1
00:00:04,309 --> 00:00:02,230
welcome to nasa's jet propulsion

2
00:00:06,470 --> 00:00:04,319
laboratory in pasadena california i'm

3
00:00:08,470 --> 00:00:06,480
veronica mcgregor we had a date with a

4
00:00:10,230 --> 00:00:08,480
comet last night and things went

5
00:00:12,070 --> 00:00:10,240
exceptionally well

6
00:00:13,830 --> 00:00:12,080
we did have to wait a long time for

7
00:00:15,430 --> 00:00:13,840
those images to come down this morning

8
00:00:17,029 --> 00:00:15,440
though and that is why we are starting a

9
00:00:18,870 --> 00:00:17,039
little bit late and

10
00:00:21,109 --> 00:00:18,880
please accept our apologies for that so

11
00:00:24,070 --> 00:00:21,119
we are bringing you the latest images

12
00:00:25,830 --> 00:00:24,080
that are hitting the ground as we speak

13
00:00:27,269 --> 00:00:25,840

let me introduce the panelists for you

14
00:00:30,630 --> 00:00:27,279
now

15
00:00:32,709 --> 00:00:30,640
first we'll have dr ed weiler he is

16
00:00:34,630 --> 00:00:32,719
nasa's associate administrator the

17
00:00:37,990 --> 00:00:34,640
science mission directorate at nasa

18
00:00:41,990 --> 00:00:39,510
tim larson

19
00:00:47,029 --> 00:00:42,000
the stardust next project manager from

20
00:00:51,510 --> 00:00:49,590
dr joe viverka the stardust next

21
00:00:56,950 --> 00:00:51,520
principal investigator from cornell

22
00:01:01,990 --> 00:00:59,750
dr don brownlee the stardust next

23
00:01:06,230 --> 00:01:02,000
co-investigator from the university of

24
00:01:11,190 --> 00:01:08,789
and dr pete schultz another stardust

25
00:01:13,670 --> 00:01:11,200
next co-investigator and he's from brown

26
00:01:16,230 --> 00:01:13,680
university in providence rhode island

27
00:01:18,310 --> 00:01:16,240
and we will begin with dr weiler

28
00:01:20,550 --> 00:01:18,320
thank you veronica

29
00:01:22,789 --> 00:01:20,560
five and a half years ago a spacecraft

30
00:01:25,190 --> 00:01:22,799
named deep impact had a close encounter

31
00:01:27,030 --> 00:01:25,200
with a comet named temple one

32
00:01:30,149 --> 00:01:27,040
the mission was designed to drop off an

33
00:01:32,390 --> 00:01:30,159
800 pound metal slug which would impact

34
00:01:34,550 --> 00:01:32,400
the comet at a high velocity and throw

35
00:01:36,230 --> 00:01:34,560
up a bunch of comet material

36
00:01:38,469 --> 00:01:36,240
the spacecraft's instruments would then

37
00:01:40,710 --> 00:01:38,479
look at that material and eject it to

38
00:01:43,510 --> 00:01:40,720

better understand the chemical makeup of

39
00:01:45,429 --> 00:01:43,520
these primordial bodies called comets in

40
00:01:47,830 --> 00:01:45,439
fact the principal scientist of that

41
00:01:49,030 --> 00:01:47,840
mission um my dr mike rahern from

42
00:01:50,630 --> 00:01:49,040
university of maryland is in the

43
00:01:53,030 --> 00:01:50,640
audience today

44
00:01:56,310 --> 00:01:53,040
but that was yesterday's news

45
00:01:58,789 --> 00:01:56,320
in 2006 dr joe vaverka from cornell sent

46
00:02:00,709 --> 00:01:58,799
a proposal to nasa with a rather novel

47
00:02:02,870 --> 00:02:00,719
idea to re-target

48
00:02:05,350 --> 00:02:02,880
a different spacecraft called stardust

49
00:02:07,429 --> 00:02:05,360
to revisit temple one

50
00:02:09,190 --> 00:02:07,439
stardust is a twelve-year-old spacecraft

51
00:02:10,389 --> 00:02:09,200
having completed its prime mission many

52
00:02:11,990 --> 00:02:10,399
years ago

53
00:02:14,150 --> 00:02:12,000
this was the second time actually that

54
00:02:17,350 --> 00:02:14,160
nasa would take advantage of an old

55
00:02:19,670 --> 00:02:17,360
mission for new science and exploration

56
00:02:21,830 --> 00:02:19,680
the first was comet hartley encounter

57
00:02:25,350 --> 00:02:21,840
with a reused deep impact spacecraft

58
00:02:27,190 --> 00:02:25,360
renamed epoxy just last fall

59
00:02:30,229 --> 00:02:27,200
thanks to a great effort by the science

60
00:02:32,390 --> 00:02:30,239
team engineers navigators lockheed jpl

61
00:02:35,110 --> 00:02:32,400
and nasa we are here today to show you

62
00:02:37,430 --> 00:02:35,120
the results of humanity's first revisit

63
00:02:39,270 --> 00:02:37,440

to a comment to study how these objects

64
00:02:40,949 --> 00:02:39,280
evolve over time

65
00:02:43,190 --> 00:02:40,959
and i might add the results you will see

66
00:02:45,270 --> 00:02:43,200
in a few minutes were achieved for less

67
00:02:47,270 --> 00:02:45,280
than 10 percent

68
00:02:48,949 --> 00:02:47,280
of the cost of a new discovery class

69
00:02:50,630 --> 00:02:48,959
mission

70
00:02:52,949 --> 00:02:50,640
before i turn over to tim i have a

71
00:02:55,190 --> 00:02:52,959
message for any school kids out there

72
00:02:57,830 --> 00:02:55,200
who might be wondering how nasa can send

73
00:03:00,470 --> 00:02:57,840
a spacecraft billions of miles through

74
00:03:03,190 --> 00:03:00,480
the solar system and somehow wind up

75
00:03:05,670 --> 00:03:03,200
flying so close to a tiny comet only a

76
00:03:09,910 --> 00:03:05,680
few kilometers in diameter

77
00:03:14,470 --> 00:03:12,149
so pay attention in math class if you

78
00:03:16,550 --> 00:03:14,480
ever dreamed of being involved in this

79
00:03:18,630 --> 00:03:16,560
kind of real science discovery and

80
00:03:20,390 --> 00:03:18,640
exploration tim

81
00:03:21,830 --> 00:03:20,400
thank you ed

82
00:03:23,110 --> 00:03:21,840
again i'd like to reiterate this is

83
00:03:24,470 --> 00:03:23,120
exciting for us because it's the first

84
00:03:26,070 --> 00:03:24,480
time we've ever had the opportunity to

85
00:03:28,949 --> 00:03:26,080
visit a comet twice

86
00:03:30,309 --> 00:03:28,959
if you roll the animation that we have

87
00:03:32,149 --> 00:03:30,319
you'll see that temple one is a

88
00:03:34,390 --> 00:03:32,159

jupiter-class comet that goes its orbit

89
00:03:35,910 --> 00:03:34,400
goes out as far as jupiter and in this

90
00:03:38,630 --> 00:03:35,920
case comes in

91
00:03:40,630 --> 00:03:38,640
as close to the sun as the orbit of mars

92
00:03:43,670 --> 00:03:40,640
and that's about where we met it last

93
00:03:44,869 --> 00:03:43,680
night with the spacecraft

94
00:03:46,229 --> 00:03:44,879
based on the data that we brought down

95
00:03:49,110 --> 00:03:46,239
