
HD

1
00:00:12,390 --> 00:00:10,790
well good afternoon welcome to nasa

2
00:00:14,789 --> 00:00:12,400
headquarters in washington i'm dwane

3
00:00:17,109 --> 00:00:14,799
brown from the office of communications

4
00:00:20,109 --> 00:00:17,119
today you will hear about earth and

5
00:00:23,990 --> 00:00:20,119
space-based assets that will study a

6
00:00:26,230 --> 00:00:24,000
once-in-a-lifetime comet flyby near mars

7
00:00:28,150 --> 00:00:26,240
on sunday october 19th

8
00:00:29,669 --> 00:00:28,160
you'll hear brief presentations then

9
00:00:32,549 --> 00:00:29,679
we'll open up a question starting here

10
00:00:33,830 --> 00:00:32,559
in washington our phone lines and social

11
00:00:36,069 --> 00:00:33,840
media

12
00:00:37,750 --> 00:00:36,079
for our viewing and listening audience

13
00:00:40,709 --> 00:00:37,760

get those questions in we have the

14
00:00:41,830 --> 00:00:40,719
answers at hashtag ask

15
00:00:43,430 --> 00:00:41,840
nasa

16
00:00:45,590 --> 00:00:43,440
and of course there's a lot of social

17
00:00:48,229 --> 00:00:45,600
media buzz go to our

18
00:00:50,549 --> 00:00:48,239
social media websites and sites

19
00:00:52,630 --> 00:00:50,559
facebook twitter

20
00:00:55,750 --> 00:00:52,640
there is a lot of excitement worldwide

21
00:00:56,869 --> 00:00:55,760
about comet and that comet is citing

22
00:00:58,950 --> 00:00:56,879
spring

23
00:01:03,430 --> 00:00:58,960
and of course all of the information is

24
00:01:07,590 --> 00:01:03,440
on the nasa website at mars.nasa

25
00:01:09,670 --> 00:01:07,600
dot gov slash comets slash siding spring

26
00:01:11,109 --> 00:01:09,680
and that's siding spring

27
00:01:12,870 --> 00:01:11,119
okay

28
00:01:14,950 --> 00:01:12,880
before we get started

29
00:01:18,070 --> 00:01:14,960
let's

30
00:01:19,670 --> 00:01:18,080
me introduce our panelists for today

31
00:01:21,030 --> 00:01:19,680
first up

32
00:01:22,789 --> 00:01:21,040
jim green

33
00:01:24,469 --> 00:01:22,799
director

34
00:01:30,070 --> 00:01:24,479
planetary science division nasa

35
00:01:33,990 --> 00:01:31,830
kerry lisz

36
00:01:36,710 --> 00:01:34,000
senior astrophysicist

37
00:01:38,630 --> 00:01:36,720
johns hopkins university

38
00:01:43,429 --> 00:01:38,640

applied physics laboratory

39
00:01:47,190 --> 00:01:45,270
kelly fast

40
00:01:48,149 --> 00:01:47,200
program scientists

41
00:01:49,749 --> 00:01:48,159
also

42
00:01:54,069 --> 00:01:49,759
nasa headquarters planetary science

43
00:02:00,310 --> 00:01:57,749
and padma yanamandra fisher

44
00:02:03,429 --> 00:02:00,320
senior research scientist

45
00:02:06,789 --> 00:02:03,439
space science institute rancho

46
00:02:09,430 --> 00:02:06,799
cucamonga branch and california

47
00:02:11,430 --> 00:02:09,440
with that toss it to jim

48
00:02:13,990 --> 00:02:11,440
thank you very much dwayne

49
00:02:16,710 --> 00:02:14,000
you know on october 19th we're going to

50
00:02:18,869 --> 00:02:16,720
observe an event that happens maybe once

51
00:02:20,949 --> 00:02:18,879
every million years

52
00:02:23,110 --> 00:02:20,959
and this is where a comet coming from

53
00:02:25,510 --> 00:02:23,120
the furthest reaches

54
00:02:27,830 --> 00:02:25,520
of the sun's gravity will come to the

55
00:02:30,070 --> 00:02:27,840
inner part of our solar system

56
00:02:31,830 --> 00:02:30,080
this comet will fly right in front of

57
00:02:34,710 --> 00:02:31,840
the planet mars

58
00:02:37,190 --> 00:02:34,720
mars will be blanketed in cometary

59
00:02:39,750 --> 00:02:37,200
material could i have the first movie

60
00:02:44,550 --> 00:02:41,509
as the planets move around the sun in

61
00:02:46,710 --> 00:02:44,560
this view we also see the comet coming

62
00:02:47,589 --> 00:02:46,720
in a retrograde motion and as you can

63
00:02:50,070 --> 00:02:47,599

see

64
00:02:51,750 --> 00:02:50,080
it comes from below a very large

65
00:02:54,390 --> 00:02:51,760
distance from the sun

66
00:02:56,710 --> 00:02:54,400
passing right in front of mars

67
00:02:57,910 --> 00:02:56,720
the comet was discovered by robert

68
00:02:59,509 --> 00:02:57,920
mcnaught

69
00:03:01,030 --> 00:02:59,519
in january

70
00:03:04,309 --> 00:03:01,040
2013

71
00:03:06,630 --> 00:03:04,319
and his observatory in australia named

72
00:03:12,309 --> 00:03:06,640
siding spring

73
00:03:15,830 --> 00:03:12,319
the ore cloud this is a cloud that's 50

74
00:03:18,309 --> 00:03:15,840
000 astronomical units away

75
00:03:20,949 --> 00:03:18,319
very distant cloud at the very reaches

76
00:03:23,110 --> 00:03:20,959
of the solar gravity

77
00:03:25,270 --> 00:03:23,120
the comet perhaps has been traveling for

78
00:03:26,630 --> 00:03:25,280
maybe more than a million years to get

79
00:03:28,229 --> 00:03:26,640
here

80
00:03:31,110 --> 00:03:28,239
now ever since

81
00:03:32,470 --> 00:03:31,120
robert announced the comet in january in

82
00:03:35,509 --> 00:03:32,480
2013

83
00:03:37,430 --> 00:03:35,519
nasa's been getting ready for this event

84
00:03:39,830 --> 00:03:37,440
may i have the first

85
00:03:42,309 --> 00:03:39,840
image please

86
00:03:44,630 --> 00:03:42,319
now nasa has a whole series of assets

87
00:03:47,910 --> 00:03:44,640
that we're planning to use and have used

88
00:03:51,110 --> 00:03:47,920

already in observing comet siding spring

89
00:03:52,949 --> 00:03:51,120
and mars and its reaction to the comet

90
00:03:55,830 --> 00:03:52,959
as you can see here

91
00:03:58,229 --> 00:03:55,840
in the tan color those assets that nasa

92
00:03:59,589 --> 00:03:58,239
has has already observed the comet and

93
00:04:01,190 --> 00:03:59,599
are still planning additional

94
00:04:03,270 --> 00:04:01,200
observations

95
00:04:05,429 --> 00:04:03,280
we see astrophysics missions

96
00:04:07,270 --> 00:04:05,439
heliophysics missions in addition to the

97
00:04:10,149 --> 00:04:07,280
planetary missions

98
00:04:13,589 --> 00:04:10,159
from astrophysics we have hubble swift

99
00:04:15,990 --> 00:04:13,599
stereo i'm sorry hubble swift neowise

100
00:04:18,229 --> 00:04:16,000
spitzer kepler and chandra

101
00:04:20,550 --> 00:04:18,239
the stereo of course in soho are

102
00:04:23,030 --> 00:04:20,560
heliophysics assets

103
00:04:24,950 --> 00:04:23,040
in planetary science we've used

104
00:04:27,430 --> 00:04:24,960
one of our balloons

105
00:04:30,469 --> 00:04:27,440
called bops just a couple weeks ago made

106
00:04:33,270 --> 00:04:30,479
fabulous observations of siding spring

107
00:04:34,629 --> 00:04:33,280
and an infrared telescope facility that

108
00:04:36,950 --> 00:04:34,639
nasa owns

109
00:04:38,950 --> 00:04:36,960
at mars we have a whole series of

110
00:04:41,830 --> 00:04:38,960
missions that are getting ready for the

111
00:04:44,710 --> 00:04:41,840
event mars reconnaissance orbiter mars

112
00:04:46,550 --> 00:04:44,720
odyssey mars express

113
00:04:48,230 --> 00:04:46,560

which we have a an

114
00:04:49,110 --> 00:04:48,240
instrument on although it's an issa

115
00:04:51,510 --> 00:04:49,120
mission

116
00:04:54,790 --> 00:04:51,520
maven which just got in orbit last month

117
00:04:56,629 --> 00:04:54,800
and is getting ready to to

118
00:04:58,950 --> 00:04:56,639
get its instruments out and be ready for

119
00:05:01,590 --> 00:04:58,960
the comment and of course opportunity

120
00:05:05,830 --> 00:05:01,600
and curiosity are eagerly awaiting on

121
00:05:07,670 --> 00:05:05,840
the surface for this fabulous event

122
00:05:09,029 --> 00:05:07,680
indeed we're getting ready for a

123
00:05:10,870 --> 00:05:09,039
spectacular

124
00:05:13,430 --> 00:05:10,880
set of observations

125
00:05:14,790 --> 00:05:13,440
but there are some hazards involved

126
00:05:16,629 --> 00:05:14,800
as the comet

127
00:05:19,350 --> 00:05:16,639
gets closer to the sun

128
00:05:21,830 --> 00:05:19,360
and generates through sublimation the

129
00:05:24,790 --> 00:05:21,840
long tail that it sees it

130
00:05:26,790 --> 00:05:24,800
carries dust away from it now the dust

131
00:05:29,350 --> 00:05:26,800
from the comet may be a hazard to our

132
00:05:30,710 --> 00:05:29,360
spacecraft we've studied and modeled it

133
00:05:32,230 --> 00:05:30,720
extensively

134
00:05:34,550 --> 00:05:32,240
and we now know

135
00:05:36,710 --> 00:05:34,560
believe that when mars gets very close

136
00:05:38,870 --> 00:05:36,720
to the dust tail which is about 100

137
00:05:40,950 --> 00:05:38,880
minutes after closest approach

138
00:05:43,110 --> 00:05:40,960

all our spacecraft will be on the

139
00:05:44,710 --> 00:05:43,120
opposite side of the planet so the

140
00:05:47,270 --> 00:05:44,720
planet will provide the additional

141
00:05:50,070 --> 00:05:47,280
protection we believe we need to be able

142
00:05:53,110 --> 00:05:50,080
to make these observations safely from

143
00:05:55,270 --> 00:05:53,120
our mars spacecraft our mars spacecraft

144
00:05:58,230 --> 00:05:55,280
will be observing it before it gets to

145
00:06:00,950 --> 00:05:58,240
the planet and then right afterwards

146
00:06:03,590 --> 00:06:00,960
with opportunity and curiosity on the

147
00:06:05,510 --> 00:06:03,600
surface observing the comet as it flies

148
00:06:07,830 --> 00:06:05,520
right in front of them

149
00:06:09,189 --> 00:06:07,840
well this is an absolutely spectacular

150
00:06:11,670 --> 00:06:09,199
event

151
00:06:14,230 --> 00:06:11,680
and what i'd like to do now is turn it

152
00:06:15,909 --> 00:06:14,240
over to carrie liss kerry's going to

153
00:06:17,990 --> 00:06:15,919
talk about the observations from the

154
00:06:19,909 --> 00:06:18,000
astrophysics assets that have already

155
00:06:22,950 --> 00:06:19,919
been made and those that are planned to

156
00:06:24,790 --> 00:06:22,960
be to be made thank you very much jim

157
00:06:26,230 --> 00:06:24,800
so um if i may have my first graphic

158
00:06:28,469 --> 00:06:26,240
please first i'm going to talk a little

159
00:06:30,550 --> 00:06:28,479
bit more about what we think why the

160
00:06:32,070 --> 00:06:30,560
comet is so important to study and then

161
00:06:33,430 --> 00:06:32,080
i'll talk about what our astrophysics

162
00:06:35,430 --> 00:06:33,440
assets have learned so far about the

163
00:06:37,189 --> 00:06:35,440

comet and what we hope to learn when it

164
00:06:38,870 --> 00:06:37,199
flies by close to mars

165
00:06:40,230 --> 00:06:38,880
so if you look at the graphic that's up

166
00:06:41,430 --> 00:06:40,240
on the screen now on the left i'm

167
00:06:43,029 --> 00:06:41,440
showing you where the comet has been

168
00:06:44,710 --> 00:06:43,039
living and that's far away in the oort

169
00:06:46,950 --> 00:06:44,720
cloud the edges of our solar system just

170
00:06:48,950 --> 00:06:46,960
as jim was describing the comet was

171
00:06:50,469 --> 00:06:48,960
placed there after it formed we think in

172
00:06:52,629 --> 00:06:50,479
the first million or a few million years

173
00:06:54,469 --> 00:06:52,639
of the beginnings of our solar system so

174
00:06:56,070 --> 00:06:54,479
it's a body that's older than the earth

175
00:06:58,230 --> 00:06:56,080
imagine a body that's about the size of

176
00:07:00,629 --> 00:06:58,240
a small appalachian mountain or downtown

177
00:07:02,469 --> 00:07:00,639
dc it's made roughly of half of rocky

178
00:07:03,909 --> 00:07:02,479
dust and half of volatile ices like

179
00:07:05,110 --> 00:07:03,919
water and carbon dioxide and carbon

180
00:07:07,270 --> 00:07:05,120
monoxide

181
00:07:08,950 --> 00:07:07,280
and it has been it was formed i think

182
00:07:09,990 --> 00:07:08,960
originally somewhere between jupiter and

183
00:07:11,749 --> 00:07:10,000
neptune

184
00:07:13,670 --> 00:07:11,759
and failed miserably and actually

185
00:07:15,029 --> 00:07:13,680
accreting and building those the planets

186
00:07:17,029 --> 00:07:15,039
like billions and billions of its

187
00:07:18,309 --> 00:07:17,039
brothers and sisters did instead it got

188
00:07:19,909 --> 00:07:18,319

a close approach to one of those bodies

189
00:07:22,790 --> 00:07:19,919
and then got thrown out on a very long

190
00:07:24,469 --> 00:07:22,800
extended orbit multi-million year orbit

191
00:07:26,870 --> 00:07:24,479
so the comet comes back every few

192
00:07:28,309 --> 00:07:26,880
million years and has never ever ever

193
00:07:30,390 --> 00:07:28,319
been closer to the sun than we think

194
00:07:32,309 --> 00:07:30,400
maybe jupiter saturn uranus or neptune's

195
00:07:33,670 --> 00:07:32,319
distance so this is its first passage

196
00:07:34,790 --> 00:07:33,680
into what we call the water ice line

197
00:07:37,110 --> 00:07:34,800
where it's really starting to boil its

198
00:07:39,510 --> 00:07:37,120
water off so it's acting very different

199
00:07:41,350 --> 00:07:39,520
um it's also its first passage ever by

200
00:07:42,950 --> 00:07:41,360
mars if you look at the image on the

201
00:07:44,790 --> 00:07:42,960
left the comet is coming in as we've

202
00:07:46,469 --> 00:07:44,800
mentioned very far away from the sun and

203
00:07:48,230 --> 00:07:46,479
from the planets it's coming at a very

204
00:07:51,350 --> 00:07:48,240
large angle it's very fortuitous that

205
00:07:53,350 --> 00:07:51,360
it's actually going anywhere near mars

206
00:07:55,589 --> 00:07:53,360
and again this if we study the comet

207
00:07:57,029 --> 00:07:55,599
with composition its structure it will

208
00:07:58,629 --> 00:07:57,039
tell us a lot about how we think maybe

209
00:07:59,909 --> 00:07:58,639
the planets were formed

210
00:08:01,430 --> 00:07:59,919
it's also important to point out that

211
00:08:02,790 --> 00:08:01,440
all of nasa's missions to comets in the

212
00:08:04,230 --> 00:08:02,800
past have been what we call jupiter

213
00:08:06,070 --> 00:08:04,240

family comets that were formed in the

214
00:08:07,990 --> 00:08:06,080
edge of our kuiper belt in the same disk

215
00:08:09,670 --> 00:08:08,000
the planets move in not from the oort

216
00:08:11,350 --> 00:08:09,680
cloud and we can't get to the north

217
00:08:12,550 --> 00:08:11,360
cloud comet with our current rockets

218
00:08:14,230 --> 00:08:12,560
they move it to

219
00:08:16,309 --> 00:08:14,240
these orbits are very long and extended

220
