1
00:00:07,590 --> 00:00:05,829
well good afternoon welcome to nasa

2
00:00:08,950 --> 00:00:07,600
headquarters in washington my name is

3
00:00:10,470 --> 00:00:08,960
dwane brown with the office of

4
00:00:12,789 --> 00:00:10,480
communications

5
00:00:15,749 --> 00:00:12,799
today's briefing will preview the don

6
00:00:18,550 --> 00:00:15,759
spacecraft's upcoming year-long visit to

7
00:00:20,310 --> 00:00:18,560
the large asteroid vesta

8
00:00:22,550 --> 00:00:20,320
we'll have presentations

9
00:00:24,550 --> 00:00:22,560
then we'll open it up for questions

10
00:00:26,470 --> 00:00:24,560
and just a quick reminder that all of

11
00:00:32,069 --> 00:00:26,480
the images and information you will see

12
00:00:34,870 --> 00:00:33,190
dawn

13
00:00:36,870 --> 00:00:34,880

before we get started let me introduce

14
00:00:38,150 --> 00:00:36,880
you to today's speakers

15
00:00:40,069 --> 00:00:38,160
first up

16
00:00:42,069 --> 00:00:40,079
will be jim adams

17
00:00:44,549 --> 00:00:42,079
deputy director

18
00:00:47,029 --> 00:00:44,559
planetary science division

19
00:00:49,110 --> 00:00:47,039
nasa headquarters

20
00:00:51,430 --> 00:00:49,120
bob mays

21
00:00:53,350 --> 00:00:51,440
don project manager

22
00:00:56,470 --> 00:00:53,360
jet propulsion laboratory

23
00:00:58,470 --> 00:00:56,480
pasadena california

24
00:01:02,389 --> 00:00:58,480
chris russell

25
00:01:05,429 --> 00:01:02,399
don principal investigator ucla

26
00:01:07,030 --> 00:01:05,439
and carol raymond the dawn deputy

27
00:01:09,109 --> 00:01:07,040
principal investigator

28
00:01:10,230 --> 00:01:09,119
also from jpl so with that i'll turn it

29
00:01:12,310 --> 00:01:10,240
over to jim

30
00:01:14,469 --> 00:01:12,320
thanks duane it's been an incredible

31
00:01:16,149 --> 00:01:14,479
year for planetary science we started

32
00:01:17,350 --> 00:01:16,159
the year off with two commentary

33
00:01:19,109 --> 00:01:17,360
encounters

34
00:01:21,590 --> 00:01:19,119
and then inserted the messenger probe

35
00:01:22,469 --> 00:01:21,600
around the planet mercury and today

36
00:01:24,870 --> 00:01:22,479
we're

37
00:01:27,510 --> 00:01:24,880
happy to tell everybody about the

38
00:01:29,590 --> 00:01:27,520

opportunity to insert in the dawn

39
00:01:32,069 --> 00:01:29,600
mission into orbit around the asteroid

40
00:01:35,030 --> 00:01:32,079
vesta one of the largest objects in our

41
00:01:40,950 --> 00:01:36,870
the dawn science campaign at vesta will

42
00:01:42,469 --> 00:01:40,960
unveil a mysterious world an object that

43
00:01:43,590 --> 00:01:42,479
can tell us much about the earliest

44
00:01:46,950 --> 00:01:43,600
formation

45
00:01:48,469 --> 00:01:46,960
of the planets and the solar system

46
00:01:50,789 --> 00:01:48,479
indeed the science community is very

47
00:01:53,270 --> 00:01:50,799
excited about that opportunity

48
00:01:55,590 --> 00:01:53,280
and to study this particular asteroid up

49
00:01:57,590 --> 00:01:55,600
close and personal is a very unique

50
00:01:59,749 --> 00:01:57,600
opportunity

51
00:02:01,270 --> 00:01:59,759
dawn's journey to vesta started back in

52
00:02:03,429 --> 00:02:01,280
2007

53
00:02:05,749 --> 00:02:03,439
and since then it's been steadily

54
00:02:07,590 --> 00:02:05,759
thrusting its way past mars and out into

55
00:02:09,990 --> 00:02:07,600
the asteroid belt

56
00:02:13,750 --> 00:02:10,000
where it's slowly catching up with the

57
00:02:17,910 --> 00:02:13,760
dawn or with the asteroid

58
00:02:21,830 --> 00:02:19,589
this system has enabled us to not only

59
00:02:24,790 --> 00:02:21,840
visit

60
00:02:27,589 --> 00:02:24,800
but when we're done there we'll move on

61
00:02:29,750 --> 00:02:27,599
to the dwarf planet series the way we

62
00:02:31,509 --> 00:02:29,760
can do that is through an ion propulsion

63
00:02:34,949 --> 00:02:31,519

system that bob is going to tell us more

64
00:02:38,229 --> 00:02:36,949
just as unique as the dawn spacecraft is

65
00:02:40,710 --> 00:02:38,239
its team

66
00:02:43,190 --> 00:02:40,720
the dawn team is going to over the next

67
00:02:45,270 --> 00:02:43,200
year enable us to get a bird's-eye view

68
00:02:48,070 --> 00:02:45,280
of this new world

69
00:02:50,309 --> 00:02:48,080
until now it's only been a fuzzy blob

70
00:02:53,430 --> 00:02:50,319
but chris and carol have more to show us

71
00:02:55,270 --> 00:02:53,440
about the science of the asteroid vesta

72
00:02:56,790 --> 00:02:55,280
and why it's important

73
00:02:57,990 --> 00:02:56,800
and plus i believe they're going to have

74
00:03:00,790 --> 00:02:58,000
a sneak peek

75
00:03:02,710 --> 00:03:00,800
at some of the earliest images

76
00:03:04,470 --> 00:03:02,720
some of us recall with amazement seeing

77
00:03:05,990 --> 00:03:04,480
those first images from the mariner

78
00:03:07,830 --> 00:03:06,000
series of mars

79
00:03:10,070 --> 00:03:07,840
and i'd like to think that this week

80
00:03:11,509 --> 00:03:10,080
next week and over the coming year that

81
00:03:14,229 --> 00:03:11,519
that's the kind of excitement that we're

82
00:03:16,830 --> 00:03:14,239
going to see as we unveil this new world

83
00:03:19,589 --> 00:03:16,840
i think that it's a fantastic

84
00:03:22,710 --> 00:03:19,599
opportunity for young and old alike to

85
00:03:25,350 --> 00:03:22,720
get a sense of just how vast and unique

86
00:03:26,949 --> 00:03:25,360
our solar system is

87
00:03:29,750 --> 00:03:26,959
over the next year

88
00:03:31,270 --> 00:03:29,760

the dawn team will paint a face on that

89
00:03:32,710 --> 00:03:31,280
fuzzy blob

90
00:03:35,030 --> 00:03:32,720
the pictures will just get better and

91
00:03:37,750 --> 00:03:35,040
better and we'll begin to understand

92
00:03:39,270 --> 00:03:37,760
this awesome new world and with that

93
00:03:41,190 --> 00:03:39,280
i'll give you bob

94
00:03:43,710 --> 00:03:41,200
all right well thank you jim

95
00:03:47,030 --> 00:03:43,720
after traveling for nearly four years

96
00:03:48,070 --> 00:03:47,040
1.7 billion miles and two laps around

97
00:03:49,990 --> 00:03:48,080
the sun

98
00:03:51,270 --> 00:03:50,000
don is finally on our final approach to

99
00:03:54,229 --> 00:03:51,280
vesta

100
00:03:55,670 --> 00:03:54,239
today we're only about 96 000 miles away

101
00:03:57,350 --> 00:03:55,680
that's about a third of the distance

102
00:03:59,589 --> 00:03:57,360
from the earth to the moon

103
00:04:01,750 --> 00:03:59,599
our destination is within sight and this

104
00:04:04,630 --> 00:04:01,760
team is very excited

105
00:04:06,309 --> 00:04:04,640
that we're finally closing in on vesta

106
00:04:07,830 --> 00:04:06,319
and i'm very pleased to be here today to

107
00:04:10,390 --> 00:04:07,840
tell you a little bit about the dawn

108
00:04:11,990 --> 00:04:10,400
mission and about the background on how

109
00:04:13,589 --> 00:04:12,000
we got here

110
00:04:15,190 --> 00:04:13,599
if we could roll the first video you'll

111
00:04:17,349 --> 00:04:15,200
see some spectacular footage of the

112
00:04:19,349 --> 00:04:17,359
delta ii launch vehicle that started

113
00:04:22,550 --> 00:04:19,359

dawn off on this amazing journey back in

114
00:04:23,909 --> 00:04:22,560
september of 2007.

