1
00:00:08,230 --> 00:00:06,309
good morning everyone welcome to our

2
00:00:09,990 --> 00:00:08,240
future science missions and nasa

3
00:00:12,470 --> 00:00:10,000
launches news conference

4
00:00:14,150 --> 00:00:12,480
here to discuss some of our upcoming

5
00:00:17,430 --> 00:00:14,160
science missions

6
00:00:21,349 --> 00:00:17,440
is walid abdullahi nasa's chief

7
00:00:28,150 --> 00:00:23,509
amanda mitschevich the nasa launch

8
00:00:32,630 --> 00:00:30,230
scott bolton the juno principal

9
00:00:37,430 --> 00:00:32,640
investigator from the southwest research

10
00:00:41,590 --> 00:00:39,670
maria zuber the grail principal

11
00:00:45,590 --> 00:00:41,600
investigator from the massachusetts

12
00:00:49,190 --> 00:00:47,430
john grossinger the mars science

13
00:00:53,910 --> 00:00:49,200

laboratory project scientist from the

14
00:00:58,549 --> 00:00:56,630
and daniel stern the nustar project

15
00:01:00,470 --> 00:00:58,559
scientist from the jet propulsion

16
00:01:02,709 --> 00:01:00,480
laboratory

17
00:01:05,590 --> 00:01:02,719
and we'll begin first with waleed

18
00:01:06,870 --> 00:01:05,600
abdullahi nasa's chief scientist

19
00:01:09,429 --> 00:01:06,880
all right thank you

20
00:01:11,510 --> 00:01:09,439
let me start by welcoming you here and i

21
00:01:13,670 --> 00:01:11,520
just want to say very briefly you're

22
00:01:15,590 --> 00:01:13,680
going to hear about some fascinating

23
00:01:17,749 --> 00:01:15,600
science missions today

24
00:01:19,590 --> 00:01:17,759
and a little more detail from my

25
00:01:21,429 --> 00:01:19,600
colleagues to my left

26
00:01:23,270 --> 00:01:21,439
but what i really wanted to do is just

27
00:01:25,830 --> 00:01:23,280
take a second to

28
00:01:28,710 --> 00:01:25,840
remind you or state how science fits

29
00:01:32,310 --> 00:01:28,720
into the nasa portfolio and really nasa

30
00:01:34,710 --> 00:01:32,320
stands very strongly on three pillars

31
00:01:37,030 --> 00:01:34,720
human space flight which is the most i

32
00:01:38,789 --> 00:01:37,040
think visible to many in the external

33
00:01:40,550 --> 00:01:38,799
community

34
00:01:42,630 --> 00:01:40,560
aeronautics which some of you heard

35
00:01:45,670 --> 00:01:42,640
about in the previous hour

36
00:01:47,590 --> 00:01:45,680
and science and science i'm the chief

37
00:01:50,550 --> 00:01:47,600
scientist at nasa so science holds a

38
00:01:52,789 --> 00:01:50,560

special place for me um

39
00:01:55,109 --> 00:01:52,799
but it's really because of what

40
00:01:57,429 --> 00:01:55,119
we can do at nasa what that science

41
00:01:59,350 --> 00:01:57,439
enables us to do and if you think about

42
00:02:00,870 --> 00:01:59,360
it i think there's there's a kid in all

43
00:02:02,870 --> 00:02:00,880
of us that's

44
00:02:05,270 --> 00:02:02,880
looking up at the heavens and wondering

45
00:02:07,109 --> 00:02:05,280
what's out there what's it like you know

46
00:02:09,510 --> 00:02:07,119
is there life out there

47
00:02:11,430 --> 00:02:09,520
just full of questions you were all on

48
00:02:12,150 --> 00:02:11,440
that camping trip or whatever when you

49
00:02:14,309 --> 00:02:12,160
were

50
00:02:16,309 --> 00:02:14,319
five or six years old and saw zillions

51
00:02:18,550 --> 00:02:16,319
of stars in the sky and just were filled

52
00:02:20,550 --> 00:02:18,560
with wonder and and i don't think that

53
00:02:22,790 --> 00:02:20,560
ever ever leaves us

54
00:02:24,790 --> 00:02:22,800
and there's the adult in us that

55
00:02:27,830 --> 00:02:24,800
appreciates the beauty of the universe

56
00:02:30,550 --> 00:02:27,840
around us that appreciates the beauty of

57
00:02:32,790 --> 00:02:30,560
the earth from space and that recognizes

58
00:02:34,949 --> 00:02:32,800
the need to understand

59
00:02:37,430 --> 00:02:34,959
our planet how it functions how it's

60
00:02:39,990 --> 00:02:37,440
changing why it's changing

61
00:02:42,150 --> 00:02:40,000
and looking more grandly our place in

62
00:02:44,309 --> 00:02:42,160
the universe how the universe works how

63
00:02:46,949 --> 00:02:44,319

the solar system works to to answer

64
00:02:49,030 --> 00:02:46,959
really some fundamental questions

65
00:02:50,630 --> 00:02:49,040
that are at the very core of the human

66
00:02:53,990 --> 00:02:50,640
spirit

67
00:02:56,550 --> 00:02:54,000
that drive us it's in our dna to explore

68
00:02:59,270 --> 00:02:56,560
to understand to learn to try and

69
00:03:01,110 --> 00:02:59,280
survive in a changing world to try and

70
00:03:03,670 --> 00:03:01,120
thrive in a changing world and the

71
00:03:05,430 --> 00:03:03,680
perspective that we get from space

72
00:03:07,110 --> 00:03:05,440
whether it's looking outward to the

73
00:03:08,470 --> 00:03:07,120
edges of the universe in the beginning

74
00:03:10,790 --> 00:03:08,480
of time

75
00:03:11,670 --> 00:03:10,800
or inward back at the planet on which we

76
00:03:15,270 --> 00:03:11,680
live

77
00:03:17,830 --> 00:03:15,280
is unique it's important it fuels that

78
00:03:21,430 --> 00:03:17,840
hunger that's in us all and you're going

79
00:03:23,670 --> 00:03:21,440
to hear today about a few missions we

80
00:03:25,589 --> 00:03:23,680
have dozens and dozens actually but you

81
00:03:27,670 --> 00:03:25,599
can hear about a few that are up and

82
00:03:29,589 --> 00:03:27,680
coming that are very very exciting so

83
00:03:31,190 --> 00:03:29,599
with that i'll turn that over all right

84
00:03:33,589 --> 00:03:31,200
thank you

85
00:03:35,670 --> 00:03:33,599
now we'll go to amanda mitzkiewicz she

86
00:03:37,750 --> 00:03:35,680
is the nasa launch services program

87
00:03:39,589 --> 00:03:37,760
manager from the kennedy space center

88
00:03:41,910 --> 00:03:39,599

amanda

89
00:03:43,990 --> 00:03:41,920
thank you george good morning it's

90
00:03:45,509 --> 00:03:44,000
really my pleasure to be here today to

91
00:03:47,750 --> 00:03:45,519
be able to talk to you about the launch

92
00:03:50,630 --> 00:03:47,760
services program and about some of the

93
00:03:53,429 --> 00:03:50,640
exciting missions that walid mentioned

94
00:03:55,270 --> 00:03:53,439
first chart please

95
00:03:57,589 --> 00:03:55,280
we are earth's bridge to space for all

96
00:04:00,710 --> 00:03:57,599
of nasa's robotic missions

97
00:04:03,429 --> 00:04:00,720
so the missions that walid needs to have

98
00:04:05,750 --> 00:04:03,439
go to space to do all of the neat nasa

99
00:04:07,350 --> 00:04:05,760
science that we that we have in place

100
00:04:08,869 --> 00:04:07,360
and that will be doing in the future

101
00:04:11,030 --> 00:04:08,879
need a rocket to get there and we

102
00:04:12,630 --> 00:04:11,040
provide that bridge to the rocket to get

103
00:04:15,190 --> 00:04:12,640
the missions there

104
00:04:17,189 --> 00:04:15,200
next chart please

105
00:04:19,590 --> 00:04:17,199
so what we do is we are really the

106
00:04:21,670 --> 00:04:19,600
broker between the spacecraft and

107
00:04:24,950 --> 00:04:21,680
between the launch vehicle so if you see

108
00:04:26,550 --> 00:04:24,960
there on the chart uh in the upper left

109
00:04:28,390 --> 00:04:26,560
those are the spacecraft customers that

110
00:04:30,950 --> 00:04:28,400
we work with several of them mentioned

111
00:04:32,390 --> 00:04:30,960
here today jet propulsion lab goddard

112
00:04:34,390 --> 00:04:32,400
space flight center

113
00:04:36,950 --> 00:04:34,400

ames research center

114
00:04:39,110 --> 00:04:36,960
applied physics lab many many different

115
00:04:42,150 --> 00:04:39,120
places across the country universities

116
00:04:43,990 --> 00:04:42,160
and nasa centers we help them determine

117
00:04:45,590 --> 00:04:44,000
what the best rocket is that suits the

118
00:04:46,950 --> 00:04:45,600
requirements that they have to do their

119
00:04:49,110 --> 00:04:46,960
science missions

120
00:04:50,310 --> 00:04:49,120
we also work with the telecommunications

121
00:04:54,070 --> 00:04:50,320
satellites

122
00:04:55,030 --> 00:04:54,080
tdrs in order to help them get to orbit

123
00:04:56,870 --> 00:04:55,040
as well

124
00:04:58,469 --> 00:04:56,880
so we work with them very early on in

125
00:05:00,629 --> 00:04:58,479
the in the program usually years and

126
00:05:02,230 --> 00:05:00,639
years in advance as the principal

127
00:05:04,469 --> 00:05:02,240
investigators are developing the science

128
00:05:06,710 --> 00:05:04,479
and the spacecraft is coming together we

129
00:05:08,710 --> 00:05:06,720
help them figure out which rocket will

130
00:05:10,469 --> 00:05:08,720
get them where they need to go and then

131
00:05:13,029 --> 00:05:10,479
throughout the process we work with them

132
00:05:15,029 --> 00:05:13,039
very closely in order to integrate all

133
00:05:17,029 --> 00:05:15,039
those requirements together to get to a

134
00:05:19,110 --> 00:05:17,039
successful launch we provide the overall

135
00:05:20,550 --> 00:05:19,120
mission assurance for the integrated

136
00:05:25,029 --> 00:05:20,560
stack of the launch vehicle and

137
00:05:29,830 --> 00:05:26,710
we have been at the kennedy space center

138
00:05:31,189 --> 00:05:29,840

since the late 90s 1998 we were formed

139
00:05:33,189 --> 00:05:31,199
at kennedy space center as the launch

140
00:05:36,230 --> 00:05:33,199
services program since then we've

141
00:05:37,670 --> 00:05:36,240
launched over 65 missions for nasa

142
00:05:39,990 --> 00:05:37,680
they include many missions that you

143
00:05:42,629 --> 00:05:40,000
probably have heard of in the past

144
00:05:45,270 --> 00:05:42,639
spirit and opportunity rovers which

145
00:05:47,029 --> 00:05:45,280
have exciting science back from mars the

146
00:05:49,590 --> 00:05:47,039
dawn mission which you'll be hearing

147
00:05:52,070 --> 00:05:49,600
about more in the next couple of weeks

148
00:05:54,629 --> 00:05:52,080
be going to the asteroid vesta you've

149
00:05:56,390 --> 00:05:54,639
already seen some images from that

150
00:05:58,950 --> 00:05:56,400
the pluto new horizons mission we

151
00:06:00,950 --> 00:05:58,960
launched that back in 2006 that'll be

152
00:06:03,270 --> 00:06:00,960
arriving closest approach to pluto in

153
00:06:05,909 --> 00:06:03,280
2015 and then in the kuiper belt in

154
00:06:07,590 --> 00:06:05,919
2016. and most recently we launched the

155
00:06:09,990 --> 00:06:07,600
aquarius mission from vandenberg air

156
00:06:12,070 --> 00:06:10,000
force base in california that's an earth

157
00:06:14,070 --> 00:06:12,080
observing mission that is studying the

158
00:06:15,670 --> 00:06:14,080
salt basically in the surface of the sea

159
00:06:18,309 --> 00:06:15,680
so that we can understand its effects

160
00:06:20,790 --> 00:06:18,319
better on the entire planet

161
00:06:22,230 --> 00:06:20,800
next chart

162
00:06:24,070 --> 00:06:22,240
so we launched all these missions from a

163
00:06:26,469 --> 00:06:24,080

variety of launch sites across the

164
00:06:28,790 --> 00:06:26,479
country and really across the world

165
00:06:30,390 --> 00:06:28,800
our majority of our launches over 50 are

166
00:06:32,710 --> 00:06:30,400
from the kennedy space center area at

167
00:06:34,309 --> 00:06:32,720
cape canaveral air force station we also

168
00:06:35,749 --> 00:06:34,319
launched about 40 percent of our

169
00:06:37,749 --> 00:06:35,759
missions out in california from the

170
00:06:39,670 --> 00:06:37,759
vandenberg air force base

171
00:06:41,189 --> 00:06:39,680
we have launched a couple from kwajalein

172
00:06:42,710 --> 00:06:41,199
and the new star mission that you'll be

173
00:06:44,790 --> 00:06:42,720
hearing about later on we'll be

174
00:06:47,510 --> 00:06:44,800
launching from kwajalein atoll we've

175
00:06:49,510 --> 00:06:47,520
also had a launch out of kodiak alaska

176
00:06:51,830 --> 00:06:49,520
and finally wallops flight facility is

177
00:06:54,150 --> 00:06:51,840
also a site that we can use if emission

178
00:06:56,469 --> 00:06:54,160
requirements drive us there so at all of

179
00:06:58,550 --> 00:06:56,479
these sites we also provide payload

180
00:07:00,390 --> 00:06:58,560
processing facilities for the spacecraft

181
00:07:02,390 --> 00:07:00,400
to show up and do their final processing

182
00:07:04,550 --> 00:07:02,400
and preparations before launch

183
00:07:06,309 --> 00:07:04,560
at any given time we have about 35

184
00:07:07,670 --> 00:07:06,319
missions in flow

185
00:07:09,830 --> 00:07:07,680
while you'll see that we have four to

186
00:07:12,150 --> 00:07:09,840
five launches each year next chart

187
00:07:15,830 --> 00:07:14,390
we typically work on 35 missions at any

188
00:07:18,070 --> 00:07:15,840

given time and i know that's a little

189
00:07:20,070 --> 00:07:18,080
bit difficult to see but this is to show

190
00:07:22,150 --> 00:07:20,080
you that that nasa has a very healthy

191
00:07:24,390 --> 00:07:22,160
manifest of science missions and robotic

192
00:07:27,029 --> 00:07:24,400
missions coming up here in the next five

193
00:07:28,469 --> 00:07:27,039
years the first mission there 2012 the

