1
00:00:17,830 --> 00:00:15,270
good morning ladies and gentlemen and

2
00:00:20,390 --> 00:00:17,840
welcome to nasa ames research center

3
00:00:23,109 --> 00:00:20,400
today we are discussing the lunar crater

4
00:00:24,310 --> 00:00:23,119
observation sensing satellite mission l

5
00:00:26,710 --> 00:00:24,320
cross

6
00:00:28,790 --> 00:00:26,720
one of nasa's next steps to exploring

7
00:00:32,310 --> 00:00:28,800
the moon and our solar system

8
00:00:34,229 --> 00:00:32,320
today we are the the mission is going to

9
00:00:36,950 --> 00:00:34,239
announce the crater that has been

10
00:00:39,510 --> 00:00:36,960
selected as the optimum uh

11
00:00:41,350 --> 00:00:39,520
as optimal location for evaluating if

12
00:00:42,229 --> 00:00:41,360
water exists on the south pole of the

13
00:00:45,350 --> 00:00:42,239

moon

14
00:00:47,510 --> 00:00:45,360
on the panel we have dan andrews l cross

15
00:00:50,470 --> 00:00:47,520
project manager

16
00:00:52,549 --> 00:00:50,480
tony culprit l cross project scientist

17
00:00:54,470 --> 00:00:52,559
and principal investigator

18
00:00:57,110 --> 00:00:54,480
and jennifer hellman coordinator of the

19
00:00:59,430 --> 00:00:57,120
l cross observation campaign

20
00:01:01,590 --> 00:00:59,440
after each has spoken we will be taking

21
00:01:05,189 --> 00:01:01,600
questions from the news media

22
00:01:07,190 --> 00:01:05,199
and with that i hand you over to dan

23
00:01:10,469 --> 00:01:07,200
well good morning everybody um it's

24
00:01:13,190 --> 00:01:10,479
truly a pleasure to uh to be here today

25
00:01:15,270 --> 00:01:13,200
um i thought i would open up with just a

26
00:01:18,070 --> 00:01:15,280
reminder of what the mission is and then

27
00:01:18,789 --> 00:01:18,080
given a status and and go forward from

28
00:01:22,710 --> 00:01:18,799
there

29
00:01:26,550 --> 00:01:22,720
so l cross is a lunar impactor mission

30
00:01:29,749 --> 00:01:26,560
uh we launched on june 18th of this year

31
00:01:32,230 --> 00:01:29,759
with our sister mission lro the lunar

32
00:01:35,270 --> 00:01:32,240
reconnaissance orbiter

33
00:01:39,429 --> 00:01:35,280
and since then we have been flying in a

34
00:01:41,350 --> 00:01:39,439
earth orbit preparing for an impact

35
00:01:44,469 --> 00:01:41,360
on october 9th

36
00:01:47,350 --> 00:01:44,479
coming up in just about 28 days

37
00:01:50,789 --> 00:01:47,360
the purpose of our mission is to see if

38
00:01:52,950 --> 00:01:50,799

there may indeed be water ice

39
00:01:55,510 --> 00:01:52,960
located in some permanently shadowed

40
00:01:57,749 --> 00:01:55,520
regions on the south pole of the moon

41
00:01:59,109 --> 00:01:57,759
the way we do that is pretty clever

42
00:02:01,670 --> 00:01:59,119
actually

43
00:02:03,590 --> 00:02:01,680
we take our spacecraft the l cross

44
00:02:04,550 --> 00:02:03,600
shepherding spacecraft

45
00:02:06,870 --> 00:02:04,560
and

46
00:02:08,630 --> 00:02:06,880
instead of separating after launch from

47
00:02:11,270 --> 00:02:08,640
the upper stage of the rocket that

48
00:02:13,510 --> 00:02:11,280
brought us to the moon we hang on to it

49
00:02:15,830 --> 00:02:13,520
and we use that as our impactor

50
00:02:18,070 --> 00:02:15,840
and so we are right now dragging around

51
00:02:19,270 --> 00:02:18,080
in orbit around the earth the upper

52
00:02:23,270 --> 00:02:19,280
atlas

53
00:02:26,070 --> 00:02:23,280
5 stage called the centaur and then

54
00:02:27,990 --> 00:02:26,080
on the day of impact we will finally

55
00:02:30,309 --> 00:02:28,000
separate from that

56
00:02:32,070 --> 00:02:30,319
impactor it will be drawn into the moon

57
00:02:33,750 --> 00:02:32,080
by lunar gravity

58
00:02:35,509 --> 00:02:33,760
of course the l cross spacecraft will be

59
00:02:37,670 --> 00:02:35,519
drawn in as well

60
00:02:39,990 --> 00:02:37,680
we will slow down the shepherding

61
00:02:41,990 --> 00:02:40,000
spacecraft so we give time for the

62
00:02:44,790 --> 00:02:42,000
impactor to go in

63
00:02:46,550 --> 00:02:44,800

it will kick up whatever is on the floor

64
00:02:48,790 --> 00:02:46,560
of the crater

65
00:02:51,350 --> 00:02:48,800
that may very well include water ice

66
00:02:54,710 --> 00:02:51,360
that is the whole point of the mission

67
00:02:57,670 --> 00:02:54,720
and kick it up into the sunlight so that

68
00:02:59,589 --> 00:02:57,680
we can monitor it we have many

69
00:03:01,750 --> 00:02:59,599
instruments on the spacecraft that will

70
00:03:04,070 --> 00:03:01,760
be checking for its composition

71
00:03:05,910 --> 00:03:04,080
and then finally about four minutes

72
00:03:07,670 --> 00:03:05,920
after the first impact the shepherding

73
00:03:10,390 --> 00:03:07,680
spacecraft impacts

74
00:03:12,869 --> 00:03:10,400
and game over we're done

75
00:03:14,630 --> 00:03:12,879
so all that data that was taken was sent

76
00:03:16,309 --> 00:03:14,640
back to earth of course live during

77
00:03:19,990 --> 00:03:16,319
those four minutes

78
00:03:22,949 --> 00:03:20,000
now status of the spacecraft is good

79
00:03:25,670 --> 00:03:22,959
um we have been working very hard this

80
00:03:28,470 --> 00:03:25,680
is a small innovative mission

81
00:03:31,190 --> 00:03:28,480
and uh pretty low cost as these things

82
00:03:33,190 --> 00:03:31,200
go and so um

83
00:03:34,789 --> 00:03:33,200
it's been a lot of work we've overcome

84
00:03:37,830 --> 00:03:34,799
some challenges

85
00:03:40,149 --> 00:03:37,840
but we at this point 28 days out

86
00:03:41,509 --> 00:03:40,159
have every expectation of finishing the

87
00:03:44,949 --> 00:03:41,519
mission with

88
00:03:50,390 --> 00:03:47,509

the l cross team however uh

89
00:03:51,509 --> 00:03:50,400
was uh in the july time frame in

90
00:03:54,550 --> 00:03:51,519
particular

91
00:03:56,229 --> 00:03:54,560
uh mid-july was saddened by the loss of

92
00:03:57,429 --> 00:03:56,239
a notable figure

93
00:03:59,509 --> 00:03:57,439
within

94
00:04:01,990 --> 00:03:59,519
the exploration community and of course

95
00:04:03,350 --> 00:04:02,000
that was uh noted journalist walter

96
00:04:07,270 --> 00:04:03,360
cronkite

97
00:04:09,110 --> 00:04:07,280
uh he was the face of exploration for

98
00:04:11,830 --> 00:04:09,120
many decades starting

99
00:04:14,470 --> 00:04:11,840
in the early mercury days of course

100
00:04:16,550 --> 00:04:14,480
through apollo we all remember seeing

101
00:04:18,390 --> 00:04:16,560
him on television

102
00:04:20,069 --> 00:04:18,400
during the apollo 11 in particular

103
00:04:21,749 --> 00:04:20,079
landing on the moon

104
00:04:23,670 --> 00:04:21,759
and so

105
00:04:25,510 --> 00:04:23,680
this notable figure

106
00:04:29,350 --> 00:04:25,520
who represented so much for the american

107
00:04:32,870 --> 00:04:29,360
public in making space exploration uh

108
00:04:35,830 --> 00:04:32,880
digestible understandable

109
00:04:36,710 --> 00:04:35,840
is someone that nasa and the l cross

110
00:04:38,950 --> 00:04:36,720
team

111
00:04:40,710 --> 00:04:38,960
would like to dedicate the l cross

112
00:04:44,710 --> 00:04:40,720
mission to

113
00:04:46,150 --> 00:04:44,720

and uh i'm very pleased to see that chip

114
00:04:47,670 --> 00:04:46,160
his son

115
00:04:49,749 --> 00:04:47,680
is here today

116
00:04:57,990 --> 00:04:49,759
and uh i understand he would like to

117
00:05:03,029 --> 00:05:00,310
some very few words

118
00:05:07,110 --> 00:05:03,039
it's a great honor thank you very much

119
00:05:11,430 --> 00:05:07,120
and dad would be very pleased to to be

120
00:05:12,629 --> 00:05:11,440
part of this uh this uh ongoing process

121
00:05:15,029 --> 00:05:12,639
uh

122
00:05:16,150 --> 00:05:15,039
we find water

123
00:05:18,629 --> 00:05:16,160
so close

124
00:05:21,189 --> 00:05:18,639
it's a uh

125
00:05:23,350 --> 00:05:21,199
attractive oasis for

126
00:05:25,430 --> 00:05:23,360
further uh exploration

127
00:05:27,430 --> 00:05:25,440
so once you

128
00:05:29,270 --> 00:05:27,440
build that refueling station up there or

129
00:05:31,830 --> 00:05:29,280
whatever it is we'll come back and we

130
00:05:33,749 --> 00:05:31,840
can have a another renaming uh ceremony

131
00:05:36,230 --> 00:05:33,759
then thank you very much and good speed

132
00:05:42,790 --> 00:05:36,240
good uh good luck thank you very much

133
00:05:49,510 --> 00:05:44,390
so

134
00:05:52,390 --> 00:05:49,520
is uh to talk about where l cross will

135
00:05:54,710 --> 00:05:52,400
be going on the moon

136
00:05:56,550 --> 00:05:54,720
today as you've heard we have

137
00:05:58,469 --> 00:05:56,560
the project scientists and principal

138
00:06:00,070 --> 00:05:58,479

investigator tony colapriet and jen

139
00:06:01,189 --> 00:06:00,080
heldman who are going to be talking

140
00:06:03,990 --> 00:06:01,199
about

141
00:06:06,230 --> 00:06:04,000
the crater that was selected and how

142
00:06:07,830 --> 00:06:06,240
the impact will be observed and with

143
00:06:10,150 --> 00:06:07,840
that i'll turn it over to tony thanks

144
00:06:13,270 --> 00:06:10,160
dan and thank you everybody for coming

145
00:06:15,350 --> 00:06:13,280
to hear uh where we plan on going

146
00:06:16,950 --> 00:06:15,360
it's uh i should say straight straight

147
00:06:18,629 --> 00:06:16,960
up that uh

148
00:06:20,870 --> 00:06:18,639
this has been a long process actually

149
00:06:22,550 --> 00:06:20,880
even before we submitted the idea the

150
00:06:24,469 --> 00:06:22,560
proposal to

151
00:06:26,070 --> 00:06:24,479
