

EXIT



**On Phone**  
Question from Media



1  
00:00:07,349 --> 00:00:04,950  
good afternoon and welcome to nasa

2  
00:00:09,509 --> 00:00:07,359  
headquarters i'm dwane brown with the

3  
00:00:11,270 --> 00:00:09,519  
office of communications today's

4  
00:00:13,830 --> 00:00:11,280  
briefing is about nasa's lunar

5  
00:00:16,550 --> 00:00:13,840  
atmosphere and dust environment explorer

6  
00:00:18,390 --> 00:00:16,560  
or lati a robotic mission was launched

7  
00:00:20,070 --> 00:00:18,400  
about two weeks away where the

8  
00:00:22,150 --> 00:00:20,080  
spacecraft will orbit the moon to help

9  
00:00:23,590 --> 00:00:22,160  
scientists answer prevailing questions

10  
00:00:26,070 --> 00:00:23,600  
about our moon

11  
00:00:27,830 --> 00:00:26,080  
and this mission has many firsts

12  
00:00:29,509 --> 00:00:27,840  
in which you will hear firsthand about

13  
00:00:31,589 --> 00:00:29,519

today

14

00:00:34,549 --> 00:00:31,599

of course for more details

15

00:00:36,630 --> 00:00:34,559

about the mission and updates on launch

16

00:00:40,069 --> 00:00:36,640

please visit nasa's website at

17

00:00:45,150 --> 00:00:41,190

laddie

18

00:00:47,029 --> 00:00:45,160

and join the conversation on twitter at

19

00:00:48,310 --> 00:00:47,039

nasaladdy

20

00:00:51,350 --> 00:00:48,320

and during our question and answer

21

00:00:53,830 --> 00:00:51,360

period please social media

22

00:00:57,990 --> 00:00:53,840

join and bring in your questions for the

23

00:01:00,150 --> 00:00:58,000

scientists to answer at hashtag ask nasa

24

00:01:02,790 --> 00:01:00,160

and of course the conversation is

25

00:01:03,990 --> 00:01:02,800

brewing and a lot is going on follow

26

00:01:06,469 --> 00:01:04,000

nasa and

27

00:01:08,070 --> 00:01:06,479

missions updates on social media on

28

00:01:11,109 --> 00:01:08,080

twitter facebook

29

00:01:13,190 --> 00:01:11,119

and other sites

30

00:01:14,390 --> 00:01:13,200

before i introduce today's panelists

31

00:01:17,429 --> 00:01:14,400

today

32

00:01:18,870 --> 00:01:17,439

to start us off with opening remarks

33

00:01:20,710 --> 00:01:18,880

please welcome

34

00:01:22,550 --> 00:01:20,720

the associate administrator for nasa's

35

00:01:31,830 --> 00:01:22,560

science mission directorate john

36

00:01:31,840 --> 00:01:34,789

thank you duane

37

00:01:40,149 --> 00:01:36,870

i love this mission

38

00:01:41,830 --> 00:01:40,159

uh laddie is going to be fantastic i'm

39

00:01:43,670 --> 00:01:41,840

getting really excited as we move to the

40

00:01:45,350 --> 00:01:43,680

launch pad

41

00:01:46,230 --> 00:01:45,360

first of all because it's going to the

42

00:01:47,030 --> 00:01:46,240

moon

43

00:01:48,789 --> 00:01:47,040

and

44

00:01:50,789 --> 00:01:48,799

ever since i was a young boy you know

45

00:01:53,670 --> 00:01:50,799

like so many folks you know looking up

46

00:01:55,350 --> 00:01:53,680

at the sky i've wondered about the moon

47

00:01:56,870 --> 00:01:55,360

with the lunar reconnaissance orbiter

48

00:01:58,550 --> 00:01:56,880

which is still in orbit around the moon

49

00:02:00,709 --> 00:01:58,560

we've learned an enormous amount about

50

00:02:02,870 --> 00:02:00,719

the surface of the moon

51  
00:02:04,950 --> 00:02:02,880  
with grail we've studied the interior of

52  
00:02:07,270 --> 00:02:04,960  
the moon and now with lady we're going

53  
00:02:09,430 --> 00:02:07,280  
to learn about the moon's atmosphere

54  
00:02:11,670 --> 00:02:09,440  
which is something very mysterious and

55  
00:02:13,190 --> 00:02:11,680  
we know very little bit about

56  
00:02:15,430 --> 00:02:13,200  
and so this is a particularly exciting

57  
00:02:16,470 --> 00:02:15,440  
mission for us

58  
00:02:19,110 --> 00:02:16,480  
the other reason i love it is it

59  
00:02:20,309 --> 00:02:19,120  
launches from wallops and duane was

60  
00:02:21,910 --> 00:02:20,319  
talking about the first and you're going

61  
00:02:22,869 --> 00:02:21,920  
to hear a lot more about all of these

62  
00:02:25,990 --> 00:02:22,879  
things

63  
00:02:29,030 --> 00:02:26,000

i think are great

64

00:02:30,949 --> 00:02:29,040

and another is that it has a laser com

65

00:02:32,150 --> 00:02:30,959

demo and this is something i'm a huge

66

00:02:35,030 --> 00:02:32,160

fan of

67

00:02:37,110 --> 00:02:35,040

and finally it's a modular spacecraft

68

00:02:38,229 --> 00:02:37,120

so that while this is the the lunar

69

00:02:40,229 --> 00:02:38,239

version

70

00:02:41,430 --> 00:02:40,239

it's a type of architecture that we

71

00:02:42,229 --> 00:02:41,440

might be able to use in a lot of

72

00:02:44,390 --> 00:02:42,239

different

73

00:02:46,710 --> 00:02:44,400

types of science experiments and others

74

00:02:47,990 --> 00:02:46,720

so i'm very excited uh you'll hear a lot

75

00:02:49,270 --> 00:02:48,000

more about it please bring your

76

00:02:56,229 --> 00:02:49,280

questions

77

00:02:58,790 --> 00:02:57,750

thank you john so let's get to our

78

00:03:00,470 --> 00:02:58,800

panelists they will have brief

79

00:03:01,910 --> 00:03:00,480

presentations but let me introduce them

80

00:03:03,190 --> 00:03:01,920

to you

81

00:03:05,030 --> 00:03:03,200

first

82

00:03:06,790 --> 00:03:05,040

joan salute

83

00:03:11,190 --> 00:03:06,800

lady program executive

84

00:03:15,110 --> 00:03:12,710

butler hine

85

00:03:21,509 --> 00:03:15,120

lady project manager from nasa's ames

86

00:03:30,229 --> 00:03:23,350

sarah noble

87

00:03:35,030 --> 00:03:32,869

don cornwell mission manager for the

88

00:03:37,430 --> 00:03:35,040

lunar laser communications demonstration

89

00:03:42,149 --> 00:03:37,440

at nasa's goddard space flight center in

90

00:03:46,869 --> 00:03:44,470

and doug voss the launch manager at

91

00:03:49,270 --> 00:03:46,879

wallops and with that i'll toss it to

92

00:03:50,789 --> 00:03:49,280

you john thank you duane thank you for

93

00:03:54,229 --> 00:03:50,799

coming this afternoon to learn more

94

00:03:56,149 --> 00:03:54,239

about lady ladies scheduled to launch on

95

00:03:57,910 --> 00:03:56,159

friday september 6 which is just two

96

00:03:59,750 --> 00:03:57,920

short weeks from tomorrow from the

97

00:04:01,110 --> 00:03:59,760

eastern shore of virginia at the wallops

98

00:04:02,869 --> 00:04:01,120

flight facility

99

00:04:04,470 --> 00:04:02,879

lady is sponsored by the science mission

100

00:04:06,550 --> 00:04:04,480

directorate and will have three

101  
00:04:07,990 --> 00:04:06,560  
scientific instruments to measure the

102  
00:04:08,949 --> 00:04:08,000  
atmosphere and the dust as john

103  
00:04:11,030 --> 00:04:08,959  
mentioned

104  
00:04:13,589 --> 00:04:11,040  
in addition it has the what we call the

105  
00:04:17,110 --> 00:04:13,599  
tech demo or tech demonstration which is

106  
00:04:19,430 --> 00:04:17,120  
the loser excuse me lunar laser optical

107  
00:04:20,949 --> 00:04:19,440  
communications demonstration this tech

108  
00:04:22,950 --> 00:04:20,959  
demo is sponsored by the human

109  
00:04:24,550 --> 00:04:22,960  
exploration operations missions

110  
00:04:26,790 --> 00:04:24,560  
directorate

111  
00:04:28,469 --> 00:04:26,800  
once in orbit laddie will orbit the moon

112  
00:04:30,870 --> 00:04:28,479  
in a lunar or

113  
00:04:32,629 --> 00:04:30,880

equatorial orbit to measure what the

114

00:04:35,430 --> 00:04:32,639

atmosphere is made up of and how that

115

00:04:36,870 --> 00:04:35,440

varies over time it will also try to

116

00:04:38,790 --> 00:04:36,880

understand whether or not the dust is

117

00:04:40,070 --> 00:04:38,800

levitated from the surface and this is

118

00:04:42,070 --> 00:04:40,080

one of the mysteries that you'll hear

119

00:04:43,350 --> 00:04:42,080

about in a minute

120

00:04:45,510 --> 00:04:43,360

before you hear the details of the

121

00:04:47,909 --> 00:04:45,520

mission from all of the fellow panelists

122

00:04:50,230 --> 00:04:47,919

i'd like to try to put into perspective

123

00:04:53,350 --> 00:04:50,240

the mission development for this project

124

00:04:55,590 --> 00:04:53,360

in 2008 we formulated a new program the

125

00:04:56,710 --> 00:04:55,600

lunar quest program which was designed

126  
00:04:59,510 --> 00:04:56,720  
specifically

127  
00:05:02,550 --> 00:04:59,520  
to accelerate lunar exploration lunar

128  
00:05:04,390 --> 00:05:02,560  
scientific exploration

129  
00:05:08,150 --> 00:05:04,400  
we wanted to do it before humans went

130  
00:05:11,270 --> 00:05:09,590  
at this time the science mission

131  
00:05:14,150 --> 00:05:11,280  
directorates was trying to figure out how

132  
00:05:15,670 --> 00:05:14,160  
to make spacecraft less expensive

133  
00:05:19,029 --> 00:05:15,680  
and ames had come up with what we're

134  
00:05:20,550 --> 00:05:19,039  
calling the reusable modular design

135  
00:05:22,790 --> 00:05:20,560  
they thought they could do it less

136  
00:05:24,950 --> 00:05:22,800  
expensively than we've done in the past

137  
00:05:27,350 --> 00:05:24,960  
so the mission was directed to aims with

138  
00:05:29,110 --> 00:05:27,360

a low-cost commitment

139

00:05:31,029 --> 00:05:29,120

now five years later we're actually

140

00:05:32,629 --> 00:05:31,039

ready to go five years after the program

141

00:05:34,550 --> 00:05:32,639

started we're ready to go back to the

142

00:05:35,990 --> 00:05:34,560

moon

143

00:05:39,110 --> 00:05:36,000

from the beginning this has been a great

144

00:05:41,670 --> 00:05:39,120

partnership across nasa we augmented the

145

00:05:43,830 --> 00:05:41,680

aims team with goddard both greenbelt

146

00:05:46,790 --> 00:05:43,840

and wallops

147

00:05:49,270 --> 00:05:46,800

goddard has a wealth of expertise that

148

00:05:51,830 --> 00:05:49,280

was able to supplement the aims team

149

00:05:53,430 --> 00:05:51,840

the program office we went to marshall

150

00:05:55,749 --> 00:05:53,440

space flight center where we already had

151  
00:05:57,990 --> 00:05:55,759  
our discovery and new frontiers program

152  
00:05:59,990 --> 00:05:58,000  
office well established

153  
00:06:02,310 --> 00:06:00,000  
during the years of development we've

154  
00:06:05,189 --> 00:06:02,320  
added team members from kennedy in

155  
00:06:07,189 --> 00:06:05,199  
florida glenn in ohio

156  
00:06:09,350 --> 00:06:07,199  
jpl in california

157  
00:06:11,670 --> 00:06:09,360  
langley and virginia and johnson space

158  
00:06:13,749 --> 00:06:11,680  
center in texas where the team needed

159  
00:06:17,990 --> 00:06:13,759  
additional expertise they reached out

160  
00:06:21,909 --> 00:06:19,590  
the mission was directed to aims for

161  
00:06:24,710 --> 00:06:21,919  
overall project management and they have

162  
00:06:26,950 --> 00:06:24,720  
designed built integrated and tested the

163  
00:06:28,469 --> 00:06:26,960

spacecraft they'll be responsible for

164

00:06:29,909 --> 00:06:28,479

all the mission operations during the

165

00:06:32,469 --> 00:06:29,919

mission

166

00:06:34,309 --> 00:06:32,479

nasa greenbelt goddard greenbelt was

167

00:06:35,990 --> 00:06:34,319

responsible for developing the payload

168

00:06:38,309 --> 00:06:36,000

which included all three scientific

169

00:06:39,749 --> 00:06:38,319

instruments and the tech demo

170

00:06:41,270 --> 00:06:39,759

and they'll be responsible to run the

171

00:06:42,550 --> 00:06:41,280

science operations center during the

172

00:06:44,710 --> 00:06:42,560

mission

173

00:06:46,870 --> 00:06:44,720

nasa wallops has the privilege to launch

174

00:06:48,790 --> 00:06:46,880

us into space they have all the launch

175

00:06:50,150 --> 00:06:48,800

vehicle services and the range

176  
00:06:52,150 --> 00:06:50,160  
operations

177  
00:06:53,909 --> 00:06:52,160  
we have a reimbursable agreement with

178  
00:06:55,670 --> 00:06:53,919  
the air force to supply the launch

179  
00:06:58,230 --> 00:06:55,680  
vehicle and they're responsible for the

180  
00:07:00,070 --> 00:06:58,240  
mission assurance of the launch vehicle

181  
00:07:02,230 --> 00:07:00,080  
we're very proud to be breaking new

182  
00:07:04,390 --> 00:07:02,240  
ground in a number of areas this

183  
00:07:06,870 --> 00:07:04,400  
includes the first time ames has built a

184  
00:07:09,350 --> 00:07:06,880  
spacecraft in-house without the help of

185  
00:07:11,830 --> 00:07:09,360  
a prime contractor

186  
00:07:13,350 --> 00:07:11,840  
it's the first deep space mission to be

187  
00:07:14,950 --> 00:07:13,360  
launched from wallops

188  
00:07:17,110 --> 00:07:14,960

the first minotaur or

189

00:07:18,629 --> 00:07:17,120

four or five to be launched from wallops

190

00:07:20,870 --> 00:07:18,639

and it's the maiden voyage of the

191

00:07:23,110 --> 00:07:20,880

minotaur five anywhere

192

00:07:25,270 --> 00:07:23,120

and as was mentioned it's nasa's first

193

00:07:27,510 --> 00:07:25,280

test from space of the optical

194

00:07:28,469 --> 00:07:27,520

communications we're especially excited

195

00:07:29,990 --> 00:07:28,479

about

196

00:07:32,070 --> 00:07:30,000

so now i'd like to ask butler the

197

00:07:33,830 --> 00:07:32,080

project manager from ames to go over

198

