1
00:00:08,870 --> 00:00:06,440
good afternoon and welcome to NASA

2
00:00:10,940 --> 00:00:08,880
headquarters I'm Dwane Brown with the

3
00:00:12,590 --> 00:00:10,950
office of communications today's

4
00:00:15,259 --> 00:00:12,600
briefing is about nasa's lunar

5
00:00:18,140 --> 00:00:15,269
atmosphere and dust environment Explorer

6
00:00:20,510 --> 00:00:18,150
or ladee a robotics mission was launched

7
00:00:22,640 --> 00:00:20,520
about two weeks away with a spacecraft

8
00:00:24,770 --> 00:00:22,650
over the moon to help scientists answer

9
00:00:28,189 --> 00:00:24,780
prevailing questions about our moon and

10
00:00:30,859 --> 00:00:28,199
this mission has many first in which you

11
00:00:33,650 --> 00:00:30,869
will hear firsthand about today of

12
00:00:36,410 --> 00:00:33,660
course for more details about the

13
00:00:43,549 --> 00:00:36,420

mission and updates on launch please

14
00:00:46,729 --> 00:00:43,559
visit NASA's website at WWE and join the

15
00:00:49,910 --> 00:00:46,739
conversation on twitter at at NASA

16
00:00:53,750 --> 00:00:49,920
laddie and doing a question and answer

17
00:00:55,490 --> 00:00:53,760
period please social media join and

18
00:00:58,760 --> 00:00:55,500
bring in your questions for the

19
00:01:01,279 --> 00:00:58,770
scientist to answer at hashtag as NASA

20
00:01:04,340 --> 00:01:01,289
and of course the conversation is

21
00:01:07,550 --> 00:01:04,350
viewing and a lot is going on follow

22
00:01:10,039 --> 00:01:07,560
NASA and missions updates on social

23
00:01:14,120 --> 00:01:10,049
media on twitter facebook and other

24
00:01:17,450 --> 00:01:14,130
sites before i introduce today's

25
00:01:20,080 --> 00:01:17,460
panelists today to start us off with

26
00:01:22,160 --> 00:01:20,090
opening remarks please welcome the

27
00:01:24,140 --> 00:01:22,170
associate administrator for NASA's

28
00:01:32,719 --> 00:01:24,150
science Mission Directorate John

29
00:01:41,120 --> 00:01:38,030
Thank You Duane I love this mission

30
00:01:43,320 --> 00:01:41,130
Letty is going to be fantastic I'm

31
00:01:46,499 --> 00:01:43,330
getting really excited as we move to the

32
00:01:49,380 --> 00:01:46,509
launch pad first of all because it's

33
00:01:51,240 --> 00:01:49,390
going to the moon and ever since I was

34
00:01:53,070 --> 00:01:51,250
young boy you know like so many folks

35
00:01:55,920 --> 00:01:53,080
you know looking up at the sky I've

36
00:01:57,630 --> 00:01:55,930
wondered about the moon with the lunar

37
00:01:58,980 --> 00:01:57,640
reconnaissance orbiter which is still in

38
00:02:00,990 --> 00:01:58,990

orbit around the moon we've learned an

39
00:02:03,719 --> 00:02:01,000
enormous amount about the surface of the

40
00:02:06,270 --> 00:02:03,729
moon with Grail we've studied the

41
00:02:07,469 --> 00:02:06,280
interior of the moon and now with laddie

42
00:02:09,630 --> 00:02:07,479
we're going to learn about the moon's

43
00:02:12,000 --> 00:02:09,640
atmosphere which is something very

44
00:02:14,430 --> 00:02:12,010
mysterious and we know very little bit

45
00:02:17,490 --> 00:02:14,440
about and so this is a particularly

46
00:02:19,110 --> 00:02:17,500
exciting mission for us the other reason

47
00:02:21,600 --> 00:02:19,120
I love it is it launches from Wallops

48
00:02:22,740 --> 00:02:21,610
and Duane was talking about the first

49
00:02:24,900 --> 00:02:22,750
and you're going to hear a lot more

50
00:02:26,460 --> 00:02:24,910
about all of these things these are just

51
00:02:29,850 --> 00:02:26,470
some personal things that I think are

52
00:02:32,160 --> 00:02:29,860
great and another is that it has a laser

53
00:02:35,190 --> 00:02:32,170
comm demo and this is something I'm a

54
00:02:38,370 --> 00:02:35,200
huge fan of and finally it's a modular

55
00:02:40,920 --> 00:02:38,380
spacecraft so that while this is the the

56
00:02:42,390 --> 00:02:40,930
lunar version it's a type of

57
00:02:44,310 --> 00:02:42,400
architecture that we might be able to

58
00:02:46,259 --> 00:02:44,320
use in a lot of different types of

59
00:02:48,360 --> 00:02:46,269
science experiments and others so I'm

60
00:02:50,970 --> 00:02:48,370
very excited you'll hear a lot more

61
00:02:57,100 --> 00:02:50,980
about it please bring your questions and

62
00:03:00,350 --> 00:02:59,270
thank you John so let's get to our

63
00:03:02,000 --> 00:03:00,360

panelists they will have brief

64
00:03:07,370 --> 00:03:02,010
presentations but let me introduce them

65
00:03:13,540 --> 00:03:07,380
to you first Jones salute laddie program

66
00:03:16,460 --> 00:03:13,550
executive NASA headquarters but lahaina

67
00:03:22,420 --> 00:03:16,470
laddie project manager from NASA's Ames

68
00:03:33,830 --> 00:03:26,930
Sarah noble lady program scientists NASA

69
00:03:35,120 --> 00:03:33,840
headquarters Don Cornwell mission

70
00:03:37,220 --> 00:03:35,130
manager for the lunar laser

71
00:03:38,690 --> 00:03:37,230
communications demonstration at NASA's

72
00:03:45,320 --> 00:03:38,700
Goddard Space Flight Center in Greenbelt

73
00:03:48,020 --> 00:03:45,330
Maryland and Doug Voss the launch

74
00:03:49,910 --> 00:03:48,030
manager at Wallops and with that I'll

75
00:03:51,980 --> 00:03:49,920
toss it to you John thank you doing

76
00:03:54,350 --> 00:03:51,990
thank you for coming this afternoon to

77
00:03:57,590 --> 00:03:54,360
learn more about laddie laddie scheduled

78
00:03:59,570 --> 00:03:57,600
to lunch on Friday September 6 was just

79
00:04:01,340 --> 00:03:59,580
two short weeks from tomorrow from the

80
00:04:03,710 --> 00:04:01,350
Eastern Shore of Virginia at the Wallops

81
00:04:05,540 --> 00:04:03,720
Flight Facility Lite is sponsored by the

82
00:04:07,699 --> 00:04:05,550
science Mission Directorate and will

83
00:04:09,350 --> 00:04:07,709
have three scientific instruments to

84
00:04:11,780 --> 00:04:09,360
measure the atmosphere in the dust as

85
00:04:13,760 --> 00:04:11,790
John mentioned in addition it has the

86
00:04:16,610 --> 00:04:13,770
what we call the tech demo or tech

87
00:04:19,430 --> 00:04:16,620
demonstration which is the loser excuse

88
00:04:21,500 --> 00:04:19,440

me lunar laser optical communications

89
00:04:23,140 --> 00:04:21,510
demonstration this tech demo is

90
00:04:26,570 --> 00:04:23,150
sponsored by the human exploration

91
00:04:28,640 --> 00:04:26,580
Operations missions Directorate once in

92
00:04:32,060 --> 00:04:28,650
orbit ladee will orbit the moon in a

93
00:04:33,920 --> 00:04:32,070
lunar or equatorial orbit to measure

94
00:04:36,350 --> 00:04:33,930
what the atmosphere is made up of and

95
00:04:38,060 --> 00:04:36,360
how that varies over time it will also

96
00:04:40,130 --> 00:04:38,070
try to understand whether or not the

97
00:04:41,480 --> 00:04:40,140
dust is levitated from the surface and

98
00:04:44,360 --> 00:04:41,490
this is one of the mysteries that you'll

99
00:04:46,100 --> 00:04:44,370
hear about a minute before you hear the

100
00:04:48,170 --> 00:04:46,110
details of the mission from all of the

101
00:04:50,510 --> 00:04:48,180
fellow panelists I'd like to try to put

102
00:04:53,600 --> 00:04:50,520
into perspective the mission development

103
00:04:56,030 --> 00:04:53,610
for this project in 2008 we formulated a

104
00:04:58,220 --> 00:04:56,040
new program the lunar quest program

105
00:05:01,070 --> 00:04:58,230
which was designed specifically to

106
00:05:04,909 --> 00:05:01,080
accelerate lunar exploration lunar

107
00:05:07,470 --> 00:05:04,919
scientific exploration we wanted to do

108
00:05:11,110 --> 00:05:07,480
it before humans went back to the moon

109
00:05:12,880 --> 00:05:11,120
at this time the science Mission

110
00:05:15,270 --> 00:05:12,890
Directorate was trying to figure out how

111
00:05:17,470 --> 00:05:15,280
to make spacecraft less expensive and

112
00:05:20,980 --> 00:05:17,480
Ames had come up with what we're calling

113
00:05:22,840 --> 00:05:20,990

the reusable modular design they thought

114
00:05:25,030 --> 00:05:22,850
they could do it less expensively than

115
00:05:27,010 --> 00:05:25,040
we've done it in the past so the mission

116
00:05:30,430 --> 00:05:27,020
was directed to Ames with a low cost

117
00:05:31,960 --> 00:05:30,440
commitment now five years later were

118
00:05:33,880 --> 00:05:31,970
actually ready to go five years after

119
00:05:37,030 --> 00:05:33,890
the program started we're ready to go

120
00:05:38,820 --> 00:05:37,040
back to the moon from the beginning this

121
00:05:41,950 --> 00:05:38,830
has been a great partnership across NASA

122
00:05:45,310 --> 00:05:41,960
we augmented the aims team with Goddard

123
00:05:48,430 --> 00:05:45,320
both greenbelt and Wallops gothic

124
00:05:51,010 --> 00:05:48,440
Goddard has a wealth of expertise that

125
00:05:53,710 --> 00:05:51,020
was able to supplement the aims team the

126
00:05:55,060 --> 00:05:53,720
program office we went to Marshall Space

127
00:05:57,310 --> 00:05:55,070
Flight Center where we already had our

128
00:06:00,220 --> 00:05:57,320
discovery and new frontiers program

129
00:06:03,040 --> 00:06:00,230
office well established during the years

130
00:06:06,330 --> 00:06:03,050
of development we've added team members

131
00:06:09,790 --> 00:06:06,340
from Kennedy in Florida Glenn in Ohio

132
00:06:12,370 --> 00:06:09,800
JPL and California Langley in Virginia

133
00:06:14,380 --> 00:06:12,380
and Johnson Space Center in Texas where

134
00:06:15,970 --> 00:06:14,390
the team needed additional expertise

135
00:06:20,200 --> 00:06:15,980
they reached out and got it from the

136
00:06:21,790 --> 00:06:20,210
other NASA centers the mission was

137
00:06:24,690 --> 00:06:21,800
directed aims for overall project

138
00:06:26,890 --> 00:06:24,700

management and they have designed built

139
00:06:28,870 --> 00:06:26,900
integrated and tested the spacecraft

140
00:06:30,750 --> 00:06:28,880
they'll be responsible for all the

141
00:06:34,120 --> 00:06:30,760
mission operations during the mission

142
00:06:35,860 --> 00:06:34,130
NASA Greenbelt Goddard Greenbelt was

143
00:06:37,570 --> 00:06:35,870
responsible for developing the payload

144
00:06:39,640 --> 00:06:37,580
which included all three scientific

145
00:06:41,410 --> 00:06:39,650
instruments and the tech demo and

146
00:06:42,850 --> 00:06:41,420
they'll be responsible to run the

147
00:06:45,940 --> 00:06:42,860
science operations center during the

148
00:06:48,190 --> 00:06:45,950
mission NASA Wallops has a privilege to

149
00:06:50,260 --> 00:06:48,200
launch us into space they have all the

150
00:06:52,540 --> 00:06:50,270
launch vehicle services and the range

151
00:06:55,090 --> 00:06:52,550
operations we have a reimbursable

152
00:06:56,530 --> 00:06:55,100
agreement with the Air Force to supply

153
00:06:58,180 --> 00:06:56,540
the launch vehicle and they're

154
00:07:00,520 --> 00:06:58,190
responsible for the mission assurance of

155
00:07:02,560 --> 00:07:00,530
the launch vehicle we're very proud to

156
00:07:05,170 --> 00:07:02,570
be breaking new ground in a number of

157
00:07:07,690 --> 00:07:05,180
areas this includes the first time Ames

158
00:07:11,320 --> 00:07:07,700
has built a spacecraft in house without

159
00:07:13,780 --> 00:07:11,330
the help of a prime contractor it's the

160
00:07:17,020 --> 00:07:13,790
first deep-space mission to be launched

161
00:07:18,610 --> 00:07:17,030
from Wallops the first minute or four or

162
00:07:20,530 --> 00:07:18,620
five to be launched from Wallops and

163
00:07:23,290 --> 00:07:20,540

it's the maiden voyage of the minute

164
00:07:26,500 --> 00:07:23,300
or five anywhere and as was mentioned

165
00:07:28,330 --> 00:07:26,510
it's NASA's first test from space of the

166
00:07:30,850 --> 00:07:28,340
optical communications were especially

167
00:07:33,400 --> 00:07:30,860
excited about so now I'd like to ask

