
LDSD

1
00:00:16,150 --> 00:00:13,270
i'm kim newton from the office of

2
00:00:17,510 --> 00:00:16,160
communications at nasa's nasa

3
00:00:19,830 --> 00:00:17,520
headquarters

4
00:00:23,269 --> 00:00:19,840
i'd like to welcome everyone to the low

5
00:00:25,349 --> 00:00:23,279
density supersonic decelerator ldsd

6
00:00:27,670 --> 00:00:25,359
overview briefing today including our

7
00:00:29,189 --> 00:00:27,680
friends from the media i'd like to start

8
00:00:31,910 --> 00:00:29,199
out by introducing our panel

9
00:00:33,590 --> 00:00:31,920
participants starting to my left we have

10
00:00:35,830 --> 00:00:33,600
captain bruce haye

11
00:00:37,910 --> 00:00:35,840
captain haye is the u.s navy commanding

12
00:00:40,150 --> 00:00:37,920
officer of the pacific missile range

13
00:00:42,790 --> 00:00:40,160

facility here in kauai

14
00:00:44,869 --> 00:00:42,800
to his left is steve jerzik steve is the

15
00:00:47,430 --> 00:00:44,879
associate administrator for the space

16
00:00:49,670 --> 00:00:47,440
technology mission directorate at nasa

17
00:00:52,709 --> 00:00:49,680
headquarters in washington

18
00:00:54,630 --> 00:00:52,719
to steve's left is dr ian clark ian is

19
00:00:57,350 --> 00:00:54,640
the principal investigator for the low

20
00:00:59,510 --> 00:00:57,360
density supersonic decelerator at the

21
00:01:02,549 --> 00:00:59,520
nasa's jet propulsion laboratory in

22
00:01:05,030 --> 00:01:02,559
pasadena california and next to ian is

23
00:01:07,109 --> 00:01:05,040
dr mark adler mark is the program

24
00:01:09,910 --> 00:01:07,119
manager for the low density supersonic

25
00:01:11,830 --> 00:01:09,920
decelerator also at nasa's jet

26
00:01:14,070 --> 00:01:11,840
propulsion laboratory in pasadena

27
00:01:16,310 --> 00:01:14,080
california

28
00:01:18,310 --> 00:01:16,320
we'll hear some opening remarks for our

29
00:01:20,390 --> 00:01:18,320
panel members they will take questions

30
00:01:22,710 --> 00:01:20,400
from reporters in the audience

31
00:01:25,510 --> 00:01:22,720
next we'll take reporters joining us on

32
00:01:28,310 --> 00:01:25,520
the telephone please enter star one to

33
00:01:31,190 --> 00:01:28,320
get into the q a q we'll also take

34
00:01:33,190 --> 00:01:31,200
questions from our you stream followers

35
00:01:36,390 --> 00:01:33,200
using the chat box and twitter using the

36
00:01:37,910 --> 00:01:36,400
hashtag asknasa now i'll turn it over to

37
00:01:39,990 --> 00:01:37,920
captain haye

38
00:01:41,270 --> 00:01:40,000

well thank you and good morning from

39
00:01:43,030 --> 00:01:41,280
kauai and

40
00:01:44,870 --> 00:01:43,040
the world's largest instrumented

41
00:01:47,990 --> 00:01:44,880
training and test range we're thrilled

42
00:01:49,590 --> 00:01:48,000
to be uh supporting nasa again this year

43
00:01:50,950 --> 00:01:49,600
for the low density supersonic

44
00:01:54,550 --> 00:01:50,960
decelerator

45
00:01:56,149 --> 00:01:54,560
it was an amazing test last year and uh

46
00:01:58,950 --> 00:01:56,159
we're looking forward to hosting them

47
00:02:01,590 --> 00:01:58,960
again next year so uh you're not here to

48
00:02:05,030 --> 00:02:01,600
see me i'll gladly turn it over to the

49
00:02:06,789 --> 00:02:05,040
professionals to my left thank you

50
00:02:08,309 --> 00:02:06,799
good morning or good afternoon everyone

51
00:02:09,910 --> 00:02:08,319
depending on where you are and first

52
00:02:13,430 --> 00:02:09,920
before i get started i want to thank

53
00:02:14,949 --> 00:02:13,440
captain hay and his team here at pmrf um

54
00:02:16,229 --> 00:02:14,959
we couldn't have done last year's flight

55
00:02:18,550 --> 00:02:16,239
test obviously without them and we

56
00:02:19,990 --> 00:02:18,560
couldn't pull off um this test coming up

57
00:02:21,589 --> 00:02:20,000
without the great support that we get

58
00:02:23,910 --> 00:02:21,599
from his team here so thank you thank

59
00:02:26,150 --> 00:02:23,920
you captain hay um we learned a great

60
00:02:27,270 --> 00:02:26,160
deal from last year's flight test um and

61
00:02:29,910 --> 00:02:27,280
used that knowledge to improve the

62
00:02:31,990 --> 00:02:29,920
design and manufacturing of the hardware

63
00:02:34,070 --> 00:02:32,000

to enhance its strength and performance

64
00:02:35,430 --> 00:02:34,080
so this year i'm cautiously optimistic

65
00:02:36,390 --> 00:02:35,440
that we'll have a fully successful

66
00:02:37,750 --> 00:02:36,400
flight test

67
00:02:38,949 --> 00:02:37,760
but either way we're going to gain again

68
00:02:41,030 --> 00:02:38,959
we're going to gain a tremendous amount

69
00:02:42,710 --> 00:02:41,040
of knowledge um before i turn things

70
00:02:44,470 --> 00:02:42,720
over to ian and mark i'll give you the

71
00:02:46,070 --> 00:02:44,480
details of the flight test i'll take a

72
00:02:48,070 --> 00:02:46,080
moment to talk about

73
00:02:50,869 --> 00:02:48,080
how important uh developing and testing

74
00:02:51,910 --> 00:02:50,879
technologies like we're doing here is to

75
00:02:53,910 --> 00:02:51,920
nasa

76
00:02:56,949 --> 00:02:53,920
technology drives exploration and our

77
00:02:59,110 --> 00:02:56,959
journey to mars and that's why we

78
00:03:00,470 --> 00:02:59,120
develop new technologies demonstrate

79
00:03:02,070 --> 00:03:00,480
them on the ground and then eventually

80
00:03:05,270 --> 00:03:02,080
fly them we have to fly them to prove

81
00:03:07,110 --> 00:03:05,280
them out and to enable the future agency

82
00:03:08,229 --> 00:03:07,120
missions both in science and in human

83
00:03:09,910 --> 00:03:08,239
exploration

84
00:03:11,990 --> 00:03:09,920
uh nasa space technology mission

85
00:03:13,270 --> 00:03:12,000
directorate uh sponsoring this project

86
00:03:15,509 --> 00:03:13,280
as well as many other technology

87
00:03:17,110 --> 00:03:15,519
projects um developing critical

88
00:03:18,470 --> 00:03:17,120

capabilities that are needed again for

89
00:03:19,910 --> 00:03:18,480
the future

90
00:03:21,509 --> 00:03:19,920
our current and planned investments

91
00:03:23,110 --> 00:03:21,519
address a high priority challenge in

92
00:03:25,190 --> 00:03:23,120
achieving safe and affordable deep space

93
00:03:26,470 --> 00:03:25,200
exploration in fact over the next 18

94
00:03:27,990 --> 00:03:26,480
months we're going to be launching

95
00:03:28,869 --> 00:03:28,000
approximately

96
00:03:31,350 --> 00:03:28,879
six

97
00:03:33,030 --> 00:03:31,360
flight demonstration missions

98
00:03:35,670 --> 00:03:33,040
right now we are kind of at the

99
00:03:38,550 --> 00:03:35,680
technological limits of what we can land

100
00:03:41,990 --> 00:03:38,560
on mars in terms of size and weight

101
00:03:44,470 --> 00:03:42,000
we landed about uh one metric ton um the

102
00:03:45,990 --> 00:03:44,480
curiosity for the msl or curse our rover

103
00:03:48,789 --> 00:03:46,000
it was about the size of a mini cooper

104
00:03:50,309 --> 00:03:48,799
and about one metric ton of 2 200 pounds

105
00:03:51,830 --> 00:03:50,319
and that's about all we can do with the

106
00:03:53,509 --> 00:03:51,840
current technology that we use which

107
00:03:55,190 --> 00:03:53,519
actually goes back to the 60s and 70s

108
00:03:57,990 --> 00:03:55,200
and is derived from the viking missions

109
00:04:00,390 --> 00:03:58,000
which flew landed on mars in 76. so this

110
00:04:01,830 --> 00:04:00,400
new technology is required

111
00:04:03,910 --> 00:04:01,840
to land

112
00:04:06,550 --> 00:04:03,920
five metric tons for human missions

113
00:04:07,750 --> 00:04:06,560

maybe 30 and beyond metric tons to the

114
00:04:09,350 --> 00:04:07,760
surface

115
00:04:11,750 --> 00:04:09,360
so the parachute we're using today can

116
00:04:13,990 --> 00:04:11,760
improve proof performance land and mass

117
00:04:15,750 --> 00:04:14,000
by 100 to 200 percent and that's really

118
00:04:17,590 --> 00:04:15,760
critical for not only

119
00:04:21,590 --> 00:04:17,600
future enhanced robotic missions but

120
00:04:25,670 --> 00:04:23,749
as i mentioned earlier stmd wants six

121
00:04:27,350 --> 00:04:25,680
additional technology demonstrations a

122
00:04:29,909 --> 00:04:27,360
couple of those are deep space atomic

123
00:04:31,830 --> 00:04:29,919
clock to improve deep space navigation

124
00:04:33,270 --> 00:04:31,840
and green propellant infusion mission

125
00:04:34,710 --> 00:04:33,280
which is going to develop a higher

126
00:04:37,270 --> 00:04:34,720
performance

127
00:04:39,510 --> 00:04:37,280
non-toxic propellant to reduce

128
00:04:41,830 --> 00:04:39,520
processing time and cost as well as

