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1
00:09:49,721 --> 00:09:53,192
- Although we've done it
before, landing on Mars is hard,

2
00:09:53,192 --> 00:09:55,161
and this mission
is no different.

3
00:09:56,595 --> 00:09:59,165
The process to get from the
top of the atmosphere of Mars

4
00:09:59,165 --> 00:10:03,769
to the surface, we call entry,
descent, and landing, or EDL.

5
00:10:03,769 --> 00:10:06,271
It takes thousands
of steps to go

6
00:10:06,271 --> 00:10:08,473
from the top of the
atmosphere to the surface,

7
00:10:08,473 --> 00:10:11,476
and each one of them
has to work perfectly

8
00:10:11,476 --> 00:10:12,945
to be a successful mission.

9
00:10:14,179 --> 00:10:16,515
The process starts
well above the top

10
00:10:16,515 --> 00:10:18,049
of the atmosphere of Mars.

11
00:10:18,049 --> 00:10:20,620

The cruise stage faces the sun.

12

00:10:22,054 --> 00:10:25,791

It also has its radio antenna which faces Earth.

13

00:10:25,791 --> 00:10:29,862

But now, we don't need the cruise stage, its job is done.

14

00:10:29,862 --> 00:10:32,264

The next step, just seven minutes before arriving

15

00:10:32,264 --> 00:10:34,399

to the top of the Mars atmosphere,

16

00:10:34,399 --> 00:10:37,269

is to separate the cruise stage.

17

00:10:37,269 --> 00:10:39,238

Before you hit the top of the atmosphere, though,

18

00:10:39,238 --> 00:10:41,640

the space capsule has to orient itself

19

00:10:41,640 --> 00:10:45,945

so that the heat shield is precisely facing the atmosphere.

20

00:10:46,979 --> 00:10:48,613

Now the fun begins.

21

00:10:48,613 --> 00:10:52,918

The vehicle is moving at nearly 13,000 miles an hour,

22

00:10:52,918 --> 00:10:54,553

but it's hitting the
top of the atmosphere

23

00:10:54,553 --> 00:10:57,589

at a very shallow
angle, 12 degrees.

24

00:10:57,589 --> 00:10:59,591

Any steeper, the
vehicle will hit

25

00:10:59,591 --> 00:11:00,825

the thicker part
of the atmosphere

26

00:11:00,825 --> 00:11:02,727

and it will melt and burn up.

27

00:11:02,727 --> 00:11:04,730

Any shallower, the vehicle will

28

00:11:05,831 --> 00:11:07,065

bounce off the
atmosphere of Mars.

29

00:11:07,065 --> 00:11:08,533

At the very top
of the atmosphere,

30

00:11:08,533 --> 00:11:11,803

it's about 70 miles above
the surface of Mars,

31

00:11:11,803 --> 00:11:12,937

and the air is starting to get

32

00:11:12,937 --> 00:11:14,339

thicker and thicker and thicker.

33

00:11:14,339 --> 00:11:16,608

As it does that, the
temperature on the heat shield

34

00:11:16,608 --> 00:11:19,178

gets well over 1,000
degrees centigrade,

35

00:11:19,178 --> 00:11:20,980

enough to melt steel.

36

00:11:20,980 --> 00:11:22,515

Over the next two minutes,

37

00:11:22,515 --> 00:11:26,418

the vehicle decelerates at
a backbreaking 12 Earth G's,

38

00:11:26,418 --> 00:11:30,389

from 13,000 miles an hour to
about 1,000 miles an hour.

39

00:11:30,389 --> 00:11:33,258

At about 10 miles above
the surface of Mars,

40

00:11:33,258 --> 00:11:35,927

a supersonic
parachute is launched

41

00:11:35,927 --> 00:11:37,596

out of the back of the vehicle.

42

00:11:37,596 --> 00:11:40,065

15 seconds after the
parachute inflates,

43

00:11:40,065 --> 00:11:41,900

it's time to get rid
of the heat shield.

44

00:11:41,900 --> 00:11:45,503

Six pyrotechnic devices
fire simultaneously,

45

00:11:45,503 --> 00:11:47,673

allowing the heat shield to fall

46

00:11:47,673 --> 00:11:49,608

and tumble away
from the vehicle,

47

00:11:49,608 --> 00:11:52,344

exposing the lander to
the surface of Mars.

48

00:11:52,344 --> 00:11:54,713

10 seconds after the
heat shield is dropped,

49

00:11:54,713 --> 00:11:57,415

three pyrotechnically
deployed legs

50

00:11:57,415 --> 00:12:00,252

are released and
locked for landing.

51

00:12:00,252 --> 00:12:03,521

About a minute later, the
landing radar is turned on

52

00:12:03,521 --> 00:12:06,558

sending pulses toward
the surface of Mars

53

00:12:06,558 --> 00:12:08,727

as the vehicle starts

to try to measure

54

00:12:08,727 --> 00:12:12,597

how high it is above the
surface and how fast it's going.

55

00:12:12,597 --> 00:12:15,033

At about a mile above
the surface of Mars,

56

00:12:15,033 --> 00:12:17,469

the lander falls away
from the back shell

57

00:12:17,469 --> 00:12:19,137

and lights its engines.

58

00:12:19,137 --> 00:12:20,339

And very quickly,

59

00:12:20,339 --> 00:12:22,975

the vehicle must
rotate out of the way

60

00:12:22,975 --> 00:12:25,043

so that the parachute
and the back shell

61

00:12:25,043 --> 00:12:27,012

doesn't come down to hit it.

62

00:12:27,012 --> 00:12:29,014

The last thing
that has to happen

63

00:12:29,014 --> 00:12:31,216

is that on the
moment of contact,

64

00:12:31,216 --> 00:12:34,786

the engines have to
shut down immediately.

65

00:12:34,786 --> 00:12:37,556

If they don't, the
vehicle will tip over.

66

00:12:37,556 --> 00:12:41,793

So if all the steps of
entry, descent, and landing

67

00:12:41,793 --> 00:12:45,598

happen perfectly and we are
safely on the surface of Mars,

68

00:12:45,598 --> 00:12:49,101

we'll be ready to do some
exciting new science.

69

00:12:57,008 --> 00:12:58,777

- Hello, and welcome to NASA's

70

00:12:58,777 --> 00:13:02,014

Jet Propulsion Laboratory
in Pasadena, California.

71

00:13:02,014 --> 00:13:05,050

In fewer than 24
hours from right now,

72

00:13:05,050 --> 00:13:07,920

we will be expecting
signals from Mars

73

00:13:07,920 --> 00:13:11,657

as NASA's InSight mission
touches down on the red planet.

74

00:13:11,657 --> 00:13:14,126

It's our first Mars
landing since 2012,

75

00:13:14,126 --> 00:13:16,528

and the excitement
is running high.

76

00:13:16,528 --> 00:13:18,063

My name is Stephanie L. Smith,

77

00:13:18,063 --> 00:13:20,966

I'm with the social
media team here at JPL,

78

00:13:20,966 --> 00:13:23,201

and with one day left to go,

79

00:13:23,201 --> 00:13:25,104

we are gonna take
a little time out.

80

00:13:25,104 --> 00:13:26,871

We are gonna get up
close and personal

81

00:13:26,871 --> 00:13:28,841

with some of the
scientists and engineers

82

00:13:28,841 --> 00:13:30,308

behind this mission.

83

00:13:30,308 --> 00:13:32,111

We're gonna ask
them some questions.

84

00:13:32,111 --> 00:13:34,513

We're joined today by
our NASA social group.

85

00:13:34,513 --> 00:13:37,282

We've got 30 digital
creators here in the house

86

00:13:37,282 --> 00:13:39,117

at Von Karman auditorium,

87

00:13:39,117 --> 00:13:42,921

selected from over
700 applications from
around the world.

88

00:13:42,921 --> 00:13:44,522

They're here to ask questions

89

00:13:44,522 --> 00:13:46,158

and then share their experiences

90

00:13:46,158 --> 00:13:48,293

with friends and
followers online.

91

00:13:48,293 --> 00:13:50,362

We'll be taking questions
here in the house.

92

00:13:50,362 --> 00:13:53,566

We will also be taking questions
online from social media,

93

00:13:53,566 --> 00:13:55,868

just tag those
questions askNASA.

94

00:13:57,335 --> 00:14:00,439

All right, so, to start us
off with some perspective,

95

00:14:00,439 --> 00:14:02,808

please welcome all the
way from NASA Headquarters

96

00:14:02,808 --> 00:14:05,810
in Washington DC,
Dr. Thomas Zurbuchen.

97

00:14:05,810 --> 00:14:07,412
He's the Associate
Administrator for

98

00:14:07,412 --> 00:14:08,914
the Science Mission Directorate,

99

00:14:08,914 --> 00:14:10,883
and he's gonna tell
us how InSight fits

100

00:14:10,883 --> 00:14:13,918
into NASA's larger plans
of planetary exploration,

101

00:14:13,918 --> 00:14:16,421
and why it's more than
just a Mars mission.

102

00:14:16,421 --> 00:14:19,124
Dr. Z?
- Hey, thanks.

103

00:14:19,124 --> 00:14:22,628
[audience applauding]

104

00:14:22,628 --> 00:14:24,496
The major reason I wanted
to quickly talk to you

105

00:14:24,496 --> 00:14:27,499
is just to thank
you, first of all.

106

00:14:27,499 --> 00:14:29,301

And I wanna thank you
just because I believe

107

00:14:29,301 --> 00:14:31,403

that one of the most
important parts of

108

00:14:31,403 --> 00:14:34,339

science missions is
actually to talk about them.

109

00:14:34,339 --> 00:14:38,877

I believe that science,
just like in my life,

110

00:14:38,877 --> 00:14:40,813

is something that
can be life-changing.

111

00:14:40,813 --> 00:14:43,916

It's not just because it
makes us safer on Earth,

112

00:14:43,916 --> 00:14:47,686

because we learn more
about our environment,

113

00:14:47,686 --> 00:14:49,588

it can also create careers.

114

00:14:49,588 --> 00:14:51,589

Many of the people
you're gonna talk to

115

00:14:51,589 --> 00:14:53,424

have careers that
relate to science.

116

00:14:53,424 --> 00:14:57,095

My career started with
that mission over there,

117

00:14:57,095 --> 00:14:58,730

with the Voyager mission,

118

00:14:58,730 --> 00:15:01,266

and I remember when I
was eight years old,

119

00:15:01,266 --> 00:15:03,902

I got that book at Christmas,

120

00:15:03,902 --> 00:15:07,940

and you know, without
any engineers or
scientists around me,

121

00:15:07,940 --> 00:15:10,576

focused on Voyager,

122

00:15:10,576 --> 00:15:11,844

and I read it,

123

00:15:11,844 --> 00:15:14,012

and of course for me,
that was like a dream,

124

00:15:14,012 --> 00:15:16,381

somebody else's dream,

125

00:15:16,381 --> 00:15:17,649

but I can tell you right now,

126

00:15:17,649 --> 00:15:20,018

and next chart,
this is mine, right?

127

00:15:20,018 --> 00:15:23,621

So not only is Voyager still
there, Voyager 1 and 2,

128

00:15:23,621 --> 00:15:27,226

by the way, Voyager just
about to make history again.

129

00:15:27,226 --> 00:15:31,063

Not going to tease that away,
it's all about InSight today,

130

00:15:31,063 --> 00:15:34,032

but the point is, we have
over a hundred missions

131

00:15:34,032 --> 00:15:35,634

that are looking at the Earth

132

00:15:35,634 --> 00:15:38,870

and looking at many
other parts of the world,

133

00:15:38,870 --> 00:15:40,739

big and close and far,

134

00:15:40,739 --> 00:15:44,409

and for us, what's really
important to me is that

135

00:15:44,409 --> 00:15:45,911

we tell those stories,

136

00:15:45,911 --> 00:15:48,480

not just the stories about
science and exploration,

137

00:15:48,480 --> 00:15:49,981

but the deeply human stories

138

00:15:49,981 --> 00:15:53,151
about doing things that
are impossible first,

139

00:15:53,151 --> 00:15:56,488
the deeply human stories
that have to do with

140

00:15:56,488 --> 00:15:58,590
taking something
that sounds crazy

141

00:15:58,590 --> 00:16:00,225
and turning it into reality.

142

00:16:00,225 --> 00:16:02,794
That's what we do each
and every day at NASA.

143

00:16:02,794 --> 00:16:04,062
That's why we're there,

144

00:16:04,062 --> 00:16:06,165
is to break through the
boundaries of ignorance,

145

00:16:06,165 --> 00:16:10,301
to really go beyond what we
can do each and every day,

146

00:16:10,301 --> 00:16:12,070
and we do so by building teams.

147

00:16:12,070 --> 00:16:13,939
It's not because of individuals,

148

00:16:13,939 --> 00:16:17,108
it's by building teams that

work and trust each other,

149

00:16:17,108 --> 00:16:19,010

teams who have different people,

150

00:16:19,010 --> 00:16:21,580

diverse viewpoints that
come together, and do this.

151

00:16:22,547 --> 00:16:23,949

So, I just wanted to thank you

152

00:16:23,949 --> 00:16:25,884

for carrying that message
to your audiences,

153

00:16:25,884 --> 00:16:27,353

because the audiences

154

00:16:27,353 --> 00:16:29,855

that listen to you on your
social media accounts,

155

00:16:29,855 --> 00:16:32,591

hopefully, will be the
people that will be there

156

00:16:32,591 --> 00:16:34,826

10 years from now,
five years from now,

157

00:16:34,826 --> 00:16:38,363

20 years from now, making
the next dreams a reality.

