1
00:00:06,869 --> 00:00:05,110
good morning everyone my name is peter

2
00:00:08,390 --> 00:00:06,879
jacob i'm the associate director of the

3
00:00:09,350 --> 00:00:08,400
smithsonian international air and space

4
00:00:11,110 --> 00:00:09,360
museum

5
00:00:13,030 --> 00:00:11,120
and i'm delighted to welcome everyone

6
00:00:14,470 --> 00:00:13,040
here to the museum for this very special

7
00:00:16,070 --> 00:00:14,480
press conference

8
00:00:18,230 --> 00:00:16,080
by nasa and the national air and space

9
00:00:20,070 --> 00:00:18,240
museum focusing on the next great

10
00:00:21,269 --> 00:00:20,080
venture in planetary science and

11
00:00:22,870 --> 00:00:21,279
exploration

12
00:00:24,790 --> 00:00:22,880
we're here this morning to announce the

13
00:00:27,189 --> 00:00:24,800

landing site for the mars science

14
00:00:29,509 --> 00:00:27,199
laboratory and also also known as the

15
00:00:31,269 --> 00:00:29,519
the rover curiosity and share some of

16
00:00:33,110 --> 00:00:31,279
the details of what the mission hopes to

17
00:00:35,670 --> 00:00:33,120
accomplish

18
00:00:38,150 --> 00:00:35,680
on july 1st 1976

19
00:00:39,590 --> 00:00:38,160
just 35 years ago on the front steps of

20
00:00:42,069 --> 00:00:39,600
the then brand new national air and

21
00:00:43,350 --> 00:00:42,079
space museum a ribbon cutting ceremony

22
00:00:45,029 --> 00:00:43,360
was held

23
00:00:47,110 --> 00:00:45,039
to dedicate the smithsonian's newest

24
00:00:48,069 --> 00:00:47,120
museum but it was no ordinary ribbon

25
00:00:49,750 --> 00:00:48,079
cutting

26
00:00:51,750 --> 00:00:49,760
the task was not accomplished by the

27
00:00:53,110 --> 00:00:51,760
traditional large scissors but by a

28
00:00:55,430 --> 00:00:53,120
signal sent from the viking one

29
00:00:56,950 --> 00:00:55,440
spacecraft orbiting mars and just days

30
00:00:59,349 --> 00:00:56,960
before its descent to the surface of the

31
00:01:01,590 --> 00:00:59,359
red planet it was a dramatic connection

32
00:01:03,510 --> 00:01:01,600
between the exploration of mars and the

33
00:01:05,109 --> 00:01:03,520
new national air and space museum but it

34
00:01:06,630 --> 00:01:05,119
would hardly be the last

35
00:01:08,390 --> 00:01:06,640
the relationship between the museum and

36
00:01:10,789 --> 00:01:08,400
mars planetary research mars and

37
00:01:12,950 --> 00:01:10,799
planetary research was just beginning

38
00:01:15,510 --> 00:01:12,960

and i might add that uh we have a viking

39
00:01:18,469 --> 00:01:15,520
spacecraft on display here in the museum

40
00:01:20,149 --> 00:01:18,479
and uh the viking that is on mars

41
00:01:22,310 --> 00:01:20,159
actually has been transferred to the

42
00:01:24,789 --> 00:01:22,320
smithsonian uh by nasa so we're free to

43
00:01:27,270 --> 00:01:24,799
go pick it up anytime we like

44
00:01:28,789 --> 00:01:27,280
but i can i dare say that uh the reach

45
00:01:30,230 --> 00:01:28,799
of the smithsonian's national air space

46
00:01:31,429 --> 00:01:30,240
museum is probably farther than any

47
00:01:34,550 --> 00:01:31,439
other museum in the world with our

48
00:01:36,789 --> 00:01:34,560
collections uh on on another world

49
00:01:38,630 --> 00:01:36,799
uh this museum is is world renowned for

50
00:01:39,990 --> 00:01:38,640
its collection of historic spacecraft

51
00:01:41,670 --> 00:01:40,000
and the millions of visitors that come

52
00:01:43,670 --> 00:01:41,680
every year to learn about them and be

53
00:01:45,749 --> 00:01:43,680
inspired by them for decades we've

54
00:01:47,670 --> 00:01:45,759
enjoyed a close relationship with nasa

55
00:01:49,429 --> 00:01:47,680
to ensure these extraordinary artifacts

56
00:01:51,350 --> 00:01:49,439
are preserved once they've completed

57
00:01:53,510 --> 00:01:51,360
their missions to expand the frontier of

58
00:01:55,109 --> 00:01:53,520
scientific understanding and to broaden

59
00:01:56,310 --> 00:01:55,119
the human experience

60
00:01:58,069 --> 00:01:56,320
this partnership to preserve the

61
00:01:59,350 --> 00:01:58,079
heritage of space flight will add

62
00:02:00,870 --> 00:01:59,360
another milestone to the national

63
00:02:02,870 --> 00:02:00,880

collection with the arrival of the space

64
00:02:04,630 --> 00:02:02,880
shuttle discovery at the smithsonian

65
00:02:06,550 --> 00:02:04,640
next spring and i'd like to take this

66
00:02:07,990 --> 00:02:06,560
opportunity to publicly thank nasa for

67
00:02:09,749 --> 00:02:08,000
selecting the national air and space

68
00:02:11,910 --> 00:02:09,759
museum as the repository for this

69
00:02:13,510 --> 00:02:11,920
treasure i can assure you that we will

70
00:02:15,190 --> 00:02:13,520
bring our very best stewardship to this

71
00:02:17,030 --> 00:02:15,200
object that represents the skill and

72
00:02:19,030 --> 00:02:17,040
vision of the millions of people who had

73
00:02:20,710 --> 00:02:19,040
a hand in his creation and fulfilling

74
00:02:21,750 --> 00:02:20,720
its mission

75
00:02:23,190 --> 00:02:21,760
with the curation of these

76
00:02:24,869 --> 00:02:23,200
world-changing artifacts and the

77
00:02:26,390 --> 00:02:24,879
stunning buildings that house them this

78
00:02:27,990 --> 00:02:26,400
one and the stephen f woodbar housing

79
00:02:28,869 --> 00:02:28,000
center that we have out near dulles

80
00:02:31,030 --> 00:02:28,879
airport

81
00:02:33,509 --> 00:02:31,040
uh enjoy widespread awareness but what

82
00:02:35,110 --> 00:02:33,519
is less well-known is the smithsonian is

83
00:02:37,030 --> 00:02:35,120
not only a keeper of history but it is

84
00:02:39,270 --> 00:02:37,040
also a maker of history

85
00:02:41,110 --> 00:02:39,280
nassem's founding director apollo 11

86
00:02:42,309 --> 00:02:41,120
command module pilot michael collins

87
00:02:45,030 --> 00:02:42,319
created the center for earth and

88
00:02:46,550 --> 00:02:45,040

planetary studies in the 1970s to engage

89
00:02:48,390 --> 00:02:46,560
in planetary research and to house

90
00:02:50,550 --> 00:02:48,400
mission data and imagery for all

91
00:02:51,910 --> 00:02:50,560
researchers to investigate thereby

92
00:02:53,589 --> 00:02:51,920
establishing the dual mission of the

93
00:02:55,430 --> 00:02:53,599
national air and space museum of both

94
00:02:57,589 --> 00:02:55,440
history and science

95
00:02:59,509 --> 00:02:57,599
he selected dr farooq albaz to build and

96
00:03:01,030 --> 00:02:59,519
lead the center farooq had been one of

97
00:03:02,630 --> 00:03:01,040
the principal scientists involved in

98
00:03:05,270 --> 00:03:02,640
selecting the landing sites for the

99
00:03:06,630 --> 00:03:05,280
apollo missions so mike collins knew him

100
00:03:08,070 --> 00:03:06,640
quite well

101
00:03:10,710 --> 00:03:08,080
in addition to the earth and lunar

102
00:03:12,309 --> 00:03:10,720
studies research on mars venus mercury

103
00:03:13,910 --> 00:03:12,319
and other satellites have been the focus

104
00:03:15,030 --> 00:03:13,920
of the center throughout its 35-year

105
00:03:16,309 --> 00:03:15,040
history

106
00:03:17,910 --> 00:03:16,319
now some scientists have been key

107
00:03:20,149 --> 00:03:17,920
contributors to many historic missions

108
00:03:22,070 --> 00:03:20,159
and are currently involved with the mars

109
00:03:23,430 --> 00:03:22,080
exploration rovers the mars

110
00:03:25,030 --> 00:03:23,440
reconnaissance orbiter featuring the

111
00:03:27,350 --> 00:03:25,040
high-rise camera and the

112
00:03:29,990 --> 00:03:27,360
chirad radar mars express with the

113
00:03:32,229 --> 00:03:30,000

marxist radar the lunar reconnaissance

114
00:03:33,750 --> 00:03:32,239
orbiter with the l rock camera the

115
00:03:35,430 --> 00:03:33,760
mercury surface space environment

116
00:03:37,350 --> 00:03:35,440
geochemistry and ranging spacecraft

117
00:03:38,869 --> 00:03:37,360
better known as messenger and of course

118
00:03:41,030 --> 00:03:38,879
the focus of today's announcement the

119
00:03:42,550 --> 00:03:41,040
mars science laboratory

120
00:03:43,990 --> 00:03:42,560
as the curators and collections care

121
00:03:46,630 --> 00:03:44,000
staff work to preserve the history of

122
00:03:47,990 --> 00:03:46,640
space exploration the museum's planetary

123
00:03:49,830 --> 00:03:48,000
scientists add to the current

124
00:03:51,670 --> 00:03:49,840
exploration of space with their highly

125
00:03:53,350 --> 00:03:51,680
regarded research and participation on

126
00:03:54,949 --> 00:03:53,360
history making missions

127
00:03:57,589 --> 00:03:54,959
we are fond of saying around here that

128
00:03:59,589 --> 00:03:57,599
if it's on mars orbiting mars or on its

129
00:04:00,710 --> 00:03:59,599
way to mars nasam scientists are

130
00:04:02,149 --> 00:04:00,720
involved

131
00:04:04,149 --> 00:04:02,159
scientists collaborate with researchers

132
00:04:05,350 --> 00:04:04,159
and mission planners all over the world

133
00:04:07,270 --> 00:04:05,360
and we are extremely proud of the

134
00:04:09,270 --> 00:04:07,280
contributions they make

135
00:04:11,030 --> 00:04:09,280
to the inhabitants of this precious

136
00:04:12,710 --> 00:04:11,040
planet we call earth as we reach out to

137
00:04:14,789 --> 00:04:12,720
other worlds and strive to understand

138
00:04:16,629 --> 00:04:14,799

where we've been as well as envision

139
00:04:17,909 --> 00:04:16,639
where we'll go next

140
00:04:19,270 --> 00:04:17,919
for those who are lamenting the end of

141
00:04:21,270 --> 00:04:19,280
the shuttle program and think at the

142
00:04:23,030 --> 00:04:21,280
closing of the curtain on american space

143
00:04:24,230 --> 00:04:23,040
exploration they need only to look at

144
00:04:25,990 --> 00:04:24,240
the planetary missions currently

145
00:04:28,070 --> 00:04:26,000
gathering data and the next one's about

146
00:04:29,830 --> 00:04:28,080
to launch to know that our space program

147
00:04:32,070 --> 00:04:29,840
is very healthy and every day is still

148
00:04:33,510 --> 00:04:32,080
taking us places we've never been

149
00:04:35,270 --> 00:04:33,520
which brings us to the subject of

150
00:04:36,710 --> 00:04:35,280
today's press conference the mars

151
00:04:38,070 --> 00:04:36,720
science laboratory

152
00:04:39,430 --> 00:04:38,080
we're very proud of our own nassau

153
00:04:41,670 --> 00:04:39,440
center for urban planetary studies

154
00:04:43,990 --> 00:04:41,680
scientist dr john grant and his role

155
00:04:46,070 --> 00:04:44,000
with msl and we'll be hearing a bit from

156
00:04:47,510 --> 00:04:46,080
him later

157
00:04:49,990 --> 00:04:47,520
and i'd also like to point out that we

158
00:04:51,110 --> 00:04:50,000
have a full-size model of

159
00:04:52,870 --> 00:04:51,120
msl

160
00:04:54,550 --> 00:04:52,880
on display in the museum at the far end

161
00:04:55,990 --> 00:04:54,560
and i invite you to take a look at that

162
00:04:57,830 --> 00:04:56,000
after the press conference as well as

163
00:05:00,070 --> 00:04:57,840

partake in the many programs we have

164
00:05:01,909 --> 00:05:00,080
going on today in our annual mars day

165
00:05:03,670 --> 00:05:01,919
program we've got stations all over the

166
00:05:04,870 --> 00:05:03,680
museum talking about the research that

167
00:05:07,270 --> 00:05:04,880
our group does

168
00:05:08,790 --> 00:05:07,280
on mars and and generally about about

169
00:05:09,590 --> 00:05:08,800
mars

170
00:05:10,629 --> 00:05:09,600
so

171
00:05:12,390 --> 00:05:10,639
with that

172
00:05:14,629 --> 00:05:12,400
i'd like to begin this discussion by

173
00:05:25,430 --> 00:05:14,639
introducing nasa chief scientist dr

174
00:05:30,950 --> 00:05:27,990
well thank you and thank you for hosting

175
00:05:33,350 --> 00:05:30,960
uh this event because i i love this

176
00:05:35,350 --> 00:05:33,360
museum every time i come in here i just

177
00:05:38,150 --> 00:05:35,360
i'm a kid again you know looking around

178
00:05:39,749 --> 00:05:38,160
at all the incredible and exciting stuff

179
00:05:42,070 --> 00:05:39,759
and

180
00:05:45,110 --> 00:05:42,080
since i've become chief scientist at

181
00:05:47,909 --> 00:05:45,120
nasa i've got to even nurture that child

182
00:05:50,070 --> 00:05:47,919
that much more

183
00:05:52,629 --> 00:05:50,080
so it i think it's a great event and a

184
00:05:54,070 --> 00:05:52,639
wonderful venue and i really appreciate

185
00:05:56,790 --> 00:05:54,080
that

186
00:05:58,629 --> 00:05:56,800
i want to start just by saying you know

187
00:05:59,990 --> 00:05:58,639
a lot of attention has been given in the

188
00:06:01,350 --> 00:06:00,000

last

189
00:06:03,909 --> 00:06:01,360
weeks

190
00:06:05,430 --> 00:06:03,919
months years perhaps even

191
00:06:08,070 --> 00:06:05,440
to

192
00:06:10,070 --> 00:06:08,080
the event that uh concluded yesterday

193
00:06:12,309 --> 00:06:10,080
with the landing of the space shuttle

194
00:06:13,270 --> 00:06:12,319
the safe and successful landing of the

195
00:06:14,550 --> 00:06:13,280
shuttle

196
00:06:17,110 --> 00:06:14,560
marking really

197
00:06:20,870 --> 00:06:17,120
the turning of a page uh to a new

198
00:06:21,749 --> 00:06:20,880
chapter in human exploration of space

199
00:06:24,469 --> 00:06:21,759
um

200
00:06:27,029 --> 00:06:24,479
things change things evolve uh but what

201
00:06:29,909 --> 00:06:27,039
remains constant and what brings us here

202
00:06:31,749 --> 00:06:29,919
today to this room for this conversation

203
00:06:34,390 --> 00:06:31,759
is the fact um

204
00:06:36,629 --> 00:06:34,400
well what remains constant is the the

205
00:06:39,110 --> 00:06:36,639
urge to explore

206
00:06:41,350 --> 00:06:39,120
the urge to reach out beyond where we

207
00:06:42,870 --> 00:06:41,360
are and understand our surroundings and

208
00:06:44,790 --> 00:06:42,880
our place in it

209
00:06:47,110 --> 00:06:44,800
um

210
00:06:49,430 --> 00:06:47,120
it's really ingrained in our dna it's

211
00:06:51,990 --> 00:06:49,440
it's it's at the very heart of who we

212
00:06:52,950 --> 00:06:52,000
are as human beings and the human spirit

213
00:06:55,350 --> 00:06:52,960

so

214
00:07:00,790 --> 00:06:58,469
to feed that uh i i believe nasa is