194
00:07:29,670 --> 00:07:28,479
new star mission again you'll hear more

195
00:07:32,150 --> 00:07:29,680
about that shortly that will be

196
00:07:34,309 --> 00:07:32,160
launching on a pegasus launch vehicle

197
00:07:36,230 --> 00:07:34,319
and then there is a good mix of earth

198
00:07:37,990 --> 00:07:36,240
observing missions and also planetary

199
00:07:39,670 --> 00:07:38,000
missions and deep space missions that

200
00:07:41,909 --> 00:07:39,680
will be launching through 2016 every

201
00:07:44,309 --> 00:07:41,919
couple years there'll be a mars mission

202
00:07:46,070 --> 00:07:44,319
that you can look forward to next chart

203
00:07:48,230 --> 00:07:46,080
please

204
00:07:50,469 --> 00:07:48,240
so more near term to us

205
00:07:52,469 --> 00:07:50,479
actually in the next four months and

206
00:07:55,110 --> 00:07:52,479
really completing in less than four

207
00:07:57,189 --> 00:07:55,120
months are four big missions for nasa

208
00:07:58,710 --> 00:07:57,199
the juno mission you can kind of see in

209
00:08:00,550 --> 00:07:58,720
that picture the huge solar array

210
00:08:02,390 --> 00:08:00,560
structure that it has those solar arrays

211
00:08:04,309 --> 00:08:02,400
will fold up within the atlas v fairing

212
00:08:05,990 --> 00:08:04,319
for launch and then deploy

213
00:08:08,629 --> 00:08:06,000

the grail mission be launching on a

214
00:08:10,070 --> 00:08:08,639
delta ii from cape canaveral

215
00:08:12,629 --> 00:08:10,080
two spacecraft that will be joined

216
00:08:14,710 --> 00:08:12,639
together within the delta ii fairing

217
00:08:17,350 --> 00:08:14,720
the npp mission that is an earth

218
00:08:19,189 --> 00:08:17,360
observing mission that's multi-agency

219
00:08:20,550 --> 00:08:19,199
something interesting that we're doing

220
00:08:22,469 --> 00:08:20,560
with that mission

221
00:08:24,869 --> 00:08:22,479
we've been putting a program together to

222
00:08:26,790 --> 00:08:24,879
launch very small cubesat satellites for

223
00:08:28,390 --> 00:08:26,800
universities there'll be several of

224
00:08:30,469 --> 00:08:28,400
those cubesats on that mission we're

225
00:08:31,749 --> 00:08:30,479
trying to provide capabilities on all of

226
00:08:33,829 --> 00:08:31,759
our launch vehicles to launch some

227
00:08:36,469 --> 00:08:33,839
educational satellites and then finally

228
00:08:38,230 --> 00:08:36,479
the mars science laboratory a giant

229
00:08:39,909 --> 00:08:38,240
rover that'll be going to mars and again

230
00:08:42,630 --> 00:08:39,919
you'll hear more about that that'll be

231
00:08:43,670 --> 00:08:42,640
on an atlas 5 around thanksgiving

232
00:08:46,310 --> 00:08:43,680
so

233
00:08:48,230 --> 00:08:46,320
this is really unprecedented in terms of

234
00:08:49,590 --> 00:08:48,240
the tempo that nasa will be doing in the

235
00:08:51,750 --> 00:08:49,600
next few months

236
00:08:53,750 --> 00:08:51,760
some really exciting missions that have

237
00:08:56,230 --> 00:08:53,760
very precise timing for launch windows

238
00:08:57,509 --> 00:08:56,240

and all the pieces come together in a

239
00:08:59,190 --> 00:08:57,519
really good fashion in order to make

240
00:09:00,870 --> 00:08:59,200
those launch dates

241
00:09:02,790 --> 00:09:00,880
next chart

242
00:09:06,070 --> 00:09:02,800
and finally i'll leave you with we are

243
00:09:07,910 --> 00:09:06,080
on all of the media twitter facebook the

244
00:09:10,710 --> 00:09:07,920
nasa app we're adding some information

245
00:09:11,590 --> 00:09:10,720
to and also at the nasa website thank

246
00:09:16,630 --> 00:09:11,600
you

247
00:09:18,790 --> 00:09:16,640
he is the juno principal investigator

248
00:09:21,430 --> 00:09:18,800
from the southwest research institute in

249
00:09:23,190 --> 00:09:21,440
san antonio scott

250
00:09:25,110 --> 00:09:23,200
hi thank you very

251
00:09:27,750 --> 00:09:25,120
having me here um

252
00:09:29,750 --> 00:09:27,760
i'm here to talk about juno and after

253
00:09:31,110 --> 00:09:29,760
the completion of this next shuttle

254
00:09:34,230 --> 00:09:31,120
launch

255
00:09:36,389 --> 00:09:34,240
juno is the next one up we leave august

256
00:09:37,509 --> 00:09:36,399
5th just a little less than a month from

257
00:09:40,070 --> 00:09:37,519
now

258
00:09:42,949 --> 00:09:40,080
and we're going to jupiter and we're

259
00:09:45,110 --> 00:09:42,959
going on an atlas 5 with the help of lsp

260
00:09:47,829 --> 00:09:45,120
that you just heard

261
00:09:49,509 --> 00:09:47,839
now what juno is is really a voyage back

262
00:09:51,829 --> 00:09:49,519
in history

263
00:09:53,590 --> 00:09:51,839

we're going back to jupiter

264
00:09:55,910 --> 00:09:53,600
in order to really

265
00:09:57,829 --> 00:09:55,920
discover

266
00:09:59,910 --> 00:09:57,839
how the planets are made and what the

267
00:10:03,269 --> 00:09:59,920
early solar system was like

268
00:10:05,190 --> 00:10:03,279
can i get the first chart please

269
00:10:07,110 --> 00:10:05,200
so the reason we go back to uh to

270
00:10:09,910 --> 00:10:07,120
jupiter is it's the largest of all the

271
00:10:11,509 --> 00:10:09,920
planets uh in fact if you took

272
00:10:13,670 --> 00:10:11,519
everything in the solar system other

273
00:10:15,829 --> 00:10:13,680
than the sun itself it would all fit

274
00:10:17,509 --> 00:10:15,839
inside of jupiter

275
00:10:19,750 --> 00:10:17,519
and so when you want to go back to the

276
00:10:22,389 --> 00:10:19,760
history and understand how planets were

277
00:10:23,990 --> 00:10:22,399
made and what was going on very early in

278
00:10:26,310 --> 00:10:24,000
the solar system you really have to go

279
00:10:27,990 --> 00:10:26,320
back to jupiter because it it grew from

280
00:10:29,910 --> 00:10:28,000
the leftovers

281
00:10:31,430 --> 00:10:29,920
of the sun so the sun formed whatever

282
00:10:33,110 --> 00:10:31,440
was left over

283
00:10:35,190 --> 00:10:33,120
form the planets and everything else in

284
00:10:37,190 --> 00:10:35,200
our solar system and the majority of it

285
00:10:39,190 --> 00:10:37,200
went into jupiter

286
00:10:41,110 --> 00:10:39,200
and so we're very much

287
00:10:43,190 --> 00:10:41,120
about going back and

288
00:10:44,310 --> 00:10:43,200

almost figuring out the recipe for

289
00:10:46,470 --> 00:10:44,320
planets

290
00:10:47,990 --> 00:10:46,480
and the way we're approaching that the

291
00:10:50,230 --> 00:10:48,000
the first step in understanding that

292
00:10:52,790 --> 00:10:50,240
recipe is we're back at the level of

293
00:10:54,949 --> 00:10:52,800
figuring out what's the ingredient list

294
00:10:56,949 --> 00:10:54,959
and so we're going back to jupiter in

295
00:10:59,190 --> 00:10:56,959
order to discover that ingredient list

296
00:11:02,550 --> 00:10:59,200
we're looking for what's really inside

297
00:11:04,389 --> 00:11:02,560
jupiter how is it put together and built

298
00:11:05,829 --> 00:11:04,399
and how does that represent how planets

299
00:11:08,389 --> 00:11:05,839
are made throughout the whole solar

300
00:11:10,550 --> 00:11:08,399
system and beyond actually in the

301
00:11:13,590 --> 00:11:10,560
extrasolar systems that we're seeing

302
00:11:14,710 --> 00:11:13,600
today with with our telescopes

303
00:11:21,990 --> 00:11:14,720
and

304
00:11:25,590 --> 00:11:22,000
jupiter

305
00:11:27,670 --> 00:11:25,600
these giant solar arrays that were

306
00:11:29,590 --> 00:11:27,680
already referred to these things are

307
00:11:32,230 --> 00:11:29,600
massive they're about eight and a half

308
00:11:34,470 --> 00:11:32,240
meters long a piece

309
00:11:36,630 --> 00:11:34,480
so they're size of a of a trailer for a

310
00:11:38,150 --> 00:11:36,640
big semi truck

311
00:11:40,150 --> 00:11:38,160
there's three of them even with that at

312
00:11:42,150 --> 00:11:40,160
the distance of jupiter from the sun

313
00:11:43,750 --> 00:11:42,160

which is five times the distance of the

314
00:11:45,750 --> 00:11:43,760
that the earth is from the sun we're

315
00:11:48,389 --> 00:11:45,760
only getting uh enough power for a few

316
00:11:50,470 --> 00:11:48,399
light bulbs and uh but with the

317
00:11:52,550 --> 00:11:50,480
spacecraft is very energy efficient and

318
00:11:54,389 --> 00:11:52,560
these solar panels are pretty special

319
00:11:55,670 --> 00:11:54,399
solar cells are made to withstand that

320
00:11:57,350 --> 00:11:55,680
cold temperature in the low light

321
00:11:59,350 --> 00:11:57,360
conditions

322
00:12:00,949 --> 00:11:59,360
and the whole spacecraft spins like a

323
00:12:02,629 --> 00:12:00,959
cartwheel through

324
00:12:04,870 --> 00:12:02,639
space and goes around jupiter and goes

325
00:12:06,629 --> 00:12:04,880
into orbit around its poles and you see

326
00:12:08,150 --> 00:12:06,639
the thing in the center there is the

327
00:12:09,269 --> 00:12:08,160
high gain antenna that transmits our

328
00:12:11,990 --> 00:12:09,279
data back

329
00:12:14,389 --> 00:12:12,000
we launch in august 5th that's when the

330
00:12:17,269 --> 00:12:14,399
window opens it's about three weeks long

331
00:12:19,750 --> 00:12:17,279
and we arrive in 2016 so it takes about

332
00:12:22,389 --> 00:12:19,760
five years to get out to jupiter

333
00:12:23,430 --> 00:12:22,399
and then we orbit for about a year

334
00:12:26,470 --> 00:12:23,440
and

335
00:12:29,590 --> 00:12:26,480
we named uh the spacecraft juno

336
00:12:30,870 --> 00:12:29,600
um after the mythological goddess juno

337
00:12:34,069 --> 00:12:30,880
which was the

338
00:12:36,389 --> 00:12:34,079

sister and wife of jupiter in roman and

339
00:12:38,870 --> 00:12:36,399
greek mythology the greeks did things a

340
00:12:40,710 --> 00:12:38,880
little funny there so they were both the

341
00:12:42,629 --> 00:12:40,720
wife and the sister

342
00:12:44,230 --> 00:12:42,639
but there was a story in a tale that

343
00:12:46,389 --> 00:12:44,240
went back in this mythology in the

344
00:12:47,509 --> 00:12:46,399
ancient greek mythology and it was about

345
00:12:48,870 --> 00:12:47,519
the wife

346
00:12:51,030 --> 00:12:48,880
juno

347
00:12:53,670 --> 00:12:51,040
you know was coming down and and saw

348
00:12:55,910 --> 00:12:53,680
jupiter and jupiter was uh being a

349
00:12:58,949 --> 00:12:55,920
little mischievous as uh the king of

350
00:13:01,269 --> 00:12:58,959
gods sometimes was

351
00:13:03,829 --> 00:13:01,279
and uh he saw juno coming and he didn't

352
00:13:06,470 --> 00:13:03,839
want her to see what he was up to so he

353
00:13:08,550 --> 00:13:06,480
cast a veil of clouds around himself

354
00:13:09,829 --> 00:13:08,560
to to cover

355
00:13:11,430 --> 00:13:09,839
what he was doing so she wouldn't be

356
00:13:13,350 --> 00:13:11,440
able to see but she was already

357
00:13:15,110 --> 00:13:13,360
suspicious and she's a was the queen of

358
00:13:17,030 --> 00:13:15,120
the gods and quite powerful herself and

359
00:13:19,829 --> 00:13:17,040
so she used her powers

360
00:13:22,550 --> 00:13:19,839
to see right through the clouds and see

361
00:13:24,629 --> 00:13:22,560
the true nature of jupiter

362
00:13:26,150 --> 00:13:24,639
and that's exactly what our juno the

363
00:13:27,269 --> 00:13:26,160

spacecraft does

364
00:13:28,470 --> 00:13:27,279
is

365
00:13:31,190 --> 00:13:28,480
we use

366
00:13:32,870 --> 00:13:31,200
our magical or special instruments

367
00:13:34,389 --> 00:13:32,880
when they get to jupiter from a very

368
00:13:36,470 --> 00:13:34,399
special vantage point

369
00:13:39,030 --> 00:13:36,480
to actually pierce through the clouds

370
00:13:41,269 --> 00:13:39,040
and see inside and see the true nature

371
00:13:43,269 --> 00:13:41,279
of jupiter and we do that in a few

372
00:13:45,269 --> 00:13:43,279
different ways and i'll

373
00:13:47,990 --> 00:13:45,279
explain those

374
00:13:49,829 --> 00:13:48,000
so the science goals of juno have to do

375
00:13:52,550 --> 00:13:49,839
with understanding the origin of jupiter

376
00:13:55,030 --> 00:13:52,560
and how it was made and figuring out you

377
00:13:56,949 --> 00:13:55,040
know where we all came from and how

378
00:13:58,230 --> 00:13:56,959
the earth was made and all the other

379
00:13:59,509 --> 00:13:58,240
planets

380
00:14:01,189 --> 00:13:59,519
we do that by understanding this

381
00:14:03,430 --> 00:14:01,199
ingredient list

382
00:14:05,590 --> 00:14:03,440
that i mentioned earlier so we pierce

383
00:14:07,590 --> 00:14:05,600
through the the clouds with three

384
00:14:08,870 --> 00:14:07,600
different techniques we use the gravity

385
00:14:10,870 --> 00:14:08,880
field which goes right down to the

386
00:14:13,030 --> 00:14:10,880
center and that'll tell us not only how

387
00:14:14,550 --> 00:14:13,040
jupiter's structure and how it's

388
00:14:16,629 --> 00:14:14,560

spinning

389
00:14:18,069 --> 00:14:16,639
but also whether there's a core of heavy

390
00:14:19,750 --> 00:14:18,079
elements maybe in the middle or is it

391
00:14:21,910 --> 00:14:19,760
just gas all the way down we don't

392