115
00:04:25,510 --> 00:04:23,919
and as you watch that i'll tell you that

116
00:04:26,710 --> 00:04:25,520
the dawn mission is unique in that we're

117
00:04:29,030 --> 00:04:26,720
going to be the first mission to

118
00:04:31,749 --> 00:04:29,040
rendezvous with not just one body but

119
00:04:33,990 --> 00:04:31,759
two solar system bodies many spacecraft

120
00:04:35,510 --> 00:04:34,000
have flown by multiple bodies but don

121
00:04:37,749 --> 00:04:35,520
will be the first to make an extended

122
00:04:39,350 --> 00:04:37,759
port of call at our two destinations

123
00:04:41,030 --> 00:04:39,360
vesta and ceres

124
00:04:43,030 --> 00:04:41,040
these are two of the last unexplored

125
00:04:44,629 --> 00:04:43,040
worlds in our inner solar system and

126
00:04:46,870 --> 00:04:44,639
these are large bodies that reside in

127
00:04:49,030 --> 00:04:46,880
the asteroid belt between mars and

128
00:04:50,550 --> 00:04:49,040
jupiter

129
00:04:53,670 --> 00:04:50,560
so if we go ahead and roll the second

130
00:04:55,590 --> 00:04:53,680
video i'll describe how do we get there

131
00:04:58,150 --> 00:04:55,600
vesta and series like the planets are in

132
00:05:00,150 --> 00:04:58,160
orbit around the sun so to get to vesta

133
00:05:02,150 --> 00:05:00,160
don is placed into orbit around the sun

134
00:05:03,670 --> 00:05:02,160
and over a period of months and years we

135
00:05:06,150 --> 00:05:03,680
shape its orbit

136
00:05:08,230 --> 00:05:06,160
to match vesta's orbit we do this with

137
00:05:09,909 --> 00:05:08,240
the iron propulsion system which is

138
00:05:11,990 --> 00:05:09,919

represented by the blue glow that you

139
00:05:13,909 --> 00:05:12,000
can see in the video

140
00:05:17,189 --> 00:05:13,919
after launch we flew by mars for a

141
00:05:19,830 --> 00:05:17,199
gravity assist in 2009 and we completed

142
00:05:22,150 --> 00:05:19,840
almost two full orbits around the sun

143
00:05:24,390 --> 00:05:22,160
will rendezvous on july the 16th and be

144
00:05:26,469 --> 00:05:24,400
captured into orbit around vesta

145
00:05:28,310 --> 00:05:26,479
we'll orbit vesta for a year before

146
00:05:30,550 --> 00:05:28,320
starting our climb out to series and

147
00:05:32,950 --> 00:05:30,560
then we'll arrive in series in early

148
00:05:35,189 --> 00:05:32,960
2015.

