1
00:00:07,670 --> 00:00:06,070
well good afternoon welcome to nasa

2
00:00:10,150 --> 00:00:07,680
headquarters in washington i'm dwane

3
00:00:12,470 --> 00:00:10,160
brown from the office of communications

4
00:00:15,390 --> 00:00:12,480
today you will hear about earth and

5
00:00:19,269 --> 00:00:15,400
space based assets that will study a

6
00:00:21,510 --> 00:00:19,279
once-in-a-lifetime comet flyby near mars

7
00:00:23,429 --> 00:00:21,520
on sunday october 19th

8
00:00:24,790 --> 00:00:23,439
you'll hear brief presentations then

9
00:00:27,509 --> 00:00:24,800
we'll open up for questions starting

10
00:00:29,109 --> 00:00:27,519
here in washington our phone lines and

11
00:00:30,390 --> 00:00:29,119
social media

12
00:00:31,830 --> 00:00:30,400
for our viewing

13
00:00:34,150 --> 00:00:31,840

and listening audience get those

14
00:00:35,990 --> 00:00:34,160
questions in we have the answers at

15
00:00:37,190 --> 00:00:36,000
hashtag ask

16
00:00:38,709 --> 00:00:37,200
nasa

17
00:00:40,869 --> 00:00:38,719
and of course there's a lot of social

18
00:00:43,510 --> 00:00:40,879
media buzz go to our

19
00:00:45,910 --> 00:00:43,520
social media websites and sites

20
00:00:47,910 --> 00:00:45,920
facebook twitter

21
00:00:51,029 --> 00:00:47,920
there is a lot of excitement worldwide

22
00:00:52,150 --> 00:00:51,039
about comet and that comet is citing

23
00:00:54,229 --> 00:00:52,160
spring

24
00:00:59,990 --> 00:00:54,239
and of course all of the information is

25
00:01:04,950 --> 00:01:03,270
comets slash siding spring and that's

26
00:01:06,390 --> 00:01:04,960
siding spring

27
00:01:08,149 --> 00:01:06,400
okay

28
00:01:10,070 --> 00:01:08,159
before we get started

29
00:01:13,350 --> 00:01:10,080
let's

30
00:01:14,950 --> 00:01:13,360
let me introduce our panelists for today

31
00:01:16,310 --> 00:01:14,960
first up

32
00:01:18,070 --> 00:01:16,320
jim green

33
00:01:19,749 --> 00:01:18,080
director

34
00:01:25,350 --> 00:01:19,759
planetary science division nasa

35
00:01:29,270 --> 00:01:27,190
carrie liss

36
00:01:31,990 --> 00:01:29,280
senior astrophysicist

37
00:01:33,910 --> 00:01:32,000
johns hopkins university

38
00:01:38,710 --> 00:01:33,920

applied physics laboratory

39
00:01:42,469 --> 00:01:40,550
kelly fast

40
00:01:43,429 --> 00:01:42,479
program scientists

41
00:01:45,030 --> 00:01:43,439
also

42
00:01:49,350 --> 00:01:45,040
nasa headquarters planetary science

43
00:01:55,590 --> 00:01:53,030
and padma yanamandra fisher

44
00:01:58,709 --> 00:01:55,600
senior research scientists

45
00:02:02,069 --> 00:01:58,719
space science institute rancho

46
00:02:03,270 --> 00:02:02,079
cucamonga branch in california

47
00:02:04,709 --> 00:02:03,280
with that

48
00:02:06,709 --> 00:02:04,719
toss at the gym

49
00:02:09,270 --> 00:02:06,719
thank you very much dwane

50
00:02:11,990 --> 00:02:09,280
you know on october 19th we're going to

51
00:02:14,150 --> 00:02:12,000
observe an event that happens maybe once

52
00:02:16,229 --> 00:02:14,160
every million years

53
00:02:18,390 --> 00:02:16,239
and this is where a comet coming from

54
00:02:20,790 --> 00:02:18,400
the furthest reaches

55
00:02:23,110 --> 00:02:20,800
of the sun's gravity will come to the

56
00:02:25,350 --> 00:02:23,120
inner part of our solar system

57
00:02:27,110 --> 00:02:25,360
this comet will fly right in front of

58
00:02:29,990 --> 00:02:27,120
the planet mars

59
00:02:31,350 --> 00:02:30,000
mars will be blanketed in commentary

60
00:02:35,030 --> 00:02:31,360
material

61
00:02:39,589 --> 00:02:36,790
as the planets move around the sun in

62
00:02:41,990 --> 00:02:39,599
this view we also see the comet coming

63
00:02:42,869 --> 00:02:42,000

uh in a retrograde motion and as you can

64
00:02:45,350 --> 00:02:42,879
see

65
00:02:47,030 --> 00:02:45,360
it comes from below at a very large

66
00:02:49,589 --> 00:02:47,040
distance from the sun

67
00:02:51,910 --> 00:02:49,599
passing right in front of mars

68
00:02:53,190 --> 00:02:51,920
the comet was discovered by robert

69
00:02:54,790 --> 00:02:53,200
mcnaught

70
00:02:56,309 --> 00:02:54,800
in january

71
00:02:59,589 --> 00:02:56,319
2013

72
00:03:01,910 --> 00:02:59,599
at his observatory in australia named

73
00:03:07,030 --> 00:03:01,920
siding spring

74
00:03:11,110 --> 00:03:07,040
from the or cloud this is a cloud that's

75
00:03:13,589 --> 00:03:11,120
50 000 astronomical units away

76
00:03:16,229 --> 00:03:13,599
very distant cloud at the very reaches

77
00:03:18,390 --> 00:03:16,239
of the solar gravity

78
00:03:20,550 --> 00:03:18,400
the comet perhaps has been traveling for

79
00:03:21,910 --> 00:03:20,560
maybe more than a million years to get

80
00:03:23,509 --> 00:03:21,920
here

81
00:03:26,229 --> 00:03:23,519
now ever since

82
00:03:29,190 --> 00:03:26,239
robert announced the comment in january

83
00:03:30,789 --> 00:03:29,200
in 2013 nasa's been getting ready for

84
00:03:35,110 --> 00:03:30,799
this event

85
00:03:37,589 --> 00:03:35,120
may i have the first uh image please

86
00:03:39,910 --> 00:03:37,599
now nasa has a whole series of assets

87
00:03:43,190 --> 00:03:39,920
that we're planning to use and have used

88
00:03:46,390 --> 00:03:43,200

already in observing comet siding spring

89
00:03:48,229 --> 00:03:46,400
and mars and its reaction to the comet

90
00:03:51,110 --> 00:03:48,239
as you can see here

91
00:03:53,509 --> 00:03:51,120
in the tan color those assets that nasa

92
00:03:54,869 --> 00:03:53,519
has has already observed the comet and

93
00:03:56,470 --> 00:03:54,879
are still planning additional

94
00:03:58,470 --> 00:03:56,480
observations

95
00:04:00,710 --> 00:03:58,480
we see astrophysics missions

96
00:04:02,550 --> 00:04:00,720
heliophysics missions in addition to the

97
00:04:05,350 --> 00:04:02,560
planetary missions

98
00:04:08,869 --> 00:04:05,360
from astrophysics we have hubble swift

99
00:04:11,270 --> 00:04:08,879
stereo i'm sorry hubble swift neowise

100
00:04:13,509 --> 00:04:11,280
spitzer kepler and chandra

101
00:04:15,830 --> 00:04:13,519
the stereo of course in soho are

102
00:04:18,469 --> 00:04:15,840
heliophysics assets

103
00:04:20,150 --> 00:04:18,479
in planetary science we've used uh one

104
00:04:22,710 --> 00:04:20,160
of our balloons

105
00:04:25,749 --> 00:04:22,720
called bops just a couple weeks ago made

106
00:04:28,550 --> 00:04:25,759
fabulous observations of siding spring

107
00:04:29,830 --> 00:04:28,560
and an infrared telescope facility that

108
00:04:32,230 --> 00:04:29,840
nasa owns

109
00:04:34,230 --> 00:04:32,240
at mars we have a whole series of

110
00:04:37,110 --> 00:04:34,240
missions that are getting ready for the

111
00:04:39,990 --> 00:04:37,120
event mars reconnaissance orbiter mars

112
00:04:42,469 --> 00:04:40,000
odyssey mars express

113
00:04:44,390 --> 00:04:42,479

which we have a an an instrument on

114
00:04:46,790 --> 00:04:44,400
although it's an issa mission

115
00:04:49,430 --> 00:04:46,800
maven which just got in orbit last month

116
00:04:51,749 --> 00:04:49,440
and is getting ready to to uh

117
00:04:53,510 --> 00:04:51,759
uh get its instruments out and be ready

118
00:04:56,150 --> 00:04:53,520
for the comment and of course

119
00:04:58,230 --> 00:04:56,160
opportunity and curiosity are eagerly

120
00:05:01,110 --> 00:04:58,240
awaiting on the surface for this

121
00:05:02,950 --> 00:05:01,120
fabulous event

122
00:05:04,310 --> 00:05:02,960
indeed we're getting ready for a

123
00:05:06,150 --> 00:05:04,320
spectacular

124
00:05:08,629 --> 00:05:06,160
set of observations

125
00:05:11,830 --> 00:05:08,639
but there are some hazards involved

126
00:05:14,629 --> 00:05:11,840
as the comet gets closer to the sun

127
00:05:17,110 --> 00:05:14,639
and generates through sublimation the

128
00:05:19,430 --> 00:05:17,120
long tail that it sees it

129
00:05:21,270 --> 00:05:19,440
carries dust away from it

130
00:05:23,749 --> 00:05:21,280
now the dust from the comet may be a

131
00:05:25,990 --> 00:05:23,759
hazard to our spacecraft we've studied

132
00:05:27,510 --> 00:05:26,000
and modeled it extensively

133
00:05:29,830 --> 00:05:27,520
and we now know

134
00:05:31,590 --> 00:05:29,840
believe that when mars gets very close

135
00:05:34,150 --> 00:05:31,600
to the dust tail which is about a

136
00:05:36,230 --> 00:05:34,160
hundred minutes after closest approach

137
00:05:38,390 --> 00:05:36,240
all our spacecraft will be on the

138
00:05:39,990 --> 00:05:38,400

opposite side of the planet so the

139
00:05:42,550 --> 00:05:40,000
planet will provide the additional

140
00:05:45,350 --> 00:05:42,560
protection we believe we need to be able

141
00:05:47,270 --> 00:05:45,360
to make these observations safely from

142
00:05:51,990 --> 00:05:47,280
our mars spacecraft

143
00:05:53,510 --> 00:05:52,000
before it gets to the planet and then

144
00:05:56,150 --> 00:05:53,520
right afterwards

145
00:05:58,870 --> 00:05:56,160
with opportunity and curiosity on the

146
00:06:00,790 --> 00:05:58,880
surface observing the comet as it flies

147
00:06:03,029 --> 00:06:00,800
right in front of them

148
00:06:04,469 --> 00:06:03,039
well this is an absolutely spectacular

149
00:06:06,870 --> 00:06:04,479
event

150
00:06:07,670 --> 00:06:06,880
and what i'd like to do now is turn it

151
00:06:09,749 --> 00:06:07,680
over

152
00:06:11,189 --> 00:06:09,759
to carrie lists kerry's going to talk

153
00:06:13,270 --> 00:06:11,199
about the observations from the

154
00:06:15,189 --> 00:06:13,280
astrophysics assets that have already

155
00:06:18,790 --> 00:06:15,199
been made and those that are planned to

156
00:06:20,469 --> 00:06:18,800
be to be made thank you very much jim so

157
00:06:21,670 --> 00:06:20,479
if i may have my first graphic please

158
00:06:24,070 --> 00:06:21,680
first i'm going to talk a little bit

159
00:06:25,990 --> 00:06:24,080
more about what we think why the comet

160
00:06:27,670 --> 00:06:26,000
is so important to study and then i'll

161
00:06:29,670 --> 00:06:27,680
talk about what our astrophysics assets

162
00:06:31,189 --> 00:06:29,680
have learned so far about the comet and

163
00:06:32,390 --> 00:06:31,199

what we hope to learn when it flies by

164
00:06:34,150 --> 00:06:32,400
close to mars

165
00:06:35,510 --> 00:06:34,160
so if you look at the graphic that's up

166
00:06:36,710 --> 00:06:35,520
on the screen now on the left i'm

167
00:06:38,230 --> 00:06:36,720
showing you where the comet has been

168
00:06:39,990 --> 00:06:38,240
living and that's far away in the oort

169
00:06:42,230 --> 00:06:40,000
cloud the edges of our solar system just

170
00:06:44,230 --> 00:06:42,240
as jim was describing the comet was

171
00:06:45,749 --> 00:06:44,240
placed there after it formed we think in

172
00:06:47,909 --> 00:06:45,759
the first million or a few million years

173
00:06:49,749 --> 00:06:47,919
of the beginnings of our solar system so

174
00:06:51,270 --> 00:06:49,759
it's a body that's older than the earth

175
00:06:53,430 --> 00:06:51,280
imagine a body that's about the size of

176
00:06:55,909 --> 00:06:53,440
a small appalachian mountain or downtown

177
00:06:57,749 --> 00:06:55,919
dc it's made roughly of half of rocky

178
00:06:59,189 --> 00:06:57,759
dust and half of volatile ices like

179
00:07:00,390 --> 00:06:59,199
water and carbon dioxide and carbon

180
00:07:02,469 --> 00:07:00,400
monoxide

181
00:07:04,230 --> 00:07:02,479
and it has been it was formed we think

182
00:07:05,270 --> 00:07:04,240
originally somewhere between jupiter and

183
00:07:07,029 --> 00:07:05,280
neptune

184
00:07:08,950 --> 00:07:07,039
and failed miserably and actually

185
00:07:10,309 --> 00:07:08,960
accreting and building those the planets

186
00:07:12,309 --> 00:07:10,319
like billions and billions of its

187
00:07:13,589 --> 00:07:12,319
brothers and sisters did instead it got

188
00:07:15,189 --> 00:07:13,599

a close approach to one of those bodies

189
00:07:18,070 --> 00:07:15,199
and then got thrown out on a very long

190
00:07:19,749 --> 00:07:18,080
extended orbit multi-million year orbit

191
00:07:21,589 --> 00:07:19,759
so the comet comes back every few

192
00:07:23,430 --> 00:07:21,599
million years and has never

193
00:07:25,189 --> 00:07:23,440
ever ever been closer to the sun than we

194
00:07:27,110 --> 00:07:25,199
think maybe jupiter saturn uranus or

195
00:07:28,710 --> 00:07:27,120
neptune's distance so this is its first

196
00:07:29,909 --> 00:07:28,720
passage into what we call the water ice

197
00:07:31,350 --> 00:07:29,919
line where it's really starting to boil

198
00:07:33,110 --> 00:07:31,360
its water off so it's acting very

199
00:07:35,430 --> 00:07:33,120
different

200
00:07:37,029 --> 00:07:35,440
it's also its first passage ever by mars

201
00:07:38,710 --> 00:07:37,039
if you look at the image on the left the

202
00:07:40,309 --> 00:07:38,720
comet is coming in as we've mentioned

203
00:07:42,070 --> 00:07:40,319
very far away from the sun and from the

204
00:07:43,670 --> 00:07:42,080
planets it's coming at a very large

205
00:07:46,550 --> 00:07:43,680
angle it's very fortuitous that it's

206
00:07:48,629 --> 00:07:46,560
actually going anywhere near mars

207
00:07:50,790 --> 00:07:48,639
and again this if we study the comet

208
00:07:52,309 --> 00:07:50,800
with composition its structure it will

209
00:07:53,830 --> 00:07:52,319
tell us a lot about how we think maybe

210
00:07:55,189 --> 00:07:53,840
the planets were formed

211
00:07:56,710 --> 00:07:55,199
it's also important to point out that

212
00:07:58,070 --> 00:07:56,720
all of nasa's missions to comets in the

213
00:07:59,510 --> 00:07:58,080

past have been what we call jupiter

214
00:08:01,350 --> 00:07:59,520
family comets that were formed in the

215
00:08:03,270 --> 00:08:01,360
edge of our kuiper belt in the same disc

216
00:08:05,510 --> 00:08:03,280
the planets move in not from the oort

217
00:08:07,749 --> 00:08:05,520
cloud and we can't get to an cloud comet

218
00:08:09,510 --> 00:08:07,759
with our current rockets they move it to

219
00:08:11,510 --> 00:08:09,520
these orbits are very long and extended

220
00:08:13,270 --> 00:08:11,520
at very great velocities so this comet

221
