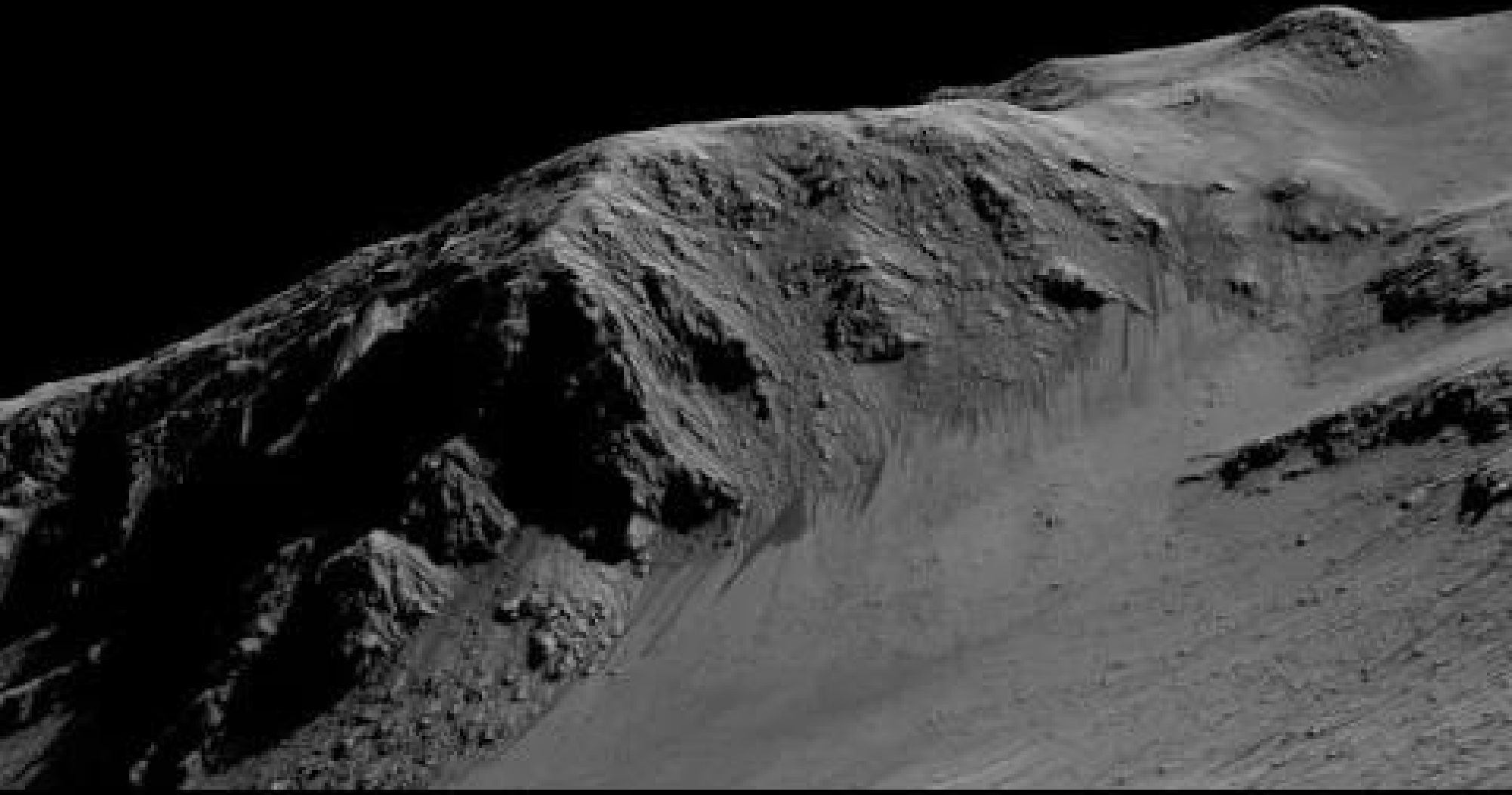

1
00:00:15,049 --> 00:00:13,399
good morning and welcome to NASA

2
00:00:16,340 --> 00:00:15,059
headquarters in Washington my name is

3
00:00:19,040 --> 00:00:16,350
Duane Brown with the Office of

4
00:00:21,529 --> 00:00:19,050
Communications ladies and gentlemen the

5
00:00:24,739 --> 00:00:21,539
journey to Mars just got a whole lot

6
00:00:27,259 --> 00:00:24,749
more fascinating this morning scientists

7
00:00:30,200 --> 00:00:27,269
will provide further details on the

8
00:00:33,470 --> 00:00:30,210
answer to a long-held mystery of the Red

9
00:00:35,630 --> 00:00:33,480
Planet and provide their thoughts and

10
00:00:39,639 --> 00:00:35,640
theories on the possibilities of what

11
00:00:42,740 --> 00:00:39,649
this could mean for life beyond Earth

12
00:00:45,590 --> 00:00:42,750
we'll have short briefings and

13
00:00:46,910 --> 00:00:45,600

presentations by participants then we'll

14
00:00:49,759 --> 00:00:46,920
open it up for questions starting here

15
00:00:52,819 --> 00:00:49,769
in Washington our phone lines and social

16
00:00:57,520 --> 00:00:52,829
media information you'll hear today and

17
00:01:07,850 --> 00:01:07,490
WWE slash Mars also nasa.gov journey to

18
00:01:10,310 --> 00:01:07,860
Mars

19
00:01:13,220 --> 00:01:10,320
and of course follow the conversation

20
00:01:15,980 --> 00:01:13,230
and the conversation is phenomenal all

21
00:01:18,110 --> 00:01:15,990
over the world of what is happening and

22
00:01:22,520 --> 00:01:18,120
what will be talked about today social

23
00:01:26,080 --> 00:01:22,530
media YouTube Twitter Facebook and send

24
00:01:28,400 --> 00:01:26,090
in your questions to hashtag ask NASA

25
00:01:30,550 --> 00:01:28,410
we've got a lot to cover so let me

26
00:01:36,380 --> 00:01:30,560
introduce you to today's participants

27
00:01:38,870 --> 00:01:36,390
first up John Grunsfeld five times space

28
00:01:42,350 --> 00:01:38,880
Fallone astronaut and associate

29
00:01:44,090 --> 00:01:42,360
administrator or head of this national

30
00:01:50,480 --> 00:01:44,100
science Mission Directorate here at NASA

31
00:01:56,170 --> 00:01:50,490
headquarters Jim Green director of

32
00:02:03,080 --> 00:02:00,380
Michael Meyer lead scientist for the

33
00:02:07,280 --> 00:02:03,090
Mars exploration program NASA

34
00:02:10,509 --> 00:02:07,290
headquarters and ladies and gentlemen

35
00:02:12,530 --> 00:02:10,519
joining us via phone from France

36
00:02:14,770 --> 00:02:12,540
individuals attending the European

37
00:02:17,750 --> 00:02:14,780
planetary science conference

38
00:02:20,210 --> 00:02:17,760

alfred mcewen principal investigator for

39
00:02:22,250 --> 00:02:20,220
the high-resolution imaging science

40
00:02:26,330 --> 00:02:22,260
experiment or high-rise from the

41
00:02:29,000 --> 00:02:26,340
University of Arizona in Tucson and Lou

42
00:02:32,900 --> 00:02:29,010
geojo of the Georgia Institute of

43
00:02:34,460 --> 00:02:32,910
Technology in Atlanta and joining us

44
00:02:37,510 --> 00:02:34,470
from the West Coast from NASA's Ames

45
00:02:40,280 --> 00:02:37,520
Research Center is Mary Beth Wilhelm

46
00:02:43,640 --> 00:02:40,290
hold onto your seats in your hats and

47
00:02:45,080 --> 00:02:43,650
I'll turn it over to John good morning

48
00:02:46,390 --> 00:02:45,090
everyone and thank you very much for

49
00:02:48,020 --> 00:02:46,400
coming this is a very exciting

50
00:02:52,009 --> 00:02:48,030
discussion that we're going to have

51
00:02:55,790 --> 00:02:52,019
today science at NASA is all about

52
00:02:58,070 --> 00:02:55,800
innovating exploring discovering and

53
00:03:00,650 --> 00:02:58,080
inspiring and we have some very

54
00:03:02,120 --> 00:03:00,660
innovative instruments orbiting Mars on

55
00:03:04,759 --> 00:03:02,130
the surface of Mars

56
00:03:06,830 --> 00:03:04,769
you know state-of-the-art technology and

57
00:03:09,710 --> 00:03:06,840
we're starting to put together a much

58
00:03:12,259 --> 00:03:09,720
more interesting picture of what Mars is

59
00:03:15,110 --> 00:03:12,269
like I grew up during the era when

60
00:03:18,740 --> 00:03:15,120
Viking had landed on Mars and revealed a

61
00:03:20,930 --> 00:03:18,750
desert-like planet apparently dead and

62
00:03:24,050 --> 00:03:20,940
not as interesting as we see it really

63
00:03:26,330 --> 00:03:24,060

is our instruments today are showing us

64
00:03:28,640 --> 00:03:26,340
a much more dynamic and complex planet

65
00:03:30,920 --> 00:03:28,650
and one that is exciting for a number of

66
00:03:33,170 --> 00:03:30,930
reasons which I'll describe and when we

67
00:03:35,690 --> 00:03:33,180
explore we make discoveries and that's

68
00:03:38,390 --> 00:03:35,700
really the human element discovery is

69
00:03:40,400 --> 00:03:38,400
why we do science we're trying to answer

70
00:03:42,740 --> 00:03:40,410
fundamental questions about our universe

71
00:03:45,110 --> 00:03:42,750
about our home planet about our solar

72
00:03:49,599 --> 00:03:45,120
system questions like where did we come

73
00:03:51,920 --> 00:03:49,609
from where are we going and are we alone

74
00:03:53,630 --> 00:03:51,930
and usually when I say where are we

75
00:03:55,160 --> 00:03:53,640
going I'm thinking in the cosmic sense

76
00:03:57,620 --> 00:03:55,170
what's the future evolution of the

77
00:04:00,289 --> 00:03:57,630
universe or what's the future evolution

78
00:04:01,640 --> 00:04:00,299
of life here on planet earth but in this

79
00:04:04,039 --> 00:04:01,650
case and one of the reasons I'm wearing

80
00:04:06,380 --> 00:04:04,049
my astronaut jacket is because we are

81
00:04:09,860 --> 00:04:06,390
going to Mars our journey to Mars is a

82
00:04:12,349 --> 00:04:09,870
science led expedition right now but

83
00:04:14,810 --> 00:04:12,359
soon I hope we'll be sending humans to

84
00:04:17,029 --> 00:04:14,820
the red planet to explore and science

85
00:04:19,069 --> 00:04:17,039
will lead the way and today's

86
00:04:22,370 --> 00:04:19,079
announcement of a really fascinating

87
00:04:24,980 --> 00:04:22,380
result about current water on Mars is

88
00:04:26,270 --> 00:04:24,990

one of the reasons why I feel it's even

89
00:04:28,040 --> 00:04:26,280
more imperative

90
00:04:30,530 --> 00:04:28,050
that we send astrobiologists and

91
00:04:33,170 --> 00:04:30,540
planetary scientists to Mars to explore

92
00:04:36,409 --> 00:04:33,180
the question of is their current life on

93
00:04:38,600 --> 00:04:36,419
Mars it's one of the things that I find

94
00:04:41,420 --> 00:04:38,610
most fascinating and and excites me

95
00:04:43,700 --> 00:04:41,430
about coming to work every day the way

96
00:04:45,409 --> 00:04:43,710
that we do that is to use our analytical

97
00:04:48,050 --> 00:04:45,419
instruments and so these are somewhat

98
00:04:50,480 --> 00:04:48,060
complex measurements and it is because

99
00:04:52,640 --> 00:04:50,490
we're trying to observe from orbit or

100
00:04:53,510 --> 00:04:52,650
observe from one spot on Mars that this

101
00:04:56,690 --> 00:04:53,520
is so difficult

102
00:04:58,430 --> 00:04:56,700
but the more we observe Mars the more

103
00:05:00,890 --> 00:04:58,440
information we're getting that it really

104
00:05:03,500 --> 00:05:00,900
is a fascinating planet from the

105
00:05:05,570 --> 00:05:03,510
Curiosity rover we now know that Mars

106
00:05:08,210 --> 00:05:05,580
what once was a planet very much like

107
00:05:10,790 --> 00:05:08,220
Earth with warm salty seas with

108
00:05:13,670 --> 00:05:10,800
freshwater lakes probably snow-capped

109
00:05:15,380 --> 00:05:13,680
peaks and clouds and a water cycle just

110
00:05:17,210 --> 00:05:15,390
like we're studying here on earth with

111
00:05:19,490 --> 00:05:17,220
our earth science satellites the water

112
00:05:22,460 --> 00:05:19,500
cycle here on earth but something has

113
00:05:25,040 --> 00:05:22,470

happened to Mars it lost its water but

114
00:05:27,409 --> 00:05:25,050
we still have in in the atmosphere and

115
00:05:29,600 --> 00:05:27,419
on the surface for the most part but we

116
00:05:32,330 --> 00:05:29,610
still have this question if did life

117
00:05:34,580 --> 00:05:32,340
arise on Mars once and can we find out

118
00:05:38,810 --> 00:05:34,590
and we have lots of intriguing clues

119
00:05:40,850 --> 00:05:38,820
about that story still that begs the

120
00:05:42,469 --> 00:05:40,860
question about if life started on Mars

121
00:05:44,270 --> 00:05:42,479
some three and a half billion years ago

122
00:05:46,700 --> 00:05:44,280
did any survive is there any life on

123
00:05:48,380 --> 00:05:46,710
Mars today and that's a fascinating

124
00:05:51,500 --> 00:05:48,390
question one that's going to take some

125
00:05:53,240 --> 00:05:51,510
time to answer but technologically we

126
00:05:54,800 --> 00:05:53,250
can answer and we can answer it by

127
00:05:56,750 --> 00:05:54,810
sending Rovers and we can answer it by

128
00:05:58,670 --> 00:05:56,760
sending people and I look forward to

129
00:06:00,350 --> 00:05:58,680
that day on our journey to Mars

130
00:06:04,700 --> 00:06:00,360
the discovery we're going to talk about

131
00:06:07,340 --> 00:06:04,710
today really is most exciting because it

132
00:06:10,159 --> 00:06:07,350
suggests that it would be possible for

133
00:06:11,600 --> 00:06:10,169
there to be life today on Mars and with

134
00:06:13,730 --> 00:06:11,610
that I'm going to turn it over to Jim

135
00:06:15,830 --> 00:06:13,740
Green to describe a little more detail

136
00:06:18,440 --> 00:06:15,840
and background thank you very much John

137
00:06:21,200 --> 00:06:18,450
you know we're making enormous progress

138
00:06:24,590 --> 00:06:21,210

with our current orbiters and Rovers as

139
00:06:27,650 --> 00:06:24,600
John mentioned and this is really to

140
00:06:30,110 --> 00:06:27,660
look at Mars because it is the planet

141
00:06:31,969 --> 00:06:30,120
that's most like the earth it is of

142
00:06:34,760 --> 00:06:31,979
course as we've talked about the

143
00:06:35,659 --> 00:06:34,770
destination or human exploration going

144
00:06:38,300 --> 00:06:35,669
beyond Earth

145
00:06:39,470 --> 00:06:38,310
if we go back perhaps three billion

146
00:06:42,560 --> 00:06:39,480
years and take a look

147
00:06:45,710 --> 00:06:42,570
Mars Mars was a very different planet it

148
00:06:48,680 --> 00:06:45,720
had an extensive atmosphere and in fact

149
00:06:52,310 --> 00:06:48,690
it had what we believe was a huge ocean

150
00:06:55,070 --> 00:06:52,320
perhaps as large as two-thirds of the

151
00:06:58,670 --> 00:06:55,080
northern hemisphere and that ocean may

152
00:07:01,100 --> 00:06:58,680
have been as much as a mile deep so Mars

153
00:07:04,760 --> 00:07:01,110
indeed 3 billion years ago had extensive

154
00:07:08,050 --> 00:07:04,770
water resources but something happened

155
00:07:14,090 --> 00:07:08,060
Mars suffered a major climate change and

156
00:07:16,670 --> 00:07:14,100
lost its surface water today we're

157
00:07:20,210 --> 00:07:16,680
revolutionizing our understanding of

158
00:07:22,340 --> 00:07:20,220
this planet our Rovers are finding that

159
00:07:25,340 --> 00:07:22,350
there's a lot more humidity in the air

160
00:07:27,920 --> 00:07:25,350
than we ever imagined is we ingest the

161
00:07:31,940 --> 00:07:27,930
soils they're moist they're hydrated

162
00:07:34,760 --> 00:07:31,950
full of water these discoveries are very

163
00:07:37,220 --> 00:07:34,770

important but they were only part of the

164
00:07:40,700 --> 00:07:37,230
hydrological cycle on Mars that we're

165
00:07:43,550 --> 00:07:40,710
just now beginning to understand what

166
00:07:46,640 --> 00:07:43,560
we're going to announce today is that

167
00:07:49,880 --> 00:07:46,650
Mars is not the dry arid planet that we

168
00:07:51,940 --> 00:07:49,890
thought of in the past today we're going

169
00:07:54,740 --> 00:07:51,950
to announce that under certain

170
00:07:58,430 --> 00:07:54,750
circumstances liquid water has been

171
00:08:00,920 --> 00:07:58,440
found on Mars now to give more of a

172
00:08:03,800 --> 00:08:00,930
background on those results let me turn

173
00:08:06,950 --> 00:08:03,810
it over to Mike Meyer Michael thank you

174
00:08:10,790 --> 00:08:06,960
Jim for the first time we have orbital

175
00:08:13,730 --> 00:08:10,800
evidence of the agent that has enabled

176
00:08:16,460 --> 00:08:13,740
water to flow on the surface of today's

177
00:08:20,440 --> 00:08:16,470