00:14:24,069 --> 00:14:21,920
really know that yet

393
00:14:27,030 --> 00:14:24,079
the other thing that we do is we look at

394
00:14:29,030 --> 00:14:27,040
the magnetic field very precisely

395
00:14:31,110 --> 00:14:29,040
and we do that because deep inside of

396
00:14:32,870 --> 00:14:31,120
jupiter the hydrogen becomes almost like

397
00:14:35,269 --> 00:14:32,880
a fluid and metallic and it generates a

398
00:14:37,189 --> 00:14:35,279
magnetic field like earth has a magnetic

399
00:14:38,389 --> 00:14:37,199
field but jupiter's is much much

400
00:14:40,069 --> 00:14:38,399
stronger

401
00:14:41,590 --> 00:14:40,079
and in fact it's the most powerful one

402
00:14:42,949 --> 00:14:41,600
in the in the solar system of all the

403
00:14:45,750 --> 00:14:42,959
planets

404
00:14:47,269 --> 00:14:45,760
and so we'll see through to the to where

405
00:14:49,110 --> 00:14:47,279
that's getting created we can't really

406
00:14:50,710 --> 00:14:49,120
do that at the earth we have a permanent

407
00:14:53,189 --> 00:14:50,720
magnetized crust on the earth so we

408
00:14:54,790 --> 00:14:53,199
can't see down to how our magnetic field

409
00:14:56,389 --> 00:14:54,800
is created

410
00:14:58,629 --> 00:14:56,399
and so we'll see that for the first time

411
00:15:00,949 --> 00:14:58,639
at jupiter and we also have special

412
00:15:02,310 --> 00:15:00,959
microwave instruments that actually go

413
00:15:04,069 --> 00:15:02,320

in and listen and

414
00:15:06,710 --> 00:15:04,079
and measure the temperature of jupiter

415
00:15:08,629 --> 00:15:06,720
at various levels inside the clouds so

416
00:15:10,949 --> 00:15:08,639
we'll see how deep those beautiful zones

417
00:15:13,430 --> 00:15:10,959
and belts go but we'll also use that to

418
00:15:15,750 --> 00:15:13,440
measure how much water is in jupiter and

419
00:15:17,910 --> 00:15:15,760
that's a very important question

420
00:15:21,110 --> 00:15:17,920
to discriminate among theories of how

421
00:15:22,949 --> 00:15:21,120
jupiter and the planets were made

422
00:15:24,470 --> 00:15:22,959
and so those are our science goals are

423
00:15:26,949 --> 00:15:24,480
sort of divided into this thing that

424
00:15:29,110 --> 00:15:26,959
finally we do the polar magnetosphere

425
00:15:31,350 --> 00:15:29,120
because we go into polar orbit we're

426
00:15:33,990 --> 00:15:31,360
perfectly suited to study jupiter's

427
00:15:35,749 --> 00:15:34,000
aurora and like earth's it's a really

428
00:15:36,870 --> 00:15:35,759
beautiful aurora except it's much more

429
00:15:38,389 --> 00:15:36,880
powerful

430
00:15:40,150 --> 00:15:38,399
and so we have a number of instruments

431
00:15:41,670 --> 00:15:40,160
that will go right over the aurora and

432
00:15:43,749 --> 00:15:41,680
measure how the particles are creating

433
00:15:47,509 --> 00:15:43,759
the aurora at jupiter to teach us about

434
00:15:51,030 --> 00:15:47,519
that and allow us to compare it to earth

435
00:15:52,310 --> 00:15:51,040
okay so can i get the next chart please

436
00:15:53,910 --> 00:15:52,320
so of course

437
00:15:55,509 --> 00:15:53,920
you know the mission juno couldn't

438
00:15:57,189 --> 00:15:55,519

happen without a great team and we have

439
00:15:59,110 --> 00:15:57,199
one of the best

440
00:16:01,829 --> 00:15:59,120
and here you see juno

441
00:16:04,629 --> 00:16:01,839
in its final stages of preparation

442
00:16:06,389 --> 00:16:04,639
it's a lockheed martin spacecraft

443
00:16:09,509 --> 00:16:06,399
and you see the solar panels folded up

444
00:16:11,670 --> 00:16:09,519
against its side and they get tucked

445
00:16:12,870 --> 00:16:11,680
into the payload fairing and then they

446
00:16:15,590 --> 00:16:12,880
open up

447
00:16:17,430 --> 00:16:15,600
about an hour or so after the launch

448
00:16:18,230 --> 00:16:17,440
and they unveil it and then the power

449
00:16:20,949 --> 00:16:18,240
starts

450
00:16:23,749 --> 00:16:20,959
surging through the blood of uh in the

451
00:16:25,829 --> 00:16:23,759
veins of of juno and then it's on its

452
00:16:26,550 --> 00:16:25,839
own it's spinning and it sends its way

453
00:16:29,990 --> 00:16:26,560
to

454
00:16:32,470 --> 00:16:30,000
couple of guys in the clean room there

455
00:16:35,269 --> 00:16:32,480
working on it

456
00:16:37,430 --> 00:16:35,279
okay the next uh slide please

457
00:16:38,230 --> 00:16:37,440
and so there you i'll leave you with our

458
00:16:41,749 --> 00:16:38,240
our

459
00:16:43,189 --> 00:16:41,759
graphic design for juno and the website

460
00:16:45,110 --> 00:16:43,199
is listed on the bottom you can learn a

461
00:16:48,069 --> 00:16:45,120
lot about juno from looking at that

462
00:16:51,189 --> 00:16:48,079
website there's also a website at the at

463
00:16:52,870 --> 00:16:51,199

nasa as well nasa.gov juno

464
00:16:54,949 --> 00:16:52,880
and i thank you i look forward to seeing

465
00:16:56,470 --> 00:16:54,959
you all at our launch next month

466
00:16:58,629 --> 00:16:56,480
thank you scott

467
00:17:00,629 --> 00:16:58,639
and now we'll hear from maria zuber she

468
00:17:02,230 --> 00:17:00,639
is the grail principal investigator from

469
00:17:04,470 --> 00:17:02,240
the massachusetts institute of

470
00:17:06,230 --> 00:17:04,480
technology maria okay

471
00:17:08,549 --> 00:17:06,240
thank you very much

472
00:17:11,029 --> 00:17:08,559
i'm really thrilled and excited to be

473
00:17:13,590 --> 00:17:11,039
here and talk to you today about the

474
00:17:14,470 --> 00:17:13,600
gravity recovery and interior laboratory

475
00:17:16,549 --> 00:17:14,480
mission

476
00:17:18,150 --> 00:17:16,559
which is going to use radio signals to

477
00:17:20,949 --> 00:17:18,160
reveal the mysteries of the moon if i

478
00:17:23,189 --> 00:17:20,959
could have the first uh

479
00:17:24,870 --> 00:17:23,199
the first chart here okay so that shows

480
00:17:26,630 --> 00:17:24,880
you the different radio signals that go

481
00:17:27,590 --> 00:17:26,640
between the two spacecraft grail is the

482
00:17:29,590 --> 00:17:27,600
first

483
00:17:31,830 --> 00:17:29,600
formation flying mission to another

484
00:17:33,830 --> 00:17:31,840
planet so technologically it's blazing

485
00:17:35,830 --> 00:17:33,840
the trail for other missions that will

486
00:17:38,150 --> 00:17:35,840
want to go to different planets and use

487
00:17:40,549 --> 00:17:38,160
coordinated observations uh to make

488
00:17:42,150 --> 00:17:40,559

measurements and a very important thing

489
00:17:45,430 --> 00:17:42,160
is timing so here here are some

490
00:17:47,990 --> 00:17:45,440
schematic of the the two spacecraft so

491
00:17:50,630 --> 00:17:48,000
here i'm the sun and the solar panels

492
00:17:52,230 --> 00:17:50,640
are pointing at the sun to power it and

493
00:17:54,549 --> 00:17:52,240
and all of you people in the audience

494
00:17:57,029 --> 00:17:54,559
there are in the direction of the moon

495
00:17:59,590 --> 00:17:57,039
and these two spacecraft will fly in

496
00:18:03,350 --> 00:17:59,600
tandem in a polar orbit around the moon

497
00:18:04,230 --> 00:18:03,360
about 55 kilometers above the surface

498
00:18:09,990 --> 00:18:04,240
and

499
00:18:11,430 --> 00:18:10,000
spacecraft as the first spacecraft

500
00:18:13,350 --> 00:18:11,440
passes over

501
00:18:15,190 --> 00:18:13,360
a mass anomaly beneath the surface of

502
00:18:17,750 --> 00:18:15,200
the moon it will

503
00:18:19,669 --> 00:18:17,760
accelerate or slow down and its distance

504
00:18:22,070 --> 00:18:19,679
will change with respect to the second

505
00:18:24,789 --> 00:18:22,080
spacecraft and by measuring tiny

506
00:18:25,830 --> 00:18:24,799
distance changes we will be able to

507
00:18:27,510 --> 00:18:25,840
recover

508
00:18:28,390 --> 00:18:27,520
what the interior structure of the moon

509
00:18:29,350 --> 00:18:28,400
looks like

510
00:18:30,789 --> 00:18:29,360
now

511
00:18:32,630 --> 00:18:30,799
measuring the distance between two

512
00:18:35,190 --> 00:18:32,640
points i tell people is not very hard

513
00:18:37,350 --> 00:18:35,200

it's something we fundamentally learn

514
00:18:38,950 --> 00:18:37,360
very early on in school but we can

515
00:18:41,990 --> 00:18:38,960
measure the distance between these two

516
00:18:44,870 --> 00:18:42,000
spacecraft to less than the size of a

517
00:18:47,430 --> 00:18:44,880
red blood cell uh in humans so a few

518
00:18:49,669 --> 00:18:47,440
tenths of a micron per second uh in the

519
00:18:51,669 --> 00:18:49,679
velocity of these two spacecraft so it's

520
00:18:53,510 --> 00:18:51,679
uh it pays to learn how to measure the

521
00:18:54,870 --> 00:18:53,520
distance between two points and to learn

522
00:18:58,070 --> 00:18:54,880
it well so if there are any kids out

523
00:19:01,110 --> 00:18:58,080
there watching study your math

524
00:19:02,630 --> 00:19:01,120
if we could have the next

525
00:19:04,470 --> 00:19:02,640
graphic here

526
00:19:06,150 --> 00:19:04,480
all of you will probably remember how it

527
00:19:08,789 --> 00:19:06,160
used to take three days to go to the

528
00:19:12,070 --> 00:19:08,799
moon and the the apollo saturn v went to

529
00:19:13,830 --> 00:19:12,080
the moon well we want it to take longer

530
00:19:16,870 --> 00:19:13,840
to go to the moon because if you leave

531
00:19:19,110 --> 00:19:16,880
earth and you go barreling to the moon

532
00:19:21,990 --> 00:19:19,120
you use a lot you need a lot of fuel to

533
00:19:23,510 --> 00:19:22,000
slow down and we wanted to use small

534
00:19:25,750 --> 00:19:23,520
spacecraft

535
00:19:27,270 --> 00:19:25,760
and small fuel tanks and so as a

536
00:19:29,909 --> 00:19:27,280
consequence of that we use something

537
00:19:32,549 --> 00:19:29,919
called a low energy trajectory where we

538
00:19:34,710 --> 00:19:32,559

go out to a point called the earth uh

539
00:19:37,110 --> 00:19:34,720
the earth sun lagrange point which is

540
00:19:38,470 --> 00:19:37,120
essentially like a boy in the ocean if

541
00:19:40,710 --> 00:19:38,480
you have a boat that comes around and

542
00:19:43,510 --> 00:19:40,720
comes to the boy so we take three and a

543
00:19:45,990 --> 00:19:43,520
half to four months to get to the moon

544
00:19:47,270 --> 00:19:46,000
now in addition to uh in addition to

545
00:19:49,909 --> 00:19:47,280
saving fuel

546
00:19:52,950 --> 00:19:49,919
what this allows to happen is that these

547
00:19:55,510 --> 00:19:52,960
two spacecraft will arrive at the moon

548
00:19:57,350 --> 00:19:55,520
on the same days no matter what day in

549
00:19:59,830 --> 00:19:57,360
the launch window we launch so we can

550
00:20:02,470 --> 00:19:59,840
completely decouple the operations and

551
00:20:04,950 --> 00:20:02,480
crews to the operations around and it

552
00:20:07,990 --> 00:20:04,960
adds simplicity and reduces our risk and

553
00:20:10,310 --> 00:20:08,000
it also allows us to do two critical

554
00:20:12,230 --> 00:20:10,320
maneuvers each of these spacecraft are

555
00:20:14,310 --> 00:20:12,240
going to insert into orbit around the

556
00:20:16,630 --> 00:20:14,320
moon separately and it allows us to

557
00:20:18,310 --> 00:20:16,640
space these maneuvers out by a day so

558
00:20:19,590 --> 00:20:18,320
we're not doing two critical maneuvers

559
00:20:21,510 --> 00:20:19,600
on the same day

560
00:20:23,510 --> 00:20:21,520
okay if i can have the next

561
00:20:24,630 --> 00:20:23,520
slide please

562
00:20:27,669 --> 00:20:24,640
here are

563
00:20:30,390 --> 00:20:27,679

the two spacecraft in testing the

564
00:20:33,789 --> 00:20:30,400
spacecraft are

565
00:20:36,950 --> 00:20:33,799
designed not exact copies but after the

566
00:20:39,350 --> 00:20:36,960
xss-11 spacecraft which was a military

567
00:20:41,990 --> 00:20:39,360
spacecraft built by lockheed martin in

568
00:20:43,430 --> 00:20:42,000
denver so we used

569
00:20:46,470 --> 00:20:43,440
essentially

570
00:20:47,990 --> 00:20:46,480
declassified military technology

571
00:20:50,149 --> 00:20:48,000
and took advantage of that these two

572
00:20:52,070 --> 00:20:50,159
spacecraft they're about the size of a

573
00:20:54,710 --> 00:20:52,080
washer and dryer in your house so

574
00:20:57,110 --> 00:20:54,720
they're very compact but they're

575
00:20:58,390 --> 00:20:57,120
as big as they need to get the job done

576
00:21:00,549 --> 00:20:58,400
um the

577
00:21:02,230 --> 00:21:00,559
the spacecraft also uses uh

578
00:21:04,470 --> 00:21:02,240
instrumentation that was built from the

579
00:21:07,029 --> 00:21:04,480
jet propulsion lab which is essentially

580
00:21:09,510 --> 00:21:07,039
a simplification of the instrument that

581
00:21:11,510 --> 00:21:09,520
was flown on the grace mission the

582
00:21:12,789 --> 00:21:11,520
gravity recover recovering climate

583
00:21:14,470 --> 00:21:12,799
explorer

584
00:21:17,110 --> 00:21:14,480
that is still operating

585
00:21:18,789 --> 00:21:17,120
around earth we took that technology and

586
00:21:20,310 --> 00:21:18,799
made use of that

587
00:21:23,510 --> 00:21:20,320
