1
00:00:05,910 --> 00:00:03,750
the moon our nearest celestial neighbor

2
00:00:07,829 --> 00:00:05,920
has intrigued and inspired us since the

3
00:00:10,629 --> 00:00:07,839
dawn of humanity

4
00:00:13,190 --> 00:00:10,639
during the apollo program 12 astronauts

5
00:00:15,190 --> 00:00:13,200
landed on its cold and cratered surface

6
00:00:18,310 --> 00:00:15,200
but they couldn't stay

7
00:00:20,790 --> 00:00:18,320
now nasa's constellation program begins

8
00:00:23,189 --> 00:00:20,800
a new journey to live and work on the

9
00:00:26,150 --> 00:00:23,199
moon setting the stage for future

10
00:00:29,029 --> 00:00:26,160
long-duration human exploration

11
00:00:31,429 --> 00:00:29,039
today two spacecraft scouts are poised

12
00:00:33,750 --> 00:00:31,439
to lift off together aboard a powerful

13
00:00:35,270 --> 00:00:33,760

atlas v rocket on the first launch of

14
00:00:36,870 --> 00:00:35,280
this new era

15
00:00:37,910 --> 00:00:36,880
they are the lunar reconnaissance

16
00:00:40,069 --> 00:00:37,920
orbiter

17
00:00:44,310 --> 00:00:40,079
and the lunar crater observation and

18
00:00:47,510 --> 00:00:44,320
sensing satellite or lro and cross

19
00:00:48,549 --> 00:00:47,520
one rocket one destination two critical

20
00:00:51,270 --> 00:00:48,559
missions

21
00:00:59,510 --> 00:00:51,280
together they're helping us pave the way

22
00:01:02,950 --> 00:01:00,950
welcome to the show

23
00:01:05,109 --> 00:01:02,960
i'm your host george diller

24
00:01:07,990 --> 00:01:05,119
i'm here at nasa's kennedy space center

25
00:01:09,030 --> 00:01:08,000
in florida inside the apollo saturn 5

26
00:01:12,630 --> 00:01:09,040
center

27
00:01:15,030 --> 00:01:12,640
behind me is an actual massive 360 long

28
00:01:16,789 --> 00:01:15,040
saturn v rocket just like those that

29
00:01:18,630 --> 00:01:16,799
boosted the apollo astronauts on

30
00:01:19,990 --> 00:01:18,640
america's first human missions to the

31
00:01:22,310 --> 00:01:20,000
moon

32
00:01:24,310 --> 00:01:22,320
today nasa is preparing to return to the

33
00:01:26,550 --> 00:01:24,320
moon beginning with the lunar

34
00:01:29,670 --> 00:01:26,560
reconnaissance orbiter and a lunar

35
00:01:31,830 --> 00:01:29,680
crater observation and sensing satellite

36
00:01:34,069 --> 00:01:31,840
this upcoming launch aboard an atlas v

37
00:01:36,630 --> 00:01:34,079
rocket is the critical first step in the

38
00:01:38,550 --> 00:01:36,640

new constellation program

39
00:01:41,030 --> 00:01:38,560
on today's show we're going to take you

40
00:01:43,030 --> 00:01:41,040
inside both of these exciting missions

41
00:01:44,789 --> 00:01:43,040
and find out what it takes to launch two

42
00:01:47,190 --> 00:01:44,799
spacecraft at once

43
00:01:48,710 --> 00:01:47,200
our first guest is kathy petty deputy

44
00:01:50,469 --> 00:01:48,720
project manager for the lunar

45
00:01:52,469 --> 00:01:50,479
reconnaissance orbiter

46
00:01:54,950 --> 00:01:52,479
she stopped by the nasa direct studio to

47
00:02:00,630 --> 00:01:54,960
give us the inside story on this moon

48
00:02:06,069 --> 00:02:03,030
the lunar reconnaissance orbiter project

49
00:02:08,790 --> 00:02:06,079
or lro's main goal is

50
00:02:11,750 --> 00:02:08,800
we're really the the first mission the

51
00:02:14,630 --> 00:02:11,760
first step uh that nasa is taking back

52
00:02:17,270 --> 00:02:14,640
to exploring our universe and so

53
00:02:18,949 --> 00:02:17,280
what we really need to do is have a

54
00:02:21,190 --> 00:02:18,959
reconnaissance mission you know get get

55
00:02:24,630 --> 00:02:21,200
more data one of the things that we want

56
00:02:26,309 --> 00:02:24,640
to do is is go back to the moon uh you

57
00:02:27,830 --> 00:02:26,319
know we've been there before

58
00:02:30,390 --> 00:02:27,840
