
InSight
InSight
REVEALING THE HEART OF MARS
60
NASA

1
00:00:09,919 --> 00:00:08,179
hello and welcome to NASA headquarters

2
00:00:12,259 --> 00:00:09,929
my name is Dwane Brown

3
00:00:14,390 --> 00:00:12,269
with the Office of Communications your

4
00:00:16,580 --> 00:00:14,400
host for today's program we're doing the

5
00:00:19,849 --> 00:00:16,590
next hour we'll take you on NASA's

6
00:00:22,939 --> 00:00:19,859
upcoming epic trek back to Mars on

7
00:00:24,370 --> 00:00:22,949
November 26 NASA's Mars insight Lander

8
00:00:28,250 --> 00:00:24,380
will touch down on the Red Planet

9
00:00:31,669 --> 00:00:28,260
becoming the first ever mission to study

10
00:00:34,069 --> 00:00:31,679
the heart of Mars Mars has a heart you

11
00:00:36,100 --> 00:00:34,079
ask well stay with us to get a better

12
00:00:38,389 --> 00:00:36,110
understanding of that and much more

13
00:00:40,670 --> 00:00:38,399

today's show will feature talks from

14
00:00:42,799 --> 00:00:40,680
Mission engineers scientists they'll

15
00:00:44,930 --> 00:00:42,809
also take your questions here from our

16
00:00:47,090 --> 00:00:44,940
audience in Washington our phone lines

17
00:00:51,319 --> 00:00:47,100
across the nation and of course social

18
00:00:53,930 --> 00:00:51,329
media using the hashtag ask NASA I have

19
00:00:56,570 --> 00:00:53,940
my red planet red tie on are you ready

20
00:00:57,240 --> 00:00:56,580
let's go to Mars

21
00:01:03,280 --> 00:00:57,250
[Music]