00:08:14,869 --> 00:08:13,280
is coming to us it's a free flyby if you

222
00:08:16,790 --> 00:08:14,879
will and that's a very fantastic event

223
00:08:18,790 --> 00:08:16,800
for us to study

224
00:08:20,550 --> 00:08:18,800
um i'll let me go to the next slide oh

225
00:08:22,070 --> 00:08:20,560
excuse me pardon me back to the previous

226
00:08:23,270 --> 00:08:22,080
slide and on the right

227
00:08:25,909 --> 00:08:23,280
i want to show you that this comet

228
00:08:27,270 --> 00:08:25,919
apparition is so close to mars that if

229
00:08:29,430 --> 00:08:27,280
we put it in our own system which we

230
00:08:30,629 --> 00:08:29,440
know much better it's coming one third

231
00:08:32,389 --> 00:08:30,639
of the distance between the earth and

232
00:08:34,709 --> 00:08:32,399
the moon this would be extremely close

233
00:08:36,630 --> 00:08:34,719
fly by even a near-earth object asteroid

234
00:08:38,389 --> 00:08:36,640
object it's closer than any comet has

235
00:08:40,230 --> 00:08:38,399
come to the earth in the last 500 years

236
00:08:42,149 --> 00:08:40,240
it's that close what we know of the

237
00:08:43,909 --> 00:08:42,159
comet's tail and its coma its tail would

238
00:08:44,870 --> 00:08:43,919

extend from between the earth to the

239
00:08:46,790 --> 00:08:44,880
moon

240
00:08:47,910 --> 00:08:46,800
and its coma would fill about half the

241
00:08:49,350 --> 00:08:47,920
distance between the earth and the moon

242
00:08:51,190 --> 00:08:49,360
it's that kind of size object to give

243
00:08:52,550 --> 00:08:51,200
you reference points so the next slide

244
00:08:54,470 --> 00:08:52,560
please

245
00:08:55,990 --> 00:08:54,480
so here's uh i'm showing you the

246
00:08:57,269 --> 00:08:56,000
different astrophysical

247
00:08:58,630 --> 00:08:57,279
assets and what they've observed from

248
00:09:00,710 --> 00:08:58,640
the comet so far and what they will

249
00:09:02,389 --> 00:09:00,720
observe during the close approach

250
00:09:04,150 --> 00:09:02,399
um let me summarize to begin with the

251
00:09:06,150 --> 00:09:04,160
assets have shown us so far the comet

252
00:09:08,949 --> 00:09:06,160
looks like it's somewhere between half

253
00:09:10,630 --> 00:09:08,959
and five miles in diameter

254
00:09:12,230 --> 00:09:10,640
um we think it's again the mass of a

255
00:09:14,870 --> 00:09:12,240
small mountain for numbers you want 10

256
00:09:16,870 --> 00:09:14,880
to 9 and 10 to 11 tons of material

257
00:09:19,430 --> 00:09:16,880
uh i mentioned how long 100 000 mile

258
00:09:20,630 --> 00:09:19,440
long wide coma and maybe 300 000 mile

259
00:09:22,710 --> 00:09:20,640
long tail

260
00:09:24,550 --> 00:09:22,720
and it's moving jim has to show you that

261
00:09:26,070 --> 00:09:24,560
movie because it's moving retrograde

262
00:09:28,070 --> 00:09:26,080
it's moving against the orbit of the

263
00:09:30,389 --> 00:09:28,080

planets it's going to coming in at 33

264
00:09:32,630 --> 00:09:30,399
miles per second relative velocity to

265
00:09:34,389 --> 00:09:32,640
mars that means very high velocity so

266
00:09:36,470 --> 00:09:34,399
anything that comes off the comet that

267
00:09:38,150 --> 00:09:36,480
hits either mars or the spacecraft is

268
00:09:40,230 --> 00:09:38,160
going to have pack a real large amount

269
00:09:41,350 --> 00:09:40,240
of kinetic energy a real wallop

270
00:09:43,990 --> 00:09:41,360
so that's one of the things we've been

271
00:09:45,110 --> 00:09:44,000
really worried about uh this is as jim

272
00:09:46,630 --> 00:09:45,120
also mentioned this is probably going to

273
00:09:48,870 --> 00:09:46,640
be our first

274
00:09:50,790 --> 00:09:48,880
capability to ever actually image and

275
00:09:52,550 --> 00:09:50,800
resolve and or cloud comets nucleus and

276
00:09:53,670 --> 00:09:52,560
that's going to be pretty exciting kelly

277
00:09:55,430 --> 00:09:53,680
will talk more about that in a minute

278
00:09:56,630 --> 00:09:55,440
but let me get back to the assets what

279
00:09:58,630 --> 00:09:56,640
i'm showing you here in this slide on

280
00:10:00,389 --> 00:09:58,640
the left this is an optical ground-based

281
00:10:02,630 --> 00:10:00,399
image but i want to set the the table

282
00:10:04,310 --> 00:10:02,640
here the big

283
00:10:05,590 --> 00:10:04,320
bright glob is that's a globular cluster

284
00:10:06,949 --> 00:10:05,600
of stars in the top but in the bottom of

285
00:10:08,870 --> 00:10:06,959
the image is a little smudge with the

286
00:10:10,470 --> 00:10:08,880
tail that's our comet that siding spring

287
00:10:12,150 --> 00:10:10,480
and that was taken at the end of august

288
00:10:13,190 --> 00:10:12,160

so you can see a nucleus and a coma

289
00:10:14,230 --> 00:10:13,200
that's the bright kind of circular

290
00:10:15,990 --> 00:10:14,240
region then there's the tail that's

291
00:10:17,430 --> 00:10:16,000
fanning out behind it

292
00:10:22,069 --> 00:10:17,440
the next

293
00:10:23,670 --> 00:10:22,079
wise neowise it was taken

294
00:10:25,350 --> 00:10:23,680
almost well just a few weeks ago the end

295
00:10:26,949 --> 00:10:25,360
of september and you're seeing four

296
00:10:28,470 --> 00:10:26,959
different images in heat radiation that

297
00:10:29,990 --> 00:10:28,480
are sensitive to the nucleus and dust

298
00:10:31,430 --> 00:10:30,000
coming off from this comet and you'll

299
00:10:33,030 --> 00:10:31,440
notice that the spots these are four

300
00:10:34,310 --> 00:10:33,040
different exposures of the comet and

301
00:10:35,910 --> 00:10:34,320
they're varying in brightness the comet

302
00:10:37,750 --> 00:10:35,920
is getting quite variable that's what

303
00:10:39,670 --> 00:10:37,760
wise is telling us and you're also

304
00:10:41,350 --> 00:10:39,680
in the next image you're seeing hubble

305
00:10:43,590 --> 00:10:41,360
and hubble has looked at the comet since

306
00:10:45,509 --> 00:10:43,600
october then in january then in march

307
00:10:47,430 --> 00:10:45,519
and is again going to look an encounter

308
00:10:49,670 --> 00:10:47,440
and humble is sensitive to the dust and

309
00:10:50,870 --> 00:10:49,680
the nucleus of the comet it can tell us

310
00:10:52,470 --> 00:10:50,880
the size of the nucleus that's where we

311
00:10:54,230 --> 00:10:52,480
have that size range of half a half a

312
00:10:56,310 --> 00:10:54,240
mile to five miles of the nucleus in

313
00:10:57,829 --> 00:10:56,320

diameter also the amount of dust that's

314
00:11:00,150 --> 00:10:57,839
coming off and that's we've watched the

315
00:11:01,750 --> 00:11:00,160
dust and we've had colleagues around the

316
00:11:03,110 --> 00:11:01,760
world who've modeled how that dust is

317
00:11:04,710 --> 00:11:03,120
coming off and it looks like it's coming

318
00:11:06,630 --> 00:11:04,720
off extremely slowly and that's where we

319
00:11:08,230 --> 00:11:06,640
think the hazard to the spacecraft on

320
00:11:09,910 --> 00:11:08,240
mars would be minimal

321
00:11:11,110 --> 00:11:09,920
on and around mars especially if we put

322
00:11:12,710 --> 00:11:11,120
them on the night side of the planet or

323
00:11:14,710 --> 00:11:12,720
the other far side of the planet when we

324
00:11:17,110 --> 00:11:14,720
come closest approach to the comet the

325
00:11:19,350 --> 00:11:17,120
next image is swift and swift is showing

326
00:11:21,190 --> 00:11:19,360
you um water molecules that are coming

327
00:11:22,790 --> 00:11:21,200
off the comet so the water ice that's

328
00:11:25,030 --> 00:11:22,800
half of roughly half the comet is

329
00:11:26,470 --> 00:11:25,040
boiling off and there's a that's that

330
00:11:28,150 --> 00:11:26,480
nice blue white image you're seeing

331
00:11:29,670 --> 00:11:28,160
there's also some points there's a graph

332
00:11:30,710 --> 00:11:29,680
and you'll notice on the graph there's

333
00:11:33,030 --> 00:11:30,720
almost

334
00:11:35,750 --> 00:11:33,040
pretty much zero activity until you get

335
00:11:37,110 --> 00:11:35,760
up to about june of 2014 and then

336
00:11:38,550 --> 00:11:37,120
suddenly you start seeing rising that's

337
00:11:40,150 --> 00:11:38,560
when the combat got close enough to the

338
00:11:42,310 --> 00:11:40,160

sun that water started boiling it's

339
00:11:43,670 --> 00:11:42,320
about two and a half au from the sun and

340
00:11:45,990 --> 00:11:43,680
so swift has been monitoring that

341
00:11:47,509 --> 00:11:46,000
takeoff spitzer on the right is

342
00:11:49,350 --> 00:11:47,519
sensitive to the dust and also the

343
00:11:51,030 --> 00:11:49,360
carbon dioxide that's fizzing off of the

344
00:11:53,030 --> 00:11:51,040
comet and what you're seeing that image

345
00:11:53,990 --> 00:11:53,040
there is the bright extended dust tail

346
00:11:55,430 --> 00:11:54,000
that's heading

347
00:11:57,269 --> 00:11:55,440
straight up in that image but there's

348
00:11:58,949 --> 00:11:57,279
also a diffuse halo of carbon dioxide

349
00:12:00,389 --> 00:11:58,959
gas we saw the same thing for isom last

350
00:12:01,829 --> 00:12:00,399
year it's pretty exciting to realize

351
00:12:03,910 --> 00:12:01,839
that carbon dioxide may be the most

352
00:12:05,829 --> 00:12:03,920
fundamental molecule after water in

353
00:12:07,509 --> 00:12:05,839
comets so those are what already been

354
00:12:08,870 --> 00:12:07,519
seen so far we're watching a comet turn

355
00:12:10,550 --> 00:12:08,880
on getting active

356
00:12:13,190 --> 00:12:10,560
it's going to interact with mars at the

357
00:12:15,030 --> 00:12:13,200
bottom are two planned observations on

358
00:12:17,590 --> 00:12:15,040
the left is chandra's which is an x-ray

359
00:12:19,590 --> 00:12:17,600
telescope and both mars and comets are

360
00:12:21,509 --> 00:12:19,600
x-ray bright objects we know they emit

361
00:12:23,590 --> 00:12:21,519
x-rays but what we're waiting for is if

362
00:12:25,190 --> 00:12:23,600
you notice the red on in that plot are

363
00:12:26,470 --> 00:12:25,200

the different positions of mars in the

364
00:12:28,389 --> 00:12:26,480
chandra field of view and the yellow is

365
00:12:29,670 --> 00:12:28,399
the comet when they cross

366
00:12:31,990 --> 00:12:29,680
we're really going to be very interested

367
00:12:33,750 --> 00:12:32,000
to see with when comet dumps material in

368
00:12:35,350 --> 00:12:33,760
the upper atmosphere of mars ions and

369
00:12:37,110 --> 00:12:35,360
neutrals if that's going to make mars

370
00:12:39,350 --> 00:12:37,120
brighten up

371
00:12:41,350 --> 00:12:39,360
also brand new to commentary science and

372
00:12:42,710 --> 00:12:41,360
the bottom right is kepler so that's the

373
00:12:44,230 --> 00:12:42,720
exoplanet finding mission it's been

374
00:12:45,829 --> 00:12:44,240
staring the northern cross for the last

375
00:12:48,629 --> 00:12:45,839
four four and a half years

376
00:12:50,150 --> 00:12:48,639
and is now in its second lifetime is now

377
00:12:52,230 --> 00:12:50,160
looking in the plane of our of our

378
00:12:53,670 --> 00:12:52,240
ecliptic planet of our solar system and

379
00:12:55,110 --> 00:12:53,680
it turns out where it's staring right

380
00:12:57,670 --> 00:12:55,120
now it's going to start about a month

381
00:12:59,350 --> 00:12:57,680
ago ago for two more months the comet if

382
00:13:00,550 --> 00:12:59,360
you see the on the very left of the

383
00:13:01,990 --> 00:13:00,560
that's the kepler field of view that

384
00:13:04,470 --> 00:13:02,000
cross of

385
00:13:06,790 --> 00:13:04,480
ccd pixels if you will or ccd fields of

386
00:13:09,110 --> 00:13:06,800
view so imagine that um

387
00:13:12,150 --> 00:13:09,120
equivalent of a thousand if you will of

388
00:13:14,150 --> 00:13:12,160

your telephone um cameras or

389
00:13:15,509 --> 00:13:14,160
focal planes and you see there's white

390
00:13:17,430 --> 00:13:15,519
dots on the very left that's where the

391
00:13:19,910 --> 00:13:17,440
comet's just going to graze the kepler

392
00:13:22,069 --> 00:13:19,920
iron cross if you will and so one day

393
00:13:23,590 --> 00:13:22,079
after the closest approach for about 25

394
00:13:25,750 --> 00:13:23,600
hours and then a gap of time and then

395
00:13:27,670 --> 00:13:25,760
another three days kepler is going to

396
00:13:28,870 --> 00:13:27,680
get us extremely precise optical light

397
00:13:31,030 --> 00:13:28,880
curves of this comet we're going to see

398
00:13:32,870 --> 00:13:31,040
if it changes and varies because of its

399
00:13:34,389 --> 00:13:32,880
interaction with mars so that's what the

400
00:13:36,790 --> 00:13:34,399
astrophysical assets that we're using

401
00:13:37,829 --> 00:13:36,800
now and what we hope to learn at the

402
00:13:39,670 --> 00:13:37,839
mars is we're going to see if there's

403
00:13:41,670 --> 00:13:39,680
any change due to the either both in

404
00:13:43,590 --> 00:13:41,680
mars and in the comet due to this closed

405
00:13:44,790 --> 00:13:43,600
approach and just remember also in the

406
00:13:46,230 --> 00:13:44,800
back your head that this is not the

407
00:13:47,750 --> 00:13:46,240
first time a comet's ever come close to

408
00:13:49,269 --> 00:13:47,760
mars it's happened before it will happen

409
00:13:50,470 --> 00:13:49,279
again

410
00:13:51,990 --> 00:13:50,480
finally i'll leave with this note and

411
00:13:53,110 --> 00:13:52,000
then i'll hand it over to kelly is i

412
00:13:54,949 --> 00:13:53,120
think it's really exciting to think

413
00:13:57,030 --> 00:13:54,959

about this is a multi-millionaire period

414
00:13:59,110 --> 00:13:57,040
comet in its orbit this comet got

415
00:14:01,509 --> 00:13:59,120
knocked into the inner system by the

416
00:14:03,189 --> 00:14:01,519
passage of a star near the oort cloud so

417
00:14:04,790 --> 00:14:03,199
think about a comet that started its

418
00:14:06,389 --> 00:14:04,800
travel probably at the dawn of man and

419
00:14:08,150 --> 00:14:06,399
it's just coming in close now and the

420
00:14:09,670 --> 00:14:08,160
reason we can actually observe it is

421
00:14:12,389 --> 00:14:09,680
because we have built satellites and

422
00:14:14,550 --> 00:14:12,399
rovers and we're now got outposts around

423
00:14:16,949 --> 00:14:14,560
mars and that's why we can do this close