158

00:16:38,363 --> 00:16:40,431

So, I really don't
want to add more to it,

159

00:16:40,431 --> 00:16:44,236
and I really want to
turn it over to Q & A.

160
00:16:44,236 --> 00:16:45,169
- So, yeah, I think
we've got time

161
00:16:45,169 --> 00:16:46,638
for one question in this block,

162
00:16:46,638 --> 00:16:49,974
and like I said, we are taking
askNASA questions online.

163
00:16:49,974 --> 00:16:51,977
Let's go to Jason.

164
00:16:51,977 --> 00:16:53,479
- Sure, Thomas.

165
00:16:53,479 --> 00:16:56,048
So, Twitter user NASAWatch
has a question for you here,

166
00:16:56,048 --> 00:16:59,050
saying that NASA has two
CubeSat-base spacecraft

167
00:16:59,050 --> 00:17:00,886
as a tech demo during InSight.

168
00:17:00,886 --> 00:17:03,955
Are you looking at so-called
Swarm mission concepts

169
00:17:03,955 --> 00:17:05,424
where you only send groups,

170

00:17:05,424 --> 00:17:08,093

i.e. many low-cost
CubeSats to a world

171

00:17:08,093 --> 00:17:10,195

so that they can do
a brief but broad

172

00:17:10,195 --> 00:17:12,764

base simultaneous
reconnaissance?

173

00:17:12,764 --> 00:17:15,500

- I have a really good
question, and the answer is yes.

174

00:17:15,500 --> 00:17:18,803

We're learning how to do
these small satellites

175

00:17:18,803 --> 00:17:21,406

in ways that are beyond
their comfort zone.

176

00:17:21,406 --> 00:17:24,275

You know, MarCOs, now you can
talk to some of the people

177

00:17:24,275 --> 00:17:26,211

who know a lot about the MarCOs,

178

00:17:26,211 --> 00:17:29,347

they're well beyond the comfort
zone of smallsat developers.

179

00:17:29,347 --> 00:17:32,651

We're extending the range
of these spacecraft,

180

00:17:32,651 --> 00:17:34,319

their utility beyond that.

181

00:17:34,319 --> 00:17:36,654

But one of the things that
we're really interested in

182

00:17:36,654 --> 00:17:39,390

is in the context of Earth
observations, for example.

183

00:17:39,390 --> 00:17:43,761

If we fly many spacecraft near
or in the Earth environment,

184

00:17:43,761 --> 00:17:46,898

we can have if you want
an eye on a given spot

185

00:17:46,898 --> 00:17:49,467

at any one time in a way that

186

00:17:49,467 --> 00:17:51,436

we could otherwise not afford.

187

00:17:51,436 --> 00:17:54,606

So constellations of
such small missions,

188

00:17:54,606 --> 00:17:56,308

perhaps missions are
even a little bit bigger

189

00:17:56,308 --> 00:17:58,977

than these CubeSats that
we could launch together

190

00:17:58,977 --> 00:18:00,778

with novel launch
vehicles or vehicles

191
00:18:00,778 --> 00:18:03,415
that we already have
now are enabling

192
00:18:03,415 --> 00:18:05,617
new ways of looking
at the Earth,

193
00:18:05,617 --> 00:18:08,019
perhaps at the Moon and
other planetary bodies.

194
00:18:08,019 --> 00:18:10,789
So yes is the answer.
We want to do that.

195
00:18:10,789 --> 00:18:14,259
- Alright, so Dr. Z is
very active on social media

196
00:18:14,259 --> 00:18:16,961
and is available to
answer some more questions

197
00:18:16,961 --> 00:18:18,530
after the briefing is over.

198
00:18:18,530 --> 00:18:20,699
You can find him at @dr_thomasz.

199
00:18:22,801 --> 00:18:24,603
With that, let's give it up.

200
00:18:25,537 --> 00:18:26,571
- Thanks.

201
00:18:26,571 --> 00:18:28,807
[applause]

202

00:18:30,374 --> 00:18:33,444

- Okay so also, check out his

203

00:18:33,444 --> 00:18:36,548

Science in Seconds
series on Twitter.

204

00:18:36,548 --> 00:18:39,851

You will learn a lot in a
very short amount of time.

205

00:18:39,851 --> 00:18:43,254

Speaking of science, that
is where all missions start.

206

00:18:43,254 --> 00:18:45,123

Science tells us the
kind of instruments,

207

00:18:45,123 --> 00:18:47,359

the kind of spacecraft
that we need to send

208

00:18:47,359 --> 00:18:49,327

to answer big questions.

209

00:18:49,327 --> 00:18:53,331

So I wanna bring out our
starting lineup: our scientists.

210

00:18:53,331 --> 00:18:56,167

Alright so please give
a warm welcome to those

211

00:18:56,167 --> 00:18:57,902

who are gonna tell us
more about InSight,

212

00:18:57,902 --> 00:19:00,138

how it will get to
the heart of Mars

213

00:19:00,138 --> 00:19:02,641
with its seismometer,
its heat flow probe,

214

00:19:02,641 --> 00:19:04,843
and its radio
science instruments.

215

00:19:04,843 --> 00:19:06,277
Let's bring them on out.

216

00:19:06,277 --> 00:19:08,680
Sue Smrekar, InSight deputy

217

00:19:08,680 --> 00:19:11,516
principal investigator
here at JPL.

218

00:19:11,516 --> 00:19:14,887
Philippe Laudet, the Seis
project manager from KNS.

219

00:19:14,887 --> 00:19:18,356
Tilman Spohn, the HP cubed
principal investigator

220

00:19:18,356 --> 00:19:20,324
all the way from Germany, DLR.

221

00:19:20,324 --> 00:19:23,127
And batting clean up, Jim Green.

222

00:19:23,127 --> 00:19:27,632
NASA's chief scientist
from Washington DC.

223

00:19:27,632 --> 00:19:29,902
[applause]

224

00:19:31,236 --> 00:19:33,971
Alright so, our panelists
are gonna tell you

225

00:19:33,971 --> 00:19:35,940
a little bit about themselves,

226

00:19:35,940 --> 00:19:39,745
what those fancy titles
mean on a day to day basis,

227

00:19:40,912 --> 00:19:42,347
and just enough so
that you'll know

228

00:19:42,347 --> 00:19:43,748
what kind of questions
you can ask them,

229

00:19:43,748 --> 00:19:46,651
and we will spend most
of this time doing Q&A.

230

00:19:46,651 --> 00:19:49,087
So Sue, I'll kick
it over to you.

231

00:19:49,087 --> 00:19:52,624
- Hey. Well good afternoon,
I'm super happy to be here

232

00:19:52,624 --> 00:19:54,559
talking to you today.

233

00:19:54,559 --> 00:19:58,663
As you heard, my title is the
deputy principal investigator

234

00:19:58,663 --> 00:20:01,632
and the principal investigator
is the person who is

235

00:20:01,632 --> 00:20:03,735
responsible for the
science on the mission

236

00:20:03,735 --> 00:20:06,737
and the integrity, trying
to get the most possible

237

00:20:06,737 --> 00:20:09,274
science we can out of
this mission and so

238

00:20:09,274 --> 00:20:11,676
I've been helping Bruce
Banerdt to do that

239

00:20:11,676 --> 00:20:16,448
for the last eight years and
I've actually been here at JPL

240

00:20:16,448 --> 00:20:21,285
for 26 years and I
have had the thrill of

241

00:20:21,285 --> 00:20:24,322
trying to answer this question:

242

00:20:24,322 --> 00:20:26,424
what makes Earth unique?

243

00:20:26,424 --> 00:20:29,795
And I've gone about
that by studying

244

00:20:29,795 --> 00:20:34,332
different disciplines and
I really like to do science

245
00:20:34,332 --> 00:20:38,403
at the intersection of different
scientific disciplines.

246
00:20:38,403 --> 00:20:40,939
So you see this picture
of me in the background,

247
00:20:40,939 --> 00:20:44,976
I got the fun of going and
doing field work in Hawaii.

248
00:20:44,976 --> 00:20:47,979
And so we learned about
how flows actually occur

249
00:20:47,979 --> 00:20:50,248
in the surface, and trying
to see the characteristics

250
00:20:50,248 --> 00:20:53,185
so we might see those
flows on Mars as well.

251
00:20:53,185 --> 00:20:57,188
And I like to study
mathematically models of how

252
00:20:57,188 --> 00:20:59,825
hot stuff comes up out
of the interior planets

253
00:20:59,825 --> 00:21:02,894
to intersect and form
volcanism at the surface.

254

00:21:02,894 --> 00:21:06,265

So I like to work with
geophysics, geology,

255

00:21:07,598 --> 00:21:09,467

and I also like to study
other planets because

256

00:21:09,467 --> 00:21:11,369

they tell us about
our own planet.

257

00:21:11,369 --> 00:21:14,505

So I've had the thrill
of being able to merge

258

00:21:14,505 --> 00:21:17,876

those things together and
I just wanna say you know,

259

00:21:17,876 --> 00:21:21,046

denial is a technique
that I have used to manage

260

00:21:21,046 --> 00:21:24,416

a lot of stress and today
I'm just kind of feeling

261

00:21:24,416 --> 00:21:28,887

overwhelmed with the thrill
of this momentous occasion

262

00:21:28,887 --> 00:21:32,757

of the decades of
work for some of us,

263

00:21:32,757 --> 00:21:35,627

the hundreds of us who have
been involved in this project,

264

00:21:35,627 --> 00:21:39,598

but beyond just our
project, 50-ish years ago,

265

00:21:41,833 --> 00:21:44,302

the Apollo astronauts put
a seismometer on the Moon.

266

00:21:44,302 --> 00:21:46,672

They put heat flow
probes on the Moon.

267

00:21:46,672 --> 00:21:51,042

So all that technology
was developed and our real

268

00:21:51,042 --> 00:21:53,745

appreciation of the value
of this kind of science

269

00:21:53,745 --> 00:21:57,082

for studying other planets
and just all the Mars missions

270

00:21:57,082 --> 00:21:58,283

that have come before us,

271

00:21:58,283 --> 00:22:00,518

all the technology
that's been developed.

272

00:22:00,518 --> 00:22:04,322

Even studying the Earth,
we've learned about plate

273

00:22:04,322 --> 00:22:06,624

tectonics about 50 years ago.

274

00:22:06,624 --> 00:22:10,094

So I just feel like it's just

this incredible culmination

275

00:22:10,094 --> 00:22:12,230

of all these people's efforts

276

00:22:12,230 --> 00:22:15,300

to bring us to this point

today so I'm just feeling

277

00:22:15,300 --> 00:22:18,303

very overwhelmed and

thrilled to be here

278

00:22:18,303 --> 00:22:19,337

and talk to you about it.

279

00:22:19,337 --> 00:22:21,106

So to you Philippe.

280

00:22:23,108 --> 00:22:24,742

- Okay. Good

afternoon everybody.

281

00:22:24,742 --> 00:22:26,777

Thank you very much to be here.

282

00:22:26,777 --> 00:22:28,312

So my name is Philippe Laudet.

283

00:22:28,312 --> 00:22:32,083

I have been working for the

National Space French Agency,

284

00:22:32,083 --> 00:22:34,986

so sorry for my

horrible French accent.

285

00:22:34,986 --> 00:22:38,223

And I apologize in advance

if I don't understand

286

00:22:38,223 --> 00:22:40,025
well your questions.

287

00:22:40,025 --> 00:22:41,426
It's the reason why.

288

00:22:42,560 --> 00:22:43,962
I have been working
on that project.

289

00:22:43,962 --> 00:22:46,063
I am the project manager
of the seismometer.

290

00:22:46,063 --> 00:22:49,867
So seismometer, seis is the
small thing that you can

291

00:22:49,867 --> 00:22:53,204
see in front on the
ground on Mars ground,

292

00:22:53,204 --> 00:22:56,141
in front of the InSight lander.

293

00:22:56,141 --> 00:23:01,146
So that seismometer was
very, very hard to develop

294

00:23:02,347 --> 00:23:04,916
but we succeeded in that
and we are very humbled

295

00:23:04,916 --> 00:23:07,018
they are stick for that.

296

00:23:07,018 --> 00:23:12,023

My job during this seven
years as mainly to be

297

00:23:13,425 --> 00:23:17,662

to face the challenges
we had in two major ways.

298

00:23:18,796 --> 00:23:21,966

The first one was
technical challenges.

299

00:23:21,966 --> 00:23:26,438

We were more than 100
engineers in the whole world.

300

00:23:27,939 --> 00:23:31,109

A hundred engineers and we
had to face very difficult

301

00:23:31,109 --> 00:23:34,979

things because as you know
this seismometer is something

302

00:23:34,979 --> 00:23:36,781

that we can do but
also as a paradox

303

00:23:36,781 --> 00:23:39,951

it's also the most robust
that we were obliged to do

304

00:23:39,951 --> 00:23:42,987

because you need to
survive to launch,

305

00:23:42,987 --> 00:23:46,124

to cruise phase, and
to landing on Mars.

306

00:23:46,124 --> 00:23:47,492

This is not obvious at all.

307

00:23:47,492 --> 00:23:51,329

So my job was mainly
to help the engineer

308

00:23:52,530 --> 00:23:54,465

to find solutions for
the technical issues,

309

00:23:54,465 --> 00:23:56,568

for the technical challenges,

310

00:23:56,568 --> 00:24:01,573

but also to discuss, to prove
that it was the right way

311

00:24:02,740 --> 00:24:04,342

and so on, to give them
the appropriate money

312

00:24:04,342 --> 00:24:06,311

to make that work and so on.