Mars for years we've had orbital

178
00:08:24,770 --> 00:08:20,450
spacecraft imaging valleys streaks

179
00:08:26,360 --> 00:08:24,780
gullies all of them look like water was

180
00:08:29,000 --> 00:08:26,370
an agent had something to do with

181
00:08:31,610 --> 00:08:29,010
forming them but we didn't have any

182
00:08:35,630 --> 00:08:31,620
proof it was not until about four years

183
00:08:39,890 --> 00:08:35,640
ago that looking at some we found the

184
00:08:43,280 --> 00:08:39,900
active process on Mars today that showed

185
00:08:46,270 --> 00:08:43,290
that water was a likely culprit these

186
00:08:48,620 --> 00:08:46,280
are called recurring slope lineae RSL

187
00:08:50,030 --> 00:08:48,630
for the rest of the press conference to

188
00:08:51,990 --> 00:08:50,040

save everybody the trouble of saying

189
00:08:54,810 --> 00:08:52,000
recurring slope lineae

190
00:08:57,860 --> 00:08:54,820
these are dark streaks that form and

191
00:09:01,340 --> 00:08:57,870
late-spring grow through the summer and

192
00:09:04,230 --> 00:09:01,350
then disappear by fall

193
00:09:08,100 --> 00:09:04,240
however for four years of scientific

194
00:09:10,230 --> 00:09:08,110
community has been unable to explain the

195
00:09:12,570 --> 00:09:10,240
waxing and waning of these dark streaks

196
00:09:14,790 --> 00:09:12,580
on the surface during this time

197
00:09:17,340 --> 00:09:14,800
additional observations have helped us

198
00:09:19,980 --> 00:09:17,350
determine that a broader distribution of

199
00:09:23,930 --> 00:09:19,990
RSL than we expected we're also finding

200
00:09:26,190 --> 00:09:23,940
that they are in expanded latitudes

201
00:09:30,770 --> 00:09:26,200
these observations have narrowed the

202
00:09:34,880 --> 00:09:30,780
constraints for how RSL might form but

203
00:09:38,700 --> 00:09:34,890
there have been no evidence for water

204
00:09:40,440 --> 00:09:38,710
until now it is through the multiple

205
00:09:42,210 --> 00:09:40,450
spacecraft and the multiple years of

206
00:09:45,390 --> 00:09:42,220
observations that would be able to make

207
00:09:48,330 --> 00:09:45,400
this discovery of water on today's Mars

208
00:09:50,570 --> 00:09:48,340
and for further details or turn it over

209
00:09:51,840 --> 00:09:50,580
to Duane who will pass it on to our

210
00:09:54,060 --> 00:09:51,850
science

211
00:09:57,470 --> 00:09:54,070
yes let's pass it on to our scientists

212
00:10:00,660 --> 00:09:57,480
in France and it aims and now let's see

213
00:10:02,820 --> 00:10:00,670

what this excitement is all about you're

214
00:10:04,980 --> 00:10:02,830
here first from alfred mcewen

215
00:10:06,930 --> 00:10:04,990
from france attending a european

216
00:10:10,550 --> 00:10:06,940
planetary science conference and in lieu

217
00:10:13,950 --> 00:10:10,560
G Oh JA Alfred

218
00:10:19,200 --> 00:10:13,960
greetings Vermont so I'm going to

219
00:10:21,360 --> 00:10:19,210
provide some background on the RSL and I

220
00:10:24,540 --> 00:10:21,370
have to explain why we have such a

221
00:10:26,700 --> 00:10:24,550
horrible acronym to deal with here for

222
00:10:28,740 --> 00:10:26,710
us scientists better to have a purely

223
00:10:31,170 --> 00:10:28,750
descriptive name that way we can argue

224
00:10:32,790 --> 00:10:31,180
about how these formed and still use the

225
00:10:34,770 --> 00:10:32,800
same name we don't want to name that

226
00:10:38,280 --> 00:10:34,780
assumes we understand what these are so

227
00:10:39,540 --> 00:10:38,290
we're stuck with RSL and so I'm going to

228
00:10:41,370 --> 00:10:39,550
give a little background and then I'll

229
00:10:45,210 --> 00:10:41,380
turn it over to lose you to describe his

230
00:10:50,850 --> 00:10:45,220
his new results could I have the first

231
00:10:53,190 --> 00:10:50,860
slide please so this first view is the

232
00:10:55,470 --> 00:10:53,200
title slide gives the title of the paper

233
00:10:58,980 --> 00:10:55,480
that's being released today in Nature

234
00:11:00,870 --> 00:10:58,990
Geoscience and this is a perspective

235
00:11:02,250 --> 00:11:00,880
view as if we are on the ground there's

236
00:11:03,960 --> 00:11:02,260
actually more verbal images but we

237
00:11:05,610 --> 00:11:03,970
projected as if we're on the ground and

238
00:11:09,329 --> 00:11:05,620

the plaque arrows there

239
00:11:11,760 --> 00:11:09,339
point to the tips of these RSL they

240
00:11:16,170 --> 00:11:11,770
actually begin way up near the tops of

241
00:11:18,480 --> 00:11:16,180
this hill here and that they flow down

242
00:11:20,040 --> 00:11:18,490
over the bedrock and when they flow out

243
00:11:22,440 --> 00:11:20,050
onto the fans about and that's where

244
00:11:25,410 --> 00:11:22,450
they stand out most distinctly so these

245
00:11:29,340 --> 00:11:25,420
are features were talking about and if I

246
00:11:31,110 --> 00:11:29,350
could go to the next view graph this

247
00:11:34,019 --> 00:11:31,120
will show you a little animated gifs

248
00:11:36,900 --> 00:11:34,029
that shows you the time sequence of

249
00:11:38,850 --> 00:11:36,910
these features so on the left is that

250
00:11:44,070 --> 00:11:38,860
black and white image this is palak your

251
00:11:46,380 --> 00:11:44,080
crater and it's all along the North

252
00:11:48,030 --> 00:11:46,390
facing and west facing rim of this

253
00:11:49,950 --> 00:11:48,040
crater you can see the black arrows

254
00:11:53,310 --> 00:11:49,960
pointing to too many of these on the

255
00:11:56,250 --> 00:11:53,320
left on the right is this animated gif

256
00:12:00,240 --> 00:11:56,260
and it shows the sequence where the

257
00:12:03,480 --> 00:12:00,250
start to form in the early summer they

258
00:12:06,360 --> 00:12:03,490
grow either gradually very gradually or

259
00:12:08,519 --> 00:12:06,370
incremental II then they and they stop

260
00:12:11,850 --> 00:12:08,529
growing and they fade then they

261
00:12:14,610 --> 00:12:11,860
disappear they're gone entirely for most

262
00:12:17,610 --> 00:12:14,620
of the Mars year the following Mars

263
00:12:20,220 --> 00:12:17,620

summer new features appear and grow that

264
00:12:21,810 --> 00:12:20,230
are very similar so that's the full

265
00:12:24,600 --> 00:12:21,820
sequence of events that we've been

266
00:12:29,220 --> 00:12:24,610
observing with high rise over the last

267
00:12:31,500 --> 00:12:29,230
four years or so and the these features

268
00:12:33,780 --> 00:12:31,510
are very sensitive to the temperature

269
00:12:37,140 --> 00:12:33,790
they form at different times at

270
00:12:39,930 --> 00:12:37,150
different latitudes on Mars all related

271
00:12:42,060 --> 00:12:39,940
to the seasonal variations at those

272
00:12:45,060 --> 00:12:42,070
locations so they're very temperature

273
00:12:46,800 --> 00:12:45,070
dependent and the darkening and the

274
00:12:49,980 --> 00:12:46,810
temperature dependence can be explained

275
00:12:52,400 --> 00:12:49,990
if these are seeps of water that seep

276
00:12:56,340 --> 00:12:52,410
through the shallow surface layer and

277
00:12:58,290 --> 00:12:56,350
darken the very surface layer but we had

278
00:13:00,210 --> 00:12:58,300
no direct detection of water that was

279
00:13:04,230 --> 00:13:00,220
just our best guess as to what these

280
00:13:08,220 --> 00:13:04,240
were if you go to the next slide

281
00:13:11,070 --> 00:13:08,230
this is a global map of Mars and it

282
00:13:13,380 --> 00:13:11,080
shows where we have what we call fully

283
00:13:15,060 --> 00:13:13,390
confirmed RSL as of a couple years ago

284
00:13:16,740 --> 00:13:15,070
this needs to be updated but it's the

285
00:13:19,380 --> 00:13:16,750
same general pattern there's three

286
00:13:22,410 --> 00:13:19,390
regions one is the southern midline

287
00:13:25,080 --> 00:13:22,420
toots another is Valles Marineris

288
00:13:27,630 --> 00:13:25,090

particular and there are a few other

289
00:13:29,130 --> 00:13:27,640
equatorial spots and then in the

290
00:13:33,380 --> 00:13:29,140
northern hemisphere we've seen quite a

291
00:13:35,850 --> 00:13:33,390
few of these now in a Sedalia Planitia

292
00:13:38,790 --> 00:13:35,860
loser was going to talk about his

293
00:13:40,710 --> 00:13:38,800
discoveries of of hydrated salts in

294
00:13:44,490 --> 00:13:40,720
three locations that are marked on here

295
00:13:47,820 --> 00:13:44,500
one is in balance Marineris in Pilates

296
00:13:49,950 --> 00:13:47,830
chasm another is pala care crater which

297
00:13:53,580 --> 00:13:49,960
I showed you the the animated gif orb

298
00:13:56,790 --> 00:13:53,590
and then we see them in the central

299
00:14:01,230 --> 00:13:56,800
peaks of Hale crater and Horowitz crater

300
00:14:03,930 --> 00:14:01,240
and John mentioned the biking results

301
00:14:05,780 --> 00:14:03,940
well Norman Horowitz was the principal

302
00:14:08,610 --> 00:14:05,790
investigator on the pyrolytic release

303
00:14:10,650 --> 00:14:08,620
experiment on the Viking landers which

304
00:14:13,710 --> 00:14:10,660
was searching one of four experiments

305
00:14:16,560 --> 00:14:13,720
searching for for life on Mars they had

306
00:14:21,660 --> 00:14:16,570
a negative result although there may be

307
00:14:25,110 --> 00:14:21,670
reasons for that so then the last slide

308
00:14:27,840 --> 00:14:25,120
I'm going to show you if you go to the

309
00:14:30,600 --> 00:14:27,850
next one this just shows Mars and its

310
00:14:32,490 --> 00:14:30,610
orbit around the Sun and this is to

311
00:14:33,780 --> 00:14:32,500
explain a little bit about why we see

312
00:14:36,900 --> 00:14:33,790
these at different times in different

313
00:14:39,750 --> 00:14:36,910

places so Mars is tilted on its axis

314
00:14:41,970 --> 00:14:39,760
about 25 degrees very similar to Earth's

315
00:14:44,430 --> 00:14:41,980
Tilton's axis so it has seasons like

316
00:14:46,290 --> 00:14:44,440
Earth when each pole is pointing towards

317
00:14:48,470 --> 00:14:46,300
the Sun it's summer in that hemisphere

318
00:14:52,380 --> 00:14:48,480
winter when it's pointing away

319
00:14:55,950 --> 00:14:52,390
in addition Mars has a more eccentric

320
00:14:58,560 --> 00:14:55,960
orbit non circular orbit than deserts so

321
00:15:02,430 --> 00:14:58,570
right now we have short and hot southern

322
00:15:06,630 --> 00:15:02,440
summers and cooler but longer northern

323
00:15:08,520 --> 00:15:06,640
summers and so we see the RSL in

324
00:15:10,350 --> 00:15:08,530
southern suburbs and southern hemisphere

325
00:15:13,020 --> 00:15:10,360
we see them actually in northern spring

326
00:15:15,690 --> 00:15:13,030
in the northern hemisphere and in the

327
00:15:19,200 --> 00:15:15,700
equator we see them year-round but they

328
00:15:21,480 --> 00:15:19,210
follow the Sun the slope is a picture

329
00:15:23,190 --> 00:15:21,490
slope is active in the season when that

330
00:15:27,210 --> 00:15:23,200
slope is getting the most Sun depending

331
00:15:28,830 --> 00:15:27,220
on how its oriented all right with that

332
00:15:30,940 --> 00:15:28,840
I will turn it over to Liz you to

333
00:15:34,150 --> 00:15:30,950
explain the new results

334
00:15:35,710 --> 00:15:34,160
thank you operas today everyone it is

335
00:15:38,590 --> 00:15:35,720
truly an honor to be addressing this

336
00:15:40,810 --> 00:15:38,600
crowd about our results and discovery as

337
00:15:42,850 --> 00:15:40,820
Alfred mentioned we have been

338
00:15:46,150 --> 00:15:42,860

investigating these narrow streets and

339
00:15:48,639 --> 00:15:46,160
Mars ever since their discovery mainly

340
00:15:51,759 --> 00:15:48,649
to elucidate their formation mechanisms

341
00:15:53,350 --> 00:15:51,769
we know from prior investigation that

342
00:15:55,780 --> 00:15:53,360
these features form on Mars one two

343
00:15:58,389 --> 00:15:55,790
temperature condition is ideal for look

344
00:16:00,970 --> 00:15:58,399
at water to exist on the surface however

345
00:16:03,069 --> 00:16:00,980
as I also mentioned the key evidence was

346
00:16:06,790 --> 00:16:03,079
missing until now and that was their

347
00:16:09,610 --> 00:16:06,800
chemical identity an excellent way to

348
00:16:11,769 --> 00:16:09,620
validate the hypothesis that look at

349
00:16:14,949 --> 00:16:11,779
water plays a key role in the formation

350
00:16:17,560 --> 00:16:14,959
mechanism of these dark Street is via

351
00:16:20,800 --> 00:16:17,570
spectroscopy and this is what I will be

352
00:16:22,750 --> 00:16:20,810
talking about in this slide so if you've