168
00:07:36,010 --> 00:07:33,410
Butler the project manager from Ames to

169
00:07:39,220 --> 00:07:36,020
go over some mission highlights thanks

170
00:07:41,950 --> 00:07:39,230
Joan one of the things that is a first

171
00:07:43,930 --> 00:07:41,960
is we're trying out a modular spacecraft

172
00:07:46,420 --> 00:07:43,940
bus that is not designed for a single

173
00:07:48,100 --> 00:07:46,430
mission it's designed in a modular

174
00:07:49,570 --> 00:07:48,110
fashion so you can use it for four

175
00:07:51,310 --> 00:07:49,580
different missions by combining it in

176
00:07:54,850 --> 00:07:51,320
different ways if you bring out my first

177
00:07:56,710 --> 00:07:54,860
slide you can see the architecture you

178
00:07:58,840 --> 00:07:56,720
see the individual modules there's a top

179
00:08:01,960 --> 00:07:58,850
module which contains mostly electronics

180
00:08:04,900 --> 00:08:01,970
and power switching devices on the

181
00:08:06,910 --> 00:08:04,910
observatory there's a payload module

182
00:08:09,280 --> 00:08:06,920
where the two biggest instruments are

183
00:08:10,840 --> 00:08:09,290
located on opposite sides for balance it

184
00:08:13,150 --> 00:08:10,850
also has our reaction wheels for fine

185
00:08:15,100 --> 00:08:13,160
pointing control there's an extension

186
00:08:17,740 --> 00:08:15,110
module and within that is the propulsion

187
00:08:19,660 --> 00:08:17,750
module you can put different types of

188
00:08:21,910 --> 00:08:19,670

propulsion modules in this spacecraft

189
00:08:24,010 --> 00:08:21,920
architecture but in this case we're

190
00:08:26,620 --> 00:08:24,020
using a proven commercial design from

191
00:08:29,830 --> 00:08:26,630
space systems loral that is a by prop

192
00:08:32,380 --> 00:08:29,840
system meaning it has two fuel tanks and

193
00:08:35,290 --> 00:08:32,390
two pressure to oxidizer tanks and it's

194
00:08:37,630 --> 00:08:35,300
pressurized system some things to notice

195
00:08:39,640 --> 00:08:37,640
about this spacecraft design is it does

196
00:08:42,190 --> 00:08:39,650
not have the wings that you normally see

197
00:08:44,290 --> 00:08:42,200
on a lot of modern designs those wings

198
00:08:48,220 --> 00:08:44,300
give you a lot of power they're deployed

199
00:08:49,870 --> 00:08:48,230
after launch but they require that you

200
00:08:52,420 --> 00:08:49,880
always point at the Sun this is very

201
00:08:53,980 --> 00:08:52,430
it's very bad for a spacecraft to lose

202
00:08:55,330 --> 00:08:53,990
power obviously so you always want to be

203
00:08:56,890 --> 00:08:55,340
pointing at the Sun one of the

204
00:08:59,380 --> 00:08:56,900
characteristics of this design that you

205
00:09:01,330 --> 00:08:59,390
can see is that it has solar panels all

206
00:09:02,770 --> 00:09:01,340
over the spacecraft what that means is

207
00:09:05,170 --> 00:09:02,780
the spacecraft can be in pretty much any

208
00:09:07,000 --> 00:09:05,180
attitude and still generate power that

209
00:09:09,100 --> 00:09:07,010
means it's very inherently safe design

210
00:09:10,990 --> 00:09:09,110
it's very difficult for this spacecraft

211
00:09:14,110 --> 00:09:11,000
to ever get in a condition that it can't

212
00:09:15,880 --> 00:09:14,120
wake up from if you go to the next slide

213
00:09:18,220 --> 00:09:15,890

in what you'll see is this is what

214
00:09:21,280 --> 00:09:18,230
laddie looks like right now when we put

215
00:09:23,650 --> 00:09:21,290
the spacecraft together in this modular

216
00:09:25,510 --> 00:09:23,660
fashion it was done in a way to lower

217
00:09:28,150 --> 00:09:25,520
the cost of production one of the

218
00:09:31,150 --> 00:09:28,160
characteristics is this carbon composite

219
00:09:33,550 --> 00:09:31,160
frame that the spacecraft is built up to

220
00:09:36,040 --> 00:09:33,560
be very strong and very lightweight

221
00:09:38,080 --> 00:09:36,050
the other things we the thing we did was

222
00:09:40,990 --> 00:09:38,090
take advantage of any of modern

223
00:09:42,730 --> 00:09:41,000
electronics any modern devices that were

224
00:09:45,790 --> 00:09:42,740
designed for space rather than designing

225
00:09:48,460 --> 00:09:45,800
things from scratch so this is a think

226
00:09:51,220 --> 00:09:48,470
of it as a bus that you can use for a

227
00:09:53,200 --> 00:09:51,230
multitude purposes I'm very happy that

228
00:09:55,960 --> 00:09:53,210
we got a chance to fly this on the first

229
00:09:57,460 --> 00:09:55,970
time for a lunar mission because that

230
00:09:59,980 --> 00:09:57,470
really proves out some of the

231
00:10:01,810 --> 00:09:59,990
characteristics of the bus after we put

232
00:10:04,450 --> 00:10:01,820
the bus together we went through a lot

233
00:10:06,820 --> 00:10:04,460
of testing you really want a spacecraft

234
00:10:10,000 --> 00:10:06,830
to experience the rigors of space before

235
00:10:13,269 --> 00:10:10,010
you fly it so we shook it we blasted it

236
00:10:14,530 --> 00:10:13,279
with loud noises we simulated the shock

237
00:10:16,360 --> 00:10:14,540
when it separates from the launch

238
00:10:18,840 --> 00:10:16,370

vehicle we put it in a hard vacuum

239
00:10:21,329 --> 00:10:18,850
chamber we baked it to high temperatures

240
00:10:23,440 --> 00:10:21,339
cooled it to very low temperatures

241
00:10:25,600 --> 00:10:23,450
tested all of its communications

242
00:10:26,710 --> 00:10:25,610
equipment with the actual relay

243
00:10:29,320 --> 00:10:26,720
satellites that we're going to be using

244
00:10:31,240 --> 00:10:29,330
we did all this in preparations shipping

245
00:10:34,210 --> 00:10:31,250
it to the range it's been at the range

246
00:10:36,670 --> 00:10:34,220
this summer we just finished doing all

247
00:10:39,160 --> 00:10:36,680
the spin balancing all the fueling of

248
00:10:42,040 --> 00:10:39,170
the spacecraft and now it's encapsulated

249
00:10:43,960 --> 00:10:42,050
with the fifth stage the upper stage

250
00:10:46,329 --> 00:10:43,970
it's encapsulated in the nose cone of

251
00:10:47,950 --> 00:10:46,339
the rocket this weekend we plan to roll

252
00:10:49,540 --> 00:10:47,960
it out and stack it on the rest of the

253
00:10:51,850 --> 00:10:49,550
launch vehicle which is already stacked

254
00:10:53,650 --> 00:10:51,860
at the pad if you go to the last

255
00:10:56,650 --> 00:10:53,660
animation you can see what it looks like

256
00:10:58,810 --> 00:10:56,660
in flight this is an animation showing

257
00:11:00,790 --> 00:10:58,820
what you would see if you were outside

258
00:11:02,560 --> 00:11:00,800
the spacecraft looking at it on the way

259
00:11:04,090 --> 00:11:02,570
to the moon there's a couple of

260
00:11:05,290 --> 00:11:04,100
interesting things about how we get to

261
00:11:07,050 --> 00:11:05,300
the moon if you're if you're my

262
00:11:09,610 --> 00:11:07,060
generation you remember the Apollo era

263
00:11:11,350 --> 00:11:09,620

they got to the moon in a classic figure

264
00:11:13,329 --> 00:11:11,360
eight pattern it's a very efficient way

265
00:11:17,530 --> 00:11:13,339
of getting to the moon it takes a lot of

266
00:11:19,480 --> 00:11:17,540
fuel however and because of trying to

267
00:11:20,949 --> 00:11:19,490
optimize the amount of fuel that we have

268
00:11:22,810 --> 00:11:20,959
for the science mission we go in a

269
00:11:25,600 --> 00:11:22,820
different way we launched from Wallops

270
00:11:27,310 --> 00:11:25,610
and then we go into these elliptic

271
00:11:29,230 --> 00:11:27,320
orbits around the earth we take a couple

272
00:11:31,449 --> 00:11:29,240
of passes around the earth and each pass

273
00:11:33,370 --> 00:11:31,459
we get higher and higher until finally

274
00:11:34,900 --> 00:11:33,380
on the third pass or hanging out there

275
00:11:38,140 --> 00:11:34,910
in space right around where the moon is

276
00:11:40,300 --> 00:11:38,150
going to come by its wings by whips us

277
00:11:42,340 --> 00:11:40,310
around behind it and then once we come

278
00:11:43,570 --> 00:11:42,350
out from behind the moon we do a big

279
00:11:45,040 --> 00:11:43,580
braking burn with our

280
00:11:47,380 --> 00:11:45,050
main engine that you can see there that

281
00:11:49,780 --> 00:11:47,390
braking burn is what captures us around

282
00:11:52,600 --> 00:11:49,790
the moon we spend about 30 days

283
00:11:55,120 --> 00:11:52,610
commissioning the science instruments we

284
00:11:57,580 --> 00:11:55,130
do the optical calm experiment during

285
00:11:59,890 --> 00:11:57,590
that time and then we drop down into the

286
00:12:03,010 --> 00:11:59,900
low science orbit the low science orbit

287
00:12:05,020 --> 00:12:03,020
is about 30 to 70 to 90 miles above the

288
00:12:06,670 --> 00:12:05,030

lunar surface it's very low and when

289
00:12:08,950 --> 00:12:06,680
you're that low above the moon the lumpy

290
00:12:11,380 --> 00:12:08,960
gravity field requires a lot of fuel to

291
00:12:13,630 --> 00:12:11,390
maintain so we drop down into that orbit

292
00:12:16,000 --> 00:12:13,640
do our active science where we're flying

293
00:12:18,220 --> 00:12:16,010
in and out of the light-dark terminators

294
00:12:19,810 --> 00:12:18,230
around the moon and and then at the end

295
00:12:22,180 --> 00:12:19,820
of the mission we terminate the mission

296
00:12:24,400 --> 00:12:22,190
by intentionally crashing into the the

297
00:12:26,560 --> 00:12:24,410
lunar surface taking science on the way

298
00:12:28,450 --> 00:12:26,570
down and now I'd like Sarah to talk

299
00:12:31,120 --> 00:12:28,460
about the the science aspects of the

300
00:12:33,100 --> 00:12:31,130
mission expire so as you've heard lady

301
00:12:35,140 --> 00:12:33,110
has two main science goals to understand

302
00:12:37,270 --> 00:12:35,150
the lunar atmosphere as well as the dust

303
00:12:38,560 --> 00:12:37,280
environment around the moon I think

304
00:12:40,030 --> 00:12:38,570
sometimes people are a little taken

305
00:12:41,890 --> 00:12:40,040
aback when we start talking about the

306
00:12:43,270 --> 00:12:41,900
lunar atmosphere because right we were

307
00:12:45,970 --> 00:12:43,280
told in school that the moon doesn't

308
00:12:48,280 --> 00:12:45,980
have an atmosphere it does it's just

309
00:12:49,900 --> 00:12:48,290
it's really really thin it's so thin

310
00:12:51,730 --> 00:12:49,910
that the individual molecules that make

311
00:12:53,560 --> 00:12:51,740
up the atmosphere are so few and far

312
00:12:54,910 --> 00:12:53,570
between that they don't interact with

313
00:12:56,800 --> 00:12:54,920

each other they never collide a

314
00:12:59,050 --> 00:12:56,810
collisionless environment which is

315
00:13:01,210 --> 00:12:59,060
something we call an exosphere if i can

316
00:13:02,830 --> 00:13:01,220
get my first graphic the earth actually

317
00:13:04,330 --> 00:13:02,840
has a nexus fear as well but you

318
00:13:05,680 --> 00:13:04,340
actually have to get out past where the

319
00:13:07,420 --> 00:13:05,690
International Space Station orbits

320
00:13:09,670 --> 00:13:07,430
before you get to this condition that we

321
00:13:11,290 --> 00:13:09,680
can consider a nexus fear on the moon

322
00:13:13,000 --> 00:13:11,300
that actually happens right at the

323
00:13:14,740 --> 00:13:13,010
surface so the term we use for this

324
00:13:17,290 --> 00:13:14,750
class of atmosphere is a surface

325
00:13:19,330 --> 00:13:17,300
boundary exosphere and it's not just the

326
00:13:20,680 --> 00:13:19,340
moon surface boundary exosphere is turn

327
00:13:22,000 --> 00:13:20,690
out to be the most common type of

328
00:13:24,880 --> 00:13:22,010
atmosphere we have in the solar system

329
00:13:27,700 --> 00:13:24,890
so mercury a lot of the moons of other

330
00:13:29,320 --> 00:13:27,710
planets even some large asteroids are

331
00:13:31,840 --> 00:13:29,330
big enough to have a surface boundary

332
