1
00:00:53,430 --> 00:00:50,790
live from the space coast of florida

2
00:00:56,549 --> 00:00:53,440
lucy is on the ground but headed towards

3
00:01:01,270 --> 00:00:56,559
some asteroids and this is nasa's launch

4
00:01:31,140 --> 00:01:29,350
[Music]

5
00:01:43,950 --> 00:01:31,150
liftoff

6
00:01:43,960 --> 00:01:58,469
[Music]

7
00:02:05,030 --> 00:02:01,990
lucy in the sky with asteroids in l

8
00:02:07,910 --> 00:02:05,040
minus 34 minutes this atlas v rocket

9
00:02:10,469 --> 00:02:07,920
will send lucy on the first ever space

10
00:02:12,470 --> 00:02:10,479
mission to study the trojan asteroids

11
00:02:13,190 --> 00:02:12,480
which share jupiter's orbit around the

12
00:02:15,110 --> 00:02:13,200
sun

13
00:02:17,589 --> 00:02:15,120

named after the lucy fossil the

14
00:02:20,790 --> 00:02:17,599
spacecraft will visit eight asteroids

15
00:02:22,710 --> 00:02:20,800
over 12 years as we seek to uncover the

16
00:02:24,070 --> 00:02:22,720
mysteries of our solar system's

17
00:02:25,990 --> 00:02:24,080
formation

18
00:02:27,990 --> 00:02:26,000
welcome and thank you for joining us

19
00:02:30,550 --> 00:02:28,000
here at nasa's kennedy space center on

20
00:02:32,470 --> 00:02:30,560
the east coast of florida i'm daryl nail

21
00:02:34,550 --> 00:02:32,480
we got a great launch for you that's

22
00:02:37,030 --> 00:02:34,560
right and i'm marie lewis and we are

23
00:02:38,550 --> 00:02:37,040
both vaccinated against covid19 which is

24
00:02:41,589 --> 00:02:38,560
why we're not wearing masks since we're

25
00:02:43,990 --> 00:02:41,599
outside launch is set for 5 34 this

26
00:02:46,710 --> 00:02:44,000
morning eastern time from space launch

27
00:02:50,070 --> 00:02:46,720
complex 41 at cape canaveral space force

28
00:02:53,270 --> 00:02:50,080
station and we are at l minus 32 minutes

29
00:02:55,270 --> 00:02:53,280
and counting no spacecraft has ever been

30
00:02:58,149 --> 00:02:55,280
to the trojan asteroids they are

31
00:03:00,229 --> 00:02:58,159
considered fossils of planet formation

32
00:03:02,790 --> 00:03:00,239
and may hold clues about our ancient

33
00:03:05,430 --> 00:03:02,800
past with boosts from earth's gravity

34
00:03:08,470 --> 00:03:05,440
lucy will fly very close to eight

35
00:03:10,949 --> 00:03:08,480
asteroids over her 12-year journey just

36
00:03:13,509 --> 00:03:10,959
as the lucy fossil has been extensively

37
00:03:15,270 --> 00:03:13,519
studied the lucy spacecraft promises to

38
00:03:19,110 --> 00:03:15,280

teach us about our solar system's

39
00:03:21,750 --> 00:03:19,120
evolution including earth now no other

40
00:03:23,750 --> 00:03:21,760
space mission in history has visited as

41
00:03:26,149 --> 00:03:23,760
many different destinations in

42
00:03:28,229 --> 00:03:26,159
independent orbits around our sun we'll

43
00:03:30,470 --> 00:03:28,239
talk with the experts about lucy's

44
00:03:32,789 --> 00:03:30,480
unprecedented journey ahead that's right

45
00:03:35,270 --> 00:03:32,799
and we'll also hear from the man who

46
00:03:38,470 --> 00:03:35,280
discovered the ancient lucy fossil in

47
00:03:40,789 --> 00:03:38,480
ethiopia in 1974. we'll learn about a

48
00:03:43,270 --> 00:03:40,799
special time capsule associated with

49
00:03:45,670 --> 00:03:43,280
this mission plus we'll hear directly

50
00:03:48,229 --> 00:03:45,680
from the scientists who've spent years

51
00:03:50,229 --> 00:03:48,239
working towards this day and to help us

52
00:03:52,229 --> 00:03:50,239
tell their story we have commentators at

53
00:03:54,869 --> 00:03:52,239
the united launch alliance atlas space

54
00:03:57,110 --> 00:03:54,879
flight operations center or asoc as we

55
00:03:59,509 --> 00:03:57,120
call it we also have folks on the roof

56
00:04:00,710 --> 00:03:59,519
of that building and at a nearby viewing

57
00:04:02,390 --> 00:04:00,720
location

58
00:04:03,750 --> 00:04:02,400
first let's introduce you to the team of

59
00:04:06,390 --> 00:04:03,760
commentators who will be calling the

60
00:04:08,390 --> 00:04:06,400
launch today nasa's joshua santora and

61
00:04:11,429 --> 00:04:08,400
mick waltman guys how's it going over

62
00:04:13,270 --> 00:04:11,439
there hey it's going uh almost

63
00:04:14,630 --> 00:04:13,280

uh unnervingly well

64
00:04:15,990 --> 00:04:14,640
every knock on wood start knocking on

65
00:04:17,990 --> 00:04:16,000
wood but i'm joined here with mick

66
00:04:19,749 --> 00:04:18,000
walton the chief of fleet uh fleet

67
00:04:21,110 --> 00:04:19,759
systems integrations mick always a

68
00:04:22,950 --> 00:04:21,120
pleasure to have you with me joshua

69
00:04:24,469 --> 00:04:22,960
thanks it's a exciting time this morning

70
00:04:26,310 --> 00:04:24,479
as you said it's been pretty quiet count

71
00:04:28,150 --> 00:04:26,320
so far the teams came on you know

72
00:04:30,310 --> 00:04:28,160
several hours ago and started preps uh

73
00:04:32,710 --> 00:04:30,320
to get the vehicle ready and things are

74
00:04:34,310 --> 00:04:32,720
looking great i mean the everything's go

75
00:04:36,550 --> 00:04:34,320
so far this morning we are in this

76
00:04:38,310 --> 00:04:36,560
t-minus four hold and the team is

77
00:04:40,230 --> 00:04:38,320
finishing up topping and doing their

78
00:04:42,550 --> 00:04:40,240
work so uh looking forward to that

79
00:04:44,070 --> 00:04:42,560
t-zero yeah it's coming up here we're on

80
00:04:46,710 --> 00:04:44,080
track still for the first uh first

81
00:04:48,390 --> 00:04:46,720
opportunity of a 75-minute window uh but

82
00:04:50,550 --> 00:04:48,400
again we finished we started fueling

83
00:04:52,230 --> 00:04:50,560
about two hours ago and then just about

84
00:04:53,430 --> 00:04:52,240
30 minutes ago we got into a topping

85
00:04:55,510 --> 00:04:53,440
phase with all of our fuels and

86
00:04:57,350 --> 00:04:55,520
oxidizers which basically means that

87
00:04:59,110 --> 00:04:57,360
we're at a point where the vehicle's

88
00:05:00,550 --> 00:04:59,120

fueled it's ready uh they're simply

89
00:05:02,070 --> 00:05:00,560
going through final checkouts and

90
00:05:04,150 --> 00:05:02,080
processes stabilizing and making sure

91
00:05:05,830 --> 00:05:04,160
that we're good to go here

92
00:05:07,990 --> 00:05:05,840
obviously under the beautiful lucy

93
00:05:09,510 --> 00:05:08,000
spacecraft today we've got the centaur

94
00:05:11,510 --> 00:05:09,520
upper stage and then the

95
00:05:13,029 --> 00:05:11,520
atlas booster make a unique atlas

96
00:05:15,029 --> 00:05:13,039
booster not originally intended for this

97
00:05:17,510 --> 00:05:15,039
flight yeah that's true uh when we

98
00:05:20,390 --> 00:05:17,520
started this mission uh the first stage

99
00:05:22,870 --> 00:05:20,400
of this atlas 401 configuration was

100
00:05:25,110 --> 00:05:22,880
originally allocated for the oft2 or

101
00:05:27,110 --> 00:05:25,120
orbital flight test 2 mission

102
00:05:29,029 --> 00:05:27,120
that was earlier this year however due

103
00:05:31,110 --> 00:05:29,039
to some manifest things that went on and

104
00:05:32,790 --> 00:05:31,120
due to the nature of lucy and the

105
00:05:34,390 --> 00:05:32,800
planetary window

106
00:05:37,189 --> 00:05:34,400
we had to work with united launch

107
00:05:39,430 --> 00:05:37,199
alliance to reallocate that booster

108
00:05:41,990 --> 00:05:39,440
reconfigure a little bit and get it

109
00:05:44,070 --> 00:05:42,000
ready for this morning's launch so the

110
00:05:45,749 --> 00:05:44,080
booster of course reallocated from oft

111
00:05:47,749 --> 00:05:45,759
but the centaur is brand new for this

112
00:05:49,550 --> 00:05:47,759
mission and as you were saying earlier

113
00:05:52,950 --> 00:05:49,560

finishing up topping we're getting about

114
00:05:54,710 --> 00:05:52,960
740 000 pounds of fuel on board once we

115
00:05:55,749 --> 00:05:54,720
finish fueling here get ready for launch

116
00:05:57,510 --> 00:05:55,759
this morning

117
00:05:59,350 --> 00:05:57,520
yeah so things progressing well a lot of

118
00:06:02,070 --> 00:05:59,360
what's left is to get lucy ready to be

119
00:06:03,670 --> 00:06:02,080
living on her own and flying free um and

120
00:06:05,270 --> 00:06:03,680
so as we look ahead to the countdown we

121
00:06:07,749 --> 00:06:05,280
have a few things coming up including a

122
00:06:09,749 --> 00:06:07,759
weather weather check uh we also have

123
00:06:10,870 --> 00:06:09,759
the spacecraft moving to internal power

124
00:06:12,390 --> 00:06:10,880
uh and

125
00:06:14,790 --> 00:06:12,400
lots more to come we're excited so even

126
00:06:15,909 --> 00:06:14,800
beyond liftoff today stay with us uh i

127
00:06:17,510 --> 00:06:15,919
think that's gonna do it for us for the

128
00:06:18,390 --> 00:06:17,520
moment again lots more to come ahead

129
00:06:19,510 --> 00:06:18,400
marine we're gonna send it back to you

130
00:06:21,590 --> 00:06:19,520
over to you

131
00:06:24,629 --> 00:06:21,600
all right thank you joshua and mick we

132
00:06:27,189 --> 00:06:24,639
are now at l minus 28 minutes 25 seconds

133
00:06:29,749 --> 00:06:27,199
and counting the trojan asteroids lucy

134
00:06:32,870 --> 00:06:29,759
will visit are named after characters in

135
00:06:36,150 --> 00:06:32,880
homer's famous poem the iliad they are

136
00:06:39,350 --> 00:06:36,160
called patroclus monitious uribetes

137
00:06:41,749 --> 00:06:39,360
aorus lucas and palimali and the main

138
00:06:43,909 --> 00:06:41,759

belt asteroid lucy will visit is called

139
00:06:46,230 --> 00:06:43,919
donald johansen after the man who

140
00:06:48,629 --> 00:06:46,240
discovered the lucy fossil now the

141
00:06:51,350 --> 00:06:48,639
eighth asteroid ketta is a small

142
00:06:53,510 --> 00:06:51,360
satellite of uribetes keto was named

143
00:06:55,909 --> 00:06:53,520
after the first woman to light the

144
00:06:58,870 --> 00:06:55,919
olympic cauldron norma and riketa

145
00:07:00,629 --> 00:06:58,880
basilio sotelo we'll show you how keta

146
00:07:01,589 --> 00:07:00,639
was discovered a little later after

147
00:07:04,469 --> 00:07:01,599
launch

148
00:07:07,029 --> 00:07:04,479
right now we are l minus 27 minutes and

149
00:07:09,110 --> 00:07:07,039
counting lucy is inside the payload

150
00:07:11,830 --> 00:07:09,120
fairing sitting on top of the united

151
00:07:14,390 --> 00:07:11,840
launch alliance atlas 5 rocket on pad

152
00:07:17,029 --> 00:07:14,400
41. we want to show you what she'll look

153
00:07:19,990 --> 00:07:17,039
like once she's flying free in space

154
00:07:22,870 --> 00:07:20,000
lucy is more than 46 feet long about the

155
00:07:25,189 --> 00:07:22,880
size of a large rv most of that length

156
00:07:27,830 --> 00:07:25,199
is from her huge solar panels each

157
00:07:30,710 --> 00:07:27,840
almost 24 feet long

158
00:07:33,189 --> 00:07:30,720
lucy has a six and a half foot antenna

159
00:07:35,670 --> 00:07:33,199
with which she communicates with earth

160
00:07:38,390 --> 00:07:35,680
and there are three main instruments for

161
00:07:39,749 --> 00:07:38,400
remote sensing fully fueled she weighs

162
00:07:42,150 --> 00:07:39,759
three thousand four hundred and

163
00:07:44,790 --> 00:07:42,160

seventeen pounds a little heavier than a

164
00:07:45,749 --> 00:07:44,800
mid-sized car and most of that weight is

165
00:07:47,110 --> 00:07:45,759
fuel

166
00:07:49,270 --> 00:07:47,120
yeah those solar arrays are really

167
00:07:51,350 --> 00:07:49,280
impressive and studying the trojan

168
00:07:54,230 --> 00:07:51,360
asteroids from hundreds of millions of

169
00:07:56,390 --> 00:07:54,240
miles away requires a highly advanced

170
00:08:00,260 --> 00:07:56,400
set of instruments let's learn more

171
00:08:06,710 --> 00:08:04,790
[Music]

172
00:08:08,390 --> 00:08:06,720
the lucy spacecraft will be taking a

173
00:08:09,670 --> 00:08:08,400
journey where no other spacecraft has

174
00:08:11,589 --> 00:08:09,680
gone before

175
00:08:13,589 --> 00:08:11,599
the trojan asteroids

176
00:08:15,430 --> 00:08:13,599
the trojans are two groups of asteroids

177
00:08:17,350 --> 00:08:15,440
that lead and trail jupiter in its orbit

178
00:08:19,350 --> 00:08:17,360
around the sun and they've been trapped

179
00:08:21,589 --> 00:08:19,360
in these stable locations for over 4

180
00:08:23,350 --> 00:08:21,599
billion years

181
00:08:25,110 --> 00:08:23,360
lucy will have a suite of scientific

182
00:08:27,670 --> 00:08:25,120
instruments for collecting data as it

183
00:08:29,670 --> 00:08:27,680
flies by the asteroids

184
00:08:32,070 --> 00:08:29,680
the lorry is a long-range reconnaissance

185
00:08:33,829 --> 00:08:32,080
imager it's often referred to as lucy's

186
00:08:35,990 --> 00:08:33,839
eagle eyes since it has the highest

187
00:08:37,269 --> 00:08:36,000
spatial resolution of all of lucy's

188
00:08:39,110 --> 00:08:37,279

cameras

189
00:08:41,430 --> 00:08:39,120
this black and white camera is actually

190
00:08:43,670 --> 00:08:41,440
a type of telescope the same kind as the

191
00:08:45,509 --> 00:08:43,680
hubble space telescope

192
00:08:47,509 --> 00:08:45,519
the lorry was built to produce clear

193
00:08:49,190 --> 00:08:47,519
images of the trojan's craters which

194
00:08:52,949 --> 00:08:49,200
will be a challenge since the trojan

195
00:08:58,150 --> 00:08:55,350
the lorry will be able to see 75-yard

196
00:08:59,670 --> 00:08:58,160
wide craters from over 600 miles away

197
00:09:01,509 --> 00:08:59,680
that's like standing at one end of a

198
00:09:03,509 --> 00:09:01,519
football field and being able to see a

199
00:09:05,350 --> 00:09:03,519
fly at the other end

200
00:09:07,430 --> 00:09:05,360
the instrument's simple design does not

201
00:09:09,750 --> 00:09:07,440
use optical filters and includes no

202
00:09:12,470 --> 00:09:09,760
moving parts reducing the risk of part

203
00:09:14,389 --> 00:09:12,480
failure during the mission

204
00:09:16,070 --> 00:09:14,399
the lorry will also search the trojans

205
00:09:17,670 --> 00:09:16,080
for evidence of any rings and new

206
00:09:19,509 --> 00:09:17,680
satellites

207
00:09:21,430 --> 00:09:19,519
the instrument's ability to see faint

208
00:09:23,200 --> 00:09:21,440
targets from far away also makes it

209
00:09:24,389 --> 00:09:23,210
perfect for optical navigation

210
00:09:26,150 --> 00:09:24,399
[Music]

