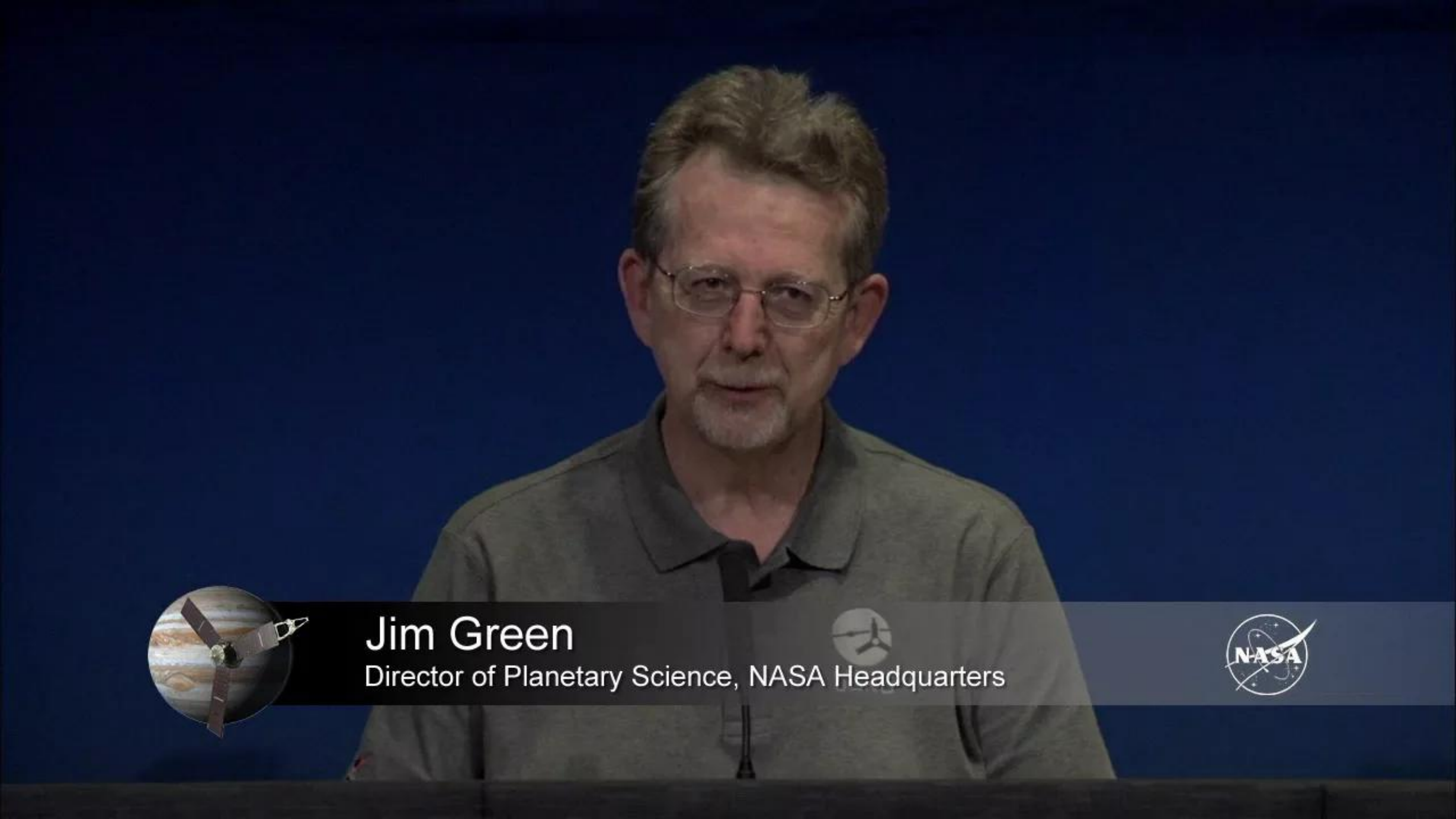
Jim Green
Director of Planetary Science, NASA Headquarters
NASA

