
NASA

1
00:00:17,189 --> 00:00:15,509
good morning and welcome to the nasa

2
00:00:19,429 --> 00:00:17,199
goddard space flight center in greenbelt

3
00:00:21,349 --> 00:00:19,439
maryland my name is nancy neal jones and

4
00:00:22,230 --> 00:00:21,359
i'm with the office of public affairs

5
00:00:23,670 --> 00:00:22,240
we're sitting in the lunar

6
00:00:25,349 --> 00:00:23,680
reconnaissance orbiter mission

7
00:00:27,589 --> 00:00:25,359
operations center in preparation for

8
00:00:29,830 --> 00:00:27,599
lunar orbit insertion the yellow

9
00:00:32,069 --> 00:00:29,840
spacecraft launched on june 18th from

10
00:00:33,590 --> 00:00:32,079
cape canaveral florida and for the past

11
00:00:36,229 --> 00:00:33,600
four and a half days it's been on a

12
00:00:37,910 --> 00:00:36,239
trajectory towards the mill now in just

13
00:00:39,670 --> 00:00:37,920

a few minutes the control engineers

14
00:00:41,270 --> 00:00:39,680
behind me will begin the burn that will

15
00:00:43,590 --> 00:00:41,280
put the spacecraft in position to be

16
00:00:46,470 --> 00:00:43,600
captured by the moon's orbit the insert

17
00:00:49,430 --> 00:00:46,480
we call this lunar orbit insertion now

18
00:00:51,430 --> 00:00:49,440
the insertion burn lasts for roughly 40

19
00:00:53,189 --> 00:00:51,440
minutes

20
00:00:55,510 --> 00:00:53,199
then for the next three days the

21
00:00:57,990 --> 00:00:55,520
engineers may do a series of short orbit

22
00:01:00,630 --> 00:00:58,000
adjust burns each day in order to reach

23
00:01:02,229 --> 00:01:00,640
the desired 30 by 216 kilometer

24
00:01:03,990 --> 00:01:02,239
commissioning orbit

25
00:01:05,509 --> 00:01:04,000
now to learn more about the yellow

26
00:01:13,910 --> 00:01:05,519
remission let's take a look at one of

27
00:01:19,830 --> 00:01:16,149
i think that it's in human nature to

28
00:01:24,070 --> 00:01:21,990
understanding the moon better will help

29
00:01:26,950 --> 00:01:24,080
us to understand our neighbors in the

30
00:01:29,670 --> 00:01:26,960
solar system we're exploring the solar

31
00:01:31,429 --> 00:01:29,680
system here not just the moon

32
00:01:34,469 --> 00:01:31,439
the moon is the natural

33
00:01:43,830 --> 00:01:34,479
next step in in our exploration of our

34
00:01:47,590 --> 00:01:46,069
the lunar reconnaissance orbiter is as

35
00:01:49,910 --> 00:01:47,600
its namesake says a reconnaissance

36
00:01:51,670 --> 00:01:49,920
mission to the moon our job is to take a

37
00:01:53,429 --> 00:01:51,680
suite of very powerful scientific

38
00:01:55,910 --> 00:01:53,439

instruments and make an atlas of the

39
00:01:58,789 --> 00:01:55,920
entire moon in some places in very great

40
00:02:01,429 --> 00:01:58,799
detail topography mountain heights

41
00:02:03,270 --> 00:02:01,439
mineralogy temperatures abundances of

42
00:02:04,550 --> 00:02:03,280
resources including potentially the

43
00:02:05,990 --> 00:02:04,560
intriguing possibility that there's

44
00:02:07,830 --> 00:02:06,000
water at the moon we put all this

45
00:02:09,749 --> 00:02:07,840
together into a data set by flying low

46
00:02:11,510 --> 00:02:09,759
over the moon for a year this is the

47
00:02:13,830 --> 00:02:11,520
data that the people designing the

48
00:02:15,270 --> 00:02:13,840
systems picking the sites need to take

49
00:02:17,510 --> 00:02:15,280
us back to the moon

50
00:02:20,150 --> 00:02:17,520
well we learned much about the moon from

51
00:02:22,390 --> 00:02:20,160
the apollo program but now we want to

52
00:02:23,430 --> 00:02:22,400
return to the moon for a more intensive

53
00:02:25,190 --> 00:02:23,440
study

54
00:02:27,270 --> 00:02:25,200
we want to be able to go back to the

55
00:02:29,910 --> 00:02:27,280
moon so that we can live there for long

56
00:02:31,990 --> 00:02:29,920
periods and work on the moon so we need

57
00:02:34,710 --> 00:02:32,000
a mission that can help us find the best

58
00:02:39,910 --> 00:02:34,720
places to go and determine how to go

59
00:02:43,750 --> 00:02:42,070
we know that you know neil armstrong and

60
00:02:45,910 --> 00:02:43,760
some of the others had a difficult time

61
00:02:47,509 --> 00:02:45,920
finding a safe landing site

62
00:02:49,270 --> 00:02:47,519
they didn't see it until they got there

63
00:02:51,270 --> 00:02:49,280

but now with with our instruments we'll

64
00:02:54,229 --> 00:02:51,280
be able to tell people ahead of time

65
00:02:57,350 --> 00:02:54,239
look don't go there lro will have a

66
00:03:00,390 --> 00:02:57,360
laser system that will give us a high

67
00:03:02,949 --> 00:03:00,400
resolution topographic map of the moon

68
00:03:04,550 --> 00:03:02,959
it also has high resolution cameras that

69
00:03:07,110 --> 00:03:04,560
will identify

70
00:03:09,190 --> 00:03:07,120
objects that are only a foot or two in

71
00:03:11,670 --> 00:03:09,200
size so that we know where there are no

72
00:03:13,750 --> 00:03:11,680
large boulders that could be a risk to

73
00:03:15,430 --> 00:03:13,760
astronauts so our job is to literally

74
00:03:18,149 --> 00:03:15,440
complete the job of mapping the moon do

75
00:03:20,630 --> 00:03:18,159
it at high resolutions and enable enable

76
00:03:22,309 --> 00:03:20,640
the designers of the human systems

77
00:03:24,630 --> 00:03:22,319
the atlas they need to pick the safe

78
00:03:30,229 --> 00:03:24,640
places to go the beneficial places to go

79
00:03:33,990 --> 00:03:31,990
in addition to the safe landing sites

80
00:03:36,229 --> 00:03:34,000
lro is looking for potential resources

81
00:03:38,149 --> 00:03:36,239
and why are we doing that

82
00:03:40,390 --> 00:03:38,159
because it's really hard to carry all

83
00:03:42,949 --> 00:03:40,400
your supplies with you i mean you can do

84
00:03:45,110 --> 00:03:42,959
it but you really spend a lot of

85
00:03:46,789 --> 00:03:45,120
not only fuel but cargo space so it'd be

86
00:03:49,190 --> 00:03:46,799
really nice to go to a place that

87
00:03:51,830 --> 00:03:49,200
already has the resources whether it's

88
00:03:54,470 --> 00:03:51,840

water ice to have water or

89
00:03:56,470 --> 00:03:54,480
potential minerals that we could use as

90
00:03:58,149 --> 00:03:56,480
raw materials to make into things that

91
00:04:00,149 --> 00:03:58,159
we would need

92
00:04:02,149 --> 00:04:00,159
we think the most interesting parts of

93
00:04:04,789 --> 00:04:02,159
the moon may be the polar regions of the

94
00:04:07,589 --> 00:04:04,799
moon uh because there could be resources

95
00:04:10,550 --> 00:04:07,599
there and so we're going to study

96
00:04:12,710 --> 00:04:10,560
intensively the polar regions with lro

97
00:04:14,470 --> 00:04:12,720
from the apollo era we chose to go for

98
00:04:16,150 --> 00:04:14,480
good reasons because it was literally

99
00:04:17,909 --> 00:04:16,160
the easiest to go to the equatorial

100
00:04:20,150 --> 00:04:17,919
regions and stay a very short time it

101
00:04:21,590 --> 00:04:20,160
was very ambitious program but

102
00:04:23,830 --> 00:04:21,600
but when you look at where would you

103
00:04:26,469 --> 00:04:23,840
like to go and and stay for a while on

104
00:04:27,990 --> 00:04:26,479
the moon you begin to realize that

105
00:04:29,270 --> 00:04:28,000
probably the polls are the most

106
00:04:31,270 --> 00:04:29,280
interesting place

107
00:04:33,350 --> 00:04:31,280
access to solar power

108
00:04:35,350 --> 00:04:33,360
continuously that may be the first and

109
00:04:38,310 --> 00:04:35,360
most important reason over you know the

110
00:04:40,150 --> 00:04:38,320
near term and then the possibility of

111
00:04:42,469 --> 00:04:40,160
resources being there

112
00:04:44,230 --> 00:04:42,479
those may take much longer time

113
00:04:46,310 --> 00:04:44,240

before we're able to really exploit

114
00:04:49,270 --> 00:04:46,320
those but the solar power is something

115
00:04:51,990 --> 00:04:49,280
we can exploit right away

116
00:04:53,670 --> 00:04:52,000
uh the second big resource on the moon

117
00:04:55,909 --> 00:04:53,680
may be water ice

118
00:04:58,550 --> 00:04:55,919
there's evidence from earlier missions

119
00:05:00,310 --> 00:04:58,560
that in dark places at the poles

120
00:05:02,550 --> 00:05:00,320
there may be water

121
00:05:04,790 --> 00:05:02,560
at the surface or below the surface in

122
00:05:06,469 --> 00:05:04,800
the form of ice crystals

123
00:05:09,350 --> 00:05:06,479
if it is abundant

124
00:05:11,990 --> 00:05:09,360
astronauts could use this for both

125
00:05:16,950 --> 00:05:12,000
human consumption and as a source of

126
00:05:21,909 --> 00:05:19,590
lro will measure for the first time this

127
00:05:23,830 --> 00:05:21,919
very energetic component of the space

128
00:05:25,670 --> 00:05:23,840
radiation environment

129
00:05:28,790 --> 00:05:25,680
in order to see whether it's going to be

130
00:05:31,110 --> 00:05:28,800
a problem for humans or not it was one

131
00:05:33,350 --> 00:05:31,120
thing to go for a handful of days in

132
00:05:35,270 --> 00:05:33,360
apollo and go when you knew that the sun

133
00:05:36,150 --> 00:05:35,280
was quiet or you hoped the sun stayed

134
00:05:38,230 --> 00:05:36,160
quiet

135
00:05:40,629 --> 00:05:38,240
and and you took the risk you calculated

136
00:05:42,230 --> 00:05:40,639
the the risk of cancer and such and and

137
00:05:43,670 --> 00:05:42,240
you made a short mission you're going to

138
00:05:45,430 --> 00:05:43,680

live there longer you need to you need

139
00:05:47,110 --> 00:05:45,440
to understand it well enough to go

140
00:05:49,110 --> 00:05:47,120
here's what i need to do to protect

141
00:05:53,029 --> 00:05:49,120
myself one of the things that we're

142
00:05:55,590 --> 00:05:53,039
looking for uh in the lro mission is

143
00:05:58,870 --> 00:05:55,600
