



1
00:00:05,305 --> 00:00:07,507
- [Jane] Good morning, I'm
Jane Platt with the newsroom

2
00:00:07,507 --> 00:00:11,778
at NASA's Jet
Propulsion Laboratory
in Pasadena, California.

3
00:00:11,778 --> 00:00:14,681
The topic of today's
media telecom:

4
00:00:14,681 --> 00:00:17,283
The very first in
depth science results

5
00:00:17,283 --> 00:00:19,386
from NASA's Juno mission.

6
00:00:19,386 --> 00:00:21,388
Juno arrived in
orbit around Jupiter

7
00:00:21,388 --> 00:00:25,759
on July fourth of 2016 and
today we're gonna find out

8
00:00:25,759 --> 00:00:29,396
some of its dramatic
discoveries about the planet.

9
00:00:29,396 --> 00:00:32,098
We'll hear brief presentations
from five speakers

10
00:00:32,098 --> 00:00:34,667
and then we'll
take reporter Q&A.

11
00:00:34,667 --> 00:00:37,203
If you do have a
question please press *1

12
00:00:37,203 --> 00:00:40,840
to be placed in the queue
and you can follow along

13
00:00:40,840 --> 00:00:44,811
with the visuals as the speakers
give their presentations

14
00:00:44,811 --> 00:00:46,513
and answer questions

15
00:00:46,513 --> 00:00:50,683
at
www.NASA.gov/feature/junoteleco,
one
word.

16
00:00:57,223 --> 00:01:01,327
Again,
www.NASA.gov/feature/junoteleco.

17
00:01:06,166 --> 00:01:08,034
Remind you that as they
go through the images,

18
00:01:08,034 --> 00:01:10,236
you can click on a
picture to get it

19
00:01:10,236 --> 00:01:13,073
full screen on your computer.

20
00:01:13,073 --> 00:01:15,942
I'd like to go ahead and
introduce our speakers.

21

00:01:15,942 --> 00:01:18,044

We'll be hearing
from Diane Brown,

22

00:01:18,044 --> 00:01:21,748

the program executive at NASA
Headquarters in Washington.

23

00:01:21,748 --> 00:01:24,084

Then we'll hear
from Scott Bolton,

24

00:01:24,084 --> 00:01:26,419

the Juno principal investigator

25

00:01:26,419 --> 00:01:30,256

at Southwest Research
Institute in San Antonio.

26

00:01:30,256 --> 00:01:32,725

Jack Connerney, the deputy
principal investigator

27

00:01:32,725 --> 00:01:35,161

at NASA's Goddard
Space Flight Center

28

00:01:35,161 --> 00:01:37,063

in Greenbelt, Maryland.

29

00:01:37,063 --> 00:01:39,566

Heidi Becker, the Juno
radiation monitoring

30

00:01:39,566 --> 00:01:42,735

investigation lead here at JPL

31

00:01:42,735 --> 00:01:45,271

and Candy Hansen, the

Juno co-investigator

32

00:01:45,271 --> 00:01:49,843
at the Planetary Science
Institute in Tucson, Arizona.

33

00:01:49,843 --> 00:01:53,246
Let's start things off
with Diane Brown, Diane.

34

00:01:53,246 --> 00:01:54,481
- [Diane] Thank you Jane.

35

00:01:54,481 --> 00:01:55,782
We're very excited to be sharing

36

00:01:55,782 --> 00:01:57,684
these first major
discoveries from Juno,

37

00:01:57,684 --> 00:01:59,586
our solar powered
space craft orbiting

38

00:01:59,586 --> 00:02:01,454
around the king of the planets.

39

00:02:01,454 --> 00:02:03,656
Juno has now completed
five science passes

40

00:02:03,656 --> 00:02:05,225
over Jupiter and has provided

41

00:02:05,225 --> 00:02:07,527
amazing images and science data.

42

00:02:07,527 --> 00:02:10,063
Members of the public have

been actively participating

43

00:02:10,063 --> 00:02:12,699

in the mission by
using the Juno cam data

44

00:02:12,699 --> 00:02:14,934

to produce beautiful
and creative images

45

00:02:14,934 --> 00:02:17,237

for us all to enjoy
and we'll get to see

46

00:02:17,237 --> 00:02:19,239

some new ones today.

47

00:02:19,239 --> 00:02:21,141

Juno launched in August of 2011

48

00:02:21,141 --> 00:02:23,376

and is one of three
currently operating missions

49

00:02:23,376 --> 00:02:25,912

within NASA's new
Frontiers program.

50

00:02:25,912 --> 00:02:29,249

As Jane mentioned, the
Juno team got to celebrate

51

00:02:29,249 --> 00:02:30,917

with our own fireworks
last fourth of July

52

00:02:30,917 --> 00:02:33,520

when we got into
orbit around Jupiter.

53

00:02:33,520 --> 00:02:35,255

The results being
announced today

54

00:02:35,255 --> 00:02:36,789

are just the beginning
as we look forward

55

00:02:36,789 --> 00:02:39,392

to even more exciting
science as we go forward.

56

00:02:39,392 --> 00:02:41,094

I'm now going to
hand it off to Scott,

57

00:02:41,094 --> 00:02:43,930

to provide the
science highlights.

58

00:02:44,864 --> 00:02:46,232

- [Scott] Okay thanks, Diane.

59

00:02:46,232 --> 00:02:47,734

It's great to be here.

60

00:02:47,734 --> 00:02:51,070

It's exciting to be able
to share what we've learned

61

00:02:51,070 --> 00:02:53,907

from some of these
first passes by Jupiter.

62

00:02:53,907 --> 00:02:58,077

I'm real excited to tell you
all of the news that we've got.

63

00:02:59,512 --> 00:03:03,449

So I'd like talk first to the
first image, ScottBolton1.

64

00:03:05,518 --> 00:03:08,855

So here I'm gonna illustrate
really how Juno works.

65

00:03:08,855 --> 00:03:12,592

So Juno flies over
the poles of Jupiter

66

00:03:12,592 --> 00:03:15,929

and it goes very,
very close to Jupiter,

67

00:03:15,929 --> 00:03:18,932

just within a few thousand
miles of the cloud tops.

68

00:03:18,932 --> 00:03:21,501

It's traveling very, very fast.

69

00:03:22,869 --> 00:03:26,973

It takes only about two
hours to screen past Jupiter.

70

00:03:26,973 --> 00:03:29,709

So the way it really
works is every 53 days

71

00:03:29,709 --> 00:03:32,979

we screen by Jupiter, dropping
down from the north pole

72

00:03:32,979 --> 00:03:36,149

and going out of the south
and we're going so fast

73

00:03:36,149 --> 00:03:38,985

that that whole pass from

north pole to south pole

74

00:03:38,985 --> 00:03:41,454
is about two hours long.

75

00:03:41,454 --> 00:03:44,257
Most of our science is collected

76

00:03:44,257 --> 00:03:46,626
during these very close passes

77

00:03:46,626 --> 00:03:48,795
and that's really
what's unique about Juno

78

00:03:48,795 --> 00:03:50,997
is because we get
so close to Jupiter

79

00:03:50,997 --> 00:03:54,300
and we cross over both
poles that allows us to see

80

00:03:54,300 --> 00:03:57,704
very new things and unique
things about the interior

81

00:03:57,704 --> 00:04:00,373
and how the magnetosphere works.

82

00:04:01,808 --> 00:04:06,479
So today what you'll hear
is what we've really learned

83

00:04:06,479 --> 00:04:09,749
from our first two
close passes by Jupiter.

84

00:04:09,749 --> 00:04:12,418

We'll also share some
more recent data,

85

00:04:12,418 --> 00:04:16,889

including our latest images
that came down last week.

86

00:04:16,889 --> 00:04:19,792

Some observations of
interplanetary dust

87

00:04:19,792 --> 00:04:24,097

and Jupiter ring and you'll
hear some recent sounds

88

00:04:24,097 --> 00:04:27,867

from Jupiter that are
actually quite unique.

89

00:04:27,867 --> 00:04:30,303

So as I go through
this, the general theme

90

00:04:30,303 --> 00:04:33,473

of our discoveries is
really how different Jupiter

91

00:04:33,473 --> 00:04:36,242

looks from what we expected.

92

00:04:36,242 --> 00:04:40,346

So Juno in many ways is
looking inside of Jupiter

93

00:04:41,547 --> 00:04:44,884

for the first time and
close up and personal.

94

00:04:44,884 --> 00:04:48,288

What scientists expected

was that Jupiter

95

00:04:49,422 --> 00:04:52,892

was relatively boring
and uniform inside

96

00:04:52,892 --> 00:04:55,128

and for decades scientists
have assumed this,

97

00:04:55,128 --> 00:04:58,331

that if we drop
below the cloud tops,

98

00:04:58,331 --> 00:05:00,967

below where the
sunlight reaches,

99

00:05:00,967 --> 00:05:03,036

that pretty much Jupiter
was all uniform inside

100

00:05:03,036 --> 00:05:04,504

and it really didn't
matter where you looked

101

00:05:04,504 --> 00:05:07,340

it would all look the same
and what we're finding

102

00:05:07,340 --> 00:05:09,842

is anything but
that is the truth.

103

00:05:09,842 --> 00:05:11,811

It's very different,
very complex

104

00:05:11,811 --> 00:05:15,448

and we're gonna share

those with you today.

105

00:05:15,448 --> 00:05:18,318

So I'd like to go
over to ScottBolton2

106

00:05:18,318 --> 00:05:22,155

and here you see an
incredibly beautiful picture

107

00:05:22,155 --> 00:05:23,956

of the north pole of Jupiter.

108

00:05:23,956 --> 00:05:27,460

This is created by
amateurs that sign on

109

00:05:27,460 --> 00:05:30,630

to the Jupiter website and
make our images for us.

110

00:05:30,630 --> 00:05:32,865

This one's unique in
the sense that each time

111

00:05:32,865 --> 00:05:36,102

we pass over Jupiter cause
we're going over the poles,

112

00:05:36,102 --> 00:05:40,373

it's half sunlight, half
dark or half night side

113

00:05:40,373 --> 00:05:42,975

and what somebody has done
here is they've actually

114

00:05:42,975 --> 00:05:46,446

stitched together pictures
from different close passes

115

00:05:46,446 --> 00:05:50,350
of Jupiter so that you can
see the whole thing sunlit

116

00:05:50,350 --> 00:05:54,454
and what you see is incredibly
just complex features,

117

00:05:54,454 --> 00:05:58,524
the cyclones and anticyclones
all over the poles.

118

00:05:59,425 --> 00:06:01,361
That wasn't really expected.

119

00:06:01,361 --> 00:06:04,163
The blue shoes is probably real

120

00:06:04,163 --> 00:06:06,966
and the biggest feature is
that Jupiter from the poles

121

00:06:06,966 --> 00:06:11,137
doesn't look anything like
it does from the equator

122

00:06:11,137 --> 00:06:13,606
or from what our usual
picture of Jupiter has

123

00:06:13,606 --> 00:06:16,509
zones and belts,
the great red spot

124

00:06:17,677 --> 00:06:19,612
and we see these stripes
and that's the Jupiter

125

00:06:19,612 --> 00:06:22,014

we've all known
and grown to love

126

00:06:22,014 --> 00:06:25,118

and when you look from the pole,
it looks totally different.

127

00:06:25,118 --> 00:06:26,919

In fact if you looked
at this picture

128

00:06:26,919 --> 00:06:29,021

and somebody had shown it
to you a few years ago,

129

00:06:29,021 --> 00:06:32,191

I don't think anybody would've
guessed this is Jupiter

130

00:06:32,191 --> 00:06:36,028

so the fact that there,
the number of cyclones

131

00:06:37,597 --> 00:06:41,067

that you see at the poles
is literally something new

132

00:06:41,067 --> 00:06:42,735

that we didn't expect and
the fact that the north

133

00:06:42,735 --> 00:06:45,571

and south poles don't
really look like each other

134

00:06:45,571 --> 00:06:47,507

is also a puzzle to us.

135

00:06:48,875 --> 00:06:50,977

So scientists are working
to try to understand

136
00:06:50,977 --> 00:06:53,045
how these dynamics
work and why Jupiter

137
00:06:53,045 --> 00:06:55,848
looks the way it is and of
course we're also wondering

138
00:06:55,848 --> 00:06:57,850
whether this is a
stable configuration.

139
00:06:57,850 --> 00:07:01,120
We've only gone over a couple
times and the question is

140
00:07:01,120 --> 00:07:04,657
do these storms or
cyclones that we see here,

141
00:07:04,657 --> 00:07:06,125
are they stable?

142
00:07:06,125 --> 00:07:07,960
Are they gonna stay the
same way for years and years

143
00:07:07,960 --> 00:07:11,864
like the great red spot which
lasted 300 years at least?

144
00:07:11,864 --> 00:07:14,300
Or is this something
that's dynamic?

145
00:07:14,300 --> 00:07:18,938
And of course only time will

tell us which one is true.

146

00:07:18,938 --> 00:07:23,176

Okay so the next slide,
slide three, ScottBolton3,

147

00:07:23,176 --> 00:07:27,013

shows you a scientific
and artistic expression

148

00:07:29,816 --> 00:07:33,352

of what the inside of
Jupiter might look like.

149

00:07:33,352 --> 00:07:35,855

So these are cutouts
of Jupiter from the top

150

00:07:35,855 --> 00:07:39,325

all the way down to
the middle of the core.

151

00:07:39,325 --> 00:07:42,128

This represents what
a lot of scientists

152

00:07:42,128 --> 00:07:46,265

believe Jupiter looked like
even before Juno got there.

153

00:07:46,265 --> 00:07:48,334

In fact a lot of our
mission was based on

154

00:07:48,334 --> 00:07:52,104

some of these kinds of
figures and what Juno is about

155

00:07:52,104 --> 00:07:54,841

is looking inside of

Jupiter pretty much

156

00:07:54,841 --> 00:07:56,776
every way we know how.

157

00:07:56,776 --> 00:08:00,146
So we have three different
techniques to look into Jupiter.