00:07:35,189 --> 00:07:33,840

some mission highlights

199

00:07:36,230 --> 00:07:35,199

uh thanks joan

200

00:07:37,990 --> 00:07:36,240

um

201  
00:07:40,390 --> 00:07:38,000  
one of the things that is the first is

202  
00:07:42,469 --> 00:07:40,400  
we're trying out a modular spacecraft

203  
00:07:44,950 --> 00:07:42,479  
bus that is not designed for a single

204  
00:07:46,469 --> 00:07:44,960  
mission it's designed in a modular

205  
00:07:47,990 --> 00:07:46,479  
fashion so you can use it for for

206  
00:07:49,670 --> 00:07:48,000  
different missions by combining it in

207  
00:07:51,110 --> 00:07:49,680  
different ways if you bring up my first

208  
00:07:51,830 --> 00:07:51,120  
slide you can see

209  
00:07:53,110 --> 00:07:51,840  
the

210  
00:07:54,550 --> 00:07:53,120  
architecture

211  
00:07:56,390 --> 00:07:54,560  
you can see the individual modules

212  
00:07:57,830 --> 00:07:56,400  
there's a top module which contains most

213  
00:08:07,589 --> 00:07:57,840

the

214

00:08:09,270 --> 00:08:07,599

located on opposite sides for balance it

215

00:08:10,550 --> 00:08:09,280

also has our reaction wheels for fine

216

00:08:12,469 --> 00:08:10,560

pointing control

217

00:08:15,270 --> 00:08:12,479

there's an extension module and within

218

00:08:16,629 --> 00:08:15,280

that is the propulsion module you can uh

219

00:08:19,029 --> 00:08:16,639

put different types of propulsion

220

00:08:21,430 --> 00:08:19,039

modules in this spacecraft architecture

221

00:08:23,029 --> 00:08:21,440

but in this case uh we're using a proven

222

00:08:26,070 --> 00:08:23,039

commercial design from space systems

223

00:08:28,390 --> 00:08:26,080

laurel that is a byprop system uh

224

00:08:30,790 --> 00:08:28,400

meaning uh it has two fuel tanks and two

225

00:08:32,870 --> 00:08:30,800

pressure uh two oxidizer tanks and its

226

00:08:34,230 --> 00:08:32,880

pressurized system

227

00:08:36,389 --> 00:08:34,240

some things to notice about this

228

00:08:38,709 --> 00:08:36,399

spacecraft design is it does not have

229

00:08:41,110 --> 00:08:38,719

the wings that you normally see on a lot

230

00:08:43,190 --> 00:08:41,120

of modern designs those wings give you a

231

00:08:44,149 --> 00:08:43,200

lot of power they're deployed after

232

00:08:45,030 --> 00:08:44,159

launch

233

00:08:47,269 --> 00:08:45,040

but

234

00:08:49,030 --> 00:08:47,279

they they require that you always point

235

00:08:51,190 --> 00:08:49,040

at the sun because it's very it's very

236

00:08:52,389 --> 00:08:51,200

uh bad for a spacecraft to lose power

237

00:08:53,670 --> 00:08:52,399

obviously so you always want to be

238

00:08:55,269 --> 00:08:53,680

pointing at the sun one of the

239

00:08:57,829 --> 00:08:55,279

characteristics of this design that you

240

00:08:59,670 --> 00:08:57,839

can see is that it has solar panels all

241

00:09:01,269 --> 00:08:59,680

over the spacecraft what that means is

242

00:09:03,509 --> 00:09:01,279

the spacecraft can be in pretty much any

243

00:09:05,990 --> 00:09:03,519

attitude and still generate power that

244

00:09:07,750 --> 00:09:06,000

means it's a very inherently safe design

245

00:09:09,350 --> 00:09:07,760

it's very difficult for this spacecraft

246

00:09:11,590 --> 00:09:09,360

to ever get in a condition that it can't

247

00:09:13,430 --> 00:09:11,600

wake up from

248

00:09:14,949 --> 00:09:13,440

if you go to the next slide what you'll

249

00:09:16,230 --> 00:09:14,959

see is this is what lady looks like

250

00:09:18,949 --> 00:09:16,240

right now

251  
00:09:20,949 --> 00:09:18,959  
when we put the spacecraft together uh

252  
00:09:23,670 --> 00:09:20,959  
in this modular fashion it was done in a

253  
00:09:25,990 --> 00:09:23,680  
way to lower the cost of production one

254  
00:09:28,710 --> 00:09:26,000  
of the characteristics is this uh carbon

255  
00:09:30,710 --> 00:09:28,720  
composite frame uh that the spacecraft

256  
00:09:32,630 --> 00:09:30,720  
is built up to be very strong and very

257  
00:09:34,310 --> 00:09:32,640  
lightweight

258  
00:09:36,470 --> 00:09:34,320  
the other things we other thing we did

259  
00:09:38,630 --> 00:09:36,480  
was take advantage of any modern

260  
00:09:40,310 --> 00:09:38,640  
electronics any modern

261  
00:09:41,670 --> 00:09:40,320  
devices that were designed for space

262  
00:09:45,269 --> 00:09:41,680  
rather than designing things from

263  
00:09:47,670 --> 00:09:45,279

scratch so this is a think of it as a

264

00:09:50,150 --> 00:09:47,680

a bus that you can use for a multitude

265

00:09:52,630 --> 00:09:50,160

purposes i'm very happy that we got the

266

00:09:54,389 --> 00:09:52,640

chance to fly this on the first time uh

267

00:09:56,150 --> 00:09:54,399

for a lunar mission because uh that

268

00:09:58,389 --> 00:09:56,160

really proves out some of the

269

00:10:00,150 --> 00:09:58,399

characteristics of the bus after we put

270

00:10:02,230 --> 00:10:00,160

the bus together we went through a lot

271

00:10:04,630 --> 00:10:02,240

of testing uh you really want a

272

00:10:07,509 --> 00:10:04,640

spacecraft to experience the rigors of

273

00:10:09,990 --> 00:10:07,519

space before you fly it so we shook it

274

00:10:11,430 --> 00:10:10,000

we blasted it with loud noises we

275

00:10:12,949 --> 00:10:11,440

simulated the

276

00:10:15,030 --> 00:10:12,959

shock when it separates from the launch

277

00:10:17,990 --> 00:10:15,040

vehicle we put it in a hard vacuum

278

00:10:20,310 --> 00:10:18,000

chamber we baked it to high temperatures

279

00:10:21,910 --> 00:10:20,320

cooled it to very low temperatures uh

280

00:10:24,150 --> 00:10:21,920

tested all of its communications

281

00:10:25,590 --> 00:10:24,160

equipment with the actual uh relay

282

00:10:27,670 --> 00:10:25,600

satellites that we're going to be using

283

00:10:28,870 --> 00:10:27,680

we did all this in preparation shipping

284

00:10:30,790 --> 00:10:28,880

it to the range

285

00:10:33,110 --> 00:10:30,800

it's been at the range this summer we

286

00:10:35,110 --> 00:10:33,120

just finished doing all the spin

287

00:10:36,630 --> 00:10:35,120

balancing all the fueling of the

288

00:10:38,870 --> 00:10:36,640

spacecraft

289

00:10:41,509 --> 00:10:38,880

and now it's encapsulated with the fifth

290

00:10:43,509 --> 00:10:41,519

stage the upper stage it's encapsulated

291

00:10:45,590 --> 00:10:43,519

in the nose cone of the rocket this

292

00:10:46,790 --> 00:10:45,600

weekend we plan to roll it out and stack

293

00:10:49,350 --> 00:10:46,800

it on the rest of the launch vehicle

294

00:10:51,350 --> 00:10:49,360

which is already stacked at the pad if

295

00:10:53,670 --> 00:10:51,360

you go to the last animation you can see

296

00:10:55,990 --> 00:10:53,680

what it looks like in flight this is a

297

00:10:57,990 --> 00:10:56,000

an animation showing what you would see

298

00:11:00,310 --> 00:10:58,000

if you were outside the spacecraft

299

00:11:01,590 --> 00:11:00,320

looking at it on the way to the moon

300

00:11:03,190 --> 00:11:01,600

there's a couple of interesting things

301  
00:11:04,870 --> 00:11:03,200  
about how we get to the moon if you're

302  
00:11:06,230 --> 00:11:04,880  
if you're my generation you remember the

303  
00:11:07,990 --> 00:11:06,240  
apollo era

304  
00:11:09,670 --> 00:11:08,000  
they got to the moon in a classic figure

305  
00:11:11,670 --> 00:11:09,680  
eight pattern it's a very efficient way

306  
00:11:15,509 --> 00:11:11,680  
of getting to the moon uh it takes a lot

307  
00:11:17,350 --> 00:11:15,519  
of fuel however and because of of

308  
00:11:18,949 --> 00:11:17,360  
trying to optimize the amount of fuel

309  
00:11:20,870 --> 00:11:18,959  
that we have for the science mission we

310  
00:11:23,509 --> 00:11:20,880  
go in a different way we we launch from

311  
00:11:25,350 --> 00:11:23,519  
wallops and then we go into these

312  
00:11:27,190 --> 00:11:25,360  
elliptic orbits around the earth we take

313  
00:11:29,430 --> 00:11:27,200

a couple of passes around the earth and

314

00:11:31,430 --> 00:11:29,440

each pass we get higher and higher until

315

00:11:32,949 --> 00:11:31,440

finally on the third pass we're hanging

316

00:11:36,069 --> 00:11:32,959

out there in space right around where

317

00:11:38,069 --> 00:11:36,079

the moon's going to come by it swings by

318

00:11:40,550 --> 00:11:38,079

whips us around behind it and then once

319

00:11:42,389 --> 00:11:40,560

we come out from behind the moon we do a

320

00:11:44,230 --> 00:11:42,399

big breaking burn with our main engine

321

00:11:46,550 --> 00:11:44,240

that you can see there that breaking

322

00:11:48,949 --> 00:11:46,560

burn is what captures us around the moon

323

00:11:50,790 --> 00:11:48,959

we spend about 30 days commissioning the

324

00:11:53,509 --> 00:11:50,800

science instruments

325

00:11:54,710 --> 00:11:53,519

we do the optical com experiment during

326  
00:11:56,310 --> 00:11:54,720  
that time

327  
00:11:58,310 --> 00:11:56,320  
and then we drop down into the low

328  
00:12:01,430 --> 00:11:58,320  
science orbit the low science orbits

329  
00:12:03,350 --> 00:12:01,440  
about 30 to 70 to 90 miles above the

330  
00:12:05,110 --> 00:12:03,360  
lunar surface it's very low and when

331  
00:12:07,350 --> 00:12:05,120  
you're that low above the moon the lumpy

332  
00:12:10,230 --> 00:12:07,360  
gravity field requires a lot of fuel to

333  
00:12:12,069 --> 00:12:10,240  
maintain so we drop down into that orbit

334  
00:12:14,470 --> 00:12:12,079  
do our active science where we're flying

335  
00:12:16,710 --> 00:12:14,480  
in and out of the light dark terminators

336  
00:12:18,389 --> 00:12:16,720  
around the moon and and then at the end

337  
00:12:20,949 --> 00:12:18,399  
of the mission we terminate the mission

338  
00:12:22,870 --> 00:12:20,959

by intentionally crashing into the the

339

00:12:25,030 --> 00:12:22,880

lunar surface taking science on the way

340

00:12:26,790 --> 00:12:25,040

down and now i'd like sarah to talk

341

00:12:28,470 --> 00:12:26,800

about the the science aspects of the

342

00:12:30,230 --> 00:12:28,480

mission thanks butler

343

00:12:31,990 --> 00:12:30,240

so as you've heard lady has two main

344

00:12:33,590 --> 00:12:32,000

science goals to understand the lunar

345

00:12:35,590 --> 00:12:33,600

atmosphere as well as the dust

346

00:12:36,949 --> 00:12:35,600

environment around the moon and i think

347

00:12:38,389 --> 00:12:36,959

sometimes people are a little taken

348

00:12:40,310 --> 00:12:38,399

aback when we start talking about the

349

00:12:41,750 --> 00:12:40,320

lunar atmosphere because right we were

350

00:12:43,350 --> 00:12:41,760

told in school that the moon doesn't

351  
00:12:45,509 --> 00:12:43,360  
have an atmosphere

352  
00:12:47,590 --> 00:12:45,519  
it does it's just it's really really

353  
00:12:49,269 --> 00:12:47,600  
thin it's so thin that the individual

354  
00:12:51,190 --> 00:12:49,279  
molecules that make up the atmosphere

355  
00:12:52,470 --> 00:12:51,200  
are so few and far between that they

356  
00:12:54,230 --> 00:12:52,480  
don't interact with each other they

357  
00:12:55,910 --> 00:12:54,240  
never collide a collisionless

358  
00:12:57,910 --> 00:12:55,920  
environment which is something we call

359  
00:12:58,949 --> 00:12:57,920  
an exosphere if i can get my first

360  
00:13:00,790 --> 00:12:58,959  
graphic

361  
00:13:02,069 --> 00:13:00,800  
the earth actually has an exosphere as

362  
00:13:03,430 --> 00:13:02,079  
well but you actually have to get out

363  
00:13:05,110 --> 00:13:03,440

past where the international space

364

00:13:06,550 --> 00:13:05,120

station orbits before you get to this

365

00:13:08,870 --> 00:13:06,560

condition that we can consider an

366

00:13:10,790 --> 00:13:08,880

exosphere on the moon that actually

367

00:13:12,870 --> 00:13:10,800

happens right at the surface so the term

368

00:13:15,350 --> 00:13:12,880

we use for this class of atmosphere is a

369

00:13:16,870 --> 00:13:15,360

surface boundary exosphere and it's not

370

00:13:18,470 --> 00:13:16,880

just the moon surface boundary

371

00:13:20,069 --> 00:13:18,480

exospheres turn out to be the most

372

00:13:22,790 --> 00:13:20,079

common type of atmosphere we have in the

373

00:13:24,949 --> 00:13:22,800

solar system so mercury a lot of the

374

00:13:27,030 --> 00:13:24,959

moons of other planets even some large

375

00:13:28,949 --> 00:13:27,040

asteroids are big enough to have a

376

00:13:30,230 --> 00:13:28,959

surface boundary exosphere

377

00:13:31,990 --> 00:13:30,240

and it's a class of atmosphere we

378

00:13:33,350 --> 00:13:32,000

actually don't know that much about so

379

00:13:35,110 --> 00:13:33,360

it turns out the moon is actually a

380

00:13:36,389 --> 00:13:35,120

really convenient place to go and learn

381

00:13:37,829 --> 00:13:36,399

about this really common type of

382

00:13:39,670 --> 00:13:37,839

atmosphere

383

00:13:41,750 --> 00:13:39,680

it's also a really good time for us to

384

00:13:44,629 --> 00:13:41,760

go and explore the lunar ecosphere

385

00:13:46,310 --> 00:13:44,639

because it's so delicate and thin

386