what we had to figure out to do at the

588
00:21:25,270 --> 00:21:23,520

moon grace uses gps to coordinate the

589
00:21:27,430 --> 00:21:25,280
timing between the two spacecraft

590
00:21:29,190 --> 00:21:27,440
there's no gps at the moon that's what

591
00:21:31,029 --> 00:21:29,200
we had to figure out to do at the moon

592
00:21:33,350 --> 00:21:31,039
and now that we've figured that out

593
00:21:35,669 --> 00:21:33,360
we have the ability to

594
00:21:36,710 --> 00:21:35,679
time correlate spacecraft around other

595
00:21:38,310 --> 00:21:36,720
planets

596
00:21:40,950 --> 00:21:38,320
i will also say that these two

597
00:21:43,029 --> 00:21:40,960
spacecraft arrived down here at cape

598
00:21:45,590 --> 00:21:43,039
canaveral a week earlier than we

599
00:21:47,430 --> 00:21:45,600
proposed in our original proposal

600
00:21:49,190 --> 00:21:47,440
and the spacecraft is

601
00:21:51,430 --> 00:21:49,200
the mission is

602
00:21:53,750 --> 00:21:51,440
on budget on schedule and ready for a

603
00:21:54,950 --> 00:21:53,760
september 8th launch

604
00:21:56,950 --> 00:21:54,960
now the

605
00:21:58,950 --> 00:21:56,960
final chart here

606
00:21:59,990 --> 00:21:58,960
let me tell you about what we hope to

607
00:22:01,190 --> 00:22:00,000
learn

608
00:22:02,549 --> 00:22:01,200
about this so there have been many

609
00:22:04,710 --> 00:22:02,559
missions that have gone to the moon

610
00:22:06,630 --> 00:22:04,720
orbited the moon landed on the moon

611
00:22:08,710 --> 00:22:06,640
brought back samples of the moon

612
00:22:10,950 --> 00:22:08,720
those samples are still a treasure that

613
00:22:13,190 --> 00:22:10,960

we continue to study today but the

614
00:22:15,990 --> 00:22:13,200
missing piece of the puzzle in trying to

615
00:22:18,710 --> 00:22:16,000
understand uh the moon was what the deep

616
00:22:20,390 --> 00:22:18,720
interior uh was like and

617
00:22:22,390 --> 00:22:20,400
so if you look at the surface of the

618
00:22:26,310 --> 00:22:22,400
moon or the other planets the moon is

619
00:22:29,110 --> 00:22:26,320
really the most accessible example of an

620
00:22:30,950 --> 00:22:29,120
old surface of a terrestrial planet okay

621
00:22:33,110 --> 00:22:30,960
all the terrestrial planets including

622
00:22:36,230 --> 00:22:33,120
the earth looked like that and what you

623
00:22:39,350 --> 00:22:36,240
see on the surface of a planet

624
00:22:41,029 --> 00:22:39,360
really records the entire history

625
00:22:43,350 --> 00:22:41,039
of the planet

626
00:22:44,630 --> 00:22:43,360
over four billion years so um so the

627
00:22:47,510 --> 00:22:44,640
surface of the moon there is four

628
00:22:49,110 --> 00:22:47,520
billion years uh earth used to look like

629
00:22:50,470 --> 00:22:49,120
that four billion years ago what the

630
00:22:52,630 --> 00:22:50,480
surface of the

631
00:22:54,470 --> 00:22:52,640
the time of the age of the surface of

632
00:22:56,470 --> 00:22:54,480
the moon is actually

633
00:22:57,830 --> 00:22:56,480
about the age of the earth at the time

634
00:23:00,870 --> 00:22:57,840
that the first

635
00:23:02,789 --> 00:23:00,880
cells were developing on earth and that

636
00:23:05,350 --> 00:23:02,799
record of time in terms of what was

637
00:23:07,270 --> 00:23:05,360
preserved on earth is not preserved well

638
00:23:09,909 --> 00:23:07,280

at all it's a few grains it's not

639
00:23:12,710 --> 00:23:09,919
surfaces but here we have a planet that

640
00:23:15,190 --> 00:23:12,720
has evolved so what we can look at is

641
00:23:17,110 --> 00:23:15,200
the external influences such as impacts

642
00:23:19,990 --> 00:23:17,120
that have shaped the surface what was

643
00:23:22,390 --> 00:23:20,000
going on in the interior how did it melt

644
00:23:24,950 --> 00:23:22,400
is there a core how did the core form

645
00:23:27,270 --> 00:23:24,960
how did the interior convect why is the

646
00:23:29,990 --> 00:23:27,280
near side flooded why are the impact

647
00:23:32,630 --> 00:23:30,000
basins on the near side flooded with uh

648
00:23:34,630 --> 00:23:32,640
magma and give us this man in the moon

649
00:23:35,990 --> 00:23:34,640
shape that we look at whereas the back

650
00:23:37,909 --> 00:23:36,000
side of the moon doesn't have any of

651
00:23:39,430 --> 00:23:37,919
this so those are all mysteries that

652
00:23:41,430 --> 00:23:39,440
despite the fact that we have studied

653
00:23:43,750 --> 00:23:41,440
the moon before we don't understand how

654
00:23:45,430 --> 00:23:43,760
that has happened and uh grail is a

655
00:23:46,230 --> 00:23:45,440
mission that's going to tell us that so

656
00:23:48,549 --> 00:23:46,240
um

657
00:23:50,149 --> 00:23:48,559
so uh we are extremely excited about

658
00:23:52,710 --> 00:23:50,159
that and

659
00:23:54,310 --> 00:23:52,720
if you come back on september 8th

660
00:23:56,149 --> 00:23:54,320
we are going to get to the launch pad on

661
00:23:57,750 --> 00:23:56,159
time

662
00:23:59,590 --> 00:23:57,760
thank you maria

663
00:24:00,630 --> 00:23:59,600

and to discuss our next mission after

664
00:24:02,789 --> 00:24:00,640
grail

665
00:24:04,710 --> 00:24:02,799
is john grossinger the mars science

666
00:24:08,149 --> 00:24:04,720
laboratory project scientist from the

667
00:24:08,950 --> 00:24:08,159
california institute of technology john

668
00:24:10,710 --> 00:24:08,960
thanks

669
00:24:12,549 --> 00:24:10,720
it's a pleasure to talk to you about

670
00:24:14,230 --> 00:24:12,559
mars science laboratory today in a

671
00:24:16,789 --> 00:24:14,240
little while i'll walk you through our

672
00:24:19,430 --> 00:24:16,799
rover here called curiosity

673
00:24:21,110 --> 00:24:19,440
named for uh the

674
00:24:23,029 --> 00:24:21,120
the great property of all scientists

675
00:24:24,549 --> 00:24:23,039
which is to want to explore things that

676
00:24:26,630 --> 00:24:24,559
you've never understood or been able to

677
00:24:30,470 --> 00:24:26,640
see before i'll come back to that in a

678
00:24:33,990 --> 00:24:30,480
minute uh curiosity is is really the

679
00:24:35,830 --> 00:24:34,000
latest installment in in the mars

680
00:24:37,350 --> 00:24:35,840
exploration program

681
00:24:38,470 --> 00:24:37,360
and i think many of us would not have

682
00:24:40,549 --> 00:24:38,480
imagined

683
00:24:42,149 --> 00:24:40,559
having started on mars exploration

684
00:24:44,230 --> 00:24:42,159
rovers one of which is still moving

685
00:24:46,789 --> 00:24:44,240
around today that we would ever really

686
00:24:49,269 --> 00:24:46,799
get on to this this next step

687
00:24:51,430 --> 00:24:49,279
curiosity is as big as a car

688
00:24:53,990 --> 00:24:51,440

it literally weighs a ton

689
00:24:55,830 --> 00:24:54,000
it requires a whole new entry descent

690
00:24:58,710 --> 00:24:55,840
and landing system in order to get it

691
00:25:01,430 --> 00:24:58,720
safely to the surface called sky crane

692
00:25:03,830 --> 00:25:01,440
which hovers and and drops the rover

693
00:25:05,430 --> 00:25:03,840
down on a on a set of bridles

694
00:25:08,230 --> 00:25:05,440
and then when it feels it's touched the

695
00:25:10,870 --> 00:25:08,240
bottom sky crane flies off and the rover

696
00:25:12,310 --> 00:25:10,880
is pretty much born ready to to start

697
00:25:15,110 --> 00:25:12,320
driving

698
00:25:18,070 --> 00:25:15,120
it's designed to drive 20 kilometers and

699
00:25:19,029 --> 00:25:18,080
it has a nominal lifetime of two earth

700
00:25:21,110 --> 00:25:19,039
years

701
00:25:23,190 --> 00:25:21,120
so if you scale that to to say

702
00:25:25,750 --> 00:25:23,200
opportunity which was built to go 300

703
00:25:27,430 --> 00:25:25,760
meters and has now gone 30 kilometers

704
00:25:28,870 --> 00:25:27,440
and was supposed to last nine months and

705
00:25:31,110 --> 00:25:28,880
is now working on

706
00:25:32,310 --> 00:25:31,120
seven seven and a half years

707
00:25:34,070 --> 00:25:32,320
we've probably probably got a pretty

708
00:25:35,750 --> 00:25:34,080
good mission ahead of us here

709
00:25:37,669 --> 00:25:35,760
so if i go to the first

710
00:25:39,990 --> 00:25:37,679
slide up there

711
00:25:41,750 --> 00:25:40,000
here you see sort of the history of

712
00:25:43,750 --> 00:25:41,760
rovers in the development of the mars

713
00:25:46,070 --> 00:25:43,760

program there in the center

714
00:25:47,750 --> 00:25:46,080
is uh is sojourner rover part of the

715
00:25:49,990 --> 00:25:47,760
pathfinder mission that's about as big

716
00:25:52,549 --> 00:25:50,000
as a small microwave oven

717
00:25:55,029 --> 00:25:52,559
and then on the left side you've got the

718
00:25:56,630 --> 00:25:55,039
model for spirit and opportunity

719
00:25:58,789 --> 00:25:56,640
opportunity of course still rolling

720
00:26:01,190 --> 00:25:58,799
today it just passed i believe over the

721
00:26:03,430 --> 00:26:01,200
weekend it drove 31 kilometers across

722
00:26:04,630 --> 00:26:03,440
that that barrier it's about as big as a

723
00:26:06,710 --> 00:26:04,640
golf cart

724
00:26:08,710 --> 00:26:06,720
and then on the right in the back then

725
00:26:10,870 --> 00:26:08,720
you've got mars science laboratory which

726
00:26:13,029 --> 00:26:10,880
is about as big as a mini cooper it has

727
00:26:15,350 --> 00:26:13,039
the wheelbase of a humvee

728
00:26:17,669 --> 00:26:15,360
and the arm out in front of it weighs

729
00:26:19,269 --> 00:26:17,679
about 85 kilograms that would be like

730
00:26:20,870 --> 00:26:19,279
trying to pick your lawn mower up in

731
00:26:22,870 --> 00:26:20,880
front of you and hold it up and that's

732
00:26:24,950 --> 00:26:22,880
where all our instruments are that touch

733
00:26:27,269 --> 00:26:24,960
the surface of mars there it's got the

734
00:26:28,470 --> 00:26:27,279
same rocker bogey suspension that was

735
00:26:31,669 --> 00:26:28,480
originally

736
00:26:33,350 --> 00:26:31,679
implemented on sojourner as part of the

737
00:26:35,590 --> 00:26:33,360
pathfinder experiment it's been so

738
00:26:39,590 --> 00:26:35,600

successful we've continued to work with

739
00:26:41,430 --> 00:26:39,600
that okay so in the next one uh what uh

740
00:26:44,230 --> 00:26:41,440
what you can see here is a view from

741
00:26:46,630 --> 00:26:44,240
atlo and jpl uh the rover just shipped

742
00:26:48,789 --> 00:26:46,640
here to the cape just a few weeks ago

743
00:26:50,630 --> 00:26:48,799
and uh you get a side view with some of

744
00:26:51,669 --> 00:26:50,640
the engineers in the in the background

745
00:26:54,230 --> 00:26:51,679
there

746
00:26:56,070 --> 00:26:54,240
the arm is partially deployed out in

747
00:26:57,430 --> 00:26:56,080
front if you were to extend that all the

748
00:26:59,190 --> 00:26:57,440
way vertically it could dunk a

749
00:27:01,669 --> 00:26:59,200
basketball

750
00:27:03,350 --> 00:27:01,679
so it's tall and if we get up to

751
00:27:06,710 --> 00:27:03,360
interesting rocks we'll be able to reach

752
00:27:09,590 --> 00:27:06,720
up quite high to study them there

753
00:27:11,750 --> 00:27:09,600
okay then in the next one

754
00:27:13,909 --> 00:27:11,760
uh we have two landing sites this has

755
00:27:15,510 --> 00:27:13,919
been an amazing process and i think

756
00:27:17,750 --> 00:27:15,520
besides the development of the rover

757
00:27:20,389 --> 00:27:17,760
itself this entry descent and landing

758
00:27:22,230 --> 00:27:20,399
system that jpl designed

759
00:27:24,149 --> 00:27:22,240
is so robust that for the first time in

760
00:27:26,310 --> 00:27:24,159
the history of mars exploration surface

761
00:27:27,909 --> 00:27:26,320
missions the scientists are able to

762
00:27:29,029 --> 00:27:27,919
choose the landing site where they want

763
00:27:31,830 --> 00:27:29,039

to go to

764
00:27:33,510 --> 00:27:31,840
so we don't just hope that we we land in

765
00:27:35,590 --> 00:27:33,520
a place that looks like something

766
00:27:37,430 --> 00:27:35,600
attractive might happen we've actually

767
00:27:40,470 --> 00:27:37,440
been able to have a process where all

768
00:27:41,990 --> 00:27:40,480
the the best sites rise to the top and

769
00:27:43,110 --> 00:27:42,000
all of those are available for

770
00:27:45,190 --> 00:27:43,120
discussion

771
00:27:46,230 --> 00:27:45,200
and what came out of that is a final

772
00:27:47,990 --> 00:27:46,240
four

773
00:27:50,070 --> 00:27:48,000
that we then went forward to with

774
00:27:52,070 --> 00:27:50,080
headquarters and we're engaged in a set

775
00:27:53,909 --> 00:27:52,080
of iterative discussions there

776
00:27:55,830 --> 00:27:53,919
we're down to the final two and this is

777
00:27:57,350 --> 00:27:55,840
one of them and what you can see there

778
00:28:00,710 --> 00:27:57,360
in the black circle is our landing

779
00:28:02,870 --> 00:28:00,720
ellipse which is 20 by 22 kilometers

780
00:28:05,110 --> 00:28:02,880
rather than mer which had a landing

781
00:28:06,870 --> 00:28:05,120
ellipse of about 150 kilometers in

782
00:28:09,350 --> 00:28:06,880
diameter by 80.