353
00:16:25,269 --> 00:16:22,760
seen this slide there's a there's a

354
00:16:26,530 --> 00:16:25,279
there's an orbiter shooting Ray's down

355
00:16:28,930 --> 00:16:26,540
and that's that's basically what the

356
00:16:31,120 --> 00:16:28,940
word spectroscopy is an excellent

357
00:16:33,579 --> 00:16:31,130
example to illustrate the theory behind

358
00:16:36,400 --> 00:16:33,589
spectroscopy is for example a reason why

359
00:16:39,400 --> 00:16:36,410
leaves the green our human eyes can

360
00:16:43,449 --> 00:16:39,410
recognize various colors we can see red

361
00:16:45,610 --> 00:16:43,459
blue yellow pink etc but the reason

362
00:16:47,410 --> 00:16:45,620
leaves were green to our human eyes is

363
00:16:49,449 --> 00:16:47,420

because a major component of leaves

364
00:16:50,920 --> 00:16:49,459
which is a chlorophyll absorbs all the

365
00:16:53,110 --> 00:16:50,930
other lights our human eyes our

366
00:16:56,079 --> 00:16:53,120
sensitivity and reflect the green light

367
00:16:58,569 --> 00:16:56,089
in the same way we can view the surface

368
00:17:00,370 --> 00:16:58,579
of Mars in different color which is what

369
00:17:03,130 --> 00:17:00,380
you see in this illustration both in

370
00:17:06,309 --> 00:17:03,140
visible and infrared light and see how

371
00:17:09,130 --> 00:17:06,319
light is absorbed by various minerals on

372
00:17:10,780 --> 00:17:09,140
the surface we have an excellent

373
00:17:13,240 --> 00:17:10,790
instrument called prism on board

374
00:17:15,520 --> 00:17:13,250
Marshall connaissance orbiter which is

375
00:17:17,590 --> 00:17:15,530
what you see in the illustration and it

376
00:17:20,500 --> 00:17:17,600
can observe the surface of Mars at

377
00:17:22,390 --> 00:17:20,510
various wavelength in this work so what

378
00:17:24,400 --> 00:17:22,400
we did was we went through these places

379
00:17:26,260 --> 00:17:24,410
were receiving nearest reef and observe

380
00:17:28,600 --> 00:17:26,270
the interaction between light and the

381
00:17:30,700 --> 00:17:28,610
surface material to see if there was any

382
00:17:33,370 --> 00:17:30,710
such as scopic evidence to support our

383
00:17:37,630 --> 00:17:33,380
liquid water hypothesis so if we go to

384
00:17:39,549 --> 00:17:37,640
next slide in the next slide in this

385
00:17:40,570 --> 00:17:39,559
slide you're seeing an animated 3d

386
00:17:43,060 --> 00:17:40,580
fly-through

387
00:17:44,580 --> 00:17:43,070
of a peak with dark narrow streets

388
00:17:47,320 --> 00:17:44,590

flowing out of them

389
00:17:49,630 --> 00:17:47,330
during the summer month this peak can

390
00:17:51,700 --> 00:17:49,640
contain hundreds of nearest street this

391
00:17:53,110 --> 00:17:51,710
is the same peak that I'm outfit was

392
00:17:55,420 --> 00:17:53,120
earlier talking about Horovitz

393
00:17:57,190 --> 00:17:55,430
we looked at the surface using the

394
00:17:58,810 --> 00:17:57,200
instrument I described before call

395
00:18:02,470 --> 00:17:58,820
curtain to see if there is any evidence

396
00:18:04,810 --> 00:18:02,480
for the liquid water hypothesis so if we

397
00:18:08,860 --> 00:18:04,820
go to the next slide I can show you some

398
00:18:11,640 --> 00:18:08,870
of the results here you can see two

399
00:18:14,170 --> 00:18:11,650
squiggly black lines which are our

400
00:18:16,060 --> 00:18:14,180
observations from the exact place where

401
00:18:18,850 --> 00:18:16,070
we saw the narrow streets in the

402
00:18:20,950 --> 00:18:18,860
previous animation these quickly lines

403
00:18:23,530 --> 00:18:20,960
they're called spectra and you can

404
00:18:26,320 --> 00:18:23,540
observe a few big dips in them if you

405
00:18:30,580 --> 00:18:26,330
read the x-axis you can see that there's

406
00:18:32,680 --> 00:18:30,590
a big dip from 1.9 microns which meet at

407
00:18:35,080 --> 00:18:32,690
that particular wavelength light is

408
00:18:37,540 --> 00:18:35,090
being absorbed by whatever is present on

409
00:18:39,940 --> 00:18:37,550
the surface additionally you see the

410
00:18:42,070 --> 00:18:39,950
same thing about at about two point one

411
00:18:44,170 --> 00:18:42,080
four micron another deep which means

412
00:18:46,000 --> 00:18:44,180
light is also being absorbed at this

413
00:18:48,250 --> 00:18:46,010

wavelength and there are a few other

414
00:18:50,860 --> 00:18:48,260
smaller absorption feature we see on the

415
00:18:52,450 --> 00:18:50,870
spectrum now we can go here on earth we

416
00:18:55,330 --> 00:18:52,460
can go to our laboratory and find out

417
00:18:58,000 --> 00:18:55,340
which ammonia which minerals can absorb

418
00:18:59,680 --> 00:18:58,010
light at the specific wavelength and I

419
00:19:02,320 --> 00:18:59,690
present that result in the colored

420
00:19:05,230 --> 00:19:02,330
squiggly lines and I label it laboratory

421
00:19:08,530 --> 00:19:05,240
observations we found that our

422
00:19:10,570 --> 00:19:08,540
observation on Mars is well matched by a

423
00:19:13,420 --> 00:19:10,580
salt composed of chlorine and oxygen

424
00:19:15,730 --> 00:19:13,430
called perchlorate and especially when

425
00:19:18,250 --> 00:19:15,740
they are hydrated and that is really the

426
00:19:20,890 --> 00:19:18,260
key here had the hydration perfectly

427
00:19:23,110 --> 00:19:20,900
salts are hydrated when we observe them

428
00:19:25,810 --> 00:19:23,120
means that there's presence of molecular

429
00:19:26,560 --> 00:19:25,820
water in their crystal structure the

430
00:19:28,660 --> 00:19:26,570
spacecraft

431
00:19:31,210 --> 00:19:28,670
mr.oat I was talking before observes the

432
00:19:33,580 --> 00:19:31,220
surface of Mars every day at roughly

433
00:19:36,130 --> 00:19:33,590
3:00 p.m. which is the driest time of

434
00:19:38,110 --> 00:19:36,140
the day so most of the liquid water

435
00:19:41,380 --> 00:19:38,120
would have been completely evaporated

436
00:19:43,720 --> 00:19:41,390
however the molecular water trapped

437
00:19:46,090 --> 00:19:43,730
inside the salt structure would be a bit

438
00:19:48,880 --> 00:19:46,100

more stable and that is exactly what we

439
00:19:51,430 --> 00:19:48,890
observe here this means that the source

440
00:19:53,230 --> 00:19:51,440
of hydration or two sources molecular

441
00:19:55,480 --> 00:19:53,240
water in the crystal structure of the

442
00:19:57,529 --> 00:19:55,490
salt itself is either due to these

443
00:19:59,810 --> 00:19:57,539
features of ourselves

444
00:20:02,899 --> 00:19:59,820
or some other processes that created

445
00:20:05,239 --> 00:20:02,909
these streaks regardless the presence of

446
00:20:06,799 --> 00:20:05,249
hydrated cells in these slopes means

447
00:20:10,849 --> 00:20:06,809
that these speakers are forming to

448
00:20:12,919 --> 00:20:10,859
contemporary liquid water we see similar

449
00:20:15,049 --> 00:20:12,929
spectroscopic signature in few of the

450
00:20:19,489 --> 00:20:15,059
places around Mars if we go to the next

451
00:20:22,159 --> 00:20:19,499
slide this is poly clear crater and you

452
00:20:24,320 --> 00:20:22,169
can see arrows pointing through some

453
00:20:26,989 --> 00:20:24,330
faded streaks flowing out of the crater

454
00:20:28,700 --> 00:20:26,999
wall this is in a slightly different

455
00:20:31,249 --> 00:20:28,710
location in the southern hemisphere of

456
00:20:33,109 --> 00:20:31,259
Mars at this location actually we have

457
00:20:35,989 --> 00:20:33,119
multiple observations from different

458
00:20:38,930 --> 00:20:35,999
times however we see the hydrated salts

459
00:20:40,969 --> 00:20:38,940
only when these streets are Vegas at

460
00:20:43,399 --> 00:20:40,979
other times when the streets are narrow

461
00:20:46,369 --> 00:20:43,409
and short we do not see any evidence of

462
00:20:48,259 --> 00:20:46,379
hydration this again just like Horace

463
00:20:50,389 --> 00:20:48,269

means that the source of hydration or

464
00:20:52,820 --> 00:20:50,399
the source of molecular water in the

465
00:20:55,369 --> 00:20:52,830
crystal structure of the salt is either

466
00:20:58,039 --> 00:20:55,379
due to the presence of ourselves or some

467
00:21:00,499 --> 00:20:58,049
other processes that created RSL

468
00:21:02,690 --> 00:21:00,509
regardless again just like all of it the

469
00:21:05,119 --> 00:21:02,700
presence of hydrated salts in its slope

470
00:21:08,539 --> 00:21:05,129
means that these features are forming

471
00:21:11,149 --> 00:21:08,549
these do contemporary liquid water we go

472
00:21:13,129 --> 00:21:11,159
to the next slide the presence of

473
00:21:16,759 --> 00:21:13,139
reploid also has some other big

474
00:21:20,359 --> 00:21:16,769
implication for water on Mars you can

475
00:21:22,009 --> 00:21:20,369
see the pure water stability on earth if

476
00:21:23,599 --> 00:21:22,019
you for example if you take a glass of

477
00:21:26,180 --> 00:21:23,609
liquid water here in Earth the water

478
00:21:28,669 --> 00:21:26,190
will remain and look at for until you

479
00:21:30,739 --> 00:21:28,679
get your degree Celsius when it will

480
00:21:32,570 --> 00:21:30,749
start turning into ice if the

481
00:21:34,219 --> 00:21:32,580
temperature opposes about 100 degrees

482
00:21:35,960 --> 00:21:34,229
Celsius then that cup of liquid water

483
00:21:38,889 --> 00:21:35,970
will start boiling and most the water

484
00:21:41,629 --> 00:21:38,899
will start going into the vapor phase

485
00:21:43,729 --> 00:21:41,639
next if we take the same glass of water

486
00:21:45,950 --> 00:21:43,739
to the surface of Mars similar thing

487
00:21:48,529 --> 00:21:45,960
will happen the water will freeze at 0

488
00:21:50,570 --> 00:21:48,539

degrees Celsius but because of the thin

489
00:21:52,190 --> 00:21:50,580
atmosphere of Mars the water will start

490
00:21:54,409 --> 00:21:52,200
boiling as soon as the temperature

491
00:21:56,869 --> 00:21:54,419
reaches close to 10 degrees Celsius

492
00:21:59,330 --> 00:21:56,879
therefore pure liquid water is highly

493
00:22:01,999 --> 00:21:59,340
unstable on the surface of Mars and this

494
00:22:06,109 --> 00:22:02,009
is where perchlorate can help us next

495
00:22:08,869 --> 00:22:06,119
consider a water mixed with Berkeley for

496
00:22:11,270 --> 00:22:08,879
perchlorate brine if that happens then

497
00:22:14,270 --> 00:22:11,280
the stability of salty looking water

498
00:22:16,880 --> 00:22:14,280
surface of Mars vastly increases and you

499
00:22:19,010 --> 00:22:16,890
can see in the graphic the perchlorate

500
00:22:21,380 --> 00:22:19,020
brine will remain in a liquid form until

501
00:22:24,020 --> 00:22:21,390
we hit negative 70 degrees Celsius and

502
00:22:26,380 --> 00:22:24,030
will not start boiling until it is 24

503
00:22:28,790 --> 00:22:26,390
degrees salty

504
00:22:31,160 --> 00:22:28,800
therefore the presence of perchlorates

505
00:22:33,920 --> 00:22:31,170
vastly increases our the stability of

506
00:22:36,350 --> 00:22:33,930
liquid water on the surface of Mars and

507
00:22:38,600 --> 00:22:36,360
perchloric also has one of the hughes

508
00:22:40,310 --> 00:22:38,610
implication for water on Mars and for

509
00:22:43,280 --> 00:22:40,320
that I'm going to turn it to Mary Beth

510
00:22:45,380 --> 00:22:43,290
to explain that and thank you gentlemen

511
00:22:47,420 --> 00:22:45,390
then we will now hear from Mary

512
00:22:48,560 --> 00:22:47,430
Bethlehem we'll go to the west coast at

513
00:22:53,390 --> 00:22:48,570

the Ames Research Center

514
00:22:56,570 --> 00:22:53,400
Mary Beth thanks Duane and thanks lose

515
00:22:58,490 --> 00:22:56,580
you so lose ooh discussed the first

516
00:23:00,470 --> 00:22:58,500
major implication of our work which

517
00:23:02,240 --> 00:23:00,480
pertains to the increased stability of

518
00:23:03,890 --> 00:23:02,250
liquid water on the surface of Mars I

519
00:23:05,780 --> 00:23:03,900
will now discuss the second major

520
00:23:09,800 --> 00:23:05,790
implication and then discuss some of the

521
00:23:11,750 --> 00:23:09,810
broader significance of our findings so

522
00:23:13,700 --> 00:23:11,760
perchlorate salts have a special

523
00:23:16,040 --> 00:23:13,710
capability pertaining to the absorption

524
00:23:16,460 --> 00:23:16,050
of atmospheric water through a process

525
00:23:19,310 --> 00:23:16,470
called

526
00:23:21,020 --> 00:23:19,320
deliquescent basically if the humidity

527
00:23:23,480 --> 00:23:21,030
and the Martian atmosphere gets high

528
00:23:25,070 --> 00:23:23,490