1
00:00:07,990 --> 00:00:05,590
happy independence day from nasa's jet

2
00:00:10,230 --> 00:00:08,000
propulsion lab in pasadena california

3
00:00:12,150 --> 00:00:10,240
i'm dc eagle and this is a media

4
00:00:13,350 --> 00:00:12,160
briefing about the juno mission to

5
00:00:16,710 --> 00:00:13,360
jupiter

6
00:00:19,029 --> 00:00:16,720
well juno is currently 11 hours and 516

7
00:00:22,150 --> 00:00:19,039
000 miles away from jupiter and tonight

8
00:00:24,630 --> 00:00:22,160
at 8 18 pm pacific it will fire its main

9
00:00:25,910 --> 00:00:24,640
engine for joi or jupiter orbit

10
00:00:28,230 --> 00:00:25,920
insertion

11
00:00:30,150 --> 00:00:28,240
here to talk about juno the science of

12
00:00:34,229 --> 00:00:30,160
jupiter and juno and jupiter orbit

13
00:00:37,350 --> 00:00:35,350

jim green

14
00:00:42,310 --> 00:00:37,360
director of planetary science

15
00:00:47,830 --> 00:00:45,590
scott bolton juno principal investigator

16
00:00:52,229 --> 00:00:47,840
southwest research institute in san

17
00:01:00,229 --> 00:00:55,350
rick neibachen juno project manager from

18
00:01:05,350 --> 00:01:02,229
and heidi becker juno radiation

19
00:01:07,590 --> 00:01:05,360
monitoring lead investigator and she is

20
00:01:09,030 --> 00:01:07,600
from jpl as well

21
00:01:10,310 --> 00:01:09,040
and we'll start things off with jim

22
00:01:13,350 --> 00:01:10,320
green jim

23
00:01:15,350 --> 00:01:13,360
thank you very much dc what a wonderful

24
00:01:17,910 --> 00:01:15,360
day to celebrate you know this is a

25
00:01:20,550 --> 00:01:17,920
milestone for our country but it's a

26
00:01:22,390 --> 00:01:20,560
milestone for planetary science

27
00:01:23,429 --> 00:01:22,400
we've had a number of probes fly by

28
00:01:25,510 --> 00:01:23,439
jupiter

29
00:01:29,109 --> 00:01:25,520
galileo actually was our last probe to

30
00:01:31,830 --> 00:01:29,119
jupiter that orbited it for many years

31
00:01:33,910 --> 00:01:31,840
it studied the the planet but only

32
00:01:36,149 --> 00:01:33,920
surfaced deep

33
00:01:39,270 --> 00:01:36,159
looked at all the moons and now we have

34
00:01:40,710 --> 00:01:39,280
a chance with juno to go back and study

35
00:01:42,710 --> 00:01:40,720
the planet

36
00:01:45,510 --> 00:01:42,720
in its own right

37
00:01:47,350 --> 00:01:45,520
juno was part of a program we call

38
00:01:49,270 --> 00:01:47,360

new frontiers

39
00:01:50,789 --> 00:01:49,280
it's a second in the series of new

40
00:01:51,910 --> 00:01:50,799
frontiers

41
00:01:53,429 --> 00:01:51,920
missions

42
00:01:56,389 --> 00:01:53,439
last one was

43
00:01:58,950 --> 00:01:56,399
new horizons which flew by pluto

44
00:02:02,149 --> 00:01:58,960
these are well-focused missions

45
00:02:04,870 --> 00:02:02,159
spectacular missions in their own right

46
00:02:07,429 --> 00:02:04,880
studying a set of science we can only

47
00:02:09,430 --> 00:02:07,439
get by dedicating

48
00:02:11,750 --> 00:02:09,440
many people across the country to

49
00:02:14,229 --> 00:02:11,760
develop a spacecraft to go after the

50
00:02:17,589 --> 00:02:14,239
science we want

51
00:02:18,470 --> 00:02:17,599
this is a spectacular time for us

52
00:02:20,070 --> 00:02:18,480
as

53
00:02:24,869 --> 00:02:20,080
dc said

54
00:02:27,190 --> 00:02:24,879
in one jupiter rotation will be there

55
00:02:28,309 --> 00:02:27,200
and so let's learn much more about the

56
00:02:29,589 --> 00:02:28,319
mission

57
00:02:31,270 --> 00:02:29,599
scott

58
00:02:32,150 --> 00:02:31,280
thanks jim

59
00:02:34,630 --> 00:02:32,160
so

60
00:02:37,830 --> 00:02:34,640
happy fourth of july everyone

61
00:02:40,630 --> 00:02:37,840
um i've always loved fourth of july in

62
00:02:41,830 --> 00:02:40,640
fact that's my favorite holiday

63
00:02:43,830 --> 00:02:41,840

and

64
00:02:45,270 --> 00:02:43,840
i think this is my favorite fourth of

65
00:02:47,589 --> 00:02:45,280
july

66
00:02:49,589 --> 00:02:47,599
that i've ever had

67
00:02:51,430 --> 00:02:49,599
and i'm really excited the team's

68
00:02:53,750 --> 00:02:51,440
excited we're

69
00:02:56,070 --> 00:02:53,760
we're barreling down on

70
00:02:57,430 --> 00:02:56,080
on jupiter really quick

71
00:02:59,990 --> 00:02:57,440
um

72
00:03:02,070 --> 00:03:00,000
it's been amazing journey

73
00:03:04,550 --> 00:03:02,080
it's it's hard to believe after 15 years

74
00:03:07,030 --> 00:03:04,560
we're finally arriving there can i get

75
00:03:09,190 --> 00:03:07,040
my first slide so

76
00:03:11,509 --> 00:03:09,200
here you see jupiter and it's galilean

77
00:03:12,869 --> 00:03:11,519
moons it's uh it's like a little mini

78
00:03:15,750 --> 00:03:12,879
solar system

79
00:03:19,110 --> 00:03:15,760
so we passed callisto last uh yesterday

80
00:03:21,350 --> 00:03:19,120
at about 11 a.m

81
00:03:24,630 --> 00:03:21,360
ganymede was next

82
00:03:26,949 --> 00:03:24,640
happened last night about 4 a.m

83
00:03:28,630 --> 00:03:26,959
in about an hour and a half we will pass

84
00:03:31,750 --> 00:03:28,640
europa

85
00:03:33,670 --> 00:03:31,760
it's getting very real

86
00:03:36,390 --> 00:03:33,680
then finally later this afternoon a

87
00:03:37,910 --> 00:03:36,400
little after two we will pass io the

88
00:03:39,750 --> 00:03:37,920

innermost moon

89
00:03:40,869 --> 00:03:39,760
of the galilean moons

90
00:03:43,030 --> 00:03:40,879
and so

91
00:03:44,710 --> 00:03:43,040
we're headed there it's it's happening

92
00:03:46,470 --> 00:03:44,720
we're moving really fast through this

93
00:03:47,910 --> 00:03:46,480
system

94
00:03:49,670 --> 00:03:47,920
next slide

95
00:03:51,350 --> 00:03:49,680
and here's where we're going that's our

96
00:03:53,589 --> 00:03:51,360
target

97
00:03:55,190 --> 00:03:53,599
here is you see

98
00:03:58,070 --> 00:03:55,200
undoubtedly and

99
00:04:00,070 --> 00:03:58,080
it is the king of our solar system

100
00:04:01,110 --> 00:04:00,080
this is it the largest planet more

101
00:04:02,869 --> 00:04:01,120
massive

102
00:04:04,309 --> 00:04:02,879
than all the other planets and

103
00:04:05,509 --> 00:04:04,319
everything else in our solar system

104
00:04:07,429 --> 00:04:05,519
combined

105
00:04:10,229 --> 00:04:07,439
other than the sun

106
00:04:12,789 --> 00:04:10,239
this beautiful picture of its zones and

107
00:04:14,630 --> 00:04:12,799
belts the great red spot this incredible

108
00:04:17,030 --> 00:04:14,640
turbulent atmosphere

109
00:04:18,949 --> 00:04:17,040
we've known it for many many years it's

110
00:04:20,870 --> 00:04:18,959
a gorgeous planet

111
00:04:22,629 --> 00:04:20,880
what juno is about is

112
00:04:26,070 --> 00:04:22,639
looking beneath that surface we've got

113
00:04:28,230 --> 00:04:26,080

to go down and look at what's inside

114
00:04:29,430 --> 00:04:28,240
see how it's built how deep do these

115
00:04:31,189 --> 00:04:29,440
features go

116
00:04:34,310 --> 00:04:31,199
learn about it's real secrets that's

117
00:04:37,909 --> 00:04:35,670
next slide

118
00:04:39,510 --> 00:04:37,919
but it's not that easy

119
00:04:41,749 --> 00:04:39,520
here's what we're facing

120
00:04:45,749 --> 00:04:41,759
so here you see a vla image this is a

121
00:04:47,909 --> 00:04:45,759
radio image of jupiter which is showing

122
00:04:49,830 --> 00:04:47,919
the extreme radiation belts that

123
00:04:51,909 --> 00:04:49,840
surround this planet

124
00:04:53,430 --> 00:04:51,919
they're the equivalent idea of what we

125
00:04:55,270 --> 00:04:53,440
have around earth called van allen

126
00:04:55,990 --> 00:04:55,280
radiation belts

127
00:04:57,430 --> 00:04:56,000
but

128
00:05:00,790 --> 00:04:57,440
jupiter's

129
00:05:02,070 --> 00:05:00,800
are on steroids they're a very serious

130
00:05:03,430 --> 00:05:02,080
hazard

131
00:05:05,110 --> 00:05:03,440
the yellow

132
00:05:06,950 --> 00:05:05,120
first the lines going around jupiter

133
00:05:08,390 --> 00:05:06,960
that are coming around are the magnetic

134
00:05:10,790 --> 00:05:08,400
field lines that are trapping these

135
00:05:12,710 --> 00:05:10,800
particles the yellow is where the most

136
00:05:15,029 --> 00:05:12,720
intense radiation is we're looking at

137
00:05:17,029 --> 00:05:15,039
electrons that are moving very close to

138
00:05:19,110 --> 00:05:17,039

the speed of light

139
00:05:21,670 --> 00:05:19,120
these things go right through anything

140
00:05:23,990 --> 00:05:21,680
we know pretty much

141
00:05:26,790 --> 00:05:24,000
we try to avoid that yellow spot as best

142
00:05:27,830 --> 00:05:26,800
we can the trick to juno is come in over

143
00:05:30,469 --> 00:05:27,840
the north

144
00:05:33,270 --> 00:05:30,479
slide between that yellow spot

145
00:05:35,909 --> 00:05:33,280
and the body or the atmosphere itself

146
00:05:38,230 --> 00:05:35,919
and then come out the south

147
00:05:40,070 --> 00:05:38,240
but you can see even even sliding

148
00:05:43,110 --> 00:05:40,080
through and doing that you can't avoid

149
00:05:44,790 --> 00:05:43,120
the green zones which are the tame part

150
00:05:47,990 --> 00:05:44,800
of jupiter but

151
00:05:49,270 --> 00:05:48,000
many many times worse than earth

152
00:05:51,909 --> 00:05:49,280
so this is

153
00:05:54,550 --> 00:05:51,919
the true hazard of jupiter now what's

154
00:05:56,469 --> 00:05:54,560
not seen on here is another hazard that

155
00:05:58,950 --> 00:05:56,479
we haven't spoken very much of it which

156
00:06:00,469 --> 00:05:58,960
is jupiter also has a ring around it a

157
00:06:03,029 --> 00:06:00,479
ring of debris

158
00:06:05,590 --> 00:06:03,039
dust meteorites

159
00:06:07,909 --> 00:06:05,600
they extend out just past

160
00:06:10,790 --> 00:06:07,919
these red parts of these radiation zones

161
00:06:13,830 --> 00:06:10,800
we've only got a few images of that

162
00:06:15,990 --> 00:06:13,840
it's believed that they're also extended

163
00:06:17,830 --> 00:06:16,000

let me have the next slide here you see

164
00:06:22,629 --> 00:06:17,840
the rings

165
00:06:23,749 --> 00:06:22,639
to about one and a half or two jovian

166
00:06:25,830 --> 00:06:23,759
radii

167
00:06:28,070 --> 00:06:25,840
but there's a vertical extent of these

168
00:06:30,070 --> 00:06:28,080
rings that isn't very well known

169
00:06:32,390 --> 00:06:30,080
juno has to pass through these these

170
00:06:34,390 --> 00:06:32,400
rings we do not know how close to the

171
00:06:36,390 --> 00:06:34,400
planet they actually go

172
00:06:37,830 --> 00:06:36,400
and if it gets hit

173
00:06:39,909 --> 00:06:37,840
even by

174
00:06:42,950 --> 00:06:39,919
a big piece of dust even a small piece

175
00:06:44,710 --> 00:06:42,960
of dust it can do very serious damage

176
00:06:47,029 --> 00:06:44,720
one of the vulnerabilities that we have

177
00:06:48,950 --> 00:06:47,039
to face is the fact that

178
00:06:50,150 --> 00:06:48,960
we had to open our engine door so the

179
00:06:52,390 --> 00:06:50,160
nozzle

180
00:06:53,990 --> 00:06:52,400
is open and vulnerable

181
00:06:56,550 --> 00:06:54,000
we're flying through

182
00:07:00,230 --> 00:06:56,560
faster than any object has ever gone

183
00:07:02,950 --> 00:07:00,240
with the nozzle facing forward

184
00:07:05,110 --> 00:07:02,960
if any dust is in our way and hits that

185
00:07:07,110 --> 00:07:05,120
nozzle it will knock a hole right

186
00:07:08,950 --> 00:07:07,120
through the coating that protects the

187
00:07:10,870 --> 00:07:08,960
nozzle and allows the engine to burn

188
00:07:13,830 --> 00:07:10,880

uninterrupted

189
00:07:15,110 --> 00:07:13,840
so that's one of the big gambles

190
00:07:16,390 --> 00:07:15,120
is

191
00:07:18,469 --> 00:07:16,400
we've done everything we can we've

192
00:07:21,749 --> 00:07:18,479
protected everything we can that we as

193
00:07:24,309 --> 00:07:21,759
best we can we've modeled it

194
00:07:26,550 --> 00:07:24,319
but we're going into unknown territory

195
00:07:28,710 --> 00:07:26,560
so you've got the radiation

196
00:07:30,790 --> 00:07:28,720
and you've got this dust and meteorite

197
00:07:32,390 --> 00:07:30,800
scare so that's part of what we're

198
00:07:35,029 --> 00:07:32,400
facing but

199
00:07:36,629 --> 00:07:35,039
we are built like an armored tank

200
00:07:37,990 --> 00:07:36,639
and to hear more about that armored tank

201
00:07:40,150 --> 00:07:38,000
i'm going to pass it to rick it'll tell

202
00:07:41,749 --> 00:07:40,160
you some of the activities

203
00:07:45,270 --> 00:07:41,759
later today

204
00:07:47,589 --> 00:07:45,280
and how we deal with them

205
00:07:50,309 --> 00:07:47,599
good morning i'm incredibly thrilled to

206
00:07:51,990 --> 00:07:50,319
be here um but it is a little surreal

207
00:07:53,189 --> 00:07:52,000
i've been on this mission ten and a half

208
00:07:55,029 --> 00:07:53,199
years and

209
00:07:57,029 --> 00:07:55,039
it's still a little hard to believe that

210
00:07:58,790 --> 00:07:57,039
today's the day we go into orbit around

211
00:08:01,430 --> 00:07:58,800
jupiter

212
00:08:03,909 --> 00:08:01,440
so let me introduce you to the juno

213
00:08:05,430 --> 00:08:03,919

spacecraft

214
00:08:08,469 --> 00:08:05,440
it's a

215
00:08:10,390 --> 00:08:08,479
spin stabilized polar orbiter

216
00:08:13,189 --> 00:08:10,400
it will operate farther from the sun

217
00:08:14,390 --> 00:08:13,199
than any other solar powered mission in

218
00:08:15,670 --> 00:08:14,400
history

219
00:08:18,790 --> 00:08:15,680
and it's the first solar powered

220
00:08:20,710 --> 00:08:18,800
spacecraft to ever operate at jupiter

221
00:08:22,150 --> 00:08:20,720
and when you look at it what really

222
00:08:24,070 --> 00:08:22,160
jumps out at you

223
00:08:27,029 --> 00:08:24,080
are the size of these solar arrays these

224
00:08:29,990 --> 00:08:27,039
massive solar rays are 60 square meters

225
00:08:32,149 --> 00:08:30,000
in area and even though we're

226
00:08:34,389 --> 00:08:32,159
receiving only 1 25th

227
00:08:35,430 --> 00:08:34,399
of the sunlight at jupiter that we would

228
00:08:37,750 --> 00:08:35,440
at earth

229
00:08:41,750 --> 00:08:37,760
these massive arrays provide over 500

230
00:08:42,949 --> 00:08:41,760
watts of power we have 18 698 solar

231
00:08:45,110 --> 00:08:42,959
cells

232
00:08:47,670 --> 00:08:45,120
