1
00:00:16,910 --> 00:00:14,629
good morning and welcome to NASA Ames

2
00:00:19,670 --> 00:00:16,920
Research Center for the El cross-post

3
00:00:22,759 --> 00:00:19,680
impact news conference my name is Jonas

4
00:00:26,359 --> 00:00:22,769
Dino and public affairs officer for the

5
00:00:29,269 --> 00:00:26,369
El cross mission on our panel today we

6
00:00:32,269 --> 00:00:29,279
have Daniel Andrews el cross project

7
00:00:34,190 --> 00:00:32,279
manager anthony cola preet el cross

8
00:00:36,950 --> 00:00:34,200
principal investigator and project

9
00:00:39,020 --> 00:00:36,960
scientist Jennifer heldmann coordinator

10
00:00:42,080 --> 00:00:39,030
for the el cross observation campaign

11
00:00:44,750 --> 00:00:42,090
and Michael Wargo chief lunar scientists

12
00:00:48,200 --> 00:00:44,760
for exploration systems at NASA

13
00:00:49,880 --> 00:00:48,210

headquarters after each has spoken we

14
00:00:53,420 --> 00:00:49,890
will be taking questions from the news

15
00:00:56,360 --> 00:00:53,430
media before we begin we have a

16
00:01:04,299 --> 00:00:56,370
statement from the are aimed center

17
00:01:12,440 --> 00:01:08,050
good morning I guess my summary is

18
00:01:15,350 --> 00:01:12,450
really cool this is an exciting and a

19
00:01:18,020 --> 00:01:15,360
historic day for NASA and for scientists

20
00:01:20,330 --> 00:01:18,030
around the world today we kicked up some

21
00:01:22,640 --> 00:01:20,340
moon dust and all indications are it's

22
00:01:26,600 --> 00:01:22,650
going to be a very interesting set of

23
00:01:28,730 --> 00:01:26,610
results but maybe even more important

24
00:01:31,340 --> 00:01:28,740
than the results are some of the other

25
00:01:33,800 --> 00:01:31,350
things that have been shown here el

26
00:01:37,700 --> 00:01:33,810
cross showed that low cost small

27
00:01:40,429 --> 00:01:37,710
innovative satellite missions are able

28
00:01:42,980 --> 00:01:40,439
to not only excite the scientific

29
00:01:45,139 --> 00:01:42,990
community and the public but also to

30
00:01:47,660 --> 00:01:45,149
gather some really neat science in

31
00:01:51,230 --> 00:01:47,670
addition this showed the value of

32
00:01:55,010 --> 00:01:51,240
teamwork and the teamwork went across

33
00:01:58,130 --> 00:01:55,020
NASA a number of NASA centers not just

34
00:02:00,830 --> 00:01:58,140
NASA Ames NASA Goddard answer Kennedy

35
00:02:03,109 --> 00:02:00,840
Space Center headquarters in folks

36
00:02:05,389 --> 00:02:03,119
remember of other centers universities

37
00:02:07,119 --> 00:02:05,399
particularly the groups that have been

38
00:02:10,639 --> 00:02:07,129

making ground-based observations

39
00:02:11,660 --> 00:02:10,649
corporate partnerships particularly our

40
00:02:14,240 --> 00:02:11,670
prime part

41
00:02:15,559 --> 00:02:14,250
Northrop Grumman and internationally

42
00:02:18,740 --> 00:02:15,569
we've got scientists around the world

43
00:02:21,530 --> 00:02:18,750
working on this so this is truly a

44
00:02:24,949 --> 00:02:21,540
historic day for NASA it expands and

45
00:02:27,170 --> 00:02:24,959
continues our exploration and eventual

46
00:02:29,059 --> 00:02:27,180
expansion into the solar system so

47
00:02:30,710 --> 00:02:29,069
without further ado I'd like to turn it

48
00:02:32,630 --> 00:02:30,720
over to those that made it happen and by

49
00:02:40,400 --> 00:02:32,640
the way on behalf of NASA thank you

50
00:02:42,140 --> 00:02:40,410
thank you sir and I know everyone wants

51
00:02:44,540 --> 00:02:42,150
to hear from the team so with that I

52
00:02:47,479 --> 00:02:44,550
will hand it off today Thank You Jonas

53
00:02:49,990 --> 00:02:47,489
well good morning I think it's morning

54
00:02:52,850 --> 00:02:50,000
the team has been working very hard

55
00:02:55,100 --> 00:02:52,860
especially with this last push pretty

56
00:02:58,940 --> 00:02:55,110
continuously one of the one of the

57
00:03:02,870 --> 00:02:58,950
benefits of such a small team multiple

58
00:03:06,080 --> 00:03:02,880
hats for long hours the L cross mission

59
00:03:08,840 --> 00:03:06,090
has been just a great experience I'm

60
00:03:10,900 --> 00:03:08,850
very proud of this team who's partially

61
00:03:13,460 --> 00:03:10,910
represented up here but there's a whole

62
00:03:17,479 --> 00:03:13,470
much larger group of people who have

63
00:03:20,300 --> 00:03:17,489

done amazing work and given incredibly

64
00:03:24,890 --> 00:03:20,310
frankly personally and professionally to

65
00:03:27,099 --> 00:03:24,900
see this great mission through the I'm

66
00:03:29,360 --> 00:03:27,109
happy to report that the spacecraft

67
00:03:31,490 --> 00:03:29,370
performed beautifully throughout the

68
00:03:34,610 --> 00:03:31,500
mission the operations team drove it

69
00:03:38,930 --> 00:03:34,620
well and you here today to hear about

70
00:03:40,640 --> 00:03:38,940
some of our initial results I caution

71
00:03:42,860 --> 00:03:40,650
people that we've been saying for some

72
00:03:45,199 --> 00:03:42,870
time now it takes a while to comb

73
00:03:50,380 --> 00:03:45,209
through the data and make sure that we

74
00:03:52,220 --> 00:03:50,390
are reporting accurate and correct data

75
00:03:55,180 --> 00:03:52,230
but we did want to give you a little

76
00:03:58,039 --> 00:03:55,190
field before the the morning was out on

77
00:03:59,240 --> 00:03:58,049
how things went some of the stuff that

78
00:04:01,849 --> 00:03:59,250
we saw and you're going to see some

79
00:04:05,240 --> 00:04:01,859
interesting imagery and data from the

80
00:04:09,020 --> 00:04:05,250
team today and so with that I'll turn it

81
00:04:10,220 --> 00:04:09,030
over to Tony thank you Dan and yes the

82
00:04:12,140 --> 00:04:10,230
first thing that I've learned is how

83
00:04:15,289 --> 00:04:12,150
much fun it is to get ready for a press

84
00:04:19,090 --> 00:04:15,299
conference in and two hours after being

85
00:04:21,840 --> 00:04:19,100
up for 36 hours watching this this ride

86
00:04:26,890 --> 00:04:21,850
listen learn make that one down um

87
00:04:29,730 --> 00:04:26,900
thanks but yeah it was everything really

88
00:04:32,910 --> 00:04:29,740

worked out well the spacecraft clue

89
00:04:34,960 --> 00:04:32,920
perfectly the instruments performed

90
00:04:38,050 --> 00:04:34,970
honestly better than expected in some

91
00:04:39,430 --> 00:04:38,060
cases we got interesting results and I'm

92
00:04:41,500 --> 00:04:39,440
going to talk to you a little bit about

93
00:04:44,230 --> 00:04:41,510
those initially but again they're just

94
00:04:45,940 --> 00:04:44,240
initial results it took us most of time

95
00:04:48,400 --> 00:04:45,950
just to get the data get it calibrated

96
00:04:50,620 --> 00:04:48,410
off one thumb drive on to another

97
00:04:51,580 --> 00:04:50,630
computer and start processing it so what

98
00:04:54,100 --> 00:04:51,590
you're really going to see is just a

99
00:04:55,570 --> 00:04:54,110
first glimpse and as we get the teams

100
00:04:58,900 --> 00:04:55,580
together and get all the other

101
00:05:02,050 --> 00:04:58,910
observations in you know you'll hear

102
00:05:04,390 --> 00:05:02,060
more and more as the days go on but I

103
00:05:06,720 --> 00:05:04,400
can certainly report there was an impact

104
00:05:09,280 --> 00:05:06,730
we saw the impact we saw the crater and

105
00:05:11,910 --> 00:05:09,290
we got good measurement spectroscopic

106
00:05:15,550 --> 00:05:11,920
measurements which is what we needed of

107
00:05:17,350 --> 00:05:15,560
the the impact event so we have the data

108
00:05:19,090 --> 00:05:17,360
we need to actually address the

109
00:05:20,590 --> 00:05:19,100
questions we sent out to address and

110
00:05:22,060 --> 00:05:20,600
that's the fundamental bottom line

111
00:05:23,590 --> 00:05:22,070
that's what I out point you to take away

112
00:05:25,990 --> 00:05:23,600
today is I'm not going to say anything

113
00:05:27,640 --> 00:05:26,000

about water or no water but we got the

114
00:05:30,880 --> 00:05:27,650
measurements we need to address the

115
00:05:34,060 --> 00:05:30,890
questions so rather me talk more we can

116
00:05:35,530 --> 00:05:34,070
go to some of the images first up so if

117
00:05:38,190 --> 00:05:35,540
we go to the first power point

118
00:05:40,330 --> 00:05:38,200
presentation that I have in here

119
00:05:42,490 --> 00:05:40,340
actually there's a movie if we can play

120
00:05:43,660 --> 00:05:42,500
that movie fir SE VI now we'll start

121
00:05:46,300 --> 00:05:43,670
here and then we'll do the movie this is

122
00:05:47,770 --> 00:05:46,310
fine so we have a variety of cameras as

123
00:05:50,100 --> 00:05:47,780
you all know the visible camera really

124
00:05:52,900 --> 00:05:50,110
is this context camera and it was really

125
00:05:55,300 --> 00:05:52,910
fantastic to actually see this visible

126
00:05:57,130 --> 00:05:55,310
camera in our target site and compare it

127
00:05:59,410 --> 00:05:57,140
to our target charts and go yep that's

128
00:06:01,140 --> 00:05:59,420
where we're going perfect what you see

129
00:06:05,380 --> 00:06:01,150
in the center here is the cabayos crater

130
00:06:08,410 --> 00:06:05,390
at that we're headed out toward the next

131
00:06:11,190 --> 00:06:08,420
camera image is our near infrared camera

132
00:06:13,750 --> 00:06:11,200
and this is a camera that was used for

133
00:06:17,230 --> 00:06:13,760
flash detection and crater detection

134
00:06:20,350 --> 00:06:17,240
ultimately as as well as looking for

135
00:06:22,360 --> 00:06:20,360
ejecta and then the next slide shows our

136
00:06:23,980 --> 00:06:22,370
thermal camera and these thermal

137
00:06:26,350 --> 00:06:23,990
comments have always been kind of a a

138
00:06:28,239 --> 00:06:26,360

sweetheart of minded performed very well

139
00:06:30,489 --> 00:06:28,249
along with the near infrared cameras

140
00:06:33,249 --> 00:06:30,499
and so it measures temperature this is a

141
00:06:37,299 --> 00:06:33,259
grayscale but bright regions are hot

142
00:06:38,829 --> 00:06:37,309
cold regions dark regions are cold so

143
00:06:40,359 --> 00:06:38,839
these are I'm going to talk a little bit

144
00:06:42,699 --> 00:06:40,369
more about each of these three cameras

145
00:06:44,469 --> 00:06:42,709
and these are some views and about this

146
00:06:46,779 --> 00:06:44,479
the same altitude of the target site as

147
00:06:48,039 --> 00:06:46,789
we flew in we're probably about seven

148
00:06:50,699 --> 00:06:48,049
hundred or so kilometers above the

149
00:06:54,519 --> 00:06:50,709
surface at this point the next slide

150
00:06:59,379 --> 00:06:54,529
shows essentially our view from the

151
00:07:02,199 --> 00:06:59,389
inferred camera at impact and we're

152
00:07:05,139 --> 00:07:02,209
impacting to the end of the shadowed

153
00:07:08,109 --> 00:07:05,149
region to the to the left there also

154
00:07:09,969 --> 00:07:08,119
good news is that the shadows rep that

155
00:07:12,069 --> 00:07:09,979
we can really only just have modeled up

156
00:07:14,139 --> 00:07:12,079
to this point really look like the model

157
00:07:16,629 --> 00:07:14,149
so the topography that seems very

158
00:07:20,399 --> 00:07:16,639
accurate that we've gotten from the

159
00:07:23,559 --> 00:07:20,409
previous missions next slide shows the

160
00:07:24,999 --> 00:07:23,569
mid-infrared flash detection and it's

161
00:07:28,419 --> 00:07:25,009
kind of hard to see in this presentation

162
00:07:32,019 --> 00:07:28,429
apologize the the top I've got three in

163
00:07:34,299 --> 00:07:32,029

sets here the the larger picture shows

164
00:07:35,799 --> 00:07:34,309
the crater and then the lower left shows

165
00:07:38,259 --> 00:07:35,809
a zoom in and you see that little white

166
00:07:40,839 --> 00:07:38,269
speck there that is the impact flash

167
00:07:42,429 --> 00:07:40,849
from 600 kilometers away seen thermally

168
00:07:44,379 --> 00:07:42,439
so what we're seeing there is the

169
00:07:46,029 --> 00:07:44,389
temperature of that impact flash so we

170
00:07:48,729 --> 00:07:46,039
can actually go back and measure how hot

171
00:07:50,649 --> 00:07:48,739
it got and watch its evolution you see

172
00:07:53,079 --> 00:07:50,659
the flash over a few frames and the

173
00:07:55,179 --> 00:07:53,089
lower right is a zoom in there you see

174
00:07:57,459 --> 00:07:55,189
that the flash is actually several

175
00:08:01,209 --> 00:07:57,469
pixels across interesting don't know

176
00:08:03,100 --> 00:08:01,219
what that means could just be a smear

177
00:08:05,169 --> 00:08:03,110
it's a 30 frame per second camera we

178
00:08:07,089 --> 00:08:05,179
have to look interesting though so what

179
00:08:10,029 --> 00:08:07,099
was great as we've got nice definitive

180
00:08:14,259 --> 00:08:10,039
detection of the flash and we can follow

181
00:08:17,079 --> 00:08:14,269
up with that next presentation shows

182
00:08:19,329 --> 00:08:17,089
some spectrometer data so one of the

183
00:08:20,649 --> 00:08:19,339
things we did actually you know that

184
00:08:24,089 --> 00:08:20,659
you've probably heard me discuss is

185
00:08:26,589 --> 00:08:24,099
arranged the observations of this event

186
00:08:28,600 --> 00:08:26,599
around the event itself so there's

187
00:08:32,170 --> 00:08:28,610
impact flash so that's what you saw was

188
00:08:33,490 --> 00:08:32,180

impact flash we get the instruments in

189
00:08:36,100 --> 00:08:33,500
certain settings for that particular

190
00:08:38,169 --> 00:08:36,110
moment then there's a curtain evolution

191
00:08:41,409 --> 00:08:38,179
where ejecta comes up into sunlight

192
00:08:42,140 --> 00:08:41,419
volatiles come up vapors come up and we

193
00:08:43,370 --> 00:08:42,150
set the

194
00:08:45,410 --> 00:08:43,380
as for different exposures and

195
00:08:47,390 --> 00:08:45,420
integrations for that and then there's

196
00:08:50,030 --> 00:08:47,400
the Creator period when we are flying

197
00:08:51,860 --> 00:08:50,040
through the debris and vapor cloud

198
00:08:53,690 --> 00:08:51,870
whatever is left and we actually then

199
00:08:55,700 --> 00:08:53,700
try to image the Creator we made and

200
00:08:58,820 --> 00:08:55,710
learn about the vapor cloud we were

201
00:09:01,220 --> 00:08:58,830
flying through this was as it turns out

202
00:09:04,720 --> 00:09:01,230
a very smart thing to do because what it

203
00:09:07,640 --> 00:09:04,730
made us impacting into the moon is a

204
00:09:09,710 --> 00:09:07,650
unpredictable business at best but what

205
00:09:11,510 --> 00:09:09,720
we did was we actually are able to

206
00:09:13,040 --> 00:09:11,520
garner different information from each

207
00:09:15,830 --> 00:09:13,050
of those periods in our data set and

208
00:09:17,630 --> 00:09:15,840
that's what I'm excited about is each of

209
00:09:19,790 --> 00:09:17,640
those periods flash we you saw the

210
00:09:23,330 --> 00:09:19,800
thermal flash we actually as you'll see

211
00:09:25,820 --> 00:09:23,340
in a second have very good ultraviolet

212
00:09:28,490 --> 00:09:25,830
visible spectroscopy of the flash that's

213
00:09:29,870 --> 00:09:28,500

really exciting that was totally

214
00:09:31,910 --> 00:09:29,880
independent of everything else so that

215
00:09:33,770 --> 00:09:31,920
by itself may constitute enough to

216
00:09:35,600 --> 00:09:33,780