158

00:08:00,146 --> 00:08:03,783
One is the gravity field
which sees all the way down

159

00:08:03,783 --> 00:08:07,453
to the bottom where
you see ice rock core

160

00:08:07,453 --> 00:08:09,522
and you're looking
at like 40 mega bars,

161

00:08:09,522 --> 00:08:13,025
40 million bars of pressure
and one bar of pressure

162

00:08:13,025 --> 00:08:16,195
is what we feel at
Earth at sea level.

163

00:08:18,030 --> 00:08:20,766
So that's the atmosphere
of the Earth at sea level

164

00:08:20,766 --> 00:08:22,401
pushing down on you.

165

00:08:22,401 --> 00:08:25,137
So in the middle of Jupiter is
a much, much higher pressure.

166
00:08:25,137 --> 00:08:27,306
So if there is an ice rock core,

167
00:08:27,306 --> 00:08:29,375
the rocks in middle
of Jupiter don't look

168
00:08:29,375 --> 00:08:31,244
like the rocks in your backyard.

169
00:08:31,244 --> 00:08:33,446
We have a magnetic
field experiment

170
00:08:33,446 --> 00:08:35,248
that looks into
that bluish region

171
00:08:35,248 --> 00:08:37,350
that's called metallic hydrogen

172
00:08:37,350 --> 00:08:40,720
and that's where the
hydrogen is squeezed so much

173
00:08:40,720 --> 00:08:43,122
and the temperature is such
that it actually behaves

174
00:08:43,122 --> 00:08:46,959
more like a metal and it's
like a liquid metallic hydrogen

175
00:08:46,959 --> 00:08:49,161
and we believe
somewhere in there,

176
00:08:49,161 --> 00:08:52,064
maybe the magnetic

field gets created

177

00:08:52,064 --> 00:08:56,068

or maybe above that
where there's enough
charged particles.

178

00:08:56,068 --> 00:08:58,838

But the magnetic field kind
of penetrates into that.

179

00:08:58,838 --> 00:09:01,474

Then at the top part
of the atmosphere,

180

00:09:01,474 --> 00:09:03,809

just on the right
you see a cut out

181

00:09:03,809 --> 00:09:05,845

called meteorological
layer, that's sort of

182

00:09:05,845 --> 00:09:07,146

the upper atmosphere
where the clouds

183

00:09:07,146 --> 00:09:08,347

and the upper
atmosphere is dynamic.

184

00:09:08,347 --> 00:09:09,815

It's actually quite deep.

185

00:09:09,815 --> 00:09:13,185

It goes down hundreds or even
a thousand kilometers deep

186

00:09:13,185 --> 00:09:15,087

and we've never seen that.

187

00:09:15,087 --> 00:09:17,456

We have a new instrument
that was pretty much invented

188

00:09:17,456 --> 00:09:21,127

for Juno called the
microwave radiometer or MWR

189

00:09:21,127 --> 00:09:23,296

and it looks into that region.

190

00:09:23,296 --> 00:09:25,798

So we have these three
ways to look into Jupiter.

191

00:09:25,798 --> 00:09:27,967

The top part is done
with the microwaves,

192

00:09:27,967 --> 00:09:30,403

the middle part is done
with the magnetic field

193

00:09:30,403 --> 00:09:34,574

and then the gravity looks all
the way down to the center.

194

00:09:35,942 --> 00:09:37,944

So now what I'd like
to do is show you

195

00:09:37,944 --> 00:09:40,179

a little bit of the new
data and what we've learned

196

00:09:40,179 --> 00:09:43,316

from this MWR the first
time we passed through.

197

00:09:43,316 --> 00:09:45,985

So go to ScottBolton slide four.

198

00:09:47,219 --> 00:09:49,422

So here you see on
the left hand side,

199

00:09:49,422 --> 00:09:53,326

an image of Jupiter from
Cassini I think it is

200

00:09:53,326 --> 00:09:57,763

and it shows you the Jupiter
that we all are used to

201

00:09:57,763 --> 00:10:00,199

with zones and
belts, the stripes

202

00:10:00,199 --> 00:10:01,801

and then you see
the great red spot.

203

00:10:01,801 --> 00:10:05,538

On the right hand
side you see some

204

00:10:05,538 --> 00:10:09,408

of the new microwave data and
what you're looking at here

205

00:10:09,408 --> 00:10:12,511

is at the far right side
of that, the top of it,

206

00:10:12,511 --> 00:10:16,482

it's sort of the cloud
tops and the part

207

00:10:16,482 --> 00:10:18,618

that turns orange
at the bottom of it

208

00:10:18,618 --> 00:10:22,755

is looking deep about
350 kilometers down.

209

00:10:22,755 --> 00:10:24,523

Now in between that what you see

210

00:10:24,523 --> 00:10:27,693

in the red, the white and
a little bit of bluish hue,

211

00:10:27,693 --> 00:10:32,465

those are indications of
how much ammonia is present.

212

00:10:32,465 --> 00:10:34,333

Or the abundance of ammonia.

213

00:10:34,333 --> 00:10:36,736

So orange means
it's very abundant.

214

00:10:36,736 --> 00:10:40,206

Yellow means a little less,
white is even less than that

215

00:10:40,206 --> 00:10:43,843

and blue is the least
amount of the ammonia.

216

00:10:43,843 --> 00:10:45,845

So at the top is
very little ammonia

217

00:10:45,845 --> 00:10:47,713

and the ammonia starts in.

218

00:10:47,713 --> 00:10:50,449

But the most startling
feature of this

219

00:10:50,449 --> 00:10:54,320

that was brand new
and unexpected was
that sort of column

220

00:10:54,320 --> 00:10:58,491

that you see in orange where
you have a band of ammonia

221

00:10:59,692 --> 00:11:02,828

around the equator of Jupiter.

222

00:11:02,828 --> 00:11:04,997

It's in the zone,
it's very deep.

223

00:11:04,997 --> 00:11:06,999

In fact this is
completely unexpected.

224

00:11:06,999 --> 00:11:09,402

You have a deep band
of ammonia that goes

225

00:11:09,402 --> 00:11:13,572

from the top of Jupiter
as deep as we can see.

226

00:11:13,572 --> 00:11:15,708

It goes down to
250 kilometers here

227

00:11:15,708 --> 00:11:17,643

because that's the limit
of where we're looking.

228

00:11:17,643 --> 00:11:21,147

It may penetrate even
deeper than that.

229

00:11:21,147 --> 00:11:23,616

So that was a new
thing that we learned

230

00:11:23,616 --> 00:11:26,052

just when we first
looked at this data

231

00:11:26,052 --> 00:11:29,321

and saw it for the
first time with MWR.

232

00:11:30,423 --> 00:11:32,491

The other thing
that's new about this

233

00:11:32,491 --> 00:11:36,162

is that in general you
see that the ammonia peaks

234

00:11:36,162 --> 00:11:40,332

across all latitudes pretty
deep, all the way at the bottom

235

00:11:41,467 --> 00:11:43,035

and what scientists
have expected

236

00:11:43,035 --> 00:11:47,440

was that that would peak and
be uniform much further up,

237

00:11:47,440 --> 00:11:49,308

near where we thought
the ammonia clouds

238

00:11:49,308 --> 00:11:51,811
were gonna be forming.

239

00:11:51,811 --> 00:11:56,749
Then finally, you see that
there's a lot of variation

240

00:11:56,749 --> 00:11:58,684
with the ammonia in latitude.

241

00:11:58,684 --> 00:12:02,121
There's some bluish parts in
the mid northern latitudes.

242

00:12:02,121 --> 00:12:04,523
There's different
yellows and oranges

243

00:12:04,523 --> 00:12:06,959
that are showing up even
at the high latitudes

244

00:12:06,959 --> 00:12:08,694
and what this is telling
us is that Jupiter

245

00:12:08,694 --> 00:12:10,096
is not very well mixed.

246

00:12:10,096 --> 00:12:11,797
It's not all uniform inside.

247

00:12:11,797 --> 00:12:13,933
The idea of once you
drop below the sunlight

248

00:12:13,933 --> 00:12:15,935
that everything

would all be uniform

249

00:12:15,935 --> 00:12:18,571

and blurring and mixed
up was completely wrong.

250

00:12:18,571 --> 00:12:22,108

It's actually very different
depending on where you look at.

251

00:12:22,108 --> 00:12:25,511

This is a brand new
result and this in fact

252

00:12:25,511 --> 00:12:28,247

addresses some questions
that we've had for decades.

253

00:12:28,247 --> 00:12:32,017

About 20 years ago we
sent in the Galileo probe

254

00:12:32,017 --> 00:12:34,253

into Jupiter to
measure its composition

255

00:12:34,253 --> 00:12:36,555

and to learn about
its atmosphere.

256

00:12:36,555 --> 00:12:38,958

At that time scientists
thought that once

257

00:12:38,958 --> 00:12:40,659

you went through the cloud tops

258

00:12:40,659 --> 00:12:44,096

you would basically
see the same thing

259

00:12:44,096 --> 00:12:47,266
and no matter where you
looked it would look the same.

260

00:12:47,266 --> 00:12:50,703
But in fact, it came back
with a surprising results

261

00:12:50,703 --> 00:12:52,671
that people didn't
completely understand

262

00:12:52,671 --> 00:12:57,009
and one of the assumptions
was that the Galileo probe

263

00:12:57,009 --> 00:12:59,345
just happened to
go into a warm spot

264

00:12:59,345 --> 00:13:01,480
and in fact it did look
warm where it went in

265

00:13:01,480 --> 00:13:03,916
and maybe that was unique
and what we're finding

266

00:13:03,916 --> 00:13:07,586
is that many parts
of Jupiter are unique

267

00:13:07,586 --> 00:13:10,289
and if you'd stuck in
three or four probes

268

00:13:10,289 --> 00:13:14,894
into Jupiter in different
places, you'd very likely

269

00:13:14,894 --> 00:13:16,929
would've gotten three or
four different results

270

00:13:16,929 --> 00:13:19,932
and you wouldn't have
necessarily known
what to make of it.

271

00:13:19,932 --> 00:13:23,469
So only through this new
look that we see with MWR

272

00:13:23,469 --> 00:13:27,406
do we realize how variable
this giant planet really is

273

00:13:27,406 --> 00:13:30,442
beneath its top layer of
clouds and that's really

274

00:13:30,442 --> 00:13:34,346
gonna force us to rethink
not only how Jupiter works

275

00:13:34,346 --> 00:13:37,950
but how do we explore
Saturn, Uranus and Neptune

276

00:13:37,950 --> 00:13:40,519
if they're highly
variable like this?

277

00:13:40,519 --> 00:13:43,189
We may need some kind
of technique like Juno

278

00:13:43,189 --> 00:13:47,059
or maybe the next generation

of these kinds of things

279

00:13:47,059 --> 00:13:49,094
where we can look beneath
the clouds globally

280

00:13:49,094 --> 00:13:52,498
to understand how
things are varying.

281

00:13:52,498 --> 00:13:55,201
You also note that the
whole signature of the zones

282

00:13:55,201 --> 00:13:59,071
and belts doesn't seem
that apparent in our data

283

00:13:59,071 --> 00:14:02,441
and that puzzled us and
surprised us so the zone

284

00:14:02,441 --> 00:14:05,010
and belt structure
either doesn't penetrate

285

00:14:05,010 --> 00:14:08,013
all the way down but you can
see there is some structure

286

00:14:08,013 --> 00:14:10,983
it just doesn't correlate
to the zones and belts

287

00:14:10,983 --> 00:14:14,920
and so it evolves to something
new inside of the planet

288

00:14:14,920 --> 00:14:17,156
other than maybe

right near the equator

289

00:14:17,156 --> 00:14:19,391

where that ammonia band is.

290

00:14:20,559 --> 00:14:23,896

So that was a surprise
to us and we've learned

291

00:14:23,896 --> 00:14:26,498

that these zones and
belts either don't exist

292

00:14:26,498 --> 00:14:30,369

or this instrument isn't
sensitive to it for some reason.

293

00:14:30,369 --> 00:14:32,805

But we don't understand
why it wouldn't be

294

00:14:32,805 --> 00:14:37,509

and so you really see this
new picture of Jupiter

295

00:14:37,509 --> 00:14:41,680

in this data that is very
dynamic underneath the surface

296

00:14:42,848 --> 00:14:45,718

of the clouds as
you penetrate down

297

00:14:46,852 --> 00:14:50,022

and there's this strange
band at the equator.

298

00:14:50,022 --> 00:14:54,793

Now it almost looks a little
reminiscent to the Earth.

299

00:14:54,793 --> 00:14:56,729

The Earth has something
called a Hadley cell

300

00:14:56,729 --> 00:14:59,598

where we have a tropical
band around the equator

301

00:14:59,598 --> 00:15:01,767

and then we have the
subtropics just above that.

302

00:15:01,767 --> 00:15:04,203

Those are dry, the
tropical band is moist.

303

00:15:04,203 --> 00:15:08,540

Jupiter looks a little bit
like that in this ammonia

304

00:15:08,540 --> 00:15:11,810

but it couldn't, it's
unlikely for that

305

00:15:13,612 --> 00:15:17,349

to have worked the same
way that Earth does.

306

00:15:17,349 --> 00:15:19,718

The reason why the Earth
has a tropical band

307

00:15:19,718 --> 00:15:22,288

is there's a surface
underneath the atmosphere

308

00:15:22,288 --> 00:15:24,757

that allows for a return flow.

309

00:15:24,757 --> 00:15:27,693

You either have an
ocean or land underneath

310

00:15:27,693 --> 00:15:32,298

and that allows for us to
create these circulation cycles

311

00:15:32,298 --> 00:15:35,401

and create these
dynamics on the Earth.

312

00:15:35,401 --> 00:15:38,070

Jupiter is gas all the way down.

313

00:15:38,070 --> 00:15:39,505

So while it might look a
little bit like the Earth,

314

00:15:39,505 --> 00:15:42,174

it can't be working
the same way.

315

00:15:42,174 --> 00:15:43,609

So that was a big
surprise to us.

316

00:15:43,609 --> 00:15:45,778

It is possible that
this band penetrates

317

00:15:45,778 --> 00:15:48,080

all the way down into
the middle of Jupiter.