129
00:04:43,270 --> 00:04:41,840
provide a higher performance in space

130
00:04:45,189 --> 00:04:43,280
propulsion

131
00:04:46,790 --> 00:04:45,199
since the formation of the national

132
00:04:49,590 --> 00:04:46,800
advisory committee on aeronautics or

133
00:04:51,670 --> 00:04:49,600
naca in 1915 we've done experiments like

134
00:04:53,430 --> 00:04:51,680
this to expand humanity's knowledge in

135
00:04:54,870 --> 00:04:53,440
air and space travel

136
00:04:58,230 --> 00:04:54,880
as was the case with those early

137
00:05:00,230 --> 00:04:58,240
pioneers of flight there's no guarantee

138
00:05:01,510 --> 00:05:00,240

that these sex tests will be completely

139
00:05:03,350 --> 00:05:01,520
successful that's why we go and fly

140
00:05:04,710 --> 00:05:03,360
their flight experiments but i'm

141
00:05:06,790 --> 00:05:04,720
confident again we will learn a great

142
00:05:08,790 --> 00:05:06,800
deal from the test and gain a lot of

143
00:05:12,710 --> 00:05:08,800
knowledge now that will shape future

144
00:05:15,110 --> 00:05:12,720
tests and future systems to land larger

145
00:05:16,950 --> 00:05:15,120
payloads on the surface of mars

146
00:05:18,790 --> 00:05:16,960
nasa could be ready for using this

147
00:05:22,150 --> 00:05:18,800
technology in future land and mars

148
00:05:24,070 --> 00:05:22,160
missions as early as the 2020s

149
00:05:27,189 --> 00:05:24,080
and it could be especially beneficial

150
00:05:29,110 --> 00:05:27,199
for uh missions like mars sample return

151
00:05:30,150 --> 00:05:29,120
and for human exploration precursor

152
00:05:31,749 --> 00:05:30,160
missions

153
00:05:33,189 --> 00:05:31,759
uh nasa space technology mission

154
00:05:34,550 --> 00:05:33,199
director is making significant real

155
00:05:36,870 --> 00:05:34,560
progress in addressing many of the

156
00:05:39,350 --> 00:05:36,880
challenges for achieving safe and

157
00:05:41,909 --> 00:05:39,360
affordable deep space exploration again

158
00:05:43,990 --> 00:05:41,919
technology drives uh exploration and our

159
00:05:45,350 --> 00:05:44,000
journey to mars and developing the

160
00:05:46,870 --> 00:05:45,360
technologies that will enable future

161
00:05:48,950 --> 00:05:46,880
exploration of the solar system and

162
00:05:51,110 --> 00:05:48,960
beyond and this is just one example of

163
00:05:53,670 --> 00:05:51,120

that we're looking forward to flying

164
00:05:55,590 --> 00:05:53,680
this week hopefully cross our fingers

165
00:05:57,189 --> 00:05:55,600
with the weather will cooperate and now

166
00:05:58,550 --> 00:05:57,199
i'd like to try and turn it over to dr

167
00:06:00,390 --> 00:05:58,560
clark who's going to tell us more about

168
00:06:02,230 --> 00:06:00,400
the flight test and the technology thank

169
00:06:03,909 --> 00:06:02,240
you steve i'd

170
00:06:06,390 --> 00:06:03,919
give you a little bit of background

171
00:06:08,710 --> 00:06:06,400
a thousand years ago the explorers

172
00:06:10,469 --> 00:06:08,720
from this planet and the technologies

173
00:06:11,990 --> 00:06:10,479
that drove their exploration across the

174
00:06:13,990 --> 00:06:12,000
expanses of ocean and helped bring the

175
00:06:15,909 --> 00:06:14,000
first inhabitants to this island relied

176
00:06:17,830 --> 00:06:15,919
on technologies like using the stars for

177
00:06:19,270 --> 00:06:17,840
navigation and using the wind to carry

178
00:06:21,430 --> 00:06:19,280
them across the ocean

179
00:06:23,350 --> 00:06:21,440
today as we cast our eyes from this land

180
00:06:25,350 --> 00:06:23,360
of red sand to another place of red sand

181
00:06:26,710 --> 00:06:25,360
the planet mars we continue to rely on a

182
00:06:28,629 --> 00:06:26,720
lot of those same technologies our

183
00:06:30,550 --> 00:06:28,639
spacecraft still use stars to navigate

184
00:06:32,390 --> 00:06:30,560
across the expanses of space

185
00:06:34,710 --> 00:06:32,400
we still rely on wind not to carry us

186
00:06:36,629 --> 00:06:34,720
across the space but to help slow us

187
00:06:38,390 --> 00:06:36,639
down when we arrive at mars our

188
00:06:40,629 --> 00:06:38,400

spacecraft enter the atmosphere going 10

189
00:06:43,270 --> 00:06:40,639
000 miles an hour and it's the oncoming

190
00:06:45,029 --> 00:06:43,280
wind and large aerodynamic drag devices

191
00:06:46,950 --> 00:06:45,039
that help produce the drag to slow us

192
00:06:49,189 --> 00:06:46,960
down to safely land us

193
00:06:51,270 --> 00:06:49,199
excuse me on the surface of mars

194
00:06:53,189 --> 00:06:51,280
so a few years ago we landed the

195
00:06:54,950 --> 00:06:53,199
curiosity rover this was the last of the

196
00:06:56,469 --> 00:06:54,960
past seven successful missions we've had

197
00:06:58,710 --> 00:06:56,479
to mars and even before we landed

198
00:07:01,110 --> 00:06:58,720
curiosity we started to realize that the

199
00:07:03,029 --> 00:07:01,120
technologies that we had to land robotic

200
00:07:05,029 --> 00:07:03,039
missions to the surface of mars were

201
00:07:06,550 --> 00:07:05,039
essentially saturated as we started

202
00:07:08,309 --> 00:07:06,560
thinking about the next generation of

203
00:07:10,390 --> 00:07:08,319
more capable more exciting more bold

204
00:07:12,150 --> 00:07:10,400
missions to mars we started realizing

205
00:07:13,830 --> 00:07:12,160
that we didn't have the technologies in

206
00:07:15,510 --> 00:07:13,840
place to land them

207
00:07:17,350 --> 00:07:15,520
and we had to start today to start

208
00:07:19,029 --> 00:07:17,360
developing those technologies things

209
00:07:20,550 --> 00:07:19,039
like inflatable drag devices that we can

210
00:07:22,870 --> 00:07:20,560
inflate at several times the speed of

211
00:07:24,469 --> 00:07:22,880
sound and a new supersonic parachute 100

212
00:07:26,390 --> 00:07:24,479
feet in diameter those are the

213
00:07:28,830 --> 00:07:26,400

technologies that ldsd is developing to

214
00:07:31,110 --> 00:07:28,840
enable those future generations of mars

215
00:07:32,710 --> 00:07:31,120
missions they'll allow more mass to the

216
00:07:35,110 --> 00:07:32,720
surface of mars and they'll also allow

217
00:07:37,350 --> 00:07:35,120
us to access more surface itself to

218
00:07:39,029 --> 00:07:37,360
regions of mars that we haven't had

219
00:07:42,390 --> 00:07:39,039
available to us in the past and so for

220
00:07:45,110 --> 00:07:42,400
example if we go to the first image here

221
00:07:46,469 --> 00:07:45,120
the colored spots denote the areas where

222
00:07:48,469 --> 00:07:46,479
we could land something like the

223
00:07:50,710 --> 00:07:48,479
curiosity rover a one ton rover and each

224
00:07:52,950 --> 00:07:50,720
of those x's are places and locations

225
00:07:54,950 --> 00:07:52,960
that we've landed previous missions all

226
00:07:57,350 --> 00:07:54,960
of the region that's shaded in black are

227
00:07:59,270 --> 00:07:57,360
elevations that are too high that is

228
00:08:00,710 --> 00:07:59,280
there's not enough atmosphere to slow us

229
00:08:02,550 --> 00:08:00,720
down if we were to try to land at some

230
00:08:05,350 --> 00:08:02,560
of these higher elevations with the

231
00:08:07,189 --> 00:08:05,360
technologies that ldsd is developing the

232
00:08:09,029 --> 00:08:07,199
something like the curiosity rover we'd

233
00:08:10,710 --> 00:08:09,039
be able to open up nearly entire surface

234
00:08:12,469 --> 00:08:10,720
of mars we'd expose much of the southern

235
00:08:14,309 --> 00:08:12,479
hemisphere and large regions of the

236
00:08:15,589 --> 00:08:14,319
northern hemisphere as well

237
00:08:17,430 --> 00:08:15,599
but if we started thinking about the

238
00:08:19,589 --> 00:08:17,440

next generation of missions we know that

239
00:08:21,029 --> 00:08:19,599
those are even more massive if we go to

240
00:08:23,110 --> 00:08:21,039
the next slide

241
00:08:25,029 --> 00:08:23,120
if we try to rely on the technologies we

242
00:08:26,550 --> 00:08:25,039
had today to land those those missions

243
00:08:29,029 --> 00:08:26,560
that would be two to three times heavier

244
00:08:30,790 --> 00:08:29,039
than the the curiosity rover the graphic

245
00:08:32,469 --> 00:08:30,800
in the upper half shows where we could

246
00:08:34,070 --> 00:08:32,479
do that it's largely entirely black

247
00:08:35,909 --> 00:08:34,080
there's actually a very small region of

248
00:08:37,509 --> 00:08:35,919
purple if you squint and hold a

249
00:08:39,190 --> 00:08:37,519
magnifying glass up to your television

250
00:08:40,870 --> 00:08:39,200
maybe you can see

251
00:08:42,389 --> 00:08:40,880