answer some fundamental questions and

217
00:09:37,580 --> 00:09:35,610
then we had the ejecta curtain we

218
00:09:39,770 --> 00:09:37,590
watched how that evolved in and looked

219
00:09:41,450 --> 00:09:39,780
for that and then the crater itself and

220
00:09:43,070 --> 00:09:41,460
so we as you'll see in a minute we

221
00:09:45,020 --> 00:09:43,080
actually saw a crater we measured its

222
00:09:47,110 --> 00:09:45,030
temperature and we're going to look at

223
00:09:50,210 --> 00:09:47,120
that even more closely coming forward

224
00:09:53,840 --> 00:09:50,220
going forward what you see here is back

225
00:09:57,530 --> 00:09:53,850
one back to human forward one they're

226
00:09:58,760 --> 00:09:57,540
good this is a visible spectrometer data

227
00:10:02,990 --> 00:09:58,770
so we have an ultraviolet visible

228
00:10:04,370 --> 00:10:03,000
spectrometer and it measures from the

229
00:10:06,920 --> 00:10:04,380
near El to violate all the way through

230
00:10:08,900 --> 00:10:06,930
red wavelengths and what you're shown

231
00:10:11,090 --> 00:10:08,910
here is a roll-up of all the energy in

232
00:10:12,410 --> 00:10:11,100
that spectrometer the total radiance so

233
00:10:14,300 --> 00:10:12,420
you're not seeing spectra here you just

234
00:10:16,520 --> 00:10:14,310
seen the toll signal and what you see

235
00:10:18,410 --> 00:10:16,530
here is that the strength of that signal

236
00:10:21,500 --> 00:10:18,420
as a function of time along the bottom

237
00:10:22,910 --> 00:10:21,510
so as we're flying in our field of view

238
00:10:24,620 --> 00:10:22,920

of that instrument what we're seeing is

239
00:10:26,180 --> 00:10:24,630
getting smaller and smaller and smaller

240
00:10:28,010 --> 00:10:26,190
and looking deeper and deeper into the

241
00:10:30,890 --> 00:10:28,020
shadow and that's exactly what you

242
00:10:33,650 --> 00:10:30,900
wanted to do and all the way to the end

243
00:10:35,030 --> 00:10:33,660
where you see that fall off way out

244
00:10:36,830 --> 00:10:35,040
towards in that's actually when the

245
00:10:41,230 --> 00:10:36,840
field of view of our spectrometer dips

246
00:10:44,420 --> 00:10:41,240
into total blackness and so on the far

247
00:10:46,400 --> 00:10:44,430
right of that image you see the little

248
00:10:48,170 --> 00:10:46,410
cliff and then you see a little blip

249
00:10:50,030 --> 00:10:48,180
right there and you'll talk more about

250
00:10:51,830 --> 00:10:50,040
that in a minute and then you see a

251
00:10:54,080 --> 00:10:51,840
larger bump the larger bump we believe

252
00:10:54,790 --> 00:10:54,090
is probably a processing artifact right

253
00:10:56,290 --> 00:10:54,800
now

254
00:10:59,050 --> 00:10:56,300
that we have to take out but the little

255
00:11:00,790 --> 00:10:59,060
blips very important that is actually

256
00:11:02,470 --> 00:11:00,800
the flash of the impact that the visible

257
00:11:04,150 --> 00:11:02,480
spectrometer picked up we're very

258
00:11:07,199 --> 00:11:04,160
excited about that because that's where

259
00:11:09,759 --> 00:11:07,209
you get thermalization of any vapors it

260
00:11:12,210 --> 00:11:09,769
hopefully will contain no H in it if

261
00:11:14,920 --> 00:11:12,220
there's water there we'll have to see

262
00:11:17,410 --> 00:11:14,930
next slide shows the near-infrared

263
00:11:21,329 --> 00:11:17,420

spectrometer so a similar pattern

264
00:11:23,590 --> 00:11:21,339
there's near-infrared spectrometer jose

265
00:11:24,880 --> 00:11:23,600
again a field of view that is getting

266
00:11:27,460 --> 00:11:24,890
smaller and smaller it's the same size

267
00:11:30,220 --> 00:11:27,470
and so it gets fainter and fainter as we

268
00:11:32,160 --> 00:11:30,230
dip into shadows that you see that

269
00:11:34,930 --> 00:11:32,170
little arrow and it's indicating it'll

270
00:11:36,190 --> 00:11:34,940
block that's missing the instrument

271
00:11:37,660 --> 00:11:36,200
actually goes into as I mentioned a

272
00:11:39,370 --> 00:11:37,670
different mode for flash and we're just

273
00:11:42,030 --> 00:11:39,380
not showing it here it actually measures

274
00:11:44,319 --> 00:11:42,040
the flash energy very quickly so we

275
00:11:46,630 --> 00:11:44,329
tempted to measure it there and then it

276
00:11:50,199 --> 00:11:46,640
comes out of that flash and looks at the

277
00:11:52,150 --> 00:11:50,209
ejecta curtain and the next slide I

278
00:11:55,990 --> 00:11:52,160
think shows these two kind of overlapped

279
00:11:57,880 --> 00:11:56,000
with each other so what you see is the

280
00:12:01,150 --> 00:11:57,890
black curve again is this an ultra light

281
00:12:04,780 --> 00:12:01,160
visible spectrometer and you see the the

282
00:12:07,120 --> 00:12:04,790
lope the first short blip is is the

283
00:12:09,220 --> 00:12:07,130
flash and its extensive and it doesn't

284
00:12:11,260 --> 00:12:09,230
go all the way down to zero hmm very

285
00:12:13,090 --> 00:12:11,270
interesting I'll just say that much

286
00:12:16,810 --> 00:12:13,100
about it it doesn't go to total

287
00:12:18,340 --> 00:12:16,820
blackness and like it did before and the

288
00:12:19,720 --> 00:12:18,350

near and Fred spectrometer has a trail

289
00:12:22,240 --> 00:12:19,730
off that's a little bit more shallow

290
00:12:25,060 --> 00:12:22,250
than expected so we're going to look at

291
00:12:27,870 --> 00:12:25,070
this but we're really excited that the

292
00:12:29,980 --> 00:12:27,880
spectrometers look to have captured the

293
00:12:31,870 --> 00:12:29,990
certainly the flash and possibly the

294
00:12:33,720 --> 00:12:31,880
ejecta cloud and given us assume that we

295
00:12:35,920 --> 00:12:33,730
need to answer the questions were after

296
00:12:38,199 --> 00:12:35,930
and then you can see at the end of that

297
00:12:40,389 --> 00:12:38,209
we go deeper and deeper into darkness

298
00:12:43,480 --> 00:12:40,399
and that's actually not next slides good

299
00:12:44,920 --> 00:12:43,490
because that's that's what we then start

300
00:12:46,689 --> 00:12:44,930
looking for the crater and this is

301
00:12:49,510 --> 00:12:46,699
really fun for me I was watching us go

302
00:12:51,100 --> 00:12:49,520
in and i gotta say i didn't i was blown

303
00:12:53,949 --> 00:12:51,110
away by how long this little spacecraft

304
00:12:55,389 --> 00:12:53,959
lasted i'm going to be it's going to be

305
00:12:57,670 --> 00:12:55,399
fun to see how close we were to the

306
00:13:01,900 --> 00:12:57,680
surface when it finally we lost contact

307
00:13:03,519 --> 00:13:01,910
with the poor poor guy but we saw it's

308
00:13:05,319 --> 00:13:03,529
hard to see again in these pictures so I

309
00:13:06,610 --> 00:13:05,329
blown it up that little those are two

310
00:13:09,670 --> 00:13:06,620
images

311
00:13:11,260 --> 00:13:09,680
like a third of a second apart from each

312
00:13:13,180 --> 00:13:11,270
other in top left net arrows pointing to

313
00:13:15,940 --> 00:13:13,190

a little blip maybe just a pixel or so

314
00:13:17,470 --> 00:13:15,950
but in the sock we've looked up and we

315
00:13:20,470 --> 00:13:17,480
saw that little blip appear and then

316
00:13:21,700 --> 00:13:20,480
also go skirting across the scene as we

317
00:13:23,920 --> 00:13:21,710
were coming in and trying to keep

318
00:13:25,480 --> 00:13:23,930
pointing at it that was a crater we made

319
00:13:27,880 --> 00:13:25,490
with the Centaur and that's what's blown

320
00:13:29,380 --> 00:13:27,890
up there it's at least a pixel across

321
00:13:31,810 --> 00:13:29,390
towards n it's a little bit more than a

322
00:13:34,120 --> 00:13:31,820
pixel and what's great about that as it

323
00:13:35,770 --> 00:13:34,130
confirms the actual size of the crater

324
00:13:37,390 --> 00:13:35,780
we were predicting I think it's pretty

325
00:13:39,520 --> 00:13:37,400
close to the crater besides we were

326
00:13:42,610 --> 00:13:39,530
thinking we have to go back and look but

327
00:13:44,380 --> 00:13:42,620
what's great is I was maybe not

328
00:13:46,840 --> 00:13:44,390
particularly optimistic we would see

329
00:13:48,640 --> 00:13:46,850
this crater like this but we actually

330
00:13:50,260 --> 00:13:48,650
got pretty good signal-to-noise and can

331
00:13:51,850 --> 00:13:50,270
actually go back and try to measure the

332
00:13:53,380 --> 00:13:51,860
temperature of this crater that's going

333
00:13:56,410 --> 00:13:53,390
to tell us something about the materials

334
00:13:58,390 --> 00:13:56,420
in there and what's great is diviner the

335
00:14:00,490 --> 00:13:58,400
instrument on LRO is making similar

336
00:14:03,550 --> 00:14:00,500
measurements with much bigger field of

337
00:14:05,830 --> 00:14:03,560
view and we can really corroborate those

338
00:14:07,780 --> 00:14:05,840

measurements and learn something more so

339
00:14:10,630 --> 00:14:07,790
that's a quick look at some of the

340
00:14:12,820 --> 00:14:10,640
camera data spectrometer data we weren't

341
00:14:13,870 --> 00:14:12,830
the only ones looking and so with that

342
00:14:17,020 --> 00:14:13,880
I'm going to actually turn it over to

343
00:14:18,700 --> 00:14:17,030
Jenn who's going to describe the broader

344
00:14:20,710 --> 00:14:18,710
observational campaign outside of

345
00:14:23,020 --> 00:14:20,720
they'll cross spacecraft great thanks

346
00:14:24,820 --> 00:14:23,030
Tony so while we pull up the slides here

347
00:14:26,680 --> 00:14:24,830
I'm I just want to echo piqued comments

348
00:14:28,720 --> 00:14:26,690
that this was so cool this is the

349
00:14:30,070 --> 00:14:28,730
greatest thing because uh this is what

350
00:14:31,810 --> 00:14:30,080
NASA does well and it's a really great

351
00:14:34,150 --> 00:14:31,820
day to be working here for the space

352
00:14:36,190 --> 00:14:34,160
agency and through through the

353
00:14:37,420 --> 00:14:36,200
observation campaign this is where a lot

354
00:14:39,640 --> 00:14:37,430
of the collaboration and cooperation

355
00:14:41,230 --> 00:14:39,650
came in we had a great number of teams

356
00:14:43,060 --> 00:14:41,240
that were observing and I'll show you a

357
00:14:44,470 --> 00:14:43,070
list of those as well we collected a

358
00:14:46,330 --> 00:14:44,480
tremendous amount of data through the

359
00:14:48,190 --> 00:14:46,340
observation campaign I should have

360
00:14:49,840 --> 00:14:48,200
mentioned that the philosophy behind the

361
00:14:52,300 --> 00:14:49,850
observing campaign was one of

362
00:14:53,680 --> 00:14:52,310
cooperation and collaboration so we

363
00:14:55,630 --> 00:14:53,690

brought this team together under the

364
00:14:57,370 --> 00:14:55,640
umbrella of observing el cross and so

365
00:14:58,720 --> 00:14:57,380
everyone's been working together we're

366
00:15:00,760 --> 00:14:58,730
looking at each other's data sharing

367
00:15:02,740 --> 00:15:00,770
data collaborating with the spacecraft

368
00:15:04,570 --> 00:15:02,750
and all the other space orbiting assets

369
00:15:05,620 --> 00:15:04,580
that have collected data as well because

370
00:15:07,660 --> 00:15:05,630
that's how we're going to learn the most

371
00:15:10,000 --> 00:15:07,670
from this from this unique experiment

372
00:15:11,500 --> 00:15:10,010
that we just did today so I want to give

373
00:15:14,560 --> 00:15:11,510
you just a flavor of some of the types

374
00:15:16,270 --> 00:15:14,570
of data that we collected we have images

375
00:15:18,490 --> 00:15:16,280
we have video we have graphs of squiggly

376
00:15:19,900 --> 00:15:18,500
lines that scientists love so we have a

377
00:15:21,220 --> 00:15:19,910
little bit of something forever

378
00:15:23,590 --> 00:15:21,230
one and I can only show you a snapshot

379
00:15:25,720 --> 00:15:23,600
here given time restrictions but there

380
00:15:26,890 --> 00:15:25,730
is a lot more that's available and a lot

381
00:15:28,870 --> 00:15:26,900
of this will be posted on the NASA

382
00:15:31,030 --> 00:15:28,880
website as well so you'll be able to go

383
00:15:32,410 --> 00:15:31,040
there just as a reminder of who is able

384
00:15:33,670 --> 00:15:32,420
to observe so we have ground-based

385
00:15:35,620 --> 00:15:33,680
observations and we also have

386
00:15:37,750 --> 00:15:35,630
space-based observations for the

387
00:15:39,550 --> 00:15:37,760
ground-based observations where the moon

388
00:15:40,750 --> 00:15:39,560

was up and where it was dark which is

389
00:15:43,900 --> 00:15:40,760
what you need for these types of

390
00:15:45,460 --> 00:15:43,910
measurements was from west of the

391
00:15:47,080 --> 00:15:45,470
Mississippi all the way out through say

392
00:15:49,120 --> 00:15:47,090
Hawaii and so that's where our

393
00:15:50,140 --> 00:15:49,130
observatories have been clustered and so

394
00:15:51,910 --> 00:15:50,150
that's where you'll see a lot of these

395
00:15:55,030 --> 00:15:51,920
observations coming from the south

396
00:15:56,710 --> 00:15:55,040
southwest us and then out to Hawaii we

397
00:15:58,060 --> 00:15:56,720
also had several space-based assets that

398
00:16:00,430 --> 00:15:58,070
were observing I'll talk about those as

399
00:16:02,350 --> 00:16:00,440
well so to give you a sense of some of

400
00:16:04,030 --> 00:16:02,360
the types of data that we have as I

401
00:16:06,270 --> 00:16:04,040
mentioned that the observation campaign

402
00:16:09,310 --> 00:16:06,280
everyone worked together on this and

403
00:16:10,390 --> 00:16:09,320
clear skies all around we really lucked

404
00:16:12,880 --> 00:16:10,400
out with the weather that was fantastic

405
00:16:15,100 --> 00:16:12,890
so all the folks that were signed up to

406
00:16:18,040 --> 00:16:15,110
observe had clear skies collected data I

407
00:16:20,230 --> 00:16:18,050
had no instrument issues or anything so

408
00:16:22,330 --> 00:16:20,240
we had all everything was nominal for

409
00:16:23,890 --> 00:16:22,340
the observatories so what we've seen

410
00:16:25,660 --> 00:16:23,900
here up on one of the maps this is a

411
00:16:27,490 --> 00:16:25,670
lunar South Pole map I want to give you

412
00:16:29,050 --> 00:16:27,500
a sense of where we actually went I want

413
00:16:31,270 --> 00:16:29,060

to get you familiar with this south

414
00:16:32,710 --> 00:16:31,280
polar region of the cabayos crater where

415
00:16:33,760 --> 00:16:32,720
we impacted so hopefully by the end of

416
00:16:35,350 --> 00:16:33,770
this you'll have a better appreciation

417
00:16:37,690 --> 00:16:35,360
for or we won't be able to pick it out

418
00:16:39,910 --> 00:16:37,700
yourself so this is an image from New

419
00:16:41,020 --> 00:16:39,920
Mexico State University and Marshall

420
00:16:42,610 --> 00:16:41,030
Space Flight Center another one of the

421
00:16:44,380 --> 00:16:42,620
NASA centers that we worked with this is

422
00:16:46,240 --> 00:16:44,390
the lunar South Pole map so you can see

423
00:16:48,070 --> 00:16:46,250
at the bottom the target crater kebaya

424
00:16:49,330 --> 00:16:48,080
siz actually labeled this is an image

425
00:16:51,640 --> 00:16:49,340
mosaic and this is part of the

426
00:16:52,750 --> 00:16:51,650
cooperation that happened before tonight

427
00:16:54,400 --> 00:16:52,760
we've been working on this for quite

428
00:16:56,620 --> 00:16:54,410
some time doing rehearsals and doing

429
00:16:58,690 --> 00:16:56,630