from the spacecraft we've been able to

96
00:03:51,270 --> 00:03:49,120
confirm that our flyby distance from the

97
00:03:52,710 --> 00:03:51,280
comet was 178 kilometers that's about

98
00:03:54,710 --> 00:03:52,720
110 miles

99
00:03:56,869 --> 00:03:54,720
uh we went past the comet at the

100
00:03:59,110 --> 00:03:56,879
velocity of 10.9 kilometers per second

101
00:04:02,229 --> 00:03:59,120
which is on the order of 24 000 miles

102
00:04:04,949 --> 00:04:02,239
per hour and our closest approach was

103
00:04:08,229 --> 00:04:04,959
right before 8 40 p.m uh here in on the

104
00:04:10,149 --> 00:04:08,239
west coast on valentine's evening

105
00:04:12,630 --> 00:04:10,159
our spacecraft telemetry shows that all

106
00:04:14,390 --> 00:04:12,640
of our subsystems operating exactly as

107
00:04:16,229 --> 00:04:14,400
we expected during the flyby

108
00:04:18,789 --> 00:04:16,239
the autonav software which is the

109
00:04:20,390 --> 00:04:18,799
autopilot software that controls the the

110
00:04:22,629 --> 00:04:20,400
motion of the mirror that keeps the

111
00:04:24,710 --> 00:04:22,639
comet in the image of field in the field

112
00:04:26,710 --> 00:04:24,720
of view of the camera worked exactly as

113
00:04:27,909 --> 00:04:26,720

planned and kept the comet exactly where

114
00:04:29,510 --> 00:04:27,919
it was supposed to be all the way

115
00:04:31,430 --> 00:04:29,520
through the flyby

116
00:04:33,030 --> 00:04:31,440
all the desired data that we wanted to

117
00:04:35,350 --> 00:04:33,040
collect was all collected and stored on

118
00:04:37,830 --> 00:04:35,360
board that's 72 images

119
00:04:39,909 --> 00:04:37,840
and approximately three megabytes of

120
00:04:41,590 --> 00:04:39,919
dust data for a total of about 78

121
00:04:43,110 --> 00:04:41,600
megabytes of data that doesn't sound

122
00:04:44,950 --> 00:04:43,120
like a lot to you but this is an old

123
00:04:49,030 --> 00:04:44,960
spacecraft

124
00:04:51,350 --> 00:04:49,040
after the flyby we were able to confirm

125
00:04:53,270 --> 00:04:51,360
that there is no noticeable degradation

126
00:04:55,189 --> 00:04:53,280
to the spacecraft to the health or

127
00:04:57,110 --> 00:04:55,199
function of the spacecraft despite the

128
00:04:58,629 --> 00:04:57,120
fact that we have detected several dust

129
00:05:01,110 --> 00:04:58,639
hits through the flyby and you'll hear a

130
00:05:02,710 --> 00:05:01,120
little bit more about that later

131
00:05:05,830 --> 00:05:02,720
so after the flyby we turned the hygiene

132
00:05:09,270 --> 00:05:05,840
antenna back to earth and began to uh

133
00:05:11,749 --> 00:05:09,280
downlink uh our our data as planned

134
00:05:14,070 --> 00:05:11,759
at that point since the spacecraft was

135
00:05:16,230 --> 00:05:14,080
healthy and we really wanted to gain a

136
00:05:17,909 --> 00:05:16,240
little bit more margin in our downlink

137
00:05:20,790 --> 00:05:17,919
to make sure that we protected this data

138
00:05:22,310 --> 00:05:20,800

and got it down in one pass safely

139
00:05:24,070 --> 00:05:22,320
we decided to delay our downlink by

140
00:05:25,830 --> 00:05:24,080
about 45 minutes so that we could

141
00:05:27,830 --> 00:05:25,840
reconfigure both the spacecraft and the

142
00:05:29,670 --> 00:05:27,840
deep space network station uh to

143
00:05:31,189 --> 00:05:29,680
accommodate that

144
00:05:33,110 --> 00:05:31,199
so that was that was accomplished and

145
00:05:35,189 --> 00:05:33,120
that went very well

146
00:05:37,990 --> 00:05:35,199
next we had our plan

147
00:05:39,830 --> 00:05:38,000
on the playback was to send five images

148
00:05:41,189 --> 00:05:39,840
that bracketed the closest approach

149
00:05:43,510 --> 00:05:41,199
period of

150
00:05:44,950 --> 00:05:43,520
of the flyby we wanted those five images

151
00:05:46,390 --> 00:05:44,960
to come down first in the queue when we

152
00:05:47,510 --> 00:05:46,400
started sending images back down to

153
00:05:49,510 --> 00:05:47,520
earth

154
00:05:50,870 --> 00:05:49,520
when we commanded that it turns out due

155
00:05:53,029 --> 00:05:50,880
to a software glitch that we had on

156
00:05:54,629 --> 00:05:53,039
board the images started coming down in

157
00:05:56,390 --> 00:05:54,639
the order they were taken

158
00:05:58,070 --> 00:05:56,400
so this did not jeopardize any of the

159
00:06:00,550 --> 00:05:58,080
data that we had on board all the data

160
00:06:02,390 --> 00:06:00,560
was safely stored in memory and was it

161
00:06:04,070 --> 00:06:02,400
was ready to be sent down we just had to

162
00:06:05,749 --> 00:06:04,080
wait a little bit longer for those

163
00:06:07,909 --> 00:06:05,759

images that all of us were really ready

164
00:06:09,590 --> 00:06:07,919
to see at that time so those images got

165
00:06:11,670 --> 00:06:09,600
down to the ground about between six and

166
00:06:12,870 --> 00:06:11,680
seven o'clock this morning uh you've

167
00:06:15,110 --> 00:06:12,880
already probably seen them out on the

168
00:06:17,590 --> 00:06:15,120
web and some very exciting findings

169
00:06:19,430 --> 00:06:17,600
coming out of those

170
00:06:21,189 --> 00:06:19,440
the spacecraft is continuing to send

171
00:06:23,430 --> 00:06:21,199
images down to earth we're at this point

172
00:06:24,870 --> 00:06:23,440
where approximately 60 out of the 72

173
00:06:27,029 --> 00:06:24,880
images are down on the ground we'll

174
00:06:29,110 --> 00:06:27,039
continue doing this until mid afternoon

175
00:06:31,270 --> 00:06:29,120
once we've confirmed that all the images

176
00:06:32,710 --> 00:06:31,280
and all the data is on the ground and

177
00:06:34,230 --> 00:06:32,720
all the packets are complete no

178
00:06:36,309 --> 00:06:34,240
corruption to any of the data that would

179
00:06:38,230 --> 00:06:36,319
require re-transmit at that point we'll

180
00:06:40,150 --> 00:06:38,240
be able to reconfigure the spacecraft

181
00:06:41,670 --> 00:06:40,160
and get ready for our outbound imaging

182
00:06:43,590 --> 00:06:41,680
when we do that we'll spend one to two

183
00:06:46,230 --> 00:06:43,600
weeks at least of looking back at the

184
00:06:47,749 --> 00:06:46,240
comet as we go away from it and as long

185
00:06:48,950 --> 00:06:47,759
as the scientists can get useful

186
00:06:51,029 --> 00:06:48,960
