



1
00:00:06,309 --> 00:00:04,470
well good afternoon and happy new year

2
00:00:08,390 --> 00:00:06,319
my name is duane brown from the office

3
00:00:09,750 --> 00:00:08,400
of communications welcome to nasa

4
00:00:12,390 --> 00:00:09,760
headquarters

5
00:00:15,110 --> 00:00:12,400
today you will hear about nasa's

6
00:00:17,430 --> 00:00:15,120
upcoming valentine's day

7
00:00:19,990 --> 00:00:17,440
rendezvous with a comment

8
00:00:22,630 --> 00:00:20,000
we'll have brief presentations and then

9
00:00:24,630 --> 00:00:22,640
we will open it up for questions

10
00:00:27,589 --> 00:00:24,640
so let's get started first let me

11
00:00:28,870 --> 00:00:27,599
introduce you to today's participants

12
00:00:31,589 --> 00:00:28,880
first up

13
00:00:34,790 --> 00:00:31,599

will be joe ververka

14

00:00:36,389 --> 00:00:34,800

start us next principal investigator

15

00:00:39,350 --> 00:00:36,399

cornell university

16

00:00:41,030 --> 00:00:39,360

ithaca new york

17

00:00:43,670 --> 00:00:41,040

tim larsen

18

00:00:46,150 --> 00:00:43,680

startup's next project manager

19

00:00:48,950 --> 00:00:46,160

from jet propulsion laboratory pasadena

20

00:00:53,830 --> 00:00:50,389

pete schultz

21

00:00:56,069 --> 00:00:53,840

starduck's next co-investigator

22

00:00:58,630 --> 00:00:56,079

brown university

23

00:01:00,310 --> 00:00:58,640

providence rhode island

24

00:01:02,790 --> 00:01:00,320

and steve chesley

25

00:01:05,109 --> 00:01:02,800

start us next co-investigator

26

00:01:07,670 --> 00:01:05,119

also from the jet propulsion laboratory

27

00:01:10,630 --> 00:01:07,680

so with that i'll turn it over to joe

28

00:01:12,789 --> 00:01:10,640

thank you duane good afternoon

29

00:01:15,270 --> 00:01:12,799

we are here to update you on the

30

00:01:16,950 --> 00:01:15,280

stardust next mission which is uh less

31

00:01:20,310 --> 00:01:16,960

than a month away from its encounter

32

00:01:22,870 --> 00:01:20,320

with comet temple one on february 14th

33

00:01:25,190 --> 00:01:22,880

and it's important to realize that uh

34

00:01:26,469 --> 00:01:25,200

stardust next involves the reuse of a

35

00:01:33,990 --> 00:01:26,479

spacecraft

36

00:01:38,630 --> 00:01:36,789

we are hoping to see the next slide

37

00:01:40,870 --> 00:01:38,640

okay all right

38

00:01:43,109 --> 00:01:40,880

as i mentioned uh stardust next uh

39

00:01:46,230 --> 00:01:43,119

reuses the stardust spacecraft which was

40

00:01:48,310 --> 00:01:46,240

originally launched in 1999

41

00:01:49,190 --> 00:01:48,320

the goal of this original stardust

42

00:01:50,630 --> 00:01:49,200

mission

43

00:01:52,550 --> 00:01:50,640

next step

44

00:01:58,230 --> 00:01:52,560

was to

45

00:02:03,270 --> 00:02:00,630

let's see where thank you

46

00:02:05,830 --> 00:02:03,280

and the idea was to fly by comet bill 2

47

00:02:08,630 --> 00:02:05,840

and collect dust

48

00:02:11,190 --> 00:02:08,640

in a capsule and return that capsule

49

00:02:13,110 --> 00:02:11,200

with the dust to urge for analysis that

50

00:02:15,110 --> 00:02:13,120

was done successfully

51
00:02:16,710 --> 00:02:15,120
two years later next

52
00:02:19,030 --> 00:02:16,720
step please

53
00:02:22,869 --> 00:02:19,040
the capsule with the sample was returned

54
00:02:24,869 --> 00:02:22,879
to earth in january 2006 and since then

55
00:02:28,790 --> 00:02:24,879
these samples have been analyzed in

56
00:02:30,710 --> 00:02:28,800
laboratories around the world next step

57
00:02:33,190 --> 00:02:30,720
and they continue to provide important

58
00:02:35,430 --> 00:02:33,200
information about how comets were formed

59
00:02:36,550 --> 00:02:35,440
and about the earliest processes in the

60
00:02:39,589 --> 00:02:36,560
solar system

61
00:02:41,589 --> 00:02:39,599
so stardust itself was a great success

62
00:02:43,670 --> 00:02:41,599
and the thing to remember was that not

63
00:02:45,509 --> 00:02:43,680

only was it a great success but it left

64

00:02:46,550 --> 00:02:45,519

a perfectly working spacecraft out in

65

00:02:49,509 --> 00:02:46,560

space

66

00:02:52,630 --> 00:02:49,519

and so the next step shows us that

67

00:02:55,030 --> 00:02:52,640

in 2006 we decided to ask nasa to send

68

00:02:57,270 --> 00:02:55,040

the spacecraft to reuse it and send it

69

00:02:59,830 --> 00:02:57,280

on another mission of exploration the

70

00:03:02,229 --> 00:02:59,840

target the next step please

71

00:03:06,070 --> 00:03:02,239

comment temple one that's the comet that

72

00:03:07,990 --> 00:03:06,080

was visited by deep impact in 2005. so

73

00:03:09,910 --> 00:03:08,000

why go back to temple one

74

00:03:11,990 --> 00:03:09,920

well there are two answers one is that

75

00:03:13,270 --> 00:03:12,000

temple one turned out to be unusually

76

00:03:16,869 --> 00:03:13,280

interesting

77

00:03:20,470 --> 00:03:16,879

the next slide shows us that in places

78

00:03:22,550 --> 00:03:20,480

on temple one we see uh layered terrains

79

00:03:25,110 --> 00:03:22,560

which probably contain information about

80

00:03:27,350 --> 00:03:25,120

how comet nuclei were put together and

81

00:03:29,509 --> 00:03:27,360

we would like to see more of these

82

00:03:30,869 --> 00:03:29,519

terrains uh deep impacts only about a

83

00:03:34,869 --> 00:03:30,879

third of the surface we would like to

84

00:03:37,589 --> 00:03:34,879

see more and as the next slide shows us

85

00:03:39,350 --> 00:03:37,599

we would also like to see more about

86

00:03:42,070 --> 00:03:39,360

see more of the areas

87

00:03:44,309 --> 00:03:42,080

that deep impacts are these smooth flows

88

00:03:46,149 --> 00:03:44,319

which apparently suggests that comet

89

00:03:48,229 --> 00:03:46,159

nuclei are not only modified by

90

00:03:50,869 --> 00:03:48,239

processes from the outside but also by

91

00:03:52,550 --> 00:03:50,879

internal processes so there are things

92

00:03:54,229 --> 00:03:52,560

that we would like to find out about

93

00:03:55,990 --> 00:03:54,239

temple which

94

00:03:57,910 --> 00:03:56,000

we we don't know at the time at this

95

00:04:00,309 --> 00:03:57,920

time but the next

96

00:04:01,830 --> 00:04:00,319

time step shows us probably the most

97

00:04:05,990 --> 00:04:01,840

important reason for going back to

98

00:04:07,750 --> 00:04:06,000

temple one and that is that

99

00:04:10,390 --> 00:04:07,760

this will be an opportunity for first

100

00:04:13,030 --> 00:04:10,400

time to see how much a comet changes

101
00:04:16,069 --> 00:04:13,040
between two close passages to the sun

102
00:04:18,550 --> 00:04:16,079
deep impact saw the comet to 2005 we'll

103
00:04:21,670 --> 00:04:18,560
be seeing it one comment here later just

104
00:04:22,390 --> 00:04:21,680
after its closest passage to the sun

105
00:04:24,950 --> 00:04:22,400
in

106
00:04:27,350 --> 00:04:24,960
2011. so the question is we know that

107
00:04:28,950 --> 00:04:27,360
comets lose material but the question is

108
00:04:30,790 --> 00:04:28,960
how much does the surface change and

109
00:04:32,550 --> 00:04:30,800
where does the surface change so we'll

110
00:04:35,189 --> 00:04:32,560
be able to answer that question by

111
00:04:38,230 --> 00:04:35,199
comparing our images with those taken by

112
00:04:40,390 --> 00:04:38,240
the deep impact in 2005. so to achieve

113
00:04:43,110 --> 00:04:40,400

these two objectives we have a definite

114

00:04:43,990 --> 00:04:43,120

plan it's summarized in the next time

115

00:04:46,870 --> 00:04:44,000

step

116

00:04:47,990 --> 00:04:46,880

which shows us a surface map of temple

117

00:04:50,710 --> 00:04:48,000

one

118

00:04:53,430 --> 00:04:50,720

the grey mosaic shows us data that were

119

00:04:55,990 --> 00:04:53,440

obtained by deep impact in 2005. the

120

00:04:58,469 --> 00:04:56,000

yellow area yellowish area is the

121

00:05:00,310 --> 00:04:58,479

projected new coverage on valentine's

122

00:05:02,150 --> 00:05:00,320

day as you can see there is a region of

123

00:05:04,230 --> 00:05:02,160

overlap where we can be looking for

124

00:05:06,310 --> 00:05:04,240

changes and there is a region where

125

00:05:08,310 --> 00:05:06,320

we're looking at new territory it was

126

00:05:10,550 --> 00:05:08,320

not seen by deep impact to extend our

127

00:05:12,629 --> 00:05:10,560

knowledge of the comet comet now you

128

00:05:14,950 --> 00:05:12,639

also notice that there is a bullseye in

129

00:05:18,070 --> 00:05:14,960

the middle of this diagram and that is

130

00:05:20,629 --> 00:05:18,080

the location where deep impact in 2005

131

00:05:22,310 --> 00:05:20,639

uh excavated a crater

132

00:05:25,029 --> 00:05:22,320

the next time step

133

00:05:27,670 --> 00:05:25,039

reminds us that that impact

134

00:05:29,590 --> 00:05:27,680

threw up so much ejecta that deep impact

135

00:05:31,590 --> 00:05:29,600

never saw the crater so it could never

136

00:05:34,070 --> 00:05:31,600

complete the experiment of seeing how

137

00:05:35,990 --> 00:05:34,080

big the crater is and what that tells us

138

00:05:38,550 --> 00:05:36,000

about the mechanical properties of the

139

00:05:40,629 --> 00:05:38,560

comet surface that's important if we're

140

00:05:42,629 --> 00:05:40,639

ever going to go back to a comet land a

141

00:05:44,390 --> 00:05:42,639

spacecraft on the surface they get

142

00:05:45,749 --> 00:05:44,400

material from the surface to bring it

143

00:05:47,670 --> 00:05:45,759

back to the earth we need to know

144

00:05:49,830 --> 00:05:47,680

something about mechanical properties so

145

