



Live from  
Jet Propulsion Laboratory  
California Institute of Technology

# NASA's InSight "Hears" the Sound of Mars News Telecon

with

**Bruce Banerdt**  
InSight Principal Investigator  
NASA's Jet Propulsion Laboratory

**Thomas Pike**  
Short Period Seismometer Science Lead  
Imperial College, London

**Don Banfield**  
Auxiliary Payload Sensor Subsystem (APSS) Science Lead  
Cornell University

**Lori Glaze**  
Acting Director of Planetary Science  
NASA HQ



1  
00:00:03,002 --> 00:00:04,203  
>> Jia-Rui: Hello everyone,

2  
00:00:04,203 --> 00:00:06,840  
and welcome to our  
NASA InSight Telecon.

3  
00:00:06,840 --> 00:00:08,040  
Sorry for the delay.

4  
00:00:08,040 --> 00:00:09,375  
We just wanna make  
sure all our materials

5  
00:00:09,375 --> 00:00:11,110  
are up and available  
for you guys

6  
00:00:11,110 --> 00:00:15,614  
because this is gonna be a  
multimedia presentation here.

7  
00:00:15,614 --> 00:00:17,950  
If you guys have  
earphones and subwoofers,

8  
00:00:17,950 --> 00:00:20,053  
you gotta make sure  
that you have 'em handy.

9  
00:00:20,053 --> 00:00:21,254  
So as you guys know,

10  
00:00:21,254 --> 00:00:24,890  
InSight landed on  
Mars on November 26th

11  
00:00:24,890 --> 00:00:26,792  
to study its deep interior.

12

00:00:26,792 --> 00:00:28,093

And now we've got some folks

13

00:00:28,093 --> 00:00:29,428

who are really excited to share

14

00:00:29,428 --> 00:00:31,965

some additional

results with you.

15

00:00:31,965 --> 00:00:34,166

So I'm Jia-Rui Cook,

I'm the moderator,

16

00:00:34,166 --> 00:00:36,302

I'm from NASA's jet

propulsion laboratory,

17

00:00:36,302 --> 00:00:39,105

we manage InSight for

NASA headquarters.

18

00:00:39,105 --> 00:00:42,308

And we've got four great

speakers for you today.

19

00:00:42,308 --> 00:00:44,377

The first speaker

will be Lori Glaze.

20

00:00:44,377 --> 00:00:46,913

She's the Acting Director

of Planetary Science

21

00:00:46,913 --> 00:00:48,447

from NASA headquarters.

22

00:00:48,447 --> 00:00:50,082

So she's gonna go  
first, and just a note

23

00:00:50,082 --> 00:00:51,618  
that she's only gonna be with us

24

00:00:51,618 --> 00:00:55,321  
until about 10:00 AM Pacific  
time, or 1:00 PM Eastern.

25

00:00:55,321 --> 00:00:57,357  
After Lori will  
be Bruce Banerdt.

26

00:00:57,357 --> 00:00:59,992  
He is the InSight  
Principal Investigator.

27

00:00:59,992 --> 00:01:03,062  
He's based here at NASA's  
Jet Propulsion Laboratory.

28

00:01:03,062 --> 00:01:04,831  
Then we have Tom Pike.

29

00:01:04,831 --> 00:01:07,533  
He is the Short Period  
Seismometer Lead

30

00:01:07,533 --> 00:01:10,036  
from Imperial College in London.

31

00:01:10,036 --> 00:01:12,272  
And then we also  
have Don Banfield.

32

00:01:12,272 --> 00:01:16,075  
He's the Auxiliary Payload  
Sensor Subsystem Lead,

33

00:01:16,075 --> 00:01:17,477  
from Cornell.

34

00:01:17,477 --> 00:01:20,846  
And the APSS are the  
environmental sensors on InSight

35

00:01:20,846 --> 00:01:22,215  
just so that you guys know.

36

00:01:23,649 --> 00:01:26,219  
You guys should also know that  
there's a follow along page.

37

00:01:39,064 --> 00:01:31,557  
It's  
at  
<https://www.nasa.gov/insightmar>.

38

00:01:39,064 --> 00:01:40,933  
So as they call  
out their graphics,

39

00:01:40,933 --> 00:01:42,568  
if you are on the  
follow along page

40

00:01:42,568 --> 00:01:44,904  
you'll see what they're  
sort of pointing out to.

41

00:01:44,904 --> 00:01:46,172  
Pointing out.

42

00:01:46,172 --> 00:01:47,574  
So I'm gonna turn  
it over to Lori.

43

00:01:49,175 --> 00:01:50,643

>> Lori: Great,  
thank you Jia-Rui.

44

00:01:50,643 --> 00:01:53,112

I'm really happy  
to be here today.

45

00:01:53,112 --> 00:01:55,414

This is an exciting,  
such an exciting mission

46

00:01:55,414 --> 00:01:59,385

and it's fun to be part of  
this briefing here today.

47

00:02:00,786 --> 00:02:04,256

There's four rocky planets  
in our solar system.

48

00:02:04,256 --> 00:02:07,359

Venus, Earth, Mercury, and Mars.

49

00:02:07,359 --> 00:02:09,228

And in trying to understand

50

00:02:09,228 --> 00:02:12,298

how planets form and  
evolve over time,

51

00:02:12,298 --> 00:02:14,733

we need to understand each  
one of those rocky planets

52

00:02:14,733 --> 00:02:16,035

to really get a better picture

53

00:02:16,035 --> 00:02:18,237

of how these types of  
planets form and evolve.

54

00:02:18,237 --> 00:02:21,406

And the InSight mission  
is a fantastic way

55

00:02:21,406 --> 00:02:23,542

to look at the inside of Mars.

56

00:02:23,542 --> 00:02:26,112

And what's really cool to me,

57

00:02:26,112 --> 00:02:28,080

we're all still on a high  
from the landing last week,

58

00:02:28,080 --> 00:02:30,183

and we're all still  
really excited about that.

59

00:02:30,183 --> 00:02:31,751

And here we are,

60

00:02:31,751 --> 00:02:34,087

less than two weeks  
after landing,

61

00:02:34,087 --> 00:02:37,957

and we've already got  
some amazing new science.

62

00:02:39,125 --> 00:02:40,960

It's cool, it's fun,  
you're gonna enjoy

63

00:02:40,960 --> 00:02:43,662

listening to the sounds  
that you're gonna hear,

64

00:02:43,662 --> 00:02:44,930

but the part I find fascinating

65

00:02:44,930 --> 00:02:46,598

is the science has  
already been done,

66

00:02:46,598 --> 00:02:48,568

and what we've already learned

67

00:02:48,568 --> 00:02:52,038

from listening to and  
looking at these data.

68

00:02:52,038 --> 00:02:54,274

So with that, I wanna  
hand it over to the folks

69

00:02:54,274 --> 00:02:56,843

who can really tell you a  
lot more about this mission,

70

00:02:56,843 --> 00:02:59,979

and about the stuff you're  
gonna see and hear about today.

71

00:02:59,979 --> 00:03:01,847

I'm gonna hand it over  
to Dr. Bruce Banerdt,

72

00:03:01,847 --> 00:03:05,218

who's Principal Investigator  
for the InSight mission.

73

00:03:05,218 --> 00:03:06,419

>> Bruce: Thanks Jia-Rui.

74

00:03:06,419 --> 00:03:09,955

So, we've been on  
Mars for 11 days now,

75

00:03:09,955 --> 00:03:12,224  
or 11 sols, as we  
call days on Mars.

76  
00:03:12,224 --> 00:03:14,627  
And we've been really busy.

77  
00:03:14,627 --> 00:03:16,529  
I've sort of pitched this

78  
00:03:16,529 --> 00:03:18,063  
as kind of a slow  
motion mission,

79  
00:03:18,063 --> 00:03:20,599  
'cause we're here  
for the long run.

80  
00:03:20,599 --> 00:03:23,102  
We have a two year  
mission to acquire

81  
00:03:23,102 --> 00:03:28,040  
the seismic, thermal,  
environmental, and tracking data

82  
00:03:28,040 --> 00:03:29,808  
that we're gonna use to study

83  
00:03:29,808 --> 00:03:31,810  
the deep, deep interior of Mars.

84  
00:03:31,810 --> 00:03:33,279  
And it's gonna take us a while

85  
00:03:33,279 --> 00:03:35,348  
to get our instruments  
all set up on the ground,

86

00:03:35,348 --> 00:03:38,084  
and ready to start  
taking that data

87  
00:03:38,084 --> 00:03:40,953  
that's going to  
allow us to probe

88  
00:03:40,953 --> 00:03:42,788  
deep down to the core of Mars.

89  
00:03:42,788 --> 00:03:45,524  
But meanwhile, this  
first couple of weeks

90  
00:03:45,524 --> 00:03:46,725  
and couple of months, really,

91  
00:03:46,725 --> 00:03:49,194  
we're gonna be checking  
out the instruments,

92  
00:03:49,194 --> 00:03:52,097  
getting them situated on the  
surface and so forth, and so,

93  
00:03:52,097 --> 00:03:54,366  
we've started down that road.

94  
00:03:54,366 --> 00:03:56,302  
This first image  
that I have up here

95  
00:03:56,302 --> 00:03:59,638  
is actually an image that  
came down just yesterday.

96  
00:03:59,638 --> 00:04:01,774  
It's a raw image, so the colors

97

00:04:01,774 --> 00:04:03,575

are a little bit

muted in this image,

98

00:04:03,575 --> 00:04:08,214

but you can see the horizon,

see the rocks in the distance.

99

00:04:08,214 --> 00:04:11,417

See this fascinating

panorama of Mars, kind of,

100

00:04:11,417 --> 00:04:15,154

that's going to unfold in front

of us in the next few days

101

00:04:15,154 --> 00:04:17,223

as we start bringing

down more images.

102

00:04:18,090 --> 00:04:19,392

It also shows the solar panel,

103

00:04:19,392 --> 00:04:22,928

which actually plays

kind of a key role

104

00:04:22,928 --> 00:04:25,331

in what we're

talking about today.

105

00:04:25,331 --> 00:04:29,602

And Dr. Pike will talk a little

bit more about that later.

106

00:04:29,602 --> 00:04:33,372

If you look at the second

image we have up here,

107

00:04:33,372 --> 00:04:35,775

it actually shows our  
instruments on the deck.