00:13:48,710 --> 00:13:46,320

it's easily disturbed by things like

387

00:13:50,310 --> 00:13:48,720

spacecraft landings

388

00:13:51,590 --> 00:13:50,320

things have been relatively quiet around

389

00:13:53,269 --> 00:13:51,600

the moon in terms of landings for the

390

00:13:54,470 --> 00:13:53,279

last few decades but that's not going to

391

00:13:56,150 --> 00:13:54,480

it's not going to stay that way for long

392

00:13:57,430 --> 00:13:56,160

there's actually a number of countries a

393

00:13:58,790 --> 00:13:57,440

number of private companies that are

394

00:14:00,230 --> 00:13:58,800

planning landings to the moon in the

395

00:14:01,910 --> 00:14:00,240

upcoming years so now is a really good

396

00:14:03,350 --> 00:14:01,920

time to go and take a look at it while

397

00:14:05,590 --> 00:14:03,360

it's still in its sort of pristine

398

00:14:07,430 --> 00:14:05,600

natural state

399

00:14:08,870 --> 00:14:07,440

the second science goal is to look at

400

00:14:12,150 --> 00:14:08,880

the dust environment around the room and

401  
00:14:13,829 --> 00:14:12,160  
if i can get the the second graphic

402  
00:14:15,269 --> 00:14:13,839  
we've actually had questions about the

403  
00:14:17,350 --> 00:14:15,279  
dust environment

404  
00:14:18,629 --> 00:14:17,360  
since even before apollo if you look at

405  
00:14:21,030 --> 00:14:18,639  
the image on the left here from the

406  
00:14:22,710 --> 00:14:21,040  
surveyor 7 mission it captured something

407  
00:14:25,189 --> 00:14:22,720  
right along the horizon just before

408  
00:14:27,509 --> 00:14:25,199  
sunrise this strange glow that we think

409  
00:14:29,189 --> 00:14:27,519  
might be due to dust scattering sunlight

410  
00:14:30,870 --> 00:14:29,199  
in the atmosphere

411  
00:14:32,790 --> 00:14:30,880  
the apollo astronauts actually saw

412  
00:14:35,430 --> 00:14:32,800  
something similar thing too if you can

413  
00:14:37,350 --> 00:14:35,440

see on the right side is a sketch from

414

00:14:38,790 --> 00:14:37,360

from apollo 17 astronaut gene cernan's

415

00:14:40,629 --> 00:14:38,800

notebook where he saw not just that

416

00:14:42,069 --> 00:14:40,639

horizon glow but also these things he

417

00:14:44,790 --> 00:14:42,079

saw streaming high up into the

418

00:14:46,470 --> 00:14:44,800

atmosphere something he called streamers

419

00:14:48,150 --> 00:14:46,480

we think this also might be due to very

420

00:14:50,470 --> 00:14:48,160

tiny particles of dust getting lofted

421

00:14:52,790 --> 00:14:50,480

tens of kilometers up into the sky

422

00:14:54,310 --> 00:14:52,800

so this is uh finally an opportunity to

423

00:14:55,670 --> 00:14:54,320

that we can go and solve this mystery

424

00:14:57,910 --> 00:14:55,680

that has been puzzling scientists for

425

00:14:59,350 --> 00:14:57,920

almost 50 years so we're very excited to

426

00:15:00,710 --> 00:14:59,360

finally get an

427

00:15:01,910 --> 00:15:00,720

opportunity to understand what the dust

428

00:15:02,949 --> 00:15:01,920

environment is going to be like around

429

00:15:04,470 --> 00:15:02,959

the moon

430

00:15:06,550 --> 00:15:04,480

so we have three science instruments if

431

00:15:09,269 --> 00:15:06,560

i can get my last graphic uh on our

432

00:15:10,790 --> 00:15:09,279

science payload to in order to explore

433

00:15:12,949 --> 00:15:10,800

these questions the first is the lunar

434

00:15:14,230 --> 00:15:12,959

dust experiment it is a

435

00:15:15,829 --> 00:15:14,240

designed and built to the by the

436

00:15:18,389 --> 00:15:15,839

university of colorado and it will

437

00:15:20,790 --> 00:15:18,399

actually analyze individual dust grains

438

00:15:22,310 --> 00:15:20,800

as they approach the spacecraft

439

00:15:23,829 --> 00:15:22,320

the second is a neutral mass

440

00:15:26,710 --> 00:15:23,839

spectrometer

441

00:15:28,550 --> 00:15:26,720

designed and built by nasa goddard

442

00:15:29,829 --> 00:15:28,560

it will actually look at the composition

443

00:15:31,590 --> 00:15:29,839

of the various molecules in the

444

00:15:33,750 --> 00:15:31,600

atmosphere as well as their distribution

445

00:15:35,829 --> 00:15:33,760

over the course of a lunar day

446

00:15:38,069 --> 00:15:35,839

the third and final instrument is an

447

00:15:40,870 --> 00:15:38,079

ultraviolet spectrometer

448

00:15:42,470 --> 00:15:40,880

brought to us by the nasa ames and it's

449

00:15:43,829 --> 00:15:42,480

not the first spectrometer that we've

450

00:15:45,670 --> 00:15:43,839

sent to the moon we've actually sent a

451  
00:15:47,189 --> 00:15:45,680  
number of spectrometers usually though

452  
00:15:48,629 --> 00:15:47,199  
when we send a spectrometer it's looking

453  
00:15:50,230 --> 00:15:48,639  
down at the surface of the moon so we

454  
00:15:51,110 --> 00:15:50,240  
can understand the mineralogy of the

455  
00:15:52,870 --> 00:15:51,120  
rocks

456  
00:15:54,790 --> 00:15:52,880  
at the surface this spectrometer will

457  
00:15:56,310 --> 00:15:54,800  
actually look sideways just above the

458  
00:15:57,910 --> 00:15:56,320  
lunar surface so that we can go through

459  
00:16:00,629 --> 00:15:57,920  
the atmosphere and analyze what is in

460  
00:16:02,629 --> 00:16:00,639  
the atmosphere and the dust environment

461  
00:16:04,069 --> 00:16:02,639  
so those are our three science payload

462  
00:16:05,110 --> 00:16:04,079  
there is a fourth payload as has been

463  
00:16:07,430 --> 00:16:05,120

mentioned and i'm going to turn it over

464

00:16:09,509 --> 00:16:07,440

to don to introduce us to that one thank

465

00:16:11,189 --> 00:16:09,519

you sarah and i'd also like to thank the

466

00:16:13,269 --> 00:16:11,199

science mission directorate and the lady

467

00:16:15,430 --> 00:16:13,279

mission for uh giving us a ride to the

468

00:16:17,030 --> 00:16:15,440

moon our technology uh demonstration

469

00:16:19,910 --> 00:16:17,040

where we're going to

470

00:16:22,629 --> 00:16:19,920

use laser communications to demonstrate

471

00:16:24,230 --> 00:16:22,639

uh at least six times uh more uh more

472

00:16:25,670 --> 00:16:24,240

data rate from the moon than we can do

473

00:16:28,710 --> 00:16:25,680

with the radio system with half the

474

00:16:30,710 --> 00:16:28,720

weight and also 25 percent less power

475

00:16:32,870 --> 00:16:30,720

and my first graphic is up and if you

476

00:16:34,470 --> 00:16:32,880

can see that uh it actually gives a good

477

00:16:35,670 --> 00:16:34,480

illustration of what the concept of the

478

00:16:37,189 --> 00:16:35,680

mission is you can see the ladder

479

00:16:39,350 --> 00:16:37,199

spacecraft on the left and our

480

00:16:42,069 --> 00:16:39,360

instrument uh at the bottom which is a

481

00:16:44,150 --> 00:16:42,079

little small telescope and uh it will

482

00:16:46,150 --> 00:16:44,160

basically uh exchange laser beams

483

00:16:47,990 --> 00:16:46,160

between the earth and the moon to a new

484

00:16:51,189 --> 00:16:48,000

type of ground station

485

00:16:53,430 --> 00:16:51,199

uh and uh so with this system here uh we

486

00:16:55,749 --> 00:16:53,440

plan to be or we we will be nasa's first

487

00:16:57,030 --> 00:16:55,759

high rate two-way laser communications

488

00:16:59,749 --> 00:16:57,040

demonstration

489

00:17:02,629 --> 00:16:59,759

uh and uh riding along with lady to the

490

00:17:04,870 --> 00:17:02,639

moon uh the next slide please

491

00:17:06,949 --> 00:17:04,880

so nasa has a need for faster download

492

00:17:08,470 --> 00:17:06,959

speeds for data from space and it grows

493

00:17:11,669 --> 00:17:08,480

every day just like it does for the rest

494

00:17:13,350 --> 00:17:11,679

of us at home and also at work uh we'd

495

00:17:16,789 --> 00:17:13,360

like to be able to send high-resolution

496

00:17:18,870 --> 00:17:16,799

images and movies in in 3d even from

497

00:17:20,630 --> 00:17:18,880

satellites that not only orbit the earth

498

00:17:22,870 --> 00:17:20,640

but also from

499

00:17:24,789 --> 00:17:22,880

probes that'll go to the moon and beyond

500

00:17:27,510 --> 00:17:24,799

so communicating with radio waves has

501  
00:17:29,190 --> 00:17:27,520  
served us well for the last 50 years but

502  
00:17:31,590 --> 00:17:29,200  
we now have the technology to use light

503  
00:17:32,870 --> 00:17:31,600  
waves to communicate even more data

504  
00:17:34,390 --> 00:17:32,880  
light waves are much shorter in

505  
00:17:35,669 --> 00:17:34,400  
wavelength than radio waves as you can

506  
00:17:38,150 --> 00:17:35,679  
see in the figure

507  
00:17:41,270 --> 00:17:38,160  
and that allows us to use smaller

508  
00:17:43,430 --> 00:17:41,280  
transmitters and smaller receivers

509  
00:17:45,990 --> 00:17:43,440  
for example in in the figure you can see

510  
00:17:48,150 --> 00:17:46,000  
that a typical radio dish is on the left

511  
00:17:49,830 --> 00:17:48,160  
hand side and our ground terminal is on

512  
00:17:53,510 --> 00:17:49,840  
the right hand side and if you can on

513  
00:17:55,990 --> 00:17:53,520

the animation please play the animation

514

00:17:57,909 --> 00:17:56,000

while we send six times more data and

515

00:18:00,150 --> 00:17:57,919

and use less power we're actually a

516

00:18:02,150 --> 00:18:00,160

bunch smaller uh quite a bit smaller as

517

00:18:03,029 --> 00:18:02,160

you can see so faster bandwidth smaller

518

00:18:05,750 --> 00:18:03,039

size

519

00:18:07,909 --> 00:18:05,760

and less power needed

520

00:18:09,830 --> 00:18:07,919

the next slide please

521

00:18:11,590 --> 00:18:09,840

so this is an animation of our actual

522

00:18:13,669 --> 00:18:11,600

mission concept right here we have three

523

00:18:15,430 --> 00:18:13,679

ground stations and then you can see the

524

00:18:18,470 --> 00:18:15,440

lady spacecraft and we've highlighted in

525

00:18:19,909 --> 00:18:18,480

bright blue our space terminal so a beam

526  
00:18:21,990 --> 00:18:19,919  
from the ground from one of the ground

527  
00:18:24,150 --> 00:18:22,000  
stations will uh scan

528  
00:18:25,430 --> 00:18:24,160  
around the moon uh to where we expect

529  
00:18:27,990 --> 00:18:25,440  
lady to be

530  
00:18:29,830 --> 00:18:28,000  
and uh when laddie sees that beam go by

531  
00:18:31,909 --> 00:18:29,840  
it will send its own signal back down to

532  
00:18:33,590 --> 00:18:31,919  
the ground station so that the two

533  
00:18:35,830 --> 00:18:33,600  
systems can lock up and acquire each

534  
00:18:39,029 --> 00:18:35,840  
other once the two systems are locked

535  
00:18:41,510 --> 00:18:39,039  
and acquired then we can send uh

536  
00:18:43,909 --> 00:18:41,520  
tens of megabits of data per second from

537  
00:18:45,510 --> 00:18:43,919  
the earth up to the moon and similarly

538  
00:18:47,909 --> 00:18:45,520

we can send hundreds of megabits per

539

00:18:49,909 --> 00:18:47,919

second from the moon and

540

00:18:51,350 --> 00:18:49,919

on lati down to the earth

541

00:18:53,830 --> 00:18:51,360

and uh

542

00:18:55,430 --> 00:18:53,840

so we we hope that successfully

543

00:18:57,270 --> 00:18:55,440

successfully demonstrating this over and

544

00:18:58,710 --> 00:18:57,280

over again during the latte mission

545

00:19:00,710 --> 00:18:58,720

under all the conditions that you can

546

00:19:02,870 --> 00:19:00,720

see in the atmosphere and and day and

547

00:19:04,470 --> 00:19:02,880

night and and moon behind you and such

548

00:19:07,110 --> 00:19:04,480

will build the confidence for future

549

00:19:09,350 --> 00:19:07,120

nasa missions to use this technology for

550

00:19:11,029 --> 00:19:09,360

their communication systems

551

00:19:13,510 --> 00:19:11,039

finally i'd like to point out that the

552

00:19:15,830 --> 00:19:13,520

mit lincoln laboratory built our flight

553

00:19:17,029 --> 00:19:15,840

terminal and also built our primary

554

00:19:19,750 --> 00:19:17,039

ground terminal and we also have

555

00:19:22,630 --> 00:19:19,760

partners nasa's jpl has built a ground

556

00:19:24,230 --> 00:19:22,640

station for us in wrightwood california

557

00:19:26,390 --> 00:19:24,240

and then finally the european space

558

00:19:28,230 --> 00:19:26,400

agency has also built a ground station

559

00:19:29,430 --> 00:19:28,240

in uh tenerife spain

560

00:19:33,190 --> 00:19:29,440

and uh we're looking forward to

561

00:19:35,350 --> 00:19:33,200

collaborating with everyone and lady

562

00:19:37,029 --> 00:19:35,360

and i at this point i hand over to uh

563

00:19:40,390 --> 00:19:37,039

doug voss who is our launch manager at

564

00:19:41,830 --> 00:19:40,400

nasa's wallops thank you very much don

565

00:19:43,990 --> 00:19:41,840

it's an honor and a privilege to

566

00:19:45,510 --> 00:19:44,000

represent wallops and nasa and be a part

567

00:19:47,270 --> 00:19:45,520

of the laddie team for the last five

568

00:19:49,510 --> 00:19:47,280

years wallops flight facility has been

569

00:19:51,270 --> 00:19:49,520

working with nasa ames and all the other

570

00:19:53,669 --> 00:19:51,280

centers mentioned

571

00:19:56,150 --> 00:19:53,679

to deliver lady to the moon on its way

572

00:19:57,669 --> 00:19:56,160

on air force minotaur 5.