on these arrays

233
00:08:49,190 --> 00:08:47,680
the other thing you notice when

234
00:08:51,990 --> 00:08:49,200
when you think about this mission is how

235
00:08:53,509 --> 00:08:52,000
do we protect our critical electronics

236
00:08:55,509 --> 00:08:53,519
the electronics that control the main

237
00:08:56,949 --> 00:08:55,519
engine burn tonight how do we protect

238
00:08:58,310 --> 00:08:56,959

them from this intense radiation

239
00:09:01,829 --> 00:08:58,320
environment

240
00:09:04,230 --> 00:09:01,839
we chose to house our electronics

241
00:09:05,910 --> 00:09:04,240
in a solid titanium walled vault or

242
00:09:07,829 --> 00:09:05,920
radiation vault it's where we protect

243
00:09:09,670 --> 00:09:07,839
our valuables if you would heidi's going

244
00:09:11,590 --> 00:09:09,680
to talk a little bit about that

245
00:09:13,670 --> 00:09:11,600
a little bit more about that but i

246
00:09:15,509 --> 00:09:13,680
wanted to introduce you to that because

247
00:09:17,590 --> 00:09:15,519
the solar rays and the radiation vault

248
00:09:18,949 --> 00:09:17,600
are two signature innovations on this

249
00:09:24,790 --> 00:09:18,959
really creative

250
00:09:29,110 --> 00:09:27,750
may have the first video please

251
00:09:33,190 --> 00:09:29,120
ignition

252
00:09:35,990 --> 00:09:33,200
and liftoff of the atlas 5 with juno on

253
00:09:38,230 --> 00:09:36,000
a trek to jupiter a planetary piece of

254
00:09:39,829 --> 00:09:38,240
the puzzle on the beginning of our solar

255
00:09:42,310 --> 00:09:39,839
system

256
00:09:44,470 --> 00:09:42,320
so this was when our journey began way

257
00:09:46,630 --> 00:09:44,480
back in 2011 we launched from florida at

258
00:09:49,269 --> 00:09:46,640
cape canaveral air force station our

259
00:09:52,070 --> 00:09:49,279
trajectory took us out past mars orbit

260
00:09:54,150 --> 00:09:52,080
where we fired our main engine twice

261
00:09:56,310 --> 00:09:54,160
and we looped back around the sun and

262
00:09:58,230 --> 00:09:56,320
did an earth flyby we got incredible

263
00:09:59,430 --> 00:09:58,240

gravity assist here that added 70

264
00:10:00,870 --> 00:09:59,440
percent

265
00:10:02,150 --> 00:10:00,880
of the velocity that we got from the

266
00:10:05,829 --> 00:10:02,160
launch vehicle

267
00:10:07,750 --> 00:10:05,839
that extra burst of velocity and speed

268
00:10:08,710 --> 00:10:07,760
gave us enough energy to get all the way

269
00:10:11,750 --> 00:10:08,720
out

270
00:10:13,829 --> 00:10:11,760
to jupiter's orbit

271
00:10:14,790 --> 00:10:13,839
so this long five-year cruise has given

272
00:10:16,310 --> 00:10:14,800
us

273
00:10:18,630 --> 00:10:16,320
a lot of time to get familiar with how

274
00:10:20,550 --> 00:10:18,640
the spacecraft operates and more

275
00:10:22,230 --> 00:10:20,560
importantly when you fire the main

276
00:10:23,750 --> 00:10:22,240
engine twice and we did it very

277
00:10:25,670 --> 00:10:23,760
successfully

278
00:10:27,190 --> 00:10:25,680
the third time

279
00:10:28,949 --> 00:10:27,200
should be a charm

280
00:10:30,389 --> 00:10:28,959
but there's a nuance here and the nuance

281
00:10:32,870 --> 00:10:30,399
this will be the first time we've ever

282
00:10:36,150 --> 00:10:32,880
fired the main engine at jupiter

283
00:10:38,069 --> 00:10:36,160
and it's a it's a make or break for us

284
00:10:39,670 --> 00:10:38,079
to help us succeed in that even if we

285
00:10:42,870 --> 00:10:39,680
get a surprise from the environment we

286
00:10:44,630 --> 00:10:42,880
added a capability called joi restart

287
00:10:47,030 --> 00:10:44,640
which means that if there is a computer

288
00:10:48,230 --> 00:10:47,040

reset for any reason

289
00:10:50,470 --> 00:10:48,240
the sequence will cycle through and

290
00:10:52,550 --> 00:10:50,480
restart the engine automatically we need

291
00:10:54,470 --> 00:10:52,560
to get into orbit tonight and i'm very

292
00:10:56,389 --> 00:10:54,480
confident that we will

293
00:10:57,269 --> 00:10:56,399
so let me show you a little bit more

294
00:10:59,110 --> 00:10:57,279
about

295
00:11:08,310 --> 00:10:59,120
the sequences that will take place

296
00:11:12,389 --> 00:11:09,910
so we approach

297
00:11:14,310 --> 00:11:12,399
high over the north pole

298
00:11:16,630 --> 00:11:14,320
and you guys are the sun so the

299
00:11:18,069 --> 00:11:16,640
spacecraft is facing the sun

300
00:11:19,910 --> 00:11:18,079
until

301
00:11:21,590 --> 00:11:19,920
we start our turn right around the time

302
00:11:26,069 --> 00:11:21,600
we hit the north pole

303
00:11:27,910 --> 00:11:26,079
so we'll start our turn around 7 30 p.m

304
00:11:29,910 --> 00:11:27,920
and we'll start to spin up at this point

305
00:11:32,150 --> 00:11:29,920
up to 5 rpm

306
00:11:33,829 --> 00:11:32,160
we start our main engine burn around 8

307
00:11:35,670 --> 00:11:33,839
18 p.m

308
00:11:37,430 --> 00:11:35,680
all the way through closest to point

309
00:11:39,190 --> 00:11:37,440
approach to the planet

310
00:11:41,030 --> 00:11:39,200
we'll complete the main engine burn

311
00:11:42,310 --> 00:11:41,040
around 8 53

312
00:11:46,949 --> 00:11:42,320
pm

313
00:11:50,230 --> 00:11:46,959

and then turn back to the sun very

314
00:11:52,629 --> 00:11:50,240
critical for a solar powered mission

315
00:11:54,629 --> 00:11:52,639
before we arrived at the planet

316
00:11:57,670 --> 00:11:54,639
we finished our setup

317
00:12:00,150 --> 00:11:57,680
in preparation for the main engine burn

318
00:12:01,829 --> 00:12:00,160
we opened the main engine cover

319
00:12:04,470 --> 00:12:01,839
two weeks ago

320
00:12:05,990 --> 00:12:04,480
we pressurized the propulsion system

321
00:12:08,150 --> 00:12:06,000
five days ago

322
00:12:10,310 --> 00:12:08,160
that's a very delicate thing

323
00:12:12,310 --> 00:12:10,320
and it came off just as we expected so

324
00:12:15,030 --> 00:12:12,320
we're ready we're ready to fire our main

325
00:12:20,069 --> 00:12:17,030
and could i have the next animation

326
00:12:22,790 --> 00:12:21,350
so

327
00:12:25,269 --> 00:12:22,800
there's another challenge that we face

328
00:12:26,230 --> 00:12:25,279
when we fire the main engine it takes 48

329
00:12:28,550 --> 00:12:26,240
minutes

330
00:12:30,230 --> 00:12:28,560
for the signal from the spacecraft to

331
00:12:32,230 --> 00:12:30,240
reach earth

332
00:12:35,190 --> 00:12:32,240
it's a 35 minute burn that means by the

333
00:12:36,790 --> 00:12:35,200
time the burn is complete

334
00:12:39,110 --> 00:12:36,800
we won't even hear about it until 13

335
00:12:41,750 --> 00:12:39,120
minutes later so it's a fully automated

336
00:12:43,190 --> 00:12:41,760
sequence and we've tested the sequence

337
00:12:45,190 --> 00:12:43,200
very very thoroughly we're confident

338
00:12:47,750 --> 00:12:45,200

it's going to be successful

339
00:12:50,550 --> 00:12:47,760
we track what's going on tonight

340
00:12:51,990 --> 00:12:50,560
by using doppler and tones doppler

341
00:12:54,310 --> 00:12:52,000
if you've ever seen a car approaching

342
00:12:55,750 --> 00:12:54,320
you or listen to it and the pitch goes

343
00:12:57,670 --> 00:12:55,760
up when it approaches you and the pitch

344
00:12:59,750 --> 00:12:57,680
goes down when it moves away we use a

345
00:13:01,670 --> 00:12:59,760
similar technique tracking the position

346
00:13:03,670 --> 00:13:01,680
of the spacecraft and that will be on

347
00:13:05,670 --> 00:13:03,680
display in our msa tonight

348
00:13:06,389 --> 00:13:05,680
we also use a special communications

349
00:13:07,750 --> 00:13:06,399
mode

350
00:13:09,269 --> 00:13:07,760
called tones

351
00:13:10,389 --> 00:13:09,279
most of our normal communications

352
00:13:12,710 --> 00:13:10,399
antennas

353
00:13:15,030 --> 00:13:12,720
when we turn to do the burn are not

354
00:13:16,629 --> 00:13:15,040
pointed at earth anymore so

355
00:13:18,710 --> 00:13:16,639
we have to use a special mode where we

356
00:13:21,190 --> 00:13:18,720
send tones down to mark all of our

357
00:13:23,190 --> 00:13:21,200
milestones as we move through the burn

358
00:13:24,389 --> 00:13:23,200
and i can tell you when we receive the

359
00:13:26,069 --> 00:13:24,399
last tone

360
00:13:29,430 --> 00:13:26,079
that tells us the burn is accessible

361
00:13:32,550 --> 00:13:29,440
it'll be music to my ears

362
00:13:35,110 --> 00:13:32,560
it's a 35 minute burn the engine has 30

363
00:13:37,430 --> 00:13:35,120

635 newtons of thrust

364
00:13:38,790 --> 00:13:37,440
and it'll increase

365
00:13:40,389 --> 00:13:38,800
our velocity

366
00:13:44,069 --> 00:13:40,399
actually against jupiter it'll slow us

367
00:13:46,310 --> 00:13:44,079
down by about 542 meters per second

368
00:13:48,230 --> 00:13:46,320
so one last thing

369
00:13:50,629 --> 00:13:48,240
at the end of our journey here what

370
00:13:53,189 --> 00:13:50,639
we're targeting is a space that's tens

371
00:13:55,430 --> 00:13:53,199
of kilometers wide we're going to hit

372
00:13:58,949 --> 00:13:55,440
that within 1.2 seconds

373
00:14:00,310 --> 00:13:58,959
after a journey of 1.7 billion miles

374
00:14:02,389 --> 00:14:00,320
that tells you just how good our

375
00:14:04,550 --> 00:14:02,399
navigation team is

376
00:14:05,829 --> 00:14:04,560
so to tell you more about the intense

377
00:14:07,509 --> 00:14:05,839
radiation environment that we're going

378
00:14:08,870 --> 00:14:07,519
to be operating in i'll pass it over to

379
00:14:10,629 --> 00:14:08,880
heidi

380
00:14:13,590 --> 00:14:10,639
thank you

381
00:14:15,590 --> 00:14:13,600
so at about 7 30 tonight juno is going

382
00:14:18,150 --> 00:14:15,600
to go into the scariest part of the

383
00:14:20,150 --> 00:14:18,160
scariest place that we know about

384
00:14:22,230 --> 00:14:20,160
because we don't know about it

385
00:14:25,350 --> 00:14:22,240
it's the part of jupiter's radiation

386
00:14:27,590 --> 00:14:25,360
environment where nobody has ever been

387
00:14:30,230 --> 00:14:27,600
and as scott mentioned these are

388
00:14:32,069 --> 00:14:30,240

high energy electrons that are so

389
00:14:34,470 --> 00:14:32,079
energetic they're moving at the speed of

390
00:14:38,069 --> 00:14:34,480
light because jupiter's magnetic field

391
00:14:40,150 --> 00:14:38,079
has accelerated them to the point where

392
00:14:42,550 --> 00:14:40,160
they will go right through a spacecraft

393
00:14:44,470 --> 00:14:42,560
and strip the atoms apart inside your

394
00:14:46,230 --> 00:14:44,480
electronics and

395
00:14:47,910 --> 00:14:46,240
and fry your brain if you don't do

396
00:14:50,230 --> 00:14:47,920
anything about it

397
00:14:51,910 --> 00:14:50,240
so we did a lot about it

398
00:14:53,990 --> 00:14:51,920
but i'd like to show you exactly how

399
00:14:57,189 --> 00:14:54,000
those electrons are moving

400
00:14:58,790 --> 00:14:57,199
and if i could have the first animation

401
00:15:00,310 --> 00:14:58,800
so this is how fast they're really

402
00:15:01,750 --> 00:15:00,320
moving they're spiraling around the

403
00:15:03,829 --> 00:15:01,760
magnetic field lines and they're

404
00:15:06,629 --> 00:15:03,839
bouncing up and down between magnetic

405
00:15:08,470 --> 00:15:06,639
mirror points in a few seconds imagine

406
00:15:09,750 --> 00:15:08,480
something like that hitting you this is

407
00:15:11,350 --> 00:15:09,760
only one

408
00:15:13,670 --> 00:15:11,360
there will be millions and millions of

409
00:15:15,829 --> 00:15:13,680
them hitting juno tonight

410
00:15:18,150 --> 00:15:15,839
and once they do the minute they hit

411
00:15:20,710 --> 00:15:18,160
that spacecraft they will ricochet and

412
00:15:22,870 --> 00:15:20,720
create shrapnel of photons and other

413
00:15:24,470 --> 00:15:22,880

particles which will then scatter and

414
00:15:27,350 --> 00:15:24,480
that's what gets in

415
00:15:30,310 --> 00:15:27,360
and degrades the electronics

416
00:15:32,150 --> 00:15:30,320
so in order to protect juno we did a

417
00:15:33,509 --> 00:15:32,160
couple of very important things and the

418
00:15:36,069 --> 00:15:33,519
first thing

419
00:15:38,310 --> 00:15:36,079
was the work of our navigation team

420
00:15:40,470 --> 00:15:38,320
they designed a very special polar orbit

421
00:15:41,509 --> 00:15:40,480
that not only allows juno to do its

422
00:15:44,230 --> 00:15:41,519
science

423
00:15:46,550 --> 00:15:44,240
but it allows us to protect ourselves a

424
00:15:49,749 --> 00:15:46,560
little bit from the radiation so if i

425
00:15:52,150 --> 00:15:49,759
could have the next animation please

426
00:15:54,470 --> 00:15:52,160
in this animation you'll see how our

427
00:15:56,150 --> 00:15:54,480
trajectory allows juno to fly around the

428
00:15:58,150 --> 00:15:56,160
really harsh parts of the radiation

429
00:16:00,230 --> 00:15:58,160
belts near the equator and duck

430
00:16:03,430 --> 00:16:00,240
underneath when we get very close to the

431
00:16:05,430 --> 00:16:03,440
planet but we still have these very high

432
00:16:08,230 --> 00:16:05,440
intensity regions near the planet that

433
00:16:09,670 --> 00:16:08,240
we can avoid and later in the mission we

434
00:16:11,590 --> 00:16:09,680
get further and further into the

435
00:16:13,910 --> 00:16:11,600
equatorial region and that's where we're

436
00:16:15,829 --> 00:16:13,920
really going to start to degrade

437
00:16:18,470 --> 00:16:15,839
so we did something else

438
00:16:21,110 --> 00:16:18,480

which is our radiation vault

439
00:16:22,949 --> 00:16:21,120
and if i could have the next animation

440
00:16:24,949 --> 00:16:22,959
if we hadn't done anything else juno

441
00:16:27,590 --> 00:16:24,959
would experience something equivalent to

442
00:16:29,350 --> 00:16:27,600
a human being having 100 million x-rays

443
00:16:31,509 --> 00:16:29,360
in less than a year

444
00:16:33,749 --> 00:16:31,519
and so what we've done to protect juno

445
00:16:36,470 --> 00:16:33,759
and bring that dose down by a factor of

446
00:16:38,870 --> 00:16:36,480
800 is to build a wall

447
00:16:40,790 --> 00:16:38,880
of titanium around the most sensitive

448
00:16:42,310 --> 00:16:40,800
electronics and that wall is about a

449
00:16:44,230 --> 00:16:42,320
half an inch thick

450