00:08:17,990 --> 00:08:16,319
at very great velocities so this comet

221
00:08:19,589 --> 00:08:18,000
is coming to us it's a free flyby if you

222
00:08:21,510 --> 00:08:19,599
will and that's a very fantastic event

223
00:08:23,510 --> 00:08:21,520
for us to study

224
00:08:25,270 --> 00:08:23,520
um i'll let me go to the next slide oh

225
00:08:26,790 --> 00:08:25,280
excuse me pardon me back to the previous

226
00:08:28,070 --> 00:08:26,800
slide and on the right

227
00:08:30,710 --> 00:08:28,080
i want to show you that this comet

228
00:08:31,990 --> 00:08:30,720
apparition is so close to mars that if

229
00:08:34,149 --> 00:08:32,000
we put it in our own system which we

230
00:08:35,430 --> 00:08:34,159
know much better it's coming one third

231
00:08:37,110 --> 00:08:35,440
of the distance between the earth and

232
00:08:39,430 --> 00:08:37,120
the moon this would be extremely close

233
00:08:41,430 --> 00:08:39,440
fly by even a near-earth object asteroid

234
00:08:43,110 --> 00:08:41,440
object it's closer than any comet has

235
00:08:44,949 --> 00:08:43,120
come to the earth in the last 500 years

236
00:08:46,949 --> 00:08:44,959
it's that close what we know of the

237
00:08:48,710 --> 00:08:46,959
comet's tail and its coma its tail would

238
00:08:49,590 --> 00:08:48,720

extend from between the earth to the

239
00:08:51,509 --> 00:08:49,600
moon

240
00:08:52,710 --> 00:08:51,519
and its coma would fill about half the

241
00:08:54,070 --> 00:08:52,720
distance between the earth and the moon

242
00:08:55,910 --> 00:08:54,080
it's that kind of size object to give

243
00:08:57,269 --> 00:08:55,920
you reference points so the next slide

244
00:08:59,190 --> 00:08:57,279
please

245
00:09:01,350 --> 00:08:59,200
so here's uh i'm showing you the

246
00:09:02,790 --> 00:09:01,360
different astrophysical assets and what

247
00:09:03,990 --> 00:09:02,800
they've observed from the comet so far

248
00:09:05,509 --> 00:09:04,000
and what they will observe during the

249
00:09:07,110 --> 00:09:05,519
close approach

250
00:09:08,949 --> 00:09:07,120
um let me summarize to begin with the

251
00:09:10,870 --> 00:09:08,959
assets have shown us so far the comet

252
00:09:14,070 --> 00:09:10,880
looks like it's somewhere between half

253
00:09:15,670 --> 00:09:14,080
and five miles in diameter

254
00:09:17,269 --> 00:09:15,680
we think it's again the mass of a small

255
00:09:19,829 --> 00:09:17,279
mountain for numbers you want 10 to 9

256
00:09:22,310 --> 00:09:19,839
and 10 to 11 tons of material

257
00:09:24,389 --> 00:09:22,320
i mentioned how long 100 000 mile long

258
00:09:25,350 --> 00:09:24,399
wide coma and maybe 300 000 mile long

259
00:09:27,430 --> 00:09:25,360
tail

260
00:09:29,269 --> 00:09:27,440
and it's moving jim has to show you that

261
00:09:30,790 --> 00:09:29,279
movie because it's moving retrograde

262
00:09:32,790 --> 00:09:30,800
it's moving against the orbit of the

263
00:09:35,110 --> 00:09:32,800

planets it's going to coming in at 33

264
00:09:37,350 --> 00:09:35,120
miles per second relative velocity to

265
00:09:39,110 --> 00:09:37,360
mars that means very high velocity so

266
00:09:41,190 --> 00:09:39,120
anything that comes off the comet that

267
00:09:42,870 --> 00:09:41,200
hits either mars or the spacecraft is

268
00:09:45,030 --> 00:09:42,880
going to have pack a real large amount

269
00:09:46,070 --> 00:09:45,040
of kinetic energy a real wallop

270
00:09:47,590 --> 00:09:46,080
so that's one of the things we've been

271
00:09:49,430 --> 00:09:47,600
really worried about

272
00:09:51,350 --> 00:09:49,440
this is as jim also mentioned this is

273
00:09:53,590 --> 00:09:51,360
probably going to be our first

274
00:09:55,509 --> 00:09:53,600
capability to ever actually image and

275
00:09:57,269 --> 00:09:55,519
resolve and or cloud comet's nucleus and

276
00:09:58,389 --> 00:09:57,279
that's going to be pretty exciting kelly

277
00:10:00,150 --> 00:09:58,399
will talk more about that in a minute

278
00:10:01,350 --> 00:10:00,160
but let me get back to the assets what

279
00:10:03,350 --> 00:10:01,360
i'm showing you here in this slide on

280
00:10:05,110 --> 00:10:03,360
the left this is an optical ground-based

281
00:10:07,430 --> 00:10:05,120
image but i want to set the the table

282
00:10:09,030 --> 00:10:07,440
here the big uh

283
00:10:10,310 --> 00:10:09,040
bright glob is that's a globular cluster

284
00:10:11,670 --> 00:10:10,320
of stars in the top but in the bottom of

285
00:10:13,590 --> 00:10:11,680
the image is a little smudge with the

286
00:10:15,190 --> 00:10:13,600
tail that's our comet that siding spring

287
00:10:16,870 --> 00:10:15,200
and that was taken at the end of august

288
00:10:17,910 --> 00:10:16,880

so you can see a nucleus and a coma

289
00:10:19,030 --> 00:10:17,920
that's the bright kind of circular

290
00:10:20,710 --> 00:10:19,040
region then there's the tail that's

291
00:10:23,509 --> 00:10:20,720
fanning out behind it

292
00:10:26,870 --> 00:10:23,519
the next um graphic or the next image

293
00:10:28,389 --> 00:10:26,880
there is from wise neowise it was taken

294
00:10:30,069 --> 00:10:28,399
almost well just a few weeks ago the end

295
00:10:31,670 --> 00:10:30,079
of september and you're seeing four

296
00:10:33,190 --> 00:10:31,680
different images in heat radiation that

297
00:10:34,710 --> 00:10:33,200
are sensitive to the nucleus and dust

298
00:10:36,150 --> 00:10:34,720
coming off from this comet and you'll

299
00:10:37,750 --> 00:10:36,160
notice that the spots these are four

300
00:10:39,110 --> 00:10:37,760
different exposures of the comet and

301
00:10:40,710 --> 00:10:39,120
they're varying in brightness the comet

302
00:10:42,630 --> 00:10:40,720
is getting quite variable that's what

303
00:10:44,630 --> 00:10:42,640
wise is telling us and you're awesome in

304
00:10:46,069 --> 00:10:44,640
the next image you're seeing hubble and

305
00:10:48,310 --> 00:10:46,079
hubble has looked at the comet since

306
00:10:50,230 --> 00:10:48,320
october then in january then in march

307
00:10:52,150 --> 00:10:50,240
and is again going to look an encounter

308
00:10:54,389 --> 00:10:52,160
and hubble is sensitive to the dust and

309
00:10:55,590 --> 00:10:54,399
the nucleus of the comet it can tell us

310
00:10:57,190 --> 00:10:55,600
the size of the nucleus that's where we

311
00:10:59,030 --> 00:10:57,200
have that size range of half a half a

312
00:11:01,030 --> 00:10:59,040
mile to five miles of the nucleus in

313
00:11:02,630 --> 00:11:01,040

diameter also the amount of dust that's

314
00:11:04,949 --> 00:11:02,640
coming off and that's we've watched the

315
00:11:06,470 --> 00:11:04,959
dust and we've had colleagues around the

316
00:11:07,829 --> 00:11:06,480
world who've modeled how that dust is

317
00:11:09,430 --> 00:11:07,839
coming off and it looks like it's coming

318
00:11:11,430 --> 00:11:09,440
off extremely slowly and that's where we

319
00:11:13,030 --> 00:11:11,440
think the hazard to the spacecraft on

320
00:11:14,630 --> 00:11:13,040
mars will be minimal

321
00:11:15,829 --> 00:11:14,640
on and around mars especially if we put

322
00:11:17,430 --> 00:11:15,839
them on the night side of the planet or

323
00:11:19,430 --> 00:11:17,440
the other far side of the planet when we

324
00:11:21,829 --> 00:11:19,440
come closest approach to the comet the

325
00:11:24,069 --> 00:11:21,839
next image is swift and swift is showing

326
00:11:25,910 --> 00:11:24,079
you um water molecules that are coming

327
00:11:27,509 --> 00:11:25,920
off the comet so the water ice that's

328
00:11:29,990 --> 00:11:27,519
half of roughly half the comet is

329
00:11:31,509 --> 00:11:30,000
boiling off and there's that's that nice

330
00:11:32,949 --> 00:11:31,519
blue white image you're seeing there's

331
00:11:34,389 --> 00:11:32,959
also some points there's a graph and

332
00:11:35,430 --> 00:11:34,399
you'll notice on the graph there's

333
00:11:37,750 --> 00:11:35,440
almost

334
00:11:40,470 --> 00:11:37,760
pretty much zero activity until you get

335
00:11:41,829 --> 00:11:40,480
up to about june of 2014 and then

336
00:11:43,269 --> 00:11:41,839
suddenly you start seeing rising that's

337
00:11:44,949 --> 00:11:43,279
when the combat got close enough to the

338
00:11:47,030 --> 00:11:44,959

sun that water i started boiling it's

339
00:11:48,389 --> 00:11:47,040
about two and a half au from the sun and

340
00:11:49,430 --> 00:11:48,399
so swift has been monitoring that

341
00:11:51,430 --> 00:11:49,440
takeoff

342
00:11:53,430 --> 00:11:51,440
spitzer on the right is sensitive to the

343
00:11:55,190 --> 00:11:53,440
dust and also the carbon dioxide that's

344
00:11:56,790 --> 00:11:55,200
fizzing off of the comet and what you're

345
00:11:58,790 --> 00:11:56,800
seeing that image there is the bright

346
00:12:00,150 --> 00:11:58,800
extended dust tail that's heading

347
00:12:02,069 --> 00:12:00,160
straight up in that image but there's

348
00:12:03,509 --> 00:12:02,079
also a diffuse halo of carbon dioxide

349
00:12:04,790 --> 00:12:03,519
gas we saw the same thing for ice on

350
00:12:06,389 --> 00:12:04,800
last year it's pretty exciting to

351
00:12:08,629 --> 00:12:06,399
realize that carbon dioxide may be the

352
00:12:09,590 --> 00:12:08,639
most fundamental molecule after water in

353
00:12:10,949 --> 00:12:09,600
comets

354
00:12:12,389 --> 00:12:10,959
so those are what already been seen so

355
00:12:14,310 --> 00:12:12,399
far we're watching a comet turn on

356
00:12:17,110 --> 00:12:14,320
getting active it's going to interact

357
00:12:19,110 --> 00:12:17,120
with mars at the bottom are two planned

358
00:12:21,350 --> 00:12:19,120
observations on the left is chandra's

359
00:12:23,350 --> 00:12:21,360
which is an x-ray telescope and both

360
00:12:25,190 --> 00:12:23,360
mars and comets are x-very bright

361
00:12:26,790 --> 00:12:25,200
objects we know they emit x-rays but

362
00:12:28,629 --> 00:12:26,800
what we're waiting for is if you notice

363
00:12:29,910 --> 00:12:28,639

the red on in that plot are the

364
00:12:31,190 --> 00:12:29,920
different positions of mars in the

365
00:12:33,110 --> 00:12:31,200
chandra field of view and the yellow is

366
00:12:34,389 --> 00:12:33,120
the comet when they cross

367
00:12:36,710 --> 00:12:34,399
we're really going to be very interested

368
00:12:38,470 --> 00:12:36,720
to see with when comet dumps material in

369
00:12:40,069 --> 00:12:38,480
the upper atmosphere of mars ions and

370
00:12:41,829 --> 00:12:40,079
neutrals if that's going to make mars

371
00:12:44,069 --> 00:12:41,839
brighten up

372
00:12:46,069 --> 00:12:44,079
also brand new to cometary science on

373
00:12:47,430 --> 00:12:46,079
the bottom right is kepler so that's the

374
00:12:48,949 --> 00:12:47,440
exoplanet finding mission it's been

375
00:12:50,550 --> 00:12:48,959
staring the northern cross for the last

376
00:12:53,350 --> 00:12:50,560
four four and a half years

377
00:12:54,870 --> 00:12:53,360
and is now in its second lifetime is now

378
00:12:57,030 --> 00:12:54,880
looking in the plane of our of our

379
00:12:58,389 --> 00:12:57,040
ecliptic plane of our solar system and

380
00:12:59,910 --> 00:12:58,399
it turns out where it's staring right

381
00:13:01,670 --> 00:12:59,920
now it's going to start about a month

382
00:13:03,829 --> 00:13:01,680
ago and ago for two more months the

383
00:13:05,350 --> 00:13:03,839
comet if you see the on the very left of

384
00:13:06,470 --> 00:13:05,360
the that's the kepler field of view that

385
00:13:09,110 --> 00:13:06,480
cross of

386
00:13:11,509 --> 00:13:09,120
uh ccd pixels if you will or ccd fields

387
00:13:13,829 --> 00:13:11,519
of view so imagine that um

388
00:13:16,949 --> 00:13:13,839

equivalent of a thousand if you will of

389
00:13:18,870 --> 00:13:16,959
your telephone um cameras or

390
00:13:20,230 --> 00:13:18,880
focal planes and you see there's white

391
00:13:22,230 --> 00:13:20,240
dots on the very left that's where the

392
00:13:24,629 --> 00:13:22,240
comet's just going to graze the kepler

393
00:13:26,790 --> 00:13:24,639
iron cross if you will and so one day

394
00:13:28,389 --> 00:13:26,800
after the closest approach for about 25

395
00:13:30,550 --> 00:13:28,399
hours and then a gap of time and then

396
00:13:32,389 --> 00:13:30,560
another three days kepler is going to

397
00:13:33,590 --> 00:13:32,399
get us extremely precise optical light

398
00:13:35,829 --> 00:13:33,600
curves of this comet we're going to see

399
00:13:37,590 --> 00:13:35,839
if it changes and varies because of its

400
00:13:39,110 --> 00:13:37,600
interaction with mars so that's what the

401
00:13:41,509 --> 00:13:39,120
astrophysical assets that we're using

402
00:13:42,629 --> 00:13:41,519
now and what we hope to learn at the

403
00:13:44,389 --> 00:13:42,639
mars is we're going to see if there's

404
00:13:46,389 --> 00:13:44,399
any change due to the either both in

405
00:13:48,310 --> 00:13:46,399
mars and in the comet due to this closed

406
00:13:49,509 --> 00:13:48,320
approach and just remember also in the

407
00:13:51,030 --> 00:13:49,519
back your head that this is not the

408
00:13:52,230 --> 00:13:51,040
first time a comet's ever come close to

409
00:13:53,990 --> 00:13:52,240
mars it's happened before and will

410
00:13:55,190 --> 00:13:54,000
happen again

411
00:13:56,710 --> 00:13:55,200
finally i'll leave with this note and

412
00:13:57,829 --> 00:13:56,720
then i'll hand it over to kelly is i

413
00:13:59,269 --> 00:13:57,839

think it's really exciting to think

414
00:14:01,750 --> 00:13:59,279
about this is a multi-million year

415
00:14:03,910 --> 00:14:01,760
period comet in its orbit this comet got

416
00:14:06,310 --> 00:14:03,920
knocked into the inner system by the

417
00:14:07,910 --> 00:14:06,320
passage of a star near the orc cloud so

418
00:14:09,670 --> 00:14:07,920
think about the comet that started its

419
00:14:11,350 --> 00:14:09,680
travel probably the dawn of man and it's

420
00:14:13,269 --> 00:14:11,360
just coming in close now and the reason

421
00:14:14,949 --> 00:14:13,279
we can actually observe it is because we

422
00:14:17,910 --> 00:14:14,959
have built satellites and rovers and

423