573

00:19:59,909 --> 00:19:57,679

wallops has been a very busy place in

574

00:20:01,590 --> 00:19:59,919

the last couple years as as you might

575

00:20:03,590 --> 00:20:01,600

note there have been a lot of missions

576  
00:20:05,350 --> 00:20:03,600  
that have been increasing in scope and

577  
00:20:06,789 --> 00:20:05,360  
size at wap's flight facility and lady

578  
00:20:08,549 --> 00:20:06,799  
is launching at a historic time at

579  
00:20:10,630 --> 00:20:08,559  
wallops wilds has been launching

580  
00:20:13,110 --> 00:20:10,640  
missions since 1945

581  
00:20:14,789 --> 00:20:13,120  
and in all of those flights uh from

582  
00:20:17,270 --> 00:20:14,799  
wallops and other places in

583  
00:20:18,710 --> 00:20:17,280  
in the uh in the world

584  
00:20:20,549 --> 00:20:18,720  
none of those flights have ever left

585  
00:20:22,870 --> 00:20:20,559  
earth's orbit so light is a historic

586  
00:20:24,310 --> 00:20:22,880  
moment as well as going to the moon and

587  
00:20:26,950 --> 00:20:24,320  
makes it very exciting for people like

588  
00:20:28,789 --> 00:20:26,960

me and other people on the team

589

00:20:30,470 --> 00:20:28,799

wallops is exercising a relationship

590

00:20:33,110 --> 00:20:30,480

with the us air force that we've been

591

00:20:35,909 --> 00:20:33,120

working with for a few years actually

592

00:20:38,230 --> 00:20:35,919

since 2006 to fly minotaur once from

593

00:20:39,990 --> 00:20:38,240

wallops for air force dod missions

594

00:20:42,149 --> 00:20:40,000

so with lady we're putting a nasa

595

00:20:43,750 --> 00:20:42,159

mission on top of a minotaur vehicle and

596

00:20:45,669 --> 00:20:43,760

it's a new minotaur vehicle that we've

597

00:20:47,270 --> 00:20:45,679

never flown from wallops flight facility

598

00:20:48,390 --> 00:20:47,280

so it's a very exciting time for us and

599

00:20:50,710 --> 00:20:48,400

the air force

600

00:20:52,390 --> 00:20:50,720

and the rest of the agency

601  
00:20:53,590 --> 00:20:52,400  
i have a visualization i'm going to show

602  
00:20:55,430 --> 00:20:53,600  
you and talk to you a little bit about

603  
00:20:56,950 --> 00:20:55,440  
the flight it's developed by engineers

604  
00:20:58,630 --> 00:20:56,960  
at wallops flight facility and we use

605  
00:20:59,750 --> 00:20:58,640  
this visualization for engineering and

606  
00:21:01,270 --> 00:20:59,760  
planning

607  
00:21:04,230 --> 00:21:01,280  
now the minotaur 5 is going to be

608  
00:21:07,510 --> 00:21:04,240  
launching from virginia spaceport pad 0b

609  
00:21:09,669 --> 00:21:07,520  
and this five-stage solid fuel rocket is

610  
00:21:11,510 --> 00:21:09,679  
going to lift off as mentioned earlier

611  
00:21:13,190 --> 00:21:11,520  
11 27 pm

612  
00:21:14,789 --> 00:21:13,200  
friday september 6th

613  
00:21:16,470 --> 00:21:14,799

and it's going to take off and fly over

614

00:21:18,549 --> 00:21:16,480

the atlantic ocean

615

00:21:20,870 --> 00:21:18,559

this five-stage rocket will drop its

616

00:21:23,190 --> 00:21:20,880

first three stages in the atlantic ocean

617

00:21:24,789 --> 00:21:23,200

while nasa systems located at wallops

618

00:21:26,390 --> 00:21:24,799

flight facility

619

00:21:28,950 --> 00:21:26,400

nearby north carolina outer banks

620

00:21:31,190 --> 00:21:28,960

coquina and on bermuda will be tracking

621

00:21:34,390 --> 00:21:31,200

the rocket on its flight out

622

00:21:35,990 --> 00:21:34,400

so as does the icbm peacekeeper stages

623

00:21:37,750 --> 00:21:36,000

fall into the ocean these systems will

624

00:21:39,590 --> 00:21:37,760

be relaying data back to wallops flight

625

00:21:41,430 --> 00:21:39,600

facility giving

626  
00:21:42,549 --> 00:21:41,440  
personnel in the range control center

627  
00:21:46,950 --> 00:21:42,559  
and in the air

628  
00:21:48,789 --> 00:21:46,960  
will be having taking that information

629  
00:21:49,909 --> 00:21:48,799  
um and observing the flight on the way

630  
00:21:53,669 --> 00:21:49,919  
out

631  
00:21:55,190 --> 00:21:53,679  
important to note that the data coming

632  
00:21:57,029 --> 00:21:55,200  
back from these

633  
00:21:58,549 --> 00:21:57,039  
these are these facilities in the

634  
00:22:01,270 --> 00:21:58,559  
atlantic ocean of bermuda

635  
00:22:03,909 --> 00:22:01,280  
will be used to to assess the vehicle

636  
00:22:05,510 --> 00:22:03,919  
and to monitor its performance

637  
00:22:07,990 --> 00:22:05,520  
it's real important to note also that

638  
00:22:10,149 --> 00:22:08,000

these stages are icbm stages that were

639

00:22:11,510 --> 00:22:10,159

on peacekeeper vehicles that were used

640

00:22:12,470 --> 00:22:11,520

by the air force so they're highly

641

00:22:15,830 --> 00:22:12,480

reliable

642

00:22:18,390 --> 00:22:17,110

the fourth and fifth stage are

643

00:22:20,870 --> 00:22:18,400

commercial rocket motors that are

644

00:22:22,149 --> 00:22:20,880

stacked on them and right now on the

645

00:22:24,070 --> 00:22:22,159

visualization you see the fairing

646

00:22:25,750 --> 00:22:24,080

separation and that fairing separation

647

00:22:29,270 --> 00:22:25,760

exposes the ladies spacecraft and the

648

00:22:32,870 --> 00:22:29,280

new minotaur five fifth stage

649

00:22:36,870 --> 00:22:35,510

you'll see that the tdrs system

650

00:22:38,870 --> 00:22:36,880

will be used

651  
00:22:40,470 --> 00:22:38,880  
to collect the data as the space as the

652  
00:22:44,070 --> 00:22:40,480  
launch vehicle gets downrange and out of

653  
00:22:45,669 --> 00:22:44,080  
range of of tracking assets

654  
00:22:47,270 --> 00:22:45,679  
so at this point in the flight the

655  
00:22:48,789 --> 00:22:47,280  
vehicle is in orbit and the stage four

656  
00:22:50,310 --> 00:22:48,799  
ignites

657  
00:22:52,870 --> 00:22:50,320  
and that the stage four takes the

658  
00:22:54,710 --> 00:22:52,880  
vehicle up to prepare it for its final

659  
00:22:58,149 --> 00:22:54,720  
phase on the way to

660  
00:23:02,549 --> 00:23:00,950  
and after stage four separates we enter

661  
00:23:04,470 --> 00:23:02,559  
the stage where the minotaur five fifth

662  
00:23:06,310 --> 00:23:04,480  
stage is going to do its work

663  
00:23:08,630 --> 00:23:06,320

the first thing we have to do is spin

664

00:23:10,549 --> 00:23:08,640

the upper stack together

665

00:23:13,510 --> 00:23:10,559

and the the lady spacecraft and minotaur

666

00:23:15,190 --> 00:23:13,520

5 will spin and be spin stabilized

667

00:23:17,750 --> 00:23:15,200

before the fifth stage ignites when the

668

00:23:19,750 --> 00:23:17,760

fifth stage ignites

669

00:23:21,350 --> 00:23:19,760

the tdrs data will be transmitted via

670

00:23:23,750 --> 00:23:21,360

the tdrs system back to wallops flight

671

00:23:27,830 --> 00:23:23,760

facility

672

00:23:31,270 --> 00:23:29,830

the system will despin we have a yo-yo

673

00:23:32,310 --> 00:23:31,280

d-spin that orbital sciences has

674

00:23:34,149 --> 00:23:32,320

developed

675

00:23:36,710 --> 00:23:34,159

along with the rest of the systems on

676  
00:23:38,549 --> 00:23:36,720  
the fifth stage this system separates

677  
00:23:39,750 --> 00:23:38,559  
the system de-spins the system so lady

678  
00:23:42,070 --> 00:23:39,760  
can separate

679  
00:23:45,510 --> 00:23:42,080  
and then turn on and begin its trip to

680  
00:23:48,470 --> 00:23:47,190  
so

681  
00:23:50,230 --> 00:23:48,480  
this vehicle is going to be launching at

682  
00:23:51,909 --> 00:23:50,240  
night so it should be easily visible

683  
00:23:53,190 --> 00:23:51,919  
from a lot of locations on the east

684  
00:23:55,270 --> 00:23:53,200  
coast

685  
00:23:57,270 --> 00:23:55,280  
the next visualization you'll see is the

686  
00:23:58,950 --> 00:23:57,280  
graphic of the east coast of the united

687  
00:24:04,630 --> 00:23:58,960  
states i'm going to switch to that

688  
00:24:07,830 --> 00:24:06,549

and so in this graphic you'll see that

689

00:24:13,590 --> 00:24:07,840

the

690

00:24:15,029 --> 00:24:13,600

west as pittsburgh you'll be able to

691

00:24:16,870 --> 00:24:15,039

be able to see the vehicle depending on

692

00:24:19,029 --> 00:24:16,880

weather conditions you can actually go

693

00:24:21,110 --> 00:24:19,039

online to nasa's website and get this

694

00:24:23,269 --> 00:24:21,120

information and figure out which way to

695

00:24:24,630 --> 00:24:23,279

look to see laddie heads on its way to

696

00:24:25,909 --> 00:24:24,640

the moon

697

00:24:27,430 --> 00:24:25,919

thank you

698

00:24:28,870 --> 00:24:27,440

and back to dwayne

699

00:24:30,630 --> 00:24:28,880

well thank you all now it's time we're

700

00:24:33,029 --> 00:24:30,640

going to go ahead and transition into

701  
00:24:35,430 --> 00:24:33,039  
the question and answer uh we're gonna

702  
00:24:37,750 --> 00:24:35,440  
go to the phone lines first and then uh

703  
00:24:38,630 --> 00:24:37,760  
of course remember the public that's out

704  
00:24:40,630 --> 00:24:38,640  
there

705  
00:24:42,950 --> 00:24:40,640  
bring send your question into hashtag

706  
00:24:45,350 --> 00:24:42,960  
ask nasa join the conversation it's

707  
00:24:48,549 --> 00:24:45,360  
building and building at

708  
00:24:50,870 --> 00:24:48,559  
atlanti i'm sorry at nasa laddie but if

709  
00:24:53,750 --> 00:24:50,880  
you have a question again send it in to

710  
00:24:55,590 --> 00:24:53,760  
hashtag ask nasa but right now we're

711  
00:24:58,070 --> 00:24:55,600  
going to go to the phones first and i

712  
00:25:08,549 --> 00:24:58,080  
believe we have marcia smith on the line

713  
00:25:12,470 --> 00:25:10,230

what i will do if marshall's not there

714

00:25:17,750 --> 00:25:12,480

let me go ahead and take and ask and ask

715

00:25:21,029 --> 00:25:19,190

okay

716

00:25:23,110 --> 00:25:21,039

i'm hearing uh marcia she's going to be

717

00:25:24,710 --> 00:25:23,120

with us so for the group here for an ask

718

00:25:26,710 --> 00:25:24,720

nasa question

719

00:25:28,230 --> 00:25:26,720

if laddie doesn't launch september 6

720

00:25:29,430 --> 00:25:28,240

what other launch opportunities will

721

00:25:31,029 --> 00:25:29,440

there be

722

00:25:31,990 --> 00:25:31,039

i can answer that

723

00:25:35,750 --> 00:25:32,000

the

724

00:25:37,830 --> 00:25:35,760

window and since we're leaving earth

725

00:25:39,590 --> 00:25:37,840

orbit we have a

726  
00:25:42,070 --> 00:25:39,600  
pretty tight constraints on when we can

727  
00:25:43,669 --> 00:25:42,080  
launch so we have a window on the six

728  
00:25:45,190 --> 00:25:43,679  
and then we have another four nights

729  
00:25:46,789 --> 00:25:45,200  
that we can launch

730  
00:25:49,110 --> 00:25:46,799  
if we don't get out for some reason the

731  
00:25:50,470 --> 00:25:49,120  
weather's too bad then we stand down for

732  
00:25:53,269 --> 00:25:50,480  
a couple of days and then we can make

733  
00:25:55,350 --> 00:25:53,279  
another attempt for uh four days before

734  
00:25:57,110 --> 00:25:55,360  
before the windows close

735  
00:25:59,669 --> 00:25:57,120  
after that we have some more windows in

736  
00:26:01,590 --> 00:25:59,679  
october but uh but we need to get off

737  
00:26:03,430 --> 00:26:01,600  
the ground by the end of october

738  
00:26:05,430 --> 00:26:03,440

otherwise an eclipse season starts

739

00:26:06,950 --> 00:26:05,440

around the moon that has very deep cold

740

00:26:08,870 --> 00:26:06,960

eclipses and

741

00:26:11,190 --> 00:26:08,880

those are eclipses of spacecraft's not

742

00:26:12,870 --> 00:26:11,200

designed to survive so

743

00:26:15,510 --> 00:26:12,880

september and october are our primary

744

00:26:18,950 --> 00:26:17,590

okay let's see if we can uh go back to

745

00:26:20,950 --> 00:26:18,960

the phone lines here and i believe we

746

00:26:22,070 --> 00:26:20,960

have uh alan boyle alan if you're there

747

00:26:23,190 --> 00:26:22,080

god please

748

00:26:24,710 --> 00:26:23,200

give your name again and your

749

00:26:26,950 --> 00:26:24,720

affiliation

750

00:26:30,549 --> 00:26:26,960

okay all right this is alan boyle with

751  
00:26:33,669 --> 00:26:30,559  
uh nbc news and uh had a question just

752  
00:26:36,789 --> 00:26:33,679  
about uh lady has had quite a history i

753  
00:26:38,390 --> 00:26:36,799  
think when the the mission was first uh

754  
00:26:42,149 --> 00:26:38,400  
raised

755  
00:26:44,950 --> 00:26:42,159  
it was going to support future nasa

756  
00:26:48,070 --> 00:26:44,960  
manned missions to the moon uh now the

757  
00:26:50,470 --> 00:26:48,080  
focus has shifted elsewhere do you feel

758  
00:26:52,549 --> 00:26:50,480  