to do outcross people have been thinking

152
00:06:27,670 --> 00:06:26,080
about this and considering where they

153
00:06:28,950 --> 00:06:27,680
would go and explore for water on the

154
00:06:31,590 --> 00:06:28,960
moon

155
00:06:35,110 --> 00:06:31,600
since then l cross has been exceedingly

156
00:06:37,430 --> 00:06:35,120
fortunate to have a number of

157
00:06:38,870 --> 00:06:37,440
observations from a variety of

158
00:06:40,550 --> 00:06:38,880
observatories

159
00:06:42,950 --> 00:06:40,560
from uh

160
00:06:44,150 --> 00:06:42,960
the international community including

161
00:06:46,390 --> 00:06:44,160
the japanese

162
00:06:48,790 --> 00:06:46,400
mission saline the indian mission

163
00:06:50,230 --> 00:06:48,800

chandrian and now lro the lunar

164
00:06:52,790 --> 00:06:50,240
reconnaissance orbiter our sister

165
00:06:54,390 --> 00:06:52,800
mission at the moon these observations

166
00:06:56,790 --> 00:06:54,400
plus those made from the ground from

167
00:06:59,510 --> 00:06:56,800
radar observatories on the ground have

168
00:07:00,950 --> 00:06:59,520
been instrumental in our understanding

169
00:07:03,670 --> 00:07:00,960
of where to go

170
00:07:06,070 --> 00:07:03,680
and have given me great confidence that

171
00:07:07,830 --> 00:07:06,080
we have picked the best possible site

172
00:07:09,189 --> 00:07:07,840
going forward

173
00:07:10,870 --> 00:07:09,199
so with that i'm going to show some

174
00:07:13,830 --> 00:07:10,880
video and some imaging

175
00:07:15,350 --> 00:07:13,840
of uh the process and the places where

176
00:07:17,990 --> 00:07:15,360
we've considered

177
00:07:20,629 --> 00:07:18,000
and revealed to you the ultimate target

178
00:07:22,790 --> 00:07:20,639
that we are sending l cross to explore

179
00:07:24,870 --> 00:07:22,800
for water ice so we can

180
00:07:26,309 --> 00:07:24,880
start the video now

181
00:07:28,070 --> 00:07:26,319
the

182
00:07:30,550 --> 00:07:28,080
uh l cross mission

183
00:07:32,710 --> 00:07:30,560
launched in june of this last year this

184
00:07:34,629 --> 00:07:32,720
year and that really set the pole we had

185
00:07:37,029 --> 00:07:34,639
to go to it's springtime in the southern

186
00:07:39,189 --> 00:07:37,039
hemisphere right now and so we have good

187
00:07:40,469 --> 00:07:39,199
lighting what you see in the video here

188
00:07:43,110 --> 00:07:40,479

is the

189
00:07:45,589 --> 00:07:43,120
lunar south pole a variety of craters

190
00:07:48,150 --> 00:07:45,599
down there that we had to consider

191
00:07:50,390 --> 00:07:48,160
what we uh had to do over the last year

192
00:07:52,950 --> 00:07:50,400
and half two years was

193
00:07:55,430 --> 00:07:52,960
pick one of these to go to and what you

194
00:07:58,070 --> 00:07:55,440
see here are our finalists

195
00:08:00,309 --> 00:07:58,080
that we've used

196
00:08:02,869 --> 00:08:00,319
kageya data and chandrian data and lro

197
00:08:03,670 --> 00:08:02,879
data to help us actually determine which

198
00:08:05,990 --> 00:08:03,680
one

199
00:08:08,230 --> 00:08:06,000
over the last three months in particular

200
00:08:10,869 --> 00:08:08,240
lro has been very active in observing

201
00:08:12,629 --> 00:08:10,879
these specific craters for us

202
00:08:14,230 --> 00:08:12,639
what you see here is a radar image from

203
00:08:16,950 --> 00:08:14,240
the goldstone

204
00:08:19,430 --> 00:08:16,960
radar dishes in california of the south

205
00:08:20,950 --> 00:08:19,440
pole you can see a variety of craters

206
00:08:23,749 --> 00:08:20,960
down there

207
00:08:26,790 --> 00:08:23,759
we looked at such craters as shackleton

208
00:08:28,710 --> 00:08:26,800
shoemaker hayworth

209
00:08:30,070 --> 00:08:28,720
but they had to meet certain criteria

210
00:08:32,070 --> 00:08:30,080
and i'll tell you what those criteria

211
00:08:33,909 --> 00:08:32,080
are in a moment and the crater we've

212
00:08:35,190 --> 00:08:33,919
finally selected is shown here now it's

213
00:08:38,709 --> 00:08:35,200

cabelius a

214
00:08:40,709 --> 00:08:38,719
quebec a is at about 81 degrees south

215
00:08:42,630 --> 00:08:40,719
it's a little bit off the south pole

216
00:08:44,550 --> 00:08:42,640
it's a relatively large crater about 40

217
00:08:46,630 --> 00:08:44,560
kilometers across

218
00:08:48,150 --> 00:08:46,640
and as we zoom in and look at it here

219
00:08:49,190 --> 00:08:48,160
you can see it has

220
00:08:55,030 --> 00:08:49,200
a

221
00:08:57,110 --> 00:08:55,040
spot exists

222
00:08:59,190 --> 00:08:57,120
we're going to continue to

223
00:09:00,870 --> 00:08:59,200
refine our understanding of this crater

224
00:09:03,990 --> 00:09:00,880
now that we've selected it

225
00:09:05,509 --> 00:09:04,000
with detailed observations from lro

226
00:09:10,870 --> 00:09:05,519
and

227
00:09:12,870 --> 00:09:10,880
impact we find the exact position within

228
00:09:15,110 --> 00:09:12,880
this crater that we are going to impact

229
00:09:18,150 --> 00:09:15,120
we already have a very good idea where

230
00:09:21,509 --> 00:09:18,160
it is but we have the fortunate ability

231
00:09:23,509 --> 00:09:21,519
to refine that in the next couple weeks

232
00:09:26,389 --> 00:09:23,519
the next image here shows

233
00:09:28,710 --> 00:09:26,399
the topography of this crater kibaysa as

234
00:09:29,990 --> 00:09:28,720
seen from the goldstone radar dishes in

235
00:09:32,150 --> 00:09:30,000
california

236
00:09:34,550 --> 00:09:32,160
yellow is low blue is high

237
00:09:37,190 --> 00:09:34,560
topography is really important because

238
00:09:38,870 --> 00:09:37,200

it really determines the illumination

239
00:09:40,949 --> 00:09:38,880
within the crater

240
00:09:42,630 --> 00:09:40,959
sunlight is blocked by topography and

241
00:09:44,870 --> 00:09:42,640
you can see here the black areas are

242
00:09:46,550 --> 00:09:44,880
actually shadows

243
00:09:48,790 --> 00:09:46,560
cast by the radar the topography is

244
00:09:51,269 --> 00:09:48,800
blocking the radar signal and we see it

245
00:09:52,310 --> 00:09:51,279
as shadows the sun does the same thing

246
00:09:54,230 --> 00:09:52,320
so

247
00:09:56,230 --> 00:09:54,240
really important to the l cross mission

248
00:09:58,070 --> 00:09:56,240
success is to get the ejected the dirt

249
00:09:59,110 --> 00:09:58,080
that's thrown up out of the crater into

250
00:10:01,030 --> 00:09:59,120
sunlight

251
00:10:02,630 --> 00:10:01,040
and that's what we want to do is get

252
00:10:04,310 --> 00:10:02,640
dirt into sunlight so that was one of

253
00:10:06,230 --> 00:10:04,320
the principal

254
00:10:08,230 --> 00:10:06,240
aspects that we looked at in terms of

255
00:10:09,430 --> 00:10:08,240
selecting a crater

256
00:10:11,190 --> 00:10:09,440
this also affects the earth

257
00:10:12,630 --> 00:10:11,200
observability how observable is the

258
00:10:14,230 --> 00:10:12,640
ejecta and the impact from earth and

259
00:10:15,430 --> 00:10:14,240
i'll comment on that a little bit more

260
00:10:17,829 --> 00:10:15,440
later

261
00:10:19,750 --> 00:10:17,839
also from this topography like this and

262
00:10:21,590 --> 00:10:19,760
topography that we got from the selene

263
00:10:24,310 --> 00:10:21,600

mission and from lro

264
00:10:27,590 --> 00:10:24,320
is slopes and roughness we want to hit a

265
00:10:29,750 --> 00:10:27,600
nice flat fluffy place the more flat the

266
00:10:32,230 --> 00:10:29,760
fluffier it is the more material gets

267
00:10:34,150 --> 00:10:32,240
thrown up in a very predictable way if

268
00:10:36,550 --> 00:10:34,160
we hit on angles and slopes or

269
00:10:38,870 --> 00:10:36,560
blockiness that affects the ejecta and

270
00:10:40,630 --> 00:10:38,880
how it how it flies upward in

271
00:10:42,870 --> 00:10:40,640
unpredictable ways so we wanted to avoid

272
00:10:46,550 --> 00:10:42,880
that what you see here in this graphic

273
00:10:49,030 --> 00:10:46,560
are slopes derived from that altimetry

274
00:10:50,870 --> 00:10:49,040
that that topography image you just saw

275
00:10:52,870 --> 00:10:50,880
blues are low slopes these are slopes

276
00:10:54,949 --> 00:10:52,880
about just a few degrees less than five

277
00:10:57,590 --> 00:10:54,959
degrees whereas the yellows and the

278
00:10:59,670 --> 00:10:57,600
blues are slopes as much as 20 or 30

279
00:11:00,630 --> 00:10:59,680
degrees we want to avoid those steep

280
00:11:02,389 --> 00:11:00,640
slopes

281
00:11:05,509 --> 00:11:02,399
luckily and most the craters we looked

282
00:11:07,990 --> 00:11:05,519
at we considered they had large flat

283
00:11:10,630 --> 00:11:08,000
even floors and the data we've looked at

284
00:11:12,710 --> 00:11:10,640
even at scales as small as 40 to 50

285
00:11:15,190 --> 00:11:12,720
meters we've been able to find areas

286
00:11:17,590 --> 00:11:15,200
that are relatively smooth boulder free

287
00:11:20,630 --> 00:11:17,600
and flat we're using image data from the

288
00:11:23,190 --> 00:11:20,640

terrain camera on saline and from lro to

289
00:11:24,949 --> 00:11:23,200
actually see down into these craters

290
00:11:27,110 --> 00:11:24,959
using just scattered light just earth

291
00:11:28,710 --> 00:11:27,120
shine light and be able to pick out

292
00:11:31,269 --> 00:11:28,720
individual boulders that we want to

293
00:11:32,949 --> 00:11:31,279
avoid so the process is ongoing but

294
00:11:35,670 --> 00:11:32,959
we've been able to find very good

295
00:11:38,790 --> 00:11:35,680