test runs to make sure that the pointing

430
00:17:01,090 --> 00:16:58,700
accuracy is correct it's not trivial to

431
00:17:02,800 --> 00:17:01,100
point these large telescopes at a very

432
00:17:04,210 --> 00:17:02,810
specific region on the moon it's

433
00:17:06,100 --> 00:17:04,220
difficult to observe the moon from the

434
00:17:08,320 --> 00:17:06,110
ground the moon's very bright so

435
00:17:09,610 --> 00:17:08,330
typically astronomers don't really like

436
00:17:11,530 --> 00:17:09,620
looking at the moon they're used to

437
00:17:13,870 --> 00:17:11,540
looking at very faint objects galactic

438
00:17:15,490 --> 00:17:13,880

extra galactic objects the Moon moves a

439
00:17:17,260 --> 00:17:15,500
different rate than a lot of other

440
00:17:19,120 --> 00:17:17,270
things that the astronomers observe so

441
00:17:21,070 --> 00:17:19,130
it took a lot of planning to be able to

442
00:17:22,360 --> 00:17:21,080
make this work and the amount of data

443
00:17:23,890 --> 00:17:22,370
that we've gotten in already is a

444
00:17:26,050 --> 00:17:23,900
testament to the success that we've had

445
00:17:27,910 --> 00:17:26,060
based on all of that prep work that we

446
00:17:30,310 --> 00:17:27,920
did before so this is just an example of

447
00:17:32,230 --> 00:17:30,320
one of the impact or one of the mosaics

448
00:17:33,960 --> 00:17:32,240
that we had ahead of time to help with

449
00:17:37,560 --> 00:17:33,970
targeting

450
00:17:39,299 --> 00:17:37,570
to the next slide so here's a zoomed-in

451
00:17:41,250 --> 00:17:39,309
region of that so you're still looking

452
00:17:43,230 --> 00:17:41,260
at the South Pole you can see several of

453
00:17:45,029 --> 00:17:43,240
the nearby craters are labeled and then

454
00:17:47,279 --> 00:17:45,039
you also see the expected plumeria

455
00:17:48,870 --> 00:17:47,289
that's labeled there towards the bottom

456
00:17:50,970 --> 00:17:48,880
I want to call your attention to there's

457
00:17:52,620 --> 00:17:50,980
a very bright sort of ridge line that

458
00:17:54,570 --> 00:17:52,630
goes across and then behind that is a

459
00:17:57,360 --> 00:17:54,580
very dark region this is where where the

460
00:17:59,820 --> 00:17:57,370
plume is expected to have come up based

461
00:18:03,720 --> 00:17:59,830
on our impact location so this is very

462
00:18:06,000 --> 00:18:03,730
good if we go to the next slide give you

463
00:18:08,039 --> 00:18:06,010

another just another example of where

464
00:18:09,299 --> 00:18:08,049
where these telescopes were pointing and

465
00:18:11,279 --> 00:18:09,309
where they're expecting this plume to be

466
00:18:14,070 --> 00:18:11,289
based on our impact location this is

467
00:18:15,840 --> 00:18:14,080
actually a rendering that was created by

468
00:18:18,120 --> 00:18:15,850
our colleagues at NASA's Goddard Space

469
00:18:19,640 --> 00:18:18,130
Flight Center on this is using Lola data

470
00:18:21,960 --> 00:18:19,650
the lunar orbiter laser altimeter

471
00:18:23,100 --> 00:18:21,970
instrument that's aboard the LRO the

472
00:18:26,039 --> 00:18:23,110
Lunar Reconnaissance Orbiter spacecraft

473
00:18:29,039 --> 00:18:26,049
right now and so using this laser

474
00:18:30,510 --> 00:18:29,049
altimetry data our colleagues at Goddard

475
00:18:32,640 --> 00:18:30,520
were able to create renderings of the

476
00:18:34,320 --> 00:18:32,650
lunar surface for us so we had even

477
00:18:35,880 --> 00:18:34,330
better ideas of what to expect when we

478
00:18:38,460 --> 00:18:35,890
were going in and you can see a white

479
00:18:41,220 --> 00:18:38,470
line we call it the dipstick showing the

480
00:18:44,279 --> 00:18:41,230
location of where the impact predict was

481
00:18:47,880 --> 00:18:44,289
for the Centaur except to go to the next

482
00:18:49,890 --> 00:18:47,890
slide so here's another image from the

483
00:18:51,600 --> 00:18:49,900
Apache point observatory in New Mexico

484
00:18:53,070 --> 00:18:51,610
I'm showing you this about these types

485
00:18:55,830 --> 00:18:53,080
of images again because I want you to be

486
00:18:57,390 --> 00:18:55,840
able to pull out that brighter Ridgeline

487
00:18:59,070 --> 00:18:57,400
that's there and then the dark that's

488
00:19:00,899 --> 00:18:59,080

behind it and that's the cabayos region

489
00:19:02,220 --> 00:19:00,909
where we are impacting and we have

490
00:19:03,779 --> 00:19:02,230
images like these at different lighting

491
00:19:05,610 --> 00:19:03,789
conditions and different tilts of the

492
00:19:09,510 --> 00:19:05,620
moon on says we would know exactly where

493
00:19:11,430 --> 00:19:09,520
to be pointing or the next slide here's

494
00:19:13,350 --> 00:19:11,440
an image from Mount aquella and Hawaii

495
00:19:15,360 --> 00:19:13,360
this is from the Keck guider this is

496
00:19:16,830 --> 00:19:15,370
taken last night so we did a practice

497
00:19:18,419 --> 00:19:16,840
run last night as well so we knew

498
00:19:19,560 --> 00:19:18,429
exactly where would be I just want to

499
00:19:21,539 --> 00:19:19,570
point out one of the techniques it's

500
00:19:23,310 --> 00:19:21,549
used to collect these observations so

501
00:19:24,779 --> 00:19:23,320
you see several different creators are

502
00:19:27,930 --> 00:19:24,789
labeled there and different way points

503
00:19:28,919 --> 00:19:27,940
and so typically in astronomy if you're

504
00:19:30,360 --> 00:19:28,929
trying to find something in the sky you

505
00:19:31,919 --> 00:19:30,370
might do star hopping you know where the

506
00:19:33,299 --> 00:19:31,929
stars are they pretty much stay in the

507
00:19:35,340 --> 00:19:33,309
same spot and so you can find the

508
00:19:37,320 --> 00:19:35,350
patterns and hop around we had to adapt

509
00:19:39,510 --> 00:19:37,330
that technique for working on the moon

510
00:19:40,860 --> 00:19:39,520
and so looking at the different lighting

511
00:19:42,750 --> 00:19:40,870
conditions and looking at the region

512
00:19:44,520 --> 00:19:42,760
where we're impacting picked out various

513
00:19:46,220 --> 00:19:44,530

waypoints so that the astronomers can

514
00:19:48,590 --> 00:19:46,230
move the telescopes and then keep

515
00:19:50,060 --> 00:19:48,600
synced up and keep them locked on the

516
00:19:52,460 --> 00:19:50,070
particular region where we needed to be

517
00:19:54,860 --> 00:19:52,470
pointed and you can see the predict area

518
00:19:59,210 --> 00:19:54,870
for the El cross impact is also labeled

519
00:20:01,610 --> 00:19:59,220
there you go to the next so here's a

520
00:20:03,409 --> 00:20:01,620
sample list of some of the observatories

521
00:20:05,720 --> 00:20:03,419
that we have confirmed data was

522
00:20:06,799 --> 00:20:05,730
collected there's a much bigger list

523
00:20:08,870 --> 00:20:06,809
here but I just want to give you a

524
00:20:10,400 --> 00:20:08,880
flavor for the varieties of the

525
00:20:12,289 --> 00:20:10,410
professional telescopes and the

526
00:20:14,330 --> 00:20:12,299
geographic locations so we have the

527
00:20:16,820 --> 00:20:14,340
Canada France Hawaii telescope located

528
00:20:19,039 --> 00:20:16,830
on Hawaii patchy point observatory New

529
00:20:21,620 --> 00:20:19,049
Mexico I nasa's infrared telescope

530
00:20:23,930 --> 00:20:21,630
facility in hawaii the mmt Observatory

531
00:20:26,150 --> 00:20:23,940
in Arizona Magdalena Ridge Observatory

532
00:20:28,370 --> 00:20:26,160
in New Mexico I'll check out in Hawaii

533
00:20:30,680 --> 00:20:28,380
Gemini North in Hawaii and also the

534
00:20:32,240 --> 00:20:30,690
Subaru telescope the Kree astronomy and

535
00:20:34,669 --> 00:20:32,250
space science institute have telescopes

536
00:20:36,980 --> 00:20:34,679
in both Arizona and Korea Mount Wilson

537
00:20:38,810 --> 00:20:36,990
down in Southern California the Air

538
00:20:40,820 --> 00:20:38,820

Force telescopes out in Hawaii as well

539
00:20:42,770 --> 00:20:40,830
the Allen telescope array up in Northern

540
00:20:45,080 --> 00:20:42,780
California Palomar Observatory in

541
00:20:47,330 --> 00:20:45,090
California Lick Observatory not too far

542
00:20:48,380 --> 00:20:47,340
away from here at NASA Ames so these are

543
00:20:50,570 --> 00:20:48,390
just a sampling of some of the

544
00:20:52,100 --> 00:20:50,580
professional ground-based observatories

545
00:20:54,799 --> 00:20:52,110
that have successfully collected data of

546
00:20:56,960 --> 00:20:54,809
the El cross impacts we also had several

547
00:20:59,380 --> 00:20:56,970
space-based observatories that were also

548
00:21:03,260 --> 00:20:59,390
observing el cross now if we go back

549
00:21:04,970 --> 00:21:03,270
back to the yeah thanks so HST Hubble

550
00:21:06,890 --> 00:21:04,980
Space Telescope newly refurbished that

551
00:21:09,409 --> 00:21:06,900
was excellent we needed that and to

552
00:21:11,090 --> 00:21:09,419
enable these el cross impacts so it's a

553
00:21:13,310 --> 00:21:11,100
great way to use this NASA asset to

554
00:21:16,610 --> 00:21:13,320
support another NASA mission we have

555
00:21:17,990 --> 00:21:16,620
confirmation we had imaging from HST at

556
00:21:20,480 --> 00:21:18,000
first we have confirmed that that has

557
00:21:22,220 --> 00:21:20,490
taken place we are following that up

558
00:21:24,110 --> 00:21:22,230
with some spectroscopy so we're looking

559
00:21:25,789 --> 00:21:24,120
at the exosphere of the moon to see how

560
00:21:27,440 --> 00:21:25,799
it could be perturbed I'm Estonian

561
00:21:28,970 --> 00:21:27,450
mentioned from the impacts those

562
00:21:30,620 --> 00:21:28,980
observations are going on now and we're

563
00:21:31,580 --> 00:21:30,630

also taking some in several hours and

564
00:21:33,620 --> 00:21:31,590
then we're taking another one tomorrow

565
00:21:36,169 --> 00:21:33,630
to see how that exosphere actually

566
00:21:38,930 --> 00:21:36,179
evolves and may relax back so we have

567
00:21:42,169 --> 00:21:38,940
confirmation that HST can't keep going

568
00:21:44,780 --> 00:21:42,179
go back yeah I think so HST operations

569
00:21:47,210 --> 00:21:44,790
were nominal expecting data it'll be

570
00:21:48,770 --> 00:21:47,220
downlink soon fortuitously will be able

571
00:21:52,010 --> 00:21:48,780
to get that data down in about an hour

572
00:21:53,930 --> 00:21:52,020
so it's for our first dump there's also

573
00:21:55,549 --> 00:21:53,940
the Lunar Reconnaissance Orbiter so this

574
00:21:57,169 --> 00:21:55,559
is our sister mission that we've been

575
00:21:59,120 --> 00:21:57,179
working with LR oh I'm quite closely

576
00:21:59,960 --> 00:21:59,130
throughout this entire process we

577
00:22:01,970 --> 00:21:59,970
launched with L

578
00:22:04,700 --> 00:22:01,980
oh I'm back in June from the Kennedy

579
00:22:06,110 --> 00:22:04,710
Space Center down in Florida LRO is in

580
00:22:08,240 --> 00:22:06,120
orbit around the moon right now so they

581
00:22:09,800 --> 00:22:08,250
are in a great position to be supporting

582
00:22:12,200 --> 00:22:09,810
el cross and they have done a tremendous

583
00:22:14,450 --> 00:22:12,210
job they have been observing the impact

584
00:22:15,890 --> 00:22:14,460
location before impact so they've been

585
00:22:17,510 --> 00:22:15,900
helping a lot with the site selection

586
00:22:19,130 --> 00:22:17,520
and characterization of where we are

587
00:22:21,920 --> 00:22:19,140
impacting they're taking observations

588
00:22:23,480 --> 00:22:21,930

during the impact as well and we hear

589
00:22:25,340 --> 00:22:23,490
that that went well and they're also

590
00:22:27,080 --> 00:22:25,350
doing follow-up observations afterwards

591
00:22:28,550 --> 00:22:27,090
since they're in and they're in lunar

592
00:22:30,440 --> 00:22:28,560
orbit they're in a great place to take

593
00:22:31,700 --> 00:22:30,450
follow-up observations as Tony had

594
00:22:33,350 --> 00:22:31,710
mentioned before that are very

595
00:22:35,210 --> 00:22:33,360
complimentary to the data that work

596
00:22:37,010 --> 00:22:35,220
that's been collected from the l cross

597
00:22:39,530 --> 00:22:37,020
shepherding spacecraft so we are working

598
00:22:41,870 --> 00:22:39,540
very closely with LR 0 and we actually

599
00:22:43,610 --> 00:22:41,880
appreciate their support a lot there's

600
00:22:45,620 --> 00:22:43,620
also a few other satellites that we have

601
00:22:47,450 --> 00:22:45,630
that have been collecting data is a

602
00:22:49,070 --> 00:22:47,460
Swedish radio telescope called Odin

603
00:22:51,560 --> 00:22:49,080
which is in Earth orbit and they have

604
00:22:53,180 --> 00:22:51,570
successfully collected data during the L

605
00:22:55,070 --> 00:22:53,190
cross impacts that data is already back

606
00:22:57,620 --> 00:22:55,080
down on the ground and it's being

607
00:23:00,230 --> 00:22:57,630
processed right now also we have the

608
00:23:01,760 --> 00:23:00,240
icono satellite was turned towards the

609
00:23:03,740 --> 00:23:01,770
moon we have confirmation that they have

610
00:23:05,750 --> 00:23:03,750
collected their data it will be downlink

611
00:23:07,130 --> 00:23:05,760
soon and so where we had nominal

612
00:23:09,620 --> 00:23:07,140
operations so we're looking forward to

613
00:23:11,510 --> 00:23:09,630

seeing that data and also that GOI one

614
00:23:13,910 --> 00:23:11,520
satellite was also it's in Earth orbit

615
00:23:14,990 --> 00:23:13,920
on earth looking satellite turned it

616
00:23:16,790 --> 00:23:15,000
towards the moon though they

617
00:23:18,560 --> 00:23:16,800
successfully collected data during the L

618
00:23:19,790 --> 00:23:18,570
cross impacts the data has been down

619
00:23:21,710 --> 00:23:19,800
linked to the ground and so we're

620
00:23:26,330 --> 00:23:21,720
expecting to be able to see that later

621
00:23:27,980 --> 00:23:26,340
today okay next slide so I want to show

622
00:23:29,270 --> 00:23:27,990
you just a sampling of some of the

623
00:23:32,630 --> 00:23:29,280
images and data that was collected

624
00:23:34,970 --> 00:23:32,640
during the El cross impacts we're still

625
00:23:36,860 --> 00:23:34,980
working in the process of processing and

626
00:23:38,990 --> 00:23:36,870
analyzing this data so as Tony mentioned

627
00:23:40,970 --> 00:23:39,000
not going to make any claims about the

628
00:23:42,890 --> 00:23:40,980
implications water no water plume

629
00:23:44,660 --> 00:23:42,900
whatever we're just trying to give you a

630
00:23:46,580 --> 00:23:44,670
flavor of the various types of data that

631
00:23:48,230 --> 00:23:46,590
we have that are being process and as

632
00:23:50,000 --> 00:23:48,240
Tony mentioned before we have collected

633
00:23:51,770 --> 00:23:50,010
the data that we needed we collected the

634
00:23:54,050 --> 00:23:51,780
data that we set out to get and so we're

635
00:23:55,970 --> 00:23:54,060
thrilled about that and as scientists

636
00:23:58,400 --> 00:23:55,980
were very excited to delve in and start

637
00:24:01,250 --> 00:23:58,410
the analysis so here you're seeing a

638
00:24:04,610 --> 00:24:01,260

picture from the NASA irts the infrared

639
00:24:05,690 --> 00:24:04,620
telescope facility out in Hawaii you can

640
00:24:07,640 --> 00:24:05,700
see you should be able to pick out you

641
00:24:09,680 --> 00:24:07,650
can see that brighter line at brighter

642
00:24:11,960 --> 00:24:09,690