318

00:15:48,080 --> 00:15:51,116

We don't know and
eventually when we combine

319

00:15:51,116 --> 00:15:53,686
all of our magnetic field
and gravity field science

320
00:15:53,686 --> 00:15:56,088
and get more microwave
science, we may be able

321
00:15:56,088 --> 00:15:58,524
to tell something about
how this band is working

322
00:15:58,524 --> 00:16:00,626
and how it's being formed.

323
00:16:02,761 --> 00:16:04,463
So I don't have
another figure for this

324
00:16:04,463 --> 00:16:06,465
but I wanted to touch
on the gravity field,

325
00:16:06,465 --> 00:16:09,201
which I think there's
sort of a general theme

326
00:16:09,201 --> 00:16:11,170
that we're seeing that the
inside of Jupiter works

327
00:16:11,170 --> 00:16:14,106
very differently than
people had assumed.

328
00:16:14,106 --> 00:16:16,976
It's much more complex
and there are motions

329
00:16:16,976 --> 00:16:20,179

deep inside that people
hadn't anticipated.

330
00:16:20,179 --> 00:16:23,248
The gravity field is
consistent with that.

331
00:16:23,248 --> 00:16:25,384
When we went to go
measure the gravity field

332
00:16:25,384 --> 00:16:28,287
what we were really
looking for was the core

333
00:16:28,287 --> 00:16:31,523
whether there was a
compact core or no core

334
00:16:31,523 --> 00:16:35,794
and instead what we found was
that it really looks fuzzy.

335
00:16:35,794 --> 00:16:37,963
There may be a core
there but it's very big

336
00:16:37,963 --> 00:16:40,466
and it may be
partially dissolved

337
00:16:40,466 --> 00:16:43,202
and we're studying that but
that came as a big surprise

338
00:16:43,202 --> 00:16:45,971
to us that there was no core.

339
00:16:45,971 --> 00:16:50,175
Now these mysteries that

have to do with the interior

340

00:16:50,175 --> 00:16:52,911

extend into our magnetic
field experiment

341

00:16:52,911 --> 00:16:55,414

and I wanna turn it
over to Jack Connerney,

342

00:16:55,414 --> 00:16:58,217

my colleague who is the lead
for the magnetometer experiment

343

00:16:58,217 --> 00:17:00,452

as well as the
deputy PI to explain

344

00:17:00,452 --> 00:17:02,021

the magnetic field discoveries.

345

00:17:02,021 --> 00:17:04,089

- [Jack] Thank you Scott.

346

00:17:04,089 --> 00:17:08,093

I'd like to start off with the
magnetic field observations.

347

00:17:08,093 --> 00:17:12,031

First off magnetometer
is like a fancy compass,

348

00:17:12,998 --> 00:17:14,400

an electronic compass.

349

00:17:14,400 --> 00:17:18,037

It measures both the direction
of the magnetic field,

350

00:17:18,037 --> 00:17:21,006
like a compass does and it
also measures the amplitude

351
00:17:21,006 --> 00:17:24,276
or the magnitude of the field.

352
00:17:24,276 --> 00:17:27,679
The Earth's magnetic field,
we have a pole in the north

353
00:17:27,679 --> 00:17:29,581
and a pole in the south.

354
00:17:29,581 --> 00:17:32,084
In between it varies a little.

355
00:17:33,185 --> 00:17:35,020
Wherever you go on
Earth the compass needle

356
00:17:35,020 --> 00:17:39,158
does not deviate very
much from north or south

357
00:17:39,158 --> 00:17:43,462
and that was kind of our
expectation for Jupiter

358
00:17:43,462 --> 00:17:47,566
before Juno's observations
based on our knowledge

359
00:17:47,566 --> 00:17:52,471
from spacecraft that passed
not so close to Jupiter.

360
00:17:52,471 --> 00:17:55,474
Juno really is the first
time we got in close,

361

00:17:55,474 --> 00:17:58,477

very close to the
surface of Jupiter

362

00:17:59,678 --> 00:18:02,114

and what we found in
our first few passes

363

00:18:02,114 --> 00:18:05,884

is that the magnetic
field was both stronger

364

00:18:05,884 --> 00:18:09,621

than we expected where we
expected it to be strong

365

00:18:09,621 --> 00:18:12,958

and it was weaker than we
expected when we expected

366

00:18:12,958 --> 00:18:14,493

it to be weak.

367

00:18:14,493 --> 00:18:18,897

In other words, it evidenced
a dramatic spatial variation

368

00:18:18,897 --> 00:18:22,501

that we were not quite
aware of previously.

369

00:18:24,670 --> 00:18:28,040

To illustrate that, I'd
like to turn to Jack1

370

00:18:28,040 --> 00:18:31,877

which is a figure drawn
up by our grad student

371
00:18:33,245 --> 00:18:35,814
up at Harvard, Kimmie
Moore and she's represented

372
00:18:35,814 --> 00:18:40,352
on this sphere, the magnetic
field that we expected

373
00:18:40,352 --> 00:18:44,256
at Jupiter and notice
the contours that extend

374
00:18:44,256 --> 00:18:45,657
from left to right.

375
00:18:45,657 --> 00:18:48,227
The red positive
contours up north

376
00:18:48,227 --> 00:18:51,964
and the blue negative
contours down south.

377
00:18:51,964 --> 00:18:55,134
On top of that globe
there's a trajectory,

378
00:18:55,134 --> 00:18:57,002
a subsurface latitude
and longitude

379
00:18:57,002 --> 00:19:00,038
of the spacecraft during PJ1.

380
00:19:00,038 --> 00:19:03,375
In those five groups
of different colors

381
00:19:03,375 --> 00:19:07,913

represent the kind of
addition to the magnetic field

382

00:19:07,913 --> 00:19:10,215

that you would have to
make to follow the field

383

00:19:10,215 --> 00:19:11,984

along the trajectory.

384

00:19:11,984 --> 00:19:15,387

It just illustrates
the spatial variation

385

00:19:16,889 --> 00:19:20,893

of field that we see
moving along the trajectory

386

00:19:22,094 --> 00:19:25,130

close to Jupiter and
we've seen that now

387

00:19:25,130 --> 00:19:27,499

on subsequent periapses.

388

00:19:27,499 --> 00:19:31,036

Of course this is just a
notional representation

389

00:19:31,036 --> 00:19:34,373

but it's very significant
because when we see this kind

390

00:19:34,373 --> 00:19:38,544

of small spatial scale
variation it indicates to us

391

00:19:39,745 --> 00:19:43,148

that we may be very
close to the source.

392

00:19:43,148 --> 00:19:46,018

So that might mean that
the dynamo is above

393

00:19:46,018 --> 00:19:47,953

that metallic hydrogen region

394

00:19:47,953 --> 00:19:51,390

that you saw in Scott3
and it may operate

395

00:19:52,791 --> 00:19:57,095

in the molecular hydrogen
envelope above there.

396

00:19:57,095 --> 00:19:59,431

So that's very significant.

397

00:19:59,431 --> 00:20:01,233

But I'd like to turn to some

398

00:20:01,233 --> 00:20:04,036

of the observations
of the aurora.

399

00:20:04,036 --> 00:20:08,273

If you can go to Jack2,
we have a little movie

400

00:20:08,273 --> 00:20:11,610

showing the ultraviolet
emissions from the south pole

401

00:20:11,610 --> 00:20:15,781

collected by the UBS
spectrometer as it
flew above the pole.

402

00:20:18,450 --> 00:20:22,154

This is the first complete
image of the south pole

403

00:20:22,154 --> 00:20:25,524

that we have because, of course,
all previous observations

404

00:20:25,524 --> 00:20:28,927

were made near the equator
plane, never from atop

405

00:20:28,927 --> 00:20:31,897

Jupiter's polar region
where we could stare down

406

00:20:31,897 --> 00:20:34,499

and look at the aurora.

407

00:20:34,499 --> 00:20:39,171

So this is an amazingly complex
aurora in the south pole.

408

00:20:39,171 --> 00:20:43,375

It has many components that
we expected to see there.

409

00:20:43,375 --> 00:20:46,845

The very innermost circle
you see is the main aurora.

410

00:20:46,845 --> 00:20:49,915

Then there are very
substantial emissions

411

00:20:49,915 --> 00:20:53,218

around that main aurora
extending all the way down

412

00:20:53,218 --> 00:20:57,456

to the emissions that
you see just to the left

413

00:20:57,456 --> 00:20:59,791
in the still which is Jack3.

414

00:21:01,093 --> 00:21:04,563
That's caused by an interaction
with the satellite Io,

415

00:21:04,563 --> 00:21:07,966
the innermost satellite in
Jupiter's magnetosphere.

416

00:21:07,966 --> 00:21:10,702
That long tail
extending past Io,

417

00:21:12,271 --> 00:21:16,441
that simply traces out Io's
orbital motion about Jupiter.

418

00:21:18,243 --> 00:21:21,847
The very significant
thing about this figure

419

00:21:21,847 --> 00:21:25,684
are the reds and the
whites and greens.

420

00:21:25,684 --> 00:21:29,521
Those colors represent
a different path length

421

00:21:30,656 --> 00:21:32,758
through the atmosphere
for these photons,

422

00:21:32,758 --> 00:21:34,593
these ultraviolet photons.

423

00:21:34,593 --> 00:21:37,829

Inside the main aurora
we see emissions

424

00:21:39,431 --> 00:21:43,669

that are largely red that
line between the red emission

425

00:21:43,669 --> 00:21:46,371

and white emission that
follows the sun around

426

00:21:46,371 --> 00:21:50,575

and illustrates a solar
wind control of the aurora

427

00:21:50,575 --> 00:21:54,379

that we were not quite
prepared to expect

428

00:21:54,379 --> 00:21:57,249

but more significantly it
looks like we can interpret

429

00:21:57,249 --> 00:22:01,653

those reds and whites in
an entirely different way

430

00:22:01,653 --> 00:22:03,622

than we have previously.

431

00:22:03,622 --> 00:22:06,658

It looks like the red
emission might evidence

432

00:22:06,658 --> 00:22:09,761

electrons being sucked
out of the atmosphere

433

00:22:09,761 --> 00:22:12,097

instead of precipitating in.

434

00:22:13,231 --> 00:22:16,268

We normally attribute
auroral emissions

435

00:22:16,268 --> 00:22:20,839

to electrons precipitating
down onto the ionosphere.

436

00:22:20,839 --> 00:22:23,108

But instead it looks like
some of these emissions

437

00:22:23,108 --> 00:22:25,644

are actually driven by
electrons being pulled

438

00:22:25,644 --> 00:22:26,878

out of the atmosphere.

439

00:22:26,878 --> 00:22:28,647

So that's intriguing.

440

00:22:30,015 --> 00:22:33,952

I have to move now to my
final graphic which is Jack4.

441

00:22:34,953 --> 00:22:36,288

I wanna talk just briefly

442

00:22:36,288 --> 00:22:39,391

about the trip from
Earth to Jupiter.

443

00:22:40,559 --> 00:22:43,562

We spent five long
cold years in space

444

00:22:43,562 --> 00:22:45,864
in transit to Jupiter.

445

00:22:45,864 --> 00:22:48,734
During that time,
the star cameras

446

00:22:48,734 --> 00:22:51,303
that we use to provide
attitude information

447

00:22:51,303 --> 00:22:53,772
for the magnetometers,
they looked out

448

00:22:53,772 --> 00:22:56,875
into space continuously
and occasionally

449

00:22:56,875 --> 00:23:01,113
they saw things flying by that
weren't in the star catalog.

450

00:23:01,113 --> 00:23:03,315
What we found is
that we could track

451

00:23:03,315 --> 00:23:06,818
some of those objects and
indeed they were excavated

452

00:23:06,818 --> 00:23:11,223
from the solar panel by the
impact of dust particles.

453

00:23:11,223 --> 00:23:12,724
Now these are tiny particles.

454

00:23:12,724 --> 00:23:15,694

You could fit 100 of them
on the head of a pin.

455

00:23:15,694 --> 00:23:17,662

But they're traveling
at enormous velocity.

456

00:23:17,662 --> 00:23:20,599

They're 10 times
a speeding bullet.

457

00:23:20,599 --> 00:23:23,668

So they excavate little
pieces from the spacecraft

458

00:23:23,668 --> 00:23:27,606

and those float off and we see
them in reflected sunlight.

459

00:23:27,606 --> 00:23:30,275

So it turns out that we
can use this spacecraft

460

00:23:30,275 --> 00:23:34,446

and its prodigious 60
square meters of solar array

461

00:23:34,446 --> 00:23:38,483

as the largest dust detector
ever flown in space.

462

00:23:38,483 --> 00:23:41,586

So we're sensitive to
particles that are larger

463

00:23:41,586 --> 00:23:45,791

and more infrequent than
those that can be measured

464

00:23:45,791 --> 00:23:48,160
in space by a dedicated
dust detector.

465
00:23:48,160 --> 00:23:49,628
So that's exciting.

466
00:23:49,628 --> 00:23:50,862
Not to worry.

467
00:23:50,862 --> 00:23:52,330
The spacecraft is
operating fine.

468
00:23:52,330 --> 00:23:56,234
It turns out all spacecraft
traveling this path

469
00:23:56,234 --> 00:23:58,970
are pelted with
numerous impacts.

470
00:24:00,272 --> 00:24:03,275
We recorded close to a
thousand of them on the way out

471
00:24:03,275 --> 00:24:05,076
and we're still operating fine.

472
00:24:05,076 --> 00:24:06,278
We're just the first spacecraft

473
00:24:06,278 --> 00:24:08,947
that's able to see what happens.

474
00:24:10,182 --> 00:24:12,717
So I'd like to turn this
over now to my colleague

475

00:24:12,717 --> 00:24:15,320
Heidi Becker to talk about
the radiation environment.

476
00:24:15,320 --> 00:24:17,489
Heidi.
- [Heidi] Thank you, Jack

477
00:24:17,489 --> 00:24:19,224
and to start I'd
actually like to keep

478
00:24:19,224 --> 00:24:21,293
on the theme of star cameras

479
00:24:21,293 --> 00:24:23,662
and share a very special
picture with everybody

480
00:24:23,662 --> 00:24:26,298
that we took with our
stellar reference unit

481
00:24:26,298 --> 00:24:28,733
which is the
spacecraft star camera.