108

00:04:37,242 --> 00:04:40,146

And so the copper colored  
object in the foreground,

109

00:04:40,146 --> 00:04:41,580

that's our seismometer,

110

00:04:41,580 --> 00:04:44,884

that's the instrument  
that's measuring vibrations.

111

00:04:44,884 --> 00:04:46,084

And in this case,  
we're measuring

112

00:04:46,084 --> 00:04:47,653

vibrations still on the deck,

113

00:04:47,653 --> 00:04:49,855

since we haven't been  
taken off the deck.

114

00:04:49,855 --> 00:04:51,490

And that's very key, again,

115

00:04:51,490 --> 00:04:53,660

to what we're gonna be  
talking about today.

116

00:04:54,793 --> 00:04:56,862

Right behind it is,  
that white dome,

117

00:04:56,862 --> 00:04:58,364

is the wind and thermal shield,

118

00:04:58,364 --> 00:05:00,733

and eventually it's gonna  
be taken off the spacecraft,

119

00:05:00,733 --> 00:05:03,502

put over the seismometer to  
protect it from the wind.

120

00:05:03,502 --> 00:05:05,971

But underneath that dome,  
that you can't see right now,

121

00:05:05,971 --> 00:05:08,174

is actually the inlet  
for our pressure sensor.

122

00:05:08,174 --> 00:05:12,010

It allows the air on the  
outside of the spacecraft

123

00:05:12,010 --> 00:05:13,946

to communicate down  
to our pressure sensor

124

00:05:13,946 --> 00:05:18,150

that's situated nice and  
snug down inside the lander

125

00:05:18,150 --> 00:05:21,086

where it's protected from  
temperature variations.

126

00:05:21,086 --> 00:05:23,589

And we actually have  
some interesting data.

127

00:05:23,589 --> 00:05:26,392

So we've been taking some  
data, while we're on the deck.

128

00:05:27,493 --> 00:05:28,928

This is not data that's  
gonna tell us much

129

00:05:28,928 --> 00:05:30,429

about the inside of Mars,

130

00:05:30,429 --> 00:05:32,431

but it's actually  
data that first,

131

00:05:32,431 --> 00:05:35,267

allows us to make  
sure our instruments  
are working properly,

132

00:05:35,267 --> 00:05:38,270

and second, allows us  
to kind of characterize

133

00:05:38,270 --> 00:05:40,807

the vibrational  
environment of the lander.

134

00:05:42,208 --> 00:05:44,644

And we really weren't expecting  
to get much more out of this

135

00:05:44,644 --> 00:05:47,946

but as we were looking  
at the data and realizing

136

00:05:47,946 --> 00:05:49,715

the frequencies  
that we're measuring

137

00:05:49,715 --> 00:05:52,752

and the frequencies that are  
audible to the human ear,

138

00:05:52,752 --> 00:05:54,586

we realized that we  
had an opportunity

139

00:05:54,586 --> 00:05:57,090

to get a very unique  
data set out of this.

140

00:05:58,491 --> 00:06:00,726

And that's what we're  
here to talk about today.

141

00:06:00,726 --> 00:06:02,829

And to explain to you  
exactly what we have,

142

00:06:03,696 --> 00:06:05,431

we have Dr. Tom Pike here

143

00:06:05,431 --> 00:06:09,635

who's been in charge of getting  
the short period sensors

144

00:06:09,635 --> 00:06:12,972

to Mars and in interpreting  
their data once we get here.

145

00:06:12,972 --> 00:06:15,341

>> Tom: Okay, thanks  
very much, Bruce.

146

00:06:15,341 --> 00:06:18,744

Yes, this is the  
very first 15 minutes

147

00:06:18,744 --> 00:06:22,948

of data that have come from  
the short period seismometer.

148

00:06:22,948 --> 00:06:25,584

So these, there  
are three sensors

149

00:06:25,584 --> 00:06:27,420

in the short period seismometer.

150

00:06:28,587 --> 00:06:30,122

And these sensors  
are part of the seis,

151

00:06:30,122 --> 00:06:32,324

the entire seismic package

152

00:06:32,324 --> 00:06:35,061

that we're going to be  
putting down onto the ground.

153

00:06:35,061 --> 00:06:37,730

But these were turned  
on for, first of all,

154

00:06:37,730 --> 00:06:41,601

to make sure that we had  
arrived to Mars in one piece.

155

00:06:41,601 --> 00:06:46,606

And, I think, let's first  
of all start off with,

156

00:06:48,040 --> 00:06:50,610

if you could get the plugin  
to the follow along site,

157

00:06:50,610 --> 00:06:54,614

and listen for at  
least a few seconds

158

00:06:55,781 --> 00:06:59,752

to this first clip of

20 seconds of sound,

159

00:06:59,752 --> 00:07:01,620  
in the base pan.

160

00:07:01,620 --> 00:07:04,089  
So this has not been  
modified in any way,

161

00:07:04,089 --> 00:07:06,558  
this is the raw data  
that you are hearing

162

00:07:06,558 --> 00:07:07,493  
through your headphones.

163

00:07:07,493 --> 00:07:08,995  
So go ahead and listen now.

164

00:07:08,995 --> 00:07:11,998  
[very low rumbling]

165

00:07:20,739 --> 00:07:23,842  
Okay, so at the risk  
of that being dead air,

166

00:07:23,842 --> 00:07:27,313  
that should have been, you  
should have been able to hear

167

00:07:27,313 --> 00:07:32,318  
a low rumble as the winds are  
coming over the solar panels.

168

00:07:33,785 --> 00:07:36,054  
As they move over  
the solar panels,

169

00:07:36,054 --> 00:07:39,825

they cause vibrations of  
the entire spacecraft.

170  
00:07:39,825 --> 00:07:41,894  
And it's those vibrations

171  
00:07:41,894 --> 00:07:45,431  
that the short period  
sensors are able to pick up.

172  
00:07:45,431 --> 00:07:48,033  
In fact we can think of  
it rather in the same way

173  
00:07:48,033 --> 00:07:52,138  
as the human ear, how  
we in fact listen.

174  
00:07:53,539 --> 00:07:56,175  
The air pressure comes  
in, it hits the ear drum,

175  
00:07:56,175 --> 00:07:59,445  
that thing goes through the  
inner ear to the cochlea,

176  
00:07:59,445 --> 00:08:01,747  
where the vibrations  
of the eardrum

177  
00:08:01,747 --> 00:08:04,951  
are amplified and then  
detected electronically.

178  
00:08:06,085 --> 00:08:08,753  
That data then  
goes to the brain.

179  
00:08:08,753 --> 00:08:11,323  
And if we look at it this way,

180

00:08:11,323 --> 00:08:14,260

we can see that the solar  
panels are like the ear drum,

181

00:08:15,661 --> 00:08:18,297

the spacecraft's structure  
is like the inner ear.

182

00:08:19,531 --> 00:08:21,066

The hammer, the  
anvil, the stirrup,

183

00:08:21,066 --> 00:08:22,501

that then goes to the cochlea,

184

00:08:22,501 --> 00:08:24,770

which is the short  
period seismometer.

185

00:08:24,770 --> 00:08:28,741

And then the ebox, the  
electronics box of size,

186

00:08:28,741 --> 00:08:30,475

converts those to the data

187

00:08:30,475 --> 00:08:32,778

that we then send back to Earth.

188

00:08:34,046 --> 00:08:36,816

And what we are  
then able to hear,

189

00:08:36,816 --> 00:08:38,483

as we just take that data

190

00:08:38,483 --> 00:08:40,952

and play it back

through your earphones,

191

00:08:40,952 --> 00:08:43,522

is the vibrations that  
the wind are causing

192

00:08:43,522 --> 00:08:47,059

to the spacecraft,  
as the solar panels

193

00:08:47,059 --> 00:08:49,195

are moved by the wind.

194

00:08:50,395 --> 00:08:52,597

Now that's pretty  
difficult to hear,

195

00:08:52,597 --> 00:08:54,266

because we're only going up to

196

00:08:54,266 --> 00:08:57,536

a little less than  
50 Hz in frequency,

197

00:08:57,536 --> 00:09:01,040

which is right at the  
bottom of human hearing.

198

00:09:01,040 --> 00:09:02,307

So we've taken this file,

199

00:09:02,307 --> 00:09:06,678

and if you go to the  
next video in the set,

200

00:09:06,678 --> 00:09:09,882

you'll be able to play that,

201

00:09:09,882 --> 00:09:12,318

multiply it up by, actually,

202

00:09:12,318 --> 00:09:14,253

shift it up by a  
couple of octaves,

203

00:09:14,253 --> 00:09:16,255

so it's the same sound file.

204

00:09:16,255 --> 00:09:20,492

But this is just played to  
make it a little more audible.

205

00:09:20,492 --> 00:09:22,895

So, we're gonna  
listen to that now,

206

00:09:22,895 --> 00:09:26,365

and give you a few  
seconds to listen to that.

207

00:09:26,365 --> 00:09:28,968

[low rumbling]

208

00:09:37,909 --> 00:09:39,711

Okay, so I hope you  
can hear that better.

209

00:09:39,711 --> 00:09:42,347

Now, if we actually  
look at that sound,

210

00:09:42,347 --> 00:09:43,282

and the way we are  
looking at this sound

211

00:09:43,282 --> 00:09:46,185

in the next picture below,

212

00:09:46,185 --> 00:09:50,456  
is in a spectrogram, and the  
way we produce that sound,

213  
00:09:50,456 --> 00:09:53,993  
it is a stereo sound  
from two of the sensors,

214  
00:09:53,993 --> 00:09:55,928  
the short period sensors.

215  
00:09:55,928 --> 00:09:59,765  
And in this image, you  
can see the spectrum,

216  
00:09:59,765 --> 00:10:02,134  
the frequency content  
of that sound,

217  
00:10:03,268 --> 00:10:05,670  
over the entire 1000 seconds,

218  
00:10:05,670 --> 00:10:10,175  
or a little less than  
20 minutes, of this  
initial recording.

219  
00:10:10,175 --> 00:10:11,943  
And you can read it like music.

220  
00:10:11,943 --> 00:10:13,646  
At the bottom end of the range,

221  
00:10:13,646 --> 00:10:15,848  
the lowest frequencies are  
at the bottom of the image,

222  
00:10:15,848 --> 00:10:18,117  
the highest  
frequencies at the top.