how the high radiation environment

144
00:06:00,629 --> 00:05:58,880
affects our ability to explore so if we

145
00:06:02,950 --> 00:06:00,639
bring cameras or

146
00:06:05,830 --> 00:06:02,960
communication devices you know how will

147
00:06:07,189 --> 00:06:05,840
they be impacted by the cosmic radiation

148
00:06:08,710 --> 00:06:07,199
we need to

149
00:06:17,270 --> 00:06:08,720
protect our equipment as well as

150
00:06:21,909 --> 00:06:19,749
when we look back on what we did in lro

151
00:06:23,909 --> 00:06:21,919
and we look at what followed i think

152
00:06:26,469 --> 00:06:23,919
we'll see a profound impact we'll see us

153
00:06:29,110 --> 00:06:26,479
as really being you know the small first

154
00:06:31,189 --> 00:06:29,120
step where we have human beings

155
00:06:32,710 --> 00:06:31,199
permanently off this planet beginning to

156
00:06:34,469 --> 00:06:32,720
move out into the solar system starting

157
00:06:36,710 --> 00:06:34,479
with the moon as that pans out i think i

158
00:06:38,790 --> 00:06:36,720
think will be a small piece of of a

159
00:06:40,230 --> 00:06:38,800
profound development that when history

160
00:06:42,150 --> 00:06:40,240
looks back so this time we went back to

161
00:07:00,070 --> 00:06:42,160
the moon this time we

162
00:07:04,309 --> 00:07:02,550
so as you can see lro is pretty critical

163
00:07:06,309 --> 00:07:04,319

to nasa's mission of returning humans to

164
00:07:08,230 --> 00:07:06,319
the moon and sitting with us today we

165
00:07:10,629 --> 00:07:08,240
have kathy petty the deputy project

166
00:07:13,430 --> 00:07:10,639
manager for the lro mission thank you

167
00:07:15,670 --> 00:07:13,440
kathy for sitting with us today

168
00:07:16,950 --> 00:07:15,680
oh you're more than welcome welcome well

169
00:07:19,350 --> 00:07:16,960
kathy um

170
00:07:21,670 --> 00:07:19,360
can you tell us a little bit more about

171
00:07:22,950 --> 00:07:21,680
um the lunar insertion burn that we're

172
00:07:24,550 --> 00:07:22,960
here to witness

173
00:07:26,390 --> 00:07:24,560
okay this is um

174
00:07:28,070 --> 00:07:26,400
lro's most critical

175
00:07:31,749 --> 00:07:28,080
activity that we've been planning for

176
00:07:34,550 --> 00:07:31,759
for um over four years

177
00:07:37,110 --> 00:07:34,560
the lunar orbit insertion burn

178
00:07:40,790 --> 00:07:37,120
is what we use to help change lro's

179
00:07:43,189 --> 00:07:40,800
velocity as lro is right now

180
00:07:45,430 --> 00:07:43,199
falling towards the moon and this burn

181
00:07:48,070 --> 00:07:45,440
will help us change its velocity so that

182
00:07:50,150 --> 00:07:48,080
the moon will be able to capture lro and

183
00:07:52,070 --> 00:07:50,160
once uh the moon captures lro then we'll

184
00:07:53,830 --> 00:07:52,080
be able to lower it into its orbit and

185
00:07:55,990 --> 00:07:53,840
begin our mission well this is a pretty

186
00:07:57,909 --> 00:07:56,000
exciting moment kathy carrie yeah can

187
00:08:00,469 --> 00:07:57,919
you tell the audience a little bit about

188
00:08:02,070 --> 00:08:00,479

your role in the llo mission

189
00:08:05,029 --> 00:08:02,080
well um

190
00:08:07,029 --> 00:08:05,039
i've been very fortunate to be the

191
00:08:08,629 --> 00:08:07,039
the deputy project manager for this

192
00:08:09,589 --> 00:08:08,639
project and gotten to be able to work

193
00:08:11,830 --> 00:08:09,599
with

194
00:08:14,150 --> 00:08:11,840
these totally awesome people that the

195
00:08:16,790 --> 00:08:14,160
engineers that not only designed and

196
00:08:18,469 --> 00:08:16,800
built and tested lro but the the people

197
00:08:20,950 --> 00:08:18,479
that you see behind in the control

198
00:08:21,909 --> 00:08:20,960
center here the mission operations team

199
00:08:25,189 --> 00:08:21,919
who

200
00:08:27,589 --> 00:08:25,199
work tires tirelessly to make sure that

201
00:08:29,749 --> 00:08:27,599
we're able to fly lro and operate it to

202
00:08:31,749 --> 00:08:29,759
the moon and things so

203
00:08:33,269 --> 00:08:31,759
i've gotten able to work with all these

204
00:08:35,269 --> 00:08:33,279
people and

205
00:08:37,110 --> 00:08:35,279
put together the whole aspects

206
00:08:39,190 --> 00:08:37,120
the business part the technical part

207
00:08:41,110 --> 00:08:39,200
it's been a really cool job and this is

208
00:08:43,509 --> 00:08:41,120
a really exciting moment for us well you

209
00:08:44,949 --> 00:08:43,519
know lro was a pretty fast-track mission

210
00:08:46,790 --> 00:08:44,959
from conception yeah very good

211
00:08:49,269 --> 00:08:46,800
development tell us a little bit more

212
00:08:50,710 --> 00:08:49,279
about you know building lro and testing

213
00:08:52,070 --> 00:08:50,720

and integrating it at the goddard space

214
00:08:53,590 --> 00:08:52,080
flight center

215
00:08:56,310 --> 00:08:53,600
goddard uh

216
00:08:58,870 --> 00:08:56,320
we we've done a really great job here at

217
00:09:01,110 --> 00:08:58,880
uh goddard in terms of designing and

218
00:09:03,990 --> 00:09:01,120
fast tracking the spacecraft

219
00:09:06,470 --> 00:09:04,000
we have a strong heritage here of of

220
00:09:07,910 --> 00:09:06,480
many spacecraft so we're able to

221
00:09:10,870 --> 00:09:07,920
take lessons learned from the many

222
00:09:11,750 --> 00:09:10,880
projects that we did before and um you

223
00:09:14,389 --> 00:09:11,760
know

224
00:09:16,470 --> 00:09:14,399
put them right to use with lro so we

225
00:09:18,630 --> 00:09:16,480
didn't have to start from a blank sheet

226
00:09:20,949 --> 00:09:18,640
of paper we were able to talk to our

227
00:09:24,470 --> 00:09:20,959
comrades on other projects and use that

228
00:09:26,150 --> 00:09:24,480
so we were um we were able to to take

229
00:09:27,350 --> 00:09:26,160
designs and lessons learned from

230
00:09:29,750 --> 00:09:27,360
projects like

231
00:09:32,790 --> 00:09:29,760
you know sdo and

232
00:09:34,470 --> 00:09:32,800
you know hubble and all the

233
00:09:36,470 --> 00:09:34,480
the multiple missions that we've had

234
00:09:38,710 --> 00:09:36,480
here and be able to take that right into

235
00:09:41,030 --> 00:09:38,720
what we need to do for the for the lro

236
00:09:42,870 --> 00:09:41,040
project and also a lot of stuff that we

237
00:09:43,829 --> 00:09:42,880
do in terms of testing the spacecraft

238
00:09:45,750 --> 00:09:43,839

and

239
00:09:47,269 --> 00:09:45,760
integrating it

240
00:09:48,790 --> 00:09:47,279
made it just a lot easier for us because

241
00:09:50,389 --> 00:09:48,800
our schedule as you said was very

242
00:09:51,350 --> 00:09:50,399
aggressive very fast

243
00:09:53,269 --> 00:09:51,360
and

244
00:09:54,710 --> 00:09:53,279
if it hadn't been for you know our

245
00:09:56,070 --> 00:09:54,720
ability here at goddard we probably

246
00:09:57,990 --> 00:09:56,080
wouldn't have been able to do it that

247
00:10:00,070 --> 00:09:58,000
quickly well that's great like on a

248
00:10:01,590 --> 00:10:00,080
personal level kathy i mean i know from

249
00:10:03,350 --> 00:10:01,600
a young age you've been really

250
00:10:05,350 --> 00:10:03,360
interested in the move so has this

251
00:10:08,710 --> 00:10:05,360
project been a dream come true for you

252
00:10:12,630 --> 00:10:08,720
yeah oh yeah absolutely i you know i uh

253
00:10:14,870 --> 00:10:12,640
i got to meet my hero neil armstrong um

254
00:10:17,110 --> 00:10:14,880
a year ago and you know as a little kid

255
00:10:19,829 --> 00:10:17,120
you know you you um you

256
00:10:21,430 --> 00:10:19,839
i always dreamed of you know being able

257
00:10:23,430 --> 00:10:21,440
to work for nasa and follow in the

258
00:10:25,750 --> 00:10:23,440
footsteps of these totally awesome

259
00:10:27,430 --> 00:10:25,760
people that got to walk on the moon and

260
00:10:28,870 --> 00:10:27,440
here i am you know with the lunar

261
00:10:31,430 --> 00:10:28,880
reconnaissance orbiter project going

262
00:10:33,269 --> 00:10:31,440
back to the moon i mean it's it's just

263
00:10:35,590 --> 00:10:33,279

it's just a dream come true that we're

264
00:10:37,590 --> 00:10:35,600
taking nasa and everyone back to the

265
00:10:39,509 --> 00:10:37,600
moon tonight it's it's it's a dream come

266
00:10:41,990 --> 00:10:39,519
true for me and and all of our team

267
00:10:43,910 --> 00:10:42,000
members we're very excited well just on

268
00:10:45,030 --> 00:10:43,920
a personal note kathy i mean how do you

269
00:10:47,190 --> 00:10:45,040
feel

270
00:10:49,030 --> 00:10:47,200
seeing your baby so there's finally

271
00:10:51,430 --> 00:10:49,040
getting ready to reach his destination i

272
00:10:53,910 --> 00:10:51,440
can i can barely contain myself you know

273
00:10:56,150 --> 00:10:53,920
this is just so exciting i'm i'm like

274
00:10:58,230 --> 00:10:56,160
nervous happy excited all at the same

275
00:10:59,990 --> 00:10:58,240
time and um this is the moment that

276
00:11:01,910 --> 00:11:00,000
we've all been waiting for you know all

277
00:11:03,030 --> 00:11:01,920
these years so we're you'll probably see

278
00:11:05,910 --> 00:11:03,040
us all get

279
00:11:07,750 --> 00:11:05,920
really excited here tonight um

280
00:11:09,829 --> 00:11:07,760
i'll probably cry i got a box of tissues

281
00:11:12,069 --> 00:11:09,839
back there because this is just a

282
00:11:13,750 --> 00:11:12,079
tremendous moment for all of us all

283
00:11:15,670 --> 00:11:13,760
right well kathy thank you so much for

284
00:11:17,350 --> 00:11:15,680
taking the time to stop by and have a

285
00:11:18,790 --> 00:11:17,360
chat with us and best of luck with the

286
00:11:21,110 --> 00:11:18,800
mission thank you very much thank you

287
00:11:23,110 --> 00:11:21,120
for being here with us so great thank

288
00:11:25,350 --> 00:11:23,120