how did that change the character of the

759  
00:26:54,230 --> 00:26:52,559  
mission and can you talk a little bit

760  
00:26:56,230 --> 00:26:54,240  
about the long-term goals that are

761  
00:27:00,470 --> 00:26:56,240  
served in terms of exploration by this

762  
00:27:05,430 --> 00:27:03,269  
you want to take a shot at uh john

763  
00:27:07,269 --> 00:27:05,440

how do you want to do this john

764

00:27:09,269 --> 00:27:07,279

but the way the question was asked about

765

00:27:10,950 --> 00:27:09,279

lady being a human mission is not

766

00:27:13,190 --> 00:27:10,960

correct it was never designed as a human

767

00:27:15,350 --> 00:27:13,200

mission it was always a low-cost robotic

768

00:27:16,789 --> 00:27:15,360

science mission uh from the beginning

769

00:27:19,350 --> 00:27:16,799

i'm personally not aware of anything

770

00:27:21,029 --> 00:27:19,360

else called lady in the agency that was

771

00:27:22,870 --> 00:27:21,039

related to humans

772

00:27:25,669 --> 00:27:22,880

so if the question wants to be repeated

773

00:27:28,310 --> 00:27:25,679

in any format go ahead but ladie was not

774

00:27:30,710 --> 00:27:28,320

designed to be involved with humans so i

775

00:27:31,909 --> 00:27:30,720

can uh i can add to that um

776  
00:27:34,390 --> 00:27:31,919  
i think what the

777  
00:27:36,549 --> 00:27:34,400  
the questioner is asking is

778  
00:27:38,390 --> 00:27:36,559  
at the early times

779  
00:27:40,149 --> 00:27:38,400  
dust is a very

780  
00:27:41,190 --> 00:27:40,159  
difficult environment to deal with on

781  
00:27:42,549 --> 00:27:41,200  
the moon

782  
00:27:44,390 --> 00:27:42,559  
it's not like terrestrial dust

783  
00:27:47,029 --> 00:27:44,400  
terrestrial dust is like talcum powder

784  
00:27:49,669 --> 00:27:47,039  
on the moon it's very rough and it can

785  
00:27:52,390 --> 00:27:49,679  
actually follow it's very kind of evil

786  
00:27:54,230 --> 00:27:52,400  
it follows electric field lines it works

787  
00:27:55,590 --> 00:27:54,240  
its way in equipment so one of the the

788  
00:27:58,230 --> 00:27:55,600

questions about

789

00:28:00,149 --> 00:27:58,240

dust on the moon is is an engineering

790

00:28:01,590 --> 00:28:00,159

question how do you design things so

791

00:28:02,470 --> 00:28:01,600

that they can survive the dust

792

00:28:04,870 --> 00:28:02,480

environment

793

00:28:07,029 --> 00:28:04,880

and that was the connection to the the

794

00:28:08,870 --> 00:28:07,039

human efforts at the beginning of lady

795

00:28:11,190 --> 00:28:08,880

was not only the scientific question

796

00:28:12,549 --> 00:28:11,200

about how elevated dust uh operates

797

00:28:14,549 --> 00:28:12,559

around the moon transports around the

798

00:28:16,230 --> 00:28:14,559

moon but also information about the dust

799

00:28:18,310 --> 00:28:16,240

transport mechanisms for engineering

800

00:28:20,389 --> 00:28:18,320

purposes and the goal of laddie was to

801  
00:28:22,549 --> 00:28:20,399  
do these measurements before

802  
00:28:25,669 --> 00:28:22,559  
future human activity occurred which is

803  
00:28:27,190 --> 00:28:25,679  
something sarah talked about

804  
00:28:29,430 --> 00:28:27,200  
i think

805  
00:28:30,710 --> 00:28:29,440  
just to expand on that a little bit

806  
00:28:32,549 --> 00:28:30,720  
butler i think

807  
00:28:33,909 --> 00:28:32,559  
you gave great answers and

808  
00:28:37,269 --> 00:28:33,919  
another thing that we've learned about

809  
00:28:39,830 --> 00:28:37,279  
the moon from the uh I cross mission is

810  
00:28:41,430 --> 00:28:39,840  
the possibility of water on the moon and

811  
00:28:43,269 --> 00:28:41,440  
how does it get trapped in these cold

812  
00:28:46,230 --> 00:28:43,279  
traps and other places that we've seen

813  
00:28:48,389 --> 00:28:46,240

it and so understanding this tenuous

814

00:28:50,549 --> 00:28:48,399

atmosphere and the transport mechanisms

815

00:28:52,389 --> 00:28:50,559

of dust and other atmospheric components

816

00:28:54,789 --> 00:28:52,399

will tell us a lot about you know both

817

00:28:57,430 --> 00:28:54,799

the scientific aspects and future lunar

818

00:29:00,070 --> 00:28:57,440

exploration aspects uh you know we're

819

00:29:02,950 --> 00:29:00,080

exploring all across the solar system uh

820

00:29:05,510 --> 00:29:02,960

you know from you know just a very rough

821

00:29:07,430 --> 00:29:05,520

view the moon kind of looks like mercury

822

00:29:08,950 --> 00:29:07,440

and you would never think that mercury

823

00:29:10,630 --> 00:29:08,960

so close to the sun would have an

824

00:29:12,870 --> 00:29:10,640

atmosphere you know but there's some

825

00:29:14,710 --> 00:29:12,880

hints that even mercury you know has a

826

00:29:16,950 --> 00:29:14,720

tenuous atmosphere from our messenger

827

00:29:18,710 --> 00:29:16,960

mission and so lady is part of a much

828

00:29:20,870 --> 00:29:18,720

broader scientific exploration of the

829

00:29:22,230 --> 00:29:20,880

solar system uh that we do here in the

830

00:29:23,029 --> 00:29:22,240

science mission directorate but of

831

00:29:25,110 --> 00:29:23,039

course

832

00:29:28,070 --> 00:29:25,120

all of our exploration science or

833

00:29:29,750 --> 00:29:28,080

otherwise is human exploration uh you

834

00:29:31,830 --> 00:29:29,760

know i have to remind my kids sometime

835

00:29:35,110 --> 00:29:31,840

that scientists are people too are

836

00:29:36,710 --> 00:29:35,120

humans too especially myself

837

00:29:39,590 --> 00:29:36,720

so you know this is part of a much

838

00:29:41,909 --> 00:29:39,600

broader exploration agenda and the same

839

00:29:44,230 --> 00:29:41,919

question can be asked about larger

840

00:29:47,269 --> 00:29:44,240

asteroids if you look at

841

00:29:49,750 --> 00:29:47,279

at a series or a vesta you know does

842

00:29:51,350 --> 00:29:49,760

ceres invest in the main asteroid belt

843

00:29:53,590 --> 00:29:51,360

do they have atmospheres what are the

844

00:29:55,269 --> 00:29:53,600

transport properties of dust

845

00:29:56,870 --> 00:29:55,279

from collisions

846

00:29:58,870 --> 00:29:56,880

clearly the moon

847

00:30:00,710 --> 00:29:58,880

is there you know this what we see on

848

00:30:02,549 --> 00:30:00,720

the moon the visual surface is the

849

00:30:03,590 --> 00:30:02,559

result of asteroid collisions on the

850

00:30:05,350 --> 00:30:03,600

moon

851  
00:30:06,549 --> 00:30:05,360  
and so in the main asteroid belt there's

852  
00:30:08,389 --> 00:30:06,559  
you know

853  
00:30:10,549 --> 00:30:08,399  
speaking in very long time frames lots

854  
00:30:11,830 --> 00:30:10,559  
of collisions uh and so the same

855  
00:30:14,870 --> 00:30:11,840  
questions are out there so this is part

856  
00:30:15,909 --> 00:30:14,880  
of the broader scientific exploration

857  
00:30:18,389 --> 00:30:15,919  
thanks john

858  
00:30:20,230 --> 00:30:18,399  
uh we're gonna take another call on the

859  
00:30:22,389 --> 00:30:20,240  
phone line and then we're gonna go

860  
00:30:25,029 --> 00:30:22,399  
back to social media again if you have a

861  
00:30:26,310 --> 00:30:25,039  
question hashtag ask nasa join the

862  
00:30:27,990 --> 00:30:26,320  
conversation

863  
00:30:29,830 --> 00:30:28,000

at nasa laddie

864

00:30:32,710 --> 00:30:29,840

on the phone next carol in chin new york

865

00:30:39,029 --> 00:30:37,029

hi um can you hear me yes

866

00:30:41,669 --> 00:30:39,039

okay great um i was wondering if you

867

00:30:43,909 --> 00:30:41,679

could um uh explain what the price tag

868

00:30:47,590 --> 00:30:43,919

of the mission is and put that into some

869

00:30:49,590 --> 00:30:47,600

context with um the original goal of the

870

00:30:51,590 --> 00:30:49,600

lunar request program to

871

00:30:53,269 --> 00:30:51,600

you know be less expensive you've

872

00:30:55,190 --> 00:30:53,279

mentioned many times that the new

873

00:30:56,070 --> 00:30:55,200

modular design has

874

00:30:58,389 --> 00:30:56,080

um

875

00:31:00,310 --> 00:30:58,399

the possibility of saving money and i

876

00:31:02,149 --> 00:31:00,320

was wondering if you could extend the

877

00:31:04,149 --> 00:31:02,159

price tag of this mission and also

878

00:31:06,070 --> 00:31:04,159

compare that to previous lunar missions

879

00:31:08,870 --> 00:31:06,080

or any other you know comparable

880

00:31:10,149 --> 00:31:08,880

missions to give some context

881

00:31:12,630 --> 00:31:10,159

sure

882

00:31:14,710 --> 00:31:12,640

ladies price tags coming in at 280

883

00:31:15,669 --> 00:31:14,720

million for the full life cycle cost of

884

00:31:17,269 --> 00:31:15,679

laddie

885

00:31:19,750 --> 00:31:17,279

and the way we one of the ways we

886

00:31:21,269 --> 00:31:19,760

categorize our missions

887

00:31:23,590 --> 00:31:21,279

there's a number of factors but one of

888

00:31:25,830 --> 00:31:23,600

those is cost and we call them cat one

889

00:31:27,590 --> 00:31:25,840

two or three based on

890

00:31:29,830 --> 00:31:27,600

costs and other things we look at

891

00:31:33,029 --> 00:31:29,840

missions that are over a billion between

892

00:31:35,909 --> 00:31:33,039

250 million and one billion or less than

893

00:31:38,950 --> 00:31:35,919

250 and this mission came in at the low

894

00:31:40,630 --> 00:31:38,960

end of cat two so it's just it almost

895

00:31:42,789 --> 00:31:40,640

made the cat one the lowest cost

896

00:31:49,830 --> 00:31:42,799

missions that we have so it's just over

897

00:31:54,870 --> 00:31:51,750

carolyn did you uh

898

00:31:56,950 --> 00:31:54,880

did that answer your question

899

00:31:58,389 --> 00:31:56,960

yeah i was wondering if that was within

900

00:32:00,630 --> 00:31:58,399

could you get some context for that

901  
00:32:03,029 --> 00:32:00,640  
number is that what was expected from

902  
00:32:05,350 --> 00:32:03,039  
the outset was how does it compare to

903  
00:32:06,149 --> 00:32:05,360  
say the grail mission

904  
00:32:13,909 --> 00:32:06,159  
or

905  
00:32:17,590 --> 00:32:13,919  
would guess grail was discovery so that

906  
00:32:19,909 --> 00:32:17,600  
was what about 350 million approximately

907  
00:32:21,750 --> 00:32:19,919  
but i really shouldn't say because i

908  
00:32:23,990 --> 00:32:21,760  
don't know for certain on that i will

909  
00:32:25,590 --> 00:32:24,000  
say that over the last 10 years

910  
00:32:27,509 --> 00:32:25,600  
approximately

911  
00:32:30,470 --> 00:32:27,519  
20 percent of our missions have been in

912  
00:32:32,950 --> 00:32:30,480  
the lowest cost range below 250 and 20

913  
00:32:35,430 --> 00:32:32,960

percent have been over a billion and 60

914

00:32:37,190 --> 00:32:35,440

percent have been in that mid-range

915

00:32:38,870 --> 00:32:37,200

and and carolyn you can call my office

916

00:32:41,029 --> 00:32:38,880

and we can get you some some additional

917

00:32:42,549 --> 00:32:41,039

figures to uh put in in context we don't

918

00:32:44,070 --> 00:32:42,559

want to put those numbers out we just

919

00:32:45,750 --> 00:32:44,080

want to make sure we can uh get them

920

00:32:46,870 --> 00:32:45,760

accurate so just give me a call on that

921

00:32:47,909 --> 00:32:46,880

so this is what we're going to do ladies

922

00:32:49,590 --> 00:32:47,919

and gentlemen we're going to go to the

923

00:32:52,070 --> 00:32:49,600

real expert on social media who's

924

00:32:53,269 --> 00:32:52,080

joining us here today with say ask and

925

00:32:54,870 --> 00:32:53,279

ask the question we're going to switch

926  
00:32:58,310 --> 00:32:54,880  
over to my colleague jason townsend

927  
00:33:00,070 --> 00:32:58,320  
who's monitoring ask nasa jason

928  
00:33:02,149 --> 00:33:00,080  
hi we have a question here from twitter

929  
00:33:04,710 --> 00:33:02,159  
user daniel fisher could someone on the

930  
00:33:06,870 --> 00:33:04,720  
panel address the hoped for involvement

931  
00:33:10,149 --> 00:33:06,880  
of amateur astronomers in support of

932  
00:33:11,830 --> 00:33:10,159  
nasa ladies science goals

933  
00:33:14,389 --> 00:33:11,840  
sure i can i can address that this is

934  
00:33:16,870 --> 00:33:14,399  
sarah so yeah we are very interested in

935  
00:33:18,870 --> 00:33:16,880  
having participation uh from amateur

936  
00:33:20,789 --> 00:33:18,880  
astronomers around the world we'd really

937  
00:33:22,870 --> 00:33:20,799  
like to be able to um

938  
00:33:25,269 --> 00:33:22,880

see what's going on on the moon so we're

939

00:33:26,710 --> 00:33:25,279

orbiting the moon we've got Iro looking

940

00:33:27,909 --> 00:33:26,720