424
00:14:18,310 --> 00:14:16,959
flyby that's pretty exciting so i'm done

425
00:14:19,350 --> 00:14:18,320
from the astrophysic and the big picture

426
00:14:20,790 --> 00:14:19,360
point of view i'd like to turn it over

427
00:14:21,910 --> 00:14:20,800
to kelly who's going to tell you what

428
00:14:23,110 --> 00:14:21,920
we've been learning from the ground and

429
00:14:24,790 --> 00:14:23,120
also from what we're going to learn when

430
00:14:26,310 --> 00:14:24,800
the comet gets to mars

431
00:14:27,750 --> 00:14:26,320
yeah in terms of the planetary science

432
00:14:30,069 --> 00:14:27,760
assets normally

433
00:14:31,829 --> 00:14:30,079
you would send a spacecraft to a comet

434
00:14:34,069 --> 00:14:31,839
and in this case the comet is coming to

435
00:14:35,990 --> 00:14:34,079
the spacecraft because we happen to have

436
00:14:39,110 --> 00:14:36,000
multiple missions at mars so it's a

437
00:14:41,110 --> 00:14:39,120
fantastic opportunity and uh

438
00:14:42,790 --> 00:14:41,120

nasa has three orbiters at mars and as

439
00:14:45,670 --> 00:14:42,800
was mentioned you know first order of

440
00:14:47,269 --> 00:14:45,680
business was a safety in determining uh

441
00:14:49,189 --> 00:14:47,279
if the orbiters would be okay and what

442
00:14:50,790 --> 00:14:49,199
to do to keep them safe and and that's

443
00:14:53,509 --> 00:14:50,800
been dealt with and so the second order

444
00:14:55,590 --> 00:14:53,519
of business is science and so you've got

445
00:14:57,430 --> 00:14:55,600
all these spacecraft they're designed to

446
00:14:59,110 --> 00:14:57,440
study mars but they're repurposing

447
00:15:02,550 --> 00:14:59,120
themselves in order to take advantage of

448
00:15:05,189 --> 00:15:02,560
this amazing opportunity to study the

449
00:15:07,509 --> 00:15:05,199
comet and study what happens to mars

450
00:15:09,750 --> 00:15:07,519
when the comet interacts with mars when

451
00:15:11,910 --> 00:15:09,760
material is deposited in the atmosphere

452
00:15:12,870 --> 00:15:11,920
interaction with the the comet's gas

453
00:15:14,790 --> 00:15:12,880
coma

454
00:15:17,590 --> 00:15:14,800
is there heating of the atmosphere and

455
00:15:19,910 --> 00:15:17,600
expansion and their meteors um studying

456
00:15:22,230 --> 00:15:19,920
the comets itself so it's a fantastic

457
00:15:24,870 --> 00:15:22,240
opportunity and if i could have the

458
00:15:25,910 --> 00:15:24,880
first animation please

459
00:15:28,389 --> 00:15:25,920
what we're seeing here we're going to

460
00:15:30,710 --> 00:15:28,399
see all the orbiters at mars in addition

461
00:15:33,110 --> 00:15:30,720
uh there's the european mars express and

462
00:15:35,430 --> 00:15:33,120
india's recent mars orbiter mission and

463
00:15:37,430 --> 00:15:35,440

then there's nasa's three orbiters

464
00:15:40,470 --> 00:15:37,440
we have the mars reconnaissance orbiter

465
00:15:42,710 --> 00:15:40,480
and mars odyssey and maven and also

466
00:15:45,509 --> 00:15:42,720
here's a schematic of the extent of what

467
00:15:48,150 --> 00:15:45,519
is really a very tenuous comet coma

468
00:15:50,230 --> 00:15:48,160
entail so just an illustration of it

469
00:15:52,389 --> 00:15:50,240
passing by and all those spacecraft

470
00:15:54,069 --> 00:15:52,399
there ready to look at mars mars

471
00:15:55,829 --> 00:15:54,079
reconnaissance orbiter is the one that

472
00:15:59,430 --> 00:15:55,839
was mentioned is going to take the first

473
00:16:01,430 --> 00:15:59,440
resolved images of an oort cloud comet

474
00:16:03,110 --> 00:16:01,440
nucleus so that's pretty exciting to

475
00:16:04,949 --> 00:16:03,120
have that opportunity to do that kind of

476
00:16:06,790 --> 00:16:04,959
science it's going to look at

477
00:16:08,550 --> 00:16:06,800
shape and rotation and the the

478
00:16:10,310 --> 00:16:08,560
brightness of the nucleus or really the

479
00:16:13,509 --> 00:16:10,320
darkness of the nucleus it's going to

480
00:16:14,870 --> 00:16:13,519
study the coma composition uh it's also

481
00:16:16,949 --> 00:16:14,880
going to look at the atmosphere of mars

482
00:16:19,350 --> 00:16:16,959
to see if it can detect any changes uh

483
00:16:20,949 --> 00:16:19,360
from the interaction between comet and

484
00:16:23,590 --> 00:16:20,959
and mars

485
00:16:26,629 --> 00:16:23,600
mars odyssey is going to be studying the

486
00:16:27,910 --> 00:16:26,639
coma and the tale of the comet it's

487
00:16:30,389 --> 00:16:27,920
going to take

488
00:16:32,230 --> 00:16:30,399

infrared and visible images and it's

489
00:16:35,590 --> 00:16:32,240
going to kind of use mars as a reference

490
00:16:36,949 --> 00:16:35,600
to understand what it's seeing

491
00:16:38,870 --> 00:16:36,959
maven

492
00:16:40,870 --> 00:16:38,880
recently got to mars and it was designed

493
00:16:43,590 --> 00:16:40,880
to study the upper atmosphere of mars so

494
00:16:45,350 --> 00:16:43,600
as part of its regular science mode it's

495
00:16:47,269 --> 00:16:45,360
going to look at

496
00:16:49,269 --> 00:16:47,279
the atmosphere and look for changes in

497
00:16:52,069 --> 00:16:49,279
the upper atmosphere due to that

498
00:16:54,550 --> 00:16:52,079
interact interaction with the comet

499
00:16:56,069 --> 00:16:54,560
and so it's ideally suited to that if

500
00:16:58,069 --> 00:16:56,079
there is any sort of heating of the

501
00:16:59,590 --> 00:16:58,079
upper atmosphere of expansion from the

502
00:17:01,350 --> 00:16:59,600
interaction

503
00:17:03,749 --> 00:17:01,360
and looking at those possible effects

504
00:17:05,590 --> 00:17:03,759
but it will also take ultraviolet images

505
00:17:08,309 --> 00:17:05,600
of the comet and we'll do a mapping of

506
00:17:10,710 --> 00:17:08,319
the composition of the comet so it's

507
00:17:12,390 --> 00:17:10,720
that's going to be really fantastic but

508
00:17:14,949 --> 00:17:12,400
in addition there are two rovers on the

509
00:17:17,110 --> 00:17:14,959
surface we've got curiosity and

510
00:17:18,870 --> 00:17:17,120
opportunity and if i could have the next

511
00:17:20,949 --> 00:17:18,880
animation please

512
00:17:22,630 --> 00:17:20,959
uh in this animation we're seeing the

513
00:17:24,309 --> 00:17:22,640

comet pass by again and it's much

514
00:17:26,230 --> 00:17:24,319
brighter here than it's really going to

515
00:17:28,549 --> 00:17:26,240
be just so we can illustrate what's

516
00:17:30,710 --> 00:17:28,559
going on but during this time when the

517
00:17:31,830 --> 00:17:30,720
comet goes by uh curiosity and

518
00:17:34,390 --> 00:17:31,840
opportunity are going to turn their

519
00:17:36,950 --> 00:17:34,400
cameras up and here's a an animation

520
00:17:38,789 --> 00:17:36,960
from opportunities viewpoint again much

521
00:17:41,110 --> 00:17:38,799
brighter so you can see what's happening

522
00:17:44,150 --> 00:17:41,120
as this kind of sped up

523
00:17:46,230 --> 00:17:44,160
animation of the comet setting goes by

524
00:17:48,230 --> 00:17:46,240
this is kind of a dusty season on mars

525
00:17:51,350 --> 00:17:48,240
too and so the dust is going to make the

526
00:17:53,270 --> 00:17:51,360
comet even less bright but still

527
00:17:55,669 --> 00:17:53,280
both opportunity and curiosity are going

528
00:17:57,830 --> 00:17:55,679
to look up try to image that comet and

529
00:17:59,830 --> 00:17:57,840
we certainly have fingers crossed for

530
00:18:01,430 --> 00:17:59,840
the first images of a comet from the

531
00:18:03,669 --> 00:18:01,440
surface of another world so that would

532
00:18:05,190 --> 00:18:03,679
be really exciting so great things going

533
00:18:06,789 --> 00:18:05,200
on at mars but let's bring it back a

534
00:18:09,350 --> 00:18:06,799
little bit closer to home

535
00:18:10,950 --> 00:18:09,360
here on earth there's lots going on

536
00:18:13,990 --> 00:18:10,960
just recently as jim mentioned if i

537
00:18:16,470 --> 00:18:14,000
could have the first image please

538
00:18:19,190 --> 00:18:16,480

nasa's balloon observation platform for

539
00:18:22,470 --> 00:18:19,200
planetary science or bops flew just a

540
00:18:25,029 --> 00:18:22,480
few weeks ago and as part of its mission

541
00:18:26,390 --> 00:18:25,039
it uh was able to make measurements of

542
00:18:29,110 --> 00:18:26,400
the comet

543
00:18:31,110 --> 00:18:29,120
and uh and it was able to do this

544
00:18:32,950 --> 00:18:31,120
because of the balloon from

545
00:18:34,710 --> 00:18:32,960
above much of earth's absorbing

546
00:18:35,990 --> 00:18:34,720
atmosphere

547
00:18:38,070 --> 00:18:36,000
now in addition there's all kinds of

548
00:18:40,950 --> 00:18:38,080
ground-based observations taking place

549
00:18:43,590 --> 00:18:40,960
all over the world to study the comet

550
00:18:46,470 --> 00:18:43,600
and if i could have the next slide uh

551
00:18:49,029 --> 00:18:46,480
here we see nasa's observatory that's

552
00:18:50,630 --> 00:18:49,039
involved in in making these observations

553
00:18:54,549 --> 00:18:50,640
this is nasa's infrared telescope

554
00:18:57,350 --> 00:18:54,559
facility or irtf on mauna kea in hawaii

555
00:18:59,430 --> 00:18:57,360
irtf meets the challenge with scheduling

556
00:19:00,390 --> 00:18:59,440
and daytime observations needed to

557
00:19:03,029 --> 00:19:00,400
really

558
00:19:05,190 --> 00:19:03,039
get the most out of this opportunity to

559
00:19:07,669 --> 00:19:05,200
maximize the access

560
00:19:09,510 --> 00:19:07,679
to the science data it has observed the

561
00:19:11,190 --> 00:19:09,520
comment already and it's going to

562
00:19:13,430 --> 00:19:11,200
continue to make observations of the

563
00:19:15,270 --> 00:19:13,440

comet the comet's composition but not

564
00:19:17,270 --> 00:19:15,280
only that also the composition of mars

565
00:19:19,350 --> 00:19:17,280
atmosphere again to see if you can see

566
00:19:21,190 --> 00:19:19,360
any signatures of uh some sort of

567
00:19:23,990 --> 00:19:21,200
interaction taking place between the

568
00:19:25,750 --> 00:19:24,000
comet the comet's coma in the atmosphere

569
00:19:27,270 --> 00:19:25,760
what happens from that

570
00:19:28,950 --> 00:19:27,280
now all that you've been hearing here a

571
00:19:31,270 --> 00:19:28,960
key part of that

572
00:19:35,350 --> 00:19:31,280
is the coordination

573
00:19:37,190 --> 00:19:35,360
and communication efforts by the um

574
00:19:39,110 --> 00:19:37,200
by the uh i have to look at the name

575
00:19:41,510 --> 00:19:39,120
because i always forget it even because

576
00:19:43,750 --> 00:19:41,520
we've rebranded it from before but it's

577
00:19:45,909 --> 00:19:43,760
the coordinated investigations of comets

578
00:19:48,630 --> 00:19:45,919
group or the seahawk they've been

579
00:19:51,590 --> 00:19:48,640
fantastic about coordinating with also

580
00:19:54,310 --> 00:19:51,600
with the mars program office out at jpl

581
00:19:58,150 --> 00:19:54,320
to get ready for this event

582
00:19:59,909 --> 00:19:58,160
convening workshops of scientists

583
00:20:02,310 --> 00:19:59,919
being able to foster coordination and

584
00:20:04,470 --> 00:20:02,320
collaboration and to really maximize the

585
00:20:07,270 --> 00:20:04,480
science coming out of this because there

586
00:20:09,270 --> 00:20:07,280
is one shot at this and uh this is the

587
00:20:11,270 --> 00:20:09,280
time to do it and so they're having had

588
00:20:13,510 --> 00:20:11,280

this lead time they're getting ready to

589
00:20:16,789 --> 00:20:13,520
get the most science out of this you'll

590
00:20:18,470 --> 00:20:16,799
see the uh jpl website at the end of uh

591
00:20:20,950 --> 00:20:18,480
at the end today i believe and then also

592
00:20:22,870 --> 00:20:20,960
the seahawks website comic campaign.org

593
00:20:24,789 --> 00:20:22,880
has plenty of information we have some

594
00:20:26,630 --> 00:20:24,799
ciac members here on the platform and

595
00:20:29,350 --> 00:20:26,640
off the platform and so we've been very

596
00:20:31,029 --> 00:20:29,360
uh thankful for their help with uh

597
00:20:33,510 --> 00:20:31,039
getting the most out of this opportunity

598
00:20:35,270 --> 00:20:33,520
the seahawk has also though engaged the

599
00:20:36,870 --> 00:20:35,280
amateur astronomy community and so with

600
00:20:39,190 --> 00:20:36,880
that i'm going to pass it to padma and

601
00:20:40,549 --> 00:20:39,200
amanda fisher to address that

602
00:20:43,510 --> 00:20:40,559
thank you kelly

603
00:20:45,750 --> 00:20:43,520
an important component of the seahawk

604
00:20:48,470 --> 00:20:45,760
observing campaign is the amateur

605
00:20:50,710 --> 00:20:48,480
community and it's important because it

606
00:20:52,950 --> 00:20:50,720
provides an extended observing team as

607
00:20:55,029 --> 00:20:52,960
well as extended observing windows that

608
00:20:58,230 --> 00:20:55,039
we can characterize the comet and also

609
00:21:01,029 --> 00:20:58,240
allows for outreach via social media

610
00:21:02,950 --> 00:21:01,039
you may have my first slide please

611
00:21:05,350 --> 00:21:02,960
as men as jim mentioned comet siding

612
00:21:07,270 --> 00:21:05,360
spring was uh discovered by rob mcnutt

613
00:21:09,830 --> 00:21:07,280

you can see the two pictures on the

614
00:21:11,669 --> 00:21:09,840
right side show both the telesco the

615
00:21:13,190 --> 00:21:11,679
telescope facility as well as the

616
00:21:14,950 --> 00:21:13,200
telescope that is used to make this

617
00:21:15,990 --> 00:21:14,960
observation

618
00:21:18,390 --> 00:21:16,000
also also

619
00:21:21,270 --> 00:21:18,400
on the left side of this uh graphic you

620
00:21:22,230 --> 00:21:21,280
see um atlas of the

621
00:21:24,950 --> 00:21:22,240
globe

622
00:21:27,110 --> 00:21:24,960
and what you see is that the red dots

623
00:21:29,750 --> 00:21:27,120
indicate where we have observers amateur

624
00:21:32,070 --> 00:21:29,760
observers as well as robotic networks so

625
00:21:34,230 --> 00:21:32,080
that observers in northern latitudes can

626
00:21:36,549 --> 00:21:34,240
use them and they've been continuously

627
00:21:39,590 --> 00:21:36,559
monitoring the the state of the comet

628
00:21:42,070 --> 00:21:39,600
since january of 2014.