but with the ldst technologies the

252
00:08:44,389 --> 00:08:42,399
inflatable drag devices and the new

253
00:08:46,470 --> 00:08:44,399
parachute we can open up

254
00:08:48,150 --> 00:08:46,480
at least half of mars to these increased

255
00:08:50,870 --> 00:08:48,160
mass payloads we can go back to a lot of

256
00:08:52,630 --> 00:08:50,880
the same places with these more capable

257
00:08:54,389 --> 00:08:52,640
missions and more capable instruments

258
00:08:57,269 --> 00:08:54,399
and we start to open up regions of mars

259
00:08:59,350 --> 00:08:57,279
for human precursor missions as well

260
00:09:00,710 --> 00:08:59,360
so last year we came here and we got to

261
00:09:02,790 --> 00:09:00,720
conduct what was a phenomenally

262
00:09:04,310 --> 00:09:02,800
successful shakeout test of a test

263
00:09:05,910 --> 00:09:04,320

architecture that we'd put together just

264
00:09:07,350 --> 00:09:05,920
to test these technologies and so i've

265
00:09:09,509 --> 00:09:07,360
got some data from that that i can show

266
00:09:11,030 --> 00:09:09,519
a video if we show the cue the first

267
00:09:12,630 --> 00:09:11,040
video

268
00:09:14,150 --> 00:09:12,640
so we have this test vehicle and mark's

269
00:09:16,790 --> 00:09:14,160
going to talk a lot in a moment about

270
00:09:18,150 --> 00:09:16,800
how we we conduct the test but just take

271
00:09:20,230 --> 00:09:18,160
for granted we're going four times the

272
00:09:22,630 --> 00:09:20,240
speed of sound and we got to inflate our

273
00:09:24,150 --> 00:09:22,640
side device an inflatable drag device

274
00:09:25,509 --> 00:09:24,160
we got to do this all year ahead of

275
00:09:27,190 --> 00:09:25,519
schedule again last year was really just

276
00:09:28,630 --> 00:09:27,200
a shakeout test we got lucky in the

277
00:09:30,630 --> 00:09:28,640
sense that the technologies were ready

278
00:09:32,790 --> 00:09:30,640
we got data a year ahead of schedule so

279
00:09:34,790 --> 00:09:32,800
we saw the side inflate phenomenally

280
00:09:36,070 --> 00:09:34,800
uniformly we saw very little disturbance

281
00:09:37,829 --> 00:09:36,080
to the vehicle during the inflation

282
00:09:39,590 --> 00:09:37,839
process and we got a ton of great

283
00:09:41,110 --> 00:09:39,600
aerodynamic data and error thermodynamic

284
00:09:42,870 --> 00:09:41,120
data and we saw the side perform better

285
00:09:43,990 --> 00:09:42,880
than we even expected if you queue the

286
00:09:45,750 --> 00:09:44,000
next video

287
00:09:47,030 --> 00:09:45,760
we also got early tests of another

288
00:09:48,790 --> 00:09:47,040

device we've had to develop just to

289
00:09:51,590 --> 00:09:48,800
deploy our large supersonic parachute

290
00:09:53,509 --> 00:09:51,600
and go ahead and press play

291
00:09:55,350 --> 00:09:53,519
so here we're going about 2.8 times the

292
00:09:57,590 --> 00:09:55,360
speed of sound we shoot out the back of

293
00:09:59,910 --> 00:09:57,600
the vehicle this large 15-foot diameter

294
00:10:01,750 --> 00:09:59,920
balut balloon parachute device that

295
00:10:02,949 --> 00:10:01,760
helps pull a parachute off the back and

296
00:10:04,870 --> 00:10:02,959
then we tried to take a hundred foot

297
00:10:08,150 --> 00:10:04,880
parachute inflate it into 2000 mile an

298
00:10:09,829 --> 00:10:08,160
hour wind and see what happens now the

299
00:10:12,230 --> 00:10:09,839
data treasure trove that we got from

300
00:10:13,829 --> 00:10:12,240
that test has been tremendous orders of

301
00:10:15,750 --> 00:10:13,839
magnitude better quality and better

302
00:10:17,350 --> 00:10:15,760
quantity than anything we've ever had

303
00:10:19,509 --> 00:10:17,360
we've been using supersonic parachutes

304
00:10:21,829 --> 00:10:19,519
for over 40 years and our understanding

305
00:10:23,430 --> 00:10:21,839
of them really stems from a few tests

306
00:10:25,910 --> 00:10:23,440
that were conducted in the 1960s and the

307
00:10:27,990 --> 00:10:25,920
1970s and the data from that test exists

308
00:10:30,150 --> 00:10:28,000
in a few technical reports and in a few

309
00:10:31,990 --> 00:10:30,160
grainy 16 millimeter videos we've

310
00:10:33,509 --> 00:10:32,000
digitized those i've personally watched

311
00:10:35,030 --> 00:10:33,519
each one of them probably hundreds of

312
00:10:36,710 --> 00:10:35,040
times i've been trying to glean more and

313
00:10:38,389 --> 00:10:36,720

more information about the nature of

314
00:10:40,389 --> 00:10:38,399
these devices how they inflate how they

315
00:10:42,470 --> 00:10:40,399
operate how they behave and we've got

316
00:10:43,509 --> 00:10:42,480
images like if we cue the this still

317
00:10:46,230 --> 00:10:43,519
right here

318
00:10:48,470 --> 00:10:46,240
you see these are images from some 1960s

319
00:10:50,069 --> 00:10:48,480
and early 1970s tests generally we see

320
00:10:52,150 --> 00:10:50,079
the parachute in fleet we get some

321
00:10:54,069 --> 00:10:52,160
understanding of the behavior now if i

322
00:10:56,630 --> 00:10:54,079
compare that to the data set we got last

323
00:10:59,590 --> 00:10:56,640
year just in the quality of the image go

324
00:11:01,110 --> 00:10:59,600
to the the next image please

325
00:11:03,750 --> 00:11:01,120
saw things that we had never seen or

326
00:11:27,509 --> 00:11:03,760
imagined existed before we saw a much

327
00:11:29,750 --> 00:11:28,710
we could see where they interfaced with

328
00:11:31,590 --> 00:11:29,760
the parachute we could see the

329
00:11:33,509 --> 00:11:31,600
individual fabric we could see where the

330
00:11:34,949 --> 00:11:33,519
fabric seams were and we could start to

331
00:11:36,790 --> 00:11:34,959
see things in the nature of the

332
00:11:37,990 --> 00:11:36,800
inflation that we had never known before

333
00:11:39,509 --> 00:11:38,000
in fact when we showed some of these

334
00:11:41,750 --> 00:11:39,519
videos to folks who had been working on

335
00:11:43,110 --> 00:11:41,760
parachutes for 40 years they immediately

336
00:11:45,190 --> 00:11:43,120
thought this was the worst parachute

337
00:11:47,030 --> 00:11:45,200
inflation they'd ever seen

338
00:11:48,870 --> 00:11:47,040

then we started watching the old videos

339
00:11:50,230 --> 00:11:48,880
again and going back and seeing those

340
00:11:51,990 --> 00:11:50,240
and we started realizing that those

341
00:11:53,269 --> 00:11:52,000
behaviors existed previously we just

342
00:11:54,870 --> 00:11:53,279
didn't know what to look for we didn't

343
00:11:56,389 --> 00:11:54,880
have this capable

344
00:11:57,910 --> 00:11:56,399
this data set available to us this

345
00:12:35,350 --> 00:11:57,920
understanding and so we've started

346
00:12:39,110 --> 00:12:37,430
here if we go to the slide

347
00:12:41,190 --> 00:12:39,120
we fundamentally changed both how we

348
00:12:42,550 --> 00:12:41,200
design and analyze a parachute but the

349
00:12:44,550 --> 00:12:42,560
parachute design itself that we're

350
00:12:46,069 --> 00:12:44,560
testing is new we've got a more

351
00:12:47,910 --> 00:12:46,079
curvature to the geometry that helps to

352
00:12:50,150 --> 00:12:47,920
reduce the stresses early on in the

353
00:12:52,389 --> 00:12:50,160
inflation process we've added a lot more

354
00:12:53,590 --> 00:12:52,399
structural high strength material

355
00:12:54,949 --> 00:12:53,600
and the crown of the parachute

356
00:12:56,629 --> 00:12:54,959
throughout the parachute to make it more

357
00:12:58,790 --> 00:12:56,639
robust to a lot of the dynamics that we

358
00:13:00,150 --> 00:12:58,800
saw during the inflation process we've

359
00:13:01,590 --> 00:13:00,160
got a lot of damage tolerant

360
00:13:03,350 --> 00:13:01,600
capabilities such that if part of the

361
00:13:04,710 --> 00:13:03,360
fabric begins to tear

362
00:13:06,870 --> 00:13:04,720
it won't propagate through the rest of

363
00:13:08,790 --> 00:13:06,880

the parachute overall it's a much

364
00:13:10,230 --> 00:13:08,800
stronger much more robust parachute that

365
00:13:12,310 --> 00:13:10,240
we think is going to

366
00:13:14,150 --> 00:13:12,320
provide another tremendous data set for

367
00:13:16,230 --> 00:13:14,160
us and hopefully perform very well for

368
00:13:17,430 --> 00:13:16,240
us under these conditions so to describe

369
00:13:19,509 --> 00:13:17,440
a little bit about how we get the

370
00:13:20,629 --> 00:13:19,519
technologies to the conditions i'll pass

371
00:13:25,590 --> 00:13:20,639
it to mark

372
00:13:29,190 --> 00:13:27,350
you can advance

373
00:13:31,350 --> 00:13:29,200
to the slide showing the site and the

374
00:13:33,030 --> 00:13:31,360