482
00:24:28,733 --> 00:24:30,469
This is our navigation
camera that takes pictures

483
00:24:30,469 --> 00:24:33,104
of the stars to guide our way.

484
00:24:33,104 --> 00:24:36,441
So if everyone would go
ahead and start Heidi1

485
00:24:36,441 --> 00:24:38,543
which is our

animation, what you see

486

00:24:38,543 --> 00:24:40,412

is where we took this image

487

00:24:40,412 --> 00:24:42,848

and it was in a

very special place.

488

00:24:42,848 --> 00:24:44,683

What you're seeing

is Juno flying

489

00:24:44,683 --> 00:24:47,219

in between the narrow

gap between the planet

490

00:24:47,219 --> 00:24:51,289

and the radiation belts

and as we turned out

491

00:24:51,289 --> 00:24:54,159

the star cameras

took this picture

492

00:24:54,159 --> 00:24:58,530

and if you go to Heidi2

you'll see the still of that

493

00:24:58,530 --> 00:25:00,999

and what you're

looking at is the view

494

00:25:00,999 --> 00:25:05,770

of the constellation Orion

from inside Jupiter's ring.

495

00:25:05,770 --> 00:25:08,473

This is the first

image of Jupiter's ring

496

00:25:08,473 --> 00:25:10,041
that has ever been collected

497

00:25:10,041 --> 00:25:12,577
from the inside
of it looking out.

498

00:25:12,577 --> 00:25:15,180
Juno is 3,000 miles
from the planet

499

00:25:15,180 --> 00:25:17,249
when we took this picture
and what you're seeing here

500

00:25:17,249 --> 00:25:20,485
is the main belt of
Jupiter, main ring,

501

00:25:26,525 --> 00:25:29,728
in the center of the
image and the bright star

502

00:25:29,728 --> 00:25:34,132
in the upper left is Betelgeuse
and the three bright ones

503

00:25:34,132 --> 00:25:38,303
in the lower right hand side
of the image is Orion's belt.

504

00:25:39,704 --> 00:25:42,140
So what you're looking
at here is a ring of dust

505

00:25:42,140 --> 00:25:46,678
that 40,000 miles away and
stars that are hundreds

506

00:25:46,678 --> 00:25:50,348

of light years away all
in the same picture.

507

00:25:51,816 --> 00:25:53,919

If you go to Heidi3, we've
connected the dots for you

508

00:25:53,919 --> 00:25:55,554

so you can see Orion there.

509

00:25:55,554 --> 00:25:57,389

It's very recognizable.

510

00:25:57,389 --> 00:25:59,858

This is what it looks like
when you see it from Earth

511

00:25:59,858 --> 00:26:03,261

and we thought it would be
nice to share it with everybody

512

00:26:03,261 --> 00:26:05,997

that you could be half
a billion miles away

513

00:26:05,997 --> 00:26:09,134

from we stargaze on Earth
and look at this stargazing

514

00:26:09,134 --> 00:26:13,438

from Juno and heaven looks
the same to us from Jupiter.

515

00:26:13,438 --> 00:26:16,975

There's no radiation
in that picture

516

00:26:16,975 --> 00:26:19,911

but that isn't true
everywhere at perijove.

517
00:26:19,911 --> 00:26:24,249
So if you will go to Heidi4
and play this animation.

518
00:26:24,249 --> 00:26:27,519
You can just keep playing
this as I explain it to you.

519
00:26:27,519 --> 00:26:32,090
This is an artist's rendition
of Juno's perijove one

520
00:26:32,090 --> 00:26:34,826
which is our pass
close to the planet

521
00:26:34,826 --> 00:26:37,762
and you see we're just
grazing the inner edges

522
00:26:37,762 --> 00:26:40,699
of the radiation belts as
we go through that gap.

523
00:26:40,699 --> 00:26:42,934
Now we know for sure
that gap is there.

524
00:26:42,934 --> 00:26:45,637
We were counting on
but no spacecraft

525
00:26:45,637 --> 00:26:48,840
has ever flown that
close to the planet.

526
00:26:48,840 --> 00:26:51,710

No one has ever been that
high in the inner edges

527

00:26:51,710 --> 00:26:55,213
of the radiation belts and
like everything else with Juno

528

00:26:55,213 --> 00:26:57,916
the radiation
environment was different

529

00:26:57,916 --> 00:26:59,651
than we thought it would be

530

00:26:59,651 --> 00:27:02,387
and the closer we got to
Jupiter the more (interference)

531

00:27:02,387 --> 00:27:03,855
it was than we
thought it would be

532

00:27:03,855 --> 00:27:07,325
and as a matter of fact when
you hit those inner edges there

533

00:27:07,325 --> 00:27:10,462
that you see in the animation,
high energy electrons

534

00:27:10,462 --> 00:27:13,832
that get into our instruments
and degrade and create noise,

535

00:27:13,832 --> 00:27:16,167
the number of those
was 10 times less

536

00:27:16,167 --> 00:27:18,303
than what we thought

it was going to be

537

00:27:18,303 --> 00:27:21,940
which is very great news from
an engineering perspective.

538

00:27:21,940 --> 00:27:23,441
It's great for science.

539

00:27:23,441 --> 00:27:25,877
All the radiation modelers
are gonna have a lot of data

540

00:27:25,877 --> 00:27:27,946
to work with and
this is something

541

00:27:27,946 --> 00:27:30,582
we never could've known
without going there.

542

00:27:30,582 --> 00:27:33,385
So now this is just
one piece of our orbit

543

00:27:33,385 --> 00:27:36,187
and we know we're gonna get
into harsher places later on

544

00:27:36,187 --> 00:27:39,624
but I also wanna let
everybody know that Juno

545

00:27:39,624 --> 00:27:42,460
is very healthy and doing great

546

00:27:42,460 --> 00:27:45,397
and the suit of armor's working.

547

00:27:45,397 --> 00:27:48,533

So with that I'd like
to hand it over to Candy

548

00:27:48,533 --> 00:27:51,436

who'll tell you about Juno cam.

549

00:27:51,436 --> 00:27:52,671

- [Candy] Thank you, Heidi.

550

00:27:52,671 --> 00:27:55,974

I'm going to be
showing some data

551

00:27:55,974 --> 00:27:59,077

that we collected
just last Friday.

552

00:27:59,077 --> 00:28:02,914

So just last Friday Juno
passed close to Jupiter

553

00:28:02,914 --> 00:28:07,085

on what we call perijove six
and what you are looking at,

554

00:28:09,921 --> 00:28:14,092

look at CandyHansen1, those
are 14 Juno cam images

555

00:28:16,661 --> 00:28:20,432

that we collected as we flew
through that two hour pass

556

00:28:20,432 --> 00:28:23,435

from the north pole
to the south pole.

557

00:28:23,435 --> 00:28:28,106

So the image on the left

is looking straight down

558

00:28:28,106 --> 00:28:29,641
at the north pole.

559

00:28:29,641 --> 00:28:32,677
It's half lit, as
Scott was describing.

560

00:28:32,677 --> 00:28:36,214
The north pole itself is
approximately in the center

561

00:28:36,214 --> 00:28:38,950
and you're seeing
all of Jupiter.

562

00:28:40,151 --> 00:28:43,855
On the far right, on
the right hand side,

563

00:28:43,855 --> 00:28:45,290
we're looking at the
southern hemisphere

564

00:28:45,290 --> 00:28:49,761
and again we're far enough
away from the planet

565

00:28:49,761 --> 00:28:53,832
that you see all of Jupiter
in our field of view.

566

00:28:55,266 --> 00:28:59,270
Now the interesting thing is
what happens as we zoom in

567

00:28:59,270 --> 00:29:03,041
and these 14 images,
the width of the image

568

00:29:03,041 --> 00:29:06,544

is the width of the
Juno cam field of view

569

00:29:08,413 --> 00:29:12,851

but we collect our images
as the spacecraft spins

570

00:29:12,851 --> 00:29:16,855

so as the spacecraft
gets closer and closer

571

00:29:16,855 --> 00:29:20,759

and closer to Jupiter
we see less and less

572

00:29:20,759 --> 00:29:23,561

of Jupiter itself
in terms of area

573

00:29:23,561 --> 00:29:27,565

but we see more and more
detail in the pictures.

574

00:29:29,033 --> 00:29:32,804

So I am going to actually
show you the fourth image

575

00:29:35,206 --> 00:29:38,610

in the sequence from
the left to start with

576

00:29:38,610 --> 00:29:40,512

and then the fourth
from the right.

577

00:29:40,512 --> 00:29:44,048

So just picking out two
of those 14 to look at

578

00:29:44,048 --> 00:29:46,284
in this higher detail.

579

00:29:46,284 --> 00:29:49,387
So if you go to
Candy2, this is taken

580

00:29:52,657 --> 00:29:56,661
at approximately 38
degrees north latitude

581

00:29:56,661 --> 00:29:59,964
and you can see a big
wavy band of clouds

582

00:29:59,964 --> 00:30:02,767
in the middle of the image.

583

00:30:02,767 --> 00:30:06,404
If you go to Candy3, I'm
drawing your attention

584

00:30:06,404 --> 00:30:08,907
to those clouds
and then in Candy4

585

00:30:08,907 --> 00:30:12,677
it's really just a cut
out of that same image

586

00:30:14,179 --> 00:30:18,016
but there's a couple of things
I wanted to point out here.

587

00:30:18,016 --> 00:30:20,652
So we've got these
big wavy clouds

588

00:30:20,652 --> 00:30:24,756
but then you can see
tiny little white dots.

589
00:30:24,756 --> 00:30:29,093
They look tiny just
because Jupiter is so big.

590
00:30:29,093 --> 00:30:30,795
These are actually clouds

591
00:30:30,795 --> 00:30:34,499
that are about 50
kilometers across.

592
00:30:34,499 --> 00:30:37,268
They are up above
the cloud deck.

593
00:30:39,337 --> 00:30:41,172
We know that because
we can actually

594
00:30:41,172 --> 00:30:44,242
see them casting
little tiny shadows.

595
00:30:45,143 --> 00:30:47,178
We've seen this actually before

596
00:30:47,178 --> 00:30:49,080
in some of our earlier images

597
00:30:49,080 --> 00:30:51,349
but in this particular perijove

598
00:30:51,349 --> 00:30:54,285
the lighting is really
good to see these features

599

00:30:54,285 --> 00:30:57,522

and we have our camera
settings dialed in

600

00:30:57,522 --> 00:31:01,292

and honestly we were so
enchanted by the poles

601

00:31:02,460 --> 00:31:04,062

that we're only now
just starting to look

602

00:31:04,062 --> 00:31:06,731

at other places on the planet.

603

00:31:06,731 --> 00:31:10,001

So these look almost
like squall lines.

604

00:31:11,169 --> 00:31:15,773

If you go to Candy5 this
is an image taken now

605

00:31:15,773 --> 00:31:17,876

in the southern hemisphere.

606

00:31:17,876 --> 00:31:21,312

This is the south
tropical zone and again

607

00:31:22,513 --> 00:31:25,984

I'm going to go to the
cutouts that show you

608

00:31:25,984 --> 00:31:28,286

in more detail what
we're looking at.

609

00:31:28,286 --> 00:31:31,122

So Candy6 and then
stop at Candy7.

610
00:31:33,858 --> 00:31:35,760
Here you can see again,

611
00:31:37,295 --> 00:31:40,698
that it's a really
stormy day on Jupiter.

612
00:31:41,900 --> 00:31:45,870
We've got these little
white storm systems

613
00:31:45,870 --> 00:31:50,041
really just scattered across
the entire south tropical zone.

614
00:31:51,542 --> 00:31:55,713
Again they're about 50
kilometers across which is,

615
00:31:57,148 --> 00:31:59,617
so I keep saying tiny but
they're really not tiny at all

616
00:31:59,617 --> 00:32:04,222
and they're up above the
cloud deck at a pressure level

617
00:32:04,222 --> 00:32:08,660
where the temperature
is going to be very cold

618
00:32:08,660 --> 00:32:12,830
and so what you're seeing
is most likely ice crystals

619
00:32:13,831 --> 00:32:16,234
of water ice and ammonia ice.

620

00:32:18,970 --> 00:32:22,373

I want to mention
that these images

621

00:32:22,373 --> 00:32:25,276

that I just showed
were processed

622

00:32:25,276 --> 00:32:28,713

by two of our amateur
citizen scientists,

623

00:32:29,681 --> 00:32:32,083

Gerald Eichstädt and Seán Doran.

624

00:32:32,083 --> 00:32:35,720

They have processed quite
a number of our images

625

00:32:35,720 --> 00:32:40,024

but it's really the whole
endeavor of Juno cam

626

00:32:40,024 --> 00:32:44,228

was to find ways for the
public to participate

627

00:32:44,228 --> 00:32:47,665

in a meaningful way
on a flight mission.

628

00:32:47,665 --> 00:32:49,934

So with that I'd like
to draw your attention

629

00:32:49,934 --> 00:32:53,871

to CandyHansen number
eight and what you'll see

630

00:32:55,139 --> 00:32:56,841

is you'll see across the top,

631

00:32:56,841 --> 00:32:59,610

I've got four images of Jupiter.

632

00:32:59,610 --> 00:33:02,347

This is just four of many images

633

00:33:02,347 --> 00:33:07,318

that our amateur astronomer
community has contributed.

634

00:33:07,318 --> 00:33:09,153

So on our website we have a way

635

00:33:09,153 --> 00:33:12,323

that the community
can upload pictures

636

00:33:14,292 --> 00:33:16,995

taken from their
backyard telescopes.

637

00:33:16,995 --> 00:33:18,463

That's the top row.

638

00:33:18,463 --> 00:33:22,467

Then we take those images
and again many more than four

639

00:33:22,467 --> 00:33:24,102

and we make a cylindrical map

640

00:33:24,102 --> 00:33:26,671

which is what you
see along the bottom.

641

00:33:26,671 --> 00:33:29,340
Then for a given perijove, pass,

642
00:33:30,908 --> 00:33:32,510
and in this case it's number six

643
00:33:32,510 --> 00:33:35,947
we ask the public to
define points of interests.