149
00:05:37,510 --> 00:05:35,199
now to get to these two small bodies is

150
00:05:39,510 --> 00:05:37,520
these two bodies is no small feat

151
00:05:41,110 --> 00:05:39,520
they're relatively far away from the sun

152
00:05:42,070 --> 00:05:41,120
two to three times farther than the

153
00:05:43,749 --> 00:05:42,080
earth

154
00:05:45,590 --> 00:05:43,759
and solar energy which powers the

155
00:05:47,909 --> 00:05:45,600
spacecraft is pretty scarce at those

156
00:05:49,909 --> 00:05:47,919
distances as well four to nine times

157
00:05:52,310 --> 00:05:49,919
less than here on the earth so to

158
00:05:55,590 --> 00:05:52,320
capture enough energy dawn has two very

159
00:05:56,469 --> 00:05:55,600
large solar arrays each is 27 feet in

160
00:05:57,990 --> 00:05:56,479
length

161
00:05:59,430 --> 00:05:58,000
that's about the width of a singles

162
00:06:01,590 --> 00:05:59,440
tennis court

163
00:06:04,309 --> 00:06:01,600

and tip to tip the total wing span is

164
00:06:06,550 --> 00:06:04,319
about 65 feet that's the distance from

165
00:06:08,950 --> 00:06:06,560
the pitcher's mound to home plate on a

166
00:06:10,550 --> 00:06:08,960
professional baseball field this makes

167
00:06:13,749 --> 00:06:10,560
dawn the largest interplanetary

168
00:06:15,749 --> 00:06:13,759
spacecraft that nasa has ever launched

169
00:06:17,830 --> 00:06:15,759
and our journey is made possible by ion

170
00:06:19,430 --> 00:06:17,840
propulsion this advanced sounding

171
00:06:21,510 --> 00:06:19,440
technology has actually been around in

172
00:06:24,070 --> 00:06:21,520
concept for decades you may have even

173
00:06:26,309 --> 00:06:24,080
heard it on the original star trek tv

174
00:06:28,230 --> 00:06:26,319
series or in the star wars movies uh

175
00:06:30,629 --> 00:06:28,240
you'll recognize the tie fighters the

176
00:06:32,710 --> 00:06:30,639
twin ion engines they're impressive

177
00:06:34,629 --> 00:06:32,720
ships but we do them one better on don

178
00:06:36,469 --> 00:06:34,639
we actually have three ion engines on

179
00:06:38,230 --> 00:06:36,479
the spacecraft

180
00:06:40,070 --> 00:06:38,240
now these ion engines are very efficient

181
00:06:41,830 --> 00:06:40,080
in the sense that they require very

182
00:06:44,629 --> 00:06:41,840
little propellant mass compared to

183
00:06:46,150 --> 00:06:44,639
conventional chemical systems xenon gas

184
00:06:48,469 --> 00:06:46,160
is used as the propellant and it's

185
00:06:50,390 --> 00:06:48,479
ionized by large electric fields and

186
00:06:52,790 --> 00:06:50,400
these ions are accelerated at very high

187
00:06:55,589 --> 00:06:52,800
velocities out of the thrusters now this

188
00:06:56,550 --> 00:06:55,599

requires a tremendous amount of energy

189
00:06:58,710 --> 00:06:56,560
up to

190
00:07:00,469 --> 00:06:58,720
2500 watts of power which is another

191
00:07:02,070 --> 00:07:00,479
reason that the dawn solar arrays are so

192
00:07:03,830 --> 00:07:02,080
large

193
00:07:05,430 --> 00:07:03,840
our conventional chemical systems can

194
00:07:07,510 --> 00:07:05,440
generate tremendous amounts of thrust

195
00:07:09,990 --> 00:07:07,520
and acceleration to use a terrestrial

196
00:07:11,670 --> 00:07:10,000
analogy they go from zero to sixty in

197
00:07:13,589 --> 00:07:11,680
just a few seconds

198
00:07:15,670 --> 00:07:13,599
ion engines on the other hand produce

199
00:07:17,670 --> 00:07:15,680
very low thrust about as much as a

200
00:07:18,870 --> 00:07:17,680
single piece of paper would push down on

201
00:07:21,029 --> 00:07:18,880
your hand

202
00:07:22,950 --> 00:07:21,039
so this means we go from zero to sixty

203
00:07:24,550 --> 00:07:22,960
in about four days

204
00:07:27,189 --> 00:07:24,560
but the ion engine can continue to

205
00:07:29,510 --> 00:07:27,199
thrust and accelerate day after day

206
00:07:32,150 --> 00:07:29,520
month after month eventually achieving

207
00:07:34,309 --> 00:07:32,160
tremendous velocities over time

208
00:07:36,469 --> 00:07:34,319
so with less than a thousand pounds of

209
00:07:38,230 --> 00:07:36,479
xenon on board over the course of our

210
00:07:40,629 --> 00:07:38,240
eight year mission

211
00:07:43,670 --> 00:07:40,639
the iron propulsion system will provide

212
00:07:46,309 --> 00:07:43,680
more than 24 000 miles per hour of

213
00:07:48,469 --> 00:07:46,319

velocity change to put that in context

214
00:07:50,629 --> 00:07:48,479
that's about the same we got from the

215
00:07:52,230 --> 00:07:50,639
delta ii launch vehicle that lifted dawn

216
00:07:53,990 --> 00:07:52,240
off of the earth

217
00:07:55,990 --> 00:07:54,000
so this is truly an innovative

218
00:07:57,670 --> 00:07:56,000
technology that enables us to do things

219
00:07:59,350 --> 00:07:57,680
and go places that would otherwise be

220
00:08:02,309 --> 00:07:59,360
either very expensive or downright

221
00:08:04,869 --> 00:08:02,319
impossible to do

222
00:08:06,629 --> 00:08:04,879
so now after nearly four years of travel

223
00:08:09,029 --> 00:08:06,639
we've matched vesta's orbit around the

224
00:08:10,950 --> 00:08:09,039
sun and like two cars traveling together

225
00:08:12,710 --> 00:08:10,960
at high speed down the freeway

226
00:08:14,550 --> 00:08:12,720
relative to each other they appear to be

227
00:08:16,869 --> 00:08:14,560
moving very slowly

228
00:08:18,550 --> 00:08:16,879
and as dawn and vesta are traveling at

229
00:08:19,990 --> 00:08:18,560
tens of thousands of miles per hour

230
00:08:22,710 --> 00:08:20,000
around the sun

231
00:08:25,990 --> 00:08:22,720
dawn is closing in on vesta at a modest

232
00:08:27,990 --> 00:08:26,000
260 miles per hour

233
00:08:29,589 --> 00:08:28,000
so as we roll the last video showing the

234
00:08:31,110 --> 00:08:29,599
approach to vesta i'll tell you a little

235
00:08:32,709 --> 00:08:31,120
bit about the team that makes this all

236
00:08:35,110 --> 00:08:32,719
happen

237
00:08:37,029 --> 00:08:35,120
our principal investigator dr russell at

238
00:08:38,469 --> 00:08:37,039

ucla leads our mission

239
00:08:40,630 --> 00:08:38,479
project management and the flight

240
00:08:42,389 --> 00:08:40,640
operations are performed at nasa's jet

241
00:08:44,630 --> 00:08:42,399
propulsion laboratory

242
00:08:46,550 --> 00:08:44,640
the spacecraft was designed and built by

243
00:08:48,310 --> 00:08:46,560
the orbital sciences corporation our

244
00:08:50,870 --> 00:08:48,320
capable partners just down the road in

245
00:08:52,710 --> 00:08:50,880
dulles virginia

246
00:08:54,070 --> 00:08:52,720
we have three scientific instruments on

247
00:08:56,070 --> 00:08:54,080
dawn and i'd like to take this

248
00:08:58,470 --> 00:08:56,080
opportunity to recognize and thank the

249
00:09:00,230 --> 00:08:58,480
german aerospace agency and the max

250
00:09:01,509 --> 00:09:00,240
planck institute for solar system

251
00:09:03,350 --> 00:09:01,519
research

252
00:09:04,630 --> 00:09:03,360
for providing and operating the framing

253
00:09:05,750 --> 00:09:04,640
camera which is going to show you some

254
00:09:07,190 --> 00:09:05,760
of the images you're going to see in

255
00:09:09,590 --> 00:09:07,200
just a few minutes

256
00:09:11,030 --> 00:09:09,600
also the italian space agency and the

257
00:09:13,430 --> 00:09:11,040
italian national institute for

258
00:09:15,269 --> 00:09:13,440
astrophysics for providing and operating

259
00:09:16,710 --> 00:09:15,279
the visible and infrared mapping

260
00:09:18,389 --> 00:09:16,720
spectrometer

261
00:09:20,389 --> 00:09:18,399
and our third instrument the gamma ray

262
00:09:22,470 --> 00:09:20,399
and neutron detector was built by the

263
00:09:24,230 --> 00:09:22,480

los alamos national labs and is now

264
00:09:26,310 --> 00:09:24,240
operated by the planetary sciences

265
00:09:27,590 --> 00:09:26,320
institute

266
00:09:29,190 --> 00:09:27,600
so in addition to our instrument

267
00:09:30,710 --> 00:09:29,200
partners our pi has assembled a

268
00:09:32,550 --> 00:09:30,720
first-rate team of scientists and

269
00:09:34,389 --> 00:09:32,560
investigators from around the country

270
00:09:36,550 --> 00:09:34,399
and around the globe

271
00:09:38,630 --> 00:09:36,560
in this regard dawn is truly a shining

272
00:09:40,070 --> 00:09:38,640
example of a successful international

273
00:09:41,829 --> 00:09:40,080
collaboration

274
00:09:43,910 --> 00:09:41,839
and of course no flight operations would

275
00:09:45,750 --> 00:09:43,920
be possible without the tireless and

276
00:09:47,590 --> 00:09:45,760
dedicated support of the deep space

277
00:09:49,509 --> 00:09:47,600
network

278
00:09:51,990 --> 00:09:49,519
so today don is halfway through our

279
00:09:54,389 --> 00:09:52,000
three-month vesta approach phase we'll

280
00:09:56,389 --> 00:09:54,399
capture into orbit in mid-july and spend

281
00:09:58,470 --> 00:09:56,399
the next several weeks slowly spiraling

282
00:10:00,550 --> 00:09:58,480
into our first science orbit then we

283
00:10:02,310 --> 00:10:00,560
will begin the science campaign in the

284
00:10:03,670 --> 00:10:02,320
second week of august

285
00:10:05,670 --> 00:10:03,680