parachute

375
00:13:34,949 --> 00:13:33,040
so this shows the two technologies that

376
00:13:36,629 --> 00:13:34,959
we're going to be testing as ian said we

377
00:13:38,310 --> 00:13:36,639
had a shakeout flight last year we

378
00:13:39,670 --> 00:13:38,320
actually tested our vehicle to make sure

379
00:13:41,750 --> 00:13:39,680
we could get these technologies to the

380
00:13:43,590 --> 00:13:41,760
right conditions we were in fact able to

381
00:13:44,870 --> 00:13:43,600
test the syad that's that donut looking

382
00:13:46,150 --> 00:13:44,880
thing that ian is standing in the middle

383
00:13:48,470 --> 00:13:46,160
of you can see with his outstretched

384
00:13:49,829 --> 00:13:48,480
arms it's about 20 feet in diameter it

385
00:13:51,750 --> 00:13:49,839
is used to increase the diameter of the

386
00:13:53,829 --> 00:13:51,760
vehicle from 15 feet to 20 feet very

387
00:13:55,350 --> 00:13:53,839
rapidly at mach 4. and we were able to

388
00:13:56,710 --> 00:13:55,360

test it last year fortunately and so in

389
00:13:58,150 --> 00:13:56,720
fact we now have that technology

390
00:14:00,069 --> 00:13:58,160
qualified for use at mars that's the

391
00:14:01,590 --> 00:14:00,079
first of two stages that we need of

392
00:14:03,670 --> 00:14:01,600
deceleration to slow down these very

393
00:14:04,790 --> 00:14:03,680
heavy payloads at mars the second stage

394
00:14:06,150 --> 00:14:04,800
is the parachute you see though it's not

395
00:14:08,069 --> 00:14:06,160
to the same scale it's a very large

396
00:14:09,350 --> 00:14:08,079
parachute it is 100 feet in diameter if

397
00:14:11,269 --> 00:14:09,360
it's laid out on the ground and you can

398
00:14:12,550 --> 00:14:11,279
see our 15-foot test vehicle hanging

399
00:14:14,230 --> 00:14:12,560
there at the bottom of it that

400
00:14:15,509 --> 00:14:14,240
technology is now a new parachute that

401
00:14:16,629 --> 00:14:15,519
we developed this year since again last

402
00:14:18,310 --> 00:14:16,639
year we were able to get an advanced

403
00:14:19,590 --> 00:14:18,320
test and we were able to see

404
00:14:20,870 --> 00:14:19,600
things about the parachute that didn't

405
00:14:22,710 --> 00:14:20,880
behave as we expected we saw the

406
00:14:24,710 --> 00:14:22,720
parachute get destroyed in the test now

407
00:14:25,829 --> 00:14:24,720
we've developed a much more robust more

408
00:14:27,350 --> 00:14:25,839
stronger parachute they're going to be

409
00:14:28,949 --> 00:14:27,360
able to test this time

410
00:14:30,310 --> 00:14:28,959
so let me go on to the next slide and

411
00:14:31,990 --> 00:14:30,320
show you how we tested this parachute on

412
00:14:33,590 --> 00:14:32,000
the ground before we flew it before

413
00:14:34,949 --> 00:14:33,600

we're going to fly it this week in the

414
00:14:36,629 --> 00:14:34,959
upper atmosphere

415
00:14:38,069 --> 00:14:36,639
this is at the naval air weapon station

416
00:14:39,590 --> 00:14:38,079
in china lake california another navy

417
00:14:41,590 --> 00:14:39,600
base that we use for doing our testing

418
00:14:43,590 --> 00:14:41,600
it's a four mile long rocket sled track

419
00:14:44,790 --> 00:14:43,600
it's a railroad track that rockets go on

420
00:14:45,910 --> 00:14:44,800
we carry up the parachute on a

421
00:14:47,750 --> 00:14:45,920
helicopter and drop it out of the

422
00:14:50,470 --> 00:14:47,760
helicopter the parachute inflates as you

423
00:14:52,230 --> 00:14:50,480
see there and then once a large bullet

424
00:14:53,509 --> 00:14:52,240
goes into that funnel that you see right

425
00:14:55,750 --> 00:14:53,519
there you see it coming down as soon as

426
00:14:57,110 --> 00:14:55,760
that latches in the rockets fire and the

427
00:14:58,870 --> 00:14:57,120
rockets pull on that rope through a

428
00:15:00,550 --> 00:14:58,880
pulley pulling the parachute straight

429
00:15:01,990 --> 00:15:00,560
down with over one hundred thousand

430
00:15:03,350 --> 00:15:02,000
pounds of force

431
00:15:04,710 --> 00:15:03,360
this parachute was supposed to survive

432
00:15:06,790 --> 00:15:04,720
to eighty thousand pounds and survived

433
00:15:08,470 --> 00:15:06,800
to 120 000 pounds and so we've shown

434
00:15:09,829 --> 00:15:08,480
that it has the strength it needs to

435
00:15:11,829 --> 00:15:09,839
survive the loads we'll experience at

436
00:15:13,110 --> 00:15:11,839
mars in the full open configuration

437
00:15:15,350 --> 00:15:13,120
we're now going to be testing it in the

438
00:15:17,030 --> 00:15:15,360

upper atmosphere here over kawaii where

439
00:15:18,150 --> 00:15:17,040
we can actually simulate the thin air of

440
00:15:19,990 --> 00:15:18,160
mars with the thin air of the

441
00:15:21,990 --> 00:15:20,000
stratosphere above our above our heads

442
00:15:23,189 --> 00:15:22,000
here do that at supersonic speeds test

443
00:15:24,470 --> 00:15:23,199
the parachute at high speeds and see how

444
00:15:26,629 --> 00:15:24,480
it behaves not just in the fully open

445
00:15:27,990 --> 00:15:26,639
configuration but as it inflates as you

446
00:15:29,430 --> 00:15:28,000
saw last time the inflation was very

447
00:15:31,430 --> 00:15:29,440
complicated so now we're going to see

448
00:15:32,470 --> 00:15:31,440
how it inflates in the supersonic flow

449
00:15:33,750 --> 00:15:32,480
and the test that we're going to do this

450
00:15:34,870 --> 00:15:33,760
week or next

451
00:15:35,990 --> 00:15:34,880
so let's go ahead and run this one this

452
00:15:37,430 --> 00:15:36,000
is a little advanced view of a

453
00:15:38,470 --> 00:15:37,440
technology that we're going to be we're

454
00:15:40,310 --> 00:15:38,480
going to be developing more over the

455
00:15:42,069 --> 00:15:40,320
next several months this is another

456
00:15:44,389 --> 00:15:42,079
sciad it's like the 20 foot diameter

457
00:15:45,829 --> 00:15:44,399
side but this one is 26 feet in diameter

458
00:15:47,030 --> 00:15:45,839
it's much larger side but it's actually

459
00:15:48,949 --> 00:15:47,040
not much heavier so it's a much more

460
00:15:50,550 --> 00:15:48,959
advanced technology it's more efficient

461
00:15:52,389 --> 00:15:50,560
and this shows a rocket sled test again

462
00:15:54,150 --> 00:15:52,399
at the same facility at china lake and

463
00:15:57,189 --> 00:15:54,160

slow motion where we deploy the side

464
00:15:58,790 --> 00:15:57,199
from a test vehicle at 250 miles an hour

465
00:16:00,150 --> 00:15:58,800
to simulate the flow of the and the

466
00:16:01,829 --> 00:16:00,160
loads it will experience at mars there

467
00:16:03,430 --> 00:16:01,839
it is at full speed going over the

468
00:16:06,629 --> 00:16:03,440
camera which then of course gets knocked

469
00:16:09,350 --> 00:16:07,910
so that was actually a very successful

470
00:16:10,870 --> 00:16:09,360
test and we showed for the first time we

471
00:16:12,389 --> 00:16:10,880
can we can build this very large site

472
00:16:14,470 --> 00:16:12,399
and it stays inflated inflates down the

473
00:16:15,990 --> 00:16:14,480
track and so we're hoping uh steve to

474
00:16:17,350 --> 00:16:16,000
actually test that supersonically in the

475
00:16:19,670 --> 00:16:17,360
future

476
00:16:21,269 --> 00:16:19,680
so next slide actually we have now the

477
00:16:22,870 --> 00:16:21,279
this this model here so i'll explain to

478
00:16:24,230 --> 00:16:22,880
you a little bit about our test vehicle

479
00:16:25,189 --> 00:16:24,240
and how we fly we loft it up on a

480
00:16:26,710 --> 00:16:25,199
balloon

481
00:16:28,710 --> 00:16:26,720
and i'll show you the what the the

482
00:16:30,949 --> 00:16:28,720
overall profile is of the flight once we

483
00:16:32,310 --> 00:16:30,959
get it up there we use this solid rocket

484
00:16:34,310 --> 00:16:32,320
motor in the middle here called a star

485
00:16:36,790 --> 00:16:34,320
48 it's very powerful solid rocket motor

486
00:16:39,189 --> 00:16:36,800
that accelerates it from zero to mach

487
00:16:40,629 --> 00:16:39,199
four in a little over a minute and is

488
00:16:41,590 --> 00:16:40,639

then flying through the air in about

489
00:16:43,110 --> 00:16:41,600
this direction something you know we

490
00:16:44,870 --> 00:16:43,120
call this a flying saucer but it doesn't

491
00:16:46,389 --> 00:16:44,880
spin around or fly like this it flies

492
00:16:48,389 --> 00:16:46,399
into the wind directly just like a mars

493
00:16:50,150 --> 00:16:48,399
entry capsule would when it enters mars

494
00:16:51,829 --> 00:16:50,160
this blunt end provides a lot of drag to

495
00:16:53,350 --> 00:16:51,839
slow down the vehicle at mars and this