00:13:33,640 --> 00:13:31,850
exosphere it's a class of atmosphere we

333
00:13:34,870 --> 00:13:33,650
actually don't know that much about so

334
00:13:36,700 --> 00:13:34,880
it turns out the moon is actually a

335
00:13:37,990 --> 00:13:36,710
really convenient place to go and learn

336
00:13:40,690 --> 00:13:38,000
about this really common type of

337
00:13:42,280 --> 00:13:40,700
atmosphere it's also a really good time

338
00:13:44,920 --> 00:13:42,290

for us to go and explore the lunar

339
00:13:47,680 --> 00:13:44,930
exosphere because it's so delicate and

340
00:13:50,710 --> 00:13:47,690
thin it's easily disturbed by things

341
00:13:52,330 --> 00:13:50,720
like spacecraft landings things have

342
00:13:53,560 --> 00:13:52,340
been relatively quiet around the moon in

343
00:13:55,090 --> 00:13:53,570
terms of landings for the last few

344
00:13:56,320 --> 00:13:55,100
decades but that's not going to decide

345
00:13:57,170 --> 00:13:56,330
to stay that way for long there's

346
00:13:58,730 --> 00:13:57,180
actually a number of

347
00:14:00,170 --> 00:13:58,740
entries a number of private companies

348
00:14:01,760 --> 00:14:00,180
that are planning landings to the moon

349
00:14:03,260 --> 00:14:01,770
in the upcoming years so now is a really

350
00:14:04,700 --> 00:14:03,270
good time to go and take a look at it

351
00:14:08,510 --> 00:14:04,710
while it's still in its sort of pristine

352
00:14:10,010 --> 00:14:08,520
natural state the second science goal is

353
00:14:11,750 --> 00:14:10,020
to look at the dust environment around

354
00:14:14,360 --> 00:14:11,760
the room and if I can get that the

355
00:14:16,090 --> 00:14:14,370
second graphic we've actually had

356
00:14:19,010 --> 00:14:16,100
questions about the dust environment

357
00:14:20,330 --> 00:14:19,020
since even before Apollo if you look at

358
00:14:22,310 --> 00:14:20,340
the image on the left here from the

359
00:14:23,960 --> 00:14:22,320
surveyor seven mission it captured

360
00:14:26,570 --> 00:14:23,970
something right along the horizon just

361
00:14:28,790 --> 00:14:26,580
before sunrise this strange glow that we

362
00:14:31,340 --> 00:14:28,800
think might be due to dust uh scattering

363
00:14:32,840 --> 00:14:31,350

sunlight in the atmosphere the Apollo

364
00:14:34,910 --> 00:14:32,850
astronauts actually saw something

365
00:14:37,580 --> 00:14:34,920
similar thing too if you can see on the

366
00:14:39,350 --> 00:14:37,590
right side is a sketch from from Apollo

367
00:14:41,060 --> 00:14:39,360
17 astronaut gene cernan's notebook

368
00:14:42,890 --> 00:14:41,070
where he saw not just that horizon glow

369
00:14:45,080 --> 00:14:42,900
but also these things he saw streaming

370
00:14:47,090 --> 00:14:45,090
high up into the atmosphere something he

371
00:14:48,920 --> 00:14:47,100
called streamers we think this also

372
00:14:50,630 --> 00:14:48,930
might be due to very tiny particles of

373
00:14:53,450 --> 00:14:50,640
dust getting lofted tens of kilometers

374
00:14:55,340 --> 00:14:53,460
up into the sky so this is a finally an

375
00:14:56,690 --> 00:14:55,350
opportunity to that we can go and solve

376
00:14:58,400 --> 00:14:56,700
this mystery that has been puzzling

377
00:15:00,220 --> 00:14:58,410
scientists for almost 50 years so we're

378
00:15:02,270 --> 00:15:00,230
very excited to finally get an

379
00:15:03,470 --> 00:15:02,280
opportunity to understand what the dust

380
00:15:05,630 --> 00:15:03,480
environment is going to be like around

381
00:15:07,000 --> 00:15:05,640
the moon so we have three science

382
00:15:10,040 --> 00:15:07,010
instruments if i can get my last graphic

383
00:15:12,110 --> 00:15:10,050
on our science payload to in order to

384
00:15:15,020 --> 00:15:12,120
explore these questions the first is the

385
00:15:16,310 --> 00:15:15,030
lunar dust experiment it is a designed

386
00:15:18,260 --> 00:15:16,320
and built to the by the university of

387
00:15:20,570 --> 00:15:18,270
colorado and it will actually analyze

388
00:15:23,750 --> 00:15:20,580

individual dust grains as they approach

389
00:15:26,180 --> 00:15:23,760
the spacecraft the second is a neutral

390
00:15:29,360 --> 00:15:26,190
mass spectrometer design and built by

391
00:15:30,950 --> 00:15:29,370
nasa goddard I it will actually look at

392
00:15:32,600 --> 00:15:30,960
the composition of the various molecules

393
00:15:34,250 --> 00:15:32,610
in the atmosphere as well as their

394
00:15:36,740 --> 00:15:34,260
distribution over the course of a lunar

395
00:15:38,950 --> 00:15:36,750
day the third and final instrument is

396
00:15:42,680 --> 00:15:38,960
the an ultraviolet spectrometer I

397
00:15:44,360 --> 00:15:42,690
brought to us by the NASA Ames it's not

398
00:15:45,800 --> 00:15:44,370
the first spectrometer that we've sent

399
00:15:47,480 --> 00:15:45,810
to the moon we've actually sent a number

400
00:15:49,250 --> 00:15:47,490
of spectrometers usually though when we

401
00:15:50,390 --> 00:15:49,260
send a spectrometer it's looking down at

402
00:15:52,040 --> 00:15:50,400
the surface of the moon so that we can

403
00:15:54,470 --> 00:15:52,050
understand the mineralogy of the rocks

404
00:15:56,330 --> 00:15:54,480
at the surface this spectrometer will

405
00:15:57,710 --> 00:15:56,340
actually look sideways just above the

406
00:15:59,600 --> 00:15:57,720
lunar surface so that we can go through

407
00:16:01,450 --> 00:15:59,610
the atmosphere and analyze what is in

408
00:16:03,860 --> 00:16:01,460
the atmosphere and the dust environment

409
00:16:05,660 --> 00:16:03,870
so those are our three science payload

410
00:16:06,890 --> 00:16:05,670
there is a fourth payload as has been

411
00:16:09,140 --> 00:16:06,900
mentioned and I'm going to turn over to

412
00:16:10,249 --> 00:16:09,150
dawn to introduce us to that one thank

413
00:16:11,629 --> 00:16:10,259

you Sarah and I'd also

414
00:16:13,369 --> 00:16:11,639
like to thank the science Mission

415
00:16:15,349 --> 00:16:13,379
Directorate and the ladee mission for

416
00:16:17,419 --> 00:16:15,359
giving us a ride to the moon our

417
00:16:20,359 --> 00:16:17,429
technology demonstration where we're

418
00:16:24,079 --> 00:16:20,369
going to use laser communications to

419
00:16:25,849 --> 00:16:24,089
demonstrate at least six times more more

420
00:16:27,469 --> 00:16:25,859
data rate from the moon than we can do

421
00:16:29,840 --> 00:16:27,479
with a radio system with half the weight

422
00:16:32,329 --> 00:16:29,850
and also twenty-five percent less power

423
00:16:34,489 --> 00:16:32,339
and my first graphic is up and if you

424
00:16:36,139 --> 00:16:34,499
can see that it actually is a good

425
00:16:37,159 --> 00:16:36,149
illustration of what the concept of the

426
00:16:38,719 --> 00:16:37,169
mission is you can see the ladee

427
00:16:40,549 --> 00:16:38,729
spacecraft on the left and our

428
00:16:43,400 --> 00:16:40,559
instrument at the bottom which is a

429
00:16:46,159 --> 00:16:43,410
little small telescope and it will

430
00:16:48,019 --> 00:16:46,169
basically exchange laser beams between

431
00:16:51,349 --> 00:16:48,029
the Earth and the moon to a new type of

432
00:16:54,799 --> 00:16:51,359
ground station and so with this system

433
00:16:56,539 --> 00:16:54,809
here we plan to be or we will be NASA's

434
00:17:00,379 --> 00:16:56,549
first high rate to a laser

435
00:17:02,479 --> 00:17:00,389
communications demonstration and riding

436
00:17:05,629 --> 00:17:02,489
along with flat e to the moon the next

437
00:17:07,490 --> 00:17:05,639
slide please so nASA has a need for

438
00:17:09,350 --> 00:17:07,500

faster download speeds for data from

439
00:17:11,029 --> 00:17:09,360
space and it grows every day just like

440
00:17:13,909 --> 00:17:11,039
it does for the rest of us at home and

441
00:17:16,100 --> 00:17:13,919
also at work we'd like to be able to

442
00:17:19,309 --> 00:17:16,110
send high-resolution images and movies

443
00:17:22,579 --> 00:17:19,319
in 3d even from satellites that not only

444
00:17:24,679 --> 00:17:22,589
orbit the Earth but also from probes

445
00:17:26,449 --> 00:17:24,689
that'll go to the moon and beyond so

446
00:17:28,970 --> 00:17:26,459
communicating with radio waves has

447
00:17:30,799 --> 00:17:28,980
served us well for the last 50 years but

448
00:17:32,440 --> 00:17:30,809
we now have the technology to use light

449
00:17:34,549 --> 00:17:32,450
waves to communicate even more data

450
00:17:36,200 --> 00:17:34,559
light waves are much shorter and

451
00:17:39,230 --> 00:17:36,210
wavelength in radio waves as you can see

452
00:17:40,879 --> 00:17:39,240
in the figure and that allows us to use

453
00:17:44,480 --> 00:17:40,889
smaller transmitters and smaller

454
00:17:47,149 --> 00:17:44,490
receivers for example in the figure you

455
00:17:49,100 --> 00:17:47,159
can see that a typical radio dish is on

456
00:17:50,659 --> 00:17:49,110
the left hand side and our ground

457
00:17:52,700 --> 00:17:50,669
terminal is on the right hand side and

458
00:17:56,180 --> 00:17:52,710
if you can on the animation please play

459
00:17:58,850 --> 00:17:56,190
the animation while we send six times

460
00:18:01,220 --> 00:17:58,860
more data and and use less power we're

461
00:18:02,840 --> 00:18:01,230
actually a bunch smaller quite a bit

462
00:18:05,750 --> 00:18:02,850
smaller as you can see so faster

463
00:18:10,039 --> 00:18:05,760

bandwidth smaller size and less power

464
00:18:11,419 --> 00:18:10,049
needed the next slide please so this is

465
00:18:13,159 --> 00:18:11,429
an amanat animation of our actual

466
00:18:15,289 --> 00:18:13,169
mission concept right here we have three

467
00:18:16,610 --> 00:18:15,299
ground stations and then you can see the

468
00:18:19,490 --> 00:18:16,620
ladee spacecraft and we've highlighted

469
00:18:21,230 --> 00:18:19,500
in bright blue our space terminal so a

470
00:18:23,610 --> 00:18:21,240
beam from the ground from one of the

471
00:18:25,770 --> 00:18:23,620
ground stations will scan

472
00:18:28,740 --> 00:18:25,780
around the moon to where we expect

473
00:18:30,870 --> 00:18:28,750
laddie to be and when laddie sees that

474
00:18:32,910 --> 00:18:30,880
beam go by it will send its own signal

475
00:18:34,799 --> 00:18:32,920
back down to the ground station so that

476
00:18:36,960 --> 00:18:34,809
the two systems can lock up and acquire

477
00:18:39,950 --> 00:18:36,970
each other once the two systems are

478
00:18:42,750 --> 00:18:39,960
locked and acquired then we can send

479
00:18:44,430 --> 00:18:42,760
tens of mega bits of data per second

480
00:18:46,530 --> 00:18:44,440
from the earth up to the moon and

481
00:18:49,560 --> 00:18:46,540
similarly we can send hundreds of

482
00:18:54,270 --> 00:18:49,570
megabits per second from the moon and on

483
00:18:56,040 --> 00:18:54,280
laddie down to the earth and so we we

484
00:18:57,330 --> 00:18:56,050
hope that successfully is successfully

485
00:18:59,490 --> 00:18:57,340
demonstrating this over and over again

486
00:19:00,780 --> 00:18:59,500
during the ladee mission under all the

487
00:19:03,060 --> 00:19:00,790
conditions that you can see in the

488
00:19:04,980 --> 00:19:03,070

atmosphere and and day and night and and

489
00:19:07,440 --> 00:19:04,990
moon behind you and such we build the

490
00:19:08,880 --> 00:19:07,450
confidence for future NASA missions to

491
00:19:11,520 --> 00:19:08,890
use this technology for their

492
00:19:13,470 --> 00:19:11,530
communication systems finally I'd like

493
00:19:15,720 --> 00:19:13,480
to point out that the MIT Lincoln

494
00:19:18,030 --> 00:19:15,730
Laboratory built our flight terminal and

495
00:19:20,700 --> 00:19:18,040
also built our primary ground terminal

496
00:19:22,280 --> 00:19:20,710
and we also have partners NASA JPL has

497
00:19:25,080 --> 00:19:22,290
