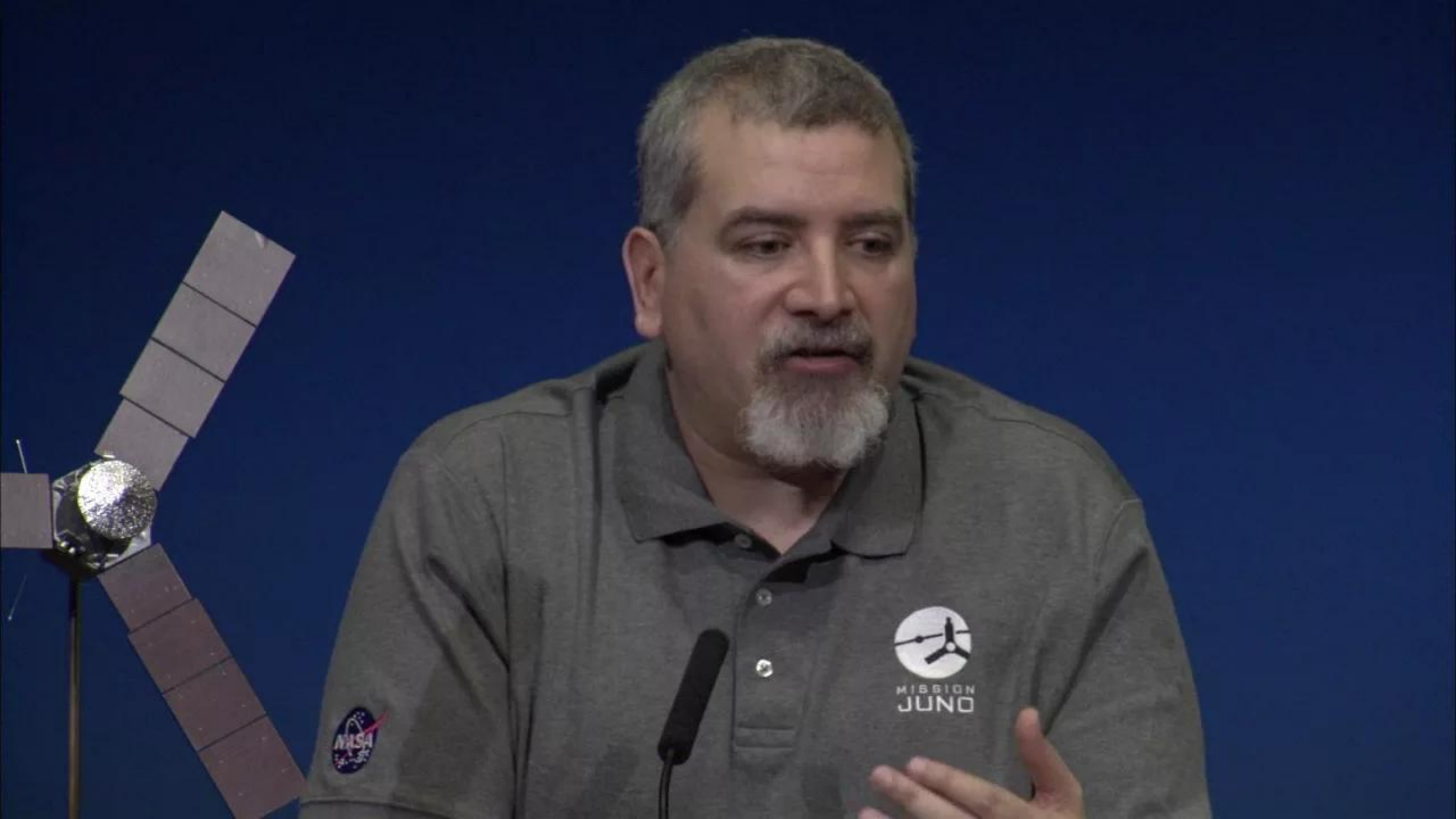
MISSION
JUNO

1
00:00:08,310 --> 00:00:06,309
good morning my name is d.c eagle from

2
00:00:10,230 --> 00:00:08,320
nasa's jet propulsion lab in pasadena

3
00:00:12,470 --> 00:00:10,240
california we're here today to talk

4
00:00:15,990 --> 00:00:12,480
about the juno mission to jupiter and

5
00:00:18,150 --> 00:00:16,000
currently juno is 7 million 71 000 miles

6
00:00:20,150 --> 00:00:18,160
from the gas giant and on july 4th it's

7
00:00:22,550 --> 00:00:20,160
going to light up its main engine and

8
00:00:23,429 --> 00:00:22,560
head into orbit so to talk about juno

9
00:00:25,830 --> 00:00:23,439
today

10
00:00:28,870 --> 00:00:25,840
and its science and jupiter orbit

11
00:00:32,069 --> 00:00:28,880
insertion we have with us

12
00:00:37,030 --> 00:00:32,079
ed hurst juno mission manager from the

13
00:00:40,549 --> 00:00:38,310

scott bolton

14
00:00:42,630 --> 00:00:40,559
juno principal investigator from the

15
00:00:48,069 --> 00:00:42,640
southwest research institute in san

16
00:00:51,189 --> 00:00:49,350
steve levin

17
00:00:56,630 --> 00:00:51,199
juno project scientist

18
00:01:01,110 --> 00:00:58,790
jack connery he's the juno deputy

19
00:01:03,510 --> 00:01:01,120
principal investigator and magnetometer

20
00:01:05,030 --> 00:01:03,520
investigation lead from the nasa goddard

21
00:01:08,789 --> 00:01:05,040
space flight center in greenbelt

22
00:01:12,550 --> 00:01:10,950
fran bagano juno magnetosphere's

23
00:01:15,749 --> 00:01:12,560
co-investigator from the university of

24
00:01:17,510 --> 00:01:15,759
colorado at boulder

25
00:01:19,429 --> 00:01:17,520
so before we start things off with our

26
00:01:21,350 --> 00:01:19,439
panel today i'd like to introduce diane

27
00:01:28,789 --> 00:01:21,360
brown she's the juno program executive

28
00:01:32,149 --> 00:01:29,990
good morning

29
00:01:34,310 --> 00:01:32,159
we could not be more excited about being

30
00:01:36,390 --> 00:01:34,320
back on jupiter's doorstep and being so

31
00:01:38,469 --> 00:01:36,400
close to our arrival on monday

32
00:01:40,789 --> 00:01:38,479
nasa has been to jupiter before but

33
00:01:43,270 --> 00:01:40,799
never this close and we know a lot about

34
00:01:45,030 --> 00:01:43,280
jupiter from previous missions but juno

35
00:01:46,630 --> 00:01:45,040
was poised to answer the questions that

36
00:01:48,310 --> 00:01:46,640
we still have

37
00:01:50,310 --> 00:01:48,320
juno is the second of three missions

38
00:01:51,510 --> 00:01:50,320

within nasa's new frontiers program

39
00:01:53,990 --> 00:01:51,520
which is in the science mission

40
00:01:56,149 --> 00:01:54,000
directorate in the um in the planetary

41
00:01:58,230 --> 00:01:56,159
science division

42
00:02:00,230 --> 00:01:58,240
the new horizons mission uh which some

43
00:02:02,230 --> 00:02:00,240
of you will probably remember last july

44
00:02:03,109 --> 00:02:02,240
gave us those amazing amazing photos as

45
00:02:05,990 --> 00:02:03,119
it flew

46
00:02:08,070 --> 00:02:06,000
past pluto and the osiris-rex mission is

47
00:02:09,589 --> 00:02:08,080
scheduled to launch this september and

48
00:02:11,910 --> 00:02:09,599
it will fly out to the near earth

49
00:02:13,589 --> 00:02:11,920
asteroid bennu and do a sample return we

50
00:02:15,190 --> 00:02:13,599
expect to see those samples as early as

51
00:02:16,710 --> 00:02:15,200
2023

52
00:02:18,229 --> 00:02:16,720
juno was selected in the second

53
00:02:20,710 --> 00:02:18,239
announcement of opportunities for the

54
00:02:23,910 --> 00:02:20,720
new frontiers program it was selected in

55
00:02:25,110 --> 00:02:23,920
2005 and it launched in 2011. the

56
00:02:27,110 --> 00:02:25,120
marshall space flight center in

57
00:02:29,589 --> 00:02:27,120
huntsville alabama manages the new for

58
00:02:31,910 --> 00:02:29,599
the new frontiers program for the

59
00:02:34,150 --> 00:02:31,920
planetary science division

60
00:02:35,670 --> 00:02:34,160
nasa has a long history of milestones on

61
00:02:38,550 --> 00:02:35,680
the 4th of july and we look forward to

62
00:02:40,150 --> 00:02:38,560
making our own fireworks this year

63
00:02:42,949 --> 00:02:40,160

we could not have reached this milestone

64
00:02:45,350 --> 00:02:42,959
without the years of dedicated work and

65
00:02:46,949 --> 00:02:45,360
and planning by the entire juno science

66
00:02:48,630 --> 00:02:46,959
team and the

67
00:02:51,350 --> 00:02:48,640
admission team and we thank them all for

68
00:02:53,430 --> 00:02:51,360
their dedication nasa's vision is to

69
00:02:55,830 --> 00:02:53,440
reach for new heights and reveal the

70
00:02:58,390 --> 00:02:55,840
unknown for the benefit of humankind and

71
00:03:04,949 --> 00:02:58,400
juno is a perfect example of how nasa

72
00:03:08,229 --> 00:03:06,710
okay thank you diane

73
00:03:09,910 --> 00:03:08,239
and to start things off with our panel

74
00:03:11,670 --> 00:03:09,920
we'll go back to ed hurst the mission

75
00:03:13,030 --> 00:03:11,680
manager for juneau

76
00:03:15,030 --> 00:03:13,040
thank you dc

77
00:03:17,190 --> 00:03:15,040
um i wanted to start out reminding

78
00:03:18,949 --> 00:03:17,200
people of some salient features on our

79
00:03:20,869 --> 00:03:18,959
spacecraft

80
00:03:23,910 --> 00:03:20,879
the most prominent thing that you see

81
00:03:25,830 --> 00:03:23,920
are our large solar panels each of them

82
00:03:29,670 --> 00:03:25,840
are 10 meters wide

83
00:03:32,390 --> 00:03:29,680
10 meters long and tip to tip they span

84
00:03:35,910 --> 00:03:32,400
rim to rim on a basketball court they

85
00:03:36,710 --> 00:03:35,920
produce 500 watts at jupiter range and

86
00:03:38,710 --> 00:03:36,720
that's

87
00:03:39,509 --> 00:03:38,720
enough power to produce

88
00:03:41,910 --> 00:03:39,519

to

89
00:03:43,750 --> 00:03:41,920
power our instruments and all the

90
00:03:46,789 --> 00:03:43,760
electronics inside

91
00:03:48,309 --> 00:03:46,799
the other salient feature is right under

92
00:03:50,949 --> 00:03:48,319
the um

93
00:03:53,110 --> 00:03:50,959
the high gain antenna it's this box

94
00:03:55,190 --> 00:03:53,120
that's under here

95
00:03:56,229 --> 00:03:55,200
that's what we call our electronics

96
00:03:58,229 --> 00:03:56,239
vault

97
00:04:00,789 --> 00:03:58,239
inside of that box we have all of our

98
00:04:02,630 --> 00:04:00,799
sensitive electronics and that's what

99
00:04:05,350 --> 00:04:02,640
that that

100
00:04:07,030 --> 00:04:05,360
that vault is made out of titanium and

101
00:04:09,350 --> 00:04:07,040
it's going to protect the electronics

102
00:04:11,910 --> 00:04:09,360
from the intense radiation belts while

103
00:04:13,509 --> 00:04:11,920
we're at jupiter

104
00:04:17,270 --> 00:04:13,519
the star of the show

105
00:04:19,430 --> 00:04:17,280
on july 4th is on the back side

106
00:04:20,390 --> 00:04:19,440
and you see here we have a main engine

107
00:04:22,710 --> 00:04:20,400
cover

108
00:04:25,350 --> 00:04:22,720
and right where the stand comes into the

109
00:04:27,430 --> 00:04:25,360
back is our main engine nozzle

110
00:04:29,710 --> 00:04:27,440
and that is

111
00:04:34,390 --> 00:04:29,720
the engine that's going to produce about

112
00:04:36,390 --> 00:04:34,400
645 newtons of force and over 35 minutes

113
00:04:39,670 --> 00:04:36,400

slow the spacecraft down

114
00:04:41,430 --> 00:04:39,680
so that we get into orbit

115
00:04:44,469 --> 00:04:41,440
so what have we been doing for the last

116
00:04:46,710 --> 00:04:44,479
few days to get ready for july 4th

117
00:04:49,590 --> 00:04:46,720
10 days ago we opened that main engine

118
00:04:52,550 --> 00:04:49,600
cover so that the engine would be ready

119
00:04:54,710 --> 00:04:52,560
to fire when we get to july 4th and a

120
00:04:57,189 --> 00:04:54,720
couple of days ago we pressurized the

121
00:04:59,350 --> 00:04:57,199
whole system so that the engine is ready

122
00:05:02,629 --> 00:04:59,360
to go all the propulsion and all the

123
00:05:04,950 --> 00:05:02,639
pipes and valves are all ready to fire

124
00:05:06,950 --> 00:05:04,960
today we're sending the last commands up

125
00:05:09,749 --> 00:05:06,960
to the spacecraft and once those

126
00:05:11,029 --> 00:05:09,759
commands are sent it'll be hands off

127
00:05:12,710 --> 00:05:11,039
from the team

128
00:05:14,950 --> 00:05:12,720
here on the ground we'll continue to

129
00:05:16,710 --> 00:05:14,960
monitor the spacecraft and make sure

130
00:05:19,270 --> 00:05:16,720
that everything is executing as we

131
00:05:21,350 --> 00:05:19,280
expect it to execute

132
00:05:22,950 --> 00:05:21,360
but the spacecraft is on its own and

133
00:05:25,110 --> 00:05:22,960
it's designed to take care of itself

134
00:05:28,550 --> 00:05:25,120
along with all of the command sequences

135
00:05:32,550 --> 00:05:30,150
so to show you a little bit more about

136
00:05:34,870 --> 00:05:32,560
what's going to happen on july 4th can i

137
00:05:38,390 --> 00:05:34,880
have the first animation

138
00:05:40,710 --> 00:05:38,400

or my only animation um what you see

139
00:05:42,710 --> 00:05:40,720
what you see on the screen

140
00:05:45,189 --> 00:05:42,720
the little puffs that you see right now

141
00:05:48,350 --> 00:05:45,199
are our smaller thrusters

142
00:05:51,110 --> 00:05:48,360
they're 4.5 newtons in size and they're

143
00:05:54,070 --> 00:05:51,120
reorienting the spacecraft so that we

144
00:05:56,070 --> 00:05:54,080
get the engine in the proper direction

145
00:05:58,390 --> 00:05:56,080
so that when it fires

146
00:06:00,390 --> 00:05:58,400
we're slowing the spacecraft down you

147
00:06:02,710 --> 00:06:00,400
now see the thrusters they're spinning

148
00:06:04,469 --> 00:06:02,720
the spacecraft up from two revolutions

149
00:06:05,430 --> 00:06:04,479
per minute to five revolutions per

150
00:06:07,350 --> 00:06:05,440
minute

151
00:06:09,590 --> 00:06:07,360
so that when we do the burn that you're

152
00:06:11,749 --> 00:06:09,600
seeing on the screen now the spacecraft

153
00:06:13,909 --> 00:06:11,759
is in a stable configuration and over

154
00:06:16,469 --> 00:06:13,919
that 35 minutes we get the thrust and

155
00:06:18,870 --> 00:06:16,479
the direction that we need to get it

156
00:06:20,390 --> 00:06:18,880
we then slow the spacecraft back down

157
00:06:23,029 --> 00:06:20,400
and revolutions to

158
00:06:25,670 --> 00:06:23,039
2 rpm

159
00:06:28,070 --> 00:06:25,680
and we turn the vehicle back to the sun

160
00:06:31,430 --> 00:06:28,080
to start recharging the batteries

161
00:06:33,110 --> 00:06:31,440
and start communicating back with earth

162
00:06:35,430 --> 00:06:33,120
while we're doing the burn we are in

163
00:06:38,629 --> 00:06:35,440

communication with the spacecraft via

164
00:06:40,469 --> 00:06:38,639
tones it's a modulation that we get on

165
00:06:44,790 --> 00:06:40,479
the radio signal that tells us that all

166
00:06:46,710 --> 00:06:44,800
the events are happening as designed

167
00:06:49,350 --> 00:06:46,720
so that's what we're looking forward to

168
00:06:51,110 --> 00:06:49,360
on july 4th and i'll hand it over to

169
00:06:53,029 --> 00:06:51,120
scott to start talking about some of the

170
00:06:54,309 --> 00:06:53,039
science

171
00:06:56,230 --> 00:06:54,319
thanks ed