00:05:51,510 --> 00:05:49,840

here we have a chance to complete the

146

00:05:53,670 --> 00:05:51,520

deep impact experiment

147

00:05:55,670 --> 00:05:53,680

so to achieve all these things as we'll

148

00:05:58,309 --> 00:05:55,680

be described in a few minutes

149

00:06:00,710 --> 00:05:58,319

we have chosen uh an encounter time

150

00:06:03,590 --> 00:06:00,720

where we can

151
00:06:04,629 --> 00:06:03,600
do these two things that we want to do

152
00:06:07,510 --> 00:06:04,639
and

153
00:06:10,390 --> 00:06:07,520
we have chosen a uh

154
00:06:12,390 --> 00:06:10,400
missed distance of 120 kilometers 120

155
00:06:14,710 --> 00:06:12,400
miles from the surface of the comet

156
00:06:16,790 --> 00:06:14,720
shown in the next time step are some of

157
00:06:19,189 --> 00:06:16,800
the images that we expect to take right

158
00:06:21,510 --> 00:06:19,199
at close approach

159
00:06:23,110 --> 00:06:21,520
not only will we be taking 72 high

160
00:06:25,430 --> 00:06:23,120
resolution images we'll also be

161
00:06:26,950 --> 00:06:25,440
collecting information on the amount and

162
00:06:29,430 --> 00:06:26,960
the type of dust that surrounds the

163
00:06:30,550 --> 00:06:29,440

comet and

164

00:06:31,749 --> 00:06:30,560

these

165

00:06:34,150 --> 00:06:31,759

measurements will be described in a

166

00:06:36,550 --> 00:06:34,160

little bit more detail by later speakers

167

00:06:39,430 --> 00:06:36,560

let me just say that the resolution that

168

00:06:42,150 --> 00:06:39,440

we expect to achieve about 12 meters per

169

00:06:45,029 --> 00:06:42,160

pixel at best is sufficient to address

170

00:06:47,430 --> 00:06:45,039

all the objectives that i've discussed

171

00:06:49,270 --> 00:06:47,440

in the last time step i just want to

172

00:06:51,189 --> 00:06:49,280

remind us that

173

00:06:53,350 --> 00:06:51,199

we are getting closer and closer to the

174

00:06:55,749 --> 00:06:53,360

comet every day the spacecraft is

175

00:06:57,990 --> 00:06:55,759

working wonderfully well the spacecraft

176
00:06:59,589 --> 00:06:58,000
team is working hard preparing all the

177
00:07:02,790 --> 00:06:59,599
data taking sequences that we'll be

178
00:07:04,870 --> 00:07:02,800
using on valentine's day the navigation

179
00:07:06,629 --> 00:07:04,880
team is working very hard to make sure

180
00:07:08,950 --> 00:07:06,639
that we get to where we need to be on

181
00:07:10,309 --> 00:07:08,960
valentine's day and all i can say about

182
00:07:12,150 --> 00:07:10,319
the science team is that the science

183
00:07:14,150 --> 00:07:12,160
team is awfully excited and just cannot

184
00:07:16,309 --> 00:07:14,160
wait to see the pictures and the dust

185
00:07:18,230 --> 00:07:16,319
data that we expect on valentine's day

186
00:07:20,390 --> 00:07:18,240
and with that i'd like to turn it over

187
00:07:21,990 --> 00:07:20,400
to our project manager tim larson who

188
00:07:23,270 --> 00:07:22,000

will give us a few more details about

189

00:07:24,950 --> 00:07:23,280

the mission itself

190

00:07:26,950 --> 00:07:24,960

thank you joe

191

00:07:28,469 --> 00:07:26,960

we mentioned already the stardust next

192

00:07:30,710 --> 00:07:28,479

is a bonus mission and it takes

193

00:07:31,909 --> 00:07:30,720

advantage of some key factors one

194

00:07:33,749 --> 00:07:31,919

we have a spacecraft that's still

195

00:07:36,150 --> 00:07:33,759

working well after being in space for

196

00:07:37,670 --> 00:07:36,160

almost 12 years now since launch uh it's

197

00:07:39,830 --> 00:07:37,680

traveled uh almost six billion

198

00:07:41,110 --> 00:07:39,840

kilometers since launch so it's it's got

199

00:07:43,589 --> 00:07:41,120

some mileage on it but it's still

200

00:07:45,990 --> 00:07:43,599

working well able to do another mission

201
00:07:47,749 --> 00:07:46,000
we also have a scientifically desirable

202
00:07:49,909 --> 00:07:47,759
target or an interesting target that we

203
00:07:52,710 --> 00:07:49,919
can get close to with the fuel that we

204
00:07:54,469 --> 00:07:52,720
have left and most importantly

205
00:07:56,469 --> 00:07:54,479
we have a team of people that has the

206
00:07:57,909 --> 00:07:56,479
skills and innovation and the dedication

207
00:07:59,830 --> 00:07:57,919
needed to pull off this kind of a

208
00:08:01,749 --> 00:07:59,840
mission we have people that have been

209
00:08:04,070 --> 00:08:01,759
flying the spacecraft at lockheed martin

210
00:08:05,589 --> 00:08:04,080
in denver colorado since the time it was

211
00:08:07,189 --> 00:08:05,599
launched so we

212
00:08:08,950 --> 00:08:07,199
some some wonderful dedicated people

213
00:08:10,309 --> 00:08:08,960

that know the spacecraft inside and out

214

00:08:12,070 --> 00:08:10,319

know how to make it do what we need it

215

00:08:13,589 --> 00:08:12,080

to do and that's what really enables

216

00:08:15,110 --> 00:08:13,599

this mission

217

00:08:16,710 --> 00:08:15,120

as you may recall this is the second

218

00:08:17,830 --> 00:08:16,720

common encounter for nasa in the last

219

00:08:19,749 --> 00:08:17,840

four months

220

00:08:22,869 --> 00:08:19,759

the deep impact spacecraft flew by comet

221

00:08:24,309 --> 00:08:22,879

hartley 2 in this last november that was

222

00:08:25,110 --> 00:08:24,319

a great success

223

00:08:27,189 --> 00:08:25,120

but

224

00:08:28,550 --> 00:08:27,199

like comets are all different also comet

225

00:08:29,830 --> 00:08:28,560

missions and flybys are all very

226
00:08:31,510 --> 00:08:29,840
different and have their own unique sets

227
00:08:33,029 --> 00:08:31,520
of challenges so let's talk about our

228
00:08:34,550 --> 00:08:33,039
spacecraft first for a little bit and

229
00:08:35,829 --> 00:08:34,560
some of the uh features of the

230
00:08:37,350 --> 00:08:35,839
spacecraft and some of the the

231
00:08:38,870 --> 00:08:37,360
challenges that we're dealing with here

232
00:08:41,589 --> 00:08:38,880
you'll see a scale model here of the

233
00:08:43,110 --> 00:08:41,599
stardust spacecraft

234
00:08:44,949 --> 00:08:43,120
you'll see at the top of the spacecraft

235
00:08:46,949 --> 00:08:44,959
are the solar arrays that generate the

236
00:08:48,389 --> 00:08:46,959
electric power that we use to to power

237
00:08:50,070 --> 00:08:48,399
the spacecraft and to operate all the

238
00:08:51,910 --> 00:08:50,080

equipment on board

239

00:08:54,070 --> 00:08:51,920

also on the top you'll see this larger

240

00:08:55,670 --> 00:08:54,080

antenna that's our high gain antenna

241

00:08:57,269 --> 00:08:55,680

part of our radial system that we use to

242

00:08:59,350 --> 00:08:57,279

communicate with earth and that's what

243

00:09:00,870 --> 00:08:59,360

enables us to get the higher data rates

244

00:09:02,150 --> 00:09:00,880

to be able to get all this data back

245

00:09:03,590 --> 00:09:02,160

down to earth

246

00:09:05,190 --> 00:09:03,600

and then you'll see these bumpers at the

247

00:09:07,269 --> 00:09:05,200

very front here and in the front of the

248

00:09:08,949 --> 00:09:07,279

spacecraft body itself these are the

249

00:09:10,949 --> 00:09:08,959

shields this spacecraft was originally

250

00:09:12,230 --> 00:09:10,959

designed as a comet fly-by spacecraft

251
00:09:14,470 --> 00:09:12,240
and these shields were designed and put

252
00:09:16,389 --> 00:09:14,480
in place to protect the spacecraft as it

253
00:09:17,990 --> 00:09:16,399
flew through the coma of the comet and

254
00:09:20,310 --> 00:09:18,000
to protect it from dust particles

255
00:09:22,790 --> 00:09:20,320
impacting the spacecraft at that time at

256
00:09:24,710 --> 00:09:22,800
six kilometers per second uh this

257
00:09:26,550 --> 00:09:24,720
current next flyby will be at a speed of

258
00:09:28,230 --> 00:09:26,560
a little over 10 kilometers per second

259
00:09:29,990 --> 00:09:28,240
and so this is what these shields are

260
00:09:32,470 --> 00:09:30,000
what provide our main protection for the

261
00:09:34,470 --> 00:09:32,480
spacecraft now in terms of instruments

262
00:09:37,269 --> 00:09:34,480
that will be gathering data as we uh fly

263
00:09:38,949 --> 00:09:37,279

by the comet uh if you look at this side

264

00:09:40,710 --> 00:09:38,959

of the spacecraft you'll see this

265

00:09:43,110 --> 00:09:40,720

feature right here that is a navigation

266

00:09:44,710 --> 00:09:43,120

camera with its mirrors and periscope

267

00:09:47,269 --> 00:09:44,720

that is able to look out past the

268

00:09:48,550 --> 00:09:47,279

shields as we approach the comet

269

00:09:50,470 --> 00:09:48,560

and then on the other side of the

270

00:09:51,750 --> 00:09:50,480

spacecraft you'll see another instrument

271

00:09:53,670 --> 00:09:51,760

that comes down

272

00:09:55,670 --> 00:09:53,680

uh with a sensor sticking down below

273

00:09:57,269 --> 00:09:55,680

again that's another sensor that's out

274

00:09:59,590 --> 00:09:57,279

in the flow of the dust this is the

275

00:10:00,470 --> 00:09:59,600

comet and interstellar dust analyzer

276

00:10:02,550 --> 00:10:00,480

instrument that will help us

277

00:10:04,230 --> 00:10:02,560

characterize the dust environment that

278

00:10:05,509 --> 00:10:04,240

we fly through and then the third

279

00:10:06,710 --> 00:10:05,519

instrument is mounted right in the

280

00:10:08,630 --> 00:10:06,720

circle that you see at the front of the

281

00:10:10,230 --> 00:10:08,640

spacecraft and that's the dust flux

282

00:10:11,910 --> 00:10:10,240

monitor that will further help us

283

00:10:13,350 --> 00:10:11,920

characterize the dust field that we fly