211
00:09:28,070 --> 00:09:26,160
the lorry will help lucy navigate to a

212
00:09:30,150 --> 00:09:28,080
point in space and then a terminal

213
00:09:32,070 --> 00:09:30,160

tracking camera aboard the spacecraft

214
00:09:33,910 --> 00:09:32,080
known as t2 cam will help the

215
00:09:36,230 --> 00:09:33,920
instruments accurately point towards the

216
00:09:37,990 --> 00:09:36,240
targets

217
00:09:40,470 --> 00:09:38,000
latas is lucy's thermal emission

218
00:09:42,790 --> 00:09:40,480
spectrometer which detects far infrared

219
00:09:45,670 --> 00:09:42,800
radiation emitted by the asteroids due

220
00:09:47,590 --> 00:09:45,680
to how they are heated up by sunlight

221
00:09:49,670 --> 00:09:47,600
the tess detects this radiation using a

222
00:09:52,070 --> 00:09:49,680
small telescope to focus the incoming

223
00:09:55,590 --> 00:09:52,080
energy onto a detector similar to the

224
00:09:59,750 --> 00:09:58,150
so the test is not taking images but

225
00:10:02,630 --> 00:09:59,760
rather temperature measurements at

226
00:10:04,230 --> 00:10:02,640
various points on the asteroid

227
00:10:05,910 --> 00:10:04,240
this data will be combined so that

228
00:10:08,710 --> 00:10:05,920
scientists can get an understanding of

229
00:10:10,389 --> 00:10:08,720
its surface properties

230
00:10:12,310 --> 00:10:10,399
the test will examine the properties of

231
00:10:14,310 --> 00:10:12,320
the regolith on the surface by measuring

232
00:10:16,150 --> 00:10:14,320
thermal inertia which is the measure of

233
00:10:18,949 --> 00:10:16,160
how slowly the asteroid heats up from

234
00:10:20,550 --> 00:10:18,959
sunlight and then releases that heat

235
00:10:22,710 --> 00:10:20,560
by taking the temperature readings at

236
00:10:24,310 --> 00:10:22,720
different parts of the asteroid the lucy

237
00:10:26,790 --> 00:10:24,320
science team can measure the thermal

238
00:10:29,110 --> 00:10:26,800

inertia and figure out how much dust

239
00:10:30,310 --> 00:10:29,120
sand or rock is present on the asteroid

240
00:10:31,990 --> 00:10:30,320
surface

241
00:10:33,990 --> 00:10:32,000
that data will tell us a lot about how

242
00:10:35,910 --> 00:10:34,000
the asteroid was formed providing

243
00:10:38,550 --> 00:10:35,920
insight into the history of our solar

244
00:10:42,630 --> 00:10:40,470
lucy's la ralph instrument will search

245
00:10:44,310 --> 00:10:42,640
the trojans for organics ices and

246
00:10:45,990 --> 00:10:44,320
hydrated minerals and will help

247
00:10:47,269 --> 00:10:46,000
determine the surface compositions of

248
00:10:49,190 --> 00:10:47,279
the asteroids

249
00:10:51,190 --> 00:10:49,200
the ralph is actually two instruments in

250
00:10:53,110 --> 00:10:51,200
one and together they will measure and

251
00:10:55,190 --> 00:10:53,120
analyze the spectra of light absorbed

252
00:10:57,509 --> 00:10:55,200
and reflected by the asteroid

253
00:11:00,150 --> 00:10:57,519
the first is a color visible imager the

254
00:11:02,630 --> 00:11:00,160
multi-spectral visible imaging camera or

255
00:11:05,030 --> 00:11:02,640
mvik it takes visible light color images

256
00:11:07,350 --> 00:11:05,040
of the trojan asteroids the second is an

257
00:11:09,750 --> 00:11:07,360
infrared imaging spectrometer known as

258
00:11:12,069 --> 00:11:09,760
lisa the linear edilon imaging spectral

259
00:11:14,630 --> 00:11:12,079
array which collects infrared spectra of

260
00:11:16,710 --> 00:11:14,640
the asteroids

261
00:11:19,350 --> 00:11:16,720
like lalory the ralph does not have a

262
00:11:21,269 --> 00:11:19,360
focusing mechanism instead it is

263
00:11:23,590 --> 00:11:21,279

designed to stay in focus despite the

264
00:11:25,350 --> 00:11:23,600
extreme temperature differences in space

265
00:11:27,110 --> 00:11:25,360
by being made almost entirely from a

266
00:11:29,430 --> 00:11:27,120
single block of aluminum

267
00:11:31,430 --> 00:11:29,440
as you can see the lucy spacecraft has a

268
00:11:33,190 --> 00:11:31,440
large suite of tools to study the trojan

269
00:11:35,110 --> 00:11:33,200
asteroids which will help us better

270
00:11:35,700 --> 00:11:35,120
understand the formation of our solar

271
00:11:41,430 --> 00:11:35,710
system

272
00:11:45,910 --> 00:11:43,190
you may have noticed in that video that

273
00:11:47,829 --> 00:11:45,920
each of lucy's instruments has an l

274
00:11:49,269 --> 00:11:47,839
added to the beginning of its name

275
00:11:51,190 --> 00:11:49,279
that's meant to designate their

276
00:11:53,350 --> 00:11:51,200
attachment to lucy and now we're going

277
00:11:55,990 --> 00:11:53,360
to hear from the deputy principal

278
00:11:58,150 --> 00:11:56,000
investigator for the lucy mission she is

279
00:12:00,069 --> 00:11:58,160
standing by with nasa's megan cruz at

280
00:12:02,150 --> 00:12:00,079
the nearby operations support building

281
00:12:04,150 --> 00:12:02,160
too that's our launch viewing location

282
00:12:05,430 --> 00:12:04,160
megan how's it going over there

283
00:12:06,790 --> 00:12:05,440
hey marie things are looking really

284
00:12:08,230 --> 00:12:06,800
great and it just got better now that

285
00:12:09,910 --> 00:12:08,240
i'm joined with kathy olk and kathy

286
00:12:11,670 --> 00:12:09,920
thank you so much for being here thank

287
00:12:13,990 --> 00:12:11,680
you for having me yeah absolutely you

288
00:12:16,389 --> 00:12:14,000

know lucy is a very ambitious mission

289
00:12:19,269 --> 00:12:16,399
where did the idea for lucy come about

290
00:12:21,190 --> 00:12:19,279
the idea for lucy was really to explore

291
00:12:22,870 --> 00:12:21,200
the trojan asteroids the scientific

292
00:12:26,150 --> 00:12:22,880
community's been wanting to see these

293
00:12:28,389 --> 00:12:26,160
objects up close for a long time and so

294
00:12:30,230 --> 00:12:28,399
we finally have a mission that's almost

295
00:12:32,310 --> 00:12:30,240
on its way yeah this is really exciting

296
00:12:34,470 --> 00:12:32,320
and i mean the goal is to study how the

297
00:12:36,629 --> 00:12:34,480
outer planets formed but why is that

298
00:12:38,710 --> 00:12:36,639
important for us to understand yeah it's

299
00:12:40,230 --> 00:12:38,720
really important to understand solar

300
00:12:42,069 --> 00:12:40,240
system formation

301
00:12:44,629 --> 00:12:42,079
uh to understand

302
00:12:47,829 --> 00:12:44,639
where we came from and how our solar

303
00:12:50,389 --> 00:12:47,839
system works it used to be that we had a

304
00:12:51,509 --> 00:12:50,399
vision that the solar system was a very

305
00:12:55,030 --> 00:12:51,519
calm

306
00:12:58,389 --> 00:12:55,040
environment and that everything was very

307
00:13:01,590 --> 00:12:58,399
stable but really our recent ideas are

308
00:13:02,550 --> 00:13:01,600
that it's not like that at all it's very

309
00:13:05,269 --> 00:13:02,560
it

310
00:13:08,069 --> 00:13:05,279
had been very chaotic in the early solar

311
00:13:10,629 --> 00:13:08,079
system history and that caused small

312
00:13:12,870 --> 00:13:10,639
bodies in the solar system many to be

313
00:13:14,710 --> 00:13:12,880

ejected out of the solar system

314
00:13:17,269 --> 00:13:14,720
and a small fraction to be captured in

315
00:13:18,550 --> 00:13:17,279
the trojan asteroids gotcha gotcha and

316
00:13:20,949 --> 00:13:18,560
it's going to take a very complex

317
00:13:22,790 --> 00:13:20,959
trajectory right to get to these trojan

318
00:13:24,790 --> 00:13:22,800
asteroids i imagine that must have been

319
00:13:27,350 --> 00:13:24,800
really difficult to plot out 4 billion

320
00:13:29,910 --> 00:13:27,360
miles over 12 years it really was it

321
00:13:31,910 --> 00:13:29,920
took the whole team to be able to make

322
00:13:34,629 --> 00:13:31,920
this amazing trajectory that really

323
00:13:36,550 --> 00:13:34,639
enables the mission on the science side

324
00:13:39,030 --> 00:13:36,560
we started with a list of objects that

325
00:13:41,110 --> 00:13:39,040
we wanted to compare against each other

326
00:13:44,069 --> 00:13:41,120
and then we handed that off to the

327
00:13:46,710 --> 00:13:44,079
mission designers and they ran with it

328
00:13:48,870 --> 00:13:46,720
and they found an amazing trajectory and

329
00:13:51,990 --> 00:13:48,880
then the people who optimize the

330
00:13:54,629 --> 00:13:52,000
trajectory did their work and so it's

331
00:13:56,550 --> 00:13:54,639
really uh effort from the whole team

332
00:13:58,150 --> 00:13:56,560
that got us this awesome trajectory

333
00:13:59,990 --> 00:13:58,160
perfect and a quick last question why

334
00:14:02,150 --> 00:14:00,000
eight asteroids that's a record-breaking

335
00:14:03,829 --> 00:14:02,160
number it is a record-breaking number

336
00:14:05,910 --> 00:14:03,839
and we really needed to go by eight

337
00:14:08,389 --> 00:14:05,920
asteroids to really explore the

338
00:14:10,710 --> 00:14:08,399

diversity of these objects there's more

339
00:14:12,710 --> 00:14:10,720
red and less red there's smaller and

340
00:14:14,790 --> 00:14:12,720
larger objects there's objects that

341
00:14:17,910 --> 00:14:14,800
we're going to be visiting that are a

342
00:14:20,550 --> 00:14:17,920
remnants from a giant collision and also

343
00:14:23,509 --> 00:14:20,560
a primitive pair a binary pair that

344
00:14:25,750 --> 00:14:23,519
orbits each other so in order to look at

345
00:14:27,910 --> 00:14:25,760
make all those comparisons we needed to

346
00:14:29,430 --> 00:14:27,920
go past eight asteroids kathy thank you

347
00:14:31,509 --> 00:14:29,440
so much it sounds so exciting and

348
00:14:33,110 --> 00:14:31,519
honestly it's so we're so lucky because

349
00:14:34,230 --> 00:14:33,120
the weather looks so great right now

350
00:14:36,550 --> 00:14:34,240
right daryl

351
00:14:38,710 --> 00:14:36,560
megan the weather is cooperating

352
00:14:40,230 --> 00:14:38,720
wonderfully you can't see it because

353
00:14:41,750 --> 00:14:40,240
it's dark out right

354
00:14:43,750 --> 00:14:41,760
but we've got great weather had a little

355
00:14:46,389 --> 00:14:43,760
bit of rain coming in just a little

356
00:14:48,949 --> 00:14:46,399
sprinkle just a little sprinkle but uh

357
00:14:51,670 --> 00:14:48,959
it looks clear overall let's take a look

358
00:14:53,990 --> 00:14:51,680
out at the live shot of our pad and the

359
00:14:56,470 --> 00:14:54,000
rocket and you can see there it is

360
00:14:57,910 --> 00:14:56,480
looking beautiful in the light just a

361
00:14:59,990 --> 00:14:57,920
note for you in the upper left hand

362
00:15:01,829 --> 00:15:00,000
corner there's the l minus time l minus

363
00:15:04,310 --> 00:15:01,839

19 minutes and counting across the

364
00:15:07,189 --> 00:15:04,320
bottom the progress bar you see we are

365
00:15:09,189 --> 00:15:07,199
in a t minus four hold more on that in a

366
00:15:10,310 --> 00:15:09,199
bit but we're talking weather now as you

367
00:15:11,350 --> 00:15:10,320
can see

368
00:15:13,670 --> 00:15:11,360
clear

369
00:15:15,910 --> 00:15:13,680
through the dark uh this is so that

370
00:15:17,670 --> 00:15:15,920
ground teams and launch teams can see

371
00:15:20,069 --> 00:15:17,680
what's going on with that illuminated

372
00:15:22,150 --> 00:15:20,079
pad and monitor what's happening around

373
00:15:23,750 --> 00:15:22,160
the rocket let's talk more about the

374
00:15:25,670 --> 00:15:23,760
weather and yeah we had a little bit of

375
00:15:27,670 --> 00:15:25,680
rain earlier will ulrich our launch

376
00:15:29,590 --> 00:15:27,680
weather officer but overall this is

377
00:15:31,829 --> 00:15:29,600
looking fantastic from a forecast

378
00:15:33,430 --> 00:15:31,839
perspective that's right daryl really

379
00:15:35,030 --> 00:15:33,440
all things considered we couldn't be

380
00:15:36,870 --> 00:15:35,040
asking for better weather early this

381
00:15:38,790 --> 00:15:36,880
morning the sprinkles that you mentioned

382
00:15:40,710 --> 00:15:38,800
have since cleared the area and now all

383
00:15:42,389 --> 00:15:40,720
we're left with is partly cloudy skies

384
00:15:43,829 --> 00:15:42,399
and light winds thanks in part to an

385
00:15:45,990 --> 00:15:43,839
area of high pressure that remains

386
00:15:47,910 --> 00:15:46,000
dominating over the southeastern united

387
00:15:49,749 --> 00:15:47,920
states a live look at satellite imagery

388
00:15:51,110 --> 00:15:49,759

behind me shows those mostly clear skies

389
00:15:52,230 --> 00:15:51,120
across much of the state and that's

390
00:15:53,990 --> 00:15:52,240
going to make for a great viewing

391
00:15:56,710 --> 00:15:54,000
opportunity regardless of whether you're

392
00:15:59,269 --> 00:15:56,720
watching in jacksonville tampa orlando

393
00:16:01,030 --> 00:15:59,279
or locally right here in the space coast

394
00:16:02,870 --> 00:16:01,040
my colleague jessica williams just gave

395
00:16:04,629 --> 00:16:02,880
her final weather brief at l minus 30

396
00:16:06,870 --> 00:16:04,639
minutes to united launch alliance

397
00:16:08,949 --> 00:16:06,880
eastern range and nasa officials and

398
00:16:10,710 --> 00:16:08,959
gave a greater than 90 percent go for

399
00:16:12,870 --> 00:16:10,720
weather so we are not tracking any

400
00:16:14,550 --> 00:16:12,880
issues at this time as a reminder my

401
00:16:16,710 --> 00:16:14,560
colleagues and i are here to ensure that

402
00:16:18,550 --> 00:16:16,720
the weather is safe for launch and we do

403
00:16:20,389 --> 00:16:18,560
that through the evaluation of 10

404
00:16:21,910 --> 00:16:20,399
lightning launch commit criteria which

405
00:16:23,990 --> 00:16:21,920
are designed to protect against both

406
00:16:25,910 --> 00:16:24,000
rocket triggered and natural lightning

407
00:16:28,150 --> 00:16:25,920
in addition we also monitor user weather

408
00:16:30,150 --> 00:16:28,160
constraints like surface wind speed and

409
00:16:31,509 --> 00:16:30,160
precipitation and while things are

410
00:16:33,030 --> 00:16:31,519
looking really good for launch this

411
00:16:34,870 --> 00:16:33,040
morning should we need to utilize

412
00:16:36,870 --> 00:16:34,880
tomorrow's backup window we do

413
00:16:38,150 --> 00:16:36,880

anticipate conditions deteriorating as

414
00:16:40,470 --> 00:16:38,160
we see a cold front move through the

415
00:16:42,230 --> 00:16:40,480
region but let's not worry about that

416
00:16:44,949 --> 00:16:42,240
right now because conditions are looking

417
00:16:47,110 --> 00:16:44,959
great mother nature is giving her thumbs

418
00:16:49,910 --> 00:16:47,120
up and i'm happy to report that the 45th

419
00:16:51,910 --> 00:16:49,920
weather squadron is go for weather daryl

420
00:16:54,790 --> 00:16:51,920
great update about the weather outside

421
00:16:58,069 --> 00:16:54,800
thank you will we are currently l minus

422
00:17:00,790 --> 00:16:58,079
17 minutes and counting until liftoff

423
00:17:03,030 --> 00:17:00,800
asteroids are prehistoric treasures that

424
00:17:05,029 --> 00:17:03,040
hold the lost stories about our origin

425
00:17:09,770 --> 00:17:05,039
of the solar system here's what else you

426
00:17:09,780 --> 00:17:24,870
[Music]

427
00:17:34,690 --> 00:17:27,859
so

428
00:18:37,029 --> 00:17:53,220
[Music]