783
00:28:11,669 --> 00:28:09,360
so we can land in the flat spot of this

784
00:28:13,750 --> 00:28:11,679
of this location called gale crater that

785
00:28:15,110 --> 00:28:13,760
crater's about just over 100 kilometers

786
00:28:16,549 --> 00:28:15,120
in diameter

787
00:28:18,310 --> 00:28:16,559
and then to the left of the landing

788
00:28:20,789 --> 00:28:18,320

ellipse towards the top of the image you

789
00:28:23,269 --> 00:28:20,799
see a mountain which is about four

790
00:28:25,029 --> 00:28:23,279
kilometers high almost five kilometers

791
00:28:26,870 --> 00:28:25,039
high so that's higher than mount whitney

792
00:28:29,990 --> 00:28:26,880
it's higher than the highest mountain in

793
00:28:31,750 --> 00:28:30,000
the lower 48 in the us and our goal is

794
00:28:34,070 --> 00:28:31,760
to climb the base of that mountain

795
00:28:35,990 --> 00:28:34,080
initially and there's a stack of layers

796
00:28:37,510 --> 00:28:36,000
there that looks like if you gaze into

797
00:28:38,950 --> 00:28:37,520
the grand canyon and wonder what all

798
00:28:41,269 --> 00:28:38,960
those layers are

799
00:28:43,510 --> 00:28:41,279
those are chapters in the history of the

800
00:28:45,029 --> 00:28:43,520
environmental evolution of mars and what

801
00:28:46,870 --> 00:28:45,039
msl is going to do

802
00:28:48,789 --> 00:28:46,880
is explore the early environmental

803
00:28:50,870 --> 00:28:48,799
history of mars with an emphasis towards

804
00:28:52,310 --> 00:28:50,880
habitable environments and habitable

805
00:28:54,230 --> 00:28:52,320
environments are those environments

806
00:28:56,870 --> 00:28:54,240
where you have a source of water a

807
00:28:59,190 --> 00:28:56,880
source of energy for microorganisms

808
00:29:00,950 --> 00:28:59,200
to be able to metabolize and then a

809
00:29:02,470 --> 00:29:00,960
source of carbon for them to be able to

810
00:29:04,389 --> 00:29:02,480
build

811
00:29:06,630 --> 00:29:04,399
structures as we as we know life is

812
00:29:08,630 --> 00:29:06,640
based on here on earth

813
00:29:10,870 --> 00:29:08,640

okay so the next one then shows the

814
00:29:12,870 --> 00:29:10,880
other competing landing site which you

815
00:29:15,669 --> 00:29:12,880
look at straight down on this image from

816
00:29:18,230 --> 00:29:15,679
mars it's a delta it's an old dried out

817
00:29:19,750 --> 00:29:18,240
delta this is probably the best place on

818
00:29:20,950 --> 00:29:19,760
mars where you can look down and if you

819
00:29:22,669 --> 00:29:20,960
ever wanted to know if there was a

820
00:29:25,430 --> 00:29:22,679
standing body of water where

821
00:29:28,230 --> 00:29:25,440
microorganisms could possibly live this

822
00:29:29,909 --> 00:29:28,240
is the place and so here you don't have

823
00:29:32,389 --> 00:29:29,919
the great thick succession that you have

824
00:29:34,070 --> 00:29:32,399
in gale crater but you've got something

825
00:29:36,310 --> 00:29:34,080
which is a really bright target

826
00:29:38,630 --> 00:29:36,320
potentially for a type of environment

827
00:29:40,710 --> 00:29:38,640
that might preserve organic carbon and

828
00:29:42,789 --> 00:29:40,720
msl comes equipped with an instrument to

829
00:29:43,590 --> 00:29:42,799
be able to detect organic carbon if it's

830
00:29:45,750 --> 00:29:43,600
there

831
00:29:47,830 --> 00:29:45,760
so we go back and forth between these we

832
00:29:49,750 --> 00:29:47,840
we love both of these as the finalists

833
00:29:51,750 --> 00:29:49,760
we don't know yet where we're going but

834
00:29:53,430 --> 00:29:51,760
uh it'll be one of them

835
00:29:55,029 --> 00:29:53,440
and when we get there

836
00:29:56,389 --> 00:29:55,039
then one of the main operations that

837
00:29:58,230 --> 00:29:56,399
we're going to do which has been

838
00:30:00,630 --> 00:29:58,240

different from the previous rover

839
00:30:02,549 --> 00:30:00,640
missions is we've got this heavy arm

840
00:30:04,950 --> 00:30:02,559
that sticks out in front

841
00:30:07,029 --> 00:30:04,960
and in the front of this arm we've got a

842
00:30:08,710 --> 00:30:07,039
drill it's like the kind of drill you go

843
00:30:10,630 --> 00:30:08,720
to buy at home depot

844
00:30:13,190 --> 00:30:10,640
if if you had to drill a hole in

845
00:30:15,430 --> 00:30:13,200
concrete so we drill the hole in the

846
00:30:16,630 --> 00:30:15,440
rock down to five centimeters collect

847
00:30:21,110 --> 00:30:16,640
the powder

848
00:30:22,470 --> 00:30:21,120
top of the arm sort of shake it back and

849
00:30:24,389 --> 00:30:22,480
forth slowly

850
00:30:26,549 --> 00:30:24,399
and it sieves through until we get the

851
00:30:29,510 --> 00:30:26,559
really really fine-grained stuff

852
00:30:30,710 --> 00:30:29,520
and then we dump it into the top of the

853
00:30:32,389 --> 00:30:30,720
rover

854
00:30:34,549 --> 00:30:32,399
so these are ports

855
00:30:36,310 --> 00:30:34,559
that allow us then to get access to one

856
00:30:37,510 --> 00:30:36,320
instrument that does x-ray diffraction

857
00:30:39,750 --> 00:30:37,520
that'll give us the definitive

858
00:30:40,710 --> 00:30:39,760
mineralogy that we wonder about from

859
00:30:42,310 --> 00:30:40,720
orbit

860
00:30:44,389 --> 00:30:42,320
but these other two ports that you see

861
00:30:45,669 --> 00:30:44,399
are here goes down into an instrument

862
00:30:47,269 --> 00:30:45,679
called sam

863
00:30:49,430 --> 00:30:47,279

and in that instrument then we're able

864
00:30:52,149 --> 00:30:49,440
to heat up the rock and turn it into

865
00:30:54,070 --> 00:30:52,159
gases and study those gases including

866
00:30:56,470 --> 00:30:54,080
look for the the presence of organic

867
00:30:59,430 --> 00:30:56,480
carbon so this this rover is really a

868
00:31:01,590 --> 00:30:59,440
mobile uh chemical laboratory

869
00:31:04,070 --> 00:31:01,600
that we take to the surface of mars so

870
00:31:05,909 --> 00:31:04,080
our launch date uh is on thanksgiving

871
00:31:07,750 --> 00:31:05,919
day and and we hope to see all there

872
00:31:11,029 --> 00:31:07,760
thanks very much

873
00:31:12,389 --> 00:31:11,039
thank you john our first mission of 2012

874
00:31:14,630 --> 00:31:12,399
is nustar

875
00:31:17,190 --> 00:31:14,640
and here to talk about that mission is

876
00:31:20,549 --> 00:31:17,200
daniel stern the project scientist from

877
00:31:22,149 --> 00:31:20,559
the jet propulsion laboratory jpl dan

878
00:31:24,310 --> 00:31:22,159
thank you for this opportunity to talk

879
00:31:26,950 --> 00:31:24,320
about nustar a little bit nustar is a

880
00:31:28,870 --> 00:31:26,960
nuclear spectroscopic telescope array it

881
00:31:31,110 --> 00:31:28,880
is a high energy or hard x-ray

882
00:31:32,710 --> 00:31:31,120
astrophysics mission unlike the other

883
00:31:33,509 --> 00:31:32,720
missions we heard about today which will

884
00:31:35,110 --> 00:31:33,519
study

885
00:31:38,230 --> 00:31:35,120
objects in our solar system like the

886
00:31:40,070 --> 00:31:38,240
moon jupiter mars nustar will spend most

887
00:31:42,070 --> 00:31:40,080
of its lifetime looking at objects far

888
00:31:44,070 --> 00:31:42,080

beyond the solar system

889
00:31:46,870 --> 00:31:44,080
including distant galaxies and black

890
00:31:49,029 --> 00:31:46,880
holes in distant galaxies

891
00:31:51,029 --> 00:31:49,039
new star works in the high energy x-rays

892
00:31:52,710 --> 00:31:51,039
a slightly higher energy x-rays than the

893
00:31:54,630 --> 00:31:52,720
chandra x-ray observatory which you

894
00:31:57,190 --> 00:31:54,640
might have heard of chandra launched on

895
00:31:58,950 --> 00:31:57,200
the space shuttle columbia back in 1999

896
00:32:02,470 --> 00:31:58,960
and is continuing to do fantastic

897
00:32:04,310 --> 00:32:02,480
science um can i get the first slide

898
00:32:06,710 --> 00:32:04,320
so the bottom left shows a picture of

899
00:32:09,909 --> 00:32:06,720
new star taken last week at orbital

900
00:32:12,389 --> 00:32:09,919
sciences corporation in dallas virginia

901
00:32:14,789 --> 00:32:12,399
the the observatory is almost fully

902
00:32:16,549 --> 00:32:14,799
integrated at this point in about a week

903
00:32:19,029 --> 00:32:16,559
it will enter into the thermal vacuum

904
00:32:20,950 --> 00:32:19,039
chamber for a series of tests in flight

905
00:32:22,870 --> 00:32:20,960
like conditions

906
00:32:25,430 --> 00:32:22,880
and everything is on schedule for a

907
00:32:27,190 --> 00:32:25,440
launch in early february on a pegasus

908
00:32:29,590 --> 00:32:27,200
rocket

909
00:32:31,669 --> 00:32:29,600
the larger image is artist's conception

910
00:32:33,590 --> 00:32:31,679
of what nustar will look like on orbit

911
00:32:36,389 --> 00:32:33,600
it has a slightly unusual design because

912
00:32:38,310 --> 00:32:36,399
the high energy or hard x-ray optics

913
00:32:40,230 --> 00:32:38,320

require a very long focal length or very

914
00:32:43,350 --> 00:32:40,240
large separation between the

915
00:32:45,269 --> 00:32:43,360
the lens or the optics and the detectors

916
00:32:48,149 --> 00:32:45,279
on the other end and we achieve that

917
00:32:52,070 --> 00:32:48,159
with a 10 meter or 30 foot mast which

918
00:32:54,389 --> 00:32:52,080
extends about a week after we launch

919
00:32:55,909 --> 00:32:54,399
nustar will be the first focusing on

920
00:32:58,230 --> 00:32:55,919
mission at working at these high energy

921
00:33:00,389 --> 00:32:58,240
x-rays which gives us a factor of more

922
00:33:02,310 --> 00:33:00,399
than 100 gain and sensitivity compared

923
00:33:03,750 --> 00:33:02,320
to previous missions

924
00:33:06,549 --> 00:33:03,760
working at these energies can i get the

925
00:33:09,990 --> 00:33:08,230
and so this shows you what you gain with

926
00:33:11,909 --> 00:33:10,000
that focusing optics you get a much

927
00:33:15,029 --> 00:33:11,919
crisper image

928
00:33:16,710 --> 00:33:15,039
the top picture shows you uh cur

929
00:33:18,950 --> 00:33:16,720
our view with current technology of the

930
00:33:20,630 --> 00:33:18,960
center of our own milky way galaxy

931
00:33:22,789 --> 00:33:20,640
obtained with the integral satellite a

932
00:33:24,789 --> 00:33:22,799
couple of years ago the bottom image

933
00:33:26,630 --> 00:33:24,799
shows a simulation of what we expect to

934
00:33:28,070 --> 00:33:26,640
achieve with the new star

935
00:33:30,950 --> 00:33:28,080
um

936
00:33:33,110 --> 00:33:30,960
and we resolve with the with the sharper

