1
00:00:09,589 --> 00:00:07,670
good morning i'm jane platt with the

2
00:00:11,589 --> 00:00:09,599
media relations office at nasa's jet

3
00:00:14,230 --> 00:00:11,599
propulsion laboratory in pasadena

4
00:00:16,150 --> 00:00:14,240
california we're all counting day down

5
00:00:18,390 --> 00:00:16,160
to the very big and dramatic day on mars

6
00:00:21,349 --> 00:00:18,400
that's coming up three days from now

7
00:00:24,150 --> 00:00:21,359
this sunday august 5th pacific time or

8
00:00:26,310 --> 00:00:24,160
august 6th in the eastern time zone

9
00:00:28,870 --> 00:00:26,320
nasa's mars science laboratory and its

10
00:00:31,589 --> 00:00:28,880
rover curiosity will land on the red

11
00:00:33,350 --> 00:00:31,599
planet this is an extremely challenging

12
00:00:35,190 --> 00:00:33,360
and ambitious mission

13
00:00:36,630 --> 00:00:35,200

and we're going to find out more about

14
00:00:38,470 --> 00:00:36,640
it and we're going to get the mission

15
00:00:40,310 --> 00:00:38,480
status and a preview of the entry

16
00:00:41,830 --> 00:00:40,320
descent and landing

17
00:00:43,350 --> 00:00:41,840
in this news conference and we're going

18
00:00:45,670 --> 00:00:43,360
to find out all about the things that

19
00:00:48,950 --> 00:00:45,680
have to happen in the next few days i'd

20
00:00:51,350 --> 00:00:48,960
like to introduce our panelists first

21
00:00:53,910 --> 00:00:51,360
we have doug mcquistion he is the mars

22
00:00:56,830 --> 00:00:53,920
exploration program director with nasa

23
00:01:01,990 --> 00:00:59,750
washington we have pete tysinger mars

24
00:01:05,429 --> 00:01:02,000
science laboratory project manager at

25
00:01:10,550 --> 00:01:08,550
also from jpl we have adam steltzner the

26
00:01:14,310 --> 00:01:10,560
mars science lab entry descent and

27
00:01:19,190 --> 00:01:16,789
and we have thomas martin mir of the

28
00:01:22,870 --> 00:01:19,200
mars science lab navigation team chief

29
00:01:27,030 --> 00:01:24,710
ashwin vasavada

30
00:01:30,390 --> 00:01:27,040
is the mars science lab deputy project

31
00:01:32,950 --> 00:01:30,400
scientist also jpl

32
00:01:35,190 --> 00:01:32,960
and we will also hear from doug ellison

33
00:01:37,670 --> 00:01:35,200
who is a visualization producer here at

34
00:01:39,270 --> 00:01:37,680
jpl

35
00:01:41,670 --> 00:01:39,280
let's get things started with doug

36
00:01:44,069 --> 00:01:41,680
mcquistion okay thank you

37
00:01:45,510 --> 00:01:44,079
well it is an extreme pleasure to be

38
00:01:47,910 --> 00:01:45,520

here it's been a lot of years we've been

39
00:01:50,310 --> 00:01:47,920
working on this mission and uh we're

40
00:01:51,429 --> 00:01:50,320
almost there this is great stuff

41
00:01:53,270 --> 00:01:51,439
i'm going to talk about something a

42
00:01:55,270 --> 00:01:53,280
little bit different today

43
00:01:59,270 --> 00:01:55,280
i'm going to talk about how big this

44
00:02:01,109 --> 00:01:59,280
mission really is msl has a huge reach

45
00:02:02,389 --> 00:02:01,119
reaches back into the past it reaches

46
00:02:04,069 --> 00:02:02,399
out into the future and frankly it

47
00:02:07,109 --> 00:02:04,079
reaches around the world if i can have

48
00:02:09,270 --> 00:02:07,119
the first graphic please

49
00:02:11,510 --> 00:02:09,280
msl is not just a randomly selected

50
00:02:13,670 --> 00:02:11,520
mission plunked down in a 2011 launch

51
00:02:15,190 --> 00:02:13,680
time frame it was a carefully selected

52
00:02:16,710 --> 00:02:15,200
mission

53
00:02:18,790 --> 00:02:16,720
in the middle of

54
00:02:20,869 --> 00:02:18,800
a program that has been a series of

55
00:02:24,710 --> 00:02:20,879
strategically selected and decided

56
00:02:26,869 --> 00:02:24,720
missions for the past 10 years

57
00:02:29,030 --> 00:02:26,879
it's built on and forged by the

58
00:02:30,869 --> 00:02:29,040
discoveries of the past of missions such

59
00:02:33,190 --> 00:02:30,879
as odyssey and mars express mars

60
00:02:35,990 --> 00:02:33,200
reconnaissance orbiter and the technical

61
00:02:38,470 --> 00:02:36,000
capabilities developed since pathfinder

62
00:02:39,589 --> 00:02:38,480
and through the spirit and opportunity

63
00:02:42,070 --> 00:02:39,599

rovers

64
00:02:43,910 --> 00:02:42,080
it reaches across thousands of people

65
00:02:45,430 --> 00:02:43,920
and many different countries around the

66
00:02:46,710 --> 00:02:45,440
world

67
00:02:48,309 --> 00:02:46,720
it reaches all the way around the

68
00:02:51,509 --> 00:02:48,319
country frankly and has been a

69
00:02:53,509 --> 00:02:51,519
powerhouse here on earth economically

70
00:02:55,750 --> 00:02:53,519
it's employed in excess of seven

71
00:02:57,670 --> 00:02:55,760
thousand people in good high-paying

72
00:02:58,790 --> 00:02:57,680
technology and technician and science

73
00:03:01,270 --> 00:02:58,800
jobs

74
00:03:02,790 --> 00:03:01,280
it's reached 37 different states of the

75
00:03:04,869 --> 00:03:02,800
union

76
00:03:06,790 --> 00:03:04,879
and a little bit appropriately like the

77
00:03:08,630 --> 00:03:06,800
olympics it's reached a number of

78
00:03:10,869 --> 00:03:08,640
foreign countries there's nearly 10

79
00:03:13,270 --> 00:03:10,879
countries that are involved in this and

80
00:03:17,670 --> 00:03:13,280
five of them are major partners spain

81
00:03:19,910 --> 00:03:17,680
canada france germany and russia

82
00:03:21,589 --> 00:03:19,920
plus the european space agency itself

83
00:03:23,430 --> 00:03:21,599
with mars express that's helping us with

84
00:03:25,110 --> 00:03:23,440
communications and and some other

85
00:03:26,229 --> 00:03:25,120
science obviously in shaping how this

86
00:03:29,110 --> 00:03:26,239
works

87
00:03:30,869 --> 00:03:29,120
so i hate to uh but i will

88
00:03:32,949 --> 00:03:30,879

uh compare it slightly to uh

89
00:03:34,470 --> 00:03:32,959
international gymnastics

90
00:03:36,789 --> 00:03:34,480
in that uh

91
00:03:38,309 --> 00:03:36,799
it is going to be a tough series of

92
00:03:40,229 --> 00:03:38,319
challenges here

93
00:03:41,750 --> 00:03:40,239
for the uh for the team to get this to

94
00:03:46,229 --> 00:03:41,760
the surface but at the end we're all

95
00:03:50,229 --> 00:03:48,470
msl reaches from the past decade into

96
00:03:52,710 --> 00:03:50,239
the next decade as well

97
00:03:55,750 --> 00:03:52,720
if i could have the next graphic please

98
00:03:57,750 --> 00:03:55,760
maven 2013 launch is the next in this

99
00:03:59,750 --> 00:03:57,760
strategically selected program this is a

100
00:04:02,710 --> 00:03:59,760
very important mission you heard from

101
00:04:05,030 --> 00:04:02,720
the science panel before about uh mars

102
00:04:07,030 --> 00:04:05,040
past one of the questions about that is

103
00:04:09,670 --> 00:04:07,040
how did it go from having a warmer

104
00:04:11,990 --> 00:04:09,680
wetter past to the to the dry somewhat

105
00:04:12,949 --> 00:04:12,000
bearing plant barren planet we see today

106
00:04:16,310 --> 00:04:12,959
maven

107
00:04:18,390 --> 00:04:16,320
is actually a decadal survey-inspired

108
00:04:20,629 --> 00:04:18,400
mission from the first decadal survey

109
00:04:22,790 --> 00:04:20,639
that mars was in that will go help

110
00:04:24,469 --> 00:04:22,800
understand help us understand what

111
00:04:26,550 --> 00:04:24,479
happened to the atmosphere of mars and

112
00:04:29,590 --> 00:04:26,560
what happened to the planet's

113
00:04:31,270 --> 00:04:29,600

water related past it's also unique in

114
00:04:33,510 --> 00:04:31,280
the fact that it's the first goddard

115
00:04:36,870 --> 00:04:33,520
space flight center-led mission and

116
00:04:41,590 --> 00:04:38,950
msl gives us a range of capabilities for

117
00:04:44,390 --> 00:04:41,600
missions after maven as well from small

118
00:04:46,629 --> 00:04:44,400
scientific analysis type landers to uh

119
00:04:48,550 --> 00:04:46,639
human scale precursor missions hopefully

120
00:04:50,310 --> 00:04:48,560
beginning in the 18 and 20 time frames

121
00:04:51,909 --> 00:04:50,320
if i could get the next graphic

122
00:04:54,710 --> 00:04:51,919
one example of this

123
00:04:56,710 --> 00:04:54,720
is an instrument called medley

124
00:04:59,990 --> 00:04:56,720
which in what you see here is actually

125
00:05:01,990 --> 00:05:00,000
the msl heat shield with technicians

126
00:05:05,590 --> 00:05:02,000
around it installing some of the medley

127
00:05:07,909 --> 00:05:05,600
sensors what these sensors do is measure

128
00:05:09,670 --> 00:05:07,919
pressure temperature and actually the

129
00:05:11,830 --> 00:05:09,680
recession rate of the thermal protection

130
00:05:13,990 --> 00:05:11,840
system during entry since this heat

131
00:05:15,909 --> 00:05:14,000
shield is nearly the size of the orion

132
00:05:18,070 --> 00:05:15,919
capsule's heat shield

133
00:05:19,510 --> 00:05:18,080
and and therefore could actually be very

134
00:05:21,189 --> 00:05:19,520
similar to what will eventually get

135
00:05:23,430 --> 00:05:21,199
humans to the surface of mars we will

136
00:05:26,150 --> 00:05:23,440
learn an enormous amount about what it

137
00:05:27,670 --> 00:05:26,160
takes on a guided entry vehicle uh what

138
00:05:29,510 --> 00:05:27,680

the impacts are on the thermal

139
00:05:31,590 --> 00:05:29,520
protection systems and and what the

140
00:05:34,550 --> 00:05:31,600
atmosphere looks like in a vertical

141
00:05:36,790 --> 00:05:34,560
uh profile this coupled with the re the

142
00:05:39,189 --> 00:05:36,800
rad data that don hassler talked about a

143
00:05:40,790 --> 00:05:39,199
few minutes ago really pushes us further

144
00:05:42,790 --> 00:05:40,800
into the future with the potential for

145
00:05:44,469 --> 00:05:42,800
humans to mars and really helps and then

146
00:05:46,950 --> 00:05:44,479
the ability to get a metric ton to the

147
00:05:49,350 --> 00:05:46,960
surface is nothing to sneeze at either

148
00:05:51,270 --> 00:05:49,360
whether it's resupply or or other things

149
00:05:53,350 --> 00:05:51,280
related to the need for humans and other

150
00:05:55,430 --> 00:05:53,360
future precursor missions

151
00:05:56,950 --> 00:05:55,440
as we forge a path forward

152
00:05:58,390 --> 00:05:56,960
everything is critical orbiters are

153
00:06:00,790 --> 00:05:58,400
critical for reconnaissance and

154
00:06:03,350 --> 00:06:00,800
communications landers are critical for

155
00:06:05,189 --> 00:06:03,360
in-situ analyses

156
00:06:07,590 --> 00:06:05,199
returning samples and potentially even

157
00:06:09,749 --> 00:06:07,600
humans to the surface

158
00:06:11,510 --> 00:06:09,759
but moving back to msl

159
00:06:13,909 --> 00:06:11,520
at the l minus 30 press conference i

160
00:06:15,590 --> 00:06:13,919
mentioned that odyssey had had an issue

161
00:06:18,070 --> 00:06:15,600
with reaction wheels and was out of

162
00:06:20,629 --> 00:06:18,080
place in phasing to be able to

163
00:06:22,710 --> 00:06:20,639

communicate the landing process

164
00:06:24,550 --> 00:06:22,720
i am very pleased to say that that team

165
00:06:26,710 --> 00:06:24,560
has done a great job moved odyssey back

166
00:06:29,189 --> 00:06:26,720
to where it should have been

167
00:06:31,189 --> 00:06:29,199
where we plan to have it all along

168
00:06:33,029 --> 00:06:31,199
and they're running tests

169
00:06:34,790 --> 00:06:33,039
and even some data flows to make sure

170
00:06:36,629 --> 00:06:34,800
that all systems are working normal it's

171
00:06:38,550 --> 00:06:36,639
looking good the mars reconnaissance

172
00:06:40,150 --> 00:06:38,560
orbiter is looking good

173
00:06:41,909 --> 00:06:40,160
there's some additional testing going on

174
00:06:44,469 --> 00:06:41,919
on that but polling of the teams is

175
00:06:47,510 --> 00:06:44,479
going on and i think by tomorrow which

176
00:06:51,110 --> 00:06:47,520
is the plan we will be in full swing for