496
00:16:55,189 --> 00:16:53,360
is shaped just like a mars vehicle would

497
00:16:56,949 --> 00:16:55,199
be shaped and is the same size as our

498
00:16:58,550 --> 00:16:56,959
mars entry vehicle so we can present the

499
00:17:00,870 --> 00:16:58,560
same environment to our devices that we

500
00:17:02,150 --> 00:17:00,880
would see at mars then to get the air

501
00:17:03,910 --> 00:17:02,160
the right air density we have to go up

502
00:17:05,510 --> 00:17:03,920
very high in our atmosphere up to 180

503
00:17:06,789 --> 00:17:05,520
000 feet and we have to get it up going

504
00:17:08,870 --> 00:17:06,799
to mach 4 that's what the big rocket

505
00:17:10,870 --> 00:17:08,880
motor is for so this thing gets spun up

506
00:17:12,470 --> 00:17:10,880
it accelerates up to mach 4 and then

507
00:17:13,990 --> 00:17:12,480
from there we deploy the side which is

508
00:17:15,510 --> 00:17:14,000
packed tightly against the vehicle a

509
00:17:17,510 --> 00:17:15,520
supersonic inflatable aerodynamic

510
00:17:19,429 --> 00:17:17,520
accelerator it then inflates in a few

511
00:17:20,630 --> 00:17:19,439
tenths of a second and make a donut

512
00:17:22,870 --> 00:17:20,640
around the vehicle that's 20 feet in

513
00:17:25,110 --> 00:17:22,880

diameter to slow it down from about mach

514
00:17:27,669 --> 00:17:25,120
3 and then we deploy that balloon that

515
00:17:28,870 --> 00:17:27,679
ian showed it's a the the yellow ram air

516
00:17:31,270 --> 00:17:28,880
balloon that's been used to pull out the

517
00:17:33,909 --> 00:17:31,280
parachute at about mach 2.9 once that

518
00:17:35,350 --> 00:17:33,919
all slows down to about mach 2.35 the

519
00:17:37,510 --> 00:17:35,360
parachute is pulled out of the pack and

520
00:17:39,270 --> 00:17:37,520
a mach 2.35 it's fully exposed to the

521
00:17:41,110 --> 00:17:39,280
flow and at that point the parachute

522
00:17:42,630 --> 00:17:41,120
then opens up and is able to do its

523
00:17:44,230 --> 00:17:42,640
mission where we then observe the

524
00:17:45,750 --> 00:17:44,240
parachute in detail with the very high

525
00:17:47,430 --> 00:17:45,760
resolution powerful cameras we have in

526
00:17:48,870 --> 00:17:47,440
the vehicle so this is the parachute

527
00:17:50,070 --> 00:17:48,880
camera gets pulled out of these are the

528
00:17:51,669 --> 00:17:50,080
cameras over here that are looking

529
00:17:54,310 --> 00:17:51,679
straight up at the parachute we have

530
00:17:56,070 --> 00:17:54,320
high resolution high speed cameras color

531
00:17:57,750 --> 00:17:56,080
stereo cameras to give us many different

532
00:17:59,350 --> 00:17:57,760
views of the parachute inflation and

533
00:18:00,870 --> 00:17:59,360
look at those detailed images and learn

534
00:18:02,710 --> 00:18:00,880
exactly what happened in that parachute

535
00:18:04,390 --> 00:18:02,720
inflation event through the supersonic

536
00:18:05,669 --> 00:18:04,400
flight and through subsonic flight we

537
00:18:07,190 --> 00:18:05,679
also measured the trajectory very

538
00:18:09,190 --> 00:18:07,200

accurately so we know how much the

539
00:18:10,230 --> 00:18:09,200
devices are slowing the system we know

540
00:18:11,830 --> 00:18:10,240
what trajectory had followed what

541
00:18:13,029 --> 00:18:11,840
density air it was in when it was doing

542
00:18:15,029 --> 00:18:13,039
it and then we can reconstruct the

543
00:18:16,710 --> 00:18:15,039
aerodynamics of these devices which then

544
00:18:18,470 --> 00:18:16,720
allows future missions to mars to use

545
00:18:19,909 --> 00:18:18,480
all that data and simulate how these

546
00:18:21,510 --> 00:18:19,919
devices will work at mars so then they

547
00:18:22,950 --> 00:18:21,520
can get great confidence that these

548
00:18:24,710 --> 00:18:22,960
things will work at mars when they want

549
00:18:26,950 --> 00:18:24,720
to put their expensive missions on these

550
00:18:28,390 --> 00:18:26,960
parachutes and inflatable decelerators

551
00:18:29,510 --> 00:18:28,400
so let me put up the next slide here and

552
00:18:31,590 --> 00:18:29,520
show you what the overall mission looks

553
00:18:33,270 --> 00:18:31,600
like here out of kauai

554
00:18:35,669 --> 00:18:33,280
so you see it's just as a schematic we

555
00:18:37,590 --> 00:18:35,679
launch from the from the pmrf base just

556
00:18:39,750 --> 00:18:37,600
uh just a little bit north of here a

557
00:18:41,590 --> 00:18:39,760
large 34 million cubic foot helium

558
00:18:43,110 --> 00:18:41,600
balloon this is a helium balloon that's

559
00:18:44,549 --> 00:18:43,120
a standard

560
00:18:45,990 --> 00:18:44,559
balloon that's used for launching

561
00:18:47,270 --> 00:18:46,000
scientific missions this is normally

562
00:18:49,110 --> 00:18:47,280
used for astrophysics missions where you

563
00:18:50,789 --> 00:18:49,120

put telescopes high in the atmosphere to

564
00:18:52,310 --> 00:18:50,799
be able to look into space we're using

565
00:18:54,310 --> 00:18:52,320
it to launch our seven thousand pound

566
00:18:56,549 --> 00:18:54,320
test vehicle we get it up to with the

567
00:18:57,830 --> 00:18:56,559
balloon 120 000 feet most of the way to

568
00:18:59,029 --> 00:18:57,840
where we need to be

569
00:19:00,390 --> 00:18:59,039
once we get up to that altitude and

570
00:19:02,310 --> 00:19:00,400
we're in a good position over the ocean

571
00:19:04,470 --> 00:19:02,320
we then drop the test vehicle within a

572
00:19:06,470 --> 00:19:04,480
few tenths of a second spin motors fire

573
00:19:08,150 --> 00:19:06,480
to spin up the test vehicle we then fire

574
00:19:09,909 --> 00:19:08,160
the main rocket motor to accelerate it

575
00:19:11,990 --> 00:19:09,919
in over 71 seconds it will accelerate

576
00:19:14,070 --> 00:19:12,000
from zero to mach four and by that time

577
00:19:15,909 --> 00:19:14,080
it's also now going at about 180 000

578
00:19:17,029 --> 00:19:15,919
feet above above the surface where the

579
00:19:19,029 --> 00:19:17,039
air is about the right density where

580
00:19:20,630 --> 00:19:19,039
these devices will be used at mars once

581
00:19:22,470 --> 00:19:20,640
we're going mock forward 180 thousand

582
00:19:24,310 --> 00:19:22,480
feet we can now deploy the devices

583
00:19:25,830 --> 00:19:24,320
observe their operation and test them

584
00:19:27,669 --> 00:19:25,840
it's going roughly horizontally to give

585
00:19:29,430 --> 00:19:27,679
us a lot of time at condition and then

586
00:19:30,870 --> 00:19:29,440
we then slow the vehicle down on the

587
00:19:32,710 --> 00:19:30,880
side then on the parachute and

588
00:19:34,230 --> 00:19:32,720

eventually the vehicle arcs over on the

589
00:19:35,750 --> 00:19:34,240
parachute and that same test parachute

590
00:19:37,750 --> 00:19:35,760
is also used to land the vehicle in the

591
00:19:39,190 --> 00:19:37,760
water it lands out in the ocean and we

592
00:19:40,390 --> 00:19:39,200
send our recovery ships to get it which

593
00:19:41,909 --> 00:19:40,400
i'll show you in a second here so let's

594
00:19:46,150 --> 00:19:41,919
show the google earth animation from

595
00:19:49,830 --> 00:19:48,230
just south of the runway here at pmrf

596
00:19:51,909 --> 00:19:49,840
that blue track is the ascent of the

597
00:19:53,590 --> 00:19:51,919
balloon it goes over the island a little

598
00:19:54,549 --> 00:19:53,600
bit and then departs out across into the

599
00:19:56,470 --> 00:19:54,559
ocean

600
00:19:58,230 --> 00:19:56,480
as the blue line continues it would

601
00:20:00,150 --> 00:19:58,240
allow it to get up to altitude we had to

602
00:20:02,310 --> 00:20:00,160
wait for it to get up to the about two

603
00:20:03,590 --> 00:20:02,320
hours for it to get up to 120 000 feet

604
00:20:05,270 --> 00:20:03,600
at the end of the blue line is float

605
00:20:07,190 --> 00:20:05,280
that red line is when we drop it and

606
00:20:08,630 --> 00:20:07,200
fire the vehicle and then goes up high

607
00:20:10,789 --> 00:20:08,640
in altitude to 100 and actually up to

608
00:20:12,310 --> 00:20:10,799
about 200 000 feet in that test it then

609
00:20:14,150 --> 00:20:12,320
conducted the test and then it arced

610
00:20:15,190 --> 00:20:14,160
over landed in the ocean and the next

611
00:20:17,190 --> 00:20:15,200
slide

612
00:20:18,310 --> 00:20:17,200
after landed we sent out a recovery boat

613
00:20:19,510 --> 00:20:18,320

and there is the vehicle after the

614
00:20:21,350 --> 00:20:19,520
mission being picked up out of the water

615
00:20:22,710 --> 00:20:21,360
you see the side hanging on the side we

616
00:20:24,470 --> 00:20:22,720