223

00:10:18,117 --> 00:10:21,287

And you can see that the  
loud parts of the sounds

224

00:10:21,287 --> 00:10:24,089

are colored red, the  
quiet parts blue.

225

00:10:24,089 --> 00:10:26,291

So you can see we're  
losing response

226

00:10:26,291 --> 00:10:28,660

right up at the  
high frequency end.

227

00:10:28,660 --> 00:10:31,197

But below that, and  
what you're hearing,

228

00:10:32,331 --> 00:10:36,035

are the resonances,  
the distinct vibrations

229

00:10:36,035 --> 00:10:39,004

which we think  
are the spacecraft

230

00:10:39,004 --> 00:10:41,974

both picking up the wind  
through the solar panels

231

00:10:41,974 --> 00:10:46,345

and also interacting  
with the regolith,

232

00:10:46,345 --> 00:10:48,947

the soil of mars below it.

233

00:10:48,947 --> 00:10:51,516

Now what you see  
as you move across

234

00:10:51,516 --> 00:10:53,486

is that it's quite steady tones

235

00:10:54,986 --> 00:10:57,923

as the spacecraft is  
responding to the wind

236

00:10:59,224 --> 00:11:03,329

coming in and exciting  
the structure.

237

00:11:03,329 --> 00:11:06,932

So it's a little like a  
flag waving in the wind.

238

00:11:08,066 --> 00:11:11,136

You've got both the  
interactions of the wind

239

00:11:11,136 --> 00:11:16,142

on the flag, you've  
got the flagpole,

240

00:11:17,276 --> 00:11:18,610

the vibrations that  
can be picked up there,

241

00:11:18,610 --> 00:11:20,946

and then the very  
sensitive sensors

242

00:11:20,946 --> 00:11:24,149

that we have at the other end,  
picking up these vibrations.

243

00:11:24,149 --> 00:11:26,318

And these are very  
very small vibrations.

244

00:11:27,485 --> 00:11:30,488

You will not see, in  
the images, any blur.

245

00:11:30,488 --> 00:11:32,925

All of the images that  
we've been taking down,

246

00:11:34,093 --> 00:11:35,961

the issue that we  
have is making sure

247

00:11:35,961 --> 00:11:37,863

that there's not  
dust in the image.

248

00:11:37,863 --> 00:11:42,100

But the images themselves  
are pinpoint clear,

249

00:11:42,100 --> 00:11:44,602

as far as vibrations  
are concerned.

250

00:11:44,602 --> 00:11:46,372

So if we go to the next image,

251

00:11:47,706 --> 00:11:50,643

you can see that the vibrations  
that we're picking up,

252

00:11:51,944 --> 00:11:55,880

so this is an overlay  
of the direction

253

00:11:55,880 --> 00:11:57,516

of the vibrations of the land.

254

00:11:57,516 --> 00:11:59,318

And they're colored for  
the different frequencies

255

00:11:59,318 --> 00:12:00,386

that we're picking up.

256

00:12:01,853 --> 00:12:03,922

And that's overlaid  
over our landing site

257

00:12:03,922 --> 00:12:05,891

where we think we've put down.

258

00:12:05,891 --> 00:12:09,494

And in the background,  
you can see that there are

259

00:12:09,494 --> 00:12:12,264

these linear streaks, all  
the way across the image,

260

00:12:12,264 --> 00:12:16,167

running from the northwest  
to the southeast.

261

00:12:16,167 --> 00:12:19,371

And these are due  
to the dust devils

262

00:12:19,371 --> 00:12:22,807

moving across this  
particular area of Mars.

263

00:12:22,807 --> 00:12:25,944

We've got, we know that  
at this time of year,

264

00:12:25,944 --> 00:12:28,247

it's fairly active from  
a wind point of view,

265

00:12:28,247 --> 00:12:31,917

and we know that the wind,  
or rather, we suspect,

266

00:12:31,917 --> 00:12:34,286

and the dust devils  
have indicated this,

267

00:12:34,286 --> 00:12:37,789

that the wind is blowing  
generally pretty steadily.

268

00:12:37,789 --> 00:12:40,358

And the dust devil  
tracks show this.

269

00:12:40,358 --> 00:12:42,894

So when you overlay the  
vibrations we're picking up

270

00:12:42,894 --> 00:12:46,798

from the lander, you can see  
that they are lined very well

271

00:12:46,798 --> 00:12:49,567

with the direction of the wind.

272

00:12:49,567 --> 00:12:52,805

So in some ways, the seismometer

273

00:12:52,805 --> 00:12:54,740

is acting a little  
like a weather vane.

274

00:12:54,740 --> 00:12:58,510

It's telling us the direction  
that the wind is coming from.

275

00:12:58,510 --> 00:13:00,412

Now to be able to do  
this, we have to have

276

00:13:00,412 --> 00:13:04,049

a very sensitive sensor  
at the other end.

277

00:13:04,049 --> 00:13:07,152

So if you go the next  
image, you can see

278

00:13:07,152 --> 00:13:09,321

the sensor that we made,

279

00:13:09,321 --> 00:13:12,157

in fact, we made three of  
these sensors at Imperial.

280

00:13:12,157 --> 00:13:14,627

This is a spare sensor here.

281

00:13:15,928 --> 00:13:18,196

And this compared,  
it's just a little less

282

00:13:18,196 --> 00:13:20,065

than an inch in size.

283

00:13:21,266 --> 00:13:25,437

About the same size  
as a two Euro coin.

284

00:13:27,106 --> 00:13:29,542

And it's carved out of a  
single piece of silicon.

285

00:13:30,409 --> 00:13:32,678

And as the silicon vibrates,

286

00:13:32,678 --> 00:13:37,683

we pick up that vibration  
with the sensor electronics.

287

00:13:39,317 --> 00:13:41,954

The sensor electronics are  
made at Oxford University,

288

00:13:41,954 --> 00:13:44,757

and then that  
signal is passed to

289

00:13:46,091 --> 00:13:50,629

a bunch of control and  
signal processing electronics

290

00:13:51,664 --> 00:13:52,864

from ETH Zurich.

291

00:13:52,864 --> 00:13:54,567

And then that is  
taken back to Earth.

292

00:13:54,567 --> 00:13:57,402

But this is the front  
end, the sensor front end.

293

00:13:57,402 --> 00:13:59,205

As I said, there's  
three of those.

294

00:14:00,372 --> 00:14:02,407

They are there  
to, at the moment,

295

00:14:02,407 --> 00:14:04,910

to really check out  
the environment.

296

00:14:04,910 --> 00:14:07,780

We're not expecting  
this part of the mission

297

00:14:08,847 --> 00:14:11,616

to be the main  
seismic part, because

298

00:14:11,616 --> 00:14:15,054

what we need to do to get  
the good seismic signals,

299

00:14:15,054 --> 00:14:18,390

is to get really down  
onto the surface of Mars.

300

00:14:18,390 --> 00:14:21,360

But before we do that,  
we need to understand

301

00:14:21,360 --> 00:14:24,963

how the lander is going to  
pick up the environment,

302

00:14:24,963 --> 00:14:26,532

and particularly from the wind.

303

00:14:28,000 --> 00:14:32,270

And then itself transfer the  
signals to our seismometer.

304

00:14:32,270 --> 00:14:34,039

And the better we  
understand that,

305

00:14:34,039 --> 00:14:36,342

the better we can

subtract those effects,

306

00:14:37,443 --> 00:14:38,443

so that instead of  
hearing what's going on

307

00:14:38,443 --> 00:14:40,279

on top of the surface of Mars,

308

00:14:40,279 --> 00:14:44,149

we're listening to what  
is going deep underneath.

309

00:14:44,149 --> 00:14:48,553

So I think this is, if  
we go to the next image,

310

00:14:48,553 --> 00:14:53,258

this is where I'll hand over  
to Don Banfield, from Cornell,

311

00:14:53,258 --> 00:14:56,561

who's going to talk about  
another way that we've been

312

00:14:56,561 --> 00:15:01,567

detecting the motion of the  
wind on the InSight lander.

313

00:15:02,301 --> 00:15:03,569

>> Don: Thanks, Tom.

314

00:15:03,569 --> 00:15:05,303

So, you've just  
heard the vibrations,

315

00:15:05,303 --> 00:15:08,506

the wind caused on  
the spacecraft itself.

316

00:15:08,506 --> 00:15:09,708

But InSight has a way to also

317

00:15:09,708 --> 00:15:12,010

directly record

the air vibrations.

318

00:15:12,010 --> 00:15:14,146

That is the sound you would

hear if you were sitting

319

00:15:14,146 --> 00:15:16,314

on the InSight's deck.

320

00:15:16,314 --> 00:15:19,684

This first graphic is a good

one to reference right now.

321

00:15:19,684 --> 00:15:21,486

So InSight carries

a pressure sensor,

322

00:15:21,486 --> 00:15:24,356

and it's used to remove

the atmospheric effects

323

00:15:24,356 --> 00:15:26,558

that can reduce the

seismometer's sensitivity

324

00:15:26,558 --> 00:15:28,126

to detect Marsquakes.

325

00:15:28,126 --> 00:15:30,929

But in addition to its

service to do that,

326

00:15:30,929 --> 00:15:33,398

to improve InSight's

seismology mission,

327

00:15:33,398 --> 00:15:34,866

we can also use  
the pressure sensor

328

00:15:34,866 --> 00:15:36,568

to study the atmosphere itself.

329

00:15:38,070 --> 00:15:40,339

We expect to capture  
the pressure signature  
of the weather

330

00:15:40,339 --> 00:15:41,573

near the lander.

331

00:15:41,573 --> 00:15:43,775

Including things,  
exciting things like

332

00:15:43,775 --> 00:15:45,577

the nearby passage  
of dust devils.

333

00:15:47,012 --> 00:15:49,548

But with the pressure sensor  
we can also capture sounds

334

00:15:49,548 --> 00:15:51,449

from natural sources.

335

00:15:51,449 --> 00:15:53,751

One of the things we  
hope to maybe capture

336

00:15:53,751 --> 00:15:55,320

over the duration of the mission

337

00:15:55,320 --> 00:15:58,456  
is things like meteors  
exploding in the atmosphere.