177
00:06:53,110 --> 00:06:51,120
communications capability for msl

178
00:06:55,749 --> 00:06:53,120
so just in case you missed it

179
00:06:57,909 --> 00:06:55,759
live under a rock or whatever

180
00:06:59,270 --> 00:06:57,919
we're about to land a small compact car

181
00:07:01,430 --> 00:06:59,280
on the surface with a trunk load of

182
00:07:03,510 --> 00:07:01,440
instruments this is a pretty amazing

183
00:07:04,870 --> 00:07:03,520
feat getting ready to happen

184
00:07:06,629 --> 00:07:04,880
it's exciting

185
00:07:08,950 --> 00:07:06,639
it's daring

186
00:07:11,589 --> 00:07:08,960
but it's fantastic

187
00:07:15,029 --> 00:07:11,599
mars science laboratory's reach is about

188
00:07:17,029 --> 00:07:15,039

to touch the planet mars only three days

189
00:07:18,950 --> 00:07:17,039
and about 12 hours from now

190
00:07:20,150 --> 00:07:18,960
so with that i think you want to hear

191
00:07:22,070 --> 00:07:20,160
about the mission and how it's doing

192
00:07:23,270 --> 00:07:22,080
i'll pass it over to pete

193
00:07:24,550 --> 00:07:23,280
thank you doug

194
00:07:26,390 --> 00:07:24,560
um

195
00:07:28,230 --> 00:07:26,400
well the mission is going extremely well

196
00:07:30,950 --> 00:07:28,240
um you'll hear uh

197
00:07:33,749 --> 00:07:30,960
from adam about idiol uh uh preparations

198
00:07:35,510 --> 00:07:33,759
and and and edie allen and from martin

199
00:07:37,909 --> 00:07:35,520
about navigation

200
00:07:39,589 --> 00:07:37,919
and ashwin about the uh the atmosphere

201
00:07:41,110 --> 00:07:39,599
and mars and the weather but everything

202
00:07:42,710 --> 00:07:41,120
is really on track

203
00:07:44,629 --> 00:07:42,720
the spacecraft is behaving perfectly

204
00:07:46,070 --> 00:07:44,639
nominally we have no anomalies to work

205
00:07:47,029 --> 00:07:46,080
everything is in the green across the

206
00:07:48,230 --> 00:07:47,039
board

207
00:07:49,909 --> 00:07:48,240
um so

208
00:07:50,629 --> 00:07:49,919
so we are really good to go three days

209
00:07:52,869 --> 00:07:50,639
out

210
00:07:55,029 --> 00:07:52,879
it's very very quiet in my office which

211
00:07:57,350 --> 00:07:55,039
is good good to have happen

212
00:07:59,990 --> 00:07:57,360
um i just wanted to say a couple thank

213
00:08:01,909 --> 00:08:00,000

yous um we've gotten great support this

214
00:08:04,710 --> 00:08:01,919
summer in preparation from our sister

215
00:08:06,070 --> 00:08:04,720
projects from odyssey and from mro

216
00:08:08,150 --> 00:08:06,080
and from mex

217
00:08:09,749 --> 00:08:08,160
in in their preparations to support us

218
00:08:12,309 --> 00:08:09,759
for communications not only during this

219
00:08:13,350 --> 00:08:12,319
critical edl period but also throughout

220
00:08:15,749 --> 00:08:13,360
the mission

221
00:08:17,589 --> 00:08:15,759
and and also our our brethren at the dsn

222
00:08:19,670 --> 00:08:17,599
who've done a great job in supporting us

223
00:08:22,390 --> 00:08:19,680
uh to get to this point we've all done a

224
00:08:24,150 --> 00:08:22,400
lot of training exercises uh this summer

225
00:08:25,990 --> 00:08:24,160
um and and we've done those have gone

226
00:08:27,350 --> 00:08:26,000
very well i think

227
00:08:28,710 --> 00:08:27,360
my deputy pointed out that you know

228
00:08:30,070 --> 00:08:28,720
you're done with the training exercises

229
00:08:32,310 --> 00:08:30,080
when you don't want to do another one

230
00:08:34,389 --> 00:08:32,320
and and we are certainly there

231
00:08:37,190 --> 00:08:34,399
so we're ready to go for real on on

232
00:08:39,350 --> 00:08:37,200
sunday night in pasadena and monday

233
00:08:41,190 --> 00:08:39,360
morning on the east coast and i let you

234
00:08:43,670 --> 00:08:41,200
adam talk about edl

235
00:08:46,150 --> 00:08:43,680
thank you pete

236
00:08:48,790 --> 00:08:46,160
well um as pete mentioned things are

237
00:08:50,389 --> 00:08:48,800
looking good for sunday night and we're

238
00:08:52,470 --> 00:08:50,399

excited

239
00:08:54,949 --> 00:08:52,480
there's a very talented team of folks

240
00:08:57,509 --> 00:08:54,959
have put this edl system together and

241
00:09:01,030 --> 00:08:57,519
invested an awesome amount of their time

242
00:09:03,030 --> 00:09:01,040
there's over 300 years of human

243
00:09:05,590 --> 00:09:03,040
individual contribution to this edl

244
00:09:08,389 --> 00:09:05,600
system and we're very excited for a

245
00:09:09,509 --> 00:09:08,399
chance to to test its metal on sunday

246
00:09:11,110 --> 00:09:09,519
night

247
00:09:12,710 --> 00:09:11,120
if you roll the video i'll take you

248
00:09:15,670 --> 00:09:12,720
through briefly some of the elements of

249
00:09:19,030 --> 00:09:15,680
our adl system or entry decent land

250
00:09:22,710 --> 00:09:19,040
we start prior to the atmosphere of mars

251
00:09:24,949 --> 00:09:22,720
about 13 000 miles an hour

252
00:09:27,430 --> 00:09:24,959
and we are at this point we separate the

253
00:09:29,990 --> 00:09:27,440
cruise stage and prepare for

254
00:09:32,230 --> 00:09:30,000
running into the atmosphere of mars it's

255
00:09:35,670 --> 00:09:32,240
a bit of an impact we will pull

256
00:09:38,550 --> 00:09:35,680
about 10 earth gs or more of

257
00:09:40,790 --> 00:09:38,560
acceleration during our first

258
00:09:42,790 --> 00:09:40,800
contact with the

259
00:09:44,630 --> 00:09:42,800
with the martian atmosphere during that

260
00:09:46,070 --> 00:09:44,640
time we're employing something called

261
00:09:48,870 --> 00:09:46,080
guided entry which i'll speak a little

262
00:09:51,750 --> 00:09:48,880
bit about later but we'll be using our

263
00:09:54,710 --> 00:09:51,760

our reaction control jets which you can

264
00:09:57,430 --> 00:09:54,720
see in this video occasionally firing

265
00:09:59,110 --> 00:09:57,440
at the back of the spacecraft to help

266
00:10:01,110 --> 00:09:59,120
curiosity steer her way through the

267
00:10:03,190 --> 00:10:01,120
atmosphere

268
00:10:04,550 --> 00:10:03,200
after we've gone through that hypersonic

269
00:10:06,710 --> 00:10:04,560
entry phase

270
00:10:08,550 --> 00:10:06,720
we adjust the attitude of the spacecraft

271
00:10:10,470 --> 00:10:08,560
by throwing off some masses and prepare

272
00:10:12,710 --> 00:10:10,480
for parachute deploy

273
00:10:15,350 --> 00:10:12,720
we open this parachute a little bit less

274
00:10:16,069 --> 00:10:15,360
than mach 2

275
00:10:18,550 --> 00:10:16,079
or

276
00:10:19,990 --> 00:10:18,560
about a thousand miles an hour at mars

277
00:10:21,750 --> 00:10:20,000
we open up the world's largest

278
00:10:25,990 --> 00:10:21,760
supersonic

279
00:10:28,150 --> 00:10:26,000
parachute 21 meter diameter parachute

280
00:10:29,430 --> 00:10:28,160
and then almost immediately remove the

281
00:10:30,949 --> 00:10:29,440
heat shield and start looking for the

282
00:10:33,030 --> 00:10:30,959
ground

283
00:10:34,790 --> 00:10:33,040
at about a mile above the surface we

284
00:10:36,069 --> 00:10:34,800
will have seen the ground with a

285
00:10:38,310 --> 00:10:36,079
custom-made

286
00:10:41,030 --> 00:10:38,320
radar landing radar and we will let go

287
00:10:43,350 --> 00:10:41,040
of the parachute and use our eight

288
00:10:47,030 --> 00:10:43,360

mars landing engines also developed

289
00:10:48,870 --> 00:10:47,040
purposefully for curiosity

290
00:10:51,670 --> 00:10:48,880
we'll use those rocket engines to slow

291
00:10:54,150 --> 00:10:51,680
us from about 200 miles an hour

292
00:10:56,790 --> 00:10:54,160
down to about

293
00:10:58,710 --> 00:10:56,800
one and a half miles an hour or three

294
00:11:01,670 --> 00:10:58,720
quarters of a meter a second

295
00:11:03,350 --> 00:11:01,680
and in straight vertical flight

296
00:11:05,990 --> 00:11:03,360
we're in that straight vertical flight

297
00:11:07,190 --> 00:11:06,000
for the last 200 meters or so looking

298
00:11:07,990 --> 00:11:07,200
straight down on where we're going to

299
00:11:12,389 --> 00:11:08,000
land

300
00:11:15,190 --> 00:11:12,399
we separate

301
00:11:17,350 --> 00:11:15,200
the the rover below the descent stage

302
00:11:19,190 --> 00:11:17,360
and the two together continue at that

303
00:11:22,069 --> 00:11:19,200
one and a half miles an hour

304
00:11:24,069 --> 00:11:22,079
down gently towards the surface

305
00:11:24,949 --> 00:11:24,079
until curiosity herself

306
00:11:33,430 --> 00:11:24,959
is

307
00:11:36,230 --> 00:11:33,440
stage free and it flies off to a safe

308
00:11:37,990 --> 00:11:36,240
distance to impact the surface

309
00:11:40,069 --> 00:11:38,000
leaving curiosity

310
00:11:42,710 --> 00:11:40,079
wheels down

311
00:11:45,430 --> 00:11:42,720
on the martian terrain ready to begin

312
00:11:48,550 --> 00:11:45,440
its surface mission

313
00:11:49,750 --> 00:11:48,560

now there are two key novel pieces to

314
00:11:51,110 --> 00:11:49,760
this entry descent and landing

315
00:11:52,550 --> 00:11:51,120
architecture

316
00:11:53,670 --> 00:11:52,560
the first is guided entry and i

317
00:11:56,949 --> 00:11:53,680
mentioned that

318
00:11:58,949 --> 00:11:56,959
i'll i'll walk you through a bit of it

319
00:12:01,110 --> 00:11:58,959
historically the

320
00:12:02,069 --> 00:12:01,120
landing footprint that our missions has

321
00:12:03,269 --> 00:12:02,079
had

322
00:12:05,670 --> 00:12:03,279
have been

323
00:12:08,150 --> 00:12:05,680
a hundred kilometers or more of landing

324
00:12:09,670 --> 00:12:08,160
uncertainty when we go to select the

325
00:12:11,990 --> 00:12:09,680
site that we're going to

326
00:12:14,550 --> 00:12:12,000
well it's quite hard to find safe sites

327
00:12:17,110 --> 00:12:14,560
to land that are that size

328
00:12:20,550 --> 00:12:17,120
curiosity uses guided entry to shrink

329
00:12:22,629 --> 00:12:20,560
that from 100 kilometers or so down to

330
00:12:25,110 --> 00:12:22,639
something a skosh less than 20

331
00:12:28,550 --> 00:12:25,120
kilometers of uncertainty

332
00:12:31,750 --> 00:12:28,560
to do that we take our entry capsule

333
00:12:36,710 --> 00:12:31,760
we have some masses

334
00:12:39,509 --> 00:12:36,720
about one mers rover worth of tungsten

335
00:12:41,030 --> 00:12:39,519
in six ports out here and when she flies

336
00:12:43,670 --> 00:12:41,040
through the atmosphere of mars because

337
00:12:44,629 --> 00:12:43,680
of these weights she flies at a canted

338
00:12:50,310 --> 00:12:44,639

angle

339
00:12:51,509 --> 00:12:50,320
she then uses the reaction control jets

340
00:12:54,629 --> 00:12:51,519
here

341
00:12:58,150 --> 00:12:54,639
to turn that lift vector

342
00:12:59,190 --> 00:12:58,160
forward and backwards up and down

343
00:13:00,629 --> 00:12:59,200
to

344
00:13:03,350 --> 00:13:00,639
control her descent through the

345
00:13:05,110 --> 00:13:03,360
atmosphere and remove both

346
00:13:07,030 --> 00:13:05,120
errors in delivery

347
00:13:09,269 --> 00:13:07,040
although tomas is not going to give us

348
00:13:11,750 --> 00:13:09,279
any errors in delivery

349
00:13:13,190 --> 00:13:11,760
and more importantly the uncertainty of

350
00:13:14,629 --> 00:13:13,200
the atmosphere that we may encounter on

351
00:13:16,629 --> 00:13:14,639
the day we land

352
00:13:18,150 --> 00:13:16,639
that's always been traditionally a big

353
00:13:20,310 --> 00:13:18,160
question mark what atmosphere are we

354
00:13:22,550 --> 00:13:20,320
going to find when we come in this

355
00:13:26,150 --> 00:13:22,560
system allows us to be robust to a large

356
00:13:29,910 --> 00:13:28,470
the second big novelty and you may have

357
00:13:32,230 --> 00:13:29,920
noticed this

358
00:13:34,310 --> 00:13:32,240
is the way that we touch

359
00:13:39,990 --> 00:13:34,320
curiosity down to the ground the

360
00:13:45,910 --> 00:13:42,310
20 meters above the surface

361
00:13:49,430 --> 00:13:45,920
curiosity still has her jet backpack

362