215
00:07:03,670 --> 00:07:00,800
actually well i don't believe i know

216
00:07:05,830 --> 00:07:03,680
that that nasa

217
00:07:07,749 --> 00:07:05,840
is phenomenal

218
00:07:11,110 --> 00:07:07,759
i believe the greatest agency in the

219
00:07:14,070 --> 00:07:11,120
world in feeding that hunger helping us

220
00:07:16,309 --> 00:07:14,080
explore helping us understand our planet

221
00:07:17,670 --> 00:07:16,319
our solar system our universe and our

222
00:07:19,830 --> 00:07:17,680
place in that

223
00:07:22,230 --> 00:07:19,840
um

224
00:07:24,870 --> 00:07:22,240
and we do this in amazing ways we have

225
00:07:26,550 --> 00:07:24,880
incredible people doing unbelievable

226
00:07:29,029 --> 00:07:26,560
things and you're you're hearing from

227
00:07:31,189 --> 00:07:29,039
several of them today

228
00:07:32,710 --> 00:07:31,199
i know four of you and you are all

229
00:07:34,550 --> 00:07:32,720
incredible and the fifth i'm just going

230
00:07:37,830 --> 00:07:34,560
to assume by virtue of the company you

231
00:07:41,909 --> 00:07:39,749
but we have incredible people doing

232
00:07:45,670 --> 00:07:41,919
incredible things i mean think about it

233
00:07:49,430 --> 00:07:45,680
landing a rover on mars with with

234
00:07:53,430 --> 00:07:51,270
at a location you're going to hear about

235
00:07:54,950 --> 00:07:53,440
today and i almost wish i didn't know it

236
00:07:57,350 --> 00:07:54,960
because i'm scared to death i'm going to

237
00:07:58,950 --> 00:07:57,360
say it you know just blurt it out and

238
00:08:00,710 --> 00:07:58,960

ruin everything

239
00:08:03,189 --> 00:08:00,720
but i don't think i will

240
00:08:05,749 --> 00:08:03,199
uh but really

241
00:08:08,309 --> 00:08:05,759
it's not just mars it's not just human

242
00:08:11,510 --> 00:08:08,319
exploration

243
00:08:13,270 --> 00:08:11,520
this year alone we we've entered orbit

244
00:08:15,909 --> 00:08:13,280
around mercury with the messenger

245
00:08:16,629 --> 00:08:15,919
spacecraft telling us secrets about this

246
00:08:23,029 --> 00:08:16,639
the

247
00:08:25,430 --> 00:08:23,039
launching in a couple weeks to jupiter

248
00:08:27,749 --> 00:08:25,440
we have earth observing capabilities in

249
00:08:29,749 --> 00:08:27,759
place we're looking to the far reaches

250
00:08:32,870 --> 00:08:29,759
of the universe we have a very very

251
00:08:35,990 --> 00:08:32,880
robust science portfolio and that's

252
00:08:37,829 --> 00:08:36,000
important for a couple reasons one is is

253
00:08:41,509 --> 00:08:37,839
science really is one of the three

254
00:08:43,350 --> 00:08:41,519
pillars on which this agency stands

255
00:08:47,190 --> 00:08:43,360
human space flight human exploration

256
00:08:49,110 --> 00:08:47,200
space science and aeronautics and to see

257
00:08:50,710 --> 00:08:49,120
it robust and to be a part of this

258
00:08:53,509 --> 00:08:50,720
conversation

259
00:08:55,990 --> 00:08:53,519
is really incredible for me and i i hope

260
00:08:58,949 --> 00:08:56,000
and believe incredible for you

261
00:09:01,269 --> 00:08:58,959
um and sort of with that in mind i want

262
00:09:04,790 --> 00:09:01,279
to invite you as you hear what you're

263
00:09:08,550 --> 00:09:04,800

going to hear in the next few minutes um

264
00:09:11,430 --> 00:09:08,560
i want to invite you to go go back

265
00:09:13,750 --> 00:09:11,440
to that kid in you that looked at stars

266
00:09:15,269 --> 00:09:13,760
that was fascinated and you you know

267
00:09:17,190 --> 00:09:15,279
what i'm talking about because i'm sure

268
00:09:20,150 --> 00:09:17,200
you felt it when you walked into this

269
00:09:24,790 --> 00:09:20,160
museum and you saw the the lamb the

270
00:09:29,190 --> 00:09:27,030
find that person as you hear this

271
00:09:31,990 --> 00:09:29,200
information and and sort of

272
00:09:34,790 --> 00:09:32,000
let that person come up inside you

273
00:09:36,550 --> 00:09:34,800
informed by all the smart stuff you've

274
00:09:38,550 --> 00:09:36,560
learned over the years from the time you

275
00:09:41,590 --> 00:09:38,560
were that kid looking up at the sky and

276
00:09:43,670 --> 00:09:41,600
the stars and in absolute wonder but

277
00:09:45,509 --> 00:09:43,680
hear this through that hear what you're

278
00:09:47,350 --> 00:09:45,519
going to hear through that prism and i

279
00:09:50,630 --> 00:09:47,360
think you'll really

280
00:09:53,910 --> 00:09:50,640
appreciate and and feel

281
00:09:56,389 --> 00:09:53,920
how unbelievable this really is i mean

282
00:09:59,190 --> 00:09:56,399
we live it we breathe it we work it and

283
00:10:01,110 --> 00:09:59,200
we are all still in awe of it you know

284
00:10:02,630 --> 00:10:01,120
there's not a day that goes by where i

285
00:10:04,389 --> 00:10:02,640
don't think about

286
00:10:06,550 --> 00:10:04,399
that rover or

287
00:10:08,710 --> 00:10:06,560
other activities we do at nasa and just

288
00:10:11,030 --> 00:10:08,720

get blown away so

289
00:10:13,509 --> 00:10:11,040
i encourage you to receive this

290
00:10:15,670 --> 00:10:13,519
information in that spirit

291
00:10:19,430 --> 00:10:15,680
and then transmit that information in

292
00:10:21,670 --> 00:10:19,440
that spirit deep deep down inside you

293
00:10:24,150 --> 00:10:21,680
there's something that craves this stuff

294
00:10:26,630 --> 00:10:24,160
that that hungers for this stuff and to

295
00:10:28,150 --> 00:10:26,640
be able to feed it the fact that we have

296
00:10:29,509 --> 00:10:28,160
the technologies the science

297
00:10:32,949 --> 00:10:29,519
capabilities the engineering

298
00:10:36,710 --> 00:10:32,959
capabilities to deliver what we are

299
00:10:37,509 --> 00:10:36,720
delivering is absolutely incredible so

300
00:10:39,430 --> 00:10:37,519
uh

301
00:10:41,430 --> 00:10:39,440
let's not lose sight of that in fact

302
00:10:45,110 --> 00:10:41,440
let's elevate that because i think it's

303
00:10:47,110 --> 00:10:45,120
it's crucial and you're going to hear

304
00:10:49,670 --> 00:10:47,120
some amazing things about some

305
00:10:51,590 --> 00:10:49,680
unbelievable capabilities and

306
00:10:53,829 --> 00:10:51,600
i'm certainly excited to hear what

307
00:10:56,550 --> 00:10:53,839
everyone has to say so

308
00:10:58,470 --> 00:10:56,560
with that as a setup

309
00:11:06,870 --> 00:10:58,480
don't let me down

310
00:11:09,750 --> 00:11:08,150
good morning ladies and gentlemen my

311
00:11:12,150 --> 00:11:09,760
name is dwayne brown

312
00:11:15,030 --> 00:11:12,160
with nasa's office of communications and

313
00:11:17,829 --> 00:11:15,040

nasa headquarters as you've heard today

314
00:11:19,590 --> 00:11:17,839
is mars day and what better venue to

315
00:11:21,590 --> 00:11:19,600
make the special announcement on the

316
00:11:23,430 --> 00:11:21,600
destination of nasa's

317
00:11:24,870 --> 00:11:23,440
next mars rover

318
00:11:26,790 --> 00:11:24,880
we have a lot to cover i'm going to

319
00:11:29,030 --> 00:11:26,800
introduce our participants they're going

320
00:11:30,230 --> 00:11:29,040
to give you an incredible presentation

321
00:11:31,509 --> 00:11:30,240
then we're going to open it up for

322
00:11:33,269 --> 00:11:31,519
questions

323
00:11:34,630 --> 00:11:33,279
first up

324
00:11:36,150 --> 00:11:34,640
michael meyer

325
00:11:38,069 --> 00:11:36,160
lead scientist

326
00:11:41,670 --> 00:11:38,079
mars exploration program nasa

327
00:11:43,350 --> 00:11:41,680
headquarters washington dc

328
00:11:45,829 --> 00:11:43,360
michael watkins

329
00:11:48,949 --> 00:11:45,839
while an engineer his official title is

330
00:11:51,350 --> 00:11:48,959
mission manager for the msl project

331
00:11:53,590 --> 00:11:51,360
to jet propulsion laboratory in pasadena

332
00:11:54,829 --> 00:11:53,600
california

333
00:11:57,590 --> 00:11:54,839
john grant

334
00:12:00,949 --> 00:11:57,600
geologists smithsonian's national air

335
00:12:04,629 --> 00:12:00,959
and space museum here in washington

336
00:12:07,910 --> 00:12:04,639
don sumner geologists

337
00:12:11,269 --> 00:12:07,920
uc davis california

338
00:12:13,190 --> 00:12:11,279

and john grotzinger msl project

339
00:12:15,670 --> 00:12:13,200
scientist at the jet propulsion

340
00:12:16,629 --> 00:12:15,680
laboratory in pasadena and with that

341
00:12:19,030 --> 00:12:16,639
michael

342
00:12:21,829 --> 00:12:19,040
kick it off hey thanks dwayne

343
00:12:25,190 --> 00:12:21,839
two days and 35 years ago

344
00:12:27,190 --> 00:12:25,200
viking one landed on the surface of mars

345
00:12:28,470 --> 00:12:27,200
and made the first astrobiology

346
00:12:31,350 --> 00:12:28,480
measurements

347
00:12:33,350 --> 00:12:31,360
on another planet

348
00:12:35,350 --> 00:12:33,360
it the landing was actually delayed

349
00:12:37,350 --> 00:12:35,360
because they didn't have the images to

350
00:12:39,829 --> 00:12:37,360
know where to land

351
00:12:41,829 --> 00:12:39,839
we are in a different era we are here

352
00:12:44,629 --> 00:12:41,839
today to announce

353
00:12:46,550 --> 00:12:44,639
exactly where we're going to put the

354
00:12:49,110 --> 00:12:46,560
mars science laboratory

355
00:12:51,509 --> 00:12:49,120
the first astrobiology mission since

356
00:12:53,750 --> 00:12:51,519
viking

357
00:12:56,389 --> 00:12:53,760
we indeed are in a different era in that

358
00:12:59,190 --> 00:12:56,399
90 in 1995

359
00:13:01,590 --> 00:12:59,200
nasa produced the exobiology strategy

360
00:13:03,910 --> 00:13:01,600
for exploring mars and and laid out a

361
00:13:05,670 --> 00:13:03,920
series of missions of how to understand

362
00:13:07,509 --> 00:13:05,680
the biological potential of the red

363
00:13:09,670 --> 00:13:07,519

planet

364
00:13:12,150 --> 00:13:09,680
basically had it led the mars

365
00:13:13,750 --> 00:13:12,160
exploration program to go from global

366
00:13:16,310 --> 00:13:13,760
reconnaissance

367
00:13:18,790 --> 00:13:16,320
to detailed measurements on the surface

368
00:13:20,870 --> 00:13:18,800
to the eventual return of samples from

369
00:13:24,870 --> 00:13:20,880
mars

370
00:13:28,230 --> 00:13:24,880
path

371
00:13:30,550 --> 00:13:28,240
and plays a very critical role in it

372
00:13:32,870 --> 00:13:30,560
we've done our homework the engineers

373
00:13:35,269 --> 00:13:32,880
have designed us a spacecraft that can

374
00:13:37,350 --> 00:13:35,279
get us to where we want to go

375
00:13:39,269 --> 00:13:37,360
and the scientists have integrated

376
00:13:40,470 --> 00:13:39,279
terabytes of information

377
00:13:42,069 --> 00:13:40,480
to

378
00:13:44,470 --> 00:13:42,079
decide on

379
00:13:46,870 --> 00:13:44,480
the best places to go on the planet and

380
00:13:48,470 --> 00:13:46,880
we're able to do that

381
00:13:50,150 --> 00:13:48,480
in fact

382
00:13:52,069 --> 00:13:50,160
we found so many wonderful places on

383
00:13:55,189 --> 00:13:52,079
mars the science community had a tough

384
00:13:58,230 --> 00:13:55,199
time deciding which one might be best

385
00:14:01,189 --> 00:13:58,240
and so is through a process of five

386
00:14:04,310 --> 00:14:01,199
science community workshops

387
00:14:07,350 --> 00:14:04,320
detailed engineering evaluations

388
00:14:08,470 --> 00:14:07,360

and a directorate program management

389
00:14:10,949 --> 00:14:08,480
council

390
00:14:13,350 --> 00:14:10,959
in which it was finally decided to adopt

391
00:14:15,910 --> 00:14:13,360
what the mars science laboratory science

392
00:14:17,110 --> 00:14:15,920
team preference was and to select the

393
00:14:19,670 --> 00:14:17,120
site

394
00:14:20,710 --> 00:14:19,680
so we are going to the mountain in gale

395
00:14:23,910 --> 00:14:20,720
crater

396
00:14:26,310 --> 00:14:23,920
this is a five kilometer high mountain

397
00:14:28,150 --> 00:14:26,320
with layered terrain

398
00:14:30,389 --> 00:14:28,160
it exhibits

399
00:14:31,590 --> 00:14:30,399
three different kinds of environmental

400
00:14:34,790 --> 00:14:31,600
settings

401
00:14:37,189 --> 00:14:34,800
perhaps a trilogy of mars history

402
00:14:40,230 --> 00:14:37,199
and it's a worthy goal a worthy

403
00:14:42,790 --> 00:14:40,240
challenge for such a capable

404
00:14:45,590 --> 00:14:43,670
so

405
00:14:48,470 --> 00:14:45,600
to tell us about the capabilities i will

406
00:14:51,910 --> 00:14:48,480
now turn the podium over to mike watkins

407
00:14:53,430 --> 00:14:51,920
who is the mission manager of msl

408
00:14:54,949 --> 00:14:53,440
okay thanks michael

409
00:14:56,389 --> 00:14:54,959
um it's great to be here at the

410
00:14:58,230 --> 00:14:56,399
aerospace museum to to announce a

411
00:14:59,670 --> 00:14:58,240
landing site and one of one of my main

412
00:15:01,509 --> 00:14:59,680
jobs on the project has been preparing

413
00:15:03,750 --> 00:15:01,519

for uh for for operations and the

414
00:15:05,509 --> 00:15:03,760
landing site is a big driver in in

415
00:15:06,550 --> 00:15:05,519
operations as you can imagine

416
00:15:08,629 --> 00:15:06,560
uh but before we get into the

417
00:15:09,750 --> 00:15:08,639
characteristics of the gale site

418
00:15:11,509 --> 00:15:09,760
i'd like to talk a little bit about the

419
00:15:13,509 --> 00:15:11,519
characteristics of the curiosity rover

420
00:15:15,670 --> 00:15:13,519
how it compares to previous rovers and

421
00:15:17,670 --> 00:15:15,680
and how those capabilities factored into

422
00:15:19,430 --> 00:15:17,680
to the landing site selection so if you

423
00:15:21,910 --> 00:15:19,440
go to the first graphic

424
00:15:24,150 --> 00:15:21,920
um this is our um family tree here

425
00:15:25,430 --> 00:15:24,160
family portrait of of rovers and they

426
00:15:27,269 --> 00:15:25,440
really are kind of kind of related

427
00:15:29,749 --> 00:15:27,279
they're all built um out of the jet

428
00:15:31,430 --> 00:15:29,759
propulsion laboratory in uh in pasadena

429
00:15:33,110 --> 00:15:31,440
um and really a lot of the same people

430
00:15:35,509 --> 00:15:33,120
worked on on on all three of these

431
00:15:36,870 --> 00:15:35,519
rovers a lot of the same engineers

432
00:15:38,870 --> 00:15:36,880