629
00:21:43,990 --> 00:21:42,080
now most of the observers

630
00:21:46,070 --> 00:21:44,000
have equipment that ranges from a few

631
00:21:48,710 --> 00:21:46,080
inches to uh one and a half meter

632
00:21:49,909 --> 00:21:48,720
telescopes uh they also observe in our

633
00:21:51,750 --> 00:21:49,919
uh in uh

634
00:21:54,310 --> 00:21:51,760
two wavelengths that are very sensitive

635
00:21:57,830 --> 00:21:54,320
dust and clouds on the planet as well as

636
00:21:59,750 --> 00:21:57,840
dust and uh gas in the comet uh comet

637
00:22:03,270 --> 00:21:59,760
features may have the next graphic

638
00:22:07,029 --> 00:22:04,950

now these are uh

639
00:22:09,350 --> 00:22:07,039
these are some of the observations that

640
00:22:11,029 --> 00:22:09,360
have been acquired in the last month

641
00:22:13,029 --> 00:22:11,039
or a few weeks from australia south

642
00:22:14,710 --> 00:22:13,039
america and south africa which are the

643
00:22:16,710 --> 00:22:14,720
three locations where

644
00:22:18,710 --> 00:22:16,720
the comet will be observable at night

645
00:22:20,390 --> 00:22:18,720
time as kelly mentioned it's going to be

646
00:22:23,029 --> 00:22:20,400
mostly a daytime for the northern

647
00:22:25,270 --> 00:22:23,039
latitudes but here we have identified

648
00:22:27,270 --> 00:22:25,280
not only observers but locations and the

649
00:22:29,510 --> 00:22:27,280
time windows where we can actually get

650
00:22:31,909 --> 00:22:29,520
uh some continuous data for the next few

651
00:22:33,669 --> 00:22:31,919
weeks um and you can see that the comet

652
00:22:36,549 --> 00:22:33,679
has changed uh it looks a little

653
00:22:39,590 --> 00:22:36,559
different from uh from the time august

654
00:22:41,750 --> 00:22:39,600
to september and like kerry mentioned it

655
00:22:42,950 --> 00:22:41,760
is variable and this is very interesting

656
00:22:44,870 --> 00:22:42,960
to see how it's going to evolve in the

657
00:22:47,110 --> 00:22:44,880
next couple of weeks may have the next

658
00:22:49,029 --> 00:22:47,120
slide please

659
00:22:51,590 --> 00:22:49,039
this graph basically shows the status of

660
00:22:53,830 --> 00:22:51,600
the comet and mars as of last week

661
00:22:56,070 --> 00:22:53,840
simply because

662
00:22:57,669 --> 00:22:56,080
what we're noticing is as the comet

663
00:23:00,070 --> 00:22:57,679

comes from the south of the ecliptic and

664
00:23:02,950 --> 00:23:00,080
is going on towards northern latitudes

665
00:23:04,710 --> 00:23:02,960
earth has crossed its uh orbital uh uh

666
00:23:06,549 --> 00:23:04,720
plane and therefore we see different

667
00:23:09,510 --> 00:23:06,559
features in the comet that we normally

668
00:23:11,190 --> 00:23:09,520
see when a planet crosses the orbital

669
00:23:14,230 --> 00:23:11,200
plane like an anti-tail which is in the

670
00:23:16,950 --> 00:23:14,240
middle uh slide middle image of the

671
00:23:18,870 --> 00:23:16,960
comet on the left side but as of last

672
00:23:21,190 --> 00:23:18,880
week it uh seems to

673
00:23:24,310 --> 00:23:21,200
have varying brightness which is shown

674
00:23:27,190 --> 00:23:24,320
in the top right

675
00:23:28,789 --> 00:23:27,200
of the comet but at the same time uh

676
00:23:30,789 --> 00:23:28,799
mars has also been

677
00:23:32,630 --> 00:23:30,799
observed by the amateurs since january

678
00:23:35,270 --> 00:23:32,640
and what we notice is this going through

679
00:23:37,270 --> 00:23:35,280
its changes of season so the top right

680
00:23:38,549 --> 00:23:37,280
mars image is from april when it was

681
00:23:40,630 --> 00:23:38,559
closest to the earth and you can see a

682
00:23:41,590 --> 00:23:40,640
lot of structure and details on the uh

683
00:23:43,750 --> 00:23:41,600
surface

684
00:23:46,630 --> 00:23:43,760
and the two uh images below that were

685
00:23:49,430 --> 00:23:46,640
taken just a few days back on october

686
00:23:51,350 --> 00:23:49,440
5th where it has entered its uh northern

687
00:23:53,669 --> 00:23:51,360
uh fall season like

688
00:23:55,669 --> 00:23:53,679

kelly mentioned it's a dust storm season

689
00:23:57,909 --> 00:23:55,679
and there were two dust storms that were

690
00:24:00,470 --> 00:23:57,919
uh observed on that day and by this

691
00:24:02,390 --> 00:24:00,480
point the disc has uh decreased to mere

692
00:24:04,710 --> 00:24:02,400
six arc seconds in the telescope from

693
00:24:06,950 --> 00:24:04,720
ground so this is very interesting that

694
00:24:08,310 --> 00:24:06,960
both planet and comet are changing so

695
00:24:09,430 --> 00:24:08,320
the interaction is going to be very

696
00:24:12,070 --> 00:24:09,440
exciting

697
00:24:14,870 --> 00:24:12,080
next slide please

698
00:24:16,549 --> 00:24:14,880
and this one basically is in addition to

699
00:24:18,549 --> 00:24:16,559
all of that happening the southern

700
00:24:20,149 --> 00:24:18,559
hemispheric sky where the interaction of

701
00:24:22,630 --> 00:24:20,159
the flyby is going to occur is a very

702
00:24:23,990 --> 00:24:22,640
busy part of the sky uh on the left side

703
00:24:26,470 --> 00:24:24,000
you can see the blue rectangle

704
00:24:28,710 --> 00:24:26,480
represents exactly where the two objects

705
00:24:30,549 --> 00:24:28,720
are going to be crossing the paths but

706
00:24:32,870 --> 00:24:30,559
you can see the rest of the sky is very

707
00:24:35,669 --> 00:24:32,880
busy as it passes lmc the large

708
00:24:38,070 --> 00:24:35,679
magellanic cloud and so it's uh our

709
00:24:40,070 --> 00:24:38,080
observers are essentially practicing

710
00:24:41,830 --> 00:24:40,080
their observing techniques um also

711
00:24:42,870 --> 00:24:41,840
getting familiar with the star field and

712
00:24:47,909 --> 00:24:42,880
as the

713
00:24:52,070 --> 00:24:47,919

on the right side what you see is the on

714
00:24:55,029 --> 00:24:52,080
the time of uh encounter on october 19th

715
00:24:57,110 --> 00:24:55,039
basically australia and uh

716
00:25:00,149 --> 00:24:57,120
south africa are going to be the best

717
00:25:02,870 --> 00:25:00,159
places to see optimally south africa and

718
00:25:04,390 --> 00:25:02,880
so we the blue stars on that map

719
00:25:07,029 --> 00:25:04,400
indicate locations where we have

720
00:25:09,190 --> 00:25:07,039
identified both robotic as well as

721
00:25:11,510 --> 00:25:09,200
individual astronomers that are going to

722
00:25:13,750 --> 00:25:11,520
be taking data continuously so that we

723
00:25:17,510 --> 00:25:13,760
can actually see what

724
00:25:19,669 --> 00:25:17,520
the how the dust structures how mars

725
00:25:21,110 --> 00:25:19,679
global features how they change and

726
00:25:23,190 --> 00:25:21,120
that's important even though there are

727
00:25:25,029 --> 00:25:23,200
lots of uh

728
00:25:26,549 --> 00:25:25,039
nasa assets that are looking at it here

729
00:25:28,149 --> 00:25:26,559
you're seeing the far environment you're

730
00:25:30,390 --> 00:25:28,159
seeing the global picture rather than

731
00:25:32,870 --> 00:25:30,400
just the nearby picture so this provides

732
00:25:35,669 --> 00:25:32,880
a complimentary view of the event

733
00:25:39,269 --> 00:25:35,679
may have the next uh slide please

734
00:25:40,390 --> 00:25:39,279
now this uh in it for as far as outreach

735
00:25:42,870 --> 00:25:40,400
part of the

736
00:25:44,710 --> 00:25:42,880
work is providing resources and access

737
00:25:49,190 --> 00:25:44,720
like star charts here's a sample star

738
00:25:51,430 --> 00:25:49,200

chart that we do provide via our various

739
00:25:53,750 --> 00:25:51,440
social media dimensions

740
00:25:57,350 --> 00:25:53,760
and this is essentially if somebody in

741
00:26:00,070 --> 00:25:57,360
australia in south africa at

742
00:26:02,070 --> 00:26:00,080
cape town walks out and takes a look up

743
00:26:04,630 --> 00:26:02,080
at the sky what would they can see in

744
00:26:06,870 --> 00:26:04,640
the sky are not only the planet mars and

745
00:26:09,430 --> 00:26:06,880
antares and saturn but you can also see

746
00:26:10,630 --> 00:26:09,440
the comet but i i this is just a

747
00:26:12,950 --> 00:26:10,640
schematic

748
00:26:14,549 --> 00:26:12,960
picture it's not a naked eye object the

749
00:26:16,390 --> 00:26:14,559
comet you cannot see it like that is

750
00:26:17,909 --> 00:26:16,400
naked eye it's a binocular object you

751
00:26:19,750 --> 00:26:17,919
can see the telescopes but it

752
00:26:22,149 --> 00:26:19,760
essentially helps people to at least

753
00:26:23,350 --> 00:26:22,159
know where to look because the sky is so

754
00:26:25,909 --> 00:26:23,360
busy

755
00:26:27,510 --> 00:26:25,919
may have the next graphic please

756
00:26:30,149 --> 00:26:27,520
and this one

757
00:26:31,350 --> 00:26:30,159
basically shows um why we study comets

758
00:26:33,430 --> 00:26:31,360
because

759
00:26:35,750 --> 00:26:33,440
jim and kerry as well as kelly have all

760
00:26:38,630 --> 00:26:35,760
mentioned this is a once in a lifetime

761
00:26:39,750 --> 00:26:38,640
event for a comet going by

762
00:26:41,830 --> 00:26:39,760
mars

763
00:26:43,269 --> 00:26:41,840

earth cloud comets it's hard to plan

764
00:26:45,029 --> 00:26:43,279
missions to them because you don't know

765
00:26:47,510 --> 00:26:45,039
where they're going to come from and how

766
00:26:50,070 --> 00:26:47,520
they're going to behave so here is a

767
00:26:51,750 --> 00:26:50,080
composition of a lot of the images of

768
00:26:54,310 --> 00:26:51,760
various comets that are available in our

769
00:26:56,149 --> 00:26:54,320
sky currently and these are amateur

770
00:26:58,070 --> 00:26:56,159
astronomers who have taken these images

771
00:27:00,149 --> 00:26:58,080
and they essentially provide the legacy

772
00:27:01,990 --> 00:27:00,159
and the data and the reference system

773
00:27:04,310 --> 00:27:02,000
against which all we can place uh the

774
00:27:06,310 --> 00:27:04,320
other other high resolution observations

775
00:27:08,070 --> 00:27:06,320
in context and that's one of the reasons

776
00:27:09,430 --> 00:27:08,080
we study comets is that because they're

777
00:27:10,630 --> 00:27:09,440
the remnants of our solar system

778
00:27:13,269 --> 00:27:10,640
formation

779
00:27:15,510 --> 00:27:13,279
so back to you duane okay thank you so

780
00:27:17,430 --> 00:27:15,520
now we're going to transition into uh

781
00:27:19,590 --> 00:27:17,440
the question and answer period a lot of

782
00:27:22,710 --> 00:27:19,600
questions and again for our

783
00:27:25,350 --> 00:27:22,720
audience viewing

784
00:27:27,590 --> 00:27:25,360
ask nasa send those questions in we have

785
00:27:30,389 --> 00:27:27,600
the answers join the conversation

786
00:27:31,830 --> 00:27:30,399
there's a lot of it worldwide on twitter

787
00:27:34,070 --> 00:27:31,840
and facebook and look at the nasa

788
00:27:35,510 --> 00:27:34,080

accounts join that conversation so what

789
00:27:37,830 --> 00:27:35,520
i'm going to do here before we go to the

790
00:27:39,990 --> 00:27:37,840
phone lines uh see we have any media

791
00:27:42,630 --> 00:27:40,000
representatives here in the auditorium

792
00:27:44,870 --> 00:27:42,640
and then we're going to uh go to

793
00:27:47,269 --> 00:27:44,880
uh mr social media himself jason

794
00:27:49,190 --> 00:27:47,279
townsend in a second any uh media reps

795
00:27:50,310 --> 00:27:49,200
will see a hand here if we can get a mic

796
00:27:58,310 --> 00:27:50,320
if you can wait for the mic give your

797
00:28:01,909 --> 00:27:59,510
um

798
00:28:03,669 --> 00:28:01,919
it was announced recently oh i'm sorry

799
00:28:05,590 --> 00:28:03,679
marcia freeman with executive

800
00:28:07,669 --> 00:28:05,600
intelligence review

801
00:28:10,950 --> 00:28:07,679
uh it was recently announced that there

802
00:28:13,430 --> 00:28:10,960
would be coordination in data collected

803
00:28:15,430 --> 00:28:13,440
by the mars orbiter admission and maven

804
00:28:18,310 --> 00:28:15,440
which is wonderful

805
00:28:22,070 --> 00:28:18,320
is there a method by which is going to

806
00:28:23,669 --> 00:28:22,080
be coordination between all of the nasa

807
00:28:26,710 --> 00:28:23,679
craft at mars

808
00:28:30,230 --> 00:28:26,720
mars express and the orbiter mission and

809
00:28:31,510 --> 00:28:30,240
international coordination

810
00:28:33,750 --> 00:28:31,520
indeed uh

811
00:28:37,350 --> 00:28:33,760
those dialogues go on uh between the

812
00:28:38,630 --> 00:28:37,360
teams uh with respect to indians

813
00:28:41,510 --> 00:28:38,640

mom mission

814
00:28:44,230 --> 00:28:41,520
uh we've just started that conversation

815
00:28:47,269 --> 00:28:44,240
uh the uh observations that probably

816
00:28:48,389 --> 00:28:47,279
relate the most are from the maven team

817
00:28:51,590 --> 00:28:48,399
and

818
00:28:53,590 --> 00:28:51,600
both the investigators from those two

819
00:28:55,430 --> 00:28:53,600
mission sets are are just now beginning

820
00:28:58,310 --> 00:28:55,440
that dialogue

821
00:29:01,269 --> 00:28:58,320
i'll add that the workshops convened by

822
00:29:03,590 --> 00:29:01,279
the ceoc and the mars program office uh

823
00:29:06,710 --> 00:29:03,600
had participation from all the nasa

824
00:29:07,510 --> 00:29:06,720
missions and from isis mars express um

825
00:29:09,190 --> 00:29:07,520
and

826
00:29:10,630 --> 00:29:09,200
from india's mars orbiter mission they

827
00:29:13,269 --> 00:29:10,640
all they all called in and share so

828
00:29:15,430 --> 00:29:13,279
there's been communication of plans and

829
00:29:17,190 --> 00:29:15,440