338  
00:15:58,456 --> 00:16:01,426  
So right now, as  
Bruce said earlier,

339  
00:16:01,426 --> 00:16:02,594  
the pressure sensor  
inlet sits underneath

340  
00:16:02,594 --> 00:16:04,095  
the wind and thermal shield,

341  
00:16:04,095 --> 00:16:05,897  
so the white dome  
that you see there

342  
00:16:05,897 --> 00:16:08,633  
with the ghostly blue outline,

343  
00:16:08,633 --> 00:16:10,335  
the white dome is the  
wind and thermal shield,

344  
00:16:10,335 --> 00:16:13,939  
the ghostly blue outline is  
the pressure sensor's inlet

345  
00:16:13,939 --> 00:16:16,274  
that sits underneath it.

346  
00:16:16,274 --> 00:16:17,910  
If you go to the next graphic.

347  
00:16:21,045 --> 00:16:23,248  
In the audio clip that  
we've got right now,

348

00:16:23,248 --> 00:16:26,017

we're hearing sounds mostly  
produced by the wind blowing

349

00:16:26,017 --> 00:16:28,987

over the lander, and through  
the wind and thermal shield,

350

00:16:28,987 --> 00:16:31,089

and then entering the  
pressure sensor inlet.

351

00:16:31,089 --> 00:16:33,492

In a few weeks, once we'll take  
the wind and thermal shield

352

00:16:33,492 --> 00:16:35,627

off where it sits  
over that inlet,

353

00:16:35,627 --> 00:16:38,030

and put it on top  
of the seismometer,

354

00:16:38,030 --> 00:16:40,733

the pressure sensor inlet  
will be completely uncovered

355

00:16:42,101 --> 00:16:44,937

and work better to hear  
environmental sounds clearly.

356

00:16:46,738 --> 00:16:50,642

So, Mars has a thin  
CO2 atmosphere, and  
it attenuates sound

357

00:16:50,642 --> 00:16:53,078

much more than Earth's  
atmosphere does,

358

00:16:53,078 --> 00:16:55,781  
especially in the  
audio range and above.

359

00:16:55,781 --> 00:16:57,749  
So if we were having this  
conversation on Mars,

360

00:16:57,749 --> 00:16:59,251  
and if we could breathe there,

361

00:17:00,118 --> 00:17:02,387  
I would sound very muffled.

362

00:17:02,387 --> 00:17:03,588  
It would probably be  
difficult to understand me

363

00:17:03,588 --> 00:17:05,024  
if you weren't sitting  
right next to me.

364

00:17:06,191 --> 00:17:07,926  
However, on Mars,  
low frequency sound,

365

00:17:07,926 --> 00:17:10,962  
those that are below  
which humans can hear,

366

00:17:10,962 --> 00:17:13,198  
but perhaps elephants  
and whales can hear,

367

00:17:14,599 --> 00:17:16,902  
those propagate on Mars  
nearly as well as on Earth.

368

00:17:18,069 --> 00:17:21,072

So the pressure sensor  
actually can only record

369

00:17:21,072 --> 00:17:24,142

these low frequency sounds,  
which are called infrasound.

370

00:17:24,142 --> 00:17:26,044

So to make that something

371

00:17:26,044 --> 00:17:28,013

that's interesting  
to humans to hear,

372

00:17:28,013 --> 00:17:30,782

we've shifted the infrasound

373

00:17:30,782 --> 00:17:33,051

from the pressure  
sensor recording

374

00:17:33,051 --> 00:17:36,021

and that's recording  
the turbulent wind noise

375

00:17:36,021 --> 00:17:37,522

blowing over the rover.

376

00:17:37,522 --> 00:17:39,524

We've shifted that up into  
the human audible range

377

00:17:39,524 --> 00:17:42,894

by speeding the clip  
up by a factor of 100,

378

00:17:42,894 --> 00:17:46,598

which shifts the frequencies  
up by that same factor of 100,

379

00:17:46,598 --> 00:17:48,400  
which is about six octaves.

380

00:17:49,834 --> 00:17:52,270  
Now maybe it's probably a good  
time to play this last clip

381

00:17:52,270 --> 00:17:54,073  
from the pressure sensor wind.

382

00:17:55,541 --> 00:17:58,143  
[wind blowing]

383

00:18:02,881 --> 00:18:03,715  
So...

384

00:18:04,882 --> 00:18:07,052  
Part of the reason that  
planetary exploration

385

00:18:07,052 --> 00:18:08,687  
is so exciting,

386

00:18:08,687 --> 00:18:12,056  
is that it gives us virtual  
telepresence on another planet.

387

00:18:12,056 --> 00:18:14,826  
And usually we do  
that with images.

388

00:18:14,826 --> 00:18:17,595  
And we've got a lot of nice  
images from InSight already.

389

00:18:17,595 --> 00:18:19,764  
But now we also have sound.

390

00:18:19,764 --> 00:18:22,400

So humans are  
multisensory people.

391

00:18:22,400 --> 00:18:25,203

And now we have  
two of our sensors

392

00:18:25,203 --> 00:18:26,605

turned on with this mission.

393

00:18:28,039 --> 00:18:31,109

Personally, listening to the  
sound from the pressure sensor

394

00:18:31,109 --> 00:18:34,780

reminds me of sitting outside  
on a windy summer afternoon,

395

00:18:34,780 --> 00:18:37,415

listening to the turbulent  
gusts come and go,

396

00:18:37,415 --> 00:18:39,884

and whistle through your ears.

397

00:18:39,884 --> 00:18:41,653

In some sense, this is  
what it would sound like

398

00:18:41,653 --> 00:18:44,089

if you were sitting on the  
InSight lander on Mars.

399

00:18:46,158 --> 00:18:48,260

>> Jia-Rui: Great,  
okay, thank you Don.

400

00:18:48,260 --> 00:18:51,362

Okay, so we're gonna turn  
to Q&A at this point.

401  
00:18:51,362 --> 00:18:53,398  
So as a reminder to reporters,

402  
00:18:53,398 --> 00:18:56,234  
if you have a question,  
press star one.

403  
00:18:56,234 --> 00:18:57,870  
And we'll get you  
into the queue.

404  
00:18:59,271 --> 00:19:01,472  
So, what Don just said I think  
was kind of a good lead in

405  
00:19:01,472 --> 00:19:03,375  
that I was gonna ask  
the rest of you guys.

406  
00:19:03,375 --> 00:19:05,577  
I mean if you had  
to make an analogy,

407  
00:19:05,577 --> 00:19:06,745  
[laughs]

408  
00:19:06,745 --> 00:19:08,213  
for what these  
sounds sounded like,

409  
00:19:09,180 --> 00:19:11,182  
how would you describe them?

410  
00:19:11,182 --> 00:19:12,417  
And then make sure you  
guys say your names,

411

00:19:12,417 --> 00:19:13,985

'cause we've got  
a couple of people

412

00:19:13,985 --> 00:19:15,987

who probably sound alike  
to the people on the phone.

413

00:19:15,987 --> 00:19:17,755

>> Bruce: Well I mean to me,

414

00:19:17,755 --> 00:19:21,526

the sounds are really unworldly,

415

00:19:21,526 --> 00:19:25,897

I mean, they do sound  
like the wind, or maybe,

416

00:19:25,897 --> 00:19:28,300

the ocean kind of roaring  
in the background,

417

00:19:28,300 --> 00:19:32,470

but it also has kind of  
an unworldly feel to it.

418

00:19:32,470 --> 00:19:36,140

And you know, when I sit at  
my computer and play the sound

419

00:19:36,140 --> 00:19:38,810

through my headphones  
and look at the images,

420

00:19:38,810 --> 00:19:41,379

I can really imagine  
being on a planet

421

00:19:41,379 --> 00:19:43,214

that's in some ways  
like the Earth,

422  
00:19:43,214 --> 00:19:45,116  
but in some ways really alien

423  
00:19:45,116 --> 00:19:47,386  
and I think that's really cool.

424  
00:19:48,286 --> 00:19:49,220  
>> Jia-Rui: That was Bruce.

425  
00:19:49,220 --> 00:19:51,623  
>> Tom: Yep, and Tom speaking.

426  
00:19:51,623 --> 00:19:52,824  
It's...

427  
00:19:52,824 --> 00:19:54,826  
When you look at  
the images of Mars,

428  
00:19:54,826 --> 00:19:58,229  
in some ways it looks like  
Earth, but a lot redder,

429  
00:19:58,229 --> 00:20:00,298  
and no vegetation.

430  
00:20:00,298 --> 00:20:03,468  
But you can imagine  
you're in a sand pit

431  
00:20:03,468 --> 00:20:05,637  
or a slightly rocky area.

432  
00:20:05,637 --> 00:20:09,740  
But the sound is a rather  
different dimension.

433

00:20:09,740 --> 00:20:12,544

Because it's got quite  
a different atmosphere,

434

00:20:12,544 --> 00:20:14,679

just 1% of the Earth's,

435

00:20:14,679 --> 00:20:18,182

quite strong winds, but  
because of the low density,

436

00:20:18,182 --> 00:20:19,951

they have a different effect.

437

00:20:19,951 --> 00:20:24,055

Our ear is just not  
attuned to recognizing

438

00:20:24,055 --> 00:20:25,189

what we are listening to.

439

00:20:25,189 --> 00:20:27,358

It really sounds otherworldly,

440

00:20:27,358 --> 00:20:29,360

and that's exactly what it is.

441

00:20:29,360 --> 00:20:33,097

And the fact that  
we're listening to  
very low frequencies,

442

00:20:33,097 --> 00:20:35,567

it's a really distant rumble

443

00:20:35,567 --> 00:20:38,503

that we appear to  
be hearing here.

444

00:20:38,503 --> 00:20:41,406

It's just rather  
different to anything

445

00:20:41,406 --> 00:20:44,408

that we experience  
on Earth, and I think

446

00:20:44,408 --> 00:20:47,278

it just give another  
way of thinking about

447

00:20:47,278 --> 00:20:49,848

how far away we are  
getting these signals.

448

00:20:51,082 --> 00:20:51,916

>> Jia-Rui: Again if  
you have a question,

449

00:20:51,916 --> 00:20:53,184

please press star one

450

00:20:53,184 --> 00:20:54,853

and please record your  
name when prompted.

451

00:20:55,920 --> 00:20:58,322

>> Don: So, and this is Don.

452

00:20:58,322 --> 00:21:00,491

I guess what I said in my piece

453

00:21:00,491 --> 00:21:02,260

was pretty much what I think.

