28,559
of inquiry but we just need some time to

1462
01:01:32,069 --> 01:01:30,000
to push through this very exciting

1463
01:01:33,109 --> 01:01:32,079

operational phase of the program and

1464
01:01:35,430 --> 01:01:33,119
start to think about some of the

1465
01:01:37,670 --> 01:01:35,440
long-term science implications we do

1466
01:01:38,630 --> 01:01:37,680
have a phenomenal scientific data set

1467
01:01:40,870 --> 01:01:38,640
tag

1468
01:01:42,309 --> 01:01:40,880
was a great science experiment

1469
01:01:43,990 --> 01:01:42,319
uh and so there's going to be a lot of

1470
01:01:46,230 --> 01:01:44,000
work that comes out of it but but we

1471
01:01:48,390 --> 01:01:46,240
need time to get the data down to get it

1472
01:01:50,549 --> 01:01:48,400
calibrated processed and let's just

1473
01:01:52,309 --> 01:01:50,559
spend some time thinking about it

1474
01:01:53,829 --> 01:01:52,319
without all these critical operational

1475
01:01:57,190 --> 01:01:53,839
decisions in front of us like we have

1476
01:01:57,200 --> 01:02:01,990
okay next question operator

1477
01:02:07,829 --> 01:02:03,589
stephen clark

1478
01:02:10,150 --> 01:02:07,839
is right now your line is open

1479
01:02:13,029 --> 01:02:10,160
hi thanks for taking another question um

1480
01:02:15,109 --> 01:02:13,039
dante the material that we see in the

1481
01:02:17,750 --> 01:02:15,119
imagery that was disturbed and kicked up

1482
01:02:19,029 --> 01:02:17,760
uh with the tag event any estimate yet

1483
01:02:21,430 --> 01:02:19,039
on how some how big some of those

1484
01:02:23,510 --> 01:02:21,440
particles might be um they look kind of

1485
01:02:24,549 --> 01:02:23,520
small but uh it's hard to tell from the

1486
01:02:27,829 --> 01:02:24,559
scale

1487
01:02:30,870 --> 01:02:27,839
and also uh if if you did collect the

1488
01:02:32,789 --> 01:02:30,880

the required sample of 60 plus grams

1489
01:02:34,710 --> 01:02:32,799
what is uh the flight plan for

1490
01:02:36,470 --> 01:02:34,720
osiris-rex over the next few months and

1491
01:02:40,150 --> 01:02:36,480
do you have a

1492
01:02:42,150 --> 01:02:40,160
date for departure for earth thanks

1493
01:02:44,069 --> 01:02:42,160
yeah great question stephen can we bring

1494
01:02:45,349 --> 01:02:44,079
up the the third set of images that i

1495
01:02:46,789 --> 01:02:45,359
was showing here where we were looking

1496
01:02:48,390 --> 01:02:46,799
at some of the debris and maybe slow it

1497
01:02:49,190 --> 01:02:48,400
down a little bit i know we talked about

1498
01:02:51,109 --> 01:02:49,200
that

1499
01:02:52,789 --> 01:02:51,119
so just remember for scale we're looking

1500
01:02:54,470 --> 01:02:52,799
at this tag sam head which is 30

1501
01:02:56,710 --> 01:02:54,480
centimeters in diameter this is the full

1502
01:02:58,950 --> 01:02:56,720
scale model here uh so you can get a

1503
01:03:00,789 --> 01:02:58,960
sense you know the the spacecraft's only

1504
01:03:02,950 --> 01:03:00,799
a little over two meters away or six

1505
01:03:05,109 --> 01:03:02,960
feet away so not much farther than than

1506
01:03:07,430 --> 01:03:05,119
my span here so you can actually kind of

1507
01:03:09,270 --> 01:03:07,440
estimate the particles uh you know so

1508
01:03:11,430 --> 01:03:09,280
we're looking at things you know that's

1509
01:03:13,349 --> 01:03:11,440
probably on the order of centimeters to

1510
01:03:14,950 --> 01:03:13,359
several centimeters and then we've got

1511
01:03:16,710 --> 01:03:14,960
this guy here

1512
01:03:19,349 --> 01:03:16,720
this is a pretty amazing looking

1513
01:03:21,109 --> 01:03:19,359

particle so if it was to scale with the