00:14:19,670 --> 00:14:17,920
we're now got outposts around mars and

424
00:14:21,030 --> 00:14:19,680
that's why we can do this close flyby

425
00:14:22,629 --> 00:14:21,040
that's pretty exciting

426
00:14:23,750 --> 00:14:22,639
so i'm done from the astrophysic and the

427
00:14:25,110 --> 00:14:23,760
big picture point of view i'd like to

428
00:14:26,150 --> 00:14:25,120
turn it over to kelly who's going to

429
00:14:27,509 --> 00:14:26,160
tell you what we've been learning from

430
00:14:29,590 --> 00:14:27,519
the ground and also from we're going to

431
00:14:31,030 --> 00:14:29,600
learn when the comet gets to mars

432
00:14:32,470 --> 00:14:31,040
yeah in terms of the planetary science

433
00:14:34,790 --> 00:14:32,480
assets normally

434
00:14:36,550 --> 00:14:34,800
you would send a spacecraft to a comet

435
00:14:38,790 --> 00:14:36,560
and in this case the comet is coming to

436
00:14:40,790 --> 00:14:38,800
the spacecraft because we happen to have

437
00:14:44,389 --> 00:14:40,800
multiple missions at mars so it's a

438
00:14:46,389 --> 00:14:44,399

fantastic opportunity and uh nasa has

439
00:14:48,230 --> 00:14:46,399
three orbiters at mars and as was uh

440
00:14:50,710 --> 00:14:48,240
mentioned the first order of business

441
00:14:52,550 --> 00:14:50,720
was a safety in determining uh if the

442
00:14:54,310 --> 00:14:52,560
orbiters would be okay and what to do to

443
00:14:56,069 --> 00:14:54,320
keep them safe and that's been dealt

444
00:14:58,550 --> 00:14:56,079
with and so the second order of business

445
00:15:00,629 --> 00:14:58,560
is science and so you've got all these

446
00:15:02,710 --> 00:15:00,639
spacecraft they're designed to study

447
00:15:04,470 --> 00:15:02,720
mars but they're repurposing themselves

448
00:15:08,069 --> 00:15:04,480
in order to take advantage of this

449
00:15:10,310 --> 00:15:08,079
amazing opportunity to study the comet

450
00:15:12,790 --> 00:15:10,320
and study what happens to mars when the

451
00:15:14,470 --> 00:15:12,800
comet interacts with mars when material

452
00:15:16,629 --> 00:15:14,480
is deposited in the atmosphere

453
00:15:19,350 --> 00:15:16,639
interaction with the the comet's gas

454
00:15:21,990 --> 00:15:19,360
coma is their heating of the atmosphere

455
00:15:23,990 --> 00:15:22,000
and expansion and their meteors

456
00:15:26,629 --> 00:15:24,000
studying the comets itself so it's a

457
00:15:29,189 --> 00:15:26,639
fantastic opportunity and if i could

458
00:15:30,710 --> 00:15:29,199
have the first animation please

459
00:15:33,110 --> 00:15:30,720
uh what we're seeing here we're going to

460
00:15:35,509 --> 00:15:33,120
see all the orbiters at mars in addition

461
00:15:37,829 --> 00:15:35,519
uh there's the european mars express and

462
00:15:40,310 --> 00:15:37,839
india's recent mars orbiter mission and

463
00:15:42,310 --> 00:15:40,320

then there's nasa's three orbiters we

464
00:15:45,590 --> 00:15:42,320
have the mars reconnaissance orbiter and

465
00:15:47,590 --> 00:15:45,600
mars odyssey and maven and also here's a

466
00:15:50,949 --> 00:15:47,600
schematic of the extent of what is

467
00:15:53,910 --> 00:15:50,959
really a very tenuous comet coma entail

468
00:15:55,670 --> 00:15:53,920
so just an illustration of it passing by

469
00:15:58,230 --> 00:15:55,680
and all those spacecraft there ready to

470
00:15:59,590 --> 00:15:58,240
look at mars mars reconnaissance orbiter

471
00:16:02,629 --> 00:15:59,600
is the one that was mentioned is going

472
00:16:05,269 --> 00:16:02,639
to take the first resolved images of an

473
00:16:07,110 --> 00:16:05,279
oort cloud comet nucleus so that's

474
00:16:08,790 --> 00:16:07,120
pretty exciting to have that opportunity

475
00:16:11,509 --> 00:16:08,800
to do that kind of science it's going to

476
00:16:13,350 --> 00:16:11,519
look at shape and rotation and the the

477
00:16:15,030 --> 00:16:13,360
brightness of the nucleus or really the

478
00:16:17,829 --> 00:16:15,040
darkness of the nucleus it's going to

479
00:16:18,870 --> 00:16:17,839
study the coma composition

480
00:16:20,150 --> 00:16:18,880
it's also going to look at the

481
00:16:22,629 --> 00:16:20,160
atmosphere of mars to see if it can

482
00:16:25,670 --> 00:16:22,639
detect any changes from the interaction

483
00:16:28,310 --> 00:16:25,680
between comet and and mars

484
00:16:31,350 --> 00:16:28,320
mars odyssey is going to be studying the

485
00:16:32,629 --> 00:16:31,360
coma and the tail of the comet it's

486
00:16:35,110 --> 00:16:32,639
going to take

487
00:16:37,030 --> 00:16:35,120
infrared and visible images and it's

488
00:16:37,749 --> 00:16:37,040

going to kind of use mars as a reference

489
00:16:40,389 --> 00:16:37,759
to

490
00:16:41,670 --> 00:16:40,399
understand what it's seeing

491
00:16:43,590 --> 00:16:41,680
maven

492
00:16:45,590 --> 00:16:43,600
recently got to mars and it was designed

493
00:16:48,310 --> 00:16:45,600
to study the upper atmosphere of mars so

494
00:16:50,949 --> 00:16:48,320
as part of its regular science mode it's

495
00:16:53,670 --> 00:16:50,959
going to look at the atmosphere and look

496
00:16:54,949 --> 00:16:53,680
for changes in the upper atmosphere due

497
00:16:56,790 --> 00:16:54,959
to that interact

498
00:16:59,269 --> 00:16:56,800
interaction with the comet

499
00:17:00,870 --> 00:16:59,279
and so it's ideally suited to that if

500
00:17:02,790 --> 00:17:00,880
there is any sort of heating of the

501
00:17:04,309 --> 00:17:02,800
upper atmosphere of expansion from the

502
00:17:06,150 --> 00:17:04,319
interaction

503
00:17:08,549 --> 00:17:06,160
and looking at those possible effects

504
00:17:10,309 --> 00:17:08,559
but it will also take ultraviolet images

505
00:17:13,110 --> 00:17:10,319
of the comet and we'll do a mapping of

506
00:17:15,510 --> 00:17:13,120
the composition of the comet so it's

507
00:17:17,189 --> 00:17:15,520
that's going to be really fantastic but

508
00:17:19,750 --> 00:17:17,199
in addition there are two rovers on the

509
00:17:21,829 --> 00:17:19,760
surface we've got curiosity and

510
00:17:23,590 --> 00:17:21,839
opportunity and if i could have the next

511
00:17:25,669 --> 00:17:23,600
animation please

512
00:17:27,429 --> 00:17:25,679
uh in this animation we're seeing the

513
00:17:29,029 --> 00:17:27,439

comet pass by again and it's much

514
00:17:31,029 --> 00:17:29,039
brighter here than it's really going to

515
00:17:33,270 --> 00:17:31,039
be just so we can illustrate what's

516
00:17:34,789 --> 00:17:33,280
going on but during this time when the

517
00:17:36,230 --> 00:17:34,799
comet goes by

518
00:17:38,710 --> 00:17:36,240
curiosity and opportunity are going to

519
00:17:40,950 --> 00:17:38,720
turn their cameras up and here's a an

520
00:17:42,870 --> 00:17:40,960
animation from opportunity's viewpoint

521
00:17:45,909 --> 00:17:42,880
again much brighter so you can see

522
00:17:48,950 --> 00:17:45,919
what's happening as this kind of sped up

523
00:17:51,029 --> 00:17:48,960
animation of the comet setting goes by

524
00:17:52,950 --> 00:17:51,039
this is kind of a dusty season on mars

525
00:17:56,070 --> 00:17:52,960
too and so the dust is going to make the

526
00:17:57,990 --> 00:17:56,080
comet even less bright but still

527
00:18:00,390 --> 00:17:58,000
both opportunity and curiosity are going

528
00:18:02,630 --> 00:18:00,400
to look up try to image that comet and

529
00:18:04,630 --> 00:18:02,640
we certainly have fingers crossed for

530
00:18:06,150 --> 00:18:04,640
the first images of a comet from the

531
00:18:08,470 --> 00:18:06,160
surface of another world so that would

532
00:18:09,909 --> 00:18:08,480
be really exciting so great things going

533
00:18:11,590 --> 00:18:09,919
on at mars but let's bring it back a

534
00:18:14,310 --> 00:18:11,600
little bit closer to home

535
00:18:15,909 --> 00:18:14,320
here on earth there's lots going on just

536
00:18:18,710 --> 00:18:15,919
recently as jim mentioned if i could

537
00:18:21,190 --> 00:18:18,720
have the first image please

538
00:18:23,990 --> 00:18:21,200

nasa's balloon observation platform for

539
00:18:27,190 --> 00:18:24,000
planetary science or bops flew just a

540
00:18:29,909 --> 00:18:27,200
few weeks ago and as part of its mission

541
00:18:31,110 --> 00:18:29,919
it was able to make measurements of the

542
00:18:32,950 --> 00:18:31,120
comet

543
00:18:34,310 --> 00:18:32,960
and

544
00:18:35,909 --> 00:18:34,320
it was able to do this because of the

545
00:18:37,669 --> 00:18:35,919
balloon from

546
00:18:39,430 --> 00:18:37,679
above much of earth's absorbing

547
00:18:40,710 --> 00:18:39,440
atmosphere

548
00:18:42,789 --> 00:18:40,720
now in addition there's all kinds of

549
00:18:45,750 --> 00:18:42,799
ground-based observations taking place

550
00:18:48,310 --> 00:18:45,760
all over the world to study the comet

551
00:18:51,270 --> 00:18:48,320
and if i could have the next slide

552
00:18:53,830 --> 00:18:51,280
here we see nasa's observatory that's

553
00:18:55,350 --> 00:18:53,840
involved in making these observations

554
00:18:59,350 --> 00:18:55,360
this is nasa's infrared telescope

555
00:19:02,150 --> 00:18:59,360
facility or irtf on mauna kea in hawaii

556
00:19:04,230 --> 00:19:02,160
irtf meets the challenge with scheduling

557
00:19:05,110 --> 00:19:04,240
and daytime observations needed to

558
00:19:07,750 --> 00:19:05,120
really

559
00:19:11,510 --> 00:19:07,760
get the most out of this opportunity to

560
00:19:13,350 --> 00:19:11,520
maximize the access to the science data

561
00:19:15,029 --> 00:19:13,360
it has observed the comet already and

562
00:19:17,350 --> 00:19:15,039
it's going to continue to make

563
00:19:19,029 --> 00:19:17,360

observations of the comet the comet's

564
00:19:21,430 --> 00:19:19,039
composition but not only that also the

565
00:19:23,669 --> 00:19:21,440
composition of mars atmosphere again to

566
00:19:25,190 --> 00:19:23,679
see if you can see any signatures of

567
00:19:27,830 --> 00:19:25,200
some sort of interaction taking place

568
00:19:30,470 --> 00:19:27,840
between the comet the comet's coma and

569
00:19:31,990 --> 00:19:30,480
the atmosphere what happens from that

570
00:19:33,669 --> 00:19:32,000
now all that you've been hearing here a

571
00:19:35,990 --> 00:19:33,679
key part of that

572
00:19:39,430 --> 00:19:36,000
is the coordination

573
00:19:41,909 --> 00:19:39,440
and communication efforts by the um

574
00:19:44,070 --> 00:19:41,919
uh by the uh i have to look at the name

575
00:19:46,230 --> 00:19:44,080
because i always forget it even because

576
00:19:48,470 --> 00:19:46,240
we've rebranded it from before but it's

577
00:19:50,630 --> 00:19:48,480
the coordinated investigations of comets

578
00:19:53,430 --> 00:19:50,640
group or the seahawk they've been

579
00:19:56,390 --> 00:19:53,440
fantastic about coordinating with also

580
00:19:59,029 --> 00:19:56,400
with the mars program office out at jpl

581
00:20:02,870 --> 00:19:59,039
to get ready for this event

582
00:20:04,630 --> 00:20:02,880
convening workshops of scientists

583
00:20:07,029 --> 00:20:04,640
being able to foster coordination and

584
00:20:09,029 --> 00:20:07,039
collaboration and to really maximize the

585
00:20:11,590 --> 00:20:09,039
science coming out of this because

586
00:20:13,590 --> 00:20:11,600
there's one shot at this and

587
00:20:15,350 --> 00:20:13,600
this is the time to do it and so they're

588
00:20:16,549 --> 00:20:15,360

having had this lead time

589
00:20:19,270 --> 00:20:16,559
they're getting ready to get the most

590
00:20:21,909 --> 00:20:19,280
science out of this you'll see the

591
00:20:23,430 --> 00:20:21,919
jpl website at the end of uh at the end

592
00:20:25,909 --> 00:20:23,440
today i believe and then also the

593
00:20:27,990 --> 00:20:25,919
seahawks website comic campaign.org has

594
00:20:29,830 --> 00:20:28,000
plenty of information we have some seac

595
00:20:32,149 --> 00:20:29,840
members here on the platform and off the

596
00:20:34,310 --> 00:20:32,159
platform and so we've been very

597
00:20:35,990 --> 00:20:34,320
thankful for their help with uh getting

598
00:20:38,230 --> 00:20:36,000
the most out of this opportunity the

599
00:20:40,070 --> 00:20:38,240
seahawk has also though engaged the

600
00:20:41,430 --> 00:20:40,080
amateur astronomy community and so with

601
00:20:43,909 --> 00:20:41,440
that i'm going to pass it to padma

602
00:20:45,350 --> 00:20:43,919
yanamandra fisher to address that

603
00:20:48,310 --> 00:20:45,360
thank you kelly

604
00:20:50,549 --> 00:20:48,320
an important component of the seahawk

605
00:20:53,190 --> 00:20:50,559
observing campaign is the amateur

606
00:20:55,430 --> 00:20:53,200
community and it's important because it

607
00:20:57,669 --> 00:20:55,440
provides an extended observing team as

608
00:20:59,830 --> 00:20:57,679
well as extended observing windows that

609
00:21:02,950 --> 00:20:59,840
we can characterize the comet and also

610
00:21:05,830 --> 00:21:02,960
allows for outreach via social media

611
00:21:08,470 --> 00:21:05,840
you may have my first slide please

612
00:21:10,710 --> 00:21:08,480
as jim mentioned comet siding spring was

613
00:21:13,110 --> 00:21:10,720

discovered by rob mcnaught you can see

614
00:21:15,909 --> 00:21:13,120
the two pictures on the right side show

615
00:21:17,510 --> 00:21:15,919
both the telesco the telescope facility

616
00:21:19,110 --> 00:21:17,520
as well as the telescope that is used to

617
00:21:20,710 --> 00:21:19,120
make this observation

618
00:21:23,190 --> 00:21:20,720
um also

619
00:21:26,070 --> 00:21:23,200
on the left side of this uh graphic you

620
00:21:26,950 --> 00:21:26,080
see um atlas of the

621
00:21:29,669 --> 00:21:26,960
globe

622
00:21:31,830 --> 00:21:29,679
and what you see is that the red dots

623
00:21:34,549 --> 00:21:31,840
indicate where we have observers amateur

624
00:21:36,789 --> 00:21:34,559
observers as well as robotic networks so

625
00:21:39,029 --> 00:21:36,799
that observers in northern latitudes can

626
00:21:41,270 --> 00:21:39,039
use them and they've been continuously

627
00:21:44,310 --> 00:21:41,280
monitoring the the state of the comet

628
00:21:46,789 --> 00:21:44,320
since january of 2014.