22
00:01:08,240 --> 00:01:05,600
first up to tell you about the

23
00:01:11,630 --> 00:01:08,250
spacecraft and how we will land on the

24
00:01:13,160 --> 00:01:11,640
Martian surface it's Tom Hoffman insight

25
00:01:22,550 --> 00:01:13,170
project manager from the Jet Propulsion

26
00:01:25,219 --> 00:01:22,560
Laboratory in Pasadena Tom thank you

27
00:01:27,140 --> 00:01:25,229
Thank You Dwayne I can't express to you

28
00:01:29,270 --> 00:01:27,150
the excitement that I have to stand up

29
00:01:31,130 --> 00:01:29,280
here in front of you today less than a

30
00:01:33,560 --> 00:01:31,140
month to landing I've been working on

31
00:01:35,210 --> 00:01:33,570
this project for more than seven years

32
00:01:37,580 --> 00:01:35,220
and to get to this point we're on the

33
00:01:39,530 --> 00:01:37,590
precipice of landing on Mars gonna get

34
00:01:41,719 --> 00:01:39,540
back some groundbreaking science is

35
00:01:43,399 --> 00:01:41,729
absolutely a tremendous feeling to me

36
00:01:44,420 --> 00:01:43,409
many of the team members that you're

37
00:01:46,160 --> 00:01:44,430
going to hear about today have been

38
00:01:47,450 --> 00:01:46,170

working on this even longer than I have

39
00:01:49,700 --> 00:01:47,460
so I know they're equally if not more

40
00:01:54,170 --> 00:01:49,710
excited than I am to tell you about this

41
00:01:56,389 --> 00:01:54,180
great mission so first off our trip to

42
00:01:58,010 --> 00:01:56,399
Mars started of May 5th of this year

43
00:01:59,959 --> 00:01:58,020
from Vandenberg Air Force Base it was

44
00:02:02,420 --> 00:01:59,969
the very first interplanetary launch

45
00:02:04,249 --> 00:02:02,430
from Vandenberg Air Force Base being a

46
00:02:05,600 --> 00:02:04,259
native Californian it was great for me

47
00:02:07,280 --> 00:02:05,610
to be able to break the monopoly that

48
00:02:10,190 --> 00:02:07,290
the East Coast has had on interplanetary

49
00:02:12,920 --> 00:02:10,200
launches and so we launched on an Atlas

50
00:02:13,850 --> 00:02:12,930
5 rocket and what we were expecting to

51
00:02:15,650 --> 00:02:13,860
see was something really

52
00:02:18,770 --> 00:02:15,660
cool like this which is an Atlas 5

53
00:02:20,450 --> 00:02:18,780
launching from Cape Canaveral that

54
00:02:22,880 --> 00:02:20,460
carried both us and that Marcus

55
00:02:25,190 --> 00:02:22,890
spacecraft that's not exactly what we

56
00:02:27,200 --> 00:02:25,200
saw anybody that's familiar with Central

57
00:02:29,180 --> 00:02:27,210
Coast of California in the summertime

58
00:02:31,640 --> 00:02:29,190
knows sometimes it can be just a little

59
00:02:33,290 --> 00:02:31,650
bit foggy and so if you're really really

60
00:02:35,960 --> 00:02:33,300
close to the rocket you might have seen

61
00:02:39,290 --> 00:02:35,970
something like this it's a lot of glow

62
00:02:40,610 --> 00:02:39,300
and a lot of fog and not too much

63
00:02:43,130 --> 00:02:40,620

excitement for the people that they were

64
00:02:45,440 --> 00:02:43,140
actually there witnessing the launch in

65
00:02:48,199 --> 00:02:45,450
Lompoc Air Force Base or Vandenberg Air

66
00:02:49,790 --> 00:02:48,209
Force Base in Lompoc but people that

67
00:02:52,790 --> 00:02:49,800
were just a little bit above the clouds

68
00:02:54,650 --> 00:02:52,800
saw some spectacular sights whether

69
00:02:56,990 --> 00:02:54,660
they're on a mountaintop or whether

70
00:02:58,520 --> 00:02:57,000
they're in a private plane looking at

71
00:03:00,500 --> 00:02:58,530
that rocket come out it was a beautiful

72
00:03:03,500 --> 00:03:00,510
sight and fortunately for anybody who

73
00:03:05,210 --> 00:03:03,510
was south of Lompoc area either santa

74
00:03:07,280 --> 00:03:05,220
barbara los angeles even all the way to

75
00:03:09,740 --> 00:03:07,290
san diego saw this beautiful streak

76
00:03:12,979 --> 00:03:09,750
through the air at about 4 or 5 a.m. on

77
00:03:14,479 --> 00:03:12,989
the 5th of may so what have we been

78
00:03:16,940 --> 00:03:14,489
doing since we've launched we've been in

79
00:03:18,050 --> 00:03:16,950
what we call our cruise phase so we've

80
00:03:19,550 --> 00:03:18,060
been doing an engineering check out

81
00:03:21,080 --> 00:03:19,560
science checkouts of the different

82
00:03:23,180 --> 00:03:21,090
instruments before we get to Mars to

83
00:03:25,490 --> 00:03:23,190
make sure we're completely ready once we

84
00:03:27,740 --> 00:03:25,500
get there and so we have we launched as

85
00:03:29,870 --> 00:03:27,750
I said on the 5th of May so we've been

86
00:03:32,720 --> 00:03:29,880
on a ballistic direct trajectory to Mars

87
00:03:35,090 --> 00:03:32,730
we've been getting closer every day and

88
00:03:37,460 --> 00:03:35,100

right now on Halloween Day we're very

89
00:03:39,620 --> 00:03:37,470
very close to Mars catching up when we

90
00:03:42,380 --> 00:03:39,630
do enter the atmosphere we're going to

91
00:03:42,830 --> 00:03:42,390
be going at about 12,000 300 miles per

92
00:03:45,140 --> 00:03:42,840
hour

93
00:03:46,850 --> 00:03:45,150
and in just six and a half minutes we're

94
00:03:48,800 --> 00:03:46,860
going to get down to five miles per hour

95
00:03:50,270 --> 00:03:48,810
just before we land and I'm going to

96
00:03:52,100 --> 00:03:50,280
explain to you exactly how we do that

97
00:03:54,170 --> 00:03:52,110
it's very it's a very interesting

98
00:03:56,150 --> 00:03:54,180
concept so we start out on with our

99
00:03:58,820 --> 00:03:56,160
cruise stage which has been giving us

100
00:04:00,920 --> 00:03:58,830
our power and our communications since

101
00:04:02,240 --> 00:04:00,930
we launched as soon as we get to the

102
00:04:04,699 --> 00:04:02,250
atmosphere we get rid of that cruise

103
00:04:06,050 --> 00:04:04,709
stage so this is what it looks like so

104
00:04:08,300 --> 00:04:06,060
our cruise stage is there at the back

105
00:04:10,400 --> 00:04:08,310
end we let that go we have the Aero

106
00:04:12,560 --> 00:04:10,410
shell which is contains our Lander in it

107
00:04:15,110 --> 00:04:12,570
it hits the atmosphere starts heating up

108
00:04:17,930 --> 00:04:15,120
you can see it gets very very hot that's

109
00:04:20,630 --> 00:04:17,940
slowing it down most of the most of the

110
00:04:23,210 --> 00:04:20,640
speed so it gets to about 850 miles per

111
00:04:26,150 --> 00:04:23,220
hour when we pop this parachute the

112
00:04:27,290 --> 00:04:26,160
parachute takes us down close to the

113
00:04:28,339 --> 00:04:27,300

ground we get rid

114
00:04:31,040 --> 00:04:28,349
of our heat shield that's been

115
00:04:32,390 --> 00:04:31,050
protecting us in the atmosphere and then

116
00:04:34,430 --> 00:04:32,400
we start acquiring the ground with our

117
00:04:35,960 --> 00:04:34,440
radar from the lander that tells us what

118
00:04:36,740 --> 00:04:35,970
our elevation is and lets us know when

119
00:04:38,689 --> 00:04:36,750
it's time to let go

120
00:04:40,309 --> 00:04:38,699
we freefall which is absolutely

121
00:04:41,779 --> 00:04:40,319
terrifying from you as a project manager

122
00:04:42,170 --> 00:04:41,789
Noah my spacecrafts falling to the

123
00:04:45,379 --> 00:04:42,180
ground

124
00:04:46,999 --> 00:04:45,389
but we do start firing rockets and we

125
00:04:48,589 --> 00:04:47,009
slow down to about five miles per hour

126
00:04:51,170 --> 00:04:48,599
by the time we actually get down to the

127
00:04:53,029 --> 00:04:51,180
surface right when we get there we'll go

128
00:04:55,640 --> 00:04:53,039
ahead and turn off those retro rockets

129
00:04:56,719 --> 00:04:55,650
let the dust settle literally you can

130
00:04:58,820 --> 00:04:56,729
see it's kicking up a fair amount of

131
00:05:00,830 --> 00:04:58,830
dust and then we have one more important

132
00:05:03,709 --> 00:05:00,840
step which is to unfurl our solar arrays

133
00:05:05,899 --> 00:05:03,719
since we're the very first Lander on

134
00:05:08,930 --> 00:05:05,909
Mars to last for an entire Martian years

135
00:05:10,790 --> 00:05:08,940
the 26 earth months not moving and just

136
00:05:13,249 --> 00:05:10,800
using solar power it's important for us

137
00:05:16,219 --> 00:05:13,259
to get the solar rays out and so that

138
00:05:18,110 --> 00:05:16,229

completes what we call our entry descent

139
00:05:19,969 --> 00:05:18,120
and landing phase and now we're ready to

140
00:05:22,129 --> 00:05:19,979
start doing the science but you might

141
00:05:24,770 --> 00:05:22,139
wonder how did we choose this particular

142
00:05:27,619 --> 00:05:24,780
landing site why did we choose that so I

143
00:05:29,270 --> 00:05:27,629
have a video to show you dr. Thomas or

144
00:05:31,779 --> 00:05:29,280
Buchan the head of the science Mission

145
00:05:34,279 --> 00:05:31,789
Directorate and Ramon de pollo who's our

146
00:05:35,779 --> 00:05:34,289
program executive here at NASA

147
00:05:38,510 --> 00:05:35,789
headquarters are here to explain that to

148
00:05:40,760 --> 00:05:38,520
you have you ever wondered how NASA

149
00:05:41,570 --> 00:05:40,770
decides where to land spacecraft on

150
00:05:43,879 --> 00:05:41,580
other planets

151
00:05:46,249 --> 00:05:43,889
hey welcome to science and seconds we're

152
00:05:48,950 --> 00:05:46,259
gonna tell you how we selected Elysium

153
00:05:51,740 --> 00:05:48,960
Phoenicia as the martian home for nasa's

154
00:05:53,719 --> 00:05:51,750
insight Lander insight purpose is to

155
00:05:55,909 --> 00:05:53,729
study the interior of Mars not the

156
00:05:58,339 --> 00:05:55,919
surface in the selection of a landing

157
00:05:59,629 --> 00:05:58,349
site what's on the surface matter less

158
00:06:01,939 --> 00:05:59,639
on this mission

159
00:06:04,670 --> 00:06:01,949
therefore previous missions Planitia is

160
00:06:07,040 --> 00:06:04,680
Latin for a flat surface Elysium is from

161
00:06:10,610 --> 00:06:07,050
the ancient Greek name for an afterlife

162
00:06:13,219 --> 00:06:10,620
paradise insights scientific success in

163
00:06:15,439 --> 00:06:13,229

safe landing depends on landing in a

164
00:06:17,689 --> 00:06:15,449
relatively flat area similar to a

165
00:06:20,659 --> 00:06:17,699
parking lot where rocks are few in

166
00:06:23,059 --> 00:06:20,669
number insight requires a landing site

167
00:06:25,909 --> 00:06:23,069
that must be close to the equator to

168
00:06:27,920 --> 00:06:25,919
make sure the Landers solar arrays can

169
00:06:30,350 --> 00:06:27,930
provide power throughout the year the

170
00:06:32,450 --> 00:06:30,360
chosen flat surface is perfect for

171
00:06:38,210 --> 00:06:32,460
insight we studied interior the red

172
00:06:43,250 --> 00:06:41,180
all right so that's how that's how we've

173
00:06:44,510 --> 00:06:43,260
chosen that particular location on Mars

174
00:06:46,670 --> 00:06:44,520
and why we chose that particular

175
00:06:48,560 --> 00:06:46,680
location one of the very first things

176
00:06:50,150 --> 00:06:48,570
that we're gonna do when we land is we

177
00:06:52,280 --> 00:06:50,160
were gonna take a picture of what it is

178
00:06:53,480 --> 00:06:52,290
our landing area looks like because we

179
00:06:55,070 --> 00:06:53,490
have to go through something we call

180
00:06:56,930 --> 00:06:55,080
instrument deployment you're gonna hear

181
00:06:59,120 --> 00:06:56,940
more about that later from some of the

182
00:07:00,620 --> 00:06:59,130
other speakers but just getting to the