1514
01:03:23,190 --> 01:03:21,119
tag sam head it would be on the order of

1515
01:03:24,950 --> 01:03:23,200
15 centimeters it's probably a little

1516
01:03:26,230 --> 01:03:24,960
closer in our field of view so it's

1517
01:03:28,230 --> 01:03:26,240
going to be a little smaller than that

1518
01:03:29,670 --> 01:03:28,240
but this is the biggest one that i've

1519
01:03:31,270 --> 01:03:29,680
seen so far

1520
01:03:32,789 --> 01:03:31,280
in my assessment of the data of course

1521
01:03:34,870 --> 01:03:32,799
the team is going through with much more

1522
01:03:37,109 --> 01:03:34,880
careful analysis but i'm guessing this

1523
01:03:39,270 --> 01:03:37,119
is multiple centimeters maybe up to 10

1524
01:03:40,789 --> 01:03:39,280
centimeters across here and this guy

1525
01:03:42,150 --> 01:03:40,799
kind of comes shooting off from the

1526
01:03:43,430 --> 01:03:42,160
right side of the field of view and

1527
01:03:46,150 --> 01:03:43,440
moves over

1528
01:03:48,789 --> 01:03:46,160
off the off the image to the left so

1529
01:03:51,109 --> 01:03:48,799
there's certainly a lot of work to do to

1530
01:03:52,950 --> 01:03:51,119
really get a sense of how far away

1531
01:03:54,789 --> 01:03:52,960
what's the depth of field of view of the

1532
01:03:56,069 --> 01:03:54,799
image that we're seeing here and to do

1533
01:03:57,750 --> 01:03:56,079
some real

1534
01:03:59,589 --> 01:03:57,760
precise measurements of the sizes of

1535
01:04:01,430 --> 01:03:59,599
these particles but

1536
01:04:03,430 --> 01:04:01,440
this one alone shows me we picked up

1537
01:04:05,029 --> 01:04:03,440
some things that are pretty big uh but

1538
01:04:06,549 --> 01:04:05,039

for the most part we're looking at

1539
01:04:07,990 --> 01:04:06,559
centimeter sub-centimeter scale

1540
01:04:09,670 --> 01:04:08,000
particles just from a quick look

1541
01:04:11,750 --> 01:04:09,680
assessment but there's a lot more

1542
01:04:13,670 --> 01:04:11,760
detailed analysis to go this is all

1543
01:04:15,190 --> 01:04:13,680
preliminary and the image processing

1544
01:04:18,230 --> 01:04:15,200
team at the university of arizona is

1545
01:04:20,150 --> 01:04:18,240
busy as we speak uh answering that exact

1546
01:04:21,990 --> 01:04:20,160
question right now

1547
01:04:23,430 --> 01:04:22,000
and then i think over to rich for the

1548
01:04:26,309 --> 01:04:23,440
departure date

1549
01:04:28,950 --> 01:04:26,319
uh and uh and the return crews right so

1550
01:04:31,109 --> 01:04:28,960
if we stow the sample uh we'll be doing

1551
01:04:33,589 --> 01:04:31,119
so in the first week of november

1552
01:04:35,430 --> 01:04:33,599
uh and we'll be and uh we'll we'll

1553
01:04:37,349 --> 01:04:35,440
follow uh continue to drift away from

1554
01:04:39,670 --> 01:04:37,359
the asteroid after we make that maneuver

1555
01:04:43,190 --> 01:04:39,680
on friday uh rather than

1556
01:04:45,750 --> 01:04:43,200
attempting to re-insert into orbit

1557
01:04:47,670 --> 01:04:45,760
our departure window opens in march

1558
01:04:50,309 --> 01:04:47,680
that's when the orbital mechanics say

1559
01:04:52,630 --> 01:04:50,319
it's uh efficiently it's fuel efficient

1560
01:04:55,349 --> 01:04:52,640
to get back to to earth and our

1561
01:04:57,910 --> 01:04:55,359
designated date in september of 2023

1562
01:05:01,349 --> 01:04:57,920
will depart the asteroid in early march

1563
01:05:17,430 --> 01:05:04,069

okay we have time for one final question

1564
01:05:17,440 --> 01:05:23,829
library do we have another question

1565
01:05:28,870 --> 01:05:27,109
i do apologize for that technical issue

1566
01:05:32,390 --> 01:05:28,880