enough perchlorate salts will absorb the

529
00:23:27,280 --> 00:23:25,080
atmospheric water until the salt

530
00:23:29,990 --> 00:23:27,290
dissolves and forms a liquid solution

531
00:23:35,150 --> 00:23:30,000
this is one possibility for explaining

532
00:23:36,800 --> 00:23:35,160
the formation of RSL so this sort of

533
00:23:39,050 --> 00:23:36,810
physical process can explain the

534
00:23:41,120 --> 00:23:39,060
features that we observed here the

535
00:23:44,200 --> 00:23:41,130
discrete darker patches observed in this

536
00:23:46,910 --> 00:23:44,210
image may be formed by deliquescent it

537
00:23:49,100 --> 00:23:46,920
is also possible that the formation of

538
00:23:51,440 --> 00:23:49,110

RSL is due to other types of processes

539
00:23:52,430 --> 00:23:51,450
in which we won't go into depth on here

540
00:23:54,380 --> 00:23:52,440
perchlorates

541
00:23:56,030 --> 00:23:54,390
have a much higher ability to dissolve

542
00:23:57,560 --> 00:23:56,040
in water compared with other salts that

543
00:23:59,900 --> 00:23:57,570
we see at the Martian surface

544
00:24:01,580 --> 00:23:59,910
so our observations could also be

545
00:24:03,770 --> 00:24:01,590
explained by some other liquid water

546
00:24:05,570 --> 00:24:03,780
source dissolving perchlorates that are

547
00:24:07,580 --> 00:24:05,580
naturally present in the soil and then

548
00:24:09,830 --> 00:24:07,590
later depositing them as a solid in

549
00:24:14,210 --> 00:24:09,840
higher concentrations but again

550
00:24:15,500 --> 00:24:14,220
deliquescent is our favorite scenario so

551
00:24:17,640 --> 00:24:15,510
here you see a map of the distribution

552
00:24:19,950 --> 00:24:17,650
of perchlorates on Mars

553
00:24:21,630 --> 00:24:19,960
the red triangles indicate places on the

554
00:24:23,670 --> 00:24:21,640
surface where perchlorates have

555
00:24:26,060 --> 00:24:23,680
previously we have previously been

556
00:24:28,260 --> 00:24:26,070
detected by Rovers or Landers

557
00:24:30,210 --> 00:24:28,270
perchlorate is suspected to be present

558
00:24:32,130 --> 00:24:30,220
at both of the Viking landing sites and

559
00:24:34,920 --> 00:24:32,140
was found in the northern plains by the

560
00:24:36,870 --> 00:24:34,930
Phoenix mission in the late 2000s most

561
00:24:38,520 --> 00:24:36,880
recently it was detected at Gale Crater

562
00:24:41,750 --> 00:24:38,530
by the sample analysis at Mars

563
00:24:44,880 --> 00:24:41,760

instrument aboard the Curiosity rover

564
00:24:47,160 --> 00:24:44,890
our detection of perchlorate sat RSL

565
00:24:49,410 --> 00:24:47,170
sites are shown here in blue are the

566
00:24:51,720 --> 00:24:49,420
first to be made using data acquired by

567
00:24:53,970 --> 00:24:51,730
an orbiter we have increased the number

568
00:24:56,370 --> 00:24:53,980
of known locations of this important

569
00:24:57,930 --> 00:24:56,380
resource on the Martian surface showing

570
00:24:59,760 --> 00:24:57,940
that perchlorates are perhaps more

571
00:25:01,640 --> 00:24:59,770
widely distributed than previously

572
00:25:04,500 --> 00:25:01,650
thought

573
00:25:05,910 --> 00:25:04,510
so to summarize our findings strongly

574
00:25:08,100 --> 00:25:05,920
suggest that these recurring slope

575
00:25:10,350 --> 00:25:08,110
lineae are formed by liquid water on

576
00:25:12,600 --> 00:25:10,360
present-day Mars the spectroscopic

577
00:25:14,940 --> 00:25:12,610
detection of hydrated perchlorates

578
00:25:17,790 --> 00:25:14,950
indicates that this water is briny and

579
00:25:19,680 --> 00:25:17,800
not pure so if that I'll now discuss

580
00:25:25,470 --> 00:25:19,690
some of the broader significance of our

581
00:25:26,880 --> 00:25:25,480
findings so water as I'm sure many of

582
00:25:28,980 --> 00:25:26,890
you have heard us say on multiple

583
00:25:29,400 --> 00:25:28,990
occasions is an essential ingredient for

584
00:25:32,130 --> 00:25:29,410
life

585
00:25:34,140 --> 00:25:32,140
our results may point to more habitable

586
00:25:37,290 --> 00:25:34,150
conditions on the near surface of Mars

587
00:25:39,660 --> 00:25:37,300
than previously thought here potential

588
00:25:42,810 --> 00:25:39,670

habitability by earth-like microbes is

589
00:25:44,760 --> 00:25:42,820
unclear to assess habitability we would

590
00:25:47,640 --> 00:25:44,770
first need to determine how cold and how

591
00:25:49,230 --> 00:25:47,650
concentrated the brine is but the

592
00:25:51,480 --> 00:25:49,240
detection that we've described warrants

593
00:25:53,850 --> 00:25:51,490
further astrobiological characterization

594
00:25:58,740 --> 00:25:53,860
and exploration of these unique regions

595
00:26:00,480 --> 00:25:58,750
on Mars finally water may be an

596
00:26:02,520 --> 00:26:00,490
important resource for future human

597
00:26:05,220 --> 00:26:02,530
explorers and inhabitants of Mars and

598
00:26:07,650 --> 00:26:05,230
may decrease the cost and increase the

599
00:26:10,410 --> 00:26:07,660
resilience of human activity on the Red

600
00:26:12,960 --> 00:26:10,420
Planet looking forward it is imperative

601
00:26:14,549 --> 00:26:12,970
for us to further understand the source

602
00:26:16,650 --> 00:26:14,559
of these water for these features as

603
00:26:18,060 --> 00:26:16,660
well as the amount and with that I'll

604
00:26:18,780 --> 00:26:18,070
turn it back over to you Dwayne at NASA

605
00:26:21,450 --> 00:26:18,790
headquarters

606
00:26:24,240 --> 00:26:21,460
Thank You Mary Beth okay ladies John we

607
00:26:27,180 --> 00:26:24,250
now will transition to our question and

608
00:26:28,380 --> 00:26:27,190
answer we have a lot of media not only

609
00:26:30,419 --> 00:26:28,390
here in Washington but on the phone

610
00:26:30,990 --> 00:26:30,429
lines and we want to get to social media

611
00:26:33,420 --> 00:26:31,000
so what

612
00:26:36,360 --> 00:26:33,430
to ask you wait for the mic please limit

613
00:26:38,280 --> 00:26:36,370

your question to one I will try to get

614
00:26:39,090 --> 00:26:38,290
to as many questions our participants

615
00:26:41,430 --> 00:26:39,100
will be here

616
00:26:43,170 --> 00:26:41,440
following a press conference but let's

617
00:26:44,930 --> 00:26:43,180
we have a gentleman here if we get a mic

618
00:26:48,180 --> 00:26:44,940
here and your name an affiliation please

619
00:26:50,190 --> 00:26:48,190
agreed I'm chip Reed with CBS News and

620
00:26:52,410 --> 00:26:50,200
I'd like to try to pin you down given

621
00:26:54,390 --> 00:26:52,420
all this new evidence how likely do you

622
00:26:56,250 --> 00:26:54,400
think it is a one to ten point scale or

623
00:27:02,160 --> 00:26:56,260
whatever you choose that today there is

624
00:27:03,660 --> 00:27:02,170
some form of life on Mars okay I guess I

625
00:27:06,930 --> 00:27:03,670
everybody's looking at me so I'll give

626
00:27:09,030 --> 00:27:06,940
you a my feeling you know when you look

627
00:27:11,490 --> 00:27:09,040
at Earth the water is an essential

628
00:27:13,080 --> 00:27:11,500
ingredient and just about well not just

629
00:27:14,790 --> 00:27:13,090
about everywhere we go whether it's

630
00:27:19,170 --> 00:27:14,800
liquid water whether it's deep in the

631
00:27:22,050 --> 00:27:19,180
earth or in the arid regions we find

632
00:27:24,180 --> 00:27:22,060
life this is tremendously exciting we

633
00:27:26,640 --> 00:27:24,190
haven't been able to answer the question

634
00:27:28,980 --> 00:27:26,650
does life exist beyond Earth but

635
00:27:32,130 --> 00:27:28,990
following the water is critical element

636
00:27:33,660 --> 00:27:32,140
of that we now have I think great

637
00:27:35,550 --> 00:27:33,670
opportunities to be in the right

638
00:27:38,160 --> 00:27:35,560

locations on Mars to thoroughly

639
00:27:40,320 --> 00:27:38,170
investigate that and I think the

640
00:27:41,580 --> 00:27:40,330
reoccurring slope lineae with the with

641
00:27:44,670 --> 00:27:41,590
the actual of water on the surface

642
00:27:47,280 --> 00:27:44,680
allows us with surface mobility that we

643
00:27:49,170 --> 00:27:47,290
have in our assets now and in the future

644
00:27:50,970 --> 00:27:49,180
to be able to go over to thoroughly

645
00:27:52,560 --> 00:27:50,980
investigate that and indeed look for

646
00:27:56,400 --> 00:27:52,570
life and then make that positive

647
00:27:58,350 --> 00:27:56,410
identification and oh good job I'm sorry

648
00:28:02,130 --> 00:27:58,360
I just think the really exciting thing

649
00:28:04,260 --> 00:28:02,140
about this is that our view of Mars of

650
00:28:07,440 --> 00:28:04,270
this ancient Mars and the possibility of

651
00:28:10,590 --> 00:28:07,450
you know life originating on Mars has

652
00:28:13,830 --> 00:28:10,600
been really about seeking chemical

653
00:28:16,500 --> 00:28:13,840
fossils of possible past life on Mars

654
00:28:19,470 --> 00:28:16,510
the existence of liquid water even if

655
00:28:23,040 --> 00:28:19,480
it's super salty briny water gives the

656
00:28:24,990 --> 00:28:23,050
possibility that if there's life on Mars

657
00:28:27,960 --> 00:28:25,000
you know that we have a way to describe

658
00:28:30,630 --> 00:28:27,970
how it might survive and that we are now

659
00:28:33,120 --> 00:28:30,640
at a point technologically with in over

660
00:28:35,910 --> 00:28:33,130
50 years of successful space flight that

661
00:28:37,950 --> 00:28:35,920
we have the capability to go there ask

662
00:28:40,680 --> 00:28:37,960
this question of is there life on Mars

663
00:28:42,180 --> 00:28:40,690

and answer it you know this is to me the

664
00:28:44,380 --> 00:28:42,190
most exciting thing is now that question

665
00:28:47,290 --> 00:28:44,390
is not an abstract

666
00:28:50,140 --> 00:28:47,300
scientific question it's a concrete one

667
00:28:52,450 --> 00:28:50,150
that we can answer okay yeah I would

668
00:28:56,190 --> 00:28:52,460
just like to add sort of a sensibility

669
00:28:58,930 --> 00:28:56,200
about how much we don't know

670
00:29:02,140 --> 00:28:58,940
we have only one example of life and

671
00:29:04,870 --> 00:29:02,150
that's us this is it on planet Earth we

672
00:29:07,510 --> 00:29:04,880
don't know how it started and so one of

673
00:29:09,490 --> 00:29:07,520
the things that we found at Mars is we

674
00:29:12,460 --> 00:29:09,500
know that Mars could have supported life

675
00:29:14,590 --> 00:29:12,470
at least what we know about life but we

676
00:29:16,990 --> 00:29:14,600
don't know how life started here so we

677
00:29:19,090 --> 00:29:17,000
don't know if it's possible for life to

678
00:29:21,310 --> 00:29:19,100
is started on Mars and so that's a huge

679
00:29:23,050 --> 00:29:21,320
question that needs further exploration

680
00:29:24,250 --> 00:29:23,060
and it's only through that exploration

681
00:29:26,290 --> 00:29:24,260
that we're going to narrow the

682
00:29:28,540 --> 00:29:26,300
possibilities down and maybe get but

683
00:29:30,910 --> 00:29:28,550
actually a direct answer doesn't of

684
00:29:32,500 --> 00:29:30,920
course a judge is going to just expand a

685
00:29:34,960 --> 00:29:32,510
little bit on that you know now that we

686
00:29:38,350 --> 00:29:34,970
know what we're looking for with with

687
00:29:41,800 --> 00:29:38,360
high rise we can begin a better search

688
00:29:44,560 --> 00:29:41,810

we can begin to be more methodical we

689
00:29:47,530 --> 00:29:44,570
can look and see if we can determine if

690
00:29:50,020 --> 00:29:47,540
there is some sort of aquifer Network

691
00:29:51,760 --> 00:29:50,030
that may be supplying these we don't

692
00:29:54,450 --> 00:29:51,770
know that there are other theories other

693
00:29:57,790 --> 00:29:54,460
ideas but that is actually the next step

694
00:29:59,950 --> 00:29:57,800
how much water that when it left the

695
00:30:02,560 --> 00:29:59,960
planet went into the soil one

696
00:30:04,030 --> 00:30:02,570
underground and that as we said is there

697
00:30:07,660 --> 00:30:04,040
also a resource for human exploration

698
00:30:10,960 --> 00:30:07,670
for us so if there is indeed those kind

699
00:30:12,820 --> 00:30:10,970
of resources that we can begin to probe

700
00:30:16,390 --> 00:30:12,830
we might be able to answer that question

701
00:30:17,800 --> 00:30:16,400
pretty quickly so that question probably

702
00:30:19,740 --> 00:30:17,810
knocks out half of the question they're

703
00:30:22,360 --> 00:30:19,750
going to get today let me see if our

704
00:30:24,220 --> 00:30:22,370
scientists in France or Mary Beth if you