also recovered the parachute we

617
00:20:25,830 --> 00:20:24,480
recovered the balut we recovered

618
00:20:27,510 --> 00:20:25,840
everything we got all of our data back

619
00:20:28,870 --> 00:20:27,520
our high speed video and high resolution

620
00:20:30,149 --> 00:20:28,880
video all are on recorders on the

621
00:20:31,350 --> 00:20:30,159
vehicle they're not telemetered down so

622
00:20:32,789 --> 00:20:31,360
we need to get the vehicle or at least

623
00:20:34,549 --> 00:20:32,799
the recorder in order to get all that

624
00:20:35,669 --> 00:20:34,559
data that was all successful last year

625
00:20:37,510 --> 00:20:35,679
and that's exactly what we're going to

626
00:20:39,029 --> 00:20:37,520
do again this year

627
00:20:40,789 --> 00:20:39,039
i mean i'd like to thank the again

628
00:20:42,230 --> 00:20:40,799
captain hay and pmrf this is really a

629
00:20:43,990 --> 00:20:42,240
unique facility for us to be able to do

630
00:20:45,430 --> 00:20:44,000
this test there's really no other place

631
00:20:46,470 --> 00:20:45,440
in the world we could find where we had

632
00:20:48,310 --> 00:20:46,480
the right conditions to be able to

633
00:20:50,070 --> 00:20:48,320
launch a balloon to have it go out away

634
00:20:51,510 --> 00:20:50,080
from populated areas to have support

635
00:20:52,950 --> 00:20:51,520
services here at the range all the

636
00:20:54,470 --> 00:20:52,960
communications the instrumentation that

637
00:20:55,750 --> 00:20:54,480
captain haye mentioned to provide

638
00:20:57,510 --> 00:20:55,760

support for the mission get our data

639
00:20:58,950 --> 00:20:57,520
back do the operations

640
00:21:00,710 --> 00:20:58,960
so now i'll show you a little bit of the

641
00:21:02,149 --> 00:21:00,720
balloon here this is a scale model of

642
00:21:03,990 --> 00:21:02,159
the balloon it's about eight feet in

643
00:21:05,750 --> 00:21:04,000
diameter and standing next to it is

644
00:21:07,430 --> 00:21:05,760
petty officer quinlan

645
00:21:09,590 --> 00:21:07,440
it's just to give you some scale the

646
00:21:11,669 --> 00:21:09,600
actual balloon is over 400 feet in

647
00:21:13,270 --> 00:21:11,679
diameter and in fact our 15-foot test

648
00:21:15,110 --> 00:21:13,280
vehicle is about the size of a coffee

649
00:21:17,270 --> 00:21:15,120
cup lid if petty officer quinlan if you

650
00:21:19,190 --> 00:21:17,280
can hold out the coffee cup lid next to

651
00:21:21,669 --> 00:21:19,200
the balloon there so you can see how the

652
00:21:23,190 --> 00:21:21,679
the size how small that is compared to

653
00:21:25,029 --> 00:21:23,200
the balloon so it's a very very large

654
00:21:27,510 --> 00:21:25,039
balloon it would sit very settle very

655
00:21:29,029 --> 00:21:27,520
nicely into the rose bowl uh carrying

656
00:21:30,149 --> 00:21:29,039
the vehicle up to the high altitude

657
00:21:31,350 --> 00:21:30,159
being able to carry seven thousand

658
00:21:33,750 --> 00:21:31,360
pounds to altitude again i'd like to

659
00:21:34,789 --> 00:21:33,760
thank also the uh wallops life facility

660
00:21:36,230 --> 00:21:34,799
and the columbia scientific balloon

661
00:21:37,909 --> 00:21:36,240
facility for providing this tremendous

662
00:21:39,430 --> 00:21:37,919
capability uh to allow our vehicle to

663
00:21:41,830 --> 00:21:39,440

get up to altitude and make this a very

664
00:21:44,630 --> 00:21:41,840
cost effective approach to testing these

665
00:21:46,149 --> 00:21:44,640
technologies into mars conditions so

666
00:21:48,630 --> 00:21:46,159
with that i guess i'll turn it back over

667
00:21:50,149 --> 00:21:48,640
to kim for questions

668
00:21:51,669 --> 00:21:50,159
now we'll turn it over to questions

669
00:21:53,430 --> 00:21:51,679
first we'll go to reporters here in the

670
00:21:55,590 --> 00:21:53,440
audience then we'll go to reporters on

671
00:21:57,830 --> 00:21:55,600
the telephone if you're on the telephone

672
00:21:59,350 --> 00:21:57,840
please hit star one to get into the

673
00:22:01,350 --> 00:21:59,360
question queue

674
00:22:02,870 --> 00:22:01,360
and then we'll go to social media so for

675
00:22:04,390 --> 00:22:02,880
questions in the audience please raise

676
00:22:06,390 --> 00:22:04,400
your hand and we'll get a mic over to

677
00:22:07,830 --> 00:22:06,400
you and state your name and media

678
00:22:09,430 --> 00:22:07,840
affiliation

679
00:22:11,590 --> 00:22:09,440
any any hear

680
00:22:15,830 --> 00:22:11,600
from reporters right here in the front

681
00:22:20,310 --> 00:22:18,310
i'm chuck lasker with social kawaii and

682
00:22:23,029 --> 00:22:20,320
i guess my question is

683
00:22:25,029 --> 00:22:23,039
with all this technology in your opinion

684
00:22:28,630 --> 00:22:25,039
how soon do you think we're going to put

685
00:22:32,470 --> 00:22:29,830
to

686
00:22:34,710 --> 00:22:32,480
put humans on mars in the 2030s

687
00:22:36,870 --> 00:22:34,720
and so we're developing a suite of edl

688
00:22:38,310 --> 00:22:36,880

technologies to land larger masses at

689
00:22:40,870 --> 00:22:38,320
higher elevations to access more of the

690
00:22:42,950 --> 00:22:40,880
planet like like ian said but we need a

691
00:22:43,990 --> 00:22:42,960
whole host of other technologies we need

692
00:22:46,149 --> 00:22:44,000
advanced in space enforcement

693
00:22:47,430 --> 00:22:46,159
technologies to shorten the trip time we

694
00:22:48,630 --> 00:22:47,440
need environmental control and life

695
00:22:49,990 --> 00:22:48,640
support system technologies that are

696
00:22:51,909 --> 00:22:50,000
more efficient so the astronauts can

697
00:22:53,590 --> 00:22:51,919
survive the trip and then we need

698
00:22:56,710 --> 00:22:53,600
systems on the surface of mars that can

699
00:22:57,990 --> 00:22:56,720
produce things like fuel and oxygen and

700
00:22:58,710 --> 00:22:58,000
so we can kind of live off the land

701
00:23:00,070 --> 00:22:58,720
because we're not going to be able to

702
00:23:01,669 --> 00:23:00,080
take everything with us

703
00:23:04,390 --> 00:23:01,679
so it's going to take a couple of

704
00:23:06,390 --> 00:23:04,400
decades to develop all that technology

705
00:23:10,549 --> 00:23:06,400
edl technologies are critical to making

706
00:23:14,310 --> 00:23:10,559
that happen and ldsd is a really great

707
00:23:15,190 --> 00:23:14,320
advancement in edl technology

708
00:23:17,190 --> 00:23:15,200
okay

709
00:23:19,029 --> 00:23:17,200
next we have a question from our

710
00:23:21,830 --> 00:23:19,039
telephone bridge irene klotz from

711
00:23:23,750 --> 00:23:21,840
reuters irene

712
00:23:26,230 --> 00:23:23,760
kim i have a couple questions the first

713
00:23:29,029 --> 00:23:26,240

i think is for mark did i hear you say

714
00:23:30,789 --> 00:23:29,039
correctly that the diameter of the cyad

715
00:23:33,110 --> 00:23:30,799
for this flight is

716
00:23:34,950 --> 00:23:33,120
larger 26 feet or were you just

717
00:23:37,110 --> 00:23:34,960
referring to the ground test that you

718
00:23:39,029 --> 00:23:37,120
did on that with that rail track and i

719
00:23:40,549 --> 00:23:39,039
have another question as well okay so

720
00:23:42,230 --> 00:23:40,559
for the first one that that was a

721
00:23:43,430 --> 00:23:42,240
26-foot diameter side is not the one

722
00:23:45,510 --> 00:23:43,440
that we're flying this year we hope to

723
00:23:46,870 --> 00:23:45,520
fly that in a future flight the one that

724
00:23:48,230 --> 00:23:46,880
we're flying this year is 20 feet in

725
00:23:49,590 --> 00:23:48,240
diameter it's like the one we flew last

726
00:23:53,029 --> 00:23:49,600
year we need that to present the right

727
00:23:55,750 --> 00:23:53,039
environment for the parachute test

728
00:23:57,270 --> 00:23:55,760
and then um i guess on that note i don't

729
00:23:59,190 --> 00:23:57,280
know who it was who

730
00:24:01,270 --> 00:23:59,200
referenced that with the successful

731
00:24:03,750 --> 00:24:01,280
deployment of the syad last year that

732
00:24:06,470 --> 00:24:03,760
this is now flight qualified for mars

733
00:24:08,310 --> 00:24:06,480
and someone else had said that

734
00:24:10,470 --> 00:24:08,320
that the

735
00:24:13,190 --> 00:24:10,480
the with the parachute test

736
00:24:15,430 --> 00:24:13,200
could be ready to be tested on mars as

737
00:24:17,510 --> 00:24:15,440
early as the mars 2020

738
00:24:19,029 --> 00:24:17,520

rover and

739
00:24:21,909 --> 00:24:19,039
just wanted to know i mean obviously you

740
00:24:24,710 --> 00:24:21,919
don't need the extra

741
00:24:27,350 --> 00:24:24,720
math on on that payload but would is

742