information out of the data we'll

187
00:06:52,230 --> 00:06:51,039
continue that process

188
00:06:54,070 --> 00:06:52,240

joel i'll leave it to you to tell us

189
00:06:56,070 --> 00:06:54,080
what we found all right well let's see

190
00:06:57,830 --> 00:06:56,080
tim a few minutes ago said that he was

191
00:06:59,189 --> 00:06:57,840
excited let me just say i mean more

192
00:07:02,629 --> 00:06:59,199
excited

193
00:07:05,909 --> 00:07:02,639
there is a great science and if we could

194
00:07:09,510 --> 00:07:05,919
have the first slide

195
00:07:11,670 --> 00:07:09,520
this shows us selected four images

196
00:07:14,390 --> 00:07:11,680
taken around closest approach

197
00:07:16,710 --> 00:07:14,400
and what i want to emphasize is

198
00:07:19,589 --> 00:07:16,720
that we achieved all of our science

199
00:07:21,350 --> 00:07:19,599
objectives we had four major science

200
00:07:23,270 --> 00:07:21,360
objectives three

201
00:07:26,230 --> 00:07:23,280
dealing with imaging and one with the

202
00:07:28,390 --> 00:07:26,240
dust experiments that we have on board

203
00:07:30,469 --> 00:07:28,400
the three imaging

204
00:07:31,749 --> 00:07:30,479
goals were first of all

205
00:07:33,270 --> 00:07:31,759
to

206
00:07:35,909 --> 00:07:33,280
look again

207
00:07:39,270 --> 00:07:35,919
at areas on temple that we had seen

208
00:07:42,950 --> 00:07:39,280
before in 2005 with deep impact to for

209
00:07:45,270 --> 00:07:42,960
the first time see what changes occur on

210
00:07:47,990 --> 00:07:45,280
a comet when it comes close to the sun

211
00:07:49,430 --> 00:07:48,000
and where those changes occur

212
00:07:51,430 --> 00:07:49,440
we also

213
00:07:53,749 --> 00:07:51,440

wanted to take the opportunity to look

214
00:07:56,070 --> 00:07:53,759
at the deep impact site where

215
00:07:58,469 --> 00:07:56,080
the deep impact impactor

216
00:08:00,070 --> 00:07:58,479
collided with the comet

217
00:08:02,629 --> 00:08:00,080
and finally we wanted to take the

218
00:08:05,189 --> 00:08:02,639
opportunity to

219
00:08:07,670 --> 00:08:05,199
extend our exploration and see areas on

220
00:08:11,029 --> 00:08:07,680
temple that we have not seen before so

221
00:08:13,510 --> 00:08:11,039
we had three imaging objectives and one

222
00:08:15,670 --> 00:08:13,520
objective having to do with analyzing

223
00:08:18,070 --> 00:08:15,680
collecting dust the dr brownlee will

224
00:08:20,710 --> 00:08:18,080
talk about dust i'll talk about imaging

225
00:08:25,350 --> 00:08:22,710
if you ask me

226
00:08:28,070 --> 00:08:25,360
was this mission a hundred percent

227
00:08:30,390 --> 00:08:28,080
successful in terms of the science

228
00:08:32,469 --> 00:08:30,400
i would have to say no it was a thousand

229
00:08:34,389 --> 00:08:32,479
percent successful

230
00:08:36,709 --> 00:08:34,399
and so i would like to just very quickly

231
00:08:38,389 --> 00:08:36,719
go over some of the highlights uh

232
00:08:39,990 --> 00:08:38,399
what we're looking at here are four

233
00:08:42,550 --> 00:08:40,000
images around closest approach and the

234
00:08:44,949 --> 00:08:42,560
way we planned this encounter was on the

235
00:08:47,350 --> 00:08:44,959
way in to see some of the old territory

236
00:08:49,030 --> 00:08:47,360
that we had seen before in 2005

237
00:08:52,070 --> 00:08:49,040
including the

238
00:08:54,710 --> 00:08:52,080

crater site and then on

239
00:08:57,750 --> 00:08:54,720
after close approach to see new parts of

240
00:08:59,509 --> 00:08:57,760
the comet so behind me here we have the

241
00:09:02,070 --> 00:08:59,519
approach images i just point out to

242
00:09:03,509 --> 00:09:02,080
craters this is the area where the deep

243
00:09:09,509 --> 00:09:03,519
impact

244
00:09:10,630 --> 00:09:09,519
can barely see in this image is a region

245
00:09:13,190 --> 00:09:10,640
that

246
00:09:15,750 --> 00:09:13,200
was intriguing to us because we expected

247
00:09:17,269 --> 00:09:15,760
that region to change significantly in

248
00:09:19,350 --> 00:09:17,279
the five and a half years between the

249
00:09:21,190 --> 00:09:19,360
encounters so let me first of all show

250
00:09:22,550 --> 00:09:21,200
you one example of the changes in the

251
00:09:24,710 --> 00:09:22,560
next slide

252
00:09:25,829 --> 00:09:24,720
which is that area that i pointed out

253
00:09:27,590 --> 00:09:25,839
before

254
00:09:29,590 --> 00:09:27,600
the smooth right this is a deep impact

255
00:09:30,870 --> 00:09:29,600
image up here

256
00:09:32,070 --> 00:09:30,880
you see

257
00:09:35,509 --> 00:09:32,080
the

258
00:09:37,829 --> 00:09:35,519
region in 2005 this is about 2 or three

259
00:09:40,230 --> 00:09:37,839
kilometers in extend this is maybe three

260
00:09:43,910 --> 00:09:40,240
or four hundred uh i'm sorry uh meters

261
00:09:46,790 --> 00:09:43,920
across here uh this is 2005 this is

262
00:09:48,470 --> 00:09:46,800
2011. this is the current situation and

263
00:09:51,509 --> 00:09:48,480

let me just point out a few things for

264
00:09:54,230 --> 00:09:51,519
example up here you see three pits

265
00:09:57,350 --> 00:09:54,240
here you see one contiguous pit

266
00:09:59,829 --> 00:09:57,360
erosion on a scale of 20 30 meters of

267
00:10:00,870 --> 00:09:59,839
material has occurred in a five or six

268
00:10:02,870 --> 00:10:00,880
years

269
00:10:04,550 --> 00:10:02,880
since we took this picture also if you

270
00:10:06,230 --> 00:10:04,560
follow the outline of this of this

271
00:10:08,150 --> 00:10:06,240
boundary and compare it to what we see

272
00:10:10,069 --> 00:10:08,160
today you will again see significant

273
00:10:12,550 --> 00:10:10,079
changes so we were successful in that

274
00:10:14,389 --> 00:10:12,560
objective we we are seeing

275
00:10:16,470 --> 00:10:14,399
changes we have to spend time and

276
00:10:19,030 --> 00:10:16,480
quantifying those changes and

277
00:10:19,829 --> 00:10:19,040
understanding what they mean our second

278
00:10:22,389 --> 00:10:19,839
uh

279
00:10:24,230 --> 00:10:22,399
goal if i could have the next slide

280
00:10:26,710 --> 00:10:24,240
uh okay

281
00:10:28,710 --> 00:10:26,720
this is just uh uh shows us the two

282
00:10:29,670 --> 00:10:28,720
areas uh the uh

283
00:10:31,190 --> 00:10:29,680
the uh

284
00:10:33,269 --> 00:10:31,200