00:13:51,670 --> 00:13:49,440
the descent stage strapped to her

363
00:13:53,750 --> 00:13:51,680

she's in vertical flight

364
00:13:55,750 --> 00:13:53,760
and at this point

365
00:13:58,790 --> 00:13:55,760
she lowers

366
00:14:00,829 --> 00:13:58,800
she's lowered by the descent stage

367
00:14:04,870 --> 00:14:00,839
as they both continue

368
00:14:07,829 --> 00:14:04,880
downward she's lowered down on a

369
00:14:10,389 --> 00:14:07,839
seven and a half meter bridle

370
00:14:12,790 --> 00:14:10,399
and the two together slowly make their

371
00:14:14,829 --> 00:14:12,800
way down until her weight is taken up by

372
00:14:19,030 --> 00:14:14,839
the train of

373
00:14:23,269 --> 00:14:21,269
with curiosity

374
00:14:25,189 --> 00:14:23,279
safely on the surface and after we've

375
00:14:26,870 --> 00:14:25,199
acknowledged that

376
00:14:29,829 --> 00:14:26,880
the weight is gone

377
00:14:33,590 --> 00:14:29,839
the descent stage cuts itself free and

378
00:14:39,750 --> 00:14:37,030
it looks a little bit crazy

379
00:14:42,629 --> 00:14:39,760
i i promise you it is the least crazy of

380
00:14:45,670 --> 00:14:42,639
the methods you could use to to land a

381
00:14:48,389 --> 00:14:45,680
rover the size of curiosity on mars and

382
00:14:50,310 --> 00:14:48,399
we've become quite fond of it and we're

383
00:14:52,069 --> 00:14:50,320
fairly confident that that sunday night

384
00:14:55,670 --> 00:14:52,079
will be a good night for us

385
00:14:58,949 --> 00:14:57,189
now tomas we'll tell you how we're going

386
00:15:00,069 --> 00:14:58,959
to get there on time and to the right

387
00:15:02,230 --> 00:15:00,079
spot

388
00:15:03,910 --> 00:15:02,240

thanks adams that's a very difficult to

389
00:15:06,949 --> 00:15:03,920
follow

390
00:15:09,910 --> 00:15:06,959
curiosity is currently about 670 000

391
00:15:13,350 --> 00:15:09,920
miles from mars and is approaching

392
00:15:15,430 --> 00:15:13,360
the planet at a speed of just 7 800

393
00:15:17,430 --> 00:15:15,440
miles per hour or as fast as it would be

394
00:15:19,509 --> 00:15:17,440
when it enters mars

395
00:15:22,470 --> 00:15:19,519
since curiosity was launched by an atlas

396
00:15:24,389 --> 00:15:22,480
5 rocket back in november of last year

397
00:15:25,829 --> 00:15:24,399
the navigation team

398
00:15:28,389 --> 00:15:25,839
has been using the tracking data from

399
00:15:30,069 --> 00:15:28,399
the antennas of the deep space network

400
00:15:32,069 --> 00:15:30,079
to determine where curiosity is and

401
00:15:34,069 --> 00:15:32,079
where it is going

402
00:15:36,069 --> 00:15:34,079
the navigation team have designed

403
00:15:38,310 --> 00:15:36,079
trajectory correction maneuvers that

404
00:15:41,670 --> 00:15:38,320
have adjusted curiosities trajectory so

405
00:15:45,269 --> 00:15:41,680
we'll enter mars at the right point

406
00:15:49,030 --> 00:15:45,279
so he can safely and accurately

407
00:15:50,790 --> 00:15:49,040
be delivered to the guild creator

408
00:15:53,350 --> 00:15:50,800
the mission control team has secured so

409
00:15:54,710 --> 00:15:53,360
far four trajectory correction maneuvers

410
00:15:56,389 --> 00:15:54,720
and the last one was successfully

411
00:15:58,550 --> 00:15:56,399
secured

412
00:16:01,269 --> 00:15:58,560
last saturday evening

413
00:16:02,629 --> 00:16:01,279

first image please

414
00:16:05,910 --> 00:16:02,639
here you can see

415
00:16:07,910 --> 00:16:05,920
a picture of the surface of mars

416
00:16:09,910 --> 00:16:07,920
you can see the entry point in which we

417
00:16:12,710 --> 00:16:09,920
enter the atmosphere so we enter at an

418
00:16:16,310 --> 00:16:12,720
angle of minus 15.5 degrees

419
00:16:18,550 --> 00:16:16,320
and then the ground track of

420
00:16:21,430 --> 00:16:18,560
curiosity as it descends into the

421
00:16:24,470 --> 00:16:21,440
surface of mars and the touch standpoint

422
00:16:27,189 --> 00:16:24,480
in the north side of the get crater

423
00:16:29,269 --> 00:16:27,199
you can also see the ground track of the

424
00:16:31,110 --> 00:16:29,279
mass reconnaissance orbiter as it will

425
00:16:32,710 --> 00:16:31,120
fly over

426
00:16:35,350 --> 00:16:32,720
curiosity

427
00:16:39,590 --> 00:16:35,360
and provide communication support

428
00:16:43,749 --> 00:16:41,990
here you can see where we were going to

429
00:16:47,509 --> 00:16:43,759
enter the atmosphere of mars before the

430
00:16:51,030 --> 00:16:48,230
the

431
00:16:52,470 --> 00:16:51,040
that

432
00:16:54,230 --> 00:16:52,480
maneuver

433
00:16:57,430 --> 00:16:54,240
the onboard state that we put in the

434
00:17:00,069 --> 00:16:57,440
spacecraft last monday and our latest

435
00:17:05,909 --> 00:17:02,790
that we have calculated three days later

436
00:17:07,590 --> 00:17:05,919
so the maneuver move us by about 13

437
00:17:11,590 --> 00:17:07,600
miles

438
00:17:13,350 --> 00:17:11,600

we are now about 100 yards 1000 yards

439
00:17:14,230 --> 00:17:13,360
from the entity target

440
00:17:15,429 --> 00:17:14,240
and

441
00:17:17,909 --> 00:17:15,439
the difference between the latest

442
00:17:19,669 --> 00:17:17,919
estimate of the onboard entry point

443
00:17:21,189 --> 00:17:19,679
of the entry point and the board state

444
00:17:24,390 --> 00:17:21,199
is just

445
00:17:26,309 --> 00:17:24,400
below 200 yards

446
00:17:28,710 --> 00:17:26,319
the main task of the navigation things

447
00:17:30,710 --> 00:17:28,720
of better the next few days

448
00:17:32,310 --> 00:17:30,720
up to london is to keep processing the

449
00:17:33,350 --> 00:17:32,320
tracking data from the deep space

450
00:17:35,510 --> 00:17:33,360
network

451
00:17:36,390 --> 00:17:35,520
so we can accurately predict this entry

452
00:17:38,310 --> 00:17:36,400
point

453
00:17:40,390 --> 00:17:38,320
and if necessary send an update to the

454
00:17:42,390 --> 00:17:40,400
spacecraft

455
00:17:44,310 --> 00:17:42,400
the other task is to determine any

456
00:17:45,830 --> 00:17:44,320
maneuvers that may be needed but it

457
00:17:47,750 --> 00:17:45,840
seems that based on on the results that

458
00:17:50,870 --> 00:17:47,760
you are seeing we may not need to do the

459
00:17:52,549 --> 00:17:50,880
maneuver that was planned for tomorrow

460
00:17:54,870 --> 00:17:52,559
the navigation team needs to tell

461
00:17:56,950 --> 00:17:54,880
curiosity where it is as it enters

462
00:17:59,270 --> 00:17:56,960
atmosphere at mars so it can find its

463
00:18:01,990 --> 00:17:59,280

way to the great creator

464
00:18:04,470 --> 00:18:02,000
there is no gps in mars we have to track

465
00:18:06,470 --> 00:18:04,480
curiosity from the antennas in the deep

466
00:18:09,190 --> 00:18:06,480
space network in the earth to tell us

467
00:18:12,070 --> 00:18:09,200
where it is as it approaches mars

468
00:18:13,909 --> 00:18:12,080
it is like driving to work

469
00:18:17,190 --> 00:18:13,919
just by looking back in the rear view

470
00:18:18,950 --> 00:18:17,200
mirror up to the antennas of your house

471
00:18:20,310 --> 00:18:18,960
the nest

472
00:18:21,750 --> 00:18:20,320
ashwin is going to tell us about the

473
00:18:23,350 --> 00:18:21,760
weather in mars

474
00:18:25,430 --> 00:18:23,360
all right

475
00:18:27,110 --> 00:18:25,440
so as adam mentioned we care about the

476
00:18:29,110 --> 00:18:27,120
navigation accuracy and then what

477
00:18:30,150 --> 00:18:29,120
weather occurs on mars when we enter and

478
00:18:31,830 --> 00:18:30,160
tomas

479
00:18:33,350 --> 00:18:31,840
is delivering us right down the middle

480
00:18:35,350 --> 00:18:33,360
but there's nothing i can do about the

481
00:18:37,510 --> 00:18:35,360
weather on mars

482
00:18:39,190 --> 00:18:37,520
except predict it and then design the

483
00:18:40,549 --> 00:18:39,200
spacecraft to be able to handle all

484
00:18:41,830 --> 00:18:40,559
those potential conditions we can

485
00:18:43,590 --> 00:18:41,840
encounter so that's what we've done the

486
00:18:44,950 --> 00:18:43,600
past few years

487
00:18:46,789 --> 00:18:44,960
we're interested in understanding the

488
00:18:48,470 --> 00:18:46,799

weather on mars

489
00:18:50,070 --> 00:18:48,480
and we've been studying it for several

490
00:18:51,990 --> 00:18:50,080
years now to design a system that can

491
00:18:55,110 --> 00:18:52,000
tolerate pretty much everything mars is

492
00:18:56,950 --> 00:18:55,120
known to come up with this season

493
00:18:59,590 --> 00:18:56,960
if we see any extreme weather in the

494
00:19:00,549 --> 00:18:59,600
next few days uh that even pushes the

495
00:19:02,310 --> 00:19:00,559
limits of what we designed the

496
00:19:03,830 --> 00:19:02,320
spacecraft to we at least want to know

497
00:19:05,430 --> 00:19:03,840
it's coming so we can understand how

498
00:19:06,710 --> 00:19:05,440
that might affect the accuracy at which

499
00:19:08,070 --> 00:19:06,720
we land

500
00:19:09,909 --> 00:19:08,080
so you might wonder how do we predict

501
00:19:12,710 --> 00:19:09,919
the weather at mars well i'm going to

502
00:19:15,270 --> 00:19:12,720
turn to the live doppler 8000 actually

503
00:19:16,789 --> 00:19:15,280
can't do that

504
00:19:19,190 --> 00:19:16,799
i wish we had that on mars but really

505
00:19:20,710 --> 00:19:19,200
what we have is a spectacular weather

506
00:19:21,990 --> 00:19:20,720
satellite up there now it's actually

507
00:19:24,310 --> 00:19:22,000
doing a lot more than measuring the

508
00:19:26,150 --> 00:19:24,320
weather the mars reconnaissance orbiter

509
00:19:27,990 --> 00:19:26,160
so in the first graphic uh shows the

510
00:19:29,590 --> 00:19:28,000
mars reconnaissance orbiter

511
00:19:30,950 --> 00:19:29,600
doing two things it's looking down at

512
00:19:32,789 --> 00:19:30,960
the surface

513
00:19:35,350 --> 00:19:32,799

taking both temperature measurements and

514
00:19:36,870 --> 00:19:35,360
taking color imagery of the surface

515
00:19:38,630 --> 00:19:36,880
just similar to whether satellites would

516
00:19:40,310 --> 00:19:38,640
do on earth the temperatures in the

517
00:19:42,150 --> 00:19:40,320
atmosphere mars are related to the

518
00:19:43,669 --> 00:19:42,160
density and the density the thickness of

519
00:19:45,430 --> 00:19:43,679
mars atmosphere is what will catch the

520
00:19:47,669 --> 00:19:45,440
spacecraft when we uh

521
00:19:49,669 --> 00:19:47,679
when we arrive at mars you can see also

522
00:19:52,150 --> 00:19:49,679
that mro is looking ahead of itself and

523
00:19:54,070 --> 00:19:52,160
looking kind of at the atmosphere

524
00:19:56,470 --> 00:19:54,080
in its thickness and that allows us to

525
00:19:58,390 --> 00:19:56,480
get very accurate temperatures

526
00:20:00,470 --> 00:19:58,400
temperature distributions with height

527
00:20:02,710 --> 00:20:00,480
which we then turn into densities that

528
00:20:05,190 --> 00:20:02,720
we use to simulate our landing many

529
00:20:07,430 --> 00:20:05,200
thousands and thousands of times

530
00:20:09,909 --> 00:20:07,440
so i'd like to show you the uh a global

531
00:20:11,430 --> 00:20:09,919
weather map of mars but to orient you

532
00:20:13,270 --> 00:20:11,440
i'd first like to show you this similar

533
00:20:14,710 --> 00:20:13,280
map of earth so this is the kind of

534
00:20:17,430 --> 00:20:14,720
format we'll be using in our maps of

535
00:20:19,590 --> 00:20:17,440
mars sort of unfolded

536
00:20:21,430 --> 00:20:19,600
unwrapped the spheres sphere of earth

537
00:20:23,830 --> 00:20:21,440
onto this weather map of earth the

538
00:20:25,430 --> 00:20:23,840

beautiful planet i'll draw your eye to

539
00:20:27,430 --> 00:20:25,440
just above australia there where there's

540
00:20:29,669 --> 00:20:27,440
a little ring

541
00:20:32,390 --> 00:20:29,679
just over indonesia and that's exactly

542
00:20:34,710 --> 00:20:32,400
uh the same location on mars where gale

543
00:20:37,430 --> 00:20:34,720