00:24:30,830 --> 00:24:27,360
nasa actually considering using either

743
00:24:33,190 --> 00:24:30,840
of these systems on the mars 2020

744
00:24:35,029 --> 00:24:33,200
rover delivery thanks right so at this

745
00:24:36,470 --> 00:24:35,039
time the mars 2020 mission design

746
00:24:38,149 --> 00:24:36,480
doesn't require the new technologies in

747
00:24:39,830 --> 00:24:38,159
fact it was designed exactly in that way

748
00:24:40,950 --> 00:24:39,840
because they didn't know and they still

749
00:24:42,310 --> 00:24:40,960
don't know whether or not we're going to

750
00:24:43,269 --> 00:24:42,320
succeed in our technology development

751
00:24:45,110 --> 00:24:43,279
and they have to proceed with the

752
00:24:46,470 --> 00:24:45,120
designs of their systems and so we'll

753
00:24:47,750 --> 00:24:46,480
wait to see after we complete our

754
00:24:48,950 --> 00:24:47,760
technology development if there's some

755
00:24:50,710 --> 00:24:48,960
reason that they might consider to need

756
00:24:53,190 --> 00:24:50,720
them but right now it is not the plan

757
00:24:55,750 --> 00:24:53,200
for 2020 to to use or require these

758
00:24:57,510 --> 00:24:55,760
technologies so the next opportunity we

759
00:24:59,029 --> 00:24:57,520
expect will be for components of mars

760
00:25:00,470 --> 00:24:59,039
sample return which in fact 2020 is

761
00:25:02,070 --> 00:25:00,480
beginning 2020 will be collecting

762
00:25:03,750 --> 00:25:02,080
samples that we hope to eventually

763
00:25:05,029 --> 00:25:03,760

return to earth and to do that we have

764
00:25:06,549 --> 00:25:05,039
to put rockets down on the surface of

765
00:25:07,990 --> 00:25:06,559
mars that can launch these samples into

766
00:25:09,750 --> 00:25:08,000
mars orbit those could be very large

767
00:25:11,430 --> 00:25:09,760
systems and they very well may require

768
00:25:12,630 --> 00:25:11,440
the syad and parachute in order to get

769
00:25:15,029 --> 00:25:12,640
that system down to the ground as well

770
00:25:17,590 --> 00:25:15,039
as other future mars exploration and as

771
00:25:19,269 --> 00:25:17,600
steve alluded to to providing cargo

772
00:25:20,870 --> 00:25:19,279
or other services to astronauts on the

773
00:25:23,269 --> 00:25:20,880
surface and again these also provide the

774
00:25:24,390 --> 00:25:23,279
first steps in a many step program for

775
00:25:26,830 --> 00:25:24,400
trying to get to the point where we can

776
00:25:30,470 --> 00:25:26,840
actually have a journey to mars with

777
00:25:34,470 --> 00:25:30,480
humans thank you mark next we have alan

778
00:25:36,870 --> 00:25:34,480
boyle with nbc news alan

779
00:25:40,310 --> 00:25:36,880
hi can you hear me yes

780
00:25:43,350 --> 00:25:40,320
okay great uh i may have missed

781
00:25:46,310 --> 00:25:43,360
some of the some of the presentation but

782
00:25:48,230 --> 00:25:46,320
i wanted to just double check on the

783
00:25:51,909 --> 00:25:48,240
weather outlook i know last year there

784
00:25:54,310 --> 00:25:51,919
was quite a delay because of the winds

785
00:25:56,870 --> 00:25:54,320
what's the outlook and what's the

786
00:25:59,750 --> 00:25:56,880
window in case you do have to

787
00:26:01,669 --> 00:25:59,760
delay the initial attempt thank you

788
00:26:03,190 --> 00:26:01,679

right so in fact as you were referring

789
00:26:04,470 --> 00:26:03,200
to last year our first two week launch

790
00:26:05,909 --> 00:26:04,480
period very much like this year's two

791
00:26:07,350 --> 00:26:05,919
week launch period we were not able to

792
00:26:08,710 --> 00:26:07,360
launch we had wind conditions that

793
00:26:10,549 --> 00:26:08,720
prevented launch because we were not

794
00:26:12,070 --> 00:26:10,559
having the right trajectories to carry

795
00:26:14,310 --> 00:26:12,080
the vehicle off the island and away from

796
00:26:15,669 --> 00:26:14,320
populated areas to make it safe and so

797
00:26:17,029 --> 00:26:15,679
of course we'll only launch a bit safe

798
00:26:18,549 --> 00:26:17,039
and so this year again we're going to be

799
00:26:20,710 --> 00:26:18,559
looking at for these first two weeks for

800
00:26:21,990 --> 00:26:20,720
a possible launch opportunity right now

801
00:26:23,590 --> 00:26:22,000
the outlook actually isn't looking too

802
00:26:24,950 --> 00:26:23,600
bad i'm hopeful that by the end of the

803
00:26:26,549 --> 00:26:24,960
week or early next week we'll have a

804
00:26:28,070 --> 00:26:26,559
good opportunity right now tomorrow

805
00:26:29,669 --> 00:26:28,080
isn't looking so great but we're going

806
00:26:31,590 --> 00:26:29,679
to continue to watch the weather it can

807
00:26:33,029 --> 00:26:31,600
change quickly if we don't get off in

808
00:26:35,110 --> 00:26:33,039
these first two weeks we do in fact have

809
00:26:37,029 --> 00:26:35,120
a backup period in july from july 7th to

810
00:26:37,990 --> 00:26:37,039
17th that we could try and get off on

811
00:26:39,110 --> 00:26:38,000
and where there might be better

812
00:26:40,310 --> 00:26:39,120
conditions in fact that's exactly what

813
00:26:42,310 --> 00:26:40,320

we did last year we didn't get off in

814
00:26:43,669 --> 00:26:42,320
the first launch period and so a couple

815
00:26:45,350 --> 00:26:43,679
weeks later we came back and launched on

816
00:26:47,510 --> 00:26:45,360
the very first day of the next backup

817
00:26:49,269 --> 00:26:47,520
opportunity

818
00:26:52,470 --> 00:26:49,279
okay do we have any more questions here

819
00:26:54,230 --> 00:26:52,480
at pmrf reporters here raise your hand

820
00:26:56,149 --> 00:26:54,240
if you have a question

821
00:26:58,230 --> 00:26:56,159
anybody else here

822
00:27:08,950 --> 00:26:58,240
okay now we'll go to social can we get a

823
00:27:13,190 --> 00:27:11,269
hi actually i have a couple so starting

824
00:27:15,909 --> 00:27:13,200
from twitter the first one is how will

825
00:27:18,789 --> 00:27:15,919
ldsd be controlled

826
00:27:21,269 --> 00:27:18,799
controlled it's uh

827
00:27:23,029 --> 00:27:21,279
it's not actively controlled actually uh

828
00:27:24,950 --> 00:27:23,039
you know we use physics to control the

829
00:27:27,510 --> 00:27:24,960
vehicle uh we point it in the direction

830
00:27:30,070 --> 00:27:27,520
that we we want the vehicle to travel uh

831
00:27:31,990 --> 00:27:30,080
and we use gyroscopic stability to help

832
00:27:33,110 --> 00:27:32,000
stabilize it and maintain it pointed so

833
00:27:35,350 --> 00:27:33,120
in the sense

834
00:27:38,390 --> 00:27:35,360
the vehicle is controlled by thrust drag

835
00:27:40,070 --> 00:27:38,400
gravity and angular momentum

836
00:27:42,710 --> 00:27:40,080
and then also on twitter i have another

837
00:27:44,950 --> 00:27:42,720
one how come aerodynamic aerodynamic

838
00:27:48,549 --> 00:27:44,960

surfaces are smooth rather than dimpled

839
00:27:51,430 --> 00:27:49,990
uh

840
00:27:53,190 --> 00:27:51,440
it depends on what you're trying to do

841
00:27:54,870 --> 00:27:53,200
with the aerodynamic surface uh in the

842
00:27:56,149 --> 00:27:54,880
case of dimples on a golf ball generally

843
00:27:58,870 --> 00:27:56,159
that's to

844
00:28:00,789 --> 00:27:58,880
help keep the boundary layer attached

845
00:28:02,630 --> 00:28:00,799
and have the golf ball fly in a

846
00:28:04,789 --> 00:28:02,640
particular way for our aerodynamic

847
00:28:06,549 --> 00:28:04,799
surfaces we are focused on trying to

848
00:28:09,110 --> 00:28:06,559
produce drag generally that means having

849
00:28:11,350 --> 00:28:09,120
very large blunt

850
00:28:12,549 --> 00:28:11,360
surfaces that face the wind to create

851
00:28:14,470 --> 00:28:12,559
that drag

852
00:28:16,470 --> 00:28:14,480
or creating geometries like parachutes

853
00:28:18,230 --> 00:28:16,480
where you have a giant bowl that's

854
00:28:20,310 --> 00:28:18,240
helping capture and slow down and create

855
00:28:21,669 --> 00:28:20,320
drag that way

856
00:28:23,510 --> 00:28:21,679
and then from facebook we have a

857
00:28:25,430 --> 00:28:23,520
question what is the height of the drop

858
00:28:28,950 --> 00:28:25,440
of ldsd

859
00:28:31,430 --> 00:28:28,960
so it's dropped from 119 to 120 000 feet

860
00:28:33,190 --> 00:28:31,440
it drops for for about 100 or 200 feet

861
00:28:37,190 --> 00:28:33,200
and then it accelerates upwards from

862
00:28:39,430 --> 00:28:37,200
there to 180 to 200 000 feet

863
00:28:42,070 --> 00:28:39,440

okay okay and uh one more from you

864
00:28:45,510 --> 00:28:42,080
stream um what are the g forces on the

865
00:28:48,310 --> 00:28:45,520
system when it opens up at mach 4.