michael gretchko with national

1567
01:05:33,829 --> 01:05:32,400
geographic your line is now open

1568
01:05:36,630 --> 01:05:33,839
all right thank you so much and

1569
01:05:39,510 --> 01:05:36,640
congratulations to the team um i had a

1570
01:05:41,990 --> 01:05:39,520
question about sort of the aftermath of

1571
01:05:43,589 --> 01:05:42,000
of this tag um what are the plans

1572
01:05:44,710 --> 01:05:43,599
defending to do any sort of remote

1573
01:05:48,549 --> 01:05:44,720
sensing

1574
01:05:50,789 --> 01:05:48,559
on nightingale site sort of see

1575
01:05:53,029 --> 01:05:50,799
the whole you've all left um and then

1576
01:05:55,029 --> 01:05:53,039
more generally for the theme itself

1577
01:05:56,549 --> 01:05:55,039
um i mean this moment has sort of

1578
01:05:58,789 --> 01:05:56,559
captured the world's

1579
01:06:00,390 --> 01:05:58,799
attention um anything at this time you

1580
01:06:02,309 --> 01:06:00,400
want to say to

1581
01:06:04,950 --> 01:06:02,319
you know people around the world who are

1582
01:06:06,549 --> 01:06:04,960
watching this and sort of taking this in

1583
01:06:07,990 --> 01:06:06,559
along with you

1584
01:06:09,829 --> 01:06:08,000
sure i'll answer that it's a tough

1585
01:06:11,430 --> 01:06:09,839
question michael because there there's

1586
01:06:14,470 --> 01:06:11,440
uh there was a lot of interest from the

1587
01:06:16,470 --> 01:06:14,480
science team on more data more

1588
01:06:18,710 --> 01:06:16,480

characterization of bennu after the

1589
01:06:20,230 --> 01:06:18,720
sampling attempt but uh you know we

1590
01:06:22,470 --> 01:06:20,240
gathered together as a management team

1591
01:06:23,910 --> 01:06:22,480
and we evaluated that exact question

1592
01:06:25,270 --> 01:06:23,920
very thoroughly

1593
01:06:28,390 --> 01:06:25,280
and uh

1594
01:06:30,829 --> 01:06:28,400
we agreed uh unanimously that this

1595
01:06:33,670 --> 01:06:30,839
mission is about safe return of this

1596
01:06:35,670 --> 01:06:33,680
sample and we do not want to do anything

1597
01:06:37,349 --> 01:06:35,680
to put that sample at risk so the plan

1598
01:06:39,109 --> 01:06:37,359
right now is we're going to go through

1599
01:06:41,029 --> 01:06:39,119
these verification activities on the

1600
01:06:43,029 --> 01:06:41,039
flight system we're going to check out

1601
01:06:45,109 --> 01:06:43,039
the state of the vehicle if everything

1602
01:06:46,950 --> 01:06:45,119
looks positive and we meet with thomas

1603
01:06:48,230 --> 01:06:46,960
on october 30th and make that decision

1604
01:06:49,829 --> 01:06:48,240
to stow

1605
01:06:53,190 --> 01:06:49,839
that is the end of the science campaign

1606
01:06:55,910 --> 01:06:53,200
at bennu we are then solely focused on

1607
01:06:58,150 --> 01:06:55,920
the return crews and quite honestly the

1608
01:07:00,549 --> 01:06:58,160
the real scientific payoff which this

1609
01:07:03,190 --> 01:07:00,559
mission is designed to to do is that

1610
01:07:04,549 --> 01:07:03,200
sample return and the sample science and

1611
01:07:06,630 --> 01:07:04,559
we'll be putting our focus and our

1612
01:07:09,109 --> 01:07:06,640
resources into that it wasn't an easy

1613
01:07:10,789 --> 01:07:09,119

decision i guarantee you

1614
01:07:12,789 --> 01:07:10,799
it was tough especially the scientist in

1615
01:07:15,270 --> 01:07:12,799
me always keeps asking those questions

1616
01:07:17,589 --> 01:07:15,280
but it's the right decision to maintain

1617
01:07:19,589 --> 01:07:17,599
that focus on the level one requirement

1618
01:07:21,910 --> 01:07:19,599
uh because i can tell you you know right

1619
