
Dust Environment Explorer
t Environment Ex

1
00:00:09,669 --> 00:00:07,749
good morning everybody welcome here to

2
00:00:12,150 --> 00:00:09,679
the nasa's wallop flight facility on the

3
00:00:13,910 --> 00:00:12,160
eastern shore here in virginia uh we are

4
00:00:16,230 --> 00:00:13,920
here for the nasa social for the launch

5
00:00:18,390 --> 00:00:16,240
of the lady mission i'm jason townes and

6
00:00:20,310 --> 00:00:18,400
nasa's deputy social media manager and

7
00:00:22,150 --> 00:00:20,320
today starts our two-day journey for the

8
00:00:23,830 --> 00:00:22,160
nasa social to launch

9
00:00:25,029 --> 00:00:23,840
over the next two days everybody here is

10
00:00:26,630 --> 00:00:25,039
going to learn more about this unique

11
00:00:28,070 --> 00:00:26,640
mission and see many of the unique

12
00:00:29,669 --> 00:00:28,080
facilities that are here at wallops that

13
00:00:31,589 --> 00:00:29,679

enable nasa to study the earth in

14
00:00:33,750 --> 00:00:31,599
incredible ways and enable us to access

15
00:00:35,830 --> 00:00:33,760
space by launching amazing missions like

16
00:00:36,950 --> 00:00:35,840
lady but before we start going into too

17
00:00:39,110 --> 00:00:36,960
much detail for the benefit of the

18
00:00:41,510 --> 00:00:39,120
viewers who are on nasa tv just what is

19
00:00:43,590 --> 00:00:41,520
a nasa social well nasa social is all

20
00:00:45,830 --> 00:00:43,600
about taking the off or the online

21
00:00:47,670 --> 00:00:45,840
taking it offline so we invite our

22
00:00:49,510 --> 00:00:47,680
followers our fans and our social media

23
00:00:51,430 --> 00:00:49,520
community members out to nasa facilities

24
00:00:53,350 --> 00:00:51,440
to go behind the scenes and see the

25
00:00:55,029 --> 00:00:53,360
unique things that we're doing here

26
00:00:56,790 --> 00:00:55,039
to meet our passionate employees who

27
00:00:59,110 --> 00:00:56,800
work on missions and those from the nasa

28
00:01:01,110 --> 00:00:59,120
social media team but also to share the

29
00:01:03,110 --> 00:01:01,120
experience back online through all of

30
00:01:04,869 --> 00:01:03,120
the nasa followers out there

31
00:01:06,390 --> 00:01:04,879
if you aren't a space geek now come on

32
00:01:08,870 --> 00:01:06,400
out to nasa social we'll make sure you

33
00:01:09,910 --> 00:01:08,880
go home a space geek that's for sure

34
00:01:11,350 --> 00:01:09,920
you can find out more about these

35
00:01:14,230 --> 00:01:11,360
incredible opportunities and everything

36
00:01:15,910 --> 00:01:14,240
about them at nasa.gov social

37
00:01:18,710 --> 00:01:15,920
you can also follow us on twitter at

38
00:01:20,230 --> 00:01:18,720

nasa social

39
00:01:21,350 --> 00:01:20,240
but back to today

40
00:01:22,469 --> 00:01:21,360
to be really honest we hope that you're

41
00:01:24,789 --> 00:01:22,479
going to follow along and join the

42
00:01:26,950 --> 00:01:24,799
conversation if you're online on twitter

43
00:01:31,990 --> 00:01:26,960
make sure to follow us on nasa and at

44
00:01:35,749 --> 00:01:33,830
on twitter or you can also find us on

45
00:01:36,950 --> 00:01:35,759
our nasa facebook page and our google

46
00:01:38,390 --> 00:01:36,960
plus page

47
00:01:40,469 --> 00:01:38,400
you can also use the hashtag for the

48
00:01:42,630 --> 00:01:40,479
nasa social today which is pound nasa

49
00:01:43,990 --> 00:01:42,640
social

50
00:01:45,109 --> 00:01:44,000
in today's televised event we're going

51
00:01:46,710 --> 00:01:45,119
to be bringing you some of the behind

52
00:01:49,030 --> 00:01:46,720
the scenes information about the lunar

53
00:01:51,030 --> 00:01:49,040
atmosphere and dust environment explorer

54
00:01:52,310 --> 00:01:51,040
satellite better known as lady

55
00:01:53,590 --> 00:01:52,320
we hope you learn a little bit more

56
00:01:55,590 --> 00:01:53,600
about this robotic probe that's going to

57
00:01:57,270 --> 00:01:55,600
be launching to the moon it's bound to

58
00:01:58,630 --> 00:01:57,280
study the moon's atmosphere the lunar

59
00:02:01,190 --> 00:01:58,640
conditions near the surface and the

60
00:02:02,469 --> 00:02:01,200
environmental influences of lunar dust

61
00:02:04,149 --> 00:02:02,479
today you'll hear from a variety of

62
00:02:05,990 --> 00:02:04,159
different folks who each have a unique

63
00:02:07,830 --> 00:02:06,000

perspective on this mission everything

64
00:02:09,430 --> 00:02:07,840
from the hands-on science work to the

65
00:02:11,029 --> 00:02:09,440
big picture view of nasa's science

66
00:02:12,550 --> 00:02:11,039
programs and how this mission fits into

67
00:02:14,710 --> 00:02:12,560
that

68
00:02:16,550 --> 00:02:14,720
does anyone here know how many nasa

69
00:02:18,790 --> 00:02:16,560
social or tweet-up events we've hosted

70
00:02:22,390 --> 00:02:18,800
anyone

71
00:02:24,229 --> 00:02:22,400
well this is number 71. this is the 71st

72
00:02:25,830 --> 00:02:24,239
in-person social media event of this

73
00:02:27,350 --> 00:02:25,840
sort for nasa

74
00:02:29,030 --> 00:02:27,360
in the past 12 months alone we've

75
00:02:31,030 --> 00:02:29,040
brought in over 1200 social media

76
00:02:32,229 --> 00:02:31,040
followers to nasa events from coast to

77
00:02:33,990 --> 00:02:32,239
coast

78
00:02:36,070 --> 00:02:34,000
it's experiences like these that really

79
00:02:38,309 --> 00:02:36,080
break down what we do here and really

80
00:02:41,270 --> 00:02:38,319
help us share nasa to new audiences in

81
00:02:42,550 --> 00:02:41,280
new ways it really allows us to work to

82
00:02:44,470 --> 00:02:42,560
show off the science and engineering

83
00:02:45,589 --> 00:02:44,480
work that's going on here at nasa we

84
00:02:47,430 --> 00:02:45,599
strive every day to promote the

85
00:02:49,030 --> 00:02:47,440
diversity of amazing work and to share

86
00:02:50,710 --> 00:02:49,040
our missions our programs and our

87
00:02:52,070 --> 00:02:50,720
absolutely talented employees in ways

88
00:02:54,470 --> 00:02:52,080

that really connect and resonate with

89
00:02:56,070 --> 00:02:54,480
everyone the nasa socials are just one

90
00:02:57,990 --> 00:02:56,080
part of this strategy and this strategy

91
00:02:59,589 --> 00:02:58,000
is always evolving we're always looking

92
00:03:01,270 --> 00:02:59,599
for new opportunities to connect with

93
00:03:03,350 --> 00:03:01,280
new audiences and share information in

94
00:03:04,949 --> 00:03:03,360
new ways we're always exploring where

95
00:03:06,790 --> 00:03:04,959
you guys are going online what you're

96
00:03:09,270 --> 00:03:06,800
looking at and where we can find out

97
00:03:11,110 --> 00:03:09,280
where social media is headed

98
00:03:13,270 --> 00:03:11,120
we're also on the most popular platforms

99
00:03:14,949 --> 00:03:13,280
out there and new ones will emerge in

100
00:03:16,550 --> 00:03:14,959
fact tomorrow we're going to be

101
00:03:19,190 --> 00:03:16,560
officially announcing some new nasa

102
00:03:21,030 --> 00:03:19,200
presences so stand by for that

103
00:03:23,670 --> 00:03:21,040
in a way to get inspired and everything

104
00:03:25,030 --> 00:03:23,680
please make sure to follow along online

105
00:03:26,229 --> 00:03:25,040
thank you for joining us for this event

106
00:03:29,030 --> 00:03:26,239
and this experience no matter if you're

107
00:03:33,110 --> 00:03:29,040
offline here in person in real life

108
00:03:34,390 --> 00:03:33,120
hashtag irl or watching online um we are

109
00:03:36,149 --> 00:03:34,400
glad that you're able to join us today

110
00:03:37,750 --> 00:03:36,159
for the incredible mission this really

111
00:03:40,309 --> 00:03:37,760
is a mission of mini first including the

112
00:03:41,190 --> 00:03:40,319
first flight of the minotaur 5 rocket

113
00:03:43,430 --> 00:03:41,200

the first

114
00:03:45,110 --> 00:03:43,440
flight testing a high data rate laser

115
00:03:46,630 --> 00:03:45,120
communication system

116
00:03:48,710 --> 00:03:46,640
lasers

117
00:03:50,550 --> 00:03:48,720
and also the first launch beyond earth

118
00:03:51,830 --> 00:03:50,560
orbit from nasa's wallops flight

119
00:03:53,270 --> 00:03:51,840
facility here

120
00:03:55,350 --> 00:03:53,280
the lady mission is also the first

121
00:03:57,429 --> 00:03:55,360
spacecraft design developed built

122
00:03:58,789 --> 00:03:57,439
integrated and tested by the nasa ames

123
00:04:01,110 --> 00:03:58,799
research center in the heart of silicon

124
00:04:03,830 --> 00:04:01,120
valley so without much further ado i'd

125
00:04:06,149 --> 00:04:03,840
like to welcome to nasa social our very

126
00:04:07,670 --> 00:04:06,159
first speaker dr john grunsfeld he's the

127
00:04:09,190 --> 00:04:07,680
associate administrator for the science

128
00:04:12,070 --> 00:04:09,200
mission directorate at nasa headquarters

129
00:04:13,589 --> 00:04:12,080
in washington d.c he's also an astronaut

130
00:04:15,030 --> 00:04:13,599
and a veteran of five space shuttle

131
00:04:16,870 --> 00:04:15,040
flights and he's visited the hubble

132
00:04:19,189 --> 00:04:16,880
space telescope three times during these

133
00:04:21,110 --> 00:04:19,199
missions so now he oversees all of

134
00:04:28,150 --> 00:04:21,120
nasa's science programs so without any

135
00:04:28,160 --> 00:04:32,070
thank you jason

136
00:04:36,469 --> 00:04:34,230
well it's really a a pleasure to be here

137
00:04:38,390 --> 00:04:36,479
at wallop sleightesley for for a lot of

138
00:04:39,830 --> 00:04:38,400

different reasons and so i thought maybe

139
00:04:43,510 --> 00:04:39,840
i'd just tell you a little story of my

140
00:04:45,430 --> 00:04:43,520
life so i hope you have a few minutes

141
00:04:47,350 --> 00:04:45,440
but i grew up and

142
00:04:49,510 --> 00:04:47,360
spent a lot of time looking at the moon

143
00:04:51,749 --> 00:04:49,520
so here for the lady mission is really

144
00:04:54,070 --> 00:04:51,759
exciting for me that you know we're one

145
00:04:55,270 --> 00:04:54,080
day away from going to the moon well

146
00:04:56,790 --> 00:04:55,280
it'll take a little while to get there

147
00:04:58,230 --> 00:04:56,800
but that's okay we're going to launch on

148
00:05:00,070 --> 00:04:58,240
our way to the moon

149
00:05:01,990 --> 00:05:00,080
with lady

150
00:05:03,270 --> 00:05:02,000
but i grew up at a really amazing time

151
00:05:04,870 --> 00:05:03,280
and looking out in the audience there's

152
00:05:07,110 --> 00:05:04,880
a few people here

153
00:05:08,870 --> 00:05:07,120
who grew up in a similar time and that's

154
00:05:11,110 --> 00:05:08,880
a time when humans had never been to the

155
00:05:12,629 --> 00:05:11,120
moon and so i got to grow up with

156
00:05:14,710 --> 00:05:12,639
mercury i don't remember very much of

157
00:05:16,390 --> 00:05:14,720
mercury but the gemini program and of

158
00:05:18,469 --> 00:05:16,400
course apollo

159
00:05:20,790 --> 00:05:18,479
and i was in summer camp

160
00:05:21,830 --> 00:05:20,800
in 1969 when neil armstrong and buzz

161
00:05:24,310 --> 00:05:21,840
aldrin

162
00:05:26,070 --> 00:05:24,320
first set foot on the moon and so i'm

163
00:05:27,990 --> 00:05:26,080

just thrilled that we're going back and

164
00:05:29,990 --> 00:05:28,000
one of the things they did is when they

165
00:05:31,590 --> 00:05:30,000
landed with the lunar module they kicked

166
00:05:33,029 --> 00:05:31,600
up a lot of dust

167
00:05:34,629 --> 00:05:33,039
and there was a lot of discussion about

168
00:05:36,150 --> 00:05:34,639
what would happen when neal stepped off

169
00:05:37,430 --> 00:05:36,160
the ladder would he sink into the dust

170
00:05:39,029 --> 00:05:37,440
you know up to his waist would he be

171
00:05:41,350 --> 00:05:39,039
swimming would it you know make any

172
00:05:42,469 --> 00:05:41,360
difference at all and of course in fact

173
00:05:45,590 --> 00:05:42,479
if you look in the back of the room

174
00:05:48,150 --> 00:05:45,600
there's the iconic apollo footprint

175
00:05:50,390 --> 00:05:48,160
so we know the moon is a dusty place but

176
00:05:53,350 --> 00:05:50,400
what we didn't know is that the moon has

177
00:05:55,110 --> 00:05:53,360
an atmosphere a very tenuous atmosphere

178
00:05:56,390 --> 00:05:55,120
really an exosphere

179
00:05:58,310 --> 00:05:56,400
so thin

180
00:05:59,510 --> 00:05:58,320
that atoms and molecules that leave the

181
00:06:01,189 --> 00:05:59,520
surface

182
00:06:02,790 --> 00:06:01,199
basically escape

183
00:06:04,150 --> 00:06:02,800
rather than colliding with each other

184
00:06:05,430 --> 00:06:04,160
the way they do here so we're going to

185
00:06:07,430 --> 00:06:05,440
go investigate that we're going to

186
00:06:09,590 --> 00:06:07,440
investigate dust that gets levitated by

187
00:06:12,070 --> 00:06:09,600
means that we don't fully understand but

188
00:06:14,710 --> 00:06:12,080

we have some ideas some theories

189
00:06:16,550 --> 00:06:14,720
you know with ultraviolet light ionizing

190
00:06:18,230 --> 00:06:16,560
perhaps electrostatic levitation at the

191
00:06:19,670 --> 00:06:18,240
terminator day night

192
00:06:22,469 --> 00:06:19,680
and so we're going to fly really close

193
00:06:24,309 --> 00:06:22,479
to the moon as close as 12 miles uh and

194
00:06:25,909 --> 00:06:24,319
investigate that

195
00:06:27,510 --> 00:06:25,919
and then also look at what the species

196
00:06:28,309 --> 00:06:27,520
what the atmosphere is made out of of

197
00:06:29,670 --> 00:06:28,319
course we know what the earth's

198
00:06:31,510 --> 00:06:29,680
atmosphere is made out of we don't know

199
00:06:33,909 --> 00:06:31,520
what the moon's atmosphere is made out

200
00:06:35,590 --> 00:06:33,919
of and we're going to learn about that

201
00:06:37,029 --> 00:06:35,600
and the moon is also a reference point

202
00:06:38,309 --> 00:06:37,039
for mercury

203
00:06:40,150 --> 00:06:38,319
for other

204
00:06:42,070 --> 00:06:40,160
dry relatively dry

205
00:06:43,590 --> 00:06:42,080
moons of other planets and maybe exo

206
00:06:45,670 --> 00:06:43,600
worlds other other worlds around other

207
00:06:46,950 --> 00:06:45,680
stars and of course we know about

208
00:06:49,430 --> 00:06:46,960
hundreds of those and there are

209
00:06:51,430 --> 00:06:49,440
thousands nearby so very very exciting

210
00:06:52,790 --> 00:06:51,440
so so growing up i got to see that whole

211
00:06:54,710 --> 00:06:52,800
moon mission well

212
00:06:56,629 --> 00:06:54,720
uh i decided i wanted to be an astronaut

213
00:06:58,629 --> 00:06:56,639

at about age six

214
00:07:00,150 --> 00:06:58,639
uh watching these astronauts on gemini

215
00:07:03,110 --> 00:07:00,160
and then later apollo

216
00:07:05,110 --> 00:07:03,120
and but i love science uh clearly i love

217
00:07:07,270 --> 00:07:05,120
science because i have the best job now

218
00:07:08,150 --> 00:07:07,280
uh for nasa's science programs and you

219
00:07:09,270 --> 00:07:08,160
know we

220
00:07:12,150 --> 00:07:09,280
basically

221
00:07:14,390 --> 00:07:12,160
do earth science solar system science

222
00:07:15,430 --> 00:07:14,400
astrophysics so we rule the universe

223
00:07:17,270 --> 00:07:15,440
pretty much

224
00:07:19,189 --> 00:07:17,280
in terms of science so it's an exciting

225
00:07:22,150 --> 00:07:19,199
job to have day by day

226
00:07:23,749 --> 00:07:22,160
but i always wanted to leave the planet

227
00:07:28,309 --> 00:07:23,759
and

228
00:07:29,909 --> 00:07:28,319
cut my teeth

229
00:07:31,990 --> 00:07:29,919
launching high high-altitude balloons

230
00:07:33,830 --> 00:07:32,000
with science experiments under them as

231
00:07:35,749 --> 00:07:33,840
an undergraduate i had the opportunity

232
00:07:38,629 --> 00:07:35,759
to be involved with an experiment x-ray

233
00:07:40,390 --> 00:07:38,639
astronomy launching a balloon in texas

234
00:07:42,230 --> 00:07:40,400
and then as a graduate student from all

235
00:07:44,550 --> 00:07:42,240
over the world i launched tile balloons

236
00:07:47,110 --> 00:07:44,560
with with experiments on them and i just

237
00:07:48,790 --> 00:07:47,120
loved going out into the field preparing

238
00:07:50,629 --> 00:07:48,800

an experiment getting it ready for the

239
00:07:52,790 --> 00:07:50,639
launch pad you know and then that

240
00:07:55,350 --> 00:07:52,800
critical moment when the the truck

241
00:07:57,029 --> 00:07:55,360
holding the space v the

242
00:07:59,350 --> 00:07:57,039
balloon payload it's a space vehicle

243
00:08:00,790 --> 00:07:59,360
goes to the edge of space let go and off

244
00:08:02,790 --> 00:08:00,800
it would go and all of my hopes and

245
00:08:04,390 --> 00:08:02,800
dreams of getting science back you know

246
00:08:06,150 --> 00:08:04,400
would go up with it

247
00:08:08,070 --> 00:08:06,160
and it was dependent on me to have that

248
00:08:10,070 --> 00:08:08,080
payload ready so i know the latte team

249
00:08:12,469 --> 00:08:10,080
is really excited for tomorrow they have

250
00:08:14,710 --> 00:08:12,479
their payload ready

251
00:08:17,029 --> 00:08:14,720
to launch and they'll be excited

252
00:08:18,469 --> 00:08:17,039
about 1400 seconds after launch when

253
00:08:19,589 --> 00:08:18,479
it's powered on and we get the first

254
00:08:21,670 --> 00:08:19,599
telemetry

255
00:08:22,790 --> 00:08:21,680
so that's their day tomorrow

256
00:08:24,629 --> 00:08:22,800
but i launched these high altitude

257
00:08:26,070 --> 00:08:24,639
balloons and in fact that program of

258
00:08:27,670 --> 00:08:26,080
high altitude balloons and rockets

259
00:08:30,150 --> 00:08:27,680
suborbital rockets

260
00:08:31,749 --> 00:08:30,160
is run out of the wallops flight center

261
00:08:33,589 --> 00:08:31,759
here where you are so i hope you enjoy

262
00:08:34,790 --> 00:08:33,599
some tours looking at that but this is

263
00:08:36,149 --> 00:08:34,800

the center of it all although the

264
00:08:37,589 --> 00:08:36,159
balloons are

265
00:08:40,310 --> 00:08:37,599
are launched all around the world we

266
00:08:42,389 --> 00:08:40,320
have a team in fort sumner new mexico

267
00:08:43,509 --> 00:08:42,399
right now launching or preparing to

268
00:08:45,110 --> 00:08:43,519
launch highlighter balloons with a

269
00:08:47,590 --> 00:08:45,120
variety of science experiments earth

270
00:08:49,750 --> 00:08:47,600
science heliophysics astrophysics and

271
00:08:52,110 --> 00:08:49,760
student experiments we just launched uh

272
00:08:54,790 --> 00:08:52,120
successfully nine student

273
00:08:56,470 --> 00:08:54,800
experiments uh

274
00:08:58,470 --> 00:08:56,480
so i love scientific ballooning i love

275
00:09:01,269 --> 00:08:58,480
space we're heading to the moon you know

276
00:09:03,430 --> 00:09:01,279
it doesn't get much better than that and

277
00:09:09,670 --> 00:09:03,440
i think at this point i'm open to taking

278
00:09:14,630 --> 00:09:12,630
oh don't be shy now

279
00:09:19,190 --> 00:09:14,640
okay this is an astronaut here

280
00:09:19,200 --> 00:09:23,990
five missions do you have a favorite

281
00:09:28,630 --> 00:09:26,870
okay so the question uh was five space

282
00:09:30,230 --> 00:09:28,640
shuttle missions do i have a favorite

283
00:09:31,670 --> 00:09:30,240
and actually that's a tough one because

284
00:09:32,949 --> 00:09:31,680
you know the first space mission is

285
00:09:35,590 --> 00:09:32,959
always special

286
00:09:38,070 --> 00:09:35,600
i went up on space shuttle endeavour for

287
00:09:40,070 --> 00:09:38,080
16 days and in the payload bay were

288
00:09:41,829 --> 00:09:40,080

three astronomical telescopes

289
00:09:43,509 --> 00:09:41,839
ultraviolet telescopes we have an

290
00:09:45,590 --> 00:09:43,519
ultraviolet telescope on lady an

291
00:09:48,230 --> 00:09:45,600
ultraviolet spectrometer

292
00:09:50,470 --> 00:09:48,240
and it was 1995 and for me it was

293
00:09:52,389 --> 00:09:50,480