candidate target locations

296
00:11:41,990 --> 00:11:38,800
uh specifically to this crater kibayase

297
00:11:44,790 --> 00:11:42,000
the conditions look very ideal

298
00:11:47,030 --> 00:11:44,800
the one of the more important criteria

299
00:11:49,269 --> 00:11:47,040
of course is its association potential

300
00:11:51,430 --> 00:11:49,279
association with water ice we don't want

301
00:11:53,190 --> 00:11:51,440
to go someplace dry even if it throws up

302
00:11:56,230 --> 00:11:53,200
a lot of material

303
00:11:58,150 --> 00:11:56,240
so how do we know if a place is wet or

304
00:11:59,829 --> 00:11:58,160
dry the data that we have the most

305
00:12:02,389 --> 00:11:59,839
reliable data is

306
00:12:03,509 --> 00:12:02,399
neutron data neutrons are emitted from

307
00:12:05,509 --> 00:12:03,519
the moon

308
00:12:06,949 --> 00:12:05,519
by observing how many neutrons come up

309
00:12:09,430 --> 00:12:06,959
from different places on the moon you

310
00:12:10,949 --> 00:12:09,440
can determine if there's hydrogen there

311
00:12:13,190 --> 00:12:10,959
and this is really one of the first

312
00:12:16,389 --> 00:12:13,200
clues from luna prospector over 11 years

313
00:12:18,710 --> 00:12:16,399

ago now that that there was potentially

314
00:12:20,710 --> 00:12:18,720
water at the poles of the moon

315
00:12:22,470 --> 00:12:20,720
there are there have been detected

316
00:12:23,910 --> 00:12:22,480
hydrogen concentrations at the poles of

317
00:12:25,670 --> 00:12:23,920
the moon and that's really what we're

318
00:12:27,910 --> 00:12:25,680
using as a guide

319
00:12:30,710 --> 00:12:27,920
to selecting crater as well

320
00:12:33,030 --> 00:12:30,720
lunar prospector's observing footprint

321
00:12:36,230 --> 00:12:33,040
the the resolution of the data it took

322
00:12:38,150 --> 00:12:36,240
was very coarse 40 to 70 kilometers the

323
00:12:40,389 --> 00:12:38,160
lro instrument has much higher

324
00:12:42,310 --> 00:12:40,399
resolution it has 10 kilometer

325
00:12:44,710 --> 00:12:42,320
resolution that crater i showed you was

326
00:12:46,389 --> 00:12:44,720
about 40 kilometers across it's about 60

327
00:12:48,870 --> 00:12:46,399
miles or so

328
00:12:49,990 --> 00:12:48,880
the footprint that lro

329
00:12:52,389 --> 00:12:50,000
can see

330
00:12:54,069 --> 00:12:52,399
measure neutrons is about a third of the

331
00:12:56,150 --> 00:12:54,079
size of that crater or a little bit less

332
00:12:58,870 --> 00:12:56,160
so we can actually tell where in that

333
00:12:59,910 --> 00:12:58,880
crater the hydrogen is is piled up so to

334
00:13:02,870 --> 00:12:59,920
speak

335
00:13:05,030 --> 00:13:02,880
we can also use analysis uh

336
00:13:06,949 --> 00:13:05,040
from and look at older data sets from

337
00:13:08,710 --> 00:13:06,959
lunar prospector to really understand

338
00:13:10,150 --> 00:13:08,720

where the hydrogen is

339
00:13:12,069 --> 00:13:10,160
assuming certain things about his

340
00:13:14,230 --> 00:13:12,079
potential distribution

341
00:13:15,750 --> 00:13:14,240
this graphic here shows

342
00:13:18,230 --> 00:13:15,760
some analysis that has been done by

343
00:13:19,350 --> 00:13:18,240
colleagues on our on our science team on

344
00:13:21,509 --> 00:13:19,360
outcross

345
00:13:23,350 --> 00:13:21,519
showing the potential water ice

346
00:13:24,710 --> 00:13:23,360
concentration in the craters that i've

347
00:13:25,509 --> 00:13:24,720
just discussed

348
00:13:29,590 --> 00:13:25,519
the

349
00:13:31,990 --> 00:13:29,600
concentration potential concentration of

350
00:13:33,590 --> 00:13:32,000
water blue being about two percent water

351
00:13:35,269 --> 00:13:33,600
that's a significant amount of water

352
00:13:38,069 --> 00:13:35,279
actually for the moon

353
00:13:39,670 --> 00:13:38,079
uh the the gray area is the topography

354
00:13:41,110 --> 00:13:39,680
of the moon and you can see cabela's say

355
00:13:42,629 --> 00:13:41,120
our target area

356
00:13:44,949 --> 00:13:42,639
circled there and we can actually zoom

357
00:13:45,750 --> 00:13:44,959
in on that a little bit and you can see

358
00:13:51,590 --> 00:13:45,760
that

359
00:13:53,509 --> 00:13:51,600
what we're really looking at and

360
00:13:55,189 --> 00:13:53,519
considering right now is what i call our

361
00:13:57,910 --> 00:13:55,199
sweet spot that's really where we think

362
00:13:59,670 --> 00:13:57,920
we need to go you can see this analysis

363
00:14:02,150 --> 00:13:59,680

suggests there's quite a bit of water in

364
00:14:04,949 --> 00:14:02,160
there it is consistent with observations

365
00:14:07,110 --> 00:14:04,959
from lunar prospector from lro the

366
00:14:08,870 --> 00:14:07,120
neutron measurements from lro all

367
00:14:11,269 --> 00:14:08,880
indicated that there's quite a bit of

368
00:14:12,629 --> 00:14:11,279
hydrogen in this area

369
00:14:14,230 --> 00:14:12,639
l cross wants to understand what that

370
00:14:16,389 --> 00:14:14,240
hydrogen is

371
00:14:17,509 --> 00:14:16,399
so the last criteria really is observing

372
00:14:18,310 --> 00:14:17,519
from earth

373
00:14:20,550 --> 00:14:18,320
we

374
00:14:22,310 --> 00:14:20,560
wanted to make a very robust observation

375
00:14:23,350 --> 00:14:22,320
campaign and have multiple assets

376
00:14:25,670 --> 00:14:23,360
looking at this you're going to hear

377
00:14:27,990 --> 00:14:25,680
more about this specifically from from

378
00:14:29,910 --> 00:14:28,000
dr hellman in a second

379
00:14:31,030 --> 00:14:29,920
but in terms of selecting a crater we

380
00:14:32,710 --> 00:14:31,040
had to make sure it had good

381
00:14:35,750 --> 00:14:32,720
observability to earth

382
00:14:37,269 --> 00:14:35,760
and so the next movie will show

383
00:14:38,949 --> 00:14:37,279
uh some observations that were made

384
00:14:41,350 --> 00:14:38,959
about a month ago from

385
00:14:43,269 --> 00:14:41,360
one of our collaborators in new mexico

386
00:14:44,790 --> 00:14:43,279
this is from the apache point

387
00:14:47,189 --> 00:14:44,800
observatory

388
00:14:48,629 --> 00:14:47,199

these are colleagues from new mexico and

389
00:14:51,269 --> 00:14:48,639
marshall space flight center made these

390
00:14:53,430 --> 00:14:51,279
observations this is with a camera on a

391
00:14:57,030 --> 00:14:53,440
24-inch telescope and you can see

392
00:14:58,949 --> 00:14:57,040
cabela's there quebec shown circled it

393
00:15:01,110 --> 00:14:58,959
is very observable from earth this is

394
00:15:03,509 --> 00:15:01,120
one again one of the reasons we selected

395
00:15:06,150 --> 00:15:03,519
it is very it gets good illumination and

396
00:15:08,870 --> 00:15:06,160
is very observable uh we'll have lots of

397
00:15:11,350 --> 00:15:08,880
assets looking in this region uh during

398
00:15:14,150 --> 00:15:11,360
the impact so we'll have lots of eyes on

399
00:15:15,990 --> 00:15:14,160
it so with that and to expand on that

400
00:15:17,189 --> 00:15:16,000
i'll hand it over to

401
00:15:18,790 --> 00:15:17,199
jen and she's going to tell you about

402
00:15:20,949 --> 00:15:18,800
the observation campaign

403
00:15:22,550 --> 00:15:20,959
great thanks tony so thank you very much

404
00:15:24,710 --> 00:15:22,560
for the opportunity today to give you a

405
00:15:26,470 --> 00:15:24,720
brief update on the observation campaign

406
00:15:27,990 --> 00:15:26,480
and as tony has mentioned we have a very

407
00:15:30,470 --> 00:15:28,000
robust observing campaign that's

408
00:15:32,629 --> 00:15:30,480
currently underway and the overarching

409
00:15:34,550 --> 00:15:32,639
philosophy is that we would like to have

410
00:15:36,470 --> 00:15:34,560
as many eyes and instruments watching

411
00:15:37,829 --> 00:15:36,480
these impacts as possible because this

412
00:15:40,069 --> 00:15:37,839
is the way that we will get the most

413
00:15:42,629 --> 00:15:40,079

data and the most information from this

414
00:15:44,629 --> 00:15:42,639
unique lunar impactor experiment so to

415
00:15:46,710 --> 00:15:44,639
that end we put together a great team of

416
00:15:49,030 --> 00:15:46,720
astronomers from around the world that

417
00:15:50,949 --> 00:15:49,040
will be using our greatest telescopes

418
00:15:52,550 --> 00:15:50,959
both on the ground and in space and i'll

419
00:15:54,310 --> 00:15:52,560
give you an overview of some of those

420
00:15:55,990 --> 00:15:54,320
and to try and get as much data back as

421
00:15:57,990 --> 00:15:56,000
we possibly can

422
00:16:00,389 --> 00:15:58,000
and our working philosophy within the

423
00:16:02,790 --> 00:16:00,399
observation team is one of

424
00:16:04,310 --> 00:16:02,800
cooperation and collaboration so we have

425
00:16:06,230 --> 00:16:04,320
taken these astronomers and we have

426
00:16:07,749 --> 00:16:06,240
folded them into the l cross science

427
00:16:09,910 --> 00:16:07,759
team and they have become a part of the

428
00:16:11,670 --> 00:16:09,920
l cross project and by doing this as

429
00:16:13,590 --> 00:16:11,680
having them official parts of the actual

430
00:16:15,269 --> 00:16:13,600
project we're able to work closely

431
00:16:16,069 --> 00:16:15,279
together with the astronomers to help

432
00:16:17,670 --> 00:16:16,079
them

433
00:16:19,509 --> 00:16:17,680
in the planning of their observations

434
00:16:22,230 --> 00:16:19,519
and securing observing time on these

435
00:16:23,829 --> 00:16:22,240
large telescopes so we're able to work

436
00:16:25,670 --> 00:16:23,839