starting with uh with the mars

433
00:15:40,230 --> 00:15:38,880
pathfinder the sojourner rover

434
00:15:41,749 --> 00:15:40,240
moving up to spirit and opportunity the

435
00:15:43,189 --> 00:15:41,759
mars exploration rovers that have been

436
00:15:44,949 --> 00:15:43,199
so fantastically successful and of

437
00:15:47,110 --> 00:15:44,959
course opportunity is still still

438
00:15:49,350 --> 00:15:47,120

trucking along on on the surface of mars

439
00:15:51,749 --> 00:15:49,360
years after landing much much much after

440
00:15:53,990 --> 00:15:51,759
its uh nominal mission and then you see

441
00:15:55,430 --> 00:15:54,000
curiosity there uh on the right and as

442
00:15:56,949 --> 00:15:55,440
mentioned earlier there's actually uh

443
00:15:58,629 --> 00:15:56,959
this ex

444
00:16:00,389 --> 00:15:58,639
this uh model of the of the rover is

445
00:16:01,509 --> 00:16:00,399
actually out uh in the hallway um that

446
00:16:03,189 --> 00:16:01,519
you can take a look at here at the

447
00:16:05,509 --> 00:16:03,199
museum

448
00:16:06,710 --> 00:16:05,519
now the progression of size um a lot of

449
00:16:07,990 --> 00:16:06,720
times we're asked why are they getting

450
00:16:09,990 --> 00:16:08,000
bigger and and the reason they're

451
00:16:11,670 --> 00:16:10,000
getting bigger is because um the mars

452
00:16:14,150 --> 00:16:11,680
program as michael meyer talked about is

453
00:16:15,670 --> 00:16:14,160
a is a science driven program

454
00:16:17,430 --> 00:16:15,680
so you're really trying to carry more

455
00:16:19,110 --> 00:16:17,440
and more instrumentation more science

456
00:16:20,790 --> 00:16:19,120
payload if you go into a scientist

457
00:16:22,389 --> 00:16:20,800
laboratory you see you know rooms full

458
00:16:24,069 --> 00:16:22,399
of of of instruments so we're trying to

459
00:16:25,910 --> 00:16:24,079
get as much of that as we can onto the

460
00:16:27,749 --> 00:16:25,920
surface of mars so we see the

461
00:16:29,350 --> 00:16:27,759
progression from a very small payload on

462
00:16:30,550 --> 00:16:29,360
on sojourner

463
00:16:32,550 --> 00:16:30,560

up to something like five or six

464
00:16:34,790 --> 00:16:32,560
kilograms maybe of payload on spirit and

465
00:16:37,189 --> 00:16:34,800
opportunity um and now more than ten

466
00:16:38,389 --> 00:16:37,199
times that on on curiosity so later on

467
00:16:40,230 --> 00:16:38,399
john grotzinger will talk about how

468
00:16:41,910 --> 00:16:40,240
we're going to use that payload uh at

469
00:16:43,430 --> 00:16:41,920
the gale landing site

470
00:16:44,949 --> 00:16:43,440
but in addition to just carrying the

471
00:16:47,030 --> 00:16:44,959
payload we've made a lot of improvements

472
00:16:49,350 --> 00:16:47,040
to um to the landing system and to the

473
00:16:51,590 --> 00:16:49,360
rover capabilities that make it easier

474
00:16:52,790 --> 00:16:51,600
to get to to better spots on mars to to

475
00:16:55,350 --> 00:16:52,800
do more detailed scientific

476
00:16:56,790 --> 00:16:55,360
investigations uh um as michael meyer

477
00:16:57,910 --> 00:16:56,800
talked about in the in the strategic

478
00:17:00,470 --> 00:16:57,920
plan

479
00:17:02,389 --> 00:17:00,480
let's go to the next graphic

480
00:17:04,390 --> 00:17:02,399
this this particular

481
00:17:05,829 --> 00:17:04,400
the family portrait of course is a model

482
00:17:07,750 --> 00:17:05,839
of the of the rover and this is a real

483
00:17:10,230 --> 00:17:07,760
thing um the rover has actually been

484
00:17:11,829 --> 00:17:10,240
shipped down to um to the kennedy space

485
00:17:14,069 --> 00:17:11,839
center in florida for a final assembly

486
00:17:15,669 --> 00:17:14,079
and test these are some images of the of

487
00:17:18,630 --> 00:17:15,679
the last testing and the spacecraft

488
00:17:20,390 --> 00:17:18,640

assembly facility um out in pasadena

489
00:17:22,470 --> 00:17:20,400
what you see there's a rover there on

490
00:17:24,549 --> 00:17:22,480
the bottom with the mobility the wheels

491
00:17:26,150 --> 00:17:24,559
the rocker bogeys tucked up

492
00:17:28,150 --> 00:17:26,160
tight there for for packaging inside the

493
00:17:29,430 --> 00:17:28,160
aeroshell and on top of it is what we

494
00:17:30,870 --> 00:17:29,440
call the descent stage and that's

495
00:17:33,669 --> 00:17:30,880
actually the kind of the rocket pack

496
00:17:35,750 --> 00:17:33,679
that attaches to the top of the rover

497
00:17:37,669 --> 00:17:35,760
that will land us on the surface after

498
00:17:39,830 --> 00:17:37,679
we get through the martian atmosphere

499
00:17:41,830 --> 00:17:39,840
and we'll show that in an animation

500
00:17:43,750 --> 00:17:41,840
later and that allows us to actually

501
00:17:45,590 --> 00:17:43,760
land directly on the wheel so we don't

502
00:17:47,110 --> 00:17:45,600
have a separate pallet or a separate you

503
00:17:48,470 --> 00:17:47,120
know landing gear we actually use the

504
00:17:50,150 --> 00:17:48,480
wheels and the mobility system of the

505
00:17:51,590 --> 00:17:50,160
rover they're actually a very effective

506
00:17:54,310 --> 00:17:51,600
landing system and that allows us to

507
00:17:56,630 --> 00:17:54,320
both use the the the strong the the

508
00:17:58,390 --> 00:17:56,640
capability of the of the mobility system

509
00:18:00,390 --> 00:17:58,400
as well as save weight by not building a

510
00:18:01,990 --> 00:18:00,400
separate landing pallet and put all the

511
00:18:04,150 --> 00:18:02,000
weight we can into the actual rover and

512
00:18:06,470 --> 00:18:04,160
the and the instruments

513
00:18:08,470 --> 00:18:06,480

let's go to the next graphic

514
00:18:10,630 --> 00:18:08,480
next graphic is the rover in test and

515
00:18:12,710 --> 00:18:10,640
here you can see testing the mobility

516
00:18:14,230 --> 00:18:12,720
system here this is actual flight flight

517
00:18:15,990 --> 00:18:14,240
unit here driving up ramps and making

518
00:18:18,390 --> 00:18:16,000
sure that uh that we have the full range

519
00:18:19,830 --> 00:18:18,400
of mobility that uh that are required

520
00:18:21,510 --> 00:18:19,840
and you can see for scale some some

521
00:18:23,350 --> 00:18:21,520
folks standing around it there it's it's

522
00:18:25,750 --> 00:18:23,360
it's quite large it's kind of car sized

523
00:18:29,830 --> 00:18:25,760
and uh and actually wider and taller

524
00:18:33,029 --> 00:18:29,840
than than uh than than most cars

525
00:18:35,029 --> 00:18:33,039
let's go to the next uh the next graphic

526
00:18:37,830 --> 00:18:35,039
the next graphics um is actually an

527
00:18:39,909 --> 00:18:37,840
animation it shows the um the um the

528
00:18:41,750 --> 00:18:39,919
entry descent and landing sequence and

529
00:18:43,270 --> 00:18:41,760
there's a couple of changes that we have

530
00:18:45,909 --> 00:18:43,280
made for this mission that will really

531
00:18:48,150 --> 00:18:45,919
improve our ability to access the um the

532
00:18:50,950 --> 00:18:48,160
most important scientific places on mars

533
00:18:52,230 --> 00:18:50,960
one of them is we we can control the um

534
00:18:54,549 --> 00:18:52,240
the lift of the vehicle a little bit

535
00:18:56,549 --> 00:18:54,559
during entry and we can cancel out some

536
00:18:58,470 --> 00:18:56,559
unexpected differences in atmospheric

537
00:19:00,630 --> 00:18:58,480
drag that would cause a landing zone to

538
00:19:02,070 --> 00:19:00,640

be large and previous missions have had

539
00:19:04,789 --> 00:19:02,080
landing zones

540
00:19:06,150 --> 00:19:04,799
up to 10 times larger than than msl and

541
00:19:07,510 --> 00:19:06,160
the cell's going to land in about a 20

542
00:19:09,510 --> 00:19:07,520
kilometer across

543
00:19:11,270 --> 00:19:09,520
landing spot and that allowed us to snug

544
00:19:12,950 --> 00:19:11,280
that up close to the very important

545
00:19:14,870 --> 00:19:12,960
sites that the scientists would like to

546
00:19:16,390 --> 00:19:14,880
explore

547
00:19:18,630 --> 00:19:16,400
after you've completed that phase we can

548
00:19:20,549 --> 00:19:18,640
dispense with the heat shield we um pull

549
00:19:22,549 --> 00:19:20,559
out the the shoot the parachute it's a

550
00:19:25,430 --> 00:19:22,559
similar shoot design to to previous mars

551
00:19:26,950 --> 00:19:25,440
missions

552
00:19:29,110 --> 00:19:26,960
um and then we reached terminal velocity

553
00:19:30,630 --> 00:19:29,120
on the chute here then we re we start

554
00:19:32,390 --> 00:19:30,640
the engines and we go into this power

555
00:19:33,990 --> 00:19:32,400
descent mode here and so that's our

556
00:19:36,630 --> 00:19:34,000
rocket pack that you saw in the in the

557
00:19:38,549 --> 00:19:36,640
in the in the previous um

558
00:19:40,630 --> 00:19:38,559
picture in the in the assembly facility

559
00:19:41,990 --> 00:19:40,640
this is uh this is the descent stage and

560
00:19:44,310 --> 00:19:42,000
you see the rover tucked up underneath

561
00:19:46,150 --> 00:19:44,320
it and when we zero out our our descent

562
00:19:49,190 --> 00:19:46,160
velocity and horizontal velocity we then

563
00:19:51,029 --> 00:19:49,200

lower the rover down on some cables

564
00:19:53,669 --> 00:19:51,039
and then we touch that thing down to the

565
00:19:55,590 --> 00:19:53,679
surface directly on the mobility system

566
00:19:57,029 --> 00:19:55,600
as as you saw earlier

567
00:19:58,630 --> 00:19:57,039
that mobility system of course is well

568
00:20:00,630 --> 00:19:58,640
designed to drive around rocks and

569
00:20:03,830 --> 00:20:00,640
slopes on the surface so it's actually a

570
00:20:05,830 --> 00:20:03,840
great a great landing system

571
00:20:07,830 --> 00:20:05,840
and then when we're done we remove those

572
00:20:09,590 --> 00:20:07,840
cables and we send the descent stage

573
00:20:10,870 --> 00:20:09,600
over uh several hundred meters away get

574
00:20:13,190 --> 00:20:10,880
it out of the way so it doesn't affect

575
00:20:14,310 --> 00:20:13,200
our our um our chemical analysis

576
00:20:15,750 --> 00:20:14,320
equipment

577
00:20:17,590 --> 00:20:15,760
and this will be a minimum of several

578
00:20:19,750 --> 00:20:17,600
hundred meters away and then the rover

579
00:20:22,470 --> 00:20:19,760
is prepared to to execute its uh its

580
00:20:23,909 --> 00:20:22,480
surface mission by driving around

581
00:20:25,750 --> 00:20:23,919
now the ability to drive a lot on the

582
00:20:27,750 --> 00:20:25,760
surface is important uh those who have

583
00:20:30,950 --> 00:20:27,760
been following spirit and opportunity

584
00:20:32,710 --> 00:20:30,960
know that um that uh that they they've

585
00:20:34,630 --> 00:20:32,720
shown that driving a lot driving many

586
00:20:36,149 --> 00:20:34,640
kilometers around the landing site

587
00:20:38,310 --> 00:20:36,159
allows you to explore a lot of different

588
00:20:40,390 --> 00:20:38,320

um geologic settings and learn a lot

589
00:20:42,310 --> 00:20:40,400
about about the history of of where

590
00:20:44,549 --> 00:20:42,320
they've been on on the surface so we've

591
00:20:46,230 --> 00:20:44,559
taken that that ability which was kind

592
00:20:47,430 --> 00:20:46,240
of a bonus for for spirit and

593
00:20:50,230 --> 00:20:47,440
opportunity and built it into the

594
00:20:51,750 --> 00:20:50,240
baseline the nominal mission for for msl

595
00:20:54,230 --> 00:20:51,760
and as don sumner and john grotzinger

596
00:20:55,669 --> 00:20:54,240
will will will describe we we actually

597
00:20:59,029 --> 00:20:55,679
intend to drive quite a bit up to 20

598
00:21:00,789 --> 00:20:59,039
kilometers or or so at um at our final

599
00:21:02,230 --> 00:21:00,799
sites

600
00:21:03,510 --> 00:21:02,240
now in terms of how to actually select a

601
00:21:05,430 --> 00:21:03,520
landing site we we have these

602
00:21:08,149 --> 00:21:05,440
capabilities of the of the rover and we

603
00:21:09,590 --> 00:21:08,159
had uh science uh goals that uh that the

604
00:21:11,669 --> 00:21:09,600
science community wanted us to to

605
00:21:13,510 --> 00:21:11,679
explore we had to take a look at each

606
00:21:15,669 --> 00:21:13,520
one of those sites and and assess its

607
00:21:17,110 --> 00:21:15,679
safety and we took advantage of a of a

608
00:21:18,950 --> 00:21:17,120
great asset and that's the mars

609
00:21:20,549 --> 00:21:18,960
reconnaissance orbiter which has a high

610
00:21:23,590 --> 00:21:20,559
resolution camera on board called

611
00:21:25,510 --> 00:21:23,600
highrise and highrise uh which uh on

612
00:21:28,870 --> 00:21:25,520
mars could easily see this table if it

613
00:21:31,990 --> 00:21:28,880

was on the surface of mars we um we

614
00:21:34,470 --> 00:21:32,000
worked with them with the mro project

615
00:21:36,710 --> 00:21:34,480
to uh to basically take swaths take

616
00:21:38,710 --> 00:21:36,720
strips of all of our sites and do kind

617
00:21:41,909 --> 00:21:38,720
of a super google mars

618
00:21:43,590 --> 00:21:41,919
uh of of all of our uh landing sites so

619
00:21:44,870 --> 00:21:43,600
we had this kind of one meter resolution

620
00:21:46,630 --> 00:21:44,880
we could see every rock that we could

621
00:21:48,149 --> 00:21:46,640
land on and every slope that we could

622
00:21:50,310 --> 00:21:48,159
land on as well as of course do

623
00:21:52,070 --> 00:21:50,320
scientific characterization of the sites

624
00:21:54,070 --> 00:21:52,080
and these on this graphic here you can

625
00:21:56,230 --> 00:21:54,080
see the blue swathes indicate where

626
00:21:57,029 --> 00:21:56,240
those high-rise high-resolution images

627
00:21:59,510 --> 00:21:57,039
are

628
00:22:01,190 --> 00:21:59,520
and in in most cases we actually have

629
00:22:02,230 --> 00:22:01,200
two images from different view angles so

630
00:22:04,390 --> 00:22:02,240
we could actually make a

631
00:22:08,230 --> 00:22:04,400
three-dimensional uh view of mars and

632
00:22:10,789 --> 00:22:08,240
and and show the slopes very accurately

633
00:22:12,070 --> 00:22:10,799
when we're completed with this analysis

634
00:22:13,990 --> 00:22:12,080
of what the characteristics of the

635