amazing because i went from

294
00:09:55,750 --> 00:09:52,399
being a senior research fellow at

295
00:09:56,949 --> 00:09:55,760
caltech going to mountaintops to observe

296
00:09:58,550 --> 00:09:56,959
space

297
00:10:00,790 --> 00:09:58,560
and just three years later i was in

298
00:10:03,110 --> 00:10:00,800
space being the telescope operator for

299
00:10:05,430 --> 00:10:03,120
some ultraviolet telescopes and spending

300
00:10:07,110 --> 00:10:05,440
16 days in space and of course it's

301
00:10:08,870 --> 00:10:07,120
really great uh

302
00:10:11,110 --> 00:10:08,880
operating a telescope doing long

303
00:10:13,350 --> 00:10:11,120
integrations you know up to 40 minutes

304
00:10:15,030 --> 00:10:13,360
of integrations on one

305
00:10:18,230 --> 00:10:15,040
for instance looking at

306
00:10:20,710 --> 00:10:18,240
the moon io of jupiter and watching a

307
00:10:22,470 --> 00:10:20,720
sulfur volcano erupt on a moon of

308
00:10:23,590 --> 00:10:22,480
jupiter from low earth orbit that's

309
00:10:25,269 --> 00:10:23,600
pretty cool

310
00:10:27,590 --> 00:10:25,279
plus you know the telescope is doing

311
00:10:29,590 --> 00:10:27,600
this long time exposure and that gave me

312
00:10:31,590 --> 00:10:29,600
some time to look at the earth too

313
00:10:33,750 --> 00:10:31,600

so astronomy emissions are pretty good

314
00:10:36,150 --> 00:10:33,760
and looking at the earth is just amazing

315
00:10:38,230 --> 00:10:36,160
from space that's uh for almost every

316
00:10:40,230 --> 00:10:38,240
astronaut the most favorite thing to do

317
00:10:41,750 --> 00:10:40,240
so the first mission is very special but

318
00:10:43,269 --> 00:10:41,760
i have to say my favorite mission was

319
00:10:45,190 --> 00:10:43,279
this last one

320
00:10:46,630 --> 00:10:45,200
may of 2009 we went up to the hubble

321
00:10:48,389 --> 00:10:46,640
space telescope

322
00:10:49,990 --> 00:10:48,399
and really did not quite a complete

323
00:10:51,910 --> 00:10:50,000
makeover but a pretty substantial

324
00:10:53,190 --> 00:10:51,920
makeover of the telescope

325
00:10:55,030 --> 00:10:53,200
repairing two instruments that were

326
00:10:56,389 --> 00:10:55,040
broken installing a new ultraviolet

327
00:10:58,630 --> 00:10:56,399
spectrometer the cosmic origin

328
00:11:01,269 --> 00:10:58,640
spectrograph repairing some power system

329
00:11:03,430 --> 00:11:01,279
components computers putting putting in

330
00:11:05,350 --> 00:11:03,440
new batteries a new fine guidance sensor

331
00:11:08,870 --> 00:11:05,360
which is an interferometer that'll that

332
00:11:11,269 --> 00:11:08,880
allows hubble to point so so steady

333
00:11:12,790 --> 00:11:11,279
and hubble's still doing great

334
00:11:14,470 --> 00:11:12,800
so we didn't break the telescope we

335
00:11:16,949 --> 00:11:14,480
fixed it and everything's going great so

336
00:11:19,750 --> 00:11:16,959
i think that mission uh commanded by

337
00:11:21,910 --> 00:11:19,760
scott altman a close friend and a great

338
00:11:23,269 --> 00:11:21,920

commander uh you know we we did

339
00:11:25,190 --> 00:11:23,279
everything we set out to do in a little

340
00:11:26,710 --> 00:11:25,200
bit more and left hubble in great shape

341
00:11:30,150 --> 00:11:26,720
for the future

342
00:11:36,870 --> 00:11:30,160
so we're that was a fun mission

343
00:11:40,870 --> 00:11:38,389
since you're an astronaut i want to ask

344
00:11:42,550 --> 00:11:40,880
you an astronaut question um

345
00:11:43,829 --> 00:11:42,560
being in the space shuttle and it's

346
00:11:46,069 --> 00:11:43,839
pretty roomy i've

347
00:11:47,509 --> 00:11:46,079
i haven't been inside or just what from

348
00:11:49,269 --> 00:11:47,519
photographs i've seen but i've seen a

349
00:11:50,790 --> 00:11:49,279
couple up close

350
00:11:53,350 --> 00:11:50,800
what do you think of the room that the

351
00:11:54,150 --> 00:11:53,360
new astronauts and the sls

352
00:11:55,670 --> 00:11:54,160
or

353
00:11:57,670 --> 00:11:55,680
how are they going to cope compared to

354
00:11:58,870 --> 00:11:57,680
the room you had

355
00:12:00,790 --> 00:11:58,880
in the space shuttle do you think it

356
00:12:02,790 --> 00:12:00,800
would be more cramped and

357
00:12:04,710 --> 00:12:02,800
tougher to work together so so the

358
00:12:05,990 --> 00:12:04,720
question really was uh the space shuttle

359
00:12:07,509 --> 00:12:06,000
is pretty roomy

360
00:12:10,069 --> 00:12:07,519
uh how does that compare to what the

361
00:12:11,990 --> 00:12:10,079
orion spacecraft will have and it's not

362
00:12:13,190 --> 00:12:12,000
quite a fair question i mean every

363
00:12:14,870 --> 00:12:13,200

question is a fair question but it's not

364
00:12:16,310 --> 00:12:14,880
a fair comparison

365
00:12:17,910 --> 00:12:16,320
and that's because the space shuttle was

366
00:12:20,389 --> 00:12:17,920
designed to be a rocket to get you to

367
00:12:22,310 --> 00:12:20,399
space which we then converted to our

368
00:12:23,190 --> 00:12:22,320
house in space and our laboratory in

369
00:12:25,350 --> 00:12:23,200
space

370
00:12:26,949 --> 00:12:25,360
and then to be you know kind of

371
00:12:27,990 --> 00:12:26,959
high-speed glider

372
00:12:29,430 --> 00:12:28,000
entering back into the earth's

373
00:12:30,710 --> 00:12:29,440
atmosphere and so it was designed to be

374
00:12:33,030 --> 00:12:30,720
very versatile and to do all these

375
00:12:36,069 --> 00:12:33,040
different things to have places to sleep

376
00:12:37,350 --> 00:12:36,079
to eat to put spacesuits airlocks to go

377
00:12:39,430 --> 00:12:37,360
out and do spacewalks and of course a

378
00:12:42,069 --> 00:12:39,440
payload bay where you could put modules

379
00:12:44,230 --> 00:12:42,079
even and so on my second flight we had a

380
00:12:46,389 --> 00:12:44,240
space have module which we did science

381
00:12:49,190 --> 00:12:46,399
research and we carried supplies up to

382
00:12:51,750 --> 00:12:49,200
the mere spacecraft and and back

383
00:12:52,870 --> 00:12:51,760
so it was just designed that way and it

384
00:12:55,110 --> 00:12:52,880
is it's

385
00:12:57,350 --> 00:12:55,120
really nice to have all that room on the

386
00:13:00,230 --> 00:12:57,360
other hand when you consider in columbia

387
00:13:02,389 --> 00:13:00,240
on the last mission we had seven people

388
00:13:04,550 --> 00:13:02,399

four space suits we had enough gear and

389
00:13:06,870 --> 00:13:04,560
supplies to repair the shuttle

390
00:13:08,870 --> 00:13:06,880
if if something happened

391
00:13:09,829 --> 00:13:08,880
externally to tiles or carbon on the

392
00:13:12,069 --> 00:13:09,839
wings

393
00:13:13,509 --> 00:13:12,079
and we had 25 days of supplies in case

394
00:13:15,350 --> 00:13:13,519
we were stranded in space and all kinds

395
00:13:17,430 --> 00:13:15,360
of other things it was pretty cramped

396
00:13:19,990 --> 00:13:17,440
actually because the four spacesuits

397
00:13:21,829 --> 00:13:20,000
that's like having four really big guys

398
00:13:23,910 --> 00:13:21,839
inside as well as the seven of us so it

399
00:13:26,870 --> 00:13:23,920
was like having you know 11 people on

400
00:13:31,829 --> 00:13:29,829
but the orion really is designed to be

401
00:13:34,870 --> 00:13:31,839
not the place that you live but the

402
00:13:36,470 --> 00:13:34,880
spacecraft that takes you to somewhere

403
00:13:38,949 --> 00:13:36,480
that where you would have a deep space

404
00:13:40,949 --> 00:13:38,959
hab and you would go to

405
00:13:44,150 --> 00:13:40,959
some place far away you know say an

406
00:13:45,509 --> 00:13:44,160
asteroid moon mars

407
00:13:47,670 --> 00:13:45,519
down down the road so it's our

408
00:13:50,550 --> 00:13:47,680
exploration transport vehicle not really

409
00:13:52,710 --> 00:13:50,560
our exploration hab vehicle now we we do

410
00:13:54,550 --> 00:13:52,720
have a very ambitious mission uh that

411
00:13:57,750 --> 00:13:54,560
we're looking at mission planning for

412
00:14:00,230 --> 00:13:57,760
now to go out uh to a trans-lunar space

413
00:14:01,910 --> 00:14:00,240

a very uh interesting lunar orbit where

414
00:14:03,829 --> 00:14:01,920
we'll rendezvous with a captured

415
00:14:05,670 --> 00:14:03,839
asteroid and for that mission we're

416
00:14:07,829 --> 00:14:05,680
looking at two crew members and actually

417
00:14:09,430 --> 00:14:07,839
at five and a half meters diameter uh

418
00:14:10,790 --> 00:14:09,440
the orion spacecraft will seem quite

419
00:14:12,470 --> 00:14:10,800
roomy

420
00:14:13,990 --> 00:14:12,480
and that's your first mission and that's

421
00:14:15,750 --> 00:14:14,000
that's the first mission queued up for

422
00:14:17,670 --> 00:14:15,760
next decade that's a pretty brave

423
00:14:19,670 --> 00:14:17,680
undertaking for first mission now if you

424
00:14:22,470 --> 00:14:19,680
want to know about cramped

425
00:14:25,189 --> 00:14:22,480
think about frank borman and jim lovell

426
00:14:27,269 --> 00:14:25,199
in a jump in a gemini capsule

427
00:14:31,670 --> 00:14:27,279
which is like riding in a two-seater

428
00:14:36,470 --> 00:14:31,680
sports car for 14 days

429
00:14:38,790 --> 00:14:37,189
hi

430
00:14:41,350 --> 00:14:38,800
um how

431
00:14:44,069 --> 00:14:41,360
do you keep your concentration when

432
00:14:46,150 --> 00:14:44,079
you're doing a complex eva like in the

433
00:14:48,470 --> 00:14:46,160
hubble when the earth is going by and

434
00:14:50,150 --> 00:14:48,480
all you want to do is look out and also

435
00:14:52,069 --> 00:14:50,160
how does it feel to be on the dark side

436
00:14:53,030 --> 00:14:52,079
when the sun goes down

437
00:14:55,430 --> 00:14:53,040
the same

438
00:14:58,470 --> 00:14:55,440

dark dark side of the moon question

439
00:15:00,150 --> 00:14:58,480
dark side of the earth

440
00:15:01,990 --> 00:15:00,160
so the concentration question is a good

441
00:15:04,230 --> 00:15:02,000
one

442
00:15:07,590 --> 00:15:04,240
and

443
00:15:08,870 --> 00:15:07,600
i just enjoy activities i when i was a

444
00:15:10,389 --> 00:15:08,880
little bit younger i spent a lot of time

445
00:15:12,230 --> 00:15:10,399
rock climbing and one of the reasons i

446
00:15:14,790 --> 00:15:12,240
like rock climbing is it's a hazardous

447
00:15:16,790 --> 00:15:14,800
activity you have to pay attention and

448
00:15:19,509 --> 00:15:16,800
it requires

449
00:15:21,189 --> 00:15:19,519
an extraordinary degree of focus because

450
00:15:23,430 --> 00:15:21,199
you don't want to fall

451
00:15:25,750 --> 00:15:23,440
and i find that very relaxing in a way

452
00:15:28,550 --> 00:15:25,760
not not stressful you know that you can

453
00:15:31,030 --> 00:15:28,560
focus on that task and to the exclusion

454
00:15:33,189 --> 00:15:31,040
of everything else

455
00:15:35,110 --> 00:15:33,199
i would hope if i ever need surgery that

456
00:15:36,470 --> 00:15:35,120
the surgeon has that same kind of focus

457
00:15:38,710 --> 00:15:36,480
that he's not worrying about oh if i

458
00:15:40,550 --> 00:15:38,720
nick something the patient will die or

459
00:15:42,550 --> 00:15:40,560
you know i'm gonna go play golf later or

460
00:15:44,710 --> 00:15:42,560
anything else other than you know that

461
00:15:46,949 --> 00:15:44,720
specific task and i think it's part of

462
00:15:48,629 --> 00:15:46,959
the way the human brain works in very

463
00:15:50,310 --> 00:15:48,639

technical activities

464
00:15:52,550 --> 00:15:50,320
flying is another example when i'm

465
00:15:53,910 --> 00:15:52,560
flying you know i'm flying the airplane

466
00:15:56,230 --> 00:15:53,920
i'm thinking about that i'm not thinking

467
00:15:58,150 --> 00:15:56,240
about you know sports or family or other

468
00:16:00,470 --> 00:15:58,160
things i'm just concentrating on you

469
00:16:02,550 --> 00:16:00,480
know navigating the airplane and flying

470
00:16:04,310 --> 00:16:02,560
the airplane

471
00:16:06,710 --> 00:16:04,320
especially in critical phases of flight

472
00:16:08,230 --> 00:16:06,720
take off landing a lot going on

473
00:16:10,389 --> 00:16:08,240
and i get a lot of enjoyment about that

474
00:16:12,230 --> 00:16:10,399
kind of focus and maybe that's why you

475
00:16:14,710 --> 00:16:12,240
know i was successful in in science and

476
00:16:16,069 --> 00:16:14,720
then as an astronaut and so during the

477
00:16:18,389 --> 00:16:16,079
space walks

478
00:16:21,030 --> 00:16:18,399
uh focusing on the task communicating

479
00:16:23,269 --> 00:16:21,040
with the folks inside and my crewmates

480
00:16:25,350 --> 00:16:23,279
you know nothing else is going on in my

481
00:16:26,790 --> 00:16:25,360
brain it's you know no other subroutines

482
00:16:28,629 --> 00:16:26,800
in particular there are some little

483
00:16:30,790 --> 00:16:28,639
safety subroutines going on you know

484
00:16:33,509 --> 00:16:30,800
sharp edges oh avoid that that kind of

485
00:16:35,269 --> 00:16:33,519
thing but but really focus on the task

486
00:16:37,990 --> 00:16:35,279
so much so that i really

487
00:16:40,550 --> 00:16:38,000
don't have very much recollection of

488
00:16:42,470 --> 00:16:40,560

sightseeing during the spacewalks

489
00:16:44,069 --> 00:16:42,480
in fact at one point

490
00:16:45,829 --> 00:16:44,079
drew who was waiting for me to hand a

491
00:16:48,230 --> 00:16:45,839
tool drew feustel my spacewalking

492
00:16:49,509 --> 00:16:48,240
partner on the last mission

493
00:16:50,629 --> 00:16:49,519
you know looked out and said oh look

494
00:16:53,189 --> 00:16:50,639
hawaii

495
00:16:55,430 --> 00:16:53,199
you know and and i was like oh yeah

496
00:16:57,110 --> 00:16:55,440
we're in space we're orbiting the earth

497
00:16:59,030 --> 00:16:57,120
i was inside the telescope at the time

498
00:17:02,310 --> 00:16:59,040
so i thought and thanks a lot i can't

499
00:17:05,829 --> 00:17:03,910
but actually i think he said something

500
00:17:07,990 --> 00:17:05,839
like wow that's amazing and i said what

501
00:17:09,990 --> 00:17:08,000
and he said hawaii and i thought

502
00:17:12,230 --> 00:17:10,000
but uh

503
00:17:13,909 --> 00:17:12,240
but it's it's actually good and i

504
00:17:17,429 --> 00:17:13,919
recommended on the last mission i was

505
00:17:19,270 --> 00:17:17,439
sort of the hubble uh lead that the

506
00:17:20,870 --> 00:17:19,280
other spacewalkers look at their

507
00:17:23,350 --> 00:17:20,880
timeline

508
00:17:24,710 --> 00:17:23,360
and identify before we launched

509
00:17:26,309 --> 00:17:24,720
what little

510
00:17:27,829 --> 00:17:26,319
two or three minute or five minute

511
00:17:30,710 --> 00:17:27,839
segment

512
00:17:32,470 --> 00:17:30,720
is available when i'm not working or

513
00:17:34,630 --> 00:17:32,480

when they're not working where you could

514
00:17:36,470 --> 00:17:34,640
plan to look around

515
00:17:38,230 --> 00:17:36,480
because my first spacewalk was eight

516
00:17:40,630 --> 00:17:38,240
hours and 40 minutes

517
00:17:42,950 --> 00:17:40,640
and i don't ever remember

518
00:17:45,029 --> 00:17:42,960
anything but the spacewalking tasks we

519
00:17:46,950 --> 00:17:45,039
were so focused we were so busy things

520
00:17:48,390 --> 00:17:46,960
were going wrong we're fixing things and

521
00:17:49,669 --> 00:17:48,400
i just don't remember you know looking

522
00:17:51,029 --> 00:17:49,679
around and saying wow you know we're

523
00:17:52,789 --> 00:17:51,039
orbiting the earth we're in a space

524
00:17:54,789 --> 00:17:52,799
shuttle we're in a spaceship look how

525
00:17:55,750 --> 00:17:54,799
black the space is nothing

526
00:17:59,029 --> 00:17:55,760
and

527
00:18:01,430 --> 00:17:59,039
still humans we go up there it's

528
00:18:05,029 --> 00:18:01,440
incredible you're in a cloth spacesuit

529
00:18:07,270 --> 00:18:05,039
in a vacuum you know that's crazy

530
00:18:14,630 --> 00:18:07,280
and it's important to you know feel that

531
00:18:19,669 --> 00:18:15,909
hi dr

532
00:18:21,270 --> 00:18:19,679
just want to say thank you very much for

533
00:18:23,510 --> 00:18:21,280
all the work you did on the hubble space

534
00:18:25,909 --> 00:18:23,520
telescope i had the privilege of working

535
00:18:28,070 --> 00:18:25,919
on hst for several years at the space

536
00:18:30,789 --> 00:18:28,080
telescope science institute in baltimore

537
00:18:32,710 --> 00:18:30,799
and uh thank you so much for uh for you

538
00:18:33,909 --> 00:18:32,720

and all the all the

539
00:18:35,190 --> 00:18:33,919
you and the crew and everybody who

540
00:18:36,630 --> 00:18:35,200
worked so hard to put those missions

541
00:18:38,310 --> 00:18:36,640
together what was it like my question

542
00:18:41,029 --> 00:18:38,320
for your service what was it like to

543
00:18:42,470 --> 00:18:41,039
know that you were the last human being

544
00:18:43,909 --> 00:18:42,480
to make contact

545
00:18:46,390 --> 00:18:43,919
physical contact with the hubble space

546
00:18:48,470 --> 00:18:46,400
telescope

547
00:18:50,870 --> 00:18:48,480
well we talked about that a lot with uh

548
00:18:52,470 --> 00:18:50,880
with the crew and and folks at the

549
00:18:54,630 --> 00:18:52,480
goddard space flight center that manage

550
00:18:58,630 --> 00:18:54,640
the hubble project

551
00:19:00,310 --> 00:18:58,640
and others and i pointed out that uh

552
00:19:01,990 --> 00:19:00,320
you know the last time i sort of let go

553
00:19:04,950 --> 00:19:02,000
of hubble actually the last

554
00:19:08,470 --> 00:19:04,960
contact was a little pat and a salute

555
00:19:11,110 --> 00:19:08,480
and a good look mr hubble the telescope

556
00:19:13,830 --> 00:19:11,120
but uh i was wearing rubber gloves

557
00:19:16,470 --> 00:19:13,840
so it's a really curious question who is

558
00:19:19,029 --> 00:19:16,480
the last human being to touch hubble

559
00:19:20,230 --> 00:19:19,039
without rubber gloves

560
00:19:22,950 --> 00:19:20,240
and that would have been you know

561
00:19:24,390 --> 00:19:22,960
sometime in 1990 probably although

562
00:19:26,789 --> 00:19:24,400
almost everybody who touched the

563
00:19:29,510 --> 00:19:26,799

telescope back then had you know gloves

564
00:19:31,029 --> 00:19:29,520
on for contamination purposes

565
00:19:33,430 --> 00:19:31,039
so we don't really know who the last

566
00:19:35,669 --> 00:19:33,440
person to touch you know skin to to

567
00:19:38,310 --> 00:19:35,679
metal or skin to paint or skin to

568
00:19:41,029 --> 00:19:38,320
aluminized mylar

569
00:19:43,029 --> 00:19:41,039
the hubble space telescope

570
00:19:45,830 --> 00:19:43,039
what i find so incredible about the

571
00:19:48,310 --> 00:19:45,840
hubble space telescope is that literally

572
00:19:50,070 --> 00:19:48,320
tens of thousands of people

573
00:19:51,990 --> 00:19:50,080
touched hubble

574
00:19:53,590 --> 00:19:52,000
all the people that it took to build the

575
00:19:55,270 --> 00:19:53,600
telescope to

576
00:19:56,549 --> 00:19:55,280
create the optics to create the

577
00:19:57,669 --> 00:19:56,559
instruments

578
00:20:00,070 --> 00:19:57,679
over

579
00:20:02,950 --> 00:20:00,080
you know 23 years we're coming up next

580
00:20:05,590 --> 00:20:02,960
april 24th birthday of hubble

581
00:20:06,390 --> 00:20:05,600
and then there's the you know literally

582
00:20:08,150 --> 00:20:06,400
you know

583
00:20:10,789 --> 00:20:08,160
hundreds of millions of people if not

584
00:20:12,310 --> 00:20:10,799
more who have been touched by hubble

585
00:20:13,669 --> 00:20:12,320
you know just an incredible human

586
00:20:16,070 --> 00:20:13,679
achievement

587
00:20:18,710 --> 00:20:16,080
and it's it's the story of the hubble

588
00:20:20,310 --> 00:20:18,720

space telescope but it's a science story

589
00:20:21,669 --> 00:20:20,320
you know it's unraveling the mysteries

590
00:20:23,510 --> 00:20:21,679
of the universe it's telling us about