Ridge and then the darker area behind it

643
00:24:13,520 --> 00:24:11,970
that's the cabayos crater on there on

644
00:24:15,050 --> 00:24:13,530
target acquired the target we're

645
00:24:16,970 --> 00:24:15,060
able to hold the target and collected

646
00:24:18,890 --> 00:24:16,980
data you can see an arrow pointed to the

647
00:24:21,050 --> 00:24:18,900
plume location and where the impact

648
00:24:23,090 --> 00:24:21,060
predict was expected to occur they're

649
00:24:24,620 --> 00:24:23,100
currently analyzing the data and so we

650
00:24:26,780 --> 00:24:24,630
also have spectra as well that are

651
00:24:28,700 --> 00:24:26,790
coming and so we're in the process so I

652
00:24:30,170 --> 00:24:28,710
just want to report that a lot of good

653
00:24:31,880 --> 00:24:30,180
observations from Hawaii I won't be able

654
00:24:36,170 --> 00:24:31,890
to show them all but this is just an

655
00:24:38,240 --> 00:24:36,180
example next here's an image from the

656
00:24:40,490 --> 00:24:38,250
Canada France Hawaii telescope this is

657
00:24:42,890 --> 00:24:40,500
also out in Hawaii this is christian

658
00:24:45,200 --> 00:24:42,900
delay as the director of the sea fht

659
00:24:46,580 --> 00:24:45,210
collected this data and i'll point out

660
00:24:48,050 --> 00:24:46,590
so you can meet you should be able to

661
00:24:49,820 --> 00:24:48,060
pick out cabayos by now so you've got

662
00:24:51,170 --> 00:24:49,830
that bright Ridge I'm sort of towards

663
00:24:53,270 --> 00:24:51,180

the middle with the dark background

664
00:24:56,510 --> 00:24:53,280
behind it I'll very good optimal viewing

665
00:24:58,700 --> 00:24:56,520
conditions you see two dark spots I'm

666
00:25:00,560 --> 00:24:58,710
one right in the middle of the ridge and

667
00:25:02,210 --> 00:25:00,570
then one above the ridge this is where

668
00:25:03,980 --> 00:25:02,220
they're taking much more detailed

669
00:25:05,720 --> 00:25:03,990
measurements and will be analyzing the

670
00:25:07,340 --> 00:25:05,730
data now looking for water so the reason

671
00:25:09,620 --> 00:25:07,350
that there are two spots are collecting

672
00:25:12,080 --> 00:25:09,630
this data one is on the ridge where

673
00:25:13,670 --> 00:25:12,090
you'd expect to see something if kicked

674
00:25:15,830 --> 00:25:13,680
up by L cross and then there's one

675
00:25:17,360 --> 00:25:15,840
that's off of the impact location for

676
00:25:19,310 --> 00:25:17,370
calibration purposes where you expect to

677
00:25:21,140 --> 00:25:19,320
see no change and so that way you can

678
00:25:23,660 --> 00:25:21,150
have a comparison point I'm to see if

679
00:25:25,310 --> 00:25:23,670
you see any change detection in the area

680
00:25:27,680 --> 00:25:25,320
where L cross was intended to hit so

681
00:25:29,870 --> 00:25:27,690
that analysis is going on right now and

682
00:25:34,070 --> 00:25:29,880
we'll be able to report back as soon as

683
00:25:36,950 --> 00:25:34,080
that's done next this is a spectacular

684
00:25:39,830 --> 00:25:36,960
image from the Palomar Observatory using

685
00:25:41,420 --> 00:25:39,840
their adaptive optics mechanism so you

686
00:25:43,190 --> 00:25:41,430
can see you see the bright Ridge and

687
00:25:44,360 --> 00:25:43,200
then you also see the dark behind in

688
00:25:46,190 --> 00:25:44,370

this is taken down in Southern

689
00:25:48,050 --> 00:25:46,200
California and we're very excited about

690
00:25:50,420 --> 00:25:48,060
this type of imagery we're going to do

691
00:25:52,130 --> 00:25:50,430
some more post data processing I would

692
00:25:54,230 --> 00:25:52,140
do enhancements and look at the other

693
00:25:55,940 --> 00:25:54,240
series images that are in the series as

694
00:25:57,800 --> 00:25:55,950
well I just wanted to give you a flavor

695
00:25:59,270 --> 00:25:57,810
of the types and the quality of the

696
00:26:04,520 --> 00:25:59,280
image data that we have been able to

697
00:26:06,560 --> 00:26:04,530
collect from the ground next and for the

698
00:26:08,780 --> 00:26:06,570
scientist we have squiggly lines which

699
00:26:11,210 --> 00:26:08,790
are very exciting Tony explained these

700
00:26:12,620 --> 00:26:11,220
are spectra so we're looking we're

701
00:26:14,360 --> 00:26:12,630
looking in different wavelengths so this

702
00:26:16,910 --> 00:26:14,370
is looking in the near of red this is

703
00:26:19,070 --> 00:26:16,920
from the mmt Observatory in Arizona this

704
00:26:21,080 --> 00:26:19,080
is faith felis and her team have been

705
00:26:23,600 --> 00:26:21,090
doing a tremendous job and so what you

706
00:26:25,539 --> 00:26:23,610
see are one spectra that's before the

707
00:26:26,919 --> 00:26:25,549
impact of the Centaur and one that

708
00:26:29,259 --> 00:26:26,929
after the impact of the Centaur and

709
00:26:30,940 --> 00:26:29,269
anyone can tell that those two squiggly

710
00:26:32,560 --> 00:26:30,950
lines are different we don't know what

711
00:26:34,690 --> 00:26:32,570
that means yet we have to go and

712
00:26:38,259 --> 00:26:34,700
interpret the data and analyze it it's

713
00:26:40,060 --> 00:26:38,269

been some preliminary productions that

714
00:26:41,859 --> 00:26:40,070
have gone on but what we have to look at

715
00:26:43,060 --> 00:26:41,869
this more closely but what we're seeing

716
00:26:45,369 --> 00:26:43,070
is that there's something interesting

717
00:26:46,600 --> 00:26:45,379
that's going on Tony mentioned a lot of

718
00:26:48,369 --> 00:26:46,610
interesting things we're seeing in the

719
00:26:49,989 --> 00:26:48,379
spacecraft data and so now we really

720
00:26:51,669 --> 00:26:49,999
have to go back and do our homework very

721
00:26:54,009 --> 00:26:51,679
meticulously and try and understand

722
00:26:55,840 --> 00:26:54,019
what's going on in all these data sets

723
00:26:59,049 --> 00:26:55,850
and try and come up with a most coherent

724
00:27:01,930 --> 00:26:59,059
story in terms of spectra as well the

725
00:27:05,259 --> 00:27:01,940
Kitt Peak Observatory I'm also detected

726
00:27:07,029 --> 00:27:05,269
a flash with a sodium flash so we had

727
00:27:09,700 --> 00:27:07,039
some emission of sodium that was what's

728
00:27:11,799 --> 00:27:09,710
happening a very strong indication very

729
00:27:13,570 --> 00:27:11,809
brief but very strong and so that folds

730
00:27:15,009 --> 00:27:13,580
into the story as well so there are some

731
00:27:17,499 --> 00:27:15,019
detection from even from the

732
00:27:18,940 --> 00:27:17,509
ground-based as to what was happening at

733
00:27:20,950 --> 00:27:18,950
the time of impact and shortly

734
00:27:22,779 --> 00:27:20,960
thereafter and so we're looking to bring

735
00:27:25,149 --> 00:27:22,789
all these data sets together to try and

736
00:27:26,889 --> 00:27:25,159
understand what's going on I have a few

737
00:27:28,749 --> 00:27:26,899
videos that I'd like to show as well I

738
00:27:30,840 --> 00:27:28,759

should mention here we commissioned we

739
00:27:33,220 --> 00:27:30,850
measured the sodium line but can in our

740
00:27:36,460 --> 00:27:33,230
spectrometer as well so we can

741
00:27:38,139 --> 00:27:36,470
cross-correlate back yeah excellent okay

742
00:27:40,899 --> 00:27:38,149
so the first video that we have playing

743
00:27:43,599 --> 00:27:40,909
here so this is interesting so this is

744
00:27:45,820 --> 00:27:43,609
this is from the Vatican advanced

745
00:27:48,249 --> 00:27:45,830
technology telescope compliments of Dave

746
00:27:50,109 --> 00:27:48,259
Harvey and Chris Johnson in southeastern

747
00:27:51,970 --> 00:27:50,119
Arizona and what you're looking at is a

748
00:27:54,399 --> 00:27:51,980
video of the Centaur taken about six

749
00:27:55,869 --> 00:27:54,409
hours before impact so if you look in

750
00:27:57,629 --> 00:27:55,879
the center you see a bright dot that

751
00:27:59,769 --> 00:27:57,639
sort of stays the same so they are

752
00:28:02,289 --> 00:27:59,779
tracking on the Centaur this is after

753
00:28:04,149 --> 00:28:02,299
separation and then you see stars that

754
00:28:05,950 --> 00:28:04,159
are moving across so we can use this

755
00:28:08,220 --> 00:28:05,960
information to actually track the

756
00:28:13,690 --> 00:28:08,230
Centaur which is very very interesting

757
00:28:15,489 --> 00:28:13,700
now if we go to the next video this is a

758
00:28:17,259 --> 00:28:15,499
video from the Magdalena Ridge

759
00:28:19,989 --> 00:28:17,269
observatory this is out in New Mexico

760
00:28:21,970 --> 00:28:19,999
this is from mark buoy and eileen ryan

761
00:28:23,409 --> 00:28:21,980
out there and this is a neat video too

762
00:28:25,389 --> 00:28:23,419
if you look in the center of the red

763
00:28:26,649 --> 00:28:25,399

circle you can see the Centaur and then

764
00:28:29,049 --> 00:28:26,659
you see the nearby stars that are

765
00:28:32,080 --> 00:28:29,059
stringing by as the Centaur actually

766
00:28:34,029 --> 00:28:32,090
moves across the sky towards the moon so

767
00:28:39,899 --> 00:28:34,039
we'll be looking at this data and even

768
00:28:45,009 --> 00:28:43,419
okay and if we go to the next video so

769
00:28:47,320 --> 00:28:45,019
in these these are videos that were

770
00:28:48,940 --> 00:28:47,330
taken during the time of impact from a

771
00:28:51,279 --> 00:28:48,950
several different observatories this one

772
00:28:54,399 --> 00:28:51,289
is from the 3.5 meter telescope at

773
00:28:57,100 --> 00:28:54,409
Apache point this video runs 15 is sped

774
00:28:58,870 --> 00:28:57,110
up 15 seconds before impact through one

775
00:29:00,789 --> 00:28:58,880
minute and 45 seconds post-impact

776
00:29:02,529 --> 00:29:00,799
Alice's compliments of new mexico state

777
00:29:05,409 --> 00:29:02,539
university in NASA's Marshall Space

778
00:29:07,419 --> 00:29:05,419
Flight Center and so you can see this is

779
00:29:09,220 --> 00:29:07,429
tilted these are we haven't rotated them

780
00:29:11,320 --> 00:29:09,230
yet but you can see up and down you can

781
00:29:12,759 --> 00:29:11,330
see that bright Ridge and then right

782
00:29:13,899 --> 00:29:12,769
behind that you see the dark part so you

783
00:29:16,480 --> 00:29:13,909
know that you're looking at conveyors

784
00:29:17,950 --> 00:29:16,490
crater so we have this type of imagery I

785
00:29:20,080 --> 00:29:17,960
want to show you a few other videos that

786
00:29:22,299 --> 00:29:20,090
we have to show you the range of scales

787
00:29:25,060 --> 00:29:22,309
that we have of the different videos and

788
00:29:27,250 --> 00:29:25,070

images because we purposely have done

789
00:29:28,840 --> 00:29:27,260
this to collect a wide range of

790
00:29:30,700 --> 00:29:28,850
different types of data so we can get as

791
00:29:33,220 --> 00:29:30,710
much information as we can so here for

792
00:29:34,870 --> 00:29:33,230
example is another movie this is a wider

793
00:29:37,509 --> 00:29:34,880
field of view this is the mmt

794
00:29:39,190 --> 00:29:37,519
observatory amount hopkins and so as you

795
00:29:41,080 --> 00:29:39,200
can see this one is more zoomed out and

796
00:29:42,970 --> 00:29:41,090
so this is a time lapse that goes on for

797
00:29:46,000 --> 00:29:42,980
a while and so we can look at different

798
00:29:47,440 --> 00:29:46,010
scales throughout before during and

799
00:29:51,009 --> 00:29:47,450
after impact and that's what we'll be

800
00:29:58,060 --> 00:29:51,019
doing after this if we go to the next

801
00:30:00,820 --> 00:29:58,070
video okay so now you can see so this is

802
00:30:02,830 --> 00:30:00,830
also from the mmt observatory same place

803
00:30:04,269 --> 00:30:02,840
but now you're more zoomed in and so now

804
00:30:06,610 --> 00:30:04,279
you're looking at higher resolution and

805
00:30:08,740 --> 00:30:06,620
so you can see the the lighter band and

806
00:30:11,080 --> 00:30:08,750
then you can see the darker part looking

807
00:30:13,299 --> 00:30:11,090
around Cabaye's crater this is it the

808
00:30:15,730 --> 00:30:13,309
six point five meter guide camera with

809
00:30:17,980 --> 00:30:15,740
no filter and this goes throughout the

810
00:30:19,659 --> 00:30:17,990
course of the impact and so we can look

811
00:30:21,310 --> 00:30:19,669
at all these different scales and try

812
00:30:23,110 --> 00:30:21,320
and put all these pieces together I'm

813
00:30:24,940 --> 00:30:23,120

also looking at the data from the

814
00:30:26,799 --> 00:30:24,950
shepherding spacecraft and also the data

815
00:30:28,960 --> 00:30:26,809
from the orbiting assets that will be

816
00:30:31,180 --> 00:30:28,970
available probably to us later this

817
00:30:33,970 --> 00:30:31,190
afternoon once all that data is down

818
00:30:35,019 --> 00:30:33,980
links and such so I hope I'd leave you

819
00:30:36,490 --> 00:30:35,029
with the message that we have a

820
00:30:37,889 --> 00:30:36,500
tremendous amount of data that was

821
00:30:40,180 --> 00:30:37,899
collected through the observing campaign

822
00:30:42,610 --> 00:30:40,190
ground-based and space-based how the

823
00:30:44,680 --> 00:30:42,620
team has worked together phenomenally to

824
00:30:46,480 --> 00:30:44,690
make sure that this happens and we'll

825
00:30:48,399 --> 00:30:46,490
continue to work together with the el

826
00:30:49,120 --> 00:30:48,409
cross science team and try and put the

827
00:30:53,770 --> 00:30:49,130
pieces together

828
00:30:55,900 --> 00:30:53,780
it's going to be seemly exciting and now

829
00:30:58,840 --> 00:30:55,910
hand it over to Mike Margo thanks an

830
00:31:00,600 --> 00:30:58,850
awful lot jen well you can tell by

831
00:31:02,700 --> 00:31:00,610
everything that we've heard here that

832
00:31:05,230 --> 00:31:02,710
you've been drinking from the firehose

833
00:31:08,220 --> 00:31:05,240
there is an enormous amount of data that

834
00:31:11,980 --> 00:31:08,230
we've we've gotten today not just from

835
00:31:15,370 --> 00:31:11,990
from Elk Ross but from assets around the

836
00:31:17,800 --> 00:31:15,380
world and it's going to be a little

837
00:31:20,260 --> 00:31:17,810
tough for me to try to bring the whole

838
00:31:22,300 --> 00:31:20,270

thing together but I'm going to try to

839
00:31:26,830 --> 00:31:22,310
take things up and bring you some

840
00:31:30,610 --> 00:31:26,840
context for what L cross has has meant

841
00:31:34,690 --> 00:31:30,620
for exploration systems for science and

842
00:31:36,070 --> 00:31:34,700
for and for NASA and really the one

843
00:31:39,240 --> 00:31:36,080
thing that I think really stands out

844
00:31:42,190 --> 00:31:39,250
here is this is NASA at it's very best

845
00:31:45,430 --> 00:31:42,200
what you're seeing here is exploration

846
00:31:48,520 --> 00:31:45,440
and science working together to provide

847
00:31:51,000 --> 00:31:48,530
great information for both this is going

848
00:31:55,330 --> 00:31:51,010
to change the way we look at the moon

849
00:31:58,240 --> 00:31:55,340
scientifically and inform our abilities

850
00:32:03,010 --> 00:31:58,250
to and our planning for continuing to

851
00:32:05,710 --> 00:32:03,020
explore the solar system we have clearly

852
00:32:09,550 --> 00:32:05,720
an outstanding team that has just done a

853
00:32:11,650 --> 00:32:09,560
magnificent job they took a advantage of

854
00:32:15,250 --> 00:32:11,660
a an opportunity that was made available