we've already begun to image our

286
00:10:07,590 --> 00:10:05,680
destination and the team is very excited

287
00:10:09,670 --> 00:10:07,600
that our destination is finally within

288
00:10:11,670 --> 00:10:09,680

sight the image of vesta is slowly

289
00:10:13,590 --> 00:10:11,680
coming into view and i'll now hand you

290
00:10:15,590 --> 00:10:13,600
over to dr russell to explain the

291
00:10:17,110 --> 00:10:15,600
significance of this unknown world that

292
00:10:19,910 --> 00:10:17,120
we're about to explore

293
00:10:22,790 --> 00:10:19,920
thank you very much bob uh as dawn

294
00:10:24,710 --> 00:10:22,800
principal investigator it's my job to uh

295
00:10:28,710 --> 00:10:24,720
make sure that the mission achieves its

296
00:10:31,190 --> 00:10:28,720
scientific uh objectives uh and uh i

297
00:10:33,509 --> 00:10:31,200
will start uh doing that in earnest very

298
00:10:36,069 --> 00:10:33,519
shortly but right now where all we're

299
00:10:38,150 --> 00:10:36,079
doing is taking navigation images and so

300
00:10:40,310 --> 00:10:38,160
they're not uh the scientific product

301
00:10:42,389 --> 00:10:40,320
that we will get but they're very

302
00:10:44,790 --> 00:10:42,399
interesting and i'm i'd like to share

303
00:10:47,750 --> 00:10:44,800
them with you today

304
00:10:50,150 --> 00:10:47,760
the when we to get these uh images the

305
00:10:53,190 --> 00:10:50,160
spacecraft's thrusting and it's not

306
00:10:55,829 --> 00:10:53,200
pointing at vesta so it has to turn off

307
00:10:58,230 --> 00:10:55,839
the thrusters turn around and look at

308
00:11:00,870 --> 00:10:58,240
vesta take the data and then return it

309
00:11:03,670 --> 00:11:00,880
to earth so we only do this about once a

310
00:11:05,910 --> 00:11:03,680
week at least at the start we're picking

311
00:11:09,190 --> 00:11:05,920
up the the speed now and taking them

312
00:11:11,590 --> 00:11:09,200
every uh twice a week but these images

313
00:11:14,790 --> 00:11:11,600

when we're staring at vesta we take the

314
00:11:17,750 --> 00:11:14,800
order of say 30 once a minute uh that

315
00:11:20,790 --> 00:11:17,760
order uh and then you'll since vesta

316
00:11:23,350 --> 00:11:20,800
spins at a degree a minute we're seeing

317
00:11:25,430 --> 00:11:23,360
about 30 degrees in these first few

318
00:11:28,790 --> 00:11:25,440
frames and then later we'll see about an

319
00:11:31,590 --> 00:11:28,800
hour's worth of images and see it rotate

320
00:11:33,269 --> 00:11:31,600
about uh 60 degrees could we have the uh

321
00:11:37,110 --> 00:11:33,279
first video please

322
00:11:40,870 --> 00:11:37,120
uh so the first uh image was taken uh in

323
00:11:42,389 --> 00:11:40,880
may uh and uh may the uh third and at

324
00:11:43,509 --> 00:11:42,399
that time we were about

325
00:11:54,629 --> 00:11:43,519
uh

326
00:11:55,509 --> 00:11:54,639
we are now

327
00:11:57,269 --> 00:11:55,519
about

328
00:11:58,710 --> 00:11:57,279
half the distance between the earth and

329
00:12:01,190 --> 00:11:58,720
the moon

330
00:12:04,150 --> 00:12:01,200
as we take a look at these images we can

331
00:12:06,150 --> 00:12:04,160
see features rotating we don't know

332
00:12:07,829 --> 00:12:06,160
exactly what they are many of them look

333
00:12:10,550 --> 00:12:07,839
like craters

334
00:12:11,750 --> 00:12:10,560
but we're waiting till we get higher

335
00:12:13,509 --> 00:12:11,760
resolution

336
00:12:14,389 --> 00:12:13,519
to make

337
00:12:17,110 --> 00:12:14,399
you know

338
00:12:18,790 --> 00:12:17,120

interpretations of what we see

339
00:12:19,829 --> 00:12:18,800
whatever

340
00:12:23,110 --> 00:12:19,839
is

341
00:12:24,629 --> 00:12:23,120
on that surface it's a lot more

342
00:12:27,190 --> 00:12:24,639
varied and

343
00:12:30,710 --> 00:12:27,200
than we would have thought from the

344
00:12:33,750 --> 00:12:30,720
earlier hubble uh pictures

345
00:12:35,430 --> 00:12:33,760
now vesta is no stranger to people on

346
00:12:38,389 --> 00:12:35,440
the earth

347
00:12:41,990 --> 00:12:38,399
because vesta has been visiting the

348
00:12:44,550 --> 00:12:42,000
earth through a set of meteorites

349
00:12:46,790 --> 00:12:44,560
that have fallen to earth over

350
00:12:48,870 --> 00:12:46,800
the earth's history and at the present

351
00:12:51,269 --> 00:12:48,880
time about one

352
00:12:53,670 --> 00:12:51,279
meteorite out of every 20 that falls the

353
00:12:56,230 --> 00:12:53,680
earth

354
00:12:57,269 --> 00:12:56,240
comes from vesta and here is an example

355
00:12:59,509 --> 00:12:57,279
this one

356
00:13:03,430 --> 00:12:59,519
fell in australia

357
00:13:04,389 --> 00:13:03,440
and we've sliced it to show the interior

358
00:13:06,870 --> 00:13:04,399
of

359
00:13:09,269 --> 00:13:06,880
the meteorite uh you can go to a store

360
00:13:11,670 --> 00:13:09,279
and buy this material it's that common

361
00:13:13,910 --> 00:13:11,680
it's not like the lunar samples we have

362
00:13:16,629 --> 00:13:13,920
more vesta samples than we have of the

363
00:13:19,350 --> 00:13:16,639

moon or uh moon and mars

364
00:13:22,150 --> 00:13:19,360
um one of the reasons we're going to

365
00:13:25,110 --> 00:13:22,160
vesta is not only because it's so big

366
00:13:27,990 --> 00:13:25,120
but it's also one of the earliest uh

367
00:13:31,670 --> 00:13:28,000
bodies to form uh in the solar system so

368
00:13:34,150 --> 00:13:31,680
the surface of vesta will hold a record

369
00:13:35,190 --> 00:13:34,160
of the earliest history of the solar

370
00:13:36,310 --> 00:13:35,200
system

371
00:13:37,590 --> 00:13:36,320
um

372
00:13:39,990 --> 00:13:37,600
and uh

373
00:13:42,470 --> 00:13:40,000
another important thing is that our

374
00:13:45,269 --> 00:13:42,480
understanding of the history of the

375
00:13:49,110 --> 00:13:45,279
solar system tells us that these bodies

376
00:13:50,629 --> 00:13:49,120
were on their way to becoming a larger

377
00:13:52,710 --> 00:13:50,639
bodies we think of

378
00:13:55,350 --> 00:13:52,720
vesta as a proto-planet it would have

379
00:13:58,710 --> 00:13:55,360
grown into a planet had it been allowed

380
00:14:01,829 --> 00:13:58,720
to continue but the formation of jupiter

381
00:14:05,030 --> 00:14:01,839
started stirring up that region of the

382
00:14:07,110 --> 00:14:05,040
uh asteroid belt and preventing uh

383
00:14:08,949 --> 00:14:07,120
materials from coming together any

384
00:14:11,590 --> 00:14:08,959
longer in fact things started bumping

385
00:14:13,750 --> 00:14:11,600
into one another and breaking up

386
00:14:17,350 --> 00:14:13,760
so uh that

387
00:14:20,470 --> 00:14:17,360
we think that vesta is a good example of

388
00:14:22,710 --> 00:14:20,480

uh those early formation uh the earth

389
00:14:26,710 --> 00:14:22,720
the bodies that were forming early in

390
00:14:29,910 --> 00:14:26,720
the solar system uh however

391
00:14:31,110 --> 00:14:29,920
it's just an example of what was around

392
00:14:32,710 --> 00:14:31,120
and

393
00:14:33,750 --> 00:14:32,720
there were other bodies that came

394
00:14:35,590 --> 00:14:33,760
together

395
00:14:38,550 --> 00:14:35,600
in the inner part of the solar system

396
00:14:41,750 --> 00:14:38,560
they grew larger they formed uh mars

397
00:14:44,629 --> 00:14:41,760
they formed the earth and so bodies like

398
00:14:46,710 --> 00:14:44,639
vesta are building blocks we believe

399
00:14:48,949 --> 00:14:46,720
that these were examples of the building

400
00:14:51,670 --> 00:14:48,959
blocks so we're going back and doing

401
00:14:54,389 --> 00:14:51,680
some sort of uh you know investigation

402
00:14:56,790 --> 00:14:54,399
in our roots the roots of the solar

403
00:15:00,310 --> 00:14:56,800
system could i have the next video

404
00:15:06,069 --> 00:15:02,870
this shows an uh basically an artist's

405
00:15:07,030 --> 00:15:06,079
conception an animation of dawn flying

406
00:15:09,189 --> 00:15:07,040
over

407
00:15:11,110 --> 00:15:09,199
the surface of vesta

408
00:15:13,750 --> 00:15:11,120
and what you see there are craters and

409
00:15:16,230 --> 00:15:13,760
craters are very important to us on this

410
00:15:19,990 --> 00:15:16,240
mission because they excavate beneath

411
00:15:22,310 --> 00:15:20,000
the surface our instruments only uh

412
00:15:25,030 --> 00:15:22,320
sense what's on the surface they're not

413
00:15:26,870 --> 00:15:25,040

sensing very deeply only about one meter

414
00:15:28,870 --> 00:15:26,880
into the surface at most

415
00:15:32,470 --> 00:15:28,880
so these craters are very useful for

416
00:15:35,910 --> 00:15:32,480
probing deeper uh down into

417
00:15:37,110 --> 00:15:35,920
the body now i'd like to hand over uh

418
00:15:40,470 --> 00:15:37,120
the mic to

419
00:15:42,870 --> 00:15:40,480
dr carol raymond dr carol is raymond is

420
00:15:45,749 --> 00:15:42,880
the dawn deputy uh principal

421
00:15:47,829 --> 00:15:45,759
investigator and in that role she's been

422
00:15:50,790 --> 00:15:47,839
doing most of the scientific planning

423
00:15:52,790 --> 00:15:50,800
and she'll tell us more about uh what

424
00:15:54,629 --> 00:15:52,800
dawn is going to do

425
00:15:56,870 --> 00:15:54,639