454

00:21:02,260 --> 00:21:06,331

I really imagine myself sitting

there on the InSight lander,

455

00:21:06,331 --> 00:21:07,799

and trying to look around,

456

00:21:07,799 --> 00:21:10,235

and see the desert  
environment that we landed in.

457

00:21:11,570 --> 00:21:12,503

And recognize that  
there's pretty strong wind

458

00:21:12,503 --> 00:21:13,705

blowing over my right shoulder,

459

00:21:15,106 --> 00:21:17,809

and this is what it sounds  
like as it blows past my head.

460

00:21:17,809 --> 00:21:21,045

And it's just, to me it's fun  
to imagine that I'm there.

461

00:21:21,045 --> 00:21:24,415

And part of the reason that  
I do planetary science.

462

00:21:24,415 --> 00:21:26,250

>> Tom: A real telly presence.

463

00:21:26,250 --> 00:21:27,419

>> Don: Exactly. That's what's,

464

00:21:27,419 --> 00:21:29,020

>> Tom: It's as  
close as being there,

465

00:21:29,020 --> 00:21:30,588

apart from being there.

466

00:21:30,588 --> 00:21:32,056

>> Don: That's why we do this.

467

00:21:32,056 --> 00:21:33,558

>> Tom: Some day we'll  
bring back smells, too,

468

00:21:33,558 --> 00:21:37,162

but until then, it's  
the best we can do.

469

00:21:37,162 --> 00:21:38,230

A little later.

470

00:21:38,230 --> 00:21:39,864

Sample return.

471

00:21:39,864 --> 00:21:42,467

>> Jia-Rui: Okay, we've got  
a question on the phone line,

472

00:21:42,467 --> 00:21:44,936

so Ken Chang from  
the New York Times,

473

00:21:44,936 --> 00:21:45,737

please go ahead.

474

00:21:53,011 --> 00:21:55,447

Oh, I think we  
might have lost him.

475

00:21:55,447 --> 00:22:00,218

Okay, can we bring up Megan  
Bartel from space.com?

476

00:22:01,453 --> 00:22:02,687

>> Megan: Sure.

477

00:22:02,687 --> 00:22:05,423

Can you talk a little  
bit about how you expect

478

00:22:05,423 --> 00:22:07,492

the data you're getting  
from these instruments

479

00:22:07,492 --> 00:22:09,728

to change over the  
course of the mission?

480

00:22:12,063 --> 00:22:14,666

>> Bruce: Well certainly, right  
now when we're on the deck,

481

00:22:14,666 --> 00:22:18,403

we're measuring the  
effects of the environment,

482

00:22:18,403 --> 00:22:22,140

and we're getting very little  
input from the ground itself,

483

00:22:23,908 --> 00:22:25,676

for the seismometer at least.

484

00:22:25,676 --> 00:22:27,912

So, our real goal, of course,

485

00:22:27,912 --> 00:22:30,114

is to deploy the  
seismometer onto the ground,

486

00:22:30,114 --> 00:22:32,150

get it covered, try  
to isolate it as much

487

00:22:32,150 --> 00:22:35,987

from the effects that  
we're measuring right now,

488

00:22:35,987 --> 00:22:40,992

and try to just isolate down  
to the very small vibrations

489

00:22:42,427 --> 00:22:44,996

that are coming through the  
ground from seismic waves,

490

00:22:44,996 --> 00:22:48,766

from Marsquakes thousands  
of kilometers away.

491

00:22:48,766 --> 00:22:52,070

But meanwhile, we need to  
understand the environment

492

00:22:52,070 --> 00:22:56,141

that these instruments  
are operating in, and so,

493

00:22:56,141 --> 00:22:58,376

I think that these  
first few weeks,

494

00:22:58,376 --> 00:23:01,479

we're really kind of  
concentrating on measurements

495

00:23:01,479 --> 00:23:04,049

that are gonna tell us about  
the environment of Mars.

496

00:23:05,483 --> 00:23:07,652

Once we get that dome off  
of the pressure sensor,

497

00:23:07,652 --> 00:23:10,255

it's really gonna  
increase its sensitivity

498

00:23:10,255 --> 00:23:13,858

to variations in the  
barometric pressure on Mars,

499

00:23:13,858 --> 00:23:15,493

which helps us with  
the seismometer,

500

00:23:15,493 --> 00:23:17,128

but also as Don says,

501

00:23:17,128 --> 00:23:20,131

this is gonna be the  
best weather station

502

00:23:20,131 --> 00:23:23,668

that's ever been placed  
on the Martian surface.

503

00:23:23,668 --> 00:23:27,738

And we're gonna be getting  
wind, barometric pressure,

504

00:23:27,738 --> 00:23:32,077

air temperature, 24.7  
hours a day, every day,

505

00:23:32,077 --> 00:23:35,980

for the next two  
years on Mars, and so,

506

00:23:35,980 --> 00:23:39,417

as we get the various  
instruments calibrated,

507

00:23:39,417 --> 00:23:41,686  
and ready to operate,

508

00:23:41,686 --> 00:23:44,255  
we're gonna start getting  
more and more precise data

509

00:23:44,255 --> 00:23:46,357  
about what's going on on Mars.

510

00:23:46,357 --> 00:23:48,560  
>> Tom: I'd like to say,  
this is Tom speaking.

511

00:23:48,560 --> 00:23:52,264  
I'd say very specifically,  
we are gonna be turning on,

512

00:23:53,231 --> 00:23:55,599  
later in the Martian day.

513

00:23:55,599 --> 00:24:00,438  
So this was taken around  
5 PM, local Mars time.

514

00:24:00,438 --> 00:24:03,675  
We're gonna be turning on  
later into the evening,

515

00:24:03,675 --> 00:24:06,511  
when we think the wind is  
going to be dying down.

516

00:24:07,846 --> 00:24:10,382  
And we'll hear definitely,  
we hope, at least,

517

00:24:10,382 --> 00:24:13,151  
that the modes of the  
lander, the lander itself

518

00:24:13,151 --> 00:24:15,520  
will be talking less to us,

519

00:24:15,520 --> 00:24:17,622  
and we'll be hearing  
a little bit more

520

00:24:17,622 --> 00:24:19,590  
from what's happening  
from underneath.

521

00:24:19,590 --> 00:24:22,893  
But at the moment, there  
could be a Marsquake

522

00:24:22,893 --> 00:24:24,696  
happening on the other  
side of the planet,

523

00:24:24,696 --> 00:24:29,134  
and we would not hear it  
above the chatter of the wind.

524

00:24:30,602 --> 00:24:34,873  
So we really want to be able  
to have, to be able to hear

525

00:24:34,873 --> 00:24:38,677  
the inside of Mars  
above that chatter.

526

00:24:38,677 --> 00:24:41,412  
And certainly we would  
like the wind to be lower,

527

00:24:41,412 --> 00:24:43,347  
but we would also  
like to be able

528  
00:24:43,347 --> 00:24:46,084  
to take the effect  
of the wind away.

529  
00:24:46,084 --> 00:24:49,687  
And then once we're on the  
ground, we really think

530  
00:24:49,687 --> 00:24:51,222  
that those lander nodes,

531  
00:24:51,222 --> 00:24:53,090  
what's causing most  
of the vibration

532  
00:24:53,090 --> 00:24:56,560  
that we're picking up at the  
moment, those should diminish.

533  
00:24:56,560 --> 00:25:00,866  
In fact, a really big part of  
what the team is working on

534  
00:25:00,866 --> 00:25:04,202  
at the moment is selecting  
just the right place,

535  
00:25:04,202 --> 00:25:05,870  
away from the lander,

536  
00:25:05,870 --> 00:25:09,574  
to make sure that we minimize  
the amount that the lander

537  
00:25:09,574 --> 00:25:13,711  
is going to be injecting  
into the size instrument.

538  
00:25:13,711 --> 00:25:16,548

And so, what you're hearing now,

539

00:25:16,548 --> 00:25:17,882

should get a lot quieter.

540

00:25:17,882 --> 00:25:20,018

I know it's quite

difficult to hear now,

541

00:25:20,018 --> 00:25:22,387

but it's going to

become, we hope at least,

542

00:25:22,387 --> 00:25:26,257

very difficult to hear the

sounds from the outside of Mars

543

00:25:26,257 --> 00:25:27,926

later on.

544

00:25:27,926 --> 00:25:30,161

And once we get to

seismic frequencies,

545

00:25:30,161 --> 00:25:33,398

those are going to be below

what we can hear audibly.

546

00:25:36,167 --> 00:25:38,403

>> Don: Yeah, so this is Don.

547

00:25:38,403 --> 00:25:40,905

I guess I would just extend a

little bit on what Bruce said.

548

00:25:40,905 --> 00:25:44,242

When the pressure sensor,

when its cover is uncovered

549

00:25:44,242 --> 00:25:45,911  
from the wind and  
thermal shield,

550  
00:25:47,111 --> 00:25:49,813  
the inlet is actually  
a pretty strange shape

551  
00:25:49,813 --> 00:25:51,849  
and that's specifically designed

552  
00:25:51,849 --> 00:25:54,286  
to reduce wind noise  
on the pressure sensor.

553  
00:25:55,387 --> 00:25:56,855  
So most of what we're  
probably hearing

554  
00:25:56,855 --> 00:25:58,757  
in the audio clip from  
the pressure sensor today,

555  
00:25:58,757 --> 00:26:01,059  
is wind noise,  
but in the future,

556  
00:26:01,059 --> 00:26:04,563  
when the inlet is exposed  
to the atmosphere,

557  
00:26:04,563 --> 00:26:06,631  
hopefully we're not  
hearing as much wind noise,

558  
00:26:06,631 --> 00:26:09,600  
and we should be hearing more  
environmental noise, like,

559  
00:26:09,600 --> 00:26:12,937

like I said, bolide explosions

560

00:26:12,937 --> 00:26:16,508  
or buoyancy oscillations  
at night time.

561

00:26:16,508 --> 00:26:18,476  
All sorts of interesting  
infrasound sources

562

00:26:18,476 --> 00:26:19,678  
that could be coming in.

563

00:26:21,145 --> 00:26:22,646  
>> Jia-Rui: Okay, well one  
thing I wanted to mention,

564

00:26:22,646 --> 00:26:23,781  
I forgot to say this earlier,

565

00:26:23,781 --> 00:26:25,916  
we do have two  
additional folks here

566

00:26:25,916 --> 00:26:29,020  
to help answer questions, and  
they are from our seis team,

567

00:26:29,020 --> 00:26:31,856  
the seismometer team, we  
have Philippe Lognonné,

568

00:26:31,856 --> 00:26:34,225  
who is the Seismometer  
Principal Investigator

569

00:26:34,225 --> 00:26:36,260  
from IPGP in Paris.