313

00:24:06,311 --> 00:24:11,316

And the second way I had to
work for help in the project

314

00:24:12,183 --> 00:24:14,152

was to coordinate all the extras

315

00:24:14,152 --> 00:24:16,454

because you know this
instrument is a result

316

00:24:16,454 --> 00:24:20,925

of an international consortium.

317

00:24:20,925 --> 00:24:25,263

France is leading that consortium but we had British

318

00:24:25,263 --> 00:24:28,266

people who gave us some subsystems,

319

00:24:28,266 --> 00:24:29,601

high frequency sensors.

320

00:24:30,768 --> 00:24:34,205

German people gave us the leveling system

321

00:24:34,205 --> 00:24:37,375

to make it horizontal.

322

00:24:37,375 --> 00:24:40,579

JPL gave us the evacuated container on the tether,

323

00:24:40,579 --> 00:24:45,550

for example, and Switzerland made the integration

324

00:24:45,550 --> 00:24:48,753

of all the electronic boards in the electronic box

325

00:24:48,753 --> 00:24:53,291

which will stay under the lander on the hover side

326

00:24:53,291 --> 00:24:54,793

of the tether.

327

00:24:54,793 --> 00:24:58,830

So this was very complicated because we had very tight

328

00:24:58,830 --> 00:25:00,765

schedule, very short time.

329

00:25:00,765 --> 00:25:03,200

All these people are
different governments

330

00:25:03,200 --> 00:25:07,339

with each it's sometimes
funding issues.

331

00:25:07,339 --> 00:25:10,141

We didn't give them
any money because

332

00:25:10,141 --> 00:25:11,676

it was without exchange.

333

00:25:11,676 --> 00:25:15,146

It's funds like that that we
proceed in space activities.

334

00:25:15,146 --> 00:25:18,516

So different culture,
different money,

335

00:25:18,516 --> 00:25:21,453

different schedules
on, I was in charge of

336

00:25:21,453 --> 00:25:24,122

monitoring the schedule in
order them to deliver that part

337

00:25:24,122 --> 00:25:27,958

at a good, appropriate time
in order Kines to be able

338

00:25:27,958 --> 00:25:31,329

to integrate as a puzzle all
of the part of the seismometer

339

00:25:31,329 --> 00:25:33,931

and after to make all the
test of the seismometer

340

00:25:33,931 --> 00:25:35,333

alone but to complete.

341

00:25:35,333 --> 00:25:37,568

And after to go to Lockheed
Martin to test those

342

00:25:37,568 --> 00:25:39,404

seismometer integrated
on the lander.

343

00:25:40,872 --> 00:25:45,443

I could take to finish an
image that part of my job was

344

00:25:45,443 --> 00:25:48,112

if I was a band
leader as a musician

345

00:25:48,112 --> 00:25:51,716

and I have a very large
band who arrive with various

346

00:25:51,716 --> 00:25:54,585

musicians, if a lot of
musicians like a symphonic

347

00:25:54,585 --> 00:25:58,022

orchestra, some every
people are playing

348

00:25:58,022 --> 00:26:00,825

and different instrument are

coming from different music.

349

00:26:00,825 --> 00:26:04,696

Some are classical music, jazz music, rock and roll music.

350

00:26:04,696 --> 00:26:08,866

I don't know, I wish why not all beautiful musics

351

00:26:08,866 --> 00:26:11,302

that don't know themselves.

352

00:26:11,302 --> 00:26:14,205

They are all the ages, they don't speak the same tongue,

353

00:26:14,205 --> 00:26:19,210

the same language, and I gave them the most difficult

354

00:26:20,678 --> 00:26:24,883

score which has been never recorded before by nobody.

355

00:26:26,350 --> 00:26:29,820

So I told them okay, we have to play this chord together

356

00:26:29,820 --> 00:26:31,656

and the concert is very soon.

357

00:26:31,656 --> 00:26:33,891

So they did the job.

358

00:26:33,891 --> 00:26:35,560

It was very interesting.

359

00:26:35,560 --> 00:26:37,328

It was not only your
technical adventure,

360
00:26:37,328 --> 00:26:40,098
it was also human adventure.

361
00:26:40,098 --> 00:26:43,868
And I am very proud of them
because they succeeded to work.

362
00:26:43,868 --> 00:26:45,637
It was sometimes
also a bit difficult

363
00:26:45,637 --> 00:26:49,440
but now they are very
proud and can tell you that

364
00:26:49,440 --> 00:26:51,943
the show on the concert
begins tomorrow.

365
00:26:55,313 --> 00:26:57,082
- Okay what a speech.

366
00:27:01,652 --> 00:27:04,388
- Hi I'm glad to be
here with you today.

367
00:27:04,388 --> 00:27:08,359
I'm Tilman Spohn from the
German Space Association,

368
00:27:08,359 --> 00:27:11,929
Institute of Planetary
Research in Berlin, Germany.

369
00:27:11,929 --> 00:27:14,799
And I'm the instrument lead
of the heat flow probe,

370

00:27:14,799 --> 00:27:16,968

or the PI of the
heat flow probe.

371

00:27:16,968 --> 00:27:21,973

I made a career as a modeler
of the interior structure

372

00:27:23,040 --> 00:27:25,009

and dynamics and
energetics of the Earth

373

00:27:25,009 --> 00:27:27,412

and terrestrial planets.

374

00:27:28,847 --> 00:27:32,817

And such I noticed how
important the quantity of

375

00:27:32,817 --> 00:27:36,720

characterizing the interior
dynamics and energy balance

376

00:27:36,720 --> 00:27:38,256

the heat flow is.

377

00:27:38,256 --> 00:27:42,126

I mean the rate of heat that
escaping from the interior,

378

00:27:42,126 --> 00:27:45,864

it sort of measures the
rate of the turnovers

379

00:27:47,665 --> 00:27:52,303

in the interior and the
dynamics and it's related to

380

00:27:52,303 --> 00:27:54,738

volcanism on the
surface and even to the

381

00:27:54,738 --> 00:27:57,208

rate of generation of quakes.

382

00:27:57,208 --> 00:28:01,479

It's basically coming all
from the heat of the interior.

383

00:28:01,479 --> 00:28:06,484

And I made up my mind that wow,
we gonna have to measure it.

384

00:28:08,385 --> 00:28:11,989

And I was in the situation
as a then director of the

385

00:28:11,989 --> 00:28:15,359

institute in Berlin
to say let's do that,

386

00:28:15,359 --> 00:28:20,098

and redevise that heat flow
probe that is flying to Mars

387

00:28:20,098 --> 00:28:24,001

and that will be
installed in January.

388

00:28:24,001 --> 00:28:28,339

Now you see the HP cubed
instrument on the screen.

389

00:28:28,339 --> 00:28:31,242

It is basically consisting
of a what we call

390

00:28:31,242 --> 00:28:35,413

a model, it's not really
a model but it's a

391
00:28:35,413 --> 00:28:38,149
sum that is hammering
itself into the ground

392
00:28:38,149 --> 00:28:41,853
carrying behind a cable
installing temperature sensors.

393
00:28:41,853 --> 00:28:45,423
And on the way down they're
measuring the semiconductivity,

394
00:28:45,423 --> 00:28:47,725
and after we've installed
the temperature sensors,

395
00:28:47,725 --> 00:28:49,327
we have the
temperature gradient.

396
00:28:49,327 --> 00:28:52,396
And the product of
both is the heat flow.

397
00:28:52,396 --> 00:28:54,899
And when we have that quantity,

398
00:28:54,899 --> 00:28:58,168
we will be able to
characterize the present energy

399
00:28:58,168 --> 00:29:01,939
balance of the interior of Mars.

400
00:29:01,939 --> 00:29:06,377
I've been bricking with
Sue, Mercar, Bruce Banerdt,

401

00:29:06,377 --> 00:29:10,180

Phillippe Laudet and
others for a very long time

402

00:29:10,180 --> 00:29:12,483

of putting a geophysical
station on Mars.

403

00:29:12,483 --> 00:29:15,920

We've become friends
over the years.

404

00:29:15,920 --> 00:29:17,755

I'm so happy to be
together on that mission.

405

00:29:17,755 --> 00:29:19,857

I thank NASA that you
made that possible.

406

00:29:19,857 --> 00:29:21,492

With that, I hand over to you.

407

00:29:21,492 --> 00:29:24,094

Thank you very much.

408

00:29:24,094 --> 00:29:27,198

- I'm Jim Green. I'm the
NASA chief scientist.

409

00:29:27,198 --> 00:29:29,800

But that position
only started in May.

410

00:29:29,800 --> 00:29:34,205

Prior to that, for twelve
years I was the planetary

411

00:29:34,205 --> 00:29:35,507
science division director,

412

00:29:36,941 --> 00:29:40,177
and so I had the opportunity
to be part of the decision

413

00:29:40,177 --> 00:29:44,215
in selecting InSight for
this spectacular opportunity

414

00:29:44,215 --> 00:29:47,118
of getting down on the surface
and making measurements

415

00:29:47,118 --> 00:29:50,154
of fundamental importance
for the understanding

416

00:29:50,154 --> 00:29:52,490
of how terrestrial
planets are put together.

417

00:29:53,625 --> 00:29:56,828
I'm a magnetus
ferrite physicist,

418

00:29:56,828 --> 00:30:00,565
which means that I never met a
magnetic field I didn't like.

419

00:30:01,732 --> 00:30:05,036
Even when they had
magnetic fields,

420

00:30:05,036 --> 00:30:07,838
and then no longer can
generate their own field.

421

00:30:07,838 --> 00:30:10,341

And that's what
Mars is all about.

422
00:30:10,341 --> 00:30:15,013
However, there's an auxiliary
science package on InSight

423
00:30:15,013 --> 00:30:18,983
and that particular package
has a magnetometer on it.

424
00:30:18,983 --> 00:30:21,018
And that magnetometer
will be important

425
00:30:21,018 --> 00:30:24,689
in helping understand and help
interpret the seismic waves,

426
00:30:24,689 --> 00:30:27,825
but it will also be
able to measure currents

427
00:30:27,825 --> 00:30:29,660
in the ionosphere.

428
00:30:29,660 --> 00:30:33,163
And so it's really our
first major experiment

429
00:30:33,163 --> 00:30:38,169
on the surface to understand
space weather effects at Mars.

430
00:30:39,537 --> 00:30:43,308
So humans which go to Mars
will rely on data from InSight.

431
00:30:45,176 --> 00:30:48,979
If Mars shakes, and it

does, how bad is that?

432

00:30:48,979 --> 00:30:51,782

What kind of structures
will we have to build?

433

00:30:51,782 --> 00:30:55,519

Solar storms that hit the
atmosphere and the ionosphere

434

00:30:55,519 --> 00:31:00,424

of Mars generating currents,
how bad are those currents?

435

00:31:00,424 --> 00:31:03,628

And will they affect
systems on the surface?

436

00:31:03,628 --> 00:31:05,697

InSight will tell
us these things.

437

00:31:07,131 --> 00:31:09,901

A spectacular mission that
feeds forward well into

438

00:31:09,901 --> 00:31:13,771

human exploration, and is
a fundamental next step

439

00:31:13,771 --> 00:31:16,240

in exploring Mars.

440

00:31:16,240 --> 00:31:21,045

Now I believe that science
isn't done until it is shared,

441

00:31:21,045 --> 00:31:24,148

and we as scientists do
that at scientific meetings.

442

00:31:25,282 --> 00:31:28,219

But what we're
doing here is indeed

443

00:31:28,219 --> 00:31:30,455

having everyone come along.

444

00:31:31,822 --> 00:31:35,326

I, like you, are coming
along for the ride.

445

00:31:35,326 --> 00:31:37,228

There's no button
I'm gonna push.

446

00:31:38,095 --> 00:31:39,863

There's nothing I'm gonna do.

447

00:31:39,863 --> 00:31:42,666

There's no decision
I have to make.

448

00:31:42,666 --> 00:31:47,404

I am just enthralled with the
process of how we're going

449

00:31:47,404 --> 00:31:50,274

to do this magnificent mission.

450

00:31:50,274 --> 00:31:53,578

Landing it on a surface
of another planet,

451

00:31:53,578 --> 00:31:55,513

and it is not easy.

452

00:31:56,914 --> 00:32:00,118

Just in the last several years

there's been some attempts

453

00:32:00,118 --> 00:32:02,020
for landing on Mars
that have failed.

454

00:32:03,420 --> 00:32:07,825
You know, are we lucky?
When will our luck run out?

455

00:32:07,825 --> 00:32:11,729
And when do we have to
apply all the engineering

456

00:32:11,729 --> 00:32:14,732
that we know to determine
what worked right

457

00:32:14,732 --> 00:32:16,901
and what didn't work right?

458

00:32:16,901 --> 00:32:19,336
These are the kind of things
that we're gonna find out

459

00:32:19,336 --> 00:32:21,806
in the next 24 hours.

460

00:32:21,806 --> 00:32:24,742
This will become a
valid science mission

461

00:32:25,977 --> 00:32:30,715
when those solar panels
are displayed like this

462

00:32:31,882 --> 00:32:34,218
and we charge the
battery back up.

463
00:32:34,218 --> 00:32:37,488
Then the mission
really will start.

464
00:32:37,488 --> 00:32:41,826
Then it's gonna be two
Earth years on the surface

465
00:32:41,826 --> 00:32:43,561
making all kinds
of measurements.

466
00:32:44,428 --> 00:32:47,865
Now with InSight is a chip.

467
00:32:47,865 --> 00:32:50,567
You know I said we want
to share with the public

468
00:32:50,567 --> 00:32:51,836
what we're doing.

469
00:32:51,836 --> 00:32:56,774
And that chip's got 2.4
million names of people

470
00:32:57,874 --> 00:33:00,678
that wanted their name on Mars.