carol thank you chris

426
00:15:58,870 --> 00:15:56,880
um so i'm gonna as chris said i'm going

427
00:16:01,269 --> 00:15:58,880
to talk to you about uh how we're going

428
00:16:03,910 --> 00:16:01,279
to explore vesta over the next year um

429
00:16:06,470 --> 00:16:03,920
this is an unprecedented opportunity to

430
00:16:08,470 --> 00:16:06,480
spend a year at a body uh that that we

431
00:16:11,269 --> 00:16:08,480
really know nothing about we're going to

432
00:16:12,230 --> 00:16:11,279
do a very comprehensive job of mapping

433
00:16:15,990 --> 00:16:12,240
it

434
00:16:18,150 --> 00:16:16,000
of the surface and in particular

435
00:16:20,870 --> 00:16:18,160
investigating the link between

436
00:16:22,470 --> 00:16:20,880
vesta and this class of meteorites which

437
00:16:23,990 --> 00:16:22,480
we have in hand

438
00:16:26,710 --> 00:16:24,000

on the earth

439
00:16:28,870 --> 00:16:26,720
we're particularly interested in a large

440
00:16:30,629 --> 00:16:28,880
feature at the south pole of vesta a

441
00:16:33,829 --> 00:16:30,639
large crater

442
00:16:35,910 --> 00:16:33,839
because it we expect it resulted from an

443
00:16:38,629 --> 00:16:35,920
impact which was large enough to have

444
00:16:40,550 --> 00:16:38,639
blown away the crust and expose the deep

445
00:16:41,749 --> 00:16:40,560
interior of vesta so we're going to be

446
00:16:45,110 --> 00:16:41,759
able to peer

447
00:16:46,470 --> 00:16:45,120
into it vesta by observing within this

448
00:16:49,590 --> 00:16:46,480
crater

449
00:16:52,389 --> 00:16:49,600
we'll be imaging to define the surface

450
00:16:53,829 --> 00:16:52,399
features of vesta at both large and

451
00:16:56,949 --> 00:16:53,839
small scales

452
00:16:59,590 --> 00:16:56,959
and using them to define geologic units

453
00:17:01,990 --> 00:16:59,600
based on their colors and textures

454
00:17:04,549 --> 00:17:02,000
and we'll be looking at individual lava

455
00:17:07,189 --> 00:17:04,559
flows and craters on the surface down to

456
00:17:08,789 --> 00:17:07,199
scales of tens of meters so we're really

457
00:17:11,590 --> 00:17:08,799
going to get to know the surface of

458
00:17:13,350 --> 00:17:11,600
vesta and and decipher its geologic

459
00:17:15,350 --> 00:17:13,360
history

460
00:17:18,069 --> 00:17:15,360
at a much coarser scale we're going to

461
00:17:19,990 --> 00:17:18,079
be looking at the abundances of the

462
00:17:21,510 --> 00:17:20,000
elements on the surface

463
00:17:23,669 --> 00:17:21,520

and this together with the mineral

464
00:17:26,230 --> 00:17:23,679
composition data is going to enable us

465
00:17:29,669 --> 00:17:26,240
to understand more about the formation

466
00:17:33,029 --> 00:17:29,679
of vesta the process by which it um

467
00:17:36,390 --> 00:17:33,039
resolved into different layers and what

468
00:17:38,630 --> 00:17:36,400
the impact of initial conditions was on

469
00:17:40,549 --> 00:17:38,640
vesta's evolution

470
00:17:42,950 --> 00:17:40,559
then finally we'll be

471
00:17:43,830 --> 00:17:42,960
mapping the gravity field of vesta

472
00:17:45,750 --> 00:17:43,840
to

473
00:17:50,789 --> 00:17:45,760
understand the internal layering and

474
00:17:53,430 --> 00:17:51,750
so

475
00:17:55,830 --> 00:17:53,440
i'll explain a little bit more then

476
00:17:58,150 --> 00:17:55,840
about what the instruments are on dawn

477
00:18:00,950 --> 00:17:58,160
and how we're using them

478
00:18:03,830 --> 00:18:00,960
we have two identical framing cameras

479
00:18:06,390 --> 00:18:03,840
from the max planck institute in germany

480
00:18:08,390 --> 00:18:06,400
um we use them one at a time

481
00:18:09,510 --> 00:18:08,400
and map the surface in seven color

482
00:18:11,830 --> 00:18:09,520
filters

483
00:18:14,390 --> 00:18:11,840
whereas most of the images are in the

484
00:18:17,590 --> 00:18:14,400
clear or panchromatic filter

485
00:18:19,590 --> 00:18:17,600
we image looking directly down at vesta

486
00:18:22,710 --> 00:18:19,600
as well as taking data from multiple

487
00:18:25,270 --> 00:18:22,720
angles so that we can use the shadows to

488
00:18:27,430 --> 00:18:25,280

develop the heights of the surface using

489
00:18:29,990 --> 00:18:27,440
stereo processing

490
00:18:31,270 --> 00:18:30,000
these image mosaics

491
00:18:33,990 --> 00:18:31,280
reveal

492
00:18:36,630 --> 00:18:34,000
the information about the craters

493
00:18:39,029 --> 00:18:36,640
and together with the

494
00:18:42,310 --> 00:18:39,039
the mineral composition data

495
00:18:44,390 --> 00:18:42,320
produce geologic maps

496
00:18:47,270 --> 00:18:44,400
we carry a visible and infrared

497
00:18:50,070 --> 00:18:47,280
spectrometer which measures the spectrum

498
00:18:52,310 --> 00:18:50,080
of reflected light from the surface in

499
00:18:54,870 --> 00:18:52,320
the uv to ir range

500
00:18:56,789 --> 00:18:54,880
and this gives us diagnostic information

501
00:18:58,230 --> 00:18:56,799
about the minerals

502
00:19:00,310 --> 00:18:58,240
so that we can

503
00:19:03,430 --> 00:19:00,320
together with the camera develop these

504
00:19:05,190 --> 00:19:03,440
geologic mosaics and and then decipher

505
00:19:08,310 --> 00:19:05,200
the processes which have been occurring

506
00:19:10,950 --> 00:19:08,320
on the surface to produce um the

507
00:19:14,710 --> 00:19:10,960
what we're uh seeing today

508
00:19:20,710 --> 00:19:18,390
is coming up we see two views of vesta

509
00:19:23,430 --> 00:19:20,720
in reflected light

510
00:19:25,909 --> 00:19:23,440
in single bands of visible light and

511
00:19:27,830 --> 00:19:25,919
infrared light and these images were

512
00:19:29,510 --> 00:19:27,840
taken from the um

513
00:19:31,510 --> 00:19:29,520

the visible infrared spectrometer

514
00:19:32,950 --> 00:19:31,520
provided by the inter

515
00:19:34,230 --> 00:19:32,960
italian national institute of

516
00:19:35,590 --> 00:19:34,240
astrophysics

517
00:19:39,029 --> 00:19:35,600
and they were taken mainly for

518
00:19:41,110 --> 00:19:39,039
calibration purposes so they're very um

519
00:19:42,789 --> 00:19:41,120
not very well resolved and

520
00:19:44,950 --> 00:19:42,799
much lower resolution than the framing

521
00:19:47,669 --> 00:19:44,960
camera images you just saw but even at

522
00:19:50,310 --> 00:19:47,679
this resolution at 200 000

523
00:19:52,710 --> 00:19:50,320
miles from vesto we can see some

524
00:19:57,909 --> 00:19:52,720
differences in the reflectance of vesta

525
00:20:00,710 --> 00:19:59,110
in the next

526
00:20:03,430 --> 00:20:00,720
animation

527
00:20:04,630 --> 00:20:03,440
we'll be looking at a simulation

528
00:20:05,669 --> 00:20:04,640
of

529
00:20:09,270 --> 00:20:05,679
dawn

530
00:20:13,590 --> 00:20:11,510
and as we spiral in on approach using

531
00:20:16,390 --> 00:20:13,600
the ion propulsion system

532
00:20:18,470 --> 00:20:16,400
we capture and then continue to thrust

533
00:20:21,029 --> 00:20:18,480
to achieve our first dedicated science

534
00:20:23,029 --> 00:20:21,039
orbit which is the survey orbit at about

535
00:20:25,510 --> 00:20:23,039
2 700 kilometers

536
00:20:26,789 --> 00:20:25,520
there we turn to vesta we spend about 20

537
00:20:29,270 --> 00:20:26,799
days

538
00:20:30,789 --> 00:20:29,280

in seven orbits making low resolution

539
00:20:33,270 --> 00:20:30,799
maps with the visible infrared

540
00:20:36,549 --> 00:20:33,280
spectrometer and taking

541
00:20:40,230 --> 00:20:36,559
limb mosaic and direct

542
00:20:42,950 --> 00:20:40,240
images of the surface with the cameras

543
00:20:45,110 --> 00:20:42,960
we then spend about 28 days thrusting

544
00:20:48,870 --> 00:20:45,120
into our high altitude mapping orbit

545
00:20:50,950 --> 00:20:48,880
where we are spending 30 days making six

546
00:20:53,750 --> 00:20:50,960
complete global mosaics of the surface

547
00:20:56,070 --> 00:20:53,760
in the clear filter and in color filters

548
00:20:58,070 --> 00:20:56,080
and at multiple angles to do the height

549
00:21:00,549 --> 00:20:58,080
mapping

550
00:21:02,789 --> 00:21:00,559
we also take high resolution

551
00:21:05,590 --> 00:21:02,799
spectrometer data mainly of the southern

552
00:21:07,990 --> 00:21:05,600
hemisphere which is well lit at the time

553
00:21:11,270 --> 00:21:08,000
of this orbit

554
00:21:13,270 --> 00:21:11,280
we subsequently spend another 39 days

555
00:21:15,990 --> 00:21:13,280
spiraling with the ion propulsion system

556
00:21:18,630 --> 00:21:16,000
down to the lowest altitude orbit which

557
00:21:20,630 --> 00:21:18,640
is only about 200 kilometers above the

558
00:21:23,510 --> 00:21:20,640
surface and there we have enough

559
00:21:26,950 --> 00:21:23,520
sensitivity to measure gamma-ray

560
00:21:29,510 --> 00:21:26,960
signatures of the individual elements

561
00:21:31,350 --> 00:21:29,520
and also to map the

562
00:21:33,590 --> 00:21:31,360
to be sensitive to the perturbations of

563
00:21:35,750 --> 00:21:33,600

the gravity field and map the the

564
00:21:38,070 --> 00:21:35,760
gravity of the body

565
00:21:39,990 --> 00:21:38,080
after spending our 70 days in the low

566
00:21:41,590 --> 00:21:40,000