429
00:18:39,270 --> 00:18:37,039
this mission is such an incredible

430
00:18:42,390 --> 00:18:39,280
opportunity and one of the many missions

431
00:18:44,630 --> 00:18:42,400
aimed at asteroid research right now

432
00:18:47,190 --> 00:18:44,640
let's head back out to nasa's megan cruz

433
00:18:49,510 --> 00:18:47,200
who is with the head of nasa science

434
00:18:51,430 --> 00:18:49,520
missions megan i am daryl joining us

435
00:18:53,270 --> 00:18:51,440
right now is dr thomas zurbukin he's the

436
00:18:55,110 --> 00:18:53,280
associate administrator for nasa's

437
00:18:56,549 --> 00:18:55,120
science mission directorate good to have

438
00:18:58,630 --> 00:18:56,559

you here this morning i'm so glad to be

439
00:19:00,070 --> 00:18:58,640
here what an exciting morning it is and

440
00:19:01,909 --> 00:19:00,080
i'm so glad you're here because i got to

441
00:19:03,510 --> 00:19:01,919
ask you a question you know first off

442
00:19:04,950 --> 00:19:03,520
tell me a little bit about the science

443
00:19:07,110 --> 00:19:04,960
mission directorate what's the goal

444
00:19:09,190 --> 00:19:07,120
there well so we're your organization at

445
00:19:10,950 --> 00:19:09,200
nasa that does all science you know and

446
00:19:12,630 --> 00:19:10,960
it of course is planetary science just

447
00:19:15,350 --> 00:19:12,640
like we're launching today it's also

448
00:19:18,070 --> 00:19:15,360
astrophysics i just got a picture of the

449
00:19:20,070 --> 00:19:18,080
james webb space telescope that in the

450
00:19:22,150 --> 00:19:20,080
crate there in guru getting ready for

451
00:19:24,789 --> 00:19:22,160
launch and then it's the earth science

452
00:19:26,710 --> 00:19:24,799
heliophysics also biological and

453
00:19:28,390 --> 00:19:26,720
physical sciences that's all the signs

454
00:19:29,909 --> 00:19:28,400
we do at the agency just an amazing

455
00:19:31,909 --> 00:19:29,919
amount yeah and when you became

456
00:19:33,909 --> 00:19:31,919
associate administrator of the um

457
00:19:36,230 --> 00:19:33,919
science mission directorate lucy was the

458
00:19:38,789 --> 00:19:36,240
first mission you selected why is that

459
00:19:40,470 --> 00:19:38,799
well so the timing was there we had five

460
00:19:42,310 --> 00:19:40,480
mission candidates and i have to tell

461
00:19:44,470 --> 00:19:42,320
you it was the first it's one of these

462
00:19:46,390 --> 00:19:44,480
amazing decisions and and of course many

463
00:19:49,590 --> 00:19:46,400

people helped with that but i looked at

464
00:19:52,150 --> 00:19:49,600
this in this orbit and the signs were so

465
00:19:53,990 --> 00:19:52,160
compelling i said we gotta fly this yeah

466
00:19:55,510 --> 00:19:54,000
the trajectory is amazing i mean the

467
00:19:57,350 --> 00:19:55,520
fact that we've been able to figure out

468
00:19:58,870 --> 00:19:57,360
how to get to the trojan asteroids in in

469
00:20:00,870 --> 00:19:58,880
relatively a short amount of time what

470
00:20:02,710 --> 00:20:00,880
do you think about that well i mean it's

471
00:20:04,070 --> 00:20:02,720
so innovative right i mean we actually

472
00:20:06,149 --> 00:20:04,080
the science community had said we want

473
00:20:08,470 --> 00:20:06,159
to do this but we want to spend a half a

474
00:20:10,470 --> 00:20:08,480
billion or a billion dollars more than

475
00:20:12,950 --> 00:20:10,480
this team proposed that's like this is

476
00:20:15,669 --> 00:20:12,960
good money let's go do this that it's

477
00:20:18,310 --> 00:20:15,679
really innovative absolutely and how

478
00:20:20,070 --> 00:20:18,320
does lucy tie into nasa's overall

479
00:20:22,149 --> 00:20:20,080
asteroid research that's going on right

480
00:20:23,830 --> 00:20:22,159
now well we're really starting a decade

481
00:20:27,270 --> 00:20:23,840
of asteroid science right we're

482
00:20:29,350 --> 00:20:27,280
launching in 23 uh osiris-rex is

483
00:20:31,750 --> 00:20:29,360
bringing back the samples of banner down

484
00:20:33,909 --> 00:20:31,760
kind of in utah well we'll come down

485
00:20:36,390 --> 00:20:33,919
there next year we're going to be here

486
00:20:38,390 --> 00:20:36,400
again and launch psyche and just later

487
00:20:40,710 --> 00:20:38,400
this year we're going to launch dart

488
00:20:42,789 --> 00:20:40,720

which is the first coalition experiment

489
00:20:45,350 --> 00:20:42,799
trying to really deflect a potentially

490
00:20:48,470 --> 00:20:45,360
threatening asteroid you know so so for

491
00:20:50,310 --> 00:20:48,480
us it's many parts and ex you know and

492
00:20:52,470 --> 00:20:50,320
of course at the heart of it lucy is

493
00:20:54,549 --> 00:20:52,480
just absolutely the mission of discovery

494
00:20:55,990 --> 00:20:54,559
yeah we're really doing a lot of amazing

495
00:20:57,430 --> 00:20:56,000
things and i think that you have a lot

496
00:20:58,950 --> 00:20:57,440
to do with that so thank you so much dr

497
00:21:00,630 --> 00:20:58,960
zurbukit i really appreciate you being

498
00:21:02,789 --> 00:21:00,640
here today appreciate it megan thanks so

499
00:21:04,390 --> 00:21:02,799
much awesome daryl back to you all right

500
00:21:06,549 --> 00:21:04,400
thank you megan and we're just seconds

501
00:21:08,549 --> 00:21:06,559
away from the nasa launch manager poll

502
00:21:11,110 --> 00:21:08,559
so let's get out to joshua and mick to

503
00:21:13,110 --> 00:21:11,120
pick it up guys hey thanks daryl yes uh

504
00:21:14,470 --> 00:21:13,120
things again proceeding really well uh

505
00:21:15,590 --> 00:21:14,480
appreciate the report from will ulrich

506
00:21:17,350 --> 00:21:15,600
because the weather is always the other

507
00:21:18,789 --> 00:21:17,360
side of the coin right we got the launch

508
00:21:20,549 --> 00:21:18,799
team and the technical we got the

509
00:21:22,789 --> 00:21:20,559
weather in good shape as you see there

510
00:21:24,149 --> 00:21:22,799
the rocket venting and uh having the

511
00:21:26,310 --> 00:21:24,159
condensation appear around the rocket as

512
00:21:28,070 --> 00:21:26,320
we would typically expect so everything

513
00:21:29,750 --> 00:21:28,080

healthy and on track

514
00:21:31,830 --> 00:21:29,760
like daryl just mentioned we will hear

515
00:21:33,990 --> 00:21:31,840
from omar baez the nasa launch manager

516
00:21:35,990 --> 00:21:34,000
he'll be pulling the nasa team so that

517
00:21:37,350 --> 00:21:36,000
he can in turn report out on the ula

518
00:21:38,630 --> 00:21:37,360
launch conductor poll that will happen a

519
00:21:40,310 --> 00:21:38,640
few minutes later

520
00:21:42,149 --> 00:21:40,320
so that should happen right here at l

521
00:21:49,110 --> 00:21:42,159
minus 13 minutes let's listen in for

522
00:21:55,430 --> 00:21:51,590
this is the nlm on the nlm net just

523
00:21:57,669 --> 00:21:55,440
providing an update the arranged it

524
00:22:01,350 --> 00:21:57,679
notify us that

525
00:22:02,549 --> 00:22:01,360
side of uh the jd mta uh command site

526
00:22:04,390 --> 00:22:02,559
hey so let's go ahead and we're gonna

527
00:22:05,830 --> 00:22:04,400
step away from that for now um and we're

528
00:22:07,669 --> 00:22:05,840
gonna obviously there's something

529
00:22:09,350 --> 00:22:07,679
developing there uh we were expecting to

530
00:22:10,630 --> 00:22:09,360
get that poll and so we wanna be

531
00:22:12,149 --> 00:22:10,640
respectful of what's happening there the

532
00:22:13,909 --> 00:22:12,159
technical data we're not sure that

533
00:22:16,870 --> 00:22:13,919
that's going to be approved for release

534
00:22:17,830 --> 00:22:16,880
so obviously we'll be standing by to to

535
00:22:20,149 --> 00:22:17,840
pay attention to that and give you

536
00:22:22,470 --> 00:22:20,159
updates as we understand more but do

537
00:22:25,430 --> 00:22:22,480
want to kind of get back on track with

538
00:22:26,789 --> 00:22:25,440

talking about the uh oh

539
00:22:28,470 --> 00:22:26,799
we are hearing that we think omar's

540
00:22:31,430 --> 00:22:28,480
going to pick up with this poll coming

541
00:22:32,870 --> 00:22:31,440
up now nasa ce go

542
00:22:36,470 --> 00:22:32,880
sma

543
00:22:40,390 --> 00:22:36,480
smd

544
00:22:42,710 --> 00:22:40,400
nasa mission manager

545
00:22:43,990 --> 00:22:42,720
now submission manager go

546
00:22:48,710 --> 00:22:44,000
lsp

547
00:22:51,510 --> 00:22:48,720
copy that the nest team's ready to

548
00:22:53,669 --> 00:22:51,520
release the hold at t minus four minutes

549
00:22:55,430 --> 00:22:53,679
yes so josh what we heard there from uh

550
00:22:57,190 --> 00:22:55,440
nasa launch manager omar baez is he was

551
00:22:59,669 --> 00:22:57,200
basically just briefing his nasa team

552
00:23:01,430 --> 00:22:59,679
and spacecraft customer of an issue that

553
00:23:03,270 --> 00:23:01,440
the team that the range had notified

554
00:23:04,870 --> 00:23:03,280
them of with one of the downrange assets

555
00:23:07,110 --> 00:23:04,880
it sounds looks like it was partially

556
00:23:08,789 --> 00:23:07,120
mission capable today the team accepted

557
00:23:10,070 --> 00:23:08,799
that and uh they are ready to move

558
00:23:12,950 --> 00:23:10,080
forward as you heard in the poll that

559
00:23:15,029 --> 00:23:12,960
all systems are go for the nasa side and

560
00:23:16,630 --> 00:23:15,039
we'll be picking that up as uh launch

561
00:23:18,310 --> 00:23:16,640
conductor scott barney does his pull

562
00:23:21,190 --> 00:23:18,320
here in a little bit

563
00:23:23,430 --> 00:23:21,200

yeah always a lot of things in play uh

564
00:23:24,630 --> 00:23:23,440
we will continue to track that again a

565
00:23:26,549 --> 00:23:24,640
great sign that the team was able to

566
00:23:28,149 --> 00:23:26,559
work through that and approve uh to move

567
00:23:29,510 --> 00:23:28,159
forward um so we'll be back in a few

568
00:23:31,830 --> 00:23:29,520
minutes bringing you the final steps of

569
00:23:34,230 --> 00:23:31,840
the countdown uh and a report up as we

570
00:23:36,630 --> 00:23:34,240
transition lucy into internal power uh

571
00:23:39,029 --> 00:23:36,640
but for now daryl back to you

572
00:23:41,590 --> 00:23:39,039
all right thank you joshua and mick lucy

573
00:23:44,070 --> 00:23:41,600
is going to visit as many asteroids in

574
00:23:47,029 --> 00:23:44,080
the far way belt of jupiter as we've

575
00:23:48,870 --> 00:23:47,039
ever discovered for near-earth asteroids

576
00:23:51,190 --> 00:23:48,880
and to get there lucy will need the

577
00:23:55,110 --> 00:23:51,200
right rocket and the right trajectory to

578
00:24:00,070 --> 00:23:57,269
we headed out to ula's vertical

579
00:24:02,549 --> 00:24:00,080
integration facility where inside we

580
00:24:05,269 --> 00:24:02,559
were all struck after walking onto a

581
00:24:07,430 --> 00:24:05,279
platform 18 stories above the ground

582
00:24:10,310 --> 00:24:07,440
because just a few feet away was the

583
00:24:13,590 --> 00:24:10,320
lucy spacecraft inside its protective

584
00:24:16,230 --> 00:24:13,600
fairing and on top of an atlas v rocket

585
00:24:18,630 --> 00:24:16,240
ula was making final preparations to

586
00:24:21,029 --> 00:24:18,640
roll this entire launch vehicle out of

587
00:24:22,470 --> 00:24:21,039
the vertical hangar we were in and onto

588
00:24:25,590 --> 00:24:22,480

the launch pad

589
00:24:26,950 --> 00:24:25,600
jermaine oliveira good to see you my man

590
00:24:28,789 --> 00:24:26,960
hey thanks for coming out here and

591
00:24:30,549 --> 00:24:28,799
telling us about this flight trajectory

592
00:24:33,110 --> 00:24:30,559
and all the fun facts about lucy going

593
00:24:35,190 --> 00:24:33,120
up his face it's my pleasure so jermaine

594
00:24:37,909 --> 00:24:35,200
you are a flight design analyst with

595
00:24:40,549 --> 00:24:37,919
launch services program you know this

596
00:24:42,789 --> 00:24:40,559
flight pretty well tell me first about

597
00:24:45,029 --> 00:24:42,799
why we're launching at this specific

598
00:24:47,029 --> 00:24:45,039
time of year we're trying to rendezvous

599
00:24:49,029 --> 00:24:47,039
with two different sets of asteroids

600
00:24:51,430 --> 00:24:49,039
that are on the jupiter line you know

601
00:24:52,950 --> 00:24:51,440
juvenile orbit so in order to do that

602
00:24:54,470 --> 00:24:52,960
you have to launch at a particular time

603
00:24:56,070 --> 00:24:54,480
they line up with where the asteroids

604
00:24:57,669 --> 00:24:56,080
are going to be at because if you don't

605
00:24:59,590 --> 00:24:57,679
you'll either get it too early or get

606
00:25:01,029 --> 00:24:59,600
there too late can you believe how close

607
00:25:03,590 --> 00:25:01,039
we're standing here next to the

608
00:25:05,750 --> 00:25:03,600
spacecraft is close before this is great

609
00:25:07,750 --> 00:25:05,760
let me ask you about this fairing what's

610
00:25:10,070 --> 00:25:07,760
its purpose referring purpose is to

611
00:25:11,430 --> 00:25:10,080
encapsulate the satellite throughout you

612
00:25:12,549 --> 00:25:11,440
know the amount of time it's going

613
00:25:13,990 --> 00:25:12,559

through the atmosphere until it gets

614
00:25:16,710 --> 00:25:14,000
into space so let's talk a little bit

615
00:25:19,990 --> 00:25:16,720
about the orbit so this spacecraft is

616
00:25:21,029 --> 00:25:20,000
going out 530 million miles away from

617
00:25:23,750 --> 00:25:21,039
the sun

618
00:25:25,909 --> 00:25:23,760
that's far and it takes a careful orbit

619
00:25:27,350 --> 00:25:25,919
to get there yes what happens is you

620
00:25:29,269 --> 00:25:27,360
have to use earth gravity assist the

621
00:25:31,590 --> 00:25:29,279
slingshot yourself to each of the

622
00:25:34,390 --> 00:25:31,600
different asteroid trojans so lucy

623
00:25:38,230 --> 00:25:34,400
weighs about the same weight as a

624
00:25:40,549 --> 00:25:38,240
midsize vehicle 3 400 pounds or so yeah

625
00:25:42,630 --> 00:25:40,559
so it's pretty heavy what kind of thrust

626
00:25:44,789 --> 00:25:42,640
does this rocket need to get it up off

627
00:25:47,110 --> 00:25:44,799
the ground and into space max thrust on

628
00:25:49,110 --> 00:25:47,120
this particular rocket is about 930 000

629
00:25:51,269 --> 00:25:49,120
pounds of thrust and it get we see on a

630
00:25:53,110 --> 00:25:51,279
trajectory that's going about maybe

631
00:25:54,710 --> 00:25:53,120
twenty seven thousand twenty eight

632