together we're working together now in

437
00:16:27,430 --> 00:16:25,680
the pre-planning phase and tony just

438
00:16:29,670 --> 00:16:27,440

showed you one of the maps from new

439
00:16:31,670 --> 00:16:29,680
mexico state and marshall space flight

440
00:16:34,389 --> 00:16:31,680
center where we have mapping so we can

441
00:16:36,550 --> 00:16:34,399
see where the craters will be targeting

442
00:16:39,030 --> 00:16:36,560
pointing information regarding the

443
00:16:40,310 --> 00:16:39,040
impact sites dates times so all of these

444
00:16:41,990 --> 00:16:40,320
details are all being worked very

445
00:16:43,350 --> 00:16:42,000
closely within the team

446
00:16:44,790 --> 00:16:43,360
so i'd like to give you just a brief

447
00:16:46,949 --> 00:16:44,800
overview of some of the observatories

448
00:16:49,590 --> 00:16:46,959
that we'll be watching for lcross so if

449
00:16:50,949 --> 00:16:49,600
we have the first graphic that comes up

450
00:16:52,710 --> 00:16:50,959
here's just a sampling there are six

451
00:16:55,350 --> 00:16:52,720
actually represented here

452
00:16:57,670 --> 00:16:55,360
in hawaii we have the keck the gemini

453
00:16:59,189 --> 00:16:57,680
and the irtf or the infrared telescope

454
00:17:00,629 --> 00:16:59,199
facility that will be observing the l

455
00:17:03,030 --> 00:17:00,639
cross impacts

456
00:17:05,750 --> 00:17:03,040
in new mexico we have the apache point

457
00:17:08,230 --> 00:17:05,760
observatory and also mro which is the

458
00:17:10,470 --> 00:17:08,240
magdalena ridge observatory and out in

459
00:17:12,230 --> 00:17:10,480
arizona we have the mmt observatory and

460
00:17:14,949 --> 00:17:12,240
these are all very large professional

461
00:17:17,350 --> 00:17:14,959
scale telescopes we'll be observing

462
00:17:19,510 --> 00:17:17,360
if we go to the next graphic

463
00:17:21,350 --> 00:17:19,520

you see here are some locations of some

464
00:17:23,429 --> 00:17:21,360
of the other additional observatories we

465
00:17:24,710 --> 00:17:23,439
have more but the point is that you

466
00:17:26,710 --> 00:17:24,720
notice that they're clustered in the

467
00:17:29,029 --> 00:17:26,720
western united states and then out to

468
00:17:30,870 --> 00:17:29,039
hawaii and there is a strategic reason

469
00:17:32,870 --> 00:17:30,880
for this and that's because these are

470
00:17:34,470 --> 00:17:32,880
the locations on the earth where l cross

471
00:17:36,070 --> 00:17:34,480
will be observable during the time of

472
00:17:37,909 --> 00:17:36,080
impact so

473
00:17:39,430 --> 00:17:37,919
for these astronomy observations you

474
00:17:41,990 --> 00:17:39,440
have to be in the night time so it has

475
00:17:43,510 --> 00:17:42,000
to be dark out and so on the eastern

476
00:17:46,310 --> 00:17:43,520
coast on the east coast of the united

477
00:17:47,990 --> 00:17:46,320
states it'll be 7 30 a.m on october 9th

478
00:17:49,990 --> 00:17:48,000
when we impact so the east coast will

479
00:17:52,150 --> 00:17:50,000
have just seen daybreak so you need to

480
00:17:54,310 --> 00:17:52,160
be from essentially the mississippi and

481
00:17:56,950 --> 00:17:54,320
westward still being in night time so

482
00:17:59,270 --> 00:17:56,960
it'll be 4 30 a.m pacific time here in

483
00:18:00,710 --> 00:17:59,280
california so still well in darkness the

484
00:18:02,789 --> 00:18:00,720
moon will be up and so these are the

485
00:18:04,789 --> 00:18:02,799
prime locations on earth where the

486
00:18:07,029 --> 00:18:04,799
observations of the actual impact event

487
00:18:09,029 --> 00:18:07,039
itself can take place

488
00:18:10,549 --> 00:18:09,039

if we go to the next slide

489
00:18:12,630 --> 00:18:10,559
there are in addition to the

490
00:18:14,789 --> 00:18:12,640
observatories we have on the ground we

491
00:18:16,070 --> 00:18:14,799
also have several space-based assets so

492
00:18:17,669 --> 00:18:16,080
we'll be observing

493
00:18:19,510 --> 00:18:17,679
in earth orbit we have the newly

494
00:18:21,909 --> 00:18:19,520
refurbished hubble space telescope we'll

495
00:18:23,590 --> 00:18:21,919
be observing the l cross impacts we also

496
00:18:25,110 --> 00:18:23,600
have odin which is a swedish radio

497
00:18:26,470 --> 00:18:25,120
telescope which is trained for looking

498
00:18:29,029 --> 00:18:26,480
for water vapor so they will be

499
00:18:31,190 --> 00:18:29,039
observing um goi will be operating their

500
00:18:32,549 --> 00:18:31,200
iconos satellite out of colorado and

501
00:18:33,750 --> 00:18:32,559
they'll be turning towards the moon at

502
00:18:35,510 --> 00:18:33,760
the time of impact to collect

503
00:18:37,350 --> 00:18:35,520
observations and then the earth

504
00:18:38,630 --> 00:18:37,360
observing one satellite will also be

505
00:18:40,150 --> 00:18:38,640
looking at the moon collecting

506
00:18:42,870 --> 00:18:40,160
observations and then sharing those with

507
00:18:44,630 --> 00:18:42,880
the l cross science team in addition to

508
00:18:47,029 --> 00:18:44,640
earth orbit we also have the lunar

509
00:18:49,029 --> 00:18:47,039
reconnaissance orbiter or lro and has

510
00:18:52,150 --> 00:18:49,039
been mentioned already lro is our sister

511
00:18:54,710 --> 00:18:52,160
mission and lro has been helping us

512
00:18:55,430 --> 00:18:54,720
both before during and after the impact

513
00:18:56,870 --> 00:18:55,440

so

514
00:18:58,390 --> 00:18:56,880
pre-impact we've been doing a lot of

515
00:19:00,070 --> 00:18:58,400
site selection work and collecting the

516
00:19:01,909 --> 00:19:00,080
data and analyzing the data in

517
00:19:03,350 --> 00:19:01,919
conjunction with the lro team that tony

518
00:19:05,990 --> 00:19:03,360
has already talked about

519
00:19:08,470 --> 00:19:06,000
lro will be observing during the impact

520
00:19:10,150 --> 00:19:08,480
event itself and then lro will still be

521
00:19:12,150 --> 00:19:10,160
in lunar orbit so they will be doing

522
00:19:14,230 --> 00:19:12,160
post impact characterizations and

523
00:19:17,190 --> 00:19:14,240
following up taking observations of the

524
00:19:18,789 --> 00:19:17,200
impact site after the impact event

525
00:19:20,310 --> 00:19:18,799
so in addition

526
00:19:22,070 --> 00:19:20,320
to the space based and the ground-based

527
00:19:23,430 --> 00:19:22,080
professional assets i'd also like to

528
00:19:25,750 --> 00:19:23,440
mention that we are mounting a very

529
00:19:27,590 --> 00:19:25,760
large amateur astronomer campaign we

530
00:19:29,830 --> 00:19:27,600
expect that the l cross impacts will be

531
00:19:31,750 --> 00:19:29,840
observable in 10 to 12 inch telescopes

532
00:19:34,150 --> 00:19:31,760
and so we are actively soliciting

533
00:19:35,750 --> 00:19:34,160
observations from the amateur community

534
00:19:38,870 --> 00:19:35,760
and encouraging folks to go out in their

535
00:19:41,110 --> 00:19:38,880
backyards planetariums science centers

536
00:19:43,750 --> 00:19:41,120
collect observations of the impact and

537
00:19:45,430 --> 00:19:43,760
then send those into nasa and we are

538
00:19:47,270 --> 00:19:45,440

imminently launching what we call a

539
00:19:49,270 --> 00:19:47,280
citizen science website where we will be

540
00:19:51,110 --> 00:19:49,280
collecting observations where people

541
00:19:52,950 --> 00:19:51,120
amateur astronomers can go out collect

542
00:19:54,390 --> 00:19:52,960
their observations of the impacts and

543
00:19:57,110 --> 00:19:54,400
send them into nasa which we will

544
00:19:58,710 --> 00:19:57,120
actually use within the science team so

545
00:20:00,789 --> 00:19:58,720
we think that we have a very strong

546
00:20:02,789 --> 00:20:00,799
robust object observing campaign that's

547
00:20:04,870 --> 00:20:02,799
underway uh we're currently doing work

548
00:20:06,390 --> 00:20:04,880
now and it's timely having this press

549
00:20:09,029 --> 00:20:06,400
conference now because

550
00:20:11,029 --> 00:20:09,039
we are about at the same phase the moon

551
00:20:13,029 --> 00:20:11,039
is at the same phase now as it will be

552
00:20:14,470 --> 00:20:13,039
at impact and so this is when the moon

553
00:20:16,710 --> 00:20:14,480
looks most similar to what it will look

554
00:20:17,990 --> 00:20:16,720
like on impact night so we have several

555
00:20:19,669 --> 00:20:18,000
teams that are out collecting

556
00:20:21,350 --> 00:20:19,679
pre-observations and practicing their

557
00:20:22,789 --> 00:20:21,360
pointing techniques and so we're getting

558
00:20:24,149 --> 00:20:22,799
a good sense of what we'll be able to

559
00:20:25,110 --> 00:20:24,159
observe and now we have the target

560
00:20:27,110 --> 00:20:25,120
crater

561
00:20:29,590 --> 00:20:27,120
so with that dan

562
00:20:31,270 --> 00:20:29,600
thank you jen and thank you tony um so

563
00:20:32,870 --> 00:20:31,280

we've got a we've got an exciting

564
00:20:36,310 --> 00:20:32,880
mission here um

565
00:20:37,669 --> 00:20:36,320
we uh this will not only uh service the

566
00:20:40,310 --> 00:20:37,679
scientific need that we're trying to

567
00:20:42,789 --> 00:20:40,320
figure out which is the presence of of

568
00:20:44,549 --> 00:20:42,799
water on the moon is it there

569
00:20:47,190 --> 00:20:44,559
but you can see there's a lot of

570
00:20:49,590 --> 00:20:47,200
good public engagement on this

571
00:20:52,470 --> 00:20:49,600
i know my kids and everyone else's kids

572
00:20:55,029 --> 00:20:52,480
on the team and around the