183
00:07:02,510 --> 00:07:00,630
surface of Mars and getting in our solar

184
00:07:04,010 --> 00:07:02,520
arrays unfurled is not enough we

185
00:07:06,200 --> 00:07:04,020
actually have to take the instruments

186
00:07:07,850 --> 00:07:06,210
off the deck and put them on the Martian

187
00:07:10,430 --> 00:07:07,860
surface so that's why we're hoping that

188
00:07:13,310 --> 00:07:10,440

we see a picture kind of like this which

189
00:07:15,650 --> 00:07:13,320
is a really flat looking area a lot much

190
00:07:17,330 --> 00:07:15,660
like a giant Walmart parking lot and

191
00:07:19,070 --> 00:07:17,340
hopefully with not very many rocks in

192
00:07:20,480 --> 00:07:19,080
the area this is a little bit rockier

193
00:07:23,690 --> 00:07:20,490
than I'd like to see so hopefully it's

194
00:07:27,380 --> 00:07:23,700
really not really a safe area to place

195
00:07:29,090 --> 00:07:27,390
our instruments one of the other things

196
00:07:30,710 --> 00:07:29,100
really interesting about this mission is

197
00:07:32,840 --> 00:07:30,720
it's not just one spacecraft going to

198
00:07:35,390 --> 00:07:32,850
Mars it's not just insight we actually

199
00:07:38,240 --> 00:07:35,400
have two Tagalongs that flew with us on

200
00:07:40,460 --> 00:07:38,250
the Atlas 5 and have been tracking us

201
00:07:42,680 --> 00:07:40,470
ever since called Marco so that stands

202
00:07:45,800 --> 00:07:42,690
for Mars cube one so we have two of them

203
00:07:47,510 --> 00:07:45,810
Marco a and Marco B they're about the

204
00:07:49,400 --> 00:07:47,520
size of a briefcase so they're not very

205
00:07:52,490 --> 00:07:49,410
big spacecraft at all but their main

206
00:07:54,380 --> 00:07:52,500
purpose is to do a technic technology

207
00:07:55,940 --> 00:07:54,390
demonstration showing that we can put

208
00:07:57,640 --> 00:07:55,950
cube SATs into interstellar space

209
00:08:00,350 --> 00:07:57,650
they've been successful in doing that

210
00:08:01,280 --> 00:08:00,360
but we're really really hoping that one

211
00:08:03,080 --> 00:08:01,290
of the other things are going to be able

212
00:08:04,520 --> 00:08:03,090
to do is give us communications while

213
00:08:07,790 --> 00:08:04,530

we're doing our entry descent and

214
00:08:09,320 --> 00:08:07,800
landing phase oftentimes we've had other

215
00:08:12,200 --> 00:08:09,330
assets they've been able to do real-time

216
00:08:13,610 --> 00:08:12,210
information for that phase but this time

217
00:08:15,320 --> 00:08:13,620
we don't have those assets in the right

218
00:08:18,230 --> 00:08:15,330
position so we brought along our own

219
00:08:20,210 --> 00:08:18,240
relay assets and they kind of look like

220
00:08:22,520 --> 00:08:20,220
this there's two of them this is the UHF

221
00:08:23,980 --> 00:08:22,530
antenna at the bottom they have an X

222
00:08:27,920 --> 00:08:23,990
band that will be talking back to earth

223
00:08:30,530 --> 00:08:27,930
for us they'll fly in formation trailing

224
00:08:32,930 --> 00:08:30,540
behind us waiting for us to start giving

225
00:08:34,700 --> 00:08:32,940
them a UHF signal through here and then

226
00:08:36,320 --> 00:08:34,710
they'll be broadcasting that back to

227
00:08:37,969 --> 00:08:36,330
earth so we know it's exactly happening

228
00:08:40,070 --> 00:08:37,979
each step of the entry descent and

229
00:08:41,300 --> 00:08:40,080
landing process all those steps that I

230
00:08:43,700 --> 00:08:41,310
showed you a little bit earlier in the

231
00:08:45,290 --> 00:08:43,710
video so this is what it looks like when

232
00:08:46,880 --> 00:08:45,300
we get there so there to Marco's or on

233
00:08:49,400 --> 00:08:46,890
either side of insight as it's entering

234
00:08:51,530 --> 00:08:49,410
we have MRO or Mars Reconnaissance

235
00:08:51,950 --> 00:08:51,540
Orbiter that will also be collecting the

236
00:08:56,000 --> 00:08:51,960
data

237
00:08:57,230 --> 00:08:56,010
real-time only the Marcos can do that

238
00:08:59,360 --> 00:08:57,240

real-time so we're really hoping that

239
00:09:01,820 --> 00:08:59,370
they work out as a technology

240
00:09:03,410 --> 00:09:01,830
demonstration the MRO will be collecting

241
00:09:04,970 --> 00:09:03,420
that data in about three hours after we

242
00:09:07,160 --> 00:09:04,980
land we'll be sending that back to the

243
00:09:08,270 --> 00:09:07,170
earth just in case the Marcos don't work

244
00:09:11,320 --> 00:09:08,280
we'll still get all the information

245
00:09:14,270 --> 00:09:11,330
about the entry descent and landing so

246
00:09:16,460 --> 00:09:14,280
that's basically how it works how ETL

247
00:09:18,170 --> 00:09:16,470
communication works to tell you more

248
00:09:21,500 --> 00:09:18,180
about how insight fits into the overall

249
00:09:22,970 --> 00:09:21,510
portfolio of the planetary science

250
00:09:29,950 --> 00:09:22,980
Directorate is the head of planetary

251
00:09:35,150 --> 00:09:33,050
thanks so much Tom for describing give

252
00:09:37,010 --> 00:09:35,160
it such a great description of what the

253
00:09:38,660 --> 00:09:37,020
insight mission looks like and how it's

254
00:09:40,610 --> 00:09:38,670
going to enter the atmosphere and

255
00:09:43,580 --> 00:09:40,620
descend down through the atmosphere and

256
00:09:47,420 --> 00:09:43,590
land on the surface so this incredible

257
00:09:48,860 --> 00:09:47,430
spacecraft you've heard this phrase the

258
00:09:50,600 --> 00:09:48,870
saying you know it takes a village well

259
00:09:52,760 --> 00:09:50,610
this spacecraft didn't just take a

260
00:09:55,370 --> 00:09:52,770
village it took almost the entire planet

261
00:09:57,440 --> 00:09:55,380
to pull this mission together multiple

262
00:09:59,750 --> 00:09:57,450
international partnerships between

263
00:10:02,330 --> 00:09:59,760

international space agencies came

264
00:10:07,010 --> 00:10:02,340
together with contributions from France

265
00:10:11,570 --> 00:10:07,020
from Germany from England from Poland

266
00:10:13,250 --> 00:10:11,580
and Switzerland and Spain contributions

267
00:10:15,650 --> 00:10:13,260
from all of those countries came

268
00:10:17,410 --> 00:10:15,660
together with the United States and with

269
00:10:19,820 --> 00:10:17,420
NASA to put together an incredible

270
00:10:22,400 --> 00:10:19,830
scientific payload that's going to be

271
00:10:25,280 --> 00:10:22,410
able to measure the heartbeat and

272
00:10:28,550 --> 00:10:25,290
actually understand Mars from the inside

273
00:10:30,020 --> 00:10:28,560
out this is an incredible feat and

274
00:10:33,830 --> 00:10:30,030
really just a tremendous tremendous

275
00:10:37,100 --> 00:10:33,840
mission this graphic here shows the

276
00:10:39,830 --> 00:10:37,110
entire planetary fleet and down here in

277
00:10:41,570 --> 00:10:39,840
the bottom right hand corner is the

278
00:10:43,970 --> 00:10:41,580
missions that we currently have at Mars

279
00:10:45,950 --> 00:10:43,980
including insight these missions are

280
00:10:47,060 --> 00:10:45,960
either in development all the missions

281
00:10:49,670 --> 00:10:47,070
are either in development or in

282
00:10:51,830 --> 00:10:49,680
operations and all of these missions are

283
00:10:54,050 --> 00:10:51,840
not all of them they're all trying to

284
00:10:55,850 --> 00:10:54,060
address fundamental questions that we

285
00:10:58,400 --> 00:10:55,860
have about how our solar system formed

286
00:11:00,700 --> 00:10:58,410
and evolved where did it come from and

287
00:11:03,440 --> 00:11:00,710
how did we get to where we are today I

288
00:11:04,530 --> 00:11:03,450

think for an example I wanted to show

289
00:11:06,720 --> 00:11:04,540
you we have a couple of

290
00:11:09,530 --> 00:11:06,730
missions on here osiris-rex over here to

291
00:11:12,120 --> 00:11:09,540
your left is a mission that's going to

292
00:11:14,160 --> 00:11:12,130
rendezvous with the asteroid near-earth

293
00:11:16,470 --> 00:11:14,170
asteroid Bennu coming up in early

294
00:11:18,270 --> 00:11:16,480
December it's going to map out that

295
00:11:19,950 --> 00:11:18,280
asteroid and then after a while it's

296
00:11:22,140 --> 00:11:19,960
going to take a sample from the surface

297
00:11:24,150 --> 00:11:22,150
of the asteroid and bring that sample

298
00:11:26,160 --> 00:11:24,160
back to earth where we're able to

299
00:11:26,970 --> 00:11:26,170
analyze that sample understand it's

300
00:11:28,950 --> 00:11:26,980
chemistry

301
00:11:30,030 --> 00:11:28,960
help us to understand the chemical

302
00:11:32,910 --> 00:11:30,040
composition of these near-earth

303
00:11:35,010 --> 00:11:32,920
asteroids that are building blocks for

304
00:11:37,830 --> 00:11:35,020
the elements of our solar system all of

305
00:11:39,150 --> 00:11:37,840
the planets another good example of how

306
00:11:40,560 --> 00:11:39,160
we address that question of the

307
00:11:43,770 --> 00:11:40,570
formation and evolution of the solar

308
00:11:47,490 --> 00:11:43,780
system is the new New Horizons mission

309
00:11:49,740 --> 00:11:47,500
which is going to fly by a Kuiper belt

310
00:11:53,880 --> 00:11:49,750
object on January 1st on New Year's Day

311
00:11:55,940 --> 00:11:53,890
the Kuiper belt is out beyond Pluto it's

312
00:11:58,320 --> 00:11:55,950
very far away and it's made up of these

313
00:11:59,730 --> 00:11:58,330

primordial objects that we think are

314
00:12:02,250 --> 00:11:59,740
remnants left over from the early

315
00:12:04,950 --> 00:12:02,260
formation of the solar system and when

316
00:12:08,100 --> 00:12:04,960
New Horizons flies by that kuyper Bell

317
00:12:09,450 --> 00:12:08,110
object mu 69 on January 1st that'll be

318
00:12:11,310 --> 00:12:09,460
the first ever time we've gotten a

319
00:12:13,830 --> 00:12:11,320
close-up view of one of those early

320
00:12:15,240 --> 00:12:13,840
objects so these missions and many of

321
00:12:17,460 --> 00:12:15,250
the other missions in our planetary

322
00:12:19,980 --> 00:12:17,470
portfolio are trying to address that

323
00:12:22,050 --> 00:12:19,990
question of how did the solar system

324
00:12:24,360 --> 00:12:22,060
form and evolve in different ways just

325
00:12:26,400 --> 00:12:24,370
as insight is going to try and

326
00:12:28,350 --> 00:12:26,410
understand how the rocky bodies in our

327
00:12:32,060 --> 00:12:28,360
solar system formed and evolved over

328
00:12:35,490 --> 00:12:32,070
time also in to mention that NASA's

329
00:12:37,710 --> 00:12:35,500
exploration campaign exploration program

330
00:12:39,870 --> 00:12:37,720
that we're undergoing now is an effort

331
00:12:42,600 --> 00:12:39,880
to try and return to the moon with

332
00:12:45,330 --> 00:12:42,610
scientific experiments and Technology

333
00:12:46,800 --> 00:12:45,340
demonstrations to help us prepare to

334
00:12:50,460 --> 00:12:46,810
send humans back to the moon and

335
00:12:52,950 --> 00:12:50,470
eventually on to Mars what's interesting

336
00:12:54,810 --> 00:12:52,960
to me is that the scientific experiments

337
00:12:57,060 --> 00:12:54,820
that are going to be done with the

338
00:13:00,270 --> 00:12:57,070

insight mission have actually already

339
00:13:03,210 --> 00:13:00,280
been done at the moon several decades

340
00:13:04,770 --> 00:13:03,220
ago as part of the Apollo program and so

341
00:13:06,660 --> 00:13:04,780
with that I'd like to introduce dr.