591
00:20:25,750 --> 00:20:23,520
our own solar system

592
00:20:28,070 --> 00:20:25,760
and the very beginnings of you know

593
00:20:29,830 --> 00:20:28,080
creation itself and and the beginning of

594
00:20:32,789 --> 00:20:29,840
the chemical elements and the evolution

595
00:20:34,310 --> 00:20:32,799
of stars and galaxies and planets

596
00:20:35,909 --> 00:20:34,320
nobody imagined that hubble would be

597
00:20:37,590 --> 00:20:35,919
studying the atmosphere of planets

598
00:20:38,549 --> 00:20:37,600
around nearby stars

599
00:20:39,909 --> 00:20:38,559
and

600
00:20:41,510 --> 00:20:39,919
our own moon

601
00:20:43,029 --> 00:20:41,520
you know we've done hubble observations

602
00:20:45,669 --> 00:20:43,039
of the moon

603
00:20:47,270 --> 00:20:45,679
and so just incredible the the

604
00:20:48,549 --> 00:20:47,280
number of science topics and the number

605
00:20:50,390 --> 00:20:48,559
of people

606
00:20:51,669 --> 00:20:50,400
that hubble has reached in science and

607
00:20:54,230 --> 00:20:51,679
the number of people that hubble has

608
00:20:57,990 --> 00:20:55,990
you know for me i was worried that you

609
00:20:59,590 --> 00:20:58,000
know when you know we let go of hubble

610
00:21:01,190 --> 00:20:59,600
with the robotic arm and

611
00:21:03,830 --> 00:21:01,200
it was drifting off into the distance

612
00:21:06,390 --> 00:21:03,840
that i'd be incredibly sad and

613
00:21:07,909 --> 00:21:06,400

in the moment i wasn't i was thrilled

614
00:21:09,430 --> 00:21:07,919
because we'd achieved everything we'd

615
00:21:11,669 --> 00:21:09,440
hoped to in

616
00:21:13,430 --> 00:21:11,679
repairing two instruments that lots of

617
00:21:15,029 --> 00:21:13,440
people said we would not be successful

618
00:21:16,630 --> 00:21:15,039
we shouldn't even try

619
00:21:18,789 --> 00:21:16,640
because it was too hard this was you

620
00:21:20,390 --> 00:21:18,799
know the hundreds of tiny screws and

621
00:21:21,669 --> 00:21:20,400
pulling out circuit cards and things

622
00:21:23,830 --> 00:21:21,679
that nobody had ever done before in

623
00:21:26,470 --> 00:21:23,840
space and everything worked and so

624
00:21:28,310 --> 00:21:26,480
hubble is uh is fully operational now

625
00:21:30,230 --> 00:21:28,320
and so i just felt very proud of our

626
00:21:31,590 --> 00:21:30,240
country you know and and the science

627
00:21:33,270 --> 00:21:31,600
teams and the instrument teams and all

628
00:21:34,549 --> 00:21:33,280
the engineers who developed those

629
00:21:36,549 --> 00:21:34,559
techniques and

630
00:21:38,470 --> 00:21:36,559
simple things building us a

631
00:21:40,390 --> 00:21:38,480
tiny little screwdriver that i could use

632
00:21:41,990 --> 00:21:40,400
in a big space glove

633
00:21:43,669 --> 00:21:42,000
that all of that actually in the end

634
00:21:45,750 --> 00:21:43,679
worked i was sort of amazed that it all

635
00:21:46,710 --> 00:21:45,760
worked but you know there we were

636
00:21:48,870 --> 00:21:46,720
so

637
00:21:51,750 --> 00:21:48,880
uh you know i wish trouble well and and

638
00:21:54,149 --> 00:21:51,760

it's doing well so uh so so i still have

639
00:21:59,750 --> 00:21:54,159
no sadness that you know you know we

640
00:22:05,270 --> 00:22:02,789
hello uh it's a pleasure meeting you and

641
00:22:06,789 --> 00:22:05,280
um i have a question about the space

642
00:22:08,710 --> 00:22:06,799
shuttle itself when you're inside the

643
00:22:09,990 --> 00:22:08,720
space shuttle and the engines fire up

644
00:22:11,029 --> 00:22:10,000
the boosters and all that you lift off

645
00:22:12,870 --> 00:22:11,039
the pad

646
00:22:14,230 --> 00:22:12,880
um i know can you describe what the

647
00:22:15,990 --> 00:22:14,240
physical sensations are like when the

648
00:22:17,190 --> 00:22:16,000
shuttle takes off i mean i know there's

649
00:22:19,110 --> 00:22:17,200
like acceleration but i heard there's

650
00:22:20,710 --> 00:22:19,120
like sounds and

651
00:22:22,549 --> 00:22:20,720
other things i think story musgrave had

652
00:22:24,549 --> 00:22:22,559
a particular name he talked about that

653
00:22:26,470 --> 00:22:24,559
the moment the engines kick on and the

654
00:22:27,669 --> 00:22:26,480
shuttle starts to shake and prepare to

655
00:22:29,029 --> 00:22:27,679
lift off the pad can you tell us a

656
00:22:31,909 --> 00:22:29,039
little more about that

657
00:22:32,950 --> 00:22:31,919
so the most interesting time is once for

658
00:22:35,029 --> 00:22:32,960
you know when you've flown multiple

659
00:22:35,830 --> 00:22:35,039
times is the first launch

660
00:22:37,909 --> 00:22:35,840
uh

661
00:22:40,230 --> 00:22:37,919
you know it's like shooting a pistol

662
00:22:41,510 --> 00:22:40,240
if any of you have ever shot a pistol

663
00:22:44,070 --> 00:22:41,520

you know the first time you pull the

664
00:22:46,710 --> 00:22:44,080
trigger you don't know what to expect

665
00:22:48,070 --> 00:22:46,720
and so you know you're calm relaxed and

666
00:22:49,990 --> 00:22:48,080
you know you can aim and all that the

667
00:22:51,669 --> 00:22:50,000
second time you know that there's going

668
00:22:53,270 --> 00:22:51,679
to be recoil and you prepare for the

669
00:22:56,149 --> 00:22:53,280
recoil but

670
00:22:58,630 --> 00:22:56,159
i digress so so the first time

671
00:23:00,070 --> 00:22:58,640
the most amazing the thing is as we well

672
00:23:01,190 --> 00:23:00,080
first of all i was out on the launch pad

673
00:23:02,950 --> 00:23:01,200
and unlike what we're going to see

674
00:23:04,470 --> 00:23:02,960
tomorrow night

675
00:23:07,190 --> 00:23:04,480
when we walked out to the launch pad it

676
00:23:09,430 --> 00:23:07,200
was raining it was dark

677
00:23:10,310 --> 00:23:09,440
stormy and we were all convinced on the

678
00:23:11,750 --> 00:23:10,320
crew

679
00:23:14,070 --> 00:23:11,760
that we were not going to go launch that

680
00:23:16,149 --> 00:23:14,080
day that it was sort of a practice event

681
00:23:17,909 --> 00:23:16,159
and the countdown kept ticking down it

682
00:23:19,029 --> 00:23:17,919
had been raining so the front windows of

683
00:23:22,390 --> 00:23:19,039
the shuttle

684
00:23:24,149 --> 00:23:22,400
were caked with a little bit of salt

685
00:23:25,510 --> 00:23:24,159
rain that had dried on the

686
00:23:26,950 --> 00:23:25,520
screen so we couldn't really see the big

687
00:23:28,149 --> 00:23:26,960
xenon lights

688
00:23:30,630 --> 00:23:28,159

so we couldn't see whether there were

689
00:23:32,950 --> 00:23:30,640
clouds or not too much scattering

690
00:23:34,310 --> 00:23:32,960
and we got down to uh to the nine-minute

691
00:23:36,310 --> 00:23:34,320
hold and held and then came out of the

692
00:23:38,230 --> 00:23:36,320
nine-minute hold and i thought well

693
00:23:40,149 --> 00:23:38,240
there you know we have other built-in

694
00:23:42,470 --> 00:23:40,159
holds we'll get down to just before we

695
00:23:44,789 --> 00:23:42,480
turn the auxiliary power units on which

696
00:23:46,630 --> 00:23:44,799
are run by hydrazine and they'll hold us

697
00:23:47,990 --> 00:23:46,640
there for you know an hour or so and

698
00:23:49,990 --> 00:23:48,000
then they'll shut it down because that's

699
00:23:51,590 --> 00:23:50,000
our window we'll get out go back you

700
00:23:54,070 --> 00:23:51,600
know call our families and that kind of

701
00:23:55,590 --> 00:23:54,080
thing get some rest get some exercise

702
00:23:57,669 --> 00:23:55,600
and we got to the five minutes and they

703
00:23:59,190 --> 00:23:57,679
said go for apu start

704
00:24:00,549 --> 00:23:59,200
and we turned the apus on and then i

705
00:24:01,909 --> 00:24:00,559
thought great we'll be out sooner

706
00:24:02,870 --> 00:24:01,919
because you can only run those for a few

707
00:24:04,870 --> 00:24:02,880
minutes

708
00:24:07,990 --> 00:24:04,880
and shut them down and still be able to

709
00:24:08,870 --> 00:24:08,000
restart them for another launch attempt

710
00:24:10,950 --> 00:24:08,880
and then

711
00:24:13,990 --> 00:24:10,960
they said

712
00:24:17,029 --> 00:24:14,000
endeavor close and lock your visors

713
00:24:19,029 --> 00:24:17,039

and and suddenly we all got really quiet

714
00:24:20,789 --> 00:24:19,039
it's like wow we're going it turns out a

715
00:24:22,310 --> 00:24:20,799
big hole that opened up in the clouds

716
00:24:24,230 --> 00:24:22,320
that we couldn't see and

717
00:24:26,310 --> 00:24:24,240
uh you know there was no discussion

718
00:24:28,230 --> 00:24:26,320
about you know recycling or anything and

719
00:24:29,909 --> 00:24:28,240
off we went so there was really no time

720
00:24:31,430 --> 00:24:29,919
to get nervous or anything but when we

721
00:24:33,190 --> 00:24:31,440
were in the last minute or so i was sort

722
00:24:35,029 --> 00:24:33,200
of surprised i didn't have butterflies

723
00:24:36,950 --> 00:24:35,039
and that i was scared

724
00:24:38,310 --> 00:24:36,960
or anything like that it was just okay

725
00:24:40,630 --> 00:24:38,320
we've trained for this we know what to

726
00:24:42,630 --> 00:24:40,640
do we're going to go

727
00:24:45,029 --> 00:24:42,640
six or so seconds before launch the main

728
00:24:46,710 --> 00:24:45,039
engine started and the vehicle really

729
00:24:48,230 --> 00:24:46,720
came alive i mean there were just

730
00:24:50,549 --> 00:24:48,240
enormous numbers of

731
00:24:52,230 --> 00:24:50,559
vibrations you could feel resonances and

732
00:24:53,110 --> 00:24:52,240
uh waves traveling up and down the

733
00:24:57,590 --> 00:24:53,120
vehicle

734
00:24:59,269 --> 00:24:57,600
other space shuttles and more flexible

735
00:25:02,230 --> 00:24:59,279
you could really feel the what's called

736
00:25:04,070 --> 00:25:02,240
the twang you could feel that because

737
00:25:05,830 --> 00:25:04,080
the crew and you know we're up in the

738
00:25:09,190 --> 00:25:05,840

cabin which is far away from the hold

739
00:25:11,269 --> 00:25:09,200
down posts and so you really feel the

740
00:25:13,029 --> 00:25:11,279
vehicle going and as it came back to

741
00:25:14,710 --> 00:25:13,039
vertical sure enough the solid rockets

742
00:25:17,190 --> 00:25:14,720
lit off and then it felt like a train

743
00:25:18,870 --> 00:25:17,200
wreck i mean it was it felt like you're

744
00:25:20,710 --> 00:25:18,880
in a car and somebody hit you hard from

745
00:25:23,110 --> 00:25:20,720
behind in a big truck because the

746
00:25:25,669 --> 00:25:23,120
shuttle really leaps off the pad

747
00:25:27,110 --> 00:25:25,679
incredible amounts of vibration

748
00:25:29,590 --> 00:25:27,120
hard to say about noise you know we're

749
00:25:31,750 --> 00:25:29,600
wearing helmets it did get very noisy

750
00:25:33,909 --> 00:25:31,760
but we have the snoopy caps on with the

751
00:25:35,750 --> 00:25:33,919
ear cups a lot of noise isolation but

752
00:25:37,909 --> 00:25:35,760
you could definitely feel it in your

753
00:25:39,350 --> 00:25:37,919
body and

754
00:25:41,269 --> 00:25:39,360
you know through first stage you could

755
00:25:42,549 --> 00:25:41,279
hear the air sound

756
00:25:44,470 --> 00:25:42,559
going up through the atmosphere until

757
00:25:45,269 --> 00:25:44,480
about 60 thousand feet and it was sort

758
00:25:53,269 --> 00:25:45,279
of a

759
00:25:54,630 --> 00:25:53,279
combination of the the velocity

760
00:25:58,230 --> 00:25:54,640
as you go through the atmosphere and the

761
00:26:01,269 --> 00:25:58,240
density out atmosphere decreasing

762
00:26:03,350 --> 00:26:01,279
a lot of uh strange kind of

763
00:26:04,630 --> 00:26:03,360

oscillations as we went through maximum

764
00:26:06,390 --> 00:26:04,640
dynamic pressure as we were going

765
00:26:08,070 --> 00:26:06,400
through the speed of sound

766
00:26:11,029 --> 00:26:08,080
and then all of that kind of started

767
00:26:13,190 --> 00:26:11,039
down in volume and vibrations as we got

768
00:26:14,710 --> 00:26:13,200
higher in the atmosphere

769
00:26:16,149 --> 00:26:14,720
then a little bit of a pause solid

770
00:26:17,350 --> 00:26:16,159
rocket motors come off and then it got

771
00:26:19,669 --> 00:26:17,360
very smooth

772
00:26:22,390 --> 00:26:19,679
for the ride to orbit and then the best

773
00:26:24,230 --> 00:26:22,400
part main engine cut off and suddenly

774
00:26:25,029 --> 00:26:24,240
you know just like turning on or off a

775
00:26:26,549 --> 00:26:25,039
light

776
00:26:29,750 --> 00:26:26,559
we're floating

777
00:26:33,990 --> 00:26:29,760
and just just a great feeling

778
00:26:38,870 --> 00:26:34,870
and

779
00:26:40,950 --> 00:26:38,880
uh you know when i wanted to become an

780
00:26:42,710 --> 00:26:40,960
astronaut it was to go to the moon

781
00:26:45,350 --> 00:26:42,720
because that was the big thing

782
00:26:47,110 --> 00:26:45,360
uh you know i had dreams about you know

783
00:26:49,590 --> 00:26:47,120
exploring the moon and you know doing

784
00:26:51,269 --> 00:26:49,600
that doing the hopping uh and and i just

785
00:26:53,110 --> 00:26:51,279
imagined that by the time i was an adult

786
00:26:55,669 --> 00:26:53,120
we'd have space stations

787
00:26:57,430 --> 00:26:55,679
arthur c clark 2001 a space odyssey that

788
00:26:59,590 --> 00:26:57,440

we would have encampments on the moon

789
00:27:01,590 --> 00:26:59,600
and that would be going on to mars and

790
00:27:03,430 --> 00:27:01,600
it's just thrilling today

791
00:27:05,990 --> 00:27:03,440
to be able to be on the cusp of having

792
00:27:07,510 --> 00:27:06,000
lady going to the moon we had the grail

793
00:27:09,110 --> 00:27:07,520
mission which was very successful we

794
00:27:10,230 --> 00:27:09,120
have the lunar reconnaissance orbiter

795
00:27:12,789 --> 00:27:10,240
around the moon we're learning an

796
00:27:14,950 --> 00:27:12,799
enormous amount of our partner

797
00:27:16,789 --> 00:27:14,960
here around the earth we have curiosity

798
00:27:19,830 --> 00:27:16,799
and opportunity and mars reconnaissance

799
00:27:21,510 --> 00:27:19,840
orbiter on mars so even though you know

800
00:27:23,510 --> 00:27:21,520
i didn't get to go to the moon or to

801
00:27:25,350 --> 00:27:23,520
mars uh you know i know that young

802
00:27:27,669 --> 00:27:25,360
people today can aspire to that because

803
00:27:29,190 --> 00:27:27,679
we will be going back uh and we are

804
00:27:31,350 --> 00:27:29,200
going to be exploring mars we're just

805
00:27:33,990 --> 00:27:31,360
about to uh release an announcement of

806
00:27:36,789 --> 00:27:34,000
opportunity for instruments for a 2020

807
00:27:40,630 --> 00:27:36,799
rover that will be like curiosity but

808
00:27:42,789 --> 00:27:40,640
the next generation of mars exploration

809
00:27:44,310 --> 00:27:42,799
so we have a lot of stuff going on maven

810
00:27:47,830 --> 00:27:44,320
in november we're going to launch maven

811
00:27:49,590 --> 00:27:47,840
to mars so in effect we are all going to

812
00:27:51,669 --> 00:27:49,600
the moon with lady we are all going to

813
00:27:53,669 --> 00:27:51,679

mars and i just want to remind everyone

814
00:27:55,990 --> 00:27:53,679
that lady

815
00:27:58,149 --> 00:27:56,000
curiosity on mars they're robots they

816
00:27:59,590 --> 00:27:58,159
don't discover things people do and i

817
00:28:00,710 --> 00:27:59,600
encourage you to talk to the science

818
00:28:02,549 --> 00:28:00,720
teams i know we're going to have some

819
00:28:05,269 --> 00:28:02,559
nasa socials

820
00:28:07,750 --> 00:28:05,279
with with other you know scientists here

821
00:28:09,430 --> 00:28:07,760
and you know it's exciting you know find

822
00:28:12,950 --> 00:28:09,440
out what what they expect to get out of

823
00:28:14,710 --> 00:28:12,960
lady and and then hang on to the mission

824
00:28:17,350 --> 00:28:14,720
and find out what lady really discovers

825
00:28:25,110 --> 00:28:17,360
with uh from the science team members

826
00:28:28,789 --> 00:28:26,789
thank you very much for uh folks who

827
00:28:32,870 --> 00:28:28,799
don't know john is on twitter you can

828
00:28:34,389 --> 00:28:32,880
find him at sciastro s-c-i-a-s-t-r-o

829
00:28:36,389 --> 00:28:34,399
um and so you're welcome to follow him

830
00:28:37,669 --> 00:28:36,399
there and everything so as he alluded to

831
00:28:39,110 --> 00:28:37,679
though there's some pretty awesome

832
00:28:40,470 --> 00:28:39,120
people behind this mission and we're

833
00:28:43,590 --> 00:28:40,480
getting ready to hear from one of them

834
00:28:46,710 --> 00:28:43,600
uh she is the program scientist for this

835
00:28:48,950 --> 00:28:46,720
mission and her name is as excuse me

836
00:28:51,269 --> 00:28:48,960
here her name is uh sarah noble and she

837
00:28:52,710 --> 00:28:51,279
works at nasa headquarters on um this

838
00:28:53,990 --> 00:28:52,720

mission and will tell you a little bit

839
00:28:55,909 --> 00:28:54,000
about all of the neat things that

840
00:28:58,470 --> 00:28:55,919
they're either hoping to find expecting

841
00:29:03,590 --> 00:28:58,480
to find or maybe the unknown unknowns

842
00:29:07,029 --> 00:29:05,750
thanks jason

843
00:29:09,269 --> 00:29:07,039
good morning guys how are you all doing

844
00:29:11,110 --> 00:29:09,279
today is everybody excited to be here

845
00:29:12,710 --> 00:29:11,120
i can tell you that i'm really excited

846
00:29:14,470 --> 00:29:12,720
to be here this is actually my first

847
00:29:15,830 --> 00:29:14,480
mission we talk about ladies this

848
00:29:17,669 --> 00:29:15,840
mission of firsts and i would like to

849
00:29:18,950 --> 00:29:17,679
add to that this is my first mission

850
00:29:20,870 --> 00:29:18,960
i've been studying the moon for a really

851
00:29:22,230 --> 00:29:20,880
long time but but you know now is

852
00:29:24,789 --> 00:29:22,240
actually an opportunity to get to go

853
00:29:26,470 --> 00:29:24,799
there sort of virtually but still so i'm

854
00:29:28,389 --> 00:29:26,480
really i'm sort of equal parts excited

855
00:29:29,750 --> 00:29:28,399
and terrified at this point but excited

856
00:29:31,029 --> 00:29:29,760
sort of winning out

857
00:29:32,789 --> 00:29:31,039
um i was asked to talk to you guys a

858
00:29:34,389 --> 00:29:32,799
little bit today about the science that

859
00:29:35,510 --> 00:29:34,399
lady is going to do well while we're up

860
00:29:36,870 --> 00:29:35,520
there

861
00:29:38,630 --> 00:29:36,880
as you might have guessed from the name

862
00:29:40,630 --> 00:29:38,640
of the mission the lunar atmosphere and

863
00:29:41,990 --> 00:29:40,640

dust environment explorer we have two

864
00:29:44,470 --> 00:29:42,000
science goals we're going to study the

865
00:29:46,710 --> 00:29:44,480
lunar atmosphere and also the dust

866
00:29:47,909 --> 00:29:46,720
environment around the moon

867
00:29:49,110 --> 00:29:47,919
i want to talk to you a little bit about

868
00:29:50,549 --> 00:29:49,120
the lunar atmosphere because i think

869
00:29:51,909 --> 00:29:50,559
sometimes people get a little confused

870
00:29:53,830 --> 00:29:51,919
when we start talking about a lunar

871
00:29:55,350 --> 00:29:53,840
atmosphere because did you all not learn

872
00:29:56,870 --> 00:29:55,360
in school that the moon doesn't have an

873
00:29:57,669 --> 00:29:56,880
atmosphere right

874
00:30:00,310 --> 00:29:57,679
yes

875
00:30:02,070 --> 00:30:00,320
it does have an atmosphere it's really

876
00:30:03,909 --> 00:30:02,080
really really thin it's something like

877
00:30:06,630 --> 00:30:03,919
10 trillion times thinner than the

878
00:30:08,389 --> 00:30:06,640
earth's atmosphere it's so thin that the

879
00:30:10,549 --> 00:30:08,399
the molecules that make up the

880
00:30:12,149 --> 00:30:10,559
atmosphere are so few and far between

881
00:30:13,430 --> 00:30:12,159
that they don't interact with each other

882
00:30:14,870 --> 00:30:13,440