172
00:06:59,589 --> 00:06:56,240
so um

173
00:07:01,749 --> 00:06:59,599
i'm just so excited to be here i can't

174
00:07:02,710 --> 00:07:01,759
express that enough i mean in just a few

175
00:07:05,510 --> 00:07:02,720
days

176
00:07:08,150 --> 00:07:05,520
we're about to arrive at jupiter

177
00:07:10,550 --> 00:07:08,160
and it's hard to believe uh it's been a

178
00:07:13,670 --> 00:07:10,560
i'm so proud to be part of this team

179
00:07:17,670 --> 00:07:13,680
that has accomplished all of this

180
00:07:19,990 --> 00:07:17,680
you know what juno is really about is

181
00:07:22,550 --> 00:07:20,000
learning about the recipe for how solar

182
00:07:24,469 --> 00:07:22,560
systems are made we really

183
00:07:26,469 --> 00:07:24,479
scientists don't really understand how

184
00:07:28,550 --> 00:07:26,479
the planets are made we know after the

185
00:07:30,870 --> 00:07:28,560
sun forms something happened and we were

186
00:07:32,790 --> 00:07:30,880
able to form jupiter it took up more

187
00:07:34,070 --> 00:07:32,800
than half of the material that was left

188
00:07:35,430 --> 00:07:34,080

over

189
00:07:37,909 --> 00:07:35,440
and it's a little bit different than the

190
00:07:40,469 --> 00:07:37,919
sun and we don't completely understand

191
00:07:42,950 --> 00:07:40,479
that and that's really the first step in

192
00:07:44,950 --> 00:07:42,960
that recipe is how do you make solar

193
00:07:46,790 --> 00:07:44,960
systems something happens that allows

194
00:07:49,110 --> 00:07:46,800
the star to be born and then afterwards

195
00:07:50,869 --> 00:07:49,120
the planets and that first step

196
00:07:53,029 --> 00:07:50,879
eventually leads to us

197
00:07:54,070 --> 00:07:53,039
and juno is poised to be able to make

198
00:07:56,469 --> 00:07:54,080
some

199
00:07:58,950 --> 00:07:56,479
great progress on learning about that

200
00:08:01,510 --> 00:07:58,960
step not only to explain how our solar

201
00:08:03,430 --> 00:08:01,520
system formed and maybe how we got here

202
00:08:05,830 --> 00:08:03,440
but how other solar systems that nasa is

203
00:08:07,589 --> 00:08:05,840
discovering in other

204
00:08:09,510 --> 00:08:07,599
star systems

205
00:08:11,430 --> 00:08:09,520
how they get created jupiter is our

206
00:08:14,150 --> 00:08:11,440
example

207
00:08:16,390 --> 00:08:14,160
and in order to to accomplish uh the

208
00:08:18,230 --> 00:08:16,400
science objectives of that we're set out

209
00:08:21,110 --> 00:08:18,240
to do and the measurements that we want

210
00:08:23,990 --> 00:08:21,120
we have a set of tools on board

211
00:08:26,150 --> 00:08:24,000
juno we call them science instruments

212
00:08:28,790 --> 00:08:26,160
but they're just different tools that we

213
00:08:30,790 --> 00:08:28,800

use uh tricks of the trade so to speak

214
00:08:32,310 --> 00:08:30,800
and i want to give you a little idea how

215
00:08:34,310 --> 00:08:32,320
those work they're situated around the

216
00:08:35,909 --> 00:08:34,320
spacecraft that you're a little bit

217
00:08:36,709 --> 00:08:35,919
familiar with from these images and and

218
00:08:38,389 --> 00:08:36,719
what

219
00:08:40,870 --> 00:08:38,399
ed just explained

220
00:08:42,709 --> 00:08:40,880
and i'll show you that on this first

221
00:08:45,590 --> 00:08:42,719
animation

222
00:08:47,269 --> 00:08:45,600
um you'll see sort of an x-ray view the

223
00:08:48,389 --> 00:08:47,279
things that are in color are the science

224
00:08:50,230 --> 00:08:48,399
instruments they're all looking out

225
00:08:51,829 --> 00:08:50,240
between the solar arrays the solar rays

226
00:08:53,430 --> 00:08:51,839
are of course the spacecraft's spinning

227
00:08:55,910 --> 00:08:53,440
so everybody gets their turn to look at

228
00:08:57,509 --> 00:08:55,920
jupiter this was a very efficient design

229
00:08:59,750 --> 00:08:57,519
in the middle you see all these boxes

230
00:09:03,190 --> 00:08:59,760
cluttered together that's inside of our

231
00:09:05,910 --> 00:09:03,200
radiation vault so that's a giant box

232
00:09:09,190 --> 00:09:05,920
that is about 400 pounds of titanium to

233
00:09:10,949 --> 00:09:09,200
shield sort of the vital organs of juno

234
00:09:12,630 --> 00:09:10,959
i mean this is where the computer and

235
00:09:14,710 --> 00:09:12,640
the brains lie all the sensitive

236
00:09:17,910 --> 00:09:14,720
electronics we have to shield it because

237
00:09:20,070 --> 00:09:17,920
jupiter is basically uh the harshest

238
00:09:22,710 --> 00:09:20,080

region in the entire solar system it is

239
00:09:24,150 --> 00:09:22,720
a planet on steroids everything about it

240
00:09:25,910 --> 00:09:24,160
is extreme

241
00:09:27,590 --> 00:09:25,920
the radiation would just

242
00:09:29,269 --> 00:09:27,600
not only kill people but it would knock

243
00:09:30,630 --> 00:09:29,279
out our electronics and so everything's

244
00:09:33,110 --> 00:09:30,640
protected

245
00:09:35,190 --> 00:09:33,120
inside that was one of the aspects of

246
00:09:37,350 --> 00:09:35,200
our design that was very efficient we

247
00:09:39,110 --> 00:09:37,360
decided it was the first time

248
00:09:41,750 --> 00:09:39,120
nasa's tried that we put all the

249
00:09:44,949 --> 00:09:41,760
electronics in this vault another aspect

250
00:09:47,030 --> 00:09:44,959
was having this spin where the so where

251
00:09:49,030 --> 00:09:47,040
the instruments are able to look out

252
00:09:51,030 --> 00:09:49,040
between the solar arrays so we don't

253
00:09:52,070 --> 00:09:51,040
have to spend a lot of

254
00:09:54,389 --> 00:09:52,080
effort

255
00:09:56,550 --> 00:09:54,399
turning the spacecraft everybody kind of

256
00:09:59,590 --> 00:09:56,560
gets their turn as we spin through so it

257
00:10:01,430 --> 00:09:59,600
was a very simple efficient design

258
00:10:03,350 --> 00:10:01,440
and that's sort of a theme throughout

259
00:10:05,670 --> 00:10:03,360
juno

260
00:10:07,910 --> 00:10:05,680
what i'm going to show you now is

261
00:10:10,230 --> 00:10:07,920
some exciting new data that we just got

262
00:10:11,590 --> 00:10:10,240
last week but before i show that to you

263
00:10:14,069 --> 00:10:11,600

let me give you a little bit of a

264
00:10:15,350 --> 00:10:14,079
background of what you're going to see

265
00:10:17,509 --> 00:10:15,360
so as you

266
00:10:19,990 --> 00:10:17,519
travel from the earth to jupiter you're

267
00:10:22,150 --> 00:10:20,000
traveling through interplanetary space

268
00:10:24,310 --> 00:10:22,160
you're basically in the sun's domain the

269
00:10:26,230 --> 00:10:24,320
sun fills interplanetary space with

270
00:10:29,750 --> 00:10:26,240
charged particles we call them the solar

271
00:10:32,389 --> 00:10:29,760
wind it's blowing through space

272
00:10:36,230 --> 00:10:32,399
that solar wind these charged particles

273
00:10:38,630 --> 00:10:36,240
ions and electrons and protons um

274
00:10:40,710 --> 00:10:38,640
they basically would bang into earth but

275
00:10:43,110 --> 00:10:40,720
the earth has a protective shield called

276
00:10:43,829 --> 00:10:43,120
a magnetosphere a magnetic field around

277
00:10:53,110 --> 00:10:43,839
it

278
00:10:55,430 --> 00:10:53,120
domain

279
00:10:57,910 --> 00:10:55,440
and then inside that balloon if you can

280
00:10:59,509 --> 00:10:57,920
think of it another balloon exists which

281
00:11:01,430 --> 00:10:59,519
is the earth's balloon and it's

282
00:11:03,910 --> 00:11:01,440
protected and inside that

283
00:11:06,150 --> 00:11:03,920
behind that shield is the earth's domain

284
00:11:08,790 --> 00:11:06,160
our charge particles

285
00:11:10,389 --> 00:11:08,800
well jupiter has its own magnetosphere

286
00:11:12,230 --> 00:11:10,399
and in fact it's

287
00:11:13,509 --> 00:11:12,240
like everything else with jupiter it's

288
00:11:18,870 --> 00:11:13,519

the biggest

289
00:11:20,870 --> 00:11:18,880
solar system is jupiter's magnetosphere

290
00:11:22,630 --> 00:11:20,880
if you could see it it would look like

291
00:11:24,230 --> 00:11:22,640
the size of the moon

292
00:11:27,190 --> 00:11:24,240
but of course it's an invisible force

293
00:11:29,590 --> 00:11:27,200
field but inside that magnetosphere

294
00:11:32,470 --> 00:11:29,600
is jupiter's domain

295
00:11:35,110 --> 00:11:32,480
that's filled with its particles it's

296
00:11:37,190 --> 00:11:35,120
blocked out the sun's particles so when

297
00:11:39,590 --> 00:11:37,200
you get close enough to jupiter you move

298
00:11:42,389 --> 00:11:39,600
a transition from

299
00:11:43,430 --> 00:11:42,399
being an interplanetary space the sun's

300
00:11:47,190 --> 00:11:43,440
domain

301
00:11:49,590 --> 00:11:47,200
means you're getting pretty close

302
00:11:51,030 --> 00:11:49,600
well we crossed that boundary

303
00:11:53,110 --> 00:11:51,040
about a week ago

304
00:11:54,870 --> 00:11:53,120
last friday or so

305
00:11:56,550 --> 00:11:54,880
and the science team spent some time

306
00:11:59,430 --> 00:11:56,560
arguing which day it was because it

307
00:12:01,430 --> 00:11:59,440
wasn't wasn't completely clear

308
00:12:03,110 --> 00:12:01,440
but we came to a conclusion that we

309
00:12:04,710 --> 00:12:03,120
think it happened last week and i have

310
00:12:06,629 --> 00:12:04,720
that data to show to you what you're

311
00:12:08,710 --> 00:12:06,639
going to see is something we call a

312
00:12:10,870 --> 00:12:08,720
spectrogram which is a little bit

313
00:12:13,590 --> 00:12:10,880

complicated it shows frequency and time

314
00:12:15,590 --> 00:12:13,600
and the colors represent uh intensity of

315
00:12:18,150 --> 00:12:15,600
the waves it's from our waves instrument

316
00:12:20,310 --> 00:12:18,160
so it's looking at plasma wave data

317
00:12:21,350 --> 00:12:20,320
but the unique thing about that data is

318
00:12:23,190 --> 00:12:21,360
that data

319
00:12:25,110 --> 00:12:23,200
can be converted

320
00:12:27,190 --> 00:12:25,120
into audio

321
00:12:29,430 --> 00:12:27,200
in other words it's coming into a radio

322
00:12:30,949 --> 00:12:29,440
frequency but we can hear

323
00:12:33,350 --> 00:12:30,959
some of those radio frequencies just

324
00:12:35,430 --> 00:12:33,360
like you hear music so the human here

325
00:12:36,870 --> 00:12:35,440
can hear about 20 to 20 000 hertz like

326
00:12:38,550 --> 00:12:36,880
i'm measuring we're measuring

327
00:12:41,190 --> 00:12:38,560
electromagnetic waves that are in that

328
00:12:43,030 --> 00:12:41,200
range so we can convert those into audio

329
00:12:45,910 --> 00:12:43,040
and we can actually listen

330
00:12:47,910 --> 00:12:45,920
to what it's like to to leave the sun

331
00:12:48,949 --> 00:12:47,920
and enter jupiter and that's what you're

332
00:13:08,790 --> 00:12:48,959
going to hear

333
00:13:14,629 --> 00:13:10,629
just the sound of it can tell you it's

334
00:13:18,550 --> 00:13:15,910
and

335
00:13:20,790 --> 00:13:18,560
so what you just crossed was what

336
00:13:22,550 --> 00:13:20,800
scientists call a bow shock it's the

337
00:13:24,310 --> 00:13:22,560
same kind of thing that you hear about

338
00:13:26,629 --> 00:13:24,320

if you're on a you know listening about

339
00:13:29,110 --> 00:13:26,639
how a supersonic jet works right it

340
00:13:31,750 --> 00:13:29,120
flies through the fluid or the air and

341