built the ground station for us in

498
00:19:26,820 --> 00:19:25,090
wrightwood California and then finally

499
00:19:29,450 --> 00:19:26,830
the European Space Agency has also built

500
00:19:31,230 --> 00:19:29,460
a ground station in tenerife spain and

501
00:19:35,520 --> 00:19:31,240
we're looking forward to collaborating

502
00:19:37,740 --> 00:19:35,530
with everyone and Lenny and I at this

503
00:19:39,210 --> 00:19:37,750
point I hand over to Doug Voss he was

504
00:19:42,660 --> 00:19:39,220
our launch manager at nasa's wallops

505
00:19:44,460 --> 00:19:42,670
thank you very much done it's an honor

506
00:19:46,530 --> 00:19:44,470
and a privilege to represent Wallops and

507
00:19:48,090 --> 00:19:46,540
NASA and be a part of the lady team for

508
00:19:50,400 --> 00:19:48,100
the last five years wallops flight

509
00:19:53,040 --> 00:19:50,410
facility has been working with NASA Ames

510
00:19:55,380 --> 00:19:53,050
and all the other centers mentioned to

511
00:19:58,410 --> 00:19:55,390
deliver laddie to the moon on its way on

512
00:19:59,790 --> 00:19:58,420
an air force Minotaur 5 Wallops has been

513
00:20:02,490 --> 00:19:59,800

a very busy place in the last couple

514
00:20:04,200 --> 00:20:02,500
years as you might note there been a lot

515
00:20:05,970 --> 00:20:04,210
of missions that have been increasing in

516
00:20:07,590 --> 00:20:05,980
scope and size at Wallops Flight

517
00:20:09,840 --> 00:20:07,600
Facility and laddie is launching at a

518
00:20:12,720 --> 00:20:09,850
historic time at Wallops loss has been

519
00:20:15,330 --> 00:20:12,730
launching missions since 1945 and in all

520
00:20:19,200 --> 00:20:15,340
of those flights from Wallops and other

521
00:20:20,640 --> 00:20:19,210
places in in the in the world none of

522
00:20:22,650 --> 00:20:20,650
those flights have ever left Earth's

523
00:20:24,870 --> 00:20:22,660
orbit so that is a historic moment as

524
00:20:26,160 --> 00:20:24,880
well as going to the moon and makes it

525
00:20:29,160 --> 00:20:26,170
very exciting for people like me and

526
00:20:31,020 --> 00:20:29,170
other people on the team Wallops is

527
00:20:33,000 --> 00:20:31,030
exercising a relationship with the US

528
00:20:36,330 --> 00:20:33,010
Air Force that we've been working with

529
00:20:36,600 --> 00:20:36,340
for a few years actually since 2006 to

530
00:20:38,340 --> 00:20:36,610
fly

531
00:20:40,980 --> 00:20:38,350
minotaur ones from Wallops for Air Force

532
00:20:42,480 --> 00:20:40,990
DoD missions so with laddie we're

533
00:20:44,220 --> 00:20:42,490
putting a NASA mission on top of a

534
00:20:45,870 --> 00:20:44,230
minute our vehicle and it's a new

535
00:20:47,640 --> 00:20:45,880
Minotaur vehicle that we've never flown

536
00:20:49,140 --> 00:20:47,650
from Wallops Flight Facility so it's a

537
00:20:52,620 --> 00:20:49,150
very exciting time for us and the Air

538
00:20:54,060 --> 00:20:52,630

Force and the rest of the agency I have

539
00:20:55,350 --> 00:20:54,070
a visualization i'm going to show you

540
00:20:57,240 --> 00:20:55,360
and talk to you a little bit about the

541
00:20:58,710 --> 00:20:57,250
flight is developed by engineers at

542
00:21:00,270 --> 00:20:58,720
wallops flight facility and we use this

543
00:21:02,850 --> 00:21:00,280
visualization for engineering and

544
00:21:04,710 --> 00:21:02,860
planning now the Minotaur 5 is going to

545
00:21:08,490 --> 00:21:04,720
be launching from Virginia spaceport pad

546
00:21:11,070 --> 00:21:08,500
0b and this five-stage solid fuel rocket

547
00:21:14,280 --> 00:21:11,080
is going to lift off at mentioned

548
00:21:16,200 --> 00:21:14,290
earlier 1127 p.m. friday September sixth

549
00:21:19,049 --> 00:21:16,210
and it's going to take off and fly over

550
00:21:20,909 --> 00:21:19,059
the Atlantic Ocean this five stage

551
00:21:23,700 --> 00:21:20,919
rocket will drop its first three stages

552
00:21:25,640 --> 00:21:23,710
in the Atlantic Ocean while NASA systems

553
00:21:27,870 --> 00:21:25,650
located at wallops flight facility

554
00:21:30,510 --> 00:21:27,880
nearby North Carolina's Outer Banks

555
00:21:33,630 --> 00:21:30,520
coquina and on Bermuda will be tracking

556
00:21:36,539 --> 00:21:33,640
the rocket on its flight out so as does

557
00:21:37,980 --> 00:21:36,549
the ICBM peacekeeper stages fall into

558
00:21:39,680 --> 00:21:37,990
the ocean these systems will be relaying

559
00:21:42,330 --> 00:21:39,690
data back to Wallops Flight Facility

560
00:21:45,270 --> 00:21:42,340
giving a personnel on the range control

561
00:21:46,830 --> 00:21:45,280
center and in the air and in the the Air

562
00:21:49,650 --> 00:21:46,840
Force and NASA personnel will be having

563
00:21:51,990 --> 00:21:49,660

taking that information and observing

564
00:21:53,940 --> 00:21:52,000
the flight on the way out so as the

565
00:21:55,680 --> 00:21:53,950
vehicle flies out it's real important to

566
00:21:58,680 --> 00:21:55,690
note that the data coming back from

567
00:22:00,720 --> 00:21:58,690
these these are these facilities in the

568
00:22:03,870 --> 00:22:00,730
Atlantic Ocean of Bermuda will be used

569
00:22:06,390 --> 00:22:03,880
to to assess the vehicle and to monitor

570
00:22:08,669 --> 00:22:06,400
its performance it's real important to

571
00:22:10,620 --> 00:22:08,679
note also that these stages are ICBM

572
00:22:12,330 --> 00:22:10,630
stages that were on peacekeeper of

573
00:22:14,580 --> 00:22:12,340
vehicles that are used by the Air Force

574
00:22:18,510 --> 00:22:14,590
so they're highly reliable on the first

575
00:22:20,010 --> 00:22:18,520
three stages the fourth and fifth stage

576
00:22:22,530 --> 00:22:20,020
our commercial rocket motors that are

577
00:22:23,730 --> 00:22:22,540
stacked on them and right now on the

578
00:22:25,710 --> 00:22:23,740
visualization you see the fairing

579
00:22:27,600 --> 00:22:25,720
separation and that fairing separation

580
00:22:31,530 --> 00:22:27,610
exposes the ladee spacecraft and the new

581
00:22:35,700 --> 00:22:31,540
Minotaur five fifth stage upon fourth

582
00:22:39,180 --> 00:22:35,710
stage burnout you'll see that the tea

583
00:22:40,830 --> 00:22:39,190
dress system will be used to collect the

584
00:22:42,539 --> 00:22:40,840
data as the spate as the launch vehicle

585
00:22:46,830 --> 00:22:42,549
gets down range and out of range of

586
00:22:48,360 --> 00:22:46,840
tracking assets so at this point in the

587
00:22:50,190 --> 00:22:48,370
flight the vehicle is in orbit and the

588
00:22:52,290 --> 00:22:50,200

stage for ignites

589
00:22:54,990 --> 00:22:52,300
and that the stage for takes the vehicle

590
00:23:00,750 --> 00:22:55,000
up to prepare it for its final phase on

591
00:23:03,240 --> 00:23:00,760
the way to insertion and after stage for

592
00:23:04,920 --> 00:23:03,250
separates we enter the stage where the

593
00:23:07,140 --> 00:23:04,930
Minotaur five fifth stage is going to do

594
00:23:10,560 --> 00:23:07,150
its work the first thing we have to do

595
00:23:12,570 --> 00:23:10,570
is spin the upper stack together and the

596
00:23:15,630 --> 00:23:12,580
ladee spacecraft and Minotaur five will

597
00:23:17,280 --> 00:23:15,640
spin and B spin stabilized before the

598
00:23:20,310 --> 00:23:17,290
fifth stage ignites when the fifth stage

599
00:23:22,290 --> 00:23:20,320
ignites the teachers data will be

600
00:23:25,890 --> 00:23:22,300
transmitted via the teacher system back

601
00:23:31,020 --> 00:23:25,900
to wallops flight facility and after

602
00:23:32,820 --> 00:23:31,030
burn out the system will d spin we have

603
00:23:35,340 --> 00:23:32,830
a yo-yo d spin that orbital sciences has

604
00:23:37,500 --> 00:23:35,350
developed along with the rest of the

605
00:23:39,750 --> 00:23:37,510
systems on the fifth stage this system

606
00:23:41,610 --> 00:23:39,760
separates this system d spins the system

607
00:23:46,280 --> 00:23:41,620
so the lad you can separate and then

608
00:23:51,600 --> 00:23:50,130
so this vehicles can be launching at

609
00:23:53,370 --> 00:23:51,610
night so it should be easily visible

610
00:23:56,220 --> 00:23:53,380
from a lot of locations on the east

611
00:23:58,530 --> 00:23:56,230
coast the next visualization you'll see

612
00:24:00,330 --> 00:23:58,540
is the graphic of the east coast of the

613
00:24:07,140 --> 00:24:00,340

United States and going to switch to

614
00:24:10,110 --> 00:24:07,150
that graphic please and so this graphic

615
00:24:12,000 --> 00:24:10,120
you'll see that the all the way from the

616
00:24:14,400 --> 00:24:12,010
coast of South Carolina up to the main

617
00:24:16,260 --> 00:24:14,410
area and as far west as Pittsburgh it

618
00:24:18,090 --> 00:24:16,270
will be able to see the vehicle

619
00:24:20,100 --> 00:24:18,100
depending on weather conditions you can

620
00:24:22,260 --> 00:24:20,110
actually go online to NASA's website and

621
00:24:24,090 --> 00:24:22,270
get this information and figure out

622
00:24:26,580 --> 00:24:24,100
which way to look to see laddie head

623
00:24:29,940 --> 00:24:26,590
it's on its way to the moon thank you

624
00:24:30,960 --> 00:24:29,950
and dr. doing well thank you all now

625
00:24:33,200 --> 00:24:30,970
it's time we're going to go ahead and

626
00:24:35,310 --> 00:24:33,210
transition into the question and answer

627
00:24:38,610 --> 00:24:35,320
we're going to go to the phone lines

628
00:24:40,800 --> 00:24:38,620
first and then of course remember the

629
00:24:43,680 --> 00:24:40,810
public that's out there bring send your

630
00:24:45,270 --> 00:24:43,690
question into hashtag as NASA join the

631
00:24:49,290 --> 00:24:45,280
conversation it's building and building

632
00:24:52,110 --> 00:24:49,300
at at laddie I'm sorry at NASA laddie

633
00:24:55,080 --> 00:24:52,120
but if you have a question again send it

634
00:24:56,670 --> 00:24:55,090
in to hashtag as NASA but right now

635
00:24:58,980 --> 00:24:56,680
we're going to go to the phones first

636
00:25:08,980 --> 00:24:58,990
and I believe we have marsha smith on

637
00:25:13,240 --> 00:25:11,650
well what I will do if Marcia is not

638
00:25:15,280 --> 00:25:13,250

there let me go ahead and take an ass

639
00:25:21,880 --> 00:25:15,290
that's a question for the panelists

640
00:25:23,830 --> 00:25:21,890
everybody going okay I'm hearing Marcia

641
00:25:26,440 --> 00:25:23,840
she's going to be with us so for the

642
00:25:28,570 --> 00:25:26,450
group here for a NASA NASA question if

643
00:25:30,570 --> 00:25:28,580
daddy doesn't launch September 6 what

644
00:25:34,570 --> 00:25:30,580
other launch opportunities will it be I

645
00:25:36,549 --> 00:25:34,580
can answer that the September 6

646
00:25:38,730 --> 00:25:36,559
opportunities the first window and since

647
00:25:41,169 --> 00:25:38,740
we're leaving Earth orbit we have a

648
00:25:43,570 --> 00:25:41,179
pretty tight constraints on when we can

649
00:25:45,160 --> 00:25:43,580
launch so we have a window on the six

650
00:25:47,620 --> 00:25:45,170
and then we have another four nights

651
00:25:48,970 --> 00:25:47,630
that we can launch if we don't get out

652
00:25:51,250 --> 00:25:48,980
for some reason the weather's too bad

653
00:25:53,020 --> 00:25:51,260
then we stand down for a couple of days

654
00:25:55,660 --> 00:25:53,030
and then we can make an another attempt

655
00:25:58,120 --> 00:25:55,670
for four days before before the windows

656
00:26:01,030 --> 00:25:58,130
closed after that we have some more

657
00:26:02,830 --> 00:26:01,040
windows in October but but we need to

658
00:26:04,990 --> 00:26:02,840
get off the ground by the end of October

659
00:26:06,940 --> 00:26:05,000
otherwise an eclipse season starts

660
00:26:09,700 --> 00:26:06,950
around the moon that has very deep cold

661
00:26:12,299 --> 00:26:09,710
eclipses and those are eclipses the

662