they never collide like in our

883
00:30:17,110 --> 00:30:14,880
atmosphere they're constantly colliding

884
00:30:19,990 --> 00:30:17,120
that's what gives us air pressure

885
00:30:21,990 --> 00:30:20,000
on the moon they never collide um

886
00:30:23,110 --> 00:30:22,000
this is something we call an exosphere

887
00:30:25,110 --> 00:30:23,120
there's a technical term for it

888
00:30:26,549 --> 00:30:25,120

exosphere and the earth actually does

889
00:30:28,470 --> 00:30:26,559
have an exosphere too but in fact you

890
00:30:30,070 --> 00:30:28,480
have to get up past where the space

891
00:30:31,669 --> 00:30:30,080
station orbits before you get to this

892
00:30:33,029 --> 00:30:31,679
environment where it's so thin that

893
00:30:34,870 --> 00:30:33,039
molecules don't collide you can call it

894
00:30:36,070 --> 00:30:34,880
an exosphere but on the moon that

895
00:30:37,990 --> 00:30:36,080
actually happens right down at the

896
00:30:40,230 --> 00:30:38,000
surface so we call that here's the

897
00:30:41,990 --> 00:30:40,240
technical term a surface boundary

898
00:30:43,590 --> 00:30:42,000
exosphere

899
00:30:45,110 --> 00:30:43,600
we like to name things in in science

900
00:30:46,389 --> 00:30:45,120
right so this is what we call a surface

901
00:30:48,070 --> 00:30:46,399
boundary accessory or we like to use

902
00:30:50,789 --> 00:30:48,080
acronyms and sbe

903
00:30:52,070 --> 00:30:50,799
right and it turns out that sbe surface

904
00:30:54,070 --> 00:30:52,080
boundary exospheres are actually the

905
00:30:55,430 --> 00:30:54,080
most common type of atmosphere we have

906
00:30:57,590 --> 00:30:55,440
in our solar system it's not just the

907
00:30:58,870 --> 00:30:57,600
moon but also mercury uh we've been

908
00:31:00,470 --> 00:30:58,880
studying that with the messenger mission

909
00:31:02,789 --> 00:31:00,480
for a while now

910
00:31:04,389 --> 00:31:02,799
a lot of the moons of other planets a

911
00:31:05,590 --> 00:31:04,399
lot of the moons of jupiter and saturn

912
00:31:08,149 --> 00:31:05,600
and some of the other outer moons out

913
00:31:09,990 --> 00:31:08,159

there even some of our larger

914
00:31:11,510 --> 00:31:10,000
asteroids and kuiper belt objects

915
00:31:13,430 --> 00:31:11,520
actually are big enough to have what we

916
00:31:14,630 --> 00:31:13,440
call a surface boundary exosphere so one

917
00:31:15,830 --> 00:31:14,640
of the cool things about ladies that

918
00:31:16,950 --> 00:31:15,840
we're not only going to learn about the

919
00:31:18,070 --> 00:31:16,960
moon when we go there but we're going

920
00:31:20,230 --> 00:31:18,080
gonna actually learn about this whole

921
00:31:22,149 --> 00:31:20,240
class of atmosphere which is something

922
00:31:23,029 --> 00:31:22,159
we don't know a lot about right now and

923
00:31:28,310 --> 00:31:23,039
so

924
00:31:31,110 --> 00:31:28,320
get to and we can learn about the entire

925
00:31:33,510 --> 00:31:31,120
solar system from from just studying

926
00:31:34,870 --> 00:31:33,520
in our local neighborhood

927
00:31:36,470 --> 00:31:34,880
the other thing that we're going to look

928
00:31:38,149 --> 00:31:36,480
at is the dust environment and we've

929
00:31:39,590 --> 00:31:38,159
been really curious about the dust

930
00:31:42,310 --> 00:31:39,600
environment around the moon for quite a

931
00:31:43,990 --> 00:31:42,320
while it's even before apollo we had

932
00:31:45,830 --> 00:31:44,000
these weird hints from from some of the

933
00:31:47,669 --> 00:31:45,840
earlier some of the surveyor landers

934
00:31:49,750 --> 00:31:47,679
that saw this strange glow on the

935
00:31:51,990 --> 00:31:49,760
horizon and we don't know what's causing

936
00:31:52,789 --> 00:31:52,000
it the atmosphere should be too thin to

937
00:31:54,230 --> 00:31:52,799
be

938
00:31:55,830 --> 00:31:54,240

scattering light in such a way that

939
00:31:58,389 --> 00:31:55,840
would make that glow so we think it

940
00:32:00,149 --> 00:31:58,399
might be dust right so now is finally

941
00:32:01,830 --> 00:32:00,159
our opportunity to go and see this and

942
00:32:03,269 --> 00:32:01,840
see it and confirm whether or not that's

943
00:32:05,110 --> 00:32:03,279
dust

944
00:32:07,029 --> 00:32:05,120
the apollo astronauts sort of saw the

945
00:32:09,029 --> 00:32:07,039
same horizon glow as well

946
00:32:11,350 --> 00:32:09,039
and so we think that again that they

947
00:32:12,389 --> 00:32:11,360
they maybe saw something

948
00:32:14,389 --> 00:32:12,399
that was

949
00:32:15,830 --> 00:32:14,399
you know dust on the horizon

950
00:32:17,830 --> 00:32:15,840
we're not sure it seems like there's

951
00:32:19,430 --> 00:32:17,840
some sort of way to get dust lofted up

952
00:32:21,590 --> 00:32:19,440
into the atmosphere and finally our

953
00:32:23,750 --> 00:32:21,600
opportunity to go and and prove them

954
00:32:24,870 --> 00:32:23,760
right or wrong so we're really excited

955
00:32:25,669 --> 00:32:24,880
about that

956
00:32:27,750 --> 00:32:25,679
um

957
00:32:29,509 --> 00:32:27,760
i just i just left the science team

958
00:32:31,110 --> 00:32:29,519
they're meeting this morning this is uh

959
00:32:33,029 --> 00:32:31,120
their last chance before the mission

960
00:32:34,870 --> 00:32:33,039
heads up to get together and make sure

961
00:32:37,430 --> 00:32:34,880
that they've got everything ready this

962
00:32:39,430 --> 00:32:37,440
is a this is a short mission ladies only

963
00:32:40,789 --> 00:32:39,440

a hundred days of science so we we get

964
00:32:41,990 --> 00:32:40,799
to the moon takes us about a month to

965
00:32:43,430 --> 00:32:42,000
get to the moon we have about a month to

966
00:32:45,430 --> 00:32:43,440
check out our instruments and whatnot

967
00:32:47,430 --> 00:32:45,440
and then we have 100 days to do science

968
00:32:48,549 --> 00:32:47,440
which is really short and so we have to

969
00:32:50,070 --> 00:32:48,559
be ready to hit the ground running so

970
00:32:51,909 --> 00:32:50,080
they are off right now making sure that

971
00:32:53,590 --> 00:32:51,919
they are ready to hit the ground running

972
00:32:55,669 --> 00:32:53,600
and and get every ounce of science out

973
00:32:57,590 --> 00:32:55,679
of this mission that they can

974
00:32:58,630 --> 00:32:57,600
and they're really excited too so it's

975
00:33:00,310 --> 00:32:58,640
going to be it's going to be a really

976
00:33:02,310 --> 00:33:00,320
great mission we are all really looking

977
00:33:03,669 --> 00:33:02,320
forward to to getting her off the ground

978
00:33:06,549 --> 00:33:03,679
and on her way to the moon where she can

979
00:33:07,750 --> 00:33:06,559
she can do some really cool things

980
00:33:09,750 --> 00:33:07,760
um

981
00:33:11,909 --> 00:33:09,760
i don't want to talk too long do can we

982
00:33:13,590 --> 00:33:11,919
take questions

983
00:33:22,789 --> 00:33:13,600
okay

984
00:33:27,350 --> 00:33:24,470
hey thanks um i'm actually posing a

985
00:33:29,830 --> 00:33:27,360
question um from the reddit r space

986
00:33:32,230 --> 00:33:29,840
subreddit um they were wanting to know

987
00:33:35,990 --> 00:33:32,240
as far as the communications testing on

988
00:33:38,389 --> 00:33:36,000

the latte uh if the 622

989
00:33:39,269 --> 00:33:38,399
megabit data link so the data link goes

990
00:33:41,990 --> 00:33:39,279
well

991
00:33:44,549 --> 00:33:42,000
um what are nasa's plans of using that

992
00:33:46,630 --> 00:33:44,559
technology for hd streaming of video

993
00:33:48,870 --> 00:33:46,640
feeds from deep space you know far as in

994
00:33:50,710 --> 00:33:48,880
orbit or from mars or even those

995
00:33:54,389 --> 00:33:50,720
asteroids that you spoke of

996
00:33:56,710 --> 00:33:54,399
that was actually uh by user jjr so uh

997
00:33:58,549 --> 00:33:56,720
thanks to jjr for fantastic wanting to

998
00:33:59,830 --> 00:33:58,559
know what's up okay so the the laser

999
00:34:01,110 --> 00:33:59,840
communication i which i didn't talk

1000
00:34:02,389 --> 00:34:01,120
about it's actually not one of the

1001
00:34:03,990 --> 00:34:02,399
science instruments but there's a

1002
00:34:06,630 --> 00:34:04,000
there's a demonstration on laddie that

1003
00:34:08,629 --> 00:34:06,640
is testing out whether we can use lasers

1004
00:34:11,669 --> 00:34:08,639
rather than radio signals to communicate

1005
00:34:14,230 --> 00:34:11,679
back and forth and 66 22 megabits per

1006
00:34:16,230 --> 00:34:14,240
second whatever is about six times what

1007
00:34:17,829 --> 00:34:16,240
we can get right now

1008
00:34:19,270 --> 00:34:17,839
so we can get much faster data rates

1009
00:34:21,109 --> 00:34:19,280
which is awesome we all want more data

1010
00:34:23,430 --> 00:34:21,119
scientists we believe me we will take

1011
00:34:25,109 --> 00:34:23,440
every megabit you can get us right

1012
00:34:27,510 --> 00:34:25,119
so we're really looking forward to

1013
00:34:29,669 --> 00:34:27,520

working on that technology

1014
00:34:31,990 --> 00:34:29,679
we're not really using it on lady for

1015
00:34:33,829 --> 00:34:32,000
our data it's just a test here

1016
00:34:35,430 --> 00:34:33,839
so we're going to use it on test it out

1017
00:34:37,909 --> 00:34:35,440
here and so that future missions we

1018
00:34:40,069 --> 00:34:37,919
might be able to put it on spacecraft

1019
00:34:41,669 --> 00:34:40,079
and which yeah which leading to things

1020
00:34:44,389 --> 00:34:41,679
like hd level

1021
00:34:46,550 --> 00:34:44,399
quality uh you know again more data is

1022
00:34:48,470 --> 00:34:46,560
better data so so we are looking forward

1023
00:34:53,430 --> 00:34:48,480
to developing this technology but we're

1024
00:34:59,349 --> 00:34:56,470
uh there is uh this is uh again not not

1025
00:35:01,109 --> 00:34:59,359
my not not my area but there is that

1026
00:35:08,870 --> 00:35:01,119
thank thank you

1027
00:35:13,109 --> 00:35:11,670
hi sarah um what can studying the moon's

1028
00:35:15,190 --> 00:35:13,119
atmosphere tell us about our own

1029
00:35:17,430 --> 00:35:15,200
atmosphere and what we can get it from

1030
00:35:19,750 --> 00:35:17,440
that so the moon's atmosphere is pretty

1031
00:35:21,349 --> 00:35:19,760
different from our atmosphere as i said

1032
00:35:23,670 --> 00:35:21,359
we're something like 10 trillion times

1033
00:35:25,030 --> 00:35:23,680
thicker and the sources of of things in

1034
00:35:26,710 --> 00:35:25,040
our atmosphere are quite different than

1035
00:35:29,430 --> 00:35:26,720
where we get sources from the moon the

1036
00:35:31,109 --> 00:35:29,440
moon's atmosphere comes largely from um

1037
00:35:33,349 --> 00:35:31,119
interaction with with particles from the

1038
00:35:34,470 --> 00:35:33,359

sun sputtering different elements off

1039
00:35:37,910 --> 00:35:34,480
into the atmosphere as well as

1040
00:35:39,430 --> 00:35:37,920
outgassing um argon that that is created

1041
00:35:41,910 --> 00:35:39,440
radioactively under the surface and sort

1042
00:35:44,069 --> 00:35:41,920
of makes its way out uh so the processes

1043
00:35:45,829 --> 00:35:44,079
are pretty are pretty different

1044
00:35:48,150 --> 00:35:45,839
as i said that the earth does have an

1045
00:35:49,510 --> 00:35:48,160
exosphere and so sort of understanding

1046
00:35:51,510 --> 00:35:49,520
some of the physics of how things

1047
00:35:53,430 --> 00:35:51,520
interact in an exosphere we might be

1048
00:35:55,750 --> 00:35:53,440
able to learn but the the bigger key

1049
00:35:57,589 --> 00:35:55,760
point is that is that atmospheres are

1050
00:35:59,270 --> 00:35:57,599
really really complicated and we don't

1051
00:36:01,670 --> 00:35:59,280
actually understand how any of them work

1052
00:36:03,030 --> 00:36:01,680
very well so these kinds of atmospheres

1053
00:36:04,310 --> 00:36:03,040
these exospheres surface boundary

1054
00:36:05,750 --> 00:36:04,320
exospheres

1055
00:36:08,069 --> 00:36:05,760
are sort of the simplest class of

1056
00:36:10,150 --> 00:36:08,079
atmosphere so by learning how these

1057
00:36:11,510 --> 00:36:10,160
atmospheres work better we can sort of

1058
00:36:18,470 --> 00:36:11,520
start to apply that to more and more

1059
00:36:23,270 --> 00:36:20,310
i have a question about how will the

1060
00:36:24,390 --> 00:36:23,280
science operations between lady and

1061
00:36:27,190 --> 00:36:24,400
other

1062
00:36:29,990 --> 00:36:27,200
lunar missions right now uh overlap one

1063
00:36:31,109 --> 00:36:30,000

another will it be any compliment or

1064
00:36:32,470 --> 00:36:31,119
signs to be clean from both

1065
00:36:34,710 --> 00:36:32,480
simultaneously great question we are

1066
00:36:36,390 --> 00:36:34,720
actually talking to the other teams so

1067
00:36:37,829 --> 00:36:36,400
uh i don't know you guys you guys are

1068
00:36:39,349 --> 00:36:37,839
probably aware of these things but maybe

1069
00:36:40,950 --> 00:36:39,359
the general public is not that there are

1070
00:36:42,870 --> 00:36:40,960
actually three other spacecraft orbiting

1071
00:36:44,230 --> 00:36:42,880
the moon right now so there's the lunar

1072
00:36:46,390 --> 00:36:44,240
reconnaissance orbiter that's been up

1073
00:36:47,829 --> 00:36:46,400
there for a number of years um doing a

1074
00:36:50,790 --> 00:36:47,839
great job and we've been talking with

1075
00:36:52,790 --> 00:36:50,800
that team quite a bit about things ways

1076
00:36:54,470 --> 00:36:52,800
that we might interact with each other

1077
00:36:57,109 --> 00:36:54,480
and build off of each other

1078
00:36:59,270 --> 00:36:57,119
uh there's also a space uh two tiny

1079
00:37:01,109 --> 00:36:59,280
little spacecraft called artemis

1080
00:37:03,270 --> 00:37:01,119
has anybody here ever heard of artemis

1081
00:37:05,750 --> 00:37:03,280
oh good look at you guys you are on top

1082
00:37:07,349 --> 00:37:05,760
of these things yes so artemis is a is a

1083
00:37:09,430 --> 00:37:07,359
continuation of a mission that was

1084
00:37:11,190 --> 00:37:09,440
studying the sun called themis

1085
00:37:12,870 --> 00:37:11,200
uh themis had five little tiny

1086
00:37:15,190 --> 00:37:12,880
spacecraft that were studying how how

1087
00:37:17,589 --> 00:37:15,200
the sun uh how the sun interacts with

1088
00:37:19,109 --> 00:37:17,599

the earth and and as that one finished

1089
00:37:20,710 --> 00:37:19,119
mission finish they moved two of those

1090
00:37:22,390 --> 00:37:20,720
spacecraft around the moon to understand

1091
00:37:24,790 --> 00:37:22,400
how the moon interacts with the sun

1092
00:37:26,390 --> 00:37:24,800
which is great for us because the sun is

1093
00:37:28,550 --> 00:37:26,400
one of the big inputs into both this

1094
00:37:29,430 --> 00:37:28,560
dust atmosphere and the solar wind and

1095
00:37:32,310 --> 00:37:29,440
so

1096
00:37:34,150 --> 00:37:32,320
give us space weather reports and tell

1097
00:37:35,750 --> 00:37:34,160
us how the sun is doing as we go through

1098
00:37:37,510 --> 00:37:35,760
the mission how active is it what's

1099
00:37:39,589 --> 00:37:37,520
going on with the sun and that will help

1100
00:37:40,950 --> 00:37:39,599
us understand how the sun is interacting

1101
00:37:42,710 --> 00:37:40,960
with the lunar atmosphere so we're

1102
00:37:44,230 --> 00:37:42,720
actually talking a lot we've got some

1103
00:37:45,430 --> 00:37:44,240
coordination between the teams to to

1104
00:37:51,109 --> 00:37:45,440
make sure that we can maximize the

1105
00:37:55,670 --> 00:37:54,230
um in 2009 uh the l cross mission found

1106
00:37:57,190 --> 00:37:55,680
water on the south pole of the moon and

1107
00:37:59,030 --> 00:37:57,200
there was a lot of discussion at that

1108
00:38:00,230 --> 00:37:59,040
time and immediately thereafter talking

1109
00:38:03,589 --> 00:38:00,240
about

1110
00:38:05,190 --> 00:38:03,599
water cycles on the moon is there any uh

1111
00:38:06,790 --> 00:38:05,200
investigations that ladies going to do

1112
00:38:10,390 --> 00:38:06,800
with any of its instruments that it's

1113
00:38:13,990 --> 00:38:10,400

looking at uh how that kind of material

1114
00:38:15,670 --> 00:38:14,000
migrates uh around the moon

1115
00:38:18,069 --> 00:38:15,680
the goals of the mission is to try to

1116
00:38:21,030 --> 00:38:18,079
understand that the water cycle on the

1117
00:38:23,190 --> 00:38:21,040
moon so uh the solar wind

1118
00:38:24,790 --> 00:38:23,200
implants hydrogen has a lot of hydrogen

1119
00:38:26,550 --> 00:38:24,800
in it which gets hits the surface and

1120
00:38:27,589 --> 00:38:26,560
interacts with the with the material on

1121
00:38:29,910 --> 00:38:27,599
the ground

1122
00:38:32,390 --> 00:38:29,920
we think they're it's creating hydroxyls

1123
00:38:33,910 --> 00:38:32,400
ho molecules that bounce around they

1124
00:38:35,589 --> 00:38:33,920
don't stick very well they sort of

1125
00:38:37,190 --> 00:38:35,599
bounce around and eventually we think

1126
00:38:39,349 --> 00:38:37,200
they eventually bounce to the poles and

1127
00:38:41,670 --> 00:38:39,359
get stuck there that's what what l cross

1128
00:38:42,710 --> 00:38:41,680
was seeing in the polls and so we'll be

1129
00:38:44,870 --> 00:38:42,720
actually able to see the sort of

1130
00:38:46,550 --> 00:38:44,880
bouncing around near the equator we are

1131
00:38:48,390 --> 00:38:46,560
in an equatorial orbit so we don't go

1132
00:38:49,829 --> 00:38:48,400
over the pole but we can see what's

1133
00:38:51,589 --> 00:38:49,839
bouncing around

1134
00:38:53,589 --> 00:38:51,599
as we fly around the equator and so that

1135
00:38:55,510 --> 00:38:53,599
will give us a lot of clues into into

1136
00:38:57,589 --> 00:38:55,520
how this hopping that we think is going

1137
00:38:58,710 --> 00:38:57,599
on actually happens

1138
00:39:00,470 --> 00:38:58,720

yeah

1139
00:39:01,190 --> 00:39:00,480
oh sorry

1140
00:39:02,230 --> 00:39:01,200
hi

1141
00:39:04,550 --> 00:39:02,240
the uh

1142
00:39:07,190 --> 00:39:04,560
couple of the elsa experiments looked at

1143
00:39:08,870 --> 00:39:07,200
uh lunar dust and atmosphere will those

1144
00:39:11,030 --> 00:39:08,880
data sets be

1145
00:39:12,790 --> 00:39:11,040
usable to give us like a timeline of

1146
00:39:15,990 --> 00:39:12,800
what's happened over the years

1147
00:39:18,630 --> 00:39:16,000
a couple of the lsip packages yeah

1148
00:39:23,750 --> 00:39:21,750
we do have yes that data is around um we

1149
00:39:25,430 --> 00:39:23,760
have been comparing it so there was a

1150
00:39:27,510 --> 00:39:25,440
couple of experiments on apollo that

1151
00:39:28,950 --> 00:39:27,520
looked at atmosphere there's one called

1152
00:39:31,349 --> 00:39:28,960
lem the lunar

1153
00:39:33,589 --> 00:39:31,359
atmosphere

1154
00:39:36,630 --> 00:39:33,599
lunar ejecta it was looking at

1155
00:39:38,069 --> 00:39:36,640
micrometeorite impacts um onto the onto

1156
00:39:39,829 --> 00:39:38,079
the surface

1157
00:39:42,950 --> 00:39:39,839
and actually what they found

1158
00:39:45,270 --> 00:39:42,960
was was actually these weird spikes uh

1159
00:39:47,190 --> 00:39:45,280
at sunset and sunrise

1160
00:39:48,310 --> 00:39:47,200
rather than the sort of steady stream of

1161
00:39:51,030 --> 00:39:48,320
my communities and what they think they

1162
00:39:51,990 --> 00:39:51,040
actually saw was the dust moving around

1163
00:39:54,870 --> 00:39:52,000

uh

1164
00:39:56,790 --> 00:39:54,880
it and and it sort of seems to peak

1165
00:39:58,870 --> 00:39:56,800
right when you turn from light to dark

1166
00:40:00,069 --> 00:39:58,880
and dark to light

1167
00:40:01,990 --> 00:40:00,079
because of

1168
00:40:03,589 --> 00:40:02,000
the mechanics of the way that the moon

1169
00:40:05,589 --> 00:40:03,599
interacts with the sun so it charges

1170
00:40:07,910 --> 00:40:05,599
positively on its front side on its day