uh um but certainly in the case of the

830
00:29:19,269 --> 00:29:17,200
indian mission it's uh that's kind of

831
00:29:20,789 --> 00:29:19,279
just starting since i mean since they

832
00:29:22,149 --> 00:29:20,799
and may even we just got there and

833
00:29:23,510 --> 00:29:22,159
getting set up

834
00:29:25,269 --> 00:29:23,520
and i'd like to add if you want to go

835
00:29:26,789 --> 00:29:25,279
and see what the um what happened those

836
00:29:28,230 --> 00:29:26,799
workshops they're on they've live

837
00:29:30,710 --> 00:29:28,240
streamed in there and everything's been

838
00:29:31,669 --> 00:29:30,720

captured on onto the web so especially

839
00:29:33,430 --> 00:29:31,679
the last one there was a lot of

840
00:29:35,830 --> 00:29:33,440
international discussion

841
00:29:37,669 --> 00:29:35,840
so i think we'll see a lot of really

842
00:29:40,470 --> 00:29:37,679
great correlative data being brought to

843
00:29:43,590 --> 00:29:40,480
bear and tackling a lot of

844
00:29:45,750 --> 00:29:43,600
uh of the science uh and that'll require

845
00:29:47,269 --> 00:29:45,760
all sorts of data from not only our

846
00:29:49,350 --> 00:29:47,279
missions but uh the ground-based

847
00:29:53,669 --> 00:29:49,360
observations and the amateur community

848
00:29:58,149 --> 00:29:55,190
yes course wait for the mic and name

849
00:30:02,389 --> 00:30:00,630
i'm dan vergano with national geographic

850
00:30:04,630 --> 00:30:02,399
um do you have any expectation about how

851
00:30:06,389 --> 00:30:04,640
long it'll take to you have a full

852
00:30:07,190 --> 00:30:06,399
picture of all these observations it's

853
00:30:08,710 --> 00:30:07,200
not

854
00:30:10,389 --> 00:30:08,720
like your switch you turn on and it's

855
00:30:12,070 --> 00:30:10,399
all immediately cooked right it's going

856
00:30:13,669 --> 00:30:12,080
to take a little bit

857
00:30:16,470 --> 00:30:13,679
that's i'll take that that's a very good

858
00:30:18,149 --> 00:30:16,480
question um most of the the data that

859
00:30:19,590 --> 00:30:18,159
comes down is going to take a day or two

860
00:30:20,630 --> 00:30:19,600
to get through the pipelines at the very

861
00:30:22,389 --> 00:30:20,640
least

862
00:30:23,830 --> 00:30:22,399
and so and then to be checked and make

863
00:30:25,190 --> 00:30:23,840

sure we want to make sure that the data

864
00:30:26,310 --> 00:30:25,200
looks good and that we removed any

865
00:30:28,789 --> 00:30:26,320
artifacts

866
00:30:29,990 --> 00:30:28,799
um the good news is that and i think

867
00:30:31,590 --> 00:30:30,000
people's attention is really going to be

868
00:30:34,389 --> 00:30:31,600
riveted on the day of counter itself

869
00:30:36,470 --> 00:30:34,399
october 19th um we're actually expecting

870
00:30:38,470 --> 00:30:36,480
to get some good imagery a few days

871
00:30:39,350 --> 00:30:38,480
before remember the what how the comet's

872
00:30:40,870 --> 00:30:39,360
going to look is going to be roughly

873
00:30:41,750 --> 00:30:40,880
symmetric with the time of closest

874
00:30:43,110 --> 00:30:41,760
approach

875
00:30:45,430 --> 00:30:43,120
so what you may see on the day of

876
00:30:48,149 --> 00:30:45,440
october 19th is actually an image of a

877
00:30:49,669 --> 00:30:48,159
day or two out from the mars assets

878
00:30:51,110 --> 00:30:49,679
and then you'll start seeing over the

879
00:30:53,110 --> 00:30:51,120
next week or two you're going to see

880
00:30:54,950 --> 00:30:53,120
more data come in and the best data

881
00:30:56,549 --> 00:30:54,960
probably won't actually

882
00:30:57,990 --> 00:30:56,559
be available and probably until about

883
00:30:59,750 --> 00:30:58,000
three or four days after we don't want

884
00:31:00,630 --> 00:30:59,760
to over promise

885
00:31:01,750 --> 00:31:00,640
but that's that's when we're going to

886
00:31:03,669 --> 00:31:01,760
really have the close approach we'll

887
00:31:05,509 --> 00:31:03,679
look through it we'll remove cosmic rays

888
00:31:06,710 --> 00:31:05,519

any sort of glitches artifacts to make

889
00:31:08,310 --> 00:31:06,720
sure one of the things we're interested

890
00:31:09,830 --> 00:31:08,320
in is we're going to see meters in mars

891
00:31:10,870 --> 00:31:09,840
atmosphere you have to be careful to

892
00:31:13,990 --> 00:31:10,880
make sure there's not any sort of

893
00:31:17,430 --> 00:31:15,430
any other questions we're actually going

894
00:31:18,630 --> 00:31:17,440
to go to the phone line so we have a in

895
00:31:25,350 --> 00:31:18,640
here wait for the mic and your

896
00:31:28,470 --> 00:31:27,110
hi my name is celina i'm from talk radio

897
00:31:31,269 --> 00:31:28,480
news service and i would just like to

898
00:31:34,630 --> 00:31:31,279
ask how long will this whole study last

899
00:31:36,549 --> 00:31:34,640
for will it um after after october 19th

900
00:31:38,149 --> 00:31:36,559
i mean you have a couple days for all of

901
00:31:39,669 --> 00:31:38,159
your day to come down but overall how

902
00:31:41,669 --> 00:31:39,679
long would it take

903
00:31:43,430 --> 00:31:41,679
certainly it's just yeah the the

904
00:31:44,789 --> 00:31:43,440
encounter is that day and it'll take

905
00:31:46,549 --> 00:31:44,799
some time to get the data down from the

906
00:31:47,509 --> 00:31:46,559
spacecraft

907
00:31:49,350 --> 00:31:47,519
days

908
00:31:50,630 --> 00:31:49,360
but then there there are so many

909
00:31:52,630 --> 00:31:50,640
observations involved and there's the

910
00:31:53,990 --> 00:31:52,640
quick look pictures which uh you know

911
00:31:55,750 --> 00:31:54,000
everybody will try to get out there as

912
00:31:57,509 --> 00:31:55,760
quick as possible and the early results

913
00:31:59,509 --> 00:31:57,519

but then the science analysis

914
00:32:02,070 --> 00:31:59,519
will go on for a long time especially to

915
00:32:03,110 --> 00:32:02,080
get to get all the science out of the

916
00:32:04,870 --> 00:32:03,120
out of all the data that aren't

917
00:32:07,190 --> 00:32:04,880
necessarily pictures and so it will it

918
00:32:09,430 --> 00:32:07,200
will extend for a long time but i know

919
00:32:10,870 --> 00:32:09,440
that scientists will want to

920
00:32:12,470 --> 00:32:10,880
work as fast as possible to try to get

921
00:32:14,870 --> 00:32:12,480
more results out at some of the major

922
00:32:16,310 --> 00:32:14,880
meetings that will be following

923
00:32:17,990 --> 00:32:16,320
like the

924
00:32:19,269 --> 00:32:18,000
perhaps the uh

925
00:32:22,389 --> 00:32:19,279
division planetary science meeting

926
00:32:24,149 --> 00:32:22,399
american geophysical union meeting uh

927
00:32:25,509 --> 00:32:24,159
lps st lunar planetary science

928
00:32:27,029 --> 00:32:25,519
conference so

929
00:32:29,110 --> 00:32:27,039
i imagine over the next year it will

930
00:32:31,669 --> 00:32:29,120
continue to dribble out but hopefully in

931
00:32:33,029 --> 00:32:31,679
the first few days some quick results

932
00:32:34,950 --> 00:32:33,039
that's a very good answer if i may just

933
00:32:36,630 --> 00:32:34,960
add is that our common ison experience

934
00:32:38,470 --> 00:32:36,640
last year the first science papers came

935
00:32:39,990 --> 00:32:38,480
out with about three months but then

936
00:32:41,830 --> 00:32:40,000
we're still getting the really the bulk

937
00:32:43,430 --> 00:32:41,840
of the papers are coming out now so

938
00:32:45,029 --> 00:32:43,440

expect most scientists to come out with

939
00:32:47,269 --> 00:32:45,039
the real serious results within about a

940
00:32:49,190 --> 00:32:47,279
year year and a half after the event

941
00:32:51,509 --> 00:32:49,200
i'd like to add to that too

942
00:32:53,350 --> 00:32:51,519
in addition to all the

943
00:32:55,509 --> 00:32:53,360
professional as well as the assets that

944
00:32:57,590 --> 00:32:55,519
are going to be taking data their

945
00:32:58,789 --> 00:32:57,600
amateurs tend to take have a longer

946
00:33:01,029 --> 00:32:58,799
timeline

947
00:33:04,070 --> 00:33:01,039
as a comet is interesting even after as

948
00:33:07,029 --> 00:33:04,080
it's receding they still take data and

949
00:33:08,549 --> 00:33:07,039
so there may be other other pictures

950
00:33:10,149 --> 00:33:08,559
that come out of it in different type of

951
00:33:12,070 --> 00:33:10,159
features that might be seen in a tale

952
00:33:13,830 --> 00:33:12,080
that you normally cannot predict but you

953
00:33:16,230 --> 00:33:13,840
can have long tenuous tales and

954
00:33:18,789 --> 00:33:16,240
disconnection events or other things and

955
00:33:21,350 --> 00:33:18,799
so on the amateur side the timeline

956
00:33:23,590 --> 00:33:21,360
might be longer as interesting features

957
00:33:25,830 --> 00:33:23,600
present themselves so it could be months

958
00:33:27,350 --> 00:33:25,840
maybe four or five months later on and

959
00:33:28,789 --> 00:33:27,360
we didn't really highlight here the uh

960
00:33:30,549 --> 00:33:28,799
some of the nasa assets are going to be

961
00:33:32,149 --> 00:33:30,559
continuing far out i know like the swift

962
00:33:35,909 --> 00:33:32,159
observations are going to continue for a

963
00:33:37,750 --> 00:33:35,919

long time and uh neo-wise and so yeah

964
00:33:39,029 --> 00:33:37,760
it is the gift that keeps on giving

965
00:33:40,310 --> 00:33:39,039
that's a very important point which we

966
00:33:41,830 --> 00:33:40,320
didn't highlight the comet is going

967
00:33:43,750 --> 00:33:41,840
through perihelion it's closest distance

968
00:33:45,669 --> 00:33:43,760
the sun five days after it's closest to

969
00:33:47,029 --> 00:33:45,679
mars so then basically then it just

970
00:33:48,789 --> 00:33:47,039
starts going out at the solar system

971
00:33:50,149 --> 00:33:48,799
again assuming it survives the mars

972
00:33:51,430 --> 00:33:50,159
encounter we're actually going to watch

973
00:33:52,870 --> 00:33:51,440
and see if there have been any changes

974
00:33:55,269 --> 00:33:52,880
because of this first passage through

975
00:33:57,190 --> 00:33:55,279
the inner system so just as kelly and

976
00:33:58,310 --> 00:33:57,200
padma mentioned following this comment

977
00:34:00,630 --> 00:33:58,320
back out again is going to be very

978
00:34:02,149 --> 00:34:00,640
important as well as the fly by my mars

979
00:34:04,149 --> 00:34:02,159
if there's one thing we've learned about

980
00:34:06,710 --> 00:34:04,159
comets and that is they're very

981
00:34:08,550 --> 00:34:06,720
unpredictable and and indeed that's why

982
00:34:10,710 --> 00:34:08,560
we want to keep watching

983
00:34:13,349 --> 00:34:10,720
you know as it passes by mars that's a

984
00:34:15,829 --> 00:34:13,359
gravitational perturbation interaction

985
00:34:17,669 --> 00:34:15,839
uh what does that do to the comet itself

986
00:34:19,589 --> 00:34:17,679
uh does it

987
00:34:21,190 --> 00:34:19,599
break it up does it rearrange it you

988
00:34:23,190 --> 00:34:21,200

know so the observations are going to

989
00:34:25,430 --> 00:34:23,200
really be critical to hang in there and

990
00:34:29,669 --> 00:34:25,440
continue to continue to make

991
00:34:31,109 --> 00:34:29,679
be made well after it passes by mars

992
00:34:33,669 --> 00:34:31,119
it certainly will be a gift that keeps

993
00:34:35,109 --> 00:34:33,679
on giving that's for sure um okay so

994
00:34:37,109 --> 00:34:35,119
what i'm gonna do here is go to the

995
00:34:38,950 --> 00:34:37,119
phone lines next uh we'll have an

996
00:34:41,109 --> 00:34:38,960
opportunity to come back so we'll do the

997
00:34:42,310 --> 00:34:41,119
phone lines next and then social media

998
00:34:44,790 --> 00:34:42,320
come back here

999
00:34:47,669 --> 00:34:44,800
um i believe we have irene from reuters

1000
00:34:48,710 --> 00:34:47,679
on the call you're up irene

1001
00:34:51,109 --> 00:34:48,720
hi

1002
00:34:53,829 --> 00:34:51,119
thanks very much um i have two questions

1003
00:34:56,230 --> 00:34:53,839
so first is is it just a coincidence

1004
00:34:58,630 --> 00:34:56,240
that the orbiters um

1005
00:34:59,430 --> 00:34:58,640
are going to be on the opposite side of

1006
00:35:10,069 --> 00:34:59,440
the

1007
00:35:12,230 --> 00:35:10,079
mars or was a uh

1008
00:35:14,710 --> 00:35:12,240
some tweaks made in the orbit to make

1009
00:35:17,030 --> 00:35:14,720
that happen and i have a follow-up

1010
00:35:19,030 --> 00:35:17,040
okay yeah that's not a coincidence um

1011
00:35:20,470 --> 00:35:19,040
the uh after that all the modeling was

1012
00:35:21,829 --> 00:35:20,480
done and one of our seahawk members here

1013
00:35:23,190 --> 00:35:21,839

was actually led one of the modeling

1014
00:35:25,430 --> 00:35:23,200
groups to look at the hazard to the

1015
00:35:28,550 --> 00:35:25,440
spacecraft once that was determined

1016
00:35:31,750 --> 00:35:28,560
and uh uh and the timing which is really

1017
00:35:34,069 --> 00:35:31,760
important when is the time of greatest

1018
00:35:35,910 --> 00:35:34,079
risk once that was determined

1019
00:35:38,310 --> 00:35:35,920
then plans were put in motion and the

1020
00:35:40,470 --> 00:35:38,320
studies were made to uh re-phase the

1021
00:35:42,630 --> 00:35:40,480
orbits to do the maneuvers needed to

1022
00:35:44,630 --> 00:35:42,640
make sure that the spacecraft are on the

1023
00:35:49,109 --> 00:35:44,640
far side of mars during the time of

1024
00:35:55,190 --> 00:35:51,270
and then just following up on that last

1025
00:35:57,510 --> 00:35:55,200
comment um is there any assessment for

1026
00:35:58,390 --> 00:35:57,520