you now let's take another look inside

289
00:11:43,269 --> 00:11:25,360
the control room as the burn

290
00:11:47,269 --> 00:11:46,150
my gnc we're on target

291
00:12:01,190 --> 00:11:47,279
attitude

292
00:12:07,829 --> 00:12:03,030
okay we're five minutes out from the

293
00:12:12,949 --> 00:12:07,839
burn this is the final go no go pull

294
00:12:16,470 --> 00:12:14,230
emmy go

295
00:12:17,670 --> 00:12:16,480
systems go

296
00:12:18,550 --> 00:12:17,680
fido

297
00:12:19,670 --> 00:12:18,560
go

298
00:12:20,629 --> 00:12:19,680
cndh

299
00:12:21,750 --> 00:12:20,639
go

300
00:12:22,629 --> 00:12:21,760
software

301
00:12:37,509 --> 00:12:22,639
go

302
00:12:39,350 --> 00:12:38,470
thermal

303
00:12:40,470 --> 00:12:39,360
go

304
00:12:41,670 --> 00:12:40,480
power

305
00:12:45,990 --> 00:12:41,680
go

306
00:12:49,670 --> 00:12:46,000
deployable

307
00:12:49,680 --> 00:15:57,110
hey all systems are good

308
00:15:57,120 --> 00:16:52,230
one minute to burn start

309
00:16:52,240 --> 00:17:19,110
10 seconds

310
00:17:19,120 --> 00:17:33,029
okay we enter delta v

311
00:17:37,350 --> 00:17:34,710
plate this is acs hardware confirming

312
00:17:39,390 --> 00:17:37,360
all thruster currents are nominal

313
00:17:41,590 --> 00:17:39,400

after that we see the three degree

314
00:17:44,710 --> 00:17:41,600
translated flight

315
00:17:49,190 --> 00:17:47,590
copy

316
00:17:50,789 --> 00:17:49,200
prop flight

317
00:17:52,630 --> 00:17:50,799
ready flight

318
00:18:40,870 --> 00:17:52,640
thruster is all located

319
00:18:45,029 --> 00:18:43,270
everything look nominal uh so far so

320
00:18:47,590 --> 00:18:45,039
good

321
00:19:22,789 --> 00:18:47,600
i'm expecting 85 to drop below 10 at

322
00:19:38,070 --> 00:19:26,230
prop plate thrusters all look nominal

323
00:19:59,270 --> 00:19:53,270
okay

324
00:20:00,870 --> 00:19:59,280
goddard's chief engineer so jim can you

325
00:20:03,110 --> 00:20:00,880
tell us a little bit about what's going

326
00:20:05,190 --> 00:20:03,120
on right now well nancy we're right in

327
00:20:07,430 --> 00:20:05,200
the middle now beginning the critical

328
00:20:09,750 --> 00:20:07,440
burn this firing of a critical rocket

329
00:20:11,669 --> 00:20:09,760
that will put lro into its safe capture

330
00:20:13,350 --> 00:20:11,679
orbit that will allow it to begin in

331
00:20:15,270 --> 00:20:13,360
about a month its mapping so this is the

332
00:20:16,549 --> 00:20:15,280
most important step of the mission right

333
00:20:18,070 --> 00:20:16,559
now that we've been dreaming of for the

334
00:20:21,190 --> 00:20:18,080
last five years

335
00:20:22,950 --> 00:20:21,200
that's just great so jim you you were

336
00:20:25,190 --> 00:20:22,960
pretty instrumental in getting this

337
00:20:27,590 --> 00:20:25,200
mission off the ground um how did this

338
00:20:30,230 --> 00:20:27,600

project begin well nancy it really began

339
00:20:32,149 --> 00:20:30,240
if you think back to when we left the

340
00:20:34,870 --> 00:20:32,159
moon with apollo and what was left from

341
00:20:36,789 --> 00:20:34,880
the samples and in the aftermath of that

342
00:20:38,870 --> 00:20:36,799
we thought we have to go back and going

343
00:20:40,230 --> 00:20:38,880
back to the moon to do both science and

344
00:20:42,789 --> 00:20:40,240
the engineering to plan for human

345
00:20:44,230 --> 00:20:42,799
exploration is really what began lro and

346
00:20:47,270 --> 00:20:44,240
the president's speech in january of

347
00:20:48,630 --> 00:20:47,280
2004 said our first step back is to open

348
00:20:51,590 --> 00:20:48,640
the frontier of the moon with something

349
00:20:53,750 --> 00:20:51,600
like lro well now we're here flying it

350
00:20:56,070 --> 00:20:53,760
well that's just great i mean jim we

351
00:20:57,029 --> 00:20:56,080
sent humans to the moon like 40 years

352
00:20:59,029 --> 00:20:57,039
ago

353
00:21:00,789 --> 00:20:59,039
why do we need to go back moon's a big

354
00:21:03,590 --> 00:21:00,799
place nancy people forget it's got a

355
00:21:05,270 --> 00:21:03,600
land area the size of africa we surveyed

356
00:21:07,590 --> 00:21:05,280
and really studied six key places with

357
00:21:09,110 --> 00:21:07,600
the lunar landings returned the samples

358
00:21:11,590 --> 00:21:09,120
we looked again with prospector but

359
00:21:13,510 --> 00:21:11,600
we've left a frontier unexplored lro

360
00:21:15,510 --> 00:21:13,520
will fill in all the gaps at the scales

361
00:21:18,310 --> 00:21:15,520
we need for the engineering decisions to

362
00:21:20,710 --> 00:21:18,320
send people back there

363
00:21:22,630 --> 00:21:20,720

so jim take a look at the screen what

364
00:21:24,470 --> 00:21:22,640
exactly are we seeing right now well

365
00:21:25,990 --> 00:21:24,480
we're seeing the beginnings of the lunar

366
00:21:28,549 --> 00:21:26,000
orbit insertion and over the next

367
00:21:30,549 --> 00:21:28,559
several minutes the primary rocket motor

368
00:21:33,430 --> 00:21:30,559
will fire with the thrusters controlling

369
00:21:35,190 --> 00:21:33,440
it and after that time we will be in a

370
00:21:37,190 --> 00:21:35,200
capture orbit around the moon and we'll

371
00:21:37,990 --> 00:21:37,200
be back for good it's kind of like we're

372
00:21:40,310 --> 00:21:38,000
back

373
00:21:42,710 --> 00:21:40,320
and this is the key step to do it

374
00:21:44,549 --> 00:21:42,720
okay so jim just a little bit more about

375
00:21:46,710 --> 00:21:44,559
what mysteries through the moon does the

376
00:21:49,510 --> 00:21:46,720
moon still hold well the moon is kind of

377
00:21:51,590 --> 00:21:49,520
mother nature's special chronometer and

378
00:21:53,270 --> 00:21:51,600
as we think about it we realize what we

379
00:21:55,909 --> 00:21:53,280
learned from apollo told us it's part of

380
00:21:56,789 --> 00:21:55,919
our history so we're interested in not

381
00:21:57,909 --> 00:21:56,799
only

382
00:21:59,190 --> 00:21:57,919
extending what apollo did but

383
00:22:00,870 --> 00:21:59,200
discovering a pneumonia one of the

384
00:22:03,270 --> 00:22:00,880
things is does the moon sequester

385
00:22:04,549 --> 00:22:03,280
resources that we could use scientific

386
00:22:06,149 --> 00:22:04,559
and for people

387
00:22:07,510 --> 00:22:06,159
what really is the history of the

388
00:22:09,510 --> 00:22:07,520

moonlight we haven't studied the poles

389
00:22:11,350 --> 00:22:09,520
of the moon what is the moon like at

390
00:22:12,950 --> 00:22:11,360
human scales and finally what's the

391
00:22:14,390 --> 00:22:12,960
temperature space of the moon like when

392
00:22:16,390 --> 00:22:14,400
we look at this planet we think it's a

393
00:22:18,549 --> 00:22:16,400
simple world but we realize now the

394
00:22:20,710 --> 00:22:18,559
lunar poles you can see them now in this

395
00:22:22,310 --> 00:22:20,720
image are really unexplored terrain

396
00:22:24,789 --> 00:22:22,320
they're almost more mysterious than

397
00:22:26,070 --> 00:22:24,799
pluto so why not go and look at this

398
00:22:28,310 --> 00:22:26,080
mysterious terrain right in our own

399
00:22:30,710 --> 00:22:28,320
backyard and finally the moon actually

400
00:22:32,789 --> 00:22:30,720
is a piece of our destiny so for all of

401
00:22:33,990 --> 00:22:32,799
us we want to get back because we think

402
00:22:36,149 --> 00:22:34,000
aspects of the earth history are

403
00:22:37,830 --> 00:22:36,159
recorded in that planet is it true to

404
00:22:40,149 --> 00:22:37,840
say that we actually know more about

405
00:22:42,390 --> 00:22:40,159
mars than we do about our own mood

406
00:22:43,990 --> 00:22:42,400
in terms of mapping absolutely in terms

407
00:22:45,909 --> 00:22:44,000
of understanding the samples we returned

408
00:22:48,950 --> 00:22:45,919
from the moon with apollo no the moon

409
00:22:51,270 --> 00:22:48,960
has that rich textbook in those rocks

410
00:22:53,350 --> 00:22:51,280
and soils that were returned from apollo

411
00:22:55,270 --> 00:22:53,360
so long ago so it's a different story

412
00:22:57,990 --> 00:22:55,280
but so much more to be done at this

413
00:22:59,510 --> 00:22:58,000

moment lro is our gateway excellent so

414
00:23:01,590 --> 00:22:59,520
just tell us a little about a little bit

415
00:23:03,190 --> 00:23:01,600
about what challenges might astronauts

416
00:23:05,510 --> 00:23:03,200
face when they when we go back to the

417
00:23:07,750 --> 00:23:05,520
moon so when we go back to the moon anc

418
00:23:09,029 --> 00:23:07,760
ideally for a sustained presence the

419
00:23:11,190 --> 00:23:09,039
things we need to know are the kind of

420
00:23:13,270 --> 00:23:11,200
things civil engineers plan for

421
00:23:15,909 --> 00:23:13,280
human adaptability to the lunar gravity

422
00:23:18,070 --> 00:23:15,919
and the space radiation the terrain the

423
00:23:19,270 --> 00:23:18,080
lunar regolith the soil this is critical

424
00:23:20,630 --> 00:23:19,280
it's everywhere it's in your boots in

425
00:23:22,390 --> 00:23:20,640
your hands in your hair well not your

426
00:23:24,310 --> 00:23:22,400
hair but it's everywhere

427
00:23:25,909 --> 00:23:24,320
and so we need to look at those things

428
00:23:27,830 --> 00:23:25,919
as if we're going to go and live there

429
00:23:28,950 --> 00:23:27,840
for good this is the kind of environment

430
00:23:30,710 --> 00:23:28,960
we're going to think about and we're

431
00:23:32,789 --> 00:23:30,720
living now on the space station but now

432
00:23:35,190 --> 00:23:32,799
it's on a new world so that's the step

433
00:23:37,350 --> 00:23:35,200
that lro has to pave the way for so

434
00:23:39,270 --> 00:23:37,360
people like you could go to the moon oh

435
00:23:40,310 --> 00:23:39,280
that's well that's pretty exciting so