00:13:33,910 --> 00:13:31,760
makes a shock in front a shock wave

342
00:13:36,470 --> 00:13:33,920
a boat going through the ocean creates a

343
00:13:37,829 --> 00:13:36,480
bow right shock a wave in front of that

344
00:13:40,069 --> 00:13:37,839
that's what jupiter is doing it's

345
00:13:42,629 --> 00:13:40,079
plowing through the sun's domain and

346
00:13:44,069 --> 00:13:42,639
it's created this bow shock and we just

347
00:13:45,750 --> 00:13:44,079
crossed it

348
00:13:48,389 --> 00:13:45,760
so we're there

349
00:13:50,790 --> 00:13:48,399
we still got a lot to do on july 4th and

350
00:13:52,949 --> 00:13:50,800
i'm still nervous but

351
00:13:55,030 --> 00:13:52,959
we crossed it we're we're in jupiter's

352
00:13:57,750 --> 00:13:55,040
domain at this point and we're measuring

353
00:14:01,269 --> 00:13:57,760
the particles that are jupiter

354
00:14:02,550 --> 00:14:01,279
not the sun so that was a big deal

355
00:14:04,550 --> 00:14:02,560
so

356
00:14:07,269 --> 00:14:04,560
juno does other kinds of science i mean

357
00:14:09,110 --> 00:14:07,279
besides the recipe and this magnesium

358
00:14:10,629 --> 00:14:09,120
this magnesium crossing we're going to

359
00:14:11,670 --> 00:14:10,639
look at the whole polar magnetosphere

360
00:14:12,629 --> 00:14:11,680
and you're going to hear that in a

361
00:14:15,030 --> 00:14:12,639
little bit

362
00:14:17,509 --> 00:14:15,040
but a lot of what juno is about is

363
00:14:20,150 --> 00:14:17,519

looking inside of jupiter seeing what is

364
00:14:22,470 --> 00:14:20,160
in the interior and we basically have

365
00:14:25,910 --> 00:14:22,480
scientific instruments that look inside

366
00:14:27,030 --> 00:14:25,920
the planet in every way we know how

367
00:14:28,629 --> 00:14:27,040
and that's what you're going to hear in

368
00:14:31,350 --> 00:14:28,639
the next couple of talks is different

369
00:14:33,509 --> 00:14:31,360
ways to look inside of jupiter

370
00:14:35,269 --> 00:14:33,519
beneath those beautiful clouds and

371
00:14:37,829 --> 00:14:35,279
meteorological features like the great

372
00:14:40,150 --> 00:14:37,839
red spot and the zones and belts and

373
00:14:41,829 --> 00:14:40,160
then eventually how we explore the polar

374
00:14:43,750 --> 00:14:41,839
magnetosphere

375
00:14:45,829 --> 00:14:43,760
okay and so for that first part i'm

376
00:14:47,990 --> 00:14:45,839
going to turn to steve levin

377
00:14:48,870 --> 00:14:48,000
good friend of ours

378
00:14:50,710 --> 00:14:48,880
hi

379
00:14:52,710 --> 00:14:50,720
so i'm going to tell you a little bit

380
00:14:54,949 --> 00:14:52,720
about the microwave radiometer

381
00:14:56,710 --> 00:14:54,959
instrument and how we measure what's

382
00:14:58,710 --> 00:14:56,720
probably the single most important

383
00:14:59,990 --> 00:14:58,720
number that juno is going to bring back

384
00:15:02,470 --> 00:15:00,000
from jupiter

385
00:15:03,269 --> 00:15:02,480
and that's how much water does jupiter

386
00:15:05,590 --> 00:15:03,279
have

387
00:15:08,150 --> 00:15:05,600
the amount of water inside jupiter is

388
00:15:09,990 --> 00:15:08,160

crucial to understanding how the solar

389
00:15:12,310 --> 00:15:10,000
system formed because it's crucial to

390
00:15:14,949 --> 00:15:12,320
understanding how did jupiter formed if

391
00:15:17,750 --> 00:15:14,959
jupiter formed far from the sun where

392
00:15:19,910 --> 00:15:17,760
it's cold out of blocks of ice frozen

393
00:15:21,350 --> 00:15:19,920
water at that great distance you'll get

394
00:15:23,269 --> 00:15:21,360
a different amount of water inside

395
00:15:25,670 --> 00:15:23,279
jupiter than if it formed closer to the

396
00:15:27,670 --> 00:15:25,680
sun where it is now or if it forms some

397
00:15:30,069 --> 00:15:27,680
other way than from starting with with

398
00:15:32,389 --> 00:15:30,079
blocks of ice so just by measuring that

399
00:15:34,710 --> 00:15:32,399
one number the amount of water inside

400
00:15:37,269 --> 00:15:34,720
jupiter we can learn a lot about how

401
00:15:38,870 --> 00:15:37,279
jupiter formed and that teaches us not

402
00:15:41,189 --> 00:15:38,880
just about jupiter but about the whole

403
00:15:44,069 --> 00:15:41,199
solar system about how solar systems

404
00:15:45,829 --> 00:15:44,079
form because jupiter formed sort of out

405
00:15:47,350 --> 00:15:45,839
of the leftovers from the sun and the

406
00:15:49,430 --> 00:15:47,360
rest of the planets formed out of the

407
00:15:51,350 --> 00:15:49,440
leftovers from jupiter

408
00:15:52,870 --> 00:15:51,360
all right so how are we going to do that

409
00:15:54,949 --> 00:15:52,880
we're going to measure that with the

410
00:15:57,030 --> 00:15:54,959
microwave radiometer

411
00:15:59,350 --> 00:15:57,040
and i'll show you in just a moment what

412
00:16:01,670 --> 00:15:59,360
the microwave radiometer looks like but

413
00:16:04,389 --> 00:16:01,680

it's a radio receiver that uses the

414
00:16:06,949 --> 00:16:04,399
natural radio emission from jupiter to

415
00:16:09,430 --> 00:16:06,959
look at six different channels that can

416
00:16:11,430 --> 00:16:09,440
see inside jupiter and get the water so

417
00:16:13,749 --> 00:16:11,440
if we go to that little animation you

418
00:16:16,389 --> 00:16:13,759
can see the antennas on the spacecraft

419
00:16:18,389 --> 00:16:16,399
and the largest microwave antenna for

420
00:16:20,790 --> 00:16:18,399
that radiometer is so big it fills up a

421
00:16:23,350 --> 00:16:20,800
whole side of the spacecraft the other

422
00:16:25,749 --> 00:16:23,360
five take up another side of the

423
00:16:27,590 --> 00:16:25,759
spacecraft in fact the overall

424
00:16:29,269 --> 00:16:27,600
dimensions of our spacecraft were partly

425
00:16:30,790 --> 00:16:29,279
determined by making it big enough to

426
00:16:32,310 --> 00:16:30,800
hold those antennas

427
00:16:34,470 --> 00:16:32,320
they're really important to us because

428
00:16:36,150 --> 00:16:34,480
they're going to get this key number

429
00:16:38,230 --> 00:16:36,160
and the way we're going to do that is

430
00:16:40,870 --> 00:16:38,240
the fact that each of those channels can

431
00:16:43,990 --> 00:16:40,880
see a different depth into jupiter so if

432
00:16:47,350 --> 00:16:44,000
you go to that next slide

433
00:16:49,670 --> 00:16:47,360
just to show each different channel sees

434
00:16:51,269 --> 00:16:49,680
below the water cloud or up to the water

435
00:16:52,550 --> 00:16:51,279
cloud sees deep into jupiter's

436
00:16:55,350 --> 00:16:52,560
atmosphere

437
00:16:57,509 --> 00:16:55,360
and how deep they can see depends on how

438
00:16:59,509 --> 00:16:57,519

much water is in the atmosphere

439
00:17:01,269 --> 00:16:59,519
what they see depends on the temperature

440
00:17:03,350 --> 00:17:01,279
of jupiter's atmosphere as you go down

441
00:17:05,189 --> 00:17:03,360
as it gets warmer and that also depends

442
00:17:07,110 --> 00:17:05,199
on how much water is in jupiter's

443
00:17:09,429 --> 00:17:07,120
atmosphere so we can take the

444
00:17:11,189 --> 00:17:09,439
measurements from the micro radiometer

445
00:17:13,429 --> 00:17:11,199
and use that to figure out how much

446
00:17:15,750 --> 00:17:13,439
water is jupiter hold which tells us

447
00:17:18,390 --> 00:17:15,760
about how did jupiter form

448
00:17:20,309 --> 00:17:18,400
if you go to the last picture i had

449
00:17:23,029 --> 00:17:20,319
you can see that we also because as the

450
00:17:25,510 --> 00:17:23,039
spacecraft comes by and it's rotating

451
00:17:27,829 --> 00:17:25,520
because we can see each point on the

452
00:17:30,070 --> 00:17:27,839
planet from a range of different angles

453
00:17:31,990 --> 00:17:30,080
we can do something like a cat scan and

454
00:17:33,909 --> 00:17:32,000
get a three-dimensional picture of

455
00:17:35,430 --> 00:17:33,919
jupiter's atmosphere so we're seeing

456
00:17:37,350 --> 00:17:35,440
each of the six channels at different

457
00:17:39,750 --> 00:17:37,360
depths and we're seeing with each of the

458
00:17:41,669 --> 00:17:39,760
six channels at a whole range of angles

459
00:17:44,470 --> 00:17:41,679
the result is we get a three-dimensional

460
00:17:46,390 --> 00:17:44,480
picture of jupiter's atmosphere to

461
00:17:48,230 --> 00:17:46,400
measure not just the water but to see

462
00:17:50,070 --> 00:17:48,240
these amazing features like the great

463
00:17:51,990 --> 00:17:50,080

red spot a storm bigger than the whole

464
00:17:53,830 --> 00:17:52,000
earth or those belts and zones jet

465
00:17:56,870 --> 00:17:53,840
streams moving at hundreds of miles an

466
00:17:58,789 --> 00:17:56,880
hour we get to see those in 3d with the

467
00:18:01,190 --> 00:17:58,799
radio receiver instead of just that

468
00:18:02,630 --> 00:18:01,200
two-dimensional picture that you can see

469
00:18:04,390 --> 00:18:02,640
on the screen

470
00:18:06,470 --> 00:18:04,400
all right so to talk a little bit more

471
00:18:08,150 --> 00:18:06,480
about how we can see inside jupiter and

472
00:18:12,549 --> 00:18:08,160
go to greater depths i'm going to pass

473
00:18:15,990 --> 00:18:14,390
if we're going to understand

474
00:18:17,990 --> 00:18:16,000
jupiter's interior we're going to have

475
00:18:19,669 --> 00:18:18,000
to look a lot deeper than we can look

476
00:18:22,150 --> 00:18:19,679
with the mwr

477
00:18:24,390 --> 00:18:22,160
and so to do that we have two techniques

478
00:18:27,669 --> 00:18:24,400
we measure the planet's gravitational

479
00:18:29,590 --> 00:18:27,679
field and we measure its magnetic field

480
00:18:32,150 --> 00:18:29,600
the gravitational field we measure just

481
00:18:34,070 --> 00:18:32,160
by looking at the orbit of juno as it

482
00:18:35,590 --> 00:18:34,080
passes over the surface

483
00:18:37,510 --> 00:18:35,600
the magnetic field we measure with a

484
00:18:40,230 --> 00:18:37,520
pair of instruments out at the pointy

485
00:18:42,390 --> 00:18:40,240
end of the solar array

486
00:18:44,789 --> 00:18:42,400
and these two

487
00:18:46,390 --> 00:18:44,799
two methods will probe the deep interior

488
00:18:47,350 --> 00:18:46,400

of the planet

489
00:18:50,390 --> 00:18:47,360
and

490
00:18:53,350 --> 00:18:50,400
oddly enough jupiter's interior is

491
00:18:55,669 --> 00:18:53,360
quite a mystery to us and that's ironic

492
00:18:56,870 --> 00:18:55,679
because it's made up of the two simplest

493
00:18:59,270 --> 00:18:56,880
and most

494
00:19:02,150 --> 00:18:59,280
abundant elements in the universe that's

495
00:19:03,830 --> 00:19:02,160
hydrogen and helium

496
00:19:05,750 --> 00:19:03,840
but the problem is it's under such great

497
00:19:08,870 --> 00:19:05,760
pressure in that environment that it

498
00:19:10,870 --> 00:19:08,880
behaves in very mysterious ways

499
00:19:12,789 --> 00:19:10,880
so i can only explain to you what we

500
00:19:15,430 --> 00:19:12,799
think the interior of jupiter looks like

501
00:19:17,350 --> 00:19:15,440
at this time

502
00:19:20,310 --> 00:19:17,360
if we could roll the

503
00:19:22,310 --> 00:19:20,320
animation so beneath the visible cloud

504
00:19:24,870 --> 00:19:22,320
tops that we see there's a layer of

505
00:19:25,830 --> 00:19:24,880
molecular hydrogen that extends to great

506
00:19:27,350 --> 00:19:25,840
depths