644
00:33:35,947 --> 00:33:39,817
Places they think would
be good spots for pictures

645
00:33:39,817 --> 00:33:42,520
and so that's what the
yellow circles represent

646
00:33:42,520 --> 00:33:45,289
and the two images
that I just showed you

647
00:33:45,289 --> 00:33:49,260
are the ones that are covered
by those green circles.

648
00:33:49,260 --> 00:33:53,898
So the public voted on
what to take pictures of,

649
00:33:53,898 --> 00:33:57,135
we ended up with
those and so our whole

650
00:33:58,336 --> 00:34:00,905
citizen science
endeavor, I think,

651
00:34:00,905 --> 00:34:04,942
is turning out to be

quite interesting.

652

00:34:04,942 --> 00:34:07,378

The last chart, CandyHansen9,

653

00:34:08,880 --> 00:34:12,550

we love to see artistic
products in addition

654

00:34:14,152 --> 00:34:16,988

to the more rigorous renditions

655

00:34:16,988 --> 00:34:19,891

of color reconstruction
and so on.

656

00:34:19,891 --> 00:34:23,895

The thing about art is
that it captures feelings

657

00:34:27,365 --> 00:34:30,034

that either you don't
recognize in yourself

658

00:34:30,034 --> 00:34:34,038

or maybe you don't know
how to express and for me,

659

00:34:34,038 --> 00:34:37,642

this image captures
how I feel to be a part

660

00:34:38,810 --> 00:34:42,346

of this project and I'll
just mention that this

661

00:34:42,346 --> 00:34:44,415

was processed by Myrna.

662

00:34:44,415 --> 00:34:47,452

With that I'm gonna
turn it back to Scott

663

00:34:47,452 --> 00:34:49,854

to give us a little bit more.

664

00:34:52,390 --> 00:34:53,791

- [Scott] So thanks, Candy.

665

00:34:53,791 --> 00:34:56,260

I'm always amazed looking
at those pictures.

666

00:34:56,260 --> 00:34:59,197

The idea of seeing those
little cloud features,

667

00:34:59,197 --> 00:35:02,400

those white caps,
coming out of Jupiter.

668

00:35:02,400 --> 00:35:04,869

I mean they're full of
ammonia and water ice.

669

00:35:04,869 --> 00:35:09,373

What you're really watching
is it's snowing on Jupiter

670

00:35:09,373 --> 00:35:13,511

and we're seeing how it works
and so I can imagine myself

671

00:35:13,511 --> 00:35:16,280

flying around in that
atmosphere while it's snowing

672

00:35:16,280 --> 00:35:19,984

and it's really great to

be able to project myself

673

00:35:19,984 --> 00:35:22,053

and use that imagination
and understand

674

00:35:22,053 --> 00:35:24,222

how another whole world works.

675

00:35:24,222 --> 00:35:28,993

Some things are similar and a
lot of things are different.

676

00:35:28,993 --> 00:35:33,164

The last picture of the
art really shows how people

677

00:35:34,265 --> 00:35:37,535

are able to artistically
express themselves

678

00:35:37,535 --> 00:35:40,071

and it's so great
that we can do that

679

00:35:40,071 --> 00:35:41,572

and enable that with the Juno.

680

00:35:41,572 --> 00:35:44,475

We have a big campaign with
Juno for public awareness

681

00:35:44,475 --> 00:35:46,177

where we're trying to
inspire and motivate

682

00:35:46,177 --> 00:35:49,647

really the connections between
science, art and music.

683

00:35:49,647 --> 00:35:52,283

A lot of the images
that are being made

684

00:35:52,283 --> 00:35:55,019

on our website by the public
are actually artistic.

685

00:35:55,019 --> 00:35:56,554

Some of them are science.

686

00:35:56,554 --> 00:35:58,890

A lot of them are artistic
and it's great to see that

687

00:35:58,890 --> 00:36:01,659

and that whole
collaboration that we do

688

00:36:01,659 --> 00:36:04,428

extends into music and
we formed a collaboration

689

00:36:04,428 --> 00:36:08,599

with Apple and we've made
some music that's Juno related

690

00:36:09,867 --> 00:36:12,436

and Apple's helped
up distribute that

691

00:36:12,436 --> 00:36:15,873

and what I'd like to play
for you next is some sounds

692

00:36:15,873 --> 00:36:18,976

that we got, that
we received on PJ4,

693

00:36:20,478 --> 00:36:23,114
the fourth time
we flew by Jupiter

694
00:36:23,114 --> 00:36:24,515
and we've been studying those

695
00:36:24,515 --> 00:36:26,551
and we wanna share them with you

696
00:36:26,551 --> 00:36:29,954
because they really
echo and demonstrate

697
00:36:29,954 --> 00:36:32,990
this connection between
science, music and art

698
00:36:32,990 --> 00:36:34,792
in the sense that these sounds

699
00:36:34,792 --> 00:36:37,395
sound a lot like musical notes.

700
00:36:38,563 --> 00:36:41,299
So you can take a listen
to nature's music here

701
00:36:41,299 --> 00:36:45,136
with going to
ScottBolton slide seven.

702
00:36:45,136 --> 00:36:47,638
Now that's a audio video file.

703
00:36:50,041 --> 00:36:53,711
(static and random beeping)

704
00:38:52,129 --> 00:38:57,034

So I'd like to go to
ScottBolton8, sort of to close.

705
00:38:57,034 --> 00:38:58,969
This is a picture of Jupiter

706
00:38:58,969 --> 00:39:00,471
that's also posted
on our website.

707
00:39:00,471 --> 00:39:02,673
We open it up to
amateur astronomers

708
00:39:02,673 --> 00:39:06,911
who help us actually plan
out the Juno cam images.

709
00:39:06,911 --> 00:39:10,047
This was taken by
Christopher Go and posted.

710
00:39:10,047 --> 00:39:11,716
It's a pretty recent
picture of Jupiter

711
00:39:11,716 --> 00:39:15,386
and what I wanted to show,
this looks like the Jupiter

712
00:39:15,386 --> 00:39:16,821
that we know and love.

713
00:39:16,821 --> 00:39:18,723
It's got the zones and
belts and the great red spot

714
00:39:18,723 --> 00:39:21,225
and I wanna extend an
invitation to all of you

715

00:39:21,225 --> 00:39:24,428
to join our team
as we look forward

716

00:39:24,428 --> 00:39:27,898
to our very next close
forward pass by Jupiter

717

00:39:27,898 --> 00:39:30,534
when we'll be targeting
that great red spot.

718

00:39:30,534 --> 00:39:32,036
Now that great
spot's moving around

719

00:39:32,036 --> 00:39:34,171
so it's not the
easiest thing to target

720

00:39:34,171 --> 00:39:38,175
but on July 11th we're targeting
to fly right over that.

721

00:39:38,175 --> 00:39:41,779
So stay tuned and you
can join us on July 11th.

722

00:39:41,779 --> 00:39:43,180
Thank you.

723

00:39:43,180 --> 00:39:45,316
- [Jane] Alright thank
you, Scott and thank you

724

00:39:45,316 --> 00:39:46,851
to all the panelists.

725

00:39:46,851 --> 00:39:50,421
We're gonna be ready to take
some questions from reporters

726
00:39:50,421 --> 00:39:53,124
and we'll try to grab a
couple from social media.

727
00:39:53,124 --> 00:39:55,126
A reminder to reporters,
if you do have a question

728
00:39:55,126 --> 00:39:58,062
please press *1, tell
the operator you name

729
00:39:58,062 --> 00:40:02,032
and your affiliation
and I do wanna mention

730
00:40:02,032 --> 00:40:05,035
that this media telecom
will be archived afterwards

731
00:40:05,035 --> 00:40:09,206
with visuals on Ustream
at www.ustream.tv/NASAJPL2

732
00:40:15,379 --> 00:40:18,349
and I'll give that out once
again before we wrap up.

733
00:40:18,349 --> 00:40:20,785
Let's go to our first question

734
00:40:20,785 --> 00:40:23,821
which comes from Alan
Boyle of Geek Wire.

735
00:40:23,821 --> 00:40:26,123

Alan?

- [Alan] Hi, thank you.

736

00:40:26,123 --> 00:40:27,892

I guess this would be
a question for Scott.

737

00:40:27,892 --> 00:40:31,429

What do you think
are the factors

738

00:40:31,429 --> 00:40:34,265

that have lead to
these surprises?

739

00:40:35,666 --> 00:40:38,369

How did you get things
so wrong I guess

740

00:40:38,369 --> 00:40:41,705

would be one way of putting it?

741

00:40:41,705 --> 00:40:44,842

- [Scott] So I think
we're all sort of feeling

742

00:40:44,842 --> 00:40:48,846

the humility and
humbleness of nature.

743

00:40:48,846 --> 00:40:50,648

You know I think a
lot of scientists,

744

00:40:50,648 --> 00:40:52,950

when we looked out
at the giant planets

745

00:40:52,950 --> 00:40:57,121

and we saw that they were so

big, these giant big gas balls

746

00:40:58,022 --> 00:40:59,323

was that a lot of Earth works

747

00:40:59,323 --> 00:41:02,993

through the sunlight

generating dynamics

748

00:41:02,993 --> 00:41:06,230

in the atmosphere and

a lot of assumptions

749

00:41:06,230 --> 00:41:08,365

were that once you

turn off that energy

750

00:41:08,365 --> 00:41:12,203

that maybe everything would

be uniform and boring.

751

00:41:12,203 --> 00:41:14,872

I think that we were just

wrong and so this was making us

752

00:41:14,872 --> 00:41:19,510

rethink how giant planets work,

not just in our own system

753

00:41:19,510 --> 00:41:21,612

but giant planets

are really important

754

00:41:21,612 --> 00:41:23,814

throughout the galaxy

and the universe.

755

00:41:23,814 --> 00:41:27,284

We see other planetary

systems and a lot of them

756

00:41:27,284 --> 00:41:28,519
have giant planets.

757

00:41:28,519 --> 00:41:31,355
Sometimes many times
bigger than Jupiter even

758

00:41:31,355 --> 00:41:34,225
and we're getting the
first really close up

759

00:41:34,225 --> 00:41:37,995
and personal look of
Jupiter and we're seeing

760

00:41:37,995 --> 00:41:42,466
that a lot of our ideas were
incorrect and maybe naive.

761

00:41:42,466 --> 00:41:46,003
That it's very complex
and really there's a lot

762

00:41:46,003 --> 00:41:48,072
of deep motions going on
and there's a theme here.

763

00:41:48,072 --> 00:41:50,341
There's motions going on
just beneath the clouds

764

00:41:50,341 --> 00:41:52,076
that we see with the microwave

765

00:41:52,076 --> 00:41:53,744
and there may be very deep winds

766

00:41:53,744 --> 00:41:55,513

and deep motions
going on that we see

767
00:41:55,513 --> 00:41:57,448
with the gravity field.

768
00:41:57,448 --> 00:42:01,151
It's hard to say yes but
more data will tell us

769
00:42:01,151 --> 00:42:03,320
how deep those really go.

770
00:42:03,320 --> 00:42:04,955
We're just at the
beginning of this mission

771
00:42:04,955 --> 00:42:09,493
where we're eventually
gonna map out that planet.

772
00:42:09,493 --> 00:42:10,895
- [Jane] Alright,
thank you, Scott.

773
00:42:10,895 --> 00:42:13,163
We're going to take
our next question

774
00:42:13,163 --> 00:42:15,599
and actually before I do I
just wanted to ask reporters

775
00:42:15,599 --> 00:42:18,068
because we do have quite
a few of you in the queue

776
00:42:18,068 --> 00:42:21,572
to keep their question
to one question

777

00:42:21,572 --> 00:42:23,641
if needed one quick follow up

778

00:42:23,641 --> 00:42:25,676
so we can go through
the first round

779

00:42:25,676 --> 00:42:28,012
and then afterwards
assuming we have time

780

00:42:28,012 --> 00:42:29,880
we can go back to everybody.

781

00:42:29,880 --> 00:42:31,815
Anyway, but that was
fine and Alan Boyle

782

00:42:31,815 --> 00:42:35,252
you did not do that so you did
not do more than one question

783

00:42:35,252 --> 00:42:37,154
so it wasn't intended at you.

784

00:42:37,154 --> 00:42:39,790
Alright, let's go ahead with
a question from Marcia Dunn

785

00:42:39,790 --> 00:42:41,392
of the Associated Press.

786

00:42:41,392 --> 00:42:42,893
- [Marcia] Yes, hi.

787

00:42:42,893 --> 00:42:47,498
For Dr. Bolton, the larger
splotches at the poles,

788

00:42:47,498 --> 00:42:50,768

not the oval cyclones but
the other weather systems

789

00:42:50,768 --> 00:42:54,171

that are thousands of kilometers
across, what are those

790

00:42:54,171 --> 00:42:58,242

and for the cyclones do you
have any idea how powerful

791

00:42:58,242 --> 00:43:01,779

they would be, what
more over category five

792

00:43:03,781 --> 00:43:08,385

and how many cyclones all
together would you guess?

793

00:43:08,385 --> 00:43:10,955

- [Scott] So I haven't done
a count of all the cyclones.

794

00:43:10,955 --> 00:43:13,057

But there's lots of them.

795

00:43:14,959 --> 00:43:16,460

I mean you could
count them yourself.

796

00:43:16,460 --> 00:43:20,130

There's dozens at least
going through the system.

797

00:43:20,130 --> 00:43:23,968

These large pieces are
other dynamic features.

798

00:43:25,703 --> 00:43:29,306

I don't think I can
explain exactly how fast

799

00:43:29,306 --> 00:43:30,908

any of these are going.

800

00:43:30,908 --> 00:43:32,977

We haven't measured
all the velocities

801

00:43:32,977 --> 00:43:34,478

for each of these cyclones.

802

00:43:34,478 --> 00:43:37,014

Of course it takes multiple
images at different times

803

00:43:37,014 --> 00:43:40,084

in order to get that kind
of dynamic information.