471
00:33:01,846 --> 00:33:04,215
Hopefully many in
this room did that.

472
00:33:04,215 --> 00:33:07,018
If you didn't, you'll have
to wait til the next mission.

473
00:33:08,719 --> 00:33:10,754
So with that, let's

get into the questions.

474

00:33:10,754 --> 00:33:14,024

- Absolutely, and just like
a spacecraft in its payload

475

00:33:14,024 --> 00:33:15,726

faring, we're trying to
pack a lot of awesome

476

00:33:15,726 --> 00:33:19,163

into a very small space,
so if you've got a question

477

00:33:19,163 --> 00:33:20,397

in the house, please
raise your hand

478

00:33:20,397 --> 00:33:21,832

so we can get a
microphone to you.

479

00:33:21,832 --> 00:33:22,934

Right there.

480

00:33:24,235 --> 00:33:26,370

- Hi. I had a question
about the mole.

481

00:33:26,370 --> 00:33:28,438

I read an article where
it was talking about

482

00:33:28,438 --> 00:33:29,973

how it works like a jackhammer.

483

00:33:29,973 --> 00:33:32,943

It just slowly hammers down
over a couple of months,

484

00:33:32,943 --> 00:33:36,046

and in one of the initial
tests they pulled all the

485

00:33:36,046 --> 00:33:37,581

atmosphere out of
the test chamber

486

00:33:37,581 --> 00:33:39,483

and it kept hammering itself up.

487

00:33:39,483 --> 00:33:40,951

How did they overcome that?

488

00:33:40,951 --> 00:33:45,623

- Yeah I mean we noticed
that the capability of it to

489

00:33:47,391 --> 00:33:50,495

enter into the surface depends
on the atmospheric pressure.

490

00:33:52,196 --> 00:33:57,201

So we made a study,
systematic study reducing the

491

00:33:58,368 --> 00:34:01,472

atmospheric pressure
in a pressure chamber.

492

00:34:01,472 --> 00:34:04,542

And we found that it works
best at the Earth's atmosphere

493

00:34:04,542 --> 00:34:07,811

and pressures higher, but
it still works fine on Mars

494

00:34:07,811 --> 00:34:12,717

but when we go to lunar, we
have to make a different design.

495

00:34:12,717 --> 00:34:14,719

It wouldn't work so
well on the Moon,

496

00:34:14,719 --> 00:34:16,654

but in Mars it
should be working.

497

00:34:18,188 --> 00:34:19,991

And the pressure
is just keeping it,

498

00:34:21,325 --> 00:34:22,293

as subtle as it is.

499

00:34:24,828 --> 00:34:28,699

- [Audience] Hi, any chance
that we can ID life on Mars?

500

00:34:28,699 --> 00:34:30,468

Maybe with the
instruments on board?

501

00:34:33,937 --> 00:34:37,975

- Not immediately, you
know. Well you know,

502

00:34:37,975 --> 00:34:39,877

we will be killing
the beasts on it

503

00:34:39,877 --> 00:34:41,512

if we hit it with the most.

504

00:34:41,512 --> 00:34:45,249

No I mean I'm
joking but you know,

505

00:34:45,249 --> 00:34:49,886
we could say something
about habitability maybe,

506

00:34:49,886 --> 00:34:51,889
but not about life immediately.

507

00:34:51,889 --> 00:34:54,257
- So the heat probe's
gonna give us information

508

00:34:54,257 --> 00:34:56,794
about how Mars radiates heat.

509

00:34:56,794 --> 00:35:00,097
That will enable a
full model of Mars,

510

00:35:00,097 --> 00:35:02,833
and then there'll be a
certain time or period,

511

00:35:02,833 --> 00:35:05,502
place rather within that
surface for which the heat

512

00:35:05,502 --> 00:35:08,005
is enough to maintain
water as a liquid.

513

00:35:09,106 --> 00:35:10,507
And if there's
aquifers down there,

514

00:35:10,507 --> 00:35:13,044
Mars has had a lot
of water in its past.

515

00:35:13,044 --> 00:35:15,847

It's in the rocks,
it's under the surface,

516

00:35:15,847 --> 00:35:19,683

and if it's below the
area where it can actually

517

00:35:19,683 --> 00:35:21,385

stay in a liquid form,

518

00:35:21,385 --> 00:35:23,020

then you got a
possibility for life.

519

00:35:23,020 --> 00:35:26,591

So indeed that would
be one of the factors

520

00:35:26,591 --> 00:35:27,525

that we look at.

521

00:35:28,993 --> 00:35:30,428

- [Stephanie] Okay let's go
ahead and take one question

522

00:35:30,428 --> 00:35:32,663

from social media and then
we'll come back into the house.

523

00:35:32,663 --> 00:35:36,066

- Sure thing. So Pixel
Princess on Twitter is asking

524

00:35:36,066 --> 00:35:38,836

how do you actually pick the
instruments to put on a lander

525

00:35:38,836 --> 00:35:41,705

in order to fulfill

the mission objectives?

526

00:35:41,705 --> 00:35:44,007

- Okay if that comes to me, I'd say that's easy.

527

00:35:44,007 --> 00:35:49,013

We solicited the best spacecraft that our scientific

528

00:35:49,747 --> 00:35:51,381

minds can put together,

529

00:35:51,381 --> 00:35:56,387

and that comes then together as a mission.

530

00:35:57,755 --> 00:36:01,291

So this was a solicited opportunity for what's called

531

00:36:01,291 --> 00:36:02,826

the discovery program,

532

00:36:02,826 --> 00:36:06,830

and this was our top pick in that program for that year.

533

00:36:06,830 --> 00:36:10,134

It beat out something like 27 other missions.

534

00:36:10,134 --> 00:36:12,769

But Sue, how do you put the instruments together?

535

00:36:12,769 --> 00:36:15,539

- Right. So as Jim said, these are competed missions

536

00:36:15,539 --> 00:36:19,744

and so the principal
investigators and
the science team

537

00:36:19,744 --> 00:36:22,746

come together to choose those
instruments for competed

538

00:36:22,746 --> 00:36:26,516

missions, so in this case it's
driven by our science team

539

00:36:26,516 --> 00:36:29,987

and the goals of understanding
the interior of Mars.

540

00:36:31,521 --> 00:36:34,125

- [Stephanie] Okay. Let's
get a mic right down here.

541

00:36:40,097 --> 00:36:41,532

- I guess this is kind
of a silly question,

542

00:36:41,532 --> 00:36:44,435

but who gets to name
these landers and rovers?

543

00:36:44,435 --> 00:36:48,305

Is it the team directly or
who gets the cool names?

544

00:36:48,305 --> 00:36:49,673

- When this proposal came in,

545

00:36:49,673 --> 00:36:52,609

the name of the
mission was Gems.

546

00:36:52,609 --> 00:36:55,846

Okay, Gems. So Sue,
what happened next?

547

00:36:56,980 --> 00:37:00,984

- Yeah so unfortunately
that name was taken

548

00:37:00,984 --> 00:37:04,221

by another spacecraft that
NASA was flying I believe

549

00:37:04,221 --> 00:37:07,358

around the Earth, so we had
to come up with a new name.

550

00:37:07,358 --> 00:37:11,495

And in fact again, that's
the domain of the principal

551

00:37:11,495 --> 00:37:14,932

investigator and with input
from the science team so

552

00:37:14,932 --> 00:37:17,301

we came up with a new name,

553

00:37:17,301 --> 00:37:20,504

and Bruce was the one who
got to make the final call.

554

00:37:20,504 --> 00:37:23,540

But I was on board
with this one too.

555

00:37:23,540 --> 00:37:25,676

So that's how we did it.

556

00:37:25,676 --> 00:37:30,280

- So it's a backronym guys.
Who among you can give

557
00:37:30,280 --> 00:37:31,448
us the full backronym?

558
00:37:31,448 --> 00:37:33,417
You guys know about backronyms?

559
00:37:33,417 --> 00:37:34,885
When you start with the
word insight and then you

560
00:37:34,885 --> 00:37:38,655
back out of it to make
the acronym? So interior-

561
00:37:38,655 --> 00:37:41,859
- Exploration using
seismology, geodyssey,

562
00:37:41,859 --> 00:37:43,494
and heat transport.

563
00:37:43,494 --> 00:37:48,399
- There you go. I think we've
got time for one more question

564
00:37:50,401 --> 00:37:53,236
in the house. Let's get
a microphone right down

565
00:37:53,236 --> 00:37:55,439
here on the aisle. There we go.

566
00:38:00,477 --> 00:38:04,415
Just trying to keep it even,
both halves of the brain here.

567

00:38:05,850 --> 00:38:09,954

- So we heard from Dr.
Banerdt this morning about

568

00:38:09,954 --> 00:38:13,124

this being kind of a dream
to get a seismometer on Mars

569

00:38:13,124 --> 00:38:15,759

for decades now.

570

00:38:15,759 --> 00:38:20,698

What changed? Why now? Why
has this all of a sudden

571

00:38:20,698 --> 00:38:22,733

become a priority for us?

572

00:38:24,034 --> 00:38:25,168

- That's a really good question.

573

00:38:25,168 --> 00:38:26,937

You know from my perspective,

574

00:38:26,937 --> 00:38:28,906

it all came together.

575

00:38:30,307 --> 00:38:34,744

You have the best
instrumentors in the world

576

00:38:34,744 --> 00:38:38,048

building the best instruments,

577

00:38:38,048 --> 00:38:39,950

the type of instruments
that we have.

578

00:38:39,950 --> 00:38:42,987

And they're put
together as a team.

579
00:38:44,422 --> 00:38:48,592
So it's all about getting
the right set of instruments

580
00:38:48,592 --> 00:38:51,995
to answer a certain
set of questions.

581
00:38:51,995 --> 00:38:54,665
In other words those instruments
will make measurements.

582
00:38:54,665 --> 00:38:58,302
The measurements
then are adequate to
answer the questions.

583
00:38:59,236 --> 00:39:00,905
And that we call
science closure.

584
00:39:01,872 --> 00:39:03,473
This mission had that.

585
00:39:03,473 --> 00:39:05,810
It's now time to select it.

586
00:39:06,944 --> 00:39:08,278
- Alright, well speaking
of science closure,

587
00:39:08,278 --> 00:39:10,781
that's all the time we
have for this panel,

588
00:39:10,781 --> 00:39:13,217
so please a round of

applause for our scientists.

589

00:39:13,217 --> 00:39:15,453

[applause]

590

00:39:16,887 --> 00:39:20,023

Alright. We will take more questions online afterwards,

591

00:39:20,023 --> 00:39:23,827

promise promise. Okay so, once InSight lands,

592

00:39:23,827 --> 00:39:27,063

she is set to be the chilliest robot on Mars.

593

00:39:27,063 --> 00:39:30,200

Get those solar arrays open, soak up some rays,

594

00:39:30,200 --> 00:39:33,103

and feel for the good vibrations, right.

595

00:39:33,103 --> 00:39:36,807

She's pretty deep. All puns intended.

596

00:39:38,108 --> 00:39:39,610

I'll be here all week guys.

597

00:39:41,278 --> 00:39:44,448

So to give us a look at the robot's eye-view of Mars

598

00:39:44,448 --> 00:39:47,050

and show you how you can try your hand at deploying

599

00:39:47,050 --> 00:39:50,053

instruments, I want to
bring out someone behind

600

00:39:50,053 --> 00:39:55,059

a new interactive experience
entitled Experience InSight,

601

00:39:55,926 --> 00:39:56,994

please welcome Jason Craig

602

00:39:56,994 --> 00:39:58,329

from our visualizations
team. Jason.

603

00:39:59,196 --> 00:40:01,465

[applause]

604

00:40:04,334 --> 00:40:08,205

- Hello, good afternoon. Just
gonna grab a keyboard here.

605

00:40:10,640 --> 00:40:13,510

Okay so I have a number of
digital playthings for you

606

00:40:13,510 --> 00:40:17,047

to experiment with,
on your phone as well.

607

00:40:17,047 --> 00:40:19,483

Good it's up here.
This is ice.nasa.gov.

608

00:40:19,483 --> 00:40:22,119

This is a site that I
maintain and we first of all,

609

00:40:22,119 --> 00:40:24,688

if you don't already
have the real-time

610
00:40:24,688 --> 00:40:26,689
Eyes on the Solar System
on your laptop or desktop,

611
00:40:26,689 --> 00:40:28,091
you should do that right away.

612
00:40:28,091 --> 00:40:30,294
But I'm here to show
you Experience InSight,

613
00:40:30,294 --> 00:40:31,528
and you can go on
your phone right now

614
00:40:31,528 --> 00:40:33,229
and follow along if you desire.

615
00:40:33,229 --> 00:40:38,235
Ice.nasa.gov/insight or click
on the little banner there.

616
00:40:39,637 --> 00:40:40,837
First I'd like, let's
just take a quick look at

617
00:40:40,837 --> 00:40:43,006
where we are as
far as events live.

618
00:40:43,006 --> 00:40:46,176
So this is Eyes on
the Solar System

619
00:40:46,176 --> 00:40:50,513
and there is the holy
triumvirate MarCO A

and B and InSight.

620

00:40:50,513 --> 00:40:53,650

So you can see it's
not quite close enough

621

00:40:53,650 --> 00:40:54,918

to be visually compelling,

622

00:40:54,918 --> 00:40:56,921

but I can fast forward.

623

00:40:56,921 --> 00:40:59,356

So as we go in so this is
what's fun about the little

624

00:40:59,356 --> 00:41:02,059

video game, you
can go have a look.

625

00:41:02,059 --> 00:41:03,027

See it come in.