629
00:21:48,710 --> 00:21:46,799
now most of the observers

630
00:21:50,870 --> 00:21:48,720
have equipment that ranges from a few

631
00:21:53,430 --> 00:21:50,880
inches to a one and a half meter

632
00:21:54,630 --> 00:21:53,440
telescopes uh they also observe in our

633
00:21:56,470 --> 00:21:54,640
uh in

634
00:21:59,029 --> 00:21:56,480
two wavelengths that are very sensitive

635
00:22:00,149 --> 00:21:59,039
dust and clouds on the planet as well as

636
00:22:02,549 --> 00:22:00,159
dust and

637
00:22:04,470 --> 00:22:02,559
gas in the comet comet

638
00:22:08,070 --> 00:22:04,480

features may have the next graphic

639
00:22:11,750 --> 00:22:09,669
now these are

640
00:22:14,070 --> 00:22:11,760
these are some of the observations that

641
00:22:15,830 --> 00:22:14,080
have been acquired in the last month uh

642
00:22:17,830 --> 00:22:15,840
or a few weeks from australia south

643
00:22:20,149 --> 00:22:17,840
america and south africa which are the

644
00:22:22,230 --> 00:22:20,159
three locations where uh the comet will

645
00:22:23,990 --> 00:22:22,240
be observable at night time as kelly

646
00:22:26,230 --> 00:22:24,000
mentioned is going to be mostly a

647
00:22:28,310 --> 00:22:26,240
daytime for the northern latitudes but

648
00:22:30,310 --> 00:22:28,320
here we have identified not only

649
00:22:32,630 --> 00:22:30,320
observers but locations in the time

650
00:22:35,430 --> 00:22:32,640
windows where we can actually get some

651
00:22:36,950 --> 00:22:35,440
continuous data for the next few weeks

652
00:22:39,270 --> 00:22:36,960
and you can see that the comet has

653
00:22:42,549 --> 00:22:39,280
changed it looks a little different from

654
00:22:45,350 --> 00:22:42,559
uh from the time august to september and

655
00:22:47,110 --> 00:22:45,360
like kerry mentioned it is variable and

656
00:22:48,310 --> 00:22:47,120
this is very interesting to see how it's

657
00:22:51,830 --> 00:22:48,320
going to evolve in the next couple of

658
00:22:53,750 --> 00:22:51,840
weeks may have the next slide please

659
00:22:56,310 --> 00:22:53,760
this graph basically shows the status of

660
00:22:58,630 --> 00:22:56,320
the comet and mars as of last week

661
00:23:00,789 --> 00:22:58,640
simply because

662
00:23:02,470 --> 00:23:00,799
what we're noticing is as the comet

663
00:23:04,789 --> 00:23:02,480

comes from the south of the ecliptic and

664
00:23:07,669 --> 00:23:04,799
is going on towards northern latitudes

665
00:23:09,430 --> 00:23:07,679
earth has crossed its orbital uh

666
00:23:11,350 --> 00:23:09,440
plane and therefore we see different

667
00:23:12,870 --> 00:23:11,360
features in the comet that we normally

668
00:23:14,870 --> 00:23:12,880
see when

669
00:23:17,029 --> 00:23:14,880
a planet crosses the orbital plane like

670
00:23:19,510 --> 00:23:17,039
an anti-tail which is in the middle

671
00:23:22,549 --> 00:23:19,520
slide middle image of the comet on the

672
00:23:25,029 --> 00:23:22,559
left side but as of last week it uh

673
00:23:26,950 --> 00:23:25,039
seems to uh have varying brightness

674
00:23:29,110 --> 00:23:26,960
which is uh shown in the

675
00:23:31,990 --> 00:23:29,120
top right

676
00:23:34,149 --> 00:23:32,000
of the comet but at the same time uh

677
00:23:36,549 --> 00:23:34,159
mars has also been observed by the

678
00:23:38,310 --> 00:23:36,559
amateur since january and what we notice

679
00:23:40,870 --> 00:23:38,320
is this going through its changes of

680
00:23:42,549 --> 00:23:40,880
season so the top right mars image is

681
00:23:44,070 --> 00:23:42,559
from april when it's closest to the

682
00:23:46,310 --> 00:23:44,080
earth and you can see a lot of structure

683
00:23:48,950 --> 00:23:46,320
and details on the surface

684
00:23:51,669 --> 00:23:48,960
and the two images below that were taken

685
00:23:54,549 --> 00:23:51,679
just a few days back on october 5th

686
00:23:55,909 --> 00:23:54,559
where it has entered its uh northern uh

687
00:23:57,669 --> 00:23:55,919
fall season like

688
00:23:59,990 --> 00:23:57,679

uh kelly mentioned it's a dust storm

689
00:24:02,470 --> 00:24:00,000
season and there were two dust storms

690
00:24:04,870 --> 00:24:02,480
that were observed on that day and by

691
00:24:06,950 --> 00:24:04,880
this point the disc has decreased to a

692
00:24:09,029 --> 00:24:06,960
mere six arc seconds in the telescope

693
00:24:11,510 --> 00:24:09,039
from ground so this is very interesting

694
00:24:13,029 --> 00:24:11,520
that both planet and comet are changing

695
00:24:14,149 --> 00:24:13,039
so the interaction is going to be very

696
00:24:16,789 --> 00:24:14,159
exciting

697
00:24:19,669 --> 00:24:16,799
next slide please

698
00:24:21,350 --> 00:24:19,679
and this one basically is in addition to

699
00:24:23,350 --> 00:24:21,360
all of that happening the southern

700
00:24:24,870 --> 00:24:23,360
hemispheric sky where the interaction or

701
00:24:27,350 --> 00:24:24,880
the flyby is going to occur is a very

702
00:24:28,710 --> 00:24:27,360
busy part of the sky uh on the left side

703
00:24:31,269 --> 00:24:28,720
you can see the blue rectangle

704
00:24:33,510 --> 00:24:31,279
represents exactly where the two objects

705
00:24:35,350 --> 00:24:33,520
are going to be crossing the paths but

706
00:24:37,590 --> 00:24:35,360
you can see the rest of the sky is very

707
00:24:40,470 --> 00:24:37,600
busy as it passes the lmc the large

708
00:24:42,789 --> 00:24:40,480
magellanic cloud and so it's uh our

709
00:24:45,029 --> 00:24:42,799
observers are essentially practicing

710
00:24:47,430 --> 00:24:45,039
their observing techniques also getting

711
00:24:49,110 --> 00:24:47,440
familiar with the star field and as the

712
00:24:49,990 --> 00:24:49,120
uh as the comet and mars move through

713
00:24:52,630 --> 00:24:50,000

that

714
00:24:56,870 --> 00:24:52,640
on the right side what you see is the on

715
00:24:59,750 --> 00:24:56,880
the time of uh encounter on october 19th

716
00:25:01,830 --> 00:24:59,760
basically australia and

717
00:25:04,710 --> 00:25:01,840
south africa are going to be the best

718
00:25:07,590 --> 00:25:04,720
places to see optimally south africa

719
00:25:09,190 --> 00:25:07,600
and so we the blue stars on that map

720
00:25:11,750 --> 00:25:09,200
indicate locations where we have

721
00:25:13,990 --> 00:25:11,760
identified both robotic as well as

722
00:25:16,310 --> 00:25:14,000
individual astronomers that are going to

723
00:25:18,950 --> 00:25:16,320
be taking data continuously so that we

724
00:25:22,230 --> 00:25:18,960
can actually see what uh

725
00:25:24,470 --> 00:25:22,240
how the dust structures how mars is

726
00:25:25,830 --> 00:25:24,480
global features how they change and

727
00:25:26,830 --> 00:25:25,840
that's important even though there are

728
00:25:29,590 --> 00:25:26,840
lots of

729
00:25:31,190 --> 00:25:29,600
uh nasa assets that are looking at it

730
00:25:32,710 --> 00:25:31,200
here you're seeing the far environment

731
00:25:34,710 --> 00:25:32,720
you're seeing the global picture rather

732
00:25:36,470 --> 00:25:34,720
than just the nearby picture so this

733
00:25:37,590 --> 00:25:36,480
provides a complementary view of the

734
00:25:40,390 --> 00:25:37,600
event

735
00:25:43,110 --> 00:25:40,400
may have the next slide please

736
00:25:43,990 --> 00:25:43,120
now this uh in it for as far as outreach

737
00:25:45,110 --> 00:25:44,000
um

738
00:25:47,190 --> 00:25:45,120

part of the

739
00:25:49,110 --> 00:25:47,200
work is uh providing resources and

740
00:25:52,710 --> 00:25:49,120
access like star charts here's a sample

741
00:25:53,909 --> 00:25:52,720
star chart that we do provide via our

742
00:25:56,870 --> 00:25:53,919
various uh

743
00:25:59,590 --> 00:25:56,880
social media dimensions and this is

744
00:26:02,149 --> 00:25:59,600
essentially if somebody in australia in

745
00:26:04,789 --> 00:26:02,159
south africa at

746
00:26:06,789 --> 00:26:04,799
cape town walks out and takes a look up

747
00:26:09,430 --> 00:26:06,799
at the sky what would they can see in

748
00:26:11,669 --> 00:26:09,440
the sky are not only the planet mars and

749
00:26:14,230 --> 00:26:11,679
antares and saturn but you can also see

750
00:26:17,110 --> 00:26:14,240
the comet but i this is a just a

751
00:26:18,789 --> 00:26:17,120
schematic uh picture it's not a naked

752
00:26:20,710 --> 00:26:18,799
eye object the comet you cannot see it

753
00:26:22,630 --> 00:26:20,720
like that as naked eye it's a binocular

754
00:26:24,470 --> 00:26:22,640
object you can see the telescopes but it

755
00:26:26,950 --> 00:26:24,480
essentially helps people to at least

756
00:26:28,070 --> 00:26:26,960
know where to look because the sky is so

757
00:26:30,710 --> 00:26:28,080
busy

758
00:26:32,230 --> 00:26:30,720
may have the next graphic please

759
00:26:34,950 --> 00:26:32,240
and this one

760
00:26:36,070 --> 00:26:34,960
basically shows um why we study comets

761
00:26:38,230 --> 00:26:36,080
because

762
00:26:40,470 --> 00:26:38,240
jim and kerry as well as kelly have all

763
00:26:43,350 --> 00:26:40,480

mentioned this is a once in a lifetime

764
00:26:46,230 --> 00:26:43,360
event for uh a comet going by

765
00:26:47,909 --> 00:26:46,240
mars uh earth cloud comets it's hard to

766
00:26:49,190 --> 00:26:47,919
plan missions to them because you don't

767
00:26:51,190 --> 00:26:49,200
know where they're going to come from

768
00:26:54,310 --> 00:26:51,200
and how they're going to behave

769
00:26:55,669 --> 00:26:54,320
so here is a composition of a lot of the

770
00:26:58,149 --> 00:26:55,679
images of various comments that are

771
00:27:00,230 --> 00:26:58,159
available in our sky currently and these

772
00:27:01,830 --> 00:27:00,240
are amateur astronomers who have taken

773
00:27:04,149 --> 00:27:01,840
these images and they essentially

774
00:27:05,669 --> 00:27:04,159
provide the legacy and the data and the

775
00:27:07,830 --> 00:27:05,679
reference system against which all we

776
00:27:10,230 --> 00:27:07,840
can place uh the other other high

777
00:27:11,510 --> 00:27:10,240
resolution observations in context and

778
00:27:12,950 --> 00:27:11,520
that's one of the reasons we study

779
00:27:15,430 --> 00:27:12,960
comets is that because they're the

780
00:27:18,070 --> 00:27:15,440
remnants of our solar system formation

781
00:27:20,230 --> 00:27:18,080
so back to you dwayne okay thank you so

782
00:27:22,230 --> 00:27:20,240
now we're going to transition into uh

783
00:27:25,269 --> 00:27:22,240
the question and answer period a lot of

784
00:27:28,710 --> 00:27:25,279
questions and again for our audience

785
00:27:31,430 --> 00:27:28,720
going uh hashtag ask nasa send those

786
00:27:33,269 --> 00:27:31,440
questions in we have the answers join

787
00:27:35,909 --> 00:27:33,279
the conversation there's a lot of it

788
00:27:37,909 --> 00:27:35,919

worldwide on twitter and facebook and

789
00:27:39,269 --> 00:27:37,919
look at the nasa accounts join that

790
00:27:41,510 --> 00:27:39,279
conversation so what i'm going to do

791
00:27:43,269 --> 00:27:41,520
here before we go to the phone lines uh

792
00:27:45,190 --> 00:27:43,279
see we have any media representatives

793
00:27:46,149 --> 00:27:45,200
here in the auditorium and then we're

794
00:27:47,350 --> 00:27:46,159
going to

795
00:27:49,590 --> 00:27:47,360
go to

796
00:27:51,990 --> 00:27:49,600
uh mr social media himself jason

797
00:27:53,909 --> 00:27:52,000
townsend in a second any uh media reps

798
00:27:55,029 --> 00:27:53,919
will see a hand here if we can get a mic

799
00:28:02,070 --> 00:27:55,039
if you can wait for the mic give your

800
00:28:04,230 --> 00:28:03,029
you

801
00:28:06,630 --> 00:28:04,240
um

802
00:28:08,389 --> 00:28:06,640
it was announced recently oh i'm sorry

803
00:28:10,310 --> 00:28:08,399
marcia freeman with executive

804
00:28:12,389 --> 00:28:10,320
intelligence review

805
00:28:15,750 --> 00:28:12,399
uh it was recently announced that there

806
00:28:18,149 --> 00:28:15,760
would be coordination in data collected

807
00:28:20,149 --> 00:28:18,159
by the mars orbiter admission and maven

808
00:28:23,029 --> 00:28:20,159
which is wonderful

809
00:28:26,789 --> 00:28:23,039
is there a method by which is going to

810
00:28:28,470 --> 00:28:26,799
be coordination between all of the nasa

811
00:28:31,430 --> 00:28:28,480
craft at mars

812
00:28:35,029 --> 00:28:31,440
mars express and the orbiter mission and

813
00:28:35,990 --> 00:28:35,039

international coordination

814
00:28:38,470 --> 00:28:36,000
indeed

815
00:28:42,149 --> 00:28:38,480
uh those dialogues go on between the

816
00:28:44,950 --> 00:28:42,159
teams with respect to indians

817
00:28:48,549 --> 00:28:44,960
mom mission uh we've just started that

818
00:28:50,549 --> 00:28:48,559
conversation uh the uh observations that

819
00:28:52,070 --> 00:28:50,559
probably relate the most are from the

820
00:28:53,110 --> 00:28:52,080
maven team

821
00:28:56,389 --> 00:28:53,120
and

822
00:28:58,310 --> 00:28:56,399
both the investigators from those two

823
00:29:00,230 --> 00:28:58,320
mission sets are are just now beginning

824
00:29:03,029 --> 00:29:00,240
that dialogue

825
00:29:05,510 --> 00:29:03,039
i'll add that the workshops convened by

826
00:29:08,310 --> 00:29:05,520
the seahawk and the mars program office

827
00:29:11,510 --> 00:29:08,320
uh had participation from all the nasa

828
00:29:13,750 --> 00:29:11,520
missions and from isis mars express um

829
00:29:15,350 --> 00:29:13,760
and uh from india's mars orbiter mission

830
00:29:17,990 --> 00:29:15,360
they all they all called in and share so

831
00:29:20,149 --> 00:29:18,000