00:16:46,710 --> 00:16:44,240
it brings the dose down

451
00:16:49,189 --> 00:16:46,720
a little bit is still going to get in

452
00:16:51,509 --> 00:16:49,199
and that is the area where the heart and

453
00:16:53,590 --> 00:16:51,519
brain of juno is that's what's going to

454
00:16:57,030 --> 00:16:53,600
have to work tonight so that all those

455
00:16:58,870 --> 00:16:57,040
steps play out at the right time

456
00:17:00,870 --> 00:16:58,880
in the right order and for the right

457
00:17:02,790 --> 00:17:00,880
period of time

458
00:17:05,110 --> 00:17:02,800
and what i'd like to show you is where

459
00:17:06,309 --> 00:17:05,120
juno will be exactly when that's going

460
00:17:09,990 --> 00:17:06,319
to happen

461
00:17:11,990 --> 00:17:10,000
if i could have the next animation

462
00:17:14,309 --> 00:17:12,000
this is a model

463
00:17:16,309 --> 00:17:14,319

of our radiation belts

464
00:17:17,350 --> 00:17:16,319
of jupiter's radiation belts near the

465
00:17:19,189 --> 00:17:17,360
planet

466
00:17:20,949 --> 00:17:19,199
this is what juno will be flying through

467
00:17:22,949 --> 00:17:20,959
while it's going through all those steps

468
00:17:25,590 --> 00:17:22,959
that rick just described so you see you

469
00:17:28,870 --> 00:17:25,600
can't avoid that nasty red

470
00:17:32,070 --> 00:17:28,880
juno goes through that twice

471
00:17:35,350 --> 00:17:32,080
so think about juno tonight at 7 30 and

472
00:17:38,549 --> 00:17:35,360
at 8 18 and it

473
00:17:43,110 --> 00:17:38,559
every moment after that and

474
00:17:47,590 --> 00:17:45,590
so back to you scott

475
00:17:49,590 --> 00:17:47,600
okay so

476
00:17:52,070 --> 00:17:49,600
after more than 15 years we're finally

477
00:17:54,950 --> 00:17:52,080
arriving there it's incredibly exciting

478
00:17:56,230 --> 00:17:54,960
this is a great journey

479
00:17:58,150 --> 00:17:56,240
and

480
00:18:00,950 --> 00:17:58,160
as you can tell

481
00:18:03,830 --> 00:18:00,960
it is not easy for nasa to get the

482
00:18:06,150 --> 00:18:03,840
answers that humanity's seeking here

483
00:18:08,230 --> 00:18:06,160
juno's really searching for some hints

484
00:18:10,310 --> 00:18:08,240
about our beginnings

485
00:18:12,950 --> 00:18:10,320
how everything started how did the solar

486
00:18:16,230 --> 00:18:12,960
system get started but these secrets are

487
00:18:18,310 --> 00:18:16,240
pretty well guarded by jupiter and it's

488
00:18:19,190 --> 00:18:18,320

pretty formidable

489
00:18:20,230 --> 00:18:19,200
so

490
00:18:22,230 --> 00:18:20,240
the team

491
00:18:24,710 --> 00:18:22,240
as you would imagine is incredibly

492
00:18:26,870 --> 00:18:24,720
excited with anticipation

493
00:18:30,070 --> 00:18:26,880
mixed with the incredible tension of the

494
00:18:32,310 --> 00:18:30,080
reality of what we face

495
00:18:33,350 --> 00:18:32,320
i can assure you that

496
00:18:35,669 --> 00:18:33,360
every

497
00:18:37,750 --> 00:18:35,679
technical aspect of human

498
00:18:39,430 --> 00:18:37,760
ingenuity has gone into this to figure

499
00:18:40,830 --> 00:18:39,440
out how we can

500
00:18:44,070 --> 00:18:40,840
conquer jupiter

501
00:18:45,750 --> 00:18:44,080
today it's not without risk

502
00:18:49,029 --> 00:18:45,760
but we have some of the world's best

503
00:18:50,950 --> 00:18:49,039
engineers working on this

504
00:18:53,990 --> 00:18:50,960
as heidi pointed out

505
00:18:56,870 --> 00:18:54,000
and rick the the navigation

506
00:18:59,110 --> 00:18:56,880
is remarkable i ever since i've been at

507
00:19:00,870 --> 00:18:59,120
jpl and working with nasa which is quite

508
00:19:02,549 --> 00:19:00,880
a long time

509
00:19:04,950 --> 00:19:02,559
i've been amazed

510
00:19:07,350 --> 00:19:04,960
that they can go where they go and get

511
00:19:10,150 --> 00:19:07,360
there and figure it out and hit these

512
00:19:11,990 --> 00:19:10,160
incredible narrow spots

513
00:19:13,510 --> 00:19:12,000

i can't even drive to the store that

514
00:19:15,350 --> 00:19:13,520
well

515
00:19:18,470 --> 00:19:15,360
so i'm really impressed with the

516
00:19:20,630 --> 00:19:18,480
engineering here and all through nasa

517
00:19:22,710 --> 00:19:20,640
and as we arrive

518
00:19:25,350 --> 00:19:22,720
i've got another last treat that we can

519
00:19:27,990 --> 00:19:25,360
show you

520
00:19:29,830 --> 00:19:28,000
the last image that we took before we

521
00:19:31,590 --> 00:19:29,840
turned off our camera

522
00:19:34,710 --> 00:19:31,600
on approach

523
00:19:36,470 --> 00:19:34,720
our we know there's a huge risk and we

524
00:19:38,789 --> 00:19:36,480
have got everything on the spacecraft

525
00:19:40,630 --> 00:19:38,799
focused on the activities tonight

526
00:19:42,310 --> 00:19:40,640
because it's so difficult and because

527
00:19:44,470 --> 00:19:42,320
it's risky

528
00:19:47,190 --> 00:19:44,480
the spacecraft is incredibly capable but

529
00:19:49,510 --> 00:19:47,200
we narrow it down so only the systems

530
00:19:50,710 --> 00:19:49,520
that we absolutely need

531
00:19:52,630 --> 00:19:50,720
are on

532
00:19:53,590 --> 00:19:52,640
and so all the science is really turned

533
00:19:55,590 --> 00:19:53,600
off

534
00:19:57,270 --> 00:19:55,600
and we did that five days out so that we

535
00:19:59,350 --> 00:19:57,280
could have the whole spacecraft and the

536
00:20:01,669 --> 00:19:59,360
team focused on the engineering but

537
00:20:04,310 --> 00:20:01,679
right before we turned everybody off

538
00:20:05,590 --> 00:20:04,320

we took this last image

539
00:20:07,190 --> 00:20:05,600
could i have that

540
00:20:10,710 --> 00:20:07,200
so there's jupiter

541
00:20:12,310 --> 00:20:10,720
we're still several million miles away

542
00:20:13,669 --> 00:20:12,320
when we took this image it was a couple

543
00:20:15,270 --> 00:20:13,679
days ago

544
00:20:17,669 --> 00:20:15,280
what you can see very clearly in this

545
00:20:18,870 --> 00:20:17,679
image the four galilean moons i pointed

546
00:20:20,950 --> 00:20:18,880
those out earlier of course they're

547
00:20:22,390 --> 00:20:20,960
orbiting so they're not in order like

548
00:20:25,590 --> 00:20:22,400
they were in the nice figure that i

549
00:20:27,590 --> 00:20:25,600
showed earlier but callisto we passed

550
00:20:29,990 --> 00:20:27,600
ganymede last night

551
00:20:32,870 --> 00:20:30,000
europa we're passing in about an hour

552
00:20:34,789 --> 00:20:32,880
right now and io's the innermost one

553
00:20:36,310 --> 00:20:34,799
one of the best things that i love about

554
00:20:38,470 --> 00:20:36,320
this image is not only can you start to

555
00:20:39,830 --> 00:20:38,480
see the zones and belts but if you look

556
00:20:41,750 --> 00:20:39,840
closely you can actually see the red

557
00:20:43,110 --> 00:20:41,760
spot facing at us

558
00:20:45,029 --> 00:20:43,120
and

559
00:20:46,630 --> 00:20:45,039
this is it this is the beast we got

560
00:20:48,390 --> 00:20:46,640
we're going after

561
00:20:49,510 --> 00:20:48,400
and we're going to conquer that thing

562
00:20:50,710 --> 00:20:49,520
tonight

563
00:20:53,350 --> 00:20:50,720

and we're going to

564
00:20:55,750 --> 00:20:53,360
get the answers we're all seeking

565
00:20:56,549 --> 00:20:55,760
about the beginning of our solar system

566
00:21:00,310 --> 00:20:56,559
so

567
00:21:05,110 --> 00:21:01,510
thank you

568
00:21:06,630 --> 00:21:05,120
open it to the floor for questions

569
00:21:12,950 --> 00:21:06,640
please state your name and media

570
00:21:12,960 --> 00:21:15,510
hi i'm

571
00:21:20,390 --> 00:21:17,350
i'm bruce lieberman with air and space

572
00:21:23,190 --> 00:21:20,400
magazine um can you clarify for me um

573
00:21:25,750 --> 00:21:23,200
how long it takes for juno on this

574
00:21:27,510 --> 00:21:25,760
capture orbit tonight to go from this

575
00:21:29,510 --> 00:21:27,520
north pole to the south pole how long is

576
00:21:31,510 --> 00:21:29,520
it in this dangerous zone and then does

577
00:21:34,149 --> 00:21:31,520
that time period change during the

578
00:21:36,710 --> 00:21:34,159
science orbits

579
00:21:39,909 --> 00:21:36,720
tonight that'll be about two hours

580
00:21:41,430 --> 00:21:39,919
uh 7 30 at the north pole to about 9 30

581
00:21:45,750 --> 00:21:41,440
at the south pole

582
00:21:47,909 --> 00:21:45,760
and the burn is 8 18 to 8 53 p.m

583
00:21:49,669 --> 00:21:47,919
and this is a 53-day orbit so i think

584
00:21:52,390 --> 00:21:49,679
that period will slow down a little bit

585
00:21:54,390 --> 00:21:52,400
when we get into the longer orbits

586
00:21:56,470 --> 00:21:54,400
so during the two weeks 40 day orbit

587
00:21:59,270 --> 00:21:56,480
sorry later on so during the two-week

588
00:22:01,990 --> 00:21:59,280

orbits the the close approach is also

589
00:22:06,789 --> 00:22:02,000
two hours or a little shorter

590
00:22:06,799 --> 00:22:15,190
okay thank you back there

591
00:22:20,390 --> 00:22:18,230
hi um joe palka from npr a question

592
00:22:21,750 --> 00:22:20,400
about the tracking and the doppler and

593
00:22:23,750 --> 00:22:21,760
the tones

594
00:22:25,909 --> 00:22:23,760
is it the same

595
00:22:28,149 --> 00:22:25,919
radio frequency that's sending the tones

596
00:22:30,230 --> 00:22:28,159
that's sending the signal for measuring

597
00:22:33,110 --> 00:22:30,240
the doppler shift or those two different

598
00:22:35,830 --> 00:22:33,120
radio systems

599
00:22:37,750 --> 00:22:35,840
the tones are sub carriers

600
00:22:39,350 --> 00:22:37,760
positioned near the carrier so the

601
00:22:40,950 --> 00:22:39,360
carrier is the high frequency signal

602
00:22:42,789 --> 00:22:40,960
that we use to

603
00:22:44,470 --> 00:22:42,799
look at doppler shift

604
00:22:46,710 --> 00:22:44,480
and then the tones are where we

605
00:22:49,029 --> 00:22:46,720
typically would modulate or mix the data

606
00:22:50,710 --> 00:22:49,039
and the telemetry with the radial signal

607
00:22:53,350 --> 00:22:50,720
but in this case it's just a simple

608
00:22:55,510 --> 00:22:53,360
subcarrier tone so it's slightly shifted

609
00:22:57,350 --> 00:22:55,520
off of the the main carrier so it's just

610
00:22:58,789 --> 00:22:57,360
sending a signal this way it's not

611
00:23:00,470 --> 00:22:58,799
advertising it's a one-way it's a

612
00:23:01,830 --> 00:23:00,480
one-way transmission it's a single

613
00:23:04,070 --> 00:23:01,840

frequency just like you hear when you

614
00:23:05,990 --> 00:23:04,080
have an emergency broadcast system test

615
00:23:07,510 --> 00:23:06,000
in your car and you just get that tone

616
00:23:09,029 --> 00:23:07,520
and we have different frequency tones

617
00:23:10,870 --> 00:23:09,039
that are sent to mark different

618
00:23:11,909 --> 00:23:10,880
milestones

619
00:23:14,070 --> 00:23:11,919
thanks

620
00:23:15,510 --> 00:23:14,080
thank you uh a reminder for reporters

621
00:23:18,149 --> 00:23:15,520
listening in who would like to ask a

622
00:23:19,669 --> 00:23:18,159
question please hit star one and we've

623
00:23:21,110 --> 00:23:19,679
got a question with the gentleman blue

624
00:23:24,230 --> 00:23:21,120
in the back of the row

625
00:23:26,390 --> 00:23:24,240
pete demetrio knx 1070 at los angeles uh

626
00:23:28,149 --> 00:23:26,400
two questions if you would from the time

627
00:23:30,390 --> 00:23:28,159
you begin the insertion when will your

628
00:23:32,070 --> 00:23:30,400
telemetry tell you that indeed you're

629
00:23:33,990 --> 00:23:32,080
successful on coming on in and that

630
00:23:37,029 --> 00:23:34,000
you're getting data flow back that's

631
00:23:38,230 --> 00:23:37,039
first rule second radiation wonderful

632
00:23:39,909 --> 00:23:38,240
things are coming into the speed of

633
00:23:41,750 --> 00:23:39,919
light that's fine let's talk about human

634
00:23:43,830 --> 00:23:41,760
dimensions and human dynamics regarding

635
00:23:46,149 --> 00:23:43,840
radiation and what that spacecraft is

636
00:23:48,630 --> 00:23:46,159
going to survive

637
00:23:50,789 --> 00:23:48,640
ld 100 for a human being is 600 rads

638
00:23:52,630 --> 00:23:50,799

over a space of two seconds

639
00:23:55,350 --> 00:23:52,640
give us an equivalent of what juno is

640
00:23:58,470 --> 00:23:55,360
going to be taking a hit

641
00:24:02,950 --> 00:24:00,630
i'm an old cold warrior guys so you know

642
00:24:05,750 --> 00:24:02,960
if those measurements are not up to you

643
00:24:09,350 --> 00:24:05,760
i can clarify okay sure

644
00:24:10,630 --> 00:24:09,360
uh joi will expose juno to

645
00:24:15,510 --> 00:24:10,640
about a million

646
00:24:18,870 --> 00:24:15,520
dental x-rays or 260 some rats

647
00:24:20,950 --> 00:24:18,880
so about what basically ld 25 lethal

648
00:24:22,950 --> 00:24:20,960
dose 25 for a human being but you expect

649
00:24:24,789 --> 00:24:22,960
the titanium will be able to stop that

650
00:24:31,350 --> 00:24:24,799
and hold it out

651
00:24:35,269 --> 00:24:33,909
hello better tot from bbc sky at night

652
00:24:37,190 --> 00:24:35,279
um can you say something about what we

653
00:24:38,390 --> 00:24:37,200
know about the ring particles that you

654
00:24:40,230 --> 00:24:38,400
were worried about do we know their

655
00:24:41,510 --> 00:24:40,240
sizes it sounds like we don't know the

656
00:24:42,789 --> 00:24:41,520
density

657
00:24:44,070 --> 00:24:42,799
um

658
00:24:45,909 --> 00:24:44,080
we we know

659
00:24:48,310 --> 00:24:45,919
uh some of those i i don't know off that

660
00:24:49,590 --> 00:24:48,320
top my head those answers but we uh

661
00:24:51,430 --> 00:24:49,600
scientists know

662
00:24:52,789 --> 00:24:51,440
the densities and rough particle

663
00:24:54,870 --> 00:24:52,799

distributions

664
00:24:57,269 --> 00:24:54,880
in certain regions of the ring plane

665
00:24:58,149 --> 00:24:57,279
which we're avoiding

666
00:24:59,830 --> 00:24:58,159
what's

667
00:25:02,310 --> 00:24:59,840
not well known is how does that

668
00:25:04,149 --> 00:25:02,320
population evolve to the parts that are

669
00:25:05,990 --> 00:25:04,159
more difficult to see because they're

670
00:25:08,149 --> 00:25:06,000
more tenuous and that we have been

671
00:25:09,430 --> 00:25:08,159
unable to image those are model