573
00:20:56,549 --> 00:20:55,039
viewable public are going to be having

574
00:20:58,149 --> 00:20:56,559
viewing mornings we're going to have

575
00:21:00,310 --> 00:20:58,159
that throughout nasa it's going to be

576
00:21:02,950 --> 00:21:00,320
very exciting

577
00:21:05,669 --> 00:21:02,960
so as a quick summary we've got about 70

578
00:21:07,270 --> 00:21:05,679
days behind us about 30 days in front of

579
00:21:08,789 --> 00:21:07,280
us roughly

580
00:21:11,110 --> 00:21:08,799
before impact

581
00:21:13,270 --> 00:21:11,120
and uh um

582
00:21:15,110 --> 00:21:13,280
stay close watch us on the web watch us

583
00:21:16,070 --> 00:21:15,120
through your own telescopes

584
00:21:20,950 --> 00:21:16,080
and

585
00:21:23,669 --> 00:21:20,960
okay thank you very much team

586
00:21:26,470 --> 00:21:23,679
and so um what we'll do now is we'll be

587
00:21:28,950 --> 00:21:26,480
taking questions locally first and then

588
00:21:32,390 --> 00:21:28,960

we'll take uh remote questions over the

589
00:21:34,710 --> 00:21:32,400
phone we have two mics on the floor uh

590
00:21:36,789 --> 00:21:34,720
my colleagues sheila and mike

591
00:21:39,350 --> 00:21:36,799
if you have a question please flag them

592
00:21:40,149 --> 00:21:39,360
down and they will bring the mic over to

593
00:21:48,710 --> 00:21:40,159
you

594
00:21:51,029 --> 00:21:48,720
okay with that let's we'll take first

595
00:21:56,950 --> 00:21:51,039
questions

596
00:21:59,909 --> 00:21:58,789
i'm dave perlman from the san francisco

597
00:22:01,350 --> 00:21:59,919
chronicle

598
00:22:03,510 --> 00:22:01,360
uh

599
00:22:05,110 --> 00:22:03,520
talk a little bit about the degree of

600
00:22:08,870 --> 00:22:05,120
resolution

601
00:22:11,029 --> 00:22:08,880
uh that l cross has an lro have

602
00:22:14,549 --> 00:22:11,039
as to uh

603
00:22:18,070 --> 00:22:14,559
so you can precisely and how precisely

604
00:22:19,590 --> 00:22:18,080
you can pick out the the final target

605
00:22:20,950 --> 00:22:19,600
sure um

606
00:22:22,789 --> 00:22:20,960
it's

607
00:22:24,470 --> 00:22:22,799
the resolution so there's a few

608
00:22:26,549 --> 00:22:24,480
resolutions there's a resolution of our

609
00:22:28,390 --> 00:22:26,559
understanding where we should go that

610
00:22:29,990 --> 00:22:28,400
has increased dramatically over the last

611
00:22:31,750 --> 00:22:30,000
uh year

612
00:22:34,630 --> 00:22:31,760
in terms of actually understanding where

613
00:22:37,590 --> 00:22:34,640

the hydrogen hydrogen is we won't know

614
00:22:39,669 --> 00:22:37,600
that to better than 10 kilometers

615
00:22:40,630 --> 00:22:39,679
that is the best resolution we can hope

616
00:22:44,070 --> 00:22:40,640
for

617
00:22:46,230 --> 00:22:44,080
now there is a radar on lro called mini

618
00:22:49,190 --> 00:22:46,240
rf and it can

619
00:22:50,149 --> 00:22:49,200
detect high concentrations of water down

620
00:22:51,750 --> 00:22:50,159
to

621
00:22:53,110 --> 00:22:51,760
less than

622
00:22:55,350 --> 00:22:53,120
100 meters

623
00:22:57,669 --> 00:22:55,360
so it has the potential of detecting

624
00:22:59,430 --> 00:22:57,679
pockets small pockets of water and we

625
00:23:02,789 --> 00:22:59,440
are certainly looking at that data with

626
00:23:04,630 --> 00:23:02,799
respect to these target sites

627
00:23:06,870 --> 00:23:04,640
what we can actually achieve from a

628
00:23:09,990 --> 00:23:06,880
capability standpoint

629
00:23:12,390 --> 00:23:10,000
is uh our science team

630
00:23:15,110 --> 00:23:12,400
is using approximately a three kilometer

631
00:23:17,270 --> 00:23:15,120
circle meaning we are very confident

632
00:23:19,750 --> 00:23:17,280
very certain we can target within a

633
00:23:21,430 --> 00:23:19,760
three kilometer circle anywhere on any

634
00:23:23,510 --> 00:23:21,440
of these targets

635
00:23:26,549 --> 00:23:23,520
our most recent performance looks like

636
00:23:27,270 --> 00:23:26,559
it's going to be much better than that

637
00:23:28,870 --> 00:23:27,280
but

638
00:23:31,270 --> 00:23:28,880

we have not

639
00:23:32,789 --> 00:23:31,280
found any place that we had to have that

640
00:23:35,669 --> 00:23:32,799
kind of performance

641
00:23:38,789 --> 00:23:35,679
meaning we can identify places that are

642
00:23:41,350 --> 00:23:38,799
smooth flat and associated with hydrogen

643
00:23:44,070 --> 00:23:41,360
at scales of three kilometers so we're

644
00:23:45,669 --> 00:23:44,080
very confident we'll hit a good place

645
00:23:47,750 --> 00:23:45,679
whether or not the hydrogen is

646
00:23:49,990 --> 00:23:47,760
distributed at very small scales that's

647
00:23:51,510 --> 00:23:50,000
a question l crosses out to answer so

648
00:23:53,430 --> 00:23:51,520
this is really what we're going to find

649
00:23:56,230 --> 00:23:53,440
out we'll never be able to detect with

650
00:23:57,990 --> 00:23:56,240
any technique right now in orbit

651
00:23:59,430 --> 00:23:58,000
exactly what the smallest scale

652
00:24:00,950 --> 00:23:59,440
distribution is

653
00:24:02,950 --> 00:24:00,960
l cross is the first mission that will

654
00:24:05,510 --> 00:24:02,960
be able to give us any kind of clue as

655
00:24:09,029 --> 00:24:05,520
to if it's distributed broadly or if

656
00:24:11,909 --> 00:24:09,039
it's distributed in small pockets

657
00:24:15,110 --> 00:24:11,919
and as i mentioned between now and up

658
00:24:18,390 --> 00:24:15,120
until october 6 even the day of impact

659
00:24:19,190 --> 00:24:18,400
will be trimming our trajectory just

660
00:24:23,830 --> 00:24:19,200
right

661
00:24:26,149 --> 00:24:23,840
and we'll know the impact time to a

662
00:24:27,190 --> 00:24:26,159
second

663
00:24:28,310 --> 00:24:27,200

okay

664
00:24:31,510 --> 00:24:28,320
next question

665
00:24:33,990 --> 00:24:31,520
hi matt bigler kcbs san francisco how

666
00:24:36,149 --> 00:24:34,000
soon after the impact and after you've

667
00:24:37,830 --> 00:24:36,159
observed some of these these shots will

668
00:24:39,669 --> 00:24:37,840
you be able to determine if there's

669
00:24:42,149 --> 00:24:39,679
water there

670
00:24:43,350 --> 00:24:42,159
really depends on how much water it is

671
00:24:44,710 --> 00:24:43,360
we hit

672
00:24:46,630 --> 00:24:44,720
you can imagine if there's a lot of

673
00:24:48,470 --> 00:24:46,640
water its signal will be very strong in

674
00:24:50,390 --> 00:24:48,480
our our instruments

675
00:24:52,390 --> 00:24:50,400
we essentially the l cross mission is a

676
00:24:54,070 --> 00:24:52,400
unique mission in the sense that

677
00:24:56,549 --> 00:24:54,080
with regards to the instrumentation and

678
00:24:58,789 --> 00:24:56,559
the measurements we never do anything uh

679
00:25:00,390 --> 00:24:58,799
more than a couple times we swung by the

680
00:25:01,990 --> 00:25:00,400
moon we turn on all of our instruments

681
00:25:03,830 --> 00:25:02,000
once that was kind of a preparatory for

682
00:25:05,510 --> 00:25:03,840
impact we've had several earth looks

683
00:25:06,950 --> 00:25:05,520
where we look at the earth and the moon

684
00:25:09,029 --> 00:25:06,960
and we practice and calibrate our

685
00:25:12,830 --> 00:25:09,039
instrument techniques so what we've

686
00:25:15,510 --> 00:25:12,840
developed is really a real real-time

687
00:25:17,269 --> 00:25:15,520
processing routine

688
00:25:19,350 --> 00:25:17,279

where as soon as the data comes in we're

689
00:25:21,430 --> 00:25:19,360
able to real time process it and turn it

690
00:25:24,310 --> 00:25:21,440
around very quickly that's kind of been

691
00:25:26,789 --> 00:25:24,320
a requirement in our mission

692
00:25:28,950 --> 00:25:26,799
we will be able to look at this data

693
00:25:31,909 --> 00:25:28,960
immediately afterwards and comment on

694
00:25:34,470 --> 00:25:31,919
how successful the experiment was in

695
00:25:36,630 --> 00:25:34,480
terms of did we get a good ejecta cloud

696
00:25:38,630 --> 00:25:36,640
did we get the kind of signal we need to

697
00:25:39,990 --> 00:25:38,640
answer the questions and that's exactly

698
00:25:42,630 --> 00:25:40,000
what we're also going to get from all

699
00:25:46,470 --> 00:25:42,640
the of the various observatories

700
00:25:48,710 --> 00:25:46,480
i suspect we're going to want consensus

701
00:25:50,149 --> 00:25:48,720
between several of the co-investigators

702
00:25:51,990 --> 00:25:50,159
before we make any kind of statement

703
00:25:53,350 --> 00:25:52,000
with regards to water it is a

704
00:25:55,990 --> 00:25:53,360
fundamental

705
00:25:57,669 --> 00:25:56,000
question and we want to be very careful

706
00:26:00,470 --> 00:25:57,679
and certain about our

707
00:26:03,350 --> 00:26:00,480
you know our declaration depending on on

708
00:26:05,669 --> 00:26:03,360
the outcome so very quickly we'll know

709
00:26:07,029 --> 00:26:05,679
if the experiment was a success within

710
00:26:09,350 --> 00:26:07,039
an hour

711
00:26:11,510 --> 00:26:09,360
um really real time people will be able

712
00:26:13,669 --> 00:26:11,520
to participate watch the impact watch

713
00:26:15,029 --> 00:26:13,679

our video we're streaming the spacecraft

714
00:26:15,830 --> 00:26:15,039
video live

715
00:26:17,990 --> 00:26:15,840
so

716
00:26:19,990 --> 00:26:18,000
everyone can actually see it as we see

717
00:26:22,870 --> 00:26:20,000
it and so i think we'll all know how

718
00:26:25,510 --> 00:26:22,880
successful the ejecta curtain was in

719
00:26:27,269 --> 00:26:25,520