the area outlined here where the changes

285
00:10:37,269 --> 00:10:33,279
occurred and also the boundary but what

286
00:10:38,790 --> 00:10:37,279
we're looking for is the following slide

287
00:10:40,230 --> 00:10:38,800
that is not the following slide but how

288
00:10:43,910 --> 00:10:40,240

about the one what have you got after

289
00:10:49,430 --> 00:10:47,829
you have anything after this one

290
00:10:50,230 --> 00:10:49,440
yep that's that's the one they have for

291
00:10:53,670 --> 00:10:50,240
you

292
00:10:58,069 --> 00:10:55,190
not at this time

293
00:11:00,550 --> 00:10:58,079
okay well then folks uh the way this is

294
00:11:03,269 --> 00:11:00,560
going to work is that

295
00:11:04,710 --> 00:11:03,279
we do in fact have a comparison of the

296
00:11:05,670 --> 00:11:04,720
deep impact

297
00:11:08,949 --> 00:11:05,680
area

298
00:11:10,870 --> 00:11:08,959
in 2005 and 2011

299
00:11:12,710 --> 00:11:10,880
and it in fact does show an impact

300
00:11:15,030 --> 00:11:12,720
crater

301
00:11:16,949 --> 00:11:15,040
and uh unfortunately i can't show it to

302
00:11:19,269 --> 00:11:16,959
you but pete schultz in a few minutes

303
00:11:22,230 --> 00:11:19,279
apparently if we are lucky he might

304
00:11:24,069 --> 00:11:22,240
actually have that comparison so we were

305
00:11:26,389 --> 00:11:24,079
again successful we achieved our

306
00:11:28,949 --> 00:11:26,399
objective we not only imaged the area of

307
00:11:31,190 --> 00:11:28,959
the deep impact event but we have an

308
00:11:32,949 --> 00:11:31,200
image of the crater that was produced

309
00:11:35,829 --> 00:11:32,959
and finally the slide that we have here

310
00:11:38,310 --> 00:11:35,839
is to exemplify our third goal which was

311
00:11:40,470 --> 00:11:38,320
to extend the exploration of temple to

312
00:11:43,590 --> 00:11:40,480
areas we have not seen before so this is

313
00:11:45,750 --> 00:11:43,600

a part of in this picture the parts that

314
00:11:48,470 --> 00:11:45,760
we have seen before are sort of behind

315
00:11:49,509 --> 00:11:48,480
up here and this is all new territory on

316
00:11:52,710 --> 00:11:49,519
the comet

317
00:11:55,509 --> 00:11:52,720
and it is simply amazing uh there are

318
00:11:58,230 --> 00:11:55,519
extensive areas of layering

319
00:12:00,310 --> 00:11:58,240
layers that have been deposited each

320
00:12:01,190 --> 00:12:00,320
layer a few meters thick maybe 10 meters

321
00:12:03,990 --> 00:12:01,200
thick

322
00:12:05,430 --> 00:12:04,000
we have to puzzle how does this happen

323
00:12:07,190 --> 00:12:05,440
we have large

324
00:12:09,110 --> 00:12:07,200
regions this is about a kilometer across

325
00:12:11,030 --> 00:12:09,120
where material has apparently been

326
00:12:14,150 --> 00:12:11,040
sublimated from the surface

327
00:12:16,150 --> 00:12:14,160
and removed there are areas on here

328
00:12:17,829 --> 00:12:16,160
which look like they're heavily pitted

329
00:12:19,269 --> 00:12:17,839
or heavily cratered

330
00:12:21,430 --> 00:12:19,279
again

331
00:12:23,750 --> 00:12:21,440
geology that we did not see on the outer

332
00:12:25,030 --> 00:12:23,760
space of temple and to understand how

333
00:12:27,110 --> 00:12:25,040
this comet works we have to put

334
00:12:29,910 --> 00:12:27,120
everything together in closing i want to

335
00:12:32,230 --> 00:12:29,920
emphasize that to achieve these three

336
00:12:34,550 --> 00:12:32,240
imaging objectives we had to arrive at

337
00:12:36,389 --> 00:12:34,560
the comet at precisely the right time as

338
00:12:38,230 --> 00:12:36,399

i mentioned we planned it so that on

339
00:12:40,710 --> 00:12:38,240
approach we would see the deep impact

340
00:12:43,430 --> 00:12:40,720
area and then after close approach we've

341
00:12:44,710 --> 00:12:43,440
seen you terrain that meant arriving

342
00:12:47,190 --> 00:12:44,720
precisely

343
00:12:48,310 --> 00:12:47,200
at the right time at the right place

344
00:12:50,710 --> 00:12:48,320
and

345
00:12:52,949 --> 00:12:50,720
to achieve that not only did we need

346
00:12:54,710 --> 00:12:52,959
first class navigation but we needed

347
00:12:55,829 --> 00:12:54,720
information on the rotation state of the

348
00:12:57,430 --> 00:12:55,839
comet

349
00:12:59,910 --> 00:12:57,440
we had an international effort over

350
00:13:02,550 --> 00:12:59,920
several years of monitoring the comet's

351
00:13:05,509 --> 00:13:02,560
rotation and and predicting what the

352
00:13:06,470 --> 00:13:05,519
state would be at encounter time

353
00:13:08,550 --> 00:13:06,480
uh

354
00:13:09,350 --> 00:13:08,560
how well did we do

355
00:13:11,670 --> 00:13:09,360
uh

356
00:13:14,069 --> 00:13:11,680
we got the longitude

357
00:13:16,790 --> 00:13:14,079
uh over which wanted to fly

358
00:13:19,030 --> 00:13:16,800
to plus or minus one or two degrees out

359
00:13:22,470 --> 00:13:19,040
of 360 degrees so that was a great

360
00:13:25,670 --> 00:13:22,480
achievement by our scientists so we're

361
00:13:28,310 --> 00:13:25,680
tremendously happy and i will now pass

362
00:13:30,069 --> 00:13:28,320
the discussion on to dr schultz who

363
00:13:31,430 --> 00:13:30,079

hopefully does have a picture of the

364
00:13:39,990 --> 00:13:31,440
crater

365
00:13:43,030 --> 00:13:40,000
but i've never had to wait five and a

366
00:13:45,110 --> 00:13:43,040
half years to see the results

367
00:13:47,110 --> 00:13:45,120
so if we can we have that first time

368
00:13:48,949 --> 00:13:47,120
step up there and you can actually see

369
00:13:51,829 --> 00:13:48,959
what deep impact saw and one of the

370
00:13:53,990 --> 00:13:51,839
close-up views that showed from the

371
00:13:56,550 --> 00:13:54,000
probe's perspective as it was zooming in

372
00:13:57,350 --> 00:13:56,560
to the surface and where it was going to

373
00:13:59,269 --> 00:13:57,360
hit

374
00:14:01,750 --> 00:13:59,279
around nine feet tempo one

375
00:14:03,829 --> 00:14:01,760
if we go to the next time step

376
00:14:06,870 --> 00:14:03,839
this is why we needed to go back on the

377
00:14:09,269 --> 00:14:06,880
left hand side is an image

378
00:14:11,750 --> 00:14:09,279
from one of the hri images and on the

379
00:14:14,389 --> 00:14:11,760
right is an image that deep impact saw

380
00:14:16,310 --> 00:14:14,399