1171
00:40:09,670 --> 00:40:07,920
side and negatively on its on its night

1172
00:40:11,750 --> 00:40:09,680
side and so right when you cross the

1173
00:40:13,510 --> 00:40:11,760
terminator when you go from day to night

1174
00:40:16,230 --> 00:40:13,520
uh there's a charge imbalance and so we

1175
00:40:18,710 --> 00:40:16,240
think that it it causes dust to

1176
00:40:21,109 --> 00:40:18,720
loft up uh as it's trying to balance

1177
00:40:23,430 --> 00:40:21,119
itself charge wise uh the other

1178
00:40:25,589 --> 00:40:23,440
experiment was looking at the atmosphere

1179
00:40:28,870 --> 00:40:25,599
it's called lace i believe was looking

1180
00:40:30,950 --> 00:40:28,880
at the atmospheric components uh and and

1181
00:40:32,470 --> 00:40:30,960
it's interesting because they've found

1182
00:40:35,270 --> 00:40:32,480
uh

1183
00:40:37,430 --> 00:40:35,280
lro has also been looking sort of at the

1184
00:40:39,670 --> 00:40:37,440
atmosphere in various ways it can't do

1185
00:40:41,750 --> 00:40:39,680
it as directly as as ladie is designed

1186
00:40:43,430 --> 00:40:41,760
to but they have found really some

1187
00:40:45,109 --> 00:40:43,440
innovative ways to look at the

1188
00:40:47,030 --> 00:40:45,119

atmosphere and they've actually seen

1189
00:40:48,390 --> 00:40:47,040
some different results than we saw on

1190
00:40:49,829 --> 00:40:48,400
apollo and so there's some some

1191
00:40:51,190 --> 00:40:49,839
interesting we're debating about whether

1192
00:40:52,790 --> 00:40:51,200
that's

1193
00:40:54,150 --> 00:40:52,800
because of the difference in looking at

1194
00:40:55,430 --> 00:40:54,160
from the ground versus the air or

1195
00:40:57,510 --> 00:40:55,440
whether that's something that has

1196
00:40:58,870 --> 00:40:57,520
stopped happening since since the apollo

1197
00:41:00,309 --> 00:40:58,880
days or there was something weird going

1198
00:41:02,230 --> 00:41:00,319
on during apollo so there's all sorts of

1199
00:41:04,150 --> 00:41:02,240
interesting questions we have that we

1200
00:41:05,990 --> 00:41:04,160
want to compare what was going on in

1201
00:41:07,430 --> 00:41:06,000
apollo to what we're seeing today so we

1202
00:41:10,150 --> 00:41:07,440
are very excited to actually be able to

1203
00:41:16,150 --> 00:41:12,230
that's all we have right now but we'll

1204
00:41:20,230 --> 00:41:18,950
thank you guys very much thank you sarah

1205
00:41:21,349 --> 00:41:20,240
so you've heard a little bit about the

1206
00:41:22,470 --> 00:41:21,359
science of the mission now we're going

1207
00:41:24,390 --> 00:41:22,480
to talk a little bit about the actual

1208
00:41:26,309 --> 00:41:24,400
spacecraft itself i'd like to welcome

1209
00:41:27,990 --> 00:41:26,319
bob barber he comes from nasa's ames

1210
00:41:31,829 --> 00:41:28,000
research center and he's the spacecraft

1211
00:41:34,950 --> 00:41:32,829
thank you

1212
00:41:36,710 --> 00:41:34,960
jason uh good morning everyone it's

1213
00:41:38,710 --> 00:41:36,720

great to be here today it was really

1214
00:41:41,109 --> 00:41:38,720
great to hear your introductions during

1215
00:41:43,510 --> 00:41:41,119
the social and and i think uh your

1216
00:41:45,510 --> 00:41:43,520
passion for this mission is and for

1217
00:41:47,510 --> 00:41:45,520
nasa's shared by the latte team and

1218
00:41:48,790 --> 00:41:47,520
we're great to have you here today i'm

1219
00:41:50,870 --> 00:41:48,800
going to talk a little bit about the

1220
00:41:52,790 --> 00:41:50,880
spacecraft today one of the things i

1221
00:41:54,790 --> 00:41:52,800
want to go over is i'll be pointing to

1222
00:41:56,710 --> 00:41:54,800
this model a lot to go over the

1223
00:41:58,790 --> 00:41:56,720
spacecraft

1224
00:42:01,750 --> 00:41:58,800
some of the key items and basic items

1225
00:42:04,550 --> 00:42:01,760
for a spacecraft is it's

1226
00:42:07,109 --> 00:42:04,560
feet tall and about 5.2 feet wide

1227
00:42:09,589 --> 00:42:07,119
essentially it's very close to these two

1228
00:42:13,750 --> 00:42:09,599
posters up here and similar in height

1229
00:42:16,710 --> 00:42:13,760
and width and that it weighs 835 pounds

1230
00:42:18,950 --> 00:42:16,720
that includes 297 pounds of fuel so

1231
00:42:21,829 --> 00:42:18,960
that's about more than a third of the

1232
00:42:23,990 --> 00:42:21,839
mass is the fuel and thinking about or

1233
00:42:25,670 --> 00:42:24,000
relating that to your car typically a

1234
00:42:28,230 --> 00:42:25,680
car's gas tank is only about three or

1235
00:42:30,150 --> 00:42:28,240
four percent of the mass of the car so

1236
00:42:32,710 --> 00:42:30,160
we carry a lot of fuel to get to the

1237
00:42:35,030 --> 00:42:32,720
moon it's a long drive

1238
00:42:36,950 --> 00:42:35,040

so we'll get in the other aspect i want

1239
00:42:38,790 --> 00:42:36,960
to as an overview is that we are

1240
00:42:41,270 --> 00:42:38,800
launching powered off

1241
00:42:43,349 --> 00:42:41,280
we're doing this primarily to reduce

1242
00:42:46,069 --> 00:42:43,359
safety concerns and then also reduce

1243
00:42:47,030 --> 00:42:46,079
complexity of the mission when we design

1244
00:42:49,030 --> 00:42:47,040
this

1245
00:42:50,470 --> 00:42:49,040
uh going over the kind of the the heart

1246
00:42:53,589 --> 00:42:50,480
of the spacecraft is really the

1247
00:42:57,990 --> 00:42:53,599
structure uh this is the main body here

1248
00:42:59,670 --> 00:42:58,000
uh this structure is a is a uh

1249
00:43:02,309 --> 00:42:59,680
carbon composite

1250
00:43:04,550 --> 00:43:02,319
structure that is a innovative design

1251
00:43:05,670 --> 00:43:04,560
that was performed by ames research

1252
00:43:08,870 --> 00:43:05,680
center

1253
00:43:10,630 --> 00:43:08,880
what this is is it's a modular concept

1254
00:43:13,349 --> 00:43:10,640
where there's if you see here there's

1255
00:43:14,309 --> 00:43:13,359
four modules it's a bus module there's

1256
00:43:20,790 --> 00:43:14,319
the

1257
00:43:23,190 --> 00:43:20,800
this is a

1258
00:43:26,309 --> 00:43:23,200
all these modules are formed by a single

1259
00:43:28,230 --> 00:43:26,319
mold and the innovative aspect of this

1260
00:43:31,349 --> 00:43:28,240
compared to most satellites most

1261
00:43:33,589 --> 00:43:31,359
spacecraft they build one structure that

1262
00:43:36,390 --> 00:43:33,599
houses everything because this is a

1263
00:43:38,630 --> 00:43:36,400

modular structure for future missions

1264
00:43:40,470 --> 00:43:38,640
you can combine these in different

1265
00:43:42,950 --> 00:43:40,480
fashions to make taller shorter

1266
00:43:44,630 --> 00:43:42,960
spacecraft you could also

1267
00:43:46,470 --> 00:43:44,640
potentially add

1268
00:43:48,309 --> 00:43:46,480
legs to this and make a lander out of

1269
00:43:50,390 --> 00:43:48,319
this so this is one of the important

1270
00:43:51,910 --> 00:43:50,400
innovative aspects of of the lady

1271
00:43:54,390 --> 00:43:51,920
mission

1272
00:43:57,349 --> 00:43:54,400
the other aspect of this main body here

1273
00:43:59,990 --> 00:43:57,359
is you see all these blue items on on

1274
00:44:02,470 --> 00:44:00,000
here uh each of those is a solar panel

1275
00:44:05,270 --> 00:44:02,480
we have 30 uh solar panels they're made

1276
00:44:07,030 --> 00:44:05,280
of also carbon composite uh the majority

1277
00:44:08,710 --> 00:44:07,040
of all of our structures carbon

1278
00:44:10,790 --> 00:44:08,720
composite

1279
00:44:12,790 --> 00:44:10,800
on that you have all the solar cells we

1280
00:44:15,349 --> 00:44:12,800
have over 1800 solar cells on the

1281
00:44:16,309 --> 00:44:15,359
spacecraft it generates a little bit

1282
00:44:18,390 --> 00:44:16,319
more than

1283
00:44:20,550 --> 00:44:18,400
300 watts of power

1284
00:44:22,630 --> 00:44:20,560
for that

1285
00:44:24,390 --> 00:44:22,640
also located around here we have what's

1286
00:44:27,030 --> 00:44:24,400
called coarse sun sensors and of course

1287
00:44:29,589 --> 00:44:27,040
sun sensors are used uh primarily

1288
00:44:31,510 --> 00:44:29,599

support our safe mode operations they

1289
00:44:33,990 --> 00:44:31,520
look for the sun find the sun let the

1290
00:44:35,750 --> 00:44:34,000
spacecraft know uh where the sun is so

1291
00:44:37,510 --> 00:44:35,760
it knows where it is in our safe mode

1292
00:44:39,109 --> 00:44:37,520
configuration

1293
00:44:41,510 --> 00:44:39,119
i'll go over some of the basic

1294
00:44:42,790 --> 00:44:41,520
components on this starting kind of at

1295
00:44:44,710 --> 00:44:42,800
the top

1296
00:44:46,150 --> 00:44:44,720
up here is the radiator assembly which

1297
00:44:48,950 --> 00:44:46,160
is aluminum

1298
00:44:51,190 --> 00:44:48,960
face sheets over aluminum honeycomb

1299
00:44:53,430 --> 00:44:51,200
that's utilized to hold most of the

1300
00:44:54,790 --> 00:44:53,440
avionics for the spacecraft there's a

1301
00:44:57,190 --> 00:44:54,800
top side and then there's also

1302
00:45:00,550 --> 00:44:57,200
components within the spacecraft

1303
00:45:02,390 --> 00:45:00,560
on the top side here these two big black

1304
00:45:04,790 --> 00:45:02,400
cones that you see

1305
00:45:07,190 --> 00:45:04,800
those are star tracker camera

1306
00:45:09,750 --> 00:45:07,200
units and what those look for is a star

1307
00:45:11,670 --> 00:45:09,760
field for navigation and control of the

1308
00:45:13,430 --> 00:45:11,680
spacecraft so those are critical

1309
00:45:15,589 --> 00:45:13,440
elements that we need

1310
00:45:18,710 --> 00:45:15,599
to let the spacecraft know know where it

1311
00:45:21,349 --> 00:45:18,720
is relative to the star field we also

1312
00:45:23,030 --> 00:45:21,359
have over on this side over here

1313
00:45:25,589 --> 00:45:23,040

for some might be difficult see we have

1314
00:45:27,430 --> 00:45:25,599
an omnidirectional antenna and we also

1315
00:45:28,470 --> 00:45:27,440
have another omnidirectional antenna

1316
00:45:30,390 --> 00:45:28,480
down here

1317
00:45:32,630 --> 00:45:30,400
those are our primary communication

1318
00:45:34,550 --> 00:45:32,640
antennas for the spacecraft for

1319
00:45:37,109 --> 00:45:34,560
commanding the spacecraft and retrieving

1320
00:45:38,870 --> 00:45:37,119
data from the spacecraft

1321
00:45:41,030 --> 00:45:38,880
another antenna we have right here is

1322
00:45:43,030 --> 00:45:41,040
called the medium gain antenna that's a

1323
00:45:45,430 --> 00:45:43,040
high data rate antenna not near as high

1324
00:45:47,990 --> 00:45:45,440
as the laser com but that's our our high

1325
00:45:50,390 --> 00:45:48,000
data antenna to get our primary science

1326
00:45:51,670 --> 00:45:50,400
data down that sarah was discussing

1327
00:45:54,790 --> 00:45:51,680
earlier

1328
00:45:56,790 --> 00:45:54,800
um additionally on the very back side we

1329
00:45:58,950 --> 00:45:56,800
have what's called a sepia box i

1330
00:46:00,470 --> 00:45:58,960
mentioned that we are launching off

1331
00:46:02,470 --> 00:46:00,480
since we're launching off we need to

1332
00:46:05,270 --> 00:46:02,480
detect when we separate from the

1333
00:46:07,670 --> 00:46:05,280
minotaur 5. the sepia detects when we

1334
00:46:09,430 --> 00:46:07,680
launch off and puts power on the bus

1335
00:46:11,670 --> 00:46:09,440
which allows the spacecraft to boot

1336
00:46:13,670 --> 00:46:11,680
itself up and that's how we activate the

1337
00:46:15,589 --> 00:46:13,680
spacecraft after separation from

1338
00:46:17,349 --> 00:46:15,599

minotaur

1339
00:46:19,910 --> 00:46:17,359
there's two science instruments on the

1340
00:46:21,670 --> 00:46:19,920
radiator one is the ultraviolet visible

1341
00:46:24,230 --> 00:46:21,680
spectrometer which

1342
00:46:25,910 --> 00:46:24,240
helps gather science data and then on

1343
00:46:28,309 --> 00:46:25,920
the other side is a lunar dust

1344
00:46:30,309 --> 00:46:28,319
experiment and those are a couple of the

1345
00:46:31,349 --> 00:46:30,319
key experiments to support primary

1346
00:46:32,790 --> 00:46:31,359
mission

1347
00:46:34,950 --> 00:46:32,800
the other key

1348
00:46:37,750 --> 00:46:34,960
science instrument for primary mission

1349
00:46:40,069 --> 00:46:37,760
is the neutral mass spectrometer on one

1350
00:46:42,230 --> 00:46:40,079
side and then we have the laser com

1351
00:46:44,790 --> 00:46:42,240
that we discussed as a communications

1352
00:46:47,829 --> 00:46:44,800
and science demo

1353
00:46:49,510 --> 00:46:47,839
on the underside of this radiator panel

1354
00:46:50,390 --> 00:46:49,520
which you can't see

1355
00:46:52,230 --> 00:46:50,400
although

1356
00:46:54,710 --> 00:46:52,240
one thing to note is these solar panels

1357
00:46:56,390 --> 00:46:54,720
i mentioned they are all removable which

1358
00:46:58,630 --> 00:46:56,400
allow us access to the internal

1359
00:47:01,829 --> 00:46:58,640
components so if during testing we have

1360
00:47:03,510 --> 00:47:01,839
any problems we can remove solar panels

1361
00:47:05,430 --> 00:47:03,520
and get access to the components and

1362
00:47:08,069 --> 00:47:05,440
swap things out

1363
00:47:10,470 --> 00:47:08,079

but under that side we have several

1364
00:47:12,309 --> 00:47:10,480
avionics boxes we have a battery for

1365
00:47:14,390 --> 00:47:12,319
storing energy that comes from the solar

1366
00:47:17,750 --> 00:47:14,400
panels we also have an integrated

1367
00:47:19,589 --> 00:47:17,760
avionics unit which is the primary

1368
00:47:21,349 --> 00:47:19,599
kind of the heart and soul of the brain

1369
00:47:24,470 --> 00:47:21,359
of the spacecraft from

1370
00:47:26,069 --> 00:47:24,480
from a data system perspective the iau

1371
00:47:28,550 --> 00:47:26,079
that we call the integrated avionics

1372
00:47:31,750 --> 00:47:28,560
unit also provides control of all the

1373
00:47:34,230 --> 00:47:31,760
power distribution on the spacecraft

1374
00:47:36,950 --> 00:47:34,240
the s-band transponder that ties to

1375
00:47:39,030 --> 00:47:36,960
these antennas is also mounted on the

1376
00:47:41,430 --> 00:47:39,040
other side and then we also have an

1377
00:47:43,270 --> 00:47:41,440
inertial measurement unit which is used

1378
00:47:45,510 --> 00:47:43,280
to support the guidance and navigation

1379
00:47:47,990 --> 00:47:45,520
system is mounted there

1380
00:47:50,630 --> 00:47:48,000
within this bus module kind of at this

1381
00:47:53,430 --> 00:47:50,640
level we have insider four reaction

1382
00:47:56,710 --> 00:47:53,440
wheel assemblies those are our primary

1383
00:47:58,470 --> 00:47:56,720
attitude control devices that we use for

1384
00:48:00,790 --> 00:47:58,480
managing the spacecraft during its

1385
00:48:02,790 --> 00:48:00,800
normal flight operations

1386
00:48:04,550 --> 00:48:02,800
for some of the for the burns that we do

1387
00:48:06,790 --> 00:48:04,560
we'll talk about the prop

1388
00:48:09,190 --> 00:48:06,800

propulsion system here in event

1389
00:48:11,349 --> 00:48:09,200
uh so that's kind of the core of kind of

1390
00:48:13,030 --> 00:48:11,359
the the bus that takes the science

1391
00:48:15,910 --> 00:48:13,040
instruments to uh

1392
00:48:18,150 --> 00:48:15,920
to the moon uh moving down to the to the

1393
00:48:20,950 --> 00:48:18,160
bottom half is we have our propulsion

1394
00:48:23,270 --> 00:48:20,960
system propulsion system essentially all

1395
00:48:26,549 --> 00:48:23,280
the components down here

1396
00:48:29,430 --> 00:48:26,559
inside of the structure we have helium

1397
00:48:31,910 --> 00:48:29,440
pressure tanks we have fuel tanks and we

1398
00:48:34,950 --> 00:48:31,920
have the oxidizer tanks

1399
00:48:36,190 --> 00:48:34,960
ladies uses a what we call bi-propellant

1400
00:48:38,390 --> 00:48:36,200
which we use

1401
00:48:41,030 --> 00:48:38,400
monomethylhydrazine combined with an

1402
00:48:42,790 --> 00:48:41,040
oxidizer which is called mixed oxides of

1403
00:48:45,270 --> 00:48:42,800
nitrogen

1404
00:48:47,990 --> 00:48:45,280
so you can google those and and look

1405
00:48:48,950 --> 00:48:48,000
those up and uh and learn about byprop

1406
00:48:52,069 --> 00:48:48,960
systems

1407
00:48:55,589 --> 00:48:52,079
they provide a good impulse power for us

1408
00:48:58,230 --> 00:48:55,599
to get to the moon um and uh those

1409
00:49:00,069 --> 00:48:58,240
propellants are then fed through we have

1410
00:49:02,150 --> 00:49:00,079
small thrusters

1411
00:49:04,710 --> 00:49:02,160
two on each side and then we have a big

1412
00:49:06,870 --> 00:49:04,720
main thruster down here those thrusters

1413
00:49:10,390 --> 00:49:06,880

are retar are required to get us to the

1414
00:49:13,030 --> 00:49:10,400
moon we use the big thruster to do some

1415
00:49:15,510 --> 00:49:13,040
loops to get us out of earth orbit and

1416
00:49:17,910 --> 00:49:15,520
then to do our breaking burn when we get

1417
00:49:20,870 --> 00:49:17,920
to the moon to slow us down so we can

1418
00:49:22,150 --> 00:49:20,880
get captured in the low gravity of the

1419
00:49:23,270 --> 00:49:22,160
of the moon

1420
00:49:24,470 --> 00:49:23,280
and

1421
00:49:27,030 --> 00:49:24,480
kind of the

1422
00:49:28,790 --> 00:49:27,040
data and power that ties all these

1423
00:49:32,549 --> 00:49:28,800
systems together

1424
00:49:34,790 --> 00:49:32,559
is comprised of over one mile of wires

1425
00:49:36,950 --> 00:49:34,800
so there's a lot of wiring inside this

1426
00:49:38,710 --> 00:49:36,960
spacecraft all spacecraft there ends up

1427
00:49:39,750 --> 00:49:38,720
being an extreme amount of wiring in

1428
00:49:41,750 --> 00:49:39,760
there

1429
00:49:43,589 --> 00:49:41,760
with a lot of connectors so that gets

1430
00:49:45,990 --> 00:49:43,599
very complicated that's why we go

1431
00:49:47,990 --> 00:49:46,000
through a very intense uh integration

1432
00:49:49,990 --> 00:49:48,000
and test process to make sure that we

1433
00:49:52,230 --> 00:49:50,000
work all those out and verify all the

1434
00:49:54,309 --> 00:49:52,240
data interfaces

1435
00:50:03,430 --> 00:49:54,319
and i think that's all i have for the

1436
00:50:07,910 --> 00:50:05,670
hi good morning

1437
00:50:10,150 --> 00:50:07,920
so i had two questions the first

1438
00:50:13,030 --> 00:50:10,160

question was since this is a modular

1439
00:50:14,870 --> 00:50:13,040
type of structure what other kind of

1440
00:50:17,109 --> 00:50:14,880
missions have used this

1441
00:50:19,190 --> 00:50:17,119
this panel architecture

1442
00:50:20,549 --> 00:50:19,200
and then the other question was what is

1443
00:50:23,589 --> 00:50:20,559
the system

1444
00:50:25,750 --> 00:50:23,599
design process that you

1445
00:50:28,069 --> 00:50:25,760
go through so how do you decide whether

1446
00:50:30,069 --> 00:50:28,079
or not you want chemical versus electric

1447
00:50:31,990 --> 00:50:30,079
propulsion how do you decide

1448
00:50:32,790 --> 00:50:32,000
um what kind of

1449
00:50:36,309 --> 00:50:32,800
uh

1450
00:50:39,349 --> 00:50:36,319
communications things like that okay

1451
00:50:41,190 --> 00:50:39,359
so the basic questions were

1452
00:50:45,430 --> 00:50:41,200
i'm sorry can you repeat the first

1453
00:50:51,030 --> 00:50:47,829
other spacecraft that use this module um

1454
00:50:53,349 --> 00:50:51,040
right now none this is a laddie first

1455
00:50:56,230 --> 00:50:53,359
and a first for ames is this was a

1456
00:50:58,309 --> 00:50:56,240
design at ames research center

1457
00:51:01,190 --> 00:50:58,319
for the intent of future missions being

1458
00:51:03,030 --> 00:51:01,200
able to support future missions and and

1459
00:51:05,349 --> 00:51:03,040
know what nasa would term an assembly

1460
00:51:07,109 --> 00:51:05,359
line kind of configuration

1461
00:51:09,190 --> 00:51:07,119
not assembly line like the automobile

1462
00:51:11,670 --> 00:51:09,200
industry or the high tech industry