855
00:32:19,050 --> 00:32:15,260
to them they were nimble they delivered

856
00:32:23,430 --> 00:32:19,060
a outstanding spacecraft on time and

857
00:32:25,980 --> 00:32:23,440
within budget this is a great lesson of

858
00:32:32,680 --> 00:32:25,990
for NASA it's a new tool in our toolbox

859
00:32:37,600 --> 00:32:32,690
for how we can continue to explore oh it

860
00:32:40,210 --> 00:32:37,610
all started and it continued starting at

861
00:32:43,990 --> 00:32:40,220
the very top Oh with the associate

862
00:32:47,080 --> 00:32:44,000
administrators of exploration system

863
00:32:50,470 --> 00:32:47,090

starting with doc Horowitz and Rick Gill

864
00:32:53,050 --> 00:32:50,480
brick and and now Doug cook and of

865
00:32:54,820 --> 00:32:53,060
course we can't forget the outstanding

866
00:32:57,240 --> 00:32:54,830
support that we got from the center

867
00:33:00,820 --> 00:32:57,250
director here at Ames Pete worden of

868
00:33:02,810 --> 00:33:00,830
having that kind of support let this

869
00:33:07,549 --> 00:33:02,820
team go off and do what they

870
00:33:09,499 --> 00:33:07,559
needed to do to be successful today this

871
00:33:11,899 --> 00:33:09,509
is really a story of teamwork and I

872
00:33:14,990 --> 00:33:11,909
think you've heard that certainly from

873
00:33:18,549 --> 00:33:15,000
Jen but it's bigger than that uh we have

874
00:33:22,240 --> 00:33:18,559
uh not just the other NASA missions of

875
00:33:24,830 --> 00:33:22,250
of LR 0 and the Hubble Space Telescope

876
00:33:27,590 --> 00:33:24,840
but other international missions that

877
00:33:30,560 --> 00:33:27,600
were key in helping us develop the

878
00:33:33,409 --> 00:33:30,570
planning for the impact as well as the

879
00:33:37,399 --> 00:33:33,419
analysis that's being done it started

880
00:33:39,619 --> 00:33:37,409
with getting high resolution altimeter

881
00:33:42,169 --> 00:33:39,629
II information from our colleagues at

882
00:33:46,149 --> 00:33:42,179
Jackson in Japan with the kagyu

883
00:33:48,379 --> 00:33:46,159
spacecraft we also were able to get a

884
00:33:51,860 --> 00:33:48,389
radar data from the chandrayaan-1

885
00:33:53,690 --> 00:33:51,870
spacecraft from India and an important

886
00:33:56,600 --> 00:33:53,700
instrument in for this in helping

887
00:33:59,299 --> 00:33:56,610
targeting uh where L cross was going to

888
00:34:01,490 --> 00:33:59,309

impact was our lunar exploration Neutron

889
00:34:06,649 --> 00:34:01,500
detector on Lunar Reconnaissance Orbiter

890
00:34:11,990 --> 00:34:06,659
and that's provided by Russia Oh Jen

891
00:34:14,740 --> 00:34:12,000
gave a really a extensive discussion of

892
00:34:16,700 --> 00:34:14,750
the the teamwork that we got from

893
00:34:19,149 --> 00:34:16,710
astronomers both here in the United

894
00:34:22,010 --> 00:34:19,159
States as well as around the world of

895
00:34:26,119 --> 00:34:22,020
what we see is that the success here

896
00:34:27,530 --> 00:34:26,129
today is really our L cross team really

897
00:34:29,720 --> 00:34:27,540
being able to stand on the shoulders of

898
00:34:33,280 --> 00:34:29,730
an awful lot of other teams that have

899
00:34:36,260 --> 00:34:33,290
really done an outstanding job today

900
00:34:39,710 --> 00:34:36,270
when we step back and look at what the

901
00:34:42,050 --> 00:34:39,720
potential for the results are it almost

902
00:34:45,950 --> 00:34:42,060
seems like a dichotomy to me it's both

903
00:34:48,109 --> 00:34:45,960
timely as well as timeless over the

904
00:34:49,940 --> 00:34:48,119
course of the last couple of weeks we've

905
00:34:52,460 --> 00:34:49,950
really been thinking about the moon in a

906
00:34:54,919 --> 00:34:52,470
different way who thought just a month

907
00:34:57,109 --> 00:34:54,929
or so ago that we'd be talking about the

908
00:35:00,290 --> 00:34:57,119
water cycle where the hydration cycle of

909
00:35:02,829 --> 00:35:00,300
the moon well now we do think that way

910
00:35:07,309 --> 00:35:02,839
we used to think of the moon as this

911
00:35:09,680 --> 00:35:07,319
desolate unchanging place over millions

912
00:35:11,990 --> 00:35:09,690
and even billions of years now we're

913
00:35:14,690 --> 00:35:12,000

seeing that there is a dynamic to the

914
00:35:16,160 --> 00:35:14,700
moon that's really changing on a

915
00:35:18,589 --> 00:35:16,170
day-by-day

916
00:35:21,440 --> 00:35:18,599
by month kind of basis so we're really

917
00:35:24,640 --> 00:35:21,450
looking at an international effort now

918
00:35:30,559 --> 00:35:24,650
across a number of spacefaring nations

919
00:35:33,620 --> 00:35:30,569
of looking at the moon and just prodding

920
00:35:35,420 --> 00:35:33,630
the moon to give up her her deepest and

921
00:35:39,920 --> 00:35:35,430
darkest secrets and we're seeing a

922
00:35:41,990 --> 00:35:39,930
perfect example that of today but not

923
00:35:45,859 --> 00:35:42,000
only is this timely in providing an

924
00:35:48,380 --> 00:35:45,869
important piece of the puzzle of water

925
00:35:51,049 --> 00:35:48,390
on the moon but also this date is

926
00:35:56,349 --> 00:35:51,059
timeless this data is going to be

927
00:36:00,230 --> 00:35:56,359
available to NASA and the other

928
00:36:02,180 --> 00:36:00,240
explorers to plan for the future and how

929
00:36:04,640 --> 00:36:02,190
we're going to explore the solar system

930
00:36:09,079 --> 00:36:04,650
that data is good and that information

931
00:36:11,870 --> 00:36:09,089
is going to be there when we need it you

932
00:36:14,480 --> 00:36:11,880
know when I was trying to get some sleep

933
00:36:18,410 --> 00:36:14,490
last night I was laying back there and I

934
00:36:20,690 --> 00:36:18,420
just went back about 40 years now about

935
00:36:22,670 --> 00:36:20,700
40 years we know was when Apollo 11

936
00:36:25,880 --> 00:36:22,680
landed I had just graduated from high

937
00:36:27,950 --> 00:36:25,890
school from a small town in western

938
00:36:29,900 --> 00:36:27,960

western Pennsylvania called clairton and

939
00:36:31,010 --> 00:36:29,910
of course you know after graduation a

940
00:36:33,440 --> 00:36:31,020
bunch of us are sitting around saying

941
00:36:36,470 --> 00:36:33,450
what well what are you going to do and

942
00:36:38,839 --> 00:36:36,480
you know I remember saying that one of

943
00:36:42,530 --> 00:36:38,849
the reasons I'm going to college is that

944
00:36:44,030 --> 00:36:42,540
I want to work with NASA I want to

945
00:36:46,280 --> 00:36:44,040
explore I want to explore through

946
00:36:48,140 --> 00:36:46,290
science I want to continue to explore

947
00:36:51,440 --> 00:36:48,150
the moon well that's exactly what we've

948
00:36:53,089 --> 00:36:51,450
been doing today and I'm sure that there

949
00:36:55,789 --> 00:36:53,099
are an awful lot of young explorers out

950
00:36:58,549 --> 00:36:55,799
there right now that are thinking and

951
00:37:01,730 --> 00:36:58,559
dreaming the same kind of dreams that

952
00:37:03,260 --> 00:37:01,740
I've had and I continue to have and that

953
00:37:05,539 --> 00:37:03,270
shows that you know one of the really

954
00:37:10,069 --> 00:37:05,549
outstanding things that NASA does and

955
00:37:12,740 --> 00:37:10,079
does best and that is we make dreams

956
00:37:15,920 --> 00:37:12,750
come true and we make dreams come true

957
00:37:22,660 --> 00:37:15,930
for for us as individuals for us as a

958
00:37:26,240 --> 00:37:22,670
nation and and for the world of you know

959
00:37:27,859 --> 00:37:26,250
we've all had our thoughts of what's

960
00:37:29,989 --> 00:37:27,869
been happening today well you can

961
00:37:31,969 --> 00:37:29,999
imagine around the around the country

962
00:37:33,229 --> 00:37:31,979
there are an awful lot of other folks

963
00:37:36,289 --> 00:37:33,239

who have been thinking about this and

964
00:37:38,749 --> 00:37:36,299
we're lucky enough to have with us the

965
00:37:42,169 --> 00:37:38,759
message from some folks I think we might

966
00:37:44,449 --> 00:37:42,179
want to hear from we have Doug cook

967
00:37:46,489 --> 00:37:44,459
who's the associate administrator for

968
00:37:49,399 --> 00:37:46,499
the exploration systems Mission

969
00:37:51,739 --> 00:37:49,409
Directorate lori Garver the deputy

970
00:37:58,309 --> 00:37:51,749
administrator of NASA and Charlie Bolden

971
00:38:00,649 --> 00:37:58,319
the NASA Administrator I rusty D'Antoni

972
00:38:02,359 --> 00:38:00,659
and all of your team i'm here with lori

973
00:38:04,879 --> 00:38:02,369
Garver and Doug cook we're at the

974
00:38:06,019 --> 00:38:04,889
Newseum in Washington DC sorry we

975
00:38:07,489 --> 00:38:06,029
couldn't be out there with you but we

976
00:38:09,049 --> 00:38:07,499
were here and the excitement was

977
00:38:11,089 --> 00:38:09,059
incredible thanks very much for the

978
00:38:13,459 --> 00:38:11,099
great job you all did please give

979
00:38:15,229 --> 00:38:13,469
everybody our best best wishes and death

980
00:38:17,269 --> 00:38:15,239
and congratulations on this and I look

981
00:38:19,399 --> 00:38:17,279
forward to seeing you all very soon hey

982
00:38:22,339 --> 00:38:19,409
congratulations team here at the Museum

983
00:38:24,229 --> 00:38:22,349
we had families we had members of the

984
00:38:26,299 --> 00:38:24,239
general public literally coming in off

985
00:38:28,639 --> 00:38:26,309
the street pointing at the screen this

986
00:38:30,979 --> 00:38:28,649
is what NASA delivers best thank you so

987
00:38:33,439 --> 00:38:30,989
much it's a great day yes and I want to

988
00:38:35,989 --> 00:38:33,449

say a special thanks to the to the NASA

989
00:38:37,399 --> 00:38:35,999
team led by Dan Andrews and a northrop

990
00:38:42,079 --> 00:38:37,409
grumman team who have done a fantastic

991
00:38:45,259 --> 00:38:42,089
job on a cost count low cost spacecraft

992
00:38:47,449 --> 00:38:45,269
that did a remarkable job through a lot

993
00:38:49,699 --> 00:38:47,459
of adversity along the way but delivered

994
00:38:51,589 --> 00:38:49,709
him and i was watching the accuracies

995
00:38:53,029 --> 00:38:51,599
along the way and it just put her you

996
00:38:56,599 --> 00:38:53,039
guys put it right where it was supposed

997
00:39:04,330 --> 00:38:56,609
to go so pleased as I can be thank you

998
00:39:12,560 --> 00:39:08,240
now Joseph okay thank you very much okay

999
00:39:14,870 --> 00:39:12,570
now that we have our things done we'll

1000
00:39:17,150 --> 00:39:14,880
take questions from the audience we have

1001
00:39:20,840 --> 00:39:17,160
John Johnson here then we'll go over

1002
00:39:25,700 --> 00:39:20,850
here and then Mike meet them at the two

1003
00:39:28,220 --> 00:39:25,710
gentlemen friend John Johnson los

1004
00:39:29,960 --> 00:39:28,230
angeles times I your you're all talking

1005
00:39:32,330 --> 00:39:29,970
about this as though it's a big success

1006
00:39:34,040 --> 00:39:32,340
but one of the things that the public

1007
00:39:36,050 --> 00:39:34,050
was out there to see today and that we

1008
00:39:38,630 --> 00:39:36,060
were expecting to see was a debris cloud

1009
00:39:41,360 --> 00:39:38,640
and we saw nothing how do you know this

1010
00:39:45,110 --> 00:39:41,370
is a success and that it didn't just hit

1011
00:39:46,430 --> 00:39:45,120
bedrock and nothing came up that's

1012
00:39:47,990 --> 00:39:46,440
that's for me well we need to go back

1013
00:39:53,240 --> 00:39:48,000

and look at the data and see what what

1014
00:39:56,240 --> 00:39:53,250
it says that's exploration has surprises

1015
00:39:58,340 --> 00:39:56,250
in it I'm certainly glad we built our

1016
00:40:02,720 --> 00:39:58,350
mission plan or science plan around all

1017
00:40:07,340 --> 00:40:02,730
aspects of the impact for sure that

1018
00:40:09,350 --> 00:40:07,350
built in that robustness I we need to go

1019
00:40:12,320 --> 00:40:09,360
and carefully look at the images you

1020
00:40:14,540 --> 00:40:12,330
know see what's in them certainly what

1021
00:40:16,760 --> 00:40:14,550
streamed out to the video is not that

1022
00:40:19,160 --> 00:40:16,770
the same fidelity is what we get fresh

1023
00:40:20,450 --> 00:40:19,170
off the spacecraft so we just need to

1024
00:40:22,220 --> 00:40:20,460
look a little bit more closer before we

1025
00:40:27,830 --> 00:40:22,230
conclude anything about an ejector cloud

1026
00:40:29,300 --> 00:40:27,840
or not I see something in the

1027
00:40:30,800 --> 00:40:29,310
spectrometer data but I can't say

1028
00:40:32,240 --> 00:40:30,810
anything more than that de spectrometers

1029
00:40:35,570 --> 00:40:32,250
are more sensitive to the camp than the

1030
00:40:38,660 --> 00:40:35,580
cameras so we go back and look at the

1031
00:40:40,700 --> 00:40:38,670
date is three hours two and a half hours

1032
00:40:42,920 --> 00:40:40,710
old so we'll be meeting later this

1033
00:40:45,050 --> 00:40:42,930
afternoon after getting some rest the

1034
00:40:46,880 --> 00:40:45,060
science team well and we'll be able to

1035
00:40:50,930 --> 00:40:46,890
delve into it right away get more

1036
00:40:53,690 --> 00:40:50,940
answers hi Peter Henderson from Reuters

1037
00:40:56,900 --> 00:40:53,700
um Tony I guess this is for you as well

1038
00:41:00,200 --> 00:40:56,910

I if you can see a would you say a

1039
00:41:03,770 --> 00:41:00,210
sulfur flash does that why sodium sodium

1040
00:41:07,430 --> 00:41:03,780
gosh can't you see if there's a hydrogen

1041
00:41:10,200 --> 00:41:07,440
oxygen flash as well yes we can great

1042
00:41:14,940 --> 00:41:10,210
was there have not looked it

1043
00:41:17,970 --> 00:41:14,950
oh come on I am NOT I spent the last

1044
00:41:20,040 --> 00:41:17,980
hour making those images i showed you we

1045
00:41:23,790 --> 00:41:20,050
have the spectra we have the Flash data

1046
00:41:26,550 --> 00:41:23,800
and you can bet that's the first place

1047
00:41:28,320 --> 00:41:26,560
I'm going after this is to go back and

1048
00:41:30,300 --> 00:41:28,330
look at the spectra itself we have not

1049
00:41:32,250 --> 00:41:30,310
honestly looked at the spectra

1050
00:41:35,040 --> 00:41:32,260
themselves except to do a quality check

1051
00:41:36,660 --> 00:41:35,050
on the radiance figures i showed it's

1052
00:41:38,040 --> 00:41:36,670
just that I think aside from the ejecta

1053
00:41:40,560 --> 00:41:38,050
cloud that's the thing we're all

1054
00:41:41,970 --> 00:41:40,570
wondering can you just call your buddies

1055
00:41:45,030 --> 00:41:41,980
who are probably looking at the data

1056
00:41:46,020 --> 00:41:45,040
right now and let us know I can but I

1057
00:41:51,000 --> 00:41:46,030
think they're all in the audience

1058
00:41:54,990 --> 00:41:51,010
actually right now so yeah there's Kim I

1059
00:41:57,150 --> 00:41:55,000
know she's not so now we we just got to

1060
00:42:00,930 --> 00:41:57,160
sit back and be careful we don't want to

1061
00:42:02,700 --> 00:42:00,940
again it's work life is full of

1062
00:42:05,630 --> 00:42:02,710
surprises want to be careful not make a

1063
00:42:09,450 --> 00:42:05,640

false negative or false positive claim

1064
00:42:11,310 --> 00:42:09,460
I'm excited we saw variations in the

1065
00:42:14,010 --> 00:42:11,320
spectra because that means we saw

1066
00:42:17,040 --> 00:42:14,020
something and it was not just blackness

1067