436
00:23:41,990 --> 00:23:40,320
look just

437
00:23:43,190 --> 00:23:42,000
what do you think i mean now the moon

438
00:23:44,390 --> 00:23:43,200

what's next

439
00:23:45,669 --> 00:23:44,400
what do you think is next i think what's

440
00:23:47,990 --> 00:23:45,679
next is the discoveries that are going

441
00:23:50,390 --> 00:23:48,000
to come from lro this whole new moon

442
00:23:52,149 --> 00:23:50,400
we're ready to see is out there waiting

443
00:23:53,909 --> 00:23:52,159
and this mission is going to capture it

444
00:23:55,510 --> 00:23:53,919
and what that will tell us is how we

445
00:23:57,350 --> 00:23:55,520
should go what we should go and ask

446
00:23:59,269 --> 00:23:57,360
about and once we get people thinking

447
00:24:01,190 --> 00:23:59,279
about and getting back to the moon then

448
00:24:04,310 --> 00:24:01,200
we can look to those farther shores the

449
00:24:06,390 --> 00:24:04,320
harder places mars asteroids wherever we

450
00:24:08,470 --> 00:24:06,400
want to go it's a big universe someone's

451
00:24:10,310 --> 00:24:08,480
got to explore it excellent thank you so

452
00:24:11,909 --> 00:24:10,320
much jim really exciting stuff we

453
00:24:14,630 --> 00:24:11,919
appreciate you stopping by thanks nancy

454
00:25:01,430 --> 00:24:14,640
go lro excellent so let's take another

455
00:25:01,440 --> 00:25:09,430
delta v time at 20 percent

456
00:25:09,440 --> 00:25:18,149
670

457
00:25:21,029 --> 00:25:19,830
okay to see flight

458
00:26:07,430 --> 00:25:21,039
be insane

459
00:26:12,390 --> 00:26:10,630
hcs hardware play

460
00:26:14,789 --> 00:26:12,400
okay we have confirmation that the burn

461
00:28:00,830 --> 00:26:14,799
is underway we're only 600 kilometers

462
00:28:05,909 --> 00:28:03,590
probably bed plate

463
00:28:33,269 --> 00:28:05,919

thrusters are still nominal

464
00:28:37,269 --> 00:28:35,350
okay the team in the control room is

465
00:28:39,590 --> 00:28:37,279
hard at work now let's take a closer

466
00:28:53,029 --> 00:28:39,600
look at all the teamwork that went into

467
00:28:53,039 --> 00:29:06,549
thirty

468
00:29:11,590 --> 00:29:08,789
the lunar reconnaissance orbiter is a

469
00:29:12,630 --> 00:29:11,600
first step to future missions mars and

470
00:29:15,110 --> 00:29:12,640
beyond

471
00:29:19,029 --> 00:29:15,120
but a lot has to happen before we get

472
00:29:21,590 --> 00:29:19,039
there and one woman plays a key role

473
00:29:23,990 --> 00:29:21,600
i plan how to build a spacecraft every

474
00:29:25,909 --> 00:29:24,000
day we have a large team and we have to

475
00:29:27,110 --> 00:29:25,919
plan every day what everybody's going to

476
00:29:29,510 --> 00:29:27,120
do

477
00:29:31,269 --> 00:29:29,520
on the spacecraft and

478
00:29:33,669 --> 00:29:31,279
so i try to coordinate all those

479
00:29:35,350 --> 00:29:33,679
activities

480
00:29:36,950 --> 00:29:35,360
yeah i have a team of people that help

481
00:29:40,230 --> 00:29:36,960
me out and they

482
00:29:42,710 --> 00:29:40,240
take shifts and we work together to to

483
00:29:44,870 --> 00:29:42,720
make sure that things keep moving

484
00:29:47,350 --> 00:29:44,880
well goddard has the responsibility of

485
00:29:49,269 --> 00:29:47,360
managing the mission and we are also

486
00:29:50,310 --> 00:29:49,279
responsible for building the spacecraft

487
00:29:52,070 --> 00:29:50,320
bus

488
00:29:54,710 --> 00:29:52,080

and integrating the instruments to the

489
00:29:56,070 --> 00:29:54,720
bus and doing the system level test and

490
00:29:58,070 --> 00:29:56,080
integration

491
00:29:59,669 --> 00:29:58,080
and then also doing all the processing

492
00:30:01,190 --> 00:29:59,679
down at the cape

493
00:30:03,830 --> 00:30:01,200
to the launch vehicle

494
00:30:05,269 --> 00:30:03,840
there's chemistry involved there's

495
00:30:08,310 --> 00:30:05,279
getting the right mix of people that

496
00:30:10,389 --> 00:30:08,320
complement each other's skills

497
00:30:13,510 --> 00:30:10,399
and when you have that all together you

498
00:30:16,950 --> 00:30:13,520
can work very efficiently and

499
00:30:18,950 --> 00:30:16,960
and come up with a great product

500
00:30:20,710 --> 00:30:18,960
i think in the amount of time that we

501
00:30:22,630 --> 00:30:20,720
were given that

502
00:30:24,789 --> 00:30:22,640
it's really interesting we've done an

503
00:30:26,870 --> 00:30:24,799
incredible job trying you know getting

504
00:30:29,029 --> 00:30:26,880
this whole spacecraft together

505
00:30:30,950 --> 00:30:29,039
um putting seven instruments which is

506
00:30:31,830 --> 00:30:30,960
not insignificant

507
00:30:43,990 --> 00:30:31,840
to

508
00:30:45,990 --> 00:30:44,000
one woman's leadership and outstanding

509
00:30:47,990 --> 00:30:46,000
teamwork are the building blocks of

510
00:30:49,350 --> 00:30:48,000
nasa's lunar reconnaissance orbiter

511
00:30:51,590 --> 00:30:49,360
mission

512
00:30:59,509 --> 00:30:51,600
go to nasa.gov

513
00:31:03,990 --> 00:31:01,509

well with us now we have dr laurie

514
00:31:06,389 --> 00:31:04,000
leshan goddard's deputy director for

515
00:31:07,350 --> 00:31:06,399
science and technology hi lori good

516
00:31:11,430 --> 00:31:07,360
morning

517
00:31:13,269 --> 00:31:11,440
much work the team has put into this

518
00:31:16,070 --> 00:31:13,279
mission isn't it they really are the

519
00:31:17,590 --> 00:31:16,080
dream team the scattered group that has

520
00:31:19,750 --> 00:31:17,600
put this mission together they're doing

521
00:31:21,669 --> 00:31:19,760
great and the burn's going great where

522
00:31:23,029 --> 00:31:21,679
we just heard we're at about 450

523
00:31:24,789 --> 00:31:23,039
kilometers above the moon so

524
00:31:26,549 --> 00:31:24,799
everything's going nominally we're so

525
00:31:29,110 --> 00:31:26,559
excited to be able to do that

526
00:31:31,029 --> 00:31:29,120
so tell us a little bit um from a

527
00:31:33,590 --> 00:31:31,039
goddard perspective what does it mean to

528
00:31:34,549 --> 00:31:33,600
have such a large role in this lunar

529
00:31:36,470 --> 00:31:34,559
mission

530
00:31:39,029 --> 00:31:36,480
well we just couldn't be more proud to

531
00:31:41,350 --> 00:31:39,039
be blazing the trail as the new explorer

532
00:31:42,630 --> 00:31:41,360
is going back to the moon at goddard and

533
00:31:44,549 --> 00:31:42,640
so

534
00:31:46,789 --> 00:31:44,559
our team has put together a mission

535
00:31:48,230 --> 00:31:46,799
that's going to give us information that

536
00:31:49,909 --> 00:31:48,240
we need to place the trail for humans

537
00:31:52,389 --> 00:31:49,919
we're like that advanced scout that goes

538
00:31:53,909 --> 00:31:52,399

out there and and uh finds all the

539
00:31:55,750 --> 00:31:53,919
hazardous places and the interesting

540
00:31:57,430 --> 00:31:55,760
places to go and we'll report back so

541
00:31:59,269 --> 00:31:57,440
that when the humans come

542
00:32:01,430 --> 00:31:59,279
they'll know exactly where to go and so

543
00:32:04,230 --> 00:32:01,440
to have that role such a critical role

544
00:32:06,070 --> 00:32:04,240
in the mission it's really incredible

545
00:32:07,830 --> 00:32:06,080
well great um tell us a little bit more

546
00:32:09,830 --> 00:32:07,840
about how goddard is prepared for this

547
00:32:11,269 --> 00:32:09,840
incredible mission well you know in many

548
00:32:12,630 --> 00:32:11,279
ways even though this is a robotic

549
00:32:13,990 --> 00:32:12,640
mission and there aren't people on it

550
00:32:16,230 --> 00:32:14,000
it's kind of like sending a member of

551
00:32:18,230 --> 00:32:16,240
your family to the moon for us i mean we

552
00:32:20,149 --> 00:32:18,240
conceived of this mission we designed it

553
00:32:21,669 --> 00:32:20,159
we built it with our own hands here at

554
00:32:23,669 --> 00:32:21,679
goddard space flight center we kind of

555
00:32:25,430 --> 00:32:23,679
brought it to life if you will and now

556
00:32:27,990 --> 00:32:25,440
we've we've sent it on its way out of

557
00:32:30,389 --> 00:32:28,000
the nest to the moon so for us there's a

558
00:32:31,669 --> 00:32:30,399
lot of personal um

559
00:32:33,029 --> 00:32:31,679
involvement in this mission from

560
00:32:33,909 --> 00:32:33,039
hundreds and hundreds of people at the

561
00:32:36,070 --> 00:32:33,919
center

562
00:32:37,830 --> 00:32:36,080
and who have put their time their nights

563
00:32:39,190 --> 00:32:37,840

their weekends many sleepless nights i

564
00:32:40,230 --> 00:32:39,200
know many of them would rather be asleep

565
00:32:41,830 --> 00:32:40,240
right now

566
00:32:43,110 --> 00:32:41,840
and also i want to take the opportunity

567
00:32:45,509 --> 00:32:43,120
while we're talking about the amazing

568
00:32:47,990 --> 00:32:45,519
team to thank the families of all those

569
00:32:49,350 --> 00:32:48,000
team members who along with the people

570
00:32:51,750 --> 00:32:49,360
who have uh

571
00:32:53,269 --> 00:32:51,760
built the mission really helped um

572
00:32:55,750 --> 00:32:53,279
enable it because those people give up

573
00:32:58,549 --> 00:32:55,760
their time and energy too that's true

574
00:32:59,990 --> 00:32:58,559
so um lori as a scientist why do you

575
00:33:02,149 --> 00:33:00,000
think it's important to go back to the

576
00:33:04,630 --> 00:33:02,159
moon well i will tell you as a scientist

577
00:33:06,389 --> 00:33:04,640
there are there are many exciting things

578
00:33:08,389 --> 00:33:06,399
still to be discovered about our moon

579
00:33:10,389 --> 00:33:08,399
it's our nearest planetary neighbor if

580
00:33:13,350 --> 00:33:10,399
you will and it's really going to allow

581
00:33:14,789 --> 00:33:13,360
us to to read the first few chapters of

582
00:33:16,470 --> 00:33:14,799