937
00:33:35,909 --> 00:33:33,120
images achieved with the focusing optics

938
00:33:37,590 --> 00:33:35,919

of nustar we resolve those half dozen

939
00:33:39,590 --> 00:33:37,600
sources that you see with integral into

940
00:33:41,909 --> 00:33:39,600
several hundred sources which in the

941
00:33:43,590 --> 00:33:41,919
galactic center are mainly black holes

942
00:33:45,430 --> 00:33:43,600
and neutron stars

943
00:33:48,310 --> 00:33:45,440
as well as the four million solar mass

944
00:33:51,110 --> 00:33:48,320
black hole in the center of our galaxy

945
00:33:54,149 --> 00:33:51,120
nustar has a range of science objectives

946
00:33:55,909 --> 00:33:54,159
we will spend two weeks studying the sun

947
00:33:57,509 --> 00:33:55,919
we'll look at micro flares and nano

948
00:33:59,190 --> 00:33:57,519
flares on the surface of the sun which

949
00:34:01,669 --> 00:33:59,200
are thought responsible for heating the

950
00:34:03,750 --> 00:34:01,679
solar corona we'll look for possible

951
00:34:05,509 --> 00:34:03,760
signatures of dark matter decay coming

952
00:34:06,549 --> 00:34:05,519
from the center of the sun

953
00:34:08,230 --> 00:34:06,559
and then we'll spend a lot of the

954
00:34:10,550 --> 00:34:08,240
mission looking at

955
00:34:13,750 --> 00:34:10,560
both objects in the solar in the

956
00:34:15,990 --> 00:34:13,760
milky way galaxy black hole binaries

957
00:34:18,550 --> 00:34:16,000
neutron stars and then one of the main

958
00:34:20,950 --> 00:34:18,560
objectives of nustar is to study black

959
00:34:23,589 --> 00:34:20,960
holes in the centers of other galaxies

960
00:34:25,669 --> 00:34:23,599
we work at similar energies that doctors

961
00:34:26,629 --> 00:34:25,679
and dentists use to probe inside your

962
00:34:28,230 --> 00:34:26,639
body

963
00:34:30,869 --> 00:34:28,240

nustar will use these high-energy

964
00:34:33,190 --> 00:34:30,879
photons to study what's going on near

965
00:34:35,109 --> 00:34:33,200
black holes in the centers of galaxies

966
00:34:37,750 --> 00:34:35,119
we think that black supermassive black

967
00:34:39,909 --> 00:34:37,760
holes are a universal property of large

968
00:34:42,389 --> 00:34:39,919
galaxies but many of them are heavily

969
00:34:43,829 --> 00:34:42,399
obscured and shrouded in gas and dust

970
00:34:45,589 --> 00:34:43,839
and nustar will use these high energy

971
00:34:48,790 --> 00:34:45,599
photons to study what's going on

972
00:34:50,149 --> 00:34:48,800
underneath that enshrouding material

973
00:34:51,430 --> 00:34:50,159
we're on schedule for launching in

974
00:34:53,190 --> 00:34:51,440
february and

975
00:34:54,470 --> 00:34:53,200
thank you for having me here thank you

976
00:34:56,869 --> 00:34:54,480
daniel

977
00:34:58,470 --> 00:34:56,879
we're ready now four questions please

978
00:35:00,710 --> 00:34:58,480
give your name an affiliation when the

979
00:35:02,470 --> 00:35:00,720
microphone comes to you and we'll start

980
00:35:04,069 --> 00:35:02,480
right here on the front

981
00:35:06,150 --> 00:35:04,079
right here

982
00:35:07,750 --> 00:35:06,160
leo enright with irish television for

983
00:35:09,270 --> 00:35:07,760
john grotzinger i'm sorry i didn't

984
00:35:11,670 --> 00:35:09,280
realize you were down to two landing

985
00:35:13,670 --> 00:35:11,680
sites i i think i was traveling uh i

986
00:35:15,190 --> 00:35:13,680
must have missed the announcement but um

987
00:35:16,390 --> 00:35:15,200
could you clarify again what the second

988
00:35:17,829 --> 00:35:16,400

site is

989
00:35:19,990 --> 00:35:17,839
it wasn't absolutely clear from your

990
00:35:21,510 --> 00:35:20,000
presentation could you talk a little bit

991
00:35:22,630 --> 00:35:21,520
about why these were picked over the

992
00:35:24,150 --> 00:35:22,640
other two

993
00:35:26,230 --> 00:35:24,160
and could you talk about where

994
00:35:28,790 --> 00:35:26,240
philosilicates specifically come into

995
00:35:30,390 --> 00:35:28,800
this and and where that is that still

996
00:35:32,630 --> 00:35:30,400
was that still a critical part of your

997
00:35:34,390 --> 00:35:32,640
decision-making process

998
00:35:35,910 --> 00:35:34,400
yeah i'll i'll work backwards there a

999
00:35:38,710 --> 00:35:35,920
little bit the all the landing sites

1000
00:35:41,670 --> 00:35:38,720
have phylosilicates and uh the two

1001
00:35:43,270 --> 00:35:41,680
finalists uh gail and eberswald gale in

1002
00:35:45,430 --> 00:35:43,280
addition to phylosilicates has a very

1003
00:35:48,550 --> 00:35:45,440
thick sequence of sulfates

1004
00:35:50,630 --> 00:35:48,560
and uh so so gale is the site where you

1005
00:35:52,069 --> 00:35:50,640
get to traverse through initially in the

1006
00:35:55,510 --> 00:35:52,079
nominal mission it would be hundreds of

1007
00:35:58,310 --> 00:35:55,520
meters first of phylosilicates uh clean

1008
00:36:00,069 --> 00:35:58,320
minerals uh and then over that uh and

1009
00:36:02,470 --> 00:36:00,079
into sulfates

1010
00:36:04,069 --> 00:36:02,480
and uh deposit an environment that

1011
00:36:06,790 --> 00:36:04,079
geomorphically looks like it could have

1012
00:36:08,069 --> 00:36:06,800
been a ponded pooled possibly lacustrine

1013
00:36:09,670 --> 00:36:08,079

type setting

1014
00:36:12,470 --> 00:36:09,680
in contrast to that you have ebber's

1015
00:36:14,790 --> 00:36:12,480
walled which shows only phallosilicates

1016
00:36:16,870 --> 00:36:14,800
uh and and what you see here at the the

1017
00:36:18,870 --> 00:36:16,880
tip of a delta so the rover would drive

1018
00:36:20,550 --> 00:36:18,880
up to the toe of the delta

1019
00:36:22,310 --> 00:36:20,560
and sample the layers that are at the

1020
00:36:24,630 --> 00:36:22,320
base of the delta where from orbit we

1021
00:36:27,589 --> 00:36:24,640
see the phylosilicates concentrated

1022
00:36:29,349 --> 00:36:27,599
there

1023
00:36:34,069 --> 00:36:29,359
additional questions

1024
00:36:38,069 --> 00:36:35,829
jim siegel celebration independent

1025
00:36:40,470 --> 00:36:38,079
newspaper uh perhaps a question for

1026
00:36:43,030 --> 00:36:40,480
hualieb

1027
00:36:46,310 --> 00:36:43,040
we've seen here a number of projects

1028
00:36:49,030 --> 00:36:46,320
that are going on in 2011 into 2012 and

1029
00:36:51,109 --> 00:36:49,040
i think it was amanda who showed us the

1030
00:36:54,550 --> 00:36:51,119
other things happening in the next few

1031
00:36:56,950 --> 00:36:54,560
years how do all these missions fit

1032
00:36:57,910 --> 00:36:56,960
together they each one have a specific

1033
00:36:58,790 --> 00:36:57,920
purpose

1034
00:37:00,230 --> 00:36:58,800
but

1035
00:37:02,870 --> 00:37:00,240
i'm wondering if there's kind of an

1036
00:37:04,870 --> 00:37:02,880
overall coordination of all of this

1037
00:37:07,030 --> 00:37:04,880
what does it all mean in other words

1038
00:37:09,910 --> 00:37:07,040

rather than just what does in each

1039
00:37:11,910 --> 00:37:09,920
individual mission mean by itself

1040
00:37:13,750 --> 00:37:11,920
well certainly each individual mission

1041
00:37:16,230 --> 00:37:13,760
is targeted at a specific science

1042
00:37:18,310 --> 00:37:16,240
objective it would not have been

1043
00:37:20,550 --> 00:37:18,320
selected

1044
00:37:23,670 --> 00:37:20,560
for development were it not to deliver

1045
00:37:26,310 --> 00:37:23,680
some valuable science in and of itself

1046
00:37:28,150 --> 00:37:26,320
in terms of the big picture what it all

1047
00:37:29,589 --> 00:37:28,160
means it comes back to what i said in

1048
00:37:31,270 --> 00:37:29,599
the beginning about the kinds of

1049
00:37:32,550 --> 00:37:31,280
questions that

1050
00:37:34,790 --> 00:37:32,560
that

1051
00:37:37,589 --> 00:37:34,800
the child in us likes to ask but the

1052
00:37:39,349 --> 00:37:37,599
adult often suppresses

1053
00:37:41,829 --> 00:37:39,359
which is

1054
00:37:44,550 --> 00:37:41,839
what's our universe like how did our

1055
00:37:46,230 --> 00:37:44,560
solar system form how did our earth form

1056
00:37:49,190 --> 00:37:46,240
where are we headed

1057
00:37:51,910 --> 00:37:49,200
how do galaxies form you know what

1058
00:37:54,310 --> 00:37:51,920
what is our place in the universe are we

1059
00:37:57,030 --> 00:37:54,320
alone there is a there is a collection

1060
00:37:59,750 --> 00:37:57,040
of i think fundamental

1061
00:38:02,150 --> 00:37:59,760
questions uh that that it's really in

1062
00:38:04,230 --> 00:38:02,160
our nature to just try and understand

1063
00:38:07,030 --> 00:38:04,240

the world around us the universe around

1064
00:38:10,310 --> 00:38:07,040
us the sun that fuels life on earth

1065
00:38:14,230 --> 00:38:10,320
all of these uh work together to really

1066
00:38:16,069 --> 00:38:14,240
help us i guess in the simplest sense

1067
00:38:19,990 --> 00:38:16,079
understand the universe that surrounds

1068
00:38:24,950 --> 00:38:21,109
ken

1069
00:38:27,270 --> 00:38:24,960
for john grotzinger please um can you

1070
00:38:29,109 --> 00:38:27,280
tell us when um you will make this final

1071
00:38:30,310 --> 00:38:29,119
selection will this be uh after the

1072
00:38:33,030 --> 00:38:30,320
launch

1073
00:38:36,069 --> 00:38:33,040
and um your landing ellipse and garlic

1074
00:38:38,390 --> 00:38:36,079
crater is is is very narrow i mean how

1075
00:38:39,510 --> 00:38:38,400
confident are you you can

1076
00:38:41,109 --> 00:38:39,520
not

1077
00:38:44,310 --> 00:38:41,119
land on top of the mountain instead of

1078
00:38:46,870 --> 00:38:44,320
on near the the edge there

1079
00:38:48,710 --> 00:38:46,880
the uh the the decision will be made in

1080
00:38:50,710 --> 00:38:48,720
the next couple of weeks i'm i'm told by

1081
00:38:52,870 --> 00:38:50,720
headquarters so i i think by the end of

1082
00:38:54,150 --> 00:38:52,880
july that that will uh

1083
00:38:55,990 --> 00:38:54,160
be public

1084
00:38:57,829 --> 00:38:56,000
uh as far as the landing ellipse goes

1085
00:39:00,069 --> 00:38:57,839
that's a three sigma error landing

1086
00:39:02,230 --> 00:39:00,079
ellipse and so the probability of

1087
00:39:03,190 --> 00:39:02,240
landing outside of it is really really

1088
00:39:03,990 --> 00:39:03,200

small

1089
00:39:05,990 --> 00:39:04,000
so

1090
00:39:08,390 --> 00:39:06,000
we we have a lot of confidence that the

1091
00:39:10,470 --> 00:39:08,400
smaller landing ellipse there's even

1092
00:39:12,150 --> 00:39:10,480
even as we get closer to launch i can i