284

00:10:15,110 --> 00:10:13,360

through so these are some of the key

285

00:10:19,269 --> 00:10:15,120

features of the spacecraft that has done

286

00:10:23,670 --> 00:10:21,350

as mentioned earlier uh this spacecraft

287

00:10:26,389 --> 00:10:23,680

is repurposed uh we've recycled it and

288

00:10:28,150 --> 00:10:26,399

uh and it's it's had a whole entire life

289

00:10:30,069 --> 00:10:28,160

and i'd like to show you with uh the

290

00:10:31,430 --> 00:10:30,079

first uh the first animation that you'll

291

00:10:33,190 --> 00:10:31,440

see here it'll show you a little

292

00:10:36,150 --> 00:10:33,200

synopsis of the life of this spacecraft

293

00:10:39,030 --> 00:10:36,160

starting with the launch in 1999

294

00:10:41,269 --> 00:10:39,040

february of 1999 so this spacecraft is

295

00:10:43,590 --> 00:10:41,279

coming up on 12 years in space it's had

296

00:10:45,670 --> 00:10:43,600

a long a long and illustrious life well

297

00:10:48,069 --> 00:10:45,680

beyond its original planned design life

298

00:10:49,750 --> 00:10:48,079

but it's still working well

299

00:10:52,550 --> 00:10:49,760

since it's launched it traveled halfway

300

00:10:54,710 --> 00:10:52,560

out to jupiter and back it executed a

301

00:10:56,710 --> 00:10:54,720

flyby of um

302

00:10:58,949 --> 00:10:56,720

of asteroid and frank

303

00:11:00,389 --> 00:10:58,959

and it also executed then the flyby of

304

00:11:02,470 --> 00:11:00,399

comet ville ii

305

00:11:04,470 --> 00:11:02,480

after that flyby where it collected the

306

00:11:06,630 --> 00:11:04,480

sample the dust samples it returned that

307

00:11:07,829 --> 00:11:06,640

capsule back to earth creating a large

308

00:11:10,470 --> 00:11:07,839

fireball as it came through the

309

00:11:11,750 --> 00:11:10,480

atmosphere it was the fastest man-made

310

00:11:14,069 --> 00:11:11,760

object to re-enter the earth's

311

00:11:15,990 --> 00:11:14,079

atmosphere and it's the first time that

312

00:11:18,310 --> 00:11:16,000

we've been able to return

313

00:11:19,829 --> 00:11:18,320

samples from outer space back to earth

314

00:11:22,550 --> 00:11:19,839

after that flyby the spacecraft

315

00:11:24,710 --> 00:11:22,560

continued circling the sun and now we've

316

00:11:26,870 --> 00:11:24,720

been able to retarget it to meet up with

317

00:11:28,630 --> 00:11:26,880

with comet tempel one and after all of

318

00:11:30,150 --> 00:11:28,640

that it still has some fuel in the tank

319

00:11:31,350 --> 00:11:30,160

but that's one of the uh that's one of

320

00:11:32,230 --> 00:11:31,360

the challenges that we're working with

321

00:11:33,430 --> 00:11:32,240

here

322

00:11:34,870 --> 00:11:33,440

is um

323

00:11:37,590 --> 00:11:34,880

is the remaining fuel and managing the

324

00:11:38,949 --> 00:11:37,600

remaining fuel um with the way we design

325

00:11:40,870 --> 00:11:38,959

our spacecraft and our missions we

326

00:11:43,110 --> 00:11:40,880

account for all kinds of uncertainties

327

00:11:45,030 --> 00:11:43,120

and and unknowns and that's why we

328

00:11:46,630 --> 00:11:45,040

usually have some fuel left after our

329

00:11:48,949 --> 00:11:46,640

primary missions and that's what enables

330

00:11:50,470 --> 00:11:48,959

these kinds of extended missions however

331

00:11:53,030 --> 00:11:50,480

the challenge is to make sure that that

332

00:11:54,310 --> 00:11:53,040

fuel lasts as long as you need it to

333

00:11:57,269 --> 00:11:54,320

everything we do on the spacecraft

334

00:11:59,269 --> 00:11:57,279

consumes fuel it is a it is a spacecraft

335

00:12:01,910 --> 00:11:59,279

that's controlled strictly by uh

336

00:12:03,750 --> 00:12:01,920

reaction control thrusters and so every

337

00:12:06,150 --> 00:12:03,760

time we turn the spacecraft every time

338

00:12:07,750 --> 00:12:06,160

we point the spacecraft our daily just

339

00:12:09,670 --> 00:12:07,760

uh dead banding as we control the

340

00:12:11,590 --> 00:12:09,680

attitude of the spacecraft all of that

341

00:12:13,670 --> 00:12:11,600

consumes fuel and so we have to predict

342

00:12:14,870 --> 00:12:13,680

all of that into the future predict

343

00:12:16,870 --> 00:12:14,880

everything we're planning on doing with

344

00:12:18,790 --> 00:12:16,880

the spacecraft calculate how much fuel

345

00:12:20,710 --> 00:12:18,800

that's going to consume and making sure

346

00:12:21,990 --> 00:12:20,720

that we have enough and we control our

347

00:12:24,069 --> 00:12:22,000

activities to make sure we have enough

348

00:12:25,350 --> 00:12:24,079

fuel to make it through the flyby and

349

00:12:26,710 --> 00:12:25,360

and playing all those images back to

350

00:12:29,509 --> 00:12:26,720

earth so that's been one of our biggest

351

00:12:32,150 --> 00:12:29,519

challenges and it's one that that that

352

00:12:33,590 --> 00:12:32,160

we pay very close attention to and uh

353

00:12:34,389 --> 00:12:33,600

and and i'm happy to tell you that we

354

00:12:35,910 --> 00:12:34,399

really

355

00:12:37,430 --> 00:12:35,920

are confident in having enough fuel to

356

00:12:38,790 --> 00:12:37,440

finish up this mission although after

357

00:12:43,829 --> 00:12:38,800

this mission there won't be much left

358

00:12:47,269 --> 00:12:45,430

in the process of re-targeting the

359

00:12:50,389 --> 00:12:47,279

spacecraft and taking over the comet

360

00:12:52,870 --> 00:12:50,399

temple one we conducted three additional

361

00:12:55,110 --> 00:12:52,880

orbits around the sun

362

00:12:56,710 --> 00:12:55,120

we conducted five targeting maneuvers

363

00:12:59,509 --> 00:12:56,720

and the largest one of those maneuvers

364

00:13:01,670 --> 00:12:59,519

was one that we executed last february

365

00:13:03,750 --> 00:13:01,680

now that maneuver head was a special

366

00:13:06,310 --> 00:13:03,760

maneuver for us because a year before

367

00:13:08,069 --> 00:13:06,320

getting to our target we had to decide

368

00:13:10,870 --> 00:13:08,079

when we wanted to arrive at the target

369

00:13:13,509 --> 00:13:10,880

within the matter of several hours and

370

00:13:15,350 --> 00:13:13,519

that was our best opportunity to uh to

371

00:13:17,190 --> 00:13:15,360

change that arrival time

372

00:13:18,550 --> 00:13:17,200

if we had waited until we seen the we

373

00:13:20,470 --> 00:13:18,560

have seen the comment or as we get close

374

00:13:22,230 --> 00:13:20,480

to the comments say for example now

375

00:13:23,750 --> 00:13:22,240

we would have very little adjustability

376

00:13:26,949 --> 00:13:23,760

left we'd maybe be able to adjust our

377

00:13:28,629 --> 00:13:26,959

arrival time by maybe an hour at most

378

00:13:30,870 --> 00:13:28,639

so the ability the ability we had the

379

00:13:32,310 --> 00:13:30,880

ability if we did the burn a year before

380

00:13:34,310 --> 00:13:32,320

getting to the target was one of our

381

00:13:35,750 --> 00:13:34,320

best lever uh times we have the best

382

00:13:37,670 --> 00:13:35,760

lever arm in our trajectory to be able

383

00:13:39,590 --> 00:13:37,680

to adjust our arrival time that's when

384

00:13:40,870 --> 00:13:39,600

we had our best shot at doing that so we

385

00:13:41,910 --> 00:13:40,880

had to make our best predictions and

386

00:13:43,750 --> 00:13:41,920

steve's going to talk to you a little

387

00:13:45,430 --> 00:13:43,760

bit about that process of predicting

388

00:13:47,269 --> 00:13:45,440

what phase of the comet we expect to see

389

00:13:50,629 --> 00:13:47,279

when we get there and based on those

390

00:13:52,629 --> 00:13:50,639

predicts is is how we chose our our

391

00:13:55,430 --> 00:13:52,639

arrival time burn this was a 23-minute

392

00:13:57,110 --> 00:13:55,440

burn of our rocket engines and it

393

00:13:59,110 --> 00:13:57,120

delayed our arrival at the comet by

394

00:14:01,350 --> 00:13:59,120

about eight or eight and a half hours

395

00:14:03,350 --> 00:14:01,360

and uh so that was a major event for us

396

00:14:06,230 --> 00:14:03,360

almost a year ago last february

397

00:14:08,870 --> 00:14:06,240

so now as we get closer to the comet

398

00:14:10,629 --> 00:14:08,880

we'll start uh getting more

399

00:14:12,470 --> 00:14:10,639

busier and busier there a lot of the

400

00:14:14,310 --> 00:14:12,480

activities that take place can only take

401
00:14:16,069 --> 00:14:14,320
place once we get very close and have

402
00:14:17,829 --> 00:14:16,079
the knowledge that we need to be able to

403
00:14:19,670 --> 00:14:17,839
design these appropriately so our last

404
00:14:22,310 --> 00:14:19,680
targeting maneuver as we approach the

405
00:14:23,990 --> 00:14:22,320
comet is two days out that is the last

406
00:14:25,829 --> 00:14:24,000
maneuver that will be fully designed to

407
00:14:27,829 --> 00:14:25,839
target to our 200 kilometer flyby

408
00:14:29,829 --> 00:14:27,839
distance and that will be executed two

409
00:14:31,430 --> 00:14:29,839
days before we arrive at the comet right

410
00:14:34,069 --> 00:14:31,440
after that maneuver we'll be taking our

411
00:14:36,389 --> 00:14:34,079
last optical navigation images and those

412
00:14:39,110 --> 00:14:36,399
are the images that we'll use to to uh

413
00:14:42,470 --> 00:14:39,120

build our best prediction of our actual

414

00:14:43,990 --> 00:14:42,480

flyby point and the the the path of the

415

00:14:46,310 --> 00:14:44,000

trajectory of the comet relative to the

416

00:14:48,470 --> 00:14:46,320

spacecraft once we build that then we

417

00:14:50,310 --> 00:14:48,480