00:25:56,870 --> 00:25:54,720
thousand miles per hour

633
00:26:00,149 --> 00:25:56,880
tell me about this rocket configuration

634
00:26:02,149 --> 00:26:00,159
that atlas 401 this is a four meter

635
00:26:03,590 --> 00:26:02,159
fairing that works great for this

636
00:26:06,070 --> 00:26:03,600
mission because given the spacecraft's

637
00:26:08,870 --> 00:26:06,080
weight about 1500 kilograms and where

638
00:26:10,470 --> 00:26:08,880

it's going the energy that is going to

639
00:26:12,549 --> 00:26:10,480
this particular rocket fits perfectly

640
00:26:14,310 --> 00:26:12,559
with it i'm really excited about the

641
00:26:16,470 --> 00:26:14,320
journey as it begins right here right

642
00:26:19,269 --> 00:26:16,480
now with this entire rocket and

643
00:26:21,110 --> 00:26:19,279
spacecraft rolling out to the pad that's

644
00:26:22,950 --> 00:26:21,120
pretty cool yes it is i've never seen it

645
00:26:24,630 --> 00:26:22,960
before actually i'm excited to see how

646
00:26:25,750 --> 00:26:24,640
this goes today you want to jump on and

647
00:26:27,350 --> 00:26:25,760
ride with uh

648
00:26:30,950 --> 00:26:27,360
thank you i'm fine

649
00:26:33,029 --> 00:26:30,960
i'm okay okay oh look there it's moving

650
00:26:37,029 --> 00:26:33,039
check it out

651
00:26:39,190 --> 00:26:37,039
well lucy's journey has begun it's been

652
00:26:40,870 --> 00:26:39,200
on okay amazing oliveira with love

653
00:26:42,390 --> 00:26:40,880
services program thank you so much for

654
00:26:43,909 --> 00:26:42,400
being here it was a pleasure being here

655
00:26:45,590 --> 00:26:43,919
thank you for having me

656
00:26:48,310 --> 00:26:45,600
and as that rolled out we had to take

657
00:26:49,750 --> 00:26:48,320
some pictures and even a selfie because

658
00:26:51,909 --> 00:26:49,760
you know what i feel like we're the last

659
00:26:54,230 --> 00:26:51,919
people to be that close to that

660
00:26:56,310 --> 00:26:54,240
spacecraft spacecraft going so far away

661
00:26:57,830 --> 00:26:56,320
yeah yeah i mean and and few people get

662
00:26:59,750 --> 00:26:57,840
to be at the base of the pad even fewer

663
00:27:01,269 --> 00:26:59,760

get to be inside the vif especially at

664
00:27:03,269 --> 00:27:01,279
that moment of rollout so that was a

665
00:27:05,669 --> 00:27:03,279
really cool opportunity that you had all

666
00:27:07,190 --> 00:27:05,679
right we are inside of l minus eight

667
00:27:08,950 --> 00:27:07,200
minutes and coming up on the launch

668
00:27:11,110 --> 00:27:08,960
conductor poll shortly so we want to

669
00:27:12,390 --> 00:27:11,120
hand it over to joshua and mick to take

670
00:27:15,510 --> 00:27:12,400
us the rest of the way through the

671
00:27:17,029 --> 00:27:15,520
countdown joshua hey thanks marie uh i

672
00:27:18,470 --> 00:27:17,039
love to say that rocketry is a team

673
00:27:19,669 --> 00:27:18,480
sport uh and that's what we're gonna get

674
00:27:21,269 --> 00:27:19,679
to kind of here with this launchpad dr

675
00:27:22,789 --> 00:27:21,279
paul in just a minute four major teams

676
00:27:24,230 --> 00:27:22,799
that play this morning nasa launch

677
00:27:26,230 --> 00:27:24,240
services program responsible for the

678
00:27:28,549 --> 00:27:26,240
launch united launch alliance providing

679
00:27:30,950 --> 00:27:28,559
the vehicle the ride to space we have

680
00:27:32,470 --> 00:27:30,960
the southwest research institute the

681
00:27:33,909 --> 00:27:32,480
nasa's goddard space flight center and

682
00:27:36,230 --> 00:27:33,919
lockheed martin part of the spacecraft

683
00:27:37,590 --> 00:27:36,240
team and then the space force

684
00:27:39,510 --> 00:27:37,600
yeah joshua we're very happy to have

685
00:27:41,190 --> 00:27:39,520
space force here as they protect the

686
00:27:42,789 --> 00:27:41,200
range and look at the weather they're

687
00:27:47,269 --> 00:27:42,799
also responsible for

688
00:27:51,190 --> 00:27:48,950

status check to proceed with terminal

689
00:27:53,190 --> 00:27:51,200
count atlas systems propulsion

690
00:27:56,470 --> 00:27:53,200
go hydraulics

691
00:27:59,750 --> 00:27:56,480
go pneumatics go lo2

692
00:28:09,830 --> 00:27:59,760
go water go centaur systems propulsion

693
00:28:17,269 --> 00:28:11,750
electrical systems airborne

694
00:28:20,230 --> 00:28:17,279
go ground go facility go rffts go flight

695
00:28:22,950 --> 00:28:20,240
control go gcq go

696
00:28:26,070 --> 00:28:22,960
operation support go com

697
00:28:29,590 --> 00:28:26,080
go umbilicals go acs

698
00:28:32,630 --> 00:28:29,600
go red light monitor go quality

699
00:28:36,149 --> 00:28:32,640
go top safety manager go ua safety

700
00:28:39,590 --> 00:28:36,159
officer go vehicle system engineer go

701
00:28:41,990 --> 00:28:39,600
anomaly chief go range coordinator clear

702
00:28:44,230 --> 00:28:42,000
to proceed launch director

703
00:28:45,510 --> 00:28:44,240
yeah permission to launch proceeding

704
00:28:48,870 --> 00:28:45,520
with account

705
00:28:50,310 --> 00:28:48,880
alc verify t-zero is set for zero nine

706
00:28:52,389 --> 00:28:50,320
three four zero

707
00:28:54,789 --> 00:28:52,399
verified

708
00:28:56,389 --> 00:28:54,799
so josh was a very successful poll there

709
00:28:58,870 --> 00:28:56,399
by launch conductor scott barney as you

710
00:29:03,190 --> 00:28:58,880
also heard we verified that t-0 is set

711
00:29:05,430 --> 00:29:03,200
for 09 34 zulu time that's 5 34 local

712
00:29:07,990 --> 00:29:05,440
very happy to hear everybody green and

713
00:29:10,389 --> 00:29:08,000

go and ins in particular our friends at

714
00:29:11,350 --> 00:29:10,399
the range there uh our space force

715
00:29:13,350 --> 00:29:11,360
friends

716
00:29:14,870 --> 00:29:13,360
gave a clear for the range today that's

717
00:29:16,870 --> 00:29:14,880
awesome they're doing their job not only

718
00:29:18,549 --> 00:29:16,880
with weather but the safety we also

719
00:29:19,750 --> 00:29:18,559
heard a little earlier in the count this

720
00:29:21,350 --> 00:29:19,760
morning that the rains reported there

721
00:29:23,990 --> 00:29:21,360
are no colas this morning which are

722
00:29:26,470 --> 00:29:24,000
collision avoidance assessments so we

723
00:29:28,549 --> 00:29:26,480
are good for our first initial

724
00:29:30,630 --> 00:29:28,559
part of the launch window this morning 5

725
00:29:33,029 --> 00:29:30,640
34. all steps are complete prior to

726
00:29:34,549 --> 00:29:33,039
terminal count yeah big thanks to the

727
00:29:36,310 --> 00:29:34,559
space launch delta 45 folks for all

728
00:29:38,070 --> 00:29:36,320
their support uh so looking ahead to

729
00:29:39,590 --> 00:29:38,080
terminal count we just heard the call

730
00:29:41,350 --> 00:29:39,600
that the spacecraft is configured for

731
00:29:43,190 --> 00:29:41,360
flight that includes being transitioned

732
00:29:44,710 --> 00:29:43,200
to internal power and then like i

733
00:29:46,870 --> 00:29:44,720
mentioned before those next few steps

734
00:29:49,190 --> 00:29:46,880
are all about getting the launch vehicle

735
00:29:51,350 --> 00:29:49,200
and the spacecraft uh able to live on

736
00:29:52,870 --> 00:29:51,360
their own so those are the things coming

737
00:29:55,269 --> 00:29:52,880
up here uh we do have this release of

738
00:29:56,870 --> 00:29:55,279

the built-in hold the eagle-eyed viewers

739
00:29:58,070 --> 00:29:56,880
that can see behind us might have

740
00:29:59,990 --> 00:29:58,080
noticed that there's a clock sitting at

741
00:30:01,909 --> 00:30:00,000
t minus four minutes and holding that's

742
00:30:03,510 --> 00:30:01,919
been that way for our entire show so far

743
00:30:05,110 --> 00:30:03,520
that will then sync up with our l clock

744
00:30:07,029 --> 00:30:05,120
you see on screen at this moment and

745
00:30:08,389 --> 00:30:07,039
those will count towards zero together

746
00:30:15,029 --> 00:30:08,399
again everything looking great for

747
00:30:18,470 --> 00:30:16,630
yeah joshua as we come out of this hole

748
00:30:20,710 --> 00:30:18,480
the you know what's very impressive this

749
00:30:22,549 --> 00:30:20,720
morning is this atlas 401 we heard

750
00:30:24,870 --> 00:30:22,559
jermaine talk about it it's a 401

751
00:30:27,990 --> 00:30:24,880
configuration a 4 meter fairing

752
00:30:31,110 --> 00:30:28,000
zero solids on it and one single

753
00:30:33,350 --> 00:30:31,120
uh centaur engine on the second stage

754
00:30:36,070 --> 00:30:33,360
this is a great configuration for the

755
00:30:38,230 --> 00:30:36,080
lucy mission it is the most common flown

756
00:30:41,830 --> 00:30:38,240
uh configuration by united launch

757
00:30:43,110 --> 00:30:41,840
alliance and uh this will be the 89th uh

758
00:30:48,710 --> 00:30:43,120
atlas v

759
00:30:52,470 --> 00:30:50,470
and there we go the clocks are released

760
00:30:55,909 --> 00:30:52,480
so we are ticking down here uh towards

761
00:30:57,430 --> 00:30:55,919
liftoff ground pirates enabled

762
00:30:58,789 --> 00:30:57,440
yeah we'll hear the team securing a lot

763
00:31:01,190 --> 00:30:58,799

of their things getting their final

764
00:31:03,110 --> 00:31:01,200
configurations in place and making sure

765
00:31:04,950 --> 00:31:03,120
the rock is ready for a t0 liftoff this

766
00:31:06,870 --> 00:31:04,960
morning so the team will be working very

767
00:31:08,389 --> 00:31:06,880
quickly yeah and uh opposed to the

768
00:31:09,669 --> 00:31:08,399
missions that we might be used to with

769
00:31:11,590 --> 00:31:09,679
where we're hitting a low earth orbit

770
00:31:13,830 --> 00:31:11,600
trajectory uh this one is going into

771
00:31:15,909 --> 00:31:13,840
deep space and so we'll be exceeding uh

772
00:31:18,310 --> 00:31:15,919
escape velocity of earth this morning so

773
00:31:19,909 --> 00:31:18,320
that's up and over 25 000 miles per hour

774
00:31:21,990 --> 00:31:19,919
we know that over the course of lucy's

775
00:31:23,909 --> 00:31:22,000
mission she will get up to about 400 000

776
00:31:26,230 --> 00:31:23,919
miles per hour so very very fast with

777
00:31:28,230 --> 00:31:26,240
all those earth gravity assists and for

778
00:31:29,590 --> 00:31:28,240
those that are in the physical area

779
00:31:31,110 --> 00:31:29,600
you'll also notice that this rocket will

780
00:31:32,789 --> 00:31:31,120
take a little bit more of a southern

781
00:31:34,310 --> 00:31:32,799
track than we're typically used to

782
00:31:35,909 --> 00:31:34,320
seeing we usually see rockets take off

783
00:31:36,870 --> 00:31:35,919
more towards the northeast this will

784
00:31:39,029 --> 00:31:36,880
move a little bit more towards the

785
00:31:41,190 --> 00:31:39,039
southeast than is typical yeah with that

786
00:31:42,389 --> 00:31:41,200
southerly trajectory people ought to be

787
00:31:59,509 --> 00:31:42,399
able to see some great things with the

788
00:32:04,389 --> 00:32:02,230

fts internal

789
00:32:06,070 --> 00:32:04,399
so there we heard the teams securing the

790
00:32:08,230 --> 00:32:06,080
topping and bringing the atlas tanks to

791
00:32:10,310 --> 00:32:08,240
flight pressure that's a huge milestone

792
00:32:11,750 --> 00:32:10,320
as we get ready for t0 this morning

793
00:32:14,710 --> 00:32:11,760
teams have finished putting locks and

794
00:32:17,350 --> 00:32:14,720
hydrogen on board and making sure that

795
00:32:20,389 --> 00:32:17,360
all that 740 thousand pounds of fuel is

796
00:32:22,230 --> 00:32:20,399
there for liftoff of lucy we also heard

797
00:32:24,389 --> 00:32:22,240
that the team brought in the flight

798
00:32:26,389 --> 00:32:24,399
termination system arm that is part of

799
00:32:28,950 --> 00:32:26,399
the range safety that is needed for the

800
00:32:30,470 --> 00:32:28,960
vehicle as we lift off this morning

801
00:32:32,230 --> 00:32:30,480
yeah previewing what's what's to come

802
00:32:34,149 --> 00:32:32,240
ahead so stay with us after liftoff

803
00:32:36,710 --> 00:32:34,159
we'll be tracking with a couple burns of

804
00:32:38,630 --> 00:32:36,720
the centaur spacecraft separation those

805
00:32:40,389 --> 00:32:38,640
beautiful solar arrays deploying and

806
00:32:41,909 --> 00:32:40,399
then signal acquisition of signal will

807
00:32:44,549 --> 00:32:41,919
kind of be the end of our our show for

808
00:32:47,990 --> 00:32:44,559
you today beginning a 12-year 4 billion

809
00:32:50,549 --> 00:32:48,000
mile journey for lucy absolutely

810
00:32:53,350 --> 00:32:50,559
159

811
00:32:56,870 --> 00:32:53,360
vehicle internal

812
00:32:58,310 --> 00:32:56,880
launch sequences start

813
00:33:01,750 --> 00:32:58,320

150

814
00:33:06,470 --> 00:33:01,760
securing centaur lh2

815
00:33:10,230 --> 00:33:08,230
140

816
00:33:13,350 --> 00:33:10,240
launch enabled

817
00:33:26,230 --> 00:33:16,149
fps armed

818
00:33:36,830 --> 00:33:28,549
120

819
00:33:46,950 --> 00:33:38,470
110.

820
00:33:50,830 --> 00:33:48,070
one minute

821
00:33:52,630 --> 00:33:50,840
rock report range status brain

822
00:33:54,149 --> 00:33:52,640
screen

823
00:33:56,149 --> 00:33:54,159
all right so stay with us again after

824
00:33:58,710 --> 00:33:56,159
liftoff i will also have the voice

825
00:34:00,789 --> 00:33:58,720
chiming in from rob kesselman from ula

826
00:34:07,029 --> 00:34:00,799
uh he'll be providing the launch vehicle

827
00:34:10,230 --> 00:34:08,470
40.

828
00:34:11,750 --> 00:34:10,240
staple that's step three

829
00:34:13,190 --> 00:34:11,760
so that's a great uh sign right there

830
00:34:15,109 --> 00:34:13,200
stable step three everything is at

831
00:34:18,230 --> 00:34:15,119
flight pressures or now the only thing

832
00:34:21,990 --> 00:34:18,240
left joshua is that final status check

833
00:34:39,909 --> 00:34:24,550
25 seconds status check

834
00:34:41,669 --> 00:34:40,790
seven

835
00:34:42,710 --> 00:34:41,679
six

836
00:34:43,669 --> 00:34:42,720
five

837
00:34:44,710 --> 00:34:43,679
four

838
00:34:45,669 --> 00:34:44,720

three

839
00:34:46,470 --> 00:34:45,679
two

840
00:34:49,270 --> 00:34:46,480
one

841
00:34:52,230 --> 00:34:49,280
zero

842
00:34:54,950 --> 00:34:52,240
liftoff atlas v takes flight sending

843
00:35:04,790 --> 00:34:54,960
lucy to uncover the fossils of our solar

844
00:35:09,990 --> 00:35:06,630
rd180 propellant utilization has gone to

845
00:35:16,370 --> 00:35:11,910
the vehicle has begun to pitch yaw roll

846
00:35:19,990 --> 00:35:17,829
[Music]