672
00:25:12,710 --> 00:25:09,440
dependent

673
00:25:14,549 --> 00:25:12,720
um however even the more tenuous

674
00:25:16,950 --> 00:25:14,559
uh things where the particles are not

675
00:25:17,830 --> 00:25:16,960
very you know as dense

676
00:25:19,269 --> 00:25:17,840
um

677
00:25:20,549 --> 00:25:19,279
give you a probability that you could

678
00:25:23,830 --> 00:25:20,559
hit something

679
00:25:25,510 --> 00:25:23,840
um and so we've modeled all that

680
00:25:27,110 --> 00:25:25,520
to the lower the we believe the

681
00:25:28,549 --> 00:25:27,120
probability is incredibly low that we're

682
00:25:30,470 --> 00:25:28,559
going to hit one

683
00:25:31,990 --> 00:25:30,480
but it's not zero

684
00:25:34,070 --> 00:25:32,000
it's the same thing if i go through the

685
00:25:35,669 --> 00:25:34,080
asteroid belt you know

686
00:25:37,110 --> 00:25:35,679
when i was younger and i or you know i'd

687
00:25:39,430 --> 00:25:37,120
give talks to children they often ask

688
00:25:41,110 --> 00:25:39,440

how do you get through the asteroid belt

689
00:25:42,470 --> 00:25:41,120
and the probability is very low that

690
00:25:44,310 --> 00:25:42,480
something's going to hit you

691
00:25:46,230 --> 00:25:44,320
but it's not zero

692
00:25:48,470 --> 00:25:46,240
thanks and what sort of size particle

693
00:25:50,310 --> 00:25:48,480
are we talking about sort of 10 micron

694
00:25:52,470 --> 00:25:50,320
sort of thing

695
00:25:54,230 --> 00:25:52,480
there's there's a distribution that

696
00:25:56,470 --> 00:25:54,240
isn't well understood but even a 10

697
00:25:59,750 --> 00:25:56,480
micron particle could do some damage

698
00:26:01,190 --> 00:25:59,760
moving at the speed that we're moving

699
00:26:03,190 --> 00:26:01,200
i understand we have a question from the

700
00:26:10,710 --> 00:26:03,200
phone please state your name and media

701
00:26:13,990 --> 00:26:12,630
hey d.c philhart with cbs news are you

702
00:26:16,230 --> 00:26:14,000
hearing me

703
00:26:18,149 --> 00:26:16,240
we got you bill okay thank you i'm sorry

704
00:26:19,669 --> 00:26:18,159
um yeah just a quick follow-up on that

705
00:26:23,110 --> 00:26:19,679
uh last answer

706
00:26:25,590 --> 00:26:23,120
where where does the the dust and debris

707
00:26:28,149 --> 00:26:25,600
threat where does that fit into your

708
00:26:30,710 --> 00:26:28,159
your danger matrix i'll call it compared

709
00:26:32,070 --> 00:26:30,720
to radiation or do you even know i mean

710
00:26:33,269 --> 00:26:32,080
you pretty much already scared me to

711
00:26:34,789 --> 00:26:33,279
death about radiation i'm trying to

712
00:26:36,230 --> 00:26:34,799
decide how nervous i should be about

713
00:26:42,070 --> 00:26:36,240

that

714
00:26:44,549 --> 00:26:42,080
radiation scare with me um

715
00:26:46,549 --> 00:26:44,559
uh but uh to answer your question the

716
00:26:48,310 --> 00:26:46,559
radiation uh

717
00:26:50,789 --> 00:26:48,320
starts at much higher latitude so

718
00:26:53,029 --> 00:26:50,799
earlier in the in the orbit insertion

719
00:26:55,430 --> 00:26:53,039
maneuver we will go through places where

720
00:26:58,390 --> 00:26:55,440
the radiation is already becoming very

721
00:27:00,470 --> 00:26:58,400
significant the the danger for the rings

722
00:27:02,230 --> 00:27:00,480
is closer to the closest approach sort

723
00:27:03,430 --> 00:27:02,240
of the middle of the burn

724
00:27:05,350 --> 00:27:03,440
region

725
00:27:08,950 --> 00:27:05,360
is where the ring

726
00:27:10,149 --> 00:27:08,960
particles are probably densest

727
00:27:11,990 --> 00:27:10,159
thank you very much

728
00:27:13,510 --> 00:27:12,000
okay great i understand we have another

729
00:27:15,669 --> 00:27:13,520
question from the phone please state

730
00:27:17,990 --> 00:27:15,679
your name and media affiliation

731
00:27:21,590 --> 00:27:18,000
hi there irene quartz with reuters can

732
00:27:24,950 --> 00:27:21,600
you hear me yes we can irene thanks um

733
00:27:26,710 --> 00:27:24,960
also so scott considering uh radiation

734
00:27:28,310 --> 00:27:26,720
and dust and

735
00:27:31,190 --> 00:27:28,320
just the dynamics of the orbiter

736
00:27:36,470 --> 00:27:31,200
insertion burn is there an overall

737
00:27:41,510 --> 00:27:38,789
uh i don't think i have a number that i

738
00:27:43,350 --> 00:27:41,520

can give you for that but um generally

739
00:27:45,269 --> 00:27:43,360
the whole mission is designed to you

740
00:27:47,430 --> 00:27:45,279
have very very high probability of

741
00:27:49,350 --> 00:27:47,440
success this one little piece is

742
00:27:51,029 --> 00:27:49,360
probably the highest risk but i don't i

743
00:27:53,110 --> 00:27:51,039
don't have a number i can throw out that

744
00:27:56,710 --> 00:27:53,120
says you know we're this many percent of

745
00:28:00,950 --> 00:27:58,710
thanks and i've had a question for jim

746
00:28:02,789 --> 00:28:00,960
green if you don't mind um not to take

747
00:28:04,470 --> 00:28:02,799
away from

748
00:28:05,830 --> 00:28:04,480
from juno but i was wondering if you

749
00:28:07,430 --> 00:28:05,840
might be able to just comment a little

750
00:28:10,789 --> 00:28:07,440
bit about the

751
00:28:13,909 --> 00:28:10,799
decision on the dawn extension to leave

752
00:28:16,950 --> 00:28:13,919
it around series versus going to a third

753
00:28:19,990 --> 00:28:16,960
asteroid thanks sure

754
00:28:22,070 --> 00:28:20,000
as many know we've announced uh after an

755
00:28:24,789 --> 00:28:22,080
extensive peer review

756
00:28:27,029 --> 00:28:24,799
uh proposals that came in for nine

757
00:28:29,510 --> 00:28:27,039
missions in planetary science that have

758
00:28:31,590 --> 00:28:29,520
completed their prime mission

759
00:28:34,149 --> 00:28:31,600
the top recommendation is all these

760
00:28:36,549 --> 00:28:34,159
missions are returning fabulous data and

761
00:28:38,549 --> 00:28:36,559
they need to continue to do so

762
00:28:41,590 --> 00:28:38,559
in the case for dawn an option was

763
00:28:44,630 --> 00:28:41,600

presented to us to go to a

764
00:28:46,470 --> 00:28:44,640
separate location another asteroid

765
00:28:48,950 --> 00:28:46,480
and it comes at a time where dawn would

766
00:28:50,789 --> 00:28:48,960
have to leave ceres within the next

767
00:28:52,549 --> 00:28:50,799
couple weeks

768
00:28:54,870 --> 00:28:52,559
the senior review took that into

769
00:28:57,190 --> 00:28:54,880
consideration plus where don was in

770
00:28:59,430 --> 00:28:57,200
completing the series science

771
00:29:01,190 --> 00:28:59,440
and projecting forward with additional

772
00:29:03,350 --> 00:29:01,200
science that it could do while it

773
00:29:05,590 --> 00:29:03,360
remained at series

774
00:29:07,830 --> 00:29:05,600
and it was judged by the peer review

775
00:29:11,350 --> 00:29:07,840
science team that remaining at series

776
00:29:13,750 --> 00:29:11,360
provided us the best science

777
00:29:16,070 --> 00:29:13,760
versus going to adiona which was an

778
00:29:20,149 --> 00:29:16,080
additional asteroid

779
00:29:22,070 --> 00:29:20,159
so we accepted that recommendation and

780
00:29:24,950 --> 00:29:22,080
told all the teams that they've been

781
00:29:27,350 --> 00:29:24,960
extended and that includes

782
00:29:29,590 --> 00:29:27,360
new horizons flying out into the kuiper

783
00:29:31,590 --> 00:29:29,600
belt and flying by another kuiper belt

784
00:29:33,750 --> 00:29:31,600
object

785
00:29:35,669 --> 00:29:33,760
thank you jim uh we're well go ahead

786
00:29:37,269 --> 00:29:35,679
irene you have a follow-up yeah i just

787
00:29:39,029 --> 00:29:37,279
kind of just said thank you

788
00:29:42,149 --> 00:29:39,039

okay all right we're going to come back

789
00:29:43,669 --> 00:29:42,159
to uh jpl and uh see what's going on in

790
00:29:45,269 --> 00:29:43,679
the von carmen auditorium emily i

791
00:29:46,950 --> 00:29:45,279
understand you have a question emily

792
00:29:48,950 --> 00:29:46,960
lochtawa the planetary society i have

793
00:29:51,029 --> 00:29:48,960
two questions once quick which of the

794
00:29:52,630 --> 00:29:51,039
dsn antennae is going to be the one

795
00:29:55,430 --> 00:29:52,640
that's primed for receiving the signals

796
00:29:57,990 --> 00:29:55,440
this evening goldstone we have five

797
00:30:00,310 --> 00:29:58,000
antennas at that complex backed up and

798
00:30:02,070 --> 00:30:00,320
full overlap with four antennas at

799
00:30:03,669 --> 00:30:02,080
canberra thank you

800
00:30:05,669 --> 00:30:03,679
and then i know you had to turn off the

801
00:30:08,149 --> 00:30:05,679
science instruments almost five days ago

802
00:30:10,070 --> 00:30:08,159
now but um can you tell me you already

803
00:30:12,070 --> 00:30:10,080
are exploring uncharted territory at

804
00:30:13,669 --> 00:30:12,080
jupiter flying at the

805
00:30:16,230 --> 00:30:13,679
latitude that you are is everything

806
00:30:17,909 --> 00:30:16,240
matching your models so far

807
00:30:20,149 --> 00:30:17,919
um

808
00:30:22,470 --> 00:30:20,159
as far as the radiation you mean

809
00:30:23,590 --> 00:30:22,480
we are not close enough to to have

810
00:30:26,149 --> 00:30:23,600
anything that

811
00:30:29,029 --> 00:30:26,159
would be significant what we did see

812
00:30:31,029 --> 00:30:29,039
is um you know as we

813
00:30:32,310 --> 00:30:31,039

mentioned earlier uh at a previous

814
00:30:34,070 --> 00:30:32,320
program as we released that we went

815
00:30:35,590 --> 00:30:34,080
through the bow shock and we entered

816
00:30:37,669 --> 00:30:35,600
into the magnetosphere

817
00:30:39,269 --> 00:30:37,679
that happened much later than anybody

818
00:30:40,950 --> 00:30:39,279
had predicted and so the general

819
00:30:42,549 --> 00:30:40,960
consensus is that the magnetosphere at

820
00:30:44,230 --> 00:30:42,559
least the time that we went through that

821
00:30:46,630 --> 00:30:44,240
was compressed meaning it was being

822
00:30:48,870 --> 00:30:46,640
banged on by the solar wind more so it

823
00:30:52,389 --> 00:30:48,880
shrunk up correspondingly

824
00:30:54,149 --> 00:30:52,399
um however it's still within model

825
00:30:55,990 --> 00:30:54,159
constraints

826
00:30:57,669 --> 00:30:56,000
that does not say a lot about the

827
00:31:00,230 --> 00:30:57,679
unknown territory

828
00:31:01,909 --> 00:31:00,240
and and in fact there's no observation

829
00:31:03,909 --> 00:31:01,919
we could make this far away that would

830
00:31:05,590 --> 00:31:03,919
tell us something about the close-up

831
00:31:07,190 --> 00:31:05,600
zones or or we would have already made

832
00:31:11,190 --> 00:31:07,200
that with galileo and voyager and we'd

833
00:31:11,200 --> 00:31:14,070
great

834
00:31:20,389 --> 00:31:16,149
okay we're going to come back to the

835
00:31:22,630 --> 00:31:20,399
room here uh ladies and gentle

836
00:31:24,710 --> 00:31:22,640
hello it's rebecca morel from bbc news

837
00:31:26,789 --> 00:31:24,720
here um can i just check when do you

838
00:31:28,630 --> 00:31:26,799

declare success is it when you get the

839
00:31:31,430 --> 00:31:28,640
tones back at the

840
00:31:33,350 --> 00:31:31,440
end of the engine burn or is it when you

841
00:31:35,590 --> 00:31:33,360
get the telemetry information back

842
00:31:37,990 --> 00:31:35,600
saying that juno is where you want it to

843
00:31:40,549 --> 00:31:38,000
be and when do you get that last a bit

844
00:31:43,350 --> 00:31:40,559
of information back about the telemetry

845
00:31:48,149 --> 00:31:45,750
well from a technical perspective

846
00:31:50,789 --> 00:31:48,159
will be in orbit when the main engine

847
00:31:52,389 --> 00:31:50,799
burn is completed 20 minutes but we want

848
00:31:55,350 --> 00:31:52,399
the whole enchilada because we want to

849
00:31:57,269 --> 00:31:55,360
be in the right orbit not a thousand day

850
00:31:58,470 --> 00:31:57,279
orbit

851
00:32:00,710 --> 00:31:58,480
so

852
00:32:02,950 --> 00:32:00,720
a lot of us will be waiting until the

853
00:32:05,750 --> 00:32:02,960
end of the 35 minute burn when we will

854
00:32:07,350 --> 00:32:05,760
get a tone and as i said uh

855
00:32:09,350 --> 00:32:07,360
that tone will be music to our ears

856
00:32:11,430 --> 00:32:09,360
because that'll mean we're exactly where

857
00:32:12,789 --> 00:32:11,440
we plan to be

858
00:32:15,350 --> 00:32:12,799
when when do when do you get the

859
00:32:18,310 --> 00:32:15,360
telemetry data back as well does that

860
00:32:20,070 --> 00:32:18,320
come come a bit a bit later well all the

861
00:32:23,110 --> 00:32:20,080
times we've talked about here are earth

862
00:32:25,909 --> 00:32:23,120
received times so the manage and burn on

863
00:32:28,070 --> 00:32:25,919

the spacecraft completes the 7 30 earth

864
00:32:29,909 --> 00:32:28,080
time but we don't get to the telemetry

865
00:32:31,990 --> 00:32:29,919
or i mean it starts and we don't get the

866
00:32:33,909 --> 00:32:32,000
the telemetry tellings the burn started

867
00:32:35,190 --> 00:32:33,919
until 48 minutes later so when we talk

868
00:32:37,590 --> 00:32:35,200
about 8 18

869
00:32:39,430 --> 00:32:37,600
to 8 53 pm that's earth receive time

870
00:32:41,750 --> 00:32:39,440
okay great thank you very much let me

871
00:32:45,110 --> 00:32:41,760
just add that um everybody has a little

872
00:32:48,710 --> 00:32:45,120
bit different feeling when they relax

873
00:32:50,710 --> 00:32:48,720
and um i won't exhale until

874
00:32:51,990 --> 00:32:50,720
we're sun pointed again

875
00:32:54,470 --> 00:32:52,000
okay so

876
00:32:57,350 --> 00:32:54,480
i wa the engine burn is a huge thing

877
00:32:59,029 --> 00:32:57,360
don't get me wrong but um until we're

878
00:33:00,310 --> 00:32:59,039
back on sun point because we're solar

879
00:33:02,470 --> 00:33:00,320
powered

880
00:33:03,830 --> 00:33:02,480
um that's when i finally start to say

881
00:33:05,190 --> 00:33:03,840
okay

882
00:33:08,149 --> 00:33:05,200
and what time

883
00:33:09,669 --> 00:33:08,159
how how long after what time is that

884
00:33:11,430 --> 00:33:09,679
approximately

885
00:33:13,350 --> 00:33:11,440
when do you get to rest

886
00:33:15,190 --> 00:33:13,360
it's it's around 9 30.