and stuff but there are impacts hitting

941

00:33:29,269 --> 00:33:27,919

the moon all the time and we want to

942

00:33:31,190 --> 00:33:29,279

know what impact

943

00:33:33,190 --> 00:33:31,200

impact those impacts are having on the

944

00:33:35,830 --> 00:33:33,200

atmosphere in dust environment

945

00:33:38,230 --> 00:33:35,840

so we've asked amateur astronomers

946

00:33:40,070 --> 00:33:38,240

to to actually watch the moon and take a

947

00:33:41,350 --> 00:33:40,080

look and see if they see impacts coming

948

00:33:47,669 --> 00:33:41,360

in

949

00:33:50,070 --> 00:33:47,679

are below that level we actually have a

950

00:33:51,190 --> 00:33:50,080

web app where you can go and actually

951  
00:33:54,870 --> 00:33:51,200  
monitor

952  
00:33:57,029 --> 00:33:54,880  
meteorites coming through in on earth so

953  
00:33:58,389 --> 00:33:57,039  
if you figure that you know as we go

954  
00:34:00,149 --> 00:33:58,399  
through a

955  
00:34:01,190 --> 00:34:00,159  
meteorite storm certain number of things

956  
00:34:02,789 --> 00:34:01,200  
are hitting the moon they're also

957  
00:34:03,750 --> 00:34:02,799  
hitting the earth at roughly the same

958  
00:34:05,590 --> 00:34:03,760  
rates

959  
00:34:08,550 --> 00:34:05,600  
so we'd actually are interested in in

960  
00:34:09,909 --> 00:34:08,560  
acquiring um data about how many things

961  
00:34:11,990 --> 00:34:09,919  
are hitting the earth at any given time

962  
00:34:13,589 --> 00:34:12,000  
as well and so there's actually an app

963  
00:34:15,430 --> 00:34:13,599

uh you can find the information for it

964

00:34:17,030 --> 00:34:15,440

on the laddie website to download the

965

00:34:19,990 --> 00:34:17,040

app it's free and you can go out at

966

00:34:21,589 --> 00:34:20,000

night and count meteors uh and and add

967

00:34:22,869 --> 00:34:21,599

that data to our collective knowledge so

968

00:34:25,109 --> 00:34:22,879

anybody can participate in the lightning

969

00:34:27,510 --> 00:34:25,119

mission

970

00:34:29,349 --> 00:34:27,520

jason some more questions indeed from

971

00:34:31,669 --> 00:34:29,359

twitter user jim way

972

00:34:36,869 --> 00:34:31,679

can you explain more about the dspin

973

00:34:41,190 --> 00:34:38,869

yeah this is doug foss from wild sure i

974

00:34:43,190 --> 00:34:41,200

can answer that question so the d spin

975

00:34:46,310 --> 00:34:43,200

proceed procedure is important because

976

00:34:49,030 --> 00:34:46,320

when we we when the upper stage is spun

977

00:34:51,270 --> 00:34:49,040

by this spin rocket motors

978

00:34:53,349 --> 00:34:51,280

the system needs to be de-spun before

979

00:34:55,270 --> 00:34:53,359

separation so that when the ladder

980

00:34:56,869 --> 00:34:55,280

spacecraft separates

981

00:34:59,270 --> 00:34:56,879

there's no forces applied onto it that

982

00:35:03,190 --> 00:34:59,280

would cause it to tumble well the d-spin

983

00:35:04,870 --> 00:35:03,200

procedure in this case is using weights

984

00:35:07,349 --> 00:35:04,880

that are connected to a cable that are

985

00:35:08,630 --> 00:35:07,359

released and as those weights expand out

986

00:35:11,349 --> 00:35:08,640

from the body

987

00:35:13,109 --> 00:35:11,359

of the the mass that the center of mass

988

00:35:15,910 --> 00:35:13,119

moves out from the body

989

00:35:17,589 --> 00:35:15,920

and the inertia is changed and the body

990

00:35:19,510 --> 00:35:17,599

the whole body slows down and stops

991

00:35:21,030 --> 00:35:19,520

eventually so these types of systems

992

00:35:23,510 --> 00:35:21,040

have been used on suborbital vehicles

993

00:35:26,790 --> 00:35:23,520

quite a bit by nasal wallops as well as

994

00:35:28,390 --> 00:35:26,800

some elvs uh before the minotaur five so

995

00:35:29,990 --> 00:35:28,400

the concept in the design is actually

996

00:35:31,829 --> 00:35:30,000

pretty old a wallops flight facility has

997

00:35:33,829 --> 00:35:31,839

been flying sounding rockets in this

998

00:35:35,109 --> 00:35:33,839

same way for many many years

999

00:35:35,990 --> 00:35:35,119

so

1000

00:35:37,349 --> 00:35:36,000

that's

1001

00:35:39,589 --> 00:35:37,359

essentially not a new part of the

1002

00:35:41,910 --> 00:35:39,599

technology but it is a new element on

1003

00:35:43,190 --> 00:35:41,920

this upper stage

1004

00:35:45,109 --> 00:35:43,200

and jason let's take a couple more

1005

00:35:47,510 --> 00:35:45,119

questions from uh ask nasa and then we

1006

00:35:48,310 --> 00:35:47,520

go back to the phone lines jason

1007

00:35:51,750 --> 00:35:48,320

sure

1008

00:35:53,430 --> 00:35:51,760

twitter user ricardo battaloni asks why

1009

00:35:56,790 --> 00:35:53,440

do you need to spin up the rocket before

1010

00:35:59,829 --> 00:35:58,230

sure doug vos from wall street and i'll

1011

00:36:01,670 --> 00:35:59,839

take that the um

1012

00:36:03,109 --> 00:36:01,680

the purpose for spin stabilization of

1013

00:36:05,270 --> 00:36:03,119

the upper stage

1014

00:36:06,790 --> 00:36:05,280

is is actually twofold when you have a

1015

00:36:08,630 --> 00:36:06,800

spinning body

1016

00:36:10,870 --> 00:36:08,640

newton's first law is that objects that

1017

00:36:12,630 --> 00:36:10,880

are in motion tend to stay in motion so

1018

00:36:14,390 --> 00:36:12,640

as the body spinning any outside

1019

00:36:17,030 --> 00:36:14,400

disturbances that are applied to it as

1020

00:36:18,550 --> 00:36:17,040

it flies are actually the the body

1021

00:36:20,710 --> 00:36:18,560

that's spinning

1022

00:36:22,550 --> 00:36:20,720

the effect is not as much on the body

1023

00:36:23,589 --> 00:36:22,560

the other thing is that while the fifth

1024

00:36:25,589 --> 00:36:23,599

stage

1025

00:36:27,030 --> 00:36:25,599

is actually thrusting the errors that

1026  
00:36:29,349 --> 00:36:27,040  
are accumulated

1027  
00:36:30,950 --> 00:36:29,359  
are averaged out because the errors are

1028  
00:36:32,710 --> 00:36:30,960  
from the thrust are pointed in multiple

1029  
00:36:34,870 --> 00:36:32,720  
directions at one time so that error is

1030  
00:36:36,950 --> 00:36:34,880  
averaged out so orbital sciences has

1031  
00:36:38,069 --> 00:36:36,960  
applied this this concept to the upper

1032  
00:36:39,910 --> 00:36:38,079  
stage

1033  
00:36:42,550 --> 00:36:39,920  
to meet the latte insertion accuracy

1034  
00:36:44,150 --> 00:36:42,560  
requirements for the mission

1035  
00:36:46,710 --> 00:36:44,160  
one more

1036  
00:36:48,870 --> 00:36:46,720  
okay from twitter user marcia smith

1037  
00:36:50,390 --> 00:36:48,880  
if laddie's laser com demo works from

1038  
00:36:52,470 --> 00:36:50,400

the moon will lasercom work from

1039

00:36:54,550 --> 00:36:52,480

anywhere in the solar system

1040

00:36:55,589 --> 00:36:54,560

uh this is don cornwall from llcd i'll

1041

00:36:57,670 --> 00:36:55,599

take that

1042

00:36:59,910 --> 00:36:57,680

uh as you go further out

1043

00:37:01,349 --> 00:36:59,920

from the moon uh then you'll need uh

1044

00:37:03,670 --> 00:37:01,359

more photons

1045

00:37:05,829 --> 00:37:03,680

and uh and bigger systems but at the

1046

00:37:08,230 --> 00:37:05,839

same time uh when you compare what you

1047

00:37:10,710 --> 00:37:08,240

can do with the laser because a laser

1048

00:37:12,950 --> 00:37:10,720

beam can be collimated to be much

1049

00:37:15,190 --> 00:37:12,960

tighter than a radio

1050

00:37:17,510 --> 00:37:15,200

wave you can deliver more

1051  
00:37:19,349 --> 00:37:17,520  
energy at a greater distance than you

1052  
00:37:21,430 --> 00:37:19,359  
can with a radio wave that might be

1053  
00:37:23,829 --> 00:37:21,440  
dispersing so actually lasercom gets

1054  
00:37:25,589 --> 00:37:23,839  
more attractive compared to radio as you

1055  
00:37:28,550 --> 00:37:25,599  
go further in the solar system so we

1056  
00:37:30,710 --> 00:37:28,560  
hope to to to use these systems from

1057  
00:37:31,510 --> 00:37:30,720  
mars one day for example and and there

1058  
00:37:33,510 --> 00:37:31,520  
are

1059  
00:37:35,190 --> 00:37:33,520  
uh some research efforts there to look

1060  
00:37:36,390 --> 00:37:35,200  
at that

1061  
00:37:37,910 --> 00:37:36,400  
okay we're gonna go back to the phone

1062  
00:37:39,750 --> 00:37:37,920  
bridge but again ladies and gentlemen

1063  
00:37:42,310 --> 00:37:39,760

keep those questions coming in

1064

00:37:43,910 --> 00:37:42,320

hashtag ask nasa and continue to join

1065

00:37:45,990 --> 00:37:43,920

the conversation

1066

00:37:48,829 --> 00:37:46,000

at nasa laddie back to the phone lines

1067

00:37:50,470 --> 00:37:48,839

and i believe we have irene from reuters

1068

00:37:52,550 --> 00:37:50,480

irene

1069

00:37:55,510 --> 00:37:52,560

thanks duane um i have a couple

1070

00:37:58,550 --> 00:37:55,520

questions the first is the 280 million

1071

00:38:00,470 --> 00:37:58,560

dollar price does that include the

1072

00:38:03,990 --> 00:38:00,480

minotaur 5 launcher

1073

00:38:05,910 --> 00:38:04,000

yes ma'am it does

1074

00:38:07,589 --> 00:38:05,920

thanks and um

1075

00:38:09,910 --> 00:38:07,599

i have another question about the rocket

1076

00:38:12,470 --> 00:38:09,920

um you know traditionally first flights

1077

00:38:15,030 --> 00:38:12,480

of new vehicles have a kind of spotty

1078

00:38:17,510 --> 00:38:15,040

track record and i'm just wondering from

1079

00:38:20,069 --> 00:38:17,520

your kind of internal assessments is

1080

00:38:22,550 --> 00:38:20,079

minotaur 5 in this configuration

1081

00:38:24,310 --> 00:38:22,560

considered a new rocket and i'll explain

1082

00:38:26,630 --> 00:38:24,320

maybe a little bit about

1083

00:38:29,030 --> 00:38:26,640

what the advantages and

1084

00:38:32,069 --> 00:38:29,040

disadvantages of picking this as the

1085

00:38:34,069 --> 00:38:32,079

launch vehicle for laddie thinks

1086

00:38:36,950 --> 00:38:34,079

sure this is doug voss i'll answer that

1087

00:38:38,870 --> 00:38:36,960

question so so the minotaur 5

1088

00:38:41,349 --> 00:38:38,880

vehicle was based on actually a

1089

00:38:43,030 --> 00:38:41,359

predecessor minotaur 4. so the first

1090

00:38:45,589 --> 00:38:43,040

four stages of the vehicle actually have

1091

00:38:47,589 --> 00:38:45,599

flight history on air force missions

1092

00:38:49,030 --> 00:38:47,599

the fifth stage is is the the new

1093

00:38:51,109 --> 00:38:49,040

element in the mission it's required to

1094

00:38:53,030 --> 00:38:51,119

get lati into orbit into the orbit it

1095

00:38:55,990 --> 00:38:53,040

needs to get to the moon

1096

00:38:57,270 --> 00:38:56,000

so the um the innovative um aspects of

1097

00:39:00,150 --> 00:38:57,280

this mission

1098

00:39:02,790 --> 00:39:00,160

um are are there in the minotaur five

1099

00:39:04,630 --> 00:39:02,800

fifth stage but they're in individually

1100

00:39:05,510 --> 00:39:04,640

none of the technologies are neat are

1101

00:39:07,430 --> 00:39:05,520

new

1102

00:39:09,589 --> 00:39:07,440

so there are a lot of proven concepts

1103

00:39:11,030 --> 00:39:09,599

folded into a new vehicle and it is true

1104

00:39:12,390 --> 00:39:11,040

that this upper stage hasn't flown

1105

00:39:14,390 --> 00:39:12,400

before

1106

00:39:16,390 --> 00:39:14,400

another good aspect of this vehicle is

1107

00:39:17,829 --> 00:39:16,400

that it's using existing motors so the

1108

00:39:20,069 --> 00:39:17,839

first three stages as i mentioned

1109

00:39:21,510 --> 00:39:20,079

earlier are peacekeeper motors so so

1110

00:39:25,109 --> 00:39:21,520

this aspect of the innovation is that

1111

00:39:27,430 --> 00:39:25,119

we're using a retired icbm assets

1112

00:39:29,750 --> 00:39:27,440

to fly a science mission and we're

1113

00:39:31,589 --> 00:39:29,760

stacking proven fourth and fifth stage

1114

00:39:33,829 --> 00:39:31,599

motors the star 48 is the fourth stage

1115

00:39:36,310 --> 00:39:33,839

and the star 37 is the fifth stage they

1116

00:39:38,710 --> 00:39:36,320

are themselves proven motors so in trade

1117

00:39:40,630 --> 00:39:38,720

for a lower cost mission you are in fact

1118

00:39:43,190 --> 00:39:40,640

accepting more risk with a new fifth

1119

00:39:45,829 --> 00:39:43,200

stage and that's the decision nasa's

1120

00:39:47,589 --> 00:39:45,839

made and accepted

1121

00:39:50,870 --> 00:39:47,599

we'll stay on the phone line here next

1122

00:39:52,710 --> 00:39:50,880

caller is ken kramer from universe today

1123

00:39:54,470 --> 00:39:52,720

ken

1124

00:39:55,990 --> 00:39:54,480

hi thanks for taking my question good

1125

00:39:58,470 --> 00:39:56,000