we we have

59
00:02:33,670 --> 00:02:30,400
really awesome data sets from our

60
00:02:35,350 --> 00:02:33,680
previous missions from the apollo era to

61
00:02:37,350 --> 00:02:35,360
to the other spacecraft that have gone

62
00:02:38,949 --> 00:02:37,360
so we want to build upon those data sets

63
00:02:41,030 --> 00:02:38,959

that we already have

64
00:02:42,869 --> 00:02:41,040
and and most of those data sets really

65
00:02:44,790 --> 00:02:42,879
focused on the equatorial region of the

66
00:02:46,150 --> 00:02:44,800
moon so now we want to go back and say

67
00:02:48,150 --> 00:02:46,160
hey

68
00:02:49,830 --> 00:02:48,160
let's map the entire moon so so have

69
00:02:53,110 --> 00:02:49,840
more of a global perspective or a

70
00:02:55,670 --> 00:02:53,120
comprehensive atlas of the moon and help

71
00:02:58,470 --> 00:02:55,680
whoever wants to to join us in exploring

72
00:03:01,190 --> 00:02:58,480
our universe or or or taking that next

73
00:03:03,589 --> 00:03:01,200
step back they need to have a more

74
00:03:05,990 --> 00:03:03,599
comprehensive atlas of the moon so that

75
00:03:08,149 --> 00:03:06,000
they know where to go what to do what to

76
00:03:10,790 --> 00:03:08,159
expect that kind of thing help them out

77
00:03:15,350 --> 00:03:10,800
we're like a scout mission for the for

78
00:03:20,949 --> 00:03:18,149
well roughly a couple of days after we

79
00:03:22,949 --> 00:03:20,959
we've launched we will begin

80
00:03:25,990 --> 00:03:22,959
what we call the lunar orbit insertion

81
00:03:28,630 --> 00:03:26,000
burn and and that burn will help us

82
00:03:30,550 --> 00:03:28,640
or help the moon and us get captured by

83
00:03:32,710 --> 00:03:30,560
the moon and so

84
00:03:35,190 --> 00:03:32,720
what happens during that burn

85
00:03:38,309 --> 00:03:35,200
as lro starts to get closer to the moon

86
00:03:41,110 --> 00:03:38,319
and the moon will capture lrl and once

87
00:03:42,470 --> 00:03:41,120
once once we have that confirmation that

88
00:03:45,270 --> 00:03:42,480

the moon has captured us we call that

89
00:03:47,990 --> 00:03:45,280
lunar acquisition and then after we have

90
00:03:49,830 --> 00:03:48,000
lunar acquisition for we we're sure that

91
00:03:52,470 --> 00:03:49,840
we have a stable orbit then we will

92
00:03:55,030 --> 00:03:52,480
begin a series of burns that are roughly

93
00:03:57,110 --> 00:03:55,040
a day apart from each other a series of

94
00:04:00,630 --> 00:03:57,120
four or five burns that begin to lower

95
00:04:03,350 --> 00:04:00,640
lro into her final orbit which is

96
00:04:06,789 --> 00:04:03,360
roughly 50 kilometers above the moon or

97
00:04:08,630 --> 00:04:06,799
31 miles and that's lro's polar orbiting

98
00:04:10,789 --> 00:04:08,640
orbit where where we lower the

99
00:04:12,550 --> 00:04:10,799
spacecraft low enough so that so that

100
00:04:13,830 --> 00:04:12,560
the instruments can focus on the surface

101
00:04:16,229 --> 00:04:13,840
of the moon and begin the data

102
00:04:17,749 --> 00:04:16,239
collection that that is what our mission

103
00:04:22,069 --> 00:04:17,759
is all about to create that

104
00:04:26,550 --> 00:04:24,390
now an interesting offshoot of our data

105
00:04:30,310 --> 00:04:26,560
is that our data will also be made

106
00:04:32,550 --> 00:04:30,320
available to google moon so that anyone

107
00:04:35,189 --> 00:04:32,560
that has access to the web or google

108
00:04:37,110 --> 00:04:35,199
will be able to punch in

109
00:04:38,950 --> 00:04:37,120
i don't know like shackleton crater and

110
00:04:41,510 --> 00:04:38,960
be able to see all the cool data from

111
00:04:45,590 --> 00:04:41,520
lro pop up right on their their own

112
00:04:49,189 --> 00:04:47,909
well at nasa we're all about exploring

113