there's been communication of plans and

832
00:29:21,909 --> 00:29:20,159
uh um but certainly in the case of the

833
00:29:23,510 --> 00:29:21,919
indian mission it's uh that's kind of

834
00:29:25,510 --> 00:29:23,520
just starting since

835
00:29:26,950 --> 00:29:25,520
since they even we just got there and

836
00:29:28,230 --> 00:29:26,960
getting set up

837
00:29:29,990 --> 00:29:28,240
and i'd like to add if you want to go

838
00:29:31,510 --> 00:29:30,000

and see what the um what happened those

839
00:29:32,950 --> 00:29:31,520
workshops they're on they've live

840
00:29:34,789 --> 00:29:32,960
streamed in there and everything's been

841
00:29:36,230 --> 00:29:34,799
captured on onto the web

842
00:29:38,149 --> 00:29:36,240
so especially the last one there was a

843
00:29:40,630 --> 00:29:38,159
lot of international discussion

844
00:29:42,470 --> 00:29:40,640
so i think we'll see a lot of really

845
00:29:43,269 --> 00:29:42,480
great correlative data being brought to

846
00:29:45,830 --> 00:29:43,279
bear

847
00:29:48,389 --> 00:29:45,840
and tackling a lot of um uh of the

848
00:29:50,470 --> 00:29:48,399
science uh and that'll require

849
00:29:51,990 --> 00:29:50,480
all sorts of data from not only our

850
00:29:54,070 --> 00:29:52,000
missions but uh the ground-based

851
00:29:55,510 --> 00:29:54,080
observations and the amateur community

852
00:29:58,470 --> 00:29:55,520
are more than welcome to join us of

853
00:30:02,870 --> 00:29:59,990
yes sir wait for the mic and name and

854
00:30:07,190 --> 00:30:05,669
i'm dan vergano with national geographic

855
00:30:09,430 --> 00:30:07,200
do you have any expectation about how

856
00:30:11,110 --> 00:30:09,440
long it'll take to you have a full

857
00:30:11,909 --> 00:30:11,120
picture of all these observations it's

858
00:30:13,669 --> 00:30:11,919
not

859
00:30:15,269 --> 00:30:13,679
like you switch you turn on and it's all

860
00:30:16,870 --> 00:30:15,279
immediately cooked right it's going to

861
00:30:18,470 --> 00:30:16,880
take a little bit

862
00:30:20,070 --> 00:30:18,480
that's i'll take that that's a very good

863
00:30:21,909 --> 00:30:20,080

question

864
00:30:23,190 --> 00:30:21,919
most of the data that comes down it's

865
00:30:25,350 --> 00:30:23,200
going to take a day or two to get

866
00:30:27,110 --> 00:30:25,360
through the pipelines at the very least

867
00:30:28,549 --> 00:30:27,120
and so and then to be checked and make

868
00:30:29,909 --> 00:30:28,559
sure we want to make sure that the data

869
00:30:33,269 --> 00:30:29,919
looks good and that we removed any

870
00:30:34,630 --> 00:30:33,279
artifacts um the good news is that and i

871
00:30:35,990 --> 00:30:34,640
think people's attention is really going

872
00:30:38,630 --> 00:30:36,000
to be riveted on the day of counter

873
00:30:40,950 --> 00:30:38,640
itself october 19th um we're actually

874
00:30:42,870 --> 00:30:40,960
expecting to get some good imagery a few

875
00:30:43,830 --> 00:30:42,880
days before remember the what how the

876
00:30:45,190 --> 00:30:43,840
comet's going to look is going to be

877
00:30:47,510 --> 00:30:45,200
roughly symmetric with the time of

878
00:30:49,590 --> 00:30:47,520
closest approach so what you may see on

879
00:30:51,590 --> 00:30:49,600
the day of october 19th is actually an

880
00:30:52,870 --> 00:30:51,600
image of a day or two out from the mars

881
00:30:54,470 --> 00:30:52,880
assets

882
00:30:55,830 --> 00:30:54,480
and then you'll start seeing over the

883
00:30:57,909 --> 00:30:55,840
next week or two you're going to see

884
00:31:00,630 --> 00:30:57,919
more data come in and the best data

885
00:31:02,149 --> 00:31:00,640
probably won't actually be available and

886
00:31:04,470 --> 00:31:02,159
probably until about three or four days

887
00:31:05,430 --> 00:31:04,480
after we don't want to over promise

888
00:31:06,470 --> 00:31:05,440

but that's that's when we're going to

889
00:31:08,470 --> 00:31:06,480
really have the close approach we'll

890
00:31:10,230 --> 00:31:08,480
look through it we'll remove cosmic rays

891
00:31:11,510 --> 00:31:10,240
any sort of glitches artifacts to make

892
00:31:12,710 --> 00:31:11,520
sure one of the things we're interested

893
00:31:14,470 --> 00:31:12,720
in is are we going to see meteors and

894
00:31:15,669 --> 00:31:14,480
mars atmosphere you have to be careful

895
00:31:18,710 --> 00:31:15,679
to make sure that it's not any sort of

896
00:31:20,230 --> 00:31:18,720
instrument issues

897
00:31:22,230 --> 00:31:20,240
any other questions we're actually going

898
00:31:23,430 --> 00:31:22,240
to go to the phone line so we have a in

899
00:31:30,149 --> 00:31:23,440
here wait for the mic and your

900
00:31:33,190 --> 00:31:31,830
hi my name is selena i'm from talk radio

901
00:31:35,990 --> 00:31:33,200
news service and i would just like to

902
00:31:37,590 --> 00:31:36,000
ask how long will this whole study last

903
00:31:39,990 --> 00:31:37,600
for will it um

904
00:31:41,669 --> 00:31:40,000
after after october 19th i mean you have

905
00:31:43,430 --> 00:31:41,679
a couple days for all of your day to

906
00:31:44,470 --> 00:31:43,440
come down but overall how long will it

907
00:31:46,389 --> 00:31:44,480
take

908
00:31:48,230 --> 00:31:46,399
certainly it's just yeah the the

909
00:31:49,509 --> 00:31:48,240
encounter is that day and it'll take

910
00:31:52,230 --> 00:31:49,519
some time to get the data down from the

911
00:31:54,070 --> 00:31:52,240
spacecraft uh uh days

912
00:31:55,430 --> 00:31:54,080
but then there there's so many

913
00:31:57,430 --> 00:31:55,440

observations involved and there's the

914
00:31:58,710 --> 00:31:57,440
quick look pictures which uh you know

915
00:32:00,470 --> 00:31:58,720
everybody will try to get out there as

916
00:32:02,710 --> 00:32:00,480
quick as possible and the early results

917
00:32:05,269 --> 00:32:02,720
but then the science analysis will go on

918
00:32:07,269 --> 00:32:05,279
for a long time especially to get to get

919
00:32:08,389 --> 00:32:07,279
all the science out of the out of all

920
00:32:10,149 --> 00:32:08,399
the data that aren't necessarily

921
00:32:12,389 --> 00:32:10,159
pictures and so it will it will extend

922
00:32:14,870 --> 00:32:12,399
for a long time but i know that

923
00:32:16,389 --> 00:32:14,880
scientists will want to work as fast as

924
00:32:17,990 --> 00:32:16,399
possible to try to get more results out

925
00:32:19,590 --> 00:32:18,000
at some of the major meetings that will

926
00:32:21,110 --> 00:32:19,600
be following

927
00:32:22,710 --> 00:32:21,120
like the

928
00:32:23,990 --> 00:32:22,720
perhaps the

929
00:32:27,190 --> 00:32:24,000
division planetary science meeting

930
00:32:28,950 --> 00:32:27,200
american geophysical union meeting uh

931
00:32:30,310 --> 00:32:28,960
lps theology and planetary science

932
00:32:31,830 --> 00:32:30,320
conference so

933
00:32:33,750 --> 00:32:31,840
i imagine over the next year it will

934
00:32:36,470 --> 00:32:33,760
continue to dribble out but uh hopefully

935
00:32:37,830 --> 00:32:36,480
in the first few days some quick results

936
00:32:39,669 --> 00:32:37,840
that's a very good answer if i may just

937
00:32:41,430 --> 00:32:39,679
add is that our common ison experience

938
00:32:43,269 --> 00:32:41,440

last year the first science papers came

939
00:32:44,789 --> 00:32:43,279
out with about three months but then

940
00:32:46,630 --> 00:32:44,799
we're still getting the really the bulk

941
00:32:48,230 --> 00:32:46,640
of the papers are coming out now so

942
00:32:49,830 --> 00:32:48,240
expect most scientists to come out with

943
00:32:52,070 --> 00:32:49,840
the real serious results within about a

944
00:32:53,909 --> 00:32:52,080
year year and a half after the event

945
00:32:56,870 --> 00:32:53,919
i'd like to add to that too

946
00:32:58,389 --> 00:32:56,880
in addition to all the um professional

947
00:33:01,430 --> 00:32:58,399
as well as the assets that are going to

948
00:33:03,509 --> 00:33:01,440
be taking uh data their amateurs tend to

949
00:33:05,830 --> 00:33:03,519
take have a longer timeline

950
00:33:08,789 --> 00:33:05,840
as a comet is interesting even after as

951
00:33:11,830 --> 00:33:08,799
it's receding they still take data and

952
00:33:13,269 --> 00:33:11,840
so there may be other other pictures

953
00:33:14,950 --> 00:33:13,279
that come out of it in different type of

954
00:33:16,870 --> 00:33:14,960
features that might be seen in a tale

955
00:33:18,630 --> 00:33:16,880
that you normally cannot predict but you

956
00:33:21,029 --> 00:33:18,640
can have long tenuous tales and

957
00:33:23,509 --> 00:33:21,039
disconnection events or other things and

958
00:33:26,149 --> 00:33:23,519
so on the amateur side the timeline

959
00:33:28,389 --> 00:33:26,159
might be longer as interesting features

960
00:33:30,630 --> 00:33:28,399
present themselves so it could be months

961
00:33:32,149 --> 00:33:30,640
maybe four or five months later on and

962
00:33:33,590 --> 00:33:32,159
we didn't really highlight here the uh

963
00:33:35,269 --> 00:33:33,600

some of the nasa assets are going to be

964
00:33:36,950 --> 00:33:35,279
continuing far out i know like the swift

965
00:33:40,710 --> 00:33:36,960
observations are going to continue for a

966
00:33:42,470 --> 00:33:40,720
long time and neo-wise and so yeah

967
00:33:43,830 --> 00:33:42,480
it is the gift that keeps on giving

968
00:33:45,110 --> 00:33:43,840
that's a very important point which we

969
00:33:46,630 --> 00:33:45,120
didn't highlight the comet is going

970
00:33:48,549 --> 00:33:46,640
through perihelion it's closest distance

971
00:33:50,389 --> 00:33:48,559
the sun five days after it's closest to

972
00:33:51,750 --> 00:33:50,399
mars so then basically then it just

973
00:33:53,509 --> 00:33:51,760
starts going out of the solar system

974
00:33:54,950 --> 00:33:53,519
again assuming it survives the mars

975
00:33:56,149 --> 00:33:54,960
encounter we're actually going to watch

976
00:33:57,669 --> 00:33:56,159
and see if there's been any changes

977
00:34:00,070 --> 00:33:57,679
because of this first passage through

978
00:34:01,269 --> 00:34:00,080
the inner system so just as kelly and

979
00:34:02,630 --> 00:34:01,279
padma mentioned

980
00:34:03,830 --> 00:34:02,640
following this comment back out again is

981
00:34:05,350 --> 00:34:03,840
going to be very important as well as

982
00:34:06,950 --> 00:34:05,360
the fly by my mars

983
00:34:08,950 --> 00:34:06,960
if there's one thing we've learned about

984
00:34:11,430 --> 00:34:08,960
comets and that is they're very

985
00:34:13,349 --> 00:34:11,440
unpredictable and and indeed that's why

986
00:34:15,510 --> 00:34:13,359
we want to keep watching

987
00:34:18,389 --> 00:34:15,520
you know as it passes by mars that's a

988
00:34:21,349 --> 00:34:18,399

gravitational perturbation interaction

989
00:34:22,470 --> 00:34:21,359
what does that do to the comet itself uh

990
00:34:25,909 --> 00:34:22,480
does it

991
00:34:27,990 --> 00:34:25,919
know so the observations are going to

992
00:34:30,230 --> 00:34:28,000
really be critical to hang in there and

993
00:34:32,829 --> 00:34:30,240
continue to continue to make

994
00:34:34,470 --> 00:34:32,839
be made well after it passes by

995
00:34:35,909 --> 00:34:34,480
mars

996
00:34:38,470 --> 00:34:35,919
it certainly will be a gift that keeps

997
00:34:39,909 --> 00:34:38,480
on giving that's for sure um okay so

998
00:34:41,909 --> 00:34:39,919
what i'm going to do here is go to the

999
00:34:43,669 --> 00:34:41,919
phone lines next uh we'll have an

1000
00:34:45,909 --> 00:34:43,679
opportunity to come back so we'll do the

1001
00:34:47,669 --> 00:34:45,919
phone lines next and then social media

1002
00:34:49,829 --> 00:34:47,679
come back here

1003
00:34:52,470 --> 00:34:49,839
i believe we have irene from reuters on

1004
00:34:53,510 --> 00:34:52,480
the call you're up irene

1005
00:34:55,829 --> 00:34:53,520
hi

1006
00:34:58,630 --> 00:34:55,839
thanks very much um i have two questions

1007
00:35:01,030 --> 00:34:58,640
so first is is it just a coincidence

1008
00:35:03,430 --> 00:35:01,040
that the orbiters

1009
00:35:04,230 --> 00:35:03,440
are going to be on the opposite side of

1010
00:35:13,270 --> 00:35:04,240
the

1011
00:35:14,790 --> 00:35:13,280
tail passing by mars or

1012
00:35:17,030 --> 00:35:14,800
was a

1013
00:35:19,510 --> 00:35:17,040

some tweaks made in the orbit to make

1014
00:35:21,829 --> 00:35:19,520
that happen and i have a follow-up

1015
00:35:23,750 --> 00:35:21,839
okay yeah that's not a coincidence um

1016
00:35:25,270 --> 00:35:23,760
the uh after that all the modeling was

1017
00:35:26,630 --> 00:35:25,280
done and one of our seahawk members here

1018
00:35:27,990 --> 00:35:26,640
was actually led one of the modeling

1019
00:35:30,710 --> 00:35:28,000
groups to look at the hazard to the

1020
00:35:31,910 --> 00:35:30,720
spacecraft once that was determined and

1021
00:35:33,829 --> 00:35:31,920
uh

1022
00:35:37,030 --> 00:35:33,839
and the timing which is really important

1023
00:35:38,870 --> 00:35:37,040
when is the time of greatest risk once

1024
00:35:40,630 --> 00:35:38,880
that was determined

1025
00:35:42,470 --> 00:35:40,640
then plans were put in motion and

1026
00:35:44,470 --> 00:35:42,480
studies were made to

1027
00:35:46,470 --> 00:35:44,480
re-phase the orbits to do the maneuvers

1028
00:35:49,030 --> 00:35:46,480
needed to make sure that the spacecraft

1029
00:35:50,950 --> 00:35:49,040
are on the uh far side of mars during

1030
00:35:52,710 --> 00:35:50,960
the time of greatest risk so it is part

1031