altitude orbit we

567
00:21:43,750 --> 00:21:41,600
spiral back out

568
00:21:46,230 --> 00:21:43,760
and stop again at the high altitude

569
00:21:48,630 --> 00:21:46,240
orbit to map the terrain which has

570
00:21:51,350 --> 00:21:48,640
become newly illuminated

571
00:21:52,950 --> 00:21:51,360
as the the sun has moved north

572
00:21:54,710 --> 00:21:52,960
relative to vesta

573
00:21:57,190 --> 00:21:54,720
so we complete our height mapping in

574
00:21:59,110 --> 00:21:57,200
that orbit and then we will continue to

575
00:22:01,909 --> 00:21:59,120
spiral out until we've

576
00:22:03,830 --> 00:22:01,919
escaped from vesta and on we go to

577
00:22:06,950 --> 00:22:03,840
series

578
00:22:08,549 --> 00:22:06,960
so while we take data all types of data

579
00:22:11,430 --> 00:22:08,559
in each orbit

580
00:22:12,470 --> 00:22:11,440
each orbit is optimized for a particular

581
00:22:14,789 --> 00:22:12,480
objective

582
00:22:16,789 --> 00:22:14,799
and as i mentioned in survey the field

583
00:22:19,110 --> 00:22:16,799
of view of the spectrometer is large

584
00:22:21,190 --> 00:22:19,120
enough that we can make a global mapping

585
00:22:24,230 --> 00:22:21,200
of the surface so that's our primary

586
00:22:26,310 --> 00:22:24,240
objective in that orbit and um we do

587
00:22:28,549 --> 00:22:26,320
this with the sun almost directly behind

588
00:22:31,270 --> 00:22:28,559

us which is optimum for measuring the

589
00:22:33,190 --> 00:22:31,280
reflected light from the surface

590
00:22:35,669 --> 00:22:33,200
as we go lower and lower in orbit the

591
00:22:37,510 --> 00:22:35,679
sun angle increases which

592
00:22:38,950 --> 00:22:37,520
is better for taking

593
00:22:41,190 --> 00:22:38,960
the framing camera data because we'd

594
00:22:43,590 --> 00:22:41,200
like to see shadows to be able to look

595
00:22:46,230 --> 00:22:43,600
at the the topography

596
00:22:47,350 --> 00:22:46,240
so um as we go lower we still obtain

597
00:22:50,470 --> 00:22:47,360
higher and higher resolution

598
00:22:52,710 --> 00:22:50,480
spectrometer data but it's um it's it's

599
00:22:56,549 --> 00:22:52,720
not as complete or as

600
00:22:58,549 --> 00:22:56,559
high sensitivity as as above

601
00:23:01,590 --> 00:22:58,559
when we we designed our low altitude

602
00:23:03,430 --> 00:23:01,600
orbit mapping mapping orbit to

603
00:23:05,270 --> 00:23:03,440
be able to resolve the individual

604
00:23:07,350 --> 00:23:05,280
elements and the ratios of those

605
00:23:09,590 --> 00:23:07,360
elements which tell us about the

606
00:23:12,070 --> 00:23:09,600
chemical evolution of the surface of

607
00:23:14,549 --> 00:23:12,080
vesta and enough resolution in the

608
00:23:18,149 --> 00:23:14,559
gravity field to be able to understand

609
00:23:22,470 --> 00:23:20,390
and then the next animation

610
00:23:25,830 --> 00:23:22,480
we see in a notional sense

611
00:23:28,470 --> 00:23:25,840
um the spacecraft uh in its high

612
00:23:31,190 --> 00:23:28,480
altitude mapping orbit um vesta is

613
00:23:34,230 --> 00:23:31,200

rotating at about 5.3 hours and this is

614
00:23:36,390 --> 00:23:34,240
a 12-hour orbit so we see um coming down

615
00:23:39,029 --> 00:23:36,400
the lit side of vesta taking the framing

616
00:23:41,269 --> 00:23:39,039
camera images which are the blue squares

617
00:23:43,590 --> 00:23:41,279
and we also see that co-located with the

618
00:23:46,630 --> 00:23:43,600
framing camera images is the the green

619
00:23:47,590 --> 00:23:46,640
slit which is the vera spectrometer

620
00:23:49,750 --> 00:23:47,600
when the

621
00:23:51,669 --> 00:23:49,760
spacecraft's on the dark side of vesta

622
00:23:53,830 --> 00:23:51,679
it's turning to earth and it's sending

623
00:23:55,590 --> 00:23:53,840
those data back before it comes around

624
00:23:58,870 --> 00:23:55,600
and starts again

625
00:24:01,510 --> 00:23:58,880
we do take these images uh constantly in

626
00:24:03,430 --> 00:24:01,520
in swaths as as the body rotates under

627
00:24:06,149 --> 00:24:03,440
us and in that manner we build up

628
00:24:13,430 --> 00:24:06,159
complete coverage of the surface over 10

629
00:24:19,590 --> 00:24:14,870
so um

630
00:24:22,470 --> 00:24:19,600
i'd like to return then to the last

631
00:24:25,350 --> 00:24:22,480
rotation movie we took of vesta on june

632
00:24:27,669 --> 00:24:25,360
20th and talk a little bit about why

633
00:24:30,950 --> 00:24:27,679
anybody should care about

634
00:24:35,830 --> 00:24:33,590
in this animation

635
00:24:39,110 --> 00:24:35,840
we compare the data from hubble space

636
00:24:41,750 --> 00:24:39,120
telescope to the latest data from dawn

637
00:24:44,230 --> 00:24:41,760
they're rotating uh in the same manner

638
00:24:46,470 --> 00:24:44,240

and what we see is the intriguing

639
00:24:49,510 --> 00:24:46,480
patterns of bright and dark and the

640
00:24:53,029 --> 00:24:49,520
ellipsoidal shape of vesta resolved by

641
00:24:55,590 --> 00:24:53,039
the hubble space telescope has now

642
00:24:57,510 --> 00:24:55,600
resolved into a very complex

643
00:24:59,510 --> 00:24:57,520
pattern of

644
00:25:00,710 --> 00:24:59,520
of brightness variations on the surface

645
00:25:02,549 --> 00:25:00,720
of vesta

646
00:25:05,269 --> 00:25:02,559
and intriguing

647
00:25:06,870 --> 00:25:05,279
suggestions of topography

648
00:25:09,430 --> 00:25:06,880
making it obvious

649
00:25:11,110 --> 00:25:09,440
why it was really worth getting to this

650
00:25:13,269 --> 00:25:11,120
body

651
00:25:15,029 --> 00:25:13,279
once we fully map the chemical nature of

652
00:25:17,110 --> 00:25:15,039
the vesta surface and understand its

653
00:25:19,190 --> 00:25:17,120
relationship to the meteorites

654
00:25:21,190 --> 00:25:19,200
write its geologic history

655
00:25:23,029 --> 00:25:21,200
understand its topography and its

656
00:25:25,110 --> 00:25:23,039
gravity field

657
00:25:27,510 --> 00:25:25,120
we are going to

658
00:25:30,390 --> 00:25:27,520
begin to understand

659
00:25:34,070 --> 00:25:30,400
the role of vesta's size the timing of

660
00:25:35,029 --> 00:25:34,080
its formation in its bombardment history

661
00:25:36,070 --> 00:25:35,039
in

662
00:25:40,549 --> 00:25:36,080
the

663
00:25:42,230 --> 00:25:40,559

we see today

664
00:25:44,230 --> 00:25:42,240
and this proto planet is chris that is

665
00:25:46,470 --> 00:25:44,240
literally a building block of the

666
00:25:47,909 --> 00:25:46,480
terrestrial planets

667
00:25:50,470 --> 00:25:47,919
this will give us better tools to

668
00:25:53,190 --> 00:25:50,480
understand the thousands of fragments

669
00:25:55,750 --> 00:25:53,200
that are out there in the asteroid belt

670
00:25:57,669 --> 00:25:55,760
that and understand better than

671
00:25:59,990 --> 00:25:57,679
how they contributed to shaping our

672
00:26:02,149 --> 00:26:00,000
planetary neighborhood

673
00:26:04,549 --> 00:26:02,159
so in the course of preparing all the

674
00:26:07,669 --> 00:26:04,559
science observation plans were done

675
00:26:08,830 --> 00:26:07,679
it's become clear that this tiny world

676
00:26:11,190 --> 00:26:08,840
has huge

677
00:26:14,149 --> 00:26:11,200
importance vest is a window into the

678
00:26:16,149 --> 00:26:14,159
early origins of our solar system and

679
00:26:18,310 --> 00:26:16,159
the terrestrial planets

680
00:26:19,750 --> 00:26:18,320
and as we explore vesta we take a

681
00:26:21,590 --> 00:26:19,760
virtual journey

682
00:26:23,350 --> 00:26:21,600
back in time to the beginning of the

683
00:26:25,110 --> 00:26:23,360
solar system

684
00:26:27,269 --> 00:26:25,120
we're all extremely excited we're

685
00:26:29,430 --> 00:26:27,279
literally on the edge of our seats

686
00:26:30,630 --> 00:26:29,440
waiting for the status to come in and we

687
00:26:31,990 --> 00:26:30,640
would like you all to come on the

688
00:26:33,269 --> 00:26:32,000

journey with us

689
00:26:36,470 --> 00:26:33,279
thank you

690
00:26:38,470 --> 00:26:36,480
okay so we're going to now transition

691
00:26:40,070 --> 00:26:38,480
into questions and

692
00:26:41,990 --> 00:26:40,080
before we go to the phone bridge i would

693
00:26:43,510 --> 00:26:42,000
like to remind our audience out there

694
00:26:45,149 --> 00:26:43,520
that all of the information is on the

695
00:26:49,269 --> 00:26:45,159
web at

696
00:26:49,279 --> 00:26:55,990
let's go to the la times tom

697
00:27:00,470 --> 00:26:58,950
uh when you say one in 20 of the

698
00:27:03,110 --> 00:27:00,480
meteorites you reach earth come from

699
00:27:04,230 --> 00:27:03,120
vesta i mean can you explain that are

700
00:27:06,390 --> 00:27:04,240
these the

701
00:27:07,510 --> 00:27:06,400
rubble that surrounds it in orbit are

702
00:27:09,750 --> 00:27:07,520
they coming

703
00:27:11,350 --> 00:27:09,760
being knocked off fester or what do you

704
00:27:14,549 --> 00:27:11,360
mean precisely

705
00:27:16,549 --> 00:27:14,559
um that if you take a look at the uh

706
00:27:19,029 --> 00:27:16,559
pictures we just showed you'll see that

707
00:27:21,510 --> 00:27:19,039
the surface is heavily uh cratered or

708
00:27:24,470 --> 00:27:21,520