00:42:19,020 --> 00:42:17,050
and so the information is there we just

1068
00:42:21,030 --> 00:42:19,030
need to get to it do you think you'll

1069
00:42:25,140 --> 00:42:21,040
know later this afternoon then whether

1070
00:42:26,880 --> 00:42:25,150
there's water or ice I very many I

1071
00:42:31,290 --> 00:42:26,890
probably will but I'm not going to tell

1072
00:42:33,480 --> 00:42:31,300
you and so we have a consensus amongst

1073
00:42:35,900 --> 00:42:33,490
team members HST data is just coming

1074
00:42:38,880 --> 00:42:35,910
down now they're looking at oho missions

1075
00:42:40,680 --> 00:42:38,890
lamp on ella rose looking multiple

1076
00:42:44,280 --> 00:42:40,690
orbits you know we're going to take our

1077
00:42:47,790 --> 00:42:44,290
time and get a you know build up a case

1078
00:42:49,530 --> 00:42:47,800
for water and in the ejecta if it's

1079
00:42:51,960 --> 00:42:49,540
there or a case against it if it's not

1080
00:42:54,420 --> 00:42:51,970
there and then understand if if we're

1081
00:42:56,220 --> 00:42:54,430
seeing variations what do these

1082
00:42:58,760 --> 00:42:56,230
variations mean we got to understand

1083
00:43:02,520 --> 00:42:58,770
that and before we say anything honestly

1084
00:43:04,349 --> 00:43:02,530
so I'm thrilled that not only us solve

1085
00:43:07,620 --> 00:43:04,359
variations that's a very good sign and

1086
00:43:10,620 --> 00:43:07,630
the spectra this spectra is where the

1087
00:43:16,760 --> 00:43:10,630
science isn't it's where the information

1088
00:43:19,920 --> 00:43:16,770

is contained so that's that was our most

1089
00:43:23,069 --> 00:43:19,930
highest priority data set so why we got

1090
00:43:25,019 --> 00:43:23,079
that we are going to work on this

1091
00:43:26,999 --> 00:43:25,029
virtually as you might expect and we're

1092
00:43:30,839 --> 00:43:27,009
going to keep everyone abreast as it

1093
00:43:32,819 --> 00:43:30,849
goes forward it's Frank Braun from the

1094
00:43:35,609 --> 00:43:32,829
brown journal of world affairs this is

1095
00:43:37,469 --> 00:43:35,619
really a two-part question here first

1096
00:43:41,309 --> 00:43:37,479
part has to do with the Hubble telescope

1097
00:43:43,109 --> 00:43:41,319
you do you expect that they'll if there

1098
00:43:45,660 --> 00:43:43,119
was a plume there would be an image of

1099
00:43:47,489 --> 00:43:45,670
that plume more distinctly observable

1100
00:43:50,609 --> 00:43:47,499
from the images from the Hubble or have

1101
00:43:53,039 --> 00:43:50,619
there been the way we've structured the

1102
00:43:56,009 --> 00:43:53,049
Hubble observations is highly focused on

1103
00:43:57,509 --> 00:43:56,019
spectroscopy so Tony's been harping on

1104
00:44:00,410 --> 00:43:57,519
this that the spectroscopy is where the

1105
00:44:02,400 --> 00:44:00,420
science is visible and so we're using

1106
00:44:03,809 --> 00:44:02,410
while we're looking at the spectra of

1107
00:44:05,370 --> 00:44:03,819
you know looking at the wavelengths to

1108
00:44:08,279 --> 00:44:05,380
get that diagnostic fingerprint of

1109
00:44:11,009 --> 00:44:08,289
anything perturb the exosphere what is

1110
00:44:13,650 --> 00:44:11,019
that when did it happen so that's the

1111
00:44:14,999 --> 00:44:13,660
that's the price yeah the HST cannot

1112
00:44:17,430 --> 00:44:15,009
look at the moon except in the most

1113
00:44:20,699 --> 00:44:17,440

narrow filters because it is so bright

1114
00:44:22,620 --> 00:44:20,709
so the way we've coordinated with HST is

1115
00:44:26,039 --> 00:44:22,630
for them to look off of the limb of the

1116
00:44:28,049 --> 00:44:26,049
moon and do long integration stairs to

1117
00:44:31,199 --> 00:44:28,059
look for o-h emission lines and vapor

1118
00:44:33,420 --> 00:44:31,209
vapor cloud emissions so that's the

1119
00:44:34,979 --> 00:44:33,430
purpose of HST second part of the

1120
00:44:36,630 --> 00:44:34,989
question is if I understand this

1121
00:44:40,279 --> 00:44:36,640
correctly then there is a doubt whether

1122
00:44:42,630 --> 00:44:40,289
they're in fact was a plume or not we

1123
00:44:44,579 --> 00:44:42,640
just haven't been able to see it clearly

1124
00:44:47,819 --> 00:44:44,589
in our image data yet so we need to go

1125
00:44:50,609 --> 00:44:47,829
back and look at it more closely yeah if

1126
00:44:53,160 --> 00:44:50,619
I could make one more comment and that

1127
00:44:55,469 --> 00:44:53,170
is we're right now you can almost think

1128
00:44:59,039 --> 00:44:55,479
are a number of folks are thinking that

1129
00:45:02,670 --> 00:44:59,049
hey it's over but if there is the

1130
00:45:05,430 --> 00:45:02,680
remnants of the disturbances to thee to

1131
00:45:08,939 --> 00:45:05,440
the exosphere they are far longer live

1132
00:45:11,339 --> 00:45:08,949
to than just the material being ejected

1133
00:45:13,009 --> 00:45:11,349
and then falling back to to the surface

1134
00:45:17,489 --> 00:45:13,019
of the Moon so there will be ongoing

1135
00:45:19,319 --> 00:45:17,499
observations to look at any perturb

1136
00:45:23,400 --> 00:45:19,329
answers or any changes in the in the

1137
00:45:26,309 --> 00:45:23,410
exosphere around the impact site and and

1138
00:45:28,329 --> 00:45:26,319

those observations that go on have the

1139
00:45:29,620 --> 00:45:28,339
advantage of having two impacts

1140
00:45:31,059 --> 00:45:29,630
we only had one to look at from the

1141
00:45:33,249 --> 00:45:31,069
Shepherd spacecraft if they get to see

1142
00:45:34,479 --> 00:45:33,259
the Shepherd spacecraft any vapor cloud

1143
00:45:37,569 --> 00:45:34,489
that could have been produced from that

1144
00:45:39,549 --> 00:45:37,579
as well David we just want another while

1145
00:45:42,549 --> 00:45:39,559
I soy tony got Dave Pearlman from the

1146
00:45:46,239 --> 00:45:42,559
San Francisco Chronicle tony is there

1147
00:45:49,329 --> 00:45:46,249
any evidence at all that the shepherding

1148
00:45:53,289 --> 00:45:49,339
satellite on its way down into the

1149
00:45:55,329 --> 00:45:53,299
crater flew through a vapor cloud or

1150
00:45:58,660 --> 00:45:55,339
anything else resembling that we got

1151
00:46:01,180 --> 00:45:58,670
very good high signal-to-noise data on

1152
00:46:04,839 --> 00:46:01,190
our side viewing spectrometer so I

1153
00:46:06,400 --> 00:46:04,849
honestly need to look closely at it I I

1154
00:46:08,799 --> 00:46:06,410
don't want to say yes or no at this

1155
00:46:12,039 --> 00:46:08,809
point we just need time to look at it

1156
00:46:13,120 --> 00:46:12,049
with the team but we got it was it was

1157
00:46:15,009 --> 00:46:13,130
honestly probably the highest

1158
00:46:17,140 --> 00:46:15,019
signal-to-noise data we could hope for

1159
00:46:18,519 --> 00:46:17,150
so if there's something there we're

1160
00:46:21,370 --> 00:46:18,529
probably going to have a good chance of

1161
00:46:25,839 --> 00:46:21,380
seeing it the fact that we saw a remnant

1162
00:46:28,329 --> 00:46:25,849
crater and we had data as far down as we

1163
00:46:30,579 --> 00:46:28,339

had is very promising very hopeful

1164
00:46:32,319 --> 00:46:30,589
because we we would get into the deepest

1165
00:46:36,249 --> 00:46:32,329
part of any kind of vapor cloud that

1166
00:46:39,009 --> 00:46:36,259
existed just on my initial eyeballing

1167
00:46:41,319 --> 00:46:39,019
from that those last few images of the

1168
00:46:43,569 --> 00:46:41,329
crater it looks to be about the size of

1169
00:46:45,309 --> 00:46:43,579
what we were predicting so that was very

1170
00:46:47,229 --> 00:46:45,319
encouraging have filled a full pixel of

1171
00:46:49,209 --> 00:46:47,239
the camera towards the end and even a

1172
00:46:52,180 --> 00:46:49,219
little bit beyond which means it was

1173
00:46:56,709 --> 00:46:52,190
probably in the 18 to 20 or more meter

1174
00:47:01,329 --> 00:46:56,719
range and to follow that up would the

1175
00:47:03,219 --> 00:47:01,339
mass of ejecta be likely to conform to

1176
00:47:05,170 --> 00:47:03,229
the predictions you made I won't say

1177
00:47:11,380 --> 00:47:05,180
predictions guesses your predictions

1178
00:47:13,719 --> 00:47:11,390
their prediction immediate is but that

1179
00:47:17,109 --> 00:47:13,729
remains to be seen I I can't answer that

1180
00:47:21,940 --> 00:47:17,119
right now that's right okay no we have a

1181
00:47:26,050 --> 00:47:24,670
the points that I heard early on was

1182
00:47:28,839 --> 00:47:26,060
that you were concerned about whether

1183
00:47:31,390 --> 00:47:28,849
the Centaur would spin properly so that

1184
00:47:33,700 --> 00:47:31,400
it would go in in right and therefore

1185
00:47:36,220 --> 00:47:33,710
the shepherding spacecraft could follow

1186
00:47:38,770 --> 00:47:36,230
did how did all that part of the mission

1187
00:47:42,069 --> 00:47:38,780
actually go the tip-off seemed very

1188
00:47:44,620 --> 00:47:42,079

clean we have and that again was nice as

1189
00:47:46,630 --> 00:47:44,630
our cameras work very well and this is

1190
00:47:48,910 --> 00:47:46,640
where I was a bit surprised how well

1191
00:47:50,710 --> 00:47:48,920
they worked that we were able to

1192
00:47:52,210 --> 00:47:50,720
essentially track the center all the way

1193
00:47:54,130 --> 00:47:52,220
up to the end of our operation very

1194
00:47:57,130 --> 00:47:54,140
clearly so we can actually derive that

1195
00:47:59,530 --> 00:47:57,140
that rate the images you saw of the

1196
00:48:02,770 --> 00:47:59,540
center coming in that the telescope's

1197
00:48:06,280 --> 00:48:02,780
made you can kind of see him flicker or

1198
00:48:07,870 --> 00:48:06,290
come and go that could be possibly due

1199
00:48:10,210 --> 00:48:07,880
to a tumble we think there was public

1200
00:48:12,310 --> 00:48:10,220
there was some small tumble to it which

1201
00:48:15,760 --> 00:48:12,320
is actually not necessarily a bad thing

1202
00:48:18,010 --> 00:48:15,770
it's a we kind of wanted to avoid a very

1203
00:48:21,339 --> 00:48:18,020
peculiar a particular impact perfectly

1204
00:48:23,710 --> 00:48:21,349
end on our perfectly flat and in any

1205
00:48:25,030 --> 00:48:23,720
case we can go back and look and see

1206
00:48:26,020 --> 00:48:25,040
what kind of a tumble right there is so

1207
00:48:27,579 --> 00:48:26,030
we have that again we have the

1208
00:48:33,480 --> 00:48:27,589
information we just need to go back now

1209
00:48:35,740 --> 00:48:33,490
and really sit through it ok next please

1210
00:48:38,280 --> 00:48:35,750
remind everyone to please state your

1211
00:48:40,720 --> 00:48:38,290
name and your affiliation thank you

1212
00:48:42,670 --> 00:48:40,730
semanek with discovery channel canada

1213
00:48:45,280 --> 00:48:42,680

immediately after the impact there was

1214
00:48:47,170 --> 00:48:45,290
some discussion about whether the gain

1215
00:48:49,720 --> 00:48:47,180
on the camera especially in the visible

1216
00:48:52,030 --> 00:48:49,730
camera was set right to actually see the

1217
00:48:54,880 --> 00:48:52,040
plume i'm wondering if that has now been

1218
00:48:58,150 --> 00:48:54,890
ruled out as a scenario for the no I

1219
00:49:00,250 --> 00:48:58,160
know it hasn't that's setting gains on

1220
00:49:02,730 --> 00:49:00,260
cameras is tricky you know most people

1221
00:49:05,550 --> 00:49:02,740
get a couple tries at this and our

1222
00:49:08,770 --> 00:49:05,560
visible camera actually has an auto game

1223
00:49:10,089 --> 00:49:08,780
and it's fixed in auto gain so for the

1224
00:49:11,620 --> 00:49:10,099
impact we go to our near infrared

1225
00:49:13,930 --> 00:49:11,630
cameras where we can control the game

1226
00:49:16,120 --> 00:49:13,940
and we were actively controlling in a

1227
00:49:19,690 --> 00:49:16,130
Kim medico the payload scientists in

1228
00:49:23,589 --> 00:49:19,700
besok did a spectacular job managing the

1229
00:49:26,140 --> 00:49:23,599
exposures but also the the data rate we

1230
00:49:28,210 --> 00:49:26,150
have a fixed data rate it snow storm

1231
00:49:30,640 --> 00:49:28,220
forward so we have to live within that

1232
00:49:33,370 --> 00:49:30,650
and actually as we come in the image

1233
00:49:34,320 --> 00:49:33,380
size changes as the complexity of the

1234
00:49:36,300 --> 00:49:34,330
terrain changes

1235
00:49:39,900 --> 00:49:36,310
so we're constantly having to actually

1236
00:49:43,320 --> 00:49:39,910
manage both those real time we need to

1237
00:49:45,240 --> 00:49:43,330
go back and look we I think Kim and the

1238
00:49:47,130 --> 00:49:45,250

team the payload team marks really the

1239
00:49:50,300 --> 00:49:47,140
payload lead and the flight director and

1240
00:49:52,590 --> 00:49:50,310
command to a spectacular job we

1241
00:49:54,780 --> 00:49:52,600
typically if we have a problem we drop

1242
00:49:57,120 --> 00:49:54,790
in inches we did we they don't get

1243
00:50:01,290 --> 00:49:57,130
through I think we maybe had 40 images

1244
00:50:04,290 --> 00:50:01,300
dropped out of thousands so we did

1245
00:50:06,150 --> 00:50:04,300
really good there the game was nice

1246
00:50:08,670 --> 00:50:06,160
about these cameras is they've got a

1247
00:50:10,950 --> 00:50:08,680
pretty large dynamic range and one of

1248
00:50:13,380 --> 00:50:10,960
the things we need to go back and look

1249
00:50:15,210 --> 00:50:13,390
closely just looking at it there you see

1250
00:50:16,770 --> 00:50:15,220
bright peaks and a dark background we

1251
00:50:18,630 --> 00:50:16,780
need to go in there just some co adding

1252
00:50:19,890 --> 00:50:18,640
some stretching and see what we can see

1253
00:50:21,210 --> 00:50:19,900
we just haven't had the chance to do

1254
00:50:23,730 --> 00:50:21,220
that and just a quick follow-up for

1255
00:50:25,320 --> 00:50:23,740
Jennifer I know the second impact would

1256
00:50:28,560 --> 00:50:25,330
have been smaller than the first one was

1257
00:50:30,990 --> 00:50:28,570
the expected debris plume what was that

1258
00:50:34,220 --> 00:50:31,000
also expected to have been seen from the

1259
00:50:37,860 --> 00:50:34,230
earth observing angle Oh from the earth

1260
00:50:39,780 --> 00:50:37,870
yeah yeah just barely maybe it's a

1261
00:50:41,970 --> 00:50:39,790
denser spacecraft so it has a little bit

1262
00:50:44,250 --> 00:50:41,980
higher flight velocity we are hoping

1263
00:50:46,700 --> 00:50:44,260

thinking but in any case as my quarrel

1264
00:50:49,950 --> 00:50:46,710
pointed out the vapor plume if it hit

1265
00:50:52,470 --> 00:50:49,960
volatiles can expand at a conservative

1266
00:50:56,180 --> 00:50:52,480
faster rate doesn't have gravity pulling

1267
00:50:58,710 --> 00:50:56,190
down on it like the grains do as much so

1268
00:51:03,180 --> 00:50:58,720
yeah hopefully that did produce a little

1269
00:51:06,960 --> 00:51:03,190
bit extra stuff for for lr 0 and h st

1270
00:51:09,210 --> 00:51:06,970
and some of the other assets I'm Theresa

1271
00:51:12,930 --> 00:51:09,220
Garcia with abc7 news in San Francisco

1272
00:51:15,930 --> 00:51:12,940
so if there is no water discovered will

1273
00:51:17,880 --> 00:51:15,940
there be an del cross 2 and if you

1274
00:51:22,410 --> 00:51:17,890
haven't found water is there anything

1275
00:51:24,720 --> 00:51:22,420
else you're looking for there oh boy and

1276
00:51:29,580 --> 00:51:24,730