informing but then we will comment the

720
00:26:30,149 --> 00:26:27,279
plan is a couple hours after impact

721
00:26:32,390 --> 00:26:30,159
comment comment on exactly what we saw

722
00:26:34,470 --> 00:26:32,400
and uh from there on out uh

723
00:26:36,310 --> 00:26:34,480
we have a requirement to report to nasa

724
00:26:38,710 --> 00:26:36,320
within three months

725
00:26:41,750 --> 00:26:38,720
of regarding the presence of water at

726
00:26:44,789 --> 00:26:42,710
okay

727
00:26:48,310 --> 00:26:44,799
you have any other questions here in the

728
00:26:48,320 --> 00:27:00,710
okay we have one over there

729
00:27:04,950 --> 00:27:02,070
japan

730
00:27:09,029 --> 00:27:04,960
you had a very pro program

731
00:27:12,950 --> 00:27:09,039
earlier does it effect sending a rocket

732
00:27:17,110 --> 00:27:14,789
aggregately

733
00:27:20,549 --> 00:27:17,120
i believe you're speaking about the the

734
00:27:22,230 --> 00:27:20,559
anomaly we had a few weeks ago dan can

735
00:27:23,750 --> 00:27:22,240
comment on that and then i think you

736
00:27:26,789 --> 00:27:23,760
could probably comment on that effect

737
00:27:29,590 --> 00:27:26,799
accuracy too yeah so um

738
00:27:31,110 --> 00:27:29,600

a couple couple weeks ago thereabouts

739
00:27:32,549 --> 00:27:31,120
we had a

740
00:27:34,310 --> 00:27:32,559
fault condition

741
00:27:36,389 --> 00:27:34,320
that was noticed while we were out of

742
00:27:39,669 --> 00:27:36,399
view now i should back up and point out

743
00:27:43,909 --> 00:27:39,679
that l cross is not in continuous view

744
00:27:46,230 --> 00:27:43,919
of earth assets uh that was by design um

745
00:27:48,470 --> 00:27:46,240
we have a shifting that goes on and we

746
00:27:52,310 --> 00:27:48,480
look at the spacecraft on a certain

747
00:27:54,710 --> 00:27:52,320
periodicity as part of our normal plant

748
00:27:56,549 --> 00:27:54,720
during one of those times when we were

749
00:27:59,430 --> 00:27:56,559
not viewing and in fact were out of view

750
00:28:02,070 --> 00:27:59,440
we were in the southern hemispheric area

751
00:28:03,909 --> 00:28:02,080
of the of the orbit so we were out of

752
00:28:06,950 --> 00:28:03,919
view of any assets

753
00:28:09,669 --> 00:28:06,960
an anomaly on one of the

754
00:28:11,990 --> 00:28:09,679
avionics elements

755
00:28:14,789 --> 00:28:12,000
caused us to switch modes into a pretty

756
00:28:17,430 --> 00:28:14,799
costly propellant consuming mode meaning

757
00:28:20,470 --> 00:28:17,440
we are using a lot of gas if you will

758
00:28:22,549 --> 00:28:20,480
and uh when we came back into view that

759
00:28:24,549 --> 00:28:22,559
was immediately apparent

760
00:28:26,389 --> 00:28:24,559
and we were able to confirm it two or

761
00:28:27,510 --> 00:28:26,399
three different ways within a minute or

762
00:28:30,710 --> 00:28:27,520
two

763
00:28:33,350 --> 00:28:30,720

so we immediately uh

764
00:28:35,350 --> 00:28:33,360
took an evasive maneuver if you will and

765
00:28:36,710 --> 00:28:35,360
uh resolve the problem stop the

766
00:28:37,669 --> 00:28:36,720
propellant burn

767
00:28:39,669 --> 00:28:37,679
so we

768
00:28:41,590 --> 00:28:39,679
we took care of of the situation and

769
00:28:42,950 --> 00:28:41,600
then we had to figure out okay so what

770
00:28:46,070 --> 00:28:42,960
are we going to do through the rest of

771
00:28:49,830 --> 00:28:46,080
the mission and so for the past two and

772
00:28:52,389 --> 00:28:49,840
a half three weeks we've been slowly

773
00:28:55,029 --> 00:28:52,399
carefully adding additional controls in

774
00:28:57,510 --> 00:28:55,039
place on the spacecraft to make sure

775
00:29:00,070 --> 00:28:57,520
that this doesn't happen again

776
00:29:03,590 --> 00:29:00,080
we've actually retuned the control

777
00:29:05,750 --> 00:29:03,600
system because we had a relatively large

778
00:29:07,990 --> 00:29:05,760
propellant margin we were carrying a lot

779
00:29:11,029 --> 00:29:08,000
of extra and now we're not carrying a

780
00:29:13,590 --> 00:29:11,039
lot of extra we still have enough to

781
00:29:16,149 --> 00:29:13,600
finish the mission with positive margin

782
00:29:19,269 --> 00:29:16,159
but now fuel efficiency is incredibly

783
00:29:21,909 --> 00:29:19,279
important and so we have

784
00:29:24,710 --> 00:29:21,919
basically redesigned the

785
00:29:28,470 --> 00:29:24,720
control system tuning to really sip on

786
00:29:30,070 --> 00:29:28,480
fuel to barely use any fuel and have

787
00:29:32,230 --> 00:29:30,080
propagated that forward through the

788
00:29:34,070 --> 00:29:32,240

completion of the mission and so as i

789
00:29:35,590 --> 00:29:34,080
said in the beginning with that

790
00:29:37,750 --> 00:29:35,600
propagation forward and with our

791
00:29:39,510 --> 00:29:37,760
controls that we have in place

792
00:29:41,990 --> 00:29:39,520
we believe that we can finish all of the

793
00:29:43,909 --> 00:29:42,000
mission objectives that we set out to

794
00:29:45,590 --> 00:29:43,919
we've just had to re-tune things to make

795
00:29:47,830 --> 00:29:45,600
sure that that's the case

796
00:29:49,750 --> 00:29:47,840
with respect to our targeting accuracy

797
00:29:51,990 --> 00:29:49,760
and the trajectories what's interesting

798
00:29:54,870 --> 00:29:52,000
about what happened was the spacecraft

799
00:29:58,389 --> 00:29:54,880
did fine from the standpoint of

800
00:30:00,389 --> 00:29:58,399
navigation and the trajectory we never

801
00:30:02,230 --> 00:30:00,399
went into a tumble we never went out of

802
00:30:04,389 --> 00:30:02,240
control everything was fine we were just

803
00:30:07,269 --> 00:30:04,399
consuming too much propellant through

804
00:30:08,870 --> 00:30:07,279
that period so when we came into view

805
00:30:10,630 --> 00:30:08,880
the spacecraft was pretty much where it

806
00:30:13,029 --> 00:30:10,640
should be

807
00:30:14,630 --> 00:30:13,039
and so there was not a

808
00:30:16,710 --> 00:30:14,640
a consequence if you will to our

809
00:30:18,710 --> 00:30:16,720
targeting accuracy in fact that's

810
00:30:19,990 --> 00:30:18,720
validated by the fact that we had

811
00:30:22,630 --> 00:30:20,000
scheduled

812
00:30:24,549 --> 00:30:22,640
several tcms trajectory control

813
00:30:26,789 --> 00:30:24,559

maneuvers across the whole mission by

814
00:30:29,909 --> 00:30:26,799
design and we've actually been turning

815
00:30:32,070 --> 00:30:29,919
them off not doing them and not as fuel

816
00:30:33,909 --> 00:30:32,080
saving measures because we don't need to

817
00:30:35,350 --> 00:30:33,919
because we're within the air band of

818
00:30:37,430 --> 00:30:35,360
where we needed to be

819
00:30:39,430 --> 00:30:37,440
and so we just are not going to hold a

820
00:30:41,269 --> 00:30:39,440
burn there and i think there's now been

821
00:30:44,310 --> 00:30:41,279
three of them that we've cancelled one

822
00:30:45,909 --> 00:30:44,320
of them being even since the anomaly so

823
00:30:48,149 --> 00:30:45,919
we're doing great on the on the

824
00:30:49,830 --> 00:30:48,159
trajectory the one that was canceled

825
00:30:52,230 --> 00:30:49,840
this last this last one that was

826
00:30:54,470 --> 00:30:52,240
canceled was our scheduled retargeting

827
00:30:56,070 --> 00:30:54,480
burn but we were so close to on target

828
00:30:58,310 --> 00:30:56,080
as it is

829
00:31:01,509 --> 00:30:58,320
we didn't need it it was we launched

830
00:31:03,750 --> 00:31:01,519
targeting cabela's as our prime but knew

831
00:31:07,509 --> 00:31:03,760
we could change up to 30 days prior to

832
00:31:10,310 --> 00:31:07,519
impact so uh yeah as dan said we're

833
00:31:11,430 --> 00:31:10,320
we're right on target

834
00:31:12,950 --> 00:31:11,440
okay

835
00:31:16,389 --> 00:31:12,960
do we have another question here in the

836
00:31:23,909 --> 00:31:20,549
okay um well we have uh some calls uh

837
00:31:26,870 --> 00:31:23,919
some questions from um from on the phone

838
00:31:30,070 --> 00:31:26,880

uh our first one is from irene klotz

839
00:31:32,389 --> 00:31:30,080
from uh discovery news go ahead irene

840
00:31:35,029 --> 00:31:32,399
hi thanks very much it's irene klotz and

841
00:31:36,149 --> 00:31:35,039
um i have a question about the um

842
00:31:38,389 --> 00:31:36,159
overall

843
00:31:39,190 --> 00:31:38,399
chances of mission success i know it's a

844
00:31:41,750 --> 00:31:39,200
very

845
00:31:43,750 --> 00:31:41,760
low cost flight and um

846
00:31:46,789 --> 00:31:43,760
with the added uh

847
00:31:49,830 --> 00:31:46,799
um i guess eating into the your fuel

848
00:31:51,990 --> 00:31:49,840
margins if you have some sort of uh

849
00:31:53,669 --> 00:31:52,000
realistic assessment of your chances

850
00:31:56,149 --> 00:31:53,679
that this is all going to work out the

851
00:31:59,029 --> 00:31:56,159
way you want it to thanks

852
00:32:01,430 --> 00:31:59,039
you bet um so what we did after we had

853
00:32:04,149 --> 00:32:01,440
gotten everything under control and and

854
00:32:05,830 --> 00:32:04,159
uh and and in nominal condition again

855
00:32:07,830 --> 00:32:05,840
was we set out and said all right what

856
00:32:10,070 --> 00:32:07,840
is the uncertainty that we have with how

857
00:32:11,669 --> 00:32:10,080
much propellant we have left right uh

858
00:32:13,590 --> 00:32:11,679
you don't have a float in the tank you

859
00:32:15,590 --> 00:32:13,600
have to figure out how much propellant

860