the likelihood that the comet will be

1027
00:36:02,150 --> 00:35:58,400
destroyed

1028
00:36:06,630 --> 00:36:03,670
well i think it's unlikely that it'll be

1029
00:36:08,550 --> 00:36:06,640
destroyed uh in the sense that we won't

1030
00:36:10,950 --> 00:36:08,560
see it as as

1031
00:36:11,670 --> 00:36:10,960
continuing to sublimate creating a coma

1032
00:36:13,750 --> 00:36:11,680
and

1033
00:36:16,390 --> 00:36:13,760
a tail but whether it retains its

1034
00:36:17,589 --> 00:36:16,400
structure or not is is uh is uh of

1035
00:36:20,310 --> 00:36:17,599
interest you know whether the

1036
00:36:23,430 --> 00:36:20,320
gravitational perturbations are so great

1037
00:36:25,589 --> 00:36:23,440
uh that that it breaks it apart

1038
00:36:27,109 --> 00:36:25,599

i think uh astronomers don't believe

1039
00:36:28,550 --> 00:36:27,119
that that will happen but you know we

1040
00:36:30,230 --> 00:36:28,560
want to be able to look at it and

1041
00:36:31,990 --> 00:36:30,240
continue to make observations to

1042
00:36:33,750 --> 00:36:32,000
determine that i'd like to add to that

1043
00:36:35,910 --> 00:36:33,760
it's a very good response is that we did

1044
00:36:38,310 --> 00:36:35,920
see in 1994 a comic called shoemaker

1045
00:36:39,990 --> 00:36:38,320
levy 9 that hit repeatedly into jupiter

1046
00:36:42,550 --> 00:36:40,000
because it had flown so close by two

1047
00:36:44,150 --> 00:36:42,560
years before that in 1992 that it got

1048
00:36:46,550 --> 00:36:44,160
ripped apart

1049
00:36:48,390 --> 00:36:46,560
uh we don't think that in the case of

1050
00:36:49,910 --> 00:36:48,400
siding springs mars is a much smaller

1051
00:36:51,510 --> 00:36:49,920
body much less mass than jupiter and

1052
00:36:52,950 --> 00:36:51,520
even though we're coming that close to

1053
00:36:54,390 --> 00:36:52,960
very close to mars

1054
00:36:55,910 --> 00:36:54,400
most of the models

1055
00:36:57,750 --> 00:36:55,920
argue that even though a comet is also

1056
00:36:59,190 --> 00:36:57,760
very weak think of the strength of maybe

1057
00:37:01,430 --> 00:36:59,200
meringue and lemon meringue pie or

1058
00:37:03,109 --> 00:37:01,440
talcum powder and a pile in your hand

1059
00:37:04,790 --> 00:37:03,119
that's how strong comets are even the

1060
00:37:05,589 --> 00:37:04,800
size of a mountain they're incredibly

1061
00:37:06,870 --> 00:37:05,599
weak

1062
00:37:08,069 --> 00:37:06,880
it's amazing that they're still around

1063
00:37:09,190 --> 00:37:08,079

after four and a half billion years but

1064
00:37:10,550 --> 00:37:09,200
the most the reason for that is that

1065
00:37:11,910 --> 00:37:10,560
they've been living very very far away

1066
00:37:13,829 --> 00:37:11,920
from the sun and they've been deep

1067
00:37:15,990 --> 00:37:13,839
freeze just kind of in a time storage

1068
00:37:17,109 --> 00:37:16,000
vault but jim's right we don't know if

1069
00:37:18,950 --> 00:37:17,119
we knew everything about comets we

1070
00:37:20,230 --> 00:37:18,960
wouldn't be studying them and they

1071
00:37:22,630 --> 00:37:20,240
wouldn't be that interesting and

1072
00:37:24,710 --> 00:37:22,640
variable and enigmatic and they are all

1073
00:37:25,910 --> 00:37:24,720
of those things so if we don't look we

1074
00:37:27,589 --> 00:37:25,920
won't find out and there is a

1075
00:37:29,109 --> 00:37:27,599
possibility that the comet may have

1076
00:37:31,030 --> 00:37:29,119
already broken up a little bit there's a

1077
00:37:33,589 --> 00:37:31,040
possibility that mars may drive some

1078
00:37:35,270 --> 00:37:33,599
more activity that's why we're looking

1079
00:37:36,710 --> 00:37:35,280
you know one of the things that we've

1080
00:37:38,630 --> 00:37:36,720
been monitoring of course is the

1081
00:37:39,829 --> 00:37:38,640
intensity of light from the comet over a

1082
00:37:41,270 --> 00:37:39,839
period of time

1083
00:37:43,430 --> 00:37:41,280
and it was uh

1084
00:37:45,190 --> 00:37:43,440
for quite a while actually at a higher

1085
00:37:47,190 --> 00:37:45,200
level than what we originally predicted

1086
00:37:49,510 --> 00:37:47,200
and then it dropped well below that so

1087
00:37:52,069 --> 00:37:49,520
we don't know how that relates to what

1088
00:37:53,829 --> 00:37:52,079

was happening with the nucleus and so

1089
00:37:55,910 --> 00:37:53,839
our mars assets when they turn and they

1090
00:37:57,750 --> 00:37:55,920
were able to get a good look high

1091
00:37:58,710 --> 00:37:57,760
resolution and and it's only going to be

1092
00:38:01,190 --> 00:37:58,720
maybe

1093
00:38:02,950 --> 00:38:01,200
half a dozen or a dozen pixels

1094
00:38:05,430 --> 00:38:02,960
but whether that's a what looks like a

1095
00:38:06,870 --> 00:38:05,440
solid shape or actually a couple shapes

1096
00:38:07,829 --> 00:38:06,880
that may really

1097
00:38:10,310 --> 00:38:07,839
really

1098
00:38:12,150 --> 00:38:10,320
fit in the puzzle very nicely as to how

1099
00:38:14,790 --> 00:38:12,160
how come the comet changed in brightness

1100
00:38:22,310 --> 00:38:19,670
next caller is alan boyle from nbc alan

1101
00:38:24,150 --> 00:38:22,320
thank you uh i had a question about the

1102
00:38:25,990 --> 00:38:24,160
composition since this is for coming in

1103
00:38:28,790 --> 00:38:26,000
for the first time from the oort cloud

1104
00:38:30,870 --> 00:38:28,800
uh do you already have a sense of how

1105
00:38:32,630 --> 00:38:30,880
those oort cloud comets are different

1106
00:38:34,790 --> 00:38:32,640
what do you expect to see

1107
00:38:37,190 --> 00:38:34,800
in terms of compositional analysis as

1108
00:38:39,750 --> 00:38:37,200
the comet comes closer and does this

1109
00:38:42,390 --> 00:38:39,760
have any bearing on the whole issue of

1110
00:38:46,230 --> 00:38:42,400
planetary defense you know the deep

1111
00:38:47,349 --> 00:38:46,240
impact scenario uh i i don't suppose

1112
00:38:49,910 --> 00:38:47,359
that you've

1113
00:38:52,150 --> 00:38:49,920

got that figured out but but uh what do

1114
00:38:54,870 --> 00:38:52,160
you expect uh that community might be

1115
00:38:57,190 --> 00:38:54,880
able to gain from this sort of encounter

1116
00:38:59,349 --> 00:38:57,200
thank you well our naive expectation for

1117
00:39:01,829 --> 00:38:59,359
the composition is that because this

1118
00:39:03,109 --> 00:39:01,839
body was formed out past the water ice

1119
00:39:05,270 --> 00:39:03,119
line and then was thrown out of the

1120
00:39:07,349 --> 00:39:05,280
solar system very early on

1121
00:39:09,109 --> 00:39:07,359
that it should have actually more of the

1122
00:39:10,790 --> 00:39:09,119
really volatile ices methane carbon

1123
00:39:12,390 --> 00:39:10,800
monoxide things that boil off very

1124
00:39:14,470 --> 00:39:12,400
easily it's never if you will been heat

1125
00:39:15,910 --> 00:39:14,480
treated very very strongly before

1126
00:39:18,069 --> 00:39:15,920
compared to the comets that like to

1127
00:39:20,550 --> 00:39:18,079
temple ones or the veiled twos that or

1128
00:39:22,310 --> 00:39:20,560
or the tracimob grasimenko the rosetta

1129
00:39:23,910 --> 00:39:22,320
target that we're coming very close to

1130
00:39:25,990 --> 00:39:23,920
right never actually flying by or

1131
00:39:27,430 --> 00:39:26,000
rendezvousing with and those comets have

1132
00:39:29,990 --> 00:39:27,440
been around the sun and the inner system

1133
00:39:31,349 --> 00:39:30,000
for many many many passages so our naive

1134
00:39:34,550 --> 00:39:31,359
expectation is that there will be more

1135
00:39:37,349 --> 00:39:34,560
volatile organic ices in in sighting

1136
00:39:39,109 --> 00:39:37,359
spring that being said

1137
00:39:40,870 --> 00:39:39,119
that also might be what created that

1138
00:39:42,550 --> 00:39:40,880

initial bump up of activity jim just

1139
00:39:43,829 --> 00:39:42,560
related to it we think it could possibly

1140
00:39:45,349 --> 00:39:43,839
be either due to the fact it's almost

1141
00:39:47,109 --> 00:39:45,359
like nitrous oxide in your gasoline

1142
00:39:48,550 --> 00:39:47,119
engine tank that that those hyper

1143
00:39:50,630 --> 00:39:48,560
volatiles could have actually increased

1144
00:39:52,470 --> 00:39:50,640
the activity and created the activity

1145
00:39:54,150 --> 00:39:52,480
that let us see this comet almost out by

1146
00:39:55,510 --> 00:39:54,160
saturn's orbit to begin with

1147
00:39:56,630 --> 00:39:55,520
there's put it in a different way

1148
00:39:58,550 --> 00:39:56,640
there's no way we would see a body

1149
00:39:59,910 --> 00:39:58,560
that's between half and five

1150
00:40:01,990 --> 00:39:59,920
miles in diameter out by saturn it's

1151
00:40:03,829 --> 00:40:02,000
just and very dark it's way too small

1152
00:40:05,589 --> 00:40:03,839
the only way we saw this comet detected

1153
00:40:08,069 --> 00:40:05,599
so early more than a year ago was

1154
00:40:10,150 --> 00:40:08,079
because it was very active very far out

1155
00:40:11,670 --> 00:40:10,160
so we that our naive expectation is that

1156
00:40:13,349 --> 00:40:11,680
that activity may have been actually

1157
00:40:15,430 --> 00:40:13,359
been driven by the very first passage

1158
00:40:16,950 --> 00:40:15,440
into the inner system and then it's now

1159
00:40:19,030 --> 00:40:16,960
slacking off that could be one reason

1160
00:40:20,710 --> 00:40:19,040
why it's run out of these hypervolatiles

1161
00:40:22,069 --> 00:40:20,720
another is that it could have broken up

1162
00:40:23,349 --> 00:40:22,079
because it's again never been stressed

1163
00:40:25,030 --> 00:40:23,359

and heat treated much before zombie in

1164
00:40:26,309 --> 00:40:25,040
the inner system

1165
00:40:27,829 --> 00:40:26,319
the other thing i would say is that what

1166
00:40:29,190 --> 00:40:27,839
we learned from comet ison last year's

1167
00:40:32,230 --> 00:40:29,200
common ison looked like it was very

1168
00:40:34,230 --> 00:40:32,240
carbon rich maybe organic materials rich

1169
00:40:35,589 --> 00:40:34,240
so and that was another oort cloud comet

1170
00:40:37,510 --> 00:40:35,599
so we're guessing that siding springs

1171
00:40:40,470 --> 00:40:37,520
should show us an awful lot of organic

1172
00:40:43,109 --> 00:40:40,480
carbon and rich material

1173
00:40:45,270 --> 00:40:43,119
so let me sort of address

1174
00:40:47,349 --> 00:40:45,280
the near-earth object aspect of your

1175
00:40:49,510 --> 00:40:47,359
question and i i think it's easy to do

1176
00:40:50,950 --> 00:40:49,520
in the sense of what we're seeing in the

1177
00:40:52,630 --> 00:40:50,960
long run

1178
00:40:54,550 --> 00:40:52,640
you know in the last couple years we've

1179
00:40:56,150 --> 00:40:54,560
really stepped up our observations of

1180
00:40:59,109 --> 00:40:56,160
near-earth objects we have a lot more

1181
00:41:01,910 --> 00:40:59,119
observatories we put more

1182
00:41:04,550 --> 00:41:01,920
telescope observing time and can see a

1183
00:41:06,390 --> 00:41:04,560
larger part of the sky and we're now

1184
00:41:09,270 --> 00:41:06,400
seeing some new trends that we haven't

1185
00:41:12,470 --> 00:41:09,280
seen before if you look back in history

1186
00:41:14,950 --> 00:41:12,480
the number of or cloud comets we observe

1187
00:41:16,390 --> 00:41:14,960
are just a matter of three or four a

1188
00:41:18,150 --> 00:41:16,400

century

1189
00:41:20,870 --> 00:41:18,160
we do see a lot of comets but those are

1190
00:41:23,270 --> 00:41:20,880
all short period comets that exist in

1191
00:41:24,790 --> 00:41:23,280
and around the the period of uh going

1192
00:41:26,950 --> 00:41:24,800
out to jupiter or maybe even a little

1193
00:41:28,710 --> 00:41:26,960
bit into the the kuiper belt but not

1194
00:41:30,710 --> 00:41:28,720
many from the ore cloud

1195
00:41:32,390 --> 00:41:30,720
but more recently now now that we've

1196
00:41:34,710 --> 00:41:32,400
really picked up our observations we're

1197
00:41:36,630 --> 00:41:34,720
now seeing many more cloud comets

1198
00:41:39,750 --> 00:41:36,640
actually there's a there's three up

1199
00:41:41,670 --> 00:41:39,760
right now there's a uh siding spring

1200
00:41:44,150 --> 00:41:41,680
there's another one called pan star and

1201
00:41:46,950 --> 00:41:44,160
there's another one called jacques

1202
00:41:48,470 --> 00:41:46,960
and uh and we believe that our

1203
00:41:50,069 --> 00:41:48,480
near-earth object

1204
00:41:52,790 --> 00:41:50,079
set of observations that we're making

1205
00:41:54,470 --> 00:41:52,800
now are becoming much more comprehensive

1206
00:41:55,829 --> 00:41:54,480
and we're getting a much better view of

1207
00:41:57,670 --> 00:41:55,839
what's happening

1208
00:41:59,829 --> 00:41:57,680
in our solar system and that's just

1209
00:42:01,750 --> 00:41:59,839
going to continue to increase so i

1210
00:42:04,870 --> 00:42:01,760
believe we'll continue to find not only

1211
00:42:07,270 --> 00:42:04,880
near earth objects but these comets

1212
00:42:09,190 --> 00:42:07,280
because they as they move across the sky

1213
00:42:10,390 --> 00:42:09,200

that's how we detect them from the

1214
00:42:12,950 --> 00:42:10,400
background

1215
00:42:14,230 --> 00:42:12,960
of stars very far away that that don't

1216
00:42:17,670 --> 00:42:14,240
move in the in the frame of our

1217
00:42:22,710 --> 00:42:21,109
okay next up tracy watson from usa today

1218
00:42:24,390 --> 00:42:22,720
greetings tracy

1219
00:42:25,990 --> 00:42:24,400
hi dwane thanks for taking my call i

1220
00:42:28,390 --> 00:42:26,000
have a couple questions

1221
00:42:30,069 --> 00:42:28,400