1463
00:51:13,030 --> 00:51:11,680

because they build millions or hundreds

1464
00:51:16,150 --> 00:51:13,040
of thousands

1465
00:51:18,309 --> 00:51:16,160
but just us building a few or several is

1466
00:51:20,630 --> 00:51:18,319
you could build multiple modules like

1467
00:51:22,790 --> 00:51:20,640
this and in that modular nature be able

1468
00:51:25,430 --> 00:51:22,800
to stack these modules and assemble them

1469
00:51:27,670 --> 00:51:25,440
more quickly and and build different

1470
00:51:29,270 --> 00:51:27,680
configurations for spacecraft so right

1471
00:51:31,430 --> 00:51:29,280
now laddy is the first to use this

1472
00:51:33,349 --> 00:51:31,440
modular concept there's a prototype that

1473
00:51:35,750 --> 00:51:33,359
was built before but this is the first

1474
00:51:37,510 --> 00:51:35,760
spacecraft that's going to the fly on

1475
00:51:39,589 --> 00:51:37,520
the design process

1476
00:51:41,349 --> 00:51:39,599
the basic one is there's a process

1477
00:51:43,430 --> 00:51:41,359
that's outlined where we do

1478
00:51:46,150 --> 00:51:43,440
concept reviews preliminary design

1479
00:51:48,069 --> 00:51:46,160
reviews critical design reviews but the

1480
00:51:49,910 --> 00:51:48,079
key items that feed into that are the

1481
00:51:52,069 --> 00:51:49,920
trade studies the items that you talked

1482
00:51:54,549 --> 00:51:52,079
about where the engineering team sits

1483
00:51:56,950 --> 00:51:54,559
down and identifies what solutions there

1484
00:51:58,950 --> 00:51:56,960
are to what we need to achieve

1485
00:52:01,589 --> 00:51:58,960
and how

1486
00:52:03,349 --> 00:52:01,599
how to get to those most effectively

1487
00:52:06,150 --> 00:52:03,359
efficient but it needs to be cost

1488
00:52:07,990 --> 00:52:06,160

effective in schedule depend so you have

1489
00:52:10,069 --> 00:52:08,000
to take in all the

1490
00:52:12,710 --> 00:52:10,079
different parameters the technical the

1491
00:52:14,710 --> 00:52:12,720
programmatic and the cost and generate

1492
00:52:16,710 --> 00:52:14,720
those you come up with trade stays

1493
00:52:18,630 --> 00:52:16,720
evaluate those and determine which are

1494
00:52:25,030 --> 00:52:18,640
the best solutions for what you need for

1495
00:52:28,710 --> 00:52:26,870
hi my name is ulysses

1496
00:52:31,109 --> 00:52:28,720
could you explain how the dust collector

1497
00:52:34,790 --> 00:52:32,950
well i'll try to explain a little bit

1498
00:52:35,829 --> 00:52:34,800
sarah would probably be better at that

1499
00:52:37,589 --> 00:52:35,839
um

1500
00:52:39,670 --> 00:52:37,599
and i don't know if

1501
00:52:41,430 --> 00:52:39,680
i don't think they'll be coming in later

1502
00:52:43,270 --> 00:52:41,440
the dust collector guys but what we

1503
00:52:45,750 --> 00:52:43,280
typically do the dust collector and the

1504
00:52:47,750 --> 00:52:45,760
neutral mass spectrometer are

1505
00:52:49,829 --> 00:52:47,760
in the direction of travel going around

1506
00:52:52,549 --> 00:52:49,839
the moon so there are apertures for

1507
00:52:55,190 --> 00:52:52,559
collecting uh the information or

1508
00:52:57,510 --> 00:52:55,200
collecting the particles that come in or

1509
00:53:00,390 --> 00:52:57,520
in the velocity vector or the direction

1510
00:53:02,309 --> 00:53:00,400
of travel to enhance them being able to

1511
00:53:04,790 --> 00:53:02,319
collect that information and then

1512
00:53:07,109 --> 00:53:04,800
internally they'll process that

1513
00:53:09,270 --> 00:53:07,119

those particles based on specific

1514
00:53:11,109 --> 00:53:09,280
designs within each one of those and

1515
00:53:13,030 --> 00:53:11,119
determine they i think the dust

1516
00:53:14,470 --> 00:53:13,040
collector and sarah might be able to

1517
00:53:16,390 --> 00:53:14,480
correct me if i'm wrong looks for

1518
00:53:17,829 --> 00:53:16,400
different sized particles

1519
00:53:19,910 --> 00:53:17,839
and and

1520
00:53:22,470 --> 00:53:19,920
based on those particle sizes then tries

1521
00:53:25,030 --> 00:53:22,480
to determine what the potential volume

1522
00:53:29,829 --> 00:53:25,040
is in the exosphere and sarah's shaking

1523
00:53:34,230 --> 00:53:31,990
yeah it doesn't it's really using the

1524
00:53:36,150 --> 00:53:34,240
the force that's coming between the

1525
00:53:41,030 --> 00:53:36,160
opposing forces for us flying through

1526
00:53:45,670 --> 00:53:43,109
hello uh one of my eighth grade students

1527
00:53:47,589 --> 00:53:45,680
was curious uh about how long it took to

1528
00:53:53,270 --> 00:53:47,599
construct

1529
00:53:56,069 --> 00:53:53,280
from from assembly phase till now i have

1530
00:53:58,150 --> 00:53:56,079
to think back when we start assembling

1531
00:53:59,349 --> 00:53:58,160
probably a couple years to construct and

1532
00:54:01,430 --> 00:53:59,359
test

1533
00:54:04,710 --> 00:54:01,440
the entire phase of course took longer

1534
00:54:06,309 --> 00:54:04,720
from preliminary design critical design

1535
00:54:08,870 --> 00:54:06,319
i'm trying

1536
00:54:10,390 --> 00:54:08,880
dates things have gone by so

1537
00:54:12,230 --> 00:54:10,400
fast lately i think

1538
00:54:14,150 --> 00:54:12,240

lost on dates but typically it takes a

1539
00:54:16,230 --> 00:54:14,160
couple years to construct and that

1540
00:54:18,230 --> 00:54:16,240
includes we usually allocate somewhere

1541
00:54:20,150 --> 00:54:18,240
between a year year and a half for

1542
00:54:23,349 --> 00:54:20,160
integration and test and that all

1543
00:54:25,910 --> 00:54:23,359
depends on the complexity of the system

1544
00:54:27,589 --> 00:54:25,920
the goal is to make things simple

1545
00:54:30,390 --> 00:54:27,599
for for this type mission try to

1546
00:54:32,309 --> 00:54:30,400
simplify versus like hubble which was

1547
00:54:34,150 --> 00:54:32,319
described earlier our james webb

1548
00:54:37,270 --> 00:54:34,160
telescope which will take a much longer

1549
00:54:40,630 --> 00:54:39,030
hi can you give us an idea of the

1550
00:54:41,829 --> 00:54:40,640
different disciplines of science and

1551
00:54:43,829 --> 00:54:41,839
engineering that are involved in

1552
00:54:46,549 --> 00:54:43,839
building a spacecraft like this

1553
00:54:48,309 --> 00:54:46,559
uh yes yes i'll go through that um we

1554
00:54:50,390 --> 00:54:48,319
have multiple subsystems and each

1555
00:54:51,670 --> 00:54:50,400
subsystem is really a discipline that we

1556
00:54:54,069 --> 00:54:51,680
do so i'll kind of mention the

1557
00:54:56,309 --> 00:54:54,079
subsystems real quick there's of course

1558
00:54:58,390 --> 00:54:56,319
the mechanical subsystem which developed

1559
00:55:01,109 --> 00:54:58,400
all the structure there's a guidance

1560
00:55:03,990 --> 00:55:01,119
navigation and control subsystem which i

1561
00:55:05,910 --> 00:55:04,000
mentioned provides all of the hardware

1562
00:55:08,230 --> 00:55:05,920
for controlling the spacecraft and

1563
00:55:10,230 --> 00:55:08,240

supporting all the activities to point

1564
00:55:12,230 --> 00:55:10,240
the spacecraft to gather science data

1565
00:55:14,150 --> 00:55:12,240
and all that guidance navigation and

1566
00:55:15,829 --> 00:55:14,160
control works really closely with our

1567
00:55:18,470 --> 00:55:15,839
flight software team

1568
00:55:20,790 --> 00:55:18,480
uh who generates all the software and

1569
00:55:23,109 --> 00:55:20,800
the algorithms for controlling the

1570
00:55:25,030 --> 00:55:23,119
spacecraft as well as all the data

1571
00:55:26,150 --> 00:55:25,040
communications and interface between

1572
00:55:27,829 --> 00:55:26,160
everything

1573
00:55:30,230 --> 00:55:27,839
of course there's an electrical power

1574
00:55:32,630 --> 00:55:30,240
system which for us is the solar rays in

1575
00:55:34,390 --> 00:55:32,640
the battery so electrical engineers very

1576
00:55:36,710 --> 00:55:34,400
important for that

1577
00:55:38,230 --> 00:55:36,720
we have the communication system

1578
00:55:39,910 --> 00:55:38,240
which is rf

1579
00:55:41,270 --> 00:55:39,920
s-band system

1580
00:55:43,549 --> 00:55:41,280
that's data

1581
00:55:45,910 --> 00:55:43,559
systems guys communications engineers

1582
00:55:49,109 --> 00:55:45,920
telecommunications and that we have the

1583
00:55:50,710 --> 00:55:49,119
cndh system so that's a lot of computer

1584
00:55:52,950 --> 00:55:50,720
science and also

1585
00:55:54,630 --> 00:55:52,960
data engineers also supporting that

1586
00:55:57,109 --> 00:55:54,640
activity so there is some

1587
00:55:58,789 --> 00:55:57,119
cross mixing on that there's a thermal

1588
00:56:00,630 --> 00:55:58,799

engineers which i really didn't discuss

1589
00:56:02,950 --> 00:56:00,640
much on this but is a very critical

1590
00:56:05,349 --> 00:56:02,960
aspect of every spacecraft

1591
00:56:07,910 --> 00:56:05,359
because ours is a passive thermal system

1592
00:56:09,589 --> 00:56:07,920
we mainly just have heaters

1593
00:56:11,190 --> 00:56:09,599
to keep things warm

1594
00:56:12,710 --> 00:56:11,200
during transit

1595
00:56:15,829 --> 00:56:12,720
but thermal

1596
00:56:18,230 --> 00:56:15,839
is a very challenging item for for

1597
00:56:20,710 --> 00:56:18,240
laddie because of the long duration in

1598
00:56:23,990 --> 00:56:20,720
the phasing loop but also going around

1599
00:56:27,030 --> 00:56:24,000
the moon going from sun to dark extreme

1600
00:56:29,270 --> 00:56:27,040
temperature difference so thermal was uh

1601
00:56:31,829 --> 00:56:29,280
was a very high consideration for us and

1602
00:56:32,630 --> 00:56:31,839
look at that so the thermal engineers

1603
00:56:37,109 --> 00:56:32,640
and

1604
00:56:39,829 --> 00:56:37,119
system so you have the the propulsion as

1605
00:56:42,390 --> 00:56:39,839
a subsystem so you have fluid systems

1606
00:56:45,829 --> 00:56:42,400
engineers sometimes mechanical engineers

1607
00:56:46,630 --> 00:56:45,839
and a variety of people for that

1608
00:56:48,789 --> 00:56:46,640
and

1609
00:56:51,349 --> 00:56:48,799
does that cover most yes thank you to

1610
00:56:53,349 --> 00:56:51,359
add on that just real quickly is

1611
00:56:55,349 --> 00:56:53,359
you also we try to transition a lot of

1612
00:56:57,190 --> 00:56:55,359
those engineers to support the mission

1613
00:56:59,109 --> 00:56:57,200

operations phase so we have an

1614
00:57:01,670 --> 00:56:59,119
engineering support team that supports

1615
00:57:08,390 --> 00:57:01,680
the mission operations team which is uh

1616
00:57:11,349 --> 00:57:09,750
uh you're talking about the spacecraft

1617
00:57:13,829 --> 00:57:11,359
bus architecture with the stacked

1618
00:57:16,069 --> 00:57:13,839
modular approach what's the rationale

1619
00:57:18,470 --> 00:57:16,079
for the tapered fairing uh not fairing

1620
00:57:20,870 --> 00:57:18,480
but the tapered edge at the at the top

1621
00:57:23,109 --> 00:57:20,880
of the stack and the second question is

1622
00:57:24,789 --> 00:57:23,119
uh do you know why it's only a 100-day

1623
00:57:27,190 --> 00:57:24,799
science mission

1624
00:57:29,750 --> 00:57:27,200
why it's only 180 okay i'll talk about

1625
00:57:31,990 --> 00:57:29,760
the tapered first the taper is really

1626
00:57:35,109 --> 00:57:32,000
comes from a heritage prototype

1627
00:57:38,870 --> 00:57:35,119
laddy kind of started as as a lander

1628
00:57:40,950 --> 00:57:38,880
concept uh and a lander especially

1629
00:57:43,430 --> 00:57:40,960
on the moon what you want

1630
00:57:45,829 --> 00:57:43,440
to make sure you're getting solar energy

1631
00:57:48,150 --> 00:57:45,839
hitting uh the top of the spacecraft

1632
00:57:50,069 --> 00:57:48,160
those solar cells it was tapered for

1633
00:57:52,309 --> 00:57:50,079
laddie they did a trait study and kind

1634
00:57:54,230 --> 00:57:52,319
of looked at do we take that taper out

1635
00:57:57,030 --> 00:57:54,240
or leave it and the decision was to

1636
00:57:59,190 --> 00:57:57,040
leave it on i think partly because

1637
00:58:01,670 --> 00:57:59,200
there's an angle to the sun depending on

1638
00:58:04,230 --> 00:58:01,680

when you launch called the beta angle

1639
00:58:06,789 --> 00:58:04,240
and if that beta angle is positive

1640
00:58:09,030 --> 00:58:06,799
essentially the spacecraft looks tilted

1641
00:58:11,430 --> 00:58:09,040
relative to the sun this gives us a

1642
00:58:13,589 --> 00:58:11,440
little bit additional power for those

1643
00:58:16,150 --> 00:58:13,599
cases so they decide in their trade

1644
00:58:17,030 --> 00:58:16,160
study to keep that

1645
00:58:23,190 --> 00:58:17,040
the

1646
00:58:25,430 --> 00:58:23,200
that was more of a directed

1647
00:58:28,470 --> 00:58:25,440
kind of activity that we wanted a short

1648
00:58:30,150 --> 00:58:28,480
duration mission it's uh there was a

1649
00:58:32,069 --> 00:58:30,160
minimum number of days that we wanted

1650
00:58:34,150 --> 00:58:32,079
based on lunar cycle to meet science

1651
00:58:36,230 --> 00:58:34,160
requirements so it's really based on

1652
00:58:38,150 --> 00:58:36,240
that but it's also based on kind of our

1653
00:58:40,630 --> 00:58:38,160
fuel capacity

1654
00:58:43,510 --> 00:58:40,640
we're weight limited on the minotaur

1655
00:58:45,510 --> 00:58:43,520
five so we had to limit how much fuel

1656
00:58:47,750 --> 00:58:45,520
that we can in the size of the tanks in

1657
00:58:50,789 --> 00:58:47,760
the fuel that we can put in and that

1658
00:58:52,789 --> 00:58:50,799
drives kind of how long our mission is

1659
00:58:54,390 --> 00:58:52,799
especially for the big burns to get us

1660
00:58:56,390 --> 00:58:54,400
out to the moon so it's kind of a

1661
00:58:58,789 --> 00:58:56,400
combination it was decided early on but

1662
00:59:01,349 --> 00:58:58,799
it's also kind of a

1663
00:59:05,270 --> 00:59:01,359

limited life item or our fuel constraint

1664
00:59:09,270 --> 00:59:06,870
that's about all the time that we have

1665
00:59:11,589 --> 00:59:09,280
for questions here today with uh bob

1666
00:59:13,030 --> 00:59:11,599
here so

1667
00:59:15,030 --> 00:59:13,040
thank you all very much thank you bob

1668
00:59:18,069 --> 00:59:15,040
for for talking a little bit about the

1669
00:59:19,190 --> 00:59:18,079
engineering behind this

1670
00:59:20,309 --> 00:59:19,200
so now that you guys have heard a little

1671
00:59:21,510 --> 00:59:20,319
bit about the science behind the

1672
00:59:22,710 --> 00:59:21,520
spacecraft a little bit about the

1673
00:59:23,829 --> 00:59:22,720
engineering behind the spacecraft

1674
00:59:25,270 --> 00:59:23,839
everything now we're going to talk a

1675
00:59:27,430 --> 00:59:25,280
little bit about getting it ready to go

1676
00:59:30,789 --> 00:59:27,440
to space and so up next we're going to

1677
00:59:32,630 --> 00:59:30,799
hear from sarah dottery and she is the

1678
00:59:34,710 --> 00:59:32,640
test director for the wallops launch

1679
00:59:39,430 --> 00:59:34,720
range here so without any further ado

1680
00:59:44,470 --> 00:59:42,470
thank you jason so as he alluded to

1681
00:59:46,069 --> 00:59:44,480
we're all very excited about going to

1682
00:59:48,390 --> 00:59:46,079
the moon and focused on that but i'm

1683
00:59:50,549 --> 00:59:48,400
going to reorient us a little bit back

1684
00:59:53,190 --> 00:59:50,559
down to earth just before we launch a

1685
00:59:55,670 --> 00:59:53,200
rocket to get there so my

1686
00:59:58,309 --> 00:59:55,680
position here at nasa's wilds flight

1687
01:00:00,069 --> 00:59:58,319
facility launch ranges test director

1688
01:00:02,950 --> 01:00:00,079

for rocket launches you can think of

1689
01:00:04,789 --> 01:00:02,960
that as sort of the launch director

1690
01:00:05,510 --> 01:00:04,799
we call it test director because there

1691
01:00:07,990 --> 01:00:05,520
are

1692
01:00:09,510 --> 01:00:08,000
numerous other missions that we do here

1693
01:00:11,349 --> 01:00:09,520
and so the same

1694
01:00:14,069 --> 01:00:11,359
position and authority resides over

1695
01:00:16,710 --> 01:00:14,079
those missions there so we just use the

1696
01:00:18,069 --> 01:00:16,720
word test to kind of bucket collect

1697
01:00:20,789 --> 01:00:18,079
everything that

1698
01:00:23,109 --> 01:00:20,799
we could be the director of all of the

1699
01:00:26,549 --> 01:00:23,119
test missions that we do do

1700
01:00:28,710 --> 01:00:26,559
but back to lady so the the launch range

1701
01:00:30,390 --> 01:00:28,720
goes through a lot of preparations in

1702
01:00:32,150 --> 01:00:30,400
order to support

1703
01:00:34,230 --> 01:00:32,160
our our customer if you don't think

1704
01:00:35,670 --> 01:00:34,240
about it like that which is the lady

1705
01:00:37,349 --> 01:00:35,680
spacecraft

1706
01:00:39,349 --> 01:00:37,359
that we will have launching from our

1707
01:00:41,750 --> 01:00:39,359
launch pads here and so

1708
01:00:43,589 --> 01:00:41,760
we provide a lot of services

1709
01:00:46,069 --> 01:00:43,599
to the mission

1710
01:00:47,990 --> 01:00:46,079
for launch operations so we provide

1711
01:00:50,630 --> 01:00:48,000
radar tracking

1712
01:00:53,829 --> 01:00:50,640
to track where the vehicle is in flight

1713
01:00:55,589 --> 01:00:53,839

we provide telemetry antennas to

1714
01:00:58,549 --> 01:00:55,599
receive data back from the launch

1715
01:01:00,390 --> 01:00:58,559
vehicle and the spacecraft during flight

1716
01:01:02,710 --> 01:01:00,400
we provide command

1717
01:01:05,030 --> 01:01:02,720
uplink capabilities and that's also for

1718
01:01:07,990 --> 01:01:05,040
range safety purposes in case the the

1719
01:01:10,470 --> 01:01:08,000
vehicle does start going off track

1720
01:01:12,789 --> 01:01:10,480
we can send commands to destruct the

1721
01:01:15,270 --> 01:01:12,799
vehicle if that so happens to keep the

1722
01:01:17,510 --> 01:01:15,280
public safe and we've defined hazard

1723
01:01:20,470 --> 01:01:17,520
areas and things like that ahead of time

1724
01:01:22,390 --> 01:01:20,480
to account for all of those so there are

1725
01:01:24,390 --> 01:01:22,400
numerous things and maybe you guys don't

1726
01:01:26,549 --> 01:01:24,400
know if you've seen out here some of the

1727
01:01:28,630 --> 01:01:26,559
telemetry dishes and radar dishes as you

1728
01:01:30,470 --> 01:01:28,640
came in today those will be some of the

1729
01:01:31,349 --> 01:01:30,480
same ones that we will use tomorrow

1730
01:01:34,309 --> 01:01:31,359
night

1731
01:01:36,829 --> 01:01:34,319
for launch to track the launch vehicle

1732
01:01:38,549 --> 01:01:36,839
as it's going to into

1733
01:01:40,789 --> 01:01:38,559
space

1734
01:01:43,430 --> 01:01:40,799
in the control center is the range

1735
01:01:45,510 --> 01:01:43,440
control center is where all of those

1736
01:01:47,990 --> 01:01:45,520
services that we're providing will sort

1737
01:01:49,670 --> 01:01:48,000
of come together and there are different

1738
01:01:51,910 --> 01:01:49,680

teams in the control center that are

1739
01:01:52,950 --> 01:01:51,920
responsible for each of those areas and

1740
01:01:55,589 --> 01:01:52,960
then

1741
01:01:57,589 --> 01:01:55,599
my job is to

1742
01:01:59,430 --> 01:01:57,599
sort of oversee that as sort of the

1743
01:02:00,789 --> 01:01:59,440
orchestra conductor and be sure that

1744
01:02:02,549 --> 01:02:00,799
everyone is going through their

1745
01:02:03,510 --> 01:02:02,559
checklists and they're doing all the

1746
01:02:08,230 --> 01:02:03,520
items

1747
01:02:10,789 --> 01:02:08,240
are checked off and we've worked through

1748
01:02:13,030 --> 01:02:10,799
any issues that may have come up

1749
01:02:15,910 --> 01:02:13,040
to give the final go for

1750
01:02:18,069 --> 01:02:15,920
excuse me go for launch or say that it

1751
01:02:21,270 --> 01:02:18,079
is okay and be sure the team

1752
01:02:23,510 --> 01:02:21,280
is very comfortable with that