00:22:16,710 --> 00:22:14,000
terrain on mars were then let's go to

636
00:22:18,950 --> 00:22:16,720
the next graphic we actually then built

637
00:22:20,549 --> 00:22:18,960
mock-ups of these surfaces and actually

638
00:22:22,070 --> 00:22:20,559

tested touching down the rover and

639
00:22:23,830 --> 00:22:22,080
driving the rover over all of those

640
00:22:26,549 --> 00:22:23,840
ranges of surfaces so here's an

641
00:22:29,430 --> 00:22:26,559
animation we actually dropped it on a

642
00:22:31,190 --> 00:22:29,440
on a slope simulating a sloped surface a

643
00:22:33,270 --> 00:22:31,200
sloped rocky surface on mars in some

644
00:22:35,110 --> 00:22:33,280
cases we put boulders on the surface to

645
00:22:37,590 --> 00:22:35,120
see how the wheels would interact with

646
00:22:38,789 --> 00:22:37,600
with that service this is an engineering

647
00:22:40,310 --> 00:22:38,799
copy of the rover of course not the

648
00:22:42,710 --> 00:22:40,320
flight one so this one we weren't afraid

649
00:22:44,470 --> 00:22:42,720
to damage and and to drop on rocks and

650
00:22:45,990 --> 00:22:44,480
slopes and so we dropped it in all

651
00:22:47,750 --> 00:22:46,000
possible orientations all possible

652
00:22:50,070 --> 00:22:47,760
orientations of rocks

653
00:22:52,310 --> 00:22:50,080
and when we were finished our conclusion

654
00:22:54,390 --> 00:22:52,320
of this was that all four of those final

655
00:22:56,390 --> 00:22:54,400
science sites were

656
00:22:58,230 --> 00:22:56,400
were safe for the mission to land on and

657
00:22:59,990 --> 00:22:58,240
we could safely execute the surface

658
00:23:02,310 --> 00:23:00,000
mission we could we could successfully

659
00:23:04,310 --> 00:23:02,320
navigate and drive to uh to the targets

660
00:23:05,990 --> 00:23:04,320
and execute the science mission

661
00:23:07,510 --> 00:23:06,000
and so at that point we turned it back

662
00:23:09,270 --> 00:23:07,520
to the science committee and say pick

663
00:23:10,470 --> 00:23:09,280

the best of the four from from a science

664
00:23:12,230 --> 00:23:10,480
perspective and that's really how you

665
00:23:14,149 --> 00:23:12,240
want these things to play out right you

666
00:23:16,390 --> 00:23:14,159
you you would love scientists to be able

667
00:23:17,990 --> 00:23:16,400
to go the site that they want the most

668
00:23:18,950 --> 00:23:18,000
and i think it's really a tribute to the

669
00:23:20,549 --> 00:23:18,960
um

670
00:23:21,990 --> 00:23:20,559
to the engineering team that built a

671
00:23:24,470 --> 00:23:22,000
really beautiful rover here that's

672
00:23:26,390 --> 00:23:24,480
capable of accessing all of these uh

673
00:23:27,909 --> 00:23:26,400
these great landing sites

674
00:23:29,350 --> 00:23:27,919
now those four landing sites that were

675
00:23:31,590 --> 00:23:29,360
the finalists that we've talked about

676
00:23:32,630 --> 00:23:31,600
actually originated with dozens over 50

677
00:23:34,390 --> 00:23:32,640
sites

678
00:23:36,390 --> 00:23:34,400
in a process that's played out over over

679
00:23:38,070 --> 00:23:36,400
a five-year period and to to talk about

680
00:23:39,750 --> 00:23:38,080
that process and the

681
00:23:41,269 --> 00:23:39,760
and the the final four sites i'd like to

682
00:23:43,190 --> 00:23:41,279
turn it over to my colleague john grant

683
00:23:44,230 --> 00:23:43,200
from here at the museum thank you very

684
00:23:45,590 --> 00:23:44,240
much

685
00:23:49,029 --> 00:23:45,600
well

686
00:23:51,190 --> 00:23:49,039
60 sites five years 150 scientists toss

687
00:23:52,549 --> 00:23:51,200
in as michael described engineering

688
00:23:54,549 --> 00:23:52,559

doesn't become the discriminator in the

689
00:23:56,789 --> 00:23:54,559
final sites and some of you might think

690
00:23:58,470 --> 00:23:56,799
that that's a recipe for chaos

691
00:24:00,630 --> 00:23:58,480
in fact it wasn't

692
00:24:02,149 --> 00:24:00,640
in fact the science community came

693
00:24:03,350 --> 00:24:02,159
together and worked very closely with

694
00:24:05,430 --> 00:24:03,360
the project

695
00:24:08,230 --> 00:24:05,440
and had very robust discussions that

696
00:24:10,390 --> 00:24:08,240
arrived at four terrific final four

697
00:24:12,390 --> 00:24:10,400
candidate sites and what i'd like to do

698
00:24:14,310 --> 00:24:12,400
before i turn it over to don and john to

699
00:24:16,630 --> 00:24:14,320
talk about gale crater is tell you a

700
00:24:17,990 --> 00:24:16,640
little bit about that process and remind

701
00:24:19,990 --> 00:24:18,000
you some of the attributes of these

702
00:24:22,470 --> 00:24:20,000
final four sites so if i could go to the

703
00:24:24,390 --> 00:24:22,480
first graphic please

704
00:24:26,549 --> 00:24:24,400
what you'll be looking at is a map of

705
00:24:28,149 --> 00:24:26,559
mars that has some shaded areas the

706
00:24:31,110 --> 00:24:28,159
white shaded areas that you'll see to

707
00:24:33,110 --> 00:24:31,120
the north and south represent latitudes

708
00:24:35,510 --> 00:24:33,120
that are too far to the north and south

709
00:24:37,350 --> 00:24:35,520
for mars science laboratory to land

710
00:24:39,110 --> 00:24:37,360
you'll also see an area that's blacked

711
00:24:40,710 --> 00:24:39,120
out through the middle and those are

712
00:24:42,870 --> 00:24:40,720
areas where the surface of mars is too

713
00:24:44,630 --> 00:24:42,880

high for msl to land so there's a

714
00:24:46,390 --> 00:24:44,640
variety of colored terrain there that

715
00:24:48,630 --> 00:24:46,400
represents the targets the potential

716
00:24:50,870 --> 00:24:48,640
targets for msl to go and try to

717
00:24:52,870 --> 00:24:50,880
evaluate the habitability of mars and

718
00:24:55,269 --> 00:24:52,880
the red dots that you see represent the

719
00:24:57,110 --> 00:24:55,279
60 locations that were proposed by

720
00:24:58,830 --> 00:24:57,120
science team members by the science

721
00:25:01,190 --> 00:24:58,840
community and evaluated during these

722
00:25:03,510 --> 00:25:01,200
workshops the four blue dots that you

723
00:25:05,750 --> 00:25:03,520
see there ebersvaldi gale holden and

724
00:25:06,710 --> 00:25:05,760
marth represent the four candidate sites

725
00:25:09,830 --> 00:25:06,720
and i want to tell you a little bit

726
00:25:11,590 --> 00:25:09,840
about why those represent terrific final

727
00:25:14,870 --> 00:25:11,600
candidate sites if i could go to the

728
00:25:16,789 --> 00:25:14,880
next graphic please

729
00:25:18,870 --> 00:25:16,799
these show you little snippets for each

730
00:25:20,789 --> 00:25:18,880
of the four sites ebersvaldi in the top

731
00:25:22,470 --> 00:25:20,799
left gale crater to the right holden

732
00:25:24,149 --> 00:25:22,480
crater to the bottom left and marth

733
00:25:25,990 --> 00:25:24,159
valles to the lower right

734
00:25:28,230 --> 00:25:26,000
why do these represent great sites well

735
00:25:31,430 --> 00:25:28,240
in ebersvaldi crater you land at what's

736
00:25:34,070 --> 00:25:31,440
perhaps the best delta on mars this is

737
00:25:36,390 --> 00:25:34,080
an incredible system of drainage into a

738
00:25:38,549 --> 00:25:36,400

crater that was probably filled by water

739
00:25:40,630 --> 00:25:38,559
standing body of water that accumulated

740
00:25:42,950 --> 00:25:40,640
deposit much like you would see at a

741
00:25:44,789 --> 00:25:42,960
river delta on the earth in grail crater

742
00:25:46,630 --> 00:25:44,799
as you've heard from michael

743
00:25:48,630 --> 00:25:46,640
there is this enormous stack five

744
00:25:50,310 --> 00:25:48,640
kilometers thick of layered material

745
00:25:52,230 --> 00:25:50,320
which represents the opportunity to

746
00:25:54,870 --> 00:25:52,240
literally read chapters in a book of the

747
00:25:57,269 --> 00:25:54,880
history of past deposition on mars for

748
00:25:59,190 --> 00:25:57,279
holden crater you've got a system of dry

749
00:26:02,310 --> 00:25:59,200
rivers much like you see flanking the

750
00:26:04,310 --> 00:26:02,320
the edges of death valley in california

751
00:26:06,870 --> 00:26:04,320
that drain down into a

752
00:26:08,789 --> 00:26:06,880
deposit of finely layered materials

753
00:26:10,710 --> 00:26:08,799
which probably represent

754
00:26:13,990 --> 00:26:10,720
an ancient lake bed so one of the most

755
00:26:15,990 --> 00:26:14,000
diverse river lake systems on mars and

756
00:26:17,110 --> 00:26:16,000
in marth valles you've got an incredibly

757
00:26:18,870 --> 00:26:17,120
detailed

758
00:26:20,789 --> 00:26:18,880
system of

759
00:26:23,269 --> 00:26:20,799
iron rich and aluminum-rich clays that

760
00:26:25,990 --> 00:26:23,279
are layered and occur in a regional

761
00:26:27,830 --> 00:26:26,000
setting that represent a long history of

762
00:26:30,310 --> 00:26:27,840
ancient water interaction and is

763
00:26:31,990 --> 00:26:30,320

probably the oldest of the four sites so

764
00:26:33,510 --> 00:26:32,000
as john grotzinger is fond of saying

765
00:26:36,390 --> 00:26:33,520
these are sort of like different flavors

766
00:26:38,390 --> 00:26:36,400
of ice cream all fantastic but slightly

767
00:26:39,990 --> 00:26:38,400
different twists on that general take

768
00:26:41,750 --> 00:26:40,000
let me give you a couple of examples of

769
00:26:45,110 --> 00:26:41,760
the details of what we might have gone

770
00:26:46,950 --> 00:26:45,120
to look at with the next graphic

771
00:26:49,190 --> 00:26:46,960
so forever's baldi crater as i mentioned

772
00:26:51,029 --> 00:26:49,200
the best delta on mars well you can see

773
00:26:53,350 --> 00:26:51,039
on the left here and all the scale bars

774
00:26:55,430 --> 00:26:53,360
that you see here are in kilometers

775
00:26:58,149 --> 00:26:55,440
the crater is represented the colors

776
00:27:00,230 --> 00:26:58,159
represent low is blue and purple high is

777
00:27:02,149 --> 00:27:00,240
yellow and red the landing ellipse is

778
00:27:04,230 --> 00:27:02,159
shown there on the left and the yellow

779
00:27:06,230 --> 00:27:04,240
box that you see represents a potential

780
00:27:08,230 --> 00:27:06,240
science target outside of the ellipse

781
00:27:10,710 --> 00:27:08,240
the white box represents one within the

782
00:27:12,950 --> 00:27:10,720
ellipse so all four sites represent a

783
00:27:15,350 --> 00:27:12,960
variety of high value science targets

784
00:27:17,029 --> 00:27:15,360
within and around the ellipse outside of

785
00:27:19,110 --> 00:27:17,039
the ellipse and eversvalda you can see

786
00:27:21,350 --> 00:27:19,120
these scrolls that are produced as the

787
00:27:23,430 --> 00:27:21,360
drainage system came down and deposited

788
00:27:25,190 --> 00:27:23,440

the delta much like we see on earth much

789
00:27:26,549 --> 00:27:25,200
like the places on earth where we go to

790
00:27:28,789 --> 00:27:26,559
look for accumulated

791
00:27:30,230 --> 00:27:28,799
organic materials further out into the

792
00:27:32,149 --> 00:27:30,240
ellipse we see

793
00:27:33,510 --> 00:27:32,159
older river beds and lake beds that

794
00:27:34,549 --> 00:27:33,520
would be explored on the way to the

795
00:27:36,789 --> 00:27:34,559
delta

796
00:27:38,789 --> 00:27:36,799
providing us with a view of a setting on

797
00:27:40,950 --> 00:27:38,799
earth that we're very familiar with

798
00:27:42,789 --> 00:27:40,960
if we go to gale crater with the next

799
00:27:44,470 --> 00:27:42,799
graphic please

800
00:27:46,230 --> 00:27:44,480
we see the landing ellipse is just to

801
00:27:47,430 --> 00:27:46,240
the north of this large mound of

802
00:27:49,510 --> 00:27:47,440
material

803
00:27:51,510 --> 00:27:49,520
we would land on an alluvial fan which

804
00:27:53,029 --> 00:27:51,520
represents material shed off the walls

805
00:27:55,430 --> 00:27:53,039
of the crater this ancient crater

806
00:27:57,430 --> 00:27:55,440
recording ancient conditions ancient

807
00:27:59,269 --> 00:27:57,440
processes on mars and then we would

808
00:28:01,190 --> 00:27:59,279
traverse to the south and access through

809
00:28:03,590 --> 00:28:01,200
a grand canyon-like

810
00:28:05,750 --> 00:28:03,600
gap into the wall of this mountain of

811
00:28:07,269 --> 00:28:05,760
material these finely layered sediments

812
00:28:09,110 --> 00:28:07,279
that allow us to go up and read the

813
00:28:11,029 --> 00:28:09,120

changing environmental conditions that

814
00:28:13,110 --> 00:28:11,039
have occurred through time and then if

815
00:28:14,389 --> 00:28:13,120
we think about holden crater the next

816
00:28:16,310 --> 00:28:14,399
graphic please

817
00:28:17,669 --> 00:28:16,320
as i mentioned this diverse river and

818
00:28:20,149 --> 00:28:17,679
lake system

819
00:28:22,630 --> 00:28:20,159
we would land and access these dry

820
00:28:24,310 --> 00:28:22,640
alluvial systems alluvial meaning much

821
00:28:26,389 --> 00:28:24,320
like the kinds of drainages that you see

822
00:28:27,830 --> 00:28:26,399
in death valley through craters we can

823
00:28:29,669 --> 00:28:27,840
see the kinds of sediments that have

824
00:28:31,750 --> 00:28:29,679
been transported and

825
00:28:33,669 --> 00:28:31,760
reconstruct the environmental conditions

826
00:28:35,110 --> 00:28:33,679
but ultimately access these finely

827
00:28:37,269 --> 00:28:35,120
layered materials that are further out

828
00:28:38,789 --> 00:28:37,279
on the floor of the crater and decide

829
00:28:40,230 --> 00:28:38,799
whether or not there was an ancient lake

830
00:28:42,310 --> 00:28:40,240
on the floor that could have accumulated

831
00:28:44,549 --> 00:28:42,320
the materials that might allow us to

832
00:28:46,870 --> 00:28:44,559
evaluate habitability and then finally

833
00:28:48,710 --> 00:28:46,880
with the last graphic marth valles this

834
00:28:50,870 --> 00:28:48,720
is in the northern hemisphere

835
00:28:53,029 --> 00:28:50,880
it lies between marth valles to the east

836
00:28:54,870 --> 00:28:53,039
and oyama crater to the west

837
00:28:56,870 --> 00:28:54,880
both within and outside the landing

838
00:28:58,870 --> 00:28:56,880

ellipse there's this incredibly detailed

839