00:35:53,829 --> 00:35:52,720
of the plan

1032
00:35:55,990 --> 00:35:53,839
okay

1033
00:35:59,910 --> 00:35:56,000
and then just following up on that last

1034
00:36:02,310 --> 00:35:59,920
comment um is there any assessment for

1035
00:36:06,870 --> 00:36:02,320
the likelihood that the comet will be

1036
00:36:11,349 --> 00:36:08,470
well i think it's unlikely that it'll be

1037
00:36:14,790 --> 00:36:11,359
destroyed uh in the sense that we won't

1038
00:36:16,470 --> 00:36:14,800

see it as as uh continuing to sublimate

1039
00:36:18,470 --> 00:36:16,480
creating a coma and

1040
00:36:21,190 --> 00:36:18,480
a tail but whether it retains its

1041
00:36:22,310 --> 00:36:21,200
structure or not is is uh is uh of

1042
00:36:25,109 --> 00:36:22,320
interest you know whether the

1043
00:36:28,230 --> 00:36:25,119
gravitational perturbations are so great

1044
00:36:30,390 --> 00:36:28,240
uh that that it breaks it apart

1045
00:36:31,829 --> 00:36:30,400
i think uh astronomers don't believe

1046
00:36:33,349 --> 00:36:31,839
that that will happen but you know we

1047
00:36:35,030 --> 00:36:33,359
want to be able to look at it and

1048
00:36:36,790 --> 00:36:35,040
continue to make observations to

1049
00:36:38,470 --> 00:36:36,800
determine that i'd like to add to that

1050
00:36:40,630 --> 00:36:38,480
it's a very good response is that we did

1051
00:36:43,109 --> 00:36:40,640
see in 1994 a comic called shoemaker

1052
00:36:44,790 --> 00:36:43,119
levy 9 that hit repeatedly into jupiter

1053
00:36:47,349 --> 00:36:44,800
because it had flown so close by two

1054
00:36:49,270 --> 00:36:47,359
years before that in 1992 that it got

1055
00:36:51,349 --> 00:36:49,280
ripped apart

1056
00:36:53,190 --> 00:36:51,359
we don't think that in the case of

1057
00:36:54,710 --> 00:36:53,200
siding springs mars is a much smaller

1058
00:36:55,990 --> 00:36:54,720
body much less mass than jupiter and

1059
00:36:57,670 --> 00:36:56,000
even though we're coming that close to

1060
00:36:59,829 --> 00:36:57,680
mars very close to mars

1061
00:37:01,430 --> 00:36:59,839
most of the models um argue that even

1062
00:37:02,950 --> 00:37:01,440
though a comet is also very weak think

1063
00:37:05,270 --> 00:37:02,960

of the strength of maybe meringue and

1064
00:37:06,870 --> 00:37:05,280
lemon meringue pie or talcum powder in a

1065
00:37:08,310 --> 00:37:06,880
pile in your hand that's how strong

1066
00:37:10,390 --> 00:37:08,320
comets are you know the size of a

1067
00:37:11,589 --> 00:37:10,400
mountain they're incredibly weak

1068
00:37:12,870 --> 00:37:11,599
it's amazing that they're still around

1069
00:37:13,990 --> 00:37:12,880
after four and a half billion years but

1070
00:37:15,270 --> 00:37:14,000
the most the reason for that is that

1071
00:37:16,710 --> 00:37:15,280
they've been living very very far away

1072
00:37:18,630 --> 00:37:16,720
from the sun and they've been deep

1073
00:37:20,790 --> 00:37:18,640
freeze just kind of in a time storage

1074
00:37:21,910 --> 00:37:20,800
fault but jim's right we don't know if

1075
00:37:23,670 --> 00:37:21,920
we knew everything about comets we

1076
00:37:25,030 --> 00:37:23,680
wouldn't be studying them and they

1077
00:37:27,430 --> 00:37:25,040
wouldn't be that interesting and

1078
00:37:29,430 --> 00:37:27,440
variable and enigmatic and they are all

1079
00:37:30,710 --> 00:37:29,440
of those things so if we don't look we

1080
00:37:32,310 --> 00:37:30,720
won't find out and there is a

1081
00:37:33,829 --> 00:37:32,320
possibility that the comet may have

1082
00:37:35,750 --> 00:37:33,839
already broken up a little bit there's a

1083
00:37:38,310 --> 00:37:35,760
possibility that mars may drive some

1084
00:37:40,069 --> 00:37:38,320
more activity that's why we're looking

1085
00:37:41,510 --> 00:37:40,079
you know one of the things that we've

1086
00:37:43,109 --> 00:37:41,520
been monitoring of course is the

1087
00:37:46,069 --> 00:37:43,119
intensity of the light from the comet

1088
00:37:48,150 --> 00:37:46,079

over a period of time and it was uh

1089
00:37:49,910 --> 00:37:48,160
for quite a while actually at a higher

1090
00:37:51,990 --> 00:37:49,920
level than what we originally predicted

1091
00:37:54,230 --> 00:37:52,000
and then it dropped well below that so

1092
00:37:56,870 --> 00:37:54,240
we don't know how that relates to what

1093
00:37:58,470 --> 00:37:56,880
was happening with the nucleus and so

1094
00:38:00,710 --> 00:37:58,480
our mars assets when they turned and

1095
00:38:02,550 --> 00:38:00,720
they were able to get a good look high

1096
00:38:03,430 --> 00:38:02,560
resolution and and it's only going to be

1097
00:38:05,910 --> 00:38:03,440
maybe

1098
00:38:07,750 --> 00:38:05,920
half a dozen or a dozen pixels

1099
00:38:10,230 --> 00:38:07,760
but whether that's a what looks like a

1100
00:38:11,670 --> 00:38:10,240
solid shape or actually a couple shapes

1101
00:38:12,550 --> 00:38:11,680
that may really

1102
00:38:15,109 --> 00:38:12,560
really

1103
00:38:16,870 --> 00:38:15,119
fit in the puzzle very nicely as to how

1104
00:38:19,589 --> 00:38:16,880
how come the comet changed in brightness

1105
00:38:24,390 --> 00:38:19,599
over time

1106
00:38:25,349 --> 00:38:24,400
next caller is alan boyle from nbc alan

1107
00:38:27,829 --> 00:38:25,359
thank you

1108
00:38:29,109 --> 00:38:27,839
i had a question about the composition

1109
00:38:31,190 --> 00:38:29,119
since this is for coming in for the

1110
00:38:33,750 --> 00:38:31,200
first time from the oort cloud

1111
00:38:35,990 --> 00:38:33,760
do you already have a sense of how those

1112
00:38:37,349 --> 00:38:36,000
oort cloud comets are different what do

1113
00:38:39,589 --> 00:38:37,359

you expect to see

1114
00:38:41,910 --> 00:38:39,599
in terms of compositional analysis as

1115
00:38:44,550 --> 00:38:41,920
the comet comes closer and does this

1116
00:38:47,190 --> 00:38:44,560
have any bearing on the whole issue of

1117
00:38:51,190 --> 00:38:47,200
planetary defense you know the deep

1118
00:38:52,150 --> 00:38:51,200
impact scenario i i i don't suppose that

1119
00:38:54,390 --> 00:38:52,160
you've

1120
00:38:55,750 --> 00:38:54,400
got that figured out but but

1121
00:38:57,829 --> 00:38:55,760
what do you expect

1122
00:39:00,470 --> 00:38:57,839
that community might be able to gain

1123
00:39:02,069 --> 00:39:00,480
from this sort of encounter thank you

1124
00:39:04,390 --> 00:39:02,079
well our naive expectation for the

1125
00:39:06,870 --> 00:39:04,400
composition is that because this body

1126
00:39:08,150 --> 00:39:06,880
was formed out past the water ice line

1127
00:39:09,990 --> 00:39:08,160
and then was thrown out of the solar

1128
00:39:12,069 --> 00:39:10,000
system very early on

1129
00:39:13,829 --> 00:39:12,079
that it should have actually more of the

1130
00:39:15,589 --> 00:39:13,839
really volatile isis methane carbon

1131
00:39:17,109 --> 00:39:15,599
monoxide things that boil off very

1132
00:39:19,270 --> 00:39:17,119
easily it's never if you will been heat

1133
00:39:20,710 --> 00:39:19,280
treated very very strongly before

1134
00:39:22,870 --> 00:39:20,720
compared to the comets that like the

1135
00:39:25,349 --> 00:39:22,880
temple ones or the veiled twos that or

1136
00:39:27,109 --> 00:39:25,359
or the trasomob grassamenko the rosetta

1137
00:39:28,630 --> 00:39:27,119
target that we're coming very close to

1138
00:39:30,790 --> 00:39:28,640

right now we're actually flying by or

1139
00:39:32,230 --> 00:39:30,800
rendezvousing with and those comets have

1140
00:39:34,710 --> 00:39:32,240
been around the sun and the inner system

1141
00:39:36,069 --> 00:39:34,720
for many many many passages so our naive

1142
00:39:38,790 --> 00:39:36,079
expectation is that there'll be more

1143
00:39:42,069 --> 00:39:38,800
volatile organic ices in

1144
00:39:43,910 --> 00:39:42,079
in sighting spring that being said um

1145
00:39:45,670 --> 00:39:43,920
that also might be what created that

1146
00:39:47,270 --> 00:39:45,680
initial bump up of activity jim just

1147
00:39:48,550 --> 00:39:47,280
related to it we think it could possibly

1148
00:39:50,150 --> 00:39:48,560
be either due to the fact it's almost

1149
00:39:51,589 --> 00:39:50,160
like nitrous oxide in your gasoline

1150
00:39:52,870 --> 00:39:51,599
engine tank that that those

1151
00:39:55,030 --> 00:39:52,880
hypervolatiles could have actually

1152
00:39:56,310 --> 00:39:55,040
increased the activity and created the

1153
00:39:57,910 --> 00:39:56,320
activity that might let us see this

1154
00:39:58,870 --> 00:39:57,920
comet almost out by saturn's orbit to

1155
00:40:00,310 --> 00:39:58,880
begin with

1156
00:40:01,349 --> 00:40:00,320
there's put it in a different way

1157
00:40:03,670 --> 00:40:01,359
there's no way we would see a body

1158
00:40:05,109 --> 00:40:03,680
that's between half and five miles in

1159
00:40:07,109 --> 00:40:05,119
diameter out by saturn it's just and

1160
00:40:09,109 --> 00:40:07,119
very dark it's way too small the only

1161
00:40:10,950 --> 00:40:09,119
way we saw this comet detected so early

1162
00:40:12,870 --> 00:40:10,960
more than a year ago was because it was

1163
00:40:14,950 --> 00:40:12,880

very active very far out

1164
00:40:16,390 --> 00:40:14,960
so we that our naive expectation is that

1165
00:40:18,150 --> 00:40:16,400
that activity may have been actually

1166
00:40:20,150 --> 00:40:18,160
been driven by the very first passage

1167
00:40:21,750 --> 00:40:20,160
into the inner system and then it's now

1168
00:40:23,750 --> 00:40:21,760
slacking off that could be one reason

1169
00:40:25,430 --> 00:40:23,760
why it's run out of these hypervolatiles

1170
00:40:26,790 --> 00:40:25,440
another is that it could have broken up

1171
00:40:28,069 --> 00:40:26,800
because it's again never been stressed

1172
00:40:29,750 --> 00:40:28,079
and heat treated much before it's ever

1173
00:40:31,030 --> 00:40:29,760
in the inner system

1174
00:40:32,550 --> 00:40:31,040
the other thing i would say is that what

1175
00:40:33,990 --> 00:40:32,560
we learned from comet ison last year is

1176
00:40:36,950 --> 00:40:34,000
common ison looked like it was very

1177
00:40:38,950 --> 00:40:36,960
carbon rich maybe organic materials rich

1178
00:40:40,390 --> 00:40:38,960
so and that was another oort cloud comet

1179
00:40:42,230 --> 00:40:40,400
so we're guessing that siding springs

1180
00:40:45,270 --> 00:40:42,240
should show us an awful lot of organic

1181
00:40:47,829 --> 00:40:45,280
carbon and rich material

1182
00:40:49,990 --> 00:40:47,839
so let me sort of address

1183
00:40:52,230 --> 00:40:50,000
the near-earth object aspect of your

1184
00:40:54,230 --> 00:40:52,240
question and i think it's easy to do in

1185
00:40:55,670 --> 00:40:54,240
the sense of what we're seeing in the

1186
00:40:57,349 --> 00:40:55,680
long run

1187
00:40:59,270 --> 00:40:57,359
you know in the last couple years we've

1188
00:41:00,870 --> 00:40:59,280

really stepped up our observations of

1189
00:41:02,230 --> 00:41:00,880
near-earth objects we have a lot more

1190
00:41:03,829 --> 00:41:02,240
observatories

1191
00:41:06,630 --> 00:41:03,839
we put more

1192
00:41:09,349 --> 00:41:06,640
telescope observing time and can see a

1193
00:41:11,109 --> 00:41:09,359
larger part of the sky and we're now

1194
00:41:13,990 --> 00:41:11,119
seeing some new trends that we haven't

1195
00:41:17,190 --> 00:41:14,000
seen before if you look back in history

1196
00:41:19,670 --> 00:41:17,200
the number of or cloud comets we observe

1197
00:41:21,109 --> 00:41:19,680
are just a matter of three or four a

1198
00:41:22,870 --> 00:41:21,119
century

1199
00:41:24,870 --> 00:41:22,880
we do see a lot of comets but those are

1200
00:41:26,870 --> 00:41:24,880
all short period comets

1201
00:41:29,270 --> 00:41:26,880
that exist in and around the the period

1202
00:41:30,950 --> 00:41:29,280
of uh going out to jupiter or maybe even

1203
00:41:33,430 --> 00:41:30,960
a little bit into the the kuiper belt

1204
00:41:35,430 --> 00:41:33,440
but not many from the ore cloud

1205
00:41:37,109 --> 00:41:35,440
but more recently now now that we've

1206
00:41:39,510 --> 00:41:37,119
really picked up our observations we're

1207
00:41:41,349 --> 00:41:39,520
now seeing many more ore cloud comets

1208
00:41:43,270 --> 00:41:41,359
actually there's a there's three up

1209
00:41:45,510 --> 00:41:43,280
right now there's a

1210
00:41:47,670 --> 00:41:45,520
siding spring there's another one called

1211
00:41:48,870 --> 00:41:47,680
pan star and there's another one called

1212
00:41:51,670 --> 00:41:48,880
jacques

1213
00:41:53,190 --> 00:41:51,680

and uh and we believe that uh our

1214
00:41:54,870 --> 00:41:53,200
near-earth object

1215
00:41:57,510 --> 00:41:54,880
set of observations that we're making

1216
00:41:59,190 --> 00:41:57,520
now are becoming much more comprehensive

1217
00:42:00,550 --> 00:41:59,200
and we're getting a much better view of

1218
00:42:02,470 --> 00:42:00,560
what's happening

1219
00:42:04,870 --> 00:42:02,480
in our solar system and and that's just

1220
00:42:06,790 --> 00:42:04,880
gonna continue to increase so i believe

1221
00:42:08,790 --> 00:42:06,800
we'll continue to find not only near

1222
00:42:11,510 --> 00:42:08,800
earth objects but these comets

1223
00:42:13,750 --> 00:42:11,520
um uh because they as they move across

1224
00:42:16,870 --> 00:42:13,760
the sky that's how we detect them from

1225
00:42:18,710 --> 00:42:16,880
the background uh of stars very far away

1226
00:42:21,750 --> 00:42:18,720
that that don't move in the in the frame

1227
00:42:27,430 --> 00:42:25,109