1753
01:02:25,750 --> 01:02:23,520
like i alluded to before the radar

1754
01:02:28,470 --> 01:02:25,760
telemetry dishes we also have an entire

1755
01:02:30,309 --> 01:02:28,480
range safety team that is

1756
01:02:33,190 --> 01:02:30,319
keeping track of

1757
01:02:34,549 --> 01:02:33,200
preparations on the ground at the launch

1758
01:02:36,470 --> 01:02:34,559
pad as

1759
01:02:38,069 --> 01:02:36,480
we're counting down and getting closer

1760
01:02:40,710 --> 01:02:38,079
and closer to launch for all the site

1761
01:02:42,950 --> 01:02:40,720
preparations that are going on out there

1762
01:02:45,589 --> 01:02:42,960
that team is also

1763
01:02:47,670 --> 01:02:45,599

focused on safety during flight so we

1764
01:02:50,390 --> 01:02:47,680
have a flight safety officer

1765
01:02:51,750 --> 01:02:50,400
that is monitoring the vehicle flight

1766
01:02:53,990 --> 01:02:51,760
during launch

1767
01:02:56,230 --> 01:02:54,000
and another big part of our launch

1768
01:02:58,870 --> 01:02:56,240
operation is surveillance

1769
01:03:01,829 --> 01:02:58,880
we have to make sure that the ocean

1770
01:03:03,030 --> 01:03:01,839
space and air space out off the coast is

1771
01:03:05,349 --> 01:03:03,040
clear

1772
01:03:08,309 --> 01:03:05,359
so that we can launch the vehicle

1773
01:03:11,510 --> 01:03:08,319
out safely and keep the public safe so

1774
01:03:14,150 --> 01:03:11,520
we have a host of aircraft and boats

1775
01:03:16,870 --> 01:03:14,160
that are on our team that are out there

1776
01:03:18,950 --> 01:03:16,880
working to clear the hazard areas we

1777
01:03:21,910 --> 01:03:18,960
work in conjunction with the local

1778
01:03:23,589 --> 01:03:21,920
mariners here to help us do that we work

1779
01:03:25,910 --> 01:03:23,599
with the coast guard

1780
01:03:27,910 --> 01:03:25,920
and the marine police and a number of

1781
01:03:31,109 --> 01:03:27,920
other entities to kind of keep the

1782
01:03:33,430 --> 01:03:31,119
waterways clear so that we can

1783
01:03:36,069 --> 01:03:33,440
we can get a safe successful launch so

1784
01:03:39,349 --> 01:03:36,079
that'll be a big part of our operation

1785
01:03:41,270 --> 01:03:39,359
that we the launch range is focused on

1786
01:03:43,109 --> 01:03:41,280
during the countdown while the the

1787
01:03:45,270 --> 01:03:43,119
engineers and the spacecraft team are

1788
01:03:46,950 --> 01:03:45,280

making sure that their

1789
01:03:49,589 --> 01:03:46,960
vehicle is okay and going through their

1790
01:03:50,549 --> 01:03:49,599
checkouts will simultaneously be doing

1791
01:03:52,549 --> 01:03:50,559
all of

1792
01:03:56,069 --> 01:03:52,559
those activities

1793
01:03:57,990 --> 01:03:56,079
so with that i think i'll open it up to

1794
01:04:00,710 --> 01:03:58,000
any questions anyone might have about

1795
01:04:05,670 --> 01:04:00,720
the launch range or any kind of services

1796
01:04:08,549 --> 01:04:06,950
hi good morning

1797
01:04:09,829 --> 01:04:08,559
i'm curious as you're preparing for

1798
01:04:12,069 --> 01:04:09,839
launches

1799
01:04:14,630 --> 01:04:12,079
why is it important to keep the vehicles

1800
01:04:16,309 --> 01:04:14,640
and the materials sterile and what

1801
01:04:17,910 --> 01:04:16,319
circumstances would the sterility not

1802
01:04:19,829 --> 01:04:17,920
matter

1803
01:04:22,230 --> 01:04:19,839
that's a good question

1804
01:04:24,150 --> 01:04:22,240
largely has to do

1805
01:04:26,789 --> 01:04:24,160
from our standpoint from the launch

1806
01:04:29,109 --> 01:04:26,799
range is the the hazards that might be

1807
01:04:31,190 --> 01:04:29,119
on the vehicle that pose to

1808
01:04:33,270 --> 01:04:31,200
the folks that need to be working on or

1809
01:04:36,230 --> 01:04:33,280
around them and so

1810
01:04:38,950 --> 01:04:36,240
it's not so much for us keeping

1811
01:04:41,029 --> 01:04:38,960
it sterile as much as just keeping other

1812
01:04:43,029 --> 01:04:41,039
things from affecting

1813
01:04:45,910 --> 01:04:43,039

affecting it or from

1814
01:04:47,430 --> 01:04:45,920
the vehicle hazardous systems affecting

1815
01:04:48,630 --> 01:04:47,440
those folks that are on the ground and

1816
01:04:50,630 --> 01:04:48,640
on the pad

1817
01:04:55,829 --> 01:04:50,640
preparing the vehicle hooking up the

1818
01:05:01,430 --> 01:04:58,630
oh yeah i live here on shanghai again no

1819
01:05:03,589 --> 01:05:01,440
some of the problems with the marine

1820
01:05:05,190 --> 01:05:03,599
keeping the area clear how far south and

1821
01:05:07,270 --> 01:05:05,200
north are they blocking the area off

1822
01:05:10,150 --> 01:05:07,280
this for this launch

1823
01:05:12,069 --> 01:05:10,160
um it's uh it's a pretty large hazard

1824
01:05:14,390 --> 01:05:12,079
area this time just because the the

1825
01:05:15,510 --> 01:05:14,400
vehicle is so large a minotaur five and

1826
01:05:18,150 --> 01:05:15,520
it will be

1827
01:05:20,470 --> 01:05:18,160
again mission of first the first flight

1828
01:05:23,029 --> 01:05:20,480
of that vehicle from here so

1829
01:05:24,870 --> 01:05:23,039
it doesn't have a history of

1830
01:05:27,270 --> 01:05:24,880
safe flight it still needs to build that

1831
01:05:31,029 --> 01:05:27,280
up so the area

1832
01:05:31,990 --> 01:05:31,039
north to south is probably about

1833
01:05:35,270 --> 01:05:32,000
20

1834
01:05:37,430 --> 01:05:35,280
or 25 nautical miles wide

1835
01:05:40,069 --> 01:05:37,440
the largest distance is how far it

1836
01:05:42,549 --> 01:05:40,079
extends out into the atlantic ocean from

1837
01:05:44,309 --> 01:05:42,559
the coast that's a pretty pretty large

1838
01:05:46,549 --> 01:05:44,319

distance i think a little over 100

1839
01:05:53,430 --> 01:05:46,559
nautical miles so

1840
01:05:59,029 --> 01:05:55,670
good morning um so does the launch

1841
01:06:00,950 --> 01:05:59,039
vehicle launch it straight into a tli or

1842
01:06:02,789 --> 01:06:00,960
does or where does the launch vehicle

1843
01:06:05,109 --> 01:06:02,799
leave the spacecraft

1844
01:06:07,750 --> 01:06:05,119
um the launch vehicle

1845
01:06:10,230 --> 01:06:07,760
will leave the spacecraft at the orbit

1846
01:06:12,150 --> 01:06:10,240
insertion point so it'll be after um

1847
01:06:13,990 --> 01:06:12,160
fifth stage separates from it and

1848
01:06:16,230 --> 01:06:14,000
there'll be a sort what we call the

1849
01:06:18,309 --> 01:06:16,240
orbit insertion point there and then the

1850
01:06:20,870 --> 01:06:18,319
spacecraft operations will take over

1851
01:06:22,630 --> 01:06:20,880
from there and use the propellant on

1852
01:06:24,870 --> 01:06:22,640
board to push it to

1853
01:06:29,190 --> 01:06:24,880
the orbit that it needs to go to

1854
01:06:34,230 --> 01:06:32,069
30 minutes after launch so it takes

1855
01:06:35,990 --> 01:06:34,240
about that long to get to that orbit

1856
01:06:38,710 --> 01:06:36,000
insertion point and then from there it

1857
01:06:41,349 --> 01:06:38,720
will be solely the spacecraft

1858
01:06:46,390 --> 01:06:41,359
powering itself and moving on to out of

1859
01:06:49,910 --> 01:06:47,270
hi

1860
01:06:53,270 --> 01:06:49,920
how far in advance do you guys start

1861
01:06:55,190 --> 01:06:53,280
doing checkups on the rocket and

1862
01:06:57,270 --> 01:06:55,200
how's it looking for tomorrow's launch

1863
01:07:01,109 --> 01:06:57,280

that's a great question

1864
01:07:03,029 --> 01:07:01,119
the team is is usually starts working on

1865
01:07:05,589 --> 01:07:03,039
the range we start working

1866
01:07:07,109 --> 01:07:05,599
several months ahead of time but right

1867
01:07:08,710 --> 01:07:07,119
around the

1868
01:07:13,029 --> 01:07:08,720
three week

1869
01:07:15,029 --> 01:07:13,039
before launch mark is when we're really

1870
01:07:17,109 --> 01:07:15,039
rigorously testing our systems we're

1871
01:07:19,750 --> 01:07:17,119
getting the the radars and telemetry

1872
01:07:23,109 --> 01:07:19,760
dishes into the configuration specific

1873
01:07:25,589 --> 01:07:23,119
for laddie um we are running through

1874
01:07:27,589 --> 01:07:25,599
practice countdowns and we're doing what

1875
01:07:30,309 --> 01:07:27,599
we call dress rehearsals which is just

1876
01:07:32,150 --> 01:07:30,319
basically a simulation of what launch

1877
01:07:34,150 --> 01:07:32,160
day would actually look like and we run

1878
01:07:36,309 --> 01:07:34,160
through the entire countdown

1879
01:07:38,470 --> 01:07:36,319
and make sure all the steps are correct

1880
01:07:41,349 --> 01:07:38,480
and the right people are making the call

1881
01:07:42,950 --> 01:07:41,359
outs and all the wording is is right and

1882
01:07:45,750 --> 01:07:42,960
we're have the

1883
01:07:46,549 --> 01:07:45,760
them in the right order sometimes uh it

1884
01:07:49,430 --> 01:07:46,559
it

1885
01:07:51,190 --> 01:07:49,440
things in

1886
01:07:54,150 --> 01:07:51,200
so that starts about three weeks out

1887
01:07:57,589 --> 01:07:54,160
from launch and then as we get uh closer

1888
01:08:00,230 --> 01:07:57,599

into launch you know the pace picks up

1889
01:08:01,829 --> 01:08:00,240
so this week we had our large mission

1890
01:08:05,349 --> 01:08:01,839
dress rehearsal

1891
01:08:08,470 --> 01:08:05,359
on tuesday so that was sort of the final

1892
01:08:10,230 --> 01:08:08,480
practice of the whole team together

1893
01:08:12,230 --> 01:08:10,240
and everybody going through the

1894
01:08:16,149 --> 01:08:12,240
countdown exactly as it's written and

1895
01:08:18,789 --> 01:08:16,159
planned to be sure that one final check

1896
01:08:21,189 --> 01:08:18,799
we are the range systems are go and

1897
01:08:24,149 --> 01:08:21,199
ready for launch so we'll do

1898
01:08:27,189 --> 01:08:24,159
just a final verification

1899
01:08:29,510 --> 01:08:27,199
today before launch tomorrow

1900
01:08:37,430 --> 01:08:29,520
but right now we're go all systems are

1901
01:08:40,870 --> 01:08:39,030
hello um

1902
01:08:42,390 --> 01:08:40,880
i was curious what uh

1903
01:08:45,269 --> 01:08:42,400
procedures

1904
01:08:48,390 --> 01:08:45,279
is are you undertaking to reduce carbon

1905
01:08:50,470 --> 01:08:48,400
footprint for for these launches

1906
01:08:52,870 --> 01:08:50,480
oh that's a good question i don't know

1907
01:08:55,749 --> 01:08:52,880
that i can answer that

1908
01:08:57,349 --> 01:08:55,759
i can tell you that we have here on the

1909
01:08:58,470 --> 01:08:57,359
launch range we have an environmental

1910
01:08:59,990 --> 01:08:58,480
office

1911
01:09:02,470 --> 01:09:00,000
filled with

1912
01:09:06,709 --> 01:09:02,480
biologists chemists environmental

1913
01:09:08,390 --> 01:09:06,719

engineers that are constantly reviewing

1914
01:09:10,709 --> 01:09:08,400
missions and projects that we're

1915
01:09:13,829 --> 01:09:10,719
bringing here like lady

1916
01:09:15,430 --> 01:09:13,839
they do the same for antares or for a

1917
01:09:17,349 --> 01:09:15,440
sounding rocket

1918
01:09:19,590 --> 01:09:17,359
program that we have come here to launch

1919
01:09:20,630 --> 01:09:19,600
and so they're always looking at our

1920
01:09:23,430 --> 01:09:20,640
impact

1921
01:09:27,590 --> 01:09:23,440
by doing those missions on the

1922
01:09:28,470 --> 01:09:27,600
environment and how that fits in

1923
01:09:30,070 --> 01:09:28,480
with

1924
01:09:34,950 --> 01:09:30,080
you know overall having sort of a

1925
01:09:38,870 --> 01:09:37,110
marshlands and wetlands here that's sort

1926
01:09:40,470 --> 01:09:38,880
of the the main thing that we're

1927
01:09:42,390 --> 01:09:40,480
concerned about just because there are a

1928
01:09:44,149 --> 01:09:42,400
lot of

1929
01:09:45,829 --> 01:09:44,159
species and things like that that we

1930
01:10:00,149 --> 01:09:45,839
like to monitor and be sure that we're

1931
01:10:03,750 --> 01:10:02,149
this is not this is more of like an

1932
01:10:05,189 --> 01:10:03,760
environmental question i'm i'm just

1933
01:10:07,189 --> 01:10:05,199
wondering because i know that there's

1934
01:10:10,630 --> 01:10:07,199
just there's so many laws and things

1935
01:10:12,790 --> 01:10:10,640
that govern um you know the impact on on

1936
01:10:14,870 --> 01:10:12,800
a marshland or coastal environment

1937
01:10:18,950 --> 01:10:14,880
um and you think of that environment as

1938
01:10:22,550 --> 01:10:21,510

how influx is this one and and how are

1939
01:10:27,270 --> 01:10:22,560
you

1940
01:10:29,350 --> 01:10:27,280
is it stable

1941
01:10:32,390 --> 01:10:29,360
um yeah you are correct in that it's

1942
01:10:36,229 --> 01:10:32,400
always sort of changing um you can

1943
01:10:37,990 --> 01:10:36,239
see that sort of yearly uh our the the

1944
01:10:41,270 --> 01:10:38,000
launch island or wallops island where

1945
01:10:43,590 --> 01:10:41,280
the actual launch pads are um

1946
01:10:45,910 --> 01:10:43,600
each year you know beach erosion and

1947
01:10:47,669 --> 01:10:45,920
that sort of thing that's a very

1948
01:10:49,990 --> 01:10:47,679
prevalent thing and so

1949
01:10:52,149 --> 01:10:50,000
we have project initiatives to kind of

1950
01:10:55,270 --> 01:10:52,159
you know firm up the beach with you know

1951
01:10:56,470 --> 01:10:55,280
big rock walls and using geotubes and

1952
01:10:58,149 --> 01:10:56,480
planting

1953
01:11:00,310 --> 01:10:58,159
beach grass and that kind of stuff to

1954
01:11:02,870 --> 01:11:00,320
hold the sand in place so

1955
01:11:05,270 --> 01:11:02,880
that's just one of several efforts that

1956
01:11:07,030 --> 01:11:05,280
our environmental office goes through so

1957
01:11:09,189 --> 01:11:07,040
i think you hit it right where it is in

1958
01:11:13,189 --> 01:11:09,199
flux and there are all those kinds of

1959
01:11:15,030 --> 01:11:13,199
considerations to take in

1960
01:11:17,270 --> 01:11:15,040
last question

1961
01:11:19,590 --> 01:11:17,280
hi um what are the weather constraints

1962
01:11:20,709 --> 01:11:19,600
for this launch and how

1963
01:11:22,709 --> 01:11:20,719

do the

1964
01:11:25,510 --> 01:11:22,719
weather constraints for minotaur 5

1965
01:11:27,669 --> 01:11:25,520
differ from other systems

1966
01:11:30,149 --> 01:11:27,679
that's a good question so there there

1967
01:11:31,910 --> 01:11:30,159
are a lot a lot of weather constraints i

1968
01:11:32,790 --> 01:11:31,920
couldn't begin to list them all here of

1969
01:11:34,790 --> 01:11:32,800
course

1970
01:11:37,270 --> 01:11:34,800
lightning and thunderstorms that's a

1971
01:11:39,669 --> 01:11:37,280
very prevalent one so we don't want

1972
01:11:41,350 --> 01:11:39,679
those you know anywhere the potential

1973
01:11:43,430 --> 01:11:41,360
for lightning or lightning actually

1974
01:11:45,270 --> 01:11:43,440
within a certain number of miles of the

1975
01:11:48,310 --> 01:11:45,280
launch pad i believe it's

1976
01:11:51,030 --> 01:11:48,320
20 or 25 miles of the launch pad so

1977
01:11:54,630 --> 01:11:51,040
there's those kinds of constraints

1978
01:11:57,110 --> 01:11:54,640
wind of course is is always a factor

1979
01:11:59,350 --> 01:11:57,120
and ground level winds as well as you

1980
01:12:01,590 --> 01:11:59,360
know upper level winds as the vehicle is

1981
01:12:05,110 --> 01:12:01,600
progressing up on its vertical flight

1982
01:12:09,189 --> 01:12:07,990
tomorrow is looking wonderful for a

1983
01:12:12,310 --> 01:12:09,199
launch there

1984
01:12:14,229 --> 01:12:12,320
it is amazing at the

1985
01:12:16,870 --> 01:12:14,239
forecast that our launch whether their

1986
01:12:20,070 --> 01:12:16,880
officer has for tomorrow

1987
01:12:22,149 --> 01:12:20,080
here being on on the coast

1988
01:12:24,550 --> 01:12:22,159

we're usually in a weird spot where

1989
01:12:27,350 --> 01:12:24,560
we're getting some strong sea winds or

1990
01:12:29,189 --> 01:12:27,360
the humidity is too high or there's fog

1991
01:12:31,270 --> 01:12:29,199
in the morning or you know clouds

1992
01:12:33,669 --> 01:12:31,280
rolling in at night but tomorrow night

1993
01:12:35,669 --> 01:12:33,679
is looking looking very great i know our

1994
01:12:37,590 --> 01:12:35,679
launch weather officer actually had a

1995
01:12:40,070 --> 01:12:37,600
hard time kind of picking something that

1996
01:12:41,990 --> 01:12:40,080
might come to get us so he said maybe

1997
01:12:44,470 --> 01:12:42,000
some low-level clouds he threw that up

1998
01:12:47,350 --> 01:12:44,480
as a five percent chance so that means

1999
01:12:48,870 --> 01:12:47,360
95 percent chance of favorable launch

2000
01:12:51,430 --> 01:12:48,880
conditions

2001
01:12:54,229 --> 01:12:51,440
tomorrow as far as weather so

2002
01:12:58,470 --> 01:12:56,550
like a second grade student

2003
01:13:02,630 --> 01:12:58,480
when i was saying that the launch was

2004
01:13:06,390 --> 01:13:02,640
like 11 20 70 pm they were like

2005
01:13:10,790 --> 01:13:06,400
why 11 27 why not 11 30

2006
01:13:15,030 --> 01:13:11,990
i'm sorry

2007
01:13:16,310 --> 01:13:15,040
i i had a second grade student asked the

2008
01:13:17,590 --> 01:13:16,320
question

2009
01:13:20,630 --> 01:13:17,600
when i was telling them that the launch

2010
01:13:22,470 --> 01:13:20,640
was going to be 11 27 p.m and to watch

2011
01:13:24,390 --> 01:13:22,480
it if they could stay up that late and

2012
01:13:29,910 --> 01:13:24,400
they were like

2013
01:13:30,709 --> 01:13:29,920

why 11 27 why not 11 30 and why at night

2014
01:13:32,310 --> 01:13:30,719
so

2015
01:13:34,390 --> 01:13:32,320
yeah

2016
01:13:35,430 --> 01:13:34,400
i don't know that the you know day and

2017
01:13:38,630 --> 01:13:35,440
night doesn't make a whole bit of

2018
01:13:41,189 --> 01:13:38,640
difference but it is that exact time um

2019
01:13:44,470 --> 01:13:41,199
it's best for the

2020
01:13:46,550 --> 01:13:44,480
most effective time or window from that

2021
01:13:48,470 --> 01:13:46,560
time plus four minutes

2022
01:13:50,950 --> 01:13:48,480
to get to

2023
01:13:52,790 --> 01:13:50,960
the orbit insertion point and get onto

2024
01:13:55,270 --> 01:13:52,800
the moon

2025
01:13:57,270 --> 01:13:55,280
with the least amount of effort or

2026
01:13:59,350 --> 01:13:57,280
stress on the spacecraft in those

2027
01:14:01,669 --> 01:13:59,360
systems so there's a lot of

2028
01:14:04,229 --> 01:14:01,679
flight dynamics and orbit mechanics that

2029
01:14:06,070 --> 01:14:04,239
goes into figuring out that time that's

2030
01:14:07,510 --> 01:14:06,080
right you know

2031
01:14:08,790 --> 01:14:07,520
angles and

2032
01:14:10,630 --> 01:14:08,800
you know just

2033
01:14:13,510 --> 01:14:10,640
variability in a number of different

2034
01:14:15,910 --> 01:14:13,520
things and that specific time is the

2035
01:14:19,590 --> 01:14:15,920
best one to hit to hit our target of the

2036
01:14:23,110 --> 01:14:21,189
all right is that all

2037
01:14:27,590 --> 01:14:23,120
thank you jason thank you thank you very

2038
01:14:30,229 --> 01:14:29,189

so our our last speaker today is going

2039
01:14:31,750 --> 01:14:30,239
to actually talk a little bit of

2040
01:14:33,110 --> 01:14:31,760
something totally different we're going

2041
01:14:34,709 --> 01:14:33,120
to change gears here a little bit this

2042
01:14:35,910 --> 01:14:34,719
is ways to get involved with this

2043
01:14:38,070 --> 01:14:35,920
mission so

2044
01:14:39,669 --> 01:14:38,080
um this is for everyone at home this is

2045
01:14:41,430 --> 01:14:39,679
for everyone that's here this is all

2046
01:14:43,110 --> 01:14:41,440
sorts of ways for everybody to get

2047
01:14:46,149 --> 01:14:43,120
involved in this and so without any

2048
01:14:48,149 --> 01:14:46,159
further ado i have a brian day and he is

2049
01:14:52,149 --> 01:14:48,159
the education and public outreach lead

2050
01:14:55,510 --> 01:14:53,690
thank you very much

2051
01:14:57,590 --> 01:14:55,520
[Applause]