crater is our landing site so if we now

544
00:20:39,350 --> 00:20:37,440
go to the map of mars this was taken

545
00:20:40,950 --> 00:20:39,360
just two days ago by the mars

546
00:20:43,110 --> 00:20:40,960
reconnaissance orbiter the mars color

547
00:20:45,510 --> 00:20:43,120
imager on that spacecraft

548
00:20:47,669 --> 00:20:45,520
and it shows gale crater as well as some

549
00:20:49,590 --> 00:20:47,679
other features that we're interested in

550
00:20:51,909 --> 00:20:49,600
when we arrive at mars it's

551
00:20:54,230 --> 00:20:51,919
coincidentally about august

552
00:20:56,470 --> 00:20:54,240
in the seasonal cycle of mars and that

553
00:20:58,230 --> 00:20:56,480
means it's just coming out of winter in

554
00:20:59,190 --> 00:20:58,240
the southern hemisphere and gale crater

555
00:21:01,750 --> 00:20:59,200
is just slightly in the southern

556
00:21:03,909 --> 00:21:01,760
hemisphere we expect this to be a cold

557
00:21:06,149 --> 00:21:03,919
time of years when mars is further away

558
00:21:07,669 --> 00:21:06,159
from the sun than in other times of year

559
00:21:09,990 --> 00:21:07,679
and because of that we see a lot of

560
00:21:12,230 --> 00:21:10,000
water ice clouds on this map and that's

561
00:21:14,310 --> 00:21:12,240
a good thing we expect

562
00:21:16,310 --> 00:21:14,320
we've modeled and predicted

563
00:21:18,549 --> 00:21:16,320

from past years that mars will be nice

564
00:21:20,870 --> 00:21:18,559
and cold and clear and covered with uh

565
00:21:23,350 --> 00:21:20,880
this water ice haze when we arrive

566
00:21:24,310 --> 00:21:23,360
and our latest map of mars does in fact

567
00:21:26,230 --> 00:21:24,320
show that

568
00:21:28,710 --> 00:21:26,240
uh the thing we do uh worry about a

569
00:21:30,310 --> 00:21:28,720
little bit is our dust storms now we've

570
00:21:32,549 --> 00:21:30,320
designed the spacecraft to be tolerant

571
00:21:34,070 --> 00:21:32,559
of all the doorstones all the dose

572
00:21:35,830 --> 00:21:34,080
storms that have uh

573
00:21:37,750 --> 00:21:35,840
occurred in previous years

574
00:21:39,190 --> 00:21:37,760
but as i mentioned we do want to

575
00:21:41,110 --> 00:21:39,200
understand if there's a chance of dust

576
00:21:43,029 --> 00:21:41,120
storms occurring on landing day because

577
00:21:44,390 --> 00:21:43,039
they may kick up extra winds that would

578
00:21:47,110 --> 00:21:44,400
cause us to land a little less

579
00:21:48,070 --> 00:21:47,120
accurately than we've been predicting

580
00:21:49,590 --> 00:21:48,080
so

581
00:21:51,430 --> 00:21:49,600
just to make things interesting on this

582
00:21:53,350 --> 00:21:51,440
map there is a pretty healthy looking

583
00:21:55,270 --> 00:21:53,360
dust storm at the bottom of the image

584
00:21:57,190 --> 00:21:55,280
it's pretty far from gale more than a

585
00:21:58,390 --> 00:21:57,200
thousand kilometers away

586
00:22:00,070 --> 00:21:58,400
but it is kicking up dust in the

587
00:22:01,590 --> 00:22:00,080
atmosphere that has the potential to

588
00:22:03,190 --> 00:22:01,600

perhaps spread over to the site now

589
00:22:05,590 --> 00:22:03,200
we're not worried about this particular

590
00:22:07,350 --> 00:22:05,600
storm it's the kind of storm that tends

591
00:22:09,190 --> 00:22:07,360
to disappear within a day or two and

592
00:22:11,909 --> 00:22:09,200
since this map is already almost two

593
00:22:13,350 --> 00:22:11,919
days old we expect by saturday when i

594
00:22:14,870 --> 00:22:13,360
give you the next weather update we

595
00:22:16,789 --> 00:22:14,880
won't even be talking about the storm

596
00:22:19,510 --> 00:22:16,799
anymore

597
00:22:21,909 --> 00:22:19,520
uh so finally um

598
00:22:23,909 --> 00:22:21,919
oh yeah i do want to show you also this

599
00:22:26,310 --> 00:22:23,919
interesting image from a this is a

600
00:22:28,950 --> 00:22:26,320
close-up image of a similar small storm

601
00:22:31,029 --> 00:22:28,960
that was taken in 2007 now these dust

602
00:22:34,149 --> 00:22:31,039
storms occur on mars at this season

603
00:22:36,710 --> 00:22:34,159
because the polar caps are receding back

604
00:22:38,549 --> 00:22:36,720
as we go from winter into spring and

605
00:22:41,990 --> 00:22:38,559
there's a temperature contrast between

606
00:22:43,590 --> 00:22:42,000
the cold co2 frost cap and the bare

607
00:22:46,549 --> 00:22:43,600
ground next to it that temperature

608
00:22:48,070 --> 00:22:46,559
contrast stirs up winds that raises dust

609
00:22:49,990 --> 00:22:48,080
and creates these local dust storms

610
00:22:51,990 --> 00:22:50,000
which you can see kind of boiling from

611
00:22:54,470 --> 00:22:52,000
the surface now this particular storm

612
00:22:55,830 --> 00:22:54,480
was from 2007 and lasted less than 48

613
00:22:58,789 --> 00:22:55,840

hours and that's the kind of storm we

614
00:23:01,590 --> 00:22:58,799
saw on the image of mars from july 31st

615
00:23:02,870 --> 00:23:01,600
and we expect it to behave the same way

616
00:23:04,549 --> 00:23:02,880
the final thing i like to share with you

617
00:23:06,390 --> 00:23:04,559
is that we don't only look at the

618
00:23:08,630 --> 00:23:06,400
weather in the atmosphere of mars we

619
00:23:11,190 --> 00:23:08,640
also look at space weather

620
00:23:13,270 --> 00:23:11,200
space weather occurs when plasma or high

621
00:23:15,590 --> 00:23:13,280
energy particles leave the sun through

622
00:23:16,630 --> 00:23:15,600
coronal mass ejections

623
00:23:18,870 --> 00:23:16,640
or

624
00:23:20,549 --> 00:23:18,880
solar flares now if these high energy

625
00:23:22,789 --> 00:23:20,559
particles come from solar flares they

626
00:23:24,789 --> 00:23:22,799
can reach mars within only about an hour

627
00:23:26,789 --> 00:23:24,799
or two of leaving the sun

628
00:23:28,549 --> 00:23:26,799
why do we care about these things

629
00:23:30,390 --> 00:23:28,559
these high energy particles can impact

630
00:23:32,230 --> 00:23:30,400
the spacecraft in two ways

631
00:23:35,270 --> 00:23:32,240
they can either cause errors in the

632
00:23:37,590 --> 00:23:35,280
memory of the spacecraft or cause stars

633
00:23:39,590 --> 00:23:37,600
that aren't really there to appear on

634
00:23:42,630 --> 00:23:39,600
the cameras that we use to track

635
00:23:44,470 --> 00:23:42,640
and navigate the spacecraft now the

636
00:23:46,070 --> 00:23:44,480
spacecraft of course has been designed

637
00:23:48,630 --> 00:23:46,080
to be very tolerant to both of these

638
00:23:50,230 --> 00:23:48,640

effects but again we just monitor the

639
00:23:52,950 --> 00:23:50,240
environment around the sun using

640
00:23:55,269 --> 00:23:52,960
spacecraft around earth and at mars even

641
00:23:56,470 --> 00:23:55,279
so we know it's coming and so we have a

642
00:23:58,470 --> 00:23:56,480
good understanding of the environment

643
00:24:00,390 --> 00:23:58,480
the spacecraft will be in when it

644
00:24:01,590 --> 00:24:00,400
performs these very tricky maneuvers on

645
00:24:03,830 --> 00:24:01,600
sunday night

646
00:24:07,110 --> 00:24:03,840
so with that we'll turn it over to doug

647
00:24:08,070 --> 00:24:07,120
thanks ashwin for about two years nasa

648
00:24:09,510 --> 00:24:08,080
has been

649
00:24:11,430 --> 00:24:09,520
sharing with the public the adventures

650
00:24:13,590 --> 00:24:11,440
that our robotic envoys have exploring

651
00:24:16,390 --> 00:24:13,600
the cosmos using a tool developed here

652
00:24:18,390 --> 00:24:16,400
at jpl called eyes on the solar system

653
00:24:21,029 --> 00:24:18,400
now thanks to some fantastic data and

654
00:24:23,029 --> 00:24:21,039
support from thomas and adam's

655
00:24:25,190 --> 00:24:23,039
colleagues in the edl and navigation

656
00:24:27,669 --> 00:24:25,200
teams we're able to actually show you

657
00:24:29,029 --> 00:24:27,679
inside your web browser exactly what

658
00:24:30,710 --> 00:24:29,039
curiosity is going to be doing over the

659
00:24:32,630 --> 00:24:30,720
next few days what you're seeing now is

660
00:24:34,470 --> 00:24:32,640
actually a live view using eyes on the

661
00:24:35,789 --> 00:24:34,480
solar system which you can get to just

662
00:24:38,310 --> 00:24:35,799
by going to

663
00:24:41,029 --> 00:24:38,320

eyes.nasa.gov inside your browser

664
00:24:43,350 --> 00:24:41,039
it needs a reasonably uh modern computer

665
00:24:44,870 --> 00:24:43,360
a mac or pc a desktop or a laptop is

666
00:24:46,950 --> 00:24:44,880
absolutely fine

667
00:24:48,470 --> 00:24:46,960
and there are two things we can do here

668
00:24:50,230 --> 00:24:48,480
one is that using this predicted

669
00:24:52,870 --> 00:24:50,240
simulation data provided by the the

670
00:24:54,549 --> 00:24:52,880
curiosity team we can show you exactly

671
00:24:57,269 --> 00:24:54,559
where curiosity should be right now in

672
00:24:59,830 --> 00:24:57,279
fact as thomas mentioned we're about 670

673
00:25:01,750 --> 00:24:59,840
000 miles from mars and doing just under

674
00:25:03,269 --> 00:25:01,760
8 000 miles an hour

675
00:25:04,470 --> 00:25:03,279
and you can track this you know all the

676
00:25:06,149 --> 00:25:04,480
time all the way through to sunday

677
00:25:07,830 --> 00:25:06,159
evening but because we already have this

678
00:25:10,149 --> 00:25:07,840
data we can hit a magic button here that

679
00:25:11,510 --> 00:25:10,159
says preview and we can fast forward

680
00:25:13,510 --> 00:25:11,520
through to sunday evening and see how

681
00:25:15,590 --> 00:25:13,520
things are going to unfold if things go

682
00:25:17,510 --> 00:25:15,600
according to plan and here we can see

683
00:25:19,110 --> 00:25:17,520
the spacecraft as it approaches mars and

684
00:25:20,710 --> 00:25:19,120
you can see the landing site way off on

685
00:25:22,070 --> 00:25:20,720
the limb right here

686
00:25:23,190 --> 00:25:22,080
and on the night if you're using the

687
00:25:25,029 --> 00:25:23,200
live mode you'll be able to watch

688
00:25:26,710 --> 00:25:25,039

exactly what happens right inside of you

689
00:25:28,390 --> 00:25:26,720
like this but we can actually skip

690
00:25:30,149 --> 00:25:28,400
forward so i'm going to skip forward

691
00:25:31,750 --> 00:25:30,159
through edl and you'll see the exact

692
00:25:33,590 --> 00:25:31,760
same things that you'll have seen in the

693
00:25:35,350 --> 00:25:33,600
animation but now you're in charge of

694
00:25:37,110 --> 00:25:35,360
the camera you can stop go backwards

695
00:25:39,269 --> 00:25:37,120
forwards look at it from any angle you

696
00:25:40,549 --> 00:25:39,279
want as i fast forward through time you

697
00:25:42,390 --> 00:25:40,559
get closer and closer to the landing

698
00:25:44,149 --> 00:25:42,400
site you can see the values screaming

699
00:25:45,669 --> 00:25:44,159
off on the side there the altitude the

700
00:25:47,830 --> 00:25:45,679
velocity the distance to the landing

701
00:25:49,590 --> 00:25:47,840
site you can see those guided turns that

702
00:25:51,350 --> 00:25:49,600
adam talked about as we uh we kind of

703
00:25:53,669 --> 00:25:51,360
guide curiosity to the exact spot and

704
00:25:54,950 --> 00:25:53,679
the surface of mars we want to get to

705
00:25:56,390 --> 00:25:54,960
and you can see a countdown to the

706
00:25:58,070 --> 00:25:56,400
different events on the right hand side

707
00:25:59,909 --> 00:25:58,080
i'm going to stop just after we get to

708
00:26:01,990 --> 00:25:59,919
the heat shield deployment which comes

709
00:26:03,510 --> 00:26:02,000
up in just a few more seconds

710
00:26:04,870 --> 00:26:03,520
there goes that ballast adam mentioned

711
00:26:06,789 --> 00:26:04,880
here comes the parachute you can see the

712
00:26:08,149 --> 00:26:06,799
beautiful parachute here

713
00:26:09,430 --> 00:26:08,159

and you can see the countdown just down

714
00:26:10,630 --> 00:26:09,440
there for a few more seconds we'll see