507
00:19:30,630 --> 00:19:27,360
and then beneath that

508
00:19:33,270 --> 00:19:30,640
there's a core of metallic

509
00:19:34,310 --> 00:19:33,280
conducting molecular hydrogen what

510
00:19:36,630 --> 00:19:34,320
happens is

511
00:19:38,710 --> 00:19:36,640
the hydrogen atoms are pressed shoulder

512
00:19:40,390 --> 00:19:38,720
to shoulder so closely together

513
00:19:43,110 --> 00:19:40,400

that the electrons that are normally

514
00:19:44,390 --> 00:19:43,120
bound to the molecular hydrogen are free

515
00:19:47,669 --> 00:19:44,400
to roam about

516
00:19:49,270 --> 00:19:47,679
that makes it a good electrical

517
00:19:51,350 --> 00:19:49,280
conductor

518
00:19:54,630 --> 00:19:51,360
and then beneath that layer

519
00:19:57,270 --> 00:19:54,640
we think there may be a dense core of

520
00:19:58,950 --> 00:19:57,280
heavy elements everything heavier than

521
00:20:01,510 --> 00:19:58,960
hydrogen and helium

522
00:20:02,390 --> 00:20:01,520
we don't know that that core is there it

523
00:20:06,549 --> 00:20:02,400
may be

524
00:20:09,029 --> 00:20:06,559
masses and part of this mission is to

525
00:20:10,549 --> 00:20:09,039
design to determine

526
00:20:13,110 --> 00:20:10,559
if there is a core at the center of

527
00:20:14,710 --> 00:20:13,120
jupiter and if that core was possibly

528
00:20:17,029 --> 00:20:14,720
the seed

529
00:20:18,950 --> 00:20:17,039
onto which the atmosphere

530
00:20:23,110 --> 00:20:18,960
collected and made jupiter the largest

531
00:20:26,149 --> 00:20:24,149
so

532
00:20:29,430 --> 00:20:26,159
if i could have the next

533
00:20:31,430 --> 00:20:29,440
shot this is a cross-section a wedge

534
00:20:32,470 --> 00:20:31,440
shape of what we think the interior

535
00:20:34,230 --> 00:20:32,480
looks like

536
00:20:35,590 --> 00:20:34,240
and you see that onion skin on top

537
00:20:37,909 --> 00:20:35,600
that's the visible surface of the

538
00:20:40,070 --> 00:20:37,919

atmosphere that we're familiar with

539
00:20:42,870 --> 00:20:40,080
and if you take a little chunk out of

540
00:20:44,630 --> 00:20:42,880
the top most piece that gives you the

541
00:20:47,029 --> 00:20:44,640
the wedge to the right

542
00:20:50,149 --> 00:20:47,039
and that's the the region at top that

543
00:20:51,830 --> 00:20:50,159
the mwr can probe that's the convective

544
00:20:54,070 --> 00:20:51,840
region of the atmosphere it goes down to

545
00:20:56,310 --> 00:20:54,080
about a thousand bars

546
00:20:57,110 --> 00:20:56,320
with the magnetic field we can penetrate

547
00:20:59,110 --> 00:20:57,120
deep

548
00:21:00,070 --> 00:20:59,120
below that surface

549
00:21:01,830 --> 00:21:00,080
this

550
00:21:03,669 --> 00:21:01,840
cutaway illustrates the metallic

551
00:21:05,909 --> 00:21:03,679
hydrogen the blue region

552
00:21:06,870 --> 00:21:05,919
which is a good electrical conductor

553
00:21:09,270 --> 00:21:06,880
in that

554
00:21:11,430 --> 00:21:09,280
that region around jupiter that scott

555
00:21:13,510 --> 00:21:11,440
bolton just talked about that is defined

556
00:21:16,390 --> 00:21:13,520
by jupiter's magnetic field

557
00:21:17,110 --> 00:21:16,400
that's generated by a dynamo that may

558
00:21:19,190 --> 00:21:17,120
be

559
00:21:21,909 --> 00:21:19,200
at the top of that metallic hydrogen

560
00:21:24,390 --> 00:21:21,919
region we don't know for sure it may be

561
00:21:25,590 --> 00:21:24,400
in the molecular uh hydrogen region

562
00:21:27,669 --> 00:21:25,600
above

563
00:21:29,909 --> 00:21:27,679

but it generates a magnetic field that's

564
00:21:32,070 --> 00:21:29,919
twenty thousand times more powerful than

565
00:21:34,870 --> 00:21:32,080
the earth's magnetic field and that is

566
00:21:37,190 --> 00:21:34,880
what gives jupiter control over its own

567
00:21:37,990 --> 00:21:37,200
domain

568
00:21:40,710 --> 00:21:38,000
so

569
00:21:43,270 --> 00:21:40,720
in order to determine where the dynamo

570
00:21:45,909 --> 00:21:43,280
is generated we have to make a series of

571
00:21:47,750 --> 00:21:45,919
very accurate observations totally

572
00:21:49,750 --> 00:21:47,760
enveloping the planet

573
00:21:51,270 --> 00:21:49,760
and so to do that we've designed a

574
00:21:54,470 --> 00:21:51,280
mission plan

575
00:21:56,230 --> 00:21:54,480
that takes jupiter in its science orbits

576
00:21:58,310 --> 00:21:56,240
very close to the surface that takes

577
00:21:59,510 --> 00:21:58,320
juno sorry very close to the surface of

578
00:22:02,070 --> 00:21:59,520
jupiter

579
00:22:03,029 --> 00:22:02,080
in its 14 day orbits and if i could show

580
00:22:04,549 --> 00:22:03,039
that

581
00:22:06,789 --> 00:22:04,559
orbit clip

582
00:22:09,830 --> 00:22:06,799
this shows you juno in its elliptical

583
00:22:12,390 --> 00:22:09,840
orbit racing over the surface of jupiter

584
00:22:14,549 --> 00:22:12,400
at its closest approach and at the end

585
00:22:19,830 --> 00:22:14,559
of its 14-day orbit they're for the most

586
00:22:25,590 --> 00:22:23,029
jupiter rotates every 10 hours roughly

587
00:22:28,630 --> 00:22:25,600
and so we phase these orbits

588
00:22:31,750 --> 00:22:28,640

specifically so that we combine the the

589
00:22:34,149 --> 00:22:31,760
surface we probe different longitudes

590
00:22:35,830 --> 00:22:34,159
and we space them out very carefully so

591
00:22:38,230 --> 00:22:35,840
that by the time we're done

592
00:22:40,870 --> 00:22:38,240
we've enveloped a jupiter in a dense net

593
00:22:42,870 --> 00:22:40,880
of observations that we need

594
00:22:44,549 --> 00:22:42,880
to characterize the magnetic field with

595
00:22:46,950 --> 00:22:44,559
the kind of resolution

596
00:22:48,870 --> 00:22:46,960
that we are searching for here

597
00:22:50,789 --> 00:22:48,880
so i can have the next animation i'll

598
00:22:54,070 --> 00:22:50,799
show you how that works

599
00:22:55,029 --> 00:22:54,080
uh after a few orbits to set up this

600
00:22:56,310 --> 00:22:55,039
mapping

601
00:22:58,549 --> 00:22:56,320
plan

602
00:23:00,630 --> 00:22:58,559
the subsequent orbits come down

603
00:23:03,350 --> 00:23:00,640
separated by about 90 degrees and you

604
00:23:07,110 --> 00:23:03,360
see juno traveling from north to south

605
00:23:09,110 --> 00:23:07,120
from pole to pole with every orbit

606
00:23:11,350 --> 00:23:09,120
we do a slight uh

607
00:23:13,830 --> 00:23:11,360
orbital trim maneuver and we phase these

608
00:23:16,630 --> 00:23:13,840
so that subsequent orbits periapsis

609
00:23:19,110 --> 00:23:16,640
passes come in in between previous

610
00:23:21,510 --> 00:23:19,120
periapsis passes so by the time we're

611
00:23:22,710 --> 00:23:21,520
done with the nominal mission over 37

612
00:23:25,350 --> 00:23:22,720
orbits

613
00:23:27,830 --> 00:23:25,360

we have periapsis passes separated into

614
00:23:30,630 --> 00:23:27,840
longitude by about 12 degrees and that

615
00:23:32,470 --> 00:23:30,640
gives us a complete map

616
00:23:34,870 --> 00:23:32,480
completely encircling the planet and

617
00:23:38,310 --> 00:23:34,880
these very accurate measurements we need

618
00:23:40,470 --> 00:23:38,320
to probe really for the first time how a

619
00:23:43,669 --> 00:23:40,480
magnetic field is generated by a dynamo

620
00:23:45,190 --> 00:23:43,679
what it looks like at the dynamo surface

621
00:23:47,430 --> 00:23:45,200
so that's probably the most exciting

622
00:23:49,909 --> 00:23:47,440
part of the of the mission for me

623
00:23:52,549 --> 00:23:49,919
we can do this at jupiter

624
00:23:54,470 --> 00:23:52,559
much more accurately and with much more

625
00:23:56,070 --> 00:23:54,480
resolution than we could ever do it in

626
00:23:58,230 --> 00:23:56,080
orbit about the earth

627
00:24:00,549 --> 00:23:58,240
and that's because jupiter's dynamo is

628
00:24:02,549 --> 00:24:00,559
generated at a larger radius relative to

629
00:24:04,470 --> 00:24:02,559
the surface of the planet so we have

630
00:24:06,950 --> 00:24:04,480
better signal to work with

631
00:24:09,430 --> 00:24:06,960
and it's also because on earth when we

632
00:24:11,669 --> 00:24:09,440
try to image the dynamo we have to look

633
00:24:12,950 --> 00:24:11,679
through a magnetized crust right beneath

634
00:24:14,950 --> 00:24:12,960
our feet

635
00:24:17,029 --> 00:24:14,960
the jupiter doesn't have that magnetized

636
00:24:19,909 --> 00:24:17,039
crust and so there's nothing to obscure

637
00:24:20,630 --> 00:24:19,919
our view of dynamo action right down in

638
00:24:23,029 --> 00:24:20,640

the

639
00:24:25,110 --> 00:24:23,039
generated

640
00:24:27,269 --> 00:24:25,120
so that's a very very exciting

641
00:24:29,430 --> 00:24:27,279
opportunity that we have

642
00:24:30,470 --> 00:24:29,440
in exploration of jupiter that we could

643
00:24:33,350 --> 00:24:30,480
never do

644
00:24:34,310 --> 00:24:33,360
in orbit about the earth

645
00:24:36,310 --> 00:24:34,320
but this

646
00:24:38,630 --> 00:24:36,320
mission plan and this trajectory that's

647
00:24:41,269 --> 00:24:38,640
designed to go from north to south

648
00:24:43,110 --> 00:24:41,279
brings us for the first time

649
00:24:45,350 --> 00:24:43,120
above the poles of jupiter into an

650
00:24:47,750 --> 00:24:45,360
entirely unexplored region

651
00:24:48,870 --> 00:24:47,760
of jupiter's magnetosphere where i'm

652
00:24:50,950 --> 00:24:48,880
sure very

653
00:24:53,830 --> 00:24:50,960
many discoveries await us

654
00:24:55,590 --> 00:24:53,840
and so to talk about those discoveries

655
00:24:57,750 --> 00:24:55,600
i'm going to hand it off to my good

656
00:24:59,350 --> 00:24:57,760
friend and colleague fran beginner talk

657
00:25:01,110 --> 00:24:59,360
about the aurora

658
00:25:04,470 --> 00:25:01,120
thank you very much jack

659
00:25:07,110 --> 00:25:04,480
so as scott said the sphere of influence

660
00:25:09,510 --> 00:25:07,120
of this very strong magnetic field is

661
00:25:11,990 --> 00:25:09,520
vast it's enormous

662
00:25:14,470 --> 00:25:12,000
and it's sitting in this a wind of

663
00:25:16,710 --> 00:25:14,480

protons and electrons that are streaming

664
00:25:17,669 --> 00:25:16,720
out from the sun at a million miles an

665
00:25:20,230 --> 00:25:17,679
hour

666
00:25:22,789 --> 00:25:20,240
and furthermore as juno has been

667
00:25:23,830 --> 00:25:22,799
observing we know that that wind is

668
00:25:26,470 --> 00:25:23,840
gusty

669
00:25:29,430 --> 00:25:26,480
it's blowing and so this magnetosphere

670
00:25:32,310 --> 00:25:29,440
is changing and moving around as the

671
00:25:34,789 --> 00:25:32,320
gust of the solar wind comes and goes

672
00:25:37,510 --> 00:25:34,799
so we have a very special opportunity

673
00:25:39,990 --> 00:25:37,520
with juno coming in

674
00:25:42,070 --> 00:25:40,000
observing the variable

675
00:25:44,390 --> 00:25:42,080
solar wind and what we want to know is

676
00:25:45,990 --> 00:25:44,400
what influence that has on the magnetic

677
00:25:48,789 --> 00:25:46,000
field and the environment close to

678
00:25:51,110 --> 00:25:48,799
jupiter and the easiest way to do that

679
00:25:53,350 --> 00:25:51,120
is to look at the aurora

680
00:25:55,350 --> 00:25:53,360
at the same time as juno is measuring

681
00:25:57,510 --> 00:25:55,360
the solar wind so let me talk a bit

682
00:26:00,070 --> 00:25:57,520