2052
01:15:01,350 --> 01:14:57,600
so as you have heard lady is a very

2053
01:15:02,790 --> 01:15:01,360
exciting very interesting mission

2054
01:15:04,870 --> 01:15:02,800
but this isn't something we're wanting

2055
01:15:07,189 --> 01:15:04,880
people to just watch us do this is

2056
01:15:09,910 --> 01:15:07,199
something that students and the general

2057
01:15:11,430 --> 01:15:09,920
public can directly participate in and

2058
01:15:24,950 --> 01:15:11,440
we're inviting you all to do that so

2059
01:15:24,960 --> 01:15:28,390
let's go one more time

2060
01:15:28,400 --> 01:15:33,350
one more slide please

2061
01:15:36,870 --> 01:15:34,550
so

2062
01:15:38,310 --> 01:15:36,880
one of the things that's going to happen

2063
01:15:39,669 --> 01:15:38,320

and we're waiting for the slide to come

2064
01:15:41,669 --> 01:15:39,679
up i'll talk one of the things that's

2065
01:15:44,070 --> 01:15:41,679
going to happen is that there's going to

2066
01:15:46,149 --> 01:15:44,080
be an opportunity for students

2067
01:15:49,590 --> 01:15:46,159
in classrooms across the country and

2068
01:15:52,390 --> 01:15:49,600
around the world to directly participate

2069
01:15:55,189 --> 01:15:52,400
in the science of the mission and even

2070
01:15:56,709 --> 01:15:55,199
in the operation of the mission

2071
01:15:59,189 --> 01:15:56,719
through a program called gavit the

2072
01:16:01,350 --> 01:15:59,199
goldstone apple valley radio telescope

2073
01:16:03,590 --> 01:16:01,360
program students will be able to take

2074
01:16:07,030 --> 01:16:03,600
remote control from their classrooms of

2075
01:16:09,189 --> 01:16:07,040
some of the giant 34 meter dishes

2076
01:16:11,110 --> 01:16:09,199
at nasa's goldstone deep space network

2077
01:16:13,030 --> 01:16:11,120
tracking facility

2078
01:16:15,510 --> 01:16:13,040
using these dishes they will be able to

2079
01:16:18,149 --> 01:16:15,520
track and monitor the health and status

2080
01:16:19,910 --> 01:16:18,159
of our spacecraft in flight

2081
01:16:22,310 --> 01:16:19,920
they'll actually be able to do doppler

2082
01:16:23,669 --> 01:16:22,320
studies of the carrier coming from our

2083
01:16:28,470 --> 01:16:23,679
spacecraft

2084
01:16:32,310 --> 01:16:28,480
orbit they will be able to do

2085
01:16:34,470 --> 01:16:32,320
basic exercises in orbital dynamics

2086
01:16:36,950 --> 01:16:34,480
but the exciting thing is during the

2087
01:16:38,630 --> 01:16:36,960
phasing loops they may be listening at

2088
01:16:40,870 --> 01:16:38,640

times that we are not

2089
01:16:43,350 --> 01:16:40,880
so if the spacecraft were to go into

2090
01:16:44,790 --> 01:16:43,360
safe mode it may well be a student that

2091
01:16:46,470 --> 01:16:44,800
hears it first

2092
01:16:48,229 --> 01:16:46,480
so this is not looking over the shoulder

2093
01:16:50,070 --> 01:16:48,239
this is not role playing this is

2094
01:16:51,669 --> 01:16:50,080
actually participating

2095
01:16:53,430 --> 01:16:51,679
exactly

2096
01:16:55,510 --> 01:16:53,440
i'd say next slide please but apparently

2097
01:16:56,790 --> 01:16:55,520
we don't have our slides

2098
01:16:58,470 --> 01:16:56,800
okay very good

2099
01:17:00,709 --> 01:16:58,480
so

2100
01:17:03,030 --> 01:17:00,719
in addition

2101
01:17:05,189 --> 01:17:03,040
and for me perhaps most excitingly

2102
01:17:07,110 --> 01:17:05,199
amateur astronomers i'm a i'm an

2103
01:17:09,189 --> 01:17:07,120
astronomer myself and i started out as

2104
01:17:12,470 --> 01:17:09,199
an amateur astronomer amateur

2105
01:17:14,310 --> 01:17:12,480
astronomers can play a key role

2106
01:17:16,870 --> 01:17:14,320
in this mission

2107
01:17:19,030 --> 01:17:16,880
it turns out that

2108
01:17:21,030 --> 01:17:19,040
meteoroid impacts striking the moon may

2109
01:17:23,669 --> 01:17:21,040
be one of the major sources for the

2110
01:17:25,830 --> 01:17:23,679
lunar atmosphere

2111
01:17:27,110 --> 01:17:25,840
and when meteoroids of

2112
01:17:29,350 --> 01:17:27,120
oh

2113
01:17:30,790 --> 01:17:29,360

maybe walnut size

2114
01:17:32,709 --> 01:17:30,800
hit the moon

2115
01:17:34,070 --> 01:17:32,719
they create a flash that is visible from

2116
01:17:35,910 --> 01:17:34,080
here on earth

2117
01:17:39,030 --> 01:17:35,920
in telescopes

2118
01:17:42,149 --> 01:17:39,040
8 to 14 inches diameter 8 to 14 inch

2119
01:17:45,030 --> 01:17:42,159
aperture telescope is the optimal range

2120
01:17:47,669 --> 01:17:45,040
of telescope size to detect these impact

2121
01:17:49,990 --> 01:17:47,679
flashes and that's the size of telescope

2122
01:17:53,030 --> 01:17:50,000
that a lot of schools

2123
01:17:54,870 --> 01:17:53,040
and a lot of amateur astronomers have

2124
01:17:56,630 --> 01:17:54,880
so we're looking to create a network of

2125
01:17:58,870 --> 01:17:56,640
observers

2126
01:18:00,149 --> 01:17:58,880
around the world watching for these

2127
01:18:02,229 --> 01:18:00,159
flashes

2128
01:18:04,550 --> 01:18:02,239
so that we can correlate these impact

2129
01:18:06,790 --> 01:18:04,560
events with changes that our instruments

2130
01:18:08,790 --> 01:18:06,800
see in the structure and composition of

2131
01:18:10,950 --> 01:18:08,800
the lunar atmosphere this will give us a

2132
01:18:14,149 --> 01:18:10,960
better understanding

2133
01:18:17,110 --> 01:18:14,159
of how these impacts play a role as a

2134
01:18:19,830 --> 01:18:17,120
source for the lunar atmosphere

2135
01:18:23,189 --> 01:18:19,840
now that's great if you happen to have

2136
01:18:26,229 --> 01:18:23,199
an 8 to 14 inch telescope

2137
01:18:29,189 --> 01:18:26,239
hands how many

2138
01:18:31,990 --> 01:18:29,199

a few and this is not a typical audience

2139
01:18:34,149 --> 01:18:32,000
i would venture a guess

2140
01:18:37,030 --> 01:18:34,159
most people out there do not have access

2141
01:18:38,630 --> 01:18:37,040
to such telescopes that's okay

2142
01:18:42,070 --> 01:18:38,640
you can still participate because it

2143
01:18:44,310 --> 01:18:42,080
turns out that the majority of impactors

2144
01:18:46,709 --> 01:18:44,320
hitting the moon are actually very very

2145
01:18:49,990 --> 01:18:46,719
small

2146
01:18:52,790 --> 01:18:50,000
if you do a plot of frequency of impact

2147
01:18:54,870 --> 01:18:52,800
versus diameter of impactor it peaks at

2148
01:18:57,110 --> 01:18:54,880
about one micron

2149
01:18:59,030 --> 01:18:57,120
now a one micron impactor is not going

2150
01:19:01,750 --> 01:18:59,040
to generate a flash that you would ever

2151
01:19:04,470 --> 01:19:01,760
be able to see from here on earth

2152
01:19:07,030 --> 01:19:04,480
but it turns out that even a very very

2153
01:19:09,830 --> 01:19:07,040
small piece of debris

2154
01:19:12,310 --> 01:19:09,840
when it hits our atmosphere becomes very

2155
01:19:14,229 --> 01:19:12,320
evident in the form of a meteor when you

2156
01:19:16,630 --> 01:19:14,239
look up in the sky and you see a meteor

2157
01:19:18,870 --> 01:19:16,640
the typical solid object causing that

2158
01:19:23,350 --> 01:19:18,880
streak of light in the sky is about the

2159
01:19:27,910 --> 01:19:25,510
now because the earth and moon are

2160
01:19:30,310 --> 01:19:27,920
traveling together through space

2161
01:19:32,149 --> 01:19:30,320
they encounter these streams of debris

2162
01:19:33,830 --> 01:19:32,159
together

2163
01:19:37,830 --> 01:19:33,840

and so if you were to go out in the

2164
01:19:39,590 --> 01:19:37,840
night sky and simply count meteors

2165
01:19:41,110 --> 01:19:39,600
and see how that varies from night to

2166
01:19:43,030 --> 01:19:41,120
night

2167
01:19:44,790 --> 01:19:43,040
we can therefore make inferences as to

2168
01:19:45,669 --> 01:19:44,800
what's happening on the surface of the

2169
01:19:47,510 --> 01:19:45,679
moon

2170
01:19:49,669 --> 01:19:47,520
the great thing about doing meteor

2171
01:19:52,870 --> 01:19:49,679
counting is the equipment requirements

2172
01:19:54,550 --> 01:19:52,880
are absolutely negligible you do not

2173
01:19:55,830 --> 01:19:54,560
need a telescope you do not need

2174
01:19:58,070 --> 01:19:55,840
binoculars

2175
01:20:00,630 --> 01:19:58,080
i do recommend a reclining lawn chair

2176
01:20:02,470 --> 01:20:00,640
you might as well be comfortable

2177
01:20:04,790 --> 01:20:02,480
but as is the case with almost

2178
01:20:08,310 --> 01:20:04,800
everything these days there's even an

2179
01:20:12,709 --> 01:20:10,229
our good friends at the nasa meteoroid

2180
01:20:13,830 --> 01:20:12,719
environment office have come up with a

2181
01:20:15,030 --> 01:20:13,840
an app

2182
01:20:17,030 --> 01:20:15,040
both for

2183
01:20:21,030 --> 01:20:17,040
iphone and for android

2184
01:20:22,630 --> 01:20:21,040
ingeniously named meteor counter

2185
01:20:24,870 --> 01:20:22,640
and the great thing your phone knows

2186
01:20:26,870 --> 01:20:24,880
what time it is it knows where you are

2187
01:20:29,270 --> 01:20:26,880
you go out under the nighttime sky and

2188
01:20:30,870 --> 01:20:29,280

you start tapping when you see a meteor

2189
01:20:32,950 --> 01:20:30,880
you tap on the right side for a bright

2190
01:20:35,750 --> 01:20:32,960
meteor on the left side for a dim meteor

2191
01:20:37,669 --> 01:20:35,760
in between for an in-between meteor

2192
01:20:39,590 --> 01:20:37,679
it records all that information along

2193
01:20:41,189 --> 01:20:39,600
with where you are and what time it is

2194
01:20:44,550 --> 01:20:41,199
and at the end of your observing session

2195
01:20:47,590 --> 01:20:44,560
it uploads that to nasa

2196
01:20:49,750 --> 01:20:47,600
anyone can be a part of the science of

2197
01:20:52,229 --> 01:20:49,760
this mission

2198
01:20:55,189 --> 01:20:52,239
now i just like to wrap up that there is

2199
01:20:57,270 --> 01:20:55,199
more information about gavit

2200
01:20:58,310 --> 01:20:57,280
out here in the exhibits area

2201
01:21:00,310 --> 01:20:58,320
i

2202
01:21:02,709 --> 01:21:00,320
encourage you to talk to them there's

2203
01:21:05,270 --> 01:21:02,719
more information on the meteoroid impact

2204
01:21:07,430 --> 01:21:05,280
observation campaign the exhibit area

2205
01:21:10,070 --> 01:21:07,440
for the nasa meteorite environment

2206
01:21:12,830 --> 01:21:10,080
office and you if you come by the latte

2207
01:21:16,870 --> 01:21:12,840
exhibit we have information on meteor

2208
01:21:19,590 --> 01:21:16,880
counter but i enjoy i invite you and the

2209
01:21:21,750 --> 01:21:19,600
rest of the public to join us in this

2210
01:21:24,440 --> 01:21:21,760
mission and the exploration of the lunar

2211
01:21:36,790 --> 01:21:24,450
atmosphere thank you very much

2212
01:21:41,189 --> 01:21:39,270
hi brian um i know the research center

2213
01:21:43,110 --> 01:21:41,199

is currently doing some archival work

2214
01:21:45,669 --> 01:21:43,120
with the surveyor

2215
01:21:47,350 --> 01:21:45,679
tapes uh with the lunar orbiter orbiter

2216
01:21:50,550 --> 01:21:47,360
sorry yes um

2217
01:21:53,669 --> 01:21:50,560
was is that information um being held by

2218
01:21:56,550 --> 01:21:53,679
ames at all important for the fact that

2219
01:21:59,110 --> 01:21:56,560
ames is creating laddie

2220
01:22:00,629 --> 01:21:59,120
well it has been very instrumental so

2221
01:22:02,470 --> 01:22:00,639
let's talk about some of the things that

2222
01:22:04,629 --> 01:22:02,480
have been happening at ames with regard

2223
01:22:07,189 --> 01:22:04,639
to lunar research

2224
01:22:08,870 --> 01:22:07,199
obviously we have the

2225
01:22:11,270 --> 01:22:08,880
lady mission

2226
01:22:13,270 --> 01:22:11,280
before that we had the l cross mission

2227
01:22:15,910 --> 01:22:13,280
that discovered water ice on the moon

2228
01:22:17,350 --> 01:22:15,920
and i see a few familiar l cross faces

2229
01:22:18,870 --> 01:22:17,360
out here in the audience and that makes

2230
01:22:20,709 --> 01:22:18,880
me feel very good

2231
01:22:23,189 --> 01:22:20,719
um

2232
01:22:24,470 --> 01:22:23,199
nasa ames was also

2233
01:22:30,550 --> 01:22:24,480
the

2234
01:22:33,590 --> 01:22:30,560
institute that was set up and has

2235
01:22:35,750 --> 01:22:33,600
recently morphed into

2236
01:22:38,310 --> 01:22:35,760
survey the solar system exploration

2237
01:22:41,910 --> 01:22:38,320
research virtual institute

2238
01:22:44,390 --> 01:22:41,920

long name but the the

2239
01:22:46,629 --> 01:22:44,400
impetus behind that name is our turf got

2240
01:22:48,310 --> 01:22:46,639
expanded so it's not just the moon

2241
01:22:50,709 --> 01:22:48,320
anymore we're still doing the moon but

2242
01:22:53,590 --> 01:22:50,719
now we've also got near earth asteroids

2243
01:22:55,910 --> 01:22:53,600
as well as phobos and deimos so we had

2244
01:22:56,790 --> 01:22:55,920
to expand our name for expanded playing

2245
01:22:59,590 --> 01:22:56,800
field

2246
01:23:02,070 --> 01:22:59,600
but there's been a lot of

2247
01:23:03,110 --> 01:23:02,080
research going on with regards to the

2248
01:23:06,390 --> 01:23:03,120
moon

2249
01:23:08,629 --> 01:23:06,400
and the loirp the lunar orbiter image

2250
01:23:11,110 --> 01:23:08,639
recovery project is something that's

2251
01:23:13,910 --> 01:23:11,120
going on there at the

2252
01:23:16,390 --> 01:23:13,920
nasa research park there in the ames

2253
01:23:18,629 --> 01:23:16,400
area and that's uh so there's been great

2254
01:23:20,310 --> 01:23:18,639
synergy between this and then we're

2255
01:23:22,070 --> 01:23:20,320
working very closely we've been working

2256
01:23:24,229 --> 01:23:22,080
very closely with the lunar quest

2257
01:23:26,790 --> 01:23:24,239
program office at marshall

2258
01:23:29,030 --> 01:23:26,800
with our friends at gpl especially the

2259
01:23:30,709 --> 01:23:29,040
lunar mapping and modeling portal

2260
01:23:32,470 --> 01:23:30,719
oh and both of those

2261
01:23:41,669 --> 01:23:32,480
fine organizations have exhibits out

2262
01:23:46,229 --> 01:23:44,070
i have a question about the

2263
01:23:48,310 --> 01:23:46,239

meteors that are impacting the moon

2264
01:23:49,830 --> 01:23:48,320
i've heard that some uh they believe

2265
01:23:51,910 --> 01:23:49,840
there might be water on the moon that

2266
01:23:53,030 --> 01:23:51,920
some of it may be cometary

2267
01:23:56,229 --> 01:23:53,040
in nature

2268
01:23:57,910 --> 01:23:56,239
and uh what kind of meteors do hit pepe

2269
01:24:00,149 --> 01:23:57,920
are they all just stony meteors or are

2270
01:24:02,790 --> 01:24:00,159
they made of other materials

2271
01:24:04,950 --> 01:24:02,800
so what types of meteoroid impacts do we

2272
01:24:07,910 --> 01:24:04,960
see on the moon uh quite frankly the

2273
01:24:09,910 --> 01:24:07,920
majority of the impacts we see

2274
01:24:13,750 --> 01:24:09,920
are shower related

2275
01:24:15,830 --> 01:24:13,760
so they are related to meteor showers

2276
01:24:17,510 --> 01:24:15,840
so a particularly good time to go out

2277
01:24:19,510 --> 01:24:17,520
and look for meteorite impacts on the

2278
01:24:21,430 --> 01:24:19,520
moon is during a meteor shower

2279
01:24:23,750 --> 01:24:21,440
now i do not want to discourage you from

2280
01:24:25,350 --> 01:24:23,760
looking on other nights because even on

2281
01:24:28,310 --> 01:24:25,360
nights when we don't have showers there

2282
01:24:30,390 --> 01:24:28,320
are important impacts to catch

2283
01:24:32,550 --> 01:24:30,400
but when we look at these meteor showers

2284
01:24:35,990 --> 01:24:32,560
the vast majority of meteor showers are

2285
01:24:37,669 --> 01:24:36,000
derived from comets they are debris left

2286
01:24:40,390 --> 01:24:37,679
behind by comets

2287
01:24:42,870 --> 01:24:40,400
and comets are particularly rich in

2288
01:24:47,030 --> 01:24:42,880

volatiles including water

2289
01:24:48,149 --> 01:24:47,040
so yes we would expect to see

2290
01:24:50,229 --> 01:24:48,159
water

2291
01:24:59,270 --> 01:24:50,239
as a component in those

2292
01:25:09,350 --> 01:25:05,910
thank you very much

2293
01:25:10,709 --> 01:25:09,360
for our audience that's watching on nasa

2294
01:25:13,030 --> 01:25:10,719
television at home we're going to go

2295
01:25:14,629 --> 01:25:13,040
ahead and be leaving you all now um we

2296
01:25:17,270 --> 01:25:14,639
really do appreciate you all tuning in

2297
01:25:19,189 --> 01:25:17,280
and watching our broadcast today um if

2298
01:25:21,030 --> 01:25:19,199
you are looking for how to find this

2299
01:25:23,510 --> 01:25:21,040
mission you can find us online on social

2300
01:25:25,510 --> 01:25:23,520
media we're gonna be doing live launch

2301
01:25:28,070 --> 01:25:25,520
coverage and admission updates tomorrow

2302
01:25:29,030 --> 01:25:28,080
night on at nasa and at nasaladdi on

2303
01:25:31,189 --> 01:25:29,040
twitter

2304
01:25:32,709 --> 01:25:31,199
also the nasa facebook page and the nasa

2305
01:25:34,470 --> 01:25:32,719
google plus page

2306
01:25:36,149 --> 01:25:34,480
moving on beyond there

2307
01:25:39,430 --> 01:25:36,159
you can find out more information about

2308
01:25:43,110 --> 01:25:39,440
this mission at www.nasa.gov

2309
01:25:45,189 --> 01:25:43,120
slash laddie that's l-a-d-e-e

2310
01:25:47,669 --> 01:25:45,199
and um as always we're gonna do live

2311
01:25:50,149 --> 01:25:47,679
television coverage starting around 9 00

2312
01:25:52,470 --> 01:25:50,159
p.m tomorrow night on nasa television if

2313
01:25:54,310 --> 01:25:52,480

you want to find out more about that uh

2314
01:25:57,350 --> 01:25:54,320
you can go onto the laddie website at

2315
01:25:59,990 --> 01:25:57,360
nasa.gov laddie and tune in to watch our

2316
01:26:01,669 --> 01:26:00,000
live broadcast and we should uh have a

2317
01:26:04,870 --> 01:26:01,679
beautiful night launch tomorrow night at

2318
01:26:07,910 --> 01:26:04,880
11 27 pm eastern time so look forward to

2319
01:26:13,590 --> 01:26:07,920
that and you all joining us on there so