715
00:26:13,029 --> 00:26:10,640
the heat shield come off so i'll skip

716
00:26:14,470 --> 00:26:13,039
forward just a little more

717
00:26:16,149 --> 00:26:14,480
there goes the heat shield and any time

718
00:26:17,590 --> 00:26:16,159
of course because it's a prediction i

719
00:26:18,950 --> 00:26:17,600
can pause the action

720
00:26:19,990 --> 00:26:18,960
i can go and have a look around i can

721
00:26:22,230 --> 00:26:20,000
say well actually i want to go and look

722
00:26:23,830 --> 00:26:22,240
at the heat shield

723
00:26:24,950 --> 00:26:23,840
and here you can see the medley suite on

724
00:26:26,950 --> 00:26:24,960
the inside of the heat shield that was

725
00:26:28,789 --> 00:26:26,960
mentioned earlier you can go back look

726
00:26:30,390 --> 00:26:28,799
at the spacecraft behind us

727
00:26:31,909 --> 00:26:30,400
and you can also see that this doesn't

728
00:26:33,750 --> 00:26:31,919
live in isolation this lives in an

729
00:26:35,510 --> 00:26:33,760
engine that hosts the whole of the solar

730
00:26:37,350 --> 00:26:35,520
system so behind us you can see there's

731
00:26:39,190 --> 00:26:37,360
mars express there's the earth that's

732
00:26:41,190 --> 00:26:39,200
about to set about a minute after this

733
00:26:42,950 --> 00:26:41,200
moment in time there's mars odyssey

734
00:26:44,390 --> 00:26:42,960
coming over the horizon and towards the

735
00:26:45,430 --> 00:26:44,400
south we can see the mars reconnaissance

736
00:26:47,110 --> 00:26:45,440
orbiter and if you want to look at

737
00:26:48,630 --> 00:26:47,120
things from over there we double click

738
00:26:50,870 --> 00:26:48,640

the mouse and we can ride on board the

739
00:26:53,029 --> 00:26:50,880
mro and see that it's tracking curiosity

740
00:26:54,870 --> 00:26:53,039
as it makes its way towards the surface

741
00:26:56,230 --> 00:26:54,880
i can unpause the action you can see mro

742
00:26:59,350 --> 00:26:56,240
is orbiting mars

743
00:27:01,110 --> 00:26:59,360
i can go back to curiosity

744
00:27:02,789 --> 00:27:01,120
and you'll see that uh 20 seconds after

745
00:27:04,470 --> 00:27:02,799
this moment in time the earth sets over

746
00:27:05,590 --> 00:27:04,480
the horizon i'm going to fast forward

747
00:27:09,029 --> 00:27:05,600
just a little bit further towards the

748
00:27:10,470 --> 00:27:09,039
surface until things get really exciting

749
00:27:11,750 --> 00:27:10,480
and now we see the spacecraft drop out

750
00:27:13,669 --> 00:27:11,760
of the back shells it makes its power

751
00:27:14,630 --> 00:27:13,679
descent towards the surface i won't show

752
00:27:15,990 --> 00:27:14,640
you all the way to the end i don't want

753
00:27:19,269 --> 00:27:16,000
to spoil it for you but it's very

754
00:27:22,630 --> 00:27:20,789
and if things go according to plan on

755
00:27:24,149 --> 00:27:22,640
sunday then what happens should be very

756
00:27:26,070 --> 00:27:24,159
very similar to this prediction you see

757
00:27:27,510 --> 00:27:26,080
right here everything i've shown you can

758
00:27:30,070 --> 00:27:27,520
do right at home inside your computer

759
00:27:32,470 --> 00:27:30,080
just by going to eyes.nasa.gov

760
00:27:34,230 --> 00:27:32,480
and with that i'll hand it back to jane

761
00:27:36,070 --> 00:27:34,240
thank you doug and thanks to all our

762
00:27:38,470 --> 00:27:36,080
panelists this morning uh we are ready

763
00:27:40,389 --> 00:27:38,480

for some questions from reporters

764
00:27:42,070 --> 00:27:40,399
here at jpl if you do have a question

765
00:27:44,950 --> 00:27:42,080
please raise your hand

766
00:27:47,269 --> 00:27:44,960
and wait for the mic to come to you and

767
00:27:50,789 --> 00:27:47,279
let's start here in the third row

768
00:27:55,510 --> 00:27:52,950
hi yeah eric hand with nature my

769
00:27:57,750 --> 00:27:55,520
question is for tomas

770
00:27:59,350 --> 00:27:57,760
so you showed us the the charts showing

771
00:28:01,990 --> 00:27:59,360
how the latest

772
00:28:04,389 --> 00:28:02,000
estimate was about a thousand yards off

773
00:28:05,350 --> 00:28:04,399
from the intended target entry

774
00:28:06,950 --> 00:28:05,360
um

775
00:28:08,950 --> 00:28:06,960
does that mean that the center of the

776
00:28:12,149 --> 00:28:08,960
landing ellipse has shifted

777
00:28:13,510 --> 00:28:12,159
uh by that amount uh and uh if you could

778
00:28:15,909 --> 00:28:13,520
also say

779
00:28:17,430 --> 00:28:15,919
what you'll use to decide whether or not

780
00:28:19,830 --> 00:28:17,440
that's too much and you need to correct

781
00:28:21,190 --> 00:28:19,840
for that in this window to to do the

782
00:28:23,190 --> 00:28:21,200
correction maneuver tomorrow want to

783
00:28:25,190 --> 00:28:23,200
take this on sure

784
00:28:26,470 --> 00:28:25,200
um because of the guided entry that we

785
00:28:29,350 --> 00:28:26,480
spoke about

786
00:28:32,230 --> 00:28:29,360
uh errors in delivery of the spacecraft

787
00:28:34,389 --> 00:28:32,240
like that thousand yards that we have

788
00:28:35,909 --> 00:28:34,399

can be flown out by curiosity on our way

789
00:28:37,909 --> 00:28:35,919
in

790
00:28:39,750 --> 00:28:37,919
as long as curi as accurately as

791
00:28:41,990 --> 00:28:39,760
curiosity knows her

792
00:28:43,590 --> 00:28:42,000
location she can

793
00:28:45,669 --> 00:28:43,600
control

794
00:28:48,470 --> 00:28:45,679
to some fair degree

795
00:28:51,029 --> 00:28:48,480
down to very accurately on on the

796
00:28:53,110 --> 00:28:51,039
surface so that thousand yards if we

797
00:28:55,750 --> 00:28:53,120
were to choose not to correct it we'll

798
00:28:59,190 --> 00:28:55,760
just let let curiosity correct it once

799
00:29:05,029 --> 00:29:00,149
no

800
00:29:07,029 --> 00:29:05,039
target that she's going to on mars

801
00:29:08,870 --> 00:29:07,039
and all that we have to do is give her

802
00:29:10,230 --> 00:29:08,880
our best estimate of where she is

803
00:29:12,310 --> 00:29:10,240
currently

804
00:29:14,230 --> 00:29:12,320
and she'll do the rest as she flies for

805
00:29:15,669 --> 00:29:14,240
the atmosphere

806
00:29:18,389 --> 00:29:15,679
okay we've got a question there in the

807
00:29:22,470 --> 00:29:20,710
hi irene klotz with with reuters um just

808
00:29:23,750 --> 00:29:22,480
to follow that up what's the range then

809
00:29:27,190 --> 00:29:23,760
that the rover

810
00:29:31,990 --> 00:29:27,200
can correct for and um when would you be

811
00:29:35,269 --> 00:29:32,000
deciding if a tcm was necessary tomorrow

812
00:29:37,909 --> 00:29:35,279
so we've established a tcm criteria

813
00:29:40,710 --> 00:29:37,919

that's well within what her control

814
00:29:41,990 --> 00:29:40,720
authority is what the the range that she

815
00:29:43,110 --> 00:29:42,000
can clean up

816
00:29:45,909 --> 00:29:43,120
is

817
00:29:48,230 --> 00:29:45,919
tens of kilometers of error but we will

818
00:29:51,190 --> 00:29:48,240
choose we would choose very likely if

819
00:29:52,389 --> 00:29:51,200
the spacecraft was healthy to perform a

820
00:29:55,350 --> 00:29:52,399
tcm

821
00:29:57,269 --> 00:29:55,360
if we were just a handful of kilometers

822
00:30:00,230 --> 00:29:57,279
off of where we thought we were because

823
00:30:01,190 --> 00:30:00,240
we want to stack the deck in her favor

824
00:30:02,789 --> 00:30:01,200
and sort of put her right down the

825
00:30:04,470 --> 00:30:02,799
middle so she doesn't have all that much

826
00:30:06,149 --> 00:30:04,480
to do when she gets to mars

827
00:30:08,070 --> 00:30:06,159
and and when would that decision be made

828
00:30:10,870 --> 00:30:08,080
tomorrow or today about whether to do

829
00:30:12,789 --> 00:30:10,880
the burn or not uh there's a there's an

830
00:30:14,710 --> 00:30:12,799
opportunity to talk we will tomorrow

831
00:30:16,470 --> 00:30:14,720
about middle of the day we'll make that

832
00:30:18,310 --> 00:30:16,480
we'll start making that decision

833
00:30:19,909 --> 00:30:18,320
and uh you really piqued my curiosity

834
00:30:22,789 --> 00:30:19,919
when you said that

835
00:30:25,669 --> 00:30:22,799
this landing system was the least crazy

836
00:30:28,630 --> 00:30:25,679
of the options that were on the table

837
00:30:31,590 --> 00:30:28,640
could you maybe uh pick one or two um

838
00:30:33,590 --> 00:30:31,600

other scenarios that were uh

839
00:30:34,389 --> 00:30:33,600
not immediately laughed out of the room

840
00:30:36,710 --> 00:30:34,399
and

841
00:30:39,269 --> 00:30:36,720
where you um what were kind of the

842
00:30:43,190 --> 00:30:39,279
trade-offs that led you to this system

843
00:30:45,029 --> 00:30:43,200
thanks certainly the the leading two

844
00:30:46,389 --> 00:30:45,039
you know the runners-up

845
00:30:49,269 --> 00:30:46,399
were um

846
00:30:51,590 --> 00:30:49,279
maybe don't look that crazy to the to

847
00:30:53,350 --> 00:30:51,600
the lay person but they their

848
00:30:55,990 --> 00:30:53,360
performance and their

849
00:30:57,750 --> 00:30:56,000
risks throw them into the crazy category

850
00:31:00,230 --> 00:30:57,760
uh though they are

851
00:31:02,549 --> 00:31:00,240
legged landers like we've successfully

852
00:31:05,509 --> 00:31:02,559
uh put on the surface of mars in viking

853
00:31:08,389 --> 00:31:05,519
one two and the phoenix lander

854
00:31:10,870 --> 00:31:08,399
also the apollo landing system

855
00:31:13,110 --> 00:31:10,880
they are not very stable

856
00:31:14,950 --> 00:31:13,120
and when you stick a rover of the size

857
00:31:17,509 --> 00:31:14,960
of curiosity on the deck of a legged

858
00:31:18,630 --> 00:31:17,519
lander it becomes very unstable and you

859
00:31:21,590 --> 00:31:18,640
need to land

860
00:31:23,269 --> 00:31:21,600
on a on a flat top spot to be able to

861
00:31:25,430 --> 00:31:23,279
make that happen so that's where that

862
00:31:26,950 --> 00:31:25,440
one loses and the other one was the

863
00:31:29,509 --> 00:31:26,960

airbag system that we've successfully

864
00:31:31,750 --> 00:31:29,519
used during pathfinder and the mers

865
00:31:33,190 --> 00:31:31,760
spirit and opportunity

866
00:31:35,990 --> 00:31:33,200
unfortunately

867
00:31:38,070 --> 00:31:36,000
we don't have fabric here on earth

868
00:31:40,710 --> 00:31:38,080
strong enough to build airbags that

869
00:31:43,669 --> 00:31:40,720
would work for a rover the size of

870
00:31:45,909 --> 00:31:43,679
curiosity and so the bags would shred

871
00:31:48,950 --> 00:31:45,919
not giving curiosity any protection and

872
00:31:50,950 --> 00:31:48,960
that's what throws that one out

873
00:31:54,549 --> 00:31:50,960
okay we've got a question was that a

874
00:31:55,830 --> 00:31:54,559
hand i saw right next to irene yes

875
00:31:58,470 --> 00:31:55,840
i read somewhere that one of the

876
00:31:59,669 --> 00:31:58,480
concerns about about not landing the

877
00:32:01,669 --> 00:31:59,679
rover

878
00:32:03,509 --> 00:32:01,679
with the this with the the the sense

879
00:32:05,430 --> 00:32:03,519
stage was that it would kick up so much

880
00:32:07,190 --> 00:32:05,440
dust that would foul up the

881
00:32:08,549 --> 00:32:07,200
equipment on the rover too is that is

882
00:32:09,830 --> 00:32:08,559
that was that a concern or was that

883
00:32:11,110 --> 00:32:09,840
already outweighed by the fact that it'd

884
00:32:13,269 --> 00:32:11,120
be unstable

885
00:32:14,870 --> 00:32:13,279
uh that the uh the issue of dust is

886
00:32:17,430 --> 00:32:14,880
certainly one

887
00:32:19,509 --> 00:32:17,440
the issue of the interaction between the

888
00:32:22,470 --> 00:32:19,519

plumes and the surface is a very

889
00:32:25,669 --> 00:32:22,480
important issue dust is one of those but

890
00:32:27,509 --> 00:32:25,679
actually when you get a propulsion

891
00:32:29,909 --> 00:32:27,519
system close to the surface you develop

892
00:32:30,710 --> 00:32:29,919