00:32:17,990 --> 00:32:15,600
is left based on the temperatures and

861
00:32:19,669 --> 00:32:18,000
pressures and so forth of the tank you

862
00:32:21,669 --> 00:32:19,679
even have to take into account how much

863
00:32:23,430 --> 00:32:21,679

propellant's in the lines you know with

864
00:32:26,149 --> 00:32:23,440
your own cars

865
00:32:27,269 --> 00:32:26,159
you can have fuel in the lines but if

866
00:32:29,590 --> 00:32:27,279
you don't have enough pressure to

867
00:32:31,190 --> 00:32:29,600
deliver it you you'll start sputtering

868
00:32:33,029 --> 00:32:31,200
and run out of fuel so we've tried to

869
00:32:34,070 --> 00:32:33,039
take into account all of those little

870
00:32:36,389 --> 00:32:34,080
features

871
00:32:38,789 --> 00:32:36,399
of our spacecraft held a little

872
00:32:41,669 --> 00:32:38,799
independent review and so

873
00:32:43,669 --> 00:32:41,679
we have a uncertainty band on how much

874
00:32:46,149 --> 00:32:43,679
propellant we have left and even if you

875
00:32:48,470 --> 00:32:46,159
were to take the worst case uncertainty

876
00:32:50,789 --> 00:32:48,480
where it's it's absolutely the lowest

877
00:32:52,789 --> 00:32:50,799
possible number we still have positive

878
00:32:54,830 --> 00:32:52,799
margin to finish the mission

879
00:32:57,509 --> 00:32:54,840
as designed so we feel pretty

880
00:32:59,190 --> 00:32:57,519
comfortable that uh we actually have

881
00:33:00,950 --> 00:32:59,200
enough to do it does does that answer

882
00:33:03,269 --> 00:33:00,960
your question

883
00:33:04,149 --> 00:33:03,279
um no actually i was more interested in

884
00:33:05,509 --> 00:33:04,159
um

885
00:33:06,789 --> 00:33:05,519
i mean there's a bunch of other things

886
00:33:09,430 --> 00:33:06,799
that need to happen you need to be able

887
00:33:10,389 --> 00:33:09,440
to separate from the upper stage you

888
00:33:12,789 --> 00:33:10,399

need to

889
00:33:15,110 --> 00:33:12,799
um you know there's just a whole

890
00:33:17,590 --> 00:33:15,120
of course of a sequence of events that

891
00:33:19,509 --> 00:33:17,600
need to go exactly right and

892
00:33:21,590 --> 00:33:19,519
i just wanted to know what you think

893
00:33:22,950 --> 00:33:21,600
your overall chances of mission success

894
00:33:25,669 --> 00:33:22,960
are

895
00:33:27,590 --> 00:33:25,679
so we did factor into uh into our

896
00:33:30,870 --> 00:33:27,600
assessment all those things the breaking

897
00:33:33,590 --> 00:33:30,880
burn uh the remaining trajectory control

898
00:33:35,750 --> 00:33:33,600
maneuvers the tcms as we've referred to

899
00:33:37,509 --> 00:33:35,760
it an earth stare where we're doing

900
00:33:39,190 --> 00:33:37,519
another calibration

901
00:33:41,669 --> 00:33:39,200
all those activities are all laid out in

902
00:33:44,230 --> 00:33:41,679
a timeline and there's a cost a

903
00:33:47,110 --> 00:33:44,240
propellant cost associated with each of

904
00:33:49,430 --> 00:33:47,120
those so those are all factored in

905
00:33:52,070 --> 00:33:49,440
as far as assigning a

906
00:33:54,789 --> 00:33:52,080
a likelihood of success we don't have a

907
00:33:55,750 --> 00:33:54,799
number associated with that we know that

908
00:33:57,590 --> 00:33:55,760
we have

909
00:34:00,070 --> 00:33:57,600
enough margin even under this worst case

910
00:34:02,470 --> 00:34:00,080
scenario that if other things were to go

911
00:34:04,549 --> 00:34:02,480
wrong if one of these maneuvers that we

912
00:34:06,470 --> 00:34:04,559
did were to be more costly and

913
00:34:08,790 --> 00:34:06,480

propellant than we had figured

914
00:34:12,230 --> 00:34:08,800
we have margin to account for that

915
00:34:14,790 --> 00:34:12,240
and so uh i i think uh what we've

916
00:34:17,190 --> 00:34:14,800
basically done is lost the great deal of

917
00:34:19,190 --> 00:34:17,200
excess propellant that we had at time of

918
00:34:21,909 --> 00:34:19,200
launch and now we have enough plus

919
00:34:23,750 --> 00:34:21,919
margin to finish it um i i hope that

920
00:34:24,950 --> 00:34:23,760
answers your question yeah one thing i

921
00:34:27,109 --> 00:34:24,960
could add to that was there were

922
00:34:30,069 --> 00:34:27,119
specific launch dates that

923
00:34:31,589 --> 00:34:30,079
we considered green meaning go with

924
00:34:33,829 --> 00:34:31,599
essentially the same kind of margins we

925
00:34:36,230 --> 00:34:33,839
have now so i don't think we're actually

926
00:34:37,109 --> 00:34:36,240
in any particularly worst case if you

927
00:34:38,950 --> 00:34:37,119
actually

928
00:34:40,230 --> 00:34:38,960
stood back and you know ignored the

929
00:34:43,430 --> 00:34:40,240
anomaly

930
00:34:46,550 --> 00:34:43,440
this is a unique mission in that it was

931
00:34:49,270 --> 00:34:46,560
a class d mission it was inexpensive

932
00:34:51,030 --> 00:34:49,280
done quickly but to this point

933
00:34:53,750 --> 00:34:51,040
things have worked out incredibly well

934
00:34:55,510 --> 00:34:53,760
so i'm very optimistic and

935
00:34:58,630 --> 00:34:55,520
that things will continue to go well

936
00:35:02,069 --> 00:34:58,640
problems always occur but the team is uh

937
00:35:05,430 --> 00:35:02,079
is incredibly sharp experienced and

938
00:35:07,030 --> 00:35:05,440

performing uh incredibly well

939
00:35:10,310 --> 00:35:07,040
the fact that we have

940
00:35:14,790 --> 00:35:10,320
and we added in an earth calibration

941
00:35:16,790 --> 00:35:14,800
uh stair uh on the 18th of uh next week

942
00:35:18,069 --> 00:35:16,800
just kind of shows i think the team's

943
00:35:22,390 --> 00:35:18,079
confidence that things are going

944
00:35:25,349 --> 00:35:24,069
who just spoke

945
00:35:28,470 --> 00:35:25,359
this was tony

946
00:35:32,470 --> 00:35:29,270
okay

947
00:35:35,750 --> 00:35:32,480
um our next question is from ron cohen

948
00:35:38,870 --> 00:35:35,760
of science news magazine uh go ahead ron

949
00:35:40,550 --> 00:35:38,880
yes i wondered um how long the plume

950
00:35:43,270 --> 00:35:40,560
would last

951
00:35:45,750 --> 00:35:43,280
and how long would be visible from

952
00:35:47,510 --> 00:35:45,760
for amateurs and then you know how long

953
00:35:50,150 --> 00:35:47,520
it might be visible for bigger

954
00:35:50,950 --> 00:35:50,160
telescopes

955
00:35:53,430 --> 00:35:50,960
sure

956
00:35:56,390 --> 00:35:53,440
good question it's a relatively short

957
00:35:58,630 --> 00:35:56,400
event it will be visible from our our

958
00:36:01,270 --> 00:35:58,640
vantage point from the get-go the

959
00:36:03,190 --> 00:36:01,280
l-cross spacecraft of course has uh the

960
00:36:04,630 --> 00:36:03,200
unique vantage point of being directly

961
00:36:06,550 --> 00:36:04,640
over the impact

962
00:36:07,990 --> 00:36:06,560
and coming in fast

963
00:36:10,550 --> 00:36:08,000

towards the impact we actually get to

964
00:36:12,550 --> 00:36:10,560
fly through the remnant vapor cloud

965
00:36:13,990 --> 00:36:12,560
imaging the crater the centaur made all

966
00:36:16,150 --> 00:36:14,000
the way down to

967
00:36:18,550 --> 00:36:16,160
we expect just several seconds before we

968
00:36:20,069 --> 00:36:18,560
impact ourselves so we'll just be 25

969
00:36:21,750 --> 00:36:20,079
kilometers or so

970
00:36:24,470 --> 00:36:21,760
just uh you know 40 miles above the

971
00:36:28,150 --> 00:36:24,480
surface before we actually lose calm

972
00:36:31,349 --> 00:36:28,160
from our spacecraft before it impacts

973
00:36:34,310 --> 00:36:31,359
the actual duration of the ejecta cloud

974
00:36:38,470 --> 00:36:34,320
where it is visible by most assets

975
00:36:41,589 --> 00:36:38,480
including ground-based observatories

976
00:36:44,870 --> 00:36:41,599
and amateur observatories is about 90

977
00:36:48,069 --> 00:36:44,880
seconds it'll be its brightest uh and

978
00:36:49,430 --> 00:36:48,079
between the 10 to 60 second time frame

979
00:36:51,750 --> 00:36:49,440
it will be

980
00:36:53,430 --> 00:36:51,760
from the ground from the earth we

981
00:36:55,829 --> 00:36:53,440
anticipate it will be

982
00:36:58,069 --> 00:36:55,839
approximately a magnitude 5

983
00:37:00,310 --> 00:36:58,079
for those astronomers out there

984
00:37:02,710 --> 00:37:00,320
which is quite visible even maybe as

985
00:37:04,950 --> 00:37:02,720
bright as magnitude 4

986
00:37:07,030 --> 00:37:04,960
so it should be

987
00:37:10,230 --> 00:37:07,040
and that that brightness will last about

988
00:37:11,510 --> 00:37:10,240

30 seconds or so before it slowly fades

989
00:37:14,150 --> 00:37:11,520
away

990
00:37:17,349 --> 00:37:14,160
as the ejecta cloud settles back to the

991
00:37:20,950 --> 00:37:19,190
hopefully that answers your question yes

992
00:37:22,470 --> 00:37:20,960
thanks

993
00:37:24,150 --> 00:37:22,480
okay um

994
00:37:27,190 --> 00:37:24,160
we have another question from paul

995
00:37:28,710 --> 00:37:27,200
taylor globe and mail in toronto

996
00:37:29,829 --> 00:37:28,720
uh go ahead paul

997
00:37:31,349 --> 00:37:29,839
hello um

998
00:37:34,550 --> 00:37:31,359
if the craters

999
00:37:35,349 --> 00:37:34,560
that are in the shadow do contain

1000
00:37:37,190 --> 00:37:35,359
water

1001
00:37:39,430 --> 00:37:37,200
might be possibly contained like i'm

1002
00:37:41,589 --> 00:37:39,440
just asking you to basically ballpark

1003
00:37:43,910 --> 00:37:41,599
based on the size of the craters and can

1004
00:37:45,349 --> 00:37:43,920
you give us some kind of uh comparison

1005