570

00:26:36,260 --> 00:26:38,029  
And we also have Philippe Lodé,

571  
00:26:38,029 --> 00:26:40,398  
the Seis Project  
Manager from KNEF,

572  
00:26:40,398 --> 00:26:42,433  
the French space agency.

573  
00:26:42,433 --> 00:26:44,135  
So if you guys have  
questions about seis,

574  
00:26:44,135 --> 00:26:46,237  
we have the people  
here to answer them.

575  
00:26:46,237 --> 00:26:48,573  
I think Philippe wanted  
to add something.

576  
00:26:48,573 --> 00:26:50,274  
Sorry, Philippe Lognonné,

577  
00:26:50,274 --> 00:26:51,509  
since we've got two Philippes.

578  
00:26:51,509 --> 00:26:52,243  
>> Philippe: So  
Philippe Lognonné.

579  
00:26:53,410 --> 00:26:56,247  
And we all learned a  
lot from transmission,

580  
00:26:56,247 --> 00:26:59,517  
so we learned a lot from Viking.

581

00:27:00,985 --> 00:27:05,256

Because Viking formed,  
the fact that the lander

582

00:27:05,256 --> 00:27:07,158

was shaking a lot  
during the daytime.

583

00:27:07,158 --> 00:27:09,827

And this is why we  
developed this strategy

584

00:27:09,827 --> 00:27:12,797

to deploy the  
seismometer far away.

585

00:27:12,797 --> 00:27:15,132

So now we have much  
better seismometer,

586

00:27:15,132 --> 00:27:16,868

we have a strategy to deploy.

587

00:27:18,168 --> 00:27:21,473

And we are very confident  
that we will get

588

00:27:22,306 --> 00:27:23,842

low noise, and we will,

589

00:27:25,276 --> 00:27:26,544

the contactor of the two,

590

00:27:27,544 --> 00:27:30,648

the rattle noise will disappear

591

00:27:30,648 --> 00:27:33,384

when we will be on the ground.

592

00:27:33,384 --> 00:27:34,585

>> Jia-Rui: Great.

593

00:27:34,585 --> 00:27:36,053

Okay we're gonna take  
another question,

594

00:27:36,053 --> 00:27:37,254

from the phone lines.

595

00:27:37,254 --> 00:27:39,190

Ken Chang, from  
the New York Times.

596

00:27:39,190 --> 00:27:40,425

Go ahead.

597

00:27:40,425 --> 00:27:42,427

>> Ken: Hi, can you  
hear me this time?

598

00:27:42,427 --> 00:27:44,495

>> Jia-Rui: Yes. [laughs]

599

00:27:44,495 --> 00:27:46,297

>> Ken: I was just asking  
about the Viking seismometers,

600

00:27:46,297 --> 00:27:48,967

and I thought they had picked  
up wind sounds as well.

601

00:27:51,202 --> 00:27:54,071

>> Bruce: The Viking  
seismometers did pick up

602

00:27:54,071 --> 00:27:57,041

the shaking of the Viking  
landers from winds,

603

00:27:57,041 --> 00:28:00,511

but they were measuring it  
at much lower sampling rates

604

00:28:00,511 --> 00:28:04,015

and didn't really,  
weren't able to sample

605

00:28:04,015 --> 00:28:06,984

at frequencies that  
would be audible.

606

00:28:06,984 --> 00:28:09,453

The first clip that we play here

607

00:28:09,453 --> 00:28:11,989

is the pure unadulterated data,

608

00:28:11,989 --> 00:28:14,558

it's not sped up, it's not  
increased in frequency.

609

00:28:14,558 --> 00:28:16,193

So, it's actually at frequencies

610

00:28:16,193 --> 00:28:19,164

that the human ear can hear.

611

00:28:19,164 --> 00:28:22,166

We can hear down to  
frequencies of about 20 Hz,

612

00:28:22,166 --> 00:28:25,803

and we're measuring all the  
way up almost to 50 Hz, and so

613

00:28:25,803 --> 00:28:29,407

even the Viking seismometer  
picked up what I would call

614

00:28:29,407 --> 00:28:32,610  
motions of the spacecraft,

615

00:28:32,610 --> 00:28:36,480  
I think it would be a  
stretch to call those sounds.

616

00:28:36,480 --> 00:28:38,516  
>> Yeah, and if I could add

617

00:28:38,516 --> 00:28:41,152  
that we are hoping, in  
the next week or two,

618

00:28:42,553 --> 00:28:45,189  
to be able to increase the  
frequencies that we can detect

619

00:28:45,189 --> 00:28:48,293  
from the short  
period seismometers.

620

00:28:48,293 --> 00:28:51,962  
So we've got an observation  
lined up to do that,

621

00:28:51,962 --> 00:28:55,099  
and we should be able to  
get the sounds up to 90 Hz.

622

00:28:55,099 --> 00:28:57,635  
So we don't know quite  
what we're going to hear

623

00:28:57,635 --> 00:29:00,638  
above the frequencies that  
we've heard at this point,

624

00:29:00,638 --> 00:29:03,541  
but this is the first  
time, and as I said,

625  
00:29:03,541 --> 00:29:05,276  
this is the very  
first 15 minutes,

626  
00:29:05,276 --> 00:29:09,113  
we've got more data  
coming down later today.

627  
00:29:09,113 --> 00:29:12,216  
And we've got more  
opportunities to listen

628  
00:29:12,216 --> 00:29:14,886  
through the next few weeks

629  
00:29:14,886 --> 00:29:17,321  
before we get down  
onto the ground.

630  
00:29:17,321 --> 00:29:19,423  
So we may get more  
information about how,

631  
00:29:19,423 --> 00:29:21,325  
we certainly hope to  
get more information

632  
00:29:21,325 --> 00:29:23,762  
about how this sound varies.

633  
00:29:25,163 --> 00:29:27,798  
But this is the first time  
on the surface of Mars

634  
00:29:27,798 --> 00:29:29,734  
that we've had instruments

that can detect

635

00:29:29,734 --> 00:29:32,103

up to the frequencies  
that we can hear.

636

00:29:32,103 --> 00:29:33,171

That humans can hear.

637

00:29:34,572 --> 00:29:37,408

>> Philippe: Viking was  
detecting only below 10 Hz.

638

00:29:37,408 --> 00:29:38,243

>> Bruce: Yeah.

639

00:29:39,410 --> 00:29:40,845

>> Ken: If I could  
ask a follow up,

640

00:29:40,845 --> 00:29:42,080

are the frequencies so low

641

00:29:42,080 --> 00:29:43,782

because the density  
of air is so thin?

642

00:29:44,915 --> 00:29:46,651

>> Tom: No, the  
frequencies are low

643

00:29:48,119 --> 00:29:52,490

because we are concentrating  
on detecting seismic waves.

644

00:29:52,490 --> 00:29:55,927

And the most energy  
of the seismic waves

645

00:29:55,927 --> 00:29:58,062  
is at the most, a few Hz.

646  
00:29:58,062 --> 00:30:02,599  
So actually below the  
threshold of human hearing.

647  
00:30:02,599 --> 00:30:05,336  
We have the short period  
seismometers on board

648  
00:30:06,704 --> 00:30:10,508  
to extend that frequency  
range from the very broadband

649  
00:30:10,508 --> 00:30:11,442  
French monitors.

650  
00:30:13,010 --> 00:30:15,880  
Partly because nearby...

651  
00:30:18,816 --> 00:30:19,651  
High frequency...

652  
00:30:58,323 --> 00:30:59,590  
>> Woman: Um, nope.

653  
00:30:59,590 --> 00:31:00,858  
>> Jia-Rui: One moment  
please, please stand by.

654  
00:31:00,858 --> 00:31:02,460  
>> Woman: So what  
I'm gonna do...

655  
00:31:16,507 --> 00:31:17,608  
>> Jia-Rui: Please stand by,

656  
00:31:17,608 --> 00:31:18,876

we have a few  
technical difficulties.

657

00:31:18,876 --> 00:31:20,645

Please stand by for  
the call to resume.

658

00:31:56,680 --> 00:31:57,515

We're back?

659

00:31:58,382 --> 00:31:59,851

Okay, we're back.

660

00:31:59,851 --> 00:32:02,352

I'm sorry about that, somehow  
our phone just went out.

661

00:32:02,352 --> 00:32:06,423

So anyways, Tom, you  
were, who was talking?

662

00:32:06,423 --> 00:32:07,959

[laughs]

663

00:32:07,959 --> 00:32:09,627

Alright, okay.

664

00:32:09,627 --> 00:32:11,729

>> Don: I actually have  
something to answer.

665

00:32:11,729 --> 00:32:12,897

>> Jia-Rui: Don, okay.

666

00:32:12,897 --> 00:32:14,732

>> Don: So Tom was  
talking about the noise

667

00:32:14,732 --> 00:32:17,735

that's coming through the  
short period seismometer.

668

00:32:17,735 --> 00:32:20,271

And that's fundamentally a  
function of the lander itself,

669

00:32:20,271 --> 00:32:24,943

but the noise that you hear  
with your ear is related to

670

00:32:26,444 --> 00:32:28,612

the eddies, the little  
turbulent eddies

671

00:32:28,612 --> 00:32:30,748

that you get from wind  
flowing over something.

672

00:32:30,748 --> 00:32:34,018

And those do have a different  
spectrum of size on Mars,

673

00:32:34,018 --> 00:32:35,820

than they would on Earth.

674

00:32:35,820 --> 00:32:38,055

On Mars, they're  
generally bigger.

675

00:32:38,055 --> 00:32:40,525

They don't get  
very small on Mars.

676

00:32:40,525 --> 00:32:42,927

And that means that their  
frequencies are lower.

677

00:32:44,095 --> 00:32:47,765

And because of that,

the sound you hear

678

00:32:47,765 --> 00:32:50,201  
is a lower frequency if  
you were sitting on Mars.

679

00:32:51,335 --> 00:32:53,904  
The thing that causes  
that difference,

680

00:32:53,904 --> 00:32:55,506  
is in fact the air density.

681

00:32:55,506 --> 00:32:56,774  
So the question was correct.