the history of our solar system which

583
00:33:18,310 --> 00:33:16,480
are kind of wiped out on the earth so

584
00:33:19,669 --> 00:33:18,320
the moon holds the history of the

585
00:33:21,190 --> 00:33:19,679
earliest part of the solar system

586
00:33:22,710 --> 00:33:21,200
frankly better than almost any other

587
00:33:24,870 --> 00:33:22,720
object out there so it's got an

588
00:33:26,630 --> 00:33:24,880

incredible science story to tell but

589
00:33:29,590 --> 00:33:26,640
more than that i think going back to the

590
00:33:30,630 --> 00:33:29,600
moon is about great nations doing great

591
00:33:33,430 --> 00:33:30,640
things

592
00:33:34,870 --> 00:33:33,440
and we have to take on great challenges

593
00:33:35,909 --> 00:33:34,880
as a nation and that's one of the things

594
00:33:38,710 --> 00:33:35,919
that makes

595
00:33:40,389 --> 00:33:38,720
america makes us who we are in addition

596
00:33:42,389 --> 00:33:40,399
i think missions like lro are so

597
00:33:43,509 --> 00:33:42,399
important because they

598
00:33:45,269 --> 00:33:43,519
um

599
00:33:47,750 --> 00:33:45,279
they bring out the best of our spirit

600
00:33:49,509 --> 00:33:47,760
they bring out the most innovative of us

601
00:33:51,190 --> 00:33:49,519
they allow us to work in the high-tech

602
00:33:53,430 --> 00:33:51,200
areas that really help drive our economy

603
00:33:55,269 --> 00:33:53,440
so there's so many reasons to be proud

604
00:33:56,710 --> 00:33:55,279
of this mission not just scientific

605
00:33:59,269 --> 00:33:56,720
although the scientific stuff is great

606
00:34:01,110 --> 00:33:59,279
too well that's great now lori

607
00:34:03,190 --> 00:34:01,120
i mean

608
00:34:04,870 --> 00:34:03,200
tell me a little bit more about you know

609
00:34:06,950 --> 00:34:04,880
the goddard community and then at the

610
00:34:09,270 --> 00:34:06,960
public at large i mean have you noticed

611
00:34:10,629 --> 00:34:09,280
that people are really excited about our

612
00:34:12,310 --> 00:34:10,639
opportunity to go back to the moon with

613
00:34:14,550 --> 00:34:12,320

lro yeah of course we hear goddard

614
00:34:16,389 --> 00:34:14,560
incredibly excited and given you know we

615
00:34:17,829 --> 00:34:16,399
conceived of the mission five years ago

616
00:34:19,349 --> 00:34:17,839
we launched it five days ago and you

617
00:34:21,669 --> 00:34:19,359
know five minutes ago we got to the moon

618
00:34:22,710 --> 00:34:21,679
so it's very exciting for all of us

619
00:34:24,230 --> 00:34:22,720
but the members of the public have

620
00:34:25,270 --> 00:34:24,240
gotten really excited as well you know

621
00:34:26,710 --> 00:34:25,280
we had

622
00:34:28,790 --> 00:34:26,720
an opportunity for people to be able to

623
00:34:30,629 --> 00:34:28,800
send their names to the moon on a chip

624
00:34:32,310 --> 00:34:30,639
that's actually right now going into

625
00:34:35,430 --> 00:34:32,320
orbit around the moon with lro we had

626
00:34:37,270 --> 00:34:35,440
over a million people sign up so

627
00:34:39,190 --> 00:34:37,280
absolutely amazing

628
00:34:40,950 --> 00:34:39,200
engagement of the public in this mission

629
00:34:42,310 --> 00:34:40,960
and we ain't seen nothing yet because

630
00:34:44,230 --> 00:34:42,320
when those pictures start coming down

631
00:34:45,829 --> 00:34:44,240
when that information starts coming back

632
00:34:47,430 --> 00:34:45,839
it's going to really transform the way

633
00:34:49,510 --> 00:34:47,440
we see the moon and it's going to be

634
00:34:51,510 --> 00:34:49,520
very exciting that's amazing stuff now

635
00:34:56,790 --> 00:34:51,520
let's take a little look at that said

636
00:35:00,829 --> 00:34:58,710
they all look nominal

637
00:35:05,750 --> 00:35:00,839
on december 17

638
00:35:10,150 --> 00:35:05,760

1972 apollo 17 left the moon

639
00:35:11,910 --> 00:35:10,160
almost 36 years later nasa is going back

640
00:35:14,069 --> 00:35:11,920
are you

641
00:35:32,069 --> 00:35:14,079
i'm going

642
00:35:34,870 --> 00:35:32,079
try and stop me

643
00:35:37,589 --> 00:35:34,880
wouldn't miss it

644
00:35:50,870 --> 00:35:37,599
i'm going are you sure where do i sign

645
00:35:54,630 --> 00:35:53,109
okay thanks again lori for joining us

646
00:36:03,910 --> 00:35:54,640
and we're going to take another look at

647
00:36:03,920 --> 00:36:13,750
before we see an eclipse

648
00:36:13,760 --> 00:36:18,150
it's approximately about five days

649
00:36:18,160 --> 00:36:45,430
dropping

650
00:36:54,069 --> 00:36:48,069
delta v time at fifty percent

651
00:36:54,079 --> 00:37:02,870
you need to see flight

652
00:37:07,430 --> 00:37:06,230
flight did you copy uh no i didn't

653
00:37:09,270 --> 00:37:07,440
i was just saying everything still looks

654
00:37:11,910 --> 00:37:09,280
normal here duty cycles are matching our

655
00:38:05,829 --> 00:37:11,920
predictions based on the trends

656
00:38:08,870 --> 00:38:07,589
flight we have stable capture about the

657
00:38:43,510 --> 00:38:08,880
moon

658
00:39:41,910 --> 00:38:46,550
pressures all look normal

659
00:39:45,750 --> 00:39:43,670
tina's heat plate

660
00:39:48,230 --> 00:39:45,760
fancy

661
00:39:51,190 --> 00:39:48,240
completely look nominal

662
00:39:53,190 --> 00:39:51,200
yeah it looks good

663
00:40:00,310 --> 00:39:53,200

wait fido we've reached perry absence at

664
00:40:00,320 --> 00:40:26,790
we have anything on the tracking

665
00:40:31,349 --> 00:40:28,550
okay

666
00:40:34,230 --> 00:40:31,359
we have with us right now dr mike wergot

667
00:40:35,910 --> 00:40:34,240
nasa's chief lunar scientist so mike can

668
00:40:37,910 --> 00:40:35,920
you just give us an update on where we

669
00:40:39,750 --> 00:40:37,920
are with the burn well i'll tell you

670
00:40:41,750 --> 00:40:39,760
this is about to be time we just

671
00:40:43,829 --> 00:40:41,760
received some of the most terrific news

672
00:40:46,069 --> 00:40:43,839
that we've been waiting for uh the

673
00:40:48,309 --> 00:40:46,079
engines have been burning now for

674
00:40:49,589 --> 00:40:48,319
uh about 15 or 20 minutes and we just

675
00:40:51,030 --> 00:40:49,599
received word

676
00:40:53,030 --> 00:40:51,040
burning long enough and we've been

677
00:40:55,910 --> 00:40:53,040
effective enough in those burns that

678
00:40:57,270 --> 00:40:55,920
we've been captured stably by the moon

679
00:40:58,790 --> 00:40:57,280
we're there

680
00:41:02,470 --> 00:40:58,800
now we're going to continue to burn so

681
00:41:05,030 --> 00:41:02,480
that we get the right orbit that we can

682
00:41:06,710 --> 00:41:05,040
then maneuver into and start to check

683
00:41:08,470 --> 00:41:06,720
out the spacecraft and start to check

684
00:41:10,069 --> 00:41:08,480
out the the instruments in the next

685
00:41:11,910 --> 00:41:10,079
couple of days well that's just great

686
00:41:14,150 --> 00:41:11,920
news so mike just tell us a little bit

687
00:41:16,630 --> 00:41:14,160
how do you feel at this moment um as

688
00:41:18,470 --> 00:41:16,640

we've begun nasa's next step to go back

689
00:41:21,030 --> 00:41:18,480
to well you know it's funny i was

690
00:41:23,510 --> 00:41:21,040
driving in this morning and it's just so

691
00:41:26,630 --> 00:41:23,520
calm and so quiet and so peaceful

692
00:41:29,349 --> 00:41:26,640
outside and yet in here the the

693
00:41:32,309 --> 00:41:29,359
excitement is just palpable uh you've

694
00:41:34,710 --> 00:41:32,319
had these teams working for years now

695
00:41:36,630 --> 00:41:34,720
for this day this is one of the key and

696
00:41:39,349 --> 00:41:36,640
critical uh

697
00:41:41,270 --> 00:41:39,359
uh events that has to occur for for us

698
00:41:42,710 --> 00:41:41,280
to have a successful mission and it

699
00:41:45,030 --> 00:41:42,720
looks like we're well along the way to

700
00:41:47,670 --> 00:41:45,040
be being able to do that excellent so

701
00:41:50,309 --> 00:41:47,680
mike you know lro is nasa's

702
00:41:52,230 --> 00:41:50,319
next lunar mission i've asked you know

703
00:41:53,990 --> 00:41:52,240
all the scientists have stopped by this

704
00:41:55,589 --> 00:41:54,000
morning to tell us you know why do we

705
00:41:56,790 --> 00:41:55,599
need to go back

706
00:41:58,870 --> 00:41:56,800
well

707
00:42:00,230 --> 00:41:58,880
going back to the moon and we were

708
00:42:02,790 --> 00:42:00,240
talking to jim garvin a little bit

709
00:42:05,349 --> 00:42:02,800
earlier and

710
00:42:06,309 --> 00:42:05,359
going back we really need to be able to

711
00:42:09,349 --> 00:42:06,319
learn

712
00:42:11,510 --> 00:42:09,359
the next steps on how to live and work

713
00:42:13,349 --> 00:42:11,520

and be productive on another planet

714
00:42:15,030 --> 00:42:13,359
uh when

715
00:42:17,510 --> 00:42:15,040
we were there for apollo

716
00:42:20,390 --> 00:42:17,520
they were unbelievably successful but it

717
00:42:22,150 --> 00:42:20,400
was only for a few days at a time

718
00:42:23,829 --> 00:42:22,160
being able to live and work on another

719
00:42:25,990 --> 00:42:23,839
planetary surface is going to prepare us

720
00:42:27,589 --> 00:42:26,000
to go beyond the moon to mars the

721
00:42:28,550 --> 00:42:27,599
asteroids and the rest of the solar

722
00:42:29,910 --> 00:42:28,560
system

723
00:42:32,309 --> 00:42:29,920
well

724
00:42:34,309 --> 00:42:32,319
lro is the first mission in nasa's

725
00:42:36,470 --> 00:42:34,319
exploration systems mission directorate

726
00:42:37,589 --> 00:42:36,480
so can you just explain to the audience

727
00:42:39,750 --> 00:42:37,599
you know a little bit more about

728
00:42:42,470 --> 00:42:39,760
exploration systems and then

729
00:42:44,790 --> 00:42:42,480
lro's role in it oh sure uh

730
00:42:45,829 --> 00:42:44,800