about the jovian aurora if we could have

683
00:26:02,470 --> 00:26:00,080
the picture here this is a hubble space

684
00:26:05,269 --> 00:26:02,480
telescope picture looking in the uv the

685
00:26:08,310 --> 00:26:05,279
ultraviolet light at these blue they

686
00:26:10,070 --> 00:26:08,320
look blue but it's ultraviolet in fact

687
00:26:12,230 --> 00:26:10,080
these are energetic particles come in

688
00:26:13,750 --> 00:26:12,240

and bombard the atmosphere of jupiter

689
00:26:17,350 --> 00:26:13,760
and make it glow

690
00:26:19,669 --> 00:26:17,360
and you can see three main regions here

691
00:26:22,149 --> 00:26:19,679
you can see a main auroral oval which is

692
00:26:24,230 --> 00:26:22,159
a sort of round region that's very

693
00:26:26,149 --> 00:26:24,240
bright and fairly steady unlike the

694
00:26:28,630 --> 00:26:26,159
earth it doesn't vary very much the

695
00:26:30,230 --> 00:26:28,640
aurora that part of the aurora doesn't

696
00:26:32,870 --> 00:26:30,240
vary very much

697
00:26:35,669 --> 00:26:32,880
we also see some bright spots

698
00:26:37,510 --> 00:26:35,679
eospot the europa spot and the ganymede

699
00:26:39,750 --> 00:26:37,520
footprint these are the footprints of

700
00:26:41,909 --> 00:26:39,760
the magnetic field that go from the

701
00:26:44,549 --> 00:26:41,919
moons that are moving in this magnetic

702
00:26:47,830 --> 00:26:44,559
field there are very strong electrical

703
00:26:49,750 --> 00:26:47,840
currents million amp electrical currents

704
00:26:52,789 --> 00:26:49,760
that are coupling these moons moving

705
00:26:54,549 --> 00:26:52,799
through the magnetic field to the planet

706
00:26:56,310 --> 00:26:54,559
and where the charged particles that are

707
00:26:59,669 --> 00:26:56,320
carrying those currents

708
00:27:01,830 --> 00:26:59,679
hit the atmosphere they make it glow and

709
00:27:05,110 --> 00:27:01,840
so you see these spots associated with

710
00:27:08,149 --> 00:27:05,120
the moons eo europa and ganymede

711
00:27:10,870 --> 00:27:08,159
the third component of the aurora is the

712
00:27:13,029 --> 00:27:10,880
polar aurora and you'll see bright spots

713
00:27:15,590 --> 00:27:13,039

in the center that are varying

714
00:27:17,590 --> 00:27:15,600
now to illustrate all this and to help

715
00:27:19,110 --> 00:27:17,600
us understand the aurora

716
00:27:20,950 --> 00:27:19,120
i'm going to show you an animation

717
00:27:23,990 --> 00:27:20,960
animation in a minute that was taken by

718
00:27:26,389 --> 00:27:24,000
hubble in the past uh month or so

719
00:27:29,510 --> 00:27:26,399
so the hubble pi of this big campaign

720
00:27:31,029 --> 00:27:29,520
hubble's been looking at uh the aurora

721
00:27:32,870 --> 00:27:31,039
in the past three months is here in the

722
00:27:35,750 --> 00:27:32,880
room johnny nichols from the university

723
00:27:38,710 --> 00:27:35,760
of leicester and they've had a about 25

724
00:27:41,669 --> 00:27:38,720
days sorry 25

725
00:27:44,230 --> 00:27:41,679
days of observing many orbits of hubble

726
00:27:47,110 --> 00:27:44,240
looking at the aurora so let's have this

727
00:27:49,669 --> 00:27:47,120
movie uh of the aurora that was taken in

728
00:27:51,909 --> 00:27:49,679
the past month or so and you can see

729
00:27:55,029 --> 00:27:51,919
we're going to repeat it three times

730
00:27:58,389 --> 00:27:55,039
this is a clip that is sped up about

731
00:28:00,710 --> 00:27:58,399
300 times it lasts about 45 minutes and

732
00:28:04,230 --> 00:28:00,720
you can see the main auroral oval you

733
00:28:06,149 --> 00:28:04,240
can see the spot of eo over on the right

734
00:28:08,549 --> 00:28:06,159
and you can see a spot of ganymede there

735
00:28:09,830 --> 00:28:08,559
too but in the middle is this very

736
00:28:12,230 --> 00:28:09,840
variable

737
00:28:14,470 --> 00:28:12,240
uh auroral polar region where it's

738
00:28:16,710 --> 00:28:14,480

coming and going and what we really

739
00:28:18,070 --> 00:28:16,720
don't know is what is controlling that

740
00:28:21,909 --> 00:28:18,080
variability

741
00:28:24,549 --> 00:28:21,919
is it the solar wind varying or is it

742
00:28:27,110 --> 00:28:24,559
the interior of the magnetosphere very

743
00:28:29,510 --> 00:28:27,120
dynamic magnetosphere which swirls

744
00:28:31,669 --> 00:28:29,520
around and changes over time

745
00:28:33,590 --> 00:28:31,679
fueled by material in fact from that

746
00:28:35,510 --> 00:28:33,600
volcanic moon eo

747
00:28:39,990 --> 00:28:35,520
is it an internal effect or is it

748
00:28:42,389 --> 00:28:40,000
external so one way to find out is to

749
00:28:45,029 --> 00:28:42,399
observe the aurora

750
00:28:47,430 --> 00:28:45,039
with hubble and in fact there are many

751
00:28:48,710 --> 00:28:47,440
observatories here at earth either in

752
00:28:50,549 --> 00:28:48,720
orbit around the earth or from the

753
00:28:52,389 --> 00:28:50,559
ground looking at the aurora looking at

754
00:28:55,430 --> 00:28:52,399
jupiter at the same time

755
00:28:57,110 --> 00:28:55,440
that juno will be going into orbit

756
00:28:59,430 --> 00:28:57,120
and so we'll get a measure of the

757
00:29:02,070 --> 00:28:59,440
variability of the solar wind upstream

758
00:29:06,230 --> 00:29:02,080
the variability of the magnesium as we

759
00:29:08,310 --> 00:29:06,240
observe it in situ with uh with juno

760
00:29:09,590 --> 00:29:08,320
as well as looking at the variability of

761
00:29:10,870 --> 00:29:09,600
the emissions

762
00:29:14,549 --> 00:29:10,880
from earth

763
00:29:16,950 --> 00:29:14,559

so um let's have a look at the next uh

764
00:29:19,110 --> 00:29:16,960
picture here this shows you the size of

765
00:29:21,350 --> 00:29:19,120
what we're talking about so if you look

766
00:29:25,110 --> 00:29:21,360
at the earth the size of the aurora

767
00:29:27,350 --> 00:29:25,120
there shown in green uh emission uh the

768
00:29:29,269 --> 00:29:27,360
the earth's atmosphere glowing is about

769
00:29:31,750 --> 00:29:29,279
the size of the united states the sort

770
00:29:34,230 --> 00:29:31,760
of size of the main uh

771
00:29:36,470 --> 00:29:34,240
auroral region on the earth

772
00:29:38,710 --> 00:29:36,480
but when we compare it with the size of

773
00:29:41,190 --> 00:29:38,720
jupiter of course jupiter is about 11

774
00:29:44,230 --> 00:29:41,200
times the size of the earth the aurora

775
00:29:46,470 --> 00:29:44,240
region is about five earths across so

776
00:29:48,950 --> 00:29:46,480
this is a big region

777
00:29:51,110 --> 00:29:48,960
and it is emitting a lot of power about

778
00:29:53,830 --> 00:29:51,120
a hundred times the aurora that comes

779
00:29:55,830 --> 00:29:53,840
from overall power that comes from earth

780
00:29:57,750 --> 00:29:55,840
and it'll be telling us about the

781
00:30:00,230 --> 00:29:57,760
magnetosphere

782
00:30:02,710 --> 00:30:00,240
and in particular if we have the last of

783
00:30:05,350 --> 00:30:02,720
my pictures you'll see here we have this

784
00:30:08,789 --> 00:30:05,360
unique situation with

785
00:30:12,470 --> 00:30:08,799
juno flying over the poles we look down

786
00:30:15,269 --> 00:30:12,480
on the aurora in the uv and the infrared

787
00:30:17,830 --> 00:30:15,279
and in the visible with junocam and then

788
00:30:20,310 --> 00:30:17,840

we will be able to also fly through the

789
00:30:23,750 --> 00:30:20,320
region where the charged particles are

790
00:30:25,430 --> 00:30:23,760
coming in and bombarding the atmosphere

791
00:30:28,310 --> 00:30:25,440
and so we'll be able to measure the

792
00:30:31,029 --> 00:30:28,320
acceleration processes that cause these

793
00:30:33,430 --> 00:30:31,039
auroral uh effects these emissions and

794
00:30:36,710 --> 00:30:33,440
at the same time we'll be measuring uh

795
00:30:38,789 --> 00:30:36,720
plasma waves and the perturbations in

796
00:30:41,990 --> 00:30:38,799
the magnetic field associated with those

797
00:30:44,389 --> 00:30:42,000
currents and the radio waves that come

798
00:30:47,590 --> 00:30:44,399
that we've known for many decades that

799
00:30:50,470 --> 00:30:47,600
come associated with the aurora missions

800
00:30:53,110 --> 00:30:50,480
so this is a very unique opportunity to

801
00:30:55,430 --> 00:30:53,120
be looking at this very interesting

802
00:30:57,190 --> 00:30:55,440
phenomena very bizarre

803
00:30:59,190 --> 00:30:57,200
glowing and flickering and so on

804
00:31:00,870 --> 00:30:59,200
associated with the aurora

805
00:31:03,750 --> 00:31:00,880
but we've never been able to get up

806
00:31:06,149 --> 00:31:03,760
close and really observe these processes

807
00:31:08,870 --> 00:31:06,159
so we can then compare them with what we

808
00:31:11,350 --> 00:31:08,880
see at earth what we see at saturn

809
00:31:13,830 --> 00:31:11,360
are the physical processes just similar

810
00:31:15,990 --> 00:31:13,840
but we have a stronger field at jupiter

811
00:31:18,230 --> 00:31:16,000
or do we have to really go back to the

812
00:31:20,389 --> 00:31:18,240
fundamental physics and work out what's

813
00:31:22,310 --> 00:31:20,399

really going on here so we're really

814
00:31:25,350 --> 00:31:22,320
looking forward to a very exciting

815
00:31:27,430 --> 00:31:25,360
opportunity to look at the aurora

816
00:31:28,950 --> 00:31:27,440
in many different ways and different

817
00:31:31,110 --> 00:31:28,960
aspects

818
00:31:32,389 --> 00:31:31,120
so i'll hand this back to scott thanks

819
00:31:34,950 --> 00:31:32,399
fran

820
00:31:37,669 --> 00:31:34,960
so uh you can tell we're all really

821
00:31:39,350 --> 00:31:37,679
excited the whole team is so thrilled

822
00:31:41,669 --> 00:31:39,360
we're we're

823
00:31:43,350 --> 00:31:41,679
really getting there and we're so close

824
00:31:45,350 --> 00:31:43,360
to jupiter

825
00:31:47,269 --> 00:31:45,360
we have a big event on july 4th as you

826
00:31:49,830 --> 00:31:47,279
know to go into orbit

827
00:31:50,789 --> 00:31:49,840
it's uh really important to us

828
00:31:52,870 --> 00:31:50,799
and

829
00:31:54,230 --> 00:31:52,880
we're about to jump on that that jupiter

830
00:31:56,950 --> 00:31:54,240
train

831
00:31:59,190 --> 00:31:56,960
so we also have a camera

832
00:32:01,830 --> 00:31:59,200
that's called junocam and it's a public

833
00:32:03,669 --> 00:32:01,840
outreach camera and we

834
00:32:05,509 --> 00:32:03,679
make those images and even the data

835
00:32:06,950 --> 00:32:05,519
available uh to the public through our

836
00:32:08,950 --> 00:32:06,960
websites

837
00:32:10,389 --> 00:32:08,960
and i want to show you uh another

838
00:32:13,269 --> 00:32:10,399

picture that we're

839
00:32:14,549 --> 00:32:13,279
releasing today um from junocam can i

840
00:32:16,549 --> 00:32:14,559
get that

841
00:32:19,990 --> 00:32:16,559
picture so this picture was taken a

842
00:32:22,230 --> 00:32:20,000
couple days ago of jupiter

843
00:32:24,230 --> 00:32:22,240
some of the unique or exciting ideas is

844
00:32:26,710 --> 00:32:24,240
that you're not only can you start to

845
00:32:28,149 --> 00:32:26,720
see the the colors and the zones and

846
00:32:30,630 --> 00:32:28,159
belts of jupiter but you can actually

847
00:32:33,269 --> 00:32:30,640
see the red spot in this image and you

848
00:32:36,870 --> 00:32:33,279