705
00:30:28,260 --> 00:30:24,230
all want to chime in on that question I

706
00:30:30,910 --> 00:30:28,270
will start with France Alpha deluging

707
00:30:32,920 --> 00:30:30,920
well I would just say that I think the

708
00:30:34,660 --> 00:30:32,930
possibility of life in the interior of

709
00:30:36,670 --> 00:30:34,670
Mars has always been very high there's

710
00:30:41,200 --> 00:30:36,680
certainly water somewhere in the crust

711
00:30:42,940 --> 00:30:41,210
of Mars and Mars has received meteorites

712
00:30:47,080 --> 00:30:42,950
from Earth it's been contaminated by

713
00:30:49,180 --> 00:30:47,090

earth rocks we know that microbes can

714
00:30:51,100 --> 00:30:49,190
survive that trip so it's very likely I

715
00:30:54,850 --> 00:30:51,110
think that there's life somewhere in the

716
00:30:56,650 --> 00:30:54,860
crust of Mars microbes but it's where is

717
00:30:58,000 --> 00:30:56,660
it how accessible is it is very

718
00:30:59,560 --> 00:30:58,010
difficult now maybe

719
00:31:01,090 --> 00:30:59,570
something we can find close to the

720
00:31:03,190 --> 00:31:01,100
surface and that's that's what's

721
00:31:05,409 --> 00:31:03,200
exciting but to me the chances of there

722
00:31:11,260 --> 00:31:05,419
being life in the subsurface of Mars has

723
00:31:13,539 --> 00:31:11,270
always been very high okay just a

724
00:31:15,159 --> 00:31:13,549
reminder to our many many many social

725
00:31:17,680 --> 00:31:15,169
media folks send in your questions at

726
00:31:19,570 --> 00:31:17,690
hashtag ask NASA and we're going to

727
00:31:22,270 --> 00:31:19,580
continue here at headquarters before we

728
00:31:25,840 --> 00:31:22,280
go to the phone lines and we have we go

729
00:31:27,880 --> 00:31:25,850
this later here then here give you name

730
00:31:29,680 --> 00:31:27,890
affiliation please hi Anna Wilding

731
00:31:31,750 --> 00:31:29,690
Harold Dupree newspaper we publish an

732
00:31:33,730 --> 00:31:31,760
English and French how today's

733
00:31:36,100 --> 00:31:33,740
announcements affect your timeline

734
00:31:37,780 --> 00:31:36,110
timeframe for going to NASA and the

735
00:31:39,310 --> 00:31:37,790
possibility of coming back and does any

736
00:31:41,860 --> 00:31:39,320
budget allocated towards cultural

737
00:31:44,110 --> 00:31:41,870
resources finding any sign of cultural

738
00:31:46,150 --> 00:31:44,120

resources on NASA I know you're looking

739
00:31:49,200 --> 00:31:46,160
at the water but what about potential

740
00:31:52,419 --> 00:31:49,210
habitats or anything like that as well

741
00:31:55,330 --> 00:31:52,429
is there a budget well we do have a Mars

742
00:31:57,460 --> 00:31:55,340
budget for future scientific exploration

743
00:32:00,580 --> 00:31:57,470
and in fact we have a number of exciting

744
00:32:03,430 --> 00:32:00,590
missions that are queued up both NASA

745
00:32:06,460 --> 00:32:03,440
led and also European Space Agency led

746
00:32:09,789 --> 00:32:06,470
with the partnership with Russia and so

747
00:32:12,220 --> 00:32:09,799
we have the insight Lander which is

748
00:32:13,960 --> 00:32:12,230
going to launch next year and will tell

749
00:32:15,610 --> 00:32:13,970
us about the interior of Mars it's the

750
00:32:18,280 --> 00:32:15,620
first time we're going to look into Mars

751
00:32:20,260 --> 00:32:18,290
by putting a seismometer sort of an

752
00:32:22,090 --> 00:32:20,270
earthquake sensor and a heat flow

753
00:32:23,680 --> 00:32:22,100
experiment to tell us about the interior

754
00:32:27,400 --> 00:32:23,690
of Mars and so that's very exciting and

755
00:32:29,080 --> 00:32:27,410
is linked to these broader questions the

756
00:32:31,450 --> 00:32:29,090
European Space Agency with Russia is

757
00:32:34,900 --> 00:32:31,460
launching a mission called ExoMars also

758
00:32:37,000 --> 00:32:34,910
in 2016 and in 2018 they have a lander

759
00:32:38,770 --> 00:32:37,010
going down and in partnership with NASA

760
00:32:40,750 --> 00:32:38,780
we have an organ organic molecular

761
00:32:42,700 --> 00:32:40,760
analyzer and they're going to have a

762
00:32:44,890 --> 00:32:42,710
deep drill that's going to drill under

763
00:32:46,330 --> 00:32:44,900

the surface bring up materials and

764
00:32:49,620 --> 00:32:46,340
analyze it to see if there's organic

765
00:32:52,510 --> 00:32:49,630
matter organic mean meaning related to

766
00:32:54,760 --> 00:32:52,520
carbon compounds but specifically ones

767
00:32:56,770 --> 00:32:54,770
that might have been created by life so

768
00:32:59,590 --> 00:32:56,780
that's very exciting and then in 2020 is

769
00:33:01,750 --> 00:32:59,600
our next big NASA rover following on

770
00:33:04,180 --> 00:33:01,760
curiosity that will actually collect

771
00:33:06,520 --> 00:33:04,190
samples so that eventually we can bring

772
00:33:08,350 --> 00:33:06,530
them back to earth put them in our best

773
00:33:10,240 --> 00:33:08,360
analytical instruments and see if we see

774
00:33:11,710 --> 00:33:10,250
any signs of ancient or

775
00:33:14,290 --> 00:33:11,720
conditions that would tell us that

776
00:33:15,700 --> 00:33:14,300
there's life on Mars that's just the

777
00:33:17,560 --> 00:33:15,710
beginning that's just in the next five

778
00:33:19,090 --> 00:33:17,570
years you know beyond that we have lots

779
00:33:21,700 --> 00:33:19,100
of plans as part of our journey to Mars

780
00:33:23,920 --> 00:33:21,710
that include developing the Space Launch

781
00:33:25,570 --> 00:33:23,930
System a big rocket that will better in

782
00:33:27,400 --> 00:33:25,580
the future be able to get payloads to

783
00:33:29,770 --> 00:33:27,410
Mars and perhaps a round-trip mission

784
00:33:31,360 --> 00:33:29,780
and we're still sketching out what that

785
00:33:33,280 --> 00:33:31,370
looks like the future is always more

786
00:33:36,100 --> 00:33:33,290
fuzzy than the current but certainly

787
00:33:39,070 --> 00:33:36,110
these exciting results only encourage us

788
00:33:40,390 --> 00:33:39,080

for the future of Mars exploration we

789
00:33:42,070 --> 00:33:40,400
also shouldn't discount what we

790
00:33:44,920 --> 00:33:42,080
currently have as assets that are there

791
00:33:46,720 --> 00:33:44,930
they're actually relatively healthy the

792
00:33:49,270 --> 00:33:46,730
Mars Reconnaissance Orbiter is doing a

793
00:33:50,950 --> 00:33:49,280
fabulous job it's got high resolution

794
00:33:52,900 --> 00:33:50,960
imaging and as we talked about the

795
00:33:55,150 --> 00:33:52,910
mineralogy and from chrism that it's

796
00:33:56,890 --> 00:33:55,160
been doing you know when you look at

797
00:33:58,870 --> 00:33:56,900
even though it's been there nearly nine

798
00:34:01,150 --> 00:33:58,880
years it's only really mapped about

799
00:34:03,670 --> 00:34:01,160
three or four percent in high resolution

800
00:34:06,370 --> 00:34:03,680
of Mars there's so much more that we

801
00:34:08,440 --> 00:34:06,380
need to do to really look and understand

802
00:34:11,409 --> 00:34:08,450
that this kind of network all over the

803
00:34:14,379 --> 00:34:11,419
place and with that it'll enable us then

804
00:34:16,750 --> 00:34:14,389
to narrow down on some better places or

805
00:34:19,780 --> 00:34:16,760
more accessible places where we can get

806
00:34:22,149 --> 00:34:19,790
access to these kind of regions to

807
00:34:24,430 --> 00:34:22,159
really thoroughly examine curiosity is

808
00:34:26,530 --> 00:34:24,440
also in a nice location it's in Mount

809
00:34:29,740 --> 00:34:26,540
sharp it's doing great there's a

810
00:34:31,540 --> 00:34:29,750
potentially some dark streaks that are

811
00:34:33,100 --> 00:34:31,550
on Mount sharp we don't know much about

812
00:34:36,190 --> 00:34:33,110
those we don't know if they're

813
00:34:39,909 --> 00:34:36,200

reoccurring slope slope lineae there's a

814
00:34:42,480 --> 00:34:39,919
possibility that more more observations

815
00:34:44,860 --> 00:34:42,490
will eliminate those or or give us more

816
00:34:46,899 --> 00:34:44,870
data that could tell us that they also

817
00:34:49,060 --> 00:34:46,909
could be ourselves that we might be able

818
00:34:50,860 --> 00:34:49,070
to visit so there's some really exciting

819
00:34:53,020 --> 00:34:50,870
things just coming up even with our

820
00:34:54,490 --> 00:34:53,030
current assets one more question and

821
00:34:56,950 --> 00:34:54,500
then we go to the phone line sir

822
00:34:59,350 --> 00:34:56,960
keep it curly from ABC News John let's

823
00:35:01,200 --> 00:34:59,360
talk about astronauts this really is a

824
00:35:04,720 --> 00:35:01,210
breakthrough for human travel to Mars

825
00:35:06,760 --> 00:35:04,730
you could now purify the water create

826
00:35:09,580 --> 00:35:06,770
oxygen this makes it much easier doesn't

827
00:35:10,900 --> 00:35:09,590
it well I think all of the scientific

828
00:35:13,180 --> 00:35:10,910
discoveries that were making on the

829
00:35:16,240 --> 00:35:13,190
surface of Mars that curiosity reality

830
00:35:18,250 --> 00:35:16,250
at Gale Crater these observations from

831
00:35:20,530 --> 00:35:18,260
Mars Reconnaissance Orbiter are giving

832
00:35:21,859 --> 00:35:20,540
us a much better view that Mars has

833
00:35:25,460 --> 00:35:21,869
resources

834
00:35:27,019 --> 00:35:25,470
that are useful to future travelers when

835
00:35:29,809 --> 00:35:27,029
you have water you know what's water

836
00:35:32,180 --> 00:35:29,819
hydrogen and oxygen that's what we make

837
00:35:34,640 --> 00:35:32,190
rocket fuel out of perchlorates

838
00:35:36,349 --> 00:35:34,650

the Space Shuttle the solid rocket

839
00:35:38,420 --> 00:35:36,359
booters our boosters are aluminum

840
00:35:41,299 --> 00:35:38,430
perchlorate in principle you could make

841
00:35:43,009 --> 00:35:41,309
solid rocket fuel and and as we've

842
00:35:45,049 --> 00:35:43,019
talked about perchlorates are ubiquitous

843
00:35:46,749 --> 00:35:45,059
around Mars but the water really is

844
00:35:49,789 --> 00:35:46,759
crucial because we need water to drink

845
00:35:51,799 --> 00:35:49,799
oxygen to breathe we have carbon dioxide

846
00:35:54,650 --> 00:35:51,809
also oxygen so there are plenty of

847
00:35:56,059 --> 00:35:54,660
resources on Mars even nitrogen in the

848
00:35:57,680 --> 00:35:56,069
atmosphere which we don't usually think

849
00:36:00,920 --> 00:35:57,690
about because for us it's relatively

850
00:36:03,739 --> 00:36:00,930
inert but it's crucial for life both if

851
00:36:04,999 --> 00:36:03,749
life exists on Mars but also you know

852
00:36:06,739 --> 00:36:05,009
once we get there we're going to need

853
00:36:08,569 --> 00:36:06,749
nitrogen for a variety purposes so I

854
00:36:11,150 --> 00:36:08,579
think you know Mars is looking more and

855
00:36:13,400 --> 00:36:11,160
more that you know it's a potential

856
00:36:16,569 --> 00:36:13,410
habitat for extant life on Mars that

857
00:36:18,769 --> 00:36:16,579
could be as you heard you know from

858
00:36:20,420 --> 00:36:18,779
transfer from Earth one way or the other

859
00:36:23,210 --> 00:36:20,430
you know some people say we're Martians

860
00:36:24,829 --> 00:36:23,220
could go either way but the exciting

861
00:36:26,720 --> 00:36:24,839
thing is that I think we will send

862
00:36:28,609 --> 00:36:26,730
humans in the near future to Mars

863
00:36:31,400 --> 00:36:28,619

there'll be scientists looking for signs

864
00:36:33,289 --> 00:36:31,410
of life and also to be able to live on

865
00:36:36,430 --> 00:36:33,299
the surface and the resources are there

866
00:36:40,430 --> 00:36:36,440
I think it's important to realize that

867
00:36:42,950 --> 00:36:40,440
NASA's approach to exploration is as not

868
00:36:45,109 --> 00:36:42,960
Star Trek it's not go where no man has

869
00:36:47,210 --> 00:36:45,119
gone before as they say it's really a

870
00:36:49,069 --> 00:36:47,220
very methodical approach for which we

871
00:36:50,690 --> 00:36:49,079
learn everything about the environment

872
00:36:53,089 --> 00:36:50,700
that we're going to subject humans to

873
00:36:55,400 --> 00:36:53,099
that we possibly can and that's why our

874
00:36:57,979 --> 00:36:55,410
rigorous scientific program is really

875
00:37:00,769 --> 00:36:57,989
the pioneers that are making steady

876
00:37:02,839 --> 00:37:00,779
discoveries and I anticipate continuing

877
00:37:04,910 --> 00:37:02,849
to do that for many many years before

878
00:37:07,339 --> 00:37:04,920
humans even get into the vicinity of

879