quite a bit of pressure that can make

893
00:32:33,029 --> 00:32:30,720
that

894
00:32:34,630 --> 00:32:33,039
landing train interaction very unstable

895
00:32:35,990 --> 00:32:34,640
and so the way legged landers have

896
00:32:37,509 --> 00:32:36,000
approached that in the past is they come

897
00:32:39,669 --> 00:32:37,519
in very quickly

898
00:32:41,990 --> 00:32:39,679
so that the the guidance system doesn't

899
00:32:43,909 --> 00:32:42,000
have a chance to try and control it it's

900
00:32:47,110 --> 00:32:43,919
more of a it looks like a soft landing

901
00:32:49,029 --> 00:32:47,120
but really it's a controlled impact

902
00:32:51,509 --> 00:32:49,039
that has features that exacerbates the

903
00:32:53,509 --> 00:32:51,519
instability and also means that the

904
00:32:56,230 --> 00:32:53,519
computer has to look for a very

905
00:32:57,590 --> 00:32:56,240
quick signal of touchdown and as some of

906
00:33:00,070 --> 00:32:57,600
you may know one of the leading

907
00:33:03,029 --> 00:33:00,080
candidates for the the reason we lost

908
00:33:05,350 --> 00:33:03,039
the mars polar lander was it triggering

909
00:33:07,110 --> 00:33:05,360
off of a touchdown sensor

910
00:33:09,430 --> 00:33:07,120
some 80 meters above the surface and

911
00:33:11,110 --> 00:33:09,440
turning off its rockets and and crashing

912
00:33:13,669 --> 00:33:11,120
the surface so we in general we don't

913
00:33:14,950 --> 00:33:13,679

like that technique either so uh there's

914
00:33:17,590 --> 00:33:14,960
several reasons to keep the descent

915
00:33:20,230 --> 00:33:17,600
stage away from the the um the ground

916
00:33:21,669 --> 00:33:20,240
the first of which being

917
00:33:23,430 --> 00:33:21,679
remove that pressure and that

918
00:33:25,669 --> 00:33:23,440
instability and then the dust is

919
00:33:28,470 --> 00:33:25,679
certainly a good thing to keep off the

920
00:33:30,070 --> 00:33:28,480
vehicle to the degree that we can

921
00:33:31,590 --> 00:33:30,080
okay and a reminder that if you do have

922
00:33:34,149 --> 00:33:31,600
a question please raise your hand so we

923
00:33:35,669 --> 00:33:34,159
can get the mic to you and uh

924
00:33:37,190 --> 00:33:35,679
also state your name and affiliation

925
00:33:40,549 --> 00:33:37,200
let's go to the back row right there

926
00:33:43,269 --> 00:33:41,509
adam

927
00:33:46,549 --> 00:33:43,279
much has been said on the internet about

928
00:33:47,509 --> 00:33:46,559
nasa's seven minutes of terror

929
00:33:49,750 --> 00:33:47,519
and

930
00:33:51,909 --> 00:33:49,760
there's a this is obviously very

931
00:33:54,149 --> 00:33:51,919
sophisticated uh procedure that you're

932
00:33:56,470 --> 00:33:54,159
going through is there any particular

933
00:33:58,149 --> 00:33:56,480
minute of those seven minutes that you

934
00:33:59,990 --> 00:33:58,159
are most focused on and most worried

935
00:34:01,990 --> 00:34:00,000
about

936
00:34:04,830 --> 00:34:02,000
like any good parent i love each of

937
00:34:09,190 --> 00:34:07,430
minutes in different ways of course

938
00:34:11,589 --> 00:34:09,200

they're all different minutes

939
00:34:16,310 --> 00:34:12,710
certainly

940
00:34:18,950 --> 00:34:16,320
the um the novelty of the guided entry

941
00:34:22,710 --> 00:34:18,960
and especially the novelty of the sky

942
00:34:27,190 --> 00:34:25,109
draw a lot of the the attention of the

943
00:34:29,349 --> 00:34:27,200
team's anxiety

944
00:34:30,629 --> 00:34:29,359
there's also that parachute that we use

945
00:34:32,829 --> 00:34:30,639
it ends up being parachutes are

946
00:34:37,109 --> 00:34:32,839
fundamentally

947
00:34:39,430 --> 00:34:37,119
um sketchy kinds of devices right we

948
00:34:42,149 --> 00:34:39,440
uh the u.s military troops jump out of

949
00:34:45,430 --> 00:34:42,159
airplanes all the time and we've done

950
00:34:47,669 --> 00:34:45,440
amazing research about how to how to

951
00:34:49,109 --> 00:34:47,679
have them jump out of airplanes safely

952
00:34:51,669 --> 00:34:49,119
but when they do they take a second

953
00:34:53,430 --> 00:34:51,679
parachute because with all that work and

954
00:34:54,869 --> 00:34:53,440
all that control

955
00:34:56,069 --> 00:34:54,879
the there's still enough uncertainty

956
00:34:57,829 --> 00:34:56,079
when you use a parachute that you would

957
00:34:59,589 --> 00:34:57,839
like to have a backup

958
00:35:01,910 --> 00:34:59,599
well it ends up being you can't work a

959
00:35:03,990 --> 00:35:01,920
backup in this system and so we have

960
00:35:06,150 --> 00:35:04,000
sort of a fundamental

961
00:35:08,150 --> 00:35:06,160
device reliability limit we've done

962
00:35:10,870 --> 00:35:08,160
everything you can do humanly possible

963
00:35:12,470 --> 00:35:10,880

to improve our odds with that parachute

964
00:35:14,230 --> 00:35:12,480
but that's sort of a fundamental

965
00:35:16,230 --> 00:35:14,240
irreducible risk about making it to the

966
00:35:17,589 --> 00:35:16,240
surface of mars is you got to use a

967
00:35:19,430 --> 00:35:17,599
parachute

968
00:35:23,190 --> 00:35:19,440
so maybe

969
00:35:25,349 --> 00:35:23,200
skycrane guided entry parachute are

970
00:35:27,109 --> 00:35:25,359
three minutes of those seven minutes

971
00:35:29,349 --> 00:35:27,119
that maybe take an extra bit of

972
00:35:31,109 --> 00:35:29,359
attention

973
00:35:32,950 --> 00:35:31,119
okay do we have more questions yeah

974
00:35:37,030 --> 00:35:32,960
let's go to the third row right here in

975
00:35:42,150 --> 00:35:39,750
yeah hi it's craig cavall with america

976
00:35:43,349 --> 00:35:42,160
space and aerospace america

977
00:35:45,589 --> 00:35:43,359
adam

978
00:35:48,630 --> 00:35:45,599
and anyone else chime into

979
00:35:51,030 --> 00:35:48,640
a given lift and guided entry

980
00:35:52,870 --> 00:35:51,040
would it be a correct analogy that you

981
00:35:55,190 --> 00:35:52,880
can relate this all the way back to

982
00:35:57,589 --> 00:35:55,200
orville and wilbur wright's genius of

983
00:35:58,550 --> 00:35:57,599
first developing and measuring lift

984
00:36:00,470 --> 00:35:58,560
and

985
00:36:02,630 --> 00:36:00,480
control

986
00:36:05,430 --> 00:36:02,640
in the history of flight taking it to

987
00:36:10,870 --> 00:36:08,710
interesting question um i i'm drawn

988
00:36:15,829 --> 00:36:10,880

towards nerding out with that question

989
00:36:19,349 --> 00:36:17,430
the only thing that makes it tough for

990
00:36:21,589 --> 00:36:19,359
me to go there is that orbital and

991
00:36:23,430 --> 00:36:21,599
wilbert were using bernoulli lift

992
00:36:25,109 --> 00:36:23,440
from a

993
00:36:27,030 --> 00:36:25,119
and we use

994
00:36:30,230 --> 00:36:27,040
a negative lifting body or that is to

995
00:36:32,550 --> 00:36:30,240
say we use blunt body momentum

996
00:36:34,790 --> 00:36:32,560
associated lift as opposed to bernoulli

997
00:36:37,990 --> 00:36:34,800
lift so whereas or

998
00:36:40,550 --> 00:36:38,000
orbital and and wilbur fly forward and

999
00:36:41,829 --> 00:36:40,560
get lifted up we sort of come crashing

1000
00:36:43,829 --> 00:36:41,839
forward

1001
00:36:45,510 --> 00:36:43,839
pitch our nose down

1002
00:36:47,190 --> 00:36:45,520
and develop lift you know the wright

1003
00:36:49,190 --> 00:36:47,200
brothers you pitch the

1004
00:36:51,589 --> 00:36:49,200
the vehicle up it gets more lift for

1005
00:36:53,190 --> 00:36:51,599
hours we get lift by pitching down

1006
00:36:58,230 --> 00:36:53,200
so

1007
00:37:00,470 --> 00:36:58,240
a bit uh certainly it is use of lift

1008
00:37:03,270 --> 00:37:00,480
and uh and we aren't the first you know

1009
00:37:05,030 --> 00:37:03,280
we're using repurposed apollo

1010
00:37:07,109 --> 00:37:05,040
guidance algorithms that were used in

1011
00:37:08,710 --> 00:37:07,119
the 60s and 70s

1012
00:37:10,870 --> 00:37:08,720
and we're using them

1013
00:37:12,310 --> 00:37:10,880

novelly in an autonomous mission at

1014
00:37:14,470 --> 00:37:12,320
another planet

1015
00:37:17,109 --> 00:37:14,480
it's also true that viking used lift it

1016
00:37:19,190 --> 00:37:17,119
just didn't guide the lift it used it

1017
00:37:22,790 --> 00:37:19,200
lift to improve its uh performance at

1018
00:37:24,870 --> 00:37:22,800
mars so we're taking pieces of

1019
00:37:26,069 --> 00:37:24,880
history perhaps reaching all the way

1020
00:37:28,150 --> 00:37:26,079
back down to

1021
00:37:33,190 --> 00:37:28,160
the wright brothers and we're using

1022
00:37:35,750 --> 00:37:33,200
those in a novel application for us yes

1023
00:37:37,190 --> 00:37:35,760
okay let's get the mic to yeah to john

1024
00:37:39,349 --> 00:37:37,200
johnson right there

1025
00:37:40,870 --> 00:37:39,359
and please go ahead and yeah since you

1026
00:37:42,470 --> 00:37:40,880
nerded out on that last one do you mind

1027
00:37:44,630 --> 00:37:42,480
nerding out on the uh

1028
00:37:46,710 --> 00:37:44,640
the tungsten weights to explain that a

1029
00:37:48,069 --> 00:37:46,720
little bit better how the how it guides

1030
00:37:50,710 --> 00:37:48,079
itself that way

1031
00:37:53,109 --> 00:37:50,720
certainly uh symmetric arrow aeroshell

1032
00:37:54,950 --> 00:37:53,119
symmetric body if the center of gravity

1033
00:37:57,829 --> 00:37:54,960
and shaped such that it's statically

1034
00:37:59,670 --> 00:37:57,839
stable aerodynamically so that is to say

1035
00:38:01,589 --> 00:37:59,680
if the center of mass were right in the

1036
00:38:03,430 --> 00:38:01,599
center of the body and it was coming in

1037
00:38:05,190 --> 00:38:03,440
like this it would have zero angle of

1038
00:38:07,670 --> 00:38:05,200

attack

1039
00:38:10,870 --> 00:38:07,680
um we put 168

1040
00:38:14,470 --> 00:38:10,880
kilograms of tungsten in six

1041
00:38:19,030 --> 00:38:14,480
slugs of 168 divided by six whatever

1042
00:38:21,589 --> 00:38:19,040
that number is about 30. um

1043
00:38:23,510 --> 00:38:21,599
here and that

1044
00:38:26,310 --> 00:38:23,520
moves the cg

1045
00:38:28,390 --> 00:38:26,320
the center of gravity and so the vehicle

1046
00:38:30,390 --> 00:38:28,400
tilts a bit

1047
00:38:32,230 --> 00:38:30,400
it's it's static equilibrium point it's

1048
00:38:34,310 --> 00:38:32,240
aerodynamic equilibrium point is an

1049
00:38:36,470 --> 00:38:34,320
angle of attack that angle attack means

1050
00:38:37,910 --> 00:38:36,480
that there's a differential pressure

1051
00:38:40,870 --> 00:38:37,920
across the bottom that differential

1052
00:38:45,430 --> 00:38:40,880
pressure results in a lift

1053
00:38:50,950 --> 00:38:47,030
all right we've got time for a few more

1054
00:38:53,510 --> 00:38:50,960
questions if anybody has any here at jpl

1055
00:38:56,230 --> 00:38:53,520
uh has everyone had a chance to ask a

1056
00:38:59,030 --> 00:38:56,240
first question if so we'll go back to

1057
00:39:01,190 --> 00:38:59,040
irene klotz over there

1058
00:39:03,109 --> 00:39:01,200
thanks um i was just curious if uh there

1059
00:39:05,670 --> 00:39:03,119
was any thought given to

1060
00:39:08,230 --> 00:39:05,680
instead of using just uh a dead weight

1061
00:39:10,069 --> 00:39:08,240
to actually putting something that might

1062
00:39:11,430 --> 00:39:10,079
be scientifically or

1063
00:39:15,270 --> 00:39:11,440

educationally

1064
00:39:15,990 --> 00:39:15,280
useful instead of that tungsten

1065
00:39:18,069 --> 00:39:16,000
well

1066
00:39:19,510 --> 00:39:18,079
i know 160 kilograms of tungsten who

1067
00:39:22,870 --> 00:39:19,520
think that they're doing just a dandy

1068
00:39:25,030 --> 00:39:22,880
job thank you very much

1069
00:39:27,829 --> 00:39:25,040
certainly we have speculated and thought

1070
00:39:30,069 --> 00:39:27,839
of different ways of doing it it feels

1071
00:39:32,950 --> 00:39:30,079
some folks think it's a tad wasteful to

1072
00:39:35,109 --> 00:39:32,960
be to be hucking off this inert mass