342
00:13:08,610 --> 00:13:06,670
Bruce Banner who is the principal

343
00:13:10,560 --> 00:13:08,620
investigator for the insight mission and

344
00:13:12,240 --> 00:13:10,570
he's going to talk to you much more

345
00:13:13,260 --> 00:13:12,250
detail about the science experiments

346
00:13:15,240 --> 00:13:13,270
that are going to be conducted on

347
00:13:17,010 --> 00:13:15,250
insight and a little bit of information

348
00:13:18,420 --> 00:13:17,020
on how they relate to what's been done

349
00:13:25,770 --> 00:13:18,430
on the moon previously

350
00:13:27,390 --> 00:13:25,780
thank you so I am I am stupendously

351
00:13:29,400 --> 00:13:27,400
excited to be up here today I've been

352
00:13:32,100 --> 00:13:29,410
dreaming about this this mission this

353
00:13:34,710 --> 00:13:32,110
science for about almost 40 years and

354
00:13:36,840 --> 00:13:34,720
and actively scheming towards it for at

355
00:13:38,340 --> 00:13:36,850
least 25 and so to get to this point

356
00:13:39,750 --> 00:13:38,350
where we're you know less than a month

357
00:13:42,500 --> 00:13:39,760
away from from landing on Mars and

358
00:13:48,210 --> 00:13:42,510
actually doing this science is just a

359
00:13:49,740 --> 00:13:48,220
real real treat for me so I'm gonna talk

360
00:13:54,420 --> 00:13:49,750
a little bit about the science but first

361
00:13:58,620 --> 00:13:54,430
I mean I have a little clip here of Dave

362
00:14:01,590 --> 00:13:58,630
Scott who was the astronaut on Apollo 15

363
00:14:03,990 --> 00:14:01,600

this is him getting out of the Apollo 15

364
00:14:06,420 --> 00:14:04,000
capsule and Laurie mentioned how we've

365
00:14:08,790 --> 00:14:06,430
we've been to the moon we're going to to

366
00:14:10,560 --> 00:14:08,800
Mars and we were going to the moon as

367
00:14:12,930 --> 00:14:10,570
well with Matt NASA and this hatch

368
00:14:15,540 --> 00:14:12,940
actually has a pretty direct connection

369
00:14:17,970 --> 00:14:15,550
to the insight now and I'll return to

370
00:14:19,530 --> 00:14:17,980
that in a few minutes so what is it that

371
00:14:22,350 --> 00:14:19,540
we're doing with with insight I mean

372
00:14:24,420 --> 00:14:22,360
insight is going to explore the deep

373
00:14:25,980 --> 00:14:24,430
interior of Mars from the crust all the

374
00:14:28,140 --> 00:14:25,990
way down to the center of the planet to

375
00:14:30,600 --> 00:14:28,150
its core so really the first first

376
00:14:33,690 --> 00:14:30,610
mission to get to go and and look deeply

377
00:14:37,220 --> 00:14:33,700
into the insides of a rocky planet other

378
00:14:40,530 --> 00:14:37,230
other than the Earth Moon system and

379
00:14:43,740 --> 00:14:40,540
we're going to Mars specifically to look

380
00:14:44,640 --> 00:14:43,750
back into the the origin of the planets

381
00:14:46,230 --> 00:14:44,650
of the solar system

382
00:14:49,290 --> 00:14:46,240
so in this graphic you can see over on

383
00:14:51,360 --> 00:14:49,300
the Left we have the earth and the Mars

384
00:14:55,380 --> 00:14:51,370
in the middle moon on on the on the

385
00:14:57,210 --> 00:14:55,390
right and in order to investigate you

386
00:14:59,160 --> 00:14:57,220
know what's going on inside the planets

387
00:15:01,740 --> 00:14:59,170
and how that relates to early solar

388
00:15:03,690 --> 00:15:01,750

system formation why are we going to

389
00:15:05,070 --> 00:15:03,700
Mars we're on the earth it's a lot

390
00:15:08,190 --> 00:15:05,080
easier to get to it's a lot easier to

391
00:15:09,630 --> 00:15:08,200
study and we've absolutely understand a

392
00:15:11,790 --> 00:15:09,640
lot about the interior of the earth and

393
00:15:13,200 --> 00:15:11,800
gotten a lot of information for it but

394
00:15:16,470 --> 00:15:13,210
if you really want to know about the the

395
00:15:18,090 --> 00:15:16,480
very beginning of the of the of the

396
00:15:20,370 --> 00:15:18,100
planets that sort of the birth of the

397
00:15:22,500 --> 00:15:20,380
planets what happens to them just in a

398
00:15:24,510 --> 00:15:22,510
few first tens of millions of years

399
00:15:26,010 --> 00:15:24,520
after their formation earth is not

400
00:15:28,440 --> 00:15:26,020
really a very good laboratory because

401
00:15:30,750 --> 00:15:28,450
Earth has been extremely active it's a

402
00:15:32,310 --> 00:15:30,760
it's a big planet holds a lot of heat a

403
00:15:34,380 --> 00:15:32,320
lot of energy and

404
00:15:36,780 --> 00:15:34,390
it's been very geologically active over

405
00:15:39,900 --> 00:15:36,790
its entire history and so most of the

406
00:15:41,760 --> 00:15:39,910
record of the early processes that forms

407
00:15:44,760 --> 00:15:41,770
the earth have been erased either by

408
00:15:47,280 --> 00:15:44,770
plate tectonics by a vigorous mantle

409
00:15:48,840 --> 00:15:47,290
convection and so forth and so we'd like

410
00:15:51,420 --> 00:15:48,850
to have a planet that's just a little

411
00:15:53,610 --> 00:15:51,430
bit calmer and that can retain that that

412
00:15:55,650 --> 00:15:53,620
evidence the moon is actually pretty

413
00:15:58,620 --> 00:15:55,660

great that way it's a it's a it's a

414
00:16:03,000 --> 00:15:58,630
small planet it cooled very quickly and

415
00:16:04,530 --> 00:16:03,010
it it does actually retain a lot of the

416
00:16:06,420 --> 00:16:04,540
evidence from from the Earth's early

417
00:16:09,450 --> 00:16:06,430
formation but the problem is it's so

418
00:16:12,120 --> 00:16:09,460
small that the conditions inside the

419
00:16:14,850 --> 00:16:12,130
pressure and temperature never get to

420
00:16:17,490 --> 00:16:14,860
the levels that are characteristic of

421
00:16:19,590 --> 00:16:17,500
the bulk of the inside of the larger

422
00:16:22,440 --> 00:16:19,600
rocky planets and so Mars is kind of in

423
00:16:24,930 --> 00:16:22,450
the sweet spot if it's big enough to

424
00:16:26,790 --> 00:16:24,940
have experienced all the processes that

425
00:16:28,590 --> 00:16:26,800
we're interested in but small enough

426
00:16:30,210 --> 00:16:28,600
that it hasn't been so vigorous that

427
00:16:32,670 --> 00:16:30,220
it's erased at all so it's kind of

428
00:16:36,390 --> 00:16:32,680
called the the Goldilocks planet it's

429
00:16:40,140 --> 00:16:36,400
just right for investigating the early

430
00:16:42,480 --> 00:16:40,150
solar system and so how do we do that

431
00:16:44,180 --> 00:16:42,490
how do you look deep inside a planet

432
00:16:47,160 --> 00:16:44,190
well the best way to do it is by using

433
00:16:48,870 --> 00:16:47,170
seismology and seismology uses we're

434
00:16:51,840 --> 00:16:48,880
called seismic waves which are basically

435
00:16:53,370 --> 00:16:51,850
just vibrations shaking as a planet to

436
00:16:55,500 --> 00:16:53,380
probe deep into the planet so those

437
00:16:57,420 --> 00:16:55,510
those waves propagate through the planet

438
00:16:59,010 --> 00:16:57,430

and as they propagate you can see that

439
00:17:01,650 --> 00:16:59,020
they get bent they go in different

440
00:17:03,930 --> 00:17:01,660
directions it affects the wavelengths it

441
00:17:06,150 --> 00:17:03,940
affects the amplitudes and then when we

442
00:17:08,640 --> 00:17:06,160
measure those amplitudes measure those

443
00:17:11,250 --> 00:17:08,650
vibrations at the surface we have

444
00:17:14,010 --> 00:17:11,260
techniques that we can use to sort of

445
00:17:16,290 --> 00:17:14,020
unravel the entire pathway through the

446
00:17:18,179 --> 00:17:16,300
planet and and figure out what kind of

447
00:17:19,829 --> 00:17:18,189
materials that they pass through what

448
00:17:22,439 --> 00:17:19,839
kind of interfaces that they may have

449
00:17:25,050 --> 00:17:22,449
bounced off of and then we can use that

450
00:17:27,420 --> 00:17:25,060
information to understand the size the

451
00:17:28,830 --> 00:17:27,430
composition and a configuration of all

452
00:17:31,110 --> 00:17:28,840
the layers of the inside of the planet

453
00:17:33,510 --> 00:17:31,120
particularly the core the mantle and the

454
00:17:37,170 --> 00:17:33,520
crust and these parameters these

455
00:17:39,840 --> 00:17:37,180
divisions and compositions are all very

456
00:17:43,110 --> 00:17:39,850
closely tied to how that planet formed

457
00:17:45,660 --> 00:17:43,120
very early on we start out with a cloud

458
00:17:47,610 --> 00:17:45,670
of material that's orbiting around this

459
00:17:49,650 --> 00:17:47,620
the very early solar system that

460
00:17:52,980 --> 00:17:49,660
condenses into planets through a

461
00:17:56,820 --> 00:17:52,990
gravitational attraction but they they

462
00:17:58,200 --> 00:17:56,830
move from a uniform ball of the material

463
00:18:00,360 --> 00:17:58,210

is kind of made up of the same kind of

464
00:18:03,270 --> 00:18:00,370
rocks as meteorites which is pretty

465
00:18:06,810 --> 00:18:03,280
uniform material and then they transform

466
00:18:09,750 --> 00:18:06,820
like a caterpillar in a chrysalis they

467
00:18:12,360 --> 00:18:09,760
transform from a featureless ball into

468
00:18:14,400 --> 00:18:12,370
the diverse and complex planets that we

469
00:18:16,500 --> 00:18:14,410
see today and that's the process called

470
00:18:21,690 --> 00:18:16,510
differentiation that we really want to

471
00:18:24,530 --> 00:18:21,700
key into with this mission in order to

472
00:18:27,210 --> 00:18:24,540
do this we need to be able to get our

473
00:18:29,520 --> 00:18:27,220
instruments onto the surface of the

474
00:18:31,230 --> 00:18:29,530
planet now for Apollo we actually had a

475
00:18:33,780 --> 00:18:31,240
very convenient deployment systems

476
00:18:36,840 --> 00:18:33,790
called a human being this is uh this is

477
00:18:38,930 --> 00:18:36,850
both Buzz Aldrin on Apollo 11 deploying

478
00:18:42,630 --> 00:18:38,940
the very first seismometer that was

479
00:18:45,960 --> 00:18:42,640
operated off of the earth back in 1969

480
00:18:48,480 --> 00:18:45,970
this is the seismometer down here that

481
00:18:50,940 --> 00:18:48,490
he's just carried from the lunar

482
00:18:53,700 --> 00:18:50,950
excursion module and placed onto the

483
00:18:56,130 --> 00:18:53,710
surface at a decent distance away from

484
00:18:58,140 --> 00:18:56,140
the spacecraft this had its own power

485
00:18:59,640 --> 00:18:58,150
supply with it and its own communication

486
00:19:02,880 --> 00:18:59,650
system and this was sort of the

487
00:19:05,630 --> 00:19:02,890
beginning of our exploration of the deep

488
00:19:09,150 --> 00:19:05,640

interior planets other than the earth

489
00:19:11,010 --> 00:19:09,160
similarly we put a heat flow probe onto

490
00:19:13,350 --> 00:19:11,020
the moon actually a several of them this

491
00:19:17,010 --> 00:19:13,360
is Dave Scott from Apollo 15 a little

492
00:19:18,539 --> 00:19:17,020
bit after he made those that trip down

493
00:19:20,940 --> 00:19:18,549
the ladder that I showed you earlier and

494
00:19:23,100 --> 00:19:20,950
here he is drilling down into the planet

495
00:19:24,960 --> 00:19:23,110
so when you in order to measure the heat

496
00:19:26,370 --> 00:19:24,970
flow coming out of a planet you have to

497
00:19:28,710 --> 00:19:26,380
measure the temperature not only at the

498
00:19:30,600 --> 00:19:28,720
surface but down at depth as well so you

499
00:19:33,060 --> 00:19:30,610
can find out how much of that heat is

500
00:19:34,710 --> 00:19:33,070
escaping from deep inside the planet and

501
00:19:36,840 --> 00:19:34,720
you can see that he's leaning on that

502
00:19:40,100 --> 00:19:36,850
thing he's pushing it down it's not

503
00:19:43,080 --> 00:19:40,110
really easy to dig into or to drill into

504
00:19:46,680 --> 00:19:43,090
into into rock or even into into soil

505
00:19:48,930 --> 00:19:46,690
and so this is a fairly difficult

506
00:19:51,720 --> 00:19:48,940
process we don't have astronauts on the

507
00:19:52,980 --> 00:19:51,730
inside you may have noticed so we have

508
00:19:55,770 --> 00:19:52,990
to get a little bit more clever about

509
00:19:57,030 --> 00:19:55,780
how to do that and our next couple of

510
00:19:59,520 --> 00:19:57,040
speakers are going to talk a little bit

511
00:20:01,860 --> 00:19:59,530
more about about the deployment process

512
00:20:03,660 --> 00:20:01,870
we robotically sort of mimic the kinds

513
00:20:06,600 --> 00:20:03,670

of things that we were doing with

514
00:20:11,520 --> 00:20:06,610
astronauts back in the 60s and 70s and

515
00:20:17,070 --> 00:20:11,530
so with that I think this is my final

516
00:20:19,500 --> 00:20:17,080
slide I'd like to go on to pass this on

517
00:20:22,500 --> 00:20:19,510
to our next speaker which is super car

518
00:20:24,330 --> 00:20:22,510
she's a deputy project deputy principal

519
00:20:26,700 --> 00:20:24,340
investigator for insight and she's going

520
00:20:28,500 --> 00:20:26,710
to talk a little bit more about the the

521
00:20:37,080 --> 00:20:28,510
instruments and the deployment system

522
00:20:39,630 --> 00:20:37,090
that that we're going to be using all

523
00:20:42,240 --> 00:20:39,640
right thanks Bruce so we're gonna talk a

524
00:20:44,490 --> 00:20:42,250
little bit about how insight actually

525
00:20:47,610 --> 00:20:44,500
accomplishes this amazing science and

526
00:20:49,080 --> 00:20:47,620