626

00:41:04,194 --> 00:41:06,196

Come into the system
which is rather busy.

627

00:41:06,196 --> 00:41:08,598

As you can see we
have a lot going on.

628

00:41:08,598 --> 00:41:09,933

And there they go.

629

00:41:09,933 --> 00:41:11,502

That's tomorrow, spoiler alert.

630

00:41:12,937 --> 00:41:14,871

Okay so do check that

out if you don't have it,

631

00:41:14,871 --> 00:41:16,539

but let's get on to InSight.

632

00:41:16,539 --> 00:41:19,476

So this is real-time,

well not real-time,

633

00:41:19,476 --> 00:41:22,579

this is a simulation of landed

operations for the mission.

634

00:41:22,579 --> 00:41:24,848

And anything with a web

browser can do this,

635

00:41:24,848 --> 00:41:27,218

including those of you

who are Linux fans.

636

00:41:27,218 --> 00:41:28,118

So that's good.

637

00:41:29,587 --> 00:41:32,422

So go full screen and the

first thing we wanna see is

638

00:41:32,422 --> 00:41:33,924

you can move around at will.

639

00:41:33,924 --> 00:41:35,492

You can go look

at what you like.

640

00:41:35,492 --> 00:41:38,395

This is actually based

on the high rise terrain

641

00:41:38,395 --> 00:41:41,331
from Mars reconnaissance orbiter
inside the landing ellipse,

642
00:41:41,331 --> 00:41:43,600
so we're trying to make it
as accurate as possible.

643
00:41:43,600 --> 00:41:45,402
It's a real 3D ray trace model.

644
00:41:45,402 --> 00:41:47,504
And we can deploy,
so let's go ahead

645
00:41:47,504 --> 00:41:49,339
and get right down to it.

646
00:41:49,339 --> 00:41:51,408
So let's get those
solar panels out.

647
00:41:51,408 --> 00:41:54,044
Now on the ground this'll
take about 16 minutes,

648
00:41:54,044 --> 00:41:55,846
but we don't have
that kind of time.

649
00:41:56,880 --> 00:41:58,182
So let's just get to it.

650
00:42:00,384 --> 00:42:01,785
So it's kind of cool,
you're free to wander about

651
00:42:01,785 --> 00:42:03,854
and take a close look.

652

00:42:06,723 --> 00:42:08,559

And then we can go ahead.

653

00:42:08,559 --> 00:42:09,826

So we can keep hitting
the next button

654

00:42:09,826 --> 00:42:11,094

to go to the next step,

655

00:42:11,094 --> 00:42:12,296

in this case which
will be just this

656

00:42:12,296 --> 00:42:16,032

little camera
deploying over here.

657

00:42:16,032 --> 00:42:18,235

So in the bottom right
corner, you can see

658

00:42:18,235 --> 00:42:22,072

this is the context camera
and we also have the,

659

00:42:22,072 --> 00:42:23,106

this is the context camera.

660

00:42:23,106 --> 00:42:25,074

And we also have the arm camera.

661

00:42:25,074 --> 00:42:27,044

So let me skip ahead
again, let's go ahead

662

00:42:27,044 --> 00:42:28,145

and get that arm going.

663

00:42:29,579 --> 00:42:32,983

And note in the bottom right,
you get the point of view

664

00:42:32,983 --> 00:42:34,718

of the camera itself.

665

00:42:38,221 --> 00:42:39,389

So again, we're speeding ahead.

666

00:42:39,389 --> 00:42:40,991

This is going to take months.

667

00:42:40,991 --> 00:42:43,193

This is going to take months
for the actual mission,

668

00:42:43,193 --> 00:42:44,761

but you can get a
little sneak preview.

669

00:42:44,761 --> 00:42:47,197

There goes the grapple,
that's kind of cool right.

670

00:42:47,197 --> 00:42:48,932

This thing just
comes off like that.

671

00:42:48,932 --> 00:42:53,103

Let's go ahead onto
the seismometer.

672

00:43:09,853 --> 00:43:11,722

Gently, oh so gently.

673

00:43:13,123 --> 00:43:14,224

I'm gonna skip ahead.

674

00:43:15,526 --> 00:43:18,262

Let's go ahead and
get the windshield.

675

00:43:23,734 --> 00:43:25,235

And you can learn
about these things.

676

00:43:25,235 --> 00:43:28,038

There's text so you can read
more about it and whatnot.

677

00:43:28,038 --> 00:43:30,006

But this is kind of cool
just to see how it actually

678

00:43:30,006 --> 00:43:31,341

physically does these things,

679

00:43:31,341 --> 00:43:32,443

puts it on the ground.

680

00:43:34,010 --> 00:43:35,311

Alright I'm gonna skip ahead,

681

00:43:35,311 --> 00:43:36,847

time is precious.

682

00:43:36,847 --> 00:43:41,118

So finally we are gonna break
out the heat flow instrument.

683

00:43:41,986 --> 00:43:42,953

Do some digging.

684

00:43:44,420 --> 00:43:45,922

So this is really fascinating.

685

00:43:45,922 --> 00:43:47,791

I don't know if you guys, if
you're into geophysics or not,

686

00:43:47,791 --> 00:43:50,194

but this is incredibly
fascinating.

687

00:43:51,328 --> 00:43:53,063

Once you start
learning about it,

688

00:43:53,063 --> 00:43:55,231

it's amazing what we can
figure out about the structure

689

00:43:55,231 --> 00:43:56,899

and evolution of another
planet and it can even

690

00:43:56,899 --> 00:43:58,201

tell us more about Earth itself,

691

00:43:58,201 --> 00:43:59,502

which I'm sure you
probably heard already

692

00:43:59,502 --> 00:44:01,004

but the more you get into it,

693

00:44:01,004 --> 00:44:02,806

the more rewarding it is.

694

00:44:02,806 --> 00:44:03,641

So there it is.

695

00:44:05,075 --> 00:44:07,645

And finally a quick look
at what it's going to do.

696

00:44:09,746 --> 00:44:10,881

But not that fast.

697

00:44:14,618 --> 00:44:16,086

So that's it.

698

00:44:16,086 --> 00:44:17,554

You can also go over each
and every instrument,

699

00:44:17,554 --> 00:44:20,023

so once you have it
out you can just kinda

700

00:44:20,023 --> 00:44:22,426

glide over all these and pick
one you wanna learn about,

701

00:44:22,426 --> 00:44:24,561

like for example this is an
extraordinarily important

702

00:44:24,561 --> 00:44:26,629

instrument on the
mission, the rise antenna,

703

00:44:26,629 --> 00:44:29,466

which will do more than any
other instrument to figure out

704

00:44:29,466 --> 00:44:31,534

do we have a rocky
core or molten core?

705

00:44:31,534 --> 00:44:33,036

What do we have down there?

706

00:44:33,036 --> 00:44:36,105

So it's like, if you have an

egg and a hard boiled egg,

707

00:44:36,105 --> 00:44:38,341

and a raw egg and you spin them,

708

00:44:38,341 --> 00:44:39,943

you can tell which one's which,

709

00:44:39,943 --> 00:44:42,879

and that's pretty much kind of
the same thing with the core.

710

00:44:42,879 --> 00:44:45,148

And so we'll detect the
wobble on Mars with this

711

00:44:45,148 --> 00:44:48,285

and hopefully get some clues
as to what's going on inside.

712

00:44:49,586 --> 00:44:51,121

And you can look at the
antennas and whatnot.

713

00:44:51,121 --> 00:44:53,590

And finally just for fun,
you can play with the arm.

714

00:44:54,757 --> 00:44:56,292

So once you have the arm there,

715

00:44:56,292 --> 00:44:58,629

you can see how it moves.
There you go. Fun fun fun.

716

00:45:03,833 --> 00:45:06,737

Okay so that is the software
and please don't forget

717

00:45:06,737 --> 00:45:10,541
to go to the
website ice.nasa.gov

718
00:45:10,541 --> 00:45:11,975
and there's a variety
of things there.

719
00:45:11,975 --> 00:45:14,611
We also have augmented
reality you can put InSight

720
00:45:14,611 --> 00:45:15,846
right on the ground
in front of you

721
00:45:15,846 --> 00:45:18,248
in Spacecraft 3D
and Spacecraft AR.

722
00:45:18,248 --> 00:45:20,717
Okay and I'll be giving
demos tomorrow so with that,

723
00:45:20,717 --> 00:45:23,186
I'd like to turn it
back over to Stephanie.

724
00:45:23,186 --> 00:45:26,122
- Alright, Jason Craig. If
you have questions for Jason,

725
00:45:26,122 --> 00:45:30,494
you can find him on
Twitter @nasa_eyes,

726
00:45:32,629 --> 00:45:35,265
so all your questions about
that awesome experience

727

00:45:35,265 --> 00:45:38,335
and all of the Eyes suite
of products that he showed.

728

00:45:38,335 --> 00:45:41,971
Okay so before those moments
of zen on the surface

729

00:45:41,971 --> 00:45:43,573
there are a few
more harrowing ones

730

00:45:43,573 --> 00:45:47,845
we have to get through first:
the seven minutes of terror.

731

00:45:47,845 --> 00:45:50,313
Yes, those final mission
milestones from the top of the

732

00:45:50,313 --> 00:45:53,583
atmosphere all the way
down to the surface,

733

00:45:53,583 --> 00:45:55,318
everything has to go just right,

734

00:45:55,318 --> 00:45:59,690
so to tell us more about that
and about how the spacecraft

735

00:45:59,690 --> 00:46:02,792
was made, all of its
instrumentations,

736

00:46:02,792 --> 00:46:05,294
how they came together, and how
we're gonna use that robotic

737

00:46:05,294 --> 00:46:08,131

arm to get our instruments
to the surface.

738

00:46:08,131 --> 00:46:11,067

Please welcome our
engineers. Give it up for

739

00:46:11,067 --> 00:46:15,906

Farah Alibay, InSight payload
systems engineer, NASA-JPL.

740

00:46:15,906 --> 00:46:19,976

Aline Zimmer, InSight EDL
systems manager, also of JPL.

741

00:46:19,976 --> 00:46:22,545

Ashitey Trebi-Ollennu,
InSight instrument deployment

742

00:46:22,545 --> 00:46:26,150

SystemOps lead of JPL.

743

00:46:26,150 --> 00:46:29,385

And bringing in here from
Lockheed Martin Space,

744

00:46:29,385 --> 00:46:31,421

Tim Priser, a quality director.

745

00:46:31,421 --> 00:46:34,324

[applause]

746

00:46:34,324 --> 00:46:37,560

So I am gonna throw a
challenge out here to you guys

747

00:46:37,560 --> 00:46:42,566

to see if we can get through
an entire engineering segment

748

00:46:43,433 --> 00:46:45,168
without three-letter acronyms.

749

00:46:45,168 --> 00:46:47,770
So we love our TLA's, we
love our alphabet soup,

750

00:46:47,770 --> 00:46:50,039
it's like speaking
another language,

751

00:46:50,039 --> 00:46:52,909
but I believe in
you. Let's do this.

752

00:46:52,909 --> 00:46:54,377
Farah, let's start us off.

753

00:46:54,377 --> 00:46:56,279
- So what I heard is we're
allowed four-letter acronyms,

754

00:46:56,279 --> 00:46:57,948
just not three-letter
ones right?

755

00:46:59,549 --> 00:47:01,818
So my name is Farah, I'm a
payload systems engineer.

756

00:47:01,818 --> 00:47:04,287
So that means absolutely
nothing to you,

757

00:47:04,287 --> 00:47:07,257
but what that means is
that my job is to make sure

758

00:47:07,257 --> 00:47:08,792

that the instruments
in the spacecraft

759
00:47:08,792 --> 00:47:10,994
play nice with each other.

760
00:47:10,994 --> 00:47:13,262
InSight is kind of an
interesting spacecraft

761
00:47:13,262 --> 00:47:15,799
in a sense that it's got
pieces from just about

762
00:47:15,799 --> 00:47:17,768
everywhere right, the
seismometer's from France,

763
00:47:17,768 --> 00:47:19,936
the probe is from Germany,

764
00:47:19,936 --> 00:47:21,738
the spacecraft is actually
built at Lockheed Martin

765
00:47:21,738 --> 00:47:23,473
over in Denver.

766
00:47:23,473 --> 00:47:26,276
So my job essentially is when
we got all of these pieces,

767
00:47:26,276 --> 00:47:29,012
was to make sure that the
instruments and the spacecraft

768
00:47:29,012 --> 00:47:30,947
could talk to each other, that
they spoke essentially the

769

00:47:30,947 --> 00:47:34,117
same language, that they would
power on when we told them

770

00:47:34,117 --> 00:47:38,155
to power on, that it behaved
the way that it should.

771

00:47:38,155 --> 00:47:40,290
Basically to make sure
that once we land on Mars,

772

00:47:40,290 --> 00:47:41,991
that the instruments
are actually gonna work.

773

00:47:41,991 --> 00:47:43,760
The other cool thing
that I got to do

774

00:47:43,760 --> 00:47:46,163
leading up to
launch was actually

775

00:47:46,163 --> 00:47:48,364
to test all of
these instruments.

776

00:47:48,364 --> 00:47:50,466
We do all sorts of crazy
things with the spacecraft.

777

00:47:50,466 --> 00:47:52,835
We fold it up, put it on a
shake table, and shake it

778

00:47:52,835 --> 00:47:54,370
as hard as we can.

779

00:47:54,370 --> 00:47:56,072
It seems like a horrible idea,

780
00:47:56,072 --> 00:47:58,307
but the reason why we do
that is because by the time

781
00:47:58,307 --> 00:48:01,344
we land tomorrow, we
want to make sure that

782
00:48:01,344 --> 00:48:03,847
that environment is gonna
see that it can survive that.