okay okay next up tracy watson from usa

1228
00:42:29,109 --> 00:42:27,440
today greetings tracy

1229
00:42:30,710 --> 00:42:29,119
hi dwane thanks for taking my call i

1230
00:42:33,109 --> 00:42:30,720
have a couple questions

1231
00:42:34,870 --> 00:42:33,119
first i understand that the modeling has

1232
00:42:36,710 --> 00:42:34,880
shown that there's going to be very

1233
00:42:39,109 --> 00:42:36,720
little big dust

1234
00:42:42,550 --> 00:42:39,119
falling on either mars or even reaching

1235
00:42:43,589 --> 00:42:42,560
its orbit from the comet so can you talk

1236
00:42:45,750 --> 00:42:43,599
about

1237
00:42:47,190 --> 00:42:45,760
whether you really expect to see

1238
00:42:50,069 --> 00:42:47,200

meteors

1239
00:42:52,150 --> 00:42:50,079
meteorites over mars and also what the

1240
00:42:54,870 --> 00:42:52,160
hazard would have been if the spacecraft

1241
00:42:56,390 --> 00:42:54,880
hadn't been moved to the backside

1242
00:42:57,750 --> 00:42:56,400
at least answer the first part of that

1243
00:43:00,230 --> 00:42:57,760
i'm going to actually kick that to

1244
00:43:01,990 --> 00:43:00,240
somebody who did the modeling so

1245
00:43:03,109 --> 00:43:02,000
if we could send a mic over here i'm

1246
00:43:05,109 --> 00:43:03,119
going to

1247
00:43:07,430 --> 00:43:05,119
have tony farnam of the university of

1248
00:43:09,270 --> 00:43:07,440
maryland answer that question since he

1249
00:43:11,109 --> 00:43:09,280
was involved in helping to make that

1250
00:43:13,910 --> 00:43:11,119
assessment

1251
00:43:16,230 --> 00:43:13,920
um yeah am i on um

1252
00:43:17,349 --> 00:43:16,240
we did the modeling to

1253
00:43:18,790 --> 00:43:17,359
look at the

1254
00:43:21,910 --> 00:43:18,800
the hazards of what was going to go on

1255
00:43:24,150 --> 00:43:21,920
at the time the comet encountered mars

1256
00:43:26,150 --> 00:43:24,160
and it's kind of a strange

1257
00:43:29,910 --> 00:43:26,160
situation because this cometh gets very

1258
00:43:31,030 --> 00:43:29,920
close but it actually doesn't uh

1259
00:43:33,270 --> 00:43:31,040
the the

1260
00:43:35,510 --> 00:43:33,280
dust that comes off the comet actually

1261
00:43:38,230 --> 00:43:35,520
doesn't make it to mars before it's

1262
00:43:41,750 --> 00:43:38,240
blown away by solar radiation pressure

1263
00:43:43,190 --> 00:43:41,760

so the the expectation is

1264
00:43:44,950 --> 00:43:43,200
that very little of the dust will

1265
00:43:47,430 --> 00:43:44,960
actually hit mars

1266
00:43:50,069 --> 00:43:47,440
um the biggest hazard actually occurs

1267
00:43:51,109 --> 00:43:50,079
after closest approach as jim said

1268
00:43:53,910 --> 00:43:51,119
when

1269
00:43:56,069 --> 00:43:53,920
the big dust that sort of trails behind

1270
00:43:57,510 --> 00:43:56,079
the comet may

1271
00:44:00,069 --> 00:43:57,520
uh

1272
00:44:01,670 --> 00:44:00,079
reach mars as mars crosses the comet's

1273
00:44:03,670 --> 00:44:01,680
orbital plane

1274
00:44:05,670 --> 00:44:03,680
the velocities that we see in the comet

1275
00:44:07,190 --> 00:44:05,680
suggest that's not going to happen

1276
00:44:09,190 --> 00:44:07,200
because these are big particles and they

1277
00:44:11,030 --> 00:44:09,200
would have had to have been emitted long

1278
00:44:12,870 --> 00:44:11,040
before perihelion something like two

1279
00:44:15,829 --> 00:44:12,880
years before perihelion

1280
00:44:16,790 --> 00:44:15,839
and from our observations that's not

1281
00:44:18,870 --> 00:44:16,800
uh

1282
00:44:21,510 --> 00:44:18,880
they suggest that that didn't happen so

1283
00:44:24,710 --> 00:44:21,520
the hazard is um expect the expectation

1284
00:44:27,829 --> 00:44:24,720
of the hazard is very small

1285
00:44:30,309 --> 00:44:27,839
yes and in terms of what the engineers

1286
00:44:32,309 --> 00:44:30,319
from the uh mission projects did they

1287
00:44:34,630 --> 00:44:32,319
took this information and then they they

1288
00:44:35,829 --> 00:44:34,640

did all the amazing work that they do uh

1289
00:44:40,230 --> 00:44:35,839
looking at

1290
00:44:42,230 --> 00:44:40,240
happen if uh if there was a dust

1291
00:44:44,790 --> 00:44:42,240
particle coming in at uh

1292
00:44:47,829 --> 00:44:44,800
it was i guess 33 miles

1293
00:44:49,270 --> 00:44:47,839
per second yeah getting the right units

1294
00:44:51,109 --> 00:44:49,280
what it would do to different components

1295
00:44:53,190 --> 00:44:51,119
on the spacecraft how they might have to

1296
00:44:54,870 --> 00:44:53,200
orient the spacecraft or all those

1297
00:44:56,710 --> 00:44:54,880
different trades that they would have to

1298
00:44:58,710 --> 00:44:56,720
do and so ultimately was decided the

1299
00:45:02,150 --> 00:44:58,720
best thing to do is uh yeah the risk is

1300
00:45:04,150 --> 00:45:02,160
small but it's there and so what we can

1301
00:45:05,750 --> 00:45:04,160
do is change the orbits so that at least

1302
00:45:07,670 --> 00:45:05,760
during that period of greatest risk the

1303
00:45:09,589 --> 00:45:07,680
spacecraft are on the other side of mars

1304
00:45:10,790 --> 00:45:09,599
so so they'll be able to do the science

1305
00:45:13,670 --> 00:45:10,800
they'll kind of hunker down and they'll

1306
00:45:15,589 --> 00:45:13,680
do the science again and uh so

1307
00:45:17,109 --> 00:45:15,599
the expectation is that it will all be

1308
00:45:18,390 --> 00:45:17,119
okay and that all the precautions have

1309
00:45:19,910 --> 00:45:18,400
been taken

1310
00:45:21,270 --> 00:45:19,920
i'd like to add that this was actually a

1311
00:45:22,950 --> 00:45:21,280
very important thing to study if you

1312
00:45:24,470 --> 00:45:22,960
think about meteor showers on our own

1313
00:45:26,390 --> 00:45:24,480

planet when we see them it's usually

1314
00:45:28,390 --> 00:45:26,400
because we're passing through a comet's

1315
00:45:29,990 --> 00:45:28,400
orbit or where an asteroid that some

1316
00:45:31,990 --> 00:45:30,000
asteroids also shed material that we're

1317
00:45:34,069 --> 00:45:32,000
passing through its orbit i don't can't

1318
00:45:35,990 --> 00:45:34,079
think or recollect a time when we pass

1319
00:45:38,710 --> 00:45:36,000
through that orbit about an hour hour

1320
00:45:40,150 --> 00:45:38,720
and a half after the body just went by

1321
00:45:41,430 --> 00:45:40,160
all right so that doesn't have we

1322
00:45:43,349 --> 00:45:41,440
usually go through an old part of the

1323
00:45:44,950 --> 00:45:43,359
orbit when the comet is way around

1324
00:45:47,750 --> 00:45:44,960
another part in the orbit you know many

1325
00:45:49,270 --> 00:45:47,760
many months to years passed us so it was

1326
00:45:51,750 --> 00:45:49,280
a perfectly reasonable and important

1327
00:45:53,510 --> 00:45:51,760
thing to do to worry about this hazard

1328
00:45:55,109 --> 00:45:53,520
it's actually amazing the hazard is so

1329
00:45:56,470 --> 00:45:55,119
low but we've had three different groups

1330
00:45:57,750 --> 00:45:56,480
international groups telling us that not

1331
00:45:59,030 --> 00:45:57,760
to worry

1332
00:46:00,550 --> 00:45:59,040
okay we're going to take one more

1333
00:46:02,150 --> 00:46:00,560
question uh from the phone and then

1334
00:46:04,309 --> 00:46:02,160
we're going to go to social media and

1335
00:46:06,230 --> 00:46:04,319
then we're going to wrap up so

1336
00:46:08,150 --> 00:46:06,240
we have kelly beatty from scott

1337
00:46:09,750 --> 00:46:08,160
telescope kelly

1338
00:46:10,870 --> 00:46:09,760

thank you you know most of my questions

1339
00:46:13,510 --> 00:46:10,880
have been answered i'm going to pass

1340
00:46:15,670 --> 00:46:13,520
them with somebody else okay

1341
00:46:17,190 --> 00:46:15,680
excellent let's go to social media jason

1342
00:46:19,109 --> 00:46:17,200
what's going on in the social media

1343
00:46:21,270 --> 00:46:19,119
world indeed we've got several questions

1344
00:46:23,190 --> 00:46:21,280
from both users on twitter and from uh

1345
00:46:25,349 --> 00:46:23,200
those that are watching on ustream here

1346
00:46:26,790 --> 00:46:25,359
first one comes from hector who asks i

1347
00:46:29,270 --> 00:46:26,800
know the numbers were crunched many

1348
00:46:31,030 --> 00:46:29,280
times and 83 miles is awfully close what

1349
00:46:34,309 --> 00:46:31,040
are the chances of a spectacular mars

1350
00:46:38,630 --> 00:46:37,510
that's 138 000 kilometers or 88 thousand

1351
00:46:40,950 --> 00:46:38,640
miles

1352
00:46:42,790 --> 00:46:40,960
is the closest approach to mars center

1353
00:46:44,630 --> 00:46:42,800
so it's a little bit farther away the

1354
00:46:47,670 --> 00:46:44,640
error bar on that if i believe is in the

1355
00:46:49,349 --> 00:46:47,680
order of maybe 10 000 miles so we i

1356
00:46:51,349 --> 00:46:49,359
believe there's almost zero chance of

1357
00:46:52,950 --> 00:46:51,359
the comet hitting mars

1358
00:46:55,990 --> 00:46:52,960
the short answer

1359
00:46:57,910 --> 00:46:56,000
wonderful then uh twitter user dms asks

1360
00:46:59,990 --> 00:46:57,920
will a spectacular meteor shower follow

1361
00:47:01,829 --> 00:47:00,000
up on the brush of the coma with mars

1362
00:47:03,510 --> 00:47:01,839
upper atmosphere and will the rovers and

1363
00:47:06,470 --> 00:47:03,520

orbiters be able to see it

1364
00:47:08,230 --> 00:47:06,480
meanwhile at the same time user t asks

1365
00:47:10,710 --> 00:47:08,240
will curiosity and opportunity be able

1366
00:47:12,630 --> 00:47:10,720
to get photos of that and if there's any

1367
00:47:14,710 --> 00:47:12,640
rain of debris

1368
00:47:16,230 --> 00:47:14,720
well they certainly will look and even

1369
00:47:18,390 --> 00:47:16,240
um like the uh

1370
00:47:19,430 --> 00:47:18,400
yeah the rovers are going to look up and

1371
00:47:22,710 --> 00:47:19,440
uh

1372
00:47:25,030 --> 00:47:22,720
orbiter is going to look at that but

1373
00:47:26,470 --> 00:47:25,040
also the hubble space telescope is going

1374
00:47:28,790 --> 00:47:26,480
to as part of its science is going to

1375
00:47:31,030 --> 00:47:28,800
take a look at that but as tony farnham

1376
00:47:32,710 --> 00:47:31,040
explained the the risk is probably

1377
00:47:34,230 --> 00:47:32,720
not the risk at this point

1378
00:47:36,710 --> 00:47:34,240
uh you know the odds of that happening

1379
00:47:38,950 --> 00:47:36,720
are are minimal but they that still

1380
00:47:40,470 --> 00:47:38,960
could happen and so again you don't know

1381
00:47:42,870 --> 00:47:40,480
if you don't look and so we're going to

1382
00:47:44,870 --> 00:47:42,880
take a look at that so a byproduct of

1383
00:47:46,950 --> 00:47:44,880
the hazard modeling was that it told you

1384
00:47:49,589 --> 00:47:46,960
how many particles we expect to be

1385
00:47:51,270 --> 00:47:49,599
hitting both mars and the spacecraft so

1386
00:47:52,870 --> 00:47:51,280
it now the hazard modeling tells you

1387
00:47:55,109 --> 00:47:52,880
what direction to look to see those

1388
00:47:56,550 --> 00:47:55,119

meteors and if i understand a quote tony

1389
00:47:58,550 --> 00:47:56,560
is in the audience is that i believe

1390
00:47:59,589 --> 00:47:58,560
they do expect some meteors but it's

1391
00:48:01,990 --> 00:47:59,599
going to be a little bit above the

1392
00:48:03,910 --> 00:48:02,000
normal background rate just from going

1393
00:48:05,349 --> 00:48:03,920
passing around the solar system so if

1394
00:48:07,190 --> 00:48:05,359
you look very carefully one place in the

1395
00:48:08,550 --> 00:48:07,200
sky you might see a bit of enhancement

1396
00:48:10,309 --> 00:48:08,560
but not much

1397
00:48:12,790 --> 00:48:10,319
so one thing we do know

1398
00:48:14,390 --> 00:48:12,800
is where opportunity will be and where

1399
00:48:16,309 --> 00:48:14,400
curiosity will be

1400
00:48:19,190 --> 00:48:16,319
so a closest approach

1401
00:48:20,550 --> 00:48:19,200
opportunity will be just coming out of

1402
00:48:23,910 --> 00:48:20,560
dawn

1403
00:48:26,309 --> 00:48:23,920
and curiosity will be going into dusk

1404
00:48:28,230 --> 00:48:26,319
so within a few hours after the event uh

1405
00:48:29,510 --> 00:48:28,240
curiosity will be on the night side of

1406
00:48:30,549 --> 00:48:29,520
the planet

1407
00:48:40,549 --> 00:48:30,559
may

1408
00:48:42,390 --> 00:48:40,559
on the day side

1409
00:48:44,870 --> 00:48:42,400
opportunity will have to

1410
00:48:47,270 --> 00:48:44,880
be looking up and that is indeed planned

1411
00:48:49,190 --> 00:48:47,280
but but indeed the larger particles

1412
00:48:51,109 --> 00:48:49,200
would have to make some sort of some

1413
00:48:53,430 --> 00:48:51,119

sort of fireball or some sort of trail

1414
00:48:55,510 --> 00:48:53,440
for it to be able to seem but as they

1415
00:48:58,069 --> 00:48:55,520
say we've got a we've got to plan these

1416
00:48:59,910 --> 00:48:58,079
observations in advance and and uh wait

1417
00:49:01,510 --> 00:48:59,920
to see what what happens

1418
00:49:02,870 --> 00:49:01,520
let's take a couple more then we'll take

1419
00:49:05,510 --> 00:49:02,880
one more from the phone and we'll wrap

1420
00:49:07,510 --> 00:49:05,520
up all right then this comes from a user

1421
00:49:09,270 --> 00:49:07,520
watching on ustream here will maven be

1422
00:49:11,990 --> 00:49:09,280
able to get a baseline observation

1423
00:49:14,710 --> 00:49:12,000
before the effects of the comet occur

1424
00:49:16,230 --> 00:49:14,720
yes actually that's part of the plan uh

1425
00:49:17,910 --> 00:49:16,240
now again they just arrived at mars and

1426
00:49:19,349 --> 00:49:17,920
so the first order of business is to go

1427
00:49:21,190 --> 00:49:19,359