866
00:28:50,149 --> 00:28:48,320
ah in the case of the sciad

867
00:28:51,909 --> 00:28:50,159
generally when we inflate last year and

868
00:28:54,070 --> 00:28:51,919
when we inflate this year it'll be on

869
00:28:56,230 --> 00:28:54,080
the order of three to four g's

870
00:28:58,389 --> 00:28:56,240
during the initial deployment a lot of

871
00:29:00,149 --> 00:28:58,399
that though is because of the the test

872
00:29:02,149 --> 00:29:00,159
vehicle that we have is relatively

873
00:29:03,510 --> 00:29:02,159
lightweight even though it's full scale

874
00:29:05,430 --> 00:29:03,520
because we're constrained in terms of

875
00:29:07,269 --> 00:29:05,440
how much mass we can take to an altitude

876
00:29:09,269 --> 00:29:07,279
it's about one-third the mass of an

877
00:29:11,269 --> 00:29:09,279
equivalent mars entry vehicle so the

878
00:29:14,230 --> 00:29:11,279
g-forces are a lot higher for this test

879
00:29:16,230 --> 00:29:14,240
than they otherwise be would be at mars

880
00:29:18,070 --> 00:29:16,240
great questions from social and remember

881
00:29:21,510 --> 00:29:18,080
if you're following us on social use the

882
00:29:24,070 --> 00:29:21,520
hashtag axenasa so we can get you in the

883
00:29:25,590 --> 00:29:24,080
queue and that's on ustream and twitter

884
00:29:28,470 --> 00:29:25,600
next we'd like to go to back to the

885
00:29:29,909 --> 00:29:28,480
phone bridge we have irene klotz

886
00:29:32,549 --> 00:29:29,919
irene

887
00:29:34,789 --> 00:29:32,559
thanks um i don't recall from last year

888
00:29:36,950 --> 00:29:34,799

um what the time frame is for when a

889
00:29:39,269 --> 00:29:36,960
decision would be made about whether an

890
00:29:40,789 --> 00:29:39,279
attempt to conduct the test tomorrow

891
00:29:43,190 --> 00:29:40,799
would take place

892
00:29:45,029 --> 00:29:43,200
so we have uh opportunities every day to

893
00:29:46,870 --> 00:29:45,039
try and launch from june 2nd to june

894
00:29:48,070 --> 00:29:46,880
12th we decide the day before of a

895
00:29:50,710 --> 00:29:48,080
launch attempt whether or not we have

896
00:29:52,630 --> 00:29:50,720
good conditions so we actually have a

897
00:29:54,070 --> 00:29:52,640
noon meeting on the day before launch

898
00:29:55,430 --> 00:29:54,080
day to go through the conditions the

899
00:29:57,430 --> 00:29:55,440
weather conditions the safety

900
00:29:59,110 --> 00:29:57,440
calculations to determine if it's good

901
00:30:00,470 --> 00:29:59,120
we will then if we if the conditions do

902
00:30:02,470 --> 00:30:00,480
look good we'll proceed with the launch

903
00:30:04,789 --> 00:30:02,480
the folk will come in in the evening

904
00:30:06,149 --> 00:30:04,799
the int team will come in at around 10

905
00:30:08,389 --> 00:30:06,159
10 in the evening to start getting the

906
00:30:10,070 --> 00:30:08,399
vehicle prepared roll it out to the pad

907
00:30:11,510 --> 00:30:10,080
and start preparing it on the pad we

908
00:30:12,789 --> 00:30:11,520
will a lot of the crew comes in then

909
00:30:14,470 --> 00:30:12,799
over the morning two in the morning four

910
00:30:16,470 --> 00:30:14,480
in the morning to uh to fill out the

911
00:30:17,669 --> 00:30:16,480
operations team and then we prepare for

912
00:30:19,750 --> 00:30:17,679
a launch that's going to be between

913
00:30:20,789 --> 00:30:19,760

about 7 30 and 8 in the morning most

914
00:30:22,310 --> 00:30:20,799
likely

915
00:30:24,070 --> 00:30:22,320
that then the vehicle will launch from

916
00:30:25,510 --> 00:30:24,080
from uh at that time and go up to

917
00:30:27,269 --> 00:30:25,520
altitude over about two hours then we

918
00:30:28,630 --> 00:30:27,279
might wait an hour to

919
00:30:30,389 --> 00:30:28,640
get to a good position to float and then

920
00:30:31,669 --> 00:30:30,399
drop and fire the vehicle now there is a

921
00:30:33,590 --> 00:30:31,679
chance that we could be a go for a

922
00:30:35,110 --> 00:30:33,600
launch the day before but then later in

923
00:30:36,549 --> 00:30:35,120
the evening or early that morning we may

924
00:30:38,630 --> 00:30:36,559
determine that the wind conditions the

925
00:30:40,070 --> 00:30:38,640
onshore breezes are not appropriate for

926
00:30:41,990 --> 00:30:40,080
a balloon launch and we may have to

927
00:30:43,269 --> 00:30:42,000
scrub at that time and then recycle and

928
00:30:44,789 --> 00:30:43,279
then come back and have again another

929
00:30:48,070 --> 00:30:44,799
noon meeting that day to see if the next

930
00:30:55,430 --> 00:30:50,950
okay next we have bill harwood with cbs

931
00:31:06,070 --> 00:31:02,070
bill

932
00:31:07,990 --> 00:31:06,080
can you hear me gotcha yeah we got to

933
00:31:10,389 --> 00:31:08,000
thank you yeah i apologize guys on a

934
00:31:11,990 --> 00:31:10,399
cell phone um hey i know you all told us

935
00:31:13,510 --> 00:31:12,000
this last year and i may have missed it

936
00:31:16,149 --> 00:31:13,520
earlier today but could you review the

937
00:31:17,909 --> 00:31:16,159
cost of the the uh the whole project i

938
00:31:20,870 --> 00:31:17,919

guess with the flight last year this one

939
00:31:23,269 --> 00:31:20,880
and what you guys have planned thanks

940
00:31:25,830 --> 00:31:23,279
so the uh the the total runout cost of

941
00:31:27,430 --> 00:31:25,840
ldsd is approximately 230 million

942
00:31:36,230 --> 00:31:27,440
dollars with our current manifest of

943
00:31:39,909 --> 00:31:37,909
okay any other

944
00:31:41,509 --> 00:31:39,919
calls on the line

945
00:31:43,430 --> 00:31:41,519
any other calls here

946
00:31:44,870 --> 00:31:43,440
at pmrf

947
00:31:47,590 --> 00:31:44,880
social

948
00:31:50,470 --> 00:31:47,600
i have one that came in from uh

949
00:31:55,110 --> 00:31:53,430
peter king ask is uh what is the weather

950
00:31:56,789 --> 00:31:55,120
forecast for tomorrow for the launch

951
00:31:57,750 --> 00:31:56,799
attempt i think you might have covered

952
00:32:00,070 --> 00:31:57,760
part of that

953
00:32:01,830 --> 00:32:00,080
yeah so we are looking at the weather

954
00:32:03,590 --> 00:32:01,840
every day for the next several days

955
00:32:05,190 --> 00:32:03,600
we're watching it very intently though

956
00:32:07,029 --> 00:32:05,200
it's it's difficult to make predictions

957
00:32:09,190 --> 00:32:07,039
over many days that right now tomorrow

958
00:32:10,389 --> 00:32:09,200
is not looking particularly favorable we

959
00:32:12,630 --> 00:32:10,399
are still going to go through all the

960
00:32:14,470 --> 00:32:12,640
process tomorrow and give it a shot

961
00:32:15,909 --> 00:32:14,480
right now i'm hopeful that by the end of

962
00:32:18,549 --> 00:32:15,919
the week or early next week we'll have

963
00:32:20,870 --> 00:32:18,559

some better opportunities

964
00:32:24,070 --> 00:32:20,880
okay mark's been honing his skills as a

965
00:32:25,830 --> 00:32:24,080
weather forecaster quite a bit lately

966
00:32:28,710 --> 00:32:25,840
so if we have no further questions this

967
00:32:30,789 --> 00:32:28,720
concludes today's pre-launch ldsd

968
00:32:33,430 --> 00:32:30,799
mission briefing you can follow us on

969
00:32:35,750 --> 00:32:33,440
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