will load up at 24 hours out we'll load

418

00:14:51,670 --> 00:14:50,320

up our final sequences that have been

419

00:14:54,949 --> 00:14:51,680

built with that latest estimate or the

420

00:14:56,629 --> 00:14:54,959

closest time and closest approach and

421

00:14:58,550 --> 00:14:56,639

that final data on the comet trajectory

422

00:15:00,069 --> 00:14:58,560

will also be loaded onto the spacecraft

423

00:15:02,150 --> 00:15:00,079

and from then on the spacecraft will be

424

00:15:03,590 --> 00:15:02,160

working autonomously we cannot control

425

00:15:05,350 --> 00:15:03,600

the spacecraft real time and here's

426
00:15:07,509 --> 00:15:05,360
another challenge with this mission the

427
00:15:09,189 --> 00:15:07,519
spacecraft is currently basically

428
00:15:11,030 --> 00:15:09,199
opposite the sun from the earth so we're

429
00:15:12,790 --> 00:15:11,040
about two astronomical units away from

430
00:15:14,389 --> 00:15:12,800
earth at the time of encounter that

431
00:15:16,870 --> 00:15:14,399
means when we send a comment up to the

432
00:15:19,110 --> 00:15:16,880
uh or command up to the spacecraft and

433
00:15:20,870 --> 00:15:19,120
wait for the confirmation that that that

434
00:15:22,949 --> 00:15:20,880
command arrived there and was executed

435
00:15:24,870 --> 00:15:22,959
properly that round-trip light time is

436
00:15:26,150 --> 00:15:24,880
approximately 40 minutes so there's

437
00:15:28,389 --> 00:15:26,160
nothing we can do to command the

438
00:15:30,230 --> 00:15:28,399

spacecraft or control it real time

439

00:15:31,990 --> 00:15:30,240

during a flyby like this therefore

440

00:15:33,829 --> 00:15:32,000

everything has to be programmed ahead of

441

00:15:35,590 --> 00:15:33,839

time put on board the spacecraft and

442

00:15:38,069 --> 00:15:35,600

sequenced and everything happens

443

00:15:39,910 --> 00:15:38,079

autonomously onboard the spacecraft so

444

00:15:41,829 --> 00:15:39,920

one hour before we get to the comet the

445

00:15:43,590 --> 00:15:41,839

spacecraft will turn to orient itself

446

00:15:45,030 --> 00:15:43,600

with these shields facing forward to

447

00:15:46,389 --> 00:15:45,040

protect itself as it flies through the

448

00:15:48,550 --> 00:15:46,399

comb of the comet

449

00:15:50,710 --> 00:15:48,560

about 30 minutes before closest approach

450

00:15:52,629 --> 00:15:50,720

our autonav software will activate and

451
00:15:54,230 --> 00:15:52,639
that's that's essentially an autopilot

452
00:15:55,990 --> 00:15:54,240
software onboard the spacecraft that

453
00:15:57,509 --> 00:15:56,000
analyzes the pictures that we're taking

454
00:15:59,509 --> 00:15:57,519
of the comet figures out where the

455
00:16:01,590 --> 00:15:59,519
brightest spot is calculates that as

456
00:16:03,189 --> 00:16:01,600
being the center of the nucleus and then

457
00:16:05,030 --> 00:16:03,199
adjusts the position of the camera

458
00:16:06,710 --> 00:16:05,040
mirror so that we can keep the nucleus

459
00:16:09,030 --> 00:16:06,720
in the field of view of the camera all

460
00:16:11,829 --> 00:16:09,040
the way through the flyby of the comet

461
00:16:14,230 --> 00:16:11,839
then if you roll the second animation

462
00:16:16,470 --> 00:16:14,240
this will show you what we expect to see

463
00:16:18,470 --> 00:16:16,480

uh as we fly by the comet and the kind

464

00:16:20,550 --> 00:16:18,480

of images we expect to get of the comet

465

00:16:22,550 --> 00:16:20,560

as we fly by if everything goes as

466

00:16:24,949 --> 00:16:22,560

planned this is assuming a 200 kilometer

467

00:16:26,550 --> 00:16:24,959

flyby about 20 degrees south of the sun

468

00:16:28,790 --> 00:16:26,560

line and

469

00:16:31,030 --> 00:16:28,800

if the phase of the comet is as we

470

00:16:32,870 --> 00:16:31,040

predicted and so it's exciting to see

471

00:16:34,629 --> 00:16:32,880

this kind of information coming out and

472

00:16:37,350 --> 00:16:34,639

and see these kind of simulations that

473

00:16:41,990 --> 00:16:37,360

show us what we expect to see on on

474

00:16:46,150 --> 00:16:44,150

as we fly by our closest approach will

475

00:16:50,150 --> 00:16:46,160

be about 8 30 in the evening pacific

476
00:16:51,590 --> 00:16:50,160
time on valentine's day february 14th

477
00:16:53,269 --> 00:16:51,600
in the few minutes around closest

478
00:16:54,790 --> 00:16:53,279
approach we'll be taking the bulk of our

479
00:16:56,550 --> 00:16:54,800
images we'll be taking 72 high

480
00:16:58,150 --> 00:16:56,560
resolution images

481
00:16:59,990 --> 00:16:58,160
we cannot transmit those to the ground

482
00:17:01,509 --> 00:17:00,000
real time because of the flyby geometry

483
00:17:03,590 --> 00:17:01,519
so we have to store all of those onboard

484
00:17:05,350 --> 00:17:03,600
in the spacecraft memory an hour after

485
00:17:06,870 --> 00:17:05,360
the flyby we turn the spacecraft to

486
00:17:09,270 --> 00:17:06,880
point the high gain antenna back at the

487
00:17:11,110 --> 00:17:09,280
earth and at that point we'll start

488
00:17:13,189 --> 00:17:11,120

relaying all this information back to

489

00:17:14,549 --> 00:17:13,199

earth and that'll take approximately 12

490

00:17:16,309 --> 00:17:14,559

hours to get all this data back down on

491

00:17:17,510 --> 00:17:16,319

the ground our first images should be

492

00:17:20,390 --> 00:17:17,520

hitting the ground around midnight

493

00:17:22,390 --> 00:17:20,400

pacific time on the evening of the 14th

494

00:17:23,750 --> 00:17:22,400

so that's what to expect uh during our

495

00:17:25,669 --> 00:17:23,760

flyby and some of the key things that

496

00:17:27,189 --> 00:17:25,679

will be happening and to talk to us a

497

00:17:28,870 --> 00:17:27,199

little bit more about what we might see

498

00:17:31,110 --> 00:17:28,880

when we get there and the geology of the

499

00:17:33,750 --> 00:17:31,120

comet i'd like to introduce pete schultz

500

00:17:36,549 --> 00:17:33,760

thanks tim deep impact was really a

501
00:17:39,190 --> 00:17:36,559
ground breaking mission with many firsts

502
00:17:40,789 --> 00:17:39,200
ground meant ground breaking also by the

503
00:17:43,350 --> 00:17:40,799
impact probe that actually produced a

504
00:17:44,950 --> 00:17:43,360
brand new impact on the nucleus

505
00:17:47,029 --> 00:17:44,960
so the first time we're going to be

506
00:17:49,110 --> 00:17:47,039
going back and we'll actually get to see

507
00:17:49,990 --> 00:17:49,120
what's happened since the time we're

508
00:17:52,789 --> 00:17:50,000
there

509
00:17:54,870 --> 00:17:52,799
now the earth has been around the sun

510
00:17:55,830 --> 00:17:54,880
five and a half times since our last

511
00:17:57,590 --> 00:17:55,840
visit

512
00:17:59,909 --> 00:17:57,600
the comet has been all the way out to

513
00:18:02,710 --> 00:17:59,919

near the orbit of jupiter back in just

514

00:18:05,110 --> 00:18:02,720

inside the orbit of mars and now it's

515

00:18:06,870 --> 00:18:05,120

heading back again and during this time

516

00:18:10,150 --> 00:18:06,880

the comets had several outbursts one of

517

00:18:11,669 --> 00:18:10,160

them happened about 10 days before our

518

00:18:13,190 --> 00:18:11,679

close visit by the deep impact

519

00:18:16,150 --> 00:18:13,200

spacecraft

520

00:18:19,270 --> 00:18:16,160

so in 2005 we saw a surface with a wide

521

00:18:20,870 --> 00:18:19,280

range of features some old some new and

522

00:18:22,950 --> 00:18:20,880

if we go to that first time step i'll

523

00:18:24,630 --> 00:18:22,960

give you some examples this is a color

524

00:18:26,150 --> 00:18:24,640

rendition done by the deep impact

525

00:18:27,990 --> 00:18:26,160

science team that shows you some of the

526

00:18:29,430 --> 00:18:28,000

different types of terrains which i'll

527

00:18:30,870 --> 00:18:29,440

be discussing a little bit more detail

528

00:18:33,270 --> 00:18:30,880

but you can see that there's these hilly

529

00:18:35,270 --> 00:18:33,280

areas smooth areas areas that look like

530

00:18:37,350 --> 00:18:35,280

they're layered but if we go to the next

531

00:18:38,870 --> 00:18:37,360

time step we can take a look at this in

532

00:18:41,270 --> 00:18:38,880

more detail

533

00:18:43,510 --> 00:18:41,280

the top image shows the raw surface

534

00:18:45,270 --> 00:18:43,520

without any markings on the lower part

535

00:18:47,350 --> 00:18:45,280

i've identified some of the interesting

536

00:18:48,870 --> 00:18:47,360

areas one of them are the crater-like

537

00:18:50,310 --> 00:18:48,880

features

538

00:18:51,990 --> 00:18:50,320

you know the first reaction is these

539

00:18:54,390 --> 00:18:52,000

might be impact craters

540

00:18:56,630 --> 00:18:54,400

but they may not be these could be sites

541

00:18:58,789 --> 00:18:56,640

of ancient vents where

542

00:19:01,510 --> 00:18:58,799

gases were erupted and this may have

543

00:19:03,430 --> 00:19:01,520

been millions of comet years ago and now

544

00:19:05,029 --> 00:19:03,440

they're just sitting there extinct

545

00:19:07,110 --> 00:19:05,039

there are other areas like that the

546

00:19:08,870 --> 00:19:07,120

little blue regions that are these knobs

547

00:19:11,029 --> 00:19:08,880

these dark knobs the dark knobs are

548

00:19:12,390 --> 00:19:11,039

poking up through a layer that we can

549

00:19:15,110 --> 00:19:12,400

actually identify

550

00:19:17,510 --> 00:19:15,120

and then the other white circles or the

551

00:19:18,630 --> 00:19:17,520

yellow arrows identify small

552

00:19:20,710 --> 00:19:18,640

white