first i understand that the modeling has

1222
00:42:31,990 --> 00:42:30,079
shown that there's going to be very

1223
00:42:34,390 --> 00:42:32,000
little big dust

1224
00:42:37,829 --> 00:42:34,400
falling on either mars or even reaching

1225
00:42:38,870 --> 00:42:37,839
its orbit from the comet so can you talk

1226
00:42:41,030 --> 00:42:38,880
about

1227
00:42:42,470 --> 00:42:41,040
whether you really expect to see

1228
00:42:45,349 --> 00:42:42,480
meteors

1229
00:42:47,430 --> 00:42:45,359
meteorites over mars and also what the

1230
00:42:50,150 --> 00:42:47,440
hazard would have been if the spacecraft

1231
00:42:51,670 --> 00:42:50,160
hadn't been moved to the back side

1232
00:42:53,030 --> 00:42:51,680
at least answer the first part of that

1233
00:42:55,750 --> 00:42:53,040
i'm going to actually kick that to

1234
00:42:58,390 --> 00:42:55,760
somebody who did the modeling so if we

1235
00:43:00,309 --> 00:42:58,400
could send a mic over here i'm going to

1236
00:43:02,630 --> 00:43:00,319
have tony farnam of the university of

1237
00:43:04,550 --> 00:43:02,640
maryland answer that question since he

1238
00:43:06,390 --> 00:43:04,560

was involved in helping to make that

1239
00:43:09,109 --> 00:43:06,400
assessment

1240
00:43:12,790 --> 00:43:09,119
um yeah am i on um

1241
00:43:14,150 --> 00:43:12,800
we did the modeling to look at the

1242
00:43:17,109 --> 00:43:14,160
hazards of what was going to go on at

1243
00:43:19,430 --> 00:43:17,119
the time the comet encountered mars

1244
00:43:21,349 --> 00:43:19,440
and it's kind of a strange

1245
00:43:25,190 --> 00:43:21,359
situation because this comet gets very

1246
00:43:28,309 --> 00:43:25,200
close but it actually doesn't uh

1247
00:43:30,550 --> 00:43:28,319
the dust that comes off the comet

1248
00:43:32,550 --> 00:43:30,560
actually doesn't make it to mars before

1249
00:43:35,270 --> 00:43:32,560
it's blown away by solar radiation

1250
00:43:36,950 --> 00:43:35,280
pressure so the the

1251
00:43:38,470 --> 00:43:36,960
expectation is

1252
00:43:40,550 --> 00:43:38,480
that very little of the dust will

1253
00:43:43,109 --> 00:43:40,560
actually hit mars

1254
00:43:45,270 --> 00:43:43,119
the biggest hazard actually occurs after

1255
00:43:46,309 --> 00:43:45,280
closest approach as jim said

1256
00:43:49,190 --> 00:43:46,319
when

1257
00:43:52,790 --> 00:43:49,200
the big dust that sort of trails behind

1258
00:43:56,950 --> 00:43:55,349
reach mars as mars crosses the comet's

1259
00:43:58,870 --> 00:43:56,960
orbital plane

1260
00:44:00,870 --> 00:43:58,880
the velocities that we see in the comet

1261
00:44:02,470 --> 00:44:00,880
suggest that's not going to happen

1262
00:44:04,150 --> 00:44:02,480
because these are big particles and they

1263
00:44:06,069 --> 00:44:04,160

would have had to have been emitted

1264
00:44:08,870 --> 00:44:06,079
long before perihelion something like

1265
00:44:11,030 --> 00:44:08,880
two years before perihelion and from our

1266
00:44:11,990 --> 00:44:11,040
observations that's not

1267
00:44:14,150 --> 00:44:12,000
uh

1268
00:44:16,790 --> 00:44:14,160
they suggest that that didn't happen so

1269
00:44:19,990 --> 00:44:16,800
the hazard is um expect the expectation

1270
00:44:23,109 --> 00:44:20,000
of the hazard is very small

1271
00:44:25,750 --> 00:44:23,119
yes and in terms of what the engineers

1272
00:44:27,750 --> 00:44:25,760
from the mission projects did they took

1273
00:44:29,829 --> 00:44:27,760
this information and then they they did

1274
00:44:32,230 --> 00:44:29,839
all the amazing work that they do uh

1275
00:44:35,109 --> 00:44:32,240
looking at uh probabilities and looking

1276
00:44:37,510 --> 00:44:35,119
at what would happen if uh if there was

1277
00:44:39,990 --> 00:44:37,520
a dust particle coming in at uh

1278
00:44:42,630 --> 00:44:40,000
it was i guess 33 miles

1279
00:44:43,990 --> 00:44:42,640
per second yeah getting the right units

1280
00:44:45,670 --> 00:44:44,000
uh what it would do to different

1281
00:44:47,990 --> 00:44:45,680
components on the spacecraft how they

1282
00:44:49,510 --> 00:44:48,000
might have to orient the spacecraft or

1283
00:44:51,510 --> 00:44:49,520
all those different trades that they

1284
00:44:53,349 --> 00:44:51,520
would have to do and so ultimately was

1285
00:44:56,870 --> 00:44:53,359
decided the best thing to do is uh yeah

1286
00:44:58,950 --> 00:44:56,880
the risk is small but it's there and so

1287
00:45:00,069 --> 00:44:58,960
what we can do is change the orbits so

1288
00:45:01,990 --> 00:45:00,079

that at least during that period of

1289
00:45:03,990 --> 00:45:02,000
greatest risk the spacecraft are on the

1290
00:45:05,510 --> 00:45:04,000
other side of mars so so they'll be able

1291
00:45:07,270 --> 00:45:05,520
to do the science they'll kind of hunker

1292
00:45:08,069 --> 00:45:07,280
down and they'll do the science again

1293
00:45:08,950 --> 00:45:08,079
and

1294
00:45:10,870 --> 00:45:08,960
so

1295
00:45:12,390 --> 00:45:10,880
the expectation is that it will all be

1296
00:45:13,670 --> 00:45:12,400
okay and that all the precautions have

1297
00:45:15,109 --> 00:45:13,680
been taken

1298
00:45:16,550 --> 00:45:15,119
i'd like to add that this was actually a

1299
00:45:18,150 --> 00:45:16,560
very important thing to study if you

1300
00:45:19,750 --> 00:45:18,160
think about meteor showers our own

1301
00:45:21,589 --> 00:45:19,760
planet when we see them it's usually

1302
00:45:23,670 --> 00:45:21,599
because we're passing through a comet's

1303
00:45:25,270 --> 00:45:23,680
orbit or where an asteroid that some

1304
00:45:27,190 --> 00:45:25,280
asteroids also shed material that we're

1305
00:45:29,270 --> 00:45:27,200
passing through its orbit i don't can't

1306
00:45:31,270 --> 00:45:29,280
think or recollect a time when we pass

1307
00:45:33,910 --> 00:45:31,280
through that orbit about an hour hour

1308
00:45:35,430 --> 00:45:33,920
and a half after the body just went by

1309
00:45:36,710 --> 00:45:35,440
all right so that doesn't have we

1310
00:45:38,550 --> 00:45:36,720
usually go through an old part of the

1311
00:45:40,150 --> 00:45:38,560
orbit when when the comet is way around

1312
00:45:43,109 --> 00:45:40,160
another part in the orbit you know many

1313
00:45:44,710 --> 00:45:43,119

many months to years past us so it was a

1314
00:45:46,950 --> 00:45:44,720
perfectly reasonable and important thing

1315
00:45:48,790 --> 00:45:46,960
to do to worry about this hazard

1316
00:45:50,309 --> 00:45:48,800
it's actually amazing the hazard is so

1317
00:45:51,750 --> 00:45:50,319
low but we've had three different groups

1318
00:45:53,030 --> 00:45:51,760
international groups telling us that not

1319
00:45:54,309 --> 00:45:53,040
to worry

1320
00:45:55,829 --> 00:45:54,319
okay we're going to take one more

1321
00:45:57,349 --> 00:45:55,839
question uh from the phone and then

1322
00:45:59,190 --> 00:45:57,359
we're going to go to social media and

1323
00:46:01,430 --> 00:45:59,200
then we're going to wrap up so

1324
00:46:03,190 --> 00:46:01,440
uh we have kelly beatty from scott

1325
00:46:04,630 --> 00:46:03,200
telescope kelly

1326
00:46:05,829 --> 00:46:04,640
oh thank you you know most of my

1327
00:46:08,790 --> 00:46:05,839
questions have been answered i'm going

1328
00:46:10,870 --> 00:46:08,800
to pass them with somebody else okay

1329
00:46:12,390 --> 00:46:10,880
excellent let's go to social media jason

1330
00:46:14,390 --> 00:46:12,400
what's going on in the social media

1331
00:46:16,550 --> 00:46:14,400
world indeed we've got several questions

1332
00:46:18,390 --> 00:46:16,560
from both users on twitter and from uh

1333
00:46:20,630 --> 00:46:18,400
those that are watching on ustream here

1334
00:46:22,069 --> 00:46:20,640
first one comes from hector who asks i

1335
00:46:24,550 --> 00:46:22,079
know the numbers were crunched many

1336
00:46:26,309 --> 00:46:24,560
times and 83 miles is awfully close what

1337
00:46:29,510 --> 00:46:26,319
are the chances of a spectacular mars

1338
00:46:33,910 --> 00:46:32,790

that's 138 000 kilometers or 88 000

1339
00:46:36,230 --> 00:46:33,920
miles

1340
00:46:38,069 --> 00:46:36,240
is the closest approach to mars center

1341
00:46:39,829 --> 00:46:38,079
so it's a little bit farther away the

1342
00:46:42,870 --> 00:46:39,839
error bar on that if i believe is in the

1343
00:46:44,630 --> 00:46:42,880
order of maybe 10 000 miles so we i

1344
00:46:46,630 --> 00:46:44,640
believe there's almost zero chance of

1345
00:46:48,150 --> 00:46:46,640
the comet hitting mars

1346
00:46:51,190 --> 00:46:48,160
the short answer

1347
00:46:53,190 --> 00:46:51,200
wonderful then uh twitter user dms asks

1348
00:46:55,270 --> 00:46:53,200
will a spectacular meteor shower follow

1349
00:46:57,030 --> 00:46:55,280
up on the brush of the coma with mars

1350
00:46:58,790 --> 00:46:57,040
upper atmosphere and will the rovers and

1351
00:47:01,750 --> 00:46:58,800
orbiters be able to see it

1352
00:47:03,430 --> 00:47:01,760
meanwhile at the same time user t asks

1353
00:47:05,910 --> 00:47:03,440
will curiosity and opportunity be able

1354
00:47:07,910 --> 00:47:05,920
to get photos of that and if there's any

1355
00:47:09,910 --> 00:47:07,920
rain of debris

1356
00:47:12,470 --> 00:47:09,920
well they certainly will look and even

1357
00:47:14,630 --> 00:47:12,480
um like the uh uh yeah the rovers are

1358
00:47:16,630 --> 00:47:14,640
going to look up and uh

1359
00:47:17,990 --> 00:47:16,640
i think i think uh i forget which

1360
00:47:20,230 --> 00:47:18,000
orbiter is going to look at that but

1361
00:47:21,750 --> 00:47:20,240
also the hubble space telescope is going

1362
00:47:23,990 --> 00:47:21,760
to as part of its science is going to

1363
00:47:26,230 --> 00:47:24,000

take a look at that but as tony farnham

1364
00:47:27,910 --> 00:47:26,240
explained the the risk is probably

1365
00:47:29,430 --> 00:47:27,920
not the risk at this point

1366
00:47:31,910 --> 00:47:29,440
uh you know the odds of that happening

1367
00:47:34,150 --> 00:47:31,920
are are minimal but they that still

1368
00:47:35,750 --> 00:47:34,160
could happen and so again you don't know

1369
00:47:38,150 --> 00:47:35,760
if you don't look and so we're going to

1370
00:47:40,150 --> 00:47:38,160
take a look at that so a byproduct of

1371
00:47:42,230 --> 00:47:40,160
the hazard modeling was that it told you

1372
00:47:44,870 --> 00:47:42,240
how many particles we expect to be

1373
00:47:46,390 --> 00:47:44,880
hitting both mars and the spacecraft so

1374
00:47:48,069 --> 00:47:46,400
it none of the hatchery modeling tells

1375
00:47:50,309 --> 00:47:48,079
you what direction to look to see those

1376
00:47:51,829 --> 00:47:50,319
meteors and if i understand a quote tony

1377
00:47:53,750 --> 00:47:51,839
is in the audience is that i believe

1378
00:47:54,870 --> 00:47:53,760
they do expect some meteors but it's

1379
00:47:57,190 --> 00:47:54,880
going to be a little bit above the

1380
00:47:59,190 --> 00:47:57,200
normal background rate just from going

1381
00:48:00,549 --> 00:47:59,200
passing around the solar system so if

1382
00:48:02,390 --> 00:48:00,559
you look very carefully one place in the

1383
00:48:03,750 --> 00:48:02,400
sky you might see a bit of enhancement

1384
00:48:05,510 --> 00:48:03,760
but not much

1385
00:48:07,990 --> 00:48:05,520
so one thing we do know

1386
00:48:09,670 --> 00:48:08,000
is where opportunity will be and where

1387
00:48:11,510 --> 00:48:09,680
curiosity will be

1388
00:48:14,470 --> 00:48:11,520

so a closest approach

1389
00:48:15,750 --> 00:48:14,480
opportunity will be just coming out of

1390
00:48:19,190 --> 00:48:15,760
dawn

1391
00:48:21,510 --> 00:48:19,200
and curiosity will be going into dusk

1392
00:48:23,430 --> 00:48:21,520
so within a few hours after the event uh

1393
00:48:27,270 --> 00:48:23,440
curiosity will be on the night side of

1394
00:48:29,990 --> 00:48:27,280
the planet uh may may may even be able

1395
00:48:32,150 --> 00:48:30,000
to observe uh even uh smaller particles

1396
00:48:35,430 --> 00:48:32,160
uh that that may make it there

1397
00:48:37,829 --> 00:48:35,440
uh uh on uh the day side

1398
00:48:40,069 --> 00:48:37,839
uh opportunity will have to uh be

1399
00:48:42,549 --> 00:48:40,079
looking up and that is indeed planned uh

1400
00:48:44,470 --> 00:48:42,559
but but uh indeed the larger particles

1401
00:48:46,390 --> 00:48:44,480
would have to make some sort of some

1402
00:48:48,710 --> 00:48:46,400
sort of fireball or some sort of trail

1403
00:48:50,790 --> 00:48:48,720
for it to be able to seem but as they

1404
00:48:53,270 --> 00:48:50,800
say we've got a we've got to plan these

1405
00:48:55,190 --> 00:48:53,280
observations in advance and and uh wait

1406
00:48:56,790 --> 00:48:55,200
to see what what happens

1407
00:48:58,150 --> 00:48:56,800
let's take a couple more then we'll take

1408
00:49:00,710 --> 00:48:58,160
one more from the phone and we'll wrap

1409
00:49:02,790 --> 00:49:00,720
up all right then this comes from a user

1410
00:49:04,549 --> 00:49:02,800
watching on ustream here will maven be

1411
00:49:07,270 --> 00:49:04,559
able to get a baseline observation

1412
00:49:09,990 --> 00:49:07,280
before the effects of the comet occur

1413
00:49:11,510 --> 00:49:10,000

yes actually that's part of the plan uh

1414
00:49:13,190 --> 00:49:11,520
now again they just arrived at mars and

1415
00:49:14,630 --> 00:49:13,200
so the first order of business is to go

1416
00:49:16,470 --> 00:49:14,640
through the activities they need to do

1417
00:49:18,230 --> 00:49:16,480