804

00:43:40,084 --> 00:43:44,254

So I think those are objective
that maybe we'll be able

805

00:43:46,290 --> 00:43:50,828

to accomplish as we go over
the poles multiple times.

806

00:43:50,828 --> 00:43:53,364

Over perijove six, the
one that we just took,

807

00:43:53,364 --> 00:43:57,301

once we saw those cyclones
we basically set out

808

00:43:58,936 --> 00:44:01,171

to take images so that
we could try to measure

809
00:44:01,171 --> 00:44:03,707
some of those velocities
that you're talking about

810
00:44:03,707 --> 00:44:07,411
but I think a lot
of this was so new.

811
00:44:07,411 --> 00:44:09,647
We really just
learned that Jupiter

812
00:44:09,647 --> 00:44:12,483
really is like this
from this data.

813
00:44:12,483 --> 00:44:15,152
Now the hard work
comes with the theories

814
00:44:15,152 --> 00:44:19,323
to try to explain why and how
is these dynamics manifested

815
00:44:20,891 --> 00:44:24,595
and how are they maintained
and are they stable.

816
00:44:24,595 --> 00:44:27,998
These are questions that
I think are new objectives

817
00:44:27,998 --> 00:44:32,002
for our mission as we
move on and get more data.

818
00:44:33,737 --> 00:44:36,040

- [Marcia] Quick followup,
these dynamic features

819

00:44:36,040 --> 00:44:38,308

that are so much bigger
than the cyclones,

820

00:44:38,308 --> 00:44:42,479

could they also be cyclones
like mega sized cyclones?

821

00:44:44,515 --> 00:44:45,783

- [Scott] They could be although

822

00:44:45,783 --> 00:44:47,418

they don't appear to
be gigantic cyclones.

823

00:44:47,418 --> 00:44:49,086

They don't have
the same morphology

824

00:44:49,086 --> 00:44:51,722

that I would be
used to but I think

825

00:44:51,722 --> 00:44:54,224

that those kinds of
questions I think

826

00:44:54,224 --> 00:44:56,593

we would be better
off pointing you

827

00:44:56,593 --> 00:44:59,830

toward our atmospheric
expects rather than me.

828

00:44:59,830 --> 00:45:02,132

- [Marcia] Okay thank you.

829

00:45:02,132 --> 00:45:03,667

- [Jane] Alright thanks, Marcia

830

00:45:03,667 --> 00:45:06,036

and then we're gonna move on
to Bill Arwood of CBS News.

831

00:45:06,036 --> 00:45:07,905

Hi Bill.

- [Bill] Hey thanks.

832

00:45:07,905 --> 00:45:12,009

For Scott, can you expand a
little bit more about the core?

833

00:45:12,009 --> 00:45:16,413

I'm not really sure how
to visualize a fuzzy core.

834

00:45:16,413 --> 00:45:19,116

I realize you don't have
a solid answer to this

835

00:45:19,116 --> 00:45:21,418

but any expansion
would be great.

836

00:45:21,418 --> 00:45:25,589

And for Candy, on CandyHansen5,
the width of that band,

837

00:45:28,258 --> 00:45:29,560

that whitish band
with all the stuff,

838

00:45:29,560 --> 00:45:31,295

it looks so much broader
than the normal belts

839

00:45:31,295 --> 00:45:33,530

we see from equatorial
views, I'm just wondering

840

00:45:33,530 --> 00:45:35,332

if it's the orientation
that's throwing me off.

841

00:45:35,332 --> 00:45:37,434

I'm not really sure
what I'm seeing there.

842

00:45:37,434 --> 00:45:38,802

Thanks.

843

00:45:38,802 --> 00:45:41,171

- [Scott] Why do we
let Candy go first.

844

00:45:41,171 --> 00:45:45,342

- [Candy] Okay yeah so
when we're close to Jupiter

845

00:45:46,443 --> 00:45:49,580

we do not see horizon to horizon

846

00:45:49,580 --> 00:45:54,118

so we're only seeing a
limited range in latitude

847

00:45:54,118 --> 00:45:56,920

and that's why it looks
so odd and if you look

848

00:45:56,920 --> 00:46:01,425

at the sequence of 14 you
can see, you can literally,

849

00:46:01,425 --> 00:46:03,260

the way to think about it is

850

00:46:03,260 --> 00:46:07,231

if you were looking through
Juno cam's camera lens

851

00:46:07,231 --> 00:46:10,200

riding on the spacecraft
you'd start out at a distance.

852

00:46:10,200 --> 00:46:12,369

Say you were looking at
your hand at a distance,

853

00:46:12,369 --> 00:46:14,872

now you pull your
hand into your nose,

854

00:46:14,872 --> 00:46:16,707

that's what it's like.

855

00:46:18,142 --> 00:46:21,512

So we are only seeing just
the south tropical zone

856

00:46:21,512 --> 00:46:25,415

at that point cause we
are so close to Jupiter.

857

00:46:27,084 --> 00:46:29,853

- [Jane] Okay, thank you and
we're going to go now to Mike-

858

00:46:29,853 --> 00:46:33,524

- [Scott] I think I owe
him a question on the core.

859

00:46:33,524 --> 00:46:34,458

- [Jane] Okay sorry about that.

860
00:46:34,458 --> 00:46:35,559
Go ahead.

861
00:46:35,559 --> 00:46:38,462
- [Scott] So the
fuzzy core idea.

862
00:46:38,462 --> 00:46:41,498
Scientists when
they've done models

863
00:46:41,498 --> 00:46:43,867
and what we were kind of
expecting to see at Jupiter,

864
00:46:43,867 --> 00:46:46,303
there were two extreme cases.

865
00:46:46,303 --> 00:46:50,107
A little compact core down
in the center of Jupiter

866
00:46:50,107 --> 00:46:53,043
maybe Earth size
or one Earth mass,

867
00:46:54,178 --> 00:46:55,879
10 Earth masses,
something like that,

868
00:46:55,879 --> 00:46:59,683
all compact and tight
in the center of Jupiter

869
00:46:59,683 --> 00:47:01,351
or maybe there was no core.

870
00:47:01,351 --> 00:47:03,620
Maybe Jupiter formed

without a core at all.

871

00:47:03,620 --> 00:47:05,856

And those were the two
kind of extreme models

872

00:47:05,856 --> 00:47:09,359

and scientists were in
one camp or the other.

873

00:47:09,359 --> 00:47:12,329

What we found was that
really neither were true.

874

00:47:12,329 --> 00:47:14,031

There may be a little
bit of a compact core

875

00:47:14,031 --> 00:47:16,667

but most of things there
may be layers there,

876

00:47:16,667 --> 00:47:20,237

there seems to be a fuzzy
core that may be much larger

877

00:47:20,237 --> 00:47:24,608

than anybody had anticipated
and so the gravity data

878

00:47:24,608 --> 00:47:27,644

that we've gotten thus far
is not really consistent

879

00:47:27,644 --> 00:47:31,215

with just a small
compact core or zero core

880

00:47:32,583 --> 00:47:35,919

but it is somewhat consistent

with a large fuzzy core

881

00:47:35,919 --> 00:47:38,021
that may be partially dissolved.

882

00:47:38,021 --> 00:47:41,792
It's also consistent maybe
with some deep motions

883

00:47:41,792 --> 00:47:43,694
or zonal winds and
things like that

884

00:47:43,694 --> 00:47:47,064
that may be going on that
are dictating the interior

885

00:47:47,064 --> 00:47:51,401
of Jupiter's dynamics
which are very different

886

00:47:51,401 --> 00:47:54,838
than what historical
models have assumed.

887

00:47:58,709 --> 00:47:59,977
- [Jane] Alright thanks,

888

00:47:59,977 --> 00:48:03,347
we're gonna go to Mike
Wahl at Space.com.

889

00:48:04,548 --> 00:48:06,416
- [Mike] Thank you
guys, this was all

890

00:48:06,416 --> 00:48:09,119
just like really,
really interesting.

891

00:48:09,119 --> 00:48:13,957

This one's probably for Scott
or also for Candy, maybe.

892

00:48:13,957 --> 00:48:18,462

Scott, you said there
was clouds, it was
snowing on Jupiter,

893

00:48:18,462 --> 00:48:22,065

is that water ice that
we're talking about?

894

00:48:23,667 --> 00:48:26,570

Snow like we're used to
here on Earth or is it

895

00:48:26,570 --> 00:48:28,438

some kind of exotic substance?

896

00:48:28,438 --> 00:48:31,775

Is it something we'd
be able to recognize?

897

00:48:31,775 --> 00:48:33,977

- [Scott] It's probably
mostly ammonia ice

898

00:48:33,977 --> 00:48:36,046

but there may be water
ice mixed into it

899

00:48:36,046 --> 00:48:39,950

so it's not exactly like
the snow that we have

900

00:48:39,950 --> 00:48:41,818

and I was using my imagination

901

00:48:41,818 --> 00:48:43,420
when I said it's snowing there.

902
00:48:43,420 --> 00:48:45,422
It could be hail.

903
00:48:45,422 --> 00:48:48,825
(panel laughing)

904
00:48:48,825 --> 00:48:50,928
- [Mike] Okay, thank you.

905
00:48:52,329 --> 00:48:54,331
- [Jane] Okay we're gonna
jump over to Ken Chang

906
00:48:54,331 --> 00:48:55,766
with the New York Times.

907
00:48:55,766 --> 00:48:58,435
Ken.
- [Ken] I was wondering if,

908
00:48:59,870 --> 00:49:01,638
this is for Jack, if you
could explain the physics

909
00:49:01,638 --> 00:49:03,407
of how electrons could be sucked

910
00:49:03,407 --> 00:49:07,010
out of the atmosphere
to create the aurora.

911
00:49:08,345 --> 00:49:12,249
- [Jack] Okay, in that
picture we had always assumed

912
00:49:12,249 --> 00:49:15,886

that if the ultraviolet
emissions are coming from deeper

913

00:49:15,886 --> 00:49:20,257

in the atmosphere which is
what that color represents,

914

00:49:20,257 --> 00:49:23,393

that it was simply due to
particles that were so energetic

915

00:49:23,393 --> 00:49:26,129

penetrating deeper
than the rest of them

916

00:49:26,129 --> 00:49:28,832

and we really never,
should have perhaps

917

00:49:28,832 --> 00:49:31,501

but never considered
the idea that well maybe

918

00:49:31,501 --> 00:49:34,972

they're just being accelerated
out of the ionosphere

919

00:49:34,972 --> 00:49:38,442

and indeed when we
crossed the polar cap,

920

00:49:38,442 --> 00:49:41,578

the electron detector,
Jedi, measured electrons

921

00:49:41,578 --> 00:49:45,749

moving up away from Jupiter
across that entire inner circle

922

00:49:48,986 --> 00:49:52,289

and so putting the two
together, we now recognize

923

00:49:52,289 --> 00:49:56,693
that what we see in red
probably shows us that electrons

924

00:49:56,693 --> 00:49:58,929
are being pulled out
of the atmosphere

925

00:49:58,929 --> 00:50:02,366
by an electric potential
is what do that.

926

00:50:03,767 --> 00:50:07,371
We put a voltage on the field
line in an electric field

927

00:50:07,371 --> 00:50:10,841
and draw the electrons
out of the ionosphere.

928

00:50:10,841 --> 00:50:12,776
And as they're
leaving, they excite,

929

00:50:12,776 --> 00:50:16,213
they collide with the
hydrogen molecules

930

00:50:16,213 --> 00:50:18,482
and excite
ultraviolet emissions.

931

00:50:18,482 --> 00:50:22,652
So it's a 180 degree turnabout
from the way we were thinking

932

00:50:24,187 --> 00:50:28,358

about those emissions prior
to the Juno observations.

933

00:50:31,361 --> 00:50:33,263

- [Jane] Okay we're
going to switch over

934

00:50:33,263 --> 00:50:35,499

for one second to social media.

935

00:50:35,499 --> 00:50:38,402

We have a question from
Jorge Vidal on Facebook

936

00:50:38,402 --> 00:50:42,005

asking if you've seen
the cyclones observed

937

00:50:42,005 --> 00:50:44,107

near Jupiter's north pole change

938

00:50:44,107 --> 00:50:47,944

when you compare pictures
of different flybys?

939

00:50:49,446 --> 00:50:52,816

- [Candy] Yeah, the quick
and simple answer is yes.

940

00:50:52,816 --> 00:50:56,620

In fact we were just
puzzling yesterday

941

00:50:56,620 --> 00:51:00,657

over trying to see if, is
this one the same as that one

942

00:51:00,657 --> 00:51:04,795

or is that one the same as this
one so yeah they do change.

943

00:51:07,664 --> 00:51:11,735

- [Jane] Alright thanks
to Candy for that reply.

944

00:51:11,735 --> 00:51:15,205

We're going to take one
more right now from Twitter.

945

00:51:15,205 --> 00:51:18,041

Tory is asking if
Jupiter's magnetic poles

946

00:51:18,041 --> 00:51:21,645

are really far from
their axis of rotation?

947

00:51:23,914 --> 00:51:26,183

- [Jack] Yeah, this is Jack.

948

00:51:26,183 --> 00:51:29,586

The magnetic poles for
Jupiter's magnetic field

949

00:51:29,586 --> 00:51:31,822

are really quite
similar to the Earth's.

950

00:51:31,822 --> 00:51:35,258

The poles are offset
by about 10 degrees.

951

00:51:36,460 --> 00:51:38,995

But what's different
of course is the small

952

00:51:38,995 --> 00:51:42,132

spatial scale features
that we're seeing now

953

00:51:42,132 --> 00:51:43,900

that have to account
for the differences

954

00:51:43,900 --> 00:51:46,069

in what we're measuring.

955

00:51:46,069 --> 00:51:50,240

To use that Earth analogy again,
if we were to follow along

956

00:51:51,708 --> 00:51:55,445

the surface of Jupiter along
that track with a compass,

957

00:51:55,445 --> 00:51:59,416

we would see it deviate
left and right much more so

958

00:51:59,416 --> 00:52:03,019

than when we see moving
around on the Earth.

959

00:52:04,221 --> 00:52:07,557

The more complex
lumpier magnetic field.