luck for everybody and i'm really

1126

00:40:00,550 --> 00:39:58,480

excited to be joining you soon for the

1127

00:40:01,750 --> 00:40:00,560

launch um over a couple of questions one

1128

00:40:03,510 --> 00:40:01,760

is about

1129

00:40:05,750 --> 00:40:03,520

the duration of the mission i guess it's

1130

00:40:07,030 --> 00:40:05,760

a hundred days i wonder if they're what

1131

00:40:09,990 --> 00:40:07,040

is the reason for that and is it

1132

00:40:12,310 --> 00:40:10,000

possible to extend it

1133

00:40:14,069 --> 00:40:12,320

this is butler i can answer that the the

1134

00:40:15,109 --> 00:40:14,079

total mission length is six months we

1135

00:40:17,190 --> 00:40:15,119

take about

1136

00:40:19,109 --> 00:40:17,200

uh a month to get to the moon we take

1137

00:40:20,950 --> 00:40:19,119

another month to do the commissioning

1138

00:40:24,069 --> 00:40:20,960

phase of the instruments and the laser

1139

00:40:26,710 --> 00:40:24,079

uh com experiment and then we drop down

1140

00:40:28,870 --> 00:40:26,720

the the length of the mission is is uh

1141

00:40:30,630 --> 00:40:28,880

uh limited by how much fuel we have i

1142

00:40:32,470 --> 00:40:30,640

mentioned that the moon has a very lumpy

1143

00:40:34,470 --> 00:40:32,480

gravity field what that means is that

1144

00:40:35,829 --> 00:40:34,480

you never get truly circular orbits

1145

00:40:38,069 --> 00:40:35,839

around the moon and the closer you get

1146

00:40:39,589 --> 00:40:38,079

to the moon the the more your orbit

1147

00:40:42,710 --> 00:40:39,599

varies up and down

1148

00:40:44,790 --> 00:40:42,720

and so to to to stay that low uh above

1149

00:40:47,510 --> 00:40:44,800

the lunar surface we expend a lot of

1150

00:40:49,829 --> 00:40:47,520

fuel and one of the limitations on how

1151  
00:40:52,069 --> 00:40:49,839  
long we can stay there is how much fuel

1152  
00:40:53,349 --> 00:40:52,079  
we carry so it's always an optimization

1153  
00:40:55,910 --> 00:40:53,359  
you can you can go with a bigger

1154  
00:40:57,990 --> 00:40:55,920  
spacecraft bigger fuel tanks uh to

1155  
00:40:59,190 --> 00:40:58,000  
extend your time above the lunar surface

1156  
00:41:01,109 --> 00:40:59,200  
but then you have to go to a bigger

1157  
00:41:03,510 --> 00:41:01,119  
launch vehicle and it's higher cost and

1158  
00:41:04,309 --> 00:41:03,520  
so it all uh it all daisy chains that

1159  
00:41:06,470 --> 00:41:04,319  
way

1160  
00:41:09,109 --> 00:41:06,480  
so this mission was designed at 100 days

1161  
00:41:11,670 --> 00:41:09,119  
because uh that's basically the amount

1162  
00:41:13,510 --> 00:41:11,680  
of fuel we can carry to get to the moon

1163  
00:41:15,349 --> 00:41:13,520

moon drop down into this science orbit

1164

00:41:18,150 --> 00:41:15,359

and then uh and stay there there's

1165

00:41:19,030 --> 00:41:18,160

really not a a way to extend the mission

1166

00:41:21,030 --> 00:41:19,040

um

1167

00:41:23,750 --> 00:41:21,040

past that hundred days we'll go as long

1168

00:41:32,829 --> 00:41:23,760

as we have fuel available but ultimately

1169

00:41:37,030 --> 00:41:34,950

exciting uh for anyone who wants to

1170

00:41:38,950 --> 00:41:37,040

answer this maybe even john grunsfeld uh

1171

00:41:42,150 --> 00:41:38,960

when do you foresee using this on

1172

00:41:44,069 --> 00:41:42,160

another planetary mission

1173

00:41:45,349 --> 00:41:44,079

can uh some of your questions got uh cut

1174

00:41:48,470 --> 00:41:45,359

off can you repeat your question again

1175

00:41:52,950 --> 00:41:50,390

follow up on the laser communication

1176

00:41:54,550 --> 00:41:52,960

system i'd like to know um

1177

00:41:57,030 --> 00:41:54,560

when that would be when do you foresee

1178

00:42:01,670 --> 00:41:57,040

using this on another planetary mission

1179

00:42:04,710 --> 00:42:02,550

you know

1180

00:42:06,309 --> 00:42:04,720

as i said in my opening remarks i'm a

1181

00:42:08,550 --> 00:42:06,319

huge fan of laser econ and one of the

1182

00:42:10,470 --> 00:42:08,560

reasons is that as you go further out

1183

00:42:12,950 --> 00:42:10,480

into the solar system it's a much more

1184

00:42:15,030 --> 00:42:12,960

efficient way to get high bandwidth at

1185

00:42:16,630 --> 00:42:15,040

low power and so i'm very confident this

1186

00:42:18,710 --> 00:42:16,640

will be a successful experiment we'll

1187

00:42:21,030 --> 00:42:18,720

see in a very short time

1188

00:42:22,230 --> 00:42:21,040

so i'm very excited to to see and hear

1189

00:42:24,550 --> 00:42:22,240

the results

1190

00:42:26,309 --> 00:42:24,560

and it could be as soon as

1191

00:42:27,750 --> 00:42:26,319

you know our mars 2020 mission we've

1192

00:42:31,190 --> 00:42:27,760

already been having discussions about

1193

00:42:34,069 --> 00:42:31,200

could you do laser calm on a rover on

1194

00:42:35,030 --> 00:42:34,079

the surface of mars uh perhaps for a

1195

00:42:35,910 --> 00:42:35,040

future

1196

00:42:38,390 --> 00:42:35,920

uh

1197

00:42:40,069 --> 00:42:38,400

mars orbiting spacecraft versus all the

1198

00:42:42,069 --> 00:42:40,079

way back to earth or directly back to

1199

00:42:43,510 --> 00:42:42,079

earth uh but i think this is just the

1200

00:42:44,950 --> 00:42:43,520

beginning of

1201

00:42:47,670 --> 00:42:44,960

you know what will be

1202

00:42:50,309 --> 00:42:47,680

you know replacing some of the r radio

1203

00:42:51,910 --> 00:42:50,319

frequency com uh in the future i think

1204

00:42:53,910 --> 00:42:51,920

there's no question that as we send

1205

00:42:55,430 --> 00:42:53,920

humans further out into the solar system

1206

00:42:57,589 --> 00:42:55,440

certainly to mars

1207

00:42:59,990 --> 00:42:57,599

that if we want to have you know high

1208

00:43:03,589 --> 00:43:00,000

def 3d video we're going to have laser

1209

00:43:05,430 --> 00:43:03,599

com sending that information back

1210

00:43:07,990 --> 00:43:05,440

this is don cornwall from llcd i have a

1211

00:43:10,550 --> 00:43:08,000

follow-up as well there is actually a

1212

00:43:12,150 --> 00:43:10,560

follow-on funded nasa program to do

1213

00:43:14,950 --> 00:43:12,160

laser communications it's called the

1214

00:43:19,270 --> 00:43:14,960

laser communications relay demonstration

1215

00:43:20,230 --> 00:43:19,280

uh it's going to have a laser com

1216

00:43:22,150 --> 00:43:20,240

package

1217

00:43:24,870 --> 00:43:22,160

on a hosted payload a commercial

1218

00:43:26,630 --> 00:43:24,880

spacecraft and in geosynchronous orbit

1219

00:43:28,309 --> 00:43:26,640

and the idea there in addition to

1220

00:43:30,390 --> 00:43:28,319

demonstrating more technologies is to

1221

00:43:32,550 --> 00:43:30,400

run that from two to five years to

1222

00:43:34,390 --> 00:43:32,560

really build confidence in in laser com

1223

00:43:36,550 --> 00:43:34,400

we are a short mission here we hope to

1224

00:43:38,150 --> 00:43:36,560

demonstrate laser communications but we

1225

00:43:40,870 --> 00:43:38,160

really want to build a lot of confidence

1226

00:43:42,550 --> 00:43:40,880

over time as well

1227

00:43:45,270 --> 00:43:42,560

okay one more question for the phone

1228

00:43:47,030 --> 00:43:45,280

line before we go back to uh jason he uh

1229

00:43:48,870 --> 00:43:47,040

has a couple more questions thanks keep

1230

00:43:51,510 --> 00:43:48,880

sending those questions in at hashtag

1231

00:43:55,829 --> 00:43:51,520

ask nasa on the phone line marion cramer

1232

00:43:59,829 --> 00:43:57,910

hi uh thanks for taking my question yeah

1233

00:44:01,910 --> 00:43:59,839

i am wondering is there a particular

1234

00:44:04,390 --> 00:44:01,920

reason that the lady mission was chosen

1235

00:44:07,990 --> 00:44:04,400

to launch from wallops um i guess i'm

1236

00:44:09,270 --> 00:44:08,000

kind of asking why uh why now um and

1237

00:44:11,349 --> 00:44:09,280

this can be for anybody who'd like to

1238

00:44:15,349 --> 00:44:11,359

answer

1239

00:44:17,430 --> 00:44:15,359

question uh as doug mentioned the first

1240

00:44:21,109 --> 00:44:17,440

three stages of the minotaur five are

1241

00:44:23,670 --> 00:44:21,119

reconditioned uh icbm motors and the

1242

00:44:26,309 --> 00:44:23,680

treaty between the u.s and russia only

1243

00:44:29,349 --> 00:44:26,319

allows a few uh launch sites for these

1244

00:44:31,430 --> 00:44:29,359

uh for these uh ex-icbms

1245

00:44:33,430 --> 00:44:31,440

we can launch out of kodiak alaska or

1246

00:44:35,510 --> 00:44:33,440

vandenberg california or wallops island

1247

00:44:37,349 --> 00:44:35,520

virginia those are the three allowed

1248

00:44:39,430 --> 00:44:37,359

under the treaty

1249

00:44:41,670 --> 00:44:39,440

kodiak alaska and vandenberg are better

1250

00:44:44,309 --> 00:44:41,680

for polar earth orbits but if we want to

1251

00:44:46,550 --> 00:44:44,319

get to the moon we need to launch

1252

00:44:48,550 --> 00:44:46,560

eastward and so wallops island is the

1253

00:44:52,150 --> 00:44:48,560

ideal place to launch this launch

1254

00:44:56,390 --> 00:44:53,829

okay well we're gonna go back to jason

1255

00:44:58,550 --> 00:44:56,400

and jason i hear uh things are uh he's

1256

00:45:01,670 --> 00:44:58,560

stacking up there what you got for me

1257

00:45:03,829 --> 00:45:01,680

sure from twitter user emily lochdawala

1258

00:45:05,829 --> 00:45:03,839

are the moon and mercury's atmosphere

1259

00:45:10,069 --> 00:45:05,839

similar and will nasa laude help us

1260

00:45:11,430 --> 00:45:10,079

understand possibly mercury's exosphere

1261

00:45:13,670 --> 00:45:11,440

thanks emily that's a great question

1262

00:45:15,430 --> 00:45:13,680

this is sarah so yeah we've we've had

1263

00:45:16,470 --> 00:45:15,440

the messenger spacecraft around mercury

1264

00:45:18,230 --> 00:45:16,480

for a couple years now and we're

1265

00:45:20,309 --> 00:45:18,240

learning a lot of stuff about mercury's

1266

00:45:22,150 --> 00:45:20,319

exosphere and it turns out it is in many

1267

00:45:23,829 --> 00:45:22,160

ways similar to the lunar exosphere it

1268

00:45:25,910 --> 00:45:23,839

has a lot of the same

1269

00:45:27,510 --> 00:45:25,920

elements in it uh the interesting thing

1270

00:45:29,430 --> 00:45:27,520

about about mercury is that we don't

1271

00:45:30,870 --> 00:45:29,440

have any samples of mercury's surface so

1272

00:45:32,390 --> 00:45:30,880

we've actually been learning about what

1273

00:45:34,150 --> 00:45:32,400

the materials at the surface of mercury

1274

00:45:36,309 --> 00:45:34,160

are based on what is getting up into the

1275

00:45:37,750 --> 00:45:36,319

atmosphere the moon we actually already

1276

00:45:40,230 --> 00:45:37,760

know what the what the rocks are at the

1277

00:45:41,670 --> 00:45:40,240

surface but um being able to compare

1278

00:45:43,270 --> 00:45:41,680

what's at the surface versus what is in

1279

00:45:45,349 --> 00:45:43,280

the atmosphere at the moon will actually

1280

00:45:47,030 --> 00:45:45,359

help us work our way back to mercury and

1281

00:45:48,309 --> 00:45:47,040

understand the difference between what

1282

00:45:49,910 --> 00:45:48,319

we're seeing in the atmosphere and what

1283

00:45:51,349 --> 00:45:49,920

might be on the ground there so we're

1284

00:45:53,990 --> 00:45:51,359

actually going to learn about mercury

1285

00:45:56,230 --> 00:45:54,000

even from this lunar mission

1286

00:45:58,950 --> 00:45:56,240

jason wonderful another question from

1287

00:46:00,150 --> 00:45:58,960

twitter this is from user ryan thurman

1288

00:46:02,069 --> 00:46:00,160

is there anything the laser

1289

00:46:03,990 --> 00:46:02,079

communication system could be used for

1290

00:46:06,550 --> 00:46:04,000

besides space communications that can

1291

00:46:08,390 --> 00:46:06,560

improve everyday life

1292

00:46:09,349 --> 00:46:08,400

well that's an excellent question

1293

00:46:11,829 --> 00:46:09,359

uh

1294

00:46:13,430 --> 00:46:11,839

our system is actually based on the same

1295

00:46:15,750 --> 00:46:13,440

technology that we're all using in our

1296

00:46:17,349 --> 00:46:15,760

our fios fiber optic to the home and

1297

00:46:19,589 --> 00:46:17,359

between the big trunk lines so in some

1298

00:46:21,589 --> 00:46:19,599

ways this is a nasa spin in of of what's

1299

00:46:23,109 --> 00:46:21,599

going on commercially we've been able to

1300

00:46:24,069 --> 00:46:23,119

take advantage of that big commercial

1301  
00:46:28,150 --> 00:46:24,079  
base of

1302  
00:46:30,790 --> 00:46:28,160  
of uh many and inexpensive components

1303  