00:04:50,950 --> 00:04:49,199

and and

114
00:04:53,830 --> 00:04:50,960
pushing our knowledge across the

115
00:04:55,430 --> 00:04:53,840
boundaries and and lro even though

116
00:04:57,270 --> 00:04:55,440
taking us back to the moon where we've

117
00:04:58,790 --> 00:04:57,280
been before that there's a lot about our

118
00:05:00,790 --> 00:04:58,800
moon that we don't know

119
00:05:03,749 --> 00:05:00,800
and and a lot about our moon that we

120
00:05:05,830 --> 00:05:03,759
want to use as as we begin to look out

121
00:05:08,150 --> 00:05:05,840
into the universe and decide you know

122
00:05:09,909 --> 00:05:08,160
where we want to go next so

123
00:05:12,469 --> 00:05:09,919
having a reconnaissance or a scout

124
00:05:14,950 --> 00:05:12,479
mission that that that begins to take us

125
00:05:17,909 --> 00:05:14,960
out is is a perfect fit into what nasa

126
00:05:19,510 --> 00:05:17,919
is all about and what what people like

127
00:05:21,350 --> 00:05:19,520
me who've dreamed about

128
00:05:23,590 --> 00:05:21,360
working for nasa have always wanted to

129
00:05:25,590 --> 00:05:23,600
do you know explore

130
00:05:29,189 --> 00:05:25,600
look out beyond who and what we are

131
00:05:33,830 --> 00:05:29,199
today and lro is is is the perfect fit

132
00:05:37,830 --> 00:05:35,590
now that we know what to expect from the

133
00:05:39,830 --> 00:05:37,840
lunar reconnaissance orbiter we turn our

134
00:05:41,909 --> 00:05:39,840
attention to its sister payload the

135
00:05:43,029 --> 00:05:41,919
lunar crater observation and sensing

136
00:05:44,790 --> 00:05:43,039
satellite

137
00:05:47,670 --> 00:05:44,800
his goal is to hunt for evidence of

138
00:05:50,150 --> 00:05:47,680

water ice using a hard hitting method

139
00:05:55,670 --> 00:05:50,160
dr kimberly iniko l cross payload

140
00:05:59,510 --> 00:05:57,670
l cross mission has

141
00:06:00,710 --> 00:05:59,520
two impact events

142
00:06:01,590 --> 00:06:00,720
the first

143
00:06:03,830 --> 00:06:01,600
is

144
00:06:05,990 --> 00:06:03,840
the upper stage of the launch vehicle

145
00:06:07,990 --> 00:06:06,000
that we take with us on our four-month

146
00:06:11,189 --> 00:06:08,000
mission into space

147
00:06:13,110 --> 00:06:11,199
and we separate from it and

148
00:06:16,469 --> 00:06:13,120
it's traveling to hit the moon

149
00:06:19,350 --> 00:06:16,479
at 5600 miles per hour

150
00:06:21,590 --> 00:06:19,360
it's going to impact one of these lunar

151
00:06:23,830 --> 00:06:21,600
permanently shadowed basins of a crater

152
00:06:24,710 --> 00:06:23,840
on the lunar poles

153
00:06:26,550 --> 00:06:24,720
and

154
00:06:28,469 --> 00:06:26,560
it's going to hit a particular place

155
00:06:32,469 --> 00:06:28,479
it's going to hit a place on the moon

156
00:06:36,390 --> 00:06:34,390
scientists who believe that there is

157
00:06:37,350 --> 00:06:36,400
water on the moon don't know whether

158
00:06:41,270 --> 00:06:37,360
it's

159
00:06:43,510 --> 00:06:41,280
smooth or chunky peanut butter type

160
00:06:45,749 --> 00:06:43,520
so where you hit is important

161
00:06:49,029 --> 00:06:45,759
the secondary impact

162
00:06:50,469 --> 00:06:49,039
is the l cross payload which will impact

163
00:06:52,950 --> 00:06:50,479

somewhere between three to five

164
00:06:54,230 --> 00:06:52,960
kilometers away from the first impact so

165
00:06:56,070 --> 00:06:54,240
we're going to hit another part of that

166
00:06:57,990 --> 00:06:56,080
crater we've targeted this crater

167
00:06:59,430 --> 00:06:58,000
because it's got a strong hydrogen

168
00:07:01,990 --> 00:06:59,440
concentration

169
00:07:02,950 --> 00:07:02,000
we're going to sample two parts of this

170
00:07:05,589 --> 00:07:02,960
crater

171
00:07:08,390 --> 00:07:05,599
and so the two impact events will tell