1073
00:39:37,910 --> 00:39:35,119
inert mass ends up being some of the

1074
00:39:40,790 --> 00:39:37,920
least expensive mass to put on mars you

1075
00:39:43,430 --> 00:39:40,800
know chunks of tungsten as opposed to

1076
00:39:45,190 --> 00:39:43,440
kilograms of engineered or

1077
00:39:47,829 --> 00:39:45,200
or other you know

1078
00:39:49,430 --> 00:39:47,839
complex pieces we studied and traded

1079
00:39:50,710 --> 00:39:49,440
many different methods of developing

1080
00:39:53,109 --> 00:39:50,720
that lift

1081
00:39:55,750 --> 00:39:53,119
including moving mercury around inside

1082
00:39:57,589 --> 00:39:55,760
the heat shield having aerodynamic

1083
00:39:58,550 --> 00:39:57,599
fixtures on the other side to develop

1084
00:40:00,310 --> 00:39:58,560
lift

1085
00:40:02,710 --> 00:40:00,320
and this was the

1086
00:40:04,870 --> 00:40:02,720
simplest most reliable

1087
00:40:06,150 --> 00:40:04,880
and most cost effective method for us to

1088
00:40:07,589 --> 00:40:06,160

get the job done

1089
00:40:08,710 --> 00:40:07,599
if you're asking the question as to

1090
00:40:10,710 --> 00:40:08,720
whether or not you could have put

1091
00:40:14,230 --> 00:40:10,720
something meaningful in that in that

1092
00:40:16,710 --> 00:40:14,240
spot the problem is once you eject it

1093
00:40:19,030 --> 00:40:16,720
um you've got it you've got it to land

1094
00:40:20,710 --> 00:40:19,040
it's itself land safely and then you've

1095
00:40:22,790 --> 00:40:20,720
got the communication issue of how does

1096
00:40:23,670 --> 00:40:22,800
it how does it talk back to us and those

1097
00:40:25,510 --> 00:40:23,680
are all

1098
00:40:27,750 --> 00:40:25,520
very very difficult engineering problems

1099
00:40:29,270 --> 00:40:27,760
that really are not the main focus of

1100
00:40:31,750 --> 00:40:29,280
the mission and so that's those things

1101
00:40:32,870 --> 00:40:31,760
tend to get avoided uh in that kind of a

1102
00:40:34,950 --> 00:40:32,880
discussion

1103
00:40:37,829 --> 00:40:34,960
thanks and um doug could you just

1104
00:40:40,550 --> 00:40:37,839
address the significance of this success

1105
00:40:43,030 --> 00:40:40,560
of this mission with regards to

1106
00:40:46,230 --> 00:40:43,040
the the planning ongoing for what's

1107
00:40:48,630 --> 00:40:46,240
going to be coming down the pike

1108
00:40:50,790 --> 00:40:48,640
sure well there's an engineering

1109
00:40:52,870 --> 00:40:50,800
impact and there's a scientific impact

1110
00:40:54,950 --> 00:40:52,880
the engineering impact is the ability to

1111
00:40:56,470 --> 00:40:54,960
get a metric ton to the surface

1112
00:40:58,309 --> 00:40:56,480
the uh

1113
00:40:59,990 --> 00:40:58,319

the studies we've done over the years

1114
00:41:01,750 --> 00:41:00,000
and that the current planning team is

1115
00:41:04,150 --> 00:41:01,760
doing

1116
00:41:06,470 --> 00:41:04,160
really we haven't come up with missions

1117
00:41:07,510 --> 00:41:06,480
in the robotic science community

1118
00:41:09,510 --> 00:41:07,520
that

1119
00:41:11,190 --> 00:41:09,520
really need more than this kind of a

1120
00:41:12,870 --> 00:41:11,200
mass delivery to the surface so i think

1121
00:41:15,190 --> 00:41:12,880
what we have is a workhorse for the

1122
00:41:17,030 --> 00:41:15,200
future and that's been developed through

1123
00:41:17,829 --> 00:41:17,040
from starting with pathfinder working

1124
00:41:19,829 --> 00:41:17,839
through

1125
00:41:21,670 --> 00:41:19,839
uh the mer missions and that includes

1126
00:41:23,510 --> 00:41:21,680
software advancements that we've made

1127
00:41:25,750 --> 00:41:23,520
for navigation auto navigation things

1128
00:41:28,069 --> 00:41:25,760
like that so so that's that's one

1129
00:41:30,470 --> 00:41:28,079
important feature of this uh the ability

1130
00:41:31,670 --> 00:41:30,480
to rov longer distances longer lifetimes

1131
00:41:34,230 --> 00:41:31,680
on the surface more advanced

1132
00:41:35,270 --> 00:41:34,240
instrumentation etc etc all all play

1133
00:41:37,030 --> 00:41:35,280
into that

1134
00:41:38,470 --> 00:41:37,040
scientifically the mars science

1135
00:41:40,630 --> 00:41:38,480
laboratory and the curiosity rover

1136
00:41:42,630 --> 00:41:40,640
itself specifically

1137
00:41:45,430 --> 00:41:42,640
are transit it's a transition mission

1138
00:41:46,390 --> 00:41:45,440

from follow the water of the last decade

1139
00:41:48,630 --> 00:41:46,400
to

1140
00:41:51,270 --> 00:41:48,640
seeking the signs of life and heading

1141
00:41:53,030 --> 00:41:51,280
towards sample return which is what the

1142
00:41:54,950 --> 00:41:53,040
decadal national academies of sciences

1143
00:41:56,950 --> 00:41:54,960
decadal survey recommended as the next

1144
00:41:59,589 --> 00:41:56,960
major step in the exploration of mars

1145
00:42:02,950 --> 00:41:59,599
and the exploration of the solar system

1146
00:42:05,349 --> 00:42:02,960
this mission including so scientifically

1147
00:42:08,150 --> 00:42:05,359
it bridges that gap with habitability

1148
00:42:12,790 --> 00:42:10,069
back to the engineering it also helps us

1149
00:42:14,309 --> 00:42:12,800
bridge that gap as well with a one-ton

1150
00:42:15,670 --> 00:42:14,319
capability to the surface we can

1151
00:42:17,750 --> 00:42:15,680
actually implement those types of

1152
00:42:20,150 --> 00:42:17,760
missions as we move forward so all of

1153
00:42:21,910 --> 00:42:20,160
these things really feed the advanced

1154
00:42:23,670 --> 00:42:21,920
planning team that's working now to come

1155
00:42:25,270 --> 00:42:23,680
up with options and approaches for the

1156
00:42:27,190 --> 00:42:25,280
next decade so all of these things will

1157
00:42:30,230 --> 00:42:27,200
get factored in

1158
00:42:32,470 --> 00:42:30,240
okay oh we have a question over here for

1159
00:42:33,910 --> 00:42:32,480
throwback and the orange or coral

1160
00:42:36,550 --> 00:42:33,920
sweater

1161
00:42:38,630 --> 00:42:36,560
hi i'm elizabeth landau with cnn i was

1162
00:42:40,710 --> 00:42:38,640
just wondering this is also for doug if

1163
00:42:42,870 --> 00:42:40,720

there have been specific engineering

1164
00:42:46,550 --> 00:42:42,880
improvements so that this rover won't

1165
00:42:49,510 --> 00:42:46,560
get stuck the way that spirit did

1166
00:42:52,790 --> 00:42:49,520
that's really better for pete to answer

1167
00:42:55,589 --> 00:42:52,800
sorry pete but that's okay um

1168
00:42:57,670 --> 00:42:55,599
well uh traffic ability uh what we call

1169
00:42:59,190 --> 00:42:57,680
traffic ability which is this problem is

1170
00:43:01,270 --> 00:42:59,200
is the subject of a lot of work and

1171
00:43:02,470 --> 00:43:01,280
studies on our standpoint so we actually

1172
00:43:03,910 --> 00:43:02,480
have a

1173
00:43:08,470 --> 00:43:03,920
a scarecrow

1174
00:43:10,630 --> 00:43:08,480
is uh a test rover on the on the earth

1175
00:43:13,270 --> 00:43:10,640
which has been offloaded off weighted so

1176
00:43:15,349 --> 00:43:13,280
that it operates with a mars

1177
00:43:18,069 --> 00:43:15,359
level of of gravity

1178
00:43:19,510 --> 00:43:18,079
and and force and we've taken to a bunch

1179
00:43:21,349 --> 00:43:19,520
of places out in the deserts and the

1180
00:43:23,990 --> 00:43:21,359
dunes and things like that to be able to

1181
00:43:25,910 --> 00:43:24,000
characterize its performance in

1182
00:43:27,270 --> 00:43:25,920
in difficult terrain so i think we have

1183
00:43:29,349 --> 00:43:27,280
a pretty good and we have a mars yard up

1184
00:43:31,510 --> 00:43:29,359
here that you may be able to see during

1185
00:43:34,790 --> 00:43:31,520
during your stay here that basically has

1186
00:43:36,550 --> 00:43:34,800
uh rocks and and and hills and sand and

1187
00:43:37,670 --> 00:43:36,560
and things to basically to basically

1188
00:43:39,430 --> 00:43:37,680

handle that

1189
00:43:42,390 --> 00:43:39,440
um the most difficult problem of course

1190
00:43:44,630 --> 00:43:42,400
is recognizing that you've got a problem

1191
00:43:46,150 --> 00:43:44,640
before you get into the problem

1192
00:43:48,470 --> 00:43:46,160
and we and we have studied the uh the

1193
00:43:50,069 --> 00:43:48,480
spirit situation not only the the last

1194
00:43:52,630 --> 00:43:50,079
incident but also the incident purgatory

1195
00:43:54,150 --> 00:43:52,640
that occurred a few years ago

1196
00:43:55,589 --> 00:43:54,160
that the spirit incident then

1197
00:43:57,190 --> 00:43:55,599
opportunity had the purgatory incident

1198
00:43:59,270 --> 00:43:57,200
to understand

1199
00:44:01,829 --> 00:43:59,280
exactly how we might find such

1200
00:44:03,829 --> 00:44:01,839
occurrences ahead of time how we might

1201
00:44:05,349 --> 00:44:03,839
avoid them those kinds of things i think

1202
00:44:06,950 --> 00:44:05,359
we have a pretty good handle on on those

1203
00:44:07,829 --> 00:44:06,960
kinds of things we also

1204
00:44:09,349 --> 00:44:07,839
have

1205
00:44:10,870 --> 00:44:09,359
a pretty hair trigger with respect to

1206
00:44:12,309 --> 00:44:10,880
our fall protection

1207
00:44:14,550 --> 00:44:12,319
i mean the first time you're in trouble

1208
00:44:16,470 --> 00:44:14,560
is when your your your wheels are moving

1209
00:44:17,829 --> 00:44:16,480
but you're not moving and you get high

1210
00:44:19,910 --> 00:44:17,839
slippage events and those kinds of

1211
00:44:22,550 --> 00:44:19,920
things and we have developed algorithms

1212
00:44:24,230 --> 00:44:22,560
to basically sense that and to stop

1213
00:44:25,750 --> 00:44:24,240

uh and so i think we're in pretty decent

1214
00:44:28,150 --> 00:44:25,760
shape with respect to traffic ability

1215
00:44:29,910 --> 00:44:28,160
issues at least we certainly have tried

1216
00:44:32,550 --> 00:44:29,920
yes let me add a little to that i mean

1217
00:44:33,750 --> 00:44:32,560
this is why we do a program where you

1218
00:44:35,589 --> 00:44:33,760
think about the missions you're going to

1219
00:44:37,829 --> 00:44:35,599
fly and what they're going to do and you

1220
00:44:39,430 --> 00:44:37,839
grow technologically in this case but

1221
00:44:40,790 --> 00:44:39,440
scientifically also

1222
00:44:42,230 --> 00:44:40,800
the things that these guys have learned

1223
00:44:43,270 --> 00:44:42,240
in spirit and opportunity have been

1224
00:44:45,030 --> 00:44:43,280
applied

1225
00:44:47,109 --> 00:44:45,040
including the software i mentioned a bit

1226
00:44:49,349 --> 00:44:47,119
ago but i mean we certainly wouldn't

1227
00:44:51,109 --> 00:44:49,359
want to run into these types of issues

1228
00:44:53,190 --> 00:44:51,119
with a rover of this magnitude the first

1229
00:44:54,470 --> 00:44:53,200
time so we learn so much each time we do

1230
00:44:56,470 --> 00:44:54,480
this and every time we do it we learn

1231
00:44:58,550 --> 00:44:56,480
more and we apply it to the next one so

1232
00:45:00,230 --> 00:44:58,560
that's the value of a continuing program

1233
00:45:02,069 --> 00:45:00,240
where you can go every opportunity or

1234
00:45:04,230 --> 00:45:02,079
every couple of opportunities and and

1235
00:45:06,150 --> 00:45:04,240
build on those experience spaces and

1236
00:45:08,069 --> 00:45:06,160
that goes for the team as well so

1237
00:45:10,230 --> 00:45:08,079
there's a lot of heritage in the folks

1238
00:45:11,430 --> 00:45:10,240

that are actually on the team and they

1239
00:45:12,950 --> 00:45:11,440
understand how to deal with these

1240
00:45:14,790 --> 00:45:12,960
situations many of them have seen them

1241
00:45:16,390 --> 00:45:14,800
before from spirit opportunity and so

1242
00:45:18,710 --> 00:45:16,400
you build a knowledge base a core

1243
00:45:21,910 --> 00:45:18,720
competency if you will that's that

1244
00:45:23,109 --> 00:45:21,920
becomes irreplaceable uh and and we've

1245
00:45:24,550 --> 00:45:23,119