00:26:14,260 --> 00:26:12,309
spacecraft's not designed to survive so

663
00:26:19,030 --> 00:26:14,270

september-october are our primary

664
00:26:20,590 --> 00:26:19,040
windows okay let's see if we can go back

665
00:26:22,750 --> 00:26:20,600
to the phone lines here and I believe we

666
00:26:24,760 --> 00:26:22,760
have alan Boyle Ellen if you there God

667
00:26:27,970 --> 00:26:24,770
please give your name again any

668
00:26:31,540 --> 00:26:27,980
affiliation okay all right this is alan

669
00:26:34,720 --> 00:26:31,550
Boyle with NBC News and had a question

670
00:26:36,669 --> 00:26:34,730
just about laddie has had quite a

671
00:26:41,500 --> 00:26:36,679
history I think when the the mission was

672
00:26:45,030 --> 00:26:41,510
first raised it was going to support

673
00:26:48,610 --> 00:26:45,040
future NASA manned missions to the moon

674
00:26:51,280 --> 00:26:48,620
now the focus is shifted elsewhere do

675
00:26:53,290 --> 00:26:51,290
you feel how did that change the

676
00:26:54,730 --> 00:26:53,300
character of the mission and can you

677
00:26:56,770 --> 00:26:54,740
talk a little bit about the long-term

678
00:27:01,290 --> 00:26:56,780
goals that are served in terms of

679
00:27:07,600 --> 00:27:05,140
you want to take a shot at John we do

680
00:27:09,940 --> 00:27:07,610
you want to do this job but the way the

681
00:27:11,530 --> 00:27:09,950
question was asked about laddie being a

682
00:27:13,299 --> 00:27:11,540
human mission is not correct it was

683
00:27:15,190 --> 00:27:13,309
never designed as a human mission was

684
00:27:16,960 --> 00:27:15,200
always a low-cost robotic science

685
00:27:18,580 --> 00:27:16,970
mission from the beginning I'm

686
00:27:20,159 --> 00:27:18,590
personally not aware of anything else

687
00:27:23,340 --> 00:27:20,169
called laddie in the

688
00:27:24,749 --> 00:27:23,350

see that was related to humans so if the

689
00:27:27,330 --> 00:27:24,759
question wants to be repeated in any

690
00:27:29,849 --> 00:27:27,340
format go ahead but laddie was not

691
00:27:32,789 --> 00:27:29,859
designed to be involved with humans so I

692
00:27:37,019 --> 00:27:32,799
could not I can add to that I think what

693
00:27:40,249 --> 00:27:37,029
the questioner is asking is at the early

694
00:27:42,060 --> 00:27:40,259
times dust is a very difficult

695
00:27:44,639 --> 00:27:42,070
environment to deal with on the moon

696
00:27:46,409 --> 00:27:44,649
it's not like terrestrial dust restoril

697
00:27:48,960 --> 00:27:46,419
dust is like talcum powder on the moon

698
00:27:51,810 --> 00:27:48,970
it's very rough and it can actually

699
00:27:54,359 --> 00:27:51,820
follow it's very kind of evil it follows

700
00:27:56,519 --> 00:27:54,369
electric field lines it works its way in

701
00:27:59,700 --> 00:27:56,529
equipment so one of the questions about

702
00:28:01,830 --> 00:27:59,710
dust on the moon is is an engineering

703
00:28:03,180 --> 00:28:01,840
question how do you design things so

704
00:28:05,310 --> 00:28:03,190
that they can survive the dust

705
00:28:07,649 --> 00:28:05,320
environment and that was the connection

706
00:28:09,629 --> 00:28:07,659
to the the human efforts at the

707
00:28:11,519 --> 00:28:09,639
beginning of laddie was not only the

708
00:28:13,919 --> 00:28:11,529
scientific question about how elevated

709
00:28:15,389 --> 00:28:13,929
dust operates around the moon transports

710
00:28:17,340 --> 00:28:15,399
around the moon but also information

711
00:28:19,259 --> 00:28:17,350
about the dust transport mechanisms for

712
00:28:20,849 --> 00:28:19,269
engineering purposes and the goal of

713
00:28:23,759 --> 00:28:20,859

laddie was to do these measurements

714
00:28:28,039 --> 00:28:23,769
before future human activity occurred

715
00:28:33,560 --> 00:28:31,289
just to expand on that a little bit well

716
00:28:35,430 --> 00:28:33,570
or I think you give great answers and

717
00:28:38,399 --> 00:28:35,440
another thing that we've learned about

718
00:28:40,639 --> 00:28:38,409
the moon from the El cross mission is

719
00:28:43,019 --> 00:28:40,649
the possibility of water on the moon and

720
00:28:44,849 --> 00:28:43,029
how does it get trapped in these cold

721
00:28:47,279 --> 00:28:44,859
traps and other places that we've seen

722
00:28:49,979 --> 00:28:47,289
it and so understanding this tenuous

723
00:28:52,259 --> 00:28:49,989
atmosphere and the transport mechanisms

724
00:28:53,999 --> 00:28:52,269
of dust and other atmosphere components

725
00:28:56,369 --> 00:28:54,009
will tell us a lot about you know both

726
00:28:59,099 --> 00:28:56,379
the scientific aspects and future lunar

727
00:29:00,830 --> 00:28:59,109
exploration aspects you know we're

728
00:29:04,259 --> 00:29:00,840
exploring all across the solar system

729
00:29:06,509 --> 00:29:04,269
you know from you know just a very rough

730
00:29:08,789 --> 00:29:06,519
view the moon kind of looks like mercury

731
00:29:10,590 --> 00:29:08,799
and you would never think that mercury

732
00:29:12,210 --> 00:29:10,600
so close to the Sun would have an

733
00:29:14,340 --> 00:29:12,220
atmosphere you know but there's some

734
00:29:16,320 --> 00:29:14,350
hints that even mercury you know has a

735
00:29:18,570 --> 00:29:16,330
tenuous atmosphere from our messenger

736
00:29:20,279 --> 00:29:18,580
mission and so laddie is part of a much

737
00:29:22,529 --> 00:29:20,289
broader scientific exploration of the

738
00:29:23,820 --> 00:29:22,539

solar system that we do here in the

739
00:29:26,460 --> 00:29:23,830
science Mission Directorate but of

740
00:29:29,789 --> 00:29:26,470
course all of our explorations science

741
00:29:31,349 --> 00:29:29,799
or otherwise is human exploration you

742
00:29:33,340 --> 00:29:31,359
know I have to remind my kids sometime

743
00:29:37,360 --> 00:29:33,350
that scientists are people too

744
00:29:38,440 --> 00:29:37,370
are humans too especially myself so you

745
00:29:41,409 --> 00:29:38,450
know this is part of a much broader

746
00:29:44,320 --> 00:29:41,419
exploration agenda and the same question

747
00:29:48,430 --> 00:29:44,330
can be asked about larger asteroids if

748
00:29:50,650 --> 00:29:48,440
you look at a series or a Vesta you know

749
00:29:52,810 --> 00:29:50,660
does series invest in the main asteroid

750
00:29:55,450 --> 00:29:52,820
belt do they have atmospheres what are

751
00:29:59,110 --> 00:29:55,460
the transport properties of dust from

752
00:30:00,730 --> 00:29:59,120
collisions clearly the moon is there was

753
00:30:02,740 --> 00:30:00,740
you know that's what we see on the moon

754
00:30:05,649 --> 00:30:02,750
the visual surface is the result of

755
00:30:07,060 --> 00:30:05,659
asteroid collisions on the moon and so

756
00:30:09,669 --> 00:30:07,070
in the main asteroid belt there's you

757
00:30:12,159 --> 00:30:09,679
know speaking in very long time frames

758
00:30:13,539 --> 00:30:12,169
lots of collisions and so the same

759
00:30:15,779 --> 00:30:13,549
questions are out there so this is part

760
00:30:19,029 --> 00:30:15,789
of the broader scientific exploration

761
00:30:20,919 --> 00:30:19,039
thanks John we're going to take another

762
00:30:23,380 --> 00:30:20,929
call on the phone line and then we're

763
00:30:26,080 --> 00:30:23,390

going to go back to social media again

764
00:30:29,680 --> 00:30:26,090
if you have a question hashtag as NASA

765
00:30:31,419 --> 00:30:29,690
join the conversation at NASA laddie on

766
00:30:37,919 --> 00:30:31,429
the phone next Kara Lynch in New York

767
00:30:41,490 --> 00:30:37,929
Times Carolyn hi can you hear me yes

768
00:30:43,539 --> 00:30:41,500
okay great I was wondering if you could

769
00:30:45,460 --> 00:30:43,549
explain what the price tag of the

770
00:30:49,210 --> 00:30:45,470
mission is and put that into some

771
00:30:52,360 --> 00:30:49,220
context with the original goal of the

772
00:30:53,860 --> 00:30:52,370
lunar quest program to you know be less

773
00:30:57,850 --> 00:30:53,870
expensive you've mentioned many times

774
00:31:00,190 --> 00:30:57,860
that their new modular design has the

775
00:31:02,140 --> 00:31:00,200
possibility of saving money and I was

776
00:31:04,210 --> 00:31:02,150
wondering if you could extend a price

777
00:31:06,070 --> 00:31:04,220
tag of business mission and also compare

778
00:31:08,230 --> 00:31:06,080
that to previous lunar missions or any

779
00:31:12,610 --> 00:31:08,240
other you know comfortable missions to

780
00:31:15,130 --> 00:31:12,620
give some context laddies price tags

781
00:31:17,980 --> 00:31:15,140
coming in at 280 million for the full

782
00:31:19,870 --> 00:31:17,990
lifecycle cost of laddie and the way we

783
00:31:22,659 --> 00:31:19,880
one of the ways we categorize our

784
00:31:24,880 --> 00:31:22,669
missions there's a number of factors but

785
00:31:28,029 --> 00:31:24,890
one of those is cost we call them cat

786
00:31:29,740 --> 00:31:28,039
one two or three based on costs and

787
00:31:32,590 --> 00:31:29,750
other things we look at missions that

788
00:31:35,980 --> 00:31:32,600

are over a billion between 250 million

789
00:31:38,289 --> 00:31:35,990
and 1 billion or less than 250 and this

790
00:31:41,110 --> 00:31:38,299
mission came in it's a low end of cat

791
00:31:42,880 --> 00:31:41,120
too so it's just it almost made the cat

792
00:31:45,100 --> 00:31:42,890
one the lowest cost missions that we

793
00:31:50,880 --> 00:31:45,110
have so it's just over that cat one

794
00:31:57,700 --> 00:31:54,070
carlin did you uh did that answer your

795
00:31:59,710 --> 00:31:57,710
question yeah I was wondering if that

796
00:32:01,450 --> 00:31:59,720
was within could you give some context

797
00:32:04,000 --> 00:32:01,460
for that number is that what was

798
00:32:08,110 --> 00:32:04,010
expected from the outset was how does it

799
00:32:13,720 --> 00:32:08,120
compare to say the Grail mission or LRO

800
00:32:15,640 --> 00:32:13,730
I don't have the LRO or Grail numbers i

801
00:32:18,390 --> 00:32:15,650
would guess Grail was discovery so that

802
00:32:21,310 --> 00:32:18,400
was what about 350 million approximately

803
00:32:23,320 --> 00:32:21,320
but I really shouldn't say because I

804
00:32:25,770 --> 00:32:23,330
don't know for certain on that i will

805
00:32:28,120 --> 00:32:25,780
say that over the last ten years

806
00:32:29,950 --> 00:32:28,130
approximately twenty percent of our

807
00:32:32,680 --> 00:32:29,960
missions have been in the lowest cost

808
00:32:34,690 --> 00:32:32,690
range below 250 and twenty percent have

809
00:32:37,870 --> 00:32:34,700
been over a billion and sixty percent

810
00:32:39,340 --> 00:32:37,880
have been in that mid range in carlan

811
00:32:41,320 --> 00:32:39,350
you can call my office and we can get

812
00:32:43,300 --> 00:32:41,330
you some some additional figures 2 i'll

813
00:32:44,500 --> 00:32:43,310

put it in context we don't want to put

814
00:32:46,270 --> 00:32:44,510
those numbers out we just want to make

815
00:32:47,920 --> 00:32:46,280
sure we can get them accurate so just

816
00:32:49,180 --> 00:32:47,930
give me a call on that so this is what

817
00:32:51,130 --> 00:32:49,190
we're going to do ladies and gentlemen

818
00:32:53,740 --> 00:32:51,140
real expert on social media who's

819
00:32:54,580 --> 00:32:53,750
joining us here today with a ass and

820
00:32:55,990 --> 00:32:54,590
that's the question we're going to

821
00:32:59,130 --> 00:32:56,000
switch over to my colleague Jason

822
00:33:01,690 --> 00:32:59,140
Townsend who's monitoring as NASA Jason

823
00:33:03,760 --> 00:33:01,700
hi we have a question here from twitter

824
00:33:06,310 --> 00:33:03,770
user Daniel Fisher could someone on the

825
00:33:08,110 --> 00:33:06,320
panel address the hoped-for involvement

826
00:33:12,550 --> 00:33:08,120
of amateur astronomers in support of

827