172
00:07:11,189 --> 00:07:08,400
us something about the distribution

173
00:07:13,589 --> 00:07:11,199
of this hydrogen concentration or

174
00:07:17,830 --> 00:07:13,599
perhaps a distribution of water if the

175
00:07:22,629 --> 00:07:21,189
the live images of our

176
00:07:24,950 --> 00:07:22,639
what we're taking with our science

177
00:07:27,350 --> 00:07:24,960
payload as we're going into the surface

178
00:07:29,830 --> 00:07:27,360
for the last four minutes of the mission

179
00:07:32,790 --> 00:07:29,840
which is 600 kilometers down to the

180
00:07:37,350 --> 00:07:32,800
surface will be streamed live

181
00:07:41,830 --> 00:07:39,510
elkhorse is important because it

182
00:07:44,950 --> 00:07:41,840
provides us a way to confirm the

183
00:07:47,830 --> 00:07:44,960
presence or absence of water ice at a

184
00:07:51,270 --> 00:07:47,840
particular location on the lunar pole

185
00:07:53,270 --> 00:07:51,280
there's water ice there or water in some

186
00:07:56,830 --> 00:07:53,280
form

187
00:07:59,749 --> 00:07:56,840
it means that for future missions to the

188
00:08:01,990 --> 00:07:59,759

moon and perhaps beyond there's there an

189
00:08:04,790 --> 00:08:02,000
in-situ a resource that's there a

190
00:08:06,390 --> 00:08:04,800
resource that's on the on the surface of

191
00:08:07,350 --> 00:08:06,400
that planet you don't need to bring it

192
00:08:08,629 --> 00:08:07,360
with you

193
00:08:11,110 --> 00:08:08,639
so

194
00:08:13,350 --> 00:08:11,120
for the human species

195
00:08:14,150 --> 00:08:13,360
in terms of exploring

196
00:08:19,350 --> 00:08:14,160
the

197
00:08:22,869 --> 00:08:19,360
out of low earth orbit

198
00:08:26,390 --> 00:08:22,879
and we need water with us if we can find

199
00:08:27,749 --> 00:08:26,400
a resource of water on the moon

200
00:08:30,230 --> 00:08:27,759
that will be

201
00:08:32,949 --> 00:08:30,240
an amazing step forward and a great

202
00:08:36,389 --> 00:08:32,959
resource to take advantage of in a very

203
00:08:39,029 --> 00:08:36,399
resource limited place

204
00:08:41,430 --> 00:08:39,039
both lro and lcross need a successful

205
00:08:43,589 --> 00:08:41,440
launch in order to begin their missions

206
00:08:45,670 --> 00:08:43,599
our next guest is an integral part in

207
00:08:47,190 --> 00:08:45,680
getting these spacecraft and many others

208
00:08:49,190 --> 00:08:47,200
off the ground

209
00:08:51,110 --> 00:08:49,200
chuck tatro is a mission manager in

210
00:08:53,350 --> 00:08:51,120
nasa's launch services program at

211
00:08:55,269 --> 00:08:53,360
kennedy space center he's going to tell

212
00:08:58,310 --> 00:08:55,279
us about the unique challenges of this

213
00:09:00,710 --> 00:08:58,320

two-for-one launch

214
00:09:02,230 --> 00:09:00,720
hello my name is chuck tatro and i'm a

215
00:09:04,630 --> 00:09:02,240
mission manager for nasa's launch

216
00:09:06,070 --> 00:09:04,640
service program at kennedy space center

217
00:09:07,590 --> 00:09:06,080
we're at the vertical integration

218
00:09:09,910 --> 00:09:07,600
facility on cape canaveral air force

219
00:09:11,910 --> 00:09:09,920
station this is where we will assemble

220
00:09:13,990 --> 00:09:11,920
the atlas v rocket that will send the

221
00:09:17,910 --> 00:09:14,000
lro and lcross spacecraft on their

222
00:09:22,230 --> 00:09:20,389
as a mission manager my job is to lead

223
00:09:23,829 --> 00:09:22,240
the effort to bring a new spacecraft and

224
00:09:27,269 --> 00:09:23,839
launch vehicle together to where they're

225
00:09:30,389 --> 00:09:28,790
about three months before launch the

226
00:09:32,230 --> 00:09:30,399
spacecraft and the launch vehicle

227
00:09:34,550 --> 00:09:32,240
components arrive at the launch site for

228
00:09:36,870 --> 00:09:34,560