to transition to doing the science and

1418
00:49:19,430 --> 00:49:18,240
so they're going to fit this science in

1419
00:49:20,870 --> 00:49:19,440
they've even released some science

1420
00:49:23,589 --> 00:49:20,880
already but that's the first order of

1421
00:49:24,950 --> 00:49:23,599
business if all goes well then they are

1422
00:49:26,470 --> 00:49:24,960
going to get a baseline measurement of

1423
00:49:28,470 --> 00:49:26,480
the atmosphere so they can see what is

1424
00:49:31,910 --> 00:49:28,480
the difference after the comet went by

1425
00:49:34,069 --> 00:49:31,920
so yes they will indeed do that

1426
00:49:36,470 --> 00:49:34,079
excellent then also coming from ustream

1427
00:49:38,470 --> 00:49:36,480
here how long might this dust persist on

1428
00:49:42,710 --> 00:49:38,480
mars and are there any effects on the

1429
00:49:47,109 --> 00:49:44,950
referring to dust from the comet or the

1430
00:49:49,349 --> 00:49:47,119
dust just in the dust in the atmosphere

1431
00:49:53,109 --> 00:49:49,359
okay well again they'll probably be very

1432
00:49:54,710 --> 00:49:53,119
little of that and uh and the period at

1433
00:49:56,470 --> 00:49:54,720
least like of greatest risk to the

1434
00:49:57,910 --> 00:49:56,480
spacecraft and when the meteors might be

1435
00:49:59,750 --> 00:49:57,920
coming in

1436
00:50:01,910 --> 00:49:59,760
would be it's only about a 20 minute per

1437
00:50:04,470 --> 00:50:01,920
period so that's actually pretty short

1438
00:50:05,910 --> 00:50:04,480

when the when mars passes the plane of

1439
00:50:08,230 --> 00:50:05,920
the comet's orbit

1440
00:50:09,670 --> 00:50:08,240
so it is a short period

1441
00:50:11,430 --> 00:50:09,680
and if you think about how much the

1442
00:50:13,349 --> 00:50:11,440
meteors affect the dust environment in

1443
00:50:15,430 --> 00:50:13,359
our atmosphere it's very small so we

1444
00:50:16,870 --> 00:50:15,440
only expect a bump up of maybe a few

1445
00:50:18,230 --> 00:50:16,880
times the background rate we don't think

1446
00:50:20,710 --> 00:50:18,240
there'll be much of an effect on the

1447
00:50:21,510 --> 00:50:20,720
rovers or on any ground assets

1448
00:50:23,349 --> 00:50:21,520
okay

1449
00:50:25,109 --> 00:50:23,359
so um for the

1450
00:50:26,390 --> 00:50:25,119
social media folks keep those questions

1451
00:50:28,630 --> 00:50:26,400
coming in we'll have some of our

1452
00:50:30,309 --> 00:50:28,640
scientists uh get you the answers as

1453
00:50:32,069 --> 00:50:30,319
soon as possible what we're going to do

1454
00:50:34,150 --> 00:50:32,079
here is take one more call from the

1455
00:50:36,549 --> 00:50:34,160
phone lines and wrap it up for the day

1456
00:50:40,309 --> 00:50:36,559
so back on the phone and mike wahl

1457
00:50:44,150 --> 00:50:42,150
thanks guys um yeah i just had a

1458
00:50:46,230 --> 00:50:44,160
question about yet then what what

1459
00:50:48,069 --> 00:50:46,240
opportunity and

1460
00:50:49,910 --> 00:50:48,079
what also curiosity might be able to

1461
00:50:51,349 --> 00:50:49,920
find i mean is this just just sort of

1462
00:50:53,109 --> 00:50:51,359
pretty pictures that you're hoping to

1463
00:50:55,190 --> 00:50:53,119

get from the mars rovers or is there

1464
00:50:57,829 --> 00:50:55,200
some science you could clean

1465
00:50:59,349 --> 00:50:57,839
like from their photos and um

1466
00:51:01,190 --> 00:50:59,359
yeah we don't want to get too excited we

1467
00:51:03,670 --> 00:51:01,200
don't but but is it possible to get a

1468
00:51:05,750 --> 00:51:03,680
big fireball photo in the martian sky is

1469
00:51:06,710 --> 00:51:05,760
that something that um that could happen

1470
00:51:10,470 --> 00:51:06,720
or

1471
00:51:13,270 --> 00:51:10,480
don't know a dim light through the dust

1472
00:51:14,549 --> 00:51:13,280
is is sort of i mean what what to expect

1473
00:51:15,349 --> 00:51:14,559
should we should we get excited about

1474
00:51:19,510 --> 00:51:15,359
those

1475
00:51:21,589 --> 00:51:19,520
opportunity might return curiosity might

1476
00:51:24,230 --> 00:51:21,599
return or or should we just sort of calm

1477
00:51:25,910 --> 00:51:24,240
down and just wait and see i still think

1478
00:51:27,829 --> 00:51:25,920
it's good to get excited because you got

1479
00:51:29,670 --> 00:51:27,839
to look and certainly there there is

1480
00:51:31,910 --> 00:51:29,680
science in the pictures just seeing what

1481
00:51:33,430 --> 00:51:31,920
the comet looks like and what actually

1482
00:51:34,230 --> 00:51:33,440
makes it through the atmosphere what the

1483
00:51:35,349 --> 00:51:34,240
light that makes it through the

1484
00:51:38,069 --> 00:51:35,359
atmosphere

1485
00:51:40,069 --> 00:51:38,079
what it sees but also on curiosity the

1486
00:51:42,230 --> 00:51:40,079
chemcam is also going to

1487
00:51:43,030 --> 00:51:42,240
take a look at

1488
00:51:44,870 --> 00:51:43,040

any

1489
00:51:46,870 --> 00:51:44,880
mineral information that it can detect

1490
00:51:48,630 --> 00:51:46,880
from the comet so yes there still is

1491
00:51:50,470 --> 00:51:48,640
science to be done though we love the

1492
00:51:51,670 --> 00:51:50,480
pretty pictures too but there's signs to

1493
00:51:53,190 --> 00:51:51,680
be done also

1494
00:51:54,790 --> 00:51:53,200
i wouldn't i'm not convinced there'll be

1495
00:51:56,230 --> 00:51:54,800
a fireball picture but i'm excited just

1496
00:51:58,069 --> 00:51:56,240
to see the first image of a comet from

1497
00:51:59,030 --> 00:51:58,079
the surface of another planet

1498
00:52:00,470 --> 00:51:59,040
i think that's going to be really

1499
00:52:03,670 --> 00:52:00,480
exciting if we get it

1500
00:52:05,349 --> 00:52:03,680
i think uh what i'd like to add is um

1501
00:52:07,270 --> 00:52:05,359
you know even though we'll be imaging

1502
00:52:10,630 --> 00:52:07,280
from uh curiosity and opportunity

1503
00:52:12,470 --> 00:52:10,640
curiosity actually has a really nice set

1504
00:52:14,470 --> 00:52:12,480
of

1505
00:52:16,309 --> 00:52:14,480
weather measurements if you will so it

1506
00:52:19,109 --> 00:52:16,319
measures the pressure and the

1507
00:52:21,030 --> 00:52:19,119
temperature at a really pretty good clip

1508
00:52:22,549 --> 00:52:21,040
now although right now we believe that

1509
00:52:24,710 --> 00:52:22,559
most of the effects that will be

1510
00:52:26,870 --> 00:52:24,720
observed will be in the ionosphere and

1511
00:52:28,710 --> 00:52:26,880
in the upper atmosphere we don't believe

1512
00:52:30,390 --> 00:52:28,720
there'll be many effects in the lower

1513
00:52:32,309 --> 00:52:30,400

atmosphere where curiosity and

1514
00:52:34,470 --> 00:52:32,319
opportunity obviously are but we're

1515
00:52:36,790 --> 00:52:34,480
making those measurements too i mean

1516
00:52:38,870 --> 00:52:36,800
it'd be it'd be great to be able to uh

1517
00:52:40,710 --> 00:52:38,880
look at those and and determine if

1518
00:52:44,309 --> 00:52:40,720
pressure changes or temperature changes

1519
00:52:45,990 --> 00:52:44,319
might be attributed uh to uh to this in

1520
00:52:47,750 --> 00:52:46,000
to this flyby and the impact of the

1521
00:52:49,510 --> 00:52:47,760
commentary material

1522
00:52:51,750 --> 00:52:49,520
the measurements will be made and the

1523
00:52:53,109 --> 00:52:51,760
scientists will take a look and and i

1524
00:52:54,470 --> 00:52:53,119
know we'll get some great stuff out of

1525
00:52:57,430 --> 00:52:54,480
it

1526
00:52:58,870 --> 00:52:57,440
okay so jason uh asks for one more he

1527
00:53:00,470 --> 00:52:58,880
you know i can't tell him no so we're

1528
00:53:02,470 --> 00:53:00,480
gonna go and get one more question for

1529
00:53:03,990 --> 00:53:02,480
social media jason not a problem there's

1530
00:53:05,589 --> 00:53:04,000
a couple of different variations of

1531
00:53:07,829 --> 00:53:05,599
questions on here all asking about how

1532
00:53:10,390 --> 00:53:07,839
people can get involved and so on um so

1533
00:53:12,790 --> 00:53:10,400
for example aubry from twitter asks will

1534
00:53:14,710 --> 00:53:12,800
i be able to see it from ohio meanwhile

1535
00:53:18,630 --> 00:53:14,720
tim asks will there be an online feed

1536
00:53:23,430 --> 00:53:22,470
um yeah i think from ohio that that one

1537
00:53:25,270 --> 00:53:23,440
that probably won't work out

1538
00:53:27,109 --> 00:53:25,280

unfortunately it's really mars has the

1539
00:53:29,190 --> 00:53:27,119
front row seat and here probably more

1540
00:53:31,190 --> 00:53:29,200
the southern hemisphere

1541
00:53:32,790 --> 00:53:31,200
but there are

1542
00:53:34,549 --> 00:53:32,800
i don't remember offhand but there's a

1543
00:53:36,549 --> 00:53:34,559
social being planned i believe but i

1544
00:53:38,150 --> 00:53:36,559
don't remember the timing of that and so

1545
00:53:40,230 --> 00:53:38,160
that might still be in the in the works

1546
00:53:41,109 --> 00:53:40,240
so there's that opportunity uh then

1547
00:53:43,349 --> 00:53:41,119
there's

1548
00:53:45,829 --> 00:53:43,359
the websites just to find out for more

1549
00:53:47,910 --> 00:53:45,839
information the comic campaign.org and

1550
00:53:50,309 --> 00:53:47,920
the mars.nasa.gov

1551
00:53:51,829 --> 00:53:50,319
comet siding spring they have all kinds

1552
00:53:53,109 --> 00:53:51,839
of background information but in terms

1553
00:53:55,510 --> 00:53:53,119
of the events

1554
00:53:57,589 --> 00:53:55,520
you can follow the nasa

1555
00:53:59,270 --> 00:53:57,599
social pages i would think and then once

1556
00:54:01,190 --> 00:53:59,280
the rest of it forms up that will be out

1557
00:54:02,710 --> 00:54:01,200
there is that correct wayne that's right

1558
00:54:04,549 --> 00:54:02,720
i'd also point out that the time when

1559
00:54:05,589 --> 00:54:04,559
the closest approach is about what's

1560
00:54:07,349 --> 00:54:05,599
going to be about there in the middle of

1561
00:54:08,390 --> 00:54:07,359
the first football game two sundays from

1562
00:54:10,309 --> 00:54:08,400
now so it's going to be the middle of

1563
00:54:11,670 --> 00:54:10,319

the day for us but i also want to point

1564
00:54:13,750 --> 00:54:11,680
out that padma has been doing an awful

1565
00:54:15,670 --> 00:54:13,760
lot on facebook and twitter so maybe we

1566
00:54:18,150 --> 00:54:15,680
should let her comment i was going to

1567
00:54:19,750 --> 00:54:18,160
say uh we do have an amateur

1568
00:54:21,349 --> 00:54:19,760
and pro it's a pro

1569
00:54:24,950 --> 00:54:21,359
professional amateur collaboration group

1570
00:54:27,990 --> 00:54:24,960
called paca and there are ways to um

1571
00:54:30,710 --> 00:54:28,000
participate uh all of this is online uh

1572
00:54:32,549 --> 00:54:30,720
as well as uh they're going to be uh

1573
00:54:35,270 --> 00:54:32,559
different social media including uh

1574
00:54:36,950 --> 00:54:35,280
twitter as well as flickr albums that we

1575
00:54:38,950 --> 00:54:36,960
already have those populated so you can

1576
00:54:41,750 --> 00:54:38,960
see the images the amateurs have been

1577
00:54:43,510 --> 00:54:41,760
taking since january and so those will

1578
00:54:45,109 --> 00:54:43,520
be continuing and even if you're not a

1579
00:54:46,950 --> 00:54:45,119
member you can

1580
00:54:48,549 --> 00:54:46,960
many people who take images can upload

1581
00:54:50,630 --> 00:54:48,559
directly to the flickr album so they're

1582
00:54:52,390 --> 00:54:50,640
available to the public

1583
00:54:53,750 --> 00:54:52,400
and also we

1584
00:54:55,349 --> 00:54:53,760
are planning to have our own google

1585
00:54:57,990 --> 00:54:55,359
hangouts or people who have taken the

1586
00:55:00,230 --> 00:54:58,000
data from the different locations uh in

1587
00:55:02,950 --> 00:55:00,240
australia south africa as well as south

1588
00:55:05,270 --> 00:55:02,960

america can pretty much uh show what

1589
00:55:07,990 --> 00:55:05,280
they have taken and pass on the bataan

1590
00:55:09,750 --> 00:55:08,000
so to speak to the next location so that

1591
00:55:12,630 --> 00:55:09,760
you can actually see what the observers

1592
00:55:15,270 --> 00:55:12,640
are taking data even though casey says

1593
00:55:17,030 --> 00:55:15,280
there's football on that sunday

1594
00:55:18,829 --> 00:55:17,040
if your team loses forget about it and

1595
00:55:21,190 --> 00:55:18,839
just go to your screen

1596
00:55:22,870 --> 00:55:21,200
and and a lot of the other rest of the

1597
00:55:24,630 --> 00:55:22,880
world doesn't watch american football so

1598
00:55:26,870 --> 00:55:24,640
there are a lot of

1599
00:55:29,750 --> 00:55:26,880
so this is a lot more exciting

1600
00:55:33,349 --> 00:55:31,349
all right so uh what we're gonna do here

1601
00:55:35,349 --> 00:55:33,359
is wrap up i would like to remind folks

1602
00:55:39,349 --> 00:55:35,359
that uh updates

1603
00:55:42,470 --> 00:55:39,359
on any images or any uh activities go to

1604
00:55:44,630 --> 00:55:42,480
the nasa website uh nasa.gov and in

1605
00:55:45,910 --> 00:55:44,640
particular mars.nasa.gov

1606
00:55:48,630 --> 00:55:45,920
comments slash

1607
00:55:51,190 --> 00:55:48,640
citing spring

1608
00:55:54,230 --> 00:55:51,200
we want to thank our participants

1609
00:55:55,670 --> 00:55:54,240
save the date october 19th

1610
00:55:58,470 --> 00:55:55,680
nasa's ready

1611
00:56:00,390 --> 00:55:58,480
astronomers worldwide are ready

1612
00:56:01,589 --> 00:56:00,400
it's a gift that's going to keep giving

1613
00:56:03,030 --> 00:56:01,599

and that gift

1614
00:56:05,430 --> 00:56:03,040
will certainly help