847
00:35:23,190 --> 00:35:20,000
now 30 seconds into flight

848
00:35:33,190 --> 00:35:23,200
vehicle is 0.6 miles in altitude

849
00:35:38,870 --> 00:35:35,109
r180 performance continues to look good

850
00:35:41,510 --> 00:35:40,230
engine pump speeds and injector

851
00:35:44,170 --> 00:35:41,520
pressures are in family for this thrust

852
00:35:49,829 --> 00:35:44,180
level

853
00:35:53,589 --> 00:35:51,510
atlas vehicle attitude remains stable at

854
00:35:58,470 --> 00:35:53,599
this time attitude weighs near zero and

855
00:36:02,390 --> 00:36:00,470
now at t plus 70 seconds into flight

856
00:36:04,069 --> 00:36:02,400
vehicle is four miles in altitude point

857
00:36:07,750 --> 00:36:04,079
two miles downrange distance traveling

858
00:36:07,760 --> 00:36:18,390
mark one alex is now supersonic

859
00:36:29,430 --> 00:36:19,990
vehicles now passing through max q

860
00:36:36,950 --> 00:36:30,790
the vehicle is now

861
00:36:40,470 --> 00:36:38,950
rd180 engine parameters continue to look

862
00:36:50,310 --> 00:36:40,480
nominal after their prior adjustment to

863
00:37:05,109 --> 00:36:51,829

approximately two minutes remain in the

864
00:37:09,030 --> 00:37:07,430
the atlas 5 rocket weighs now just one

865
00:37:10,950 --> 00:37:09,040
half of what it did at launch burning

866
00:37:14,230 --> 00:37:10,960
propellant at a rate of 2600 pounds per

867
00:37:14,240 --> 00:37:25,190
vehicle's now executing closed steering

868
00:37:28,470 --> 00:37:27,109
since our five central reaction control

869
00:37:33,030 --> 00:37:28,480
system is now pressurizing the flight

870
00:37:38,069 --> 00:37:35,430
so beautiful launch sequence there we do

871
00:37:40,069 --> 00:37:38,079
have another minute and a half or so to

872
00:37:42,230 --> 00:37:40,079
go with the booster in operation uh

873
00:37:44,630 --> 00:37:42,240
getting uh loose now just under three

874
00:37:48,230 --> 00:37:44,640
minutes into flight

875
00:37:51,109 --> 00:37:48,240
atlas is 33 miles in altitude 59 miles

876
00:37:57,990 --> 00:37:51,119
downrange distance traveling at 5600

877
00:38:01,589 --> 00:37:59,990
so lucy being lifted up out of the

878
00:38:03,510 --> 00:38:01,599
atmosphere by the booster getting on its

879
00:38:05,430 --> 00:38:03,520
way into a park orbit

880
00:38:06,790 --> 00:38:05,440
before we get towards our first stage

881
00:38:09,270 --> 00:38:06,800
vehicle systems are operating as

882
00:38:10,870 --> 00:38:09,280
expected at this time future

883
00:38:12,950 --> 00:38:10,880
future portions of the launch activity

884
00:38:17,430 --> 00:38:12,960
we have the centaur multiple burns ahead

885
00:38:20,950 --> 00:38:19,109
and the big milestone we should see josh

886
00:38:22,470 --> 00:38:20,960
coming up is booster engine cut off

887
00:38:23,750 --> 00:38:22,480
which would be the first stage cut off

888
00:38:25,589 --> 00:38:23,760

and then stability main engine is now

889
00:38:28,310 --> 00:38:25,599
throttling to maintain a constant 5g

890
00:38:29,589 --> 00:38:28,320
acceleration limit

891
00:38:31,190 --> 00:38:29,599
we're going to see a few things happen

892
00:38:32,870 --> 00:38:31,200
pretty rapidly the the booster will cut

893
00:38:34,950 --> 00:38:32,880
off just after four minutes and then

894
00:38:36,870 --> 00:38:34,960
within the next 15 seconds after that we

895
00:38:38,630 --> 00:38:36,880
should see the atlas separate from the

896
00:38:40,550 --> 00:38:38,640
centaur and then the centaur engine

897
00:38:42,150 --> 00:38:40,560
ignite for its first burn

898
00:38:45,030 --> 00:38:42,160
centaur has begun the boost phase

899
00:38:49,030 --> 00:38:46,870
and the rd-180 is now throttling to

900
00:38:50,630 --> 00:38:49,040
maintain a constant 4.6 g acceleration

901
00:38:51,829 --> 00:38:50,640
limit

902
00:38:54,790 --> 00:38:51,839
boost phase children sequence has

903
00:39:00,550 --> 00:38:58,310
and we have beco boost engine cutoff

904
00:39:01,990 --> 00:39:00,560
and a successful stage separation event

905
00:39:03,510 --> 00:39:02,000
so what you're seeing on screen is an

906
00:39:06,230 --> 00:39:03,520
animation that's being driven by actual

907
00:39:09,510 --> 00:39:08,550
so we are watching these things uh in an

908
00:39:11,270 --> 00:39:09,520
animation happen here but they're

909
00:39:13,030 --> 00:39:11,280
happening in real time as well right and

910
00:39:15,510 --> 00:39:13,040
mesh one we have ignition for the first

911
00:39:17,109 --> 00:39:15,520
burn all right so there we go uh we

912
00:39:19,670 --> 00:39:17,119
should see the fair the fairing jettison

913
00:39:23,190 --> 00:39:19,680

here we have indications

914
00:39:27,750 --> 00:39:25,109
all right nick so that wraps up the the

915
00:39:29,190 --> 00:39:27,760
first round of of major milestones here

916
00:39:31,589 --> 00:39:29,200
uh still very much in the middle of

917
00:39:33,510 --> 00:39:31,599
dynamic flight the system on the rl10 is

918
00:39:34,870 --> 00:39:33,520
now in an open loop burn off mode to

919
00:39:36,870 --> 00:39:34,880
burn off excess fuel in the early

920
00:39:38,390 --> 00:39:36,880
portion of this burn

921
00:39:40,710 --> 00:39:38,400
so walk us quickly through mick what are

922
00:39:42,230 --> 00:39:40,720
we looking for in the next and this burn

923
00:39:45,270 --> 00:39:42,240
in the next one so this sperm is going

924
00:39:47,510 --> 00:39:45,280
to end with uh mikko uh getting uh

925
00:39:49,750 --> 00:39:47,520
centaur and lucy into its park orbit

926
00:39:51,430 --> 00:39:49,760
around earth and then we will then get

927
00:39:53,349 --> 00:39:51,440
into mess two which will get us into

928
00:39:54,310 --> 00:39:53,359
that transfer orbit getting lucy on its

929
00:39:56,310 --> 00:39:54,320
way

930
00:39:57,829 --> 00:39:56,320
awesome so that's going to do it for now

931
00:39:59,190 --> 00:39:57,839
uh finishing up the initial launch

932
00:40:01,829 --> 00:39:59,200
activities everything sounding like it's

933
00:40:03,670 --> 00:40:01,839
going perfectly uh daryl back to you

934
00:40:06,470 --> 00:40:03,680
thank you joshua and mick a beautiful

935
00:40:09,750 --> 00:40:06,480
launch out here from our vantage point

936
00:40:12,150 --> 00:40:09,760
incredible all right lucy was built at

937
00:40:14,309 --> 00:40:12,160
the lockheed martin facility in colorado

938
00:40:17,109 --> 00:40:14,319

before arriving at the cape canaveral

939
00:40:19,349 --> 00:40:17,119
space force station for launch engineers

940
00:40:21,829 --> 00:40:19,359
at lockheed's waterton facility use

941
00:40:24,710 --> 00:40:21,839
lessons learned from prior spacecraft

942
00:40:27,510 --> 00:40:24,720
like new horizons and osiris-rex to

943
00:40:29,670 --> 00:40:27,520
build lucy and in july lucy was packed

944
00:40:33,349 --> 00:40:29,680
up and flown on board a united states

945
00:40:35,270 --> 00:40:33,359
air force c-17 cargo plane from colorado

946
00:40:37,750 --> 00:40:35,280
to the launch and landing facility

947
00:40:39,510 --> 00:40:37,760
runway at the kennedy space center from

948
00:40:41,910 --> 00:40:39,520
there lucy was transported to an

949
00:40:44,950 --> 00:40:41,920
astrotech space operations processing

950
00:40:46,870 --> 00:40:44,960
facility in nearby titusville for final

951
00:40:48,390 --> 00:40:46,880
preparations before liftoff yeah just a

952
00:40:50,870 --> 00:40:48,400
few miles from here before it was

953
00:40:53,190 --> 00:40:50,880
brought to the pad for more about how

954
00:40:56,150 --> 00:40:53,200
lucy was built let's send it over to

955
00:40:57,990 --> 00:40:56,160
nasa's megan cruz

956
00:40:59,990 --> 00:40:58,000
hey daryl yeah right now i'm joined by

957
00:41:02,069 --> 00:41:00,000
ari vogel he's the deep space

958
00:41:03,750 --> 00:41:02,079
exploration director at lockheed martin

959
00:41:05,030 --> 00:41:03,760
space how are you i'm doing wonderful

960
00:41:06,309 --> 00:41:05,040
thanks so much for having me wasn't that

961
00:41:08,230 --> 00:41:06,319
just a beautiful lodge what did you

962
00:41:10,470 --> 00:41:08,240
think about that incredible you know

963
00:41:12,230 --> 00:41:10,480

seeing it go over the clouds and ride it

964
00:41:14,150 --> 00:41:12,240
brighten up the whole sky was just

965
00:41:15,270 --> 00:41:14,160
fantastic yeah to see it rise over the

966
00:41:16,309 --> 00:41:15,280
clouds because you know we lost it a

967
00:41:17,990 --> 00:41:16,319
little bit because of some cloud

968
00:41:19,430 --> 00:41:18,000
coverage but then it just rose out of it

969
00:41:21,670 --> 00:41:19,440
it was so beautiful and you know i

970
00:41:23,349 --> 00:41:21,680
really wanted to talk to you because you

971
00:41:24,950 --> 00:41:23,359
your team at lockheed martin space knew

972
00:41:26,470 --> 00:41:24,960
that you were going into a project that

973
00:41:28,630 --> 00:41:26,480
would require you to develop a

974
00:41:31,190 --> 00:41:28,640
spacecraft that would travel farther

975
00:41:33,589 --> 00:41:31,200
than any other solar-powered spacecraft

976
00:41:35,430 --> 00:41:33,599
ever i mean was that intimidating you

977
00:41:37,910 --> 00:41:35,440
know it was it was a really exciting

978
00:41:39,910 --> 00:41:37,920
challenge to to solve right and

979
00:41:41,990 --> 00:41:39,920
obviously the most prominent feature of

980
00:41:43,750 --> 00:41:42,000
lucia's are big solar arrays each one is

981
00:41:45,829 --> 00:41:43,760
about the length of a bus

982
00:41:47,270 --> 00:41:45,839
and um you know what we did is we

983
00:41:48,950 --> 00:41:47,280
basically just broke the problem down

984
00:41:50,390 --> 00:41:48,960
into smaller pieces and then applied

985
00:41:52,230 --> 00:41:50,400
systems thinking

986
00:41:54,390 --> 00:41:52,240
to make sure that the design trades we

987
00:41:56,470 --> 00:41:54,400
were doing uh didn't impact or that we

988
00:41:58,150 --> 00:41:56,480

fully understood the impacts for over

989
00:42:00,550 --> 00:41:58,160
the 12-year mission

990
00:42:02,230 --> 00:42:00,560
so you know being the farthest solar

991
00:42:03,750 --> 00:42:02,240
powered spacecraft is certainly

992
00:42:04,630 --> 00:42:03,760
something that was difficult to prepare

993
00:42:07,270 --> 00:42:04,640
for

994
00:42:09,190 --> 00:42:07,280
um as is going to a record eight

995
00:42:10,470 --> 00:42:09,200
asteroids in one mission

996
00:42:12,230 --> 00:42:10,480
uh but that's why we have such a

997
00:42:13,589 --> 00:42:12,240
comprehensive test like you fly program

998
00:42:15,190 --> 00:42:13,599
at lockheed martin and we took it

999
00:42:17,589 --> 00:42:15,200
through the ringer at our facility in

1000
00:42:19,829 --> 00:42:17,599
denver yeah and you did it all within 14

1001
00:42:21,109 --> 00:42:19,839
months that's during a pandemic that's

1002
00:42:23,270 --> 00:42:21,119
incredible can you talk to me about the

1003
00:42:25,589 --> 00:42:23,280
challenges of that yeah you know it's

1004
00:42:27,670 --> 00:42:25,599
it's really awe-inspiring i mean to to

1005
00:42:29,589 --> 00:42:27,680
be able to to build a one-on-one of a

1006
00:42:31,829 --> 00:42:29,599
kind spacecraft during normal

1007
00:42:33,910 --> 00:42:31,839
circumstances is incredible

1008
00:42:35,910 --> 00:42:33,920
and the team just really pulled together

1009
00:42:37,910 --> 00:42:35,920
didn't miss a beat connected and

1010
00:42:40,550 --> 00:42:37,920
collaborated you know made sure that we

1011
00:42:41,829 --> 00:42:40,560
didn't uh didn't have any mistakes and

1012
00:42:43,670 --> 00:42:41,839
it really accelerated some of our

1013
00:42:46,309 --> 00:42:43,680

digital transformation initiatives too

1014
00:42:49,670 --> 00:42:46,319
having to to work during the pandemic

1015
00:42:52,069 --> 00:42:49,680
and not a single shift was missed during

1016
00:42:54,230 --> 00:42:52,079
integration and tests due to covet so

1017
00:42:55,750 --> 00:42:54,240
teams just did an awesome job leadership

1018
00:42:58,230 --> 00:42:55,760
with the preparation and the over

1019
00:43:00,390 --> 00:42:58,240
communication and the transparency and

1020
00:43:03,270 --> 00:43:00,400
then all the team you know just didn't

1021
00:43:04,470 --> 00:43:03,280
let their commitment to lucy waiver

1022
00:43:06,150 --> 00:43:04,480
and i think the thing that i'm most

1023
00:43:08,069 --> 00:43:06,160
proud about actually is is that through

1024
00:43:10,309 --> 00:43:08,079
it all we still continue to all of our

1025
00:43:11,430 --> 00:43:10,319
stem events all our mentoring our

1026
00:43:13,670 --> 00:43:11,440
coaching

1027
00:43:16,069 --> 00:43:13,680
uh lockheed martin nasa southwest

1028
00:43:18,470 --> 00:43:16,079
research institute

1029
00:43:20,710 --> 00:43:18,480
hundreds of thousands of hours in into

1030
00:43:21,910 --> 00:43:20,720
that so it's really really a great job

1031
00:43:23,190 --> 00:43:21,920
and really quick you also built the

1032
00:43:24,950 --> 00:43:23,200
antenna that's on there that's going to

1033
00:43:26,390 --> 00:43:24,960
help us communicate with lucy can you

1034
00:43:28,870 --> 00:43:26,400
tell me a little bit about that yeah we

1035
00:43:31,829 --> 00:43:28,880
did uh six and a half foot uh wide

1036
00:43:33,190 --> 00:43:31,839
antenna that we built main job is to is

1037
00:43:35,670 --> 00:43:33,200
to do the communication between the

1038
00:43:37,430 --> 00:43:35,680

spacecraft and um you know it's also

1039
00:43:38,950 --> 00:43:37,440
gonna send back some of the first images

1040
00:43:40,950 --> 00:43:38,960
of the trojans so the whole team is

1041
00:43:42,470 --> 00:43:40,960
super excited for that absolutely thank

1042
00:43:44,309 --> 00:43:42,480
you so much aria i really appreciate you

1043
00:43:45,990 --> 00:43:44,319
being here today and for bringing lucy

1044
00:43:47,430 --> 00:43:46,000
to life so thank you thanks for having

1045
00:43:49,190 --> 00:43:47,440
me all right derral back to you all

1046
00:43:52,710 --> 00:43:49,200
right thank you megan and in case you're

1047
00:43:56,069 --> 00:43:52,720
just joining us we here at uh nasa are

1048
00:43:58,710 --> 00:43:56,079
at the beginning of lucy's 530 mile

1049
00:44:01,589 --> 00:43:58,720
journey to the trojan asteroids beyond

1050
00:44:03,670 --> 00:44:01,599
the sun going to the same orbit marie as

1051
00:44:05,190 --> 00:44:03,680
jupiter that's right it was a beautiful

1052
00:44:07,030 --> 00:44:05,200
launch here we could see it light up the

1053
00:44:08,790 --> 00:44:07,040
water behind us and we actually had a

1054
00:44:11,829 --> 00:44:08,800
gator in the water just behind us

1055
00:44:14,390 --> 00:44:11,839
joining us for lift us yeah uh lucy is

1056
00:44:17,190 --> 00:44:14,400
named after a skeleton fossil more than

1057
00:44:19,829 --> 00:44:17,200
three million years old lucy was an

1058
00:44:23,030 --> 00:44:19,839
early human ancestor and the trojan

1059
00:44:30,309 --> 00:44:23,040
asteroids are fossils too of how planets

1060
00:44:35,430 --> 00:44:32,790
beyond the asteroid belt are fossils of

1061
00:44:37,430 --> 00:44:35,440
planet formation known as the trojan

1062
00:44:39,670 --> 00:44:37,440
asteroids

1063
00:44:42,630 --> 00:44:39,680

these primitive bodies share jupiter's

1064
00:44:45,589 --> 00:44:42,640
orbit in two vast swarms leading and

1065
00:44:48,069 --> 00:44:45,599
trailing the planet

1066
00:44:53,349 --> 00:44:48,079
now nasa is preparing to visit seven

1067
00:44:58,360 --> 00:44:56,150
embarking on a 12-year odyssey that will

1068
00:44:59,829 --> 00:44:58,370
span jupiter's orbit

1069
00:45:02,309 --> 00:44:59,839
[Music]

1070
00:45:05,500 --> 00:45:02,319
one mission will explore these objects

1071
00:45:13,270 --> 00:45:05,510
for the first time

1072
00:45:19,030 --> 00:45:15,829
lucy the first mission to the trojan

1073
00:45:22,950 --> 00:45:21,109
and another special guest that we had

1074
00:45:25,109 --> 00:45:22,960
watching the launch from the atlas space

1075
00:45:27,349 --> 00:45:25,119
flight operations center was not under

1076
00:45:29,670 --> 00:45:27,359
none other than nasa's associate

1077
00:45:30,870 --> 00:45:29,680
administrator bob cabana he is standing

1078
00:45:33,349 --> 00:45:30,880
by with

1079
00:45:35,030 --> 00:45:33,359
blair allen of nasa edge

1080
00:45:37,990 --> 00:45:35,040
actually they're telling me that we lost

1081
00:45:40,470 --> 00:45:38,000
audio with that group so we will we will

1082
00:45:42,150 --> 00:45:40,480
come back to that um if we can but while

1083
00:45:44,950 --> 00:45:42,160
they try to work out their audio issues

1084
00:45:47,670 --> 00:45:44,960
but daryl uh you know we had we had a

1085
00:45:49,430 --> 00:45:47,680
really unmatched view of of launch here

1086
00:45:51,670 --> 00:45:49,440
it was just spectacular yeah it was

1087
00:45:54,069 --> 00:45:51,680
incredible because uh we're sitting you

1088
00:45:56,309 --> 00:45:54,079

can't really tell but this behind us is

1089
00:45:58,390 --> 00:45:56,319
the kennedy basin right the turn basin

1090
00:46:01,510 --> 00:45:58,400
where they brought in uh you know the

1091
00:46:04,470 --> 00:46:01,520
space shuttle uh main uh tank as well as

1092
00:46:07,349 --> 00:46:04,480
just recently uh the core stage for the

1093
00:46:09,190 --> 00:46:07,359
artemis rocket which is in uh the vab

1094
00:46:12,390 --> 00:46:09,200
right now getting stacked you're looking

1095
00:46:13,829 --> 00:46:12,400
at the flight of centaur and lucy we are

1096
00:46:17,109 --> 00:46:13,839
elm plus

1097
00:46:18,870 --> 00:46:17,119
11 minutes and 26 seconds as we cruise

1098
00:46:19,670 --> 00:46:18,880
along and we want to talk a little bit

1099
00:46:21,829 --> 00:46:19,680
now

1100
00:46:24,950 --> 00:46:21,839
about the message that lucy is going to

1101
00:46:26,470 --> 00:46:24,960
be sending that's right lucy is carrying

1102
00:46:28,230 --> 00:46:26,480
something on board

1103
00:46:29,349 --> 00:46:28,240
aside from her scientific instruments

1104
00:46:32,069 --> 00:46:29,359
she's got something a little more

1105
00:46:34,150 --> 00:46:32,079
philosophical there is actually a plaque

1106
00:46:36,630 --> 00:46:34,160
affixed to the side of the lucy

1107
00:46:39,430 --> 00:46:36,640
spacecraft and it contains quotes and

1108
00:46:41,670 --> 00:46:39,440
messages from artists poets and thought

1109
00:46:44,390 --> 00:46:41,680
leaders and the plaque is meant to serve

1110
00:46:47,190 --> 00:46:44,400
as a time capsule of sorts for our own

1111
00:46:49,750 --> 00:46:47,200
descendants you see after lucy's 12-year

1112
00:46:52,710 --> 00:46:49,760
mission is complete the spacecraft will

1113
00:46:54,069 --> 00:46:52,720

remain on a stable orbit traveling back

1114
00:46:57,270 --> 00:46:54,079
and forth between the earth and the

1115
00:46:59,990 --> 00:46:57,280
trojan asteroids for perhaps hundreds of

1116
00:47:02,630 --> 00:47:00,000
thousands of years and one day in the

1117
00:47:05,030 --> 00:47:02,640
distant future our descendants may be

1118
00:47:07,190 --> 00:47:05,040
able to retrieve lucy uh there it is

1119
00:47:08,870 --> 00:47:07,200
this the uh the plaque you can see on

1120
00:47:09,829 --> 00:47:08,880
the side of the spacecraft this was

1121
00:47:11,349 --> 00:47:09,839
before

1122
00:47:13,829 --> 00:47:11,359
lucy was packed inside the payload

1123
00:47:16,870 --> 00:47:13,839
fairing uh but this is meant to be a

1124
00:47:18,870 --> 00:47:16,880
relic for our and for our descendants

1125
00:47:21,670 --> 00:47:18,880
of the early days of humanity's

1126
00:47:23,190 --> 00:47:21,680
exploration of the solar system

1127
00:47:25,270 --> 00:47:23,200
and when they do they will see some

1128
00:47:26,790 --> 00:47:25,280
great messages we'll see those uh we'll

1129
00:47:27,829 --> 00:47:26,800
talk more about those in just a couple

1130
00:47:30,470 --> 00:47:27,839
of minutes

1131
00:47:33,190 --> 00:47:30,480
oh we actually have we do have it um so

1132
00:47:36,630 --> 00:47:33,200
this is um a representation it's hidden

1133
00:47:38,790 --> 00:47:36,640
a little bit behind your computer daryl

1134
00:47:40,870 --> 00:47:38,800
but this is the actual plaque on the

1135
00:47:43,270 --> 00:47:40,880
spacecraft is about a tenth of the size

1136
00:47:45,750 --> 00:47:43,280
of this so this is blown up um but it's

1137
00:47:48,069 --> 00:47:45,760
got a diagram on it this shows the

1138
00:47:50,150 --> 00:47:48,079

positions of the planets as they are

1139
00:47:51,589 --> 00:47:50,160
today on the day of the lucy launch

1140
00:47:53,670 --> 00:47:51,599
that's right and there are some great

1141
00:47:55,910 --> 00:47:53,680
quotes you mentioned some of the great

1142
00:47:57,589 --> 00:47:55,920
philosophers and uh

1143
00:48:00,630 --> 00:47:57,599
thought leaders over time down at the

1144
00:48:02,549 --> 00:48:00,640
bottom left you can see uh that one

1145
00:48:04,950 --> 00:48:02,559
there is from albert einstein the

1146
00:48:07,030 --> 00:48:04,960
important thing is to never stop

1147
00:48:09,589 --> 00:48:07,040
questioning and then in the middle we've

1148
00:48:12,790 --> 00:48:09,599
got uh the beetles in fact every single

1149
00:48:15,589 --> 00:48:12,800
beetle is here including john lennon and

1150
00:48:16,950 --> 00:48:15,599
he says we'll all shine on like the moon

1151
00:48:18,230 --> 00:48:16,960
and the stars

1152
00:48:19,349 --> 00:48:18,240
and the sun

1153
00:48:21,190 --> 00:48:19,359
and then

1154
00:48:23,349 --> 00:48:21,200
up here at the top

1155
00:48:25,910 --> 00:48:23,359
um actually right here on the far right

1156
00:48:27,670 --> 00:48:25,920
we've got amanda gorman who just came to

1157
00:48:30,069 --> 00:48:27,680
recent fame at the presidential

1158
00:48:32,790 --> 00:48:30,079
inauguration and she actually wrote this

1159
00:48:35,190 --> 00:48:32,800
poem specifically for lucy and there's a

1160
00:48:37,670 --> 00:48:35,200
great quote in here she says hope

1161
00:48:40,309 --> 00:48:37,680
implores us may ancient

1162
00:48:43,270 --> 00:48:40,319
um the ancient study and the

1163
00:48:45,670 --> 00:48:43,280

uncompromising core of us to keep rising

1164
00:48:49,030 --> 00:48:45,680
for an earth more than worth fighting

1165
00:48:51,190 --> 00:48:49,040
for great words from a young poet yes

1166
00:48:54,630 --> 00:48:51,200
she's a she's an amazing poet just blows

1167
00:48:57,349 --> 00:48:54,640
me away uh we are going to uh now get a

1168
00:48:59,270 --> 00:48:57,359
look at uh some more of the messages

1169
00:49:01,950 --> 00:48:59,280
that we intend to leave behind for our

1170
00:49:29,670 --> 00:49:01,960
descendants take a look

1171
00:49:36,390 --> 00:49:32,790
and this is what i want to say

1172
00:49:39,589 --> 00:49:36,400
to people to beings to consciousness who

1173
00:49:43,109 --> 00:49:39,599
are so far away i can't even imagine

1174
00:49:44,470 --> 00:49:43,119
them to represent our culture

1175
00:49:46,069 --> 00:49:44,480
accurately we should include

1176
00:49:47,510 --> 00:49:46,079
hopelessness

1177
00:49:49,030 --> 00:49:47,520
risk-taking

1178
00:49:51,270 --> 00:49:49,040
the role of

1179
00:49:54,710 --> 00:49:51,280
fortune good or bad

1180
00:49:56,630 --> 00:49:54,720
to understand each desire has an edge

1181
00:50:00,150 --> 00:49:56,640
to know that we are responsible for the

1182
00:50:03,030 --> 00:50:00,160
lives we change no faith comes without

1183
00:50:04,790 --> 00:50:03,040
cost no one believes without dying

1184
00:50:07,430 --> 00:50:04,800
there are no curses

1185
00:50:10,110 --> 00:50:07,440
only mirrors held up to the souls of

1186
00:50:11,589 --> 00:50:10,120
gods and mortals

1187
00:50:14,150 --> 00:50:11,599
[Music]

1188
00:50:16,630 --> 00:50:14,160

remember you are all people and all

1189
00:50:20,069 --> 00:50:16,640
people are you remember you are this

1190
00:50:21,190 --> 00:50:20,079
universe this universe is you

1191
00:50:23,030 --> 00:50:21,200
i would just

1192
00:50:25,910 --> 00:50:23,040
like to say that

1193
00:50:29,190 --> 00:50:25,920
this wonderful emissary to the trojan

1194
00:50:34,390 --> 00:50:29,200
asteroids is itself a message

1195
00:50:35,430 --> 00:50:34,400
lucy speaks for all that is best about

1196
00:50:37,190 --> 00:50:35,440
human

1197
00:50:38,950 --> 00:50:37,200
ingenuity

1198
00:50:41,270 --> 00:50:38,960
curiosity

1199
00:50:43,349 --> 00:50:41,280
and endeavor do you still have birds

1200
00:50:45,990 --> 00:50:43,359
that wake you up in the morning

1201
00:50:48,470 --> 00:50:46,000
with their singing and lovers

1202
00:50:50,230 --> 00:50:48,480
who gaze at the stars

1203
00:50:52,710 --> 00:50:50,240
trying to read in them

1204
00:50:54,630 --> 00:50:52,720
the fate of their love

1205
00:50:56,870 --> 00:50:54,640
if you do

1206
00:50:59,670 --> 00:50:56,880
we'll recognize that

1207
00:51:01,030 --> 00:50:59,680
and receive those those words inscribed

1208
00:51:04,150 --> 00:51:01,040
on a plaque

1209
00:51:05,430 --> 00:51:04,160
from all of us for all of us

1210
00:51:07,589 --> 00:51:05,440
filled with those

1211
00:51:09,349 --> 00:51:07,599
those aspirations and that inspiration

1212
00:51:10,080 --> 00:51:09,359
and that imagination that we need so

1213
00:51:17,910 --> 00:51:10,090

much right now

1214
00:51:21,109 --> 00:51:17,920
[Music]