01:07:23,109 --> 01:07:21,920
before we kicked off the tag activity i

1620
01:07:25,510 --> 01:07:23,119
went i went through all of our

1621
01:07:26,710 --> 01:07:25,520
publications and all of our data and i

1622
01:07:28,150 --> 01:07:26,720
mapped them to the level one

1623
01:07:30,549 --> 01:07:28,160
requirements of the mission which is

1624
01:07:32,710 --> 01:07:30,559
what i agreed to with thomas and lori

1625
01:07:35,270 --> 01:07:32,720
that this program would deliver and we

1626
01:07:37,349 --> 01:07:35,280
have met and in most cases vastly

1627
01:07:38,710 --> 01:07:37,359
exceeded all of the science requirements

1628
01:07:41,910 --> 01:07:38,720
associated with the remote sensing

1629
01:07:43,990 --> 01:07:41,920
campaign of bennu so all we have left to

1630
01:07:46,309 --> 01:07:44,000
do to deliver on our promise to the

1631
01:07:48,789 --> 01:07:46,319
agency is get that sample safely back to

1632
01:07:50,470 --> 01:07:48,799
the earth get it into our laboratories

1633
01:07:52,789 --> 01:07:50,480
and answer the fundamental questions

1634
01:07:55,750 --> 01:07:52,799
about the formation of our solar system

1635
01:07:58,309 --> 01:07:55,760
and why earth is a habitable world

1636
01:08:01,349 --> 01:07:58,319
and then uh you gave me a chance to to

1637
01:08:02,950 --> 01:08:01,359
uh to promote a message and and

1638
01:08:05,430 --> 01:08:02,960

i'll just say

1639
01:08:07,349 --> 01:08:05,440
osiris-rex in my opinion is the

1640
01:08:09,510 --> 01:08:07,359
culmination of

1641
01:08:11,190 --> 01:08:09,520
human activity as a species

1642
01:08:13,109 --> 01:08:11,200
we built this mission

1643
01:08:14,950 --> 01:08:13,119
for peaceful purposes

1644
01:08:17,430 --> 01:08:14,960
out of curiosity in our desire for

1645
01:08:20,149 --> 01:08:17,440
knowledge it's a team that comes from a

1646
01:08:21,990 --> 01:08:20,159
variety of backgrounds and viewpoints

1647
01:08:24,229 --> 01:08:22,000
but none of that matters because we work

1648
01:08:26,630 --> 01:08:24,239
together united in a common vision and a

1649
01:08:28,709 --> 01:08:26,640
common goal and when we do that we

1650
01:08:30,630 --> 01:08:28,719
achieve amazing things

1651
01:08:32,789 --> 01:08:30,640
and so i told the team

1652
01:08:35,030 --> 01:08:32,799
you know i know we focus so much on the

1653
01:08:38,390 --> 01:08:35,040
details and the technical implementation

1654
01:08:40,709 --> 01:08:38,400
of this program but we serve as a model

1655
01:08:42,229 --> 01:08:40,719
for what we can do as human beings uh

1656
01:08:43,749 --> 01:08:42,239
when we unite

1657
01:08:45,590 --> 01:08:43,759
in a common vision

1658
01:08:48,149 --> 01:08:45,600
when we're united we're strong and when

1659
01:08:51,510 --> 01:08:48,159
we're divided we're weak and so i hope

1660
01:08:53,189 --> 01:08:51,520
the message of unity and common purpose

1661
01:08:54,789 --> 01:08:53,199
and that we're all in this together

1662
01:08:57,030 --> 01:08:54,799
right we've got this precious planet

1663
01:08:59,910 --> 01:08:57,040

earth uh that we're the stewards of that

1664
01:09:00,950 --> 01:08:59,920
we're responsible for and when we come

1665
01:09:04,229 --> 01:09:00,960
together

1666
01:09:06,870 --> 01:09:04,239
and unite uh we achieve amazing things

1667
01:09:07,749 --> 01:09:06,880
could i follow on to that as well please

1668
01:09:09,990 --> 01:09:07,759
um

1669
01:09:12,070 --> 01:09:10,000
yeah i think one one additional thing to

1670
01:09:14,789 --> 01:09:12,080
add on to that you know beautifully put

1671
01:09:17,510 --> 01:09:14,799
uh uh words from dante

1672
01:09:19,349 --> 01:09:17,520