553

00:19:22,830 --> 00:19:20,720

patches that could be ice could be mini

554

00:19:25,270 --> 00:19:22,840

jets that are coming out this old

555

00:19:27,990 --> 00:19:25,280

surface and the most interesting thing

556

00:19:30,950 --> 00:19:28,000

is this large plateau that looks like a

557

00:19:33,590 --> 00:19:30,960

flow and if that's the flow it's it was

558

00:19:36,310 --> 00:19:33,600

indicating that there was gas and dust

559

00:19:38,310 --> 00:19:36,320

emanating out from the left hand side

560

00:19:40,549 --> 00:19:38,320

off the terminator edge and then flowing

561

00:19:42,310 --> 00:19:40,559

into the region toward the center

562

00:19:43,990 --> 00:19:42,320

but the other idea is that maybe this

563

00:19:45,669 --> 00:19:44,000

was there beforehand and this was just

564

00:19:47,990 --> 00:19:45,679

an old accumulation of being around the

565

00:19:49,669 --> 00:19:48,000

sun several times and now it's simply

566

00:19:52,310 --> 00:19:49,679

receding backwards

567

00:19:53,909 --> 00:19:52,320

so the real point is that now with going

568

00:19:56,549 --> 00:19:53,919

back we'll be able to take a look at the

569

00:19:58,630 --> 00:19:56,559

surface and actually see what's changed

570

00:20:01,270 --> 00:19:58,640

has this gotten longer has it gotten

571

00:20:03,590 --> 00:20:01,280

more forward or has it moved backwards

572

00:20:04,549 --> 00:20:03,600

so the next time step we look at the two

573

00:20:07,029 --> 00:20:04,559

ends

574

00:20:09,590 --> 00:20:07,039

of of the comet here we can actually see

575

00:20:11,830 --> 00:20:09,600

again a smooth deposit or flow and we

576

00:20:14,710 --> 00:20:11,840

can also see a bright deposit right next

577

00:20:16,549 --> 00:20:14,720

to a pit now that bright deposit turns

578

00:20:18,549 --> 00:20:16,559

out to have been water ice the deep

579

00:20:20,630 --> 00:20:18,559

impact science team members discovered

580

00:20:21,990 --> 00:20:20,640

that with the spectrometers but the

581

00:20:23,669 --> 00:20:22,000

other thing i want to point out are the

582

00:20:26,149 --> 00:20:23,679

layers that joe mentioned

583

00:20:28,470 --> 00:20:26,159

one idea these were two proto-cometary

584

00:20:30,630 --> 00:20:28,480

bodies that collided at very low speeds

585

00:20:32,549 --> 00:20:30,640

and smooshed together the comet to form

586

00:20:33,909 --> 00:20:32,559

like a stack of pancakes

587

00:20:35,270 --> 00:20:33,919

and that's what we see left we don't

588

00:20:36,549 --> 00:20:35,280

know if that exists all the way around

589

00:20:38,070 --> 00:20:36,559

the side so it's going to be something

590

00:20:39,990 --> 00:20:38,080

to be looking for

591

00:20:41,750 --> 00:20:40,000

at the bottom you see the knobby terrain

592

00:20:43,190 --> 00:20:41,760

at the other end of the comet so what we

593

00:20:46,390 --> 00:20:43,200

can see out of this

594

00:20:49,270 --> 00:20:46,400

is that this surface this comet is has

595

00:20:51,990 --> 00:20:49,280

really a complicated uh geologic history

596

00:20:53,830 --> 00:20:52,000

it's not just a fuzzball it has history

597

00:20:56,070 --> 00:20:53,840

and so by going back we can see how it's

598

00:20:57,669 --> 00:20:56,080

been changed and we can look at other

599

00:20:58,950 --> 00:20:57,679

features that we've yet to see on the

600

00:21:01,110 --> 00:20:58,960

other side

601
00:21:02,870 --> 00:21:01,120
so as it's been mentioned it may be

602
00:21:05,750 --> 00:21:02,880
difficult to see the craters so give you

603
00:21:07,990 --> 00:21:05,760
an idea let's go back and take a look an

604
00:21:09,909 --> 00:21:08,000
example of the next time step

605
00:21:11,669 --> 00:21:09,919
and at a couple craters now this case

606
00:21:14,549 --> 00:21:11,679
this is the crater of the moon on the

607
00:21:17,590 --> 00:21:14,559
moon it's an oblique impact on the left

608
00:21:19,669 --> 00:21:17,600
there's uh an image of the moon from um

609
00:21:21,590 --> 00:21:19,679
high sun angles so the sun's right

610
00:21:23,669 --> 00:21:21,600
overhead and the other one is where the

611
00:21:26,070 --> 00:21:23,679
sun is off to the right which casts as

612
00:21:27,350 --> 00:21:26,080
this shadow so what you can tell is that

613
00:21:29,350 --> 00:21:27,360

you can tell there's a crater you can

614

00:21:30,390 --> 00:21:29,360

tell it's a bleep let's go to the next

615

00:21:32,549 --> 00:21:30,400

time step

616

00:21:34,149 --> 00:21:32,559

now we've degraded this down to about 10

617

00:21:35,750 --> 00:21:34,159

meters per pixel this is a little bit

618

00:21:38,390 --> 00:21:35,760

better than what we'll see with the

619

00:21:41,270 --> 00:21:38,400

closest approach by stardust next

620

00:21:44,630 --> 00:21:41,280

the next one is around 25 meters next

621

00:21:46,310 --> 00:21:44,640

time step 25 meters per pixel this is

622

00:21:47,190 --> 00:21:46,320

probably going to be probably what we'll

623

00:21:49,830 --> 00:21:47,200

get

624

00:21:51,190 --> 00:21:49,840

if we're lucky probably not a problem um

625

00:21:53,750 --> 00:21:51,200

measuring the created diameter or the

626

00:21:55,510 --> 00:21:53,760

ejected if we're on that side

627

00:21:57,830 --> 00:21:55,520

and finally if we keep going to 50

628

00:21:59,830 --> 00:21:57,840

meters per pixel and then 75 meters per

629

00:22:01,750 --> 00:21:59,840

pixel you can tell that we're beginning

630

00:22:03,510 --> 00:22:01,760

to lose resolution and that may be the

631

00:22:05,029 --> 00:22:03,520

case if we don't come in on the side

632

00:22:06,710 --> 00:22:05,039

that we expect

633

00:22:08,149 --> 00:22:06,720

so regardless i think if we see the

634

00:22:09,750 --> 00:22:08,159

ejector we should be able to see the

635

00:22:10,630 --> 00:22:09,760

crater and we might be able to measure

636

00:22:13,110 --> 00:22:10,640

it

637

00:22:15,270 --> 00:22:13,120

so the real point about this is that

638

00:22:17,110 --> 00:22:15,280

even though these things are uh from a

639

00:22:19,270 --> 00:22:17,120

great distance because this will be

640

00:22:21,590 --> 00:22:19,280

going uh slightly even though it's

641

00:22:23,510 --> 00:22:21,600

closer the cameras are not the same

642

00:22:26,149 --> 00:22:23,520

cameras we have for deep impact we

643

00:22:27,350 --> 00:22:26,159

should be able to resolve the impact now

644

00:22:28,630 --> 00:22:27,360

what happens if we see the crater and

645

00:22:31,029 --> 00:22:28,640

there's no objective well one

646

00:22:33,430 --> 00:22:31,039

possibility is that the ejecta was

647

00:22:36,549 --> 00:22:33,440

thrown out it was icy stuff and all that

648

00:22:38,870 --> 00:22:36,559

ice has sublimated away evaporated away

649

00:22:40,470 --> 00:22:38,880

the other possibility had hit and formed

650

00:22:42,470 --> 00:22:40,480

a dark halo because there was a dark

651
00:22:44,549 --> 00:22:42,480
layer that we saw there

652
00:22:46,230 --> 00:22:44,559
so we're dealing with a lot of unknowns

653
00:22:47,990 --> 00:22:46,240
here and we're hoping we'll be able to

654
00:22:49,990 --> 00:22:48,000
get back to see it

655
00:22:51,990 --> 00:22:50,000
so this particular encounter is going to

656
00:22:53,510 --> 00:22:52,000
answer a lot of very fundamental

657
00:22:55,990 --> 00:22:53,520
questions

658
00:22:57,430 --> 00:22:56,000
and i really hope we get to see this

659
00:23:00,630 --> 00:22:57,440
impact crater but that's going to be a

660
00:23:03,190 --> 00:23:00,640
bonus everything depends on how that

661
00:23:05,750 --> 00:23:03,200
nucleus of the comet has rotated around

662
00:23:07,029 --> 00:23:05,760
and with that i'll hand it over to steve

663
00:23:08,710 --> 00:23:07,039

tesley

664

00:23:10,950 --> 00:23:08,720

thanks pete

665

00:23:12,950 --> 00:23:10,960

so as tim mentioned about a year ago the

666

00:23:14,230 --> 00:23:12,960

stardust next spacecraft executed a

667

00:23:16,230 --> 00:23:14,240

timing maneuver it's the biggest

668

00:23:18,470 --> 00:23:16,240

maneuver of the follow-on mission

669

00:23:19,750 --> 00:23:18,480

and it was a culmination of a massive

670

00:23:22,230 --> 00:23:19,760

undertaking

671

00:23:23,990 --> 00:23:22,240

to to try and predict model and predict

672

00:23:26,470 --> 00:23:24,000

the spin state the rotational

673

00:23:28,070 --> 00:23:26,480

orientation of the comet

674

00:23:30,950 --> 00:23:28,080

so that we could meet the mission's

675

00:23:32,789 --> 00:23:30,960

primary objectives and hopefully get get

676

00:23:34,390 --> 00:23:32,799

a glance at the crater

677

00:23:35,510 --> 00:23:34,400

we can go ahead and start the animation

678

00:23:37,510 --> 00:23:35,520

please

679

00:23:40,149 --> 00:23:37,520

so comments are comments because of the

680

00:23:41,990 --> 00:23:40,159

the gas and dust that they emit as the

681

00:23:44,070 --> 00:23:42,000

ice is on their surface cook off when

682

00:23:46,149 --> 00:23:44,080

they approach the sun at the closest

683

00:23:48,950 --> 00:23:46,159

approach to the sun we call perihelion

684

00:23:51,510 --> 00:23:48,960

here's a video highly processed

685

00:23:53,430 --> 00:23:51,520

showing that the jets that are rotating

686

00:23:55,269 --> 00:23:53,440

especially on the right you can see

687

00:23:57,350 --> 00:23:55,279

they turn on they turn off they spin

688

00:24:00,630 --> 00:23:57,360

around

689

00:24:03,269 --> 00:24:00,640

this this that video is from the epoxy

690

00:24:05,110 --> 00:24:03,279

flyby of hartley 2.