see three of the galilean moons

849
00:32:38,870 --> 00:32:36,880
the lower one um is europa it's actually

850
00:32:41,350 --> 00:32:38,880
the second moon the one just above that

851
00:32:43,110 --> 00:32:41,360
is io and that's the closest galleon

852
00:32:44,789 --> 00:32:43,120
moon that's the most volcanic body in

853
00:32:46,710 --> 00:32:44,799
the solar system

854
00:32:48,710 --> 00:32:46,720
and then the furthest out one is

855
00:32:49,990 --> 00:32:48,720
ganymede and those

856
00:32:51,430 --> 00:32:50,000
bodies

857
00:32:53,110 --> 00:32:51,440
are those are the satellites moving

858
00:32:55,110 --> 00:32:53,120
around jupiter those are three of the

859
00:32:57,590 --> 00:32:55,120
four galilean satellites and in the

860
00:32:59,430 --> 00:32:57,600
auroral pictures that you saw

861
00:33:01,590 --> 00:32:59,440
that fran just showed

862
00:33:04,389 --> 00:33:01,600
the footprints of those are in the

863
00:33:06,310 --> 00:33:04,399

aurora so there's an umbilical cord

864
00:33:07,190 --> 00:33:06,320
through the magnetic field that's tying

865
00:33:08,389 --> 00:33:07,200
those

866
00:33:09,750 --> 00:33:08,399
moons

867
00:33:11,909 --> 00:33:09,760
into jupiter

868
00:33:13,350 --> 00:33:11,919
and they're sending particles back and

869
00:33:16,230 --> 00:33:13,360
forth and when the particles from those

870
00:33:17,909 --> 00:33:16,240
moons go into jupiter they light up

871
00:33:19,269 --> 00:33:17,919
and that's kind of cool

872
00:33:20,870 --> 00:33:19,279
so

873
00:33:22,389 --> 00:33:20,880
uh

874
00:33:24,389 --> 00:33:22,399
i hope you all join us we're getting

875
00:33:26,149 --> 00:33:24,399
really close

876
00:33:27,750 --> 00:33:26,159
we're really excited

877
00:33:29,269 --> 00:33:27,760
we want to invite everybody along for

878
00:33:31,909 --> 00:33:29,279
the ride

879
00:33:33,590 --> 00:33:31,919
come see us on july 4th

880
00:33:35,590 --> 00:33:33,600
thank you

881
00:33:37,509 --> 00:33:35,600
back to udc

882
00:33:40,230 --> 00:33:37,519
thank you scott so we're going to open

883
00:33:42,070 --> 00:33:40,240
it up to the floor here at jpl for any

884
00:33:44,149 --> 00:33:42,080
questions from the media

885
00:33:47,029 --> 00:33:44,159
if you have a question

886
00:33:50,630 --> 00:33:49,029
emily over there and please wait for the

887
00:33:53,430 --> 00:33:50,640
microphone please state your name in

888
00:33:55,190 --> 00:33:53,440

media affiliation hi uh emily lochtala

889
00:33:56,789 --> 00:33:55,200
the planetary society i think this is

890
00:33:58,389 --> 00:33:56,799
for steve it's a question about the

891
00:33:59,590 --> 00:33:58,399
hydrogen that you're looking for in

892
00:34:01,029 --> 00:33:59,600
jupiter

893
00:34:02,630 --> 00:34:01,039
how do you know that the water that

894
00:34:04,789 --> 00:34:02,640
you're going to be measuring there is

895
00:34:06,630 --> 00:34:04,799
primordial water that is not kind of

896
00:34:08,149 --> 00:34:06,640
exchanged with the supply of molecular

897
00:34:09,909 --> 00:34:08,159
hydrogen in jupiter how do you tell the

898
00:34:12,950 --> 00:34:09,919
difference between those two okay so

899
00:34:16,310 --> 00:34:12,960
remember uh it's really the oxygen that

900
00:34:19,829 --> 00:34:16,320
we're we're after right water is h2o

901
00:34:22,149 --> 00:34:19,839
jupiter is mostly hydrogen the next most

902
00:34:23,510 --> 00:34:22,159
abundant element is helium but the third

903
00:34:26,470 --> 00:34:23,520
most abundant element in the solar

904
00:34:28,389 --> 00:34:26,480
system is oxygen and yet so far we

905
00:34:30,149 --> 00:34:28,399
haven't found very much oxygen in

906
00:34:31,190 --> 00:34:30,159
jupiter so we're looking for water

907
00:34:33,510 --> 00:34:31,200
because

908
00:34:35,669 --> 00:34:33,520
that's the form in which oxygen will be

909
00:34:36,550 --> 00:34:35,679
found but it's it's the oxygen we're

910
00:34:39,909 --> 00:34:36,560
after

911
00:34:43,109 --> 00:34:39,919
and it's got to be primordial because

912
00:34:45,030 --> 00:34:43,119
you can't really affect jupiter with

913
00:34:47,349 --> 00:34:45,040

small things if you know a few years

914
00:34:49,030 --> 00:34:47,359
back when a comet hit jupiter the mass

915
00:34:51,349 --> 00:34:49,040
of that compared to the size of jupiter

916
00:34:53,349 --> 00:34:51,359
is very small so the amount of water we

917
00:34:54,869 --> 00:34:53,359
find in jupiter should be representative

918
00:34:57,430 --> 00:34:54,879
of the water that got there when the

919
00:34:58,550 --> 00:34:57,440
planet formed in its early history

920
00:35:00,950 --> 00:34:58,560
does that answer what you were asking

921
00:35:04,069 --> 00:35:02,710
great thank you uh the gentleman in the

922
00:35:05,990 --> 00:35:04,079
back row there please state your name

923
00:35:07,990 --> 00:35:06,000
and media affiliation

924
00:35:11,109 --> 00:35:08,000
hi i'm devin coldway with techcrunch um

925
00:35:13,030 --> 00:35:11,119
i was curious um steve you mentioned the

926
00:35:14,870 --> 00:35:13,040
magnetic field being about 20 000 times

927
00:35:17,109 --> 00:35:14,880
stronger than the earth's i'm curious

928
00:35:19,910 --> 00:35:17,119
about the scales of other major

929
00:35:21,190 --> 00:35:19,920
deviations uh like the the

930
00:35:23,910 --> 00:35:21,200
scale of the pressure that would be

931
00:35:25,589 --> 00:35:23,920
needed to create metallic hydrogen uh

932
00:35:27,510 --> 00:35:25,599
radiation and stuff like that i'm just

933
00:35:30,470 --> 00:35:27,520
curious about the the other sort of huge

934
00:35:31,510 --> 00:35:30,480
magnitude uh factors in jupiter and

935
00:35:32,950 --> 00:35:31,520
whether we're going to find out much

936
00:35:35,270 --> 00:35:32,960
more about those

937
00:35:37,270 --> 00:35:35,280
so it's actually jack who mentioned

938
00:35:39,349 --> 00:35:37,280

the magnetic field and he's our magnetic

939
00:35:40,630 --> 00:35:39,359
field expert as well so i'm going to let

940
00:35:43,349 --> 00:35:40,640
him answer

941
00:35:45,589 --> 00:35:43,359
okay thanks steve

942
00:35:47,829 --> 00:35:45,599
so the dynamo generates this magnetic

943
00:35:49,430 --> 00:35:47,839
field it needs a lot of uh energy a lot

944
00:35:51,510 --> 00:35:49,440
of power to do it

945
00:35:53,589 --> 00:35:51,520
uh but you have to have a conductive

946
00:35:55,510 --> 00:35:53,599
fluid and it has to be in some kind of a

947
00:35:56,790 --> 00:35:55,520
convective motion that drags the

948
00:35:59,190 --> 00:35:56,800
magnetic field

949
00:36:01,270 --> 00:35:59,200
around with the fluid and manages to

950
00:36:02,390 --> 00:36:01,280
sustain a dynamo just like the earth's

951
00:36:03,750 --> 00:36:02,400
dynamo

952
00:36:05,990 --> 00:36:03,760
of course the earth's magnetic field

953
00:36:08,069 --> 00:36:06,000
flips every couple hundred thousand

954
00:36:10,870 --> 00:36:08,079
years we don't know if jupiter's

955
00:36:13,109 --> 00:36:10,880
magnetic field flips or not i suspect it

956
00:36:15,750 --> 00:36:13,119
does

957
00:36:18,550 --> 00:36:15,760
but it's it's enormously strong because

958
00:36:21,109 --> 00:36:18,560
everything about jupiter is enormous the

959
00:36:23,190 --> 00:36:21,119
gravity is is huge

960
00:36:25,190 --> 00:36:23,200
the planet itself is huge

961
00:36:27,190 --> 00:36:25,200
the part of the planet that is

962
00:36:29,430 --> 00:36:27,200
conductive that can participate in a

963
00:36:31,670 --> 00:36:29,440

dynamo is is huge

964
00:36:33,750 --> 00:36:31,680
so it's no surprise that it generates a

965
00:36:36,550 --> 00:36:33,760
magnetic field that's

966
00:36:38,390 --> 00:36:36,560
about 20 000 times more powerful than

967
00:36:39,270 --> 00:36:38,400
the earth's magnetic field

968
00:36:42,150 --> 00:36:39,280
but

969
00:36:43,910 --> 00:36:42,160
jupiter itself is such a large body that

970
00:36:45,829 --> 00:36:43,920
uh when you're at the surface you're

971
00:36:47,270 --> 00:36:45,839
kind of far from where the field is

972
00:36:49,109 --> 00:36:47,280
generated

973
00:36:51,109 --> 00:36:49,119
and at the surface the field magnitude

974
00:36:53,829 --> 00:36:51,119
is only about 20 times the field

975
00:36:55,109 --> 00:36:53,839
magnitude of the surface of the earth

976
00:36:57,670 --> 00:36:55,119
but even still

977
00:37:00,150 --> 00:36:57,680
this this spacecraft is going to fly in

978
00:37:02,069 --> 00:37:00,160
space through a magnetic field that is

979
00:37:04,550 --> 00:37:02,079
ten times greater than anything we've

980
00:37:05,910 --> 00:37:04,560
ever experienced and so that's one of

981
00:37:10,069 --> 00:37:05,920
the curiosities we're going to have to

982
00:37:15,589 --> 00:37:13,190
great gentleman for real

983
00:37:17,910 --> 00:37:15,599
jay pasikov representing the huffington

984
00:37:21,349 --> 00:37:17,920
post

985
00:37:23,829 --> 00:37:21,359
you have staged the fly the close flybys

986
00:37:26,470 --> 00:37:23,839
uh to cover all the longitudes of

987
00:37:28,550 --> 00:37:26,480
jupiter but jupiter's surface of course

988
00:37:31,030 --> 00:37:28,560

is in differential rotation

989
00:37:32,550 --> 00:37:31,040
uh how are you planning to un uncouple

990
00:37:33,670 --> 00:37:32,560
the atmosphere or you're just looking

991
00:37:37,349 --> 00:37:33,680
through the atmosphere and it's more

992
00:37:38,470 --> 00:37:37,359
stable below and as a second question

993
00:37:40,550 --> 00:37:38,480
um

994
00:37:42,390 --> 00:37:40,560
can you give us some timeline for the

995
00:37:44,950 --> 00:37:42,400
insertion when the key

996
00:37:46,870 --> 00:37:44,960
key times for us to be worried or

997
00:37:48,950 --> 00:37:46,880
pleased on

998
00:37:50,950 --> 00:37:48,960
july 4th will be

999
00:37:52,790 --> 00:37:50,960
so would jack take the first part of the

1000
00:37:55,910 --> 00:37:52,800
question and then maybe ed can answer

1001
00:38:00,870 --> 00:37:58,710
okay so we phase these orbits so that we

1002
00:38:03,349 --> 00:38:00,880
get the

1003
00:38:05,190 --> 00:38:03,359
equally spaced longitudes

1004
00:38:06,950 --> 00:38:05,200
what's happening at the very

1005
00:38:09,030 --> 00:38:06,960
top of the atmosphere the parts that we

1006
00:38:09,829 --> 00:38:09,040
see the belts and zones that are red and

1007
00:38:12,069 --> 00:38:09,839
white

1008
00:38:13,829 --> 00:38:12,079
they are in differential rotation you're

1009
00:38:15,270 --> 00:38:13,839
very right

1010
00:38:17,510 --> 00:38:15,280
that's not where the magnetic field is

1011
00:38:19,910 --> 00:38:17,520
generated though the magnetic field is

1012
00:38:21,829 --> 00:38:19,920
deep below that and it's a good question

1013
00:38:24,150 --> 00:38:21,839

we don't know how deep that convective

1014
00:38:26,550 --> 00:38:24,160
motion is in the atmosphere but what we

1015
00:38:28,710 --> 00:38:26,560
do know is that that magnetic field

1016
00:38:31,190 --> 00:38:28,720
rotates like a clock

1017
00:38:33,589 --> 00:38:31,200
we've been measuring via the

1018
00:38:36,069 --> 00:38:33,599
radio emissions we get from jupiter

1019
00:38:38,550 --> 00:38:36,079
uh for 40 50 years

1020
00:38:43,510 --> 00:38:38,560
uh ever since it was first discovered

1021
00:38:47,270 --> 00:38:45,190
55.