you saw in Bruce's presentation how

527
00:20:51,360 --> 00:20:49,090
seismic waves travel through the

528
00:20:55,310 --> 00:20:51,370
interior of the planet when they

529
00:20:57,960 --> 00:20:55,320
encounter those waves those layers the

530
00:21:00,390 --> 00:20:57,970
seismic waves can speed up or slow down

531
00:21:02,610 --> 00:21:00,400
depending on the on the density of the

532
00:21:05,970 --> 00:21:02,620
material and they create multiple waves

533
00:21:08,700 --> 00:21:05,980
so I want to show you here is a seismic

534
00:21:09,930 --> 00:21:08,710
event happening near the surface and

535
00:21:11,850 --> 00:21:09,940
it's gonna interact with these layers

536
00:21:14,280 --> 00:21:11,860
near the surface and I'll show you what

537
00:21:16,890 --> 00:21:14,290
it actually looks like at our Lander so

538
00:21:18,540 --> 00:21:16,900

here the seismic wave is is interacting

539
00:21:19,590 --> 00:21:18,550
with those layers near the surface at

540
00:21:22,440 --> 00:21:19,600
the top you're seeing what the

541
00:21:23,940 --> 00:21:22,450
seismometer records so this is you know

542
00:21:26,430 --> 00:21:23,950
we've been talking about the the pulse

543
00:21:27,930 --> 00:21:26,440
of Mars the heartbeat and this is what

544
00:21:30,870 --> 00:21:27,940
our seismometer is actually going to

545
00:21:32,730 --> 00:21:30,880
record we're seeing two different waves

546
00:21:34,650 --> 00:21:32,740
there you're seeing the vertical

547
00:21:36,540 --> 00:21:34,660
displacement of the ground and you're

548
00:21:39,600 --> 00:21:36,550
also seeing the horizontal displacement

549
00:21:42,510 --> 00:21:39,610
of the ground so here we've shown what

550
00:21:44,430 --> 00:21:42,520
what to seismometers would record we on

551
00:21:46,680 --> 00:21:44,440
inside actually have six seismometers

552
00:21:49,200 --> 00:21:46,690
inside that small package that we place

553
00:21:52,590 --> 00:21:49,210
on the surface and we do that so that we

554
00:21:55,200 --> 00:21:52,600
can not only record the full spectrum of

555
00:21:58,140 --> 00:21:55,210
a seismic wave but also to tell what

556
00:22:00,690 --> 00:21:58,150
direction is coming from so the the

557
00:22:03,150 --> 00:22:00,700
shape of the of these waves their

558
00:22:04,440 --> 00:22:03,160
amplitude their spacing it tells us all

559
00:22:06,990 --> 00:22:04,450
about that the path that they've

560
00:22:08,700 --> 00:22:07,000
traveled to to actually get to our

561
00:22:10,680 --> 00:22:08,710
seismometer and that gives us the

562
00:22:13,190 --> 00:22:10,690
ability to discern what the layers are

563
00:22:17,430 --> 00:22:13,200

inside the planet

564
00:22:19,980 --> 00:22:17,440
okay so as you know we have also heat

565
00:22:23,070 --> 00:22:19,990
flow and physical properties package the

566
00:22:25,259 --> 00:22:23,080
HP cubes and we don't have the benefit

567
00:22:29,279 --> 00:22:25,269
of the astronauts to drill a hole for us

568
00:22:31,350 --> 00:22:29,289
so the HP cube actually has to hammer

569
00:22:34,590 --> 00:22:31,360
itself under the ground and what you're

570
00:22:36,509 --> 00:22:34,600
seeing here it's basically a nail that

571
00:22:38,639 --> 00:22:36,519
contains its own hammer a motor

572
00:22:40,740 --> 00:22:38,649
compresses the spring that spring is

573
00:22:43,350 --> 00:22:40,750
released and it accelerates that mass

574
00:22:46,350 --> 00:22:43,360
downward which it acts like a hammer on

575
00:22:49,350 --> 00:22:46,360
top of these this a cylinder which we

576
00:22:51,539 --> 00:22:49,360
call a mole the mole goes down a couple

577
00:22:53,909 --> 00:22:51,549
of feet into the ground and it sends out

578
00:22:55,860 --> 00:22:53,919
a pulse of heat what's it do what it's

579
00:22:58,980 --> 00:22:55,870
doing there is measuring the thermal

580
00:23:01,049 --> 00:22:58,990
properties of the soil when it sends out

581
00:23:03,180 --> 00:23:01,059
that pulse we determine how long it

582
00:23:05,610 --> 00:23:03,190
takes for it to cool off again and that

583
00:23:09,840 --> 00:23:05,620
tells us whether the soil is insulating

584
00:23:12,029 --> 00:23:09,850
or conducting we go down all the way to

585
00:23:13,860 --> 00:23:12,039
the end of the tether and you know my

586
00:23:14,850 --> 00:23:13,870
family likes to tell me I'm short and so

587
00:23:16,919 --> 00:23:14,860
it looks like it's kind of a short

588
00:23:20,129 --> 00:23:16,929

tether compared to me but in fact what

589
00:23:22,889 --> 00:23:20,139
we want to do is get down to about 10 to

590
00:23:25,529 --> 00:23:22,899
16 feet all along this tether there is a

591
00:23:27,960 --> 00:23:25,539
string of 10 10 temperature sensors and

592
00:23:29,789 --> 00:23:27,970
what we're gonna do is determine how

593
00:23:31,710 --> 00:23:29,799
fast the temperature increases with

594
00:23:33,749 --> 00:23:31,720
depth that tells us about the heat

595
00:23:36,090 --> 00:23:33,759
coming out of the planet that energy

596
00:23:39,149 --> 00:23:36,100
that's available for driving geologic

597
00:23:41,519 --> 00:23:39,159
activity so we want to go down 10 to 16

598
00:23:43,409 --> 00:23:41,529
feet because at the surface there's a

599
00:23:45,060 --> 00:23:43,419
lot of temperature variation going on

600
00:23:46,590 --> 00:23:45,070
there's a daily temperature variation

601
00:23:48,960 --> 00:23:46,600
there's a seasonal temperature variation

602
00:23:50,610 --> 00:23:48,970
even our Lander causes as variations in

603
00:23:52,560 --> 00:23:50,620
the temperature so we want to get down

604
00:23:54,389 --> 00:23:52,570
to 10 to 16 feet because when we get

605
00:23:56,490 --> 00:23:54,399
down that deep would get away from all

606
00:23:58,320 --> 00:23:56,500
the the temperature variations near the

607
00:24:01,560 --> 00:23:58,330
surface so that's why we're trying to

608
00:24:06,720 --> 00:24:01,570
deploy it down all the way to this full

609
00:24:09,090 --> 00:24:06,730
extent ok so as you know before we can

610
00:24:10,830 --> 00:24:09,100
start working with our instruments we

611
00:24:14,220 --> 00:24:10,840
have to be able to deploy them onto the

612
00:24:16,440 --> 00:24:14,230
surface and this is an animation of our

613
00:24:18,539 --> 00:24:16,450

robotic arm picking up the seismometer

614
00:24:20,970 --> 00:24:18,549
or the 6 seismometers inside this

615
00:24:25,049 --> 00:24:20,980
package and placing it on the surface of

616
00:24:26,700 --> 00:24:25,059
mars in this video it takes about 20

617
00:24:28,980 --> 00:24:26,710
seconds for this to occur

618
00:24:30,390 --> 00:24:28,990
on Mars it's gonna take about two or

619
00:24:32,790 --> 00:24:30,400
three months before we actually have our

620
00:24:34,500 --> 00:24:32,800
seismometer on the ground the reason for

621
00:24:36,270 --> 00:24:34,510
that is that we're gonna take all of the

622
00:24:38,130 --> 00:24:36,280
data that we possibly can to choose an

623
00:24:40,950 --> 00:24:38,140
optimal place before we put our

624
00:24:42,060 --> 00:24:40,960
instruments down so as soon as we get on

625
00:24:44,700 --> 00:24:42,070
the surface we're gonna start taking

626
00:24:46,710 --> 00:24:44,710
image data to look for the rock

627
00:24:48,630 --> 00:24:46,720
distribution we're going to take stereo

628
00:24:51,390 --> 00:24:48,640
images that help us determine how big

629
00:24:53,400 --> 00:24:51,400
are those rocks are there any slopes in

630
00:24:55,410 --> 00:24:53,410
the in the within the reach of the arm

631
00:24:57,390 --> 00:24:55,420
we're also gonna take temperature change

632
00:24:59,670 --> 00:24:57,400
of the surface that temperature data

633
00:25:02,250 --> 00:24:59,680
helps us determine what the particle

634
00:25:03,870 --> 00:25:02,260
sizes are on the surface and that can

635
00:25:06,060 --> 00:25:03,880
give us information about whether we

636
00:25:07,950 --> 00:25:06,070
think the instruments might settle at

637
00:25:10,140 --> 00:25:07,960
all after we place them on the surface

638
00:25:12,080 --> 00:25:10,150

so we want to take all the data and

639
00:25:14,970 --> 00:25:12,090
simulate that and try to choose the best

640
00:25:16,980 --> 00:25:14,980
location to put our instruments down so

641
00:25:19,020 --> 00:25:16,990
that's going to take us we're gonna take

642
00:25:22,170 --> 00:25:19,030
our time and do that to the best of our

643
00:25:24,680 --> 00:25:22,180
ability okay so you've seen what it

644
00:25:27,930 --> 00:25:24,690
looks like in the animation I'd like to

645
00:25:31,620 --> 00:25:27,940
Mexico to JPL introduce you to our lead

646
00:25:34,350 --> 00:25:31,630
deployment engineer Jamie singer and she

647
00:25:39,720 --> 00:25:34,360
is going to tell us where are you

648
00:25:42,000 --> 00:25:39,730
standing right now hi Steve I'm at the

649
00:25:43,890 --> 00:25:42,010
Jet Propulsion Laboratory in Institue

650
00:25:45,750 --> 00:25:43,900
instrumental laboratory instrument

651
00:25:48,390 --> 00:25:45,760
laboratory which we call its low for

652
00:25:50,580 --> 00:25:48,400
short this is a space where for many

653
00:25:52,740 --> 00:25:50,590
years now engineers like myself have

654
00:25:54,750 --> 00:25:52,750
been practicing and preparing to do the

655
00:25:56,550 --> 00:25:54,760
instrument deployment with our testbed

656
00:26:00,450 --> 00:25:56,560
so that's what you see right here behind

657
00:26:01,860 --> 00:26:00,460
me this is the deployment testbed it is

658
00:26:03,390 --> 00:26:01,870
like a stunt double it's kind of

659
00:26:05,760 --> 00:26:03,400
contains a lot of the similar hardware

660
00:26:07,110 --> 00:26:05,770
to the flight Lander so you know the

661
00:26:10,560 --> 00:26:07,120
flight one is on its way to Mars right

662
00:26:11,790 --> 00:26:10,570
now this one has the instrument

663
00:26:14,430 --> 00:26:11,800

deployment arm which you can see right

664
00:26:16,950 --> 00:26:14,440
here as well as a sandbox area that

665
00:26:20,640 --> 00:26:16,960
allows us to practice deploying models

666
00:26:22,560 --> 00:26:20,650
of the instruments cool so once we

667
00:26:24,360 --> 00:26:22,570
actually land on Mars can you tell us

668
00:26:26,070 --> 00:26:24,370
about what you you and your team are

669
00:26:30,600 --> 00:26:26,080
gonna do to actually get ready to put

670
00:26:33,240 --> 00:26:30,610
our instruments on the ground yeah sure

671
00:26:35,970 --> 00:26:33,250
that's a great question so within the

672
00:26:39,030 --> 00:26:35,980
first week or so on Mars we're going to

673
00:26:39,980 --> 00:26:39,040
be taking images with the two cameras

674
00:26:41,570 --> 00:26:39,990
that we have

675
00:26:44,930 --> 00:26:41,580
I'll actually take a moment to point

676
00:26:47,960 --> 00:26:44,940
those out now so we've got two cameras

677
00:26:52,669 --> 00:26:47,970
one here is on the robotic arm this is

678
00:26:54,440 --> 00:26:52,679
the instrument deployment camera and the

679
00:26:55,880 --> 00:26:54,450
second camera is the instrument context

680
00:26:59,120 --> 00:26:55,890
camera which will take the first image

681
00:27:03,620 --> 00:26:59,130
that we see of the insights landing spot

682
00:27:06,140 --> 00:27:03,630
after insight lands so once we have the

683
00:27:08,930 --> 00:27:06,150
detailed images from the camera that's

684
00:27:10,850 --> 00:27:08,940
on the arm of the entire workspace

685
00:27:12,110 --> 00:27:10,860
that's that work area right here in

686
00:27:14,240 --> 00:27:12,120
front of the lander that's reachable

687
00:27:16,700 --> 00:27:14,250
with the robotic arm the engineers and

688
00:27:18,500 --> 00:27:16,710

scientists will evaluate the data and

689
00:27:20,390 --> 00:27:18,510
find kind of the second landing site for

690
00:27:22,280 --> 00:27:20,400
the instruments which is the place that

691
00:27:24,860 --> 00:27:22,290
we're going to deploy them with the

692
00:27:27,049 --> 00:27:24,870
robotic arm in parallel right here in

693
00:27:28,580 --> 00:27:27,059
it's all in the testbed we're going to

694
00:27:30,440 --> 00:27:28,590
also do what we've been calling Mars

695
00:27:34,400 --> 00:27:30,450
forming which is we're gonna create this

696
00:27:38,570 --> 00:27:34,410
work area to look like the surface we

697
00:27:40,310 --> 00:27:38,580
see on Mars so we've got our shovels and

698
00:27:42,440 --> 00:27:40,320
our rakes and some some rocks all

699
00:27:44,720 --> 00:27:42,450
prepared to kind of Mars form and make

700
00:27:46,549 --> 00:27:44,730
this this sandbox look like the surface

701
00:27:50,270 --> 00:27:46,559
of Mars let me see and do a final

702
00:27:51,799 --> 00:27:50,280
deployment test of the instruments Oh so

703
00:27:53,720 --> 00:27:51,809
I hope you don't have to pull out any of

704
00:27:57,049 --> 00:27:53,730
the really big heavy rocks to put out

705
00:27:58,970 --> 00:27:57,059
there but um so maybe could you show us

706
00:28:03,830 --> 00:27:58,980
a little bit more of what you have set

707
00:28:06,770 --> 00:28:03,840
up in the lab today yeah sure

708
00:28:08,630 --> 00:28:06,780
so as you just showed the video of the

709
00:28:10,130 --> 00:28:08,640
seismometer being deployed I'll show you

710
00:28:13,549 --> 00:28:10,140
that that's the configuration that

711
00:28:15,410 --> 00:28:13,559