final testing about two months before

229
00:09:38,710 --> 00:09:36,880
launch this rocket components are

230
00:09:40,949 --> 00:09:38,720
erected on the mobile launch platform

231
00:09:42,550 --> 00:09:40,959
and filled with cryogenic fluids for a

232
00:09:44,389 --> 00:09:42,560
wet dress rehearsal

233
00:09:46,310 --> 00:09:44,399
about two weeks before launch the

234
00:09:47,910 --> 00:09:46,320
spacecraft is brought out here to the

235
00:09:49,590 --> 00:09:47,920
vertical integration facility and

236
00:09:51,670 --> 00:09:49,600
stacked on the rocket

237
00:09:53,509 --> 00:09:51,680
about one week before launch we do a

238
00:09:56,310 --> 00:09:53,519

launch countdown rehearsal so the team

239
00:09:59,030 --> 00:09:56,320
can practice for countdown

240
00:10:00,710 --> 00:09:59,040
in a dual payload flow both spacecraft

241
00:10:02,949 --> 00:10:00,720
have their own

242
00:10:05,509 --> 00:10:02,959
intricate and intimate requirements that

243
00:10:07,509 --> 00:10:05,519
are separate and may not play together

244
00:10:09,430 --> 00:10:07,519
nicely with the other spacecraft for

245
00:10:12,069 --> 00:10:09,440
example contamination orbital

246
00:10:14,389 --> 00:10:12,079
requirements because lcross is going to

247
00:10:16,230 --> 00:10:14,399
impact the moon and lro is going to go

248
00:10:18,150 --> 00:10:16,240
in orbit around the moon we need to make

249
00:10:21,829 --> 00:10:18,160
sure that one doesn't adversely impact

250
00:10:25,750 --> 00:10:23,509
the first challenge on this mission is

251
00:10:27,430 --> 00:10:25,760
the fact that the centaur second stage

252
00:10:29,750 --> 00:10:27,440
will remain attached to the l cross

253
00:10:32,069 --> 00:10:29,760
spacecraft after it does its normal job

254
00:10:33,590 --> 00:10:32,079
of delivering lro and l-cross on their

255
00:10:35,670 --> 00:10:33,600
journey to the moon

256
00:10:37,590 --> 00:10:35,680
l-cross then will command the centaur

257
00:10:39,829 --> 00:10:37,600
stage for an impact into the lunar

258
00:10:42,230 --> 00:10:39,839
surface

259
00:10:43,829 --> 00:10:42,240
the second challenge is that

260
00:10:46,550 --> 00:10:43,839
the orbit requirements for each

261
00:10:48,389 --> 00:10:46,560
spacecraft are complex this narrows the

262
00:10:50,069 --> 00:10:48,399
daily launch window that we have to

263
00:10:52,310 --> 00:10:50,079

launch this mission

264
00:10:54,550 --> 00:10:52,320
the third challenge is that this is

265
00:10:56,230 --> 00:10:54,560
nasa's first step in our return to the

266
00:10:58,310 --> 00:10:56,240
moon so there's a lot of public

267
00:10:59,990 --> 00:10:58,320
awareness and increased interest in this

268
00:11:01,350 --> 00:11:00,000
mission we want to make sure that this

269
00:11:04,230 --> 00:11:01,360
mission is launched safely and

270
00:11:08,550 --> 00:11:05,590
that's our show

271
00:11:11,030 --> 00:11:08,560
to our guests kathy petty dr kimberly

272
00:11:12,710 --> 00:11:11,040
eneko and chuck tatro thanks for giving

273
00:11:13,750 --> 00:11:12,720
us an insider's view of these two

274
00:11:15,910 --> 00:11:13,760
missions

275
00:11:18,550 --> 00:11:15,920
we also thank all of you for joining us

276
00:11:20,630 --> 00:11:18,560
for today's webcast be sure to join us

277
00:11:22,790 --> 00:11:20,640
on launch day for the liftoff of the

278
00:11:25,030 --> 00:11:22,800
atlas v rocket carrying the lunar

279
00:11:28,150 --> 00:11:25,040
reconnaissance orbiter and the lunar

280
00:11:31,030 --> 00:11:28,160
crater observation and sensing satellite

281
00:11:33,590 --> 00:11:31,040
you can follow the countdown on nasa tv

282
00:11:36,949 --> 00:11:33,600
and on each mission's website at

283
00:11:41,030 --> 00:11:38,069
lro

284
00:11:46,389 --> 00:11:43,829
gov www.nasa.gov l cross