00:33:14,680 --> 00:33:12,560
NASA laude science goals sure I think I

828
00:33:16,240 --> 00:33:14,690
can address that this is Sarah so yeah

829
00:33:18,430 --> 00:33:16,250
we are very interested in having

830
00:33:20,380 --> 00:33:18,440
participation from amateur astronomer

831
00:33:23,380 --> 00:33:20,390
astronomers around the world we'd really

832
00:33:25,030 --> 00:33:23,390
like to be able to see what's going on

833
00:33:27,340 --> 00:33:25,040
on the moon so we're orbiting the moon

834
00:33:28,660 --> 00:33:27,350
we've got LRO looking and stuff but

835
00:33:30,280 --> 00:33:28,670
there are impacts hitting the moon all

836
00:33:32,800 --> 00:33:30,290
the time and we want to know what impact

837
00:33:35,140 --> 00:33:32,810
impact those impacts are having on the

838
00:33:38,050 --> 00:33:35,150

atmosphere and dust environment so we've

839
00:33:40,000 --> 00:33:38,060
asked amateur astronomers yeah to to

840
00:33:42,180 --> 00:33:40,010
actually watch the moon and take a look

841
00:33:44,650 --> 00:33:42,190
and see if they see impacts coming in

842
00:33:46,960 --> 00:33:44,660
that requires a certain level of

843
00:33:48,970 --> 00:33:46,970
sophistication in your telescope if you

844
00:33:51,490 --> 00:33:48,980
were below that level we actually have a

845
00:33:55,000 --> 00:33:51,500
web app where you can go and actually

846
00:33:58,000 --> 00:33:55,010
monitor meteorites coming through in on

847
00:33:59,410 --> 00:33:58,010
earth so if you figure that you know as

848
00:34:01,540 --> 00:33:59,420
we go through a

849
00:34:02,740 --> 00:34:01,550
a meteorite storm certain number of

850
00:34:04,210 --> 00:34:02,750
things are hitting the moon they're also

851
00:34:06,850 --> 00:34:04,220
hitting the earth at roughly the same

852
00:34:10,180 --> 00:34:06,860
rates so we'd actually are interested in

853
00:34:11,470 --> 00:34:10,190
in acquiring data about how many things

854
00:34:13,060 --> 00:34:11,480
are hitting the earth at any given time

855
00:34:15,370 --> 00:34:13,070
as well and so there's actually an app

856
00:34:17,200 --> 00:34:15,380
you can find the information for it on

857
00:34:18,669 --> 00:34:17,210
the lady website to download the app

858
00:34:21,760 --> 00:34:18,679
it's free and you can go out at night

859
00:34:23,260 --> 00:34:21,770
and count meteors and and and add that

860
00:34:24,490 --> 00:34:23,270
data to our collective knowledge so

861
00:34:28,570 --> 00:34:24,500
anybody can participate in the landing

862
00:34:31,930 --> 00:34:28,580
mission Jason so more questions indeed

863
00:34:34,330 --> 00:34:31,940

from twitter user gemway can you explain

864
00:34:39,130 --> 00:34:34,340
more about the d spin procedure did you

865
00:34:40,690 --> 00:34:39,140
call it a yo-yo yeah this is Doug

866
00:34:43,120 --> 00:34:40,700
possible from well sure I can answer

867
00:34:45,070 --> 00:34:43,130
that question so the D spin proceed

868
00:34:48,190 --> 00:34:45,080
procedure is important because when we

869
00:34:51,370 --> 00:34:48,200
when they use upper stage is spun by the

870
00:34:54,430 --> 00:34:51,380
spin rocket motors the system needs to

871
00:34:56,160 --> 00:34:54,440
be dees fun before separation so that

872
00:34:58,570 --> 00:34:56,170
when the ladee spacecraft separates

873
00:35:00,370 --> 00:34:58,580
there's no forces applied onto it that

874
00:35:03,820 --> 00:35:00,380
would cause it to tumble now that he's

875
00:35:06,010 --> 00:35:03,830
been procedure and in this case is using

876
00:35:08,200 --> 00:35:06,020
weights that are connected to a cable

877
00:35:11,740 --> 00:35:08,210
that are released and as those weights

878
00:35:13,840 --> 00:35:11,750
expand out from the body of the the mass

879
00:35:16,930 --> 00:35:13,850
that the center of mass moves out in the

880
00:35:18,790 --> 00:35:16,940
body and the inertia is changed and the

881
00:35:21,010 --> 00:35:18,800
body the whole body slows down and stops

882
00:35:22,600 --> 00:35:21,020
eventually so these types of systems

883
00:35:24,730 --> 00:35:22,610
have been used on suborbital vehicles

884
00:35:27,910 --> 00:35:24,740
quite a bit by nasa wallops as well as

885
00:35:30,070 --> 00:35:27,920
some al vs before the Minotaur five so

886
00:35:31,600 --> 00:35:30,080
the concept in the design is actually

887
00:35:33,460 --> 00:35:31,610
pretty old a waltz flight facilities

888
00:35:37,050 --> 00:35:33,470

been flying sounding rockets in this

889
00:35:39,040 --> 00:35:37,060
same way for many many years so that's

890
00:35:41,170 --> 00:35:39,050
essentially not a new part of the

891
00:35:44,140 --> 00:35:41,180
technology but it is a new element on

892
00:35:45,790 --> 00:35:44,150
this upper stage an additional let's

893
00:35:47,410 --> 00:35:45,800
take a couple more questions from as

894
00:35:51,100 --> 00:35:47,420
NASA and then we go back to the phone

895
00:35:53,830 --> 00:35:51,110
lines Jason sure twitter user ricardo

896
00:35:55,630 --> 00:35:53,840
abbott alani asks why do you need to

897
00:35:59,680 --> 00:35:55,640
spin up the rocket before stage 5

898
00:36:01,990 --> 00:35:59,690
ignition sure you duck Voss from wolski

899
00:36:04,860 --> 00:36:02,000
and I'll take that the the purpose for

900
00:36:06,850 --> 00:36:04,870
spin stabilization of the upper stage is

901
00:36:09,460 --> 00:36:06,860
actually twofold when you have a

902
00:36:11,290 --> 00:36:09,470
spinning body Newton's first law is that

903
00:36:13,240 --> 00:36:11,300
objects that are in motion tend to stay

904
00:36:14,980 --> 00:36:13,250
in motion so as the bodies

905
00:36:16,810 --> 00:36:14,990
spinning any outside disturbances that

906
00:36:19,350 --> 00:36:16,820
are applied to it as it flies are

907
00:36:21,760 --> 00:36:19,360
actually that the body that's spinning

908
00:36:24,070 --> 00:36:21,770
the effect is not as much on the body

909
00:36:27,100 --> 00:36:24,080
the other thing is that while the fifth

910
00:36:29,440 --> 00:36:27,110
stage is actually thrusting the errors

911
00:36:31,600 --> 00:36:29,450
that are accumulated are averaged out

912
00:36:33,130 --> 00:36:31,610
because the errors are from the thrust

913
00:36:34,870 --> 00:36:33,140

are pointed in multiple directions at

914
00:36:37,030 --> 00:36:34,880
one time so that error is averaged out

915
00:36:40,060 --> 00:36:37,040
the orbital sciences is applied this

916
00:36:41,500 --> 00:36:40,070
this concept to the upper stage to meet

917
00:36:45,000 --> 00:36:41,510
the ladee insertion accuracy

918
00:36:48,070 --> 00:36:45,010
requirements for the mission one more

919
00:36:50,560 --> 00:36:48,080
okay from twitter user marsha smith if

920
00:36:52,180 --> 00:36:50,570
laddies lasercom demo works from the

921
00:36:55,240 --> 00:36:52,190
moon will laser comm work from anywhere

922
00:36:58,000 --> 00:36:55,250
in the solar system this is Don Cornwall

923
00:37:00,820 --> 00:36:58,010
from llcd I'll take that as you go

924
00:37:04,600 --> 00:37:00,830
further out from the moon then you'll

925
00:37:07,210 --> 00:37:04,610
need more photons and and bigger systems

926
00:37:08,860 --> 00:37:07,220
but at the same time when you compare

927
00:37:12,220 --> 00:37:08,870
what you can do with a laser because a

928
00:37:15,460 --> 00:37:12,230
laser beam can be collimated to be much

929
00:37:17,950 --> 00:37:15,470
tighter than a radio wave you can

930
00:37:20,470 --> 00:37:17,960
deliver more energy at a greater

931
00:37:22,210 --> 00:37:20,480
distance than you can with a radio wave

932
00:37:24,610 --> 00:37:22,220
that might be dispersing so actually

933
00:37:26,350 --> 00:37:24,620
laser comm gets more attractive compared

934
00:37:29,140 --> 00:37:26,360
to radio as you go further in the solar

935
00:37:31,570 --> 00:37:29,150
system so we hope to to to use these

936
00:37:34,540 --> 00:37:31,580
systems from Mars one day for example

937
00:37:37,390 --> 00:37:34,550
and and there are some research efforts

938
00:37:38,890 --> 00:37:37,400

there to look at that ok we're going to

939
00:37:39,820 --> 00:37:38,900
go back to the phone bridge but again

940
00:37:42,970 --> 00:37:39,830
ladies and gentlemen keep those

941
00:37:44,980 --> 00:37:42,980
questions coming in hashtag ask NASA and

942
00:37:47,680 --> 00:37:44,990
continue to join the conversation at

943
00:37:51,420 --> 00:37:47,690
NASA laddie back to the phone lines and

944
00:37:54,280 --> 00:37:51,430
believe we have Irene from Reuters Irene

945
00:37:57,340 --> 00:37:54,290
thanks Wayne I have a couple questions

946
00:38:00,880 --> 00:37:57,350
the first is the 280 million dollar

947
00:38:07,180 --> 00:38:00,890
price does that include the Minotaur 5

948
00:38:08,950 --> 00:38:07,190
launcher yes ma'am it does thanks and I

949
00:38:11,410 --> 00:38:08,960
have another question about the rocket

950
00:38:13,840 --> 00:38:11,420
um you know traditionally first flights

951
00:38:15,790 --> 00:38:13,850
of new vehicles have a kind of spotty

952
00:38:18,820 --> 00:38:15,800
track record and i'm just wondering from

953
00:38:21,210 --> 00:38:18,830
your kind of internal assessments as

954
00:38:24,130 --> 00:38:21,220
Minotaur 5 in this configuration

955
00:38:26,290 --> 00:38:24,140
considered a new rocket and not complain

956
00:38:27,110 --> 00:38:26,300
maybe a little bit about what the

957
00:38:34,250 --> 00:38:27,120
advantages

958
00:38:36,650 --> 00:38:34,260
vehicle for ladee thanks sure this is

959
00:38:39,470 --> 00:38:36,660
Doug vasa I'll answer that question so

960
00:38:42,590 --> 00:38:39,480
the Minotaur 5 vehicle is based on

961
00:38:44,120 --> 00:38:42,600
actually a predecessor Minotaur for so

962
00:38:45,590 --> 00:38:44,130
the first four stages of the vehicle

963
00:38:48,620 --> 00:38:45,600

actually have flight history on air

964
00:38:50,120 --> 00:38:48,630
force Missions the fifth stage is the

965
00:38:52,280 --> 00:38:50,130
the new element in the mission it's

966
00:38:54,800 --> 00:38:52,290
required to get laddie into orbit into

967
00:38:57,740 --> 00:38:54,810
the orbit it needs to get to the moon so

968
00:39:01,670 --> 00:38:57,750
the the innovative aspects of this

969
00:39:04,400 --> 00:39:01,680
mission are there in the Minotaur five

970
00:39:06,410 --> 00:39:04,410
fifth stage but they're individually

971
00:39:08,990 --> 00:39:06,420
none of the technologies Arnie are new

972
00:39:11,210 --> 00:39:09,000
so there are a lot of proven concepts

973
00:39:12,620 --> 00:39:11,220
folded into a new vehicle and it is true

974
00:39:15,410 --> 00:39:12,630
that this upper stage hasn't flown

975
00:39:17,060 --> 00:39:15,420
before another good aspect of this

976
00:39:19,130 --> 00:39:17,070
vehicle is that it's using existing

977
00:39:20,750 --> 00:39:19,140
motors the first three stages as I

978
00:39:23,180 --> 00:39:20,760
mentioned earlier our peacekeeper motors

979
00:39:27,410 --> 00:39:23,190
so this aspect of the innovation is that

980
00:39:29,330 --> 00:39:27,420
we're using a retired ICBM assets to fly

981
00:39:31,910 --> 00:39:29,340
out science mission and we're stacking

982
00:39:33,590 --> 00:39:31,920
proven fourth and fifth stage motors the

983
00:39:35,810 --> 00:39:33,600
star 48 is the fourth stage and the star

984
00:39:38,390 --> 00:39:35,820
37 is a fifth stage they are themselves

985
00:39:40,790 --> 00:39:38,400
proven motors so in trade for a lower

986
00:39:42,850 --> 00:39:40,800
cost mission you are in fact accepting

987
00:39:45,170 --> 00:39:42,860
more risk with a new fifth stage and

988
00:39:48,440 --> 00:39:45,180

that's the decision nasa's made and

989
00:39:50,780 --> 00:39:48,450
accepted will stay on the phone line

990
00:39:54,890 --> 00:39:50,790
here next caller is Ken Kramer from

991
00:39:56,450 --> 00:39:54,900
universe today again hi thanks for

992
00:39:58,400 --> 00:39:56,460