1215
00:51:24,710 --> 00:51:21,119
a little noisy but i'm so excited lucy

1216
00:51:27,349 --> 00:51:24,720
is going back in the sky with diamonds

1217
00:51:29,430 --> 00:51:27,359
johnny will love that anyway

1218
00:51:31,960 --> 00:51:29,440
if you meet anyone up there lucy give

1219
00:51:37,829 --> 00:51:31,970
them peace and love for me

1220
00:51:40,870 --> 00:51:39,430
all right we've got that audio issue

1221
00:51:43,109 --> 00:51:40,880
taken care of so we're going to go over

1222
00:51:46,390 --> 00:51:43,119
now to nasa edge's blair allen standing

1223
00:51:48,309 --> 00:51:46,400
by with bob cabana blair

1224
00:51:50,390 --> 00:51:48,319
thanks so much marie sorry about the

1225
00:51:52,150 --> 00:51:50,400
technical difficulties you know the uh

1226
00:51:55,589 --> 00:51:52,160
the launch was so impressive even our

1227
00:51:56,950 --> 00:51:55,599
gear was affected uh but bob it's really

1228
00:51:59,030 --> 00:51:56,960
impressive to see this launch this

1229
00:52:01,109 --> 00:51:59,040
morning tell us how is it from your

1230
00:52:03,190 --> 00:52:01,119
perspective well first off from my

1231
00:52:05,589 --> 00:52:03,200
perspective i i got my very own nasa

1232
00:52:08,069 --> 00:52:05,599
edge microphone i'm just elated

1233
00:52:10,069 --> 00:52:08,079
now blair you know anytime you see a

1234
00:52:12,470 --> 00:52:10,079
rocket ship leave planet earth it is an

1235
00:52:14,950 --> 00:52:12,480
experience it's a feast for the senses

1236
00:52:17,270 --> 00:52:14,960
sight sound and feel it's emotional and

1237
00:52:19,510 --> 00:52:17,280
heaven lucy on board i mean this is the

1238
00:52:21,589 --> 00:52:19,520

coolest darn mission going to the trojan

1239
00:52:24,390 --> 00:52:21,599
asteroids looking back at the beginning

1240
00:52:26,790 --> 00:52:24,400
of our universe 5 billion years ago

1241
00:52:28,230 --> 00:52:26,800
absolutely amazing that's kind of what's

1242
00:52:30,870 --> 00:52:28,240
impressive i mean we're talking about

1243
00:52:34,069 --> 00:52:30,880
this important science mission but here

1244
00:52:36,470 --> 00:52:34,079
at kennedy we've had 24 launches so far

1245
00:52:38,630 --> 00:52:36,480
what's going on well i i tell you first

1246
00:52:41,270 --> 00:52:38,640
off i could not be more proud of our

1247
00:52:43,190 --> 00:52:41,280
nasa team our contractor civil service

1248
00:52:45,750 --> 00:52:43,200
team that has persevered through this

1249
00:52:47,270 --> 00:52:45,760
pandemic not missing a beat you know

1250
00:52:48,710 --> 00:52:47,280
making all our missions i mean we've

1251
00:52:50,390 --> 00:52:48,720
launched humans to the international

1252
00:52:52,390 --> 00:52:50,400
space station for the first time since

1253
00:52:54,870 --> 00:52:52,400
the end of the shuttle program during it

1254
00:52:56,870 --> 00:52:54,880
we've launched perseverance to mars you

1255
00:52:58,470 --> 00:52:56,880
know we're getting ready to launch james

1256
00:53:00,630 --> 00:52:58,480
webb here in

1257
00:53:02,790 --> 00:53:00,640
december that's going to be amazing and

1258
00:53:04,390 --> 00:53:02,800
and getting lucy off on time you know we

1259
00:53:06,069 --> 00:53:04,400
only if we didn't get off in this launch

1260
00:53:08,870 --> 00:53:06,079
window we're talking another year before

1261
00:53:10,470 --> 00:53:08,880
we launch yeah and that is impressive to

1262
00:53:12,870 --> 00:53:10,480
see how things came together so

1263
00:53:15,030 --> 00:53:12,880

perfectly but tell us a little bit about

1264
00:53:16,630 --> 00:53:15,040
what's coming down the pike you've we've

1265
00:53:18,390 --> 00:53:16,640
seen a lot of things happen here at

1266
00:53:20,950 --> 00:53:18,400
kennedy and lots of things to look

1267
00:53:23,190 --> 00:53:20,960
forward to well absolutely you know i

1268
00:53:25,910 --> 00:53:23,200
mean first off from a science mission

1269
00:53:27,109 --> 00:53:25,920
point of view uh of course next month

1270
00:53:28,390 --> 00:53:27,119
we're going out to the west coast for

1271
00:53:30,069 --> 00:53:28,400
dart then we're coming back here in

1272
00:53:32,309 --> 00:53:30,079
december for xp

1273
00:53:34,950 --> 00:53:32,319
in december down in french guyana we're

1274
00:53:37,589 --> 00:53:34,960
launching james webb what an amazing

1275
00:53:40,390 --> 00:53:37,599
telescope that's going to be a 21 foot

1276
00:53:42,549 --> 00:53:40,400
mirror you know and then a solar shield

1277
00:53:43,829 --> 00:53:42,559
a sun shield the size of a tennis court

1278
00:53:46,230 --> 00:53:43,839
you know they talk about the nine

1279
00:53:48,549 --> 00:53:46,240
minutes of terror landing on mars we're

1280
00:53:50,790 --> 00:53:48,559
talking four weeks and nile nail biting

1281
00:53:53,349 --> 00:53:50,800
as that thing unfolds but to look back

1282
00:53:55,589 --> 00:53:53,359
13 and a half billion years almost to

1283
00:53:57,670 --> 00:53:55,599
the beginning of our

1284
00:53:58,790 --> 00:53:57,680
universe you know three and a half 350

1285
00:54:00,790 --> 00:53:58,800
million years from the beginning it's

1286
00:54:02,630 --> 00:54:00,800
going to be amazing and then over in the

1287
00:54:05,510 --> 00:54:02,640
vehicle assembly building over there in

1288
00:54:08,069 --> 00:54:05,520

high bay 3 stacked up is that awesome

1289
00:54:10,069 --> 00:54:08,079
space launch system that boeing core

1290
00:54:13,670 --> 00:54:10,079
stage with the northrop grumman solids

1291
00:54:16,390 --> 00:54:13,680
and those four aerojet rocketdyne rs25s

1292
00:54:18,710 --> 00:54:16,400
the orion spacecraft rolls over here in

1293
00:54:20,069 --> 00:54:18,720
uh on the 19th stack down on top it's

1294
00:54:21,510 --> 00:54:20,079
going out to the pad for a wet dress

1295
00:54:22,950 --> 00:54:21,520
rehearsal and then we're going to launch

1296
00:54:24,309 --> 00:54:22,960
it to the moon we're going to do that

1297
00:54:25,990 --> 00:54:24,319
first test flight without crew in

1298
00:54:28,150 --> 00:54:26,000
preparation for going back to the moon

1299
00:54:31,750 --> 00:54:28,160
in a sustainable way so that we can go

1300
00:54:33,510 --> 00:54:31,760
on to mars just so much going on i love

1301
00:54:35,430 --> 00:54:33,520
it thank you so much for being on the

1302
00:54:37,990 --> 00:54:35,440
show from center director now to nasa

1303
00:54:39,829 --> 00:54:38,000
administrator back to you marie great

1304
00:54:41,670 --> 00:54:39,839
things here at nasa

1305
00:54:44,630 --> 00:54:41,680
all right thank you blair one of the

1306
00:54:46,710 --> 00:54:44,640
asteroids lucy will visit uribetes has

1307
00:54:49,430 --> 00:54:46,720
already given researchers a recent

1308
00:54:53,030 --> 00:54:49,440
surprise revealed by the hubble space

1309
00:54:56,309 --> 00:54:53,040
telescope take a look

1310
00:54:57,910 --> 00:54:56,319
on january 9th 2020 nasa's lucy mission

1311
00:54:59,589 --> 00:54:57,920
team revealed that the spacecraft would

1312
00:55:02,309 --> 00:54:59,599
be visiting not seven asteroids as

1313
00:55:04,630 --> 00:55:02,319

planned but eight as it turns out

1314
00:55:07,349 --> 00:55:04,640
uribides one of the trojan asteroids

1315
00:55:09,670 --> 00:55:07,359
along lucy's path has a small satellite

1316
00:55:11,670 --> 00:55:09,680
or moonlit orbiting it finding these

1317
00:55:14,069 --> 00:55:11,680
tiny new worlds before lucy is launched

1318
00:55:16,230 --> 00:55:14,079
in 2021 means that the team can

1319
00:55:17,910 --> 00:55:16,240
investigate their orbits and plan for

1320
00:55:19,349 --> 00:55:17,920
more detailed follow-up observations

1321
00:55:21,510 --> 00:55:19,359
during flybys

1322
00:55:23,270 --> 00:55:21,520
dr keith null and other lucy science

1323
00:55:25,349 --> 00:55:23,280
team members have been using the hubble

1324
00:55:27,750 --> 00:55:25,359
space telescope to search for satellites

1325
00:55:29,510 --> 00:55:27,760
and rings around lucy's targets this can

1326
00:55:31,109 --> 00:55:29,520
be challenging since the raw images are

1327
00:55:32,950 --> 00:55:31,119
often filled with bumps blobs and

1328
00:55:34,789 --> 00:55:32,960
diffraction spikes

1329
00:55:37,990 --> 00:55:34,799
the lucy team didn't see any evidence of

1330
00:55:39,510 --> 00:55:38,000
a new satellite until november 2019.

1331
00:55:41,589 --> 00:55:39,520
after experimenting with the brightness

1332
00:55:44,150 --> 00:55:41,599
and contrast on the hubble images

1333
00:55:46,630 --> 00:55:44,160
dr knoll saw a peculiar faint spot near

1334
00:55:48,710 --> 00:55:46,640
the much brighter uribetes dr mike brown

1335
00:55:50,230 --> 00:55:48,720
another team member noticed the spot

1336
00:55:52,069 --> 00:55:50,240
showed up in a slightly different

1337
00:55:53,910 --> 00:55:52,079
position on another set of hubble images

1338
00:55:55,829 --> 00:55:53,920

taken two days later

1339
00:55:57,670 --> 00:55:55,839
this change suggested that the spot was

1340
00:55:59,349 --> 00:55:57,680
an orbiting satellite the team went back

1341
00:56:00,950 --> 00:55:59,359
to hubble and got three more chances to

1342
00:56:02,870 --> 00:56:00,960
make observations of the possible new

1343
00:56:05,349 --> 00:56:02,880
satellite on the first two tries the

1344
00:56:07,510 --> 00:56:05,359
little moonlit was nowhere to be found

1345
00:56:10,150 --> 00:56:07,520
but on the third observation on january

1346
00:56:11,750 --> 00:56:10,160
3rd 2020 they found the possible new

1347
00:56:13,750 --> 00:56:11,760
satellite again

1348
00:56:16,470 --> 00:56:13,760
it was clearly visible next to eurivides

1349
00:56:18,230 --> 00:56:16,480
which was over 6 000 times brighter this

1350
00:56:19,829 --> 00:56:18,240
huge difference in brightness suggests

1351
00:56:21,910 --> 00:56:19,839
that the satellite is less than one

1352
00:56:24,789 --> 00:56:21,920
kilometer in diameter very small

1353
00:56:26,549 --> 00:56:24,799
compared to uribetes at 64 kilometers

1354
00:56:27,990 --> 00:56:26,559
with a few more hubble observations the

1355
00:56:29,670 --> 00:56:28,000
team pinned down the new satellite's

1356
00:56:31,750 --> 00:56:29,680
orbit and they proposed a name the

1357
00:56:33,109 --> 00:56:31,760
international astronomical unit approved

1358
00:56:35,270 --> 00:56:33,119
and from now on the little satellite

1359
00:56:37,030 --> 00:56:35,280
will be known as quetza after enriqueta

1360
00:56:39,030 --> 00:56:37,040
basilio the first woman to light the

1361
00:56:41,190 --> 00:56:39,040
olympic cauldron evidence indicates that

1362
00:56:43,109 --> 00:56:41,200
the trojan asteroid derivities is the

1363
00:56:44,549 --> 00:56:43,119

largest fragment from a massive asteroid

1364
00:56:46,309 --> 00:56:44,559
collision that happened billions of

1365
00:56:47,990 --> 00:56:46,319
years ago it is possible that the new

1366
00:56:50,390 --> 00:56:48,000
satellite quetza is a remnant of that

1367
00:56:52,470 --> 00:56:50,400
catastrophic event whether with hubble

1368
00:56:54,230 --> 00:56:52,480
or with the lucy spacecraft flyby each

1369
00:56:56,230 --> 00:56:54,240
observation enriches our understanding

1370
00:56:57,990 --> 00:56:56,240
about the trojan asteroids formation and

1371
00:56:59,990 --> 00:56:58,000
european's relationship with its newly

1372
00:57:01,349 --> 00:57:00,000
discovered companion the discovery of

1373
00:57:03,589 --> 00:57:01,359
this new movement around the trojan

1374
00:57:05,190 --> 00:57:03,599
asteroid uribeties is just a preview of

1375
00:57:07,270 --> 00:57:05,200
the incredible scientific knowledge that

1376
00:57:09,030 --> 00:57:07,280
will be captured by the lucy mission as

1377
00:57:11,510 --> 00:57:09,040
it explores this area of our solar

1378
00:57:15,430 --> 00:57:13,829
all right our our next guest is uh one

1379
00:57:17,430 --> 00:57:15,440
of the great minds behind the mighty

1380
00:57:19,430 --> 00:57:17,440
atlas five uh which just had another

1381
00:57:21,829 --> 00:57:19,440
spectacular launch here he's standing by

1382
00:57:24,390 --> 00:57:21,839
with uh franklin fitzgerald from nasa

1383
00:57:26,069 --> 00:57:24,400
edge over at the asoc franklin

1384
00:57:29,829 --> 00:57:26,079
yeah thanks marie i'm here with scott

1385
00:57:32,069 --> 00:57:29,839
messer ula program manager uh scott how

1386
00:57:33,270 --> 00:57:32,079
did the launch go from ula ula's

1387
00:57:36,069 --> 00:57:33,280
perspective

1388
00:57:38,470 --> 00:57:36,079

well uh it was uh near perfect so far uh

1389
00:57:40,230 --> 00:57:38,480
we we never

1390
00:57:42,150 --> 00:57:40,240
claimed success until we separate and

1391
00:57:45,349 --> 00:57:42,160
get the spacecraft where it wants to be

1392
00:57:48,150 --> 00:57:45,359
but so far the first stage was great the

1393
00:57:50,309 --> 00:57:48,160
countdown was very quiet and

1394
00:57:53,030 --> 00:57:50,319
it's a beautiful launch so far great

1395
00:57:55,750 --> 00:57:53,040
great to hear um this is a mission

1396
00:57:58,470 --> 00:57:55,760
unlike any other before can you tell us

1397
00:58:00,549 --> 00:57:58,480
exactly how unique the trajectory was

1398
00:58:03,109 --> 00:58:00,559
for the atlas 5 on this mission

1399
00:58:05,750 --> 00:58:03,119
yeah so certainly the trajectory for the

1400
00:58:08,470 --> 00:58:05,760
spacecraft is very unique

1401
00:58:10,710 --> 00:58:08,480
probably never been done before but from

1402
00:58:13,030 --> 00:58:10,720
an atlas standpoint we've launched a

1403
00:58:14,150 --> 00:58:13,040
many planetary missions over the years

1404
00:58:17,750 --> 00:58:14,160
and

1405
00:58:19,430 --> 00:58:17,760
in order to get the spacecraft ready to

1406
00:58:20,309 --> 00:58:19,440
go

1407
00:58:22,150 --> 00:58:20,319
you know

1408
00:58:25,190 --> 00:58:22,160
getting ready for this mission through

1409
00:58:27,589 --> 00:58:25,200
covid uh was a challenge for i know many

1410
00:58:29,910 --> 00:58:27,599
people uh were there any challenges that

1411
00:58:31,829 --> 00:58:29,920
you had to overcome is there any kind of

1412
00:58:32,950 --> 00:58:31,839
anecdote that you can tell about this

1413
00:58:38,549 --> 00:58:32,960

mission

1414
00:58:42,309 --> 00:58:40,390
aggressive week a couple of weeks with

1415
00:58:47,109 --> 00:58:42,319
us you know we launched lance at

1416
00:58:48,630 --> 00:58:47,119
nine just a few weeks ago turned around

1417
00:58:51,510 --> 00:58:48,640
the end of the week so we launched on

1418
00:58:53,990 --> 00:58:51,520
monday and we turned around and had uh

1419
00:58:57,349 --> 00:58:54,000
the wet dress rehearsal here for lucy on

1420
00:58:58,069 --> 00:58:57,359
friday and uh then turned around and did

1421
00:59:02,150 --> 00:58:58,079
our

1422
00:59:04,390 --> 00:59:02,160
vulcan ptt test here so it's been really

1423
00:59:06,150 --> 00:59:04,400
a very exciting week for the team here

1424
00:59:07,910 --> 00:59:06,160
and the team has worked really hard

1425
00:59:10,390 --> 00:59:07,920
through all the covet stuff through all

1426
00:59:12,710 --> 00:59:10,400
of the activities uh

1427
00:59:14,230 --> 00:59:12,720
in order to maintain the launch date and

1428
00:59:17,109 --> 00:59:14,240
here we are right at the beginning of

1429
00:59:20,309 --> 00:59:17,119
the window and uh a beautiful launch so

1430
00:59:22,470 --> 00:59:20,319
far absolutely well scott uh we wish you

1431
00:59:25,109 --> 00:59:22,480
the best of luck uh over the next 12

1432
00:59:28,789 --> 00:59:25,119
years and uh thanks for joining us here

1433
00:59:30,630 --> 00:59:28,799
on the show today uh marie daryl back to

1434
00:59:33,270 --> 00:59:30,640
you to learn more about science all

1435
00:59:34,870 --> 00:59:33,280
right scott and franklin thank you very

1436
00:59:36,549 --> 00:59:34,880
much as you look at the bottom of your

1437
00:59:39,030 --> 00:59:36,559
screen want to remind you we have a

1438
00:59:40,549 --> 00:59:39,040

progress bar which is tracking where

1439
00:59:42,710 --> 00:59:40,559
we're going you can see that we have the

1440
00:59:45,190 --> 00:59:42,720
main engine cut off we're awaiting that

1441
00:59:47,670 --> 00:59:45,200
second burn of the centaur and of course

1442
00:59:50,470 --> 00:59:47,680
we'll have all of that for you but we

1443
00:59:53,430 --> 00:59:50,480
have about an hour to go before signal

1444
00:59:56,309 --> 00:59:53,440
acquisition from lucy only then will the

1445
00:59:58,150 --> 00:59:56,319
team be able to breathe a sigh of relief

1446
01:00:01,349 --> 00:59:58,160
so let's hear from some of the

1447
01:00:03,750 --> 01:00:01,359
scientists about their passion for lucy

1448
01:00:06,549 --> 01:00:03,760
in their own words

1449
01:00:09,030 --> 01:00:06,559
hi my name is donya douglas bradshaw and

1450
01:00:11,190 --> 01:00:09,040
i'm the project manager for the lucy

1451
01:00:13,510 --> 01:00:11,200
project which will be the first mission

1452
01:00:16,789 --> 01:00:13,520
to the trojan asteroids building a

1453
01:00:19,430 --> 01:00:16,799
spacecraft is quite exciting i worked

1454
01:00:21,750 --> 01:00:19,440
many decades as a mechanical engineer

1455
01:00:23,910 --> 01:00:21,760
really focused on thermal and heat

1456
01:00:25,190 --> 01:00:23,920
transfer and so when you work in that

1457
01:00:27,510 --> 01:00:25,200
capacity

1458
01:00:30,789 --> 01:00:27,520
you are supporting the development of

1459
01:00:33,589 --> 01:00:30,799
spacecraft as well as instruments

1460
01:00:35,510 --> 01:00:33,599
hi my name is dr carly howitt and i am

1461
01:00:38,230 --> 01:00:35,520
the instrument scientist of the mvic

1462
01:00:40,789 --> 01:00:38,240
camera on lucy i love working on lucy

1463
01:00:42,950 --> 01:00:40,799

for so many reasons but one of them is

1464
01:00:45,349 --> 01:00:42,960
being able to explore the universe from

1465
01:00:48,069 --> 01:00:45,359
the comfort of my own office so i don't

1466
01:00:50,630 --> 01:00:48,079
have to don diving gear or you know go

1467
01:00:52,950 --> 01:00:50,640
into these dangerous or hard situations

1468
01:00:54,870 --> 01:00:52,960
i get to enjoy the data as it comes back

1469
01:00:56,870 --> 01:00:54,880
from the comfort of my office and

1470
01:00:58,470 --> 01:00:56,880
explore the universe that way

1471
01:01:00,309 --> 01:00:58,480
my name is corey prichal and i am the

1472
01:01:02,870 --> 01:01:00,319
mechanical operations lead for the

1473
01:01:04,950 --> 01:01:02,880
interplanetary spacecraft lucy

1474
01:01:07,430 --> 01:01:04,960
my job is to plan and lead major

1475
01:01:09,910 --> 01:01:07,440
mechanical operations such as spacecraft

1476
01:01:11,750 --> 01:01:09,920
transportations spacecraft crane lifts

1477
01:01:13,750 --> 01:01:11,760
or testing of major spacecraft

1478
01:01:15,990 --> 01:01:13,760
components and ensure they go off

1479
01:01:17,670 --> 01:01:16,000
without a hitch

1480
01:01:19,589 --> 01:01:17,680
my name is mike secarec i'm the deputy

1481
01:01:20,950 --> 01:01:19,599
product system engineer for lucy the

1482
01:01:22,870 --> 01:01:20,960
thing i like the most about product

1483
01:01:25,109 --> 01:01:22,880
system engineering that you get to touch

1484
01:01:27,750 --> 01:01:25,119
all aspects of the mission from the

1485
01:01:29,430 --> 01:01:27,760
spacecraft payload launch vehicle ground

1486
01:01:31,190 --> 01:01:29,440
systems flight dynamics

1487
01:01:32,710 --> 01:01:31,200
private system engineers have oversight

1488
01:01:33,750 --> 01:01:32,720

of all of those different aspects of the

1489
01:01:36,309 --> 01:01:33,760
mission

1490
01:01:38,630 --> 01:01:36,319
i'm tiffany kapler i am a public

1491
01:01:40,870 --> 01:01:38,640
outreach specialist with the lucy

1492
01:01:43,829 --> 01:01:40,880
mission and one of the things that i

1493
01:01:47,190 --> 01:01:43,839
love about my job is that it gives me an

1494
01:01:50,150 --> 01:01:47,200
opportunity to use my creativity and

1495
01:01:52,549 --> 01:01:50,160
share my enthusiasm for science with

1496
01:01:54,470 --> 01:01:52,559
others while i get them excited about

1497
01:01:56,470 --> 01:01:54,480
space exploration

1498
01:01:58,390 --> 01:01:56,480
hi i'm rick berry and i am the

1499
01:02:00,150 --> 01:01:58,400
configuration management lead for the

1500
01:02:01,990 --> 01:02:00,160
lucy mission at goddard space flight

1501
01:02:03,109 --> 01:02:02,000
center we're building spacecraft we're

1502
01:02:05,109 --> 01:02:03,119
building

1503
01:02:07,829 --> 01:02:05,119
payloads and instruments at goddard we

1504
01:02:10,789 --> 01:02:07,839
coordinate with our team members to

1505
01:02:13,750 --> 01:02:10,799
ensure that the configuration management

1506
01:02:15,990 --> 01:02:13,760
is correct by managing the changes and

1507
01:02:17,670 --> 01:02:16,000
the requirements hello my name is

1508
01:02:19,829 --> 01:02:17,680
elizabeth mccall and i'm the project

1509
01:02:21,510 --> 01:02:19,839
support specialist for the lucy project

1510
01:02:24,309 --> 01:02:21,520
one of the more memorable experiences

1511
01:02:26,230 --> 01:02:24,319
i've had was just in july of this year i

1512
01:02:29,510 --> 01:02:26,240
was able to fly with the spacecraft from

1513
01:02:31,430 --> 01:02:29,520

colorado to florida on a c-17 my name is

1514
01:02:34,390 --> 01:02:31,440
vince elliott and i'm the lucy deputy

1515
01:02:36,630 --> 01:02:34,400
project manager over resources i lead a

1516
01:02:37,910 --> 01:02:36,640
team of 12 and they are exceptional at

1517
01:02:39,589 --> 01:02:37,920
what they do

1518
01:02:41,430 --> 01:02:39,599
it also means i get to work with some of

1519
01:02:43,190 --> 01:02:41,440
the brightest engineers and scientists

1520
01:02:45,430 --> 01:02:43,200
the world has ever known

1521
01:02:46,950 --> 01:02:45,440
doing something that i love

1522
01:02:49,109 --> 01:02:46,960
hi my name is james trayley and i'm a

1523
01:02:50,950 --> 01:02:49,119
producer and animator at nasa goddard

1524
01:02:52,549 --> 01:02:50,960
space flight center and i created the

1525
01:02:53,750 --> 01:02:52,559
video series you're currently watching

1526
01:02:56,069 --> 01:02:53,760
right now

1527
01:02:57,829 --> 01:02:56,079
i'm so excited to see lucy launch and i

1528
01:02:59,750 --> 01:02:57,839
can't wait to share the complex and

1529
01:03:01,750 --> 01:02:59,760
exciting discoveries that we make out

1530
01:03:03,430 --> 01:03:01,760
there at the trojans to you the public

1531
01:03:06,810 --> 01:03:03,440
through film and animation

1532
01:03:09,750 --> 01:03:06,820
go nasa go lucy

1533
01:03:11,990 --> 01:03:09,760
[Music]