691

00:24:07,590 --> 00:24:05,120

but but the point here is that comets

692

00:24:09,430 --> 00:24:07,600

are not is just inert

693

00:24:12,230 --> 00:24:09,440

simple objects floating out in space

694

00:24:14,549 --> 00:24:12,240

they're they're dynamic they're active

695

00:24:16,310 --> 00:24:14,559

they're uh much more like a rocket with

696

00:24:19,190 --> 00:24:16,320

no one at the controls than than

697

00:24:20,390 --> 00:24:19,200

something that's just idling idling

698

00:24:22,149 --> 00:24:20,400

there

699

00:24:24,470 --> 00:24:22,159

and these unpredictable jets can change

700

00:24:26,230 --> 00:24:24,480

not only the comet's rotation but also

701
00:24:28,549 --> 00:24:26,240
its orbital path through the solar

702
00:24:31,430 --> 00:24:28,559
system and this is the reason why the

703
00:24:34,149 --> 00:24:31,440
comet dynamics can be so complex even

704
00:24:35,029 --> 00:24:34,159
even erratic in some cases

705
00:24:39,750 --> 00:24:35,039
and

706
00:24:41,669 --> 00:24:39,760
to target a spacecraft to a flyby or

707
00:24:44,630 --> 00:24:41,679
rendezvous with a comet in our

708
00:24:46,149 --> 00:24:44,640
particular case the challenges is

709
00:24:48,310 --> 00:24:46,159
a bit higher because we haven't even

710
00:24:52,070 --> 00:24:48,320
seen this comet of until a couple weeks

711
00:24:53,669 --> 00:24:52,080
ago we we saw it last in june of 2010

712
00:24:55,350 --> 00:24:53,679
and just as it was starting to become

713
00:24:58,230 --> 00:24:55,360

active and we were not able to monitor

714

00:25:00,390 --> 00:24:58,240

its its progression as it became active

715

00:25:02,070 --> 00:25:00,400

and passed through perihelion about last

716

00:25:06,950 --> 00:25:02,080

week

717

00:25:08,870 --> 00:25:06,960

magdalena ridge observatory

718

00:25:11,750 --> 00:25:08,880

in new mexico was able to image it in

719

00:25:13,269 --> 00:25:11,760

the dawn twilight about only about 25

720

00:25:15,750 --> 00:25:13,279

degrees from the sun and on the other

721

00:25:17,350 --> 00:25:15,760

side of the sun and we were all very

722

00:25:18,950 --> 00:25:17,360

pleased to see that it was

723

00:25:21,110 --> 00:25:18,960

right about where we had predicted it to

724

00:25:22,310 --> 00:25:21,120

be

725

00:25:24,310 --> 00:25:22,320

and

726

00:25:26,070 --> 00:25:24,320

that's finding the temple one close to

727

00:25:27,750 --> 00:25:26,080

the prediction is important because it

728

00:25:29,590 --> 00:25:27,760

suggests that

729

00:25:31,750 --> 00:25:29,600

this time around through the sun while

730

00:25:33,669 --> 00:25:31,760

we weren't able to monitor it it has

731

00:25:35,990 --> 00:25:33,679

behaved more or less as it has in

732

00:25:38,630 --> 00:25:36,000

previous passages and there's no rule

733

00:25:40,149 --> 00:25:38,640

that says comets have to do that

734

00:25:42,070 --> 00:25:40,159

and that's important for our mission

735

00:25:44,710 --> 00:25:42,080

because our fuel budget is tight and it

736

00:25:46,710 --> 00:25:44,720

would be unfortunate to be forced to

737

00:25:48,470 --> 00:25:46,720

expend a lot of fuel trying to make a

738

00:25:50,310 --> 00:25:48,480

large course correction to get lined up

739

00:25:52,630 --> 00:25:50,320

with the comet because it had decided to

740

00:25:55,430 --> 00:25:52,640

take a crazy turn

741

00:25:57,909 --> 00:25:55,440

also seeing it behave predictably is

742

00:26:00,230 --> 00:25:57,919

reassuring for our efforts to model the

743

00:26:01,430 --> 00:26:00,240

rotation of the comet

744

00:26:02,789 --> 00:26:01,440

and uh

745

00:26:05,669 --> 00:26:02,799

and that's uh

746

00:26:07,350 --> 00:26:05,679

as i mentioned was a huge effort that we

747

00:26:09,750 --> 00:26:07,360

we wanted to achieve the mission

748

00:26:11,269 --> 00:26:09,760

objectives which is to put

749

00:26:13,909 --> 00:26:11,279

basically put the high dollar real

750

00:26:15,510 --> 00:26:13,919

estate in sunlight facing the spacecraft

751

00:26:18,390 --> 00:26:15,520

at the flyby

752

00:26:22,789 --> 00:26:18,400

and and hopefully as a bonus get a

753

00:26:28,070 --> 00:26:25,430

so this was a worldwide effort the next

754

00:26:29,669 --> 00:26:28,080

slide is up and you can see that the

755

00:26:30,950 --> 00:26:29,679

observing side of this campaign

756

00:26:33,350 --> 00:26:30,960

comprised

757

00:26:35,990 --> 00:26:33,360

dozens of telescopes around the globe

758

00:26:37,590 --> 00:26:36,000

many dozens of observers this was led

759

00:26:39,510 --> 00:26:37,600

a massive

760

00:26:41,269 --> 00:26:39,520

observation campaign led by karen meach

761

00:26:43,190 --> 00:26:41,279

at the university of hawaii

762

00:26:46,230 --> 00:26:43,200

and as a result it's safe to say the

763

00:26:48,310 --> 00:26:46,240

temple one is the best observed comet in

764

00:26:49,750 --> 00:26:48,320

the catalog this is these observations

765

00:26:51,350 --> 00:26:49,760

have been accumulating over more than a

766

00:26:52,549 --> 00:26:51,360

decade now

767

00:26:56,149 --> 00:26:52,559

what i have here

768

00:26:58,230 --> 00:26:56,159

is a model of the temple one nucleus you

769

00:26:59,510 --> 00:26:58,240

can see the north pole is here south

770

00:27:01,909 --> 00:26:59,520

pole is here

771

00:27:03,350 --> 00:27:01,919

uh and the the deep impact crater is

772

00:27:06,789 --> 00:27:03,360

just here deep in the southern

773

00:27:09,190 --> 00:27:06,799

hemisphere and it rotates like so

774

00:27:11,029 --> 00:27:09,200

and it puts the

775

00:27:13,669 --> 00:27:11,039

broad side to the observer sometimes at

776

00:27:15,590 --> 00:27:13,679

which point it's bright or it puts the

777

00:27:17,110 --> 00:27:15,600

uh the skinny end towards the observer

778

00:27:19,269 --> 00:27:17,120

so it's a little bit dimmer you can go

779

00:27:21,269 --> 00:27:19,279

to the next slide and you can see what

780

00:27:22,230 --> 00:27:21,279

happens is what the observer sees at

781

00:27:30,470 --> 00:27:22,240

this

782

00:27:32,470 --> 00:27:30,480

case taken from the hubble space

783

00:27:34,549 --> 00:27:32,480

telescope that show it brightening and

784

00:27:35,430 --> 00:27:34,559

dimming as we see these alternate ends

785

00:27:37,029 --> 00:27:35,440

of this

786

00:27:39,590 --> 00:27:37,039

comet

787

00:27:40,870 --> 00:27:39,600

and our objective is to take this data i

788

00:27:42,789 --> 00:27:40,880

should mention that this is the hubble

789

00:27:44,630 --> 00:27:42,799

space telescope data for for

790

00:27:47,110 --> 00:27:44,640

ground-based observing which comprise

791

00:27:49,430 --> 00:27:47,120

the bulk of the of the data we used

792

00:27:51,990 --> 00:27:49,440

we don't get to see a full revolution as

793

00:27:54,389 --> 00:27:52,000

is shown here we see maybe 10 or 15

794

00:27:56,630 --> 00:27:54,399

percent of one rotation period in a

795

00:27:58,789 --> 00:27:56,640

given night

796

00:28:00,630 --> 00:27:58,799

but the point is to take this model of

797

00:28:02,149 --> 00:28:00,640

the comet and

798

00:28:04,310 --> 00:28:02,159

combine it with these data next slide

799

00:28:05,909 --> 00:28:04,320

please and you can see how we try and

800

00:28:06,789 --> 00:28:05,919

line these things up but the alignment

801
00:28:13,510 --> 00:28:06,799
is

802
00:28:14,389 --> 00:28:13,520
the way around

803
00:28:16,230 --> 00:28:14,399
the

804
00:28:18,710 --> 00:28:16,240
comet surface

805
00:28:20,950 --> 00:28:18,720
uh next slide so we use this to

806
00:28:22,470 --> 00:28:20,960
to line things up and measure the speed

807
00:28:24,549 --> 00:28:22,480
and and estimate the alignment of the

808
00:28:26,230 --> 00:28:24,559
comet but as you can see next slide

809
00:28:27,750 --> 00:28:26,240
there's two there's a primary solution

810
00:28:29,510 --> 00:28:27,760
that you're looking at here

811
00:28:31,909 --> 00:28:29,520
and there's an alternate solution on the

812
00:28:33,350 --> 00:28:31,919
next slide

813
00:28:35,750 --> 00:28:33,360

and

814

00:28:38,070 --> 00:28:35,760