00:37:46,950 --> 00:37:45,359
of how much water that might be like

1006
00:37:49,510 --> 00:37:46,960
might be the same amount of water in

1007
00:37:52,310 --> 00:37:49,520
lake erie or lake ontario and i know

1008
00:37:54,069 --> 00:37:52,320
there's just pure speculation but how

1009
00:37:57,270 --> 00:37:54,079
much might you be how might might be

1010
00:37:59,430 --> 00:37:57,280
there in the best case scenario

1011
00:38:00,950 --> 00:37:59,440
i i think i cut most of your question is

1012
00:38:03,430 --> 00:38:00,960
how much water could potentially be in

1013
00:38:05,190 --> 00:38:03,440

this crater where we've selected

1014
00:38:06,390 --> 00:38:05,200
and you know give give some kind of real

1015
00:38:08,950 --> 00:38:06,400
comparison

1016
00:38:10,310 --> 00:38:08,960
i i once did the math with a lot of

1017
00:38:12,470 --> 00:38:10,320
assumptions like you said you have to

1018
00:38:15,589 --> 00:38:12,480
make a few assumptions but if you took

1019
00:38:18,710 --> 00:38:15,599
all the areas that are shadowed on the

1020
00:38:21,670 --> 00:38:18,720
moon and you assume the top uh three

1021
00:38:26,710 --> 00:38:21,680
feet or meter of that material

1022
00:38:28,390 --> 00:38:26,720
contained one percent water ice it is uh

1023
00:38:30,390 --> 00:38:28,400
i worked it out using the great salt

1024
00:38:31,910 --> 00:38:30,400
lake which uh i've had a lot of people

1025
00:38:33,910 --> 00:38:31,920
criticize me because this great salt

1026
00:38:36,069 --> 00:38:33,920
lake changes its level quite often it's

1027
00:38:38,230 --> 00:38:36,079
about three percent or so of the great

1028
00:38:39,190 --> 00:38:38,240
salt lake water

1029
00:38:41,829 --> 00:38:39,200
uh

1030
00:38:43,750 --> 00:38:41,839
as you saw in my presentation we think

1031
00:38:44,710 --> 00:38:43,760
potentially in some of these regions you

1032
00:38:46,550 --> 00:38:44,720
could have

1033
00:38:48,630 --> 00:38:46,560
several percent water

1034
00:38:50,630 --> 00:38:48,640
there are some radar indications that

1035
00:38:52,310 --> 00:38:50,640
may be that in some locations you have

1036
00:38:53,109 --> 00:38:52,320
much more water than that and that's you

1037
00:38:55,589 --> 00:38:53,119
know

1038
00:38:58,069 --> 00:38:55,599

so it could be substantially more you

1039
00:39:01,349 --> 00:38:58,079
are talking lake erie kind of volumes if

1040
00:39:03,589 --> 00:39:01,359
the water actually extends below a meter

1041
00:39:05,750 --> 00:39:03,599
and why i say a meter why i say three

1042
00:39:08,150 --> 00:39:05,760
feet is because the neutron measurements

1043
00:39:10,069 --> 00:39:08,160
only can detect hydrogen

1044
00:39:12,230 --> 00:39:10,079
to that depth they don't know we really

1045
00:39:14,950 --> 00:39:12,240
don't have any idea except through

1046
00:39:16,790 --> 00:39:14,960
theory what could exist below that depth

1047
00:39:19,109 --> 00:39:16,800
there's every reason to believe that if

1048
00:39:21,270 --> 00:39:19,119
there's some hydrogen and water in the

1049
00:39:23,270 --> 00:39:21,280
top meter or so there's probably some

1050
00:39:24,550 --> 00:39:23,280
below that too so that's prob those are

1051
00:39:27,190 --> 00:39:24,560
probably

1052
00:39:28,390 --> 00:39:27,200
lower estimates the new data sets from

1053
00:39:30,630 --> 00:39:28,400
lend

1054
00:39:33,030 --> 00:39:30,640
and from lro in general the instruments

1055
00:39:35,109 --> 00:39:33,040
on lro will will really help us

1056
00:39:36,950 --> 00:39:35,119
understand what the global distribution

1057
00:39:38,470 --> 00:39:36,960
is on the moon

1058
00:39:40,710 --> 00:39:38,480
likewise then

1059
00:39:43,030 --> 00:39:40,720
l cross ground truthset measurement we

1060
00:39:45,109 --> 00:39:43,040
actually go to one of these places lift

1061
00:39:47,670 --> 00:39:45,119
it so we could observe it and so you can

1062
00:39:49,750 --> 00:39:47,680
really say what that means in terms of

1063
00:39:50,710 --> 00:39:49,760

like you said how much water is really

1064
00:39:51,510 --> 00:39:50,720
there

1065
00:39:53,990 --> 00:39:51,520
so

1066
00:39:55,510 --> 00:39:54,000
you know ask us again about 30 days

1067
00:39:58,390 --> 00:39:55,520
after impact and i think we'll have a

1068
00:40:03,030 --> 00:40:00,550
okay

1069
00:40:05,829 --> 00:40:03,040
we don't have any other calls from uh

1070
00:40:07,990 --> 00:40:05,839
remote remote calls so uh i believe we

1071
00:40:10,950 --> 00:40:08,000
have another question here for uh

1072
00:40:14,710 --> 00:40:10,960
mr pearlman

1073
00:40:18,710 --> 00:40:14,720
hi it's dave perlman again uh tony

1074
00:40:23,589 --> 00:40:22,710
the big question i think a big question

1075
00:40:25,430 --> 00:40:23,599
is

1076
00:40:28,069 --> 00:40:25,440
why water

1077
00:40:30,309 --> 00:40:28,079
why do we want water on the moon

1078
00:40:31,829 --> 00:40:30,319
and i'm thinking particularly and this

1079
00:40:33,589 --> 00:40:31,839
may be tough for you

1080
00:40:34,630 --> 00:40:33,599
uh i'm thinking particularly of the

1081
00:40:36,390 --> 00:40:34,640
recent

1082
00:40:40,069 --> 00:40:36,400
panel that

1083
00:40:42,150 --> 00:40:40,079
suggested that maybe we should defer our

1084
00:40:43,750 --> 00:40:42,160
human landings on the moon right well i

1085
00:40:45,829 --> 00:40:43,760
can certainly answer your first question

1086
00:40:47,109 --> 00:40:45,839
i'll probably wave off the second

1087
00:40:50,069 --> 00:40:47,119
question because that's a that's a

1088
00:40:52,870 --> 00:40:50,079

policy question uh beyond uh

1089
00:40:55,030 --> 00:40:52,880
what my my job entails but

1090
00:40:57,990 --> 00:40:55,040
i think the first question will actually

1091
00:40:59,589 --> 00:40:58,000
uh dilute your second question why water

1092
00:41:01,750 --> 00:40:59,599
on the moon first of all we know it's

1093
00:41:04,710 --> 00:41:01,760
hydrogen it could be other compounds it

1094
00:41:07,750 --> 00:41:04,720
could be water it could be methane it

1095
00:41:09,750 --> 00:41:07,760
could be hydrocarbons or organics and so

1096
00:41:11,750 --> 00:41:09,760
actually from a scientific standpoint

1097
00:41:14,390 --> 00:41:11,760
this is incredibly

1098
00:41:16,870 --> 00:41:14,400
important whatever the moon has

1099
00:41:18,470 --> 00:41:16,880
collected over the last three and a half

1100
00:41:21,349 --> 00:41:18,480
billion years

1101
00:41:24,069 --> 00:41:21,359
in terms of water organics materials

1102
00:41:26,390 --> 00:41:24,079
from comets asteroids from the sun

1103
00:41:29,270 --> 00:41:26,400
could be trapped in these pockets on the

1104
00:41:31,349 --> 00:41:29,280
moon uh it's it's a time capsule it's a

1105
00:41:32,710 --> 00:41:31,359
window into the past

1106
00:41:34,470 --> 00:41:32,720
that

1107
00:41:36,069 --> 00:41:34,480
of the past of the entire inner solar

1108
00:41:39,910 --> 00:41:36,079
system of earth

1109
00:41:40,790 --> 00:41:39,920
so i see l cross really an lro combine

1110
00:41:43,510 --> 00:41:40,800
as

1111
00:41:45,510 --> 00:41:43,520
a gateway a pathfinder towards truly

1112
00:41:47,670 --> 00:41:45,520
understanding even the origins of

1113
00:41:49,670 --> 00:41:47,680

volatiles of water in the inner solar

1114
00:41:52,069 --> 00:41:49,680
system the moon is right there it's

1115
00:41:53,750 --> 00:41:52,079
right next to us we can go there

1116
00:41:56,630 --> 00:41:53,760
much more easily than a lot of other

1117
00:41:58,150 --> 00:41:56,640
places and make these studies and so

1118
00:41:59,829 --> 00:41:58,160
that's why it's incredibly important to

1119
00:42:02,069 --> 00:41:59,839
make these studies

1120
00:42:03,030 --> 00:42:02,079
water in terms of exploration is very

1121
00:42:05,430 --> 00:42:03,040
important

1122
00:42:07,829 --> 00:42:05,440
even if we don't go back to the moon

1123
00:42:10,150 --> 00:42:07,839
it is a principal resource throughout

1124
00:42:11,589 --> 00:42:10,160
the solar system on mars for mars

1125
00:42:14,550 --> 00:42:11,599
exploration

1126
00:42:17,349 --> 00:42:14,560
and beyond quite frankly so

1127
00:42:19,430 --> 00:42:17,359
you know the mars the old mars mantra

1128
00:42:21,270 --> 00:42:19,440
was follow the water and really that

1129
00:42:23,589 --> 00:42:21,280
extends in my mind through the entire

1130
00:42:25,510 --> 00:42:23,599
solar system and the entire universe and

1131
00:42:26,230 --> 00:42:25,520
so really lro and l cross are the first

1132
00:42:28,550 --> 00:42:26,240
uh

1133
00:42:31,270 --> 00:42:28,560
first steps and directed focus steps in

1134
00:42:34,470 --> 00:42:31,280
that direction towards the moon

1135
00:42:38,630 --> 00:42:34,480
hopefully that answers your question

1136
00:42:42,829 --> 00:42:41,190
okay seeing no other questions

1137
00:42:46,390 --> 00:42:42,839
this wraps up

1138
00:42:49,030 --> 00:42:46,400

the l cross media briefing

1139
00:42:50,950 --> 00:42:49,040
from nasa ames research center i would

1140
00:42:53,349 --> 00:42:50,960
like to thank our panelists

1141
00:42:55,510 --> 00:42:53,359
and our special guest chip cronkite for

1142
00:42:57,750 --> 00:42:55,520
uh for their time today

1143
00:43:00,470 --> 00:42:57,760
for more in-depth information about the

1144
00:43:03,349 --> 00:43:00,480
l cross mission please visit

1145
00:43:06,390 --> 00:43:03,359
www.nasa.gov

1146
00:43:07,270 --> 00:43:06,400
lcross it's on your screen at the moment

1147
00:43:12,069 --> 00:43:07,280
and