887
00:33:17,509 --> 00:33:15,200
by the time we'll we'll spin down to 2

888
00:33:18,389 --> 00:33:17,519

rpm and be turned back to sun

889
00:33:19,590 --> 00:33:18,399
great

890
00:33:23,269 --> 00:33:19,600
thank you

891
00:33:25,350 --> 00:33:23,279
the gentleman

892
00:33:27,110 --> 00:33:25,360
back row there

893
00:33:30,389 --> 00:33:27,120
hi good morning andrew mullenbeck from

894
00:33:32,870 --> 00:33:30,399
kfi how quickly do you begin learning

895
00:33:36,710 --> 00:33:32,880
information about jupiter and what sorts

896
00:33:40,389 --> 00:33:36,720
of information will you learn first

897
00:33:41,509 --> 00:33:40,399
so um the first orbit is 53 days long

898
00:33:44,070 --> 00:33:41,519
um

899
00:33:46,230 --> 00:33:44,080
so the next time we uh come close to

900
00:33:47,990 --> 00:33:46,240
jupiter which is where we really delve

901
00:33:50,230 --> 00:33:48,000
in and start to look for

902
00:33:51,029 --> 00:33:50,240
you know have all the eyes and ears

903
00:33:57,269 --> 00:33:51,039
of

904
00:33:58,870 --> 00:33:57,279
and and uh i ima even though that's

905
00:34:00,549 --> 00:33:58,880
really um

906
00:34:01,830 --> 00:34:00,559
something to just sample and see how the

907
00:34:04,070 --> 00:34:01,840
instruments are going and check the

908
00:34:06,389 --> 00:34:04,080
environment very close before we go down

909
00:34:08,790 --> 00:34:06,399
to the 14 day orbits we'll learn a huge

910
00:34:10,710 --> 00:34:08,800
amount from that first pass

911
00:34:11,829 --> 00:34:10,720
but i'd also like to emphasize that on

912
00:34:14,069 --> 00:34:11,839
approach

913
00:34:15,750 --> 00:34:14,079

as emily already pointed out we're

914
00:34:17,270 --> 00:34:15,760
getting data we're looking at stuff we

915
00:34:20,069 --> 00:34:17,280
shut off the instruments a couple days

916
00:34:22,230 --> 00:34:20,079
ago but we'd already started to look at

917
00:34:25,430 --> 00:34:22,240
jupiter and its interaction with the

918
00:34:26,790 --> 00:34:25,440
solar wind and the aurora and so the

919
00:34:27,990 --> 00:34:26,800
scientists are already combing through

920
00:34:29,669 --> 00:34:28,000
that data

921
00:34:31,430 --> 00:34:29,679
learning about things so we're already

922
00:34:33,750 --> 00:34:31,440
producing things

923
00:34:35,430 --> 00:34:33,760
that are scientifically important but

924
00:34:39,510 --> 00:34:35,440
the real investigation of getting in

925
00:34:43,270 --> 00:34:41,430
thank you scott and i understand we have

926
00:34:46,069 --> 00:34:43,280
a question from the phone i believe it's

927
00:34:48,230 --> 00:34:46,079
keith cowling of nasa watch keith

928
00:34:50,069 --> 00:34:48,240
hi a question for you folks for uh dr

929
00:34:52,710 --> 00:34:50,079
bolton or anybody on the mission team

930
00:34:54,470 --> 00:34:52,720
uh the last time you had a spacecraft in

931
00:34:56,629 --> 00:34:54,480
orbit around jupiter there really wasn't

932
00:34:58,950 --> 00:34:56,639
anything approved that would come back

933
00:35:00,550 --> 00:34:58,960
to be in orbit now depending on who you

934
00:35:03,030 --> 00:35:00,560
listen to you either have one or two

935
00:35:04,950 --> 00:35:03,040
missions to europa and so the question

936
00:35:07,030 --> 00:35:04,960
being given that these orbital missions

937
00:35:08,950 --> 00:35:07,040
aren't that common are frequent do you

938
00:35:11,190 --> 00:35:08,960

have a special session section of the

939
00:35:12,470 --> 00:35:11,200
bleachers set aside for the europa guys

940
00:35:14,630 --> 00:35:12,480
like the cheap seats to sort of look

941
00:35:15,349 --> 00:35:14,640
over your shoulder given that although

942
00:35:21,829 --> 00:35:15,359
the

943
00:35:24,069 --> 00:35:21,839
a unique opportunity to look at a very

944
00:35:26,470 --> 00:35:24,079
difficult mission

945
00:35:29,670 --> 00:35:26,480
so let me take that um

946
00:35:31,910 --> 00:35:29,680
what keith is referring to is we have in

947
00:35:33,910 --> 00:35:31,920
the planning stage and it's a very early

948
00:35:37,430 --> 00:35:33,920
planning stage

949
00:35:38,310 --> 00:35:37,440
a formulation of a europa mission

950
00:35:39,910 --> 00:35:38,320
and

951
00:35:42,069 --> 00:35:39,920
because europa is sitting in the

952
00:35:44,630 --> 00:35:42,079
radiation belts it was well explained

953
00:35:46,390 --> 00:35:44,640
and it's in a really tough environment

954
00:35:48,390 --> 00:35:46,400
we had a couple decisions to make

955
00:35:50,790 --> 00:35:48,400
whether we could actually put something

956
00:35:52,870 --> 00:35:50,800
in orbit around europa and allow it to

957
00:35:56,069 --> 00:35:52,880
last and we find out it doesn't last

958
00:35:58,630 --> 00:35:56,079
very long so we had to be more creative

959
00:36:00,230 --> 00:35:58,640
and so concepts like juno

960
00:36:02,550 --> 00:36:00,240
where we can

961
00:36:06,710 --> 00:36:02,560
orbit the planet with

962
00:36:08,710 --> 00:36:06,720
specific flybys of europa on multiple

963
00:36:11,109 --> 00:36:08,720

occasions

964
00:36:12,870 --> 00:36:11,119
over and over again allows us to put

965
00:36:14,310 --> 00:36:12,880
together a complete picture of what

966
00:36:18,390 --> 00:36:14,320
europa is like

967
00:36:21,109 --> 00:36:18,400
this is exactly what cassini is doing

968
00:36:23,990 --> 00:36:21,119
at saturn by looking at multiple flybys

969
00:36:26,069 --> 00:36:24,000
of titan we have about 75 or 85 percent

970
00:36:28,630 --> 00:36:26,079
of the surface knowledge of titan from

971
00:36:31,430 --> 00:36:28,640
those flybys

972
00:36:34,310 --> 00:36:31,440
the europa mission though is not about

973
00:36:36,390 --> 00:36:34,320
jupiter you know that'll be done by juno

974
00:36:39,030 --> 00:36:36,400
it's really all about

975
00:36:40,550 --> 00:36:39,040
europa itself so it's going to look at

976
00:36:42,630 --> 00:36:40,560
its composition

977
00:36:44,710 --> 00:36:42,640
it's going to look at

978
00:36:46,390 --> 00:36:44,720
high resolution imaging we're going to

979
00:36:49,829 --> 00:36:46,400
look at the surface

980
00:36:51,910 --> 00:36:49,839
how it changes over time tidal forces

981
00:36:54,390 --> 00:36:51,920
ground penetrating radar will tell us

982
00:36:56,230 --> 00:36:54,400
perhaps how deep the ice shell is at

983
00:36:59,270 --> 00:36:56,240
various locations because we know

984
00:37:01,910 --> 00:36:59,280
underneath the ice shell is a huge ocean

985
00:37:04,630 --> 00:37:01,920
with perhaps twice the amount of water

986
00:37:06,950 --> 00:37:04,640
that we have here on earth so

987
00:37:10,150 --> 00:37:06,960
jupiter's environment where the tidal

988
00:37:12,150 --> 00:37:10,160

forces are so great that's changing the

989
00:37:13,910 --> 00:37:12,160
structure of these satellites these

990
00:37:16,710 --> 00:37:13,920
galilean satellites

991
00:37:18,069 --> 00:37:16,720
allow us to go uh back to jupiter in

992
00:37:20,230 --> 00:37:18,079
another mission

993
00:37:22,310 --> 00:37:20,240
so that's just at the drawing boards

994
00:37:25,670 --> 00:37:22,320
we're not planning to put any

995
00:37:28,710 --> 00:37:25,680
instruments on this europa mission that

996
00:37:30,950 --> 00:37:28,720
would delve into looking at uh looking

997
00:37:33,349 --> 00:37:30,960
at jupiter it's all about

998
00:37:35,190 --> 00:37:33,359
europa

999
00:37:37,510 --> 00:37:35,200
thank you jim we're going to go back to

1000
00:37:39,270 --> 00:37:37,520
the phones again for uh i understand leo

1001
00:37:41,510 --> 00:37:39,280
enright of irish tv

1002
00:37:44,230 --> 00:37:41,520
how you doing today leo

1003
00:37:45,990 --> 00:37:44,240
hi dc uh good to hear you um this is a

1004
00:37:48,150 --> 00:37:46,000
question for rick but i i'm a bit

1005
00:37:49,670 --> 00:37:48,160
reluctant to ask it so maybe a jim and

1006
00:37:51,510 --> 00:37:49,680
the scientist might want to kind of

1007
00:37:55,190 --> 00:37:51,520
close their ears and home

1008
00:37:57,349 --> 00:37:55,200
um but i'm wondering if in this in a

1009
00:37:59,910 --> 00:37:57,359
situation where the engine burn for some

1010
00:38:01,990 --> 00:37:59,920
reason doesn't work

1011
00:38:04,550 --> 00:38:02,000
has there been any contingency planning

1012
00:38:07,430 --> 00:38:04,560
or is there even any point in having

1013
00:38:09,829 --> 00:38:07,440

contingency planning to try and do some

1014
00:38:11,829 --> 00:38:09,839
data collection on what would

1015
00:38:17,270 --> 00:38:11,839
unfortunately in those circumstances

1016
00:38:20,470 --> 00:38:18,550
well i'll give the first answer and

1017
00:38:23,270 --> 00:38:20,480
scott can add to it but our instruments

1018
00:38:26,550 --> 00:38:23,280
are off right now so um normally if you

1019
00:38:27,990 --> 00:38:26,560
do a flyby you have your instruments on

1020
00:38:30,310 --> 00:38:28,000
right now we don't plan to turn them on

1021
00:38:31,510 --> 00:38:30,320
in a nominal sense until 50 hours

1022
00:38:33,910 --> 00:38:31,520
afterwards

1023
00:38:36,950 --> 00:38:33,920
and we pick up such an incredible

1024
00:38:39,030 --> 00:38:36,960
velocity boost from uh jupiter that if

1025
00:38:40,150 --> 00:38:39,040
the main engine doesn't fire we're just

1026
00:38:43,589 --> 00:38:40,160
slung out

1027
00:38:45,910 --> 00:38:43,599
the bottom of the planet like a

1028
00:38:48,550 --> 00:38:45,920
like a bullet and

1029
00:38:50,550 --> 00:38:48,560
so we'd have to move pretty quick to uh

1030
00:38:52,950 --> 00:38:50,560
turn the instruments on faster we'd want

1031
00:38:54,150 --> 00:38:52,960
to do that in a safe way of course

1032
00:38:56,230 --> 00:38:54,160
and we would take a quick look at

1033
00:38:58,150 --> 00:38:56,240
whether there was some maneuver we could

1034
00:39:00,470 --> 00:38:58,160
do to alter our trajectory and allow us

1035
00:39:02,630 --> 00:39:00,480
more time to look at jupiter but we move

1036
00:39:07,670 --> 00:39:02,640
by so fast i think we lose most of the

1037
00:39:12,150 --> 00:39:09,910
and if i might dc could i ask a

1038
00:39:14,390 --> 00:39:12,160

follow-up of scott again

1039
00:39:16,790 --> 00:39:14,400
a slightly uh

1040
00:39:20,150 --> 00:39:16,800
speculative scenario but are there any

1041
00:39:22,069 --> 00:39:20,160
circumstances in the orbital geometry

1042
00:39:25,670 --> 00:39:22,079
that would allow you to do some direct

1043
00:39:27,349 --> 00:39:25,680
sensing of the joven moons uh you know

1044
00:39:29,510 --> 00:39:27,359
the magnetosphere of

1045
00:39:31,589 --> 00:39:29,520
europa the magnetic field around europa

1046
00:39:33,670 --> 00:39:31,599
stuff like that or is that not a

1047
00:39:36,630 --> 00:39:33,680
possibility

1048
00:39:39,510 --> 00:39:36,640
we we generally don't go close enough um

1049
00:39:41,990 --> 00:39:39,520
to look at uh you know in-situ samples

1050
00:39:44,150 --> 00:39:42,000
of of that type of territory

1051
00:39:45,589 --> 00:39:44,160
we try to avoid getting very close to

1052
00:39:46,630 --> 00:39:45,599
europa

1053
00:39:48,790 --> 00:39:46,640
however

1054
00:39:50,790 --> 00:39:48,800
we have uh you know remote sensing

1055
00:39:52,230 --> 00:39:50,800
instruments on board we have a very

1056
00:39:54,069 --> 00:39:52,240
unique perspective because we're in

1057
00:39:56,390 --> 00:39:54,079
polar orbit and we will have

1058
00:39:58,230 --> 00:39:56,400
opportunities to look from afar at the

1059
00:40:00,069 --> 00:39:58,240
galan satellites and we certainly plan

1060
00:40:01,990 --> 00:40:00,079
to do that and there will be some

1061
00:40:03,990 --> 00:40:02,000
science value to those kinds of

1062
00:40:05,829 --> 00:40:04,000
observations and we may learn some

1063
00:40:09,270 --> 00:40:05,839

things that are important about europa

1064
00:40:11,750 --> 00:40:09,280
and we have some people on the team

1065
00:40:13,670 --> 00:40:11,760
you know that share um

1066
00:40:15,589 --> 00:40:13,680
where they're part of the europa teams

1067
00:40:17,190 --> 00:40:15,599
and and they're on the juno teams just

1068
00:40:19,430 --> 00:40:17,200
like we also have people that are on the

1069
00:40:21,750 --> 00:40:19,440
cassini team and as an example i'm on

1070
00:40:24,230 --> 00:40:21,760
all three missions as a scientist so we

1071
00:40:25,750 --> 00:40:24,240
certainly will do what we can and but we

1072
00:40:28,309 --> 00:40:25,760
won't go directly in and look at the

1073
00:40:30,470 --> 00:40:28,319
magnetic field of europa

1074
00:40:31,910 --> 00:40:30,480
okay thank you leo and thank you scott

1075
00:40:33,990 --> 00:40:31,920
uh we're gonna go to social media in a

1076
00:40:36,710 --> 00:40:34,000
moment here but i understand there's a

1077
00:40:37,829 --> 00:40:36,720
question from my carmen auditorium

1078
00:40:39,990 --> 00:40:37,839
please state your name and media

1079
00:40:41,510 --> 00:40:40,000
affiliation amanda barnett with cnn

1080
00:40:43,030 --> 00:40:41,520
digital

1081
00:40:44,790 --> 00:40:43,040
about the camera that great image you

1082
00:40:46,309 --> 00:40:44,800
had earlier when will we see more photos

1083
00:40:48,710 --> 00:40:46,319
when will you know cam come on and what

1084
00:40:50,710 --> 00:40:48,720
can folks expect to see and a second

1085
00:40:52,309 --> 00:40:50,720
question how do we

1086
00:40:54,309 --> 00:40:52,319
how soon will we know whether there's a

1087
00:40:55,589 --> 00:40:54,319
core at jupiter how do you tell us a

1088
00:40:57,829 --> 00:40:55,599

little bit about the science behind

1089
00:41:00,550 --> 00:40:57,839
determining the core

1090
00:41:03,190 --> 00:41:00,560
um okay so first question was uh about

1091
00:41:06,950 --> 00:41:03,200
the camera um i believe it's planned to

1092
00:41:09,750 --> 00:41:06,960
go back on a couple days after joi

1093
00:41:11,670 --> 00:41:09,760
and we'll start taking pictures again

1094
00:41:13,829 --> 00:41:11,680
i don't think we have a plan exactly of

1095
00:41:15,750 --> 00:41:13,839
the release it depends on what we see

1096
00:41:18,230 --> 00:41:15,760
and how interesting it is and but we'll

1097
00:41:19,349 --> 00:41:18,240
certainly release periodic images and as

1098
00:41:21,750 --> 00:41:19,359
we approach

1099
00:41:23,109 --> 00:41:21,760
the planet again very close at the end

1100
00:41:25,349 --> 00:41:23,119
of august

1101
00:41:28,470 --> 00:41:25,359
i expect to have quite a few images and

1102
00:41:30,230 --> 00:41:28,480
and we will release those including um

1103
00:41:32,829 --> 00:41:30,240
some of our first glimpses of the polar

1104
00:41:35,349 --> 00:41:32,839
regions which will be very exciting

1105
00:41:37,430 --> 00:41:35,359
um what was the second question i forgot

1106
00:41:38,630 --> 00:41:37,440
i'm sorry

1107
00:41:40,470 --> 00:41:38,640
about the core

1108
00:41:41,990 --> 00:41:40,480