about 700 seconds afterwards you notice

381
00:14:18,069 --> 00:14:16,320
we can't see the crater it's it's

382
00:14:20,069 --> 00:14:18,079
obscured by all the ejecta that was

383
00:14:22,230 --> 00:14:20,079
tossed up by the impact

384
00:14:23,590 --> 00:14:22,240
we never saw the craters went by is

385
00:14:25,189 --> 00:14:23,600
there somewhere

386
00:14:27,509 --> 00:14:25,199
um you know that created a lot of

387
00:14:28,629 --> 00:14:27,519
mystery it also created help to create

388
00:14:29,590 --> 00:14:28,639

this mission

389
00:14:31,590 --> 00:14:29,600
uh

390
00:14:32,550 --> 00:14:31,600
um let's take a look at the next time

391
00:14:34,949 --> 00:14:32,560
step

392
00:14:37,030 --> 00:14:34,959
i just want to show you how well we can

393
00:14:40,069 --> 00:14:37,040
correlate the different features on the

394
00:14:42,150 --> 00:14:40,079
left is an image of from deep impact on

395
00:14:44,150 --> 00:14:42,160
the right is stardust next and you can

396
00:14:46,150 --> 00:14:44,160
see those two craters those two

397
00:14:49,030 --> 00:14:46,160
crater-like features each one of them

398
00:14:51,189 --> 00:14:49,040
about 300 meters across

399
00:14:52,790 --> 00:14:51,199
almost a thousand feet

400
00:14:54,389 --> 00:14:52,800
where we were aiming was right in

401
00:14:55,910 --> 00:14:54,399
between with deep impact that's where

402
00:14:57,590 --> 00:14:55,920
that probe went in

403
00:14:58,870 --> 00:14:57,600
and if we take a look at the next time

404
00:15:06,870 --> 00:14:58,880
step

405
00:15:09,269 --> 00:15:06,880
huh that's the next picture that's a

406
00:15:10,949 --> 00:15:09,279
nice picture yeah very nice picture

407
00:15:13,350 --> 00:15:10,959
um i i don't know yeah we're going to

408
00:15:14,949 --> 00:15:13,360
put that last one up

409
00:15:16,790 --> 00:15:14,959
okay is there another one after this no

410
00:15:20,069 --> 00:15:16,800
there is not there is no hey joe guess

411
00:15:23,590 --> 00:15:22,150
it's it's clearly well done let me just

412
00:15:27,110 --> 00:15:23,600
let me just tell them

413
00:15:29,430 --> 00:15:27,120

hey we saw the crater

414
00:15:30,470 --> 00:15:29,440
yeah really we really did see we saw the

415
00:15:33,110 --> 00:15:30,480
crater

416
00:15:35,829 --> 00:15:33,120
and i tell you what i'll give you

417
00:15:36,870 --> 00:15:35,839
stay with me here okay we saw this

418
00:15:38,310 --> 00:15:36,880
crater

419
00:15:40,870 --> 00:15:38,320
it's subdued

420
00:15:43,430 --> 00:15:40,880
it's about 150 meters across and has a

421
00:15:45,430 --> 00:15:43,440
small central mound in the center it

422
00:15:47,430 --> 00:15:45,440
looks as if from the impact the stuff

423
00:15:50,069 --> 00:15:47,440
went up and came back down

424
00:15:52,069 --> 00:15:50,079
so we did get it there's no doubt and i

425
00:15:54,310 --> 00:15:52,079
think one of the bottom uh bottom line

426
00:15:56,790 --> 00:15:54,320
messages is that this surface of the

427
00:15:59,509 --> 00:15:56,800
comet where we hit is very weak

428
00:16:00,870 --> 00:15:59,519
uh it's fragile so the crater partly

429
00:16:02,710 --> 00:16:00,880
healed itself

430
00:16:04,629 --> 00:16:02,720
so let's let me turn this over to don

431
00:16:07,030 --> 00:16:04,639
brownlee and see if he can give them

432
00:16:08,870 --> 00:16:07,040
some data

433
00:16:11,590 --> 00:16:08,880
do do you have the picture of the crater

434
00:16:17,269 --> 00:16:14,069
we had a lot we had thousands of craters

435
00:16:19,189 --> 00:16:17,279
the uh uh comets unlike any other body

436
00:16:20,470 --> 00:16:19,199
in the solar system are unique because

437
00:16:22,310 --> 00:16:20,480
when they're in the inner part of the

438
00:16:25,110 --> 00:16:22,320

solar system where the earth is they're

439
00:16:27,749 --> 00:16:25,120
literally coming apart and sending tons

440
00:16:29,030 --> 00:16:27,759
and tons of gas and rocks and dust out

441
00:16:30,629 --> 00:16:29,040
in space

442
00:16:32,790 --> 00:16:30,639
so last night

443
00:16:34,949 --> 00:16:32,800
this spacecraft stardust

444
00:16:36,949 --> 00:16:34,959
went through this cloud of dust and

445
00:16:38,710 --> 00:16:36,959
rocks coming off the comet the second

446
00:16:41,509 --> 00:16:38,720
time it survived this

447
00:16:43,189 --> 00:16:41,519
it actually had a dozen impacts on the

448
00:16:45,590 --> 00:16:43,199
front leading edge of the spacecraft

449
00:16:48,069 --> 00:16:45,600
here called the whipple bumper that went

450
00:16:50,870 --> 00:16:48,079
through the front that's a it's a

451
00:16:52,629 --> 00:16:50,880
graphite cyanate honeycomb

452
00:16:53,590 --> 00:16:52,639
sheet that's about as thick as your

453
00:16:56,470 --> 00:16:53,600
finger

454
00:16:58,790 --> 00:16:56,480
and a dozen of those were big enough

455
00:17:00,710 --> 00:16:58,800
about almost a millimeter size they went

456
00:17:04,069 --> 00:17:00,720
punctured into it and went into the

457
00:17:06,309 --> 00:17:04,079
inside of the whipple shield from behind

458
00:17:07,270 --> 00:17:06,319
in addition to that we have uh the

459
00:17:10,630 --> 00:17:07,280
instrument

460
00:17:12,309 --> 00:17:10,640
spacecraft called dust flux monitor

461
00:17:14,230 --> 00:17:12,319
instrument and this was made by a

462
00:17:16,630 --> 00:17:14,240
collaboration of the university of

463
00:17:19,270 --> 00:17:16,640

chicago and university of kent

464
00:17:22,470 --> 00:17:19,280
in england and they have sensor to

465
00:17:24,390 --> 00:17:22,480
detect these impacts they detected 5 000

466
00:17:26,309 --> 00:17:24,400
smaller particles

467
00:17:29,190 --> 00:17:26,319
but one of the really interesting things

468
00:17:30,870 --> 00:17:29,200
about just the impact rate and i hope we

469
00:17:33,350 --> 00:17:30,880
can hear the impact rate in just a

470
00:17:35,750 --> 00:17:33,360
second was the nature of the impact rate

471
00:17:37,110 --> 00:17:35,760
when we flew past the previous comet

472
00:17:39,270 --> 00:17:37,120
bill 2

473
00:17:41,990 --> 00:17:39,280
years ago we were stunned

474
00:17:43,909 --> 00:17:42,000
that instead of having a slow rise in

475
00:17:46,630 --> 00:17:43,919
the impact rate and then peaking out

476
00:17:49,190 --> 00:17:46,640
when we got closest and then dropping