682

00:32:56,774 --> 00:32:59,377  
The air density  
being low on Mars,

683

00:32:59,377 --> 00:33:02,814  
lowers the turbulent wind buffet  
noise that you would hear.

684

00:33:03,948 --> 00:33:05,649  
>> Tom: I mean one  
other important factor

685

00:33:05,649 --> 00:33:07,651  
for the InSight  
mission as a whole,

686

00:33:07,651 --> 00:33:11,255  
is that we're going  
to be listening 24/7.

687

00:33:11,255 --> 00:33:12,857  
Actually, 365.

688

00:33:14,559 --> 00:33:16,327  
736 days a year.

689  
00:33:16,327 --> 00:33:19,530  
Don't quote me on that exact  
number, of the Mars year.

690  
00:33:19,530 --> 00:33:21,699  
And it's actually 24  
and a half, seven.

691  
00:33:21,699 --> 00:33:23,166  
I don't think there  
is a Mars week

692  
00:33:23,166 --> 00:33:24,868  
that we can really put in there.

693  
00:33:24,868 --> 00:33:27,104  
But we're going to be  
listening continuously.

694  
00:33:27,104 --> 00:33:30,040  
If we were to fill that data up

695  
00:33:30,040 --> 00:33:32,676  
to a high sounding frequency,

696  
00:33:32,676 --> 00:33:35,746  
we would not be able to  
get it all back to Earth.

697  
00:33:35,746 --> 00:33:39,283  
So we're concentrating, and  
the electronics concentrate

698  
00:33:39,283 --> 00:33:41,652  
on the lower frequencies,  
where we expect

699

00:33:41,652 --> 00:33:45,623

most of the seismic  
energy to be placed.

700

00:33:46,824 --> 00:33:48,992

And in fact, we go to  
even lower frequencies

701

00:33:48,992 --> 00:33:50,728

and send back the  
data continuously,

702

00:33:50,728 --> 00:33:52,697

and then pick up the  
higher frequencies

703

00:33:54,031 --> 00:33:56,467

when we see something  
interesting happening on Mars.

704

00:33:56,467 --> 00:33:58,536

So we're really data limited

705

00:33:59,937 --> 00:34:02,973

because we're on  
continuously through,

706

00:34:02,973 --> 00:34:04,908

once we're deployed,  
we're on continuously

707

00:34:04,908 --> 00:34:06,310

for the rest of the mission.

708

00:34:07,311 --> 00:34:08,646

>> Jia-Rui: Alright.

709

00:34:08,646 --> 00:34:09,780

As a reminder to reporters,

710

00:34:09,780 --> 00:34:12,783

if you have a question,  
press star one.

711

00:34:12,783 --> 00:34:14,752

We do have some questions  
on social media,

712

00:34:14,752 --> 00:34:15,953

so I'm gonna read them out.

713

00:34:15,953 --> 00:34:18,422

So Nove on Twitter asks,

714

00:34:18,422 --> 00:34:21,025

how can wind gusts go on Mars?

715

00:34:23,160 --> 00:34:24,595

>> Don: That's a good question.

716

00:34:24,595 --> 00:34:27,698

I think we've seen  
winds up to, like,

717

00:34:27,698 --> 00:34:32,003

in the range of 30 meters  
per second, but it's,

718

00:34:32,003 --> 00:34:34,404

there's no obvious  
reason that it couldn't

719

00:34:34,404 --> 00:34:35,840

be somewhat higher than that.

720

00:34:37,608 --> 00:34:39,377

We'll see what we  
see with InSight.

721

00:34:41,678 --> 00:34:43,580

Yeah, I think the  
theoretical limit

722

00:34:43,580 --> 00:34:45,916

that you'd expect in dust devils

723

00:34:45,916 --> 00:34:47,484

is something higher than that,

724

00:34:47,484 --> 00:34:49,287

something like 80  
meters per second.

725

00:34:50,154 --> 00:34:52,323

>> Bruce: 100 miles an hour.

726

00:34:52,323 --> 00:34:55,225

>> Don: Yeah, so the winds  
can be pretty high on Mars.

727

00:34:55,225 --> 00:34:57,562

We haven't observed  
terribly strong winds yet.

728

00:34:58,729 --> 00:35:00,731

Not like hurricane  
strength winds.

729

00:35:00,731 --> 00:35:04,001

We have observed pretty  
strong winds though, almost,

730

00:35:04,001 --> 00:35:05,635

what was it you said?

731

00:35:05,635 --> 00:35:06,937

Almost 70 mile an hour winds?

732

00:35:06,937 --> 00:35:08,172

So that's pretty strong.

733

00:35:10,574 --> 00:35:11,776

>> Jia-Rui: Great.

734

00:35:11,776 --> 00:35:13,877

Another social  
media question is,

735

00:35:13,877 --> 00:35:17,381

when can we buy our Martian  
wind sound white noise track?

736

00:35:17,381 --> 00:35:19,750

[laughter]

737

00:35:19,750 --> 00:35:21,185

So one answer is,

738

00:35:21,185 --> 00:35:22,052

>> Bruce: It's free!

739

00:35:22,052 --> 00:35:22,887

[laughter]

740

00:35:22,887 --> 00:35:24,355

>> Jia-Rui: Exactly.

741

00:35:24,355 --> 00:35:27,591

Yes it is for free, so if you  
guys go to [nasa.gov/sound](http://nasa.gov/sound),

742

00:35:27,591 --> 00:35:30,728

you can actually  
download these things,

743

00:35:30,728 --> 00:35:32,229  
but that might be  
another question for,

744

00:35:32,229 --> 00:35:33,731  
what are you guys gonna  
do with these sounds now,

745

00:35:33,731 --> 00:35:36,134  
besides use them to help  
you go to sleep at night?

746

00:35:37,534 --> 00:35:39,870  
>> Bruce: Well one thing  
we're gonna do is basically,

747

00:35:39,870 --> 00:35:42,773  
we're trying to design  
a noise cancellation

748

00:35:42,773 --> 00:35:44,908  
headphone system  
for our seismometer.

749

00:35:44,908 --> 00:35:48,045  
So, we're using these  
sounds to understand

750

00:35:48,045 --> 00:35:51,615  
what the environmental  
activity is,

751

00:35:51,615 --> 00:35:55,018  
and helping us to  
fine tune the software

752

00:35:55,018 --> 00:35:57,188  
that we're gonna use to  
try to eliminate that

753

00:35:57,188 --> 00:36:02,059  
from our seismic signal, when  
we're looking specifically at

754

00:36:02,059 --> 00:36:04,995  
Marsquakes, impact, and  
those sorts of things.

755

00:36:04,995 --> 00:36:07,632  
On the other hand,  
it's also allowing us

756

00:36:08,999 --> 00:36:13,370  
to fine tune our data  
analysis techniques

757

00:36:13,370 --> 00:36:15,606  
for the people who are  
actually using the seismometers

758

00:36:15,606 --> 00:36:18,475  
to look at atmospheric  
phenomena on Mars.

759

00:36:18,475 --> 00:36:20,945  
And so the pressure  
sensor and the seismometer

760

00:36:20,945 --> 00:36:23,181  
actually are gonna  
be working together.

761

00:36:24,648 --> 00:36:27,217  
We're gonna combine those  
data to better understand,

762

00:36:27,217 --> 00:36:29,186  
better characterize things like

763

00:36:29,186 --> 00:36:31,989

the turbulent  
activity of the wind

764  
00:36:31,989 --> 00:36:33,524  
near the surface of Mars.

765  
00:36:33,524 --> 00:36:36,994  
The passage of dust  
devils or vortexes

766  
00:36:36,994 --> 00:36:41,165  
that we know occur on Mars,  
and some things like that.

767  
00:36:41,165 --> 00:36:44,168  
And so, as we characterize  
these environmental signals,

768  
00:36:44,168 --> 00:36:47,137  
they're helping us to  
fine tune our analysis

769  
00:36:47,137 --> 00:36:48,705  
that later on, will  
allow us to make

770  
00:36:48,705 --> 00:36:51,541  
some very, very precise  
measurements on Mars.

771  
00:36:51,541 --> 00:36:54,445  
>> Tom: In fact, the  
variety of instruments

772  
00:36:54,445 --> 00:36:56,881  
that we're bringing to  
bear onto the problem

773  
00:36:56,881 --> 00:37:00,284  
go beyond just the

InSight instruments.

774

00:37:00,284 --> 00:37:05,223

Because the dust tracks  
that we imaged from orbit,

775

00:37:06,423 --> 00:37:07,592

they come from the  
high rise cameras.

776

00:37:08,725 --> 00:37:11,162

And that imaging over  
40, 50 kilometers,

777

00:37:11,162 --> 00:37:15,699

in fact they've built a mosaic  
of the entire landing ellipse

778

00:37:15,699 --> 00:37:18,001

where InSight landed.

779

00:37:18,001 --> 00:37:20,838

And so we've got at  
one level, we've got

780

00:37:20,838 --> 00:37:24,408

imaging over tens  
of kilometers scale.

781

00:37:24,408 --> 00:37:26,911

The vibrations that  
we're picking up

782

00:37:26,911 --> 00:37:31,882

are less than a millionth  
of a meter of displacement.

783

00:37:31,882 --> 00:37:34,418

These are very very  
small vibrations.

784

00:37:35,719 --> 00:37:38,456

So we're covering an enormous scale of measurement

785

00:37:38,456 --> 00:37:42,026

and able to tease out what is precisely happening

786

00:37:42,026 --> 00:37:45,028

at where we're putting down our seismometers.

787

00:37:45,028 --> 00:37:47,598

I think this is going to end up, Bruce,

788

00:37:47,598 --> 00:37:50,934

as being the most studied point on Mars.

789

00:37:50,934 --> 00:37:54,238

Every dimension, and we're just kind of building up

790

00:37:54,238 --> 00:37:57,942

these hyperdimensions of information over these weeks.

791

00:37:59,543 --> 00:38:00,744

>> Don: This is Don.

792

00:38:00,744 --> 00:38:02,345

For the pressure sensors down,

793

00:38:02,345 --> 00:38:04,681

mostly what you're hearing today

794

00:38:04,681 --> 00:38:07,184

is close to white noise.

795

00:38:07,184 --> 00:38:08,953

Hopefully in the  
future, we'll have

796

00:38:10,153 --> 00:38:11,655

sources of environmental noise

797

00:38:11,655 --> 00:38:14,525

that should be more like  
pure tones or chirps,

798

00:38:14,525 --> 00:38:16,960

depending upon what  
causes the noise.