783
00:48:03,847 --> 00:48:08,217
We also put it in Mars,
well not vacuum but Mars'

784
00:48:08,217 --> 00:48:11,221
pressure and temperature
and test all of that.

785
00:48:11,221 --> 00:48:12,555
So that was leading
up to launch,

786
00:48:12,555 --> 00:48:15,625
and then my second
job is starting,

787
00:48:15,625 --> 00:48:17,393
oh and behind you you're
seeing sort of what the

788
00:48:17,393 --> 00:48:18,828
test environment looks like.

789
00:48:18,828 --> 00:48:22,165
This is our indoors Mars

test bed here at JPL.

790

00:48:23,533 --> 00:48:25,235

So yeah, my second job starts actually on Tuesday,

791

00:48:25,235 --> 00:48:26,936

once we land on the surface.

792

00:48:26,936 --> 00:48:30,374

I'm a TUSL, and what that stands for is tactical uplink

793

00:48:30,374 --> 00:48:34,711

shift lead, which is terrifying because my job is

794

00:48:34,711 --> 00:48:37,113

essentially to manage what we call a tactical shift.

795

00:48:37,113 --> 00:48:38,715

We essentially at JPL work

796

00:48:38,715 --> 00:48:41,050

when the spacecraft is asleep at night.

797

00:48:41,050 --> 00:48:42,151

Obviously it has solar arrays so

798

00:48:42,151 --> 00:48:43,453

we don't do anything at night.

799

00:48:43,453 --> 00:48:45,588

And then when it wakes up in the morning,

800

00:48:45,588 --> 00:48:48,091

we have sent it a piece
of code essentially,

801
00:48:48,091 --> 00:48:50,794
it's a piece of code that
we built together as a team,

802
00:48:50,794 --> 00:48:52,829
send it, and then it
does that during the day

803
00:48:52,829 --> 00:48:54,163
and at night before
it goes to sleep,

804
00:48:54,163 --> 00:48:56,032
it sends us all its data down.

805
00:48:56,032 --> 00:48:57,567
It's like hey guys,
this is what I did.

806
00:48:57,567 --> 00:49:00,804
We look at it and create
another piece of code

807
00:49:00,804 --> 00:49:02,005
that we send up.

808
00:49:02,005 --> 00:49:05,408
So my job is essentially
to manage that shift

809
00:49:05,408 --> 00:49:07,811
and to make sure that
everyone's working together,

810
00:49:07,811 --> 00:49:10,314
that all of these different
pieces of code essentially

811

00:49:10,314 --> 00:49:13,050
are behaving well and
that they're going to do,

812

00:49:13,050 --> 00:49:15,785
the spacecraft will do
what it's supposed to do.

813

00:49:15,785 --> 00:49:18,521
So my first shift is
actually going to be Tuesday,

814

00:49:18,521 --> 00:49:20,756
that's when we first
turn on the instruments.

815

00:49:20,756 --> 00:49:23,092
So I'm super excited about that.

816

00:49:23,092 --> 00:49:25,595
But in the meantime
we still have to land.

817

00:49:25,595 --> 00:49:27,164
And one of the really
neat things about InSight

818

00:49:27,164 --> 00:49:28,932
is that there's a
ton of young people

819

00:49:28,932 --> 00:49:29,865
working on this mission,

820

00:49:29,865 --> 00:49:31,835
so for me it's been super fun.

821

00:49:31,835 --> 00:49:33,803

We're all really good
friends and so it's actually

822
00:49:33,803 --> 00:49:35,172
really fun to come in to work.

823
00:49:35,172 --> 00:49:37,007
And one of these
young people is Aline.

824
00:49:37,007 --> 00:49:39,876
I've actually known Aline
since I was an intern.

825
00:49:39,876 --> 00:49:41,210
I first interned
here back in 2012

826
00:49:41,210 --> 00:49:42,779
when Curiosity was landing,

827
00:49:42,779 --> 00:49:45,982
and we were next door office
mates for a very long time.

828
00:49:45,982 --> 00:49:48,284
So I'll hand off to
her to talk about EDL.

829
00:49:48,284 --> 00:49:51,087
- Thank you Farah. So
my name is Aline Zimmer,

830
00:49:51,087 --> 00:49:54,257
I am a systems engineer for the

831
00:49:54,257 --> 00:49:56,259
entry, descent,
and landing team.

832

00:49:56,259 --> 00:49:58,494

And the job of the entry,
descent, and landing team

833

00:49:58,494 --> 00:50:02,432

is essentially to, and then
ultimately the responsibility

834

00:50:02,432 --> 00:50:04,701

as we heard at the beginning
of the programming,

835

00:50:04,701 --> 00:50:08,205

to take the InSight lander
and its precious science

836

00:50:08,205 --> 00:50:11,307

instruments from more
than 12,000 miles per hour

837

00:50:11,307 --> 00:50:15,846

at the top of the atmosphere
down to a slow, soft,

838

00:50:15,846 --> 00:50:18,748

gentle landing and
essentially a full stop

839

00:50:18,748 --> 00:50:20,650

on the Martian surface.

840

00:50:20,650 --> 00:50:23,119

And all that happens
in only seven minutes,

841

00:50:23,119 --> 00:50:24,787

and those are the
seven minutes of terror

842

00:50:24,787 --> 00:50:26,689
that you've heard about so much.

843
00:50:26,689 --> 00:50:29,092
And I'd like to give you
a little insight into,

844
00:50:29,092 --> 00:50:33,997
no pun intended, into why I
think that is so terrifying.

845
00:50:35,164 --> 00:50:38,301
And there's so many
layers of terrifying.

846
00:50:39,769 --> 00:50:43,406
One is that it's this
really carefully crafted

847
00:50:43,406 --> 00:50:46,375
and orchestrated series of
events that all have to happen

848
00:50:46,375 --> 00:50:49,045
perfectly, at the right time,

849
00:50:49,045 --> 00:50:52,014
at the right conditions,
for this to go well,

850
00:50:52,014 --> 00:50:53,917
for tomorrow to be successful,

851
00:50:53,917 --> 00:50:55,184
and that's one thing.

852
00:50:55,184 --> 00:50:57,387
But it's not that it
has to go perfectly,

853

00:50:57,387 --> 00:51:00,056

it also has to be
completely autonomous

854

00:51:00,056 --> 00:51:03,226

because while it takes the
spacecraft seven minutes

855

00:51:03,226 --> 00:51:05,862

to get from the top of the
atmosphere to the surface,

856

00:51:05,862 --> 00:51:08,698

the signal that the
spacecraft sends back to Earth

857

00:51:08,698 --> 00:51:11,634

takes eight minutes,
so when we hear

858

00:51:11,634 --> 00:51:16,005

tomorrow in the control
room where I'm gonna be,

859

00:51:16,005 --> 00:51:19,142

when we hear that the spacecraft
has entered the atmosphere,

860

00:51:19,142 --> 00:51:20,877

the spacecraft's actually
already on the surface,

861

00:51:20,877 --> 00:51:24,414

and all we can do is sit
back and watch and find out

862

00:51:24,414 --> 00:51:27,050

together with you
guys what happened.

863

00:51:27,050 --> 00:51:28,985

And there's absolutely
nothing we can do about it

864

00:51:28,985 --> 00:51:30,486

at that point.

865

00:51:30,486 --> 00:51:32,922

And then the third thing that
makes it really terrifying

866

00:51:32,922 --> 00:51:37,093

is that historically,
as a species,

867

00:51:37,093 --> 00:51:40,296

we've not been very
good at this, right.

868

00:51:40,296 --> 00:51:45,302

From any space agency
around the world,

869

00:51:46,502 --> 00:51:47,703

of all the attempts
of landing on Mars,

870

00:51:47,703 --> 00:51:49,872

less than half have
been successful.

871

00:51:49,872 --> 00:51:52,742

So even though we think
we've done everything

872

00:51:52,742 --> 00:51:54,911

to be prepared for tomorrow,

873

00:51:54,911 --> 00:51:56,312

and we're confident
that we have,

874

00:51:56,312 --> 00:51:59,315

there's always that
what-if, right.

875

00:51:59,315 --> 00:52:01,650

That little bit that
you may not know about

876

00:52:01,650 --> 00:52:04,854

that you having a bad day or,

877

00:52:04,854 --> 00:52:06,456

that's just terrifying.

878

00:52:06,456 --> 00:52:08,958

And so with all this
terrifying stuff,

879

00:52:08,958 --> 00:52:10,927

I'd be amiss not to
mention that this is also

880

00:52:10,927 --> 00:52:12,929

really exciting, right.

881

00:52:12,929 --> 00:52:16,166

As maybe for you, for me
and I know also for Farah,

882

00:52:16,166 --> 00:52:19,402

this is my first
attempting to land on Mars.

883

00:52:20,570 --> 00:52:23,572

And I'm really excited
about that because

884

00:52:23,572 --> 00:52:26,075
these opportunities are so rare.

885

00:52:26,075 --> 00:52:29,879
In this entire decade, NASA
has only attempted it twice.

886

00:52:29,879 --> 00:52:32,314
So these opportunities just
don't come around very often

887

00:52:32,314 --> 00:52:34,684
and I'm really excited
and really grateful

888

00:52:35,818 --> 00:52:38,488
and honored to be
part of this tomorrow.

889

00:52:38,488 --> 00:52:40,757
And I'm really excited
to be in the MSA and the-

890

00:52:40,757 --> 00:52:42,692
sorry, I messed up.

891

00:52:44,127 --> 00:52:47,663
- [Stephanie] You can fix
it. You have the power.

892

00:52:47,663 --> 00:52:50,800
- I know, so when we call
the mission support area,

893

00:52:50,800 --> 00:52:52,802
the control room essentially,

894

00:52:52,802 --> 00:52:54,203
I'll be in the

control room tomorrow.

895

00:52:54,203 --> 00:52:55,738

I'll be watching
the data come down.

896

00:52:55,738 --> 00:52:58,174

I'll be listening for
these beacons and the tones

897

00:52:58,174 --> 00:53:00,009

to hear that the
spacecraft is okay.

898

00:53:00,009 --> 00:53:01,878

And that's probably
the most exciting thing

899

00:53:01,878 --> 00:53:02,712

at this point.

900

00:53:03,946 --> 00:53:05,881

And then the last thing
is as Farah has said,

901

00:53:05,881 --> 00:53:07,617

it's really exciting
to work in this team.

902

00:53:07,617 --> 00:53:08,551

It's an amazing team.

903

00:53:08,551 --> 00:53:10,353

It's a bunch of young people,

904

00:53:10,353 --> 00:53:12,055

but it's also a
bunch of veterans.

905

00:53:12,055 --> 00:53:14,223

People that have landed
on Mars multiple times.

906

00:53:14,223 --> 00:53:17,427

I don't know how many of those
are even exist in the world,

907

00:53:17,427 --> 00:53:19,062

but a lot of them, right.

908

00:53:20,896 --> 00:53:22,732

I was actually gonna
be my segue way.

909

00:53:23,899 --> 00:53:25,268

So there's a lot of
these people that have

910

00:53:25,268 --> 00:53:27,770

so much experience that
we get to learn from

911

00:53:27,770 --> 00:53:29,406

and I really appreciate that.

912

00:53:29,406 --> 00:53:31,774

It's been a really
exciting time,

913

00:53:31,774 --> 00:53:33,476

and with that I
want to hand it over

914

00:53:33,476 --> 00:53:34,677

to one of these veterans.

915

00:53:34,677 --> 00:53:37,546

Ashitey, tell us
about your time.

916

00:53:37,546 --> 00:53:40,517

- Hey, thank you. So right now
I just feel like a dinosaur.

917

00:53:43,152 --> 00:53:44,787

I don't know what he feels so,

918

00:53:44,787 --> 00:53:46,389

this is my fifth
landing on Mars.

919

00:53:46,389 --> 00:53:48,991

And my name is Ashitey
Trobi-Ollennu and I'm in charge

920

00:53:48,991 --> 00:53:51,060

of the instrument
deployment system,

921

00:53:51,060 --> 00:53:53,162

and basically what the
instrument deployment system

922

00:53:53,162 --> 00:53:54,764

consists of is the robotic arm,

923

00:53:54,764 --> 00:53:56,699

the camera on the arm,

924

00:53:56,699 --> 00:53:59,969

the grapple, and then the
camera underneath the lander.

925

00:53:59,969 --> 00:54:03,172

And our responsibility
is to pick up the

926

00:54:03,172 --> 00:54:06,442

tens of millions of payloads
and put them on the surface.

927

00:54:06,442 --> 00:54:10,679

The key thing is that you
don't drop them. Easy to say.

928

00:54:10,679 --> 00:54:12,315

And we don't want to end up like

929

00:54:12,315 --> 00:54:14,717

Viking where the seismometer
was left on the deck,

930

00:54:14,717 --> 00:54:18,688

so my PI, my co-deputy PI
reminds me of that every day.

931

00:54:19,923 --> 00:54:24,127

So before we got here,
I was a manager of the

932

00:54:24,127 --> 00:54:27,530

robotic arm, developing
the robotic arm system,

933

00:54:27,530 --> 00:54:30,633

testing it, going through
all environmental testing.

934

00:54:30,633 --> 00:54:32,435

The grapple, and
I'm sure most people

935

00:54:32,435 --> 00:54:33,903

know about the grapple,

936

00:54:33,903 --> 00:54:35,171

so if you think about the
instrument deployment system,

937

00:54:35,171 --> 00:54:38,007

you can think of it as
the hand, the fingers,

938

00:54:38,007 --> 00:54:39,776

and the eyes of the scientist.