taking my question a good luck for

993
00:40:00,980 --> 00:39:58,410
everybody and I'm really excited to be

994
00:40:03,530 --> 00:40:00,990
joining you soon for the launch all over

995
00:40:05,270 --> 00:40:03,540
a couple of questions one is about the

996
00:40:07,490 --> 00:40:05,280
duration of the mission I guess it's a

997
00:40:09,050 --> 00:40:07,500
hundred days I wonder if there what is

998
00:40:12,680 --> 00:40:09,060
the reason for that and is it possible

999
00:40:15,230 --> 00:40:12,690
to extend it this is Butler I can answer

1000
00:40:18,050 --> 00:40:15,240
that the the total mission length is 6

1001
00:40:20,090 --> 00:40:18,060
months we take about a month to get to

1002
00:40:21,800 --> 00:40:20,100
the moon we take another month to do the

1003
00:40:24,380 --> 00:40:21,810
commissioning phase of the instruments

1004
00:40:26,720 --> 00:40:24,390
and the laser comm experiment and then

1005
00:40:29,930 --> 00:40:26,730
we drop down the the length of the

1006
00:40:31,550 --> 00:40:29,940
mission is is limited by how much fuel

1007
00:40:33,740 --> 00:40:31,560
we have I mentioned that the moon has a

1008
00:40:35,720 --> 00:40:33,750
very lumpy gravity field what that means

1009
00:40:37,130 --> 00:40:35,730
is that you never get truly circular

1010
00:40:38,310 --> 00:40:37,140
orbits around the moon and the closer

1011
00:40:40,380 --> 00:40:38,320
you get to the moon

1012
00:40:44,400 --> 00:40:40,390
the the more your orbit varies up and

1013
00:40:46,440 --> 00:40:44,410

down and so to to stay that low above

1014
00:40:49,080 --> 00:40:46,450
the lunar surface we expend a lot of

1015
00:40:51,390 --> 00:40:49,090
fuel and one of the limitations on how

1016
00:40:53,640 --> 00:40:51,400
long we can stay there is how much fuel

1017
00:40:54,720 --> 00:40:53,650
we carry so it's always an optimization

1018
00:40:57,930 --> 00:40:54,730
you can you can go with a bigger

1019
00:40:59,790 --> 00:40:57,940
spacecraft bigger fuel tanks to extend

1020
00:41:00,990 --> 00:40:59,800
your time above the lunar surface but

1021
00:41:03,030 --> 00:41:01,000
then you have to go to a bigger launch

1022
00:41:06,300 --> 00:41:03,040
vehicle and it's higher costs and so it

1023
00:41:07,860 --> 00:41:06,310
all at all daisy chains that way so this

1024
00:41:10,800 --> 00:41:07,870
mission was designed at a hundred days

1025
00:41:12,810 --> 00:41:10,810
because that's basically the amount of

1026
00:41:15,090 --> 00:41:12,820
fuel we can carry to get to the moon

1027
00:41:17,070 --> 00:41:15,100
moon drop down into this science orbit

1028
00:41:20,880 --> 00:41:17,080
and then and stay there there's really

1029
00:41:22,890 --> 00:41:20,890
not a way to extend the mission past

1030
00:41:25,530 --> 00:41:22,900
that hundred days will go as long as we

1031
00:41:33,940 --> 00:41:25,540
have fuel available but ultimately will

1032
00:41:38,950 --> 00:41:36,849
exciting for anyone who wants to answer

1033
00:41:40,839 --> 00:41:38,960
this maybe even John Grunsfeld when do

1034
00:41:44,740 --> 00:41:40,849
you foresee using this on another

1035
00:41:46,300 --> 00:41:44,750
planetary mission can some of your

1036
00:41:50,680 --> 00:41:46,310
questions got cut off can you repeat

1037
00:41:52,690 --> 00:41:50,690
your question again please follow up on

1038
00:41:55,720 --> 00:41:52,700

the laser communication system I'd like

1039
00:41:58,089 --> 00:41:55,730
to know when that would be when do you

1040
00:42:05,050 --> 00:41:58,099
foresee using this on another planetary

1041
00:42:06,819 --> 00:42:05,060
mission thanks you know um as I said in

1042
00:42:08,530 --> 00:42:06,829
my opening remarks I'm a huge fan of

1043
00:42:10,480 --> 00:42:08,540
laser comm and one of the reasons is

1044
00:42:12,640 --> 00:42:10,490
that as you go further out into the

1045
00:42:14,950 --> 00:42:12,650
solar system it's a much more efficient

1046
00:42:16,960 --> 00:42:14,960
way to get high bandwidth at low power

1047
00:42:19,089 --> 00:42:16,970
and some very confident this will be a

1048
00:42:22,329 --> 00:42:19,099
successful experiment will see in a very

1049
00:42:25,030 --> 00:42:22,339
short time so I'm very excited to see

1050
00:42:27,760 --> 00:42:25,040
and hear the results and it could be as

1051
00:42:28,690 --> 00:42:27,770
soon as you know our Mars 2020 mission

1052
00:42:32,349 --> 00:42:28,700
we've already been having discussions

1053
00:42:35,589 --> 00:42:32,359
about could you do laser come on a rover

1054
00:42:39,730 --> 00:42:35,599
on the surface of Mars perhaps for a

1055
00:42:41,260 --> 00:42:39,740
future Mars orbiting spacecraft versus

1056
00:42:43,329 --> 00:42:41,270
all the way back to earth or directly

1057
00:42:46,030 --> 00:42:43,339
back to earth but I think this is just

1058
00:42:49,210 --> 00:42:46,040
the beginning of you know what will be

1059
00:42:51,970 --> 00:42:49,220
you know replacing some of the radio

1060
00:42:53,380 --> 00:42:51,980
frequency come in the future I think

1061
00:42:55,450 --> 00:42:53,390
there's no question that as we send

1062
00:42:57,940 --> 00:42:55,460
humans further out into the solar system

1063
00:43:00,880 --> 00:42:57,950

certainly to mars that if we want to

1064
00:43:02,319 --> 00:43:00,890
have you know high-def 3d video we're

1065
00:43:06,069 --> 00:43:02,329
going to have laser comm sending that

1066
00:43:07,839 --> 00:43:06,079
information back this is Don Cornwell

1067
00:43:10,630 --> 00:43:07,849
from llcd I have a follow-up as well

1068
00:43:13,180 --> 00:43:10,640
there is actually a follow-on funded

1069
00:43:14,859 --> 00:43:13,190
NASA program to do laser communications

1070
00:43:18,010 --> 00:43:14,869
it's called the laser communications

1071
00:43:23,200 --> 00:43:18,020
relay demonstration it's going to have a

1072
00:43:25,120 --> 00:43:23,210
laser comm package on a hosted payload a

1073
00:43:27,339 --> 00:43:25,130
commercial spacecraft and in

1074
00:43:29,020 --> 00:43:27,349
geosynchronous orbit and the idea there

1075
00:43:30,790 --> 00:43:29,030
in addition to demonstrating more

1076
00:43:32,800 --> 00:43:30,800
technologies is to run that from two to

1077
00:43:35,349 --> 00:43:32,810
five years to really build confidence

1078
00:43:36,790 --> 00:43:35,359
and laser comm we are short mission here

1079
00:43:38,680 --> 00:43:36,800
we hope to demonstrate laser

1080
00:43:40,480 --> 00:43:38,690
communications but we really want to

1081
00:43:41,960 --> 00:43:40,490
build a lot of confidence over time as

1082
00:43:44,210 --> 00:43:41,970
well

1083
00:43:47,120 --> 00:43:44,220
okay one more question for the phone

1084
00:43:48,680 --> 00:43:47,130
line before we go back to Jason he has a

1085
00:43:50,120 --> 00:43:48,690
couple more questions thanks keep

1086
00:43:52,970 --> 00:43:50,130
sending those questions in at hashtag

1087
00:43:58,400 --> 00:43:52,980
ask NASA on the phone on Marion crema

1088
00:44:00,380 --> 00:43:58,410

from space com Marion hi thanks for

1089
00:44:02,180 --> 00:44:00,390
taking my question yeah I am wondering

1090
00:44:04,250 --> 00:44:02,190
is there a particular reason that the

1091
00:44:07,150 --> 00:44:04,260
ladee mission was chosen to launch from

1092
00:44:10,700 --> 00:44:07,160
wallets there from kind of asking why

1093
00:44:14,000 --> 00:44:10,710
why now and it can be for anybody who'd

1094
00:44:15,740 --> 00:44:14,010
like to answer this is Butler I can

1095
00:44:18,290 --> 00:44:15,750
answer that question as Doug mentioned

1096
00:44:21,680 --> 00:44:18,300
the first three stages of the Minotaur

1097
00:44:24,349 --> 00:44:21,690
five are reconditioned icbm motors and

1098
00:44:27,740 --> 00:44:24,359
the treaty between the US and Russia

1099
00:44:31,820 --> 00:44:27,750
only allows a few launch sites for these

1100
00:44:34,160 --> 00:44:31,830
for these X ICBMs we can launch out of

1101
00:44:36,230 --> 00:44:34,170
Kodiak Alaska or Vandenberg California

1102
00:44:39,380 --> 00:44:36,240
or Wallops Island Virginia those are the

1103
00:44:41,180 --> 00:44:39,390
three allowed under the treaty Kodiak

1104
00:44:43,430 --> 00:44:41,190
Alaska and Vandenberg are better for

1105
00:44:46,339 --> 00:44:43,440
polar earth orbits but if we want to get

1106
00:44:48,800 --> 00:44:46,349
to the moon we need to launch eastward

1107
00:44:50,960 --> 00:44:48,810
and so wallops island is the ideal place

1108
00:44:54,800 --> 00:44:50,970
to launch this launch vehicle to get us

1109
00:44:56,720 --> 00:44:54,810
to the moon okay well we're gonna go

1110
00:44:59,300 --> 00:44:56,730
back to Jason and Jason I hear things

1111
00:45:02,150 --> 00:44:59,310
are stacking up there what you got for

1112
00:45:04,670 --> 00:45:02,160
me sure from Twitter user Emily lock

1113
00:45:06,950 --> 00:45:04,680

dawala are the moon and Mercury's

1114
00:45:08,960 --> 00:45:06,960
atmosphere similar and we'll NASA laddie

1115
00:45:12,680 --> 00:45:08,970
help us understand possibly Mercury's

1116
00:45:14,690 --> 00:45:12,690
exosphere thanks Emily that's a great

1117
00:45:16,040 --> 00:45:14,700
question this is Sarah so yeah we've

1118
00:45:17,720 --> 00:45:16,050
we've had the messenger spacecraft

1119
00:45:19,280 --> 00:45:17,730
around mercury for a couple years now

1120
00:45:21,380 --> 00:45:19,290
and we're learning a lot of stuff about

1121
00:45:23,150 --> 00:45:21,390
Mercury's exosphere and it turns out it

1122
00:45:25,970 --> 00:45:23,160
is in many ways similar to the lunar

1123
00:45:28,250 --> 00:45:25,980
exosphere has a lot of the same elements

1124
00:45:29,420 --> 00:45:28,260
in it the interesting thing about about

1125
00:45:31,220 --> 00:45:29,430
mercury is that we don't have any

1126
00:45:32,660 --> 00:45:31,230
samples of Mercury's surface so we've

1127
00:45:33,740 --> 00:45:32,670
actually been learning about what the

1128
00:45:35,750 --> 00:45:33,750
materials that the surface of mercury

1129
00:45:37,820 --> 00:45:35,760
are based on what is getting up into the

1130
00:45:39,320 --> 00:45:37,830
atmosphere the moon we actually already

1131
00:45:41,780 --> 00:45:39,330
know what the what the rocks are at the

1132
00:45:43,339 --> 00:45:41,790
surface but um being able to compare

1133
00:45:44,900 --> 00:45:43,349
what's at the surface versus what is in

1134
00:45:46,910 --> 00:45:44,910
the atmosphere at the moon will actually

1135
00:45:48,740 --> 00:45:46,920
help us work our way back to mercury and

1136
00:45:49,940 --> 00:45:48,750
understand the difference between what

1137
00:45:50,990 --> 00:45:49,950
we're seeing in the atmosphere and what

1138
00:45:52,250 --> 00:45:51,000

might be on the ground there

1139
00:45:54,940 --> 00:45:52,260
we're actually going to learn about

1140
00:45:57,710 --> 00:45:54,950
mercury even from this lunar mission

1141
00:46:00,200 --> 00:45:57,720
Jason wonderful another question from

1142
00:46:01,640 --> 00:46:00,210
Twitter this is from user Ryan Thurmond

1143
00:46:03,500 --> 00:46:01,650
is there anything the laser

1144
00:46:05,600 --> 00:46:03,510
communication system could be used for

1145
00:46:08,720 --> 00:46:05,610
besides space communications that can

1146
00:46:11,810 --> 00:46:08,730
improve everyday life well that's an

1147
00:46:14,030 --> 00:46:11,820
excellent question our system is

1148
00:46:15,830 --> 00:46:14,040
actually based on the same technology

1149
00:46:17,840 --> 00:46:15,840
that we're all using in our fios

1150
00:46:19,490 --> 00:46:17,850
fiber-optic to the home and between the

1151
00:46:21,530 --> 00:46:19,500
big trunk lines so in some ways this is

1152
00:46:23,390 --> 00:46:21,540
a NASA spin in of what's going on

1153
00:46:25,900 --> 00:46:23,400
commercially we've been able to take

1154
00:46:30,500 --> 00:46:25,910
advantage of that big commercial base of

1155
00:46:32,600 --> 00:46:30,510