got it we're the leaders in this

1246
00:45:26,470 --> 00:45:24,560
capability in the world and we want to

1247
00:45:28,069 --> 00:45:26,480
maintain that and it's crucial to

1248
00:45:29,109 --> 00:45:28,079
continue doing these types of missions

1249
00:45:31,109 --> 00:45:29,119
to be able to maintain those

1250
00:45:33,670 --> 00:45:31,119
capabilities it's not like riding a bike

1251
00:45:35,430 --> 00:45:33,680
you do lose it if you don't use it

1252
00:45:38,069 --> 00:45:35,440
do we have any more questions here at

1253
00:45:39,750 --> 00:45:38,079
jpl uh yeah let's get the mic over to

1254
00:45:41,750 --> 00:45:39,760
right there you got her

1255
00:45:43,750 --> 00:45:41,760
alicia chang from ap um question for

1256
00:45:45,270 --> 00:45:43,760
doug with regard to the mars exploration

1257
00:45:47,990 --> 00:45:45,280
planning how soon do you expect to

1258
00:45:49,670 --> 00:45:48,000
release this new road map and you know

1259
00:45:51,829 --> 00:45:49,680
what are the chances of another landed

1260
00:45:54,470 --> 00:45:51,839
mission this decade and you know how

1261
00:45:56,550 --> 00:45:54,480
will the successive um or lack of from

1262
00:45:59,829 --> 00:45:56,560
this current mission curiosity mission

1263
00:46:02,230 --> 00:45:59,839

affect the planning

1264
00:46:05,030 --> 00:46:02,240
the team will be done with their report

1265
00:46:07,750 --> 00:46:05,040
in august and at the end of august they

1266
00:46:09,589 --> 00:46:07,760
are planned uh to brief us at nasa on

1267
00:46:11,510 --> 00:46:09,599
what their findings are and provide us

1268
00:46:13,910 --> 00:46:11,520
those findings

1269
00:46:16,230 --> 00:46:13,920
we are putting a schedule together for

1270
00:46:19,270 --> 00:46:16,240
when we go public with that report it

1271
00:46:20,950 --> 00:46:19,280
will be a public report

1272
00:46:23,430 --> 00:46:20,960
that report will probably be in a view

1273
00:46:25,349 --> 00:46:23,440
graph form the fancy color glossy

1274
00:46:27,190 --> 00:46:25,359
version of that that everybody likes to

1275
00:46:30,069 --> 00:46:27,200
put on the shelf will be a couple months

1276
00:46:31,670 --> 00:46:30,079
later but we will go through and brief

1277
00:46:33,030 --> 00:46:31,680
obviously the executive office of the

1278
00:46:34,390 --> 00:46:33,040
president will brief congress we'll

1279
00:46:35,589 --> 00:46:34,400
brief the communities will brief the

1280
00:46:37,349 --> 00:46:35,599
media

1281
00:46:40,470 --> 00:46:37,359
once we have that report in our hands at

1282
00:46:45,829 --> 00:46:43,190
next opportunity for a land admission

1283
00:46:48,150 --> 00:46:45,839
the budget in 18 is thin per the

1284
00:46:51,190 --> 00:46:48,160
president's 13 budget it probably can't

1285
00:46:52,790 --> 00:46:51,200
support a rover or a lander

1286
00:46:55,589 --> 00:46:52,800
however

1287
00:46:57,910 --> 00:46:55,599
a rover is the next logical step after

1288
00:47:00,870 --> 00:46:57,920

msl we have the orbiter in

1289
00:47:02,550 --> 00:47:00,880
13 which is maven and nothing in 16.

1290
00:47:05,109 --> 00:47:02,560
however that's balanced not just with

1291
00:47:06,630 --> 00:47:05,119
budget but balanced with infrastructure

1292
00:47:09,030 --> 00:47:06,640
all the information that you're hearing

1293
00:47:12,550 --> 00:47:09,040
about us getting back from msl whether

1294
00:47:15,510 --> 00:47:12,560
it's during edl or on the surface

1295
00:47:18,470 --> 00:47:15,520
virtually all of it comes back

1296
00:47:20,309 --> 00:47:18,480
through the orbiters so we have learned

1297
00:47:22,309 --> 00:47:20,319
we have created a monster we have

1298
00:47:25,030 --> 00:47:22,319
developed a network of communication

1299
00:47:26,549 --> 00:47:25,040
capabilities that give us insight both

1300
00:47:28,470 --> 00:47:26,559
engineering insight and scientific

1301
00:47:31,829 --> 00:47:28,480
insight like we've never had before at

1302
00:47:33,750 --> 00:47:31,839
another planet big pipes of data

1303
00:47:35,670 --> 00:47:33,760
we would not really want to go to the

1304
00:47:38,549 --> 00:47:35,680
surface with a surface mission and use

1305
00:47:40,230 --> 00:47:38,559
the soda straw that is a direct to earth

1306
00:47:42,230 --> 00:47:40,240
so that has to be factored into what

1307
00:47:44,549 --> 00:47:42,240
that first mission is as well so once we

1308
00:47:46,790 --> 00:47:44,559
get all the pieces and of the puzzle and

1309
00:47:48,150 --> 00:47:46,800
we work it out then then nasa will be

1310
00:47:49,430 --> 00:47:48,160
the one that makes the decision of what

1311
00:47:50,710 --> 00:47:49,440
the uh

1312
00:47:52,150 --> 00:47:50,720
of what that

1313
00:47:54,390 --> 00:47:52,160

road map actually is that we'll go

1314
00:47:55,990 --> 00:47:54,400
forward with when we are public with

1315
00:47:57,510 --> 00:47:56,000
that will depend on how long it takes us

1316
00:47:59,829 --> 00:47:57,520
to come up with that as well as the

1317
00:48:02,150 --> 00:47:59,839
discussions internally within

1318
00:48:04,230 --> 00:48:02,160
uh within the agency and within the

1319
00:48:07,430 --> 00:48:04,240
executive office of the president since

1320
00:48:09,349 --> 00:48:07,440
uh it will all fit into the 2014 budget

1321
00:48:11,109 --> 00:48:09,359
process

1322
00:48:12,710 --> 00:48:11,119
okay and we do have time for another

1323
00:48:14,230 --> 00:48:12,720
quick question uh let's get the mic in

1324
00:48:16,790 --> 00:48:14,240
the second row here and can you please

1325
00:48:19,270 --> 00:48:16,800
state your name and affiliation

1326
00:48:21,910 --> 00:48:19,280
steve gorman with reuters so once the

1327
00:48:23,270 --> 00:48:21,920
the lander uh the rover's on the ground

1328
00:48:24,710 --> 00:48:23,280
and it's it's checked goes through all

1329
00:48:26,549 --> 00:48:24,720
his checkouts which i understand will

1330
00:48:28,549 --> 00:48:26,559
take a number of weeks how long do you

1331
00:48:29,990 --> 00:48:28,559
estimate you know roughly give it uh

1332
00:48:32,790 --> 00:48:30,000
would it be before

1333
00:48:35,109 --> 00:48:32,800
curiosity is sort of ready to begin its

1334
00:48:36,470 --> 00:48:35,119
scientific experiments in in earnest i

1335
00:48:37,750 --> 00:48:36,480
realize that every time you move

1336
00:48:39,910 --> 00:48:37,760
something you're collecting some data

1337
00:48:41,750 --> 00:48:39,920
but in terms of you know the the thrust

1338
00:48:44,230 --> 00:48:41,760

of its scientific mission how long do

1339
00:48:46,309 --> 00:48:44,240
you think it'll be ready it'd be before

1340
00:48:48,710 --> 00:48:46,319
the rover is ready to to

1341
00:48:50,470 --> 00:48:48,720
start that in earnest well you know we

1342
00:48:52,710 --> 00:48:50,480
will do we will be doing science right

1343
00:48:54,230 --> 00:48:52,720
away i mean uh we have medley science

1344
00:48:55,750 --> 00:48:54,240
coming in and we are doing descent

1345
00:48:57,430 --> 00:48:55,760
imagery coming in and we'll begin to

1346
00:48:58,950 --> 00:48:57,440
play those pictures back

1347
00:49:01,109 --> 00:48:58,960
after a few days

1348
00:49:02,630 --> 00:49:01,119
uh in terms of the

1349
00:49:04,630 --> 00:49:02,640
remote science we'll be doing some of

1350
00:49:07,109 --> 00:49:04,640
that except with the except for the chem

1351
00:49:09,270 --> 00:49:07,119
cam right away

1352
00:49:11,030 --> 00:49:09,280
the contact science will occur

1353
00:49:12,549 --> 00:49:11,040
somewhere between two weeks and and

1354
00:49:14,150 --> 00:49:12,559
three four weeks later depending upon

1355
00:49:16,069 --> 00:49:14,160
how the checkouts go

1356
00:49:17,750 --> 00:49:16,079
the sampling science the actual taking

1357
00:49:20,630 --> 00:49:17,760
of a sample and ingesting it into the

1358
00:49:22,710 --> 00:49:20,640
chemin or the or the sam probably

1359
00:49:23,510 --> 00:49:22,720
between a month and two months after we

1360
00:49:25,430 --> 00:49:23,520
land

1361
00:49:28,309 --> 00:49:25,440
those are all very rough

1362
00:49:34,470 --> 00:49:31,349
this is a very complicated beast um it

1363
00:49:37,430 --> 00:49:34,480

is much much more complicated than than

1364
00:49:39,750 --> 00:49:37,440
spirit or opportunity in terms

1365
00:49:41,910 --> 00:49:39,760
of the interactions amongst the various

1366
00:49:43,829 --> 00:49:41,920
pieces and the the things you have to

1367
00:49:45,270 --> 00:49:43,839
keep track of in order to operate it

1368
00:49:47,190 --> 00:49:45,280
successfully

1369
00:49:49,589 --> 00:49:47,200
um we have

1370
00:49:52,150 --> 00:49:49,599
a tremendous reliance on the orbiters i

1371
00:49:53,990 --> 00:49:52,160
mean and as doug mentioned for uh for

1372
00:49:55,670 --> 00:49:54,000
data communication with us

1373
00:49:58,390 --> 00:49:55,680
and the orbiters don't arrive over our

1374
00:49:59,990 --> 00:49:58,400
station at the same time every day so

1375
00:50:03,750 --> 00:50:00,000
things keep moving around in a very

1376
00:50:04,470 --> 00:50:03,760
dynamic way so so it's going to be

1377
00:50:06,390 --> 00:50:04,480
uh

1378
00:50:08,150 --> 00:50:06,400
when we when we land i think that we're

1379
00:50:10,870 --> 00:50:08,160
going to go through a novel educational

1380
00:50:12,630 --> 00:50:10,880
experience about oh that's what we did

1381
00:50:14,230 --> 00:50:12,640
okay did we really build it that way boy

1382
00:50:15,750 --> 00:50:14,240
that wasn't the right thing to do anyway

1383
00:50:17,349 --> 00:50:15,760
and we'll go through that

1384
00:50:18,630 --> 00:50:17,359
and so i think it will it's going to be

1385
00:50:19,589 --> 00:50:18,640
very slow

1386
00:50:20,710 --> 00:50:19,599
um

1387
00:50:23,030 --> 00:50:20,720
process

1388
00:50:24,950 --> 00:50:23,040

in kind of getting us ready to do

1389
00:50:26,630 --> 00:50:24,960
nominal science we we've worked very

1390
00:50:28,870 --> 00:50:26,640
heavily with the science people on what

1391
00:50:30,549 --> 00:50:28,880
to do we put um

1392
00:50:33,829 --> 00:50:30,559
an intermission in place to provide some

1393
00:50:35,430 --> 00:50:33,839
opportunity science about uh 10 days out

1394
00:50:37,670 --> 00:50:35,440
so we've tried very much to fill these

1395
00:50:39,990 --> 00:50:37,680
blacks in but i you know i think we all

1396
00:50:41,990 --> 00:50:40,000
need to exercise caution

1397
00:50:44,870 --> 00:50:42,000
the speech i make to the team

1398
00:50:47,589 --> 00:50:44,880
is to recognize that on sunday night

1399
00:50:50,309 --> 00:50:47,599
at 10 32

1400
00:50:52,390 --> 00:50:50,319
okay we will have a priceless

1401
00:50:54,549 --> 00:50:52,400
priceless asset that we have placed on

1402
00:50:55,910 --> 00:50:54,559
the surface of another planet

1403
00:50:58,710 --> 00:50:55,920
that could last

1404
00:51:01,510 --> 00:50:58,720
a long time if we operate it correctly

1405
00:51:03,510 --> 00:51:01,520
and so we will be cautious as hell

1406
00:51:06,390 --> 00:51:03,520
about what we do with it

1407
00:51:08,069 --> 00:51:06,400
okay on that important note we're going

1408
00:51:10,390 --> 00:51:08,079
to wrap up the q a and the news

1409
00:51:11,750 --> 00:51:10,400
conference and we will be replaying the

1410
00:51:13,670 --> 00:51:11,760
visuals from this news conference

1411
00:51:15,270 --> 00:51:13,680
immediately afterwards

1412
00:51:17,190 --> 00:51:15,280
and just a reminder that there is a lot

1413
00:51:21,349 --> 00:51:17,200

of useful information online at

1414
00:51:25,030 --> 00:51:23,510
mars and that includes a schedule of

1415
00:51:27,990 --> 00:51:25,040
events coming up in the next couple of

1416
00:51:30,309 --> 00:51:28,000
days and updates so also the press kit a

1417
00:51:31,990 --> 00:51:30,319
lot a lot of stuff there i want to thank

1418
00:51:39,430 --> 00:51:32,000
our panelists and thanks everybody for