appears to be and it's very irregular

709
00:27:25,750 --> 00:27:24,480
so over the years much material has been

710
00:27:29,510 --> 00:27:25,760
knocked off

711
00:27:32,870 --> 00:27:29,520
the uh body and is floating between us

712
00:27:34,470 --> 00:27:32,880
and the earth or the earth and vesta

713
00:27:37,830 --> 00:27:34,480

and it gets into

714
00:27:40,310 --> 00:27:37,840
uh gravitational resonances with jupiter

715
00:27:42,389 --> 00:27:40,320
and gets scattered uh towards the earth

716
00:27:44,789 --> 00:27:42,399
and so there's this constant stream

717
00:27:47,430 --> 00:27:44,799
almost like a highway of material uh

718
00:27:49,350 --> 00:27:47,440
from the neighborhood of vesta the stuff

719
00:27:52,149 --> 00:27:49,360
that was uh knocked off perhaps

720
00:27:54,149 --> 00:27:52,159
originally uh four billion years ago but

721
00:27:56,789 --> 00:27:54,159
maybe some only one billion

722
00:27:59,350 --> 00:27:56,799
some maybe just a million years ago uh

723
00:28:01,029 --> 00:27:59,360
and that makes its way to the earth and

724
00:28:03,350 --> 00:28:01,039
uh falls through the atmosphere and we

725
00:28:06,789 --> 00:28:03,360
pick it up on the surface of the earth

726
00:28:08,230 --> 00:28:06,799
now uh having said that these are from

727
00:28:12,230 --> 00:28:08,240
vesta

728
00:28:15,669 --> 00:28:12,240
all i can say is that this material

729
00:28:18,549 --> 00:28:15,679
has the same reflectivity as vesta the

730
00:28:21,750 --> 00:28:18,559
same uh sort of inferred composition as

731
00:28:24,789 --> 00:28:21,760
we'd expect from vesta it looks like it

732
00:28:27,269 --> 00:28:24,799
was formed on the surface of a body

733
00:28:28,789 --> 00:28:27,279
about the size of vesta

734
00:28:31,110 --> 00:28:28,799
and it

735
00:28:34,389 --> 00:28:31,120
the material that comes down to earth

736
00:28:37,990 --> 00:28:34,399
shows the uh evidence of a heavy

737
00:28:40,549 --> 00:28:38,000
bombardment so we put all that uh

738
00:28:42,710 --> 00:28:40,559

information together and we believe that

739
00:28:47,190 --> 00:28:42,720
the original source the ultimate source

740
00:28:51,269 --> 00:28:49,590
okay our next caller is

741
00:28:56,070 --> 00:28:51,279
pete spots on the christian science

742
00:28:59,510 --> 00:28:58,549
yeah can you hear me go ahead

743
00:29:01,669 --> 00:28:59,520
hello

744
00:29:03,510 --> 00:29:01,679
we can hear you yeah uh but the question

745
00:29:05,750 --> 00:29:03,520
i have is um

746
00:29:08,070 --> 00:29:05,760
oh good good okay thanks uh yeah i was

747
00:29:09,110 --> 00:29:08,080
wondering um uh and you were sort of

748
00:29:11,750 --> 00:29:09,120
getting to it when you were showing the

749
00:29:13,830 --> 00:29:11,760
humble images but i wonder um with the

750
00:29:15,750 --> 00:29:13,840
support you may have been getting over

751
00:29:16,870 --> 00:29:15,760
the you know last couple of years from

752
00:29:18,870 --> 00:29:16,880
hubble and from ground-based

753
00:29:20,789 --> 00:29:18,880
observatories i wonder if there are any

754
00:29:22,630 --> 00:29:20,799
examples of sort of specific

755
00:29:25,110 --> 00:29:22,640
observations that have

756
00:29:27,029 --> 00:29:25,120
tended to to wet your folks appetite for

757
00:29:28,710 --> 00:29:27,039
this understanding the excitement level

758
00:29:31,750 --> 00:29:28,720
already is pretty high

759
00:29:34,230 --> 00:29:31,760
uh well we have uh in the audience here

760
00:29:37,590 --> 00:29:34,240
uh with us john young lee

761
00:29:39,990 --> 00:29:37,600
uh who was one of those who took the uh

762
00:29:41,750 --> 00:29:40,000
hubble the most recent hubble pictures

763
00:29:45,350 --> 00:29:41,760

and so if

764
00:29:48,310 --> 00:29:45,360
uh to as a typical excited observer uh

765
00:29:51,269 --> 00:29:48,320
let's ask john young what uh has whetted

766
00:29:54,549 --> 00:29:52,549
well um

767
00:29:56,870 --> 00:29:54,559
previously hubble has given us a lot of

768
00:29:58,549 --> 00:29:56,880
support to observe vesta and

769
00:30:01,990 --> 00:29:58,559
in the mission and uh

770
00:30:04,149 --> 00:30:02,000
um there are there were totally four hst

771
00:30:07,430 --> 00:30:04,159
hubble space telescope observations of

772
00:30:09,029 --> 00:30:07,440
vesta and we used those images to map

773
00:30:11,029 --> 00:30:09,039
vesta's northern hemisphere southern

774
00:30:13,510 --> 00:30:11,039
hemisphere and also to infer the shape

775
00:30:16,230 --> 00:30:13,520
of vesta and most recently we used

776
00:30:19,029 --> 00:30:16,240
hubble images to um to improve the

777
00:30:20,950 --> 00:30:19,039
orientation of vesta and that has give

778
00:30:24,470 --> 00:30:20,960
down a lot of help in the trajectory

779
00:30:26,310 --> 00:30:24,480
trajectory design and long-term planning

780
00:30:28,950 --> 00:30:26,320
but you know the limit of hubble is that

781
00:30:31,350 --> 00:30:28,960
it is uh near the earth and it's very

782
00:30:33,110 --> 00:30:31,360
far from vesta so the spatial resolution

783
00:30:34,230 --> 00:30:33,120
is very very low

784
00:30:36,070 --> 00:30:34,240
and

785
00:30:37,269 --> 00:30:36,080
that's why we still need dawn to go

786
00:30:43,269 --> 00:30:37,279
there and

787
00:30:47,190 --> 00:30:45,350
okay thank you

788
00:30:48,950 --> 00:30:47,200

well actually i have a question that's

789
00:30:50,070 --> 00:30:48,960
come in we have a lot of media watching

790
00:30:53,269 --> 00:30:50,080
this and

791
00:30:55,070 --> 00:30:53,279
also some museums and the question is

792
00:30:58,710 --> 00:30:55,080
from the

793
00:31:00,149 --> 00:30:58,720
com.coms that talk about careers and

794
00:31:02,070 --> 00:31:00,159
scientists and engineers when they get

795
00:31:04,230 --> 00:31:02,080
together exciting things happen so they

796
00:31:05,909 --> 00:31:04,240
would like a question on for each of you

797
00:31:07,990 --> 00:31:05,919
what inspired you all to go on your

798
00:31:10,789 --> 00:31:08,000
respective careers

799
00:31:14,549 --> 00:31:10,799
jim you want to start that

800
00:31:19,750 --> 00:31:17,509
actually my father

801
00:31:21,669 --> 00:31:19,760
was in the aerospace industry and worked

802
00:31:25,509 --> 00:31:21,679
on the apollo lem

803
00:31:28,230 --> 00:31:25,519
and encouraged me uh to pursue

804
00:31:29,990 --> 00:31:28,240
my talents in science and math and so i

805
00:31:32,470 --> 00:31:30,000
went to college and i got a degree in

806
00:31:34,870 --> 00:31:32,480
physics and found that i liked it and

807
00:31:38,630 --> 00:31:34,880
over time ended up back in the aerospace

808
00:31:42,389 --> 00:31:40,549
okay well i grew up in florida which was

809
00:31:44,470 --> 00:31:42,399
not too far from the kennedy space

810
00:31:47,269 --> 00:31:44,480
center so i could actually

811
00:31:48,549 --> 00:31:47,279
watch the space shuttle as it was

812
00:31:51,110 --> 00:31:48,559
launched and so

813
00:31:53,830 --> 00:31:51,120

uh that that in addition to an interest

814
00:31:55,590 --> 00:31:53,840
in science and engineering uh led me to

815
00:31:57,830 --> 00:31:55,600
a degree in aerospace engineering at

816
00:32:00,470 --> 00:31:57,840
purdue university and of course that uh

817
00:32:01,830 --> 00:32:00,480
led me to the jeffer paulson laboratory

818
00:32:04,389 --> 00:32:01,840
chris

819
00:32:06,950 --> 00:32:04,399
well when i was in high school i took an

820
00:32:09,110 --> 00:32:06,960
aptitude test and the guidance counselor

821
00:32:10,870 --> 00:32:09,120
came up to me and said you should be an

822
00:32:12,630 --> 00:32:10,880
engineer

823
00:32:15,430 --> 00:32:12,640
and i said

824
00:32:18,549 --> 00:32:15,440
engineer uh maybe you know i rather do

825
00:32:21,430 --> 00:32:18,559
science okay so i started uh you know

826
00:32:24,070 --> 00:32:21,440
taking courses that uh prepared me for

827
00:32:27,190 --> 00:32:24,080
uh doing scientific research and uh when

828
00:32:29,350 --> 00:32:27,200
i got my uh bachelor's degree uh i

829
00:32:31,110 --> 00:32:29,360
really didn't know exactly i mean

830
00:32:32,950 --> 00:32:31,120
there's a you know a lot of boring

831
00:32:33,830 --> 00:32:32,960
things you can do in physics

832
00:32:36,149 --> 00:32:33,840
and

833
00:32:37,830 --> 00:32:36,159
i had uh got prepared myself well in

834
00:32:39,509 --> 00:32:37,840
physics but uh

835
00:32:41,190 --> 00:32:39,519
look choosing between these various

836
00:32:43,430 --> 00:32:41,200
things was a little bit difficult but i

837
00:32:45,750 --> 00:32:43,440
took a summer job in which i

838
00:32:48,789 --> 00:32:45,760

worked on satellite data we were taking

839
00:32:51,750 --> 00:32:48,799
observations basically of the sun using

840
00:32:52,789 --> 00:32:51,760
measurements in the earth's ionosphere

841
00:32:54,710 --> 00:32:52,799
and

842
00:32:56,310 --> 00:32:54,720
i like that of course then the summer

843
00:32:57,909 --> 00:32:56,320
was over and that's the problem with

844
00:33:00,389 --> 00:32:57,919
summer vacations you know you have to

845
00:33:02,710 --> 00:33:00,399
then hit back into the real world and so

846
00:33:04,870 --> 00:33:02,720