how do you detect the core how do tell a

1109
00:41:43,589 --> 00:41:42,000
little bit about the science behind that

1110
00:41:45,990 --> 00:41:43,599
and how soon you might know something

1111
00:41:48,309 --> 00:41:46,000
okay so the core works uh the core

1112
00:41:50,630 --> 00:41:48,319
science of trying to constrain whether

1113
00:41:52,150 --> 00:41:50,640

jupiter has a core of heavy elements is

1114
00:41:54,309 --> 00:41:52,160
what that question is about which is a

1115
00:41:56,390 --> 00:41:54,319
very important question

1116
00:41:58,790 --> 00:41:56,400
um

1117
00:41:59,829 --> 00:41:58,800
it works a little bit similar to how

1118
00:42:03,670 --> 00:41:59,839
rich

1119
00:42:05,430 --> 00:42:03,680
described um knowing that we're in orbit

1120
00:42:07,349 --> 00:42:05,440
we're looking at the path of the

1121
00:42:08,390 --> 00:42:07,359
spacecraft as it gets very very close to

1122
00:42:10,309 --> 00:42:08,400
jupiter

1123
00:42:11,510 --> 00:42:10,319
and we're looking at how that path gets

1124
00:42:13,829 --> 00:42:11,520
distorted

1125
00:42:15,190 --> 00:42:13,839
by the pull and tug of jupiter's gravity

1126
00:42:16,470 --> 00:42:15,200
field

1127
00:42:18,309 --> 00:42:16,480
and

1128
00:42:20,230 --> 00:42:18,319
one way to think of how we sensed

1129
00:42:22,550 --> 00:42:20,240
whether there's a core or not is jupiter

1130
00:42:24,870 --> 00:42:22,560
is not a perfect sphere it's what

1131
00:42:26,470 --> 00:42:24,880
scientists call a blade which means it's

1132
00:42:28,950 --> 00:42:26,480
fatter in the middle than it is at the

1133
00:42:33,270 --> 00:42:28,960
top it's squashed

1134
00:42:35,190 --> 00:42:33,280
and as we fly by very very close we look

1135
00:42:37,510 --> 00:42:35,200
at the signal from the radio

1136
00:42:39,990 --> 00:42:37,520
and can tell how it's being changed

1137
00:42:42,470 --> 00:42:40,000
which gives us information about how

1138
00:42:44,470 --> 00:42:42,480

squashed exactly is jupiter

1139
00:42:46,870 --> 00:42:44,480
we have a a very good measurement of how

1140
00:42:48,630 --> 00:42:46,880
it's squashed but to really sense what's

1141
00:42:51,030 --> 00:42:48,640
going on inside

1142
00:42:52,950 --> 00:42:51,040
we need we need to add a lot of decimal

1143
00:42:55,510 --> 00:42:52,960
points to that knowledge and that's

1144
00:42:58,870 --> 00:42:55,520
exactly what juno does is we go by and

1145
00:43:01,270 --> 00:42:58,880
we add a whole bunch of extra

1146
00:43:05,270 --> 00:43:01,280
points of accuracy so to speak to

1147
00:43:07,270 --> 00:43:05,280
exactly how squashed is jupiter and it's

1148
00:43:09,510 --> 00:43:07,280
spinning which is why it's squashed then

1149
00:43:11,349 --> 00:43:09,520
that tells us about how the interior

1150
00:43:12,710 --> 00:43:11,359
must be structured

1151
00:43:15,030 --> 00:43:12,720
and so

1152
00:43:17,190 --> 00:43:15,040
um it's a bit more complicated than the

1153
00:43:19,510 --> 00:43:17,200
way i'm describing but that's sort of

1154
00:43:21,910 --> 00:43:19,520
how it works and

1155
00:43:23,829 --> 00:43:21,920
we will get our first indication of that

1156
00:43:25,829 --> 00:43:23,839
at the end of august when we fly by

1157
00:43:27,829 --> 00:43:25,839
really close and the radio system is on

1158
00:43:29,990 --> 00:43:27,839
completely with all of its bells and

1159
00:43:32,390 --> 00:43:30,000
whistles but even then you you need

1160
00:43:33,910 --> 00:43:32,400
multiple flybys

1161
00:43:36,550 --> 00:43:33,920
to do this so

1162
00:43:39,910 --> 00:43:36,560
um i'm hesitant to promise when we will

1163
00:43:41,589 --> 00:43:39,920

know the answer about that core

1164
00:43:43,589 --> 00:43:41,599
we would like all the orbits and that

1165
00:43:45,589 --> 00:43:43,599
may keep modifying

1166
00:43:46,309 --> 00:43:45,599
the scientists understanding

1167
00:43:48,309 --> 00:43:46,319
but

1168
00:43:50,150 --> 00:43:48,319
certainly would i think until we get

1169
00:43:52,150 --> 00:43:50,160
into our 14 day orbits we probably won't

1170
00:43:53,430 --> 00:43:52,160
be able to say very much about the

1171
00:43:56,309 --> 00:43:53,440
details we will be learning and

1172
00:43:57,829 --> 00:43:56,319
constraining it but we'll be hesitant to

1173
00:44:00,069 --> 00:43:57,839
guessing the wrong answer until we see

1174
00:44:02,150 --> 00:44:00,079
some more information

1175
00:44:03,430 --> 00:44:02,160
so juno is very susceptible to mass

1176
00:44:05,270 --> 00:44:03,440
variations

1177
00:44:07,589 --> 00:44:05,280
and of course

1178
00:44:09,750 --> 00:44:07,599
there's convection zones right below the

1179
00:44:11,990 --> 00:44:09,760
cloud tops that we see and that changes

1180
00:44:13,670 --> 00:44:12,000
the mass distribution and that has to be

1181
00:44:16,150 --> 00:44:13,680
taken into account too

1182
00:44:17,510 --> 00:44:16,160
as as well as each flyby has the

1183
00:44:19,270 --> 00:44:17,520
satellites

1184
00:44:21,430 --> 00:44:19,280
in a different arrangement as you would

1185
00:44:23,270 --> 00:44:21,440
imagine they're orbiting around so

1186
00:44:24,390 --> 00:44:23,280
they're pulling and tugging on jupiter

1187
00:44:26,230 --> 00:44:24,400
as well

1188
00:44:28,950 --> 00:44:26,240

called tidal forces the same way our

1189
00:44:31,270 --> 00:44:28,960
moon works on us which is why the

1190
00:44:32,870 --> 00:44:31,280
ocean's fun to go in

1191
00:44:35,030 --> 00:44:32,880
so it's doing that to jupiter's

1192
00:44:36,870 --> 00:44:35,040
atmosphere as well so each time we fly

1193
00:44:38,470 --> 00:44:36,880
by we also have to calculate where were

1194
00:44:39,670 --> 00:44:38,480
the satellites and try to understand

1195
00:44:41,190 --> 00:44:39,680
those and you can learn about the

1196
00:44:44,069 --> 00:44:41,200
interior of jupiter by doing that as

1197
00:44:45,829 --> 00:44:44,079
well so each flyby or i should say each

1198
00:44:47,349 --> 00:44:45,839
orbit that we have

1199
00:44:48,710 --> 00:44:47,359
has a different longitude that we're

1200
00:44:50,309 --> 00:44:48,720
passing as well as a different

1201
00:44:52,710 --> 00:44:50,319
arrangement of the satellites and all of

1202
00:44:54,550 --> 00:44:52,720
that goes into our database in order to

1203
00:44:56,230 --> 00:44:54,560
interpret

1204
00:44:57,510 --> 00:44:56,240
thank you scott uh i understand we have

1205
00:44:59,190 --> 00:44:57,520
at least one more question from von

1206
00:45:01,109 --> 00:44:59,200
carmen but first we're off to the world

1207
00:45:02,870 --> 00:45:01,119
wide web uh jason do you have some

1208
00:45:04,550 --> 00:45:02,880
social media questions

1209
00:45:06,230 --> 00:45:04,560
indeed there's lots of interest out here

1210
00:45:08,309 --> 00:45:06,240
so uh first question comes from twitter

1211
00:45:10,550 --> 00:45:08,319
user aaron who asks is it possible that

1212
00:45:12,150 --> 00:45:10,560
juno could discover new moons of jupiter

1213
00:45:14,230 --> 00:45:12,160

or is the mission only focused on the

1214
00:45:16,230 --> 00:45:14,240
planet itself

1215
00:45:18,150 --> 00:45:16,240
no i think there's no question we will

1216
00:45:20,390 --> 00:45:18,160
probably discover new moons of jupiter

1217
00:45:23,030 --> 00:45:20,400
we have quite a few cameras

1218
00:45:24,309 --> 00:45:23,040
on board some are just star tracker some

1219
00:45:26,790 --> 00:45:24,319
of them are

1220
00:45:27,750 --> 00:45:26,800
more powerful like junocam but they're

1221
00:45:30,309 --> 00:45:27,760
very

1222
00:45:31,910 --> 00:45:30,319
sensitive to being able to find

1223
00:45:33,109 --> 00:45:31,920
moons of different sizes and different

1224
00:45:34,630 --> 00:45:33,119
places

1225
00:45:36,950 --> 00:45:34,640
obviously i can't tell you where to look

1226
00:45:39,430 --> 00:45:36,960
to find those but i expect that we will

1227
00:45:40,790 --> 00:45:39,440
see some and and the number will keep

1228
00:45:44,069 --> 00:45:40,800
going up

1229
00:45:45,990 --> 00:45:44,079
serendipitous discoveries right yeah

1230
00:45:47,750 --> 00:45:46,000
wonderful twitter user michelle asks

1231
00:45:49,750 --> 00:45:47,760
what is the most exciting possible new

1232
00:45:52,309 --> 00:45:49,760
discovery or piece of information that

1233
00:45:54,390 --> 00:45:52,319
you hope to gain from juno

1234
00:45:56,470 --> 00:45:54,400
so it's hard to say what uh

1235
00:45:58,630 --> 00:45:56,480
the best new discovery will be because i

1236
00:46:01,510 --> 00:45:58,640
can't imagine what the discovery is

1237
00:46:03,589 --> 00:46:01,520
almost any of it is exciting to me

1238
00:46:05,670 --> 00:46:03,599

one of the most important scientific

1239
00:46:07,589 --> 00:46:05,680
measurements for me personally is

1240
00:46:09,750 --> 00:46:07,599
understanding the core and the water

1241
00:46:10,950 --> 00:46:09,760
abundance because i'm really curious

1242
00:46:12,870 --> 00:46:10,960
about

1243
00:46:14,390 --> 00:46:12,880
what the beginning was like in the solar

1244
00:46:17,670 --> 00:46:14,400
system

1245
00:46:19,589 --> 00:46:17,680
so for me in addition to the the core

1246
00:46:22,390 --> 00:46:19,599
the magnetic field structure you know

1247
00:46:24,950 --> 00:46:22,400
jupiter has a very complicated structure

1248
00:46:26,710 --> 00:46:24,960
although as we showed those field lines

1249
00:46:28,550 --> 00:46:26,720
look very much like the earth we call

1250
00:46:30,470 --> 00:46:28,560
those dipole

1251
00:46:32,550 --> 00:46:30,480
as we get closer to the planet we'll

1252
00:46:34,790 --> 00:46:32,560
find additional currents are creating

1253
00:46:36,710 --> 00:46:34,800
new types of fields there might be

1254
00:46:39,349 --> 00:46:36,720
several current systems inside of

1255
00:46:41,829 --> 00:46:39,359
jupiter and so understanding those

1256
00:46:44,710 --> 00:46:41,839
contributes to the entire magnetosphere

1257
00:46:46,950 --> 00:46:44,720
connects with the aurora and and really

1258
00:46:48,150 --> 00:46:46,960
uh tells us a lot about that whole

1259
00:46:50,230 --> 00:46:48,160
system

1260
00:46:51,589 --> 00:46:50,240
so i'm quite excited about that and

1261
00:46:52,870 --> 00:46:51,599
actually connects to the interior

1262
00:46:54,710 --> 00:46:52,880
structure as well

1263
00:46:56,390 --> 00:46:54,720

correct all that measurement is

1264
00:46:59,030 --> 00:46:56,400
incredibly valuable to almost every

1265
00:47:01,270 --> 00:46:59,040
objective we have

1266
00:47:03,270 --> 00:47:01,280
wonderful twitter user george here asks

1267
00:47:04,790 --> 00:47:03,280
when juno will be deorbiting is there

1268
00:47:06,550 --> 00:47:04,800
any chance that junocam will be able to

1269
00:47:09,190 --> 00:47:06,560
return final images from under the

1270
00:47:12,309 --> 00:47:11,030
a picture from under the clouds well i

1271
00:47:13,430 --> 00:47:12,319
would love that

1272
00:47:14,550 --> 00:47:13,440
um

1273
00:47:18,950 --> 00:47:14,560
so

1274
00:47:21,589 --> 00:47:18,960
that can't happen um

1275
00:47:23,670 --> 00:47:21,599
because the spacecraft if it's operating

1276
00:47:25,430 --> 00:47:23,680
the instruments would work as well

1277
00:47:27,510 --> 00:47:25,440
however um

1278
00:47:30,549 --> 00:47:27,520
as we go into the atmosphere of jupiter

1279
00:47:32,230 --> 00:47:30,559
at the end of the mission um

1280
00:47:34,309 --> 00:47:32,240
the drag

1281
00:47:35,910 --> 00:47:34,319
from these giant solar arrays and us

1282
00:47:38,549 --> 00:47:35,920
spinning it's a big spacecraft right

1283
00:47:41,109 --> 00:47:38,559
we're going in with wings basically

1284
00:47:43,190 --> 00:47:41,119
is going to start to

1285
00:47:45,670 --> 00:47:43,200
turn our spacecraft and take control of

1286
00:47:48,230 --> 00:47:45,680
the of the pointing we'll be wobbling as

1287
00:47:50,549 --> 00:47:48,240
rick is pointing out and as soon as that

1288
00:47:52,790 --> 00:47:50,559

happens uh enough to the point where we

1289
00:47:54,470 --> 00:47:52,800
can't maintain the signal of the antenna

1290
00:47:56,470 --> 00:47:54,480
pointing at the earth we won't be able

1291
00:47:58,309 --> 00:47:56,480
to transmit the data so junocam may get

1292
00:48:00,470 --> 00:47:58,319
a great image the question is is when's

1293
00:48:02,549 --> 00:48:00,480
the last time it can send it back

1294
00:48:06,549 --> 00:48:02,559
and i can't predict that but i sure hope

1295
00:48:08,390 --> 00:48:06,559
we can see really close in the clouds

1296
00:48:09,670 --> 00:48:08,400
thank you scott uh i understand we have

1297
00:48:11,030 --> 00:48:09,680
a follow-up from bill harwood and then

1298
00:48:13,349 --> 00:48:11,040
after that we're going to come back to

1299
00:48:15,190 --> 00:48:13,359
von carmen auditorium bill harwood cbs

1300
00:48:16,630 --> 00:48:15,200
news do you have a follow-up question

1301
00:48:18,549 --> 00:48:16,640
yeah i do thank you very much and it's

1302
00:48:20,790 --> 00:48:18,559
for scott um could he talk for just a

1303
00:48:22,549 --> 00:48:20,800
moment please about the great red spot

1304
00:48:24,069 --> 00:48:22,559
and what juno might contribute to

1305
00:48:25,670 --> 00:48:24,079
understanding

1306
00:48:27,910 --> 00:48:25,680
what's powering that and how deeply it

1307
00:48:30,230 --> 00:48:27,920
extends into the atmosphere um you know

1308
00:48:31,670 --> 00:48:30,240
maybe answering the whole question of

1309
00:48:33,030 --> 00:48:31,680
just what it is and how it's working

1310
00:48:34,790 --> 00:48:33,040
thanks

1311
00:48:37,670 --> 00:48:34,800
yeah that's one of my favorite topics i

1312
00:48:39,589 --> 00:48:37,680
love that great red spot um

1313
00:48:41,190 --> 00:48:39,599

so we don't actually understand very

1314
00:48:42,710 --> 00:48:41,200
much about the great red spot we see it

1315
00:48:45,829 --> 00:48:42,720
evolving and in fact it's getting

1316
00:48:46,549 --> 00:48:45,839
smaller uh since i first got amazed by

1317
00:48:57,510 --> 00:48:46,559
it

1318
00:48:59,510 --> 00:48:57,520
back hundreds of years

1319
00:49:02,150 --> 00:48:59,520
most scientists think that that means

1320
00:49:04,710 --> 00:49:02,160
that it must have fairly deep roots and

1321
00:49:06,790 --> 00:49:04,720
that's one of the key things that juno

1322
00:49:08,549 --> 00:49:06,800
gets to address is

1323
00:49:10,549 --> 00:49:08,559
we have instruments on board called the

1324
00:49:11,750 --> 00:49:10,559
microwave radiometer which is basically

1325
00:49:13,670 --> 00:49:11,760
listening

1326
00:49:15,270 --> 00:49:13,680
from deep down

1327
00:49:18,470 --> 00:49:15,280
of what's happening with the temperature

1328
00:49:20,470 --> 00:49:18,480
and the pressures at at jupiter and so

1329
00:49:23,109 --> 00:49:20,480
one of the questions is is

1330
00:49:25,829 --> 00:49:23,119