799

00:38:16,960 --> 00:38:19,296

So we're gonna be  
looking very carefully

800

00:38:19,296 --> 00:38:22,366

of two years of data to see  
if we can find any of these

801

00:38:22,366 --> 00:38:26,771

more interesting signatures  
of environmental phenomena.

802

00:38:28,705 --> 00:38:30,607

>> Bruce: Whale chirps.

803

00:38:30,607 --> 00:38:32,009

>> Don: Something like that.

804

00:38:34,911 --> 00:38:36,246

>> Jia-Rui: Okay.

805

00:38:36,246 --> 00:38:38,549

Okay, so, sorry,  
thank you for that.

806  
00:38:38,549 --> 00:38:40,784  
Another question  
on social media,

807  
00:38:40,784 --> 00:38:42,552  
Don started alluding to this,

808  
00:38:42,552 --> 00:38:44,588  
but we can maybe get  
into it a little more.

809  
00:38:44,588 --> 00:38:45,790  
Julius on Twitter asks,

810  
00:38:46,991 --> 00:38:48,592  
since wind is a flow of  
gases on a large scale,

811  
00:38:48,592 --> 00:38:50,860  
what kind of gases are  
we talking about here,

812  
00:38:50,860 --> 00:38:52,496  
and how fast are they moving?

813  
00:38:53,864 --> 00:38:55,499  
>> Don: So Mars atmosphere  
is dominated by CO<sub>2</sub>.

814  
00:38:55,499 --> 00:38:58,803  
But it also has nitrogen  
and oxygen in it.

815  
00:39:00,171 --> 00:39:04,675  
So it's somewhat different  
makeup than Earth's atmosphere.

816

00:39:04,675 --> 00:39:07,511

The other big difference is  
that the density of the air

817

00:39:07,511 --> 00:39:09,380

is down by about  
a factor of 100.

818

00:39:10,414 --> 00:39:11,482

What was the end  
of the question?

819

00:39:11,482 --> 00:39:12,416

Something about,

820

00:39:12,416 --> 00:39:13,917

>> Bruce: How fast is it?

821

00:39:13,917 --> 00:39:15,285

>> Don: So the typical winds  
that we think we're gonna see

822

00:39:15,285 --> 00:39:18,289

at InSight's landing  
site are on the order

823

00:39:18,289 --> 00:39:20,190

of about seven  
meters per second.

824

00:39:20,190 --> 00:39:22,826

So about 15 miles an hour.

825

00:39:22,826 --> 00:39:24,094

As the seasons evolve,

826

00:39:24,094 --> 00:39:25,563

we're gonna be there  
a full Mars year,

827

00:39:25,563 --> 00:39:27,965

so we're gonna see  
the seasons change.

828

00:39:29,400 --> 00:39:31,302

And that'll probably slow  
down later in the year.

829

00:39:31,302 --> 00:39:33,503

And then as we come back  
around to near this time year,

830

00:39:33,503 --> 00:39:35,873

it's should pick back up again.

831

00:39:35,873 --> 00:39:38,509

We don't have perfect  
predictions for the weather,

832

00:39:38,509 --> 00:39:39,743

and the wind on Mars

833

00:39:39,743 --> 00:39:42,246

because we don't have  
very many observations.

834

00:39:42,246 --> 00:39:47,251

But there are computer  
models that have been tuned,

835

00:39:48,685 --> 00:39:50,987

over the years, for the  
other data that we've got.

836

00:39:50,987 --> 00:39:52,189

And it turns out that  
they're pretty accurate.

837

00:39:52,189 --> 00:39:54,691

The first inkling  
we've got of the wind

838

00:39:54,691 --> 00:39:57,094

at the InSight landing  
site matches pretty well

839

00:39:58,194 --> 00:39:59,730

with the model predictions, so.

840

00:40:01,265 --> 00:40:02,466

>> Jia-Rui: Great, okay.

841

00:40:02,466 --> 00:40:03,901

We have a question  
from Emily Lakdawalla

842

00:40:05,035 --> 00:40:07,304

of the Planetary  
Society via Twitter.

843

00:40:07,304 --> 00:40:08,672

So, she wants to ask  
about figure six,

844

00:40:08,672 --> 00:40:10,741

so this is the one  
where you have MRO

845

00:40:10,741 --> 00:40:12,742

and the dust devil tracks.

846

00:40:12,742 --> 00:40:15,346

Does figure six show a  
localized landing site,

847

00:40:15,346 --> 00:40:16,780

or is it just a comparison

848

00:40:16,780 --> 00:40:19,150  
to regional dust  
devil track features?

849

00:40:20,417 --> 00:40:23,720  
>> Tom: So I think that  
is our best estimate,

850

00:40:23,720 --> 00:40:27,057  
at this point, Bruce,  
of where we have landed.

851

00:40:28,492 --> 00:40:31,395  
And so, it's certainly,

852

00:40:31,395 --> 00:40:33,330  
we know that we  
are in that area.

853

00:40:34,498 --> 00:40:36,466  
And so given that  
the dust devils

854

00:40:36,466 --> 00:40:39,403  
are seen over this entire image,

855

00:40:39,403 --> 00:40:42,740  
the wind direction  
is persistent,

856

00:40:42,740 --> 00:40:47,344  
and so it's kind of  
a nice validation

857

00:40:47,344 --> 00:40:52,316  
that the spacecraft is being  
affected in the same direction.

858

00:40:53,717 --> 00:40:56,553

We'll be looking for  
more data as time goes on

859  
00:40:56,553 --> 00:40:59,089  
to see how that might  
shift over time.

860  
00:40:59,089 --> 00:41:01,658  
But the dust devil  
tracks clearly show

861  
00:41:01,658 --> 00:41:04,060  
that this is an  
area where the wind,

862  
00:41:04,060 --> 00:41:07,064  
the prevailing wind is a  
very well defined direction.

863  
00:41:07,064 --> 00:41:09,633  
At least the strongest winds  
with the dust devils in it.

864  
00:41:09,633 --> 00:41:13,037  
>> Bruce: Yeah, we know that  
InSight has landed somewhere

865  
00:41:13,037 --> 00:41:17,408  
very close to that, those  
words, InSight landing site.

866  
00:41:19,442 --> 00:41:23,814  
This of course, is high rise  
image from several years ago,

867  
00:41:23,814 --> 00:41:26,016  
of that area, so InSight's  
not in this image.

868  
00:41:26,016 --> 00:41:28,952

But if we take a  
picture of it today,

869

00:41:28,952 --> 00:41:33,958  
and the high rise camera on  
MRO has been imaging this area,

870

00:41:35,091 --> 00:41:37,194  
we will see the  
InSight lander here.

871

00:41:37,194 --> 00:41:41,131  
So this is the actual place  
where InSight has landed.

872

00:41:41,131 --> 00:41:44,835  
We don't have an  
exact dot on the map,

873

00:41:44,835 --> 00:41:47,705  
but it's very close to the  
center of this image somewhere.

874

00:41:48,872 --> 00:41:50,407  
>> Jia-Rui: Great.

875

00:41:50,407 --> 00:41:52,208  
Okay, we have a question  
from Bob on Twitter who says,

876

00:41:52,208 --> 00:41:54,311  
I love that the sound  
of the Martian wind

877

00:41:54,311 --> 00:41:57,348  
had to be sped up for 100  
times for us to listen to it.

878

00:41:57,348 --> 00:41:59,049  
Will the first

astronauts on mars

879

00:41:59,049 --> 00:42:00,417

be able to hear it at all?

880

00:42:03,320 --> 00:42:04,821

>> Don: Probably not,

881

00:42:04,821 --> 00:42:06,323

because they're gonna  
have space suits on,

882

00:42:06,323 --> 00:42:09,226

so it seems unlikely.

883

00:42:09,226 --> 00:42:11,895

I guess they could  
have microphones

884

00:42:11,895 --> 00:42:13,864

on the outside of their  
spacesuit and listen.

885

00:42:15,298 --> 00:42:17,868

Yeah, I'm not sure that  
you'd do that, though,

886

00:42:17,868 --> 00:42:20,738

because it's probably  
not worth the effort.

887

00:42:21,905 --> 00:42:23,908

>> [Philippe Lognonné]

But maybe they will hear

888

00:42:25,309 --> 00:42:26,143

inside their armor,

889

00:42:27,343 --> 00:42:31,148

the vibration of the culture,

890

00:42:31,148 --> 00:42:32,416

through the air.

891

00:42:32,416 --> 00:42:33,950

>> Bruce: Yes.

892

00:42:33,950 --> 00:42:34,818

The habitat.

893

00:42:34,818 --> 00:42:35,685

>> Don: Yes.

894

00:42:35,685 --> 00:42:37,187

>> Jia-Rui: Right.

895

00:42:37,187 --> 00:42:39,156

Yeah, you probably don't wanna die on Mars just to hear it.

896

00:42:39,156 --> 00:42:40,757

[laughs]

897

00:42:40,757 --> 00:42:42,259

>> Don: Not worth that one second.

898

00:42:42,259 --> 00:42:45,162

>> Jia-Rui: Alright, well we're gonna wrap up our telecon,

899

00:42:46,296 --> 00:42:47,697

and just for the folks on the phone,

900

00:42:47,697 --> 00:42:49,433

the telecon will be archived.

901  
00:42:50,634 --> 00:42:52,503  
You can go to  
[youtube.com/nasajpl](https://youtube.com/nasajpl),

902  
00:42:55,906 --> 00:43:00,010  
and also [ustream.tv/nasajpl](https://ustream.tv/nasajpl).

903  
00:43:00,010 --> 00:43:03,179  
So, thank you for  
everyone who called in,

904  
00:43:03,179 --> 00:43:05,081  
for listening to our telecon.

905  
00:43:05,081 --> 00:43:07,584  
Might wanna go off  
after the telecon,

906  
00:43:07,584 --> 00:43:10,153  
put your headphones  
on and just kind of

907  
00:43:10,153 --> 00:43:11,855  
feel the vibrations of Mars.

908  
00:43:11,855 --> 00:43:13,390  
So thank you very much.

909  
00:43:13,390 --> 00:43:14,224  
Okay.

910  
00:43:15,592 --> 00:43:17,527  
Thank you, this concludes  
today's conference,