I'll cross to can I finish up cross one

1277
00:51:34,680 --> 00:51:29,590
first yeah if there's no water you know

1278
00:51:36,570 --> 00:51:34,690
science is science it's we need to see

1279
00:51:38,340 --> 00:51:36,580
what we see you know what made these

1280
00:51:39,870 --> 00:51:38,350
changes in the spectra first of all was

1281
00:51:42,000 --> 00:51:39,880
it an instrument response or was there

1282
00:51:44,040 --> 00:51:42,010
really something there if we don't see

1283
00:51:46,530 --> 00:51:44,050
water what does that tells us something

1284
00:51:48,570 --> 00:51:46,540
about the processes where we hit

1285
00:51:50,520 --> 00:51:48,580
did we hit somebody mentioned bedrock or

1286
00:51:53,250 --> 00:51:50,530
do but when we go back and look at the

1287
00:51:55,530 --> 00:51:53,260
maps and the data no we hit into fluff

1288
00:51:58,230 --> 00:51:55,540

well what does that say why didn't we

1289
00:51:59,820 --> 00:51:58,240
see the water it means it's in the

1290
00:52:01,410 --> 00:51:59,830
certain distribution you know we have to

1291
00:52:03,870 --> 00:52:01,420
make go through that whole process of

1292
00:52:06,660 --> 00:52:03,880
piecing it together the puzzle together

1293
00:52:09,060 --> 00:52:06,670
so if we see water if we don't see water

1294
00:52:11,550 --> 00:52:09,070
both those represent two separate

1295
00:52:13,830 --> 00:52:11,560
individual unique pieces of the puzzle

1296
00:52:17,820 --> 00:52:13,840
that we're going to fit in with all the

1297
00:52:20,310 --> 00:52:17,830
other pieces and certainly el Cross does

1298
00:52:24,120 --> 00:52:20,320
provide a strategic direction forward

1299
00:52:27,450 --> 00:52:24,130
for whatever the agency decides to do it

1300
00:52:30,840 --> 00:52:27,460
is a experiment a sample two samples and

1301
00:52:32,310 --> 00:52:30,850
in a particular location and that data's

1302
00:52:35,100 --> 00:52:32,320
of now available to carry us forward

1303
00:52:38,160 --> 00:52:35,110
decide what we do next were you looking

1304
00:52:39,600 --> 00:52:38,170
for anything else other than water we're

1305
00:52:40,950 --> 00:52:39,610
looking for just about everything we're

1306
00:52:45,060 --> 00:52:40,960
going someplace we've never been before

1307
00:52:47,250 --> 00:52:45,070
so we're primarily interested in what's

1308
00:52:49,200 --> 00:52:47,260
the source of the hydrogen so it could

1309
00:52:53,790 --> 00:52:49,210
been water hydrated minerals adsorbed

1310
00:52:56,010 --> 00:52:53,800
water organics you know who knows but

1311
00:52:57,420 --> 00:52:56,020
the fact that we see a sodium flash wow

1312
00:52:59,280 --> 00:52:57,430
that's really interesting that's telling

1313
00:53:01,860 --> 00:52:59,290

us something about the moon that we have

1314
00:53:03,870 --> 00:53:01,870
to think about you know something about

1315
00:53:07,080 --> 00:53:03,880
this atmosphere around the moon which is

1316
00:53:10,740 --> 00:53:07,090
in part potentially responsible for the

1317
00:53:12,510 --> 00:53:10,750
migration of water so I know there's a

1318
00:53:14,580 --> 00:53:12,520
lot more in this than just the water

1319
00:53:16,950 --> 00:53:14,590
honestly and I think Mike mentioned how

1320
00:53:19,830 --> 00:53:16,960
this this this data is going to keep

1321
00:53:22,530 --> 00:53:19,840
giving for a long time ever since the

1322
00:53:24,030 --> 00:53:22,540
swing by of the moon four months ago we

1323
00:53:26,340 --> 00:53:24,040
took some very unique data sets that

1324
00:53:28,710 --> 00:53:26,350
will be released very soon to the public

1325
00:53:30,900 --> 00:53:28,720
and then this data after it gets through

1326
00:53:35,610 --> 00:53:30,910
quality checks and will be released and

1327
00:53:37,230 --> 00:53:35,620
hopefully in a few months honestly so it

1328
00:53:39,870 --> 00:53:37,240
remains to be seen what's in it just

1329
00:53:43,680 --> 00:53:39,880
don't know yet okay any other questions

1330
00:53:51,220 --> 00:53:48,880
hi can change your times I was wondering

1331
00:53:54,850 --> 00:53:51,230
whether any signs of blooming any

1332
00:53:56,950 --> 00:53:54,860
earth-based observations I know a couple

1333
00:53:58,780 --> 00:53:56,960
of those telescopes said to have

1334
00:54:01,390 --> 00:53:58,790
definitely did not see that cleaned

1335
00:54:03,820 --> 00:54:01,400
including Palomar well I wouldn't say

1336
00:54:05,770 --> 00:54:03,830
definitely for any of them yet because

1337
00:54:07,060 --> 00:54:05,780
it's tony mentioned it's so early and

1338
00:54:09,670 --> 00:54:07,070

the ground-based teams are still

1339
00:54:11,920 --> 00:54:09,680
analyzing their data so we're just

1340
00:54:14,290 --> 00:54:11,930
looking at the very preliminary you know

1341
00:54:16,300 --> 00:54:14,300
images to give a sense of the types of

1342
00:54:17,920 --> 00:54:16,310
data that have been collected but it's

1343
00:54:21,790 --> 00:54:17,930
just too early to tell to make that

1344
00:54:24,100 --> 00:54:21,800
determination okay and follow up I know

1345
00:54:25,960 --> 00:54:24,110
you said most the most important data is

1346
00:54:29,850 --> 00:54:25,970
the spectra but if they're turns out

1347
00:54:35,410 --> 00:54:29,860
there is no plume what do you lose I

1348
00:54:39,400 --> 00:54:35,420
think what you lose is some estimation

1349
00:54:44,110 --> 00:54:39,410
of the total excavation what the total

1350
00:54:47,260 --> 00:54:44,120
excavation mass that said we imaged the

1351
00:54:49,630 --> 00:54:47,270
crater so we actually have some data

1352
00:54:54,100 --> 00:54:49,640
that we honestly counting on to help us

1353
00:54:56,260 --> 00:54:54,110
fill in that hole so we lose some we

1354
00:54:58,870 --> 00:54:56,270
lose you know what we hope to get out of

1355
00:55:01,180 --> 00:54:58,880
the ejecta cloud was an ability to say

1356
00:55:03,820 --> 00:55:01,190
AHA we see this much stuff this much

1357
00:55:05,260 --> 00:55:03,830
dirt and we can somehow relate that to

1358
00:55:07,240 --> 00:55:05,270
how much actually came out of the

1359
00:55:08,620 --> 00:55:07,250
Creator now we're going to if we don't

1360
00:55:10,120 --> 00:55:08,630
see it Jack dear i'm not convinced it's

1361
00:55:12,910 --> 00:55:10,130
not in our data yet i'm not at all

1362
00:55:15,760 --> 00:55:12,920
commands that we've gotta look we've got

1363
00:55:17,770 --> 00:55:15,770

to go back and use a combination of the

1364
00:55:22,270 --> 00:55:17,780
data we have to fill in that missing gap

1365
00:55:24,670 --> 00:55:22,280
if it's if it's in be missing but again

1366
00:55:27,940 --> 00:55:24,680
our primary objectives are what is that

1367
00:55:29,890 --> 00:55:27,950
hydrogen honestly the images didn't

1368
00:55:34,720 --> 00:55:29,900
answer that question the spectroscopy

1369
00:55:37,000 --> 00:55:34,730
answer that question so that's why when

1370
00:55:41,070 --> 00:55:37,010
I saw actually the spectra I was like we

1371
00:55:47,970 --> 00:55:44,670
okay Tony hi this is Mike Swift with the

1372
00:55:49,560 --> 00:55:47,980
San Jose Mercury News can you give us

1373
00:55:51,780 --> 00:55:49,570
some sense of the timetable it's going

1374
00:55:53,730 --> 00:55:51,790
to take you to build the case either for

1375
00:55:57,570 --> 00:55:53,740
or against water is that a matter of

1376
00:55:59,340 --> 00:55:57,580
days weeks months and hypothetically

1377
00:56:02,100 --> 00:55:59,350
those little blips that you saw in the

1378
00:56:08,220 --> 00:56:02,110
spectra what hypothetically could that

1379
00:56:14,750 --> 00:56:08,230
mean now I you're right days weeks

1380
00:56:17,340 --> 00:56:14,760
months yeah that's going to make it yet

1381
00:56:19,740 --> 00:56:17,350
the timetable I've set forward for the

1382
00:56:21,840 --> 00:56:19,750
team and I'm challenge a team but I'll

1383
00:56:23,790 --> 00:56:21,850
cross is unique in every single way I

1384
00:56:25,740 --> 00:56:23,800
mean the way one we kind of lay it all

1385
00:56:27,900 --> 00:56:25,750
out there to swing by return on

1386
00:56:29,700 --> 00:56:27,910
streaming video boy we hope this works

1387
00:56:31,650 --> 00:56:29,710
you know in the same way here it's boy

1388
00:56:34,770 --> 00:56:31,660

we hope this works but the instruments

1389
00:56:37,500 --> 00:56:34,780
the spacecraft it's a real time mission

1390
00:56:42,120 --> 00:56:37,510
we never repeat anything twice I think

1391
00:56:44,030 --> 00:56:42,130
on this mission so we were at two hours

1392
00:56:46,230 --> 00:56:44,040
this is our two hour mark after impact

1393
00:56:49,350 --> 00:56:46,240
then we have a two-day mark that the

1394
00:56:50,820 --> 00:56:49,360
team most the science team is here we're

1395
00:56:53,660 --> 00:56:50,830
going to get together later this

1396
00:56:56,940 --> 00:56:53,670
afternoon tomorrow look at the data

1397
00:57:00,600 --> 00:56:56,950
scratch our heads fight over who gets to

1398
00:57:02,910 --> 00:57:00,610
analyze what and then we go off and we

1399
00:57:05,640 --> 00:57:02,920
meet in two weeks and that two weeks is

1400
00:57:10,010 --> 00:57:05,650
where we hopefully will say we've got

1401
00:57:12,210 --> 00:57:10,020
something for for this particular

1402
00:57:16,230 --> 00:57:12,220
hypothesis or this particular process

1403
00:57:19,680 --> 00:57:16,240
and from that then we hope to make a

1404
00:57:21,780 --> 00:57:19,690
public announcement etc and two in a

1405
00:57:23,730 --> 00:57:21,790
two-month time frame so it's kind of two

1406
00:57:25,260 --> 00:57:23,740
hours two days two weeks two months so

1407
00:57:27,420 --> 00:57:25,270
when what you said what you describe is

1408
00:57:28,920 --> 00:57:27,430
quite accurate we will be making

1409
00:57:31,290 --> 00:57:28,930
presentations at the American

1410
00:57:34,530 --> 00:57:31,300
Geophysical Union and in san francisco

1411
00:57:37,410 --> 00:57:34,540
in december and hopefully there we can

1412
00:57:40,080 --> 00:57:37,420
say something quite definitive what

1413
00:57:42,690 --> 00:57:40,090

those little blips mean I'm just glad

1414
00:57:45,630 --> 00:57:42,700
they're there honestly because that's it

1415
00:57:47,910 --> 00:57:45,640
could have been a flat black line and it

1416
00:57:49,740 --> 00:57:47,920
wasn't and we're not the only one since

1417
00:57:50,880 --> 00:57:49,750
I interesting blips so we just got to go

1418
00:57:53,150 --> 00:57:50,890
back and see what it is it could be

1419
00:57:57,170 --> 00:57:53,160
honestly it could be purely interesting

1420
00:57:58,549 --> 00:57:57,180
I don't think that flash is I am anxious

1421
00:58:00,680 --> 00:57:58,559
to go back and see if I see an o H

1422
00:58:04,039 --> 00:58:00,690
emission line in h2o plus line a sodium

1423
00:58:08,930 --> 00:58:04,049
line whatever so we just gotta get into

1424
00:58:10,700 --> 00:58:08,940
it just haven't met okay we'll take one

1425
00:58:13,760 --> 00:58:10,710
more question here in the audience and

1426
00:58:16,099 --> 00:58:13,770
then we'll take questions over from the

1427
00:58:20,000 --> 00:58:16,109
phone Donald Robertson spaceflight

1428
00:58:21,980 --> 00:58:20,010
London what um how can you have a crater

1429
00:58:23,930 --> 00:58:21,990
and no ejecta if you don't see the

1430
00:58:25,640 --> 00:58:23,940
ejecta what does that tell you and you

1431
00:58:27,890 --> 00:58:25,650
do see a crater well yeah that's a

1432
00:58:30,559 --> 00:58:27,900
that's a great question and I think we

1433
00:58:35,539 --> 00:58:30,569
got a couple of theses and people could

1434
00:58:37,220 --> 00:58:35,549
right here on that so the the process of

1435
00:58:40,520 --> 00:58:37,230
making a crater is pretty complex and

1436
00:58:42,319 --> 00:58:40,530
not necessarily entirely understood we

1437
00:58:45,890 --> 00:58:42,329
have some of the world experts in the

1438
00:58:48,829 --> 00:58:45,900

audience here who are on the team what

1439
00:58:51,140 --> 00:58:48,839
would that mean to me one the ejecta did

1440
00:58:54,620 --> 00:58:51,150
not fly up high enough we hit a slope we

1441
00:58:57,769 --> 00:58:54,630
hit some blocks that Kareem the dejected

1442
00:58:59,269 --> 00:58:57,779
laterally I've we've actually seen this

1443
00:59:00,740 --> 00:58:59,279
work in the other way gotten lucky and

1444
00:59:04,400 --> 00:59:00,750
hit a slope in the right direction and

1445
00:59:07,279 --> 00:59:04,410
Korean the ejecta upward so there's that

1446
00:59:09,740 --> 00:59:07,289
there's some just unfortunately luck

1447
00:59:11,390 --> 00:59:09,750
that that has to come in here to get

1448
00:59:15,170 --> 00:59:11,400
dejected to fly in the direction you

1449
00:59:17,569 --> 00:59:15,180
wanted to fly there is the type of

1450
00:59:21,799 --> 00:59:17,579
material you hit is it at roccos it

1451
00:59:23,059 --> 00:59:21,809
consolidated is it compressible that we

1452
00:59:29,569 --> 00:59:23,069
don't really know there's a part of this

1453
00:59:31,849 --> 00:59:29,579
experiment tells us that there's a the

1454
00:59:33,740 --> 00:59:31,859
composition the material itself how the

1455
00:59:36,559 --> 00:59:33,750
energy coupled to it and how actually

1456
00:59:38,269 --> 00:59:36,569
the energy propagated through the sound

1457
00:59:39,859 --> 00:59:38,279
waves and actually lift the material up

1458
00:59:41,660 --> 00:59:39,869
we just don't know exactly how that

1459
00:59:44,870 --> 00:59:41,670
works necessarily for all the

1460
00:59:46,430 --> 00:59:44,880
possibilities on the moon and there's

1461
00:59:47,839 --> 00:59:46,440
the possibility that the shadow heights

1462
00:59:50,599 --> 00:59:47,849
were deeper than we thought they were

1463
00:59:53,420 --> 00:59:50,609

you know we're basing this on the latest

1464
00:59:54,950 --> 00:59:53,430
and best available data and we just need

1465
00:59:57,799 --> 00:59:54,960
to go back and take a look at all of it

1466
01:00:00,440 --> 00:59:57,809
there's explanations for sure how you

1467
01:00:01,930 --> 01:00:00,450
can have a crater we saw a crater we saw

1468
01:00:03,910 --> 01:00:01,940
a flash so that something had

1469
01:00:05,500 --> 01:00:03,920
in between and we're going to go fine

1470
01:00:06,910 --> 01:00:05,510
and we see it in the spectrometers

1471
01:00:08,470 --> 01:00:06,920
that's what's very you know we do see

1472
01:00:10,300 --> 01:00:08,480
something in the spectrometers it's I

1473
01:00:12,309 --> 01:00:10,310
don't know what it is I'm not gonna say

1474
01:00:14,079 --> 01:00:12,319
it's the ejecta cloud right now but

1475
01:00:15,970 --> 01:00:14,089
something happened in between we just

1476
01:00:19,030 --> 01:00:15,980
got to go back in and with a finer tooth

1477
01:00:21,280 --> 01:00:19,040
comb and if I can just make a quick

1478
01:00:24,339 --> 01:00:21,290
comment what you're seeing here is this

1479
01:00:27,099 --> 01:00:24,349
is what exploration is you know the

1480
01:00:29,500 --> 01:00:27,109
these areas haven't seen the light of

1481
01:00:33,099 --> 01:00:29,510
the Sun for some estimate up to two

1482
01:00:36,670 --> 01:00:33,109
billion years so if we don't have that

1483
01:00:39,609 --> 01:00:36,680
kind of information we make estimates

1484
01:00:41,410 --> 01:00:39,619
and we plan as best we can but you take

1485
01:00:43,240 --> 01:00:41,420