uh you know we're hoping to serve for an

1673
01:09:20,709 --> 01:09:19,359
inspiration for future scientists and

1674
01:09:22,470 --> 01:09:20,719
engineers

1675
01:09:24,470 --> 01:09:22,480
this mission is

1676
01:09:25,349 --> 01:09:24,480
as much fun as you can have and get paid

1677
01:09:27,829 --> 01:09:25,359
to do

1678
01:09:29,510 --> 01:09:27,839
right so i had our

1679
01:09:30,789 --> 01:09:29,520
one of our instrument scientists was

1680
01:09:32,950 --> 01:09:30,799
examining

1681
01:09:35,189 --> 01:09:32,960
uh the images from our navigation

1682
01:09:36,149 --> 01:09:35,199
cameras as it came down this morning he

1683
01:09:40,390 --> 01:09:36,159
said

1684
01:09:42,870 --> 01:09:40,400
the image was this is so cool

1685
01:09:45,349 --> 01:09:42,880
right and it is he go and what he

1686
01:09:46,309 --> 01:09:45,359
finished his email with was i love this

1687
01:09:48,950 --> 01:09:46,319
job

1688
01:09:51,110 --> 01:09:48,960

so we're hoping that you know there's uh

1689
01:09:53,910 --> 01:09:51,120
five six ten-year-olds out there that

1690
01:09:55,669 --> 01:09:53,920
get inspired by this mission the amazing

1691
01:09:56,790 --> 01:09:55,679
achievements of this mission and it's

1692
01:09:58,790 --> 01:09:56,800
the people

1693
01:10:00,550 --> 01:09:58,800
the engineers and the scientists on this

1694
01:10:02,870 --> 01:10:00,560
mission that made it happen

1695
01:10:04,630 --> 01:10:02,880
so we need our future generations

1696
01:10:06,229 --> 01:10:04,640
uh to be inspired by this and that's

1697
01:10:08,149 --> 01:10:06,239
what we're hoping to do i think the

1698
01:10:09,750 --> 01:10:08,159
other thing is dante mentioned the

1699
01:10:11,669 --> 01:10:09,760
sample allocation

1700
01:10:13,510 --> 01:10:11,679
a large fraction of the sample is going

1701
01:10:15,669 --> 01:10:13,520
to be reserved for study of future

1702
01:10:18,310 --> 01:10:15,679
generations so we're hoping that future

1703
01:10:21,110 --> 01:10:18,320
sample scientists are inspired by this

1704
01:10:23,110 --> 01:10:21,120
and you know kids kids at home today

1705
01:10:26,070 --> 01:10:23,120
could be the ones studying this sample

1706
01:10:28,070 --> 01:10:26,080
in 10 or 20 or 30 years and make new

1707
01:10:30,790 --> 01:10:28,080
discoveries that aren't even possible

1708
01:10:31,990 --> 01:10:30,800
with today's technology so

1709
01:10:34,470 --> 01:10:32,000
thank you

1710
01:10:36,310 --> 01:10:34,480
well that was a great way to wrap the

1711
01:10:38,709 --> 01:10:36,320
show up and as your engineer said the

1712
01:10:41,270 --> 01:10:38,719
images they are cool

1713
01:10:43,270 --> 01:10:41,280

so before we close we'd just like to

1714
01:10:45,430 --> 01:10:43,280
invite everyone to tune into the nasa

1715
01:10:47,510 --> 01:10:45,440
science live that's going to follow this

1716
01:10:50,390 --> 01:10:47,520
press briefing at 6 15

1717
01:10:52,950 --> 01:10:50,400
so go on over to nasa.gov

1718
01:10:54,870 --> 01:10:52,960
osiris-rex you'll see a presentation

1719
01:10:56,229 --> 01:10:54,880
from various osiris-rex scientists

1720
01:10:59,110 --> 01:10:56,239
they'll talk a little bit more about the

1721
01:11:00,229 --> 01:10:59,120
images and about the overall osiris-rex

1722
01:11:02,310 --> 01:11:00,239
mission

1723
01:11:03,350 --> 01:11:02,320
i just want to say congratulations to

1724
01:11:05,110 --> 01:11:03,360
the team

1725
01:11:44,470 --> 01:11:05,120
goal osiris-rex

1726
01:11:44,480 --> 01:11:48,120
so

1727
01:12:04,630 --> 01:12:03,030
[Music]

1728
01:12:06,470 --> 01:12:04,640
when we are called to do an experiment