from a variety of perspectives we've

815

00:28:41,110 --> 00:28:38,080

we're very confident that we have chosen

816

00:28:44,230 --> 00:28:41,120

the right orientation but comets being

817

00:28:46,950 --> 00:28:44,240

the unruly beasts that they can be there

818

00:28:50,549 --> 00:28:46,960

is always a chance that this opposite

819

00:28:52,070 --> 00:28:50,559

phase correlation is the right one

820

00:28:53,430 --> 00:28:52,080

well to

821

00:28:55,350 --> 00:28:53,440

reach these

822

00:28:56,950 --> 00:28:55,360

conclusions we had two independent

823

00:28:59,190 --> 00:28:56,960

groups

824

00:29:01,750 --> 00:28:59,200

using different but very complementary

825

00:29:04,070 --> 00:29:01,760

analysis techniques mike belton that

826

00:29:06,310 --> 00:29:04,080

what we call the tucson group and i led

827

00:29:08,470 --> 00:29:06,320

a group at jpl and after more than a

828

00:29:10,870 --> 00:29:08,480

year of intense effort lots and lots of

829

00:29:12,630 --> 00:29:10,880

cross-checking we've we reached the same

830

00:29:14,389 --> 00:29:12,640

conclusion that temple one is

831

00:29:16,630 --> 00:29:14,399

accelerating every time it passes

832

00:29:18,470 --> 00:29:16,640

through the close approach to the sun

833

00:29:20,710 --> 00:29:18,480

it it gets a little boost in its

834

00:29:22,470 --> 00:29:20,720

rotation speed we could even see that

835

00:29:25,909 --> 00:29:22,480

acceleration in the light curve that

836

00:29:28,149 --> 00:29:25,919

came from the deep impact spacecraft

837

00:29:29,750 --> 00:29:28,159

all by itself

838

00:29:31,510 --> 00:29:29,760

and this shared conclusion went went

839

00:29:34,070 --> 00:29:31,520

further we actually have a very detailed

840

00:29:36,230 --> 00:29:34,080

model of the jet induced torques that

841

00:29:39,110 --> 00:29:36,240

the comet is experiencing we see a very

842

00:29:40,870 --> 00:29:39,120

strong and brief acceleration

843

00:29:42,870 --> 00:29:40,880

around the time of perihelion but in the

844

00:29:44,870 --> 00:29:42,880

background there's a much weaker

845

00:29:47,269 --> 00:29:44,880

deceleration that operates for a much

846

00:29:49,510 --> 00:29:47,279

longer time period

847

00:29:50,950 --> 00:29:49,520

so temple one is the first comet to have

848

00:29:53,029 --> 00:29:50,960

such a detailed

849

00:29:55,269 --> 00:29:53,039

and precisely measured and modeled

850

00:29:56,470 --> 00:29:55,279

rotation and

851

00:29:59,190 --> 00:29:56,480

of course this was originally a

852

00:30:01,990 --> 00:29:59,200

scientific objective but eventually the

853

00:30:03,990 --> 00:30:02,000

status next mission needed to know

854

00:30:05,750 --> 00:30:04,000

the orientation of the the

855

00:30:08,070 --> 00:30:05,760

comet and so it became a mission

856

00:30:10,470 --> 00:30:08,080

objective as well

857

00:30:12,630 --> 00:30:10,480

so if we have aligned our

858

00:30:14,710 --> 00:30:12,640

light curves correctly and if the comet

859

00:30:16,470 --> 00:30:14,720

continues to cooperate as opposed to

860

00:30:18,710 --> 00:30:16,480

deviating radically from its previous

861

00:30:20,950 --> 00:30:18,720

behavior then we will meet our mission

862

00:30:23,430 --> 00:30:20,960

objectives on february 14th

863

00:30:25,510 --> 00:30:23,440

and hopefully also have a fantastic view

864

00:30:27,269 --> 00:30:25,520

of the deep impact crater

865

00:30:29,590 --> 00:30:27,279

but the alternative is not so bad

866

00:30:32,230 --> 00:30:29,600

because then we'll get a fantastic views

867

00:30:34,149 --> 00:30:32,240

of never before seen commentary terrain

868

00:30:35,510 --> 00:30:34,159

so we'll have fantastic science no

869

00:30:37,029 --> 00:30:35,520

matter what

870

00:30:39,510 --> 00:30:37,039

there is the question of will we see the

871

00:30:41,190 --> 00:30:39,520

crater or will it be camera shy

872

00:30:43,110 --> 00:30:41,200

and we won't know until a few hours

873

00:30:44,789 --> 00:30:43,120

after the flyby i'll be on the edge of

874

00:30:46,149 --> 00:30:44,799

my seat but

875

00:30:48,710 --> 00:30:46,159

i think it's important to emphasize that

876

00:30:51,110 --> 00:30:48,720

that aspect of the mission is is bonus

877

00:30:53,190 --> 00:30:51,120

science and we're going to find out a

878

00:30:56,630 --> 00:30:53,200

lot about how comets evolve from

879

00:30:58,950 --> 00:30:56,640

perihelion passage to perihelion passage

880

00:31:00,789 --> 00:30:58,960

come come february 14th with that i'll

881

00:31:02,870 --> 00:31:00,799

pass it back to dwayne brown okay well

882

00:31:05,509 --> 00:31:02,880

thank you gentlemen we're going to now

883

00:31:07,669 --> 00:31:05,519

go to the phones and before we do that i

884

00:31:09,590 --> 00:31:07,679

have a couple of questions from some of

885

00:31:12,549 --> 00:31:09,600

the dot coms that are

886

00:31:14,789 --> 00:31:12,559

on the line here probably for you joe to

887

00:31:16,710 --> 00:31:14,799

start off

888

00:31:18,710 --> 00:31:16,720

why is it important and

889

00:31:21,909 --> 00:31:18,720

summarize this in layman's terms as you

890

00:31:25,750 --> 00:31:21,919

can to study comets and if what we know

891

00:31:28,070 --> 00:31:25,760

now how is stardust next going to change

892

00:31:30,950 --> 00:31:28,080

the knowledge and data well generally

893

00:31:33,509 --> 00:31:30,960

the idea is that comets preserve some of

894

00:31:36,230 --> 00:31:33,519

the most faithful information about what

895

00:31:37,669 --> 00:31:36,240

happened when the solar system formed

896

00:31:38,389 --> 00:31:37,679

and

897

00:31:41,269 --> 00:31:38,399

we

898

00:31:43,909 --> 00:31:41,279

do know that comets do contain

899

00:31:46,389 --> 00:31:43,919

interesting molecules some of which

900

00:31:48,310 --> 00:31:46,399

could have been involved in the

901
00:31:50,710 --> 00:31:48,320
origin of life on the earth so the

902
00:31:52,710 --> 00:31:50,720
overall objective of comet studies is to

903
00:31:55,990 --> 00:31:52,720
get to the point where

904
00:31:58,549 --> 00:31:56,000
we can actually return

905
00:32:00,789 --> 00:31:58,559
sizable samples of commentary material

906
00:32:02,710 --> 00:32:00,799
to do a chemical analysis which will

907
00:32:04,310 --> 00:32:02,720
answer the question whether we are comet

908
00:32:06,870 --> 00:32:04,320
stuff or not now

909
00:32:08,630 --> 00:32:06,880
what does the role start us next well

910
00:32:10,070 --> 00:32:08,640
we we are not going to be returning

911
00:32:13,750 --> 00:32:10,080
examples but

912
00:32:15,909 --> 00:32:13,760
for example uh by imaging the crater if

913
00:32:18,149 --> 00:32:15,919

we're successful we will learn more

914

00:32:20,630 --> 00:32:18,159

about the mechanical properties of the

915

00:32:23,269 --> 00:32:20,640

surface so when there is a next mission

916

00:32:24,950 --> 00:32:23,279

that tries to land on the surface

917

00:32:26,310 --> 00:32:24,960

there will be data on how difficult it

918

00:32:28,149 --> 00:32:26,320

will be to remove a sample from the

919

00:32:29,669 --> 00:32:28,159

subsurface to bring back to earth to

920

00:32:31,830 --> 00:32:29,679

answer these questions so it's a step

921

00:32:34,630 --> 00:32:31,840

towards the ultimate answer

922

00:32:36,149 --> 00:32:34,640

anyone else want to chime in on that

923

00:32:38,389 --> 00:32:36,159

you got it

924

00:32:39,669 --> 00:32:38,399

the next question this is actually for

925

00:32:42,389 --> 00:32:39,679

for each one of you and i'm going to

926

00:32:44,630 --> 00:32:42,399

start at the opposite end with steve

927

00:32:46,950 --> 00:32:44,640

uh they want to know your personal

928

00:32:49,110 --> 00:32:46,960

thoughts on the success so far of the

929

00:32:51,990 --> 00:32:49,120

spacecraft and what are your

930

00:32:55,750 --> 00:32:52,000

possible expectations and uh

931

00:32:57,269 --> 00:32:55,760

and uh excitement building personally so

932

00:32:58,870 --> 00:32:57,279

steve start with you

933

00:33:01,110 --> 00:32:58,880