the results of the experiment and you

1486
01:00:45,730 --> 01:00:43,250
move from there and you start to use

1487
01:00:48,819 --> 01:00:45,740
those results to constrain what the

1488
01:00:51,370 --> 01:00:48,829

answer might look like so you're right

1489
01:00:56,079 --> 01:00:51,380
in the middle of it with us um in in

1490
01:00:58,660 --> 01:00:56,089
trying to understand this okay thank you

1491
01:01:02,910 --> 01:00:58,670
very much now we'll take the question

1492
01:01:06,099 --> 01:01:02,920
from Denver igano with USA Today dan

1493
01:01:10,120 --> 01:01:06,109
thanks very very much I have to question

1494
01:01:11,890 --> 01:01:10,130
Oh could you speak a little about more

1495
01:01:14,230 --> 01:01:11,900
of I want you to lose with the flu I'm

1496
01:01:15,910 --> 01:01:14,240
raising into sunlight my understanding

1497
01:01:17,349 --> 01:01:15,920
was there's some cooking of the

1498
01:01:22,300 --> 01:01:17,359
ingredients that would tell you

1499
01:01:24,609 --> 01:01:22,310
something some repeat the last by the

1500
01:01:26,980 --> 01:01:24,619
question this way what it wasn't part of

1501
01:01:28,599 --> 01:01:26,990
the plume uh the intended creating it

1502
01:01:30,339 --> 01:01:28,609
was that it was so sighs above the

1503
01:01:31,690 --> 01:01:30,349
crater wall did the sunlight and you

1504
01:01:33,250 --> 01:01:31,700
would have see some reactions there that

1505
01:01:35,589 --> 01:01:33,260
might give you support well yeah you

1506
01:01:37,240 --> 01:01:35,599
know notionally if for example you have

1507
01:01:39,760 --> 01:01:37,250
cold ejected you want to bring it into

1508
01:01:41,650 --> 01:01:39,770
sunlight one you can see if there's ice

1509
01:01:44,020 --> 01:01:41,660
in the ejecta or you can see if there's

1510
01:01:47,020 --> 01:01:44,030
subliming water you know that's that's

1511
01:01:48,579 --> 01:01:47,030
one of the things you hope for now that

1512
01:01:52,000 --> 01:01:48,589
doesn't mean that didn't happen it means

1513
01:01:55,270 --> 01:01:52,010

maybe it was much fainter more diffuse

1514
01:01:57,370 --> 01:01:55,280
did this gets to you know the earlier

1515
01:01:58,690 --> 01:01:57,380
question about well if you didn't see a

1516
01:02:01,150 --> 01:01:58,700
jekking to south crater was it means

1517
01:02:03,849 --> 01:02:01,160
even just a flight angle of the ejecta

1518
01:02:05,290 --> 01:02:03,859
can make that the cloud less dense but

1519
01:02:07,390 --> 01:02:05,300
you know then what we had thought it was

1520
01:02:11,260 --> 01:02:07,400
going to be or whatever so we just need

1521
01:02:13,599 --> 01:02:11,270
to be careful and one say we just don't

1522
01:02:14,289 --> 01:02:13,609
know right now what what what we saw

1523
01:02:18,459 --> 01:02:14,299
entirely

1524
01:02:20,799 --> 01:02:18,469
but what uh what I don't think you

1525
01:02:23,529 --> 01:02:20,809
necessarily lose any information with

1526
01:02:25,029 --> 01:02:23,539
regards to understanding what it is is

1527
01:02:27,849 --> 01:02:25,039
there it would have been you know

1528
01:02:29,979 --> 01:02:27,859
assuming we had no eject it would have

1529
01:02:32,079 --> 01:02:29,989
been a very nice thing to have but the

1530
01:02:34,449 --> 01:02:32,089
fact that we got good spectroscopic data

1531
01:02:36,219 --> 01:02:34,459
and I mean ejecting cameras we got the

1532
01:02:38,890 --> 01:02:36,229
spectroscopic data and that's what

1533
01:02:41,650 --> 01:02:38,900
really matters so something occurred in

1534
01:02:43,719 --> 01:02:41,660
the sunlight or from the heat from the

1535
01:02:45,699 --> 01:02:43,729
crater the fact that we flew in saw the

1536
01:02:49,689 --> 01:02:45,709
crater and it was school still glowing

1537
01:02:51,819 --> 01:02:49,699
hot means that if there was ice there or

1538
01:02:55,989 --> 01:02:51,829

absorb water or whatever else it was

1539
01:02:58,599 --> 01:02:55,999
subliming so we just go back and take a

1540
01:03:00,400 --> 01:02:58,609
look thanks very much my second question

1541
01:03:02,019 --> 01:03:00,410
was whether you could say anything about

1542
01:03:03,910 --> 01:03:02,029
this mission to the model for future

1543
01:03:05,289 --> 01:03:03,920
mission that a lots been made of this

1544
01:03:07,269 --> 01:03:05,299
being off-the-shelf technology and that

1545
01:03:09,459 --> 01:03:07,279
sort of thing would you be able to do

1546
01:03:12,039 --> 01:03:09,469
something identical to this to explore

1547
01:03:13,900 --> 01:03:12,049
earth asteroid for its contents or it's

1548
01:03:18,309 --> 01:03:13,910
just a special situation they'll promise

1549
01:03:19,779 --> 01:03:18,319
that you will do please yeah this this

1550
01:03:21,880 --> 01:03:19,789
is actually something that is being

1551
01:03:25,989 --> 01:03:21,890
considered this is a really novel

1552
01:03:29,019 --> 01:03:25,999
approach as far as spacecraft complexity

1553
01:03:30,579 --> 01:03:29,029
goes I mean spacecraft can be very

1554
01:03:32,469 --> 01:03:30,589
complicated things and pretty

1555
01:03:34,630 --> 01:03:32,479
unforgiving because once you let go of

1556
01:03:37,839 --> 01:03:34,640
them you can't go back and fix them and

1557
01:03:39,609 --> 01:03:37,849
so keeping your complexity as low as

1558
01:03:42,039 --> 01:03:39,619
possible keeping everything as simple as

1559
01:03:44,289 --> 01:03:42,049
possible helps keep your wrist down and

1560
01:03:46,509 --> 01:03:44,299
I think that's why this mission has been

1561
01:03:49,419 --> 01:03:46,519
so successful in how quickly it turned

1562
01:03:51,669 --> 01:03:49,429
around how quickly we got it up and able

1563
01:03:54,160 --> 01:03:51,679

to be launched and and the mission even

1564
01:03:56,949 --> 01:03:54,170
through some trouble spots was able to

1565
01:04:00,039 --> 01:03:56,959
complete so I think this is a great

1566
01:04:01,719 --> 01:04:00,049
paradigm and I think it is extensible I

1567
01:04:05,339 --> 01:04:01,729
think it could be applied to other

1568
01:04:07,749 --> 01:04:05,349
mission types and so forth absolutely

1569
01:04:10,589 --> 01:04:07,759
okay we're starting to run out of time

1570
01:04:15,880 --> 01:04:10,599
here so we'll take our last two people

1571
01:04:17,799 --> 01:04:15,890
Seth bornstein from 80 thank you for

1572
01:04:21,459 --> 01:04:17,809
doing that's just more ejecta question

1573
01:04:23,349 --> 01:04:21,469
first can you say that it is a fair to

1574
01:04:26,259 --> 01:04:23,359
say well you have absolutely no images

1575
01:04:28,210 --> 01:04:26,269
so far of the ejector visually the

1576
01:04:31,570 --> 01:04:28,220
spectroscopic data is

1577
01:04:33,880 --> 01:04:31,580
confirm the ejecta and can use from mass

1578
01:04:37,089 --> 01:04:33,890
spectra targets drop it data can you say

1579
01:04:38,890 --> 01:04:37,099
how far the ejecta reached or how big a

1580
01:04:40,750 --> 01:04:38,900
plume you had just from that data and

1581
01:04:42,580 --> 01:04:40,760
then can you just say whether you're I

1582
01:04:45,370 --> 01:04:42,590
mean the public was somewhat

1583
01:04:47,290 --> 01:04:45,380
disappointed is my colleague at the LA

1584
01:04:48,970 --> 01:04:47,300
Times that could are you somewhat

1585
01:04:53,970 --> 01:04:48,980
disappointed and surprised by the lack

1586
01:04:59,800 --> 01:04:57,040
the first I'll take the last one first

1587
01:05:03,460 --> 01:04:59,810
and then comment more detail honest it

1588
01:05:05,770 --> 01:05:03,470

on the first question I'm I guess I'm

1589
01:05:08,260 --> 01:05:05,780
not necessarily surprised because I knew

1590
01:05:09,640 --> 01:05:08,270
I would be surprised if that makes any

1591
01:05:11,800 --> 01:05:09,650
sense I knew we were going someplace

1592
01:05:13,780 --> 01:05:11,810
that to expect what you're not going to

1593
01:05:16,270 --> 01:05:13,790
expect and and so that's why we really

1594
01:05:18,070 --> 01:05:16,280
try to build this as robust as possible

1595
01:05:20,470 --> 01:05:18,080
in terms of measuring every possible

1596
01:05:22,330 --> 01:05:20,480
aspect intention in case any one of them

1597
01:05:24,099 --> 01:05:22,340
didn't work like the flash didn't work

1598
01:05:26,109 --> 01:05:24,109
or couldn't see the crater or the

1599
01:05:28,890 --> 01:05:26,119
objective was hard to see I'm not

1600
01:05:31,510 --> 01:05:28,900
convinced we haven't seen the ejecta I

1601
01:05:34,240 --> 01:05:31,520
want to go back to those images and look

1602
01:05:39,070 --> 01:05:34,250
at them carefully what you saw was you

1603
01:05:41,859 --> 01:05:39,080
know about 15-20 minutes of my efforts

1604
01:05:43,839 --> 01:05:41,869
with the images while my team worked to

1605
01:05:45,579 --> 01:05:43,849
other aspects and we're going to work on

1606
01:05:47,440 --> 01:05:45,589
that tip this afternoon and tomorrow so

1607
01:05:50,440 --> 01:05:47,450
stay tuned you know I I certainly hope

1608
01:05:53,740 --> 01:05:50,450
we can dig something out of there that

1609
01:05:55,150 --> 01:05:53,750
that will be telling you know you just

1610
01:05:58,060 --> 01:05:55,160
never know how these things are going to

1611
01:05:59,650 --> 01:05:58,070
go and as we said our emphasis was on

1612
01:06:02,950 --> 01:05:59,660
the spectra that's where the information

1613
01:06:07,359 --> 01:06:02,960

is I'm very hopeful but i'm not going to

1614
01:06:11,950 --> 01:06:07,369
say I'm unequivocally certain that we

1615
01:06:16,750 --> 01:06:11,960
have curtain spectra i can say i am very

1616
01:06:20,440 --> 01:06:16,760
confident we have flash spectra that's a

1617
01:06:23,349 --> 01:06:20,450
certain and and and it looks promising

1618
01:06:27,510 --> 01:06:23,359
beyond that but again i just have to go

1619
01:06:29,510 --> 01:06:27,520
back and do more than a once-over

1620
01:06:32,760 --> 01:06:29,520
with with you know total radiance

1621
01:06:35,190 --> 01:06:32,770
measurements yeah this may sound really

1622
01:06:38,040 --> 01:06:35,200
obvious but this isn't the end this is

1623
01:06:41,940 --> 01:06:38,050
the beginning there's an awful lot of

1624
01:06:44,280 --> 01:06:41,950
work that still needs to be done and for

1625
01:06:45,600 --> 01:06:44,290
those of you who've conducted

1626
01:06:48,900 --> 01:06:45,610
experiments in the past to have

1627
01:06:51,360 --> 01:06:48,910
something absolutely certain right after

1628
01:06:54,270 --> 01:06:51,370
you're done with the experiment is not

1629
01:06:55,830 --> 01:06:54,280
the way most scientists have have

1630
01:06:59,040 --> 01:06:55,840
experienced the results of their

1631
01:07:00,510 --> 01:06:59,050
experiments if there's anything I would

1632
01:07:02,700 --> 01:07:00,520
add to that the one thing I was

1633
01:07:05,790 --> 01:07:02,710
surprised by was how quick four minutes

1634
01:07:08,040 --> 01:07:05,800
goes by that's this that was the one

1635
01:07:10,050 --> 01:07:08,050
thing I really noticed was ok here's

1636
01:07:11,580 --> 01:07:10,060
flash we're halfway through curtain wait

1637
01:07:14,640 --> 01:07:11,590
wait wait what happened and then clear

1638
01:07:15,960 --> 01:07:14,650

crater oh there it goes Wow yeah get

1639
01:07:19,380 --> 01:07:15,970
ready for the press conference you know

1640
01:07:22,290 --> 01:07:19,390
that's basically how it went ok we have

1641
01:07:24,390 --> 01:07:22,300
only a couple more minutes left we'll

1642
01:07:28,140 --> 01:07:24,400
take our last question from our Lee

1643
01:07:32,280 --> 01:07:28,150
Irene Klotz from this Irene Klotz thank

1644
01:07:35,040 --> 01:07:32,290
you very much yet can hear me yes thank

1645
01:07:37,230 --> 01:07:35,050
you um congratulations first of all I

1646
01:07:38,970 --> 01:07:37,240
have two questions on the first I'm

1647
01:07:40,680 --> 01:07:38,980
afraid I was going to display my

1648
01:07:44,070 --> 01:07:40,690
scientific ignorance but could you

1649
01:07:45,630 --> 01:07:44,080
explain why this sodium measurement

1650
01:07:46,950 --> 01:07:45,640
popped out to the point where you're

1651
01:07:50,670 --> 01:07:46,960
even mentioning it it's a press

1652
01:07:53,670 --> 01:07:50,680
conference I can comment down and

1653
01:07:56,010 --> 01:07:53,680
possibly genuine and Mike could to the

1654
01:07:58,620 --> 01:07:56,020
we don't understand right now how the

1655
01:08:01,200 --> 01:07:58,630
lunar exosphere works and the exosphere

1656
01:08:05,580 --> 01:08:01,210
is the atmosphere that very tenuous

1657
01:08:07,230 --> 01:08:05,590
atmosphere around the moon it is there's

1658
01:08:08,850 --> 01:08:07,240
a variety of theories and the most

1659
01:08:11,390 --> 01:08:08,860
recently heard about the the

1660
01:08:13,500 --> 01:08:11,400
observations of very small amounts of

1661
01:08:16,860 --> 01:08:13,510
hydroxyls and waters near the surface

1662
01:08:20,190 --> 01:08:16,870
and sunlight how that might move around

1663
01:08:23,160 --> 01:08:20,200

is through this atmosphere the fact that

1664
01:08:25,079 --> 01:08:23,170
we saw sodium line means that something

1665
01:08:27,450 --> 01:08:25,089
was thermalized down in the crater when

1666
01:08:29,730 --> 01:08:27,460
we hit it temperatures got hot enough

1667
01:08:31,410 --> 01:08:29,740
reacted with the surface perhaps or

1668
01:08:35,410 --> 01:08:31,420
reacted with the atmosphere ambient

1669
01:08:37,849 --> 01:08:35,420
atmosphere enough to excite sodium atoms

1670
01:08:40,760 --> 01:08:37,859
sodium atoms exist naturally in the

1671
01:08:43,340 --> 01:08:40,770
lunar atmosphere why an impact like this

1672
01:08:44,479 --> 01:08:43,350
would excite it is a good question and

1673
01:08:47,419 --> 01:08:44,489
that's something we're really going to

1674
01:08:49,280 --> 01:08:47,429
follow up on sodium is easy to observe

1675
01:08:54,349 --> 01:08:49,290
from Earth it's a very strong line in

1676
01:08:55,910 --> 01:08:54,359
the visible we on HST and on our

1677
01:08:57,919 --> 01:08:55,920
shipping spacecraft can see a variety of

1678
01:08:59,809 --> 01:08:57,929
other emission lines that are more

1679
01:09:01,849 --> 01:08:59,819
indicative of other interesting things

1680
01:09:03,320 --> 01:09:01,859
like water and so that's you know we'll

1681
01:09:05,390 --> 01:09:03,330
have to go back and see what we see in

1682
01:09:07,309 --> 01:09:05,400
there so the fact we saw a sodium line

1683
01:09:09,769 --> 01:09:07,319
is exciting because it means we did

1684
01:09:11,539 --> 01:09:09,779
excite something in the crater and it

1685
01:09:15,979 --> 01:09:11,549
did express itself such that we can

1686
01:09:17,809 --> 01:09:15,989
measure it okay thank you very much I'd

1687
01:09:19,820 --> 01:09:17,819
like to thank the panelists for all

1688
01:09:21,559 --> 01:09:19,830

their hard work and I know you guys are

1689
01:09:25,729 --> 01:09:21,569
in to get some sleep and then look at

1690
01:09:27,019 --> 01:09:25,739
this data with new eyes rested eyes okay

1691
01:09:29,959 --> 01:09:27,029
I know everyone here is going to be

1692
01:09:31,970 --> 01:09:29,969
waiting for these results any new

1693
01:09:36,260 --> 01:09:31,980
results we will have will be posted on

1694
01:09:39,410 --> 01:09:36,270
the El cross website www nasa gov / l

1695
01:09:42,950 --> 01:09:39,420
cross and with that thank you very much