1093
00:39:14,870 --> 00:39:12,160
think you can expect us to shrink it

1094
00:39:16,630 --> 00:39:14,880
down even further as the calculations

1095
00:39:19,030 --> 00:39:16,640
run out a little bit further

1096
00:39:21,829 --> 00:39:19,040
but uh it it looks very safe to land and

1097
00:39:24,069 --> 00:39:21,839
we we have no concerns about that at all

1098
00:39:25,670 --> 00:39:24,079
which is what enabled the the sites

1099
00:39:27,910 --> 00:39:25,680
finally in the last instance to be

1100
00:39:32,550 --> 00:39:27,920
considered on the basis of of science

1101
00:39:38,710 --> 00:39:36,710
any additional questions yes right here

1102
00:39:40,790 --> 00:39:38,720
uh sawyer rosenstein for talking space

1103
00:39:43,270 --> 00:39:40,800
the question is for amanda i was

1104
00:39:45,109 --> 00:39:43,280
wondering what process you used to

1105
00:39:47,109 --> 00:39:45,119
decide the launch vehicle for each

1106
00:39:48,950 --> 00:39:47,119
mission if you could explain that please

1107
00:39:50,950 --> 00:39:48,960
sure

1108
00:39:52,630 --> 00:39:50,960
typically what we do i guess always what

1109
00:39:54,069 --> 00:39:52,640
we do is we work with the mission very

1110
00:39:55,349 --> 00:39:54,079
early on

1111
00:39:57,349 --> 00:39:55,359
to let them understand what the

1112
00:39:59,670 --> 00:39:57,359
capabilities are of the launch vehicles

1113
00:40:01,349 --> 00:39:59,680

that we currently have on the market or

1114
00:40:03,990 --> 00:40:01,359
on contract

1115
00:40:06,550 --> 00:40:04,000
it's based specifically on what the

1116
00:40:09,510 --> 00:40:06,560
orbit requirements are of the satellite

1117
00:40:11,270 --> 00:40:09,520
what the mass of the satellite is

1118
00:40:13,910 --> 00:40:11,280
what it needs to do from a science

1119
00:40:15,829 --> 00:40:13,920
perspective and we put all that together

1120
00:40:17,430 --> 00:40:15,839
and decide which rocket it'll fit on top

1121
00:40:18,790 --> 00:40:17,440
of physically

1122
00:40:21,270 --> 00:40:18,800
dimensionally

1123
00:40:22,870 --> 00:40:21,280
and also analytically

1124
00:40:24,630 --> 00:40:22,880
and then as we go forward through the

1125
00:40:26,390 --> 00:40:24,640
process

1126
00:40:29,030 --> 00:40:26,400
we provide those requirements out to the

1127
00:40:31,030 --> 00:40:29,040
launch service providers that we have

1128
00:40:33,510 --> 00:40:31,040
available to us and we compete that

1129
00:40:34,950 --> 00:40:33,520
amongst those providers and the one that

1130
00:40:37,109 --> 00:40:34,960
can meet those requirements the best

1131
00:40:40,710 --> 00:40:37,119
will be selected

1132
00:40:44,230 --> 00:40:40,720
okay further questions yes right here

1133
00:40:48,710 --> 00:40:46,710
yeah brandi atwood space ref interactive

1134
00:40:50,230 --> 00:40:48,720
a question about the grail mission could

1135
00:40:52,069 --> 00:40:50,240
you talk a little bit about the the

1136
00:40:54,309 --> 00:40:52,079
imager that's flying on the mission

1137
00:40:56,630 --> 00:40:54,319
that's there specifically for education

1138
00:40:59,510 --> 00:40:56,640

and public outreach certainly

1139
00:41:02,550 --> 00:40:59,520
certainly um so grail is the first

1140
00:41:04,630 --> 00:41:02,560
mission to fly an imaging system that

1141
00:41:07,349 --> 00:41:04,640
does not have a scientific objective

1142
00:41:08,870 --> 00:41:07,359
okay this uh imaging system uh which is

1143
00:41:11,829 --> 00:41:08,880
called the mooncam

1144
00:41:14,630 --> 00:41:11,839
uh is devoted entirely to education and

1145
00:41:16,390 --> 00:41:14,640
outreach uh the uh the investigation is

1146
00:41:20,150 --> 00:41:16,400
led by sally ride

1147
00:41:21,270 --> 00:41:20,160
um who uh now dedicates her life to

1148
00:41:23,270 --> 00:41:21,280
working with

1149
00:41:25,190 --> 00:41:23,280
middle school students particularly

1150
00:41:26,230 --> 00:41:25,200
young women but all students

1151
00:41:27,829 --> 00:41:26,240
to

1152
00:41:30,790 --> 00:41:27,839
raise their awareness and understanding

1153
00:41:31,750 --> 00:41:30,800
of science math and technology and these

1154
00:41:33,030 --> 00:41:31,760
uh

1155
00:41:35,030 --> 00:41:33,040
these cameras they're they're

1156
00:41:36,870 --> 00:41:35,040
essentially rocket cams the kind of

1157
00:41:39,190 --> 00:41:36,880
cameras that we put on the the rockets

1158
00:41:42,230 --> 00:41:39,200
to see the stages separate so they're

1159
00:41:45,030 --> 00:41:42,240
they're not very expensive and uh and

1160
00:41:47,349 --> 00:41:45,040
this uh investigation it's totally best

1161
00:41:48,790 --> 00:41:47,359
efforts okay there are no requirements

1162
00:41:51,190 --> 00:41:48,800
for number of

1163
00:41:54,710 --> 00:41:51,200

images that we have to get

1164
00:41:57,109 --> 00:41:54,720
each spacecraft will have

1165
00:41:59,910 --> 00:41:57,119
camera electronics and four camera heads

1166
00:42:01,030 --> 00:41:59,920
so that we don't have moving parts

1167
00:42:02,630 --> 00:42:01,040
and

1168
00:42:05,030 --> 00:42:02,640
middle school students will be able to

1169
00:42:06,630 --> 00:42:05,040
log on and if their school is registered

1170
00:42:08,630 --> 00:42:06,640
in the program

1171
00:42:10,790 --> 00:42:08,640
the software is available to see where

1172
00:42:11,589 --> 00:42:10,800
the grail ground tracks will be passing

1173
00:42:14,390 --> 00:42:11,599
over

1174
00:42:15,829 --> 00:42:14,400
and then students can target images of

1175
00:42:16,550 --> 00:42:15,839
something they'd like to take a picture

1176
00:42:17,829 --> 00:42:16,560
of

1177
00:42:21,829 --> 00:42:17,839
and

1178
00:42:24,470 --> 00:42:21,839
there is a mission operations center

1179
00:42:26,790 --> 00:42:24,480
that sally runs out at the

1180
00:42:27,670 --> 00:42:26,800
university of california at san diego

1181
00:42:29,109 --> 00:42:27,680
where

1182
00:42:30,550 --> 00:42:29,119
college students

1183
00:42:32,710 --> 00:42:30,560
run this

1184
00:42:35,750 --> 00:42:32,720
and get the software input and then we

1185
00:42:37,670 --> 00:42:35,760
take as many of these images as our

1186
00:42:39,109 --> 00:42:37,680
operations allow

1187
00:42:42,069 --> 00:42:39,119
but this is done in a completely

1188
00:42:43,829 --> 00:42:42,079

non-interference basis with the gravity

1189
00:42:45,910 --> 00:42:43,839
mission so in the gravity mission the

1190
00:42:48,309 --> 00:42:45,920
spacecraft are just ranging to each

1191
00:42:50,069 --> 00:42:48,319
other constantly we don't move the

1192
00:42:51,829 --> 00:42:50,079
spacecraft around that actually

1193
00:42:54,230 --> 00:42:51,839
interferes with gravity we just want to

1194
00:42:56,470 --> 00:42:54,240
put them in orbit and let them fly and

1195
00:42:57,990 --> 00:42:56,480
watch how they perturb uh get perturbed

1196
00:43:00,390 --> 00:42:58,000
by the moon

1197
00:43:01,190 --> 00:43:00,400
so the the way that we were able to do

1198
00:43:03,750 --> 00:43:01,200
this

1199
00:43:05,349 --> 00:43:03,760
make it cost effective not introduce

1200
00:43:06,630 --> 00:43:05,359
risk in the mission was to make it

1201
00:43:09,910 --> 00:43:06,640
entirely

1202
00:43:16,230 --> 00:43:13,750
question uh here in the front

1203
00:43:19,349 --> 00:43:16,240
uh jonathan amos from bbc news question

1204
00:43:21,030 --> 00:43:19,359
for scott uh about juno what was the um

1205
00:43:23,510 --> 00:43:21,040
the thinking behind going with with

1206
00:43:25,510 --> 00:43:23,520
solar panels rosetta is i think the most

1207
00:43:28,150 --> 00:43:25,520
distant spacecraft currently with with

1208
00:43:30,069 --> 00:43:28,160
solar panels you'll break that record

1209
00:43:32,550 --> 00:43:30,079
why not go with an rtg is it a cost

1210
00:43:34,230 --> 00:43:32,560
issue practicality issue what is it

1211
00:43:37,109 --> 00:43:34,240
it was

1212
00:43:40,630 --> 00:43:37,119
primarily a practicality and risk issue

1213
00:43:43,109 --> 00:43:40,640

back when we were formulating juno

1214
00:43:45,030 --> 00:43:43,119
as a principle investigator mission it

1215
00:43:46,790 --> 00:43:45,040
the way it works is nasa puts out an

1216
00:43:49,109 --> 00:43:46,800
ounce of opportunity and and different

1217
00:43:50,230 --> 00:43:49,119
teams come together and and uh

1218
00:43:52,230 --> 00:43:50,240
and compete

1219
00:43:55,430 --> 00:43:52,240
and when we were putting that together

1220
00:43:58,230 --> 00:43:55,440
the um the i there wasn't really an rtg

1221
00:44:00,069 --> 00:43:58,240
available anymore there there was a plan

1222
00:44:02,390 --> 00:44:00,079
to develop new ones

1223
00:44:04,470 --> 00:44:02,400
a new kind that we would be able to use

1224
00:44:06,150 --> 00:44:04,480
and they advertised that as a as a

1225
00:44:09,190 --> 00:44:06,160
possibility

1226
00:44:10,470 --> 00:44:09,200
but when we looked at it i thought um

1227
00:44:12,790 --> 00:44:10,480
the team kind of thought well there's

1228
00:44:14,790 --> 00:44:12,800
some risk that that development won't

1229
00:44:17,109 --> 00:44:14,800
uh happen on time

1230
00:44:19,270 --> 00:44:17,119
and or the costs will go up higher than

1231
00:44:21,349 --> 00:44:19,280
we predicted and so we looked at whether

1232
00:44:23,750 --> 00:44:21,359
there was an alternative of existing

1233
00:44:25,589 --> 00:44:23,760
technology or with a small leap which

1234
00:44:26,630 --> 00:44:25,599
was what the solar cells represented we

1235
00:44:29,190 --> 00:44:26,640
needed to

1236
00:44:33,510 --> 00:44:29,200
and so we judged it as a as a smaller

1237
00:44:37,750 --> 00:44:35,750
and that was primarily what it what

1238
00:44:39,589 --> 00:44:37,760

if there had been rtgs available we may

1239
00:44:41,829 --> 00:44:39,599
have gone that way

1240
00:44:45,030 --> 00:44:41,839
because it would simplify operations i

1241
00:44:46,630 --> 00:44:45,040
mean i i as a as a solar orbiter solar

1242
00:44:48,870 --> 00:44:46,640
paneled mission we have to keep those

1243
00:44:50,710 --> 00:44:48,880
solar panels facing the sun we never go

1244
00:44:52,069 --> 00:44:50,720
into jupiter shadow

1245
00:44:53,349 --> 00:44:52,079
those are things that we can do and

1246
00:44:55,430 --> 00:44:53,359
still accomplish all our science it

1247
00:44:56,470 --> 00:44:55,440
doesn't hurt us at all but it would have

1248
00:44:59,430 --> 00:44:56,480
been easier if we just could have

1249
00:45:01,589 --> 00:44:59,440