things are in right now so we have here

712
00:28:17,210 --> 00:28:15,420
actually the wind and thermal shield

713
00:28:20,630 --> 00:28:17,220

that will be deployed on top of the

714
00:28:22,460 --> 00:28:20,640
seismometer so I'll lift this up what

715
00:28:25,100 --> 00:28:22,470
this does is it keeps the seismometer

716
00:28:28,640 --> 00:28:25,110
from getting too cold at night it also

717
00:28:33,420 --> 00:28:28,650
protects it from the wind

718
00:28:35,370 --> 00:28:33,430
like they're supposed to pull the the

719
00:28:39,180 --> 00:28:35,380
wind measurements that could affect the

720
00:28:41,270 --> 00:28:39,190
seismic data so this is the seismometer

721
00:28:43,710 --> 00:28:41,280
itself continuing the six and

722
00:28:46,950 --> 00:28:43,720
seismometers or sensors that you talked

723
00:28:49,380 --> 00:28:46,960
about earlier and it's tethered here

724
00:28:51,570 --> 00:28:49,390
with cabling so we call this the tether

725
00:28:54,120 --> 00:28:51,580
it's cabling that connects the

726
00:28:56,100 --> 00:28:54,130
seismometer to the lander which allows

727
00:28:57,840 --> 00:28:56,110
the lander to provide power to the

728
00:29:01,620 --> 00:28:57,850
seismometer and allows the seismometer

729
00:29:03,500 --> 00:29:01,630
to send data back to the lander so the

730
00:29:06,180 --> 00:29:03,510
other instrument the heat flow probe is

731
00:29:07,740 --> 00:29:06,190
still up here on the deck this is where

732
00:29:09,780 --> 00:29:07,750
it will be when it land before it's

733
00:29:14,310 --> 00:29:09,790
deployed so you can see it back here

734
00:29:16,320 --> 00:29:14,320
here's the heat flow probe HP cubed okay

735
00:29:18,690 --> 00:29:16,330
and then yeah I've already pointed out

736
00:29:21,870 --> 00:29:18,700
again the two cameras that are right

737
00:29:23,910 --> 00:29:21,880
here and this is the grapple that we

738
00:29:26,250 --> 00:29:23,920

have at the end of the robotic arm this

739
00:29:27,780 --> 00:29:26,260
has got five fingers and which connect

740
00:29:29,130 --> 00:29:27,790
to a hook on top of each of the

741
00:29:33,000 --> 00:29:29,140
instruments and that's what enables us

742
00:29:41,510 --> 00:29:33,010
to play them with the robotic arm all

743
00:29:49,260 --> 00:29:47,190
all right so I can't wait to see the I

744
00:29:51,540 --> 00:29:49,270
can't wait to see the images of the

745
00:29:53,550 --> 00:29:51,550
surface of Mars and to let Jamie and her

746
00:29:55,770 --> 00:29:53,560
team get into action so thank you so

747
00:30:01,930 --> 00:29:55,780
much and back to you join let's give I

748
00:30:06,890 --> 00:30:04,610
see not only can we go to Mars but we

749
00:30:09,620 --> 00:30:06,900
can give a high-five 3,000 miles away so

750
00:30:11,270 --> 00:30:09,630
we like to have fun scientists now we're

751
00:30:13,700 --> 00:30:11,280
going to transition into our Q&A but I

752
00:30:15,260 --> 00:30:13,710
gotta ask because I believe folks you

753
00:30:17,360 --> 00:30:15,270
know it looks like our young scientist

754
00:30:19,400 --> 00:30:17,370
was was tethered also what does that

755
00:30:23,650 --> 00:30:19,410
mean that she's tethered to the lander

756
00:30:26,840 --> 00:30:23,660
there we're gonna let her answer yeah

757
00:30:29,510 --> 00:30:26,850
yeah okay so I think you're talking

758
00:30:31,820 --> 00:30:29,520
about this tether right here which is a

759
00:30:34,100 --> 00:30:31,830
bracelet but I've got to wear in contact

760
00:30:36,620 --> 00:30:34,110
to my skin and connects me here to the

761
00:30:38,690 --> 00:30:36,630
lander so I think that we've all kind of

762
00:30:42,170 --> 00:30:38,700
felt like if we slide down a slide of

763
00:30:43,820 --> 00:30:42,180

the playground or away go get across

764
00:30:44,990 --> 00:30:43,830
walk across a carpet and touch a light

765
00:30:49,310 --> 00:30:45,000
switch or something there's a little

766
00:30:51,140 --> 00:30:49,320
sparkle discharge of that charge it

767
00:30:53,180 --> 00:30:51,150
builds up and in those types of

768
00:30:54,620 --> 00:30:53,190
environments well we don't ever want

769
00:30:56,390 --> 00:30:54,630
that to happen here with the hardware

770
00:30:58,760 --> 00:30:56,400
because that could damage the hardware

771
00:30:59,900 --> 00:30:58,770
and so this smock as well as this wrist

772
00:31:01,540 --> 00:30:59,910
strap kind of prevents that from

773
00:31:05,000 --> 00:31:01,550
happening

774
00:31:06,590 --> 00:31:05,010
okay thank you okay so here's what we're

775
00:31:09,530 --> 00:31:06,600
gonna do we're gonna transition here

776
00:31:10,880 --> 00:31:09,540
starting with questions in Washington

777
00:31:12,200 --> 00:31:10,890
then we're gonna go to the phone lines

778
00:31:14,570 --> 00:31:12,210
and then of course we're gonna go to

779
00:31:16,670 --> 00:31:14,580
social media send those questions in

780
00:31:21,320 --> 00:31:16,680
there's a lot of excitement on social

781
00:31:23,960 --> 00:31:21,330
media hashtag ask NASA shout out we have

782
00:31:25,040 --> 00:31:23,970
students here from local University and

783
00:31:28,780 --> 00:31:25,050
we're gonna give them an opportunity

784
00:31:31,400 --> 00:31:28,790
there they have their laptops and in

785
00:31:32,960 --> 00:31:31,410
covering the story so we're gonna give

786
00:31:34,310 --> 00:31:32,970
you a chance to ask a question and we

787
00:31:39,320 --> 00:31:34,320
were talking your viewers raise your

788
00:31:40,970 --> 00:31:39,330

hand wait for the microphone and here we

789
00:31:41,420 --> 00:31:40,980
got we've got somebody behind it let's

790
00:31:43,310 --> 00:31:41,430
do that

791
00:31:45,350 --> 00:31:43,320
wait for the microphone please give you

792
00:31:47,210 --> 00:31:45,360
a name and affiliation if you can and

793
00:31:48,950 --> 00:31:47,220
then we'll take a few questions here

794
00:31:50,330 --> 00:31:48,960
stand up and then we'll go to the phone

795
00:31:51,860 --> 00:31:50,340
lines and then social media with you

796
00:31:55,190 --> 00:31:51,870
ready yes sir our name and affiliation

797
00:31:57,140 --> 00:31:55,200
Ivan Curran of agile france-presse do

798
00:32:00,080 --> 00:31:57,150
you know if there could be a dust storm

799
00:32:02,660 --> 00:32:00,090
or strong winds and how much would it

800
00:32:04,850 --> 00:32:02,670
affect the descent and can you postpone

801
00:32:07,790 --> 00:32:04,860
the landing if anything happens I'll

802
00:32:12,020 --> 00:32:07,800
answer that question we're going to land

803
00:32:14,750 --> 00:32:12,030
on November 26th at about 1147 Pacific

804
00:32:16,460 --> 00:32:14,760
time regardless of anything that is

805
00:32:18,950 --> 00:32:16,470
we're on a ballistic entry and we can't

806
00:32:20,930 --> 00:32:18,960
change it we can't make any changes we

807
00:32:22,580 --> 00:32:20,940
can't go back around again so we're

808
00:32:24,380 --> 00:32:22,590
gonna we know we're gonna land there but

809
00:32:25,970 --> 00:32:24,390
what we did know from the very beginning

810
00:32:27,560 --> 00:32:25,980
in the outset of this project that we

811
00:32:29,630 --> 00:32:27,570
were landing during what is considered

812
00:32:31,610 --> 00:32:29,640
global dust storm season on Mars so we

813
00:32:33,470 --> 00:32:31,620

knew that was a possibility and so we've

814
00:32:35,240 --> 00:32:33,480
actually designed our entry descent and

815
00:32:38,570 --> 00:32:35,250
landing system to accommodate for that

816
00:32:40,730 --> 00:32:38,580
so we've increased this thickness of our

817
00:32:43,610 --> 00:32:40,740
thermal protection system the parts that

818
00:32:45,350 --> 00:32:43,620
you saw getting very hot in the video so

819
00:32:47,060 --> 00:32:45,360
we've we've taken in and do it that into

820
00:32:48,890 --> 00:32:47,070
account and we'll be looking as we get

821
00:32:50,630 --> 00:32:48,900
closer to Mars we actually have Mars

822
00:32:52,640 --> 00:32:50,640
weather men which I hope are better than

823
00:32:54,950 --> 00:32:52,650
earth wet weather men but they're gonna

824
00:32:57,500 --> 00:32:54,960
be trying to predict what what it looks

825
00:32:59,330 --> 00:32:57,510
like on Mars on the day that we're gonna

826
00:33:03,070 --> 00:32:59,340
land and we'll make fine-tuning

827
00:33:05,570 --> 00:33:05,060
please stand up name and filiation

828
00:33:07,730 --> 00:33:05,580
please

829
00:33:09,320 --> 00:33:07,740
afternoon this is Tom Ryan with

830
00:33:11,840 --> 00:33:09,330
aerospace America thanks again I'm

831
00:33:14,540 --> 00:33:11,850
excited about the landing when it does

832
00:33:16,580 --> 00:33:14,550
arrive on the 26th what kind of images

833
00:33:17,540 --> 00:33:16,590
will people be able to see first I know

834
00:33:19,190 --> 00:33:17,550
it's gonna take a while to get

835
00:33:21,080 --> 00:33:19,200
everything going but will there be a

836
00:33:23,540 --> 00:33:21,090
live stream when you're on the surface

837
00:33:24,740 --> 00:33:23,550
so they'll be photos from orbit and you

838
00:33:26,990 --> 00:33:24,750

said there'll be one when you get on the

839
00:33:29,510 --> 00:33:27,000
surface but would there be anything from

840
00:33:32,660 --> 00:33:29,520
orbit or any what will people be able to

841
00:33:34,970 --> 00:33:32,670
see first the first couple days that the

842
00:33:36,740 --> 00:33:34,980
landing happens yeah so the very first

843
00:33:38,990 --> 00:33:36,750
image that we're going to get back might

844
00:33:41,240 --> 00:33:39,000
be very cloudy and and not particularly

845
00:33:43,190 --> 00:33:41,250
good because we're gonna take it right

846
00:33:46,000 --> 00:33:43,200
after we land and remember we saw that

847
00:33:48,440 --> 00:33:46,010
dust being kicked up will be from the

848
00:33:50,150 --> 00:33:48,450
under deck camera that that Jamie

849
00:33:52,100 --> 00:33:50,160
pointed out that gives us a fish

850
00:33:54,080 --> 00:33:52,110
view of the entire landing space if

851
00:33:55,970 --> 00:33:54,090
we're lucky we might get a good picture

852
00:33:58,280 --> 00:33:55,980
but it's likely because the cover will

853
00:34:00,650 --> 00:33:58,290
still be on that'll be a little bit hazy

854
00:34:03,170 --> 00:34:00,660
we're gonna throw the cover off later

855
00:34:05,060 --> 00:34:03,180
and take some pictures on the next day

856
00:34:06,260 --> 00:34:05,070
that hopefully we'll get back but we

857
00:34:07,880 --> 00:34:06,270
have to kind of wait for all that

858
00:34:10,700 --> 00:34:07,890
literally for the desk to settle before

859
00:34:12,140 --> 00:34:10,710
we start taking a bunch of pictures and

860
00:34:13,760 --> 00:34:12,150
then we want to make sure that we're

861
00:34:14,990 --> 00:34:13,770
really in a good power state which is

862
00:34:16,760 --> 00:34:15,000
going to take us about another day

863
00:34:18,909 --> 00:34:16,770

before we start doing a bunch of imaging

864
00:34:21,409 --> 00:34:18,919
but because we're a stationary Lander

865
00:34:23,150 --> 00:34:21,419
once we start taking images we're not

866
00:34:24,850 --> 00:34:23,160
going to be you know every day a new

867
00:34:27,440 --> 00:34:24,860
image it's going to be kind of the same

868
00:34:29,030 --> 00:34:27,450
image because we're in the same area for

869
00:34:33,980 --> 00:34:29,040
the duration which is what we need for

870
00:34:35,810 --> 00:34:33,990
the science reading no no we're gonna

871
00:34:38,260 --> 00:34:35,820
ream it-- we might try the question is

872
00:34:40,850 --> 00:34:38,270
are we gonna get any shots in on-orbit

873
00:34:43,850 --> 00:34:40,860
we will make an attempt as we've done in

874
00:34:46,930 --> 00:34:43,860
the past to get a picture of us on the

875
00:34:49,190 --> 00:34:46,940
parachute but that's always a very dicey

876
00:34:50,720 --> 00:34:49,200
chance we've been very lucky in the past

877
00:34:52,310 --> 00:34:50,730
of getting those but we'll have to see

878
00:34:54,380 --> 00:34:52,320
if that works out again from Mars

879
00:34:56,000 --> 00:34:54,390
Reconnaissance Orbiter but we don't have

880
00:34:59,810 --> 00:34:56,010
any descent imaging on the spacecraft

881
00:35:02,450 --> 00:34:59,820
itself okay thank you so we're gonna

882
00:35:52,340 --> 00:35:02,460
we're gonna come back we're gonna go to

883
00:35:55,150 --> 00:35:52,350
the phone lines next we have a great

884
00:35:58,340 --> 00:35:55,160
question we're taking advantage of

885
00:36:00,680 --> 00:35:58,350
several programs around the world called

886
00:36:02,870 --> 00:36:00,690
in the United States called seismometers

887
00:36:03,920 --> 00:36:02,880
in the schools in in France it's

888
00:36:07,280 --> 00:36:03,930

seasonal

889
00:36:08,540 --> 00:36:07,290
ah Nicole and and similar programs in in

890
00:36:11,240 --> 00:36:08,550
Germany and Switzerland which are

891
00:36:12,740 --> 00:36:11,250
actually set up for looking at

892
00:36:17,540 --> 00:36:12,750
terrestrial you know earth-based

893
00:36:21,110 --> 00:36:17,550
earthquakes and showing students you

894
00:36:23,390 --> 00:36:21,120
know how how earthquakes are sensed with

895
00:36:26,180 --> 00:36:23,400
it with the seismometers and what kinds

896
00:36:27,830 --> 00:36:26,190
of analysis you can do and we're

897
00:36:30,110 --> 00:36:27,840