1022
00:38:49,750 --> 00:38:47,280
you get the idea when i was born we've

1023
00:38:51,990 --> 00:38:49,760
been measuring it for a long long time

1024
00:38:53,910 --> 00:38:52,000
and uh and so it's very precise it's

1025
00:38:56,630 --> 00:38:53,920
like a clock and so we know that the

1026
00:38:57,829 --> 00:38:56,640
interior rotates uh as a

1027
00:39:00,950 --> 00:38:57,839
as a body

1028
00:39:02,390 --> 00:39:00,960
uh with that 10 hour rotation rate

1029
00:39:05,589 --> 00:39:02,400
thank you friend

1030
00:39:07,910 --> 00:39:05,599
i want to add in here that uh we measure

1031
00:39:09,670 --> 00:39:07,920
our longitude uh what we call system

1032
00:39:13,750 --> 00:39:09,680
three longitude is based on the magnetic

1033
00:39:15,270 --> 00:39:13,760
field so we use that as our our way of

1034
00:39:16,790 --> 00:39:15,280
measuring longitude and mapping it

1035
00:39:18,870 --> 00:39:16,800
around we don't care what happens the

1036
00:39:22,150 --> 00:39:18,880
clouds the clouds come and go what we're

1037
00:39:24,069 --> 00:39:22,160
interested in is that magnetic longitude

1038
00:39:26,829 --> 00:39:24,079

so you can see it's not not necessarily

1039
00:39:28,710 --> 00:39:26,839
easy to manage this team

1040
00:39:30,230 --> 00:39:28,720
um so

1041
00:39:32,069 --> 00:39:30,240
there are atmospheric scientists that

1042
00:39:34,230 --> 00:39:32,079
are interested in the field and we uh in

1043
00:39:37,109 --> 00:39:34,240
the atmosphere clouds too so we have

1044
00:39:37,990 --> 00:39:37,119
them on the team but um

1045
00:39:40,390 --> 00:39:38,000
let me

1046
00:39:42,950 --> 00:39:40,400
franz wright so the rotation

1047
00:39:44,710 --> 00:39:42,960
of jupiter the rotation period itself is

1048
00:39:46,150 --> 00:39:44,720
basically defined by the rotation of the

1049
00:39:48,230 --> 00:39:46,160
magnetic field

1050
00:39:49,990 --> 00:39:48,240
and then but one thing you should

1051
00:39:51,030 --> 00:39:50,000
realize is we also measure the gravity

1052
00:39:53,349 --> 00:39:51,040
field

1053
00:39:55,109 --> 00:39:53,359
very precisely during this mission and

1054
00:39:58,390 --> 00:39:55,119
one of the goals of that is to

1055
00:40:01,030 --> 00:39:58,400
understand how it's rotating inside how

1056
00:40:03,270 --> 00:40:01,040
deep and when does that rotation start

1057
00:40:04,870 --> 00:40:03,280
and how does it work

1058
00:40:07,430 --> 00:40:04,880
let me go back to add further the

1059
00:40:08,870 --> 00:40:07,440
details of the orbit insertion times

1060
00:40:11,349 --> 00:40:08,880
yeah the the

1061
00:40:13,910 --> 00:40:11,359
two key times that i would keep an eye

1062
00:40:17,190 --> 00:40:13,920
on are when the main engine burn starts

1063
00:40:21,910 --> 00:40:19,910

and the the signal that we get

1064
00:40:25,030 --> 00:40:21,920
the event will be over by the time we

1065
00:40:27,750 --> 00:40:25,040
see that happen there's 48 minutes of

1066
00:40:29,910 --> 00:40:27,760
light time for the signal to reach

1067
00:40:31,430 --> 00:40:29,920
from jupiter to the earth we get the

1068
00:40:35,430 --> 00:40:31,440
signal that the main engine burns

1069
00:40:36,790 --> 00:40:35,440
started at 8 18 pm

1070
00:40:40,710 --> 00:40:36,800
pacific time

1071
00:40:41,670 --> 00:40:40,720
and then 35 minutes after that at 8 53

1072
00:40:43,270 --> 00:40:41,680
pm

1073
00:40:45,270 --> 00:40:43,280
we'll see the signal that the main

1074
00:40:46,950 --> 00:40:45,280
engine burn has stopped

1075
00:40:48,309 --> 00:40:46,960
there's obviously activity before and

1076
00:40:49,910 --> 00:40:48,319
after that and we can get you a more

1077
00:40:52,309 --> 00:40:49,920
detailed timeline

1078
00:40:55,030 --> 00:40:52,319
but those are the really two key times

1079
00:40:56,950 --> 00:40:55,040
on july 4th

1080
00:40:59,430 --> 00:40:56,960
okay thank you ed and panel and i

1081
00:41:01,430 --> 00:40:59,440
understand we have a question from uh

1082
00:41:04,470 --> 00:41:01,440
media on the phone so please state your

1083
00:41:06,710 --> 00:41:04,480
name and media affiliation

1084
00:41:09,349 --> 00:41:06,720
hi thanks dc it's irene klotz with

1085
00:41:11,270 --> 00:41:09,359
reuters i have a couple questions um

1086
00:41:13,750 --> 00:41:11,280
for scott you uh mentioned in your

1087
00:41:16,710 --> 00:41:13,760
opening comments that you uh still feel

1088
00:41:19,430 --> 00:41:16,720

a little nervous about the upcoming uh

1089
00:41:21,910 --> 00:41:19,440
burn and um orbit insertion if you could

1090
00:41:23,589 --> 00:41:21,920
maybe just talk a little bit about what

1091
00:41:26,150 --> 00:41:23,599
about that gives you

1092
00:41:28,309 --> 00:41:26,160
pause and also give us the

1093
00:41:31,510 --> 00:41:28,319
speed that juno will be moving relative

1094
00:41:33,430 --> 00:41:31,520
to earth just before the burn starts and

1095
00:41:36,870 --> 00:41:33,440
the speed of the spacecraft when the

1096
00:41:41,829 --> 00:41:39,750
okay so uh did i say little in the

1097
00:41:44,470 --> 00:41:41,839
nervous um

1098
00:41:47,270 --> 00:41:44,480
that was probably a mis uh statement um

1099
00:41:49,589 --> 00:41:47,280
so yeah i'm nervous i'm i have mixed

1100
00:41:51,190 --> 00:41:49,599
emotions i'm excited uh

1101
00:41:53,510 --> 00:41:51,200
and with anticipation of course because

1102
00:41:55,670 --> 00:41:53,520
we're finally arriving but i've also uh

1103
00:41:57,270 --> 00:41:55,680
have tension and nervousness because

1104
00:41:59,589 --> 00:41:57,280
there's a lot riding on what happens

1105
00:42:02,150 --> 00:41:59,599
july 4th we have to perform this

1106
00:42:04,870 --> 00:42:02,160
critical maneuver the as ed described

1107
00:42:07,190 --> 00:42:04,880
the the rocket motor has to burn uh at

1108
00:42:09,349 --> 00:42:07,200
just the right time uh in the right

1109
00:42:10,950 --> 00:42:09,359
direction uh

1110
00:42:13,430 --> 00:42:10,960
at the right moment for the right amount

1111
00:42:15,670 --> 00:42:13,440
of time for us to get into orbit and if

1112
00:42:17,829 --> 00:42:15,680
that doesn't all go just right we fly

1113
00:42:20,710 --> 00:42:17,839

past jupiter and

1114
00:42:22,710 --> 00:42:20,720
of course the that's not desirable

1115
00:42:24,390 --> 00:42:22,720
we would like to go into orbit to do the

1116
00:42:25,349 --> 00:42:24,400
science so

1117
00:42:27,750 --> 00:42:25,359
um

1118
00:42:29,109 --> 00:42:27,760
so that part of it is challenging and of

1119
00:42:31,589 --> 00:42:29,119
course

1120
00:42:34,390 --> 00:42:31,599
the idea that we're going into this

1121
00:42:36,150 --> 00:42:34,400
planet this extreme environment that

1122
00:42:38,069 --> 00:42:36,160
that is so much greater than anything

1123
00:42:40,069 --> 00:42:38,079
we've ever experienced before

1124
00:42:43,190 --> 00:42:40,079
is all happening for the first time when

1125
00:42:46,390 --> 00:42:43,200
we have to fire this this complicated

1126
00:42:48,870 --> 00:42:46,400
delicate maneuver and um

1127
00:42:51,510 --> 00:42:48,880
and so and and having the lack of any

1128
00:42:53,349 --> 00:42:51,520
control it's all automated right so

1129
00:42:55,270 --> 00:42:53,359
the light time between jupiter and earth

1130
00:42:58,069 --> 00:42:55,280
is 40 minutes

1131
00:43:00,550 --> 00:42:58,079
or so or more than 40 minutes and so the

1132
00:43:01,990 --> 00:43:00,560
whole burn is about 35 minutes so so

1133
00:43:04,950 --> 00:43:02,000
everything's automated the spacecraft's

1134
00:43:07,349 --> 00:43:04,960
a smart robot we've tested everything

1135
00:43:08,470 --> 00:43:07,359
but still everything's riding on it and

1136
00:43:10,790 --> 00:43:08,480
and

1137
00:43:12,710 --> 00:43:10,800
i kind of felt the same way when i was

1138
00:43:14,710 --> 00:43:12,720

at the launch i was so excited to be

1139
00:43:16,710 --> 00:43:14,720
there that we were finally leaving earth

1140
00:43:19,270 --> 00:43:16,720
and launching on the rocket to go to

1141
00:43:20,790 --> 00:43:19,280
jupiter but i kept looking and thinking

1142
00:43:22,390 --> 00:43:20,800
gosh the whole spacecraft's on top of

1143
00:43:24,950 --> 00:43:22,400
that rocket

1144
00:43:27,990 --> 00:43:24,960
what if something happens and and that's

1145
00:43:30,550 --> 00:43:28,000
a big risk uh you know and of course um

1146
00:43:32,710 --> 00:43:30,560
you don't get the great gains um of

1147
00:43:34,630 --> 00:43:32,720
reaching out you know and exploring and

1148
00:43:36,150 --> 00:43:34,640
learning about nature unless you take

1149
00:43:38,630 --> 00:43:36,160
those risks so

1150
00:43:41,990 --> 00:43:38,640
i'm not against the risks but it doesn't

1151
00:43:46,870 --> 00:43:44,710
the second part of the question was the

1152
00:43:49,270 --> 00:43:46,880
speed

1153
00:43:50,790 --> 00:43:49,280
so i i may not remember all of these we

1154
00:43:51,990 --> 00:43:50,800
may have to get that to you but i think

1155
00:43:53,510 --> 00:43:52,000
at the time

1156
00:43:57,589 --> 00:43:53,520
that we arrived there right before the

1157
00:44:01,190 --> 00:43:57,599
burn we're moving about 160

1158
00:44:02,950 --> 00:44:01,200
000 or 165 000 miles an hour so we're

1159
00:44:06,390 --> 00:44:02,960
relative to earth

1160
00:44:07,430 --> 00:44:06,400
so that's uh incredibly fast and i don't

1161
00:44:09,270 --> 00:44:07,440
think we've

1162
00:44:11,510 --> 00:44:09,280
had anything any human object that's

1163
00:44:12,710 --> 00:44:11,520

moved that fast that's left the earth

1164
00:44:15,109 --> 00:44:12,720
um

1165
00:44:16,470 --> 00:44:15,119
after the burn uh somebody would i don't

1166
00:44:19,910 --> 00:44:16,480
have that number at the

1167
00:44:21,510 --> 00:44:19,920
top of my fingertips relative to earth

1168
00:44:23,589 --> 00:44:21,520
thanks um the other question i have is

1169
00:44:26,390 --> 00:44:23,599
just about the um kind of the big

1170
00:44:27,510 --> 00:44:26,400
picture science of uh understanding more

1171
00:44:30,550 --> 00:44:27,520
about how

1172
00:44:33,910 --> 00:44:30,560
and where uh jupiter formed um what is

1173
00:44:36,230 --> 00:44:33,920
the kind of the range of opinions on

1174
00:44:37,910 --> 00:44:36,240
uh where that where the planet um

1175
00:44:39,510 --> 00:44:37,920
started off and

1176
00:44:41,750 --> 00:44:39,520
how it got to where it is today i know

1177
00:44:43,750 --> 00:44:41,760
that's a really big question for

1178
00:44:45,190 --> 00:44:43,760
a short press conference but if there's

1179
00:44:48,150 --> 00:44:45,200
a way to kind of

1180
00:44:50,630 --> 00:44:48,160
generalize um even just how

1181
00:44:53,670 --> 00:44:50,640
divided the community is on the question

1182
00:44:56,630 --> 00:44:53,680
that'd be helpful thanks

1183
00:44:58,630 --> 00:44:56,640
well i i i think there's um

1184
00:45:00,069 --> 00:44:58,640
there's a lot of scientists on the team

1185
00:45:02,790 --> 00:45:00,079
and there are many scientists not on the

1186
00:45:05,430 --> 00:45:02,800
team and and um there's not a consensus

1187
00:45:07,190 --> 00:45:05,440
on on the answer of where jupiter formed

1188
00:45:09,589 --> 00:45:07,200

um

1189
00:45:11,030 --> 00:45:09,599
you know initially we it's it's at five

1190
00:45:13,750 --> 00:45:11,040
times the distance of the sun and that

1191
00:45:15,750 --> 00:45:13,760
was sort of the idea traditionally

1192
00:45:18,150 --> 00:45:15,760
now there are models that show uh

1193
00:45:19,829 --> 00:45:18,160
planetary migration might exist jupiter

1194
00:45:22,550 --> 00:45:19,839
may have moved

1195
00:45:24,470 --> 00:45:22,560
to its present location from further out

1196
00:45:27,670 --> 00:45:24,480
forming further out

1197
00:45:30,069 --> 00:45:27,680
trying to explain the composition

1198
00:45:31,349 --> 00:45:30,079
some some models show jupiter forming

1199
00:45:33,829 --> 00:45:31,359
out

1200
00:45:34,870 --> 00:45:33,839
near uranus or neptune and then moving

1201
00:45:36,950 --> 00:45:34,880
in

1202
00:45:39,270 --> 00:45:36,960
but the the the truth is is we don't

1203
00:45:41,270 --> 00:45:39,280
know the answer to that and and one of

1204
00:45:43,030 --> 00:45:41,280
the big clues will be the oxygen

1205
00:45:46,069 --> 00:45:43,040
abundance and how much water is in

1206
00:45:50,550 --> 00:45:46,079
jupiter um that will help us but but

1207
00:45:54,230 --> 00:45:52,710
great thank you scott uh i understand we

1208
00:45:55,589 --> 00:45:54,240
have some questions from social media

1209
00:45:57,910 --> 00:45:55,599
jason

1210
00:45:59,030 --> 00:45:57,920
indeed first question here comes from

1211
00:46:01,430 --> 00:45:59,040
ria

1212
00:46:03,990 --> 00:46:01,440
novostovi reporter from a newswire

1213
00:46:06,470 --> 00:46:04,000

service here asking how will nasa deal

1214
00:46:08,390 --> 00:46:06,480
with solar panel fouling and degradation

1215
00:46:09,910 --> 00:46:08,400
in the course of the mission what are

1216
00:46:13,589 --> 00:46:09,920
the chances that it will last longer

1217
00:46:20,390 --> 00:46:17,190
i planned take it um so so we have um

1218
00:46:22,390 --> 00:46:20,400
solar arrays that are um

1219
00:46:23,829 --> 00:46:22,400
tested and specifically designed to be

1220
00:46:25,910 --> 00:46:23,839
able to last through the cold

1221
00:46:27,829 --> 00:46:25,920
temperatures and the high levels of

1222
00:46:28,870 --> 00:46:27,839
radiation they have a cover glass on

1223
00:46:31,270 --> 00:46:28,880
them

1224
00:46:32,230 --> 00:46:31,280
but we also have designed into the

1225