477
00:17:51,669 --> 00:17:49,200
off it came in sputters and starts never

478
00:17:53,830 --> 00:17:51,679
thought what on earth is going on what's

479
00:17:56,310 --> 00:17:53,840
going on this is the way comets

480
00:17:58,789 --> 00:17:56,320
act they don't just spew off things in a

481
00:18:01,029 --> 00:17:58,799
uniform way they send it out in bursts

482
00:18:02,070 --> 00:18:01,039
and puffs and even more than that they

483
00:18:05,190 --> 00:18:02,080
send out

484
00:18:06,390 --> 00:18:05,200
clods of dirt and ice and rock that come

485
00:18:08,870 --> 00:18:06,400
apart

486
00:18:11,909 --> 00:18:08,880
and so a good analogy of thinking of

487
00:18:13,510 --> 00:18:11,919
like a b17 in world war ii flying

488
00:18:15,590 --> 00:18:13,520

through flack

489
00:18:17,270 --> 00:18:15,600
and so instead of being big bing bing

490
00:18:19,270 --> 00:18:17,280
bing like that it's just burst of things

491
00:18:21,110 --> 00:18:19,280
we had sometimes a large number of

492
00:18:23,190 --> 00:18:21,120
impacts in less than a tenth

493
00:18:26,150 --> 00:18:23,200
of a second so it's a very dramatic

494
00:18:30,070 --> 00:18:26,160
environment do we have the audio tape on

495
00:18:31,110 --> 00:18:30,080
on on that we'll have a little

496
00:18:37,110 --> 00:18:31,120
okay

497
00:18:37,120 --> 00:18:46,150
that's it

498
00:18:49,510 --> 00:18:47,830
so weren't you glad you weren't on the

499
00:18:51,990 --> 00:18:49,520
spacecraft

500
00:18:54,470 --> 00:18:52,000
and this went on and on and on and the

501
00:18:56,230 --> 00:18:54,480
first impacts are several minutes be

502
00:18:58,950 --> 00:18:56,240
before the closest approach and they

503
00:19:01,350 --> 00:18:58,960
continued on but thousands of impacts

504
00:19:03,590 --> 00:19:01,360
including you know firecracker size uh

505
00:19:05,430 --> 00:19:03,600
burst so that was really exciting and

506
00:19:07,270 --> 00:19:05,440
and from the comet science is very

507
00:19:09,350 --> 00:19:07,280
interesting so there's two comets we've

508
00:19:11,190 --> 00:19:09,360
seen that behave this way

509
00:19:13,029 --> 00:19:11,200
but even more you know we've been to

510
00:19:15,270 --> 00:19:13,039
several comets now

511
00:19:17,110 --> 00:19:15,280
and comet harley didn't have a dust

512
00:19:18,710 --> 00:19:17,120
detector on it but it took these

513
00:19:21,350 --> 00:19:18,720

marvelous pictures

514
00:19:22,470 --> 00:19:21,360
of these snow and dirt balls coming

515
00:19:24,950 --> 00:19:22,480
apart

516
00:19:27,430 --> 00:19:24,960
in space after they're admitted for from

517
00:19:30,470 --> 00:19:27,440
the comets so these clods come off

518
00:19:32,230 --> 00:19:30,480
disintegrate and then the spacecraft uh

519
00:19:33,830 --> 00:19:32,240
goes through them

520
00:19:37,350 --> 00:19:33,840
the

521
00:19:39,510 --> 00:19:37,360
massage is detecting dust we also had an

522
00:19:42,230 --> 00:19:39,520
instrument on the side of the spacecraft

523
00:19:44,150 --> 00:19:42,240
called cita made by max blanc institute

524
00:19:46,710 --> 00:19:44,160
in germany and this measures the

525
00:19:48,950 --> 00:19:46,720
chemical composition of dust

526
00:19:52,549 --> 00:19:48,960
and there are several dozen particles

527
00:19:54,630 --> 00:19:52,559
that were analyzed last night

528
00:19:57,510 --> 00:19:54,640
during the flyby and

529
00:20:00,230 --> 00:19:57,520
this time the instrument was carefully

530
00:20:03,029 --> 00:20:00,240
tuned to be very sensitive to very small

531
00:20:05,270 --> 00:20:03,039
particles and also to measure organics

532
00:20:06,710 --> 00:20:05,280
and the first spectra i saw was very

533
00:20:07,750 --> 00:20:06,720
exciting because it showed peaks for

534
00:20:13,510 --> 00:20:07,760
carbon

535
00:20:16,310 --> 00:20:13,520
anyway it was a real thrill to do this

536
00:20:18,470 --> 00:20:16,320
the whole mission was was a real thrill

537
00:20:20,950 --> 00:20:18,480
and it's it's great to use one

538
00:20:24,950 --> 00:20:20,960

spacecraft to go to multiple targets

539
00:20:28,149 --> 00:20:26,789
okay we are going to open it up to

540
00:20:31,750 --> 00:20:28,159
questions in the meantime they are

541
00:20:34,710 --> 00:20:31,760
trying to find uh the images um

542
00:20:36,149 --> 00:20:34,720
they're they were

543
00:20:37,669 --> 00:20:36,159
and we're hoping also to have a flicker

544
00:20:39,430 --> 00:20:37,679
movie of the

545
00:20:41,029 --> 00:20:39,440
images altogether all the images that we

546
00:20:42,549 --> 00:20:41,039
have so far but in the meantime let me

547
00:20:44,549 --> 00:20:42,559
go ahead and open it up to questions

548
00:20:46,390 --> 00:20:44,559
we'll start in the room first if there

549
00:20:48,549 --> 00:20:46,400
are any questions if not we do have some

550
00:20:55,430 --> 00:20:48,559
people on the phone uh are there any

551
00:20:59,110 --> 00:20:57,270
yes go ahead and give us your name and

552
00:21:02,390 --> 00:20:59,120
affiliation sure stand in totten with

553
00:21:03,510 --> 00:21:02,400
kpcc uh you pointed to an image of uh

554
00:21:05,029 --> 00:21:03,520
i'm not sure what it was but it was a

555
00:21:07,350 --> 00:21:05,039
shape that you said had changed it had

556
00:21:08,950 --> 00:21:07,360
eroded over time uh can you explain a

557
00:21:10,630 --> 00:21:08,960
little bit more what that what caused

558
00:21:11,909 --> 00:21:10,640
that shape and what caused the changes

559
00:21:13,669 --> 00:21:11,919
how did that happen when we were well

560
00:21:17,510 --> 00:21:13,679
what caused the changes the surface of

561
00:21:19,350 --> 00:21:17,520
the comet is uh in part made of water

562
00:21:20,149 --> 00:21:19,360
ice when the comet comes close to the

563
00:21:20,950 --> 00:21:20,159

sun

564
00:21:28,070 --> 00:21:20,960
the

565
00:21:31,830 --> 00:21:28,080
that's why we see gases and dust coming

566
00:21:34,230 --> 00:21:31,840
from a comet and so

567
00:21:38,230 --> 00:21:34,240
what you saw are places where during the

568
00:21:40,870 --> 00:21:38,240
last five years ice has evaporated and

569
00:21:45,270 --> 00:21:40,880
carried with a dust into space

570
00:21:45,280 --> 00:21:50,870
sorry about that

571
00:21:55,750 --> 00:21:52,390
any other questions from news media in