plugging into that program and we're

898
00:36:33,380 --> 00:36:30,120
going to be supplying the seismic data

899
00:36:35,240 --> 00:36:33,390
coming down from from Mars directly to

900
00:36:37,640 --> 00:36:35,250
those those programs in the schools

901
00:36:38,750 --> 00:36:37,650
around the world and in some cases I

902
00:36:40,310 --> 00:36:38,760
think the students might actually be

903
00:36:44,090 --> 00:36:40,320
getting the data before scientists do

904
00:36:46,190 --> 00:36:44,100
and and and we've they've told us they

905
00:36:49,070 --> 00:36:46,200
promise not to publish before we do but

906
00:36:50,330 --> 00:36:49,080
so they'll be getting Mars data they'll

907
00:36:52,550 --> 00:36:50,340
be able to you know put it next to the

908
00:36:55,340 --> 00:36:52,560
Earth data they'll be able to you know

909
00:36:57,590 --> 00:36:55,350
analyze the the arrival times and things

910
00:36:59,840 --> 00:36:57,600
like that of the marsquakes just like

911
00:37:02,390 --> 00:36:59,850
the scientists on the teams are going to

912
00:37:03,890 --> 00:37:02,400
be doing and so we have a lot of a lot

913
00:37:05,210 --> 00:37:03,900

of excitement around that and I think

914
00:37:07,580 --> 00:37:05,220
there's there's a lot of students that

915
00:37:10,400 --> 00:37:07,590
are really really raring to go on that

916
00:37:11,780 --> 00:37:10,410
on that program okay we're gonna take

917
00:37:13,550 --> 00:37:11,790
one more question from the phone and

918
00:37:14,930 --> 00:37:13,560
then we're gonna go to social media

919
00:37:17,900 --> 00:37:14,940
again send them to your questions

920
00:37:22,730 --> 00:37:17,910
hashtag ask NASA I believe we have space

921
00:37:24,680 --> 00:37:22,740
comm on the phone hi this is Sarah Lewis

922
00:37:26,600 --> 00:37:24,690
from space comm

923
00:37:28,340 --> 00:37:26,610
I was curious which of insights early

924
00:37:33,410 --> 00:37:28,350
operations after landing will make you

925
00:37:35,690 --> 00:37:33,420
the most nervous at the papinek yeah

926
00:37:38,150 --> 00:37:35,700
well after after landing I'm gonna be

927
00:37:40,700 --> 00:37:38,160
very very happy after we get a safe

928
00:37:42,530 --> 00:37:40,710
landing but really I'm gonna be nervous

929
00:37:45,560 --> 00:37:42,540
until we get that first really good

930
00:37:47,390 --> 00:37:45,570
image back of what our work space the

931
00:37:48,740 --> 00:37:47,400
area in front of the lander is going to

932
00:37:51,020 --> 00:37:48,750
show us we're hoping that it's really

933
00:37:53,630 --> 00:37:51,030
flat literally a parking lot is what

934
00:37:55,580 --> 00:37:53,640
we're wanting but if there's rocks in

935
00:37:57,530 --> 00:37:55,590
there and there's slopes in there then

936
00:38:00,080 --> 00:37:57,540
Jamie and the rest of the ployment team

937
00:38:02,240 --> 00:38:00,090
is really going to have a job in front

938
00:38:04,160 --> 00:38:02,250

of them luckily our lander what there's

939
00:38:06,320 --> 00:38:04,170
nothing that's real-time critical for us

940
00:38:09,740 --> 00:38:06,330
to get stuff done right away after we

941
00:38:10,910 --> 00:38:09,750
land but if we do encounter a difficult

942
00:38:12,290 --> 00:38:10,920
work space it's going to take us a

943
00:38:14,240 --> 00:38:12,300
little bit longer than we would like to

944
00:38:16,250 --> 00:38:14,250
finish that deployment operation and

945
00:38:20,250 --> 00:38:16,260
Jamie will be much busier than she would

946
00:38:27,010 --> 00:38:24,250
okay now we go from the phone lines into

947
00:38:28,630 --> 00:38:27,020
social media and I want to welcome to

948
00:38:29,980 --> 00:38:28,640
our social media team and helping out

949
00:38:32,920 --> 00:38:29,990
today Joanna Wynn Dale

950
00:38:33,790 --> 00:38:32,930
Joanna social media is abuzz right we've

951
00:38:36,960 --> 00:38:33,800
got some questions

952
00:38:39,790 --> 00:38:36,970
oh yeah there's tons of questions so

953
00:38:43,089 --> 00:38:39,800
let's see first one from Andrew on

954
00:38:45,730 --> 00:38:43,099
YouTube asks can insight detect impacts

955
00:38:48,220 --> 00:38:45,740
and landslides what other science will

956
00:38:53,050 --> 00:38:48,230
insight give us besides corn mantle

957
00:38:56,109 --> 00:38:53,060
activity we'll be able to say we'll be

958
00:38:58,530 --> 00:38:56,119
able to do to see Mars quakes will be

959
00:39:02,230 --> 00:38:58,540
able to see impacts with a seismometer

960
00:39:03,910 --> 00:39:02,240
we're pretty far away from any you know

961
00:39:05,920 --> 00:39:03,920
mountains or cliffs that we probably

962
00:39:07,690 --> 00:39:05,930
won't be able to see landslides all

963
00:39:10,120 --> 00:39:07,700

those seismically you can see landslides

964
00:39:13,420 --> 00:39:10,130
it's possible that we could actually see

965
00:39:17,830 --> 00:39:13,430
some vibrational activity quake activity

966
00:39:20,740 --> 00:39:17,840
from looking at the the motion of magma

967
00:39:23,530 --> 00:39:20,750
in the crust from from active active

968
00:39:25,870 --> 00:39:23,540
volcanic activity as well as doing the

969
00:39:28,570 --> 00:39:25,880
seismic measurements we're measuring the

970
00:39:30,460 --> 00:39:28,580
heat flow from the planet seeing how how

971
00:39:32,650 --> 00:39:30,470
much energy is coming up from deep in

972
00:39:35,859 --> 00:39:32,660
the planet which is sort of the driving

973
00:39:38,680 --> 00:39:35,869
force behind most geologic activity on a

974
00:39:40,870 --> 00:39:38,690
planet and and then we also have a very

975
00:39:43,120 --> 00:39:40,880
capable weather station on an insight

976
00:39:44,680 --> 00:39:43,130
we're measuring the pressure the

977
00:39:46,870 --> 00:39:44,690
barometric pressure were measuring a

978
00:39:48,040 --> 00:39:46,880
winds we're measuring the atmospheric

979
00:39:49,839 --> 00:39:48,050
temperature and were measuring actually

980
00:39:52,240 --> 00:39:49,849
the the the ground temperature on a

981
00:39:55,960 --> 00:39:52,250
continuous basis around the clock and so

982
00:39:58,060 --> 00:39:55,970
we'll have the the best weather record

983
00:40:01,000 --> 00:39:58,070
of any place on Mars when we're done

984
00:40:03,280 --> 00:40:01,010
done with this mission and we've I think

985
00:40:04,420 --> 00:40:03,290
we're still you know still thinking

986
00:40:05,770 --> 00:40:04,430
about all the different things that we

987
00:40:08,320 --> 00:40:05,780
can do with the instance we have and

988
00:40:10,270 --> 00:40:08,330

once we get on Mars I will think of even

989
00:40:12,700 --> 00:40:10,280
more things because this is an extremely

990
00:40:15,849 --> 00:40:12,710
capable extremely flexible payload that

991
00:40:19,480 --> 00:40:15,859
we're sending to Mars great so a

992
00:40:21,220 --> 00:40:19,490
question from Facebook how can you

993
00:40:23,109 --> 00:40:21,230
figure out the interior of Mars with

994
00:40:27,430 --> 00:40:23,119
only one seismometer I thought it

995
00:40:30,190 --> 00:40:27,440
requires at least two that that's a

996
00:40:32,380 --> 00:40:30,200
great question it's a question that

997
00:40:35,079 --> 00:40:32,390
I've been asking myself and people have

998
00:40:38,019 --> 00:40:35,089
been asking me for decades and of course

999
00:40:40,420 --> 00:40:38,029
on the earth you usually like to have at

1000
00:40:43,029 --> 00:40:40,430
least three or four seismometers so you

1001
00:40:44,799 --> 00:40:43,039
can triangulate on the on the on the

1002
00:40:46,690 --> 00:40:44,809
earthquake and figure out you know how

1003
00:40:48,279 --> 00:40:46,700
far away it is once you know how far

1004
00:40:49,900 --> 00:40:48,289
away it is you know how long it took you

1005
00:40:52,059 --> 00:40:49,910
to get there then you know what the

1006
00:40:54,069 --> 00:40:52,069
velocity is the velocity of the of the

1007
00:40:55,359 --> 00:40:54,079
waves the speed at which it goes depends

1008
00:40:57,069 --> 00:40:55,369
on the material and so that's where you

1009
00:40:59,200 --> 00:40:57,079
start getting all the science out of it

1010
00:41:00,490 --> 00:40:59,210
if you only have one station you have to

1011
00:41:03,579 --> 00:41:00,500
get a little bit more clever and

1012
00:41:05,799 --> 00:41:03,589
actually going back to some of the the

1013
00:41:08,529 --> 00:41:05,809

the technology and techniques that were

1014
00:41:09,970 --> 00:41:08,539
used around the turn of the twentieth

1015
00:41:13,029 --> 00:41:09,980
century you know a hundred years ago

1016
00:41:16,420 --> 00:41:13,039
when the first seismology was was being

1017
00:41:18,400 --> 00:41:16,430
developed in the early 1900's and you

1018
00:41:20,529 --> 00:41:18,410
can actually find out figure out how far

1019
00:41:22,299 --> 00:41:20,539
away it is from from a couple of

1020
00:41:25,660 --> 00:41:22,309
different methods usually by the spacing

1021
00:41:27,910 --> 00:41:25,670
of different wave arrivals you have P

1022
00:41:29,200 --> 00:41:27,920
ways s ways surface ways by putting

1023
00:41:31,120 --> 00:41:29,210
those things together you can figure out

1024
00:41:33,220 --> 00:41:31,130
how far away it is and we're able to use

1025
00:41:36,069 --> 00:41:33,230
something called polarimetry looking at

1026
00:41:38,289 --> 00:41:36,079
the actual direction that the waves are

1027
00:41:40,509 --> 00:41:38,299
vibrating we can actually I'll use that

1028
00:41:42,910 --> 00:41:40,519
to trace back to the direction and

1029
00:41:44,890 --> 00:41:42,920
figure out where those where the Mars

1030
00:41:46,809 --> 00:41:44,900
quake occurred and and we've been

1031
00:41:49,630 --> 00:41:46,819
simulating that with with earth data

1032
00:41:51,460 --> 00:41:49,640
with with single seismometers on the

1033
00:41:53,829 --> 00:41:51,470
earth pretending like we don't have that

1034
00:41:55,539 --> 00:41:53,839
information and we've been able to show

1035
00:41:57,759 --> 00:41:55,549
that these techniques are working really

1036
00:42:00,279 --> 00:41:57,769
well and you get us those locations and

1037
00:42:03,490 --> 00:42:00,289
get us those seismic velocities and

1038
00:42:08,049 --> 00:42:03,500

timings at an accuracy that's good

1039
00:42:09,640 --> 00:42:08,059
enough to make the the measurements and

1040
00:42:12,309 --> 00:42:09,650
the determinations we want to make in

1041
00:42:15,309 --> 00:42:12,319
terms of the compositions and and and

1042
00:42:19,870 --> 00:42:15,319
depths alright I've got one more

1043
00:42:23,140 --> 00:42:19,880
question from Facebook hey scientists

1044
00:42:25,380 --> 00:42:23,150
what if there are no Mars quakes what

1045
00:42:31,180 --> 00:42:25,390
happens then why don't you take that one

1046
00:42:32,859 --> 00:42:31,190
okay well we we as Bruce was talking

1047
00:42:34,569 --> 00:42:32,869
about we do have other instruments we

1048
00:42:36,759 --> 00:42:34,579
are certainly gonna learn about the heat

1049
00:42:38,620 --> 00:42:36,769
flow coming out of the interior and we

1050
00:42:40,900 --> 00:42:38,630
actually still are able to measure the

1051
00:42:42,360 --> 00:42:40,910
size of the core because one of the

1052
00:42:46,320 --> 00:42:42,370
experiments we didn't

1053
00:42:49,760 --> 00:42:46,330
time to talk about today is called the

1054
00:42:53,190 --> 00:42:49,770
rise experiment and what it does is use

1055
00:42:57,210 --> 00:42:53,200
two small low-gain antennas on either

1056
00:42:59,520 --> 00:42:57,220
side of the lander and that what we do

1057
00:43:02,280 --> 00:42:59,530
is track the position of a lander very

1058
00:43:04,470 --> 00:43:02,290
precisely over the course of a Mars here

1059
00:43:06,450 --> 00:43:04,480
and of course what we're really doing is

1060
00:43:09,180 --> 00:43:06,460
not tracking the position of the lander

1061
00:43:11,990 --> 00:43:09,190
which is not going anywhere but we are

1062
00:43:14,880 --> 00:43:12,000
we are monitoring the wobble of Mars and

1063
00:43:19,470 --> 00:43:14,890

you know the classic example is if you

1064
00:43:21,150 --> 00:43:19,480
take a hard-boiled egg and a raw egg put

1065
00:43:23,010 --> 00:43:21,160
them on a table and you spin them they

1066
00:43:27,300 --> 00:43:23,020
wobble differently right and so

1067
00:43:29,700 --> 00:43:27,310
basically by using the very minor very

1068
00:43:31,350 --> 00:43:29,710
very small wobble of Mars as it goes

1069
00:43:32,910 --> 00:43:31,360
around and it's on its axis and goes

1070
00:43:35,760 --> 00:43:32,920
around and it's orbit we're actually

1071
00:43:37,860 --> 00:43:35,770
able to derive both the size of the core

1072
00:43:41,880 --> 00:43:37,870
from that information as well as whether

1073
00:43:43,290 --> 00:43:41,890
it's liquid or or solid so we get that

1074
00:43:45,060 --> 00:43:43,300
information about the core we get

1075
00:43:47,850 --> 00:43:45,070
information about heat flow and if we

1076
00:43:49,800 --> 00:43:47,860
you know and and further it's extremely

1077
00:43:52,020 --> 00:43:49,810
unlikely they will see no Mars quakes

1078
00:43:54,720 --> 00:43:52,030
because you know we know the rate of

1079
00:43:57,450 --> 00:43:54,730
impacts hitting the surface of Mars so

1080
00:43:59,610 --> 00:43:57,460
you know we have calculated how many we

1081