many an inexpensive components so the

1156
00:46:34,250 --> 00:46:32,610
other the other possibilities are there

1157
00:46:36,710 --> 00:46:34,260
are commercial companies that talk about

1158
00:46:38,840 --> 00:46:36,720
using laser communications for satellite

1159
00:46:40,250 --> 00:46:38,850
networks around the earth to deliver

1160
00:46:42,410 --> 00:46:40,260
data around the earth so this would help

1161
00:46:46,310 --> 00:46:42,420
to to make them feel more comfortable

1162
00:46:49,040 --> 00:46:46,320
confident with that as well one more

1163
00:46:50,990 --> 00:46:49,050

sure one more from Twitter user Isaac

1164
00:46:52,850 --> 00:46:51,000
young once the link is established is

1165
00:46:55,610 --> 00:46:52,860
there no communication delay like you

1166
00:46:57,950 --> 00:46:55,620
get with a radio signal so that's an

1167
00:47:00,110 --> 00:46:57,960
also an excellent question light waves

1168
00:47:02,420 --> 00:47:00,120
and radio waves both travel at the same

1169
00:47:04,610 --> 00:47:02,430
speed they're both the the different

1170
00:47:06,950 --> 00:47:04,620
forms of the same of the same thing

1171
00:47:09,440 --> 00:47:06,960
electromagnetic waves what's different

1172
00:47:11,930 --> 00:47:09,450
here is that we can pack more bits into

1173
00:47:16,070 --> 00:47:11,940
any given second but the time of flight

1174
00:47:17,900 --> 00:47:16,080
will actually be the same ok thank you

1175
00:47:20,180 --> 00:47:17,910
Jason and again keep those calls coming

1176
00:47:22,400 --> 00:47:20,190
in and if we can't get answer them doing

1177
00:47:25,310 --> 00:47:22,410
this broadcast we will make sure that we

1178
00:47:28,640 --> 00:47:25,320
get back to you and again we almost two

1179
00:47:29,840 --> 00:47:28,650
weeks away and a lot is going on so back

1180
00:47:33,640 --> 00:47:29,850
to the phone lines and I believe we have

1181
00:47:36,260 --> 00:47:33,650
marsha smith back with this moisture yes

1182
00:47:38,330 --> 00:47:36,270
sorry about the earlier attempt i think

1183
00:47:42,890 --> 00:47:38,340
i hit the wrong button but anyway i'm

1184
00:47:45,800 --> 00:47:42,900
curious about the 15 pneus of the lunar

1185
00:47:48,230 --> 00:47:45,810
atmosphere i think sarah was talking

1186
00:47:50,450 --> 00:47:48,240
earlier about how spacecraft easily

1187
00:47:52,130 --> 00:47:50,460
disturbed the atmosphere and so they

1188
00:47:54,170 --> 00:47:52,140

want to do this experiment now before

1189
00:47:56,330 --> 00:47:54,180
there are even more launches there but

1190
00:47:58,940 --> 00:47:56,340
this was going to impact the moon and

1191
00:48:01,160 --> 00:47:58,950
Grail impacted the moon so it seems as

1192
00:48:03,590 --> 00:48:01,170
though the spacecraft are creating a lot

1193
00:48:04,090 --> 00:48:03,600
of dust themselves is that a problem are

1194
00:48:07,150 --> 00:48:04,100
you going to be

1195
00:48:10,210 --> 00:48:07,160
metallic dust with cream by Grail versus

1196
00:48:12,310 --> 00:48:10,220
by comet impacts does it matter that's

1197
00:48:16,480 --> 00:48:12,320
it that's a good question mar said that

1198
00:48:18,130 --> 00:48:16,490
the an impact things impact the moon all

1199
00:48:20,080 --> 00:48:18,140
the time so these small impact you

1200
00:48:21,880 --> 00:48:20,090
create a small spacecraft impacting the

1201
00:48:23,620 --> 00:48:21,890
moon don't do a lot I mean something the

1202
00:48:25,330 --> 00:48:23,630
size of laddie hits the moon like once a

1203
00:48:26,920 --> 00:48:25,340
month so it the moon's not really

1204
00:48:28,900 --> 00:48:26,930
noticing these thing but when space

1205
00:48:30,940 --> 00:48:28,910
press land they have a lot of fuel that

1206
00:48:33,400 --> 00:48:30,950
they use as their landing and that

1207
00:48:35,440 --> 00:48:33,410
actually can add a lot a lot of material

1208
00:48:37,390 --> 00:48:35,450
to the atmosphere so because the

1209
00:48:39,970 --> 00:48:37,400
atmosphere is so thin I mean it's it

1210
00:48:41,560 --> 00:48:39,980
becomes a significant component of the

1211
00:48:43,990 --> 00:48:41,570
atmosphere when you land something on

1212
00:48:45,460 --> 00:48:44,000
the moon so yes we have we have impacted

1213
00:48:47,170 --> 00:48:45,470

into the moon right recently but we have

1214
00:48:49,060 --> 00:48:47,180
not landed there in quite a while so a

1215
00:48:50,650 --> 00:48:49,070
landing like that will disturb the

1216
00:48:53,440 --> 00:48:50,660
atmosphere for for several months

1217
00:48:58,390 --> 00:48:53,450
whereas an impact is just part of the

1218
00:49:02,050 --> 00:48:58,400
usual processes on the moon Masha did

1219
00:49:04,690 --> 00:49:02,060
you ever follow up that's the last best

1220
00:49:08,020 --> 00:49:04,700
chance to study a more or less pristine

1221
00:49:10,000 --> 00:49:08,030
lunar atmosphere like I guess that

1222
00:49:11,950 --> 00:49:10,010
depends on the rates of when we start

1223
00:49:13,600 --> 00:49:11,960
landing back on the moon again but as I

1224
00:49:15,610 --> 00:49:13,610
said there are a number of countries and

1225
00:49:17,890 --> 00:49:15,620
a number of private companies the google

1226
00:49:20,320 --> 00:49:17,900
lunar xprize folks that are intending on

1227
00:49:22,750 --> 00:49:20,330
on landing things on the moon on several

1228
00:49:24,340 --> 00:49:22,760
things over the next several years so it

1229
00:49:27,090 --> 00:49:24,350
seems like it is gonna be a busy time

1230
00:49:29,020 --> 00:49:27,100
for the moon over the next decade or so

1231
00:49:31,330 --> 00:49:29,030
okay what we're going to do we've got a

1232
00:49:33,910 --> 00:49:31,340
few minutes left and we you know we're

1233
00:49:35,020 --> 00:49:33,920
sending stage here two weeks away on the

1234
00:49:38,680 --> 00:49:35,030
ladee mission i'm going to ask the

1235
00:49:40,000 --> 00:49:38,690
panelists individually what's going

1236
00:49:42,130 --> 00:49:40,010
through your mind now you're two weeks

1237
00:49:44,830 --> 00:49:42,140
away how do you feel about this mission

1238
00:49:46,690 --> 00:49:44,840

and we start with you John I'm

1239
00:49:48,940 --> 00:49:46,700
tremendously excited we've been working

1240
00:49:51,040 --> 00:49:48,950
on this for about seven years the team's

1241
00:49:52,990 --> 00:49:51,050
just grown and grown in their ability to

1242
00:49:55,030 --> 00:49:53,000
pull it all together there were a number

1243
00:49:56,740 --> 00:49:55,040
of moments when we weren't sure we'd you

1244
00:49:59,800 --> 00:49:56,750
know be here today for all kinds of

1245
00:50:01,300 --> 00:49:59,810
reasons things happen but everything has

1246
00:50:03,550 --> 00:50:01,310
worked out the team has done an

1247
00:50:06,310 --> 00:50:03,560
excellent excellent job of building the

1248
00:50:08,260 --> 00:50:06,320
spacecraft on time all the testing has

1249
00:50:11,380 --> 00:50:08,270
gone great we haven't had any major

1250
00:50:12,760 --> 00:50:11,390
setbacks we're here we're ready and we

1251
00:50:15,490 --> 00:50:12,770
all just can't wait to get everything

1252
00:50:18,460 --> 00:50:15,500
turned on and working Butler

1253
00:50:20,290 --> 00:50:18,470
I'm very excited for this mission and

1254
00:50:22,140 --> 00:50:20,300
that the team is very excited you've had

1255
00:50:25,930 --> 00:50:22,150
a lot of people have been working this

1256
00:50:27,970 --> 00:50:25,940
not just for the the ladee phase for the

1257
00:50:31,270 --> 00:50:27,980
last five years but but also before that

1258
00:50:33,310 --> 00:50:31,280
to prove out this bus design prototype

1259
00:50:35,440 --> 00:50:33,320
this bus design so you've got a lot of

1260
00:50:39,010 --> 00:50:35,450
people that have spent a lot of a lot of

1261
00:50:40,870 --> 00:50:39,020
sweat equity in this once we closed it

1262
00:50:42,820 --> 00:50:40,880
into the fairing yesterday we were very

1263
00:50:44,440 --> 00:50:42,830

excited there's a little sad too because

1264
00:50:47,470 --> 00:50:44,450
that's the last time we'll ever see the

1265
00:50:49,540 --> 00:50:47,480
spacecraft again since it won't be

1266
00:50:51,280 --> 00:50:49,550
coming back from the moon so you have a

1267
00:50:55,120 --> 00:50:51,290
lot of people with their fingers crossed

1268
00:50:58,930 --> 00:50:55,130
really hoping for the best and excited

1269
00:51:00,730 --> 00:50:58,940
to see see their baby fly Sarah this is

1270
00:51:02,530 --> 00:51:00,740
my first mission I am really excited

1271
00:51:04,330 --> 00:51:02,540
about it it's been such a such a joy

1272
00:51:05,980 --> 00:51:04,340
watching the science team come together

1273
00:51:07,510 --> 00:51:05,990
and they've you know this is a short

1274
00:51:08,740 --> 00:51:07,520
mission and they know they have to get

1275
00:51:10,240 --> 00:51:08,750
there hit the ground running and they

1276
00:51:11,650 --> 00:51:10,250
have been so fantastic and getting

1277
00:51:13,300 --> 00:51:11,660
themselves prepared and ready to go for

1278
00:51:17,080 --> 00:51:13,310
this mission it's been really really

1279
00:51:18,460 --> 00:51:17,090
exciting to watch well this is a NASA's

1280
00:51:20,710 --> 00:51:18,470
first real opportunity to fly a

1281
00:51:23,260 --> 00:51:20,720
dedicated laser communication system and

1282
00:51:25,480 --> 00:51:23,270
as I kind of alluded to before you know

1283
00:51:27,460 --> 00:51:25,490
on the earth year we've been using laser

1284
00:51:29,140 --> 00:51:27,470
communications and our fiber optics to

1285
00:51:31,240 --> 00:51:29,150
power our internet and everything else

1286
00:51:33,460 --> 00:51:31,250
for the last couple of decades and and

1287
00:51:35,440 --> 00:51:33,470
NASA has really been wanting to take

1288
00:51:37,120 --> 00:51:35,450

that same technological leap and put it

1289
00:51:39,130 --> 00:51:37,130
into space and this is our chance to do

1290
00:51:42,400 --> 00:51:39,140
that so we're very excited to get the

1291
00:51:44,350 --> 00:51:42,410
opportunity from the perspective of

1292
00:51:45,910 --> 00:51:44,360
Wallops and our Air Force partners with

1293
00:51:49,240 --> 00:51:45,920
the launch vehicle it's been very

1294
00:51:51,310 --> 00:51:49,250
exciting to have a NASA spacecraft hand

1295
00:51:53,290 --> 00:51:51,320
it over for the launch vehicle take on

1296
00:51:56,050 --> 00:51:53,300
to orbit wallops flight facility is very

1297
00:51:57,550 --> 00:51:56,060
excited as NASA's launch range to be

1298
00:51:58,870 --> 00:51:57,560
sending this spacecraft to the moon so

1299
00:52:00,460 --> 00:51:58,880
it's a very exciting time a very busy

1300
00:52:03,280 --> 00:52:00,470
time right now in launch preparations

1301
00:52:04,210 --> 00:52:03,290
but they've been going very well and so

1302
00:52:06,580 --> 00:52:04,220
we're looking forward to a very

1303
00:52:09,730 --> 00:52:06,590
successful launch and flight operation

1304
00:52:12,220 --> 00:52:09,740
for ladee well ladies and gentlemen the

1305
00:52:14,950 --> 00:52:12,230
stage is set the team is ready they're

1306
00:52:17,830 --> 00:52:14,960
excited John Grunsfeld loves the mission

1307
00:52:22,360 --> 00:52:17,840
we all love the mission and mark your

1308
00:52:25,780 --> 00:52:22,370
calendar September six friday night 11

1309
00:52:29,140 --> 00:52:25,790
27 p.m. eastern daylight time a night

1310
00:52:31,269 --> 00:52:29,150
launch if the weathers right is you

1311
00:52:34,569 --> 00:52:31,279
it will be seen not just on the east

1312
00:52:38,019 --> 00:52:34,579
coast but up to Maine something to the

1313
00:52:41,609 --> 00:52:38,029

south west virginia a good show friday

1314
00:52:45,960 --> 00:52:41,619
night market date again join us again on

1315
00:52:49,120 --> 00:52:45,970
ww NSA gov / lady for the latest updates

1316
00:52:52,480 --> 00:52:49,130
ladee September 6 a mission of many