00:37:10,099 --> 00:37:07,349
Mars will make rapid progress in these

880
00:37:13,190 --> 00:37:10,109
areas that does indeed help us

881
00:37:16,069 --> 00:37:13,200
understand the parameters and design

882
00:37:18,559 --> 00:37:16,079
better missions leverage and utilize the

883
00:37:20,809 --> 00:37:18,569
resources that are available and even

884
00:37:23,059 --> 00:37:20,819
make those kind of trips more feasible

885
00:37:25,849 --> 00:37:23,069
in the future than ever before fact I'll

886
00:37:28,640 --> 00:37:25,859
be very specific on our Mars 2020 lander

887
00:37:30,799 --> 00:37:28,650
we have an experiment that's not a

888
00:37:33,609 --> 00:37:30,809

classical science experiment in fact

889
00:37:35,660 --> 00:37:33,619
it's a Institute resource utilization

890
00:37:38,000 --> 00:37:35,670
experiment so you may hear that

891
00:37:41,360 --> 00:37:38,010
and we love our acronyms is ru but it's

892
00:37:44,060 --> 00:37:41,370
a small apparatus that's going to take

893
00:37:46,610 --> 00:37:44,070
in Martian atmosphere mostly carbon

894
00:37:49,670 --> 00:37:46,620
dioxide and extract the oxygen and

895
00:37:50,660 --> 00:37:49,680
that's its function we know we can do

896
00:37:52,760 --> 00:37:50,670
that on earth but we're going to

897
00:37:55,790 --> 00:37:52,770
demonstrate it on Mars and that's you

898
00:37:59,360 --> 00:37:55,800
know part of in our combination of human

899
00:38:01,700 --> 00:37:59,370
spaceflight space technology and science

900
00:38:05,030 --> 00:38:01,710
all in one now in addition to that on

901
00:38:06,980 --> 00:38:05,040
2020 is a underneath the rover is a

902
00:38:08,870 --> 00:38:06,990
radar actually it's a from Norway

903
00:38:12,700 --> 00:38:08,880
they're building it Norwegian Space

904
00:38:14,810 --> 00:38:12,710
Agency and this is a radar that will

905
00:38:17,000 --> 00:38:14,820
send weight radio waves through the

906
00:38:19,400 --> 00:38:17,010
ground return reflections will tell us

907
00:38:21,890 --> 00:38:19,410
what that strat is like and you know it

908
00:38:24,140 --> 00:38:21,900
might be able to uncover aquifers that

909
00:38:26,150 --> 00:38:24,150
are close to the close to the surface it

910
00:38:28,310 --> 00:38:26,160
could tell us how important experiments

911
00:38:30,920 --> 00:38:28,320
like that are for humans to be able to

912
00:38:32,900 --> 00:38:30,930
take and go to Mars and in fact the

913
00:38:34,820 --> 00:38:32,910

Moxie instrument which is great we're

914
00:38:36,200 --> 00:38:34,830
going to operate that all times during

915
00:38:38,060 --> 00:38:36,210
the day you know there's huge

916
00:38:40,370 --> 00:38:38,070
temperature and pressure swings on Mars

917
00:38:42,800 --> 00:38:40,380
so what is it like what's the efficiency

918
00:38:44,960 --> 00:38:42,810
of extracting the oxygen under various

919
00:38:47,300 --> 00:38:44,970
extremes not only during the day but all

920
00:38:49,220 --> 00:38:47,310
throughout a season so these are huge

921
00:38:51,200 --> 00:38:49,230
steps for us to be able to plan the

922
00:38:54,020 --> 00:38:51,210
right resources to support humans in the

923
00:38:56,330 --> 00:38:54,030
future okay let's go to the phone lines

924
00:39:00,550 --> 00:38:56,340
now and we're going to start out with

925
00:39:02,950 --> 00:39:00,560
Kim Chang of new york times again

926
00:39:05,420 --> 00:39:02,960
alright thanks for taking my question

927
00:39:07,820 --> 00:39:05,430
so you always say how exciting this is

928
00:39:09,620 --> 00:39:07,830
and we want and this thing wanted to go

929
00:39:11,510 --> 00:39:09,630
study the possibility of current life I

930
00:39:13,880 --> 00:39:11,520
was wondering when would you actually

931
00:39:17,060 --> 00:39:13,890
get there since none of the current

932
00:39:18,530 --> 00:39:17,070
spacecraft there or being planned have

933
00:39:20,840 --> 00:39:18,540
been clean enough to go to a special

934
00:39:22,700 --> 00:39:20,850
region I heard dr. green said that

935
00:39:25,990 --> 00:39:22,710
curiosity might goatees dark streaks

936
00:39:28,670 --> 00:39:26,000
under what parameters would that happen

937
00:39:30,410 --> 00:39:28,680
can you brought up a really important

938
00:39:33,170 --> 00:39:30,420

point I know Michael and Jim will

939
00:39:35,540 --> 00:39:33,180
comment on this but the question of is

940
00:39:37,700 --> 00:39:35,550
there life on Mars we know there's life

941
00:39:40,040 --> 00:39:37,710
on Mars already because we sent it there

942
00:39:42,560 --> 00:39:40,050
we try and clean our spacecraft as best

943
00:39:44,480 --> 00:39:42,570
as we can and the Vikings certainly were

944
00:39:46,060 --> 00:39:44,490
sterilized the best of any of our

945
00:39:48,900 --> 00:39:46,070
spacecraft because we just didn't know

946
00:39:52,140 --> 00:39:48,910
but the surface of Mars is really

947
00:39:54,030 --> 00:39:52,150
very harsh place it's got ultraviolet

948
00:39:55,620 --> 00:39:54,040
light from the Sun that bakes the

949
00:39:57,150 --> 00:39:55,630
outside of the spacecraft and it and if

950
00:39:59,160 --> 00:39:57,160
you want to kill microbes on earth you

951
00:40:01,680 --> 00:39:59,170
take a UV light and you kill the

952
00:40:04,260 --> 00:40:01,690
microbes how we've cleaned the

953
00:40:06,330 --> 00:40:04,270
spacecraft as best as we can but we know

954
00:40:08,310 --> 00:40:06,340
that you know microbial life bacteria

955
00:40:11,010 --> 00:40:08,320
are so tenacious that it's impossible to

956
00:40:13,860 --> 00:40:11,020
kill them all so we do the best job we

957
00:40:16,280 --> 00:40:13,870
can and then we send our spacecraft into

958
00:40:18,600 --> 00:40:16,290
areas that we think are the least

959
00:40:21,300 --> 00:40:18,610
sensitive to the possibility of

960
00:40:23,070 --> 00:40:21,310
contaminating extant Mars life and so

961
00:40:24,630 --> 00:40:23,080
what Ken Chang of the New York Times has

962
00:40:26,280 --> 00:40:24,640
suggested is how can we take a

963
00:40:28,200 --> 00:40:26,290

spacecraft like curiosity that may not

964
00:40:30,210 --> 00:40:28,210
have been cleaned as well as say Viking

965
00:40:31,380 --> 00:40:30,220
to an area that might have extant life

966
00:40:34,020 --> 00:40:31,390
and it's a great question

967
00:40:36,840 --> 00:40:34,030
but this is the scientific process this

968
00:40:38,520 --> 00:40:36,850
is why you know were you know crawling

969
00:40:41,520 --> 00:40:38,530
before we walk so to speak that we're

970
00:40:43,230 --> 00:40:41,530
being very careful that we don't send a

971
00:40:45,780 --> 00:40:43,240
spacecraft to Mars with the intention of

972
00:40:47,700 --> 00:40:45,790
detecting Martian life and find out we

973
00:40:50,430 --> 00:40:47,710
detected the earth life we took with us

974
00:40:52,980 --> 00:40:50,440
and this is the general well I mean it's

975
00:40:54,930 --> 00:40:52,990
you know that's tough to do when you

976
00:40:56,580 --> 00:40:54,940
actually go down and list you know how

977
00:40:59,640 --> 00:40:56,590
do you avoid doing that it's very hard

978
00:41:01,530 --> 00:40:59,650
and this is the general field that you

979
00:41:04,470 --> 00:41:01,540
may hear us talk about if planetary

980
00:41:06,600 --> 00:41:04,480
protection it's not only protecting the

981
00:41:08,910 --> 00:41:06,610
earth from bringing some alien life-form

982
00:41:10,590 --> 00:41:08,920
to earth but more so right now it's

983
00:41:13,170 --> 00:41:10,600
protecting the environments that we go

984
00:41:14,910 --> 00:41:13,180
to whether it's Mars or Europa to make

985
00:41:16,890 --> 00:41:14,920
sure you know that we don't contaminate

986
00:41:19,200 --> 00:41:16,900
other planets before we find out if

987
00:41:21,000 --> 00:41:19,210
we're alone in the universe yeah we

988
00:41:23,700 --> 00:41:21,010

don't really know if curiosity will be a

989
00:41:27,060 --> 00:41:23,710
have an opportunity to be able to go to

990
00:41:30,450 --> 00:41:27,070
one of these areas and find make

991
00:41:32,730 --> 00:41:30,460
measurement we as I mentioned have some

992
00:41:34,800 --> 00:41:32,740
linear streaks on Mount sharp that we

993
00:41:38,490 --> 00:41:34,810
just don't know enough about they may or

994
00:41:40,320 --> 00:41:38,500
may not be RSL's we've got a lot of work

995
00:41:42,360 --> 00:41:40,330
to do on that and then we have to make

996
00:41:43,620 --> 00:41:42,370
decisions on is curiosity really good

997
00:41:45,810 --> 00:41:43,630
enough to be able to go over to that

998
00:41:48,500 --> 00:41:45,820
area and make appropriate measurements

999
00:41:50,880 --> 00:41:48,510
with the width as John said without

1000
00:41:52,500 --> 00:41:50,890
measuring us you know without it

1001
00:41:54,510 --> 00:41:52,510
measuring things that we might have

1002
00:41:56,670 --> 00:41:54,520
taken with us but even then it has a

1003
00:41:59,670 --> 00:41:56,680
limited set of capability to be able to

1004
00:42:01,920 --> 00:41:59,680
make or any any sort of detection in

1005
00:42:07,319 --> 00:42:01,930
this area next up 10

1006
00:42:08,910 --> 00:42:07,329
Rison US News and World Report Tim yes

1007
00:42:10,260 --> 00:42:08,920
thank you this is Tom Ransome with US

1008
00:42:12,150 --> 00:42:10,270
News and World Report yes

1009
00:42:14,790 --> 00:42:12,160
congratulations everyone great research

1010
00:42:16,559 --> 00:42:14,800
on Mars very exciting that together the

1011
00:42:19,799 --> 00:42:16,569
surface of Mars can at some point

1012
00:42:21,900 --> 00:42:19,809
support water it sounds a bit like Game

1013
00:42:23,160 --> 00:42:21,910

of Thrones where there's extreme seas in

1014
00:42:23,700 --> 00:42:23,170
this work it's really cold it's really

1015
00:42:25,680 --> 00:42:23,710
warm

1016
00:42:28,170 --> 00:42:25,690
do you think that if we hit it right on

1017
00:42:31,200 --> 00:42:28,180
one of the warm seasons that humans

1018
00:42:33,599 --> 00:42:31,210
could grow crops on Mars that the soil

1019
00:42:36,630 --> 00:42:33,609
will be and be alive enough to support

1020
00:42:38,549 --> 00:42:36,640
some kind of earth crops well I think

1021
00:42:41,280 --> 00:42:38,559
the real challenge and if you think

1022
00:42:42,900 --> 00:42:41,290
about the progression of altitude on

1023
00:42:44,910 --> 00:42:42,910
earth you know as you climb a mountain

1024
00:42:46,260 --> 00:42:44,920
say you're climbing Mount Everest when

1025
00:42:48,660 --> 00:42:46,270
you're in the you know the verdant

1026
00:42:50,880 --> 00:42:48,670
valleys of Nepal you know you have

1027
00:42:52,500 --> 00:42:50,890
wonderful plant life but as you go

1028
00:42:54,750 --> 00:42:52,510
higher that plant life sort of

1029
00:42:57,120 --> 00:42:54,760
disappears till you see only lichens on

1030
00:42:59,700 --> 00:42:57,130
rock which are this unique symbiosis

1031
00:43:00,990 --> 00:42:59,710
between fungus and algae and as you go a

1032
00:43:03,030 --> 00:43:01,000
little bit higher all the plant life

1033
00:43:06,270 --> 00:43:03,040
disappears that's largely because the

1034
00:43:08,010 --> 00:43:06,280
atmosphere gets so thin that any life

1035
00:43:11,670 --> 00:43:08,020
would be desiccated would lose its

1036
00:43:13,620 --> 00:43:11,680
moisture well Mars is about the altitude

1037
00:43:16,440 --> 00:43:13,630
as an Everest that's three times higher

1038
00:43:17,970 --> 00:43:16,450

higher than any airplanes can fly and so

1039
00:43:21,420 --> 00:43:17,980
you'd have a challenge growing plants on

1040
00:43:23,640 --> 00:43:21,430
the surface of Mars even with maybe some

1041
00:43:25,650 --> 00:43:23,650
extreme genetic engineering but

1042
00:43:27,809 --> 00:43:25,660
certainly you could build you know

1043
00:43:30,510 --> 00:43:27,819
inflatable or small greenhouses with

1044
00:43:32,160 --> 00:43:30,520
higher pressure and if there's a lot of

1045
00:43:34,170 --> 00:43:32,170
water on Mars you could then use that

1046
00:43:35,700 --> 00:43:34,180
water to grow plants inside the

1047
00:43:37,440 --> 00:43:35,710
greenhouse because after all it has

1048
00:43:39,900 --> 00:43:37,450
plenty of carbon dioxide which is what

1049
00:43:41,670 --> 00:43:39,910
plants breathe to create oxygen so that

1050
00:43:44,549 --> 00:43:41,680
might be another mechanism that we have

1051
00:43:47,520 --> 00:43:44,559
future explorers with the plants that

1052
00:43:49,650 --> 00:43:47,530
they eat as part of the system to

1053
00:43:52,109 --> 00:43:49,660