960

00:52:07,557 --> 00:52:11,728

But overall the broad scale
as you step away from Jupiter,

961

00:52:13,930 --> 00:52:17,033

we'll call it a dipole field,
that's really quite similar

962

00:52:17,033 --> 00:52:21,204

to the Earth's dipole field
only much, much stronger.

963

00:52:23,440 --> 00:52:24,374

- [Jane] Thank you, Jack.

964

00:52:24,374 --> 00:52:25,809

We're gonna take a question now

965

00:52:25,809 --> 00:52:29,212

from Space Flight Insider
and Ocean McIntyre.

966

00:52:30,580 --> 00:52:33,750

- [Ocean] I was just
wondering on ScottBolton3,

967

00:52:33,750 --> 00:52:36,586

you have this large amount
of metallic hydrogen,

968

00:52:36,586 --> 00:52:39,923

is there an estimate at
this point of the percentage

969

00:52:39,923 --> 00:52:43,894

of the planet that is
made of metallic hydrogen

970

00:52:43,894 --> 00:52:46,062

versus molecular hydrogen?

971

00:52:48,298 --> 00:52:50,901

- [Jack] This is Jack again.

972

00:52:50,901 --> 00:52:55,071

The current models place the
molecular hydrogen transition

973

00:52:56,540 --> 00:53:00,243

to metallic hydrogen down at
about 0.75, 0.8 planet radius

974

00:53:02,846 --> 00:53:05,782

and this is where the pressure,
about two million times

975

00:53:05,782 --> 00:53:08,218

the atmosphere pressure
on Earth, is so great

976

00:53:08,218 --> 00:53:11,488

that it squeezes the
electrons off the nuclei

977

00:53:11,488 --> 00:53:15,959

and they're free to move about
much as they are in a metal.

978

00:53:15,959 --> 00:53:19,196

But that's at about 0.75
or 0.8 of the planet radius

979

00:53:19,196 --> 00:53:22,966

and it depends on our
knowledge of the behavior

980

00:53:22,966 --> 00:53:27,137

of hydrogen under such extreme
pressure and temperature.

981

00:53:28,572 --> 00:53:32,576

This is about the pressure
that we can achieve on Earth

982

00:53:32,576 --> 00:53:35,512

in a laboratory with
a diamond anvil.

983

00:53:35,512 --> 00:53:39,583

So it's an area of
intense research right now

984
00:53:39,583 --> 00:53:43,353
and they're just
getting to mega bars

985
00:53:43,353 --> 00:53:46,556
where we can see stable
metallic hydrogen.

986
00:53:46,556 --> 00:53:48,124
- [Ocean] Thank you.

987
00:53:48,124 --> 00:53:49,960
- [Jane] Our next question
is from Kelly Beedee

988
00:53:49,960 --> 00:53:52,262
at Sky Intelliscope.

989
00:53:52,262 --> 00:53:53,463
- [Kelly] Yeah thanks very much.

990
00:53:53,463 --> 00:53:54,965
Scott, I hope at some
point you tell us

991
00:53:54,965 --> 00:53:57,534
which of those plasma waves
are from the monolith, Scott.

992
00:53:57,534 --> 00:54:02,038
This is actually for Heidi
Becker and I'm wondering,

993
00:54:02,038 --> 00:54:05,809
you said that there's
a gap at the inner edge

994
00:54:05,809 --> 00:54:07,644
of the radiation belt

that you expected.

995

00:54:07,644 --> 00:54:10,013

Why do you expect that
there's a gap there?

996

00:54:10,013 --> 00:54:14,251

Why doesn't the radiation belt
go all the way to the planet?

997

00:54:14,251 --> 00:54:16,620

- [Heidi] Well it keeps
the electrons trapped

998

00:54:16,620 --> 00:54:19,656

in the magnetic field it's
kind of a special cocktail

999

00:54:19,656 --> 00:54:23,860

of their direction relative
to the magnetic field

1000

00:54:23,860 --> 00:54:26,763

and their energy relative to
the magnetic field strength.

1001

00:54:26,763 --> 00:54:29,332

So it kinda has to be just
perfect to stay trapped

1002

00:54:29,332 --> 00:54:33,036

and if it's not those electrons
will just keep on going

1003

00:54:33,036 --> 00:54:36,072

and go into the
planet and be lost.

1004

00:54:36,072 --> 00:54:40,343

As you heard Jack talk about,

there are all of these kind

1005

00:54:40,343 --> 00:54:43,713
of strange non uniformities
of the magnetic field

1006

00:54:43,713 --> 00:54:47,150
so we expect there to be
some region where electrons

1007

00:54:47,150 --> 00:54:49,286
have gone into the
planet and been lost

1008

00:54:49,286 --> 00:54:51,655
and that it will be empty.

1009

00:54:51,655 --> 00:54:54,090
So we did expect,
based on that theory,

1010

00:54:54,090 --> 00:54:55,692
that there would be a gap.

1011

00:54:55,692 --> 00:54:57,527
But we were just
crossing our fingers

1012

00:54:57,527 --> 00:55:00,964
that there would be
for Juno and their is.

1013

00:55:00,964 --> 00:55:02,165
- [Kelly] So if I
could just follow up.

1014

00:55:02,165 --> 00:55:04,100
Are you saying that
very close to the planet

1015

00:55:04,100 --> 00:55:06,770

the notion of a dipole
field breaks down

1016

00:55:06,770 --> 00:55:08,672

and it becomes a
higher order field

1017

00:55:08,672 --> 00:55:12,142

that allows the
electrons to be lost?

1018

00:55:12,142 --> 00:55:13,576

- [Scott] Yes in some sense.

1019

00:55:13,576 --> 00:55:16,980

We have an offset tilted dipole
at Jupiter, this is Scott,

1020

00:55:16,980 --> 00:55:20,317

to some extent and
so as these electrons

1021

00:55:21,418 --> 00:55:24,521

move around the
planet they're trapped

1022

00:55:28,658 --> 00:55:30,860

in the magnetic field
but the magnetic field

1023

00:55:30,860 --> 00:55:35,365

is not perfectly aligned
with Jupiter's synapses

1024

00:55:35,365 --> 00:55:37,967

and it's offset a
little from the middle.

1025

00:55:37,967 --> 00:55:39,436

So as they go to one
side of the planet,

1026

00:55:39,436 --> 00:55:40,970

they get a little bit
closer to the atmosphere

1027

00:55:40,970 --> 00:55:44,541

than on the other side
because they move around

1028

00:55:44,541 --> 00:55:46,443

in constant magnetic
field strength.

1029

00:55:46,443 --> 00:55:49,012

So in one side they're gonna
smash into the atmosphere

1030

00:55:49,012 --> 00:55:51,247

before they smash into
it on the other side

1031

00:55:51,247 --> 00:55:53,216

so they're gonna create
a little bit of a gap.

1032

00:55:53,216 --> 00:55:55,919

The other thing
that creates the gap

1033

00:55:55,919 --> 00:55:58,655

is that they're radiating
their energy away

1034

00:55:58,655 --> 00:56:02,492

very, very quickly due
to synchrotron emission.

1035

00:56:03,660 --> 00:56:06,296

The high energy radio
emission that comes out

1036

00:56:06,296 --> 00:56:09,499

from relativistic motions of
these high energy electrons.

1037

00:56:09,499 --> 00:56:12,402

So as they get
close to the planet

1038

00:56:12,402 --> 00:56:14,437

and the magnetic field goes
up, they start radiating away.

1039

00:56:14,437 --> 00:56:17,540

So those two processes
kind of compete

1040

00:56:17,540 --> 00:56:19,843

against each other
to create the gap.

1041

00:56:19,843 --> 00:56:21,711

And we knew there was a
little bit of a gap there

1042

00:56:21,711 --> 00:56:24,314

because the Galileo
probe showed evidence

1043

00:56:24,314 --> 00:56:26,816

of a gap as it went in.

1044

00:56:26,816 --> 00:56:29,252

But it only sampled one spot.

1045

00:56:31,254 --> 00:56:32,756

And there's a gap like that

1046

00:56:32,756 --> 00:56:36,025
at the Earth's
radiation belts as well.

1047

00:56:37,227 --> 00:56:38,762
- [Jane] Alright thank you.

1048

00:56:38,762 --> 00:56:41,030
Our next question is going
to come from Mental Floss

1049

00:56:41,030 --> 00:56:42,432
with David Brown.

1050

00:56:43,867 --> 00:56:45,335
- [David] Hi, this
question's for Scott.

1051

00:56:45,335 --> 00:56:47,303
Having collected so
much data, the challenge

1052

00:56:47,303 --> 00:56:49,973
is fundamental
assumptions about Jupiter,

1053

00:56:49,973 --> 00:56:53,543
how does that affect
future passes by Juno?

1054

00:56:56,112 --> 00:56:59,015
- [Scott] Well it makes
them more exciting.

1055

00:56:59,015 --> 00:57:02,585
But the truth is we've just
started to scratch the surface.

1056

00:57:02,585 --> 00:57:05,188

One of the great things
about exploration

1057

00:57:05,188 --> 00:57:08,525

is that you go to a place
that you've never been before

1058

00:57:08,525 --> 00:57:11,161

and you invent new instruments
and new kinds of ways

1059

00:57:11,161 --> 00:57:13,930

to make measurements
and you discover things

1060

00:57:13,930 --> 00:57:17,100

that you never
could've anticipated.

1061

00:57:17,100 --> 00:57:19,402

That's the whole point of
exploring and learning.

1062

00:57:19,402 --> 00:57:22,705

So we went, and of course
we're up close and personal

1063

00:57:22,705 --> 00:57:24,674

to Jupiter for the first
time and we have some

1064

00:57:24,674 --> 00:57:27,977

very unique instruments and
some that have been invented

1065

00:57:27,977 --> 00:57:30,480

basically for this
mission and we saw

1066

00:57:30,480 --> 00:57:32,649
brand new kinds of things.

1067
00:57:32,649 --> 00:57:36,186
Now the plan always was to
go over and map the planet.

1068
00:57:36,186 --> 00:57:39,055
So we wanna go over many
different longitudes

1069
00:57:39,055 --> 00:57:42,459
and eventually learn
how the planet looks

1070
00:57:42,459 --> 00:57:44,761
all the way around and
that really what tells us

1071
00:57:44,761 --> 00:57:47,163
about how it works
inside completely

1072
00:57:47,163 --> 00:57:50,333
and so what we've seen
is we're surprised

1073
00:57:50,333 --> 00:57:53,670
and in fact all the data
really points to the fact

1074
00:57:53,670 --> 00:57:57,006
that we need the
rest of our mission

1075
00:57:57,006 --> 00:58:01,010
in order to really figure
out how Jupiter works.

1076
00:58:01,010 --> 00:58:04,013

The good news is that
we also have confirmed

1077
00:58:04,013 --> 00:58:06,216
that Juno is the
right tool to do this.

1078
00:58:06,216 --> 00:58:08,184
We have the right
set of instruments.

1079
00:58:08,184 --> 00:58:10,119
We have the right orbit.

1080
00:58:10,119 --> 00:58:13,790
We actually are going
to win over this beast

1081
00:58:14,924 --> 00:58:17,227
and we're gonna
learn how it works.

1082
00:58:17,227 --> 00:58:21,764
But it's gonna take time
and we have to be patient

1083
00:58:21,764 --> 00:58:24,367
in order to unravel
the mysteries

1084
00:58:24,367 --> 00:58:26,669
because many of them
are wrapped into

1085
00:58:26,669 --> 00:58:29,472
how does Jupiter look
at different longitudes

1086
00:58:29,472 --> 00:58:31,241
or in different time periods

1087

00:58:31,241 --> 00:58:34,711

and so we have the
right tool to do the job

1088

00:58:34,711 --> 00:58:38,748

and so we're not gonna
change our observing strategy

1089

00:58:38,748 --> 00:58:41,918

necessarily in order to
accomplish the answers

1090

00:58:41,918 --> 00:58:45,622

to these questions but we
are changing the models

1091

00:58:45,622 --> 00:58:48,458

and more data of course
goes in to constrain it

1092

00:58:48,458 --> 00:58:50,693

and so that's how science works.

1093

00:58:50,693 --> 00:58:53,162

We will modify some of
the imaging in order

1094

00:58:53,162 --> 00:58:57,333

to try to measure the cyclone
speeds and things like that.

1095

00:58:58,501 --> 00:59:01,070

- [Jane] Alright we're
at the top of the hour.

1096

00:59:01,070 --> 00:59:03,773

We can go a few
minutes past to wrap up

1097

00:59:03,773 --> 00:59:06,543

a couple of questions
that have been waiting

1098

00:59:06,543 --> 00:59:10,747

on sort of a last call
for reporters on the line.

1099

00:59:10,747 --> 00:59:12,982

If you do have a
question please press *1

1100

00:59:12,982 --> 00:59:15,485

and we'll get you in the queue

1101

00:59:15,485 --> 00:59:17,353

for a couple of final questions.

1102

00:59:17,353 --> 00:59:19,689

In the meantime let's jump in

1103

00:59:19,689 --> 00:59:22,525

for a followup from Ken
Chang, New York Times.

1104

00:59:22,525 --> 00:59:24,294

- [Ken] Thank you.

1105

00:59:24,294 --> 00:59:26,729

I was wondering if you
managed to do any comparisons

1106

00:59:26,729 --> 00:59:30,900

between the Juno data and what
Cassini is getting at Saturn?

1107

00:59:31,968 --> 00:59:33,536

- [Scott] We absolutely
plan to do that.

1108

00:59:33,536 --> 00:59:36,506

In fact I'm glad you brought that up, it's a great question.

1109

00:59:36,506 --> 00:59:38,274

So I'm on the Cassini team.

1110

00:59:38,274 --> 00:59:41,878

Many of us on Juno are on that team as well.

1111

00:59:41,878 --> 00:59:44,747

In fact, many, many years ago when we first started

1112

00:59:44,747 --> 00:59:48,818

to develop Juno I went to the team and said

1113

00:59:48,818 --> 00:59:51,187

why don't we try to take Cassini at the end

1114

00:59:51,187 --> 00:59:53,623

and go into a Juno like orbit

1115

00:59:53,623 --> 00:59:57,260

and we could learn about both planets in a similar fashion.