572
00:21:58,870 --> 00:21:55,760
the room uh yes alicia chang

573
00:22:00,470 --> 00:21:58,880
alicia chang from ap um tim the reason

574
00:22:02,549 --> 00:22:00,480
why it took so long to download the

575
00:22:04,549 --> 00:22:02,559
pictures was it a result of commands

576
00:22:07,750 --> 00:22:04,559
that were already sent up disgrace

577
00:22:10,390 --> 00:22:07,760
spacecraft before or

578
00:22:12,630 --> 00:22:10,400
when you had to do the reconfiguration

579
00:22:14,630 --> 00:22:12,640
during the mission oh that was yeah the

580
00:22:16,390 --> 00:22:14,640
initial reconfiguration we did that that

581
00:22:17,830 --> 00:22:16,400
configuration was planned ahead of time

582
00:22:19,510 --> 00:22:17,840
we designed that as part of the

583
00:22:20,630 --> 00:22:19,520
encounter but we wanted to make sure

584
00:22:22,070 --> 00:22:20,640
that no matter what kind of

585
00:22:23,990 --> 00:22:22,080
contingencies happened during the

586
00:22:25,909 --> 00:22:24,000
encounter we came on out on the other

587
00:22:27,830 --> 00:22:25,919
side of it in a known configuration that

588
00:22:29,909 --> 00:22:27,840

we could support with telecom that's why

589
00:22:32,390 --> 00:22:29,919
we had that particular configuration

590
00:22:34,789 --> 00:22:32,400
selected once we knew we were healthy

591
00:22:36,630 --> 00:22:34,799
and could support a different decoder at

592
00:22:37,830 --> 00:22:36,640
the station we went ahead and asked for

593
00:22:39,990 --> 00:22:37,840
that because that gave us a little bit

594
00:22:41,750 --> 00:22:40,000
more margin on our on our down like just

595
00:22:44,070 --> 00:22:41,760
to make sure we had uh

596
00:22:45,669 --> 00:22:44,080
more safety net above above the signal

597
00:22:47,029 --> 00:22:45,679
that we had

598
00:22:48,310 --> 00:22:47,039
but the fact that it took so long for

599
00:22:50,470 --> 00:22:48,320
the pictures to download was it a

600
00:22:52,950 --> 00:22:50,480
mistake in the commands that were sent

601
00:22:54,870 --> 00:22:52,960
up no uh that that initial one was

602
00:22:56,549 --> 00:22:54,880
driven purely by physics because it

603
00:22:58,470 --> 00:22:56,559
required a command to the spacecraft and

604
00:22:59,350 --> 00:22:58,480
the round-trip light time is around 40

605
00:23:01,669 --> 00:22:59,360
minutes

606
00:23:04,070 --> 00:23:01,679
um the second downlink uh issue that i

607
00:23:06,549 --> 00:23:04,080
talked about that was that is a software

608
00:23:09,590 --> 00:23:06,559
issue that we're looking into uh it was

609
00:23:12,070 --> 00:23:09,600
supposed to have put the uh

610
00:23:13,909 --> 00:23:12,080
the five pre-selected images uh into the

611
00:23:16,390 --> 00:23:13,919
downlink queue first and we don't know

612
00:23:18,630 --> 00:23:16,400
yet why it didn't

613
00:23:20,149 --> 00:23:18,640

also 200 million miles away but those

614
00:23:23,669 --> 00:23:20,159
images are on the ground they're all on

615
00:23:27,270 --> 00:23:24,870
all right we're going to take a question

616
00:23:29,510 --> 00:23:27,280
next from the phone lines uh the la

617
00:23:31,750 --> 00:23:29,520
times is on the line amina khan please

618
00:23:33,510 --> 00:23:31,760
go ahead with your question

619
00:23:35,990 --> 00:23:33,520
hi and thank you for taking my call i

620
00:23:38,710 --> 00:23:36,000
have a couple of questions uh you

621
00:23:40,870 --> 00:23:38,720
mentioned that the cost would be about

622
00:23:43,029 --> 00:23:40,880
10 percent of a new discovery type

623
00:23:45,669 --> 00:23:43,039
mission how much is the actual cost of

624
00:23:47,750 --> 00:23:45,679
this mission um the second question

625
00:23:51,190 --> 00:23:47,760
is related to

626
00:23:53,430 --> 00:23:51,200
the surface of the comet um yeah i heard

627
00:23:55,430 --> 00:23:53,440
yesterday that there were some smooth

628
00:23:57,590 --> 00:23:55,440
areas that seemed to suggest there had

629
00:23:59,110 --> 00:23:57,600
been flows along the surface could you

630
00:24:00,710 --> 00:23:59,120
um talk a little bit about that and what

631
00:24:02,390 --> 00:24:00,720
might have caused that

632
00:24:05,669 --> 00:24:02,400
okay i'll take this is ed weiler from

633
00:24:08,149 --> 00:24:05,679
nasa the uh i'll take the first question

634
00:24:10,310 --> 00:24:08,159
the cost of a new discovery mission to

635
00:24:12,149 --> 00:24:10,320
do this kind of sciences in the range

636
00:24:14,070 --> 00:24:12,159
counting the launch vehicle of perhaps

637
00:24:15,430 --> 00:24:14,080
three to four to five hundred million

638
00:24:18,390 --> 00:24:15,440

dollars

639
00:24:20,070 --> 00:24:18,400
uh this mission cost nasa exactly 29

640
00:24:22,310 --> 00:24:20,080
million dollars so i was being

641
00:24:25,590 --> 00:24:22,320
conservative when i said 10 it may be as

642
00:24:30,149 --> 00:24:27,430
uh the smooth flaws that you're

643
00:24:33,990 --> 00:24:30,159
referring to were discovered on temple

644
00:24:37,029 --> 00:24:34,000
uh in 2005 by deep impact and they came

645
00:24:38,149 --> 00:24:37,039
as a surprise to comet scientists

646
00:24:40,789 --> 00:24:38,159
uh

647
00:24:43,909 --> 00:24:40,799
they have been interpreted as places

648
00:24:46,710 --> 00:24:43,919
where uh very volatile gas

649
00:24:49,669 --> 00:24:46,720
from below the surface

650
00:24:53,510 --> 00:24:49,679
has erupted carrying with it

651
00:24:55,590 --> 00:24:53,520
small particles of ice and dust and

652
00:24:56,470 --> 00:24:55,600
while some of this stuff leaves into

653
00:24:58,549 --> 00:24:56,480
space

654
00:25:01,430 --> 00:24:58,559
some of it just

655
00:25:03,669 --> 00:25:01,440
flows downhill because the comet does

656
00:25:05,510 --> 00:25:03,679
have a little bit of gravity

657
00:25:07,190 --> 00:25:05,520
so what is surprising about those

658
00:25:08,230 --> 00:25:07,200
features is that they seem to be fairly

659
00:25:09,590 --> 00:25:08,240
recent

660
00:25:11,830 --> 00:25:09,600
and

661
00:25:13,990 --> 00:25:11,840
apparently they also change

662
00:25:16,070 --> 00:25:14,000
with time readily because that's where

663
00:25:20,149 --> 00:25:16,080

we have seen the most obvious changes in

664
00:25:21,510 --> 00:25:20,159
the comparison between 2005 and 2011.