00:46:34,630 --> 00:46:32,240
mission

1226
00:46:35,990 --> 00:46:34,640
the ability to

1227
00:46:37,589 --> 00:46:36,000
have some of those

1228
00:46:39,750 --> 00:46:37,599
decrease in their efficiency for

1229
00:46:40,550 --> 00:46:39,760
producing electricity

1230
00:46:43,510 --> 00:46:40,560
and

1231
00:46:45,510 --> 00:46:43,520
if if uh

1232
00:46:47,750 --> 00:46:45,520
there's a huge amount of energy that's

1233
00:46:49,190 --> 00:46:47,760
lost more than we've accounted for and

1234
00:46:51,430 --> 00:46:49,200
more than the margin and the reserves

1235
00:46:52,870 --> 00:46:51,440
that we've already taken into account we

1236
00:46:54,790 --> 00:46:52,880
can um

1237
00:46:57,829 --> 00:46:54,800
reduce the amount of energy consumption

1238
00:46:59,829 --> 00:46:57,839

by uh time sharing on the in scientific

1239
00:47:02,710 --> 00:46:59,839
instruments but we don't think we're

1240
00:47:04,309 --> 00:47:02,720
going to need to do that

1241
00:47:06,470 --> 00:47:04,319
all right next question comes from a

1242
00:47:08,710 --> 00:47:06,480
twitter user per lobby who asks what's

1243
00:47:11,829 --> 00:47:08,720
the average lifespan for the instruments

1244
00:47:13,750 --> 00:47:11,839
given jupiter's environment

1245
00:47:15,910 --> 00:47:13,760
so i'll take that one too that varies a

1246
00:47:18,470 --> 00:47:15,920
little bit there are um the instruments

1247
00:47:20,069 --> 00:47:18,480
that have all of their electronics uh

1248
00:47:22,549 --> 00:47:20,079
inside the vault

1249
00:47:24,549 --> 00:47:22,559
um are designed to last through the end

1250
00:47:26,549 --> 00:47:24,559
of the mission all the way through the

1251
00:47:28,069 --> 00:47:26,559
completion of all the orbits

1252
00:47:31,109 --> 00:47:28,079
we have a couple of instruments that

1253
00:47:33,190 --> 00:47:31,119
were added late that we um

1254
00:47:34,710 --> 00:47:33,200
did not feel we needed to put into that

1255
00:47:37,430 --> 00:47:34,720
radiation the same kind of level of

1256
00:47:40,069 --> 00:47:37,440
radiation protection

1257
00:47:42,950 --> 00:47:40,079
i think the infrared camera and the

1258
00:47:47,670 --> 00:47:45,990
are outside that box and they were and

1259
00:47:49,349 --> 00:47:47,680
and they were designed to

1260
00:47:51,349 --> 00:47:49,359
be able to last long enough to

1261
00:47:53,430 --> 00:47:51,359
accomplish all the science objectives

1262
00:47:55,030 --> 00:47:53,440
but our analysis now

1263
00:47:57,910 --> 00:47:55,040

indicates that they'll probably last

1264
00:47:59,750 --> 00:47:57,920
much longer so um but there's there's a

1265
00:48:01,190 --> 00:47:59,760
little bit of variation so some of them

1266
00:48:02,309 --> 00:48:01,200
last through about the first half of the

1267
00:48:03,910 --> 00:48:02,319
mission and

1268
00:48:06,710 --> 00:48:03,920
but the bulk of the science instruments

1269
00:48:08,549 --> 00:48:06,720
go all through the whole mission

1270
00:48:12,069 --> 00:48:08,559
all right coming off of our ustream feed

1271
00:48:14,069 --> 00:48:12,079
here um penn state phil asks uh if juno

1272
00:48:15,990 --> 00:48:14,079
determines there is a solid core can it

1273
00:48:19,109 --> 00:48:16,000
detect what elements that core might be

1274
00:48:25,270 --> 00:48:21,910
i'll let jack take that

1275
00:48:30,470 --> 00:48:27,589
i don't believe so

1276
00:48:31,990 --> 00:48:30,480
we'll know what the what the mass is the

1277
00:48:37,750 --> 00:48:32,000
the

1278
00:48:38,549 --> 00:48:37,760
lithium or

1279
00:48:41,510 --> 00:48:38,559
or

1280
00:48:43,030 --> 00:48:41,520
what the elements are

1281
00:48:46,309 --> 00:48:43,040
it might also be pointing out because

1282
00:48:49,109 --> 00:48:46,319
the question assumed it was solid

1283
00:48:50,950 --> 00:48:49,119
core we're talking about a dense core

1284
00:48:53,030 --> 00:48:50,960
in the center of jupiter it may not be

1285
00:48:54,870 --> 00:48:53,040
as solid

1286
00:48:56,950 --> 00:48:54,880
so i've been going to all these science

1287
00:48:59,030 --> 00:48:56,960
team meetings for many years certainly

1288
00:49:00,549 --> 00:48:59,040

since large five years and every time i

1289
00:49:02,390 --> 00:49:00,559
have a science team meeting the

1290
00:49:04,309 --> 00:49:02,400
interiors group come up with a different

1291
00:49:06,390 --> 00:49:04,319
theory for how

1292
00:49:08,150 --> 00:49:06,400
this material works at these very high

1293
00:49:09,910 --> 00:49:08,160
pressures we're working in a new

1294
00:49:11,990 --> 00:49:09,920
environment which we we don't know the

1295
00:49:13,910 --> 00:49:12,000
physics of how things work at these high

1296
00:49:15,430 --> 00:49:13,920
pressures and they're coming up with

1297
00:49:17,349 --> 00:49:15,440
theoretical quantum

1298
00:49:18,309 --> 00:49:17,359
quantum mechanical models but they can

1299
00:49:19,829 --> 00:49:18,319
be wrong

1300
00:49:21,670 --> 00:49:19,839
and so we're going to make the

1301
00:49:23,750 --> 00:49:21,680
observations that will be key they will

1302
00:49:25,990 --> 00:49:23,760
be important but i'll bet you that the

1303
00:49:28,470 --> 00:49:26,000
theorists are going to keep adjusting

1304
00:49:32,309 --> 00:49:28,480
and adapting their models

1305
00:49:34,309 --> 00:49:32,319
but we we will have constraints

1306
00:49:36,390 --> 00:49:34,319
wonderful this last question comes from

1307
00:49:38,950 --> 00:49:36,400
twitter user carl who asks when will we

1308
00:49:43,030 --> 00:49:38,960
get the first images uh from jupiter

1309
00:49:51,750 --> 00:49:47,910
um

1310
00:49:53,990 --> 00:49:51,760
couple days later but i'm not sure what

1311
00:49:57,190 --> 00:49:54,000
the schedule is to send down the the

1312
00:49:59,750 --> 00:49:57,200
first image after that happens

1313
00:50:01,510 --> 00:49:59,760

we'll have to get back to you on that

1314
00:50:02,710 --> 00:50:01,520
okay great i underst

1315
00:50:04,790 --> 00:50:02,720
i understand we have a follow-up

1316
00:50:07,030 --> 00:50:04,800
question from irene klotz at reuters

1317
00:50:08,390 --> 00:50:07,040
irene go ahead

1318
00:50:10,549 --> 00:50:08,400
hi thank you

1319
00:50:11,670 --> 00:50:10,559
for scott i just was wondering if there

1320
00:50:14,470 --> 00:50:11,680
is

1321
00:50:16,790 --> 00:50:14,480
something more dynamic or more

1322
00:50:20,390 --> 00:50:16,800
challenging about going into a polar

1323
00:50:22,390 --> 00:50:20,400
orbit around jupiter versus the

1324
00:50:24,630 --> 00:50:22,400
orbit that galileo

1325
00:50:27,510 --> 00:50:24,640
put itself into

1326
00:50:29,750 --> 00:50:27,520
many many years ago and um also if you

1327
00:50:30,549 --> 00:50:29,760
could just characterize you you've

1328
00:50:32,790 --> 00:50:30,559
you've

1329
00:50:34,549 --> 00:50:32,800
portrayed this mission as um

1330
00:50:36,150 --> 00:50:34,559
the spacecraft that will come closest to

1331
00:50:37,510 --> 00:50:36,160
jupiter but just was wondering if you

1332
00:50:39,109 --> 00:50:37,520
could put that into

1333
00:50:41,510 --> 00:50:39,119
context with the

1334
00:50:43,670 --> 00:50:41,520
hour of data that the galileo

1335
00:50:46,950 --> 00:50:43,680
atmospheric probe was able to

1336
00:50:51,349 --> 00:50:48,710
yeah well a galileo probe of course went

1337
00:50:53,589 --> 00:50:51,359
into jupiter but it uh when we talk

1338
00:50:55,990 --> 00:50:53,599

about the closest of the spacecraft we

1339
00:50:58,069 --> 00:50:56,000
mean in orbit so galileo probe wasn't in

1340
00:50:59,109 --> 00:50:58,079
orbit around jupiter this is the closest

1341
00:51:02,150 --> 00:50:59,119
orbit

1342
00:51:03,589 --> 00:51:02,160
that the spacecraft has uh gone into

1343
00:51:06,470 --> 00:51:03,599
around jupiter and it's considerably

1344
00:51:08,950 --> 00:51:06,480
closer than galileo's orbit which was

1345
00:51:11,430 --> 00:51:08,960
started out at about um four jovian

1346
00:51:12,790 --> 00:51:11,440
radii and then and then went out further

1347
00:51:15,109 --> 00:51:12,800
from that until the very end of the

1348
00:51:16,549 --> 00:51:15,119
mission they they of course went in to

1349
00:51:18,309 --> 00:51:16,559
jupiter but again they they weren't

1350
00:51:21,670 --> 00:51:18,319
really in orbit they were

1351
00:51:24,710 --> 00:51:21,680
uh going in to dispose of the spacecraft

1352
00:51:27,670 --> 00:51:24,720
the polar orbit itself is is is

1353
00:51:29,670 --> 00:51:27,680
challenging um but when you're coming in

1354
00:51:32,069 --> 00:51:29,680
from essentially infinity and you're

1355
00:51:33,510 --> 00:51:32,079
arriving at jupiter you can target over

1356
00:51:35,349 --> 00:51:33,520
the pole or over the equator and

1357
00:51:36,790 --> 00:51:35,359
basically enable yourself to choose that

1358
00:51:39,750 --> 00:51:36,800
inclination

1359
00:51:42,630 --> 00:51:39,760
so the the challenging part of the our

1360
00:51:44,710 --> 00:51:42,640
aspect of the of the juno orbit is the

1361
00:51:47,589 --> 00:51:44,720
fact that we're so close we're both

1362
00:51:49,190 --> 00:51:47,599
polar and we're going in so close that

1363
00:51:51,270 --> 00:51:49,200

we're threading a needle between the

1364
00:51:53,990 --> 00:51:51,280
radiation belts

1365
00:51:56,230 --> 00:51:54,000
and and the atmosphere and and getting

1366
00:51:57,430 --> 00:51:56,240
into what we believe is a gap in the

1367
00:51:59,829 --> 00:51:57,440
radiation

1368
00:52:01,750 --> 00:51:59,839
and and each time you go over the poles

1369
00:52:04,950 --> 00:52:01,760
there's parts of the radiation belts

1370
00:52:06,630 --> 00:52:04,960
that are that are reaching out uh into

1371
00:52:08,390 --> 00:52:06,640
higher latitudes and you're and you're

1372
00:52:10,549 --> 00:52:08,400
getting closer and closer to those and

1373
00:52:12,630 --> 00:52:10,559
so that polar part of the that polar

1374
00:52:14,309 --> 00:52:12,640
aspect of the magnetosphere puts you in

1375
00:52:17,589 --> 00:52:14,319
jeopardy because you're closer to these

1376
00:52:18,950 --> 00:52:17,599
other parts of the radiation belts

1377
00:52:20,950 --> 00:52:18,960
great thank you scott i understand we

1378
00:52:23,270 --> 00:52:20,960
have a follow-up from emily

1379
00:52:25,030 --> 00:52:23,280
yeah um you showed data from the plasma

1380
00:52:26,710 --> 00:52:25,040
waves instrument and junocam i'm

1381
00:52:28,549 --> 00:52:26,720
wondering about the rest of the science

1382
00:52:30,150 --> 00:52:28,559
instruments have they been on have they

1383
00:52:32,230 --> 00:52:30,160
taken data yet that's relevant to the

1384
00:52:34,549 --> 00:52:32,240
study of jupiter have they all gotten

1385
00:52:35,910 --> 00:52:34,559
data are the scientists happy

1386
00:52:37,589 --> 00:52:35,920
i think the scientists are generally

1387
00:52:40,150 --> 00:52:37,599
happy

1388
00:52:41,510 --> 00:52:40,160

we've got a lot of data

1389
00:52:43,109 --> 00:52:41,520
not all of it is

1390
00:52:45,670 --> 00:52:43,119
is easy

1391
00:52:47,829 --> 00:52:45,680
to analyze and interpret so

1392
00:52:49,990 --> 00:52:47,839
we've provided some insights into some

1393
00:52:51,990 --> 00:52:50,000
of the data that we were

1394
00:52:53,990 --> 00:52:52,000
more straightforward to understand but

1395
00:52:56,630 --> 00:52:54,000
we are definitely analyzing the other

1396
00:52:57,990 --> 00:52:56,640
data that we get throughout the about

1397
00:53:00,549 --> 00:52:58,000
the solar wind

1398
00:53:03,430 --> 00:53:00,559
and uv data on the aurora and things

1399
00:53:05,589 --> 00:53:03,440
that we are taking ourselves and um and

1400
00:53:07,190 --> 00:53:05,599
as we get through that and interpret it

1401
00:53:08,390 --> 00:53:07,200
and get ready to write the publications

1402
00:53:11,109 --> 00:53:08,400
and understand it we'll of course

1403
00:53:13,510 --> 00:53:12,150
great

1404
00:53:16,069 --> 00:53:13,520
well thank you i think that's going to

1405
00:53:17,910 --> 00:53:16,079
do it for us here today at jpl this is

1406
00:53:19,589 --> 00:53:17,920
the first of two briefings though so

1407
00:53:21,270 --> 00:53:19,599
please stick around for the second one

1408
00:53:22,790 --> 00:53:21,280
which will start uh pretty close to the

1409
00:53:24,549 --> 00:53:22,800
top of the hour

1410
00:53:26,710 --> 00:53:24,559
for more information about juno please

1411
00:53:30,950 --> 00:53:26,720
visit nasa.gov

1412
00:53:33,430 --> 00:53:30,960
juno and mission juno dot sweary.edu

1413
00:53:35,349 --> 00:53:33,440

and for those of you who want to join

1414
00:53:37,430 --> 00:53:35,359
in in the conversation

1415
00:53:39,349 --> 00:53:37,440
visit on facebook or twitter

1416
00:53:42,950 --> 00:53:39,359
facebook.com

1417
00:53:45,270 --> 00:53:42,960
nasajuno and twitter.com

1418
00:53:47,349 --> 00:53:45,280
nasajuno

1419
00:53:50,870 --> 00:53:47,359
thank you for joining us today and

1420
00:53:52,630 --> 00:53:50,880
please join us as well on july 4th

1421
00:53:54,390 --> 00:53:52,640
it's a big day for us here at jpl and

1422
00:53:56,950 --> 00:53:54,400
for the juno mission things start off at

1423
00:53:59,030 --> 00:53:56,960
9 00 a.m pacific daylight time with

1424
00:54:01,589 --> 00:53:59,040
another briefing here in von carmen

1425
00:54:04,870 --> 00:54:01,599
auditorium and then at 7 30 pm pacific

1426
00:54:06,950 --> 00:54:04,880
time we'll start commentary uh for the

1427
00:54:08,630 --> 00:54:06,960
jupiter orbit insertion

1428
00:54:10,870 --> 00:54:08,640
so want to thank you for your time