1116

00:59:57,260 --> 00:59:59,128

Now Cassini doesn't have the exact same

1117

00:59:59,128 --> 01:00:01,598

kind of instruments we have and of course

1118

01:00:01,598 --> 01:00:03,666
we're tuned to do this
interior research.

1119
01:00:03,666 --> 01:00:05,301
But it has a lot of
great instruments

1120
01:00:05,301 --> 01:00:07,637
that can learn about
about the interior

1121
01:00:07,637 --> 01:00:10,073
and other things that
it can do close up

1122
01:00:10,073 --> 01:00:14,377
and so after awhile the
Cassini team and NASA

1123
01:00:14,377 --> 01:00:16,079
all got behind that
and of course Cassini

1124
01:00:16,079 --> 01:00:17,780
is in that mode now.

1125
01:00:17,780 --> 01:00:20,149
It's exciting because
we have two spacecraft

1126
01:00:20,149 --> 01:00:22,251
orbiting two of the giant
planets in the system

1127
01:00:22,251 --> 01:00:25,788
and we're both doing these
close covert like flybys

1128
01:00:25,788 --> 01:00:27,724

and so there are plans.

1129

01:00:29,092 --> 01:00:31,160

Of course we're both trying
to figure out our data

1130

01:00:31,160 --> 01:00:33,162

from our own planet
at the moment.

1131

01:00:33,162 --> 01:00:36,499

But eventually we will
compare and of course

1132

01:00:36,499 --> 01:00:39,102

that's the key to
scientific advancement

1133

01:00:39,102 --> 01:00:40,903

is comparative study.

1134

01:00:40,903 --> 01:00:43,773

So being able to compare
Cassini's measurements

1135

01:00:43,773 --> 01:00:47,710

of Saturn and Jupiter's
measurements by Juno

1136

01:00:47,710 --> 01:00:51,914

we will really be able to
advance our understanding

1137

01:00:51,914 --> 01:00:54,584

of how these giant planets work.

1138

01:00:55,985 --> 01:00:57,387

- [Jane] Alright we're
going to take a question now

1139

01:00:57,387 --> 01:01:00,857

from Aminah Collin of
the Los Angeles Times.

1140

01:01:00,857 --> 01:01:02,091

- [Aminah] Hi, I just
had a quick question.

1141

01:01:02,091 --> 01:01:04,127

You mentioned that
the radiation levels

1142

01:01:04,127 --> 01:01:07,296

were about 10 times lower than
expected, which is good news.

1143

01:01:07,296 --> 01:01:11,034

Does this have any
implication for the orbit?

1144

01:01:12,301 --> 01:01:14,837

You go back to some of
these shorter orbits

1145

01:01:14,837 --> 01:01:18,875

if it seems like it's
less damaging out there?

1146

01:01:18,875 --> 01:01:20,343

- [Heidi] Well
this is Heidi, hi.

1147

01:01:20,343 --> 01:01:21,978

The place that it
is referring to is

1148

01:01:21,978 --> 01:01:25,181

this really brief sort
of two 15 minute blips

1149

01:01:25,181 --> 01:01:27,583

that we have very
close to the planet.

1150

01:01:27,583 --> 01:01:30,019

Our orbit is a lot
bigger and it's great

1151

01:01:30,019 --> 01:01:33,523

that the levels were
appearing to be 10 times less

1152

01:01:33,523 --> 01:01:36,225

close to the planet but
that's not all of the orbit

1153

01:01:36,225 --> 01:01:38,928

so there's a lot more
data from further out

1154

01:01:38,928 --> 01:01:43,099

and the really nasty part that
we're gonna get into later

1155

01:01:43,099 --> 01:01:45,168

is near the equator further out

1156

01:01:45,168 --> 01:01:46,602

from where I was talking about

1157

01:01:46,602 --> 01:01:50,940

so it's a little early
to speculate on levels.

1158

01:01:50,940 --> 01:01:52,942

What we're seeing
now is very good.

1159

01:01:52,942 --> 01:01:55,211

The spacecraft is
behaving very well

1160
01:01:55,211 --> 01:01:58,748
but we can really
only say right now

1161
01:01:58,748 --> 01:02:00,316
that what we're seeing
close to the planet

1162
01:02:00,316 --> 01:02:03,586
is certainly much less than
what we thought would get in.

1163
01:02:03,586 --> 01:02:05,321
- [Aminah] Thank you.

1164
01:02:06,189 --> 01:02:07,356
- [Jane] Alright thanks.

1165
01:02:07,356 --> 01:02:09,058
And we're going to
take one final question

1166
01:02:09,058 --> 01:02:12,061
from social media
then we'll wrap up

1167
01:02:12,061 --> 01:02:14,731
with one or two media questions.

1168
01:02:14,731 --> 01:02:18,367
And again to remind you that
the audio with the visuals

1169
01:02:18,367 --> 01:02:22,538
of this telecom will be archived
on www.ustream.tv/NASAJPL2.

1170

01:02:28,811 --> 01:02:30,613

That's the number two.

1171

01:02:30,613 --> 01:02:34,751

Okay and then also any reporter
who has not had a chance

1172

01:02:34,751 --> 01:02:36,419

to ask a question
when we wrap up

1173

01:02:36,419 --> 01:02:40,056

you can call us here
at the JPL newsroom

1174

01:02:40,056 --> 01:02:41,791

which is 818-354-5011

1175

01:02:44,293 --> 01:02:47,630

or at NASA headquarters
newsroom as well

1176

01:02:48,798 --> 01:02:51,934

and I'll get you that
number when we wrap up.

1177

01:02:51,934 --> 01:02:54,303

Alright so in the meantime we
are going to take a question

1178

01:02:54,303 --> 01:02:57,874

from Twitter and the
question is from Leonardo

1179

01:02:57,874 --> 01:03:01,244

who asks why are
Jupiter's storms so big?

1180

01:03:05,281 --> 01:03:09,252

- [Candy] Well Jupiter
itself is really big

1181
01:03:09,252 --> 01:03:13,156
so I think the scaling,
if you compare the size

1182
01:03:15,324 --> 01:03:18,361
of the storms on Earth
to the size of the Earth.

1183
01:03:18,361 --> 01:03:21,831
The size of storms on Jupiter
to the size of Jupiter

1184
01:03:21,831 --> 01:03:24,901
I don't think it's
really unexpected.

1185
01:03:28,905 --> 01:03:31,174
I think that the
scaling sort of works

1186
01:03:31,174 --> 01:03:33,342
in a very, very rough way.

1187
01:03:37,647 --> 01:03:39,115
- [Jane] Okay.

1188
01:03:39,115 --> 01:03:41,384
We're going to go back
to a quick question again

1189
01:03:41,384 --> 01:03:44,453
from Sky Intelliscope,
Kelly Beedee.

1190
01:03:44,453 --> 01:03:45,955
- [Kelly] This is
for Candy Hansen.

1191

01:03:45,955 --> 01:03:48,991

Candy, I've been following a lot of the amateur processing

1192

01:03:48,991 --> 01:03:53,129

of the images interaction with the team.

1193

01:03:53,129 --> 01:03:56,432

Can you characterize how valuable

1194

01:03:56,432 --> 01:03:58,734

the role of amateur astronomers has been

1195

01:03:58,734 --> 01:04:03,673

in creating targets and actually enhancing the science?

1196

01:04:03,673 --> 01:04:07,310

Is this the most intensive interaction

1197

01:04:07,310 --> 01:04:10,079

that you've had on a mission?

1198

01:04:10,079 --> 01:04:13,115

- [Candy] Yes, it definitely is.

1199

01:04:13,115 --> 01:04:17,286

We have a very tiny, tiny ops team and the contributions

1200

01:04:20,656 --> 01:04:23,559

of the amateurs are essential.

1201

01:04:23,559 --> 01:04:27,797

I cannot understate how important the contributions are.

1202
01:04:27,797 --> 01:04:30,800
We don't have a way to plan our data

1203
01:04:32,235 --> 01:04:35,771
without the contributions of the amateur astronomers.

1204
01:04:35,771 --> 01:04:39,275
We don't have a big image processing team.

1205
01:04:40,476 --> 01:04:43,613
So we are completely relying on the help

1206
01:04:45,915 --> 01:04:49,886
of our citizen scientists and in fact,

1207
01:04:49,886 --> 01:04:52,555
the data interpretation as well.

1208
01:04:53,990 --> 01:04:58,327
We have people jumping in to help us with that as well.

1209
01:04:58,327 --> 01:05:02,431
So if you go to the image processing section

1210
01:05:02,431 --> 01:05:04,767
of the mission Juno website,

1211
01:05:05,935 --> 01:05:09,538
you'll see that we have over 900 contributions

1212

01:05:10,673 --> 01:05:13,776
of images that have been
processed by members

1213

01:05:13,776 --> 01:05:17,546
of the public and what
I find really actually

1214

01:05:19,982 --> 01:05:24,153
the most phenomenal of all
is that this takes real work.

1215

01:05:25,755 --> 01:05:28,925
When you download a Juno
cam image and process it,

1216

01:05:28,925 --> 01:05:31,494
it's not something you
do in five minutes.

1217

01:05:31,494 --> 01:05:34,397
The pictures that we
get that people upload

1218

01:05:34,397 --> 01:05:38,467
back onto our site, they've
invested hours and hours

1219

01:05:38,467 --> 01:05:42,638
of their own time then
generously returned that to us.

1220

01:05:44,540 --> 01:05:47,109
So it's really been remarkable.

1221

01:05:49,412 --> 01:05:50,913
- [Kelly] Thank you.

1222

01:05:50,913 --> 01:05:53,149
- [Jane] Alright and our
last question comes again

1223
01:05:53,149 --> 01:05:56,819
from Ocean McIntyre at
Space Flight Insider.

1224
01:05:57,954 --> 01:06:00,756
- [Ocean] Regarding
the formal information,

1225
01:06:00,756 --> 01:06:03,793
I know the microwave
radiometer has been tracking

1226
01:06:03,793 --> 01:06:06,462
some of that information,
getting that data.

1227
01:06:06,462 --> 01:06:09,799
Has it been anything
regarding the different

1228
01:06:09,799 --> 01:06:12,969
thermal information,
the thermal data?

1229
01:06:14,170 --> 01:06:17,306
Or different layers
from within Jupiter?

1230
01:06:19,108 --> 01:06:20,977
- [Scott] I'm not sure I
understand the question.

1231
01:06:20,977 --> 01:06:24,513
You mean in addition to
the microwave instrument?

1232

01:06:24,513 --> 01:06:26,615
- [Ocean] Well I know that
the microwave instrument

1233
01:06:26,615 --> 01:06:30,386
is also looking at
thermal emissions.

1234
01:06:30,386 --> 01:06:32,922
Has there been any
data that's come back

1235
01:06:32,922 --> 01:06:37,259
or that's different than
what you expected to see?

1236
01:06:37,259 --> 01:06:41,430
- [Scott] Yeah well the way
the microwave radiometer works

1237
01:06:45,601 --> 01:06:48,237
is we're looking at thermal
emission coming out of Jupiter

1238
01:06:48,237 --> 01:06:50,506
and so the data that I
presented on slide four

1239
01:06:50,506 --> 01:06:53,509
is really the
microwave emission.

1240
01:06:53,509 --> 01:06:55,745
We're interpreting it
and showing it to you

1241
01:06:55,745 --> 01:06:59,148
in terms of ammonia abundance
but we're really looking at

1242

01:06:59,148 --> 01:07:01,183
brightness temperatures
which are related

1243
01:07:01,183 --> 01:07:04,420
to the temperatures inside
Jupiter's atmosphere.

1244
01:07:04,420 --> 01:07:07,156
So that's exactly
what we're looking at

1245
01:07:07,156 --> 01:07:08,891
and showing you
the variability on.

1246
01:07:08,891 --> 01:07:12,328
Then we have another instrument
that was built in Italy

1247
01:07:12,328 --> 01:07:15,331
called JIRAM that
also looks at thermal

1248
01:07:15,331 --> 01:07:17,466
but it looks at the
top part of the clouds.

1249
01:07:17,466 --> 01:07:20,269
It doesn't penetrate down
like the microwave does

1250
01:07:20,269 --> 01:07:22,538
and we have maps
and we publish data

1251
01:07:22,538 --> 01:07:26,242
associated with the thermal
emission from that as well.

1252

01:07:26,242 --> 01:07:28,377

- [Ocean] Okay
thank you very much.

1253

01:07:28,377 --> 01:07:29,845

- [Jane] Alright, thank you.

1254

01:07:29,845 --> 01:07:31,981

That wraps up our Q&A
and actually wraps up

1255

01:07:31,981 --> 01:07:33,916

this whole event.

1256

01:07:33,916 --> 01:07:35,985

I wanna thank our
panelists today

1257

01:07:35,985 --> 01:07:37,853

for some super interesting stuff

1258

01:07:37,853 --> 01:07:41,791

and thanks to all our media
and social media followers

1259

01:07:41,791 --> 01:07:45,194

who had some excellent questions

1260

01:07:45,194 --> 01:07:48,697

and again a reminder that
you can rewatch this.

1261

01:07:48,697 --> 01:07:52,868

It should be posted shortly
on www.ustream.tv/NASAJPL2.

1262

01:07:55,471 --> 01:07:57,673

Any follow up questions
from news media again

1263

01:07:57,673 --> 01:08:00,109
to JPL newsroom, 818-354-5011

1264

01:08:03,012 --> 01:08:07,183
or Laurie Cantillo at NASA
headquarters at 202-358-1077.

1265

01:08:11,353 --> 01:08:13,022
That's 202-358-1077.

1266

01:08:15,858 --> 01:08:19,829
Of course there's lots
of info about Juno online

1267

01:08:19,829 --> 01:08:22,431
at www.nasa.gov/juno

1268

01:08:25,401 --> 01:08:28,137
and also at
missionjuno.swri.edu.

1269

01:08:32,308 --> 01:08:34,844
We do have the press
release that just went out

1270

01:08:34,844 --> 01:08:36,612
a little while ago
and that is now posted

1271

01:08:36,612 --> 01:08:38,514
on the telecom page.