665
00:25:22,950 --> 00:25:21,520
but uh

666
00:25:24,549 --> 00:25:22,960
in short i mean they are they are

667
00:25:26,549 --> 00:25:24,559
parental places where material from the

668
00:25:31,110 --> 00:25:26,559
subsurface is erupted onto the surface

669
00:25:34,549 --> 00:25:32,390
we'll take another question from the

670
00:25:36,470 --> 00:25:34,559
phone lines we have denise chao with

671
00:25:37,909 --> 00:25:36,480
space.com please go ahead with your

672
00:25:43,269 --> 00:25:37,919
question

673
00:25:45,830 --> 00:25:43,279
crash site um when you were looking at

674
00:25:48,070 --> 00:25:45,840
the the comparison images um i think it

675
00:25:50,549 --> 00:25:48,080
was maybe dr larson that said that um

676
00:25:51,909 --> 00:25:50,559
when the impactor had had hit the comet

677
00:25:54,870 --> 00:25:51,919
that it had all this material that sort

678
00:25:56,149 --> 00:25:54,880
of obscured the view in 2005

679
00:25:57,190 --> 00:25:56,159
when you're looking at the images from

680
00:26:00,710 --> 00:25:57,200
last night was there anything that

681
00:26:03,110 --> 00:26:00,720
surprised you about the impact site

682
00:26:05,190 --> 00:26:03,120
yeah i'll take that um yeah there was a

683
00:26:06,549 --> 00:26:05,200
surprise in the sense that you know you

684
00:26:08,230 --> 00:26:06,559
could have expected a crater that was

685
00:26:10,310 --> 00:26:08,240
very very well defined

686
00:26:11,830 --> 00:26:10,320
and the creator was more subdued than i

687
00:26:15,590 --> 00:26:11,840
think some of us thought

688
00:26:18,230 --> 00:26:15,600

but it was still uh basically what the

689
00:26:21,110 --> 00:26:18,240
the kind of the size that we expected

690
00:26:23,430 --> 00:26:21,120
um and i think the real point is is that

691
00:26:25,430 --> 00:26:23,440
it's consistent with what we saw in 2005

692
00:26:27,430 --> 00:26:25,440
with the ejector going up and then a

693
00:26:29,830 --> 00:26:27,440
component coming down

694
00:26:32,149 --> 00:26:29,840
and so in a way it partly buried itself

695
00:26:36,549 --> 00:26:32,159
and i think we saw that very clearly in

696
00:26:36,559 --> 00:26:40,710
trust us

697
00:26:43,750 --> 00:26:41,510
okay

698
00:26:45,029 --> 00:26:43,760
we're going to put up an image um it is

699
00:26:46,950 --> 00:26:45,039
the image that we do have in our

700
00:26:47,990 --> 00:26:46,960
broadcast system you can tell us if it's

701
00:26:49,590 --> 00:26:48,000
the image you want and just so

702
00:26:52,230 --> 00:26:49,600
everyone's clear the image that they

703
00:26:53,430 --> 00:26:52,240
wanted will be posted to the internet no

704
00:26:55,909 --> 00:26:53,440
matter what so you'll all see it does

705
00:26:59,029 --> 00:26:55,919
this one work for you yeah great okay

706
00:27:00,470 --> 00:26:59,039
i'll talk to the speed please

707
00:27:02,390 --> 00:27:00,480
there's several things in this image i

708
00:27:04,149 --> 00:27:02,400
wanted to point out one of them

709
00:27:06,310 --> 00:27:04,159
is that these are the two craters we're

710
00:27:09,029 --> 00:27:06,320
talking about the other thing is notice

711
00:27:10,950 --> 00:27:09,039
this feature that's here if you notice

712
00:27:12,470 --> 00:27:10,960
over here that feature is gone even

713
00:27:14,950 --> 00:27:12,480

though many other features you can

714
00:27:16,549 --> 00:27:14,960
identify you can easily identify

715
00:27:18,870 --> 00:27:16,559
the interesting thing is that these

716
00:27:21,350 --> 00:27:18,880
concentric circles represent

717
00:27:23,350 --> 00:27:21,360
our estimate of the crater rim and then

718
00:27:24,710 --> 00:27:23,360
the inner circle is an estimate of the

719
00:27:26,230 --> 00:27:24,720
crater floor

720
00:27:29,029 --> 00:27:26,240
you can barely see this but there's a

721
00:27:30,950 --> 00:27:29,039
little lit area on that side and a dark

722
00:27:33,110 --> 00:27:30,960
area on the other and that's the central

723
00:27:34,870 --> 00:27:33,120
mound where we think the material came

724
00:27:37,350 --> 00:27:34,880
down so

725
00:27:38,149 --> 00:27:37,360
we think we see the crater with a sunlit

726
00:27:40,389 --> 00:27:38,159
rim

727
00:27:42,630 --> 00:27:40,399
on that side or some wall on that side a

728
00:27:44,789 --> 00:27:42,640
small little bit of a shadow there and

729
00:27:46,070 --> 00:27:44,799
we see the mound on the floor this is

730
00:27:48,950 --> 00:27:46,080
kind of what you would expect for an

731
00:27:50,389 --> 00:27:48,960
oblique impact at an angle of 30 degrees

732
00:27:52,710 --> 00:27:50,399
with a lot of material that went up and

733
00:27:55,190 --> 00:27:52,720
came back down

734
00:27:57,430 --> 00:27:55,200
so the picture on the on one side is a

735
00:27:59,269 --> 00:27:57,440
deep impact yeah that's the deep impact

736
00:28:00,149 --> 00:27:59,279
view over here and that's the stardust

737
00:28:03,029 --> 00:28:00,159
next

738
00:28:05,110 --> 00:28:03,039

it's about 150 meters across

739
00:28:09,430 --> 00:28:05,120
is what the current estimate um but you

740
00:28:11,990 --> 00:28:10,549
all right we're going to go to another

741
00:28:14,310 --> 00:28:12,000
question on the phone line sky and

742
00:28:15,990 --> 00:28:14,320
telescope kelly beatty please go ahead

743
00:28:17,590 --> 00:28:16,000
okay thank you very much uh this is for

744
00:28:20,630 --> 00:28:17,600
pete schultz i guess pete i'm sure glad

745
00:28:22,470 --> 00:28:20,640
you're convinced um is the muted nature

746
00:28:24,230 --> 00:28:22,480
of this crater

747
00:28:26,470 --> 00:28:24,240
more muted than when you would have

748
00:28:29,510 --> 00:28:26,480
expected and are you anticipating

749
00:28:31,510 --> 00:28:29,520
finding a kind of mantling all over uh

750
00:28:33,590 --> 00:28:31,520
the comet's nucleus due to all the dust

751
00:28:35,029 --> 00:28:33,600
and debris that was ejected

752
00:28:36,870 --> 00:28:35,039
well two you know the two questions

753
00:28:37,750 --> 00:28:36,880
first is that

754
00:28:39,269 --> 00:28:37,760
you know

755
00:28:40,630 --> 00:28:39,279
one of the reasons for going back to see

756
00:28:42,149 --> 00:28:40,640
what the crater looked like you know

757
00:28:45,190 --> 00:28:42,159
there were some thoughts that maybe the

758
00:28:47,430 --> 00:28:45,200
creator would simply bury itself or that

759
00:28:49,990 --> 00:28:47,440
it would sort of collapse

760
00:28:51,990 --> 00:28:50,000
because of its formation

761
00:28:53,510 --> 00:28:52,000
in terms of the ejecta

762
00:28:55,590 --> 00:28:53,520
if that was all ice that could have

763
00:28:58,789 --> 00:28:55,600

sublimated away very quickly and

764
00:29:01,029 --> 00:28:58,799
completely by the time we got back to it

765
00:29:02,870 --> 00:29:01,039
so i think when we look at the stereo we

766
00:29:05,269 --> 00:29:02,880
can see this feature

767
00:29:07,190 --> 00:29:05,279
and we can see it in multiple images and

768
00:29:14,549 --> 00:29:07,200
so i think i feel very confident that we

769
00:29:19,029 --> 00:29:16,870
okay thanks um we have one more question

770
00:29:21,190 --> 00:29:19,039
on the phone lines leo enright from

771
00:29:23,590 --> 00:29:21,200
irish television please go ahead

772
00:29:25,590 --> 00:29:23,600
thanks very much uh i was just wondering

773
00:29:26,789 --> 00:29:25,600
about this low bait feature that has

774
00:29:28,950 --> 00:29:26,799
been

775
00:29:31,029 --> 00:29:28,960
mentioned several times is this

776
00:29:33,029 --> 00:29:31,039
advancing or retreating i think that was

777
00:29:35,029 --> 00:29:33,039
one of the questions that you wanted to

778
00:29:36,389 --> 00:29:35,039
answer

779
00:29:38,230 --> 00:29:36,399
that's an excellent question the

780
00:29:41,190 --> 00:29:38,240
question is about the bait feature we

781
00:29:43,669 --> 00:29:41,200
talked about is it eroding or increasing

782
00:29:45,510 --> 00:29:43,679
at the present time it is eroding so it

783
00:29:51,029 --> 00:29:45,520
was formed at some time past and since

784
00:29:56,870 --> 00:29:52,470
do we have any more questions from the

785
00:30:00,389 --> 00:29:58,470
no i'm going to do one last check to see

786
00:30:02,630 --> 00:30:00,399
if we have any new images if the control

787
00:30:04,950 --> 00:30:02,640
room can tell me no we are done those

788
00:30:06,950 --> 00:30:04,960

are all the images that we have but we

789
00:30:08,710 --> 00:30:06,960
will be posting new images and new

790
00:30:10,549 --> 00:30:08,720
products to the web all day long as

791
00:30:12,590 --> 00:30:10,559
those become available so please do

792
00:30:15,430 --> 00:30:12,600
visit

793
00:30:17,750 --> 00:30:15,440
www.nasa.gov you'll find links there to

794
00:30:19,590 --> 00:30:17,760
all of the images from this comment

795
00:30:21,350 --> 00:30:19,600
encounter we want to thank all of you

796
00:30:54,870 --> 00:30:21,360
for joining us today

797
00:30:54,880 --> 00:31:08,870
oh

798
00:31:08,880 --> 00:31:34,470
uh