1534
01:03:14,309 --> 01:03:12,000
this lucy mission is dedicated to a

1535
01:03:16,710 --> 01:03:14,319
number of team members at nasa and

1536
01:03:18,390 --> 01:03:16,720
united launch alliance some of them no

1537
01:03:20,390 --> 01:03:18,400
longer with us today

1538
01:03:23,510 --> 01:03:20,400

there are three dedications placed on

1539
01:03:26,549 --> 01:03:23,520
the side of the atlas v rocket the first

1540
01:03:28,630 --> 01:03:26,559
says lucy strong recognizing the team's

1541
01:03:31,109 --> 01:03:28,640
hard work throughout the covet 19

1542
01:03:33,510 --> 01:03:31,119
pandemic there it is uh we got a shot of

1543
01:03:36,470 --> 01:03:33,520
it before liftoff and the second is a

1544
01:03:39,670 --> 01:03:36,480
memorial to ula team members mark kaz

1545
01:03:41,349 --> 01:03:39,680
kazubowski and william billy joyner mark

1546
01:03:43,910 --> 01:03:41,359
was an accomplished engineer and

1547
01:03:45,829 --> 01:03:43,920
respected mentor during his 30-year

1548
01:03:48,230 --> 01:03:45,839
career he focused on launch vehicle

1549
01:03:51,750 --> 01:03:48,240
structures and integration he led the

1550
01:03:54,549 --> 01:03:51,760
structural design of the atlas 2 2as and

1551
01:03:57,270 --> 01:03:54,559
3 development programs mark was also a

1552
01:03:59,109 --> 01:03:57,280
family man reminding his team always to

1553
01:04:00,150 --> 01:03:59,119
take care of themselves and their

1554
01:04:02,230 --> 01:04:00,160
families

1555
01:04:04,789 --> 01:04:02,240
billy spent much of his 35-year career

1556
01:04:06,549 --> 01:04:04,799
at lockheed martin and ula he was an

1557
01:04:08,470 --> 01:04:06,559
accomplished technician who supported

1558
01:04:11,270 --> 01:04:08,480
critical payload processing for the

1559
01:04:12,710 --> 01:04:11,280
department of defense and nasa billy was

1560
01:04:14,710 --> 01:04:12,720
known for his diligence and

1561
01:04:16,710 --> 01:04:14,720
dependability contributing to the

1562
01:04:18,950 --> 01:04:16,720
successful launch of many historic

1563
01:04:20,630 --> 01:04:18,960

missions he was a great friend and

1564
01:04:22,789 --> 01:04:20,640
teammate to many

1565
01:04:25,910 --> 01:04:22,799
and finally a dedication in memory of

1566
01:04:28,549 --> 01:04:25,920
craig m whitaker his 40-year career

1567
01:04:31,190 --> 01:04:28,559
began as a student with the navy you can

1568
01:04:33,510 --> 01:04:31,200
see his name there also on the rocket

1569
01:04:35,510 --> 01:04:33,520
that led him to nasa where he was a

1570
01:04:38,950 --> 01:04:35,520
founding member of nasa's launch

1571
01:04:41,109 --> 01:04:38,960
services program in 1998. craig was

1572
01:04:43,270 --> 01:04:41,119
instrumental in developing and managing

1573
01:04:45,829 --> 01:04:43,280
the program's launch service contracts

1574
01:04:48,309 --> 01:04:45,839
over many years the final highlight of

1575
01:04:51,430 --> 01:04:48,319
craig's career was the award of the

1576
01:04:53,349 --> 01:04:51,440
atlas 5 rocket for the lucy mission

1577
01:04:55,750 --> 01:04:53,359
craig was a devoted family man a

1578
01:04:59,190 --> 01:04:55,760
respected leader and a humble public

1579
01:05:01,190 --> 01:04:59,200
servant and we are here with his son

1580
01:05:04,549 --> 01:05:01,200
craig whitaker's son jared whitaker

1581
01:05:06,390 --> 01:05:04,559
vehicle systems engineer who also works

1582
01:05:08,870 --> 01:05:06,400
just like his father did for nasa's

1583
01:05:11,029 --> 01:05:08,880
launch services program jared great to

1584
01:05:12,630 --> 01:05:11,039
have you here i appreciate it glad to be

1585
01:05:14,309 --> 01:05:12,640
here how was the launch how was the

1586
01:05:16,069 --> 01:05:14,319
experience being up there and watching

1587
01:05:18,390 --> 01:05:16,079
this rocket which had been dedicated to

1588
01:05:20,549 --> 01:05:18,400

your father i it was really

1589
01:05:22,069 --> 01:05:20,559
really great i mean i usually work on

1590
01:05:23,829 --> 01:05:22,079
the missions and things and so sitting

1591
01:05:25,430 --> 01:05:23,839
on console so

1592
01:05:27,589 --> 01:05:25,440
it was really great to be able to see it

1593
01:05:29,990 --> 01:05:27,599
from this vantage point out here at osb2

1594
01:05:32,230 --> 01:05:30,000
fantastic fantastic view from up there

1595
01:05:34,309 --> 01:05:32,240
and night latches are always spectacular

1596
01:05:37,349 --> 01:05:34,319
and so just really really really enjoyed

1597
01:05:39,270 --> 01:05:37,359
it what did lsp mean to your father the

1598
01:05:41,190 --> 01:05:39,280
launch services program and then you

1599
01:05:43,430 --> 01:05:41,200
following in his footsteps

1600
01:05:45,430 --> 01:05:43,440
yeah so like um

1601
01:05:47,109 --> 01:05:45,440
lsp i think he really embodied a lot of

1602
01:05:49,190 --> 01:05:47,119
the things that lsp stands for like a

1603
01:05:50,549 --> 01:05:49,200
good family man as

1604
01:05:52,549 --> 01:05:50,559
we said um

1605
01:05:55,190 --> 01:05:52,559
really dedicated to to the work

1606
01:05:56,950 --> 01:05:55,200
dedicated to his family and um always

1607
01:05:58,230 --> 01:05:56,960
curious always learning learning new

1608
01:06:01,109 --> 01:05:58,240
about science missions and things like

1609
01:06:03,510 --> 01:06:01,119
that um really really meant a lot to him

1610
01:06:06,230 --> 01:06:03,520
so i think he he definitely enjoyed his

1611
01:06:08,390 --> 01:06:06,240
20 plus years with lsp and his all his

1612
01:06:09,990 --> 01:06:08,400
time with nasa for sure and jared we

1613
01:06:12,630 --> 01:06:10,000

know your dad was one of the founding

1614
01:06:14,390 --> 01:06:12,640
members of lsp from its earliest days in

1615
01:06:17,029 --> 01:06:14,400
the 90s and now you work for the program

1616
01:06:19,029 --> 01:06:17,039
yourself i got to ask did his influence

1617
01:06:21,349 --> 01:06:19,039
kind of steer you in that direction oh

1618
01:06:23,430 --> 01:06:21,359
yeah i would say absolutely um yeah in

1619
01:06:25,990 --> 01:06:23,440
1998 i was i was only seven years old

1620
01:06:28,630 --> 01:06:26,000
and so every afternoon pick me up from

1621
01:06:30,309 --> 01:06:28,640
school or whatnot go home and over over

1622
01:06:32,950 --> 01:06:30,319
dinner we had conversations about what

1623
01:06:34,950 --> 01:06:32,960
the last uh science mission was what was

1624
01:06:36,710 --> 01:06:34,960
coming up with lsp and so he always

1625
01:06:39,029 --> 01:06:36,720
encouraged me to do whatever i wanted

1626
01:06:41,109 --> 01:06:39,039
but i definitely enjoyed um

1627
01:06:42,630 --> 01:06:41,119
going into engineering and i ended up

1628
01:06:44,230 --> 01:06:42,640
coming to lsp i think in my heart i

1629
01:06:46,230 --> 01:06:44,240
always knew i was gonna i'm always gonna

1630
01:06:47,990 --> 01:06:46,240
end up with lsp and i'm very glad i did

1631
01:06:50,309 --> 01:06:48,000
and so enjoyed the the couple years we

1632
01:06:51,670 --> 01:06:50,319
got to work together and and share uh

1633
01:06:52,950 --> 01:06:51,680
more from the business side from him and

1634
01:06:54,710 --> 01:06:52,960
more from the engineering side for me it

1635
01:06:56,549 --> 01:06:54,720
was a nice uh give and take so really

1636
01:06:58,390 --> 01:06:56,559
enjoyed our time for sure yeah and glad

1637
01:07:00,470 --> 01:06:58,400
you got to actually enjoy it as a

1638
01:07:02,630 --> 01:07:00,480

spectator for a change instead of uh

1639
01:07:04,069 --> 01:07:02,640
working it was very relaxing it was nice

1640
01:07:05,990 --> 01:07:04,079
yeah great and

1641
01:07:07,990 --> 01:07:06,000
there was some overlap between you and

1642
01:07:10,069 --> 01:07:08,000
your father at lsp

1643
01:07:12,630 --> 01:07:10,079
yeah so i finished my master's

1644
01:07:14,230 --> 01:07:12,640
in mechanical engineering in 2015 and so

1645
01:07:16,230 --> 01:07:14,240
we worked together almost five years so

1646
01:07:17,750 --> 01:07:16,240
it was really nice like in the on some

1647
01:07:19,990 --> 01:07:17,760
afternoons like later in the week he'd

1648
01:07:21,990 --> 01:07:20,000
come by we were we're not morning people

1649
01:07:23,589 --> 01:07:22,000
so we'd come by in the afternoon and

1650
01:07:24,870 --> 01:07:23,599
chit chat about how things were going

1651
01:07:26,870 --> 01:07:24,880
and and what our plans for the weekend

1652
01:07:28,549 --> 01:07:26,880
were so it's nice to just pass by and

1653
01:07:29,750 --> 01:07:28,559
kind of talk a little bit a little bit

1654
01:07:30,950 --> 01:07:29,760
of work a little bit of personal stuff

1655
01:07:33,109 --> 01:07:30,960
at the end of the day and it was it was

1656
01:07:34,870 --> 01:07:33,119
really enjoyable yeah

1657
01:07:36,789 --> 01:07:34,880
that's awesome yeah as a as a

1658
01:07:38,230 --> 01:07:36,799
non-morning person myself i used to

1659
01:07:38,950 --> 01:07:38,240
appreciate you getting up early with

1660
01:07:40,549 --> 01:07:38,960
that

1661
01:07:42,150 --> 01:07:40,559
it was well worth it well worth it thank

1662
01:07:43,910 --> 01:07:42,160
you so much derek thank you all thank

1663
01:07:45,750 --> 01:07:43,920

you all right thank you for being here

1664
01:07:47,990 --> 01:07:45,760
all right learning what an asteroid is

1665
01:07:50,230 --> 01:07:48,000
made of without coming into contact with

1666
01:07:52,230 --> 01:07:50,240
it takes the right scientific

1667
01:07:53,670 --> 01:07:52,240
instruments we'll talk about that in a

1668
01:07:57,430 --> 01:07:53,680
moment but first let's check in with

1669
01:07:59,829 --> 01:07:57,440
megan cruz on top of osb2 with another

1670
01:08:01,589 --> 01:07:59,839
program scientist megan

1671
01:08:03,190 --> 01:08:01,599
hey there daryl yeah now i have tom

1672
01:08:04,870 --> 01:08:03,200
stadler tom what did you think of the

1673
01:08:06,470 --> 01:08:04,880
launch today oh it was absolutely

1674
01:08:08,710 --> 01:08:06,480
beautiful i just couldn't couldn't hope

1675
01:08:10,470 --> 01:08:08,720
for a more spectacular launch yeah and

1676
01:08:11,829 --> 01:08:10,480
you know you're the program scientist on

1677
01:08:14,150 --> 01:08:11,839
this mission can you talk to us about

1678
01:08:15,430 --> 01:08:14,160
what that role entails uh sure i mean

1679
01:08:17,110 --> 01:08:15,440
all of our missions have program

1680
01:08:19,269 --> 01:08:17,120
scientists at headquarters we're the

1681
01:08:21,110 --> 01:08:19,279
main science advocate for the mission

1682
01:08:23,110 --> 01:08:21,120
and we also work with the mission teams

1683
01:08:25,030 --> 01:08:23,120
kind of as coaches to make sure that the

1684
01:08:27,510 --> 01:08:25,040
science ambitions that they have for the

1685
01:08:29,269 --> 01:08:27,520
mission fit with nasa processes gotcha

1686
01:08:31,590 --> 01:08:29,279
and we saw lucy lift off about 30

1687
01:08:33,590 --> 01:08:31,600
minutes ago can you talk to us about how

1688
01:08:35,910 --> 01:08:33,600

her three main instruments are going to

1689
01:08:37,510 --> 01:08:35,920
work together to study the trojans sure

1690
01:08:39,349 --> 01:08:37,520
so lucy has three main instruments

1691
01:08:41,910 --> 01:08:39,359
there's lori which is a high resolution

1692
01:08:44,950 --> 01:08:41,920
black and white camera le ralph that is

1693
01:08:47,110 --> 01:08:44,960
a spectroscopic camera and lotus that is

1694
01:08:49,349 --> 01:08:47,120
a thermal imager like a no touch

1695
01:08:51,510 --> 01:08:49,359
thermometer and so we'll be able to get

1696
01:08:54,070 --> 01:08:51,520
detailed images of the landforms the

1697
01:08:56,709 --> 01:08:54,080
craters cliffs landslides anything else

1698
01:08:58,229 --> 01:08:56,719
that's been going on on the surfaces

1699
01:09:00,309 --> 01:08:58,239
la ralph will be able to tell us about

1700
01:09:01,990 --> 01:09:00,319
composition so we'll get an indication

1701
01:09:05,349 --> 01:09:02,000
of the mineralogy the chemical

1702
01:09:07,189 --> 01:09:05,359
composition and latest will tell us from

1703
01:09:09,749 --> 01:09:07,199
the temperature readings uh what's the

1704
01:09:11,910 --> 01:09:09,759
texture of the surface is it rocky is it

1705
01:09:13,590 --> 01:09:11,920
uh sandy is it gravelly they're all work

1706
01:09:15,110 --> 01:09:13,600
together to tell us what what's going on

1707
01:09:16,709 --> 01:09:15,120
on these asteroids wow without even

1708
01:09:18,709 --> 01:09:16,719
landing on them that's amazing and we

1709
01:09:20,709 --> 01:09:18,719
know that lucy was named after the lucy

1710
01:09:22,149 --> 01:09:20,719
fossil the lucy fossil was named after

1711
01:09:24,709 --> 01:09:22,159
the beatles song lucy in the sky with

1712
01:09:26,229 --> 01:09:24,719
diamonds and actually lucy actually has

1713
01:09:28,550 --> 01:09:26,239

a diamond on board can you talk to us

1714
01:09:31,110 --> 01:09:28,560
about that it does so the latest

1715
01:09:33,590 --> 01:09:31,120
instrument that touchless thermometer is

1716
01:09:34,789 --> 01:09:33,600
uh is an interferometer and people who

1717
01:09:37,030 --> 01:09:34,799
are indian instrumentation know what

1718
01:09:38,870 --> 01:09:37,040
that means but in an interferometer you

1719
01:09:40,870 --> 01:09:38,880
need to divide the incoming light into

1720
01:09:42,630 --> 01:09:40,880
two paths and so you need a device an

1721
01:09:43,990 --> 01:09:42,640
optical device called a beam splitter

1722
01:09:45,669 --> 01:09:44,000
and one of the best ways to make a beam

1723
01:09:47,829 --> 01:09:45,679
splitter is to make it out of synthetic

1724
01:09:49,749 --> 01:09:47,839
diamond so there is a synthetic diamond

1725
01:09:51,510 --> 01:09:49,759
not a natural diamond it's a pretty big

1726
01:09:53,590 --> 01:09:51,520
one i understand it's about 20 carats

1727
01:09:55,669 --> 01:09:53,600
which would make a big

1728
01:09:57,110 --> 01:09:55,679
diamond right yeah it's an industrial

1729
01:09:58,550 --> 01:09:57,120
piece of piece of

1730
01:09:59,830 --> 01:09:58,560
synthetic diamond that's really

1731
01:10:01,510 --> 01:09:59,840
essential for getting these temperature

1732
01:10:03,110 --> 01:10:01,520
readings on the surfaces of the trojan

1733
01:10:04,709 --> 01:10:03,120
asteroids awesome and you're also the

1734
01:10:06,870 --> 01:10:04,719
program scientist for dart that's

1735
01:10:09,030 --> 01:10:06,880
scheduled to launch uh next month can

1736
01:10:11,669 --> 01:10:09,040
you tell us about that experiment i can

1737
01:10:13,510 --> 01:10:11,679
well dart dart like lucy is going to an

1738
01:10:15,669 --> 01:10:13,520

asteroid and that's where the similarity

1739
01:10:17,189 --> 01:10:15,679
ends because dart

1740
01:10:19,030 --> 01:10:17,199
lucy of course is going to the trojan

1741
01:10:21,350 --> 01:10:19,040
asteroids and the outer solar system and

1742
01:10:23,110 --> 01:10:21,360
dart is going to a near-earth asteroid

1743
01:10:25,910 --> 01:10:23,120
not so much with the intent of studying

1744
01:10:27,830 --> 01:10:25,920
it but to demonstrate that we have the

1745
01:10:30,149 --> 01:10:27,840
technological ability to be able to

1746
01:10:32,550 --> 01:10:30,159
deflect an asteroid if we're ever in a

1747
01:10:34,630 --> 01:10:32,560
situation where there's an asteroid on

1748
01:10:37,990 --> 01:10:34,640
collision course with earth there is not

1749
01:10:39,750 --> 01:10:38,000
one now no no no known asteroid is on a

1750
01:10:41,750 --> 01:10:39,760
collision course with earth and the

1751
01:10:43,350 --> 01:10:41,760
asteroid that we're going to collide

1752
01:10:45,189 --> 01:10:43,360
with deliberately with the dart

1753
01:10:46,550 --> 01:10:45,199
spacecraft is not a danger to earth and

1754
01:10:48,390 --> 01:10:46,560
there's nothing that we can do to make

1755
01:10:50,950 --> 01:10:48,400
it a danger to the earth but we're going

1756
01:10:53,030 --> 01:10:50,960
to test our ability to uh target an

1757
01:10:54,870 --> 01:10:53,040
asteroid to execute a kinetic impact

1758
01:10:56,470 --> 01:10:54,880
that is run a spacecraft into it and

1759
01:10:58,630 --> 01:10:56,480
then we're going to test the asteroids

1760
01:11:00,149 --> 01:10:58,640
response to that impact how much do we

1761
01:11:02,390 --> 01:11:00,159
move it by and how effective that will

1762
01:11:05,990 --> 01:11:02,400
be to protect earth in the future

1763
01:11:08,630 --> 01:11:06,000

sounds like a movie strange huh

1764
01:11:10,470 --> 01:11:08,640