i uh went into a physics department and

847
00:33:07,750 --> 00:33:04,880
uh started to uh

848
00:33:10,149 --> 00:33:07,760
do uh some of these things that uh

849
00:33:11,669 --> 00:33:10,159
you know large teams of 200 physicists

850
00:33:12,789 --> 00:33:11,679
do

851
00:33:14,549 --> 00:33:12,799
and

852
00:33:16,789 --> 00:33:14,559
i said you know maybe

853
00:33:18,870 --> 00:33:16,799
maybe there's some space physics around

854
00:33:21,430 --> 00:33:18,880
here that so i went around the

855
00:33:24,710 --> 00:33:21,440
university and talked to people and i

856
00:33:26,389 --> 00:33:24,720
found a group that was working in space

857
00:33:28,230 --> 00:33:26,399
i said do you have room for another

858
00:33:30,230 --> 00:33:28,240
person and they said yes and that

859
00:33:32,310 --> 00:33:30,240
started me off and i just have been

860
00:33:35,350 --> 00:33:32,320
lucky ever since of

861
00:33:37,430 --> 00:33:35,360
being able to get into exciting projects

862
00:33:39,269 --> 00:33:37,440
and go to one

863
00:33:43,350 --> 00:33:39,279

stage of exploration to another and i've

864
00:33:46,789 --> 00:33:43,360
been very very lucky in my career carol

865
00:33:49,830 --> 00:33:46,799
yeah i always loved science in school

866
00:33:51,750 --> 00:33:49,840
and i studied geology and physics got a

867
00:33:53,669 --> 00:33:51,760
degree in both

868
00:33:55,830 --> 00:33:53,679
and then went on to grad school

869
00:33:57,750 --> 00:33:55,840
and while i was getting my degree at

870
00:33:59,269 --> 00:33:57,760
columbia university i was studying the

871
00:34:00,710 --> 00:33:59,279
floor of the ocean

872
00:34:03,269 --> 00:34:00,720
and how the

873
00:34:05,269 --> 00:34:03,279
interior of the earth convected and um

874
00:34:08,550 --> 00:34:05,279
and you know various things about the

875
00:34:09,349 --> 00:34:08,560
dynamics on the interior of the earth

876
00:34:11,990 --> 00:34:09,359
but

877
00:34:13,909 --> 00:34:12,000
during that time was a time when

878
00:34:15,669 --> 00:34:13,919
earth observation from space was

879
00:34:16,710 --> 00:34:15,679
becoming more and more

880
00:34:19,190 --> 00:34:16,720
common

881
00:34:21,909 --> 00:34:19,200
and i started to pull in satellite data

882
00:34:22,790 --> 00:34:21,919
sets to to to get a different view of of

883
00:34:24,629 --> 00:34:22,800
things

884
00:34:27,270 --> 00:34:24,639
and before i knew it i was working at

885
00:34:29,270 --> 00:34:27,280
the jet propulsion lab

886
00:34:30,790 --> 00:34:29,280
trying to

887
00:34:32,710 --> 00:34:30,800
help with getting

888
00:34:35,270 --> 00:34:32,720

gravity and magnetic field satellites

889
00:34:36,629 --> 00:34:35,280
launched around the earth

890
00:34:39,109 --> 00:34:36,639
but

891
00:34:41,589 --> 00:34:39,119
you know a geophysicist on the earth is

892
00:34:43,030 --> 00:34:41,599
no different than a planetary scientist

893
00:34:44,389 --> 00:34:43,040
at mars

894
00:34:47,030 --> 00:34:44,399
pretty much interested in the same

895
00:34:49,669 --> 00:34:47,040
things and the data from the mars global

896
00:34:52,710 --> 00:34:49,679
surveyor began to come in

897
00:34:55,750 --> 00:34:52,720
and opened a whole new

898
00:34:56,869 --> 00:34:55,760
view into mars history which then just

899
00:34:59,510 --> 00:34:56,879
became

900
00:35:01,829 --> 00:34:59,520
incredibly interesting so

901
00:35:04,390 --> 00:35:01,839
at that point i i really started to

902
00:35:06,150 --> 00:35:04,400
invest most of my time into planetary

903
00:35:09,190 --> 00:35:06,160
scientists and the evolution of

904
00:35:11,109 --> 00:35:09,200
terrestrial bodies of which uh vesta is

905
00:35:13,270 --> 00:35:11,119
one uh we call it the smallest

906
00:35:15,510 --> 00:35:13,280
terrestrial planet um

907
00:35:17,030 --> 00:35:15,520
and it's it's very uh a lot of the

908
00:35:19,030 --> 00:35:17,040
things are going on there are not that

909
00:35:20,710 --> 00:35:19,040
much different than what happens on the

910
00:35:22,950 --> 00:35:20,720
earth

911
00:35:25,829 --> 00:35:22,960
but i'll also say that i i think what

912
00:35:26,550 --> 00:35:25,839
really drove me and a lot in my career

913
00:35:27,349 --> 00:35:26,560

was

914
00:35:29,270 --> 00:35:27,359
the

915
00:35:31,750 --> 00:35:29,280
desire to explore

916
00:35:33,589 --> 00:35:31,760
to always go to new places to see new

917
00:35:36,150 --> 00:35:33,599
things i've done a lot of research in

918
00:35:38,470 --> 00:35:36,160
antarctica i've sailed on ships

919
00:35:40,790 --> 00:35:38,480
surveying the ocean and taking this

920
00:35:42,630 --> 00:35:40,800
virtual journey is is very similar in

921
00:35:43,430 --> 00:35:42,640
terms of the excitement level and and

922
00:35:45,829 --> 00:35:43,440
just

923
00:35:47,670 --> 00:35:45,839
the wonderful um

924
00:35:50,310 --> 00:35:47,680
feeling of of achievement you get when

925
00:35:52,470 --> 00:35:50,320
you've done something really really

926
00:35:54,630 --> 00:35:52,480
really interesting so

927
00:35:57,109 --> 00:35:54,640
thank you all let's uh take at least

928
00:35:59,750 --> 00:35:57,119
another call from our phone line let's

929
00:36:05,589 --> 00:35:59,760
go to mike wahl from space.com mike are

930
00:36:08,630 --> 00:36:06,870
um

931
00:36:13,349 --> 00:36:08,640
yeah sure can you guys hear me go ahead

932
00:36:17,190 --> 00:36:16,069
all right yeah i was just hoping that

933
00:36:18,550 --> 00:36:17,200
that you guys could actually talk a

934
00:36:21,109 --> 00:36:18,560
little bit about what it's going to be

935
00:36:21,990 --> 00:36:21,119
like to have to be captured

936
00:36:25,430 --> 00:36:22,000
by

937
00:36:27,109 --> 00:36:25,440
concerned at all i mean is this going to

938
00:36:29,829 --> 00:36:27,119

be a very complicated maneuver or a

939
00:36:31,670 --> 00:36:29,839
tricky one because it's it's it's a

940
00:36:33,670 --> 00:36:31,680
relatively small body it doesn't have

941
00:36:35,670 --> 00:36:33,680
all that much gravity i mean is this

942
00:36:37,589 --> 00:36:35,680
like a like a very complicated maneuver

943
00:36:41,190 --> 00:36:37,599
that you're going to be doing to

944
00:36:43,430 --> 00:36:41,200
actually to go into orbit around vesta

945
00:36:46,069 --> 00:36:43,440
okay i'll go ahead and take that one um

946
00:36:47,829 --> 00:36:46,079
it turns out that uh this is a different

947
00:36:50,550 --> 00:36:47,839
type of encounter than we're used to

948
00:36:52,310 --> 00:36:50,560
with most of either the planetary types

949
00:36:54,470 --> 00:36:52,320
of encounters you've seen that have the

950
00:36:56,230 --> 00:36:54,480
critical orbit insertion burns and it's

951
00:36:58,310 --> 00:36:56,240
also different than the small body

952
00:37:00,550 --> 00:36:58,320
flybys that we've seen on some of the

953
00:37:03,510 --> 00:37:00,560
recent missions as well

954
00:37:04,310 --> 00:37:03,520
vesta is not a tiny small body

955
00:37:05,990 --> 00:37:04,320
like

956
00:37:07,829 --> 00:37:06,000
temple or hartley or any of those which

957
00:37:10,069 --> 00:37:07,839
are only just a few kilometers very

958
00:37:13,589 --> 00:37:10,079
small traveling at very high speeds

959
00:37:14,870 --> 00:37:13,599
vesta's large is 500 kilometers across

960
00:37:16,710 --> 00:37:14,880
it has a

961
00:37:18,630 --> 00:37:16,720
small but a significant amount of

962
00:37:21,270 --> 00:37:18,640
gravity and so

963
00:37:24,390 --> 00:37:21,280

being captured by vesta's gravity

964
00:37:26,470 --> 00:37:24,400
is not a problem it's not challenging

965
00:37:28,550 --> 00:37:26,480
we're also different because we're using

966
00:37:30,470 --> 00:37:28,560
our ion propulsion system

967
00:37:32,870 --> 00:37:30,480
to capture into orbit around vesta as

968
00:37:35,349 --> 00:37:32,880
opposed to more conventional missions

969
00:37:37,109 --> 00:37:35,359
that use a chemical system where they

970
00:37:38,950 --> 00:37:37,119
have a specific burn that has to happen

971
00:37:40,710 --> 00:37:38,960
at a very specific time

972
00:37:43,430 --> 00:37:40,720
with the ion propulsion system again

973
00:37:46,230 --> 00:37:43,440
we're just shaping our orbit to gently

974
00:37:47,990 --> 00:37:46,240
uh pace vesta's orbit around the sun and

975
00:37:50,390 --> 00:37:48,000
so at that point we really just slowly

976
00:37:52,790 --> 00:37:50,400
rendezvous with vesta and slowly

977
00:37:55,510 --> 00:37:52,800
captured by into orbit around it and

978
00:37:56,790 --> 00:37:55,520
it's a it's a very slow smooth gradual

979
00:37:58,950 --> 00:37:56,800
process

980
00:38:00,550 --> 00:37:58,960
that happens uh very gently on this

981
00:38:01,990 --> 00:38:00,560
mission as opposed to some of the more

982
00:38:04,550 --> 00:38:02,000
conventional missions that we've seen in

983
00:38:05,910 --> 00:38:04,560
the past

984
00:38:07,910 --> 00:38:05,920
okay we're going to go ahead and wrap it

985
00:38:10,470 --> 00:38:07,920
up i want to thank you all for joining

986
00:38:14,230 --> 00:38:10,480
us congratulations to the dawn team and

987
00:38:15,910 --> 00:38:14,240
again visit www.nasa.gov