provide environmental can now we know

1054
00:43:54,420 --> 00:43:52,119
there's a significant amount of water in

1055
00:43:57,120 --> 00:43:54,430
the humidity and water resources to be

1056
00:44:00,710 --> 00:43:57,130
able to bring to bear hey next up

1057
00:44:06,059 --> 00:44:04,680
thanks very much doing um I also had a

1058
00:44:08,250 --> 00:44:06,069
question about planetary protection

1059
00:44:11,760 --> 00:44:08,260
issues is it I understand

1060
00:44:15,749 --> 00:44:11,770
Mars 2020 doesn't have the budget to do

1061
00:44:19,319 --> 00:44:15,759
a necessary sterilization to

1062
00:44:20,870 --> 00:44:19,329
to an area of special interest and just

1063
00:44:25,859 --> 00:44:20,880

wondering in light of this discovery

1064
00:44:32,129 --> 00:44:25,869
might that be revisited and could the

1065
00:44:39,199 --> 00:44:32,139
landing team consider sites close to our

1066
00:44:42,419 --> 00:44:39,209
SL locations a budget question well uh

1067
00:44:45,719 --> 00:44:42,429
indeed the current sites that are being

1068
00:44:47,909 --> 00:44:45,729
considered for Mars 2020 are being

1069
00:44:50,069 --> 00:44:47,919
classified relative to planetary

1070
00:44:54,109 --> 00:44:50,079
protection and our plans indeed are to

1071
00:44:57,179 --> 00:44:54,119
make sure that Mars 2020 does indeed

1072
00:45:00,179 --> 00:44:57,189
recognize what classification and then

1073
00:45:03,479 --> 00:45:00,189
sterilize appropriately at a particular

1074
00:45:05,609 --> 00:45:03,489
level returning samples is one of the

1075
00:45:09,089 --> 00:45:05,619
highest levels of planetary protection

1076
00:45:12,199 --> 00:45:09,099
no matter what and so we have a whole

1077
00:45:15,659 --> 00:45:12,209
variety of plans to be able to sterilize

1078
00:45:18,269 --> 00:45:15,669
Mars 2020 and and and we have the budget

1079
00:45:20,459 --> 00:45:18,279
in the plan to be able to do that so

1080
00:45:23,009 --> 00:45:20,469
it's incorrect to say we're not going to

1081
00:45:25,679 --> 00:45:23,019
consider planetary protection on 2020 we

1082
00:45:28,649 --> 00:45:25,689
are and we have plans in terms of how to

1083
00:45:30,679 --> 00:45:28,659
handle that and I mean I think the other

1084
00:45:34,769 --> 00:45:30,689
part of that question though is that

1085
00:45:38,579 --> 00:45:34,779
these are cells these streaks of briny

1086
00:45:41,819 --> 00:45:38,589
water are in challenging locations so to

1087
00:45:43,399 --> 00:45:41,829
design a rover and the 2020 Rover is the

1088
00:45:45,419 --> 00:45:43,409

same design as the Curiosity rover

1089
00:45:48,689 --> 00:45:45,429
curiosity has gone up some pretty steep

1090
00:45:51,149 --> 00:45:48,699
slopes but some of these briny features

1091
00:45:53,370 --> 00:45:51,159
are on very steep slope very in tough

1092
00:45:54,989 --> 00:45:53,380
terrain that would be trivial for an

1093
00:45:56,669 --> 00:45:54,999
astronaut in a space suit to go up and

1094
00:45:59,009 --> 00:45:56,679
investigate but it's very hard for a

1095
00:46:00,870 --> 00:45:59,019
rover so we're a little ways off so I

1096
00:46:04,409 --> 00:46:00,880
think that the investigation of these

1097
00:46:06,989 --> 00:46:04,419
with proper planetary protection lays in

1098
00:46:08,879 --> 00:46:06,999
the domain of future robotic spacecraft

1099
00:46:10,739 --> 00:46:08,889
that are designed specifically to go

1100
00:46:12,779 --> 00:46:10,749
there and they're designed in a way that

1101
00:46:14,009 --> 00:46:12,789
they can be appropriately sterilized and

1102
00:46:16,229 --> 00:46:14,019
I think the exciting thing about this

1103
00:46:18,329 --> 00:46:16,239
announcement is it's the confirmation of

1104
00:46:20,639 --> 00:46:18,339
what we suspected that this is due to

1105
00:46:24,389 --> 00:46:20,649
some kind of water feature that I think

1106
00:46:26,279 --> 00:46:24,399
will really drive the ingenuity of our

1107
00:46:28,799 --> 00:46:26,289
engineers and scientists to come up with

1108
00:46:29,430 --> 00:46:28,809
a viable experiment and hopefully that

1109
00:46:31,020 --> 00:46:29,440
we can do in the

1110
00:46:34,020 --> 00:46:31,030
2020s that would go and investigate

1111
00:46:36,349 --> 00:46:34,030
these areas and you know perhaps even

1112
00:46:38,640 --> 00:46:36,359
return samples from these areas someday

1113
00:46:40,500 --> 00:46:38,650

okay Irene we're going to get your

1114
00:46:42,510 --> 00:46:40,510
planetary protection question another

1115
00:46:43,260 --> 00:46:42,520
time we'll have to do a lot of

1116
00:46:45,450 --> 00:46:43,270
follow-ups

1117
00:46:47,309 --> 00:46:45,460
I believe folks in France want to

1118
00:46:51,630 --> 00:46:47,319
respond to the question and please

1119
00:46:53,550 --> 00:46:51,640
identify yourself hi this is Delta I was

1120
00:46:55,349 --> 00:46:53,560
going to say exactly what janja says

1121
00:46:58,040 --> 00:46:55,359
that these are a seller on steep slope

1122
00:47:00,990 --> 00:46:58,050
that's the VRS all that we know about

1123
00:47:03,240 --> 00:47:01,000
there may be water from deliquescent

1124
00:47:05,970 --> 00:47:03,250
flat areas as well that we just don't

1125
00:47:09,270 --> 00:47:05,980
know about and the problem is that we

1126
00:47:11,990 --> 00:47:09,280
observed with MRO at 3 p.m. the driest

1127
00:47:14,819 --> 00:47:12,000
time days that with a morning orbiter

1128
00:47:17,520 --> 00:47:14,829
maybe we would see and high-resolution

1129
00:47:19,109 --> 00:47:17,530
observations maybe we could find this in

1130
00:47:21,540 --> 00:47:19,119
other locations that are more accessible

1131
00:47:23,849 --> 00:47:21,550
but right now these are only known to

1132
00:47:27,210 --> 00:47:23,859
exist on these very steep rocky slopes

1133
00:47:29,670 --> 00:47:27,220
places we can't land directly we could

1134
00:47:31,319 --> 00:47:29,680
land close to them and observe them from

1135
00:47:33,089 --> 00:47:31,329
a distance

1136
00:47:34,650 --> 00:47:33,099
so it'd be remote sensing from the

1137
00:47:36,329 --> 00:47:34,660
ground and that would be valuable

1138
00:47:38,609 --> 00:47:36,339

especially to watch these things

1139
00:47:42,420 --> 00:47:38,619
throughout the day which we can't do

1140
00:47:45,450 --> 00:47:42,430
from orbit okay I would also just say

1141
00:47:47,970 --> 00:47:45,460
that if I were a microbe on Mars I would

1142
00:47:48,690 --> 00:47:47,980
probably not live near one of these

1143
00:47:51,630 --> 00:47:48,700
RSL's

1144
00:47:54,480 --> 00:47:51,640
I would want to live probably further

1145
00:47:56,250 --> 00:47:54,490
north or south higher latitudes under

1146
00:47:57,930 --> 00:47:56,260
the surface quite far under the surface

1147
00:48:00,660 --> 00:47:57,940
and where there's more of a freshwater

1148
00:48:02,250 --> 00:48:00,670
glacier we only suspect those places

1149
00:48:04,349 --> 00:48:02,260
exist and we have some scientific

1150
00:48:06,089 --> 00:48:04,359
evidence that they do and that's the

1151
00:48:08,400 --> 00:48:06,099
subject of future exploration when we

1152
00:48:11,099 --> 00:48:08,410
can find subsurface ice that's a few

1153
00:48:13,050 --> 00:48:11,109
meters or deeper below the surface and

1154
00:48:14,819 --> 00:48:13,060
that's freshwater and I think that's

1155
00:48:17,880 --> 00:48:14,829
going to be an a very exciting area of

1156
00:48:19,230 --> 00:48:17,890
exploration in the future all right

1157
00:48:20,430 --> 00:48:19,240
we're running short on time but we're

1158
00:48:22,260 --> 00:48:20,440
going to take one more call from the

1159
00:48:26,270 --> 00:48:22,270
phone social media and then come back

1160
00:48:30,240 --> 00:48:26,280
here Keith's counting on the phone a

1161
00:48:34,050 --> 00:48:30,250
question for Michael mutt up I mean yes

1162
00:48:35,700 --> 00:48:34,060
you hear me yes again Michael Mayer um

1163
00:48:37,170 --> 00:48:35,710

this is sort of a perennial question I

1164
00:48:38,849 --> 00:48:37,180
have that you guys always say you want

1165
00:48:40,800 --> 00:48:38,859
to look for life on Mars but you don't

1166
00:48:41,910 --> 00:48:40,810
know what Mars life looks like and since

1167
00:48:42,609 --> 00:48:41,920
you don't know what it looks like you

1168
00:48:45,430 --> 00:48:42,619
don't have to look

1169
00:48:47,559 --> 00:48:45,440
or it that said this discovery is just a

1170
00:48:49,480 --> 00:48:47,569
series of papers that have finally come

1171
00:48:50,349 --> 00:48:49,490
to a conclusion about the water and

1172
00:48:52,960 --> 00:48:50,359
perchlorates

1173
00:48:55,089 --> 00:48:52,970
a are there analogues an earth that you

1174
00:48:57,670 --> 00:48:55,099
are very specifically looking at that

1175
00:48:59,980 --> 00:48:57,680
mirror aspects of what you found in Mars

1176
00:49:02,529 --> 00:48:59,990
and B as you prepare to send people

1177
00:49:04,109 --> 00:49:02,539
there and maybe more robots have you

1178
00:49:06,940 --> 00:49:04,119
ever given thought to building a large

1179
00:49:09,130 --> 00:49:06,950
refrigerator and trying to simulate the

1180
00:49:10,599 --> 00:49:09,140
geology by dumping stuff in there and

1181
00:49:13,769 --> 00:49:10,609
seeing how it reacts and then

1182
00:49:17,799 --> 00:49:13,779
inoculating it with known life-forms

1183
00:49:20,400 --> 00:49:17,809
so number one we are actually looking

1184
00:49:23,710 --> 00:49:20,410
for life on Mars we're taking a very

1185
00:49:25,720 --> 00:49:23,720
measured approach to it because in many

1186
00:49:27,420 --> 00:49:25,730
ways we don't know what exactly to look

1187
00:49:30,309 --> 00:49:27,430
for so we're looking for things that

1188
00:49:32,019 --> 00:49:30,319

frame it and give us a context to make

1189
00:49:35,049 --> 00:49:32,029
us understand whether or not life was

1190
00:49:37,210 --> 00:49:35,059
even possible and then what may be sort

1191
00:49:40,019 --> 00:49:37,220
of a biochemical discontinuity that

1192
00:49:43,299 --> 00:49:40,029
would be a clue that that life was there

1193
00:49:44,680 --> 00:49:43,309
and included in that search is in fact

1194
00:49:47,680 --> 00:49:44,690
the idea that we're going to cache

1195
00:49:50,019 --> 00:49:47,690
samples in 2020 this has been a

1196
00:49:52,539 --> 00:49:50,029
long-standing scientific opinion from

1197
00:49:54,789 --> 00:49:52,549
the Natural Research Council etc is that

1198
00:49:56,529 --> 00:49:54,799
the only way we'll ever be able to tell

1199
00:49:58,269 --> 00:49:56,539
whether or not there is life on Mars is

1200
00:50:00,579 --> 00:49:58,279
in fact to be able to bring a sample

1201
00:50:04,509 --> 00:50:00,589
back to look at it thoroughly to

1202
00:50:07,349 --> 00:50:04,519
understand what is there and what the

1203
00:50:12,880 --> 00:50:10,539
yes there are some earth analogs and

1204
00:50:15,849 --> 00:50:12,890
then in fact they see streaks forming

1205
00:50:20,460 --> 00:50:15,859
that look similar in places like

1206
00:50:22,690 --> 00:50:20,470
Antarctica but the difficulty is is that

1207
00:50:24,519 --> 00:50:22,700
something that looks the same doesn't

1208
00:50:26,499 --> 00:50:24,529
mean it is the same so we don't know if

1209
00:50:27,999 --> 00:50:26,509
it's the same mechanism but at least we

1210
00:50:32,200 --> 00:50:28,009
have something that visually looks

1211
00:50:33,700 --> 00:50:32,210
similar and that's being studied the

1212
00:50:35,859 --> 00:50:33,710
idea of throwing stuff in the freezer

1213
00:50:38,220 --> 00:50:35,869

and seeing if it grows I think the food

1214
00:50:41,440 --> 00:50:38,230
industry does that all the time

1215
00:50:43,210 --> 00:50:41,450
and that's one of the things that helps

1216
00:50:44,980 --> 00:50:43,220
sets what the temperature of your

1217
00:50:46,870 --> 00:50:44,990
freezer is which is you know around

1218
00:50:51,280 --> 00:50:46,880
minus 20 because you don't get things

1219
00:50:52,480 --> 00:50:51,290
growing in them I think the other the

1220
00:50:54,880 --> 00:50:52,490
other point to make is that the

1221
00:50:57,010 --> 00:50:54,890
scientific process and how we decide

1222
00:50:59,380 --> 00:50:57,020
what missions to send that are our large

1223
00:51:02,020 --> 00:50:59,390
strategic missions like Mars Science

1224
00:51:04,330 --> 00:51:02,030
Laboratory Curiosity like Mars 2020 is

1225
00:51:07,210 --> 00:51:04,340
based on a rather large scientific

1226
00:51:09,040 --> 00:51:07,220
community that's heavily influenced by