00:29:01,510 --> 00:28:58,880
stratigraphy of iron rich and

840
00:29:03,590 --> 00:29:01,520
aluminum-rich clays that represents sort

841
00:29:05,830 --> 00:29:03,600
of a regional deposit it's an incredibly

842
00:29:07,909 --> 00:29:05,840
ancient deposit and records something

843
00:29:10,389 --> 00:29:07,919
fundamental about the early interaction

844
00:29:11,830 --> 00:29:10,399
of water on mars with those rocks and

845
00:29:14,070 --> 00:29:11,840
tells us something about ancient

846
00:29:16,149 --> 00:29:14,080
habitability so i hope i've told you

847
00:29:18,149 --> 00:29:16,159
that all four of the final candidate

848
00:29:20,950 --> 00:29:18,159
sites represent an incredible

849
00:29:22,630 --> 00:29:20,960
opportunity for msl and as michael and

850
00:29:24,950 --> 00:29:22,640
michael pointed out it was a very

851
00:29:27,669 --> 00:29:24,960
difficult decision to arrive at a final

852
00:29:29,750 --> 00:29:27,679
one i will now let don sumner tell you a

853
00:29:32,549 --> 00:29:29,760
little bit about gale crater and why it

854
00:29:37,350 --> 00:29:32,559
ended up being the eventual landing site

855
00:29:40,070 --> 00:29:37,360
so i had the um the joy of

856
00:29:41,909 --> 00:29:40,080
co-chairing the projects a landing site

857
00:29:43,110 --> 00:29:41,919
working group and we spent hundreds of

858
00:29:45,830 --> 00:29:43,120
hours

859
00:29:48,230 --> 00:29:45,840
discussing the sites uh doing uh

860
00:29:50,950 --> 00:29:48,240
analysis of the sites and and trying to

861
00:29:53,510 --> 00:29:50,960
come up with the best science that we

862
00:29:55,909 --> 00:29:53,520
can do with the msl payload there are

863
00:29:58,230 --> 00:29:55,919

lots of flavors of ice cream

864
00:29:59,990 --> 00:29:58,240
and we have certain ways to to

865
00:30:03,590 --> 00:30:00,000
investigate those

866
00:30:05,269 --> 00:30:03,600
and the project scientists and nasa

867
00:30:07,909 --> 00:30:05,279
felt like gale

868
00:30:10,470 --> 00:30:07,919
was the best match for the goals of the

869
00:30:13,430 --> 00:30:10,480
mission evaluating habitability and also

870
00:30:15,110 --> 00:30:13,440
for the instrumentation that we have

871
00:30:18,389 --> 00:30:15,120
for

872
00:30:21,350 --> 00:30:18,399
msl so if we could get the first graphic

873
00:30:23,990 --> 00:30:21,360
i'm just going to show a fly

874
00:30:25,990 --> 00:30:24,000
through into gale crater

875
00:30:29,510 --> 00:30:26,000
and give you a sense of what an

876
00:30:33,350 --> 00:30:29,520
incredible place it is geologically

877
00:30:35,590 --> 00:30:33,360
so we'll land in a landing ellipse which

878
00:30:38,070 --> 00:30:35,600
is in the flat part

879
00:30:39,510 --> 00:30:38,080
towards us from the mound in in the view

880
00:30:42,549 --> 00:30:39,520
that you see now

881
00:30:44,470 --> 00:30:42,559
and um within that uh the landing

882
00:30:46,549 --> 00:30:44,480
ellipse there's material shed off the

883
00:30:49,430 --> 00:30:46,559
crater wall that will give us a chance

884
00:30:52,549 --> 00:30:49,440
to look at what the the mars crust is

885
00:30:54,789 --> 00:30:52,559
like that material was moved by water

886
00:30:57,110 --> 00:30:54,799
those rocks were transported by water

887
00:30:58,789 --> 00:30:57,120
and that water either infiltrated into

888
00:31:01,190 --> 00:30:58,799

the ground or evaporated and so there's

889
00:31:03,430 --> 00:31:01,200
also a unit that's very hard and dense

890
00:31:05,830 --> 00:31:03,440
that we're wondering about

891
00:31:07,430 --> 00:31:05,840
how it reflects that that change of

892
00:31:11,590 --> 00:31:07,440
environment so this is the youngest

893
00:31:13,669 --> 00:31:11,600
environment we'll we'll look at with msl

894
00:31:16,230 --> 00:31:13,679
one of the fantastic things about this

895
00:31:20,470 --> 00:31:16,240
rover that mike talked about is that we

896
00:31:23,430 --> 00:31:20,480
can go a long ways and this allows us to

897
00:31:25,190 --> 00:31:23,440
uh rove towards places where the rocks

898
00:31:27,830 --> 00:31:25,200
are better exposed geologists like

899
00:31:30,149 --> 00:31:27,840
climbing up cliffs and we get to we get

900
00:31:33,029 --> 00:31:30,159
to go to those places with this rover

901
00:31:35,590 --> 00:31:33,039
for the first time on mars so the area

902
00:31:37,590 --> 00:31:35,600
of most scientific interest in gale is

903
00:31:40,549 --> 00:31:37,600
at the base of the mountain which we're

904
00:31:43,029 --> 00:31:40,559
zooming into here and there we see

905
00:31:45,990 --> 00:31:43,039
mineral signatures of clays and also

906
00:31:47,909 --> 00:31:46,000
sulfate salts and both of those are key

907
00:31:49,830 --> 00:31:47,919
classes of minerals that tell us about

908
00:31:51,590 --> 00:31:49,840
the environment on mars and the

909
00:31:53,350 --> 00:31:51,600
interaction of water with that

910
00:31:54,870 --> 00:31:53,360
environment and water is critical to

911
00:31:57,110 --> 00:31:54,880
habitability

912
00:31:59,110 --> 00:31:57,120
so the rover will

913
00:32:01,110 --> 00:31:59,120

go towards the mountain there are layers

914
00:32:02,630 --> 00:32:01,120
that we hope to see variations in this

915
00:32:04,870 --> 00:32:02,640
mineral that will tell us about how

916
00:32:07,909 --> 00:32:04,880
those minerals formed how the

917
00:32:10,070 --> 00:32:07,919
environment changed through time

918
00:32:12,470 --> 00:32:10,080
and based on the

919
00:32:15,110 --> 00:32:12,480
signatures from the orbital instruments

920
00:32:17,830 --> 00:32:15,120
we we expect to find variations in those

921
00:32:21,110 --> 00:32:17,840
minerals and particularly in the sulfate

922
00:32:22,070 --> 00:32:21,120
salts which will tell us about the water

923
00:32:23,590 --> 00:32:22,080
how

924
00:32:26,070 --> 00:32:23,600
concentrated it was whether it

925
00:32:27,830 --> 00:32:26,080
evaporated those the sources of the

926
00:32:29,509 --> 00:32:27,840
water

927
00:32:32,230 --> 00:32:29,519
and that will give us a history of some

928
00:32:34,389 --> 00:32:32,240
of the ancient uh environments on mars

929
00:32:36,549 --> 00:32:34,399
how those changed and and help us

930
00:32:39,110 --> 00:32:36,559
evaluate the the habitability of the

931
00:32:40,870 --> 00:32:39,120
planet those those sulfate salts also

932
00:32:42,710 --> 00:32:40,880
contain water in them and when they heat

933
00:32:44,870 --> 00:32:42,720
up they release that water and when they

934
00:32:47,029 --> 00:32:44,880
cool down they can absorb the water and

935
00:32:49,509 --> 00:32:47,039
so we have a great instrument package to

936
00:32:51,269 --> 00:32:49,519
look at how the water in those salts is

937
00:32:52,549 --> 00:32:51,279
exchanging with the modern martian

938
00:32:56,389 --> 00:32:52,559

atmosphere and will give us a better

939
00:32:57,190 --> 00:32:56,399
sense of of the water cycle on mars

940
00:32:58,870 --> 00:32:57,200
which

941
00:32:59,669 --> 00:32:58,880
has been very difficult

942
00:33:01,029 --> 00:32:59,679
to

943
00:33:02,389 --> 00:33:01,039
evaluate

944
00:33:05,350 --> 00:33:02,399
now

945
00:33:06,710 --> 00:33:05,360
there is also after the deposition of

946
00:33:09,430 --> 00:33:06,720
all these layers recording the

947
00:33:11,750 --> 00:33:09,440
environment we had a time when you had

948
00:33:13,350 --> 00:33:11,760
water flowing down the mountain of mars

949
00:33:14,870 --> 00:33:13,360
and that kind of canyon a lot like the

950
00:33:16,310 --> 00:33:14,880
grand canyon so that gives us the

951
00:33:19,110 --> 00:33:16,320
opportunity

952
00:33:21,430 --> 00:33:19,120
to read the environments um through time

953
00:33:24,070 --> 00:33:21,440
and those changes but that that canyon

954
00:33:25,110 --> 00:33:24,080
cutting event also represents an

955
00:33:26,870 --> 00:33:25,120
environment that could have been

956
00:33:28,789 --> 00:33:26,880
habitable where you have the flowing

957
00:33:30,950 --> 00:33:28,799
water you have erosion and you have

958
00:33:32,710 --> 00:33:30,960
deposition of those sediments at the

959
00:33:36,230 --> 00:33:32,720
mouth of the canyon which is at the

960
00:33:37,110 --> 00:33:36,240
front view of the video here and so the

961
00:33:38,630 --> 00:33:37,120
uh

962
00:33:40,950 --> 00:33:38,640
sort of suite of things that we can see

963
00:33:43,509 --> 00:33:40,960

at gale represent a diverse number of

964
00:33:45,590 --> 00:33:43,519
environments over a long period of time

965
00:33:49,350 --> 00:33:45,600
possibly tens to hundreds of millions of

966
00:33:51,830 --> 00:33:49,360
years plus the modern environment and so

967
00:33:54,389 --> 00:33:51,840
the gale site represents just a an

968
00:33:56,630 --> 00:33:54,399
incredibly rich suite of scientific

969
00:33:58,389 --> 00:33:56,640
investigations that we can do

970
00:34:00,230 --> 00:33:58,399
and it's also just going to be an

971
00:34:03,990 --> 00:34:00,240
incredibly beautiful place it will be a

972
00:34:05,590 --> 00:34:04,000
lot like a lot of the the southwest

973
00:34:07,590 --> 00:34:05,600
areas like monument valley where we have

974
00:34:09,829 --> 00:34:07,600
these steep sided air cliffs with the

975
00:34:11,829 --> 00:34:09,839
rover going in the shallower valley

976
00:34:13,669 --> 00:34:11,839
valleys between them and we have the

977
00:34:15,669 --> 00:34:13,679
incredible instrumentation to

978
00:34:19,190 --> 00:34:15,679
characterize the texture and shapes of

979
00:34:21,430 --> 00:34:19,200
the of the cliffs and the mobility to to

980
00:34:23,589 --> 00:34:21,440
travel through this area so the

981
00:34:25,829 --> 00:34:23,599
the science at gale is going to be

982
00:34:27,430 --> 00:34:25,839
amazing and it's going to be a beautiful

983
00:34:29,750 --> 00:34:27,440
site to visit and

984
00:34:31,349 --> 00:34:29,760
john will tell us more about how we'll

985
00:34:33,270 --> 00:34:31,359
actually use the instrumentation to make

986
00:34:35,669 --> 00:34:33,280
some of these investigations

987
00:34:38,629 --> 00:34:35,679
thanks very much don so what i'd like to

988
00:34:41,829 --> 00:34:38,639

talk to you now about uh is is the way

989
00:34:43,990 --> 00:34:41,839
that uh curiosity is going to explore

990
00:34:45,829 --> 00:34:44,000
the the gale landing site but let me

991
00:34:48,950 --> 00:34:45,839
drop back to a minute to try to

992
00:34:52,149 --> 00:34:48,960
reinforce to you what an what an amazing

993
00:34:54,710 --> 00:34:52,159
uh precedent is being set right now on

994
00:34:55,589 --> 00:34:54,720
with the msl mission as mike talked

995
00:34:57,430 --> 00:34:55,599
about

996
00:34:59,190 --> 00:34:57,440
one of the things that became obvious to

997
00:35:00,790 --> 00:34:59,200
the to the science team members in the

998
00:35:03,349 --> 00:35:00,800
community and john said there was about

999
00:35:06,470 --> 00:35:03,359
150 that attended these workshops our

1000
00:35:08,710 --> 00:35:06,480
science team has 263 science team

1001
00:35:11,190 --> 00:35:08,720
members at this time and by the time

1002
00:35:13,670 --> 00:35:11,200
that students are added to this and

1003
00:35:15,430 --> 00:35:13,680
post-docs and people like that we're and

1004
00:35:17,990 --> 00:35:15,440
participating scientists we're likely to

1005
00:35:20,150 --> 00:35:18,000
swell to 300 team members

1006
00:35:23,430 --> 00:35:20,160
what we saw happening was

1007
00:35:25,270 --> 00:35:23,440
the unexpected possible outcome that we

1008
00:35:27,430 --> 00:35:25,280
may be left with four

1009
00:35:29,349 --> 00:35:27,440
science four uh

1010
00:35:32,310 --> 00:35:29,359
landing sites

1011
00:35:34,550 --> 00:35:32,320
any any of which might be chosen as the

1012
00:35:37,190 --> 00:35:34,560
final landing site that engineering

1013
00:35:38,710 --> 00:35:37,200

would not kick one or more of them out

1014
00:35:40,230 --> 00:35:38,720
and that's what's always happened in

1015
00:35:41,910 --> 00:35:40,240
previous missions

1016
00:35:43,910 --> 00:35:41,920
so we began to think about this in the

1017
00:35:47,030 --> 00:35:43,920
project and how in the world we were

1018
00:35:49,109 --> 00:35:47,040
eventually going to to come to together

1019
00:35:51,190 --> 00:35:49,119
with headquarters and arrive at this

1020
00:35:52,150 --> 00:35:51,200
decision and as michael said it was not

1021
00:35:54,069 --> 00:35:52,160
easy

1022
00:35:55,910 --> 00:35:54,079
here's why

1023
00:35:58,150 --> 00:35:55,920
this metaphor of thinking about ice

1024
00:35:59,829 --> 00:35:58,160
cream it's a hot day if any four of you

1025
00:36:01,510 --> 00:35:59,839
go out afterwards and decide to go out

1026
00:36:03,910 --> 00:36:01,520
and get ice cream i'll bet you you will

1027
00:36:05,829 --> 00:36:03,920
not all get the same thing

1028
00:36:07,270 --> 00:36:05,839
and if somebody asks you why you choose

1029
00:36:08,950 --> 00:36:07,280
between vanilla and chocolate you're

1030
00:36:10,230 --> 00:36:08,960
just gonna say well it tastes good it's

1031
00:36:11,990 --> 00:36:10,240
what i prefer

1032
00:36:13,750 --> 00:36:12,000
and when you come down to four landing

1033
00:36:17,109 --> 00:36:13,760
sites that's basically what it comes

1034
00:36:20,069 --> 00:36:17,119
down to which one feels right and so in

1035
00:36:22,230 --> 00:36:20,079
the end there's no hard yes or no answer

1036
00:36:24,069 --> 00:36:22,240
you don't make a long list of things and

1037
00:36:26,630 --> 00:36:24,079
put numbers by them and add them up and

1038
00:36:29,750 --> 00:36:26,640

figure out what goes on so we as a

1039
00:36:32,069 --> 00:36:29,760
science team as a community uh we got

1040
00:36:34,310 --> 00:36:32,079
together and in the end we picked the

1041
00:36:36,550 --> 00:36:34,320
one that felt best

1042
00:36:38,390 --> 00:36:36,560
and so why does it feel good well as

1043
00:36:40,870 --> 00:36:38,400
dawn was explaining

1044
00:36:43,109 --> 00:36:40,880
you've got a mountain of rocks that's

1045
00:36:45,670 --> 00:36:43,119
five kilometers high that's higher than

1046
00:36:47,510 --> 00:36:45,680
the tallest mountain in the lower 48.