exploration systems has been given the

731
00:42:48,390 --> 00:42:45,839
job

732
00:42:49,750 --> 00:42:48,400
to develop the equipment and the

733
00:42:51,910 --> 00:42:49,760
techniques and

734
00:42:53,349 --> 00:42:51,920
to be able to take us back to the moon

735
00:42:57,349 --> 00:42:53,359
so that we can be

736
00:43:00,710 --> 00:42:57,359
uh effective we can explore we can

737
00:43:02,630 --> 00:43:00,720
learn to live and work on another planet

738
00:43:05,589 --> 00:43:02,640

we're going to be able to develop the

739
00:43:08,230 --> 00:43:05,599
the the capabilities to get us there all

740
00:43:10,630 --> 00:43:08,240
of the equipment to allow us to to live

741
00:43:13,109 --> 00:43:10,640
there live there safely

742
00:43:15,430 --> 00:43:13,119
and to maneuver around the moon to to

743
00:43:16,950 --> 00:43:15,440
learn about the moon as well as how to

744
00:43:18,470 --> 00:43:16,960
um

745
00:43:19,750 --> 00:43:18,480
develop those kinds of techniques we're

746
00:43:21,750 --> 00:43:19,760
going to be able to

747
00:43:23,990 --> 00:43:21,760
uh

748
00:43:25,349 --> 00:43:24,000
to we're going to need to explore beyond

749
00:43:28,470 --> 00:43:25,359
beyond the moon

750
00:43:30,790 --> 00:43:28,480
and lro's role in it is really pivotal

751
00:43:32,230 --> 00:43:30,800
uh if we were going to go on a summer

752
00:43:34,150 --> 00:43:32,240
vacation one of the first things we'd

753
00:43:36,870 --> 00:43:34,160
want to do is go out and get the best

754
00:43:39,829 --> 00:43:36,880
map that we possibly could well lro is

755
00:43:42,069 --> 00:43:39,839
going to provide a full atlas of all

756
00:43:43,990 --> 00:43:42,079
kinds of information about the moon that

757
00:43:45,990 --> 00:43:44,000
we're going to need to first of all

758
00:43:48,870 --> 00:43:46,000
develop that equipment so that it so

759
00:43:51,750 --> 00:43:48,880
that it works well and works effectively

760
00:43:52,630 --> 00:43:51,760
as well as to find those places on the

761
00:43:54,950 --> 00:43:52,640
moon

762
00:43:57,109 --> 00:43:54,960
that where we can really understand not

763
00:43:58,870 --> 00:43:57,119

just the evolution of the moon but

764
00:44:02,550 --> 00:43:58,880
really

765
00:44:04,230 --> 00:44:02,560
witness plate to

766
00:44:06,870 --> 00:44:04,240
uh the development of the whole solar

767
00:44:08,390 --> 00:44:06,880
system well you know mike we know that

768
00:44:10,630 --> 00:44:08,400
you know lro is not gonna be the only

769
00:44:12,390 --> 00:44:10,640
spacecraft orbiting the moon um there

770
00:44:13,910 --> 00:44:12,400
seems to be this renewed interest in the

771
00:44:15,030 --> 00:44:13,920
moon internationally why do you think

772
00:44:17,190 --> 00:44:15,040
that's so

773
00:44:19,589 --> 00:44:17,200
well from the scientists point of view

774
00:44:22,630 --> 00:44:19,599
that interest has always been there we

775
00:44:24,710 --> 00:44:22,640
just now have the opportunities from a

776
00:44:28,230 --> 00:44:24,720
number of nations

777
00:44:31,190 --> 00:44:28,240
for that as a next step in exploration

778
00:44:33,589 --> 00:44:31,200
and science the european space agency's

779
00:44:35,910 --> 00:44:33,599
smart one mission was the little

780
00:44:37,829 --> 00:44:35,920
spacecraft that could

781
00:44:39,589 --> 00:44:37,839
developed and demonstrated new

782
00:44:41,510 --> 00:44:39,599
technologies and at the same time made

783
00:44:43,349 --> 00:44:41,520
measurements of the moon that hadn't

784
00:44:45,430 --> 00:44:43,359
been made before

785
00:44:47,430 --> 00:44:45,440
our colleagues from japan

786
00:44:51,270 --> 00:44:47,440
have launched

787
00:44:53,430 --> 00:44:51,280
selenae and later renamed kaguya and it

788
00:44:56,550 --> 00:44:53,440

was an unbelievably successful mission

789
00:44:58,870 --> 00:44:56,560
and just ended ended recently

790
00:45:00,550 --> 00:44:58,880
china has launched chongling one and is

791
00:45:04,470 --> 00:45:00,560
still in orbit around the moon at around

792
00:45:07,670 --> 00:45:04,480
the 200 kilometer uh altitude and

793
00:45:11,349 --> 00:45:07,680
our colleagues in in india uh with the

794
00:45:13,190 --> 00:45:11,359
chandrayaan one mission we have um

795
00:45:15,270 --> 00:45:13,200
two u.s instruments on board that

796
00:45:19,030 --> 00:45:15,280
mission making measurements that are

797
00:45:21,910 --> 00:45:19,040
helping both lro as well as our

798
00:45:24,069 --> 00:45:21,920
companion spacecraft lcross and lro

799
00:45:25,910 --> 00:45:24,079
itself has

800
00:45:28,630 --> 00:45:25,920
a lunar neutron

801
00:45:30,069 --> 00:45:28,640
exploration neutron detector that

802
00:45:32,550 --> 00:45:30,079
was provided by

803
00:45:35,030 --> 00:45:32,560
by russia with an extraordinary team

804
00:45:37,589 --> 00:45:35,040
from the institute for space research

805
00:45:39,030 --> 00:45:37,599
so one final question mike

806
00:45:40,790 --> 00:45:39,040
what does lro mean what do you think

807
00:45:42,710 --> 00:45:40,800
ella is going to mean for the future

808
00:45:44,230 --> 00:45:42,720
space exploration well

809
00:45:47,349 --> 00:45:44,240
i really think that

810
00:45:49,750 --> 00:45:47,359
lro and the way in which the team work

811
00:45:51,829 --> 00:45:49,760
together and so quickly and so

812
00:45:53,109 --> 00:45:51,839
effectively is a real model for how

813
00:45:56,230 --> 00:45:53,119

we're going to

814
00:45:59,270 --> 00:45:56,240
explore space in in the future uh the

815
00:46:01,270 --> 00:45:59,280
the mission had a an aggressive timeline

816
00:46:03,750 --> 00:46:01,280
we have a great team

817
00:46:05,829 --> 00:46:03,760
and that team worked together and was

818
00:46:06,630 --> 00:46:05,839
unbelievably flexible to

819
00:46:08,069 --> 00:46:06,640
uh

820
00:46:10,470 --> 00:46:08,079
take the little bumps in the road that

821
00:46:12,390 --> 00:46:10,480
show that show up and be able to respond

822
00:46:14,710 --> 00:46:12,400
to those and ended up producing a

823
00:46:16,470 --> 00:46:14,720
spacecraft that right now is in orbit

824
00:46:18,470 --> 00:46:16,480
around the moon excellent well thank you

825
00:46:20,870 --> 00:46:18,480
mike for stopping by i really appreciate

826
00:46:22,230 --> 00:46:20,880
it oh absolutely my pleasure okay now

827
00:47:09,349 --> 00:46:22,240
let's take another look inside the

828
00:47:09,359 --> 00:47:45,750
copy that 10 hours

829
00:47:48,870 --> 00:47:47,030
everything looks good we're expecting

830
00:47:53,829 --> 00:47:48,880
at2 to uh

831
00:47:53,839 --> 00:48:22,630
okay copy

832
00:48:26,069 --> 00:48:24,309
delta v time at eighty percent for

833
00:49:00,069 --> 00:48:26,079
listening

834
00:49:05,750 --> 00:49:02,549
okay let's take another look at one of

835
00:49:11,670 --> 00:49:05,760
lro's videos lro scouts for safe landing

836
00:49:15,829 --> 00:49:13,109
one of the lunar reconnaissance

837
00:49:18,230 --> 00:49:15,839
orbiter's primary objectives is to scout

838
00:49:21,030 --> 00:49:18,240

safe landing sites for future manned and

839
00:49:22,230 --> 00:49:21,040
robotic missions to the moon

840
00:49:24,230 --> 00:49:22,240
to do so

841
00:49:26,870 --> 00:49:24,240
lro's suite of instruments work

842
00:49:28,710 --> 00:49:26,880
collectively to build a detailed picture

843
00:49:33,190 --> 00:49:28,720
of the surface

844
00:49:38,710 --> 00:49:35,349
the first thing we want to assess is the

845
00:49:41,829 --> 00:49:38,720
topography of the lunar terrain

846
00:49:44,710 --> 00:49:41,839
lro uses an instrument called lola that

847
00:49:46,630 --> 00:49:44,720
bounces laser pulses off of the surface

848
00:49:49,750 --> 00:49:46,640
to measure its height

849
00:49:52,549 --> 00:49:49,760
the resulting map shows steep slopes

850
00:49:54,710 --> 00:49:52,559
rough terrain and gives a general idea

851
00:49:57,670 --> 00:49:54,720
of what areas might be level enough to

852
00:49:59,349 --> 00:49:57,680
provide safe landing sites shown here in

853
00:50:02,150 --> 00:49:59,359
green

854
00:50:04,470 --> 00:50:02,160
lro's next step is to create a

855
00:50:07,270 --> 00:50:04,480
temperature map of the surface using an

856
00:50:09,510 --> 00:50:07,280
instrument called diviner temperatures

857
00:50:12,309 --> 00:50:09,520
change more slowly in areas with lots of

858
00:50:14,870 --> 00:50:12,319
loose materials so by looking at thermal

859
00:50:17,109 --> 00:50:14,880
maps we can eliminate areas for landing

860
00:50:18,549 --> 00:50:17,119
that may have a dangerous abundance of

861
00:50:21,270 --> 00:50:18,559
rocks

862
00:50:23,670 --> 00:50:21,280
the regions in yellow represent places

863
00:50:26,790 --> 00:50:23,680

where the thermal signatures indicate

864
00:50:29,190 --> 00:50:26,800
they are unsafe landing sites

865
00:50:31,670 --> 00:50:29,200
lastly we want to double check and

866
00:50:34,630 --> 00:50:31,680
refine our map even further

867
00:50:37,109 --> 00:50:34,640
lro does this with a set of cameras that

868
00:50:39,190 --> 00:50:37,119
make detailed pictures of the surface

869
00:50:41,510 --> 00:50:39,200
looking closely at these images we can

870
00:50:43,109 --> 00:50:41,520
actually pick out individual boulders

871
00:50:45,270 --> 00:50:43,119
and craters

872
00:50:48,150 --> 00:50:45,280
these will clearly be hazardous places

873
00:50:51,670 --> 00:50:48,160
to land so we've labeled them red and

874
00:50:54,150 --> 00:50:51,680
removed them from our safe areas

875
00:50:57,109 --> 00:50:54,160
at this point any sites that are left

876
00:51:00,950 --> 00:50:57,119
green have been checked and rechecked to

877
00:51:03,829 --> 00:51:00,960
be level smooth and free from hazards

878
00:51:07,349 --> 00:51:03,839
based on lro scouting we would consider