1227
00:51:12,580 --> 00:51:09,050
scientific discovery that's the

1228
00:51:14,020 --> 00:51:12,590
scientific process and in just about

1229
00:51:16,390 --> 00:51:14,030
five years we're going to start up the

1230
00:51:19,540 --> 00:51:16,400
next major review of planetary science

1231
00:51:21,910 --> 00:51:19,550
and I can anticipate that with the

1232
00:51:24,130 --> 00:51:21,920
results from sample analysis at Mars the

1233
00:51:25,870 --> 00:51:24,140
Sam instrument that shows you know

1234
00:51:28,000 --> 00:51:25,880
perchlorates at Gale Crater that shows

1235
00:51:30,040 --> 00:51:28,010
organic materials that had a transient

1236
00:51:33,340 --> 00:51:30,050
methane signal that we still don't know

1237
00:51:35,560 --> 00:51:33,350
what it's from from these results on our

1238
00:51:37,750 --> 00:51:35,570

cells and all the rest I can't imagine

1239
00:51:39,460 --> 00:51:37,760
that it won't be a high priority and

1240
00:51:41,200 --> 00:51:39,470
with the scientific community to send

1241
00:51:43,450 --> 00:51:41,210
something that has the right planetary

1242
00:51:46,750 --> 00:51:43,460
protection to go to these areas and may

1243
00:51:48,370 --> 00:51:46,760
have a life detection capability to see

1244
00:51:49,990 --> 00:51:48,380
if if there's life there that's similar

1245
00:51:51,250 --> 00:51:50,000
to earth and that may be you know that's

1246
00:51:53,110 --> 00:51:51,260
always risky because what if you don't

1247
00:51:54,910 --> 00:51:53,120
see it that doesn't rule out life it

1248
00:51:57,160 --> 00:51:54,920
just means it's not just like us and

1249
00:51:59,740 --> 00:51:57,170
from an evolution standpoint you

1250
00:52:02,230 --> 00:51:59,750
wouldn't expect that so let me let me

1251
00:52:04,480 --> 00:52:02,240
close this out notice we have we have

1252
00:52:06,730 --> 00:52:04,490
yep okay couple people minutes but then

1253
00:52:08,830 --> 00:52:06,740
let you close it out let's go to social

1254
00:52:10,570 --> 00:52:08,840
media I know we've got a lot of

1255
00:52:13,300 --> 00:52:10,580
questions but let's take two quick ones

1256
00:52:14,980 --> 00:52:13,310
and then I'm gonna give Associated Press

1257
00:52:16,660 --> 00:52:14,990
on the phone Marsha done one question

1258
00:52:18,910 --> 00:52:16,670
and we come back and then I'll turn it

1259
00:52:20,620 --> 00:52:18,920
over to the boss okay Emily what we got

1260
00:52:23,950 --> 00:52:20,630
sure yeah this first question is from

1261
00:52:26,140 --> 00:52:23,960
Melissa on Twitter and she said so you

1262
00:52:28,080 --> 00:52:26,150
found water what are the next steps what

1263
00:52:32,500 --> 00:52:28,090

do you plan to do with this information

1264
00:52:34,720 --> 00:52:32,510
drink it drink it well let's do that I

1265
00:52:37,600 --> 00:52:34,730
mean one of the big things is okay now

1266
00:52:40,000 --> 00:52:37,610
we found water we see it participate in

1267
00:52:42,310 --> 00:52:40,010
forming these streaks but we don't know

1268
00:52:46,330 --> 00:52:42,320
where the water actually comes from and

1269
00:52:48,010 --> 00:52:46,340
so it could be hiding major source of

1270
00:52:50,620 --> 00:52:48,020
water in the subsurface but we don't

1271
00:52:51,490 --> 00:52:50,630
have any idea and so this this is sort

1272
00:52:54,370 --> 00:52:51,500
of the next puzzle

1273
00:52:56,200 --> 00:52:54,380
to this recent discovery and a critical

1274
00:52:58,150 --> 00:52:56,210
part of that is to find out other places

1275
00:52:59,770 --> 00:52:58,160
on Mars that we see this as Adam said

1276
00:53:01,930 --> 00:52:59,780
we've on Jim green said we've only

1277
00:53:04,510 --> 00:53:01,940
imaged about three to four percent total

1278
00:53:07,000 --> 00:53:04,520
at this high resolution and different

1279
00:53:08,410 --> 00:53:07,010
times a year so yeah we need that high

1280
00:53:11,650 --> 00:53:08,420
resolution I mean these streaks are

1281
00:53:12,670 --> 00:53:11,660
maybe four or five meters in width you

1282
00:53:15,870 --> 00:53:12,680
know there may be a couple football

1283
00:53:19,420 --> 00:53:15,880
fields long but you know with with our

1284
00:53:21,280 --> 00:53:19,430
normal imagers that that that major you

1285
00:53:22,570 --> 00:53:21,290
know half a kilometer by half a

1286
00:53:25,240 --> 00:53:22,580
kilometer they're totally lost

1287
00:53:28,660 --> 00:53:25,250
we need that high-resolution imaging we

1288
00:53:30,910 --> 00:53:28,670

need that ability to see this table and

1289
00:53:33,430 --> 00:53:30,920
several pixels from orbit and we have

1290
00:53:34,080 --> 00:53:33,440
that with high rise right now hey one

1291
00:53:36,370 --> 00:53:34,090
more question

1292
00:53:38,470 --> 00:53:36,380
sure this one's from Meredith she said

1293
00:53:40,000 --> 00:53:38,480
does this mean that it rains on Mars is

1294
00:53:44,020 --> 00:53:40,010
there a full water cycle like there is

1295
00:53:45,760 --> 00:53:44,030
on Earth so we haven't seen rain on Mars

1296
00:53:48,700 --> 00:53:45,770
because the surface pressure is way too

1297
00:53:51,370 --> 00:53:48,710
low but we have seen snow and so even

1298
00:53:54,010 --> 00:53:51,380
today we know from the humidity the fact

1299
00:53:56,530 --> 00:53:54,020
that when the Sun Goes Down it cools the

1300
00:53:58,990 --> 00:53:56,540
humidity precipitates out it is ice

1301
00:54:01,750 --> 00:53:59,000
crystals on the surface of Rovers and on

1302
00:54:03,910 --> 00:54:01,760
rocks so we know there is a water cycle

1303
00:54:06,460 --> 00:54:03,920
and we know from the evidence of

1304
00:54:07,930 --> 00:54:06,470
curiosity roving on the surface that

1305
00:54:09,550 --> 00:54:07,940
three and a half four billion years ago

1306
00:54:11,710 --> 00:54:09,560
there was a very active water cycle

1307
00:54:13,780 --> 00:54:11,720
because we're driving over river deltas

1308
00:54:16,960 --> 00:54:13,790
and so at that time it certainly did

1309
00:54:19,540 --> 00:54:16,970
rain in fact the Phoenix lander which

1310
00:54:22,720 --> 00:54:19,550
are landed very close to the North Pole

1311
00:54:25,900 --> 00:54:22,730
up and what we'd call the artic sone

1312
00:54:27,940 --> 00:54:25,910
region of Mars actually made some great

1313
00:54:29,440 --> 00:54:27,950

observations with their lighter and that

1314
00:54:31,870 --> 00:54:29,450
was a Canadian instrument from the

1315
00:54:33,610 --> 00:54:31,880
Canadian Space Agency watching the snow

1316
00:54:35,830 --> 00:54:33,620
come in I mean there's some really great

1317
00:54:40,120 --> 00:54:35,840
data from from Phoenix alone that shows

1318
00:54:42,760 --> 00:54:40,130
us that before we go to the phone one

1319
00:54:44,380 --> 00:54:42,770
last time I for social media keep

1320
00:54:46,810 --> 00:54:44,390
sending those questions in a hashtag ask

1321
00:54:48,160 --> 00:54:46,820
NASA we'll have folks responding as

1322
00:54:50,470 --> 00:54:48,170
quickly as possible to all of your

1323
00:54:52,150 --> 00:54:50,480
questions on social media so on the

1324
00:54:55,600 --> 00:54:52,160
phone Marsha Dunn Associated Press

1325
00:55:00,580 --> 00:54:55,610
Marsha yes can you hear me loud and

1326
00:55:03,580 --> 00:55:00,590
clear yes my question about the RSL's

1327
00:55:04,870 --> 00:55:03,590
would you anticipate the water being as

1328
00:55:06,220 --> 00:55:04,880
Saudi as fierce

1329
00:55:10,150 --> 00:55:06,230
oceans I'm just wondering on the

1330
00:55:12,400 --> 00:55:10,160
salinity and can you even estimate or

1331
00:55:15,100 --> 00:55:12,410
guess how much water we're talking about

1332
00:55:17,800 --> 00:55:15,110
flowing I don't know if I'm envisioning

1333
00:55:20,680 --> 00:55:17,810
streams rivers a trickle is there a

1334
00:55:24,010 --> 00:55:20,690
drought just sort of give me a picture

1335
00:55:29,890 --> 00:55:24,020
of what you think how much water there

1336
00:55:32,790 --> 00:55:29,900
might be in how salty thank you oh yeah

1337
00:55:34,750 --> 00:55:32,800
Luigi did you did you copy that question

1338
00:55:37,720 --> 00:55:34,760

yeah the hoppers going to answer that

1339
00:55:41,580 --> 00:55:37,730
question okay yeah I'll say what I think

1340
00:55:44,470 --> 00:55:41,590
and lose use in containment as well but

1341
00:55:46,360 --> 00:55:44,480
Earth's oceans seem pretty salty to us

1342
00:55:48,790 --> 00:55:46,370
but walking it much much saltier than

1343
00:55:50,680 --> 00:55:48,800
that and if the process of deliquescent

1344
00:55:52,600 --> 00:55:50,690
occurs if that's how the water is being

1345
00:55:56,470 --> 00:55:52,610
made it will be much much saltier than

1346
00:55:58,510 --> 00:55:56,480
our thirst oceans how much water we made

1347
00:56:01,270 --> 00:55:58,520
an attempt to estimate in part of Ellis

1348
00:56:03,520 --> 00:56:01,280
Marineris how much water might be the

1349
00:56:05,890 --> 00:56:03,530
minimum amount to explain the darkening

1350
00:56:07,630 --> 00:56:05,900
assuming only 5% water which is

1351
00:56:09,910 --> 00:56:07,640
sufficient for metrically to darken it

1352
00:56:12,700 --> 00:56:09,920
and only 10 millimeters thickness which

1353
00:56:15,460 --> 00:56:12,710
is enough for it to actually flow down

1354
00:56:18,970 --> 00:56:15,470
the slopes the minimum was 10 to the

1355
00:56:20,770 --> 00:56:18,980
fifth cubic meters of water which sounds

1356
00:56:22,120 --> 00:56:20,780
like a lot of it was all in one place I

1357
00:56:24,310 --> 00:56:22,130
don't know how many Olympic swimming

1358
00:56:26,680 --> 00:56:24,320
pools that is but that's dispersed over

1359
00:56:30,070 --> 00:56:26,690
very wide areas and so we're dealing

1360
00:56:34,120 --> 00:56:30,080
with is wet soil thin layers of wet soil

1361
00:56:36,130 --> 00:56:34,130
not not standing water but Mars there's

1362
00:56:38,320 --> 00:56:36,140
a lot of surface area so if you could

1363
00:56:44,860 --> 00:56:38,330

add it all up it could be a significant

1364
00:56:46,990 --> 00:56:44,870
volume okay all right what I'd like to

1365
00:56:50,140 --> 00:56:47,000
do now is turn it over to dr. John

1366
00:56:52,090 --> 00:56:50,150
Grunsfeld and obviously Mars the Mars

1367
00:56:54,100 --> 00:56:52,100
missions the Mars program is in his

1368
00:56:55,570 --> 00:56:54,110
portfolio but he also has nearly a

1369
00:56:59,590 --> 00:56:55,580
hundred missions than the science

1370
00:57:00,970 --> 00:56:59,600
portfolio so sir wrap up Thanks well

1371
00:57:02,950 --> 00:57:00,980
again thank you all for coming I know

1372
00:57:04,450 --> 00:57:02,960
this is an exciting and interesting

1373
00:57:05,920 --> 00:57:04,460
result I know you'll have lots more

1374
00:57:08,530 --> 00:57:05,930
questions we'll try and answer the

1375
00:57:11,220 --> 00:57:08,540
questions from social media we encourage

1376
00:57:13,690 --> 00:57:11,230
you to talk to our scientists after this

1377
00:57:15,610 --> 00:57:13,700
we are on our journey to Mars and

1378
00:57:17,710 --> 00:57:15,620
science is leading the way and I think

1379
00:57:20,109 --> 00:57:17,720
each time we learn about some

1380
00:57:21,550 --> 00:57:20,119
knew about Mars Mars becomes more and

1381
00:57:24,460 --> 00:57:21,560
more interesting and I think it's just

1382
00:57:27,310 --> 00:57:24,470
going to provide us with you know a

1383
00:57:30,450 --> 00:57:27,320
great sense of our place in the universe

1384
00:57:32,349 --> 00:57:30,460
and our solar system in particular as

1385
00:57:34,000 --> 00:57:32,359
Dwayne says we have a lot of other

1386
00:57:36,099 --> 00:57:34,010
missions we've just started this year a

1387
00:57:38,470 --> 00:57:36,109
mission to Europa which we know has an

1388
00:57:40,750 --> 00:57:38,480

undersea ocean and we'll be exploring

1389
00:57:42,940 --> 00:57:40,760
that in the next decade so please stay

1390
00:57:44,859 --> 00:57:42,950
tuned to science

1391
00:57:46,780 --> 00:57:44,869
you know basically science never sleeps

1392
00:57:48,190 --> 00:57:46,790
we have lots of discoveries and we

1393
00:57:59,530 --> 00:57:48,200
appreciate your interest thank you very

1394
00:58:05,510 --> 00:58:02,329
so with that thanks for joining us from

1395
00:58:07,490 --> 00:58:05,520
Washington DC again goto nasa.gov slash

1396
00:58:10,010 --> 00:58:07,500
mars and i said that gulf slash journey

1397
00:58:12,290 --> 00:58:10,020
to mars follow us on social media

1398
00:58:34,510 --> 00:58:12,300
ladies and gentlemen NASA's journey to