through the activities they need to do

1428
00:49:22,950 --> 00:49:21,200
to transition to doing the science and

1429
00:49:24,150 --> 00:49:22,960
so they're going to fit this science in

1430
00:49:25,589 --> 00:49:24,160
they've even released some science

1431
00:49:28,309 --> 00:49:25,599
already but that's the first order of

1432
00:49:29,670 --> 00:49:28,319
business if all goes well then they are

1433
00:49:31,270 --> 00:49:29,680
going to get a baseline measurement of

1434
00:49:33,190 --> 00:49:31,280
the atmosphere so they can see what is

1435
00:49:36,630 --> 00:49:33,200
the difference after the comet went by

1436
00:49:38,790 --> 00:49:36,640
so yes they will indeed do that

1437
00:49:41,190 --> 00:49:38,800
excellent then also coming from ustream

1438
00:49:43,270 --> 00:49:41,200

here how long might this dust persist on

1439
00:49:47,510 --> 00:49:43,280
mars and are there any effects on the

1440
00:49:51,910 --> 00:49:49,670
referring to dust from the comet or the

1441
00:49:53,829 --> 00:49:51,920
dust just in the dust in the atmosphere

1442
00:49:55,670 --> 00:49:53,839
okay well again there'll probably be

1443
00:49:58,470 --> 00:49:55,680
very little of that

1444
00:50:00,549 --> 00:49:58,480
and uh and the period at least like of

1445
00:50:02,870 --> 00:50:00,559
greatest risk to the spacecraft and when

1446
00:50:04,549 --> 00:50:02,880
the meteors might be coming in uh would

1447
00:50:06,630 --> 00:50:04,559
be it's only about a 20 minute per

1448
00:50:09,270 --> 00:50:06,640
period so that's actually pretty short

1449
00:50:10,710 --> 00:50:09,280
when the when mars passes the plane of

1450
00:50:13,030 --> 00:50:10,720
the comet's orbit

1451
00:50:14,470 --> 00:50:13,040
so it is a short period

1452
00:50:16,150 --> 00:50:14,480
and if you think about how much the

1453
00:50:18,150 --> 00:50:16,160
meteors affect the dust environment in

1454
00:50:20,150 --> 00:50:18,160
our atmosphere it's very small so we

1455
00:50:21,589 --> 00:50:20,160
only expect a bump up of maybe a few

1456
00:50:22,950 --> 00:50:21,599
times the background rate we don't think

1457
00:50:25,430 --> 00:50:22,960
there'll be much of an effect on the

1458
00:50:28,069 --> 00:50:25,440
rovers or on any ground assets

1459
00:50:29,829 --> 00:50:28,079
okay so um for the

1460
00:50:31,109 --> 00:50:29,839
social media folks keep those questions

1461
00:50:33,430 --> 00:50:31,119
coming in we'll have some of our

1462
00:50:35,109 --> 00:50:33,440
scientists uh get you the answers as

1463
00:50:36,790 --> 00:50:35,119

soon as possible what we're gonna do

1464
00:50:38,470 --> 00:50:36,800
here is take one more call from the

1465
00:50:41,270 --> 00:50:38,480
phone lines and uh wrap it up for the

1466
00:50:45,030 --> 00:50:41,280
day so back on the phone and mike wahl

1467
00:50:48,950 --> 00:50:46,950
thanks guys um yeah and i just had a

1468
00:50:51,030 --> 00:50:48,960
question about yet then what what

1469
00:50:52,790 --> 00:50:51,040
opportunity and

1470
00:50:54,710 --> 00:50:52,800
what can also curiosity might be able to

1471
00:50:56,150 --> 00:50:54,720
find i mean is this just just sort of

1472
00:50:57,910 --> 00:50:56,160
pretty pictures that you're hoping to

1473
00:50:59,990 --> 00:50:57,920
get from the mars rovers or is there

1474
00:51:02,549 --> 00:51:00,000
some science you could clean

1475
00:51:04,150 --> 00:51:02,559
like from their photos and um

1476
00:51:06,230 --> 00:51:04,160
yeah we don't want to get too excited we

1477
00:51:08,390 --> 00:51:06,240
know but but is it possible to get a big

1478
00:51:10,549 --> 00:51:08,400
fireball photo in the martian sky is

1479
00:51:11,510 --> 00:51:10,559
that something that um that could happen

1480
00:51:15,190 --> 00:51:11,520
or

1481
00:51:18,069 --> 00:51:15,200
don't know a dim light through the dust

1482
00:51:19,349 --> 00:51:18,079
is is sort of i mean what what to expect

1483
00:51:22,069 --> 00:51:19,359
should we should we get excited about

1484
00:51:23,589 --> 00:51:22,079
those those sort of possibilities of

1485
00:51:25,750 --> 00:51:23,599
like of what opportunity might return

1486
00:51:27,510 --> 00:51:25,760
curiosity might return or or should we

1487
00:51:28,230 --> 00:51:27,520
just sort of calm down and just wait and

1488
00:51:29,589 --> 00:51:28,240

see

1489
00:51:31,589 --> 00:51:29,599
well i still think it's good to get

1490
00:51:33,270 --> 00:51:31,599
excited because you got to look and

1491
00:51:34,950 --> 00:51:33,280
certainly there there is science in the

1492
00:51:37,030 --> 00:51:34,960
pictures just seeing what the comet

1493
00:51:38,390 --> 00:51:37,040
looks like and what actually makes it

1494
00:51:40,150 --> 00:51:38,400
through the atmosphere what the light

1495
00:51:42,870 --> 00:51:40,160
that makes it through the atmosphere

1496
00:51:44,790 --> 00:51:42,880
what it sees but also on curiosity the

1497
00:51:47,030 --> 00:51:44,800
chemcam is also going to

1498
00:51:47,829 --> 00:51:47,040
take a look at

1499
00:51:49,589 --> 00:51:47,839
any

1500
00:51:51,589 --> 00:51:49,599
mineral information that it can detect

1501
00:51:53,349 --> 00:51:51,599
from the comet so yes there still is

1502
00:51:55,109 --> 00:51:53,359
science to be done though we love the

1503
00:51:56,470 --> 00:51:55,119
pretty pictures too but there are signs

1504
00:51:57,910 --> 00:51:56,480
to be done also

1505
00:51:59,589 --> 00:51:57,920
i wouldn't i'm not convinced there'll be

1506
00:52:01,030 --> 00:51:59,599
a fireball picture but i'm excited just

1507
00:52:02,870 --> 00:52:01,040
to see the first image of a comet from

1508
00:52:03,750 --> 00:52:02,880
the surface of another planet

1509
00:52:05,190 --> 00:52:03,760
i think that's going to be really

1510
00:52:08,470 --> 00:52:05,200
exciting if we get it

1511
00:52:10,150 --> 00:52:08,480
i think what i'd like to add is um

1512
00:52:12,790 --> 00:52:10,160
you know even though we'll be imaging

1513
00:52:15,430 --> 00:52:12,800

from curiosity and opportunity curiosity

1514
00:52:17,190 --> 00:52:15,440
actually has a really nice set

1515
00:52:19,270 --> 00:52:17,200
of

1516
00:52:21,109 --> 00:52:19,280
weather measurements if you will so it

1517
00:52:23,910 --> 00:52:21,119
measures the pressure and the

1518
00:52:25,750 --> 00:52:23,920
temperature at a really pretty good clip

1519
00:52:27,270 --> 00:52:25,760
now although right now we believe that

1520
00:52:29,430 --> 00:52:27,280
most of the effects that will be

1521
00:52:31,589 --> 00:52:29,440
observed will be in the ionosphere and

1522
00:52:33,430 --> 00:52:31,599
in the upper atmosphere we don't believe

1523
00:52:35,190 --> 00:52:33,440
there'll be many effects in the lower

1524
00:52:37,030 --> 00:52:35,200
atmosphere where curiosity and

1525
00:52:39,190 --> 00:52:37,040
opportunity obviously are but we're

1526
00:52:41,829 --> 00:52:39,200
making those measurements too i mean

1527
00:52:43,990 --> 00:52:41,839
it'd be it'd be great to be able to look

1528
00:52:45,910 --> 00:52:44,000
at those and and determine if pressure

1529
00:52:47,109 --> 00:52:45,920
changes or temperature changes might be

1530
00:52:48,150 --> 00:52:47,119
attributed

1531
00:52:52,470 --> 00:52:48,160
to

1532
00:52:54,309 --> 00:52:52,480
the cometary material

1533
00:52:56,470 --> 00:52:54,319
the measurements will be made and the

1534
00:52:57,910 --> 00:52:56,480
scientists will take a look and and i

1535
00:52:59,190 --> 00:52:57,920
know we'll get some great stuff out of

1536
00:53:02,230 --> 00:52:59,200
it

1537
00:53:03,670 --> 00:53:02,240
okay so jason uh asks for one more he

1538
00:53:05,190 --> 00:53:03,680

you know i can't tell him no so we're

1539
00:53:07,190 --> 00:53:05,200
gonna go and get one more question for

1540
00:53:08,710 --> 00:53:07,200
social media jason not a problem there's

1541
00:53:10,309 --> 00:53:08,720
a couple of different variations of

1542
00:53:12,630 --> 00:53:10,319
questions on here all asking about how

1543
00:53:15,190 --> 00:53:12,640
people can get involved and so on um so

1544
00:53:17,510 --> 00:53:15,200
for example aubry from twitter asks will

1545
00:53:19,430 --> 00:53:17,520
i be able to see it from ohio meanwhile

1546
00:53:23,349 --> 00:53:19,440
tim asks will there be an online feed

1547
00:53:28,230 --> 00:53:27,270
um yeah i think from ohio that that one

1548
00:53:30,069 --> 00:53:28,240
that probably won't work out

1549
00:53:31,829 --> 00:53:30,079
unfortunately it's really mars has the

1550
00:53:34,790 --> 00:53:31,839
front row seat and here probably more

1551
00:53:35,910 --> 00:53:34,800
the southern hemisphere um but there are

1552
00:53:37,510 --> 00:53:35,920
uh

1553
00:53:39,270 --> 00:53:37,520
i don't remember offhand but there's a

1554
00:53:41,349 --> 00:53:39,280
social being planned i believe but i

1555
00:53:42,950 --> 00:53:41,359
don't remember the timing of that and so

1556
00:53:44,950 --> 00:53:42,960
that might still be in the in the works

1557
00:53:47,510 --> 00:53:44,960
so there's that opportunity uh then

1558
00:53:49,430 --> 00:53:47,520
there's uh the websites uh just to find

1559
00:53:51,230 --> 00:53:49,440
out for more information the comic

1560
00:53:54,309 --> 00:53:51,240
campaign.org and the

1561
00:53:55,510 --> 00:53:54,319
mars.nasa.gov slash comet siding spring

1562
00:53:57,510 --> 00:53:55,520
they have all kinds of background

1563
00:54:00,230 --> 00:53:57,520

information but in terms of the events

1564
00:54:02,309 --> 00:54:00,240
um you could follow the nasa

1565
00:54:04,069 --> 00:54:02,319
social pages i would think and then once

1566
00:54:05,589 --> 00:54:04,079
the rest of it forms up that will be out

1567
00:54:07,270 --> 00:54:05,599
there is that correct dwayne that's

1568
00:54:09,030 --> 00:54:07,280
right i'd also point out that the time

1569
00:54:10,069 --> 00:54:09,040
when the closest approach is about

1570
00:54:11,430 --> 00:54:10,079
what's going to be about there in the

1571
00:54:12,950 --> 00:54:11,440
middle of the first football game two

1572
00:54:14,790 --> 00:54:12,960
sundays from now so it's going to be the

1573
00:54:16,150 --> 00:54:14,800
middle of the day for us but i also want

1574
00:54:18,069 --> 00:54:16,160
to point out that padma has been doing

1575
00:54:20,230 --> 00:54:18,079
an awful lot on facebook and twitter so

1576
00:54:22,870 --> 00:54:20,240
maybe we should let her comment i was

1577
00:54:24,470 --> 00:54:22,880
going to say we do have an amateur

1578
00:54:26,069 --> 00:54:24,480
and pro it's a pro

1579
00:54:29,670 --> 00:54:26,079
professional amateur collaboration group

1580
00:54:32,710 --> 00:54:29,680
called packa and there are ways to um

1581
00:54:35,430 --> 00:54:32,720
participate uh all of this is online uh

1582
00:54:37,910 --> 00:54:35,440
as well as uh they're going to be uh

1583
00:54:40,309 --> 00:54:37,920
different social media including twitter

1584
00:54:42,470 --> 00:54:40,319
as well as flickr albums that we already

1585
00:54:44,390 --> 00:54:42,480
have those populated so you can see the

1586
00:54:46,630 --> 00:54:44,400
images the amateurs have been taking

1587
00:54:48,309 --> 00:54:46,640
since january and so those will be

1588
00:54:49,910 --> 00:54:48,319

continuing and even if you're not a

1589
00:54:51,750 --> 00:54:49,920
member you can

1590
00:54:53,349 --> 00:54:51,760
many people who take images can upload

1591
00:54:54,950 --> 00:54:53,359
directly to the flickr album so they're

1592
00:54:57,750 --> 00:54:54,960
available to the public

1593
00:54:59,510 --> 00:54:57,760
um and also we pr we're planning to have

1594
00:55:01,030 --> 00:54:59,520
our own google hangouts or people who

1595
00:55:04,150 --> 00:55:01,040
have taken the data from the different

1596
00:55:06,870 --> 00:55:04,160
locations uh in australia south africa

1597
00:55:09,430 --> 00:55:06,880
as well as south america can pretty much

1598
00:55:11,430 --> 00:55:09,440
uh show what they have taken and pass on

1599
00:55:13,670 --> 00:55:11,440
the baton so to speak to the next

1600
00:55:15,990 --> 00:55:13,680
location so that you can actually see

1601
00:55:18,230 --> 00:55:16,000
what the observers are taking data even

1602
00:55:21,270 --> 00:55:18,240
though casey says there's football on

1603
00:55:24,710 --> 00:55:21,280
that sunday if your team loses forget

1604
00:55:26,150 --> 00:55:24,720
about it and just go to your stream

1605
00:55:27,750 --> 00:55:26,160
and a lot of the other rest of the world

1606
00:55:29,430 --> 00:55:27,760
doesn't watch american football so there

1607
00:55:31,670 --> 00:55:29,440
are a lot of

1608
00:55:34,549 --> 00:55:31,680
so this is a lot more exciting

1609
00:55:36,150 --> 00:55:34,559
okay

1610
00:55:38,150 --> 00:55:36,160
all right so uh what we're gonna do here

1611
00:55:40,069 --> 00:55:38,160
is wrap up i would like to remind folks

1612
00:55:44,150 --> 00:55:40,079
that uh updates

1613
00:55:45,670 --> 00:55:44,160

on any images or any uh activities go to

1614
00:55:47,670 --> 00:55:45,680
the nasa website

1615
00:55:49,349 --> 00:55:47,680
uh nasa.gov and in particular

1616
00:55:52,630 --> 00:55:49,359
mars.nasa.gov

1617
00:55:55,910 --> 00:55:52,640
comment slash citing spring

1618
00:55:58,950 --> 00:55:55,920
uh we want to thank our participants

1619
00:56:00,470 --> 00:55:58,960
save the date october 19th

1620
00:56:03,190 --> 00:56:00,480
nasa's ready

1621
00:56:05,190 --> 00:56:03,200
astronomers worldwide already

1622
00:56:06,390 --> 00:56:05,200
it's a gift that's going to keep giving

1623
00:56:07,750 --> 00:56:06,400
and that gift

1624
00:56:10,150 --> 00:56:07,760
will certainly help