879
00:51:18,230 --> 00:51:07,359
these safe locations to land

880
00:51:22,390 --> 00:51:20,150
it should be noted that while it is

881
00:51:23,829 --> 00:51:22,400
absolutely essential to find safe

882
00:51:26,950 --> 00:51:23,839
landing sites

883
00:51:29,430 --> 00:51:26,960
a safe place to land is not necessarily

884
00:51:31,510 --> 00:51:29,440
an interesting place to land

885
00:51:32,870 --> 00:51:31,520
when it comes time to pick the best

886
00:51:35,349 --> 00:51:32,880
landing sites

887
00:51:39,430 --> 00:51:35,359
many other factors and measurements will

888
00:51:43,430 --> 00:51:41,670

as astronauts make their descent toward

889
00:51:46,470 --> 00:51:43,440
the lunar surface late in the next

890
00:51:49,670 --> 00:51:46,480
decade they can thank nasa's small robot

891
00:51:58,870 --> 00:51:49,680
scout lro for showing them the safest

892
00:52:03,670 --> 00:52:01,349
okay we have with us

893
00:52:06,230 --> 00:52:03,680
dr rich vondrack the lro project

894
00:52:08,150 --> 00:52:06,240
scientist so which can you just give us

895
00:52:11,109 --> 00:52:08,160
another update on where we are

896
00:52:13,270 --> 00:52:11,119
well we're uh right now if the burn

897
00:52:15,910 --> 00:52:13,280
stopped we'd be in a weekly captured

898
00:52:18,470 --> 00:52:15,920
orbit uh but the good news is we only

899
00:52:20,710 --> 00:52:18,480
have about six more minutes to go and at

900
00:52:23,270 --> 00:52:20,720
that point we'll be uh finished with our

901
00:52:25,109 --> 00:52:23,280
orbit for today and uh getting ready

902
00:52:27,990 --> 00:52:25,119
over the next few days to move into our

903
00:52:30,790 --> 00:52:28,000
commissioning orbit excellent so um rich

904
00:52:33,190 --> 00:52:30,800
as the lro project scientist what's your

905
00:52:35,829 --> 00:52:33,200
role in this in this incredible lunar

906
00:52:37,990 --> 00:52:35,839
mission yeah i i have the great job of

907
00:52:40,710 --> 00:52:38,000
working with the seven uh instrument

908
00:52:44,950 --> 00:52:40,720
teams uh with the project here at

909
00:52:46,710 --> 00:52:44,960
goddard and then also with the uh

910
00:52:49,270 --> 00:52:46,720
instrument uh builders and the

911
00:52:52,390 --> 00:52:49,280
headquarters folks uh to work on the

912
00:52:54,950 --> 00:52:52,400
instruments uh this shows the uh crater

913
00:52:57,430 --> 00:52:54,960

instrument our radiation sensor uh the

914
00:53:00,309 --> 00:52:57,440
lunar radiometer experiment that'll

915
00:53:03,270 --> 00:53:00,319
measure the temperature on the moon our

916
00:53:04,390 --> 00:53:03,280
5 beam laser altimeter

917
00:53:08,710 --> 00:53:04,400
the

918
00:53:11,670 --> 00:53:08,720
which will make

919
00:53:14,309 --> 00:53:11,680
very precise images of the moon a uv

920
00:53:17,270 --> 00:53:14,319
spectrometer to search for water frost

921
00:53:19,670 --> 00:53:17,280
in the polar regions and then a neutron

922
00:53:22,790 --> 00:53:19,680
detector from russia that will look for

923
00:53:25,349 --> 00:53:22,800
hydrogen at the poles and then finally

924
00:53:27,589 --> 00:53:25,359
our technology demonstrator

925
00:53:28,630 --> 00:53:27,599
an advanced synthetic aperture radar

926
00:53:30,710 --> 00:53:28,640
system

927
00:53:33,270 --> 00:53:30,720
and this shows the spacecraft here at

928
00:53:35,430 --> 00:53:33,280
goddard in this final testing

929
00:53:37,190 --> 00:53:35,440
so rich tell me a little bit how are

930
00:53:39,349 --> 00:53:37,200
these measurements that you just talked

931
00:53:41,990 --> 00:53:39,359
about through the other video

932
00:53:43,750 --> 00:53:42,000
how will they aid humans in the return

933
00:53:45,670 --> 00:53:43,760
to the moon especially for extended

934
00:53:48,309 --> 00:53:45,680
periods of time right

935
00:53:51,510 --> 00:53:48,319
in order to return safely to the moon we

936
00:53:53,030 --> 00:53:51,520
have to identify a level terrain

937
00:53:54,710 --> 00:53:53,040
our five beam

938
00:53:57,910 --> 00:53:54,720

laser altimeter

939
00:54:00,950 --> 00:53:57,920
will measure precisely the unevenness of

940
00:54:02,790 --> 00:54:00,960
the terrain and identify here in green

941
00:54:04,630 --> 00:54:02,800
safe landing sites

942
00:54:06,470 --> 00:54:04,640
we look at the temperature of the moon

943
00:54:08,870 --> 00:54:06,480
and from the temperature variation we

944
00:54:12,150 --> 00:54:08,880
can tell rock abundances and then

945
00:54:15,190 --> 00:54:12,160
finally our camera system is able to

946
00:54:18,230 --> 00:54:15,200
measure objects that are only a few feet

947
00:54:20,950 --> 00:54:18,240
in diameter and find small craters and

948
00:54:22,790 --> 00:54:20,960
by combining all of this information

949
00:54:25,430 --> 00:54:22,800
we'll be able to tell

950
00:54:28,230 --> 00:54:25,440
where it is safe for explorers to land

951
00:54:29,349 --> 00:54:28,240
here shown in green and then after they

952
00:54:31,990 --> 00:54:29,359
land there

953
00:54:34,069 --> 00:54:32,000
they can explore the new nearby regions

954
00:54:35,910 --> 00:54:34,079
so rich tell us a little bit more about

955
00:54:37,510 --> 00:54:35,920
what resources you're hoping to find on

956
00:54:40,470 --> 00:54:37,520
the moon you know searching for

957
00:54:43,030 --> 00:54:40,480
resources is a very important goal the

958
00:54:46,309 --> 00:54:43,040
one resource we know that is on the moon

959
00:54:49,109 --> 00:54:46,319
is uh nearly continuous sunlight

960
00:54:50,390 --> 00:54:49,119
when explorers land in the uh pull in

961
00:54:53,589 --> 00:54:50,400
the equator

962
00:54:56,230 --> 00:54:53,599
they're faced with two weeks of

963
00:54:59,270 --> 00:54:56,240

sunlight and two weeks of darkness

964
00:55:01,910 --> 00:54:59,280
this video here shows the normal a

965
00:55:04,150 --> 00:55:01,920
variation of sunlight on the moon the

966
00:55:06,950 --> 00:55:04,160
moon rotates in one month

967
00:55:09,109 --> 00:55:06,960
but here at the poles uh we see that

968
00:55:11,829 --> 00:55:09,119
there are regions that are

969
00:55:12,870 --> 00:55:11,839
high elevations like hills or small

970
00:55:15,829 --> 00:55:12,880
mountains

971
00:55:18,710 --> 00:55:15,839
where the sun shines nearly all the time

972
00:55:21,190 --> 00:55:18,720
and uh explorers can use this sunlight

973
00:55:22,150 --> 00:55:21,200
as a source of electric power and of

974
00:55:24,390 --> 00:55:22,160
warmth

975
00:55:26,470 --> 00:55:24,400
to survive for longer periods than they

976
00:55:29,670 --> 00:55:26,480
could at the equator

977
00:55:32,870 --> 00:55:29,680
also at the poles we see that there are

978
00:55:36,069 --> 00:55:32,880
permanently shadowed regions the bottoms

979
00:55:37,430 --> 00:55:36,079
of craters that get very very cold here

980
00:55:39,829 --> 00:55:37,440
shown in blue

981
00:55:41,829 --> 00:55:39,839
and we think that over the course of the

982
00:55:44,950 --> 00:55:41,839
last 2 billion years

983
00:55:47,910 --> 00:55:44,960
water and other volatiles on the moon

984
00:55:50,309 --> 00:55:47,920
may have settled here and then uh

985
00:55:52,150 --> 00:55:50,319
they've condensed and they can be used

986
00:55:54,230 --> 00:55:52,160
uh as a resource

987
00:55:56,230 --> 00:55:54,240
for not only human consumption but also

988
00:55:58,230 --> 00:55:56,240

for rocket fuel well that's just great i

989
00:56:00,230 --> 00:55:58,240
think i just heard that we're about 20

990
00:56:03,190 --> 00:56:00,240
seconds from the uh from the end of the

991
00:56:04,470 --> 00:56:03,200
burn so very important milestone so just

992
00:56:05,910 --> 00:56:04,480
tell us are you

993
00:56:07,430 --> 00:56:05,920
i mean hearing that are you really

994
00:56:10,870 --> 00:56:07,440
excited to learn what are you what are

995
00:56:13,829 --> 00:56:10,880
you hoping to learn from lro uh lro is

996
00:56:14,789 --> 00:56:13,839
going to give us an atlas of the moon

997
00:56:17,829 --> 00:56:14,799
it'll

998
00:56:19,750 --> 00:56:17,839
start to unlock the secrets of the moon

999
00:56:21,670 --> 00:56:19,760
and there are many interesting places on

1000
00:56:24,309 --> 00:56:21,680
the moon but i i personally am most

1001
00:56:27,190 --> 00:56:24,319
excited about what we'll learn about the

1002
00:56:30,549 --> 00:56:27,200
polar regions the uh polar regions are

1003
00:56:31,589 --> 00:56:30,559
the terra incognita

1004
00:56:33,030 --> 00:56:31,599
and

1005
00:56:35,349 --> 00:56:33,040
we think that those are going to be

1006
00:56:37,670 --> 00:56:35,359
important destinations and we're very

1007
00:56:40,069 --> 00:56:37,680
excited about what we'll learn there

1008
00:56:41,750 --> 00:56:40,079
and uh now they're just telling stations

1009
00:56:44,630 --> 00:56:41,760
it's a split congratulations on a

1010
00:56:59,990 --> 00:56:44,640
successful lli lrl's returned nasa to

1011
00:57:00,000 --> 00:57:13,829
foreign

1012
00:57:18,150 --> 00:57:15,829
okay we're really excited here in the

1013
00:57:19,990 --> 00:57:18,160

lunar uh reconnaissance orbiter mission

1014
00:57:23,270 --> 00:57:20,000
operations center we have just been

1015
00:57:25,510 --> 00:57:23,280
captured by the moon and we are at our

1016
00:57:27,589 --> 00:57:25,520
what 30 by 216

1017
00:57:29,750 --> 00:57:27,599
uh we're a little bit higher than that

1018
00:57:32,390 --> 00:57:29,760
we're going to trim the orbit over the

1019
00:57:34,870 --> 00:57:32,400
next few days but the good news is we

1020
00:57:35,910 --> 00:57:34,880
are in lunar orbit we're not going past

1021
00:57:38,549 --> 00:57:35,920
the moon

1022
00:57:41,829 --> 00:57:38,559
we're there to stay we're ready to start

1023
00:57:44,230 --> 00:57:41,839
doing our checkout of the instruments