939

00:54:41,611 --> 00:54:46,616

And the grapple basically
is a five finger crawl

940

00:54:47,783 --> 00:54:49,451

that opens and closes,
and it's almost like an

941

00:54:49,451 --> 00:54:51,387

arcade, the one that
you see at the arcade

942

00:54:51,387 --> 00:54:53,489

when your kids went
to pick up those bears

943

00:54:53,489 --> 00:54:56,393

that you're never able
to actually get them.

944

00:54:58,595 --> 00:55:01,398

So this grapple works a
little bit differently.

945

00:55:01,398 --> 00:55:06,403

So it's always closed. You
need to power it on to open it.

946

00:55:07,771 --> 00:55:10,373

So the chances of you dropping
the instrument is zero.

947

00:55:10,373 --> 00:55:11,373

So even if you lose
power it's always closed.

948

00:55:11,373 --> 00:55:13,442

You have to actively open it.

949

00:55:13,442 --> 00:55:15,111

And it also uses a wax actuator.

950

00:55:15,111 --> 00:55:18,881

Basically we melt
wax to open it up.

951

00:55:18,881 --> 00:55:21,184

And then once it's open,
we turn the heater off

952

00:55:21,184 --> 00:55:23,385

and then it closes.

953

00:55:23,385 --> 00:55:25,688

So we only have an open button.

954

00:55:25,688 --> 00:55:27,057

We don't have a close button.

955

00:55:28,425 --> 00:55:31,861

Then we have a camera. Our
camera actually is loaned from,

956

00:55:31,861 --> 00:55:36,866

it's a spare from MSL, Mars
Science Lab, Curiosity rover.

957

00:55:37,733 --> 00:55:38,901

And then our fisheye camera

958

00:55:38,901 --> 00:55:41,237
underneath the
lander is from MER.

959
00:55:41,237 --> 00:55:43,673
And then the arm
that we're gonna use

960
00:55:43,673 --> 00:55:46,375
in a few days when
we land on Mars

961
00:55:46,375 --> 00:55:48,211
is also from Mars 01.

962
00:55:48,211 --> 00:55:50,213
So if you think about the
instrument deployment system

963
00:55:50,213 --> 00:55:54,683
on InSight, it's like
a kinda used car.

964
00:55:54,683 --> 00:55:57,486
So we've got all
these used elements,

965
00:55:57,486 --> 00:55:58,654
and then we've
brought them together

966
00:55:58,654 --> 00:55:59,855
and they're from different eras.

967
00:55:59,855 --> 00:56:01,290
The arm is from what we call the

968
00:56:01,290 --> 00:56:03,225
faster, better, cheaper era,

969

00:56:03,225 --> 00:56:04,927

where we would try
to develop things

970

00:56:04,927 --> 00:56:06,295

a little bit faster,
cutting corners.

971

00:56:06,295 --> 00:56:08,264

So we now have to
make it compliant

972

00:56:08,264 --> 00:56:10,133

in our new routine
that is more rigorous.

973

00:56:10,133 --> 00:56:12,835

So we had to go through
several iterations

974

00:56:12,835 --> 00:56:14,537

and design and
testing to be able to

975

00:56:14,537 --> 00:56:17,773

get it to be flight-worthy.

976

00:56:17,773 --> 00:56:19,542

And right now we're
transitioning,

977

00:56:19,542 --> 00:56:21,644

and the lead for the team
that would actually be doing

978

00:56:21,644 --> 00:56:24,513

the instrument deployment,
we have a good group

979

00:56:24,513 --> 00:56:27,716
of guys, sorry two
ladies and three guys.

980
00:56:27,716 --> 00:56:29,219
And we're gonna have
a lot of fun on Mars.

981
00:56:29,219 --> 00:56:32,221
So I've worked on all the
Mars robotic arms from MER,

982
00:56:32,221 --> 00:56:34,557
Spirit of Opportunity,
worked on Phoenix

983
00:56:34,557 --> 00:56:36,091
sticking eyes on Mars.

984
00:56:36,091 --> 00:56:39,061
We used to call ourselves
the grave diggers on Mars.

985
00:56:39,061 --> 00:56:41,997
And we're gonna do a very unique

986
00:56:41,997 --> 00:56:43,500
robotic arm operation on Mars.

987
00:56:44,901 --> 00:56:47,103
The first time we're gonna
pick an instrument off a deck,

988
00:56:47,103 --> 00:56:48,670
and we're gonna place
it on the ground

989
00:56:48,670 --> 00:56:49,973
and we're gonna leave it there

990
00:56:49,973 --> 00:56:51,807
for the rest of its life.

991
00:56:51,807 --> 00:56:53,042
That has never been done before.

992
00:56:53,042 --> 00:56:55,845
We usually have the
instrument on the arm,

993
00:56:55,845 --> 00:56:57,880
we put it down, and
we pick it back up.

994
00:56:57,880 --> 00:57:00,183
So this is gonna
be pretty exciting.

995
00:57:00,183 --> 00:57:04,120
And we feel very privileged
to be working on a mission

996
00:57:04,120 --> 00:57:06,088
that will make the
footnote of history.

997
00:57:06,088 --> 00:57:08,324
So by that, I'll hand
over to my friend here.

998
00:57:09,758 --> 00:57:13,929
- Thank you Ashitey. I'm very
fortunate to have worked on

999
00:57:13,929 --> 00:57:18,701
nine Mars missions with
the folks here at JPL.

1000
00:57:18,701 --> 00:57:21,670

It's a very powerful
relationship in my mind,

1001

00:57:21,670 --> 00:57:23,940

and the two of you have
talked about the team

1002

00:57:23,940 --> 00:57:26,442

that you're building. It's
turning into a family.

1003

00:57:26,442 --> 00:57:30,447

I can tell you my memories
of Odyssey was my first,

1004

00:57:31,613 --> 00:57:34,417

and then MRO, but the
memories that I have

1005

00:57:34,417 --> 00:57:37,954

of those missions are
the people, the faces.

1006

00:57:37,954 --> 00:57:40,690

I can hear the voices and
the discussions and the very,

1007

00:57:40,690 --> 00:57:43,292

I remember the very conference
room and whiteboard,

1008

00:57:43,292 --> 00:57:45,028

may have been
chalkboard back then.

1009

00:57:46,462 --> 00:57:50,700

But that's the memories that
I have of the early missions.

1010

00:57:50,700 --> 00:57:53,869

I've worked on four
of the aeroshells,

1011
00:57:53,869 --> 00:57:56,672
three of the orbiters, and two,

1012
00:57:56,672 --> 00:57:59,008
including this one,
of the landers.

1013
00:57:59,008 --> 00:58:02,645
And JPL has done
just a fantastic job

1014
00:58:02,645 --> 00:58:05,681
of pulling together, and
you've seen them already

1015
00:58:05,681 --> 00:58:09,585
in this presentation, the
best scientists in the world.

1016
00:58:09,585 --> 00:58:11,153
The best engineers in the world,

1017
00:58:11,153 --> 00:58:13,923
and they're better today than
they were when I was there.

1018
00:58:13,923 --> 00:58:17,092
I mean they come with the
skillset and a toolbox

1019
00:58:17,092 --> 00:58:18,561
that I could not have imagined.

1020
00:58:18,561 --> 00:58:20,930
Look at the visualization
we just got to enjoy.

1021
00:58:20,930 --> 00:58:24,300
And then Rob Manning, right.

1022
00:58:24,300 --> 00:58:27,503
Early on he talked us how,
that was on a whiteboard

1023
00:58:27,503 --> 00:58:29,505
but it wasn't nearly as
exciting and informative

1024
00:58:29,505 --> 00:58:32,241
as to what he was able
to walk through that.

1025
00:58:32,241 --> 00:58:35,811
What I wanted to do, I
brought some building blocks

1026
00:58:35,811 --> 00:58:38,915
of some of the
engineering solutions that

1027
00:58:38,915 --> 00:58:41,116
we have come up with
at Lockheed Martin

1028
00:58:41,116 --> 00:58:42,885
to solve some of those problems.

1029
00:58:42,885 --> 00:58:46,856
And it's just four pieces
of the thousand miracles

1030
00:58:46,856 --> 00:58:49,859
that have to happen at the
right time and the right place

1031
00:58:49,859 --> 00:58:52,561

in the right order to
survive that environment.

1032
00:58:52,561 --> 00:58:56,465
And I talked to Ashitey
just before we came up here.

1033
00:58:56,465 --> 00:58:59,669
As soon as we clear
the tower back in May,

1034
00:58:59,669 --> 00:59:04,173
all the EDL guys said oh,
guess what we have to do now?

1035
00:59:04,173 --> 00:59:06,876
Well as soon as we
touch down tomorrow,

1036
00:59:06,876 --> 00:59:10,012
Ashitey and the scientists
are gonna say uh-oh,

1037
00:59:10,012 --> 00:59:12,481
I guess we have to
deploy and get this stuff

1038
00:59:12,481 --> 00:59:14,149
on the surface successfully.

1039
00:59:14,149 --> 00:59:18,120
Every event is critical
until it's behind you

1040
00:59:18,120 --> 00:59:21,290
and then suddenly the
next one is critical,

1041
00:59:21,290 --> 00:59:24,193
however simple or

complex that is.

1042

00:59:24,193 --> 00:59:28,197

And to think about the
hundreds or thousands of

1043

00:59:28,197 --> 00:59:32,968

critical events that have
to happen during that

1044

00:59:32,968 --> 00:59:36,172

seven minutes, and you know
these folks have been going

1045

00:59:36,172 --> 00:59:38,608

through that in their
minds, on whiteboards,

1046

00:59:38,608 --> 00:59:41,744

in discussions, for the
last six to seven years.

1047

00:59:41,744 --> 00:59:45,014

They've watched it play
out in simulations.

1048

00:59:45,014 --> 00:59:49,518

They've actually been
the articles under
test in the ORT's.

1049

00:59:49,518 --> 00:59:52,755

So they've lived this, and
tomorrow when it plays out

1050

00:59:52,755 --> 00:59:55,057

on those telemetry screens,
they've seen it already.

1051

00:59:55,057 --> 00:59:56,325

They saw it in the ORT's.

1052

00:59:56,325 --> 00:59:57,859

They've seen it when
they reviewed data.

1053

00:59:57,859 --> 01:00:00,229

And it's going to be so surreal,

1054

01:00:00,229 --> 01:00:01,431

because they've seen it.

1055

01:00:02,798 --> 01:00:04,233

You don't have to imagine
it, you've seen it.

1056

01:00:04,233 --> 01:00:05,834

You've seen it in the data.

1057

01:00:05,834 --> 01:00:07,837

You've seen it in the tests.

1058

01:00:07,837 --> 01:00:09,105

You've seen it in
your arguments.

1059

01:00:09,105 --> 01:00:10,907

You've seen it in
your nightmares.

1060

01:00:12,307 --> 01:00:13,876

It's gonna play
out just like that.

1061

01:00:13,876 --> 01:00:17,546

So what I've got here
is just a simple,

1062

01:00:17,546 --> 01:00:20,717

this is for the 2,000 degrees.

1063

01:00:20,717 --> 01:00:25,254

Not only does it have to survive
heat that can melt steel,

1064

01:00:25,254 --> 01:00:29,925

which by the way we've crafted
this concoction of cork

1065

01:00:29,925 --> 01:00:34,831

powder and some adhesive
and that absorbs that heat.

1066

01:00:36,265 --> 01:00:40,235

But we also have to survive
the 12 G's of deceleration

1067

01:00:40,235 --> 01:00:43,706

and the cork isn't very
good at structural stability

1068

01:00:43,706 --> 01:00:45,808

and strength but we have
this honeycomb material

1069

01:00:45,808 --> 01:00:48,210

that we do use for
that structure.

1070

01:00:48,210 --> 01:00:51,480

And we will actually
test structural loads

1071

01:00:51,480 --> 01:00:54,250

of the heat shield without
the thermal protection system

1072

01:00:54,250 --> 01:00:55,751

on it for that very reason.

1073

01:00:55,751 --> 01:01:00,590

So we need to make sure the
12 G's of 850 pound spacecraft

1074

01:01:01,924 --> 01:01:03,425

can be survived structurally
and then thermally.

1075

01:01:03,425 --> 01:01:06,628

We have this magic I
wanna call it cake batter

1076

01:01:06,628 --> 01:01:11,634

that we hand pack into
this honeycomb material.

1077

01:01:14,103 --> 01:01:16,205

- Speaking of the structural
integrity of the shell,

1078

01:01:16,205 --> 01:01:18,775

I think this is gonna
have to be the last thing

1079

01:01:18,775 --> 01:01:21,010

that we show. We're gonna
take one social media

1080

01:01:21,010 --> 01:01:23,879

question and maybe one more
quick question in the house.

1081

01:01:23,879 --> 01:01:25,480

And then we're gonna have
to move on because we're

1082

01:01:25,480 --> 01:01:27,216

almost at the top of the hour.

1083

01:01:27,216 --> 01:01:29,885

- Perfect. Come up and talk to me. This is cool stuff.

1084

01:01:29,885 --> 01:01:31,353

- And we'll get hands on with that tomorrow,

1085

01:01:31,353 --> 01:01:35,257

so everybody at home, watch #NASASocial #MarsLanding

1086

01:01:35,257 --> 01:01:37,393

for more on that. Jason?

1087

01:01:37,393 --> 01:01:40,629

- Sure so we have a comment here actually from a Twitter

1088

01:01:40,629 --> 01:01:43,131

user Stein Monster who's asking:

1089

01:01:43,131 --> 01:01:44,767

instead of calling it seven minutes of terror,

1090

01:01:44,767 --> 01:01:45,935

can we call it seven minutes

1091

01:01:45,935 --> 01:01:47,870

of engineering confidence instead?