00:46:32,390 --> 00:46:30,800  
so the other the other uh possibilities

1304  
00:46:34,470 --> 00:46:32,400  
are there are commercial companies that

1305  
00:46:36,710 --> 00:46:34,480  
talk about using laser communications

1306  
00:46:38,309 --> 00:46:36,720  
for satellite networks around the earth

1307  
00:46:39,510 --> 00:46:38,319  
to deliver data around the earth so this

1308  
00:46:41,030 --> 00:46:39,520  
would help to

1309  
00:46:44,230 --> 00:46:41,040  
to make them feel more comfortable

1310  
00:46:49,349 --> 00:46:47,030  
one more sure one more from twitter user

1311  
00:46:51,109 --> 00:46:49,359  
isaac young once the link is established

1312  
00:46:53,349 --> 00:46:51,119  
is there no communication delay like

1313  
00:46:55,589 --> 00:46:53,359

you'd get with a radio signal

1314

00:46:57,750 --> 00:46:55,599

so that's an also an excellent question

1315

00:46:59,270 --> 00:46:57,760

uh light waves and radio waves both

1316

00:47:00,470 --> 00:46:59,280

travel at the same speed they're both

1317

00:47:05,190 --> 00:47:00,480

the

1318

00:47:07,270 --> 00:47:05,200

thing electromagnetic waves what's

1319

00:47:10,069 --> 00:47:07,280

different here is that we can pack more

1320

00:47:13,750 --> 00:47:10,079

bits into any given second but the time

1321

00:47:15,670 --> 00:47:13,760

of flight will actually be the same

1322

00:47:17,430 --> 00:47:15,680

okay thank you jason and again keep

1323

00:47:19,829 --> 00:47:17,440

those calls coming in and if we can't

1324

00:47:22,150 --> 00:47:19,839

answer them during this broadcast we

1325

00:47:24,390 --> 00:47:22,160

will make sure that we get back to you

1326

00:47:27,109 --> 00:47:24,400

and again uh we're almost two weeks away

1327

00:47:28,230 --> 00:47:27,119

and uh a lot is going on uh so back to

1328

00:47:31,670 --> 00:47:28,240

the phone lines and i believe we have

1329

00:47:34,470 --> 00:47:31,680

marsha smith back with us marcia

1330

00:47:35,990 --> 00:47:34,480

yes uh sorry about the earlier attempt i

1331

00:47:38,790 --> 00:47:36,000

think i hit the wrong button

1332

00:47:43,030 --> 00:47:38,800

but anyway i'm curious about the

1333

00:47:44,870 --> 00:47:43,040

pristineness of the lunar atmosphere uh

1334

00:47:45,589 --> 00:47:44,880

i think sarah was talking earlier about

1335

00:47:47,190 --> 00:47:45,599

how

1336

00:47:49,430 --> 00:47:47,200

spacecraft easily disturbed the

1337

00:47:51,030 --> 00:47:49,440

atmosphere and so they want to do this

1338

00:47:53,270 --> 00:47:51,040

experiment now before there are even

1339

00:47:55,589 --> 00:47:53,280

more launches there but this was going

1340

00:47:58,150 --> 00:47:55,599

to impact the moon and grail impacted

1341

00:47:59,670 --> 00:47:58,160

the moon so it seems as though

1342

00:48:01,910 --> 00:47:59,680

these spacecraft are creating a lot of

1343

00:48:03,990 --> 00:48:01,920

dust themselves is that a problem are

1344

00:48:06,390 --> 00:48:04,000

you going to be able to tell what dust

1345

00:48:08,390 --> 00:48:06,400

was created by grail versus by comet

1346

00:48:09,990 --> 00:48:08,400

impacts does it matter

1347

00:48:12,630 --> 00:48:10,000

that's it that's a good question uh

1348

00:48:15,030 --> 00:48:12,640

marshall that the uh

1349

00:48:17,430 --> 00:48:15,040

an impact things impact the moon all the

1350

00:48:19,430 --> 00:48:17,440

time so these small impact crater small

1351

00:48:20,950 --> 00:48:19,440

spacecraft impacting the moon don't do a

1352

00:48:23,030 --> 00:48:20,960

lot i mean something the size of lady

1353

00:48:24,710 --> 00:48:23,040

hits the moon like once a month so the

1354

00:48:26,630 --> 00:48:24,720

moon's not really noticing these things

1355

00:48:28,470 --> 00:48:26,640

but when spacecrafts land they have a

1356

00:48:30,950 --> 00:48:28,480

lot of fuel that they use as they're

1357

00:48:33,270 --> 00:48:30,960

landing and that actually can add a lot

1358

00:48:35,430 --> 00:48:33,280

a lot of material to the atmosphere so

1359

00:48:37,349 --> 00:48:35,440

because the atmosphere is so thin i mean

1360

00:48:39,109 --> 00:48:37,359

it's it's it becomes a significant

1361

00:48:41,270 --> 00:48:39,119

component of the atmosphere when you

1362

00:48:42,790 --> 00:48:41,280

land something on the moon so yes we

1363

00:48:44,390 --> 00:48:42,800

have we have impacted into the moon

1364

00:48:46,309 --> 00:48:44,400

right recently but we have not landed

1365

00:48:48,069 --> 00:48:46,319

there in quite a while so a landing like

1366

00:48:50,630 --> 00:48:48,079

that will will disturb the atmosphere

1367

00:48:52,870 --> 00:48:50,640

for for several months whereas an impact

1368

00:48:56,309 --> 00:48:52,880

is is just part of the usual processes

1369

00:49:01,990 --> 00:48:59,349

marcia did you have a follow-up

1370

00:49:05,510 --> 00:49:02,000

is this the last best chance to study a

1371

00:49:07,349 --> 00:49:05,520

more or less pristine lunar atmosphere

1372

00:49:09,190 --> 00:49:07,359

like i guess that depends on the rates

1373

00:49:10,950 --> 00:49:09,200

of when we start landing back on the

1374

00:49:12,710 --> 00:49:10,960

moon again but as i said there are a

1375

00:49:14,390 --> 00:49:12,720

number of countries and a number of

1376

00:49:16,630 --> 00:49:14,400

private companies the google lunar x

1377

00:49:18,710 --> 00:49:16,640

prize folks that that are intending on

1378

00:49:21,349 --> 00:49:18,720

on landing things on the moon um several

1379

00:49:22,790 --> 00:49:21,359

things over the next several years so it

1380

00:49:26,150 --> 00:49:22,800

seems like it is going to be a busy time

1381

00:49:27,430 --> 00:49:26,160

for the moon over the next decade or so

1382

00:49:29,670 --> 00:49:27,440

okay what we're going to do we've got a

1383

00:49:31,990 --> 00:49:29,680

few minutes left and uh you know we're

1384

00:49:33,349 --> 00:49:32,000

setting the stage here two weeks away

1385

00:49:36,470 --> 00:49:33,359

on the landing mission i'm going to ask

1386

00:49:37,829 --> 00:49:36,480

the panelists uh individually um

1387

00:49:39,510 --> 00:49:37,839

what's going through your mind now

1388

00:49:41,750 --> 00:49:39,520

you're two weeks away how do you feel

1389

00:49:43,109 --> 00:49:41,760

about this mission and we'll start with

1390

00:49:44,870 --> 00:49:43,119

you john

1391

00:49:46,870 --> 00:49:44,880

i'm tremendously excited we've been

1392

00:49:49,030 --> 00:49:46,880

working on this for about seven years

1393

00:49:50,950 --> 00:49:49,040

the team's just grown and grown in their

1394

00:49:52,630 --> 00:49:50,960

ability to pull it all together there

1395

00:49:54,790 --> 00:49:52,640

were a number of moments when we weren't

1396

00:49:56,069 --> 00:49:54,800

sure we'd you know be here today for all

1397

00:49:58,470 --> 00:49:56,079

kinds of reasons

1398

00:50:00,390 --> 00:49:58,480

things happen but everything has worked

1399

00:50:02,710 --> 00:50:00,400

out the team has done an excellent

1400

00:50:05,670 --> 00:50:02,720

excellent job of building the spacecraft

1401  
00:50:08,390 --> 00:50:05,680  
on time all the testing has gone great

1402  
00:50:10,150 --> 00:50:08,400  
we haven't had any major setbacks

1403  
00:50:11,670 --> 00:50:10,160  
we're here we're ready and we all just

1404  
00:50:13,910 --> 00:50:11,680  
can't wait to get everything turned on

1405  
00:50:16,790 --> 00:50:13,920  
and working butler

1406  
00:50:18,549 --> 00:50:16,800  
um i'm very excited for this mission uh

1407  
00:50:19,910 --> 00:50:18,559  
and the the team is very excited you've

1408  
00:50:22,870 --> 00:50:19,920  
had a lot of people that have been

1409  
00:50:24,950 --> 00:50:22,880  
working this uh not just for the the

1410  
00:50:27,829 --> 00:50:24,960  
lady phase uh for the last five years

1411  
00:50:29,829 --> 00:50:27,839  
but but also before that to to prove out

1412  
00:50:31,990 --> 00:50:29,839  
this uh bus design and prototype this

1413  
00:50:33,829 --> 00:50:32,000

bus design so you've got a lot of people

1414

00:50:36,950 --> 00:50:33,839

that have spent a lot of uh a lot of

1415

00:50:38,870 --> 00:50:36,960

sweat equity uh in this um once we

1416

00:50:40,790 --> 00:50:38,880

closed it into the fairing yesterday we

1417

00:50:42,309 --> 00:50:40,800

were very excited there's a little sad

1418

00:50:45,190 --> 00:50:42,319

too because that's the last time we'll

1419

00:50:46,630 --> 00:50:45,200

ever see the spacecraft again

1420

00:50:47,430 --> 00:50:46,640

since it won't be coming back from the

1421

00:50:49,270 --> 00:50:47,440

moon

1422

00:50:51,270 --> 00:50:49,280

so you have a lot of people with their

1423

00:50:53,990 --> 00:50:51,280

fingers crossed really

1424

00:50:56,069 --> 00:50:54,000

hoping for the best and excited to see

1425

00:50:57,030 --> 00:50:56,079

uh see their baby fly

1426

00:50:58,950 --> 00:50:57,040

sarah

1427

00:51:00,390 --> 00:50:58,960

this is my first mission i'm i am really

1428

00:51:02,390 --> 00:51:00,400

excited about it and it's been such a

1429

00:51:03,910 --> 00:51:02,400

such a joy watching the science team

1430

00:51:05,510 --> 00:51:03,920

come together and they've you know this

1431

00:51:06,870 --> 00:51:05,520

is a short mission and they know they

1432

00:51:08,309 --> 00:51:06,880

have to get their hit the ground running

1433

00:51:09,829 --> 00:51:08,319

and they have been so fantastic in

1434

00:51:11,510 --> 00:51:09,839

getting themselves prepared and ready to

1435

00:51:14,069 --> 00:51:11,520

go for this mission it's been really

1436

00:51:15,990 --> 00:51:14,079

really exciting to watch

1437

00:51:17,829 --> 00:51:16,000

well this is uh nasa's first real

1438

00:51:19,750 --> 00:51:17,839

opportunity to fly a dedicated laser

1439

00:51:21,349 --> 00:51:19,760

communication system and as i kind of

1440

00:51:22,950 --> 00:51:21,359

alluded to before

1441

00:51:25,349 --> 00:51:22,960

you know on the earth here we've been

1442

00:51:26,950 --> 00:51:25,359

using laser communications and our fiber

1443

00:51:28,870 --> 00:51:26,960

optics to power our internet and

1444

00:51:31,030 --> 00:51:28,880

everything else for the last couple of

1445

00:51:33,109 --> 00:51:31,040

decades and and nasa has really been

1446

00:51:34,790 --> 00:51:33,119

wanting to take that same technological

1447

00:51:36,790 --> 00:51:34,800

leap and put it into space and this is

1448

00:51:39,910 --> 00:51:36,800

our chance to do that so we're very

1449

00:51:41,589 --> 00:51:39,920

excited to get the opportunity

1450

00:51:43,030 --> 00:51:41,599

from the perspective of wallops and our

1451

00:51:45,430 --> 00:51:43,040

air force partners with the launch

1452

00:51:48,710 --> 00:51:45,440

vehicle it's been very exciting to have

1453

00:51:50,230 --> 00:51:48,720

a nasa spacecraft handed over for the

1454

00:51:52,150 --> 00:51:50,240

launch vehicle to take on to orbit

1455

00:51:54,069 --> 00:51:52,160

wallops flight facility is very excited

1456

00:51:55,750 --> 00:51:54,079

as as nasa's launch range

1457

00:51:57,430 --> 00:51:55,760

to be sending the spacecraft to the moon

1458

00:51:59,190 --> 00:51:57,440

so it's a very exciting time a very busy

1459

00:52:01,589 --> 00:51:59,200

time right now in launch preparations

1460

00:52:02,630 --> 00:52:01,599

but they've been going very well and so

1461

00:52:05,109 --> 00:52:02,640

we're looking forward to a very

1462

00:52:07,030 --> 00:52:05,119

successful launch and flight operation

1463

00:52:08,549 --> 00:52:07,040

for laddie

1464

00:52:11,829 --> 00:52:08,559

well ladies and gentlemen the stage is

1465

00:52:13,750 --> 00:52:11,839

set the team is ready they're excited

1466

00:52:15,190 --> 00:52:13,760

john grunsfeld loves the mission we all

1467

00:52:19,030 --> 00:52:15,200

love the mission

1468

00:52:23,109 --> 00:52:19,040

and mark your calendar september 6

1469

00:52:25,670 --> 00:52:23,119

friday night 11 27 pm eastern daylight

1470

00:52:26,470 --> 00:52:25,680

time a night launch if the weather's

1471

00:52:29,030 --> 00:52:26,480

right

1472

00:52:30,950 --> 00:52:29,040

as you heard it will be seen not just on

1473

00:52:32,710 --> 00:52:30,960

the east coast but

1474

00:52:33,990 --> 00:52:32,720

up to maine's

1475

00:52:37,109 --> 00:52:34,000

to the south

1476

00:52:41,950 --> 00:52:37,119

west virginia a good show friday night

1477

00:52:45,109 --> 00:52:41,960

market date again join us again on

1478

00:52:47,589 --> 00:52:45,119

www.nasa.gov lady for the latest updates

1479

00:52:50,549 --> 00:52:47,599

ladies september 6 a mission of many