1047
00:36:50,150 --> 00:36:47,520
it's taller than mount whitney

1048
00:36:52,069 --> 00:36:50,160
it's it looks like hawaii if you come

1049
00:36:53,750 --> 00:36:52,079
sailing up to hawaii the thing about

1050
00:36:57,430 --> 00:36:53,760
this mountain is that it's not a tall

1051
00:36:59,030 --> 00:36:57,440
spire it's a broad low mound like shape

1052
00:37:00,310 --> 00:36:59,040
what that means we can drive up it with

1053
00:37:02,630 --> 00:37:00,320
a rover

1054
00:37:04,630 --> 00:37:02,640
so this might be the tallest mountain

1055
00:37:06,790 --> 00:37:04,640
anywhere in the solar system that we

1056
00:37:09,109 --> 00:37:06,800
could actually climb with a rover so we

1057
00:37:11,349 --> 00:37:09,119
think and plan around a two-year message

1058
00:37:12,870 --> 00:37:11,359
mission but we have a hope that if we

1059
00:37:15,270 --> 00:37:12,880
lived longer we might be able to keep

1060
00:37:17,670 --> 00:37:15,280
going higher and higher up that mountain

1061
00:37:19,829 --> 00:37:17,680
that alone it justifies sending the

1062
00:37:21,589 --> 00:37:19,839
spacecraft there then when you start

1063
00:37:23,349 --> 00:37:21,599

adding in the science goals that are on

1064
00:37:25,430 --> 00:37:23,359
top of it we turns out that the most

1065
00:37:27,829 --> 00:37:25,440
attractive targets are at the base of

1066
00:37:30,069 --> 00:37:27,839
the mountain and we have a payload that

1067
00:37:31,829 --> 00:37:30,079
we can address those with so in the two

1068
00:37:34,710 --> 00:37:31,839
years that we have to run this mission

1069
00:37:36,710 --> 00:37:34,720
before the warranty expires

1070
00:37:38,230 --> 00:37:36,720
we can address the principal goals which

1071
00:37:40,390 --> 00:37:38,240
are the kinds of things that that the

1072
00:37:41,349 --> 00:37:40,400
mars community would really like answers

1073
00:37:43,190 --> 00:37:41,359
to

1074
00:37:45,829 --> 00:37:43,200
so what you can see in the first graphic

1075
00:37:48,310 --> 00:37:45,839
that uh that we have up there

1076
00:37:51,190 --> 00:37:48,320
uh is the spacecraft with all the

1077
00:37:53,430 --> 00:37:51,200
instruments that are on and and we have

1078
00:37:55,030 --> 00:37:53,440
nine principal investigators that have

1079
00:37:56,630 --> 00:37:55,040
contributed instruments that are now

1080
00:37:57,829 --> 00:37:56,640
part of the rover which is down at cape

1081
00:38:00,950 --> 00:37:57,839
canaveral

1082
00:38:02,230 --> 00:38:00,960
and those principal investigators are um

1083
00:38:07,190 --> 00:38:02,240
dave blake

1084
00:38:09,910 --> 00:38:07,200
ken edgett uh uh javier gomez elvira

1085
00:38:12,710 --> 00:38:09,920
ralph gellert don hassler

1086
00:38:15,430 --> 00:38:12,720
uh mike malin paul mahaffey igor

1087
00:38:17,270 --> 00:38:15,440
mitrofanoff and roger wiens and they

1088
00:38:20,069 --> 00:38:17,280

have built ten instruments that sit on

1089
00:38:20,950 --> 00:38:20,079
the rover and if i just describe a few

1090
00:38:22,870 --> 00:38:20,960
of them

1091
00:38:25,829 --> 00:38:22,880
we can start off with everybody's

1092
00:38:29,270 --> 00:38:25,839
favorite which are the cameras on msl we

1093
00:38:31,349 --> 00:38:29,280
have 17 cameras y'all get lots of

1094
00:38:33,109 --> 00:38:31,359
pictures to look at

1095
00:38:34,950 --> 00:38:33,119
there's a camera that's mounted to the

1096
00:38:36,950 --> 00:38:34,960
bottom of the rover and in the video

1097
00:38:39,109 --> 00:38:36,960
that mike showed you where the sky crane

1098
00:38:40,870 --> 00:38:39,119
is reeling down the rover this camera is

1099
00:38:43,829 --> 00:38:40,880
going to turn on it's going to take a

1100
00:38:46,230 --> 00:38:43,839
movie at 5 frames per second full color

1101
00:38:48,230 --> 00:38:46,240
hd resolution that'll be one of the most

1102
00:38:50,230 --> 00:38:48,240
spectacular public outreach data

1103
00:38:51,829 --> 00:38:50,240
products that's ever been created

1104
00:38:54,470 --> 00:38:51,839
we have cameras that are up on top of

1105
00:38:56,950 --> 00:38:54,480
the mast that we can use to look around

1106
00:38:59,430 --> 00:38:56,960
and try to find the types of rocks that

1107
00:39:00,790 --> 00:38:59,440
we would like to do chemical analysis on

1108
00:39:02,790 --> 00:39:00,800
and when we think that something is

1109
00:39:05,109 --> 00:39:02,800
particularly promising we can drive up

1110
00:39:07,510 --> 00:39:05,119
closer and then we have a laser that

1111
00:39:09,750 --> 00:39:07,520
shoots out in front of the rover up to a

1112
00:39:12,150 --> 00:39:09,760
distance of seven meters away

1113
00:39:15,030 --> 00:39:12,160

that zaps the rock creates a spark of

1114
00:39:16,950 --> 00:39:15,040
light and then we look at that spark and

1115
00:39:19,109 --> 00:39:16,960
based on the light content it tells us

1116
00:39:20,790 --> 00:39:19,119
about what chemical elements are in the

1117
00:39:22,069 --> 00:39:20,800
rock and are they the kind of chemical

1118
00:39:25,030 --> 00:39:22,079
elements that are consistent with a

1119
00:39:27,829 --> 00:39:25,040
habitable environment and then if so

1120
00:39:30,630 --> 00:39:27,839
we drive over to the rock and then we

1121
00:39:32,870 --> 00:39:30,640
take the arm we deploy the arm we put it

1122
00:39:33,750 --> 00:39:32,880
down on top of the rock and we have a

1123
00:39:40,829 --> 00:39:33,760
drill

1124
00:39:44,069 --> 00:39:40,839
rock up to five centimeters creates a

1125
00:39:45,510 --> 00:39:44,079
powder the arm then collects the powder

1126
00:39:47,190 --> 00:39:45,520
brings it back

1127
00:39:49,589 --> 00:39:47,200
takes it on top

1128
00:39:51,670 --> 00:39:49,599
drops it down into one of these holes on

1129
00:39:53,349 --> 00:39:51,680
the on the top of the rover

1130
00:39:55,589 --> 00:39:53,359
and we have two instruments that are

1131
00:39:58,550 --> 00:39:55,599
inside the rover there and what you can

1132
00:40:01,109 --> 00:39:58,560
see in those instruments is the

1133
00:40:02,790 --> 00:40:01,119
mineralogic composition of of what's

1134
00:40:04,470 --> 00:40:02,800
down there on mars so we hear about all

1135
00:40:06,069 --> 00:40:04,480
these hydrated minerals that we see from

1136
00:40:08,309 --> 00:40:06,079
orbit and now we're going to be able to

1137
00:40:09,589 --> 00:40:08,319
really determine the the composition of

1138
00:40:11,670 --> 00:40:09,599

those minerals

1139
00:40:13,910 --> 00:40:11,680
in addition to that we can also take a

1140
00:40:15,349 --> 00:40:13,920
look for organic carbon now let me

1141
00:40:18,230 --> 00:40:15,359
emphasize that we are not a life

1142
00:40:21,349 --> 00:40:18,240
detection mission and we cannot look for

1143
00:40:23,589 --> 00:40:21,359
fossils microbial fossils of any type

1144
00:40:25,589 --> 00:40:23,599
but we can look potentially for organic

1145
00:40:26,950 --> 00:40:25,599
carbon that might be preserved there our

1146
00:40:29,030 --> 00:40:26,960
primary goal in this mission is to

1147
00:40:31,270 --> 00:40:29,040
explore habitable environment and that

1148
00:40:33,430 --> 00:40:31,280
means we had water present that means we

1149
00:40:36,150 --> 00:40:33,440
had a source of energy for microbes to

1150
00:40:38,069 --> 00:40:36,160
to undertake metabolism to live and then

1151
00:40:39,190 --> 00:40:38,079
we also have a source of carbon for life

1152
00:40:41,270 --> 00:40:39,200
as we know it

1153
00:40:44,230 --> 00:40:41,280
but here's the trick if we want to look

1154
00:40:46,630 --> 00:40:44,240
for organic carbon we have to be able to

1155
00:40:48,150 --> 00:40:46,640
work with rocks that look much like this

1156
00:40:50,390 --> 00:40:48,160
one does

1157
00:40:53,270 --> 00:40:50,400
this is a rock that comes from the early

1158
00:40:55,430 --> 00:40:53,280
earth it's almost 3 billion years old

1159
00:40:57,589 --> 00:40:55,440
and it tells us a lot about the early

1160
00:40:59,910 --> 00:40:57,599
environmental evolution of earth

1161
00:41:01,670 --> 00:40:59,920
particularly the rise of oxygen on earth

1162
00:41:03,589 --> 00:41:01,680
and these layers that you see here are

1163
00:41:05,430 --> 00:41:03,599

the things that we're interested in this

1164
00:41:07,430 --> 00:41:05,440
rock started out as sedimentary

1165
00:41:09,190 --> 00:41:07,440
particles and those sedimentary

1166
00:41:12,150 --> 00:41:09,200
particles may have been associated with

1167
00:41:15,190 --> 00:41:12,160
organic matter but here's the problem

1168
00:41:17,670 --> 00:41:15,200
when the sediment becomes a hard rock

1169
00:41:19,430 --> 00:41:17,680
all that organic matter can be destroyed

1170
00:41:21,190 --> 00:41:19,440
so this is a very very difficult

1171
00:41:23,670 --> 00:41:21,200
challenge that we have

1172
00:41:25,750 --> 00:41:23,680
for us on a planet that teams with life

1173
00:41:28,790 --> 00:41:25,760
on earth we almost never see organic

1174
00:41:30,950 --> 00:41:28,800
carbon preserved but it does happen and

1175
00:41:32,950 --> 00:41:30,960
so we hope to be able to look for

1176
00:41:35,030 --> 00:41:32,960
organic carbon that's what we can hope

1177
00:41:36,790 --> 00:41:35,040
for what we can promise to deliver with

1178
00:41:39,349 --> 00:41:36,800
msl is an understanding of the

1179
00:41:40,950 --> 00:41:39,359
environmental history of mars okay so if

1180
00:41:43,829 --> 00:41:40,960
we go to the next one

1181
00:41:45,990 --> 00:41:43,839
what we can see in this slide now is the

1182
00:41:48,150 --> 00:41:46,000
is the rover itself mike's already

1183
00:41:49,910 --> 00:41:48,160
showed a picture of this you can see all

1184
00:41:52,710 --> 00:41:49,920
the instruments that we've been through

1185
00:41:54,470 --> 00:41:52,720
uh before so i'd like to skip on to the

1186
00:41:57,270 --> 00:41:54,480
next one

1187
00:41:58,710 --> 00:41:57,280
and uh and what you can see here is the

1188
00:42:01,670 --> 00:41:58,720

is where we'll land

1189
00:42:03,030 --> 00:42:01,680
in the images that that dawn was showing

1190
00:42:04,550 --> 00:42:03,040
right in the center of the ellipse we

1191
00:42:06,870 --> 00:42:04,560
have something that looks like one of

1192
00:42:09,349 --> 00:42:06,880
these water lane deposits it's called a

1193
00:42:11,190 --> 00:42:09,359
alluvial fan we think that water was

1194
00:42:12,790 --> 00:42:11,200
flowing along and transporting sediment

1195
00:42:15,109 --> 00:42:12,800
particles and then out in front of it in

1196
00:42:16,710 --> 00:42:15,119
the blue outline we have this very hard

1197
00:42:18,309 --> 00:42:16,720
rock that dawn was talking about we

1198
00:42:20,870 --> 00:42:18,319
don't know how this is formed it's a big

1199
00:42:22,390 --> 00:42:20,880
mystery to us but it looks very special

1200
00:42:24,630 --> 00:42:22,400
and it's one of the things that uniquely

1201
00:42:26,550 --> 00:42:24,640
goes along with the gale site then we

1202
00:42:28,550 --> 00:42:26,560
can drive out of the ellipse and go up

1203
00:42:30,470 --> 00:42:28,560
to where it says clays which is one of

1204
00:42:32,069 --> 00:42:30,480
the types of minerals that's associated

1205
00:42:33,990 --> 00:42:32,079
with water it formed in an aqueous

1206
00:42:36,390 --> 00:42:34,000
environment and that patch of green

1207
00:42:38,390 --> 00:42:36,400
there is a place that we would study

1208
00:42:39,829 --> 00:42:38,400