1024
00:57:46,789 --> 00:57:44,240
over the next few days we'll be turning

1025
00:57:49,030 --> 00:57:46,799
on the instruments and we hope to make

1026
00:58:04,630 --> 00:57:49,040
data available in images as soon as we

1027
00:58:04,640 --> 00:58:13,109
go ahead and turn the cap heaters off

1028
00:58:16,069 --> 00:58:14,710
um

1029
00:58:21,430 --> 00:58:16,079
they want to do this congratulations i

1030
00:58:36,710 --> 00:58:23,270
because questions was so much talking

1031
00:58:36,720 --> 00:58:57,430
um

1032
00:59:02,470 --> 00:58:59,589
okay i have one more question for him

1033
00:59:32,150 --> 00:59:02,480
that i want to keep okay okay

1034
00:59:32,160 --> 00:59:52,630
go ahead and disable presser firing

1035
00:59:56,630 --> 00:59:54,950
okay as we see all the excitement going

1036
00:59:58,150 --> 00:59:56,640
on in the control room i have one final

1037
00:59:59,910 --> 00:59:58,160
question for you rich

1038
01:00:01,990 --> 00:59:59,920

when will we be able to see the images

1039
01:00:03,990 --> 01:00:02,000
from the lro spacecraft now that we're

1040
01:00:06,549 --> 01:00:04,000
safely in orbit around the moon yes now

1041
01:00:09,190 --> 01:00:06,559
that we're there we we uh start the job

1042
01:00:11,349 --> 01:00:09,200
of turning on and calibrating all of the

1043
01:00:14,870 --> 01:00:11,359
instruments on lro

1044
01:00:17,109 --> 01:00:14,880
we hope to have uh the camera operating

1045
01:00:19,990 --> 01:00:17,119
in the next couple of weeks and then we

1046
01:00:21,750 --> 01:00:20,000
as soon as we get some images from our

1047
01:00:23,109 --> 01:00:21,760
camera we'll make them available to the

1048
01:00:25,510 --> 01:00:23,119
public

1049
01:00:27,430 --> 01:00:25,520
the mission continues uh doing the

1050
01:00:29,430 --> 01:00:27,440
checkout of the instruments for about

1051
01:00:31,910 --> 01:00:29,440
the next six to eight weeks and then in

1052
01:00:34,710 --> 01:00:31,920
august we move into our normal mapping

1053
01:00:36,470 --> 01:00:34,720
uh orbit planet oh great congratulations

1054
01:00:44,069 --> 01:00:36,480
thank you very much this is wonderful

1055
01:00:48,549 --> 01:00:46,150
and obsolete

1056
01:00:51,349 --> 01:00:48,559
go ahead and close the hpl vivo

1057
01:00:51,359 --> 01:00:58,150
primary

1058
01:01:05,510 --> 01:01:00,150
you want to leave the pdu load services

1059
01:01:05,520 --> 01:01:59,670
you can go in and turn them off

1060
01:02:04,870 --> 01:02:02,309
okay we have with us craig tully the lro

1061
01:02:06,789 --> 01:02:04,880
project manager so craig can you confirm

1062
01:02:10,309 --> 01:02:06,799
that lro is safely in orbit around the

1063
01:02:12,230 --> 01:02:10,319

moon i sure i certainly can um as the

1064
01:02:14,390 --> 01:02:12,240
last commentator said we reached into

1065
01:02:16,870 --> 01:02:14,400
our orbit we're in an orbit that's about

1066
01:02:19,270 --> 01:02:16,880
200 by 3 000.

1067
01:02:20,549 --> 01:02:19,280
first initial orbit

1068
01:02:22,230 --> 01:02:20,559
and the tracking already shows that

1069
01:02:24,710 --> 01:02:22,240
we're essentially where we plan to be

1070
01:02:26,309 --> 01:02:24,720
we're at the moon so just personally how

1071
01:02:27,910 --> 01:02:26,319
do you think obviously you're excited

1072
01:02:29,589 --> 01:02:27,920
because you've reached

1073
01:02:33,270 --> 01:02:29,599
a goal but how do you think the loi

1074
01:02:34,950 --> 01:02:33,280
event went overall um the yellow it went

1075
01:02:36,789 --> 01:02:34,960
like clockwork

1076
01:02:38,309 --> 01:02:36,799
you know with a mission like this we

1077
01:02:40,390 --> 01:02:38,319
spent literally

1078
01:02:41,910 --> 01:02:40,400
years and certainly the last year

1079
01:02:44,150 --> 01:02:41,920
practicing for every possible

1080
01:02:46,710 --> 01:02:44,160
contingency and being ready for this

1081
01:02:49,349 --> 01:02:46,720
in the end it went exactly as planned

1082
01:02:51,190 --> 01:02:49,359
well great now that elroy has

1083
01:02:53,430 --> 01:02:51,200
finished this critical

1084
01:02:54,710 --> 01:02:53,440
first burn what's next in the timeline

1085
01:02:56,630 --> 01:02:54,720
for the mission

1086
01:02:58,789 --> 01:02:56,640
what we do next is even as we speak

1087
01:03:00,470 --> 01:02:58,799
what's going on is we're putting the

1088
01:03:01,910 --> 01:03:00,480

spacecraft back in the configuration

1089
01:03:03,589 --> 01:03:01,920
that essentially it was in as we flew to

1090
01:03:05,910 --> 01:03:03,599
the moon where we're repointing our high

1091
01:03:07,750 --> 01:03:05,920
gain antenna dish to the earth to erase

1092
01:03:09,270 --> 01:03:07,760
our data rate we're putting it back in

1093
01:03:11,349 --> 01:03:09,280
the in the mode that it's going to fly

1094
01:03:12,870 --> 01:03:11,359
in this orbit and that after we get in

1095
01:03:14,549 --> 01:03:12,880
that mode we'll begin the work because

1096
01:03:16,950 --> 01:03:14,559
this was the first and the most critical

1097
01:03:18,789 --> 01:03:16,960
burn loi one we call that lunar orbit

1098
01:03:21,510 --> 01:03:18,799
insertion but we have four more to do

1099
01:03:23,910 --> 01:03:21,520
that take that take us from that large

1100
01:03:26,150 --> 01:03:23,920
uh eccentric orbit oriented and begin to

1101
01:03:28,069 --> 01:03:26,160
first lower it down to 200 kilometers

1102
01:03:30,230 --> 01:03:28,079
and then finally put us in our 30

1103
01:03:31,510 --> 01:03:30,240
kilometer by 216 kilometer orbit that

1104
01:03:33,029 --> 01:03:31,520
we'll spend the next two months and

1105
01:03:34,789 --> 01:03:33,039
while we do the work to get ready to

1106
01:03:36,470 --> 01:03:34,799
actually execute the mission okay so

1107
01:03:38,789 --> 01:03:36,480
tell me specifically when do the

1108
01:03:40,230 --> 01:03:38,799
instruments turn on we begin to well we

1109
01:03:42,069 --> 01:03:40,240
already have two instruments turned on

1110
01:03:43,510 --> 01:03:42,079
because they uh the blend instrument in

1111
01:03:45,670 --> 01:03:43,520
the craters both of which measure

1112
01:03:46,870 --> 01:03:45,680
radiation blend measures neutrons

1113
01:03:48,630 --> 01:03:46,880

eventually at the moon crater the

1114
01:03:50,870 --> 01:03:48,640
background radiation those were turned

1115
01:03:52,710 --> 01:03:50,880
on during our transit out to the moon so

1116
01:03:54,549 --> 01:03:52,720
we can measure the environment as we as

1117
01:03:56,870 --> 01:03:54,559
we travel there the other instruments

1118
01:03:58,390 --> 01:03:56,880
begin to be switched on in about a week

1119
01:04:00,150 --> 01:03:58,400
first we get the rest of the spacecraft

1120
01:04:01,750 --> 01:04:00,160
checked out and then we begin a

1121
01:04:03,430 --> 01:04:01,760
methodical process of bringing the

1122
01:04:05,430 --> 01:04:03,440
instruments online doing their

1123
01:04:08,230 --> 01:04:05,440
calibrations in orbit and beginning to

1124
01:04:10,230 --> 01:04:08,240
do observations over the next

1125
01:04:11,829 --> 01:04:10,240
over the next weeks so craig on a

1126
01:04:14,230 --> 01:04:11,839
personal note what do you hope will be

1127
01:04:16,230 --> 01:04:14,240
llo's legacy

1128
01:04:18,150 --> 01:04:16,240
well i believe lro's legacy and i

1129
01:04:20,549 --> 01:04:18,160
believe this says do almost everybody on

1130
01:04:22,470 --> 01:04:20,559
this team will be that when we look back

1131
01:04:25,430 --> 01:04:22,480
upon this we'll see that this small

1132
01:04:27,430 --> 01:04:25,440
spacecraft is this unmanned mechanical

1133
01:04:29,750 --> 01:04:27,440
surrogate for the human beings was the

1134
01:04:31,349 --> 01:04:29,760
beginning of when eventually we return

1135
01:04:33,510 --> 01:04:31,359
human beings to the moon our legacy will

1136
01:04:35,270 --> 01:04:33,520
be fresh footprints on the moon

1137
01:04:36,789 --> 01:04:35,280
excellent thank you so much you're very

1138
01:04:53,670 --> 01:04:36,799

welcome thank you talking with us and

1139
01:04:57,349 --> 01:04:55,349
well we would like to thank all the

1140
01:04:59,670 --> 01:04:57,359
viewers for joining us today for this

1141
01:05:00,870 --> 01:04:59,680
critical milestone for lro we look

1142
01:05:02,390 --> 01:05:00,880
forward to learning more about the

1143
01:05:05,510 --> 01:05:02,400
moon's features environment and

1144
01:05:19,589 --> 01:05:05,520
topography courtesy of lro thank you and

1145
01:05:23,270 --> 01:05:20,870
drop flight

1146
01:05:25,510 --> 01:05:23,280
go ahead flight i think we completed all

1147
01:05:27,270 --> 01:05:25,520
the prop cleanup activities everything's

1148
01:05:31,990 --> 01:05:27,280
good

1149
01:05:36,950 --> 01:05:35,029
acs hardware flight

1150
01:05:37,829 --> 01:05:36,960
go ahead flight

1151
01:05:39,430 --> 01:05:37,839
yeah

1152
01:05:41,029 --> 01:05:39,440
do we have any other cleanup activities

1153
01:05:42,309 --> 01:05:41,039
for you

1154
01:05:49,270 --> 01:05:42,319
all cleanup activities have been

1155
01:05:52,950 --> 01:05:51,349
everything looks good for you

1156
01:05:55,029 --> 01:05:52,960
everything looks good to us we just need

1157
01:05:58,630 --> 01:05:55,039
to switch tracker sources soon but we

1158
01:06:03,589 --> 01:06:01,510
okay copy that

1159
01:06:06,710 --> 01:06:03,599
we were just i was just going to let the

1160
01:06:11,270 --> 01:06:08,789
copy

1161
01:06:12,870 --> 01:06:11,280
we start slowing back at around 11 36 or

1162
01:06:15,910 --> 01:06:12,880
11 30.

1163
01:06:17,430 --> 01:06:15,920

yeah 11 30 48 the start of the saloon

1164
01:06:19,270 --> 01:06:17,440
okay

1165
01:06:20,630 --> 01:06:19,280
about an hour from now

1166
01:06:23,349 --> 01:06:20,640
all right we're just gonna hang out here