00:44:01,620 --> 00:43:59,620
expect to hit that we can detect so

1082
00:44:04,050 --> 00:44:01,630
that's a you know pretty much an assured

1083
00:44:08,100 --> 00:44:04,060
source and you know we do certainly

1084
00:44:10,170 --> 00:44:08,110
expect Mars quake so we'll get we expect

1085
00:44:13,440 --> 00:44:10,180
to get them but we get some science as

1086
00:44:15,360 --> 00:44:13,450
well even if there are none okay before

1087
00:44:18,090 --> 00:44:15,370
we come back here we're gonna send out a

1088
00:44:21,720 --> 00:44:18,100

question to JPL actually it's a couple

1089
00:44:23,880 --> 00:44:21,730
of questions the first is what is the

1090
00:44:28,410 --> 00:44:23,890
team doing now what we will be doing

1091
00:44:31,290 --> 00:44:28,420
leading up to landing and the primary

1092
00:44:32,580 --> 00:44:31,300
mission can you explain how that's going

1093
00:44:37,560 --> 00:44:32,590
to work how long with that primary

1094
00:44:43,230 --> 00:44:41,220
okay so let's see what we're doing right

1095
00:44:44,790 --> 00:44:43,240
now so for the service team the team

1096
00:44:46,860 --> 00:44:44,800
that works on the deployment like myself

1097
00:44:48,960 --> 00:44:46,870
it's actually we've finished all the

1098
00:44:51,450 --> 00:44:48,970
testing that we have to do before

1099
00:44:52,890 --> 00:44:51,460
landing and now we're starting to plan

1100
00:44:54,180 --> 00:44:52,900
the first few Sol's

1101
00:44:56,070 --> 00:44:54,190
that we're going to have on Mars a

1102
00:44:57,570 --> 00:44:56,080
really detailed way so we're climbing

1103
00:44:59,820 --> 00:44:57,580
those initial Sol's and making sure

1104
00:45:01,740 --> 00:44:59,830
everything is completely ready to go on

1105
00:45:03,270 --> 00:45:01,750
those activities that we're gonna do the

1106
00:45:06,240 --> 00:45:03,280
first few stalls like on stowing the

1107
00:45:08,700 --> 00:45:06,250
robotic arm acquiring the the images of

1108
00:45:10,320 --> 00:45:08,710
the workspace that type of thing so

1109
00:45:12,840 --> 00:45:10,330
that's what we're doing right now on the

1110
00:45:16,170 --> 00:45:12,850
the surface team of course the crews and

1111
00:45:19,140 --> 00:45:16,180
EDL team are preparing for the landing

1112
00:45:22,080 --> 00:45:19,150
as as you know we had our last final

1113
00:45:24,240 --> 00:45:22,090

rehearsal of that last week so then I

1114
00:45:26,310 --> 00:45:24,250
think the question is is about the prime

1115
00:45:28,680 --> 00:45:26,320
mission and I'm not sure if that was

1116
00:45:30,660 --> 00:45:28,690
about actually deployment or the entire

1117
00:45:32,280 --> 00:45:30,670
I'm two years of the science monitoring

1118
00:45:34,680 --> 00:45:32,290
so I'll talk a little bit about

1119
00:45:37,260 --> 00:45:34,690
deployment and then I might ask Bruce to

1120
00:45:38,630 --> 00:45:37,270
talk about the science monitoring part

1121
00:45:41,640 --> 00:45:38,640
of if that's what the question was about

1122
00:45:43,380 --> 00:45:41,650
so the deployment phase will take two to

1123
00:45:45,630 --> 00:45:43,390
three months which I think sue touched

1124
00:45:47,970 --> 00:45:45,640
on a little bit so it's gonna take us a

1125
00:45:49,710 --> 00:45:47,980
couple weeks to acquire the images and

1126
00:45:51,180 --> 00:45:49,720
detail of the workspace and do the

1127
00:45:52,920 --> 00:45:51,190
testing and get ready to deploy the

1128
00:45:55,350 --> 00:45:52,930
seismometer once we deploy the

1129
00:45:56,760 --> 00:45:55,360
seismometer it's got some activities

1130
00:45:59,690 --> 00:45:56,770
that it needs to do it's got a level

1131
00:46:03,450 --> 00:45:59,700
itself a tree centers the sensors and

1132
00:46:05,100 --> 00:46:03,460
inside the sensor assembly so it can get

1133
00:46:06,630 --> 00:46:05,110
good seismic data we've got to release

1134
00:46:09,270 --> 00:46:06,640
more tether out of the tether box

1135
00:46:11,310 --> 00:46:09,280
there's there's a lot of activities in

1136
00:46:13,050 --> 00:46:11,320
there with the ground the operations

1137
00:46:14,880 --> 00:46:13,060
team checking in kind of along the way

1138
00:46:16,260 --> 00:46:14,890

every day because we're only gonna do

1139
00:46:18,360 --> 00:46:16,270
this deployment once inside we want to

1140
00:46:21,210 --> 00:46:18,370
do it correctly then we'll deploy the

1141
00:46:24,690 --> 00:46:21,220
wind and thermal shield that maybe after

1142
00:46:26,940 --> 00:46:24,700
maybe one to two months after we've been

1143
00:46:29,130 --> 00:46:26,950
on Mars and then the heat flow probe

1144
00:46:30,510 --> 00:46:29,140
will de be deployed next and then we'll

1145
00:46:32,370 --> 00:46:30,520
release the mole and that's the end of

1146
00:46:34,260 --> 00:46:32,380
the instrument deployment phase and then

1147
00:46:36,210 --> 00:46:34,270
it's ready for the science team to

1148
00:46:37,710 --> 00:46:36,220
really take over and start taking their

1149
00:46:39,750 --> 00:46:37,720
science observations and get great

1150
00:46:42,270 --> 00:46:39,760
science which will go on for at least

1151
00:46:45,810 --> 00:46:42,280
two earth years which is one Mars here

1152
00:46:47,490 --> 00:46:45,820
about oh thank you so much okay so we're

1153
00:46:49,560 --> 00:46:47,500
gonna before we come back here the

1154
00:46:51,370 --> 00:46:49,570
social is really really excited about

1155
00:46:52,450 --> 00:46:51,380
this we're gonna take one more question

1156
00:46:55,359 --> 00:46:52,460
come back here and then we're gonna wrap

1157
00:46:57,490 --> 00:46:55,369
it up so go ahead Joyner so from Twitter

1158
00:47:02,910 --> 00:46:57,500
we have a question how does the robotic

1159
00:47:08,470 --> 00:47:06,160
okay so let me maybe show you guys a

1160
00:47:12,190 --> 00:47:08,480
little bit more detail about the robotic

1161
00:47:14,319 --> 00:47:12,200
arm so the robotic arm has three joints

1162
00:47:17,019 --> 00:47:14,329
that we use to do the instruments

1163
00:47:19,420 --> 00:47:17,029

employment so we'll look first here this

1164
00:47:21,849 --> 00:47:19,430
is the shoulder which has an azimuth and

1165
00:47:24,009 --> 00:47:21,859
in elevation so azimuth allows the arm

1166
00:47:25,900 --> 00:47:24,019
from kind of move from side to side here

1167
00:47:28,900 --> 00:47:25,910
then elevation brings this whole upper

1168
00:47:31,630 --> 00:47:28,910
arm up and down then we also have the

1169
00:47:33,910 --> 00:47:31,640
elbow joint here which changes the angle

1170
00:47:37,150 --> 00:47:33,920
between the forearm and upper arm just

1171
00:47:40,390 --> 00:47:37,160
like our elbow and then we have the

1172
00:47:43,029 --> 00:47:40,400
grapple which is down here so it's got

1173
00:47:45,789 --> 00:47:43,039
five fingers that open when the wax

1174
00:47:47,109 --> 00:47:45,799
actuator in here heats up so that's what

1175
00:47:49,599 --> 00:47:47,119
controls this so when we heat it up

1176
00:47:50,980 --> 00:47:49,609
these fingers open and then when it

1177
00:47:52,720 --> 00:47:50,990
cools off and there's a little spring in

1178
00:47:55,420 --> 00:47:52,730
there that helps close it and keep it

1179
00:47:57,819 --> 00:47:55,430
securely around the grapple grapple hook

1180
00:47:59,529 --> 00:47:57,829
on the instruments and so this is

1181
00:48:03,339 --> 00:47:59,539
controlled by software that's also

1182
00:48:06,279 --> 00:48:03,349
running on the computer in you know like

1183
00:48:07,960 --> 00:48:06,289
in the spacecraft and we also have

1184
00:48:10,809 --> 00:48:07,970
operators here on the ground that write

1185
00:48:13,450 --> 00:48:10,819
the commands on everyday of how exactly

1186
00:48:15,940 --> 00:48:13,460
to operate the arms so it may be on the

1187
00:48:17,680 --> 00:48:15,950
level of you know when we do the

1188
00:48:19,539 --> 00:48:17,690

deployment it's one sequence and I'd be

1189
00:48:21,759 --> 00:48:19,549
you know several different moves that

1190
00:48:24,999 --> 00:48:21,769
the operators are determining here on

1191
00:48:27,999 --> 00:48:25,009
the ground and simulating thank you so

1192
00:48:29,859 --> 00:48:28,009
much okay so before we wrap up we're

1193
00:48:31,120 --> 00:48:29,869
gonna take one more question coming back

1194
00:48:32,499 --> 00:48:31,130
here in Washington wait for the

1195
00:48:36,490 --> 00:48:32,509
microphone and your name and affiliation

1196
00:48:38,680 --> 00:48:36,500
please Aloha my name is Pascal Crete

1197
00:48:41,349 --> 00:48:38,690
Pinner I'm an Albert Einstein fellow and

1198
00:48:44,160 --> 00:48:41,359
I'm here with some fellow fellows we're

1199
00:48:47,950 --> 00:48:44,170
all educators so my question is about

1200
00:48:50,049 --> 00:48:47,960
students how are you going to engage our

1201
00:48:53,019 --> 00:48:50,059
students both with the deployment phase

1202
00:48:55,180 --> 00:48:53,029
the landing all of that and then with

1203
00:48:57,279 --> 00:48:55,190
the ensuing science over the next two

1204
00:49:01,509 --> 00:48:57,289
years what kind of things are you going

1205
00:49:03,759 --> 00:49:01,519
to have for our kids well I already

1206
00:49:04,810 --> 00:49:03,769
talked about the the seismology in the

1207
00:49:06,700 --> 00:49:04,820
schools

1208
00:49:08,350 --> 00:49:06,710
a project that we're working on to get

1209
00:49:12,490 --> 00:49:08,360
the the seismic data out out to the

1210
00:49:14,200 --> 00:49:12,500
students we're also we have a lot of lot

1211
00:49:17,680 --> 00:49:14,210
of interns that come in to JPL and

1212
00:49:19,720 --> 00:49:17,690
actually get it incorporated into our

1213
00:49:22,240 --> 00:49:19,730

daily operations and trying to you know

1214
00:49:26,410 --> 00:49:22,250
get get the students come in and see

1215
00:49:29,140 --> 00:49:26,420
what we do help us to take care of some

1216
00:49:31,390 --> 00:49:29,150
of the some of the jobs that we have we

1217
00:49:33,810 --> 00:49:31,400
have a lot of material that that we're

1218
00:49:36,850 --> 00:49:33,820
preparing that it'll be available both

1219
00:49:39,880 --> 00:49:36,860
online and that we'll be pushing out to

1220
00:49:41,980 --> 00:49:39,890
the schools that sort of relates the

1221
00:49:44,260 --> 00:49:41,990
kinds of questions that we're asking and

1222
00:49:46,750 --> 00:49:44,270
the data that we're getting to earth

1223
00:49:49,390 --> 00:49:46,760
science and and to the you know the the

1224
00:49:50,590 --> 00:49:49,400
the processes on the earth and and

1225
00:49:53,020 --> 00:49:50,600
really we want to bring all this stuff

1226
00:49:54,940 --> 00:49:53,030
back to you know what does it mean about

1227
00:49:57,400 --> 00:49:54,950
you know our planet what does it mean

1228
00:49:59,140 --> 00:49:57,410
about you know why the earth is the way

1229
00:50:01,930 --> 00:49:59,150
it is today you know where we've come

1230
00:50:05,820 --> 00:50:01,940
from basically in some sense and that

1231
00:50:10,870 --> 00:50:05,830
connection I think at a level that is

1232
00:50:12,490 --> 00:50:10,880
accessible and exciting to to to kids I

1233
00:50:13,570 --> 00:50:12,500
think is one of the most important

1234
00:50:18,100 --> 00:50:13,580
things that we're gonna be doing on this

1235
00:50:19,510 --> 00:50:18,110
mission well thanks to the Mazda insight

1236
00:50:22,000 --> 00:50:19,520
team for today's program we're gonna

1237
00:50:24,310 --> 00:50:22,010
wrap it up here the Mars insight Lander

1238
00:50:27,370 --> 00:50:24,320

touching down on the Red Planet November

1239
00:50:30,570 --> 00:50:27,380
26 now studying the Red Planet as never

1240
00:50:32,980 --> 00:50:30,580
before it's not just a mission to Mars

1241
00:50:34,780 --> 00:50:32,990
learning how other rocky worlds

1242
00:50:36,850 --> 00:50:34,790
including earth and the moon will form

1243
00:50:38,860 --> 00:50:36,860
better understanding our solar system

1244
00:50:41,560 --> 00:50:38,870
even aiding in the search for earth-like

1245
00:50:44,680 --> 00:50:41,570
exoplanets and perhaps just perhaps

1246
00:50:46,870 --> 00:50:44,690
which ones might be able to support life

1247
00:50:49,770 --> 00:50:46,880
and of course for more information and

1248
00:50:53,950 --> 00:50:49,780
landing updates on the website visit

1249
00:50:55,810 --> 00:50:53,960
www.nasa.gov slash insight and we know

1250
00:50:59,280 --> 00:50:55,820
we have lots of questions as we lead up

1251
00:51:04,150 --> 00:50:59,290
to the landing the press kit the insight

1252
00:51:05,830 --> 00:51:04,160
landing press kit it is a magnificent

1253
00:51:11,790 --> 00:51:05,840
document that pretty much can answer any

1254
00:51:16,360 --> 00:51:11,800
question from A to Z online at HTP HTTP

1255
00:51:18,820 --> 00:51:16,370
colon slash slash gonna dot gov slash

1256
00:51:20,620 --> 00:51:18,830
insight underscore pique

1257
00:51:21,970 --> 00:51:20,630
and I hope I got that right so it's it's

1258
00:51:24,430 --> 00:51:21,980
up on the screen here and keep those

1259
00:51:27,900 --> 00:51:24,440
questions coming at hashtag ask NASA

1260
00:51:31,000 --> 00:51:27,910
again mark your calendars November 26

1261
00:51:33,490 --> 00:51:31,010
humanity is going back to Mars and to

1262
00:51:34,360 --> 00:51:33,500
our JPL colleagues a message to you from