then we go up into where it says

1209
00:42:41,829 --> 00:42:39,839
sulfates that's another kind of a

1210
00:42:43,190 --> 00:42:41,839
hydrated mineral and then we work our

1211
00:42:45,670 --> 00:42:43,200
way up the mound

1212
00:42:47,910 --> 00:42:45,680
so what we're doing is we're exploring a

1213
00:42:50,550 --> 00:42:47,920

geological environment that consists of

1214
00:42:52,150 --> 00:42:50,560
a stack of layers that tell us about the

1215
00:42:53,430 --> 00:42:52,160
environment so now let me skip to the

1216
00:42:56,150 --> 00:42:53,440
next one

1217
00:42:58,790 --> 00:42:56,160
and why do these layers matter well this

1218
00:43:01,270 --> 00:42:58,800
is the history of geological exploration

1219
00:43:03,190 --> 00:43:01,280
on earth and 150 years ago when the

1220
00:43:05,270 --> 00:43:03,200
first explorers went down the colorado

1221
00:43:07,349 --> 00:43:05,280
river and discovered the grand canyon

1222
00:43:09,270 --> 00:43:07,359
they saw all these layers of rocks and

1223
00:43:11,510 --> 00:43:09,280
what we have learned from 150 years of

1224
00:43:13,829 --> 00:43:11,520
exploration is that if you start at the

1225
00:43:15,990 --> 00:43:13,839
bottom of the pile of lairs and you go

1226
00:43:17,510 --> 00:43:16,000
to the top it's like reading a novel and

1227
00:43:19,030 --> 00:43:17,520
we think gale crater is going to be a

1228
00:43:21,349 --> 00:43:19,040
great novel about the early

1229
00:43:24,230 --> 00:43:21,359
environmental evolution of mars that

1230
00:43:26,390 --> 00:43:24,240
offers strong prospects potentially for

1231
00:43:29,430 --> 00:43:26,400
the discovery of habitable environments

1232
00:43:31,990 --> 00:43:29,440
and maybe even a shot at at potentially

1233
00:43:33,990 --> 00:43:32,000
discovering or organic compounds but

1234
00:43:35,510 --> 00:43:34,000
even if we don't find those organics

1235
00:43:37,510 --> 00:43:35,520
what we learned from studying a place

1236
00:43:39,589 --> 00:43:37,520
like the grand canyon is the way that

1237
00:43:41,430 --> 00:43:39,599
the environmental history and habitable

1238
00:43:43,349 --> 00:43:41,440

environments changed on earth and we

1239
00:43:46,069 --> 00:43:43,359
think we're going to get that for gail

1240
00:43:47,510 --> 00:43:46,079
so let me finish with the last one

1241
00:43:49,670 --> 00:43:47,520
this is what our book is going to look

1242
00:43:51,430 --> 00:43:49,680
like as we go up through the mound we're

1243
00:43:52,630 --> 00:43:51,440
going to start out the first chapter is

1244
00:43:54,230 --> 00:43:52,640
going to be what we've got in the

1245
00:43:55,990 --> 00:43:54,240
landing ellipse which looks pretty darn

1246
00:43:57,510 --> 00:43:56,000
exciting already and then we're going to

1247
00:43:59,990 --> 00:43:57,520
head out of the landing ellipse and go

1248
00:44:02,630 --> 00:44:00,000
towards that green star and that's where

1249
00:44:04,470 --> 00:44:02,640
the clay minerals are are are forming

1250
00:44:05,829 --> 00:44:04,480
the layers and then after we're done

1251
00:44:07,670 --> 00:44:05,839
with those we're going to head up into

1252
00:44:10,150 --> 00:44:07,680
the third chapter and look at these

1253
00:44:11,510 --> 00:44:10,160
sulfates where the yellow star is and

1254
00:44:13,349 --> 00:44:11,520
then after we're done with that we can

1255
00:44:15,109 --> 00:44:13,359
go up to the top and now we've gone

1256
00:44:16,390 --> 00:44:15,119
through hundreds and hundreds of meters

1257
00:44:18,069 --> 00:44:16,400
and just for reference with the

1258
00:44:20,230 --> 00:44:18,079
opportunity rover we've been working

1259
00:44:22,470 --> 00:44:20,240
seven years we've gone through about 20

1260
00:44:24,870 --> 00:44:22,480
meters of rock what we see here in this

1261
00:44:26,150 --> 00:44:24,880
image is hundreds of meters of rock so

1262
00:44:28,230 --> 00:44:26,160
we have that more

1263
00:44:29,829 --> 00:44:28,240

that many more pages to to read in this

1264
00:44:32,230 --> 00:44:29,839
book of the early environmental history

1265
00:44:33,750 --> 00:44:32,240
of mars and just one thing that in

1266
00:44:36,309 --> 00:44:33,760
addition to these minerals that we can

1267
00:44:38,150 --> 00:44:36,319
see from orbit that gives us a lot of

1268
00:44:40,150 --> 00:44:38,160
excitement for the site is in the next

1269
00:44:42,309 --> 00:44:40,160
slide the blue star

1270
00:44:44,630 --> 00:44:42,319
is a feature that we can see from orbit

1271
00:44:46,790 --> 00:44:44,640
that's been published uh observed

1272
00:44:48,790 --> 00:44:46,800
elsewhere on mars by the high-rise team

1273
00:44:50,950 --> 00:44:48,800
led by alfred mcewen we see these

1274
00:44:52,550 --> 00:44:50,960
fracture systems they occur all over

1275
00:44:55,109 --> 00:44:52,560
mars and in some places they are

1276
00:44:57,109 --> 00:44:55,119
spectacularly developed gale crater is

1277
00:44:59,030 --> 00:44:57,119
one of them and they're not down at the

1278
00:45:01,430 --> 00:44:59,040
bottom of the mound they're developed

1279
00:45:03,109 --> 00:45:01,440
hundreds of meters up into that story

1280
00:45:04,470 --> 00:45:03,119
about the environmental evolution and

1281
00:45:06,550 --> 00:45:04,480
what we see

1282
00:45:08,470 --> 00:45:06,560
the the fracture that that blue star is

1283
00:45:10,630 --> 00:45:08,480
on if you look at that thing it makes a

1284
00:45:11,910 --> 00:45:10,640
line and notice that there's a dark line

1285
00:45:13,910 --> 00:45:11,920
right in the middle on either side

1286
00:45:15,589 --> 00:45:13,920
there's two white lines those two white

1287
00:45:18,630 --> 00:45:15,599
lines tell us that that was likely an

1288
00:45:20,630 --> 00:45:18,640

open space in which there was water that

1289
00:45:21,990 --> 00:45:20,640
filled in with minerals and that's the

1290
00:45:23,510 --> 00:45:22,000
kind of thing that we think is a very

1291
00:45:25,990 --> 00:45:23,520
bright prospect for a habitable

1292
00:45:27,589 --> 00:45:26,000
environment so to summarize we have many

1293
00:45:29,829 --> 00:45:27,599
attractive

1294
00:45:32,230 --> 00:45:29,839
possibilities at gale we think it has

1295
00:45:33,510 --> 00:45:32,240
exceptionally high diversity for

1296
00:45:35,430 --> 00:45:33,520
different kinds of

1297
00:45:37,270 --> 00:45:35,440
habitable environments and it is

1298
00:45:39,109 --> 00:45:37,280
possible that some of those might

1299
00:45:41,030 --> 00:45:39,119
preserve organic carbon

1300
00:45:41,990 --> 00:45:41,040
so with that i'll turn it back to dwayne

1301
00:45:43,750 --> 00:45:42,000
thank you

1302
00:45:44,950 --> 00:45:43,760
i'd like to ask the media who are

1303
00:45:46,470 --> 00:45:44,960
attending here if they can make their

1304
00:45:47,990 --> 00:45:46,480
way to the microphone if they have

1305
00:45:49,670 --> 00:45:48,000
questions and then we'll go to the phone

1306
00:45:51,190 --> 00:45:49,680
line i would like to

1307
00:45:53,109 --> 00:45:51,200
remind folks out there watching this

1308
00:45:56,550 --> 00:45:53,119
program that you can find all this all

1309
00:45:58,790 --> 00:45:56,560
of this information on www.nasa.gov

1310
00:46:00,470 --> 00:45:58,800
msl and for folks out there who have

1311
00:46:03,349 --> 00:46:00,480
google earth

1312
00:46:05,829 --> 00:46:03,359
an incredible google mars component to

1313
00:46:08,069 --> 00:46:05,839

that check that out

1314
00:46:09,990 --> 00:46:08,079
and i think it's certainly appropriate

1315
00:46:12,069 --> 00:46:10,000
not only to give a round of applause

1316
00:46:14,069 --> 00:46:12,079
again to the folks up here but also to

1317
00:46:15,910 --> 00:46:14,079
all of the folks across this great

1318
00:46:17,750 --> 00:46:15,920
country and and worldwide that are

1319
00:46:19,510 --> 00:46:17,760
working on this mission and particularly

1320
00:46:21,190 --> 00:46:19,520
the folks at the kennedy space center

1321
00:46:28,550 --> 00:46:21,200
who are going to take us back to mars

1322
00:46:33,349 --> 00:46:30,230
okay let's go to the phone line here

1323
00:46:33,359 --> 00:46:39,670
with reuters irene

1324
00:46:45,750 --> 00:46:41,510
we'll come back here go ahead eric you

1325
00:46:48,630 --> 00:46:47,030
some people some people on your science

1326
00:46:50,950 --> 00:46:48,640
team are saying that this could even be

1327
00:46:52,870 --> 00:46:50,960
a bathtub that was once filled all the

1328
00:46:55,510 --> 00:46:52,880
way to the top with water

1329
00:46:58,150 --> 00:46:55,520
others are are worried that maybe

1330
00:47:00,150 --> 00:46:58,160
some of these watery signs could just be

1331
00:47:02,630 --> 00:47:00,160
carried in you know

1332
00:47:04,470 --> 00:47:02,640
almost as a layer of dust by wind

1333
00:47:05,430 --> 00:47:04,480
what's your best estimate for how much

1334
00:47:07,829 --> 00:47:05,440
water

1335
00:47:09,750 --> 00:47:07,839
was once in gale crater and can you

1336
00:47:13,430 --> 00:47:09,760
describe some of the ways in which

1337
00:47:16,550 --> 00:47:14,950
there is one we're going to begin to get

1338
00:47:17,990 --> 00:47:16,560

answers to these questions that you're

1339
00:47:20,150 --> 00:47:18,000
asking and right now what we've got are

1340
00:47:22,309 --> 00:47:20,160
hypotheses and so the way that we can go

1341
00:47:25,829 --> 00:47:22,319
about testing them is using the payload

1342
00:47:27,910 --> 00:47:25,839
to make particular uh estimates of

1343
00:47:30,309 --> 00:47:27,920
the environments that that water may

1344
00:47:31,910 --> 00:47:30,319
have been present in and what i would

1345
00:47:33,829 --> 00:47:31,920
say the most important thing that we

1346
00:47:36,950 --> 00:47:33,839
need to be left with is to make sure

1347
00:47:38,390 --> 00:47:36,960
that in the year that we arrive at at

1348
00:47:40,549 --> 00:47:38,400
the gale landing site

1349
00:47:42,549 --> 00:47:40,559
we continue to continue to refine our

1350
00:47:44,230 --> 00:47:42,559
our hypotheses and and come up with

1351
00:47:45,109 --> 00:47:44,240
particular observations that we would

1352
00:47:47,109 --> 00:47:45,119
make

1353
00:47:49,829 --> 00:47:47,119
and and i think the most important thing

1354
00:47:51,349 --> 00:47:49,839
is the the question of how much water

1355
00:47:53,349 --> 00:47:51,359
may have been there there may not be one

1356
00:47:55,030 --> 00:47:53,359
answer there could be multiple answers

1357
00:47:56,630 --> 00:47:55,040
the reason that gail's attractive is

1358
00:47:58,630 --> 00:47:56,640
because there's likely to be multiple

1359
00:48:00,150 --> 00:47:58,640
scenarios in which in which water would

1360
00:48:01,510 --> 00:48:00,160
have been present but at this time we

1361
00:48:07,589 --> 00:48:01,520
just don't know how much would have been

1362
00:48:12,390 --> 00:48:09,589
space magazine i don't know if you can

1363
00:48:14,549 --> 00:48:12,400

go back a couple of slides to that whole

1364
00:48:16,950 --> 00:48:14,559
stratigraphy that you were showing but

1365
00:48:18,710 --> 00:48:16,960
have you started to map out how you

1366
00:48:20,790 --> 00:48:18,720
actually climb the mountain i mean to

1367
00:48:23,270 --> 00:48:20,800
the first order of uh that's a

1368
00:48:25,270 --> 00:48:23,280
three-mile high mountain i mean

1369
00:48:26,950 --> 00:48:25,280
and i i realize the relief has been