as we see down into the depths of of the

1331
00:49:28,309 --> 00:49:25,839
atmosphere do we still see hints of the

1332
00:49:30,630 --> 00:49:28,319
structure of the great red spot so i

1333
00:49:33,670 --> 00:49:30,640
think how deep the roots of the great

1334
00:49:35,430 --> 00:49:33,680
red spot and how that root system

1335
00:49:37,750 --> 00:49:35,440
compares to the roots of the zones and

1336
00:49:38,870 --> 00:49:37,760
belts and other storms that we see is

1337
00:49:40,950 --> 00:49:38,880
one of the

1338
00:49:44,069 --> 00:49:40,960

most exciting things that juno is going

1339
00:49:46,470 --> 00:49:44,079
to return so we will we will delve down

1340
00:49:48,230 --> 00:49:46,480
and and kind of try to understand

1341
00:49:50,069 --> 00:49:48,240
really what's powering

1342
00:49:52,230 --> 00:49:50,079
that great red spot how does it work it

1343
00:49:54,150 --> 00:49:52,240
looks looks a little bit like a

1344
00:49:56,549 --> 00:49:54,160
hurricane on the earth

1345
00:49:58,069 --> 00:49:56,559
but we know it can't be working exactly

1346
00:49:59,030 --> 00:49:58,079
like that because hurricanes on the

1347
00:50:01,109 --> 00:49:59,040
earth

1348
00:50:02,950 --> 00:50:01,119
you know need an ocean underneath and

1349
00:50:04,630 --> 00:50:02,960
feed off of the the liquid and then when

1350
00:50:07,030 --> 00:50:04,640
they go on land they change well with

1351
00:50:09,109 --> 00:50:07,040
jupiter it's all you know gas and

1352
00:50:11,190 --> 00:50:09,119
compressed gas all the way down so

1353
00:50:13,190 --> 00:50:11,200
fundamentally we need to learn more

1354
00:50:15,030 --> 00:50:13,200
about how the deep atmosphere and the

1355
00:50:18,230 --> 00:50:15,040
dynamics of the deep atmosphere work and

1356
00:50:19,670 --> 00:50:18,240
that's exactly what juno set up to do

1357
00:50:21,589 --> 00:50:19,680
you know one of the really special

1358
00:50:23,670 --> 00:50:21,599
things about jupiter in my mind and

1359
00:50:24,829 --> 00:50:23,680
indeed is indeed the red spot

1360
00:50:29,030 --> 00:50:24,839
but uh

1361
00:50:32,069 --> 00:50:29,040
juno will look at jupiter in a way that

1362
00:50:35,270 --> 00:50:32,079
utilizes the fact that this planet is

1363
00:50:36,630 --> 00:50:35,280

still hot it's like you've taken a cake

1364
00:50:38,230 --> 00:50:36,640
out of the oven

1365
00:50:40,470 --> 00:50:38,240
after it was made

1366
00:50:43,109 --> 00:50:40,480
and it has to cool

1367
00:50:45,750 --> 00:50:43,119
and so the manifestations on the surface

1368
00:50:47,670 --> 00:50:45,760
many of which are really due to that

1369
00:50:50,470 --> 00:50:47,680
heat leaking through

1370
00:50:52,870 --> 00:50:50,480
and causing the structures that we see

1371
00:50:54,630 --> 00:50:52,880
so the excitement about the red spot may

1372
00:50:56,630 --> 00:50:54,640
tell us about how

1373
00:50:58,630 --> 00:50:56,640
that heat is coming through the surface

1374
00:51:01,990 --> 00:50:58,640
and how that may be very different at

1375
00:51:03,990 --> 00:51:02,000
this location than any of the others

1376
00:51:06,790 --> 00:51:04,000
that's very true jim and the other thing

1377
00:51:08,870 --> 00:51:06,800
is is you know as we fly over uh very

1378
00:51:11,190 --> 00:51:08,880
close

1379
00:51:13,750 --> 00:51:11,200
and over the red spot at times we'll be

1380
00:51:15,829 --> 00:51:13,760
also sensing the gravity and we'll be

1381
00:51:18,069 --> 00:51:15,839
trying to determine whether there's some

1382
00:51:20,710 --> 00:51:18,079
sort of enhanced signal how much mass is

1383
00:51:22,710 --> 00:51:20,720
tied into that great red spot is one of

1384
00:51:25,589 --> 00:51:22,720
the questions is there a bump

1385
00:51:26,710 --> 00:51:25,599
can we detect that what does it mean

1386
00:51:30,470 --> 00:51:26,720
and

1387
00:51:32,710 --> 00:51:30,480
heat coming out of

1388
00:51:35,030 --> 00:51:32,720

jupiter from different depths is the key

1389
00:51:36,630 --> 00:51:35,040
to how the microwave really works and

1390
00:51:38,069 --> 00:51:36,640
how it also determines the water

1391
00:51:42,549 --> 00:51:38,079
abundance

1392
00:51:44,230 --> 00:51:42,559
near the great red spot than other spots

1393
00:51:48,470 --> 00:51:44,240
we don't really know that and juno is

1394
00:51:50,710 --> 00:51:48,480
poised to tell us about that as well

1395
00:51:52,630 --> 00:51:50,720
thank you scott uh we're going to go

1396
00:51:53,750 --> 00:51:52,640
around the room here at von carmen one

1397
00:51:56,390 --> 00:51:53,760
last time here we have a couple

1398
00:51:58,630 --> 00:51:56,400
questions this gentleman

1399
00:52:01,589 --> 00:51:58,640
paul verkaman from cnn

1400
00:52:05,190 --> 00:52:01,599
as you sit here decades in the making

1401
00:52:07,829 --> 00:52:05,200
high risk you describe the debris

1402
00:52:10,710 --> 00:52:07,839
radiation and more your emotions right

1403
00:52:13,349 --> 00:52:10,720
now as you're so close

1404
00:52:14,390 --> 00:52:13,359
it's hard to describe i'm torn with the

1405
00:52:16,870 --> 00:52:14,400
incredible

1406
00:52:21,030 --> 00:52:16,880
excitement and anticipation

1407
00:52:23,510 --> 00:52:21,040
with oh my god we're we're going in

1408
00:52:25,270 --> 00:52:23,520
it's it's really happening um

1409
00:52:27,750 --> 00:52:25,280
and it's and it's i know it's

1410
00:52:29,750 --> 00:52:27,760
challenging i mean i know the business

1411
00:52:31,109 --> 00:52:29,760
you know nasa and jpl are in the

1412
00:52:33,430 --> 00:52:31,119
business of

1413
00:52:36,470 --> 00:52:33,440

taking challenges we we have to do it as

1414
00:52:37,910 --> 00:52:36,480
a as a culture as our our society

1415
00:52:40,390 --> 00:52:37,920
if we're going to go after these hard

1416
00:52:43,510 --> 00:52:40,400
questions we got to do the hard problems

1417
00:52:44,870 --> 00:52:43,520
and we got to take chances and risks

1418
00:52:47,109 --> 00:52:44,880
but it's all

1419
00:52:49,750 --> 00:52:47,119
so real right now

1420
00:52:50,950 --> 00:52:49,760
the risk is right in front of us it's

1421
00:52:53,349 --> 00:52:50,960
less i mean

1422
00:52:55,270 --> 00:52:53,359
i hadn't heard dc say

1423
00:52:57,589 --> 00:52:55,280
you know we're within one jupiter

1424
00:53:02,950 --> 00:52:57,599
rotation i mean i've studied jupiter

1425
00:53:06,309 --> 00:53:05,109
just a quick follow my perspective uh

1426
00:53:09,349 --> 00:53:06,319
you know i've been the director of

1427
00:53:11,190 --> 00:53:09,359
planetary science for 10 years now

1428
00:53:14,230 --> 00:53:11,200
i've been involved in curiosity's

1429
00:53:15,750 --> 00:53:14,240
landing fly by of new horizons at pluto

1430
00:53:17,990 --> 00:53:15,760
the launches

1431
00:53:20,470 --> 00:53:18,000
you know these are enormous milestones

1432
00:53:22,790 --> 00:53:20,480
that occur and each and every one of

1433
00:53:25,190 --> 00:53:22,800
them carry their own risks

1434
00:53:28,069 --> 00:53:25,200
but what gives me wonderful confidence

1435
00:53:30,230 --> 00:53:28,079
about the success of juno is how this

1436
00:53:32,549 --> 00:53:30,240
team has worked so hard

1437
00:53:34,790 --> 00:53:32,559
to study those risks and create a

1438
00:53:36,230 --> 00:53:34,800

variety of scenarios and mission

1439
00:53:38,790 --> 00:53:36,240
architectures

1440
00:53:40,390 --> 00:53:38,800
and and structures on the spacecraft to

1441
00:53:43,910 --> 00:53:40,400
mitigate them

1442
00:53:47,030 --> 00:53:43,920
we have done everything humanly possible

1443
00:53:48,870 --> 00:53:47,040
to make this mission a success

1444
00:53:49,990 --> 00:53:48,880
and so

1445
00:53:52,150 --> 00:53:50,000
uh

1446
00:53:55,430 --> 00:53:52,160
it's still it's still you know a

1447
00:53:57,349 --> 00:53:55,440
cliffhanger for for me too

1448
00:53:59,030 --> 00:53:57,359
and yet somehow you haven't lost your

1449
00:54:00,549 --> 00:53:59,040
sense of humor what does it say about

1450
00:54:03,270 --> 00:54:00,559
you all that you have three lego

1451
00:54:05,270 --> 00:54:03,280
figurines on board

1452
00:54:09,430 --> 00:54:05,280
um i thought i wasn't thinking that much

1453
00:54:13,990 --> 00:54:11,109
okay then thank you very much and we

1454
00:54:16,549 --> 00:54:14,000
have one more question over there

1455
00:54:18,790 --> 00:54:16,559
yes hi mike wahl from from

1456
00:54:21,670 --> 00:54:18,800
space.com um sorry to keep dwelling on

1457
00:54:23,589 --> 00:54:21,680
the risk um but but like if you could

1458
00:54:25,270 --> 00:54:23,599
quantify what are you most afraid of

1459
00:54:26,710 --> 00:54:25,280
tonight are you most afraid of radiation

1460
00:54:27,990 --> 00:54:26,720
you're most afraid of the the kind of

1461
00:54:29,430 --> 00:54:28,000
dust in the

1462
00:54:30,950 --> 00:54:29,440
like in the ring are you most afraid of

1463
00:54:33,349 --> 00:54:30,960

the engine like whether it's going to

1464
00:54:35,030 --> 00:54:33,359
fire on autopilot or not can you kind of

1465
00:54:36,630 --> 00:54:35,040
can you kind of quantify what's the

1466
00:54:38,950 --> 00:54:36,640
biggest thing that that you're scared of

1467
00:54:40,150 --> 00:54:38,960
tonight

1468
00:54:42,150 --> 00:54:40,160
um

1469
00:54:44,390 --> 00:54:42,160
i'm not sure i can at least for me that

1470
00:54:45,990 --> 00:54:44,400
i can identify one thing that i'm most

1471
00:54:48,470 --> 00:54:46,000
scared of you know

1472
00:54:51,510 --> 00:54:48,480
the bottom line is is is jupiter is

1473
00:54:54,150 --> 00:54:51,520
extreme in every way i mean i studied

1474
00:54:56,230 --> 00:54:54,160
the radiation belts a lot and so i know

1475
00:54:58,789 --> 00:54:56,240
more about those and i'm

1476
00:55:01,030 --> 00:54:58,799
maybe scared more because of that

1477
00:55:03,030 --> 00:55:01,040
but the truth is it has the strongest

1478
00:55:05,349 --> 00:55:03,040
magnetic field it's spinning the facet

1479
00:55:07,589 --> 00:55:05,359
it has the strongest gravity field it

1480
00:55:10,230 --> 00:55:07,599
has the most intense radiation and we're

1481
00:55:13,030 --> 00:55:10,240
flying the fastest of any spacecraft and

1482
00:55:15,829 --> 00:55:13,040
we're carrying these giant solar rays

1483
00:55:19,829 --> 00:55:17,910
so that all sounds okay but you know i

1484
00:55:21,510 --> 00:55:19,839
also look at it and i'm like what were

1485
00:55:22,549 --> 00:55:21,520
we thinking

1486
00:55:27,750 --> 00:55:22,559
you know

1487
00:55:29,589 --> 00:55:27,760
world's best engineers working this out

1488
00:55:31,670 --> 00:55:29,599

we're doing everything humanly possible

1489
00:55:35,430 --> 00:55:31,680
i'm confident it's going to work

1490
00:55:37,750 --> 00:55:35,440
but i'll be happy when it's over and

1491
00:55:41,670 --> 00:55:37,760
we're in orbit um

1492
00:55:44,549 --> 00:55:41,680
so by you know to sum it up in one thing

1493
00:55:47,430 --> 00:55:44,559
i'm really just nervous that the whole

1494
00:55:48,549 --> 00:55:47,440
um orbit insertion rocket burn is going

1495
00:55:50,950 --> 00:55:48,559
to work

1496
00:55:54,150 --> 00:55:50,960
enough to get us into an orbit and then

1497
00:55:57,109 --> 00:55:54,160
allow us to turn back to the sun before

1498
00:55:58,630 --> 00:55:57,119
we run out of battery power so you know

1499
00:56:02,069 --> 00:55:58,640
one thing that we didn't emphasize is

1500
00:56:04,230 --> 00:56:02,079
that as soon as we turn off the sun

1501
00:56:05,750 --> 00:56:04,240
there's a time clock that starts it's a

1502
00:56:08,069 --> 00:56:05,760
stop watch

1503
00:56:10,309 --> 00:56:08,079
and that means you're on battery power

1504
00:56:12,309 --> 00:56:10,319
the whole game is get back to the sun

1505
00:56:14,390 --> 00:56:12,319
before you run out of battery

1506
00:56:16,870 --> 00:56:14,400
and and in the middle of it oh i have to

1507
00:56:19,270 --> 00:56:16,880
do this orbit insertion burn

1508
00:56:19,910 --> 00:56:19,280
but i've got to get back to that and and

1509
00:56:47,109 --> 00:56:19,920
i

1510
00:56:48,950 --> 00:56:47,119
and um

1511
00:56:51,190 --> 00:56:48,960
and i had my fingers crossed and i was

1512
00:56:54,870 --> 00:56:51,200
excited but tense and it went up

1513
00:56:57,190 --> 00:56:54,880

everything worked great i came down

1514
00:56:58,950 --> 00:56:57,200
one of the nasa managers was there next

1515
00:57:01,030 --> 00:56:58,960
to me he goes how are you feeling like

1516
00:57:02,309 --> 00:57:01,040
oh god we're we did it we launched we

1517
00:57:03,750 --> 00:57:02,319
launched he goes

1518
00:57:05,910 --> 00:57:03,760
you're not done yet

1519
00:57:07,750 --> 00:57:05,920
got to get the solar rays out

1520
00:57:08,549 --> 00:57:07,760
got to point to the sun

1521
00:57:10,630 --> 00:57:08,559
and

1522
00:57:13,589 --> 00:57:10,640
that was a sobering moment because i was

1523
00:57:16,549 --> 00:57:13,599
excited about the rocket

1524
00:57:18,950 --> 00:57:16,559
and um basically you know we've got to

1525
00:57:20,230 --> 00:57:18,960
get the blood flowing through juno's

1526
00:57:21,990 --> 00:57:20,240
veins again

1527
00:57:23,270 --> 00:57:22,000
and that's the key

1528
00:57:25,270 --> 00:57:23,280
um so

1529
00:57:27,109 --> 00:57:25,280
maybe i'm most scared of not getting

1530
00:57:29,030 --> 00:57:27,119
back on the sun

1531
00:57:30,549 --> 00:57:29,040
well thank you very much scott well

1532
00:57:33,030 --> 00:57:30,559
that's going to wrap it up from here

1533
00:57:36,390 --> 00:57:33,040
today at jpl

1534
00:57:38,710 --> 00:57:36,400
for more information about juno and joi

1535
00:57:41,670 --> 00:57:38,720
and juno science please visit

1536
00:57:46,950 --> 00:57:41,680
www

1537
00:57:50,630 --> 00:57:48,710
and for those of you who want to join in

1538
00:57:52,789 --> 00:57:50,640

on the conversation

1539
00:57:56,470 --> 00:57:52,799
juno mission has a facebook and twitter

1540
00:57:59,270 --> 00:57:56,480
feed and those are facebook.com nasajuno

1541
00:58:01,589 --> 00:57:59,280
and twitter.com nasajuno

1542
00:58:04,870 --> 00:58:01,599
well uh after this uh

1543
00:58:06,789 --> 00:58:04,880
we're going to be spending uh some time

1544
00:58:09,510 --> 00:58:06,799
getting ready for this evening

1545
00:58:12,309 --> 00:58:09,520
nasa commentary for joi jupiter orbit

1546
00:58:13,270 --> 00:58:12,319
insertion is going to begin at 7 30 pm

1547
00:58:15,430 --> 00:58:13,280
tonight

1548
00:58:18,230 --> 00:58:15,440
and it will wrap at approximately 9 p.m

1549
00:58:20,390 --> 00:58:18,240
pacific there will be a post joe joi

1550
00:58:21,430 --> 00:58:20,400
news briefing that will start at 10 p.m

1551
00:58:24,710 --> 00:58:21,440
pacific

1552
00:58:26,950 --> 00:58:24,720
and uh lastly we wish everybody a happy

1553
00:58:29,270 --> 00:58:26,960
and healthy july 4th and come back and