1092

01:01:49,738 --> 01:01:51,907

How are you guys feeling about that?

1093

01:01:51,907 --> 01:01:53,476

- It would still be terrifying.

1094

01:01:54,710 --> 01:01:56,312

- I've actually
thought about that,

1095

01:01:56,312 --> 01:01:59,147

and I was in your seat,
and I was terrified.

1096

01:01:59,147 --> 01:02:03,119

But there is, after we have
been able to demonstrate this,

1097

01:02:03,119 --> 01:02:07,423

starting with MERA and
BE then Phoenix then MSL,

1098

01:02:07,423 --> 01:02:11,827

there are some aspirational
changes into expectational

1099

01:02:11,827 --> 01:02:14,997

changes that have
happened to some guys

1100

01:02:14,997 --> 01:02:16,098

that have survived it.

1101

01:02:16,098 --> 01:02:18,133

So there is a difference, right.

1102

01:02:18,133 --> 01:02:19,135

- It's so scary to us
cause we're doing it

1103

01:02:19,135 --> 01:02:20,670

for the first time.

1104

01:02:20,670 --> 01:02:23,472

- The terror does
change to something

1105
01:02:23,472 --> 01:02:24,841
a little bit more confident.

1106
01:02:26,308 --> 01:02:28,711
- Okay we've got time for one
quick question in the house.

1107
01:02:28,711 --> 01:02:30,546
Let's get a microphone
right down here.

1108
01:02:37,386 --> 01:02:38,887
- Mr. Priser, this
one's for you.

1109
01:02:38,887 --> 01:02:40,089
I'm gonna be filming the answer

1110
01:02:40,089 --> 01:02:41,624
so you don't have to
look directly at me but,

1111
01:02:41,624 --> 01:02:43,726
you've worked on nine
missions, correct?

1112
01:02:45,161 --> 01:02:47,196
So astronauts talk about
their perspective changing

1113
01:02:47,196 --> 01:02:48,464
when they're in space,

1114
01:02:48,464 --> 01:02:50,966
so I'm just curious
how your perspective

1115

01:02:50,966 --> 01:02:52,334

in your everyday
life has changed

1116

01:02:52,334 --> 01:02:54,603

working on technology
that has gone

1117

01:02:54,603 --> 01:02:57,072

millions of miles
away from Earth?

1118

01:02:57,072 --> 01:03:00,242

- It's fun because the
discussion is just like this one

1119

01:03:00,242 --> 01:03:02,645

also happen in the
caldesac at home.

1120

01:03:02,645 --> 01:03:06,281

When we go into work and we
work with our simulations

1121

01:03:06,281 --> 01:03:07,917

and on our assumptions
and our fears

1122

01:03:07,917 --> 01:03:10,719

and we ask the what-if's and
we go off and answer them,

1123

01:03:10,719 --> 01:03:12,921

they become that's what we do.

1124

01:03:12,921 --> 01:03:15,657

That's who we are
while we come to work

1125

01:03:15,657 --> 01:03:19,061
at either JPL or
Lockheed Martin or DLR.

1126
01:03:20,496 --> 01:03:22,464
But when we get to go home
and someone asks the simple

1127
01:03:22,464 --> 01:03:27,470
question and then you get to
answer it in a conversational

1128
01:03:28,671 --> 01:03:30,005
way and then you
start to realize,

1129
01:03:30,005 --> 01:03:31,640
you start to see
expressions on people's face

1130
01:03:31,640 --> 01:03:34,743
that you're doing what?
You guys are crazy.

1131
01:03:34,743 --> 01:03:36,245
And it's like yeah
I guess we are,

1132
01:03:36,245 --> 01:03:38,047
but it's really, really fun.

1133
01:03:38,047 --> 01:03:43,052
And it has changed from a
job and problem to solve

1134
01:03:44,253 --> 01:03:46,255
to an amazing story
that we get to share

1135
01:03:46,255 --> 01:03:48,290

and especially when you
get to talk to the folks

1136
01:03:48,290 --> 01:03:50,593
that are single-digit in age.

1137
01:03:51,927 --> 01:03:54,229
Their eyes light up
and you can just see

1138
01:03:54,229 --> 01:03:56,965
what they're going to accomplish
in about 15 to 20 years

1139
01:03:56,965 --> 01:03:58,934
with what we've been
able to say hey,

1140
01:03:58,934 --> 01:04:01,671
you have a problem to solve,
let's solve it with a,

1141
01:04:03,138 --> 01:04:05,674
whatever you have
on hand, right, or
innovate something new.

1142
01:04:05,674 --> 01:04:07,342
And they all start nodding.

1143
01:04:07,342 --> 01:04:09,211
And they can come
up with solutions

1144
01:04:09,211 --> 01:04:10,913
that we just don't even imagine.

1145
01:04:10,913 --> 01:04:13,549
Like I said, they come with
talents and skills and tools

1146

01:04:13,549 --> 01:04:17,420
in their toolbox that we just
didn't have, still don't.

1147

01:04:18,521 --> 01:04:20,889
But yeah it's an
amazing conversation.

1148

01:04:20,889 --> 01:04:22,892
I can talk, and she's
gonna make me stop,

1149

01:04:22,892 --> 01:04:27,262
but I could talk for
hours with people

1150

01:04:27,262 --> 01:04:28,697
about what we get to do here.

1151

01:04:28,697 --> 01:04:30,799
Absolutely, and like I said,

1152

01:04:30,799 --> 01:04:33,902
we all had Mars
aspirations at one point.

1153

01:04:33,902 --> 01:04:35,771
Some people, and I'm
happy that they do.

1154

01:04:35,771 --> 01:04:39,542
There's a lot of excitement for
Mars and the Moon right now.

1155

01:04:39,542 --> 01:04:42,878
But when those aspirations
get to change into

1156

01:04:42,878 --> 01:04:45,681
expectations because
we've done it

1157
01:04:45,681 --> 01:04:47,683
and we've started to
learn from how to do it,

1158
01:04:47,683 --> 01:04:49,485
and to do it better
the next time.

1159
01:04:49,485 --> 01:04:50,919
That's pretty special.

1160
01:04:50,919 --> 01:04:52,788
- Alright. Thank you so much.

1161
01:04:52,788 --> 01:04:54,924
Let's give it up for
our engineering panel.

1162
01:04:56,492 --> 01:04:59,995
Okay and in our few
remaining minutes,

1163
01:04:59,995 --> 01:05:02,231
I just want to take
time to talk about the

1164
01:05:02,231 --> 01:05:04,433
spacecraft flying in
tandem with InSight

1165
01:05:04,433 --> 01:05:05,634
on the way to Mars.

1166
01:05:05,634 --> 01:05:08,704
Two briefcase-sized
satellites called MarCO,

1167

01:05:08,704 --> 01:05:10,338

MarCO A and MarCO B.

1168

01:05:10,338 --> 01:05:13,141

To tell us more about them and
why they have the nicknames

1169

01:05:13,141 --> 01:05:16,845

Wall-E and Eve, please
welcome Andy Klesh,

1170

01:05:16,845 --> 01:05:19,481

MarCO chief engineer from JPL,

1171

01:05:19,481 --> 01:05:23,018

and Anne Maranin, the
MarCO B mission manager.

1172

01:05:23,018 --> 01:05:24,220

- Thank you very much.

1173

01:05:27,323 --> 01:05:29,125

So as she said, I am
the chief engineer

1174

01:05:29,125 --> 01:05:32,361

on the MarCO spacecraft, and
this is a full-size model

1175

01:05:32,361 --> 01:05:34,296

of one of our two
spacecraft that are headed

1176

01:05:34,296 --> 01:05:36,031

by Mars right now.

1177

01:05:36,031 --> 01:05:37,999

As chief engineer, you

can think of my role as

1178

01:05:37,999 --> 01:05:39,468
chief firefighter.

1179

01:05:39,468 --> 01:05:41,904
On any given day I could do
anything from washing the floors

1180

01:05:41,904 --> 01:05:44,105
up to actually going into
the technical challenge

1181

01:05:44,105 --> 01:05:46,242
that we have in order
to make these spacecraft

1182

01:05:46,242 --> 01:05:49,478
be successful and
support InSight at Mars.

1183

01:05:49,478 --> 01:05:51,780
And really we had
a lot of work to do

1184

01:05:51,780 --> 01:05:53,615
to make these things successful.

1185

01:05:53,615 --> 01:05:55,483
Because it was a
technology demonstration.

1186

01:05:55,483 --> 01:05:57,520
It was a challenge to us to see

1187

01:05:57,520 --> 01:05:59,288
what could we do
with small spacecraft

1188

01:05:59,288 --> 01:06:01,990

to support such a
large and compelling

1189

01:06:01,990 --> 01:06:04,092

science mission such as InSight.

1190

01:06:04,092 --> 01:06:05,728

When we started the spacecraft,

1191

01:06:05,728 --> 01:06:07,696

we were given just
15 months to go from

1192

01:06:07,696 --> 01:06:11,366

PowerPoint slides to actually
being flight-ready on here.

1193

01:06:11,366 --> 01:06:13,602

And today I'm proud to
say that after traveling

1194

01:06:13,602 --> 01:06:16,371

300 million kilometers,
our two spacecraft

1195

01:06:16,371 --> 01:06:18,573

are going to be flying
by Mars tomorrow.

1196

01:06:18,573 --> 01:06:20,309

To tell you more about
what's actually going on

1197

01:06:20,309 --> 01:06:22,311

with the MarCOS themselves
and how they were built,

1198

01:06:22,311 --> 01:06:23,511

I'll pass it to Anne.

1199

01:06:23,511 --> 01:06:25,814
- Hi my name is Anne Maranin.

1200

01:06:25,814 --> 01:06:29,017
For tomorrow I will be the
MarCO B mission manager.

1201

01:06:29,017 --> 01:06:32,387
I've had a couple different
roles on the spacecraft

1202

01:06:32,387 --> 01:06:35,290
in the only one year that I've
actually been working on it.

1203

01:06:35,290 --> 01:06:37,860
And in that year we've
put one together,

1204

01:06:37,860 --> 01:06:40,229
tested both of them, have
launched both of them,

1205

01:06:40,229 --> 01:06:42,330
and have now operated
them up until this point.

1206

01:06:42,330 --> 01:06:44,165
So there's a lot that happened

1207

01:06:44,165 --> 01:06:45,634
in a very short amount of time

1208

01:06:45,634 --> 01:06:46,601
and it was all very exciting.

1209

01:06:46,601 --> 01:06:49,437
So tomorrow I will be on console

1210

01:06:49,437 --> 01:06:52,074

looking at data
from the spacecraft

1211

01:06:52,074 --> 01:06:53,942

and interpreting
that data to see

1212

01:06:53,942 --> 01:06:55,811

how healthy the spacecraft is

1213

01:06:55,811 --> 01:06:59,114

in its support of InSight
entry, descent, and landing.

1214

01:06:59,114 --> 01:07:04,019

On the spacecraft itself as
Stephanie alluded to before,

1215

01:07:04,019 --> 01:07:05,320

they're known as Wall-E and Eve

1216

01:07:05,320 --> 01:07:08,557

and the reason for that is the,

1217

01:07:08,557 --> 01:07:10,926

about half of the
internal volume

1218

01:07:10,926 --> 01:07:14,496

of the spacecraft has fire
extinguisher fluid inside,

1219

01:07:14,496 --> 01:07:16,064

and that is our propellant.

1220

01:07:16,064 --> 01:07:17,999

So the two MarCO spacecraft

had done their own

1221

01:07:17,999 --> 01:07:19,568
trajectory correction maneuvers

1222

01:07:19,568 --> 01:07:21,703
kind of very similar to
what InSight had to do,

1223

01:07:21,703 --> 01:07:25,340
so we'd fly by Mars at a very
precise time and location.

1224

01:07:25,340 --> 01:07:28,610
And just like
Wall-E in the movie,

1225

01:07:28,610 --> 01:07:30,712
we use a fire extinguisher
to fly around Mars,

1226

01:07:30,712 --> 01:07:32,881
or fly around space
to get to Mars.

1227

01:07:32,881 --> 01:07:36,818
So that's why the nickname
they kind of stuck.

1228

01:07:36,818 --> 01:07:39,789
So MarCO B is the
one affectionately
referred to as Wall-E.

1229

01:07:40,655 --> 01:07:42,324
- There you have it everybody.

1230

01:07:42,324 --> 01:07:45,860
A trajectory correction maneuver
to get us where they need

1231

01:07:45,860 --> 01:07:47,963
to be at the end of this show.

1232

01:07:47,963 --> 01:07:50,499
A round of applause
for Anne and Andy.

1233

01:07:51,533 --> 01:07:54,469
And a reminder to all of you,

1234

01:07:54,469 --> 01:07:57,072
please join us
online, on NASA TV.

1235

01:07:57,072 --> 01:07:58,407
We're streaming everywhere.

1236

01:07:58,407 --> 01:08:00,843
Go to nasa.gov/live.

1237

01:08:00,843 --> 01:08:04,313
Landing coverage starts at
11 AM Pacific, 2 PM Eastern,

1238

01:08:04,313 --> 01:08:07,282
1900 UTC or GMT.

1239

01:08:07,282 --> 01:08:09,819
Follow us online, we're
using #MarsLanding.

1240

01:08:11,019 --> 01:08:13,555
Follow @NASA InSight
for the blow by blow

1241

01:08:13,555 --> 01:08:16,325
@NASAJPL for news.

1242

01:08:16,325 --> 01:08:18,027

We will see you online.