pointed any way we wanted and

1250
00:45:02,309 --> 00:45:01,599
and so we've we've been able to develop

1251
00:45:04,390 --> 00:45:02,319
that

1252
00:45:06,950 --> 00:45:04,400
and and in fact we've advanced solar

1253
00:45:07,829 --> 00:45:06,960
cell technology so that's also good

1254
00:45:09,510 --> 00:45:07,839
um

1255
00:45:11,349 --> 00:45:09,520
i like to say that we're you know we're

1256
00:45:15,270 --> 00:45:11,359
green and we were green before it was in

1257
00:45:19,109 --> 00:45:16,870
but i also wanted to

1258
00:45:20,870 --> 00:45:19,119
let you know i'll take this opportunity

1259
00:45:23,030 --> 00:45:20,880
that we also have a camera on board

1260
00:45:25,270 --> 00:45:23,040
that's strictly for outreach there's no

1261
00:45:27,670 --> 00:45:25,280
science requirements very similar

1262
00:45:29,670 --> 00:45:27,680
and not that i want to battle maria

1263
00:45:33,430 --> 00:45:29,680

she's a good friend but we're launching

1264
00:45:36,870 --> 00:45:35,430
we're getting there first yeah but i'm

1265
00:45:37,829 --> 00:45:36,880
going to turn on that camera before you

1266
00:45:42,470 --> 00:45:37,839
get there

1267
00:45:46,470 --> 00:45:44,950
have we any additional questions more

1268
00:45:49,589 --> 00:45:46,480
here in the front

1269
00:45:53,910 --> 00:45:51,510
jim siegel celebration independent news

1270
00:45:54,790 --> 00:45:53,920
i have a question for amanda regarding

1271
00:45:58,069 --> 00:45:54,800
the

1272
00:46:01,910 --> 00:45:58,079
launch capacity of of ksc with all of

1273
00:46:05,990 --> 00:46:01,920
the the news now about the shuttle going

1274
00:46:08,309 --> 00:46:06,000
concluding and potential layoffs here

1275
00:46:09,990 --> 00:46:08,319
in central florida

1276
00:46:12,390 --> 00:46:10,000
i'm interested in whether your

1277
00:46:14,630 --> 00:46:12,400
organization also coordinates

1278
00:46:16,470 --> 00:46:14,640
launches for the commercial side of the

1279
00:46:19,109 --> 00:46:16,480
business and

1280
00:46:21,589 --> 00:46:19,119
what is the capacity of of kennedy space

1281
00:46:22,950 --> 00:46:21,599
center or the adjoining air force base

1282
00:46:25,430 --> 00:46:22,960
to launch

1283
00:46:27,589 --> 00:46:25,440
vehicles are you going to use many

1284
00:46:29,030 --> 00:46:27,599
different pads just one or two pads how

1285
00:46:29,910 --> 00:46:29,040
is that going to work

1286
00:46:31,910 --> 00:46:29,920
sure

1287
00:46:34,309 --> 00:46:31,920
so we don't coordinate missions for

1288
00:46:36,230 --> 00:46:34,319

commercial they do that themselves now

1289
00:46:37,030 --> 00:46:36,240
dod coordinates their own missions as

1290
00:46:39,750 --> 00:46:37,040
well

1291
00:46:41,349 --> 00:46:39,760
all of our launches are from that are in

1292
00:46:42,550 --> 00:46:41,359
florida are from cape canaveral air

1293
00:46:45,270 --> 00:46:42,560
force station

1294
00:46:46,790 --> 00:46:45,280
and it's really uh depends on which

1295
00:46:49,109 --> 00:46:46,800
launch service provider that you're

1296
00:46:51,349 --> 00:46:49,119
using so for instance united launch

1297
00:46:52,950 --> 00:46:51,359
alliance has the atlas 5 that we have

1298
00:46:55,750 --> 00:46:52,960
two of our missions launching on this

1299
00:46:57,910 --> 00:46:55,760
fall typically the launch flow runs

1300
00:46:59,750 --> 00:46:57,920
between 60 and 90 days depending on the

1301
00:47:03,030 --> 00:46:59,760
complexity of the mission

1302
00:47:05,030 --> 00:47:03,040
so so the timing between juno and msl

1303
00:47:07,670 --> 00:47:05,040
is larger because the both missions are

1304
00:47:09,589 --> 00:47:07,680
very complex for the nustar mission

1305
00:47:11,349 --> 00:47:09,599
which will be launching out of kwajalein

1306
00:47:13,270 --> 00:47:11,359
we like to have a larger separation

1307
00:47:14,550 --> 00:47:13,280
there because the travel time is is a

1308
00:47:16,390 --> 00:47:14,560
good bit you have to integrate the

1309
00:47:19,030 --> 00:47:16,400
spacecraft at vandenberg air force base

1310
00:47:21,750 --> 00:47:19,040
first before you you actually ferry it

1311
00:47:23,750 --> 00:47:21,760
under an l-1011 on a pegasus rocket to

1312
00:47:26,790 --> 00:47:23,760
its launch site in kwajalein so

1313
00:47:28,470 --> 00:47:26,800

typically we like about 30 to 60 days

1314
00:47:30,309 --> 00:47:28,480
between missions if we have one out of

1315
00:47:31,990 --> 00:47:30,319
kwajalein just to make sure that we can

1316
00:47:33,109 --> 00:47:32,000
get everything once you get their

1317
00:47:34,950 --> 00:47:33,119
logistics are a little bit more

1318
00:47:36,549 --> 00:47:34,960
difficult to handle so you like to have

1319
00:47:38,230 --> 00:47:36,559
a little bit more separation time

1320
00:47:40,309 --> 00:47:38,240
between that mission so it's really very

1321
00:47:41,910 --> 00:47:40,319
highly dependent upon

1322
00:47:43,829 --> 00:47:41,920
which rocket you're using and which

1323
00:47:45,670 --> 00:47:43,839
provider you're using and then

1324
00:47:47,270 --> 00:47:45,680
the science requirements as well this as

1325
00:47:51,270 --> 00:47:47,280
of the spacecraft that drive the actual

1326
00:47:54,950 --> 00:47:53,030
ken you had a follow-up

1327
00:47:57,829 --> 00:47:54,960
yes ken kramer for space flight magazine

1328
00:48:00,230 --> 00:47:57,839
a quick one for uh john and scott um

1329
00:48:02,390 --> 00:48:00,240
uh for scott uh quickly about the epo

1330
00:48:04,150 --> 00:48:02,400
camera will you take any approach images

1331
00:48:06,470 --> 00:48:04,160
of jupiter i understand you're

1332
00:48:09,030 --> 00:48:06,480
deciding whether to do this or not and

1333
00:48:10,790 --> 00:48:09,040
for john can you talk a little bit about

1334
00:48:12,870 --> 00:48:10,800
the sampling how many samples you can

1335
00:48:14,950 --> 00:48:12,880
take will you use them up on the primary

1336
00:48:16,549 --> 00:48:14,960
mission all or will you save some of

1337
00:48:19,190 --> 00:48:16,559
that sampling possibility for the

1338
00:48:21,670 --> 00:48:19,200

extended mission thank you

1339
00:48:23,750 --> 00:48:21,680
so you want me to go first um

1340
00:48:26,790 --> 00:48:23,760
we will take some not real distant

1341
00:48:28,549 --> 00:48:26,800
approach shots um our cameras uh it's a

1342
00:48:30,470 --> 00:48:28,559
outreach camera so it was very much a

1343
00:48:32,630 --> 00:48:30,480
best efforts basis the same way maria

1344
00:48:34,950 --> 00:48:32,640
described it and it's it's designed in

1345
00:48:37,510 --> 00:48:34,960
order to capture the first images of the

1346
00:48:40,309 --> 00:48:37,520
pole when we go over the poles

1347
00:48:41,910 --> 00:48:40,319
and also we go very close to jupiter at

1348
00:48:43,829 --> 00:48:41,920
closest approach we're only 5 000

1349
00:48:46,309 --> 00:48:43,839
kilometers above the cloud top so we're

1350
00:48:48,950 --> 00:48:46,319
really right on top of that baby and so

1351
00:48:51,190 --> 00:48:48,960
you'll see images that are really

1352
00:48:53,270 --> 00:48:51,200
um for the first time giving you details

1353
00:48:54,790 --> 00:48:53,280
of these beautiful clouds and zones and

1354
00:48:56,150 --> 00:48:54,800
belts and swirls and so that's really

1355
00:48:57,750 --> 00:48:56,160
what the camera is designed to do it's a

1356
00:48:59,349 --> 00:48:57,760
color camera

1357
00:49:01,270 --> 00:48:59,359
and

1358
00:49:03,030 --> 00:49:01,280
so far away we won't be able to get very

1359
00:49:04,790 --> 00:49:03,040
good images it's not one of these you

1360
00:49:07,510 --> 00:49:04,800
know narrow and wide angle cameras that

1361
00:49:09,270 --> 00:49:07,520
you have on on some flagship missions

1362
00:49:10,870 --> 00:49:09,280
and so

1363
00:49:13,910 --> 00:49:10,880

we'll get a couple of shots but they

1364
00:49:15,670 --> 00:49:13,920
probably won't be great outreach shots

1365
00:49:19,589 --> 00:49:15,680
it's mostly the closer in stuff that

1366
00:49:23,430 --> 00:49:21,750
as far as msl goes there's a couple of

1367
00:49:25,670 --> 00:49:23,440
different ways that we'll we'll do

1368
00:49:27,589 --> 00:49:25,680
sampling the the most involved sampling

1369
00:49:29,430 --> 00:49:27,599
is when we actually drill and then pass

1370
00:49:31,510 --> 00:49:29,440
a powder in in

1371
00:49:33,670 --> 00:49:31,520
into the rover we have no mission

1372
00:49:35,109 --> 00:49:33,680
requirements uh about when we must

1373
00:49:36,790 --> 00:49:35,119
collect samples

1374
00:49:39,510 --> 00:49:36,800
and i think what we learned with with

1375
00:49:41,510 --> 00:49:39,520
mer is that studying rocks on on mars is

1376
00:49:42,950 --> 00:49:41,520
much like that on earth you don't want

1377
00:49:44,390 --> 00:49:42,960
to sample everything that you come

1378
00:49:46,470 --> 00:49:44,400
across because not everything that you

1379
00:49:48,150 --> 00:49:46,480
come across is interesting so we'll

1380
00:49:50,150 --> 00:49:48,160
high-grade it if it turns out that

1381
00:49:52,309 --> 00:49:50,160
there's really exciting stuff

1382
00:49:54,069 --> 00:49:52,319
uh you know halfway through the nominal

1383
00:49:56,470 --> 00:49:54,079
mission then we we might collect a lot

1384
00:49:59,349 --> 00:49:56,480
of samples or we might

1385
00:50:00,950 --> 00:49:59,359
choose to defer until later on so we we

1386
00:50:02,870 --> 00:50:00,960
have that flexibility

1387
00:50:05,190 --> 00:50:02,880
now we do have remote sensing as well

1388
00:50:08,069 --> 00:50:05,200

that that features a lot of excellent

1389
00:50:10,870 --> 00:50:08,079
camel cameras plus a laser

1390
00:50:12,549 --> 00:50:10,880
that creates a plasma

1391
00:50:15,190 --> 00:50:12,559
up to seven meters away so as we're

1392
00:50:17,030 --> 00:50:15,200
driving along we will we will be zapping

1393
00:50:19,109 --> 00:50:17,040
this laser all over the place getting

1394
00:50:20,790 --> 00:50:19,119
elemental chemistry so we'll have some

1395
00:50:21,829 --> 00:50:20,800
record of what we drive by that we don't

1396
00:50:24,549 --> 00:50:21,839
do

1397
00:50:27,030 --> 00:50:24,559
more involved sampling with

1398
00:50:28,710 --> 00:50:27,040
thank you john and

1399
00:50:31,430 --> 00:50:28,720
that means our

1400
00:50:34,230 --> 00:50:31,440
next launch after sts-135 is almost

1401
00:50:35,990 --> 00:50:34,240
right away it's juno on august the 5th

1402
00:50:37,430 --> 00:50:36,000
on an atlas v