1370
00:48:28,790 --> 00:48:26,960
exaggerated there but

1371
00:48:31,589 --> 00:48:28,800
yeah it's a it's a three times vertical

1372
00:48:33,349 --> 00:48:31,599
exaggeration and and we are committing

1373
00:48:35,030 --> 00:48:33,359
only to climbing the lower part of the

1374
00:48:36,790 --> 00:48:35,040
mountain and in the project one of the

1375
00:48:39,270 --> 00:48:36,800
things that we did

1376
00:48:41,030 --> 00:48:39,280
to to to confirm this site as being

1377
00:48:44,230 --> 00:48:41,040
viable from an engineering perspective

1378
00:48:45,510 --> 00:48:44,240
was we conducted a study by a subset of

1379
00:48:47,829 --> 00:48:45,520
people on the team and within the

1380
00:48:49,030 --> 00:48:47,839
project called the gale summit team and

1381
00:48:50,630 --> 00:48:49,040
they were charged with the

1382
00:48:52,790 --> 00:48:50,640
responsibility of making sure that we

1383
00:48:54,630 --> 00:48:52,800
could actually drive there so mike and i

1384
00:48:57,589 --> 00:48:54,640
got together with some of the engineers

1385
00:49:00,390 --> 00:48:57,599
and a handful of scientists to to try to

1386
00:49:02,069 --> 00:49:00,400
drive this terrain because now don't

1387
00:49:04,390 --> 00:49:02,079
forget this high-rise camera is

1388
00:49:06,549 --> 00:49:04,400

incredibly valuable because you can see

1389
00:49:08,630 --> 00:49:06,559
this table from orbit and so that means

1390
00:49:11,270 --> 00:49:08,640
we can come up with accurate models in

1391
00:49:12,790 --> 00:49:11,280
advance of arriving there and drive them

1392
00:49:15,270 --> 00:49:12,800
across the terrain and make sure we can

1393
00:49:17,349 --> 00:49:15,280
do it so we had multiple paths that we

1394
00:49:19,270 --> 00:49:17,359
can that we found that we can get get us

1395
00:49:20,950 --> 00:49:19,280
up through those layers

1396
00:49:23,589 --> 00:49:20,960
okay um

1397
00:49:24,630 --> 00:49:23,599
and if you were to get all the way to

1398
00:49:26,710 --> 00:49:24,640
the summit

1399
00:49:27,990 --> 00:49:26,720
can you even guess at how long that

1400
00:49:29,430 --> 00:49:28,000
would take

1401
00:49:31,190 --> 00:49:29,440
the full year

1402
00:49:33,109 --> 00:49:31,200
no no uh

1403
00:49:34,710 --> 00:49:33,119
i think basically where the blue star is

1404
00:49:36,710 --> 00:49:34,720
that would probably take us two years to

1405
00:49:39,270 --> 00:49:36,720
get there and then after that as i said

1406
00:49:41,190 --> 00:49:39,280
you know the warranty expires but if

1407
00:49:43,349 --> 00:49:41,200
history is a predictor of the future we

1408
00:49:45,990 --> 00:49:43,359
we expect to have you know some some

1409
00:49:47,750 --> 00:49:46,000
future life left to go but if we if we

1410
00:49:48,950 --> 00:49:47,760
were to go on for 10 years we think we

1411
00:49:50,549 --> 00:49:48,960
could just keep climbing it's going to

1412
00:49:51,670 --> 00:49:50,559
take years to get to the top if it's

1413
00:49:53,910 --> 00:49:51,680

possible

1414
00:49:55,990 --> 00:49:53,920
well one of the issues with how fast we

1415
00:49:59,109 --> 00:49:56,000
go is how long we spend on the

1416
00:50:00,710 --> 00:49:59,119
scientific investigations so it's not

1417
00:50:04,150 --> 00:50:00,720
just a matter of the engineering

1418
00:50:05,750 --> 00:50:04,160
capability of of driving it's it's the

1419
00:50:08,309 --> 00:50:05,760
fact that there's a

1420
00:50:10,470 --> 00:50:08,319
a sort of rich suite of things to to

1421
00:50:14,069 --> 00:50:10,480
look at and so there's a balance between

1422
00:50:16,230 --> 00:50:14,079
characterizing what where you're at and

1423
00:50:17,670 --> 00:50:16,240
going to see the next thing and that's

1424
00:50:20,549 --> 00:50:17,680
that'll be a very exciting part of the

1425
00:50:23,109 --> 00:50:20,559
mission and one last one can you say how

1426
00:50:24,150 --> 00:50:23,119
steep a slope this can climb and compare

1427
00:50:27,190 --> 00:50:24,160
that to

1428
00:50:28,069 --> 00:50:27,200
spirit and opportunity

1429
00:50:29,430 --> 00:50:28,079
um

1430
00:50:31,190 --> 00:50:29,440
in some ways it's similar you know i

1431
00:50:33,990 --> 00:50:31,200
think we probably will generally be

1432
00:50:36,710 --> 00:50:34,000
climbing slopes around 20 degrees or so

1433
00:50:39,750 --> 00:50:36,720
um and that's that's a similar in slope

1434
00:50:42,390 --> 00:50:39,760
capability in terms of traverse to to

1435
00:50:43,430 --> 00:50:42,400
speed opportunity has has similar ground

1436
00:50:45,829 --> 00:50:43,440
pressure

1437
00:50:47,430 --> 00:50:45,839
and um and so you probably expect it to

1438
00:50:48,870 --> 00:50:47,440

be to be able to negotiate slopes that

1439
00:50:50,470 --> 00:50:48,880
are that are similar to what we've seen

1440
00:50:53,190 --> 00:50:50,480
for columbia hills or some of the some

1441
00:50:54,309 --> 00:50:53,200
of the crater um entries thanks okay

1442
00:50:55,750 --> 00:50:54,319
we're going to take one more question

1443
00:50:57,829 --> 00:50:55,760
then we'll go to the phones and try to

1444
00:51:00,630 --> 00:50:57,839
come back and wrap up so good

1445
00:51:02,549 --> 00:51:00,640
suzanne presto from voa i had a similar

1446
00:51:04,150 --> 00:51:02,559
question about time frame and how

1447
00:51:06,230 --> 00:51:04,160
quickly will you be getting information

1448
00:51:07,670 --> 00:51:06,240
back from this mission and also given

1449
00:51:09,670 --> 00:51:07,680
that opportunity and spirit have been

1450
00:51:11,030 --> 00:51:09,680
going years beyond oh do you really

1451
00:51:14,309 --> 00:51:11,040
think that this could be going for 10

1452
00:51:15,510 --> 00:51:14,319
years and beyond that possibly

1453
00:51:17,589 --> 00:51:15,520
you know i

1454
00:51:19,109 --> 00:51:17,599
we'll see what happens

1455
00:51:21,589 --> 00:51:19,119
i you know we have planned for a

1456
00:51:23,430 --> 00:51:21,599
two-year mission uh the two-year mission

1457
00:51:25,990 --> 00:51:23,440
we we understand that we can achieve the

1458
00:51:29,030 --> 00:51:26,000
principal science goals that we observe

1459
00:51:31,270 --> 00:51:29,040
at and and create hypotheses about there

1460
00:51:32,630 --> 00:51:31,280
and after that we'll just have to see

1461
00:51:34,309 --> 00:51:32,640
uh but the

1462
00:51:36,790 --> 00:51:34,319
the point that dawn was making is a good

1463
00:51:38,950 --> 00:51:36,800

one if we land and find something that's

1464
00:51:40,870 --> 00:51:38,960
so incredibly interesting that we want

1465
00:51:43,109 --> 00:51:40,880
to spend six months there we probably

1466
00:51:45,190 --> 00:51:43,119
will so there's no requirement on this

1467
00:51:47,829 --> 00:51:45,200
mission to drill a certain number of

1468
00:51:49,910 --> 00:51:47,839
samples analyze a number of rocks drive

1469
00:51:51,670 --> 00:51:49,920
a certain number of kilometers we are

1470
00:51:54,870 --> 00:51:51,680
really in the phase now where we are

1471
00:51:56,870 --> 00:51:54,880
doing true scientific exploration and

1472
00:51:59,589 --> 00:51:56,880
and we'll test hypotheses and when we're

1473
00:52:01,990 --> 00:51:59,599
satisfied we'll move on but that said

1474
00:52:03,910 --> 00:52:02,000
our our hope is that our plan going into

1475
00:52:05,990 --> 00:52:03,920
this is that we will move through some

1476
00:52:07,510 --> 00:52:06,000
targets in the landing ellipse and we do

1477
00:52:09,829 --> 00:52:07,520
want to get to the base of that now that

1478
00:52:11,670 --> 00:52:09,839
that is our target for the mission okay

1479
00:52:13,910 --> 00:52:11,680
let's let's go back to the phone and

1480
00:52:15,430 --> 00:52:13,920
irene

1481
00:52:17,109 --> 00:52:15,440
hi thanks very much can you hear me all

1482
00:52:19,430 --> 00:52:17,119
right yes go ahead

1483
00:52:20,470 --> 00:52:19,440
hi thanks i had two questions the first

1484
00:52:21,750 --> 00:52:20,480
is um

1485
00:52:23,270 --> 00:52:21,760
if someone could maybe just talk a

1486
00:52:25,510 --> 00:52:23,280
little bit about what the deciding

1487
00:52:28,069 --> 00:52:25,520
factor was in giving gail

1488
00:52:29,990 --> 00:52:28,079

the edge over um hebrews baldy which i

1489
00:52:32,470 --> 00:52:30,000
believe was kind of tied for the top

1490
00:52:33,349 --> 00:52:32,480
slot

1491
00:52:37,510 --> 00:52:33,359
um

1492
00:52:39,349 --> 00:52:37,520
i'll take a one crack at it essentially

1493
00:52:41,030 --> 00:52:39,359
it really was flavors of ice cream it's

1494
00:52:43,349 --> 00:52:41,040
very difficult and so one of the things

1495
00:52:46,870 --> 00:52:43,359
that we did was we had a meeting of the

1496
00:52:49,030 --> 00:52:46,880
mars science laboratory uh science team

1497
00:52:50,150 --> 00:52:49,040
so this is uh the principal

1498
00:52:52,470 --> 00:52:50,160
investigators and all the

1499
00:52:55,670 --> 00:52:52,480
co-investigators involved in the mission

1500
00:52:58,470 --> 00:52:55,680
and basically just did a vote and

1501
00:53:01,990 --> 00:52:58,480
we ended up with two front runners

1502
00:53:04,230 --> 00:53:02,000
ebber's valdez crater and uh gale crater

1503
00:53:05,349 --> 00:53:04,240
and then but there's a slight preference

1504
00:53:06,870 --> 00:53:05,359
for gail

1505
00:53:11,109 --> 00:53:06,880
and

1506
00:53:12,710 --> 00:53:11,119
asking the pis themselves the people who

1507
00:53:14,230 --> 00:53:12,720
the nine people who built the ten

1508
00:53:16,150 --> 00:53:14,240
instruments

1509
00:53:17,510 --> 00:53:16,160
there was a real preference for gail in

1510
00:53:19,829 --> 00:53:17,520
that

1511
00:53:23,030 --> 00:53:19,839
it's it's not a

1512
00:53:24,950 --> 00:53:23,040
one trick pony as we saw from this

1513
00:53:27,109 --> 00:53:24,960

talks today that there's several

1514
00:53:30,230 --> 00:53:27,119
different environment environmental

1515
00:53:31,910 --> 00:53:30,240
settings that can be explored

1516
00:53:34,950 --> 00:53:31,920
any one of which might have the

1517
00:53:36,230 --> 00:53:34,960
possibility of preserving some organic

1518
00:53:37,829 --> 00:53:36,240
so

1519
00:53:39,670 --> 00:53:37,839
you don't have to

1520
00:53:41,589 --> 00:53:39,680
have the scientific hubris of thinking

1521
00:53:42,790 --> 00:53:41,599
that you know exactly where to go or

1522
00:53:45,109 --> 00:53:42,800
what mineral

1523
00:53:47,510 --> 00:53:45,119
to target you actually have the choice

1524
00:53:49,349 --> 00:53:47,520
of several different things so that

1525
00:53:52,630 --> 00:53:49,359
if one doesn't work perhaps the other

1526
00:53:53,750 --> 00:53:52,640
one gives you the great payoff okay

1527
00:53:55,910 --> 00:53:53,760
ladies and gentlemen i'm gonna have to

1528
00:53:57,589 --> 00:53:55,920
jump in here we are unfortunately out of

1529
00:53:59,109 --> 00:53:57,599
time this room has to be reconfigured

1530
00:54:01,030 --> 00:53:59,119
for the mars day but i would like to

1531
00:54:02,470 --> 00:54:01,040
tell the media who are sitting here and

1532
00:54:03,910 --> 00:54:02,480
the folks on the phone that these folks

1533
00:54:05,190 --> 00:54:03,920
will be available we will make them

1534
00:54:07,109 --> 00:54:05,200
available following this press

1535
00:54:08,470 --> 00:54:07,119
conference and i want to thank you all

1536
00:54:10,710 --> 00:54:08,480
for joining us we want to thank the