well that's that's a great question i

934

00:33:02,470 --> 00:33:01,120

mean the stardust spacecraft has been

935

00:33:04,389 --> 00:33:02,480

around the block as we've heard many

936

00:33:06,950 --> 00:33:04,399

times and so it's it's pretty exciting

937

00:33:09,029 --> 00:33:06,960

to see something to keep on getting

938

00:33:11,350 --> 00:33:09,039

reused and reused

939

00:33:13,669 --> 00:33:11,360

and producing bonus science at every

940

00:33:16,549 --> 00:33:13,679

turn for me personally i've been closely

941

00:33:18,789 --> 00:33:16,559

involved with uh the trajectory analysis

942

00:33:21,509 --> 00:33:18,799

for this comet and so i'm hoping to see

943

00:33:23,990 --> 00:33:21,519

it be close to where i predicted uh when

944

00:33:25,669 --> 00:33:24,000

we finally get there and i also have

945

00:33:27,990 --> 00:33:25,679

been working

946

00:33:30,310 --> 00:33:28,000

hard on the rotation modeling so i've

947

00:33:32,070 --> 00:33:30,320

kind of got two irons in the fire here

948

00:33:33,830 --> 00:33:32,080

and i'm excited to see whether or not

949

00:33:36,149 --> 00:33:33,840

the the

950

00:33:37,669 --> 00:33:36,159

things pan out for the predictions

951
00:33:39,350 --> 00:33:37,679

pete

952
00:33:40,789 --> 00:33:39,360

you know i i think

953
00:33:42,149 --> 00:33:40,799

you know as we said i mean all of us

954
00:33:44,389 --> 00:33:42,159

have said we want to see what the

955
00:33:45,750 --> 00:33:44,399

surface has done it may be a very

956
00:33:47,430 --> 00:33:45,760

different place

957
00:33:48,870 --> 00:33:47,440

there are some structures that have to

958
00:33:50,389 --> 00:33:48,880

have been around for a long while but

959
00:33:52,070 --> 00:33:50,399

it's these other features that we want

960
00:33:53,509 --> 00:33:52,080

to see of course i want to see the

961
00:33:55,029 --> 00:33:53,519

impact greater

962
00:33:58,070 --> 00:33:55,039

bets are in

963
00:33:59,029 --> 00:33:58,080

um i want to find out if i win the pool

964

00:34:01,509 --> 00:33:59,039

um

965

00:34:04,149 --> 00:34:01,519

and that that's my hope uh personally i

966

00:34:05,669 --> 00:34:04,159

want to see the crater but i'll take

967

00:34:10,710 --> 00:34:05,679

i'll take the other option to see the

968

00:34:14,310 --> 00:34:12,710

in terms of expectations of for this

969

00:34:16,149 --> 00:34:14,320

flyby

970

00:34:17,669 --> 00:34:16,159

i'm

971

00:34:19,270 --> 00:34:17,679

very confident in our ability to get

972

00:34:22,310 --> 00:34:19,280

there we have a great navigation team at

973

00:34:23,669 --> 00:34:22,320

jpl that that's working hard to

974

00:34:25,589 --> 00:34:23,679

make sure we get to the right place at

975

00:34:27,829 --> 00:34:25,599

the right time um

976

00:34:29,829 --> 00:34:27,839

i've been working uh closely with the

977

00:34:32,310 --> 00:34:29,839

with the spacecraft team at lockheed

978

00:34:34,790 --> 00:34:32,320

martin in denver now for the last uh

979

00:34:37,030 --> 00:34:34,800

two and a half years or so and i'm very

980

00:34:38,790 --> 00:34:37,040

confident in in the ability of this team

981

00:34:40,710 --> 00:34:38,800

to do everything that needs to be done

982

00:34:43,030 --> 00:34:40,720

to make it make the spacecraft do what

983

00:34:45,430 --> 00:34:43,040

it's supposed to do and uh we've

984

00:34:46,790 --> 00:34:45,440

assessed uh all all our major

985

00:34:49,030 --> 00:34:46,800

uncertainties our challenges we've

986

00:34:51,589 --> 00:34:49,040

addressed all of them so i'm i'm frankly

987

00:34:53,349 --> 00:34:51,599

very very confident in uh the results of

988

00:34:55,829 --> 00:34:53,359

the that that we're gonna get a good

989

00:34:58,390 --> 00:34:55,839

flyby and good images of the comet

990

00:35:00,870 --> 00:34:58,400

uh on a personal note though

991

00:35:02,310 --> 00:35:00,880

i think i would also

992

00:35:03,829 --> 00:35:02,320

to me it's going to be a great follow-up

993

00:35:05,430 --> 00:35:03,839

to previous comet missions i've been

994

00:35:08,630 --> 00:35:05,440

involved with started out with deep

995

00:35:10,870 --> 00:35:08,640

impact and the temple one flyby in 2005.

996

00:35:13,430 --> 00:35:10,880

um following that up with uh the hartley

997

00:35:15,510 --> 00:35:13,440

ii fly by this last november and now an

998

00:35:17,510 --> 00:35:15,520

opportunity to go back to temple one for

999

00:35:19,109 --> 00:35:17,520

me it's a huge excitement and every time

1000

00:35:20,950 --> 00:35:19,119

we've we've pulled one of these missions

1001
00:35:22,230 --> 00:35:20,960
off

1002
00:35:24,150 --> 00:35:22,240
new discoveries have come out of them

1003
00:35:25,510 --> 00:35:24,160
and so i expect this to deal some new

1004
00:35:27,109 --> 00:35:25,520
discoveries for us no matter what side

1005
00:35:29,349 --> 00:35:27,119
of the comet we see

1006
00:35:31,910 --> 00:35:29,359
joe final thought well

1007
00:35:33,510 --> 00:35:31,920
i guess two points uh one is i just want

1008
00:35:35,990 --> 00:35:33,520
to emphasize that uh

1009
00:35:39,349 --> 00:35:36,000
we know very little about how comets

1010
00:35:41,190 --> 00:35:39,359
behave and uh we saw some images today

1011
00:35:43,030 --> 00:35:41,200
where peter schultz showed us different

1012
00:35:44,390 --> 00:35:43,040
features on the surface

1013
00:35:47,190 --> 00:35:44,400

we have no idea

1014

00:35:48,950 --> 00:35:47,200

uh how fast any of these features change

1015

00:35:51,510 --> 00:35:48,960

you know are some of them you know

1016

00:35:52,790 --> 00:35:51,520

millions of years old or some of them uh

1017

00:35:54,150 --> 00:35:52,800

two years old

1018

00:35:56,710 --> 00:35:54,160

and so i think the thing that we're

1019

00:35:59,190 --> 00:35:56,720

looking for is to start answering that

1020

00:36:00,710 --> 00:35:59,200

question okay

1021

00:36:01,589 --> 00:36:00,720

the second thing i wanted to say was

1022

00:36:03,990 --> 00:36:01,599

that

1023

00:36:07,510 --> 00:36:04,000

i think it is very

1024

00:36:09,030 --> 00:36:07,520

extremely rewarding to be able to

1025

00:36:10,870 --> 00:36:09,040

look forward to accomplishing first

1026
00:36:12,790 --> 00:36:10,880
straight science with a spacecraft

1027
00:36:15,829 --> 00:36:12,800
that's already done wonderful things

1028
00:36:18,069 --> 00:36:15,839
that you know has uh uh

1029
00:36:19,910 --> 00:36:18,079
used up most of its fuel and managing

1030
00:36:21,510 --> 00:36:19,920
all those resources to achieve great

1031
00:36:23,589 --> 00:36:21,520
science and i think that's you know very

1032
00:36:25,030 --> 00:36:23,599
rewarding to all of us

1033
00:36:26,390 --> 00:36:25,040
well gentlemen we have a number of folks

1034
00:36:28,310 --> 00:36:26,400
on the phone but

1035
00:36:30,069 --> 00:36:28,320
i believe you guys presentations were so

1036
00:36:32,470 --> 00:36:30,079
airtight you answered all the questions

1037
00:36:34,550 --> 00:36:32,480
so what i'm going to do here is wrap it

1038
00:36:36,150 --> 00:36:34,560

up i want to thank folks for joining us

1039

00:36:37,589 --> 00:36:36,160

of course if you want

1040

00:36:40,990 --> 00:36:37,599

additional information about this

1041

00:36:44,069 --> 00:36:41,000

incredible mission of spacecraft go to

1042

00:36:46,470 --> 00:36:44,079

www.nasa.gov also on a programming note

1043

00:36:48,310 --> 00:36:46,480

tomorrow at 1 pm eastern time here at

1044

00:36:50,630 --> 00:36:48,320

nasa headquarters will be a media

1045

00:36:51,589 --> 00:36:50,640

briefing about the agency's next

1046

00:36:53,510 --> 00:36:51,599

earth

1047

00:36:55,430 --> 00:36:53,520

observing satellite mission

1048

00:36:57,829 --> 00:36:55,440

called glory it's scheduled to launch on

1049

00:36:59,829 --> 00:36:57,839

february 23rd and panelists will discuss

1050

00:37:02,710 --> 00:36:59,839

the spacecraft's mission to study the

1051

00:37:05,349 --> 00:37:02,720

impact of the sun and airborne particles

1052

00:37:08,069 --> 00:37:05,359

on earth's climate thank you again happy