no maybe not not with as dramatic as

1765
01:11:12,709 --> 01:11:10,480
sound a script as some of the past

1766
01:11:14,310 --> 01:11:12,719
movies but it'll be very exciting when

1767
01:11:15,510 --> 01:11:14,320
we execute the kinetic impact and then

1768
01:11:17,110 --> 01:11:15,520
get the data from ground-based

1769
01:11:18,550 --> 01:11:17,120
telescopes afterwards that tells us what

1770
01:11:20,229 --> 01:11:18,560
we actually accomplished great tom thank

1771
01:11:22,870 --> 01:11:20,239
you so much i appreciate you being here

1772
01:11:24,550 --> 01:11:22,880
maureen back to you

1773
01:11:26,870 --> 01:11:24,560
all right thank you megan if you're just

1774
01:11:28,470 --> 01:11:26,880
joining us we had a spectacular launch

1775
01:11:31,030 --> 01:11:28,480
this morning in florida

1776
01:11:33,270 --> 01:11:31,040
nasa's lucy launched into the sky with a

1777
01:11:36,470 --> 01:11:33,280
diamond a pretty big one it sounds like

1778
01:11:38,550 --> 01:11:36,480
apparently about 36 minutes ago and the

1779
01:11:40,870 --> 01:11:38,560
spacecraft lifted off on a united launch

1780
01:11:43,430 --> 01:11:40,880
alliance atlas v rocket from space

1781
01:11:46,630 --> 01:11:43,440
launch complex 41 at cape canaveral

1782
01:11:49,350 --> 01:11:46,640
space force station that was at 5 34 a.m

1783
01:11:51,110 --> 01:11:49,360
eastern time and in just a little bit we

1784
01:11:53,189 --> 01:11:51,120
expect to hear confirmation of

1785
01:11:55,430 --> 01:11:53,199
spacecraft separation and there's a

1786
01:11:57,189 --> 01:11:55,440
replay of the launch from this morning a

1787
01:12:00,070 --> 01:11:57,199
beautiful shot there as you see the

1788
01:12:02,950 --> 01:12:00,080

atlas 5 launching away from space launch

1789
01:12:04,790 --> 01:12:02,960
complex 41 here at the cape canaveral

1790
01:12:06,550 --> 01:12:04,800
space force station it was a beautiful

1791
01:12:07,669 --> 01:12:06,560
launch and every launch is always a

1792
01:12:09,990 --> 01:12:07,679
little different right we had some

1793
01:12:12,229 --> 01:12:10,000
clouds up high and it went behind them

1794
01:12:14,709 --> 01:12:12,239
and then popped back out yeah i love

1795
01:12:16,550 --> 01:12:14,719
that i love i love when it illuminates

1796
01:12:18,790 --> 01:12:16,560
the clouds because you don't i mean it's

1797
01:12:19,910 --> 01:12:18,800
it's pitch dark behind us now and so you

1798
01:12:22,470 --> 01:12:19,920
don't even know they're there and the

1799
01:12:24,550 --> 01:12:22,480
rocket just lights up the entire sky and

1800
01:12:26,709 --> 01:12:24,560
it's stunning it's like a sunrise

1801
01:12:29,270 --> 01:12:26,719
wonderful right the lucy spacecraft

1802
01:12:31,430 --> 01:12:29,280
named after the early human fossil and

1803
01:12:33,750 --> 01:12:31,440
the famous beatles song is just

1804
01:12:36,950 --> 01:12:33,760
beginning a 12-year mission to uncover

1805
01:12:40,310 --> 01:12:36,960
the mysteries of our outer solar system

1806
01:12:42,709 --> 01:12:40,320
lucy shows us more

1807
01:12:45,270 --> 01:12:42,719
lucy's long journey to space begins

1808
01:12:46,550 --> 01:12:45,280
today but her story actually started

1809
01:12:47,990 --> 01:12:46,560
years ago

1810
01:12:50,310 --> 01:12:48,000
it took a team of scientists and

1811
01:12:53,030 --> 01:12:50,320
engineers many years to plan where lucy

1812
01:12:55,270 --> 01:12:53,040
would go and what she would have to do

1813
01:12:57,350 --> 01:12:55,280

then lucy's engineers had to build her

1814
01:12:59,750 --> 01:12:57,360
out of individual parts and put her

1815
01:13:01,830 --> 01:12:59,760
together like a puzzle

1816
01:13:05,110 --> 01:13:01,840
lucy had to go through tough physical

1817
01:13:08,550 --> 01:13:05,120
tests to prove she was mission ready

1818
01:13:12,390 --> 01:13:10,310
these are the vibration and acoustic

1819
01:13:14,709 --> 01:13:12,400
tests to make sure that lucy won't lose

1820
01:13:15,590 --> 01:13:14,719
any screws during the shaky launch on a

1821
01:13:18,470 --> 01:13:15,600
rocket

1822
01:13:19,990 --> 01:13:18,480
lucy wasn't quite ready just yet the

1823
01:13:21,910 --> 01:13:20,000
engineers still had to be sure that she

1824
01:13:23,189 --> 01:13:21,920
was prepared for the harsh environment

1825
01:13:24,950 --> 01:13:23,199
of space

1826
01:13:27,350 --> 01:13:24,960
they chilled lucy to freezing

1827
01:13:29,590 --> 01:13:27,360
temperatures then warmed her up to

1828
01:13:31,830 --> 01:13:29,600
scalding hot temperatures in the thermal

1829
01:13:34,310 --> 01:13:31,840
vacuum test sure those tests weren't

1830
01:13:38,850 --> 01:13:34,320
easy but they prepared lucy for the long

1831
01:14:05,990 --> 01:13:45,300
[Music]

1832
01:14:08,070 --> 01:14:06,000
we're glad you can join lucy on her

1833
01:14:09,270 --> 01:14:08,080
adventure to explore the trojan

1834
01:14:11,830 --> 01:14:09,280
asteroids

1835
01:14:13,430 --> 01:14:11,840
now let's get the journey started

1836
01:14:16,229 --> 01:14:13,440
i'm really starting to love that cartoon

1837
01:14:18,709 --> 01:14:16,239
lucy yeah she's great really cute thank

1838
01:14:21,590 --> 01:14:18,719

you lucy let's send it over now to megan

1839
01:14:25,350 --> 01:14:21,600
she is with the paleoanthropologist who

1840
01:14:27,830 --> 01:14:25,360
discovered the lucy fossil in 1974.

1841
01:14:29,669 --> 01:14:27,840
megan yeah daryl what an honor to have

1842
01:14:31,590 --> 01:14:29,679
donald johansen here with me today good

1843
01:14:33,110 --> 01:14:31,600
morning to you good morning to you you

1844
01:14:35,510 --> 01:14:33,120
know you have to take me back to that

1845
01:14:37,669 --> 01:14:35,520
day when you discovered lucy in ethiopia

1846
01:14:39,750 --> 01:14:37,679
back in 1974 tell me how you found her

1847
01:14:42,070 --> 01:14:39,760
well it's amazing it'll be 50 years

1848
01:14:44,630 --> 01:14:42,080
since that discovery two years from now

1849
01:14:47,270 --> 01:14:44,640
i was a young anthropologist i was

1850
01:14:50,229 --> 01:14:47,280
searching in the extreme northeast of

1851
01:14:52,070 --> 01:14:50,239
ethiopia for looking for remains of our

1852
01:14:54,470 --> 01:14:52,080
human ancestors i glanced over my

1853
01:14:56,550 --> 01:14:54,480
shoulder one day i saw a little piece of

1854
01:14:59,990 --> 01:14:56,560
bone recognized it as belonging to a

1855
01:15:02,390 --> 01:15:00,000
human skeleton and it led to lucy and

1856
01:15:04,790 --> 01:15:02,400
lucy has become the benchmark by which

1857
01:15:06,630 --> 01:15:04,800
all discoveries are judged that's

1858
01:15:08,550 --> 01:15:06,640
amazing just to see over the shoulder

1859
01:15:11,350 --> 01:15:08,560
like how did you pick the small piece of

1860
01:15:12,550 --> 01:15:11,360
bone out from from all around you well

1861
01:15:14,070 --> 01:15:12,560
you know you when you're out there you

1862
01:15:15,430 --> 01:15:14,080
train your eye and you know how you

1863
01:15:17,030 --> 01:15:15,440

always say you look

1864
01:15:18,149 --> 01:15:17,040
you find something in the last place you

1865
01:15:19,910 --> 01:15:18,159
look well

1866
01:15:22,390 --> 01:15:19,920
that's sort of like what happened oh my

1867
01:15:24,870 --> 01:15:22,400
god i carry these images in my mind of

1868
01:15:27,510 --> 01:15:24,880
bones and teeth and so on and when i saw

1869
01:15:29,270 --> 01:15:27,520
that elbow piece of elbow i knew it

1870
01:15:31,590 --> 01:15:29,280
couldn't be from a baboon it couldn't be

1871
01:15:33,350 --> 01:15:31,600
from an antelope and from all the work i

1872
01:15:35,270 --> 01:15:33,360
had done in graduate school i knew that

1873
01:15:36,709 --> 01:15:35,280
it had to come from a human ancestor and

1874
01:15:38,630 --> 01:15:36,719
why did you name her after the beatles

1875
01:15:40,709 --> 01:15:38,640
song well i thought it was a female

1876
01:15:42,630 --> 01:15:40,719
because of the very small size of the

1877
01:15:45,110 --> 01:15:42,640
bones and we thought well is this a

1878
01:15:47,430 --> 01:15:45,120
child no the third molars were erupted

1879
01:15:49,590 --> 01:15:47,440
the wisdom teeth as we call them today

1880
01:15:51,590 --> 01:15:49,600
and that night in camp in the middle of

1881
01:15:54,149 --> 01:15:51,600
nowhere when we were celebrating her

1882
01:15:56,229 --> 01:15:54,159
discovery someone was we were listening

1883
01:15:58,550 --> 01:15:56,239
to a beatles tape sergeant pepper's

1884
01:16:00,709 --> 01:15:58,560
lonely hearts club band and the song

1885
01:16:02,470 --> 01:16:00,719
lucy in the sky with diamonds was

1886
01:16:04,390 --> 01:16:02,480
playing and someone said

1887
01:16:06,630 --> 01:16:04,400
why don't you just call her lucy and

1888
01:16:09,270 --> 01:16:06,640

that was it you could not go back and

1889
01:16:10,870 --> 01:16:09,280
call her anything else

1890
01:16:12,149 --> 01:16:10,880
and now i you just told me that this was

1891
01:16:13,990 --> 01:16:12,159
your first launch and it gave you

1892
01:16:15,830 --> 01:16:14,000
goosebumps that's so wonderful i mean

1893
01:16:17,910 --> 01:16:15,840
how was it to know that there's a

1894
01:16:19,830 --> 01:16:17,920
spacecraft on there that's named after

1895
01:16:22,390 --> 01:16:19,840
the fossil you discovered well i will

1896
01:16:24,149 --> 01:16:22,400
never look at jupiter the same

1897
01:16:26,390 --> 01:16:24,159
jupiter was always interesting to me as

1898
01:16:28,870 --> 01:16:26,400
a kid i had my little telescope i

1899
01:16:30,630 --> 01:16:28,880
watched the moons go around jupiter and

1900
01:16:32,870 --> 01:16:30,640
to be out here this morning was

1901
01:16:35,590 --> 01:16:32,880
absolutely mind expanding and it was at

1902
01:16:37,750 --> 01:16:35,600
such a positive experience you know the

1903
01:16:40,149 --> 01:16:37,760
world is going through some tribulations

1904
01:16:42,310 --> 01:16:40,159
something as positive as like this as

1905
01:16:44,950 --> 01:16:42,320
positive as this is people should look

1906
01:16:47,590 --> 01:16:44,960
at and see what the creativity of the

1907
01:16:49,990 --> 01:16:47,600
human mind can do and there it is she's

1908
01:16:53,350 --> 01:16:50,000
on her way yeah i'm so glad

1909
01:16:55,030 --> 01:16:53,360
so much yes and i i just said goosebumps

1910
01:16:56,310 --> 01:16:55,040
yeah perfect thank you so much for being

1911
01:16:58,149 --> 01:16:56,320
here i appreciate it why don't we send

1912
01:17:00,390 --> 01:16:58,159
it back over to joshua and mick for

1913
01:17:02,790 --> 01:17:00,400

another update on lucy

1914
01:17:05,110 --> 01:17:02,800
hey thanks so much uh megan uh

1915
01:17:07,669 --> 01:17:05,120
unfortunately we didn't quite fly over

1916
01:17:09,750 --> 01:17:07,679
ethiopia we did fly over part of

1917
01:17:11,510 --> 01:17:09,760
southern africa uh on our way there and

1918
01:17:13,669 --> 01:17:11,520
we're in the middle now of the second

1919
01:17:15,990 --> 01:17:13,679
burn of the centaur mick talk to us

1920
01:17:18,229 --> 01:17:16,000
about what the second burn is so main

1921
01:17:21,430 --> 01:17:18,239
engine start did occur uh just a few

1922
01:17:23,990 --> 01:17:21,440
minutes ago and this will get uh centaur

1923
01:17:26,229 --> 01:17:24,000
and lucy into its transfer orbit leaving

1924
01:17:28,229 --> 01:17:26,239
the park orbit around earth heading into

1925
01:17:30,630 --> 01:17:28,239
that orbit heading uh to get lucy on her

1926
01:17:32,390 --> 01:17:30,640
way to the trojan asteroids so very

1927
01:17:34,950 --> 01:17:32,400
important burn this will last about six

1928
01:17:36,390 --> 01:17:34,960
minutes uh and to get her the velocity

1929
01:17:39,189 --> 01:17:36,400
and everything she needs to go to get on

1930
01:17:40,390 --> 01:17:39,199
her way to uh to to the trojan asteroids

1931
01:17:42,709 --> 01:17:40,400
there you go so just under about four

1932
01:17:45,590 --> 01:17:42,719
minutes left in this burn uh so going

1933
01:17:49,750 --> 01:17:45,600
back today uh we did kick off at 534 on

1934
01:17:50,870 --> 01:17:49,760
the button uh and got a report um

1935
01:17:52,950 --> 01:17:50,880
during the burn

1936
01:17:54,550 --> 01:17:52,960
uh from the storage bottle pressures

1937
01:17:57,110 --> 01:17:54,560
look good

1938
01:17:59,189 --> 01:17:57,120

from the ula commentator rob kesselman

1939
01:18:01,350 --> 01:17:59,199
ula always expecting excellence but he

1940
01:18:03,270 --> 01:18:01,360
reported that it the booster performed

1941
01:18:04,550 --> 01:18:03,280
better than expected i'm not sure what's

1942
01:18:07,110 --> 01:18:04,560
better than excellent but they got it

1943
01:18:08,630 --> 01:18:07,120
today yeah that just means we had some

1944
01:18:10,470 --> 01:18:08,640
great performance from the first stage

1945
01:18:13,110 --> 01:18:10,480
booster in the rd180

1946
01:18:15,030 --> 01:18:13,120
putting centaur into the proper order uh

1947
01:18:17,590 --> 01:18:15,040
and that injection that they needed uh

1948
01:18:20,070 --> 01:18:17,600
for getting lucy on her way and now that

1949
01:18:22,470 --> 01:18:20,080
we're into main engine start two uh that

1950
01:18:24,630 --> 01:18:22,480
just means we have a more precise uh

1951
01:18:26,709 --> 01:18:24,640
trajectory and everything's looking good

1952
01:18:28,310 --> 01:18:26,719
spacecraft customer and ula and launch

1953
01:18:31,110 --> 01:18:28,320
services provider

1954
01:18:34,149 --> 01:18:31,120
program are very happy at this point

1955
01:18:36,709 --> 01:18:34,159
yeah so uh lucy after this burn is

1956
01:18:39,270 --> 01:18:36,719
completed uh we'll then wait a few more

1957
01:18:41,750 --> 01:18:39,280
minutes before we get into uh separation

1958
01:18:44,310 --> 01:18:41,760
from the centaur and at that point lucy

1959
01:18:46,950 --> 01:18:44,320
will be set up for her first orbit her

1960
01:18:48,390 --> 01:18:46,960
first major orbit of earth uh which will

1961
01:18:50,149 --> 01:18:48,400
be just

1962
01:18:52,470 --> 01:18:50,159
just under one year

1963
01:18:55,590 --> 01:18:52,480

uh to complete and then have the first

1964
01:18:57,910 --> 01:18:55,600
earth gravity assist flyby where lucy

1965
01:18:59,990 --> 01:18:57,920
will get close enough to earth where uh

1966
01:19:01,750 --> 01:19:00,000
she'll literally just be sl it's like a

1967
01:19:04,390 --> 01:19:01,760
slingshot effect where she will just

1968
01:19:06,470 --> 01:19:04,400
pick up speed flying past earth to start

1969
01:19:07,990 --> 01:19:06,480
getting out towards where the uh the

1970
01:19:10,229 --> 01:19:08,000
asteroid belt and the trojan asteroids

1971
01:19:12,070 --> 01:19:10,239
are yeah first of three

1972
01:19:14,390 --> 01:19:12,080
that's right so it'll it'll be a big

1973
01:19:16,070 --> 01:19:14,400
move for her that's right and so uh kind

1974
01:19:17,510 --> 01:19:16,080
of again thinking about the complexity

1975
01:19:20,709 --> 01:19:17,520
of this it's a little bit shocking to

1976
01:19:22,470 --> 01:19:20,719
think about the first asteroid uh won't

1977
01:19:25,030 --> 01:19:22,480
be explored won't be passed by for

1978
01:19:26,790 --> 01:19:25,040
another four years uh and then beyond

1979
01:19:28,630 --> 01:19:26,800
that there's another gravity assist

1980
01:19:30,550 --> 01:19:28,640
later on down the right after a few uh

1981
01:19:32,950 --> 01:19:30,560
trojan asteroids being explored

1982
01:19:34,550 --> 01:19:32,960
yeah 12-year mission uh very excited

1983
01:19:36,950 --> 01:19:34,560
about this we just started this this

1984
01:19:39,350 --> 01:19:36,960
morning right and uh the team did a

1985
01:19:41,430 --> 01:19:39,360
great job uh you know developing this

1986
01:19:43,110 --> 01:19:41,440
trajectory and making sure that we could

1987
01:19:44,950 --> 01:19:43,120
get out to those lagrange points that

1988
01:19:46,950 --> 01:19:44,960

needed where those asteroids are is it

1989
01:19:48,149 --> 01:19:46,960
lagrange or lagrange

1990
01:19:49,270 --> 01:19:48,159
i think depending upon what part of

1991
01:19:50,790 --> 01:19:49,280
america or the part of the world you're

1992
01:19:52,630 --> 01:19:50,800
from it could be a different different

1993
01:19:53,990 --> 01:19:52,640
pronunciation you know daryl reminds me

1994
01:19:55,830 --> 01:19:54,000
all the time it's lagrange but if you're

1995
01:19:57,669 --> 01:19:55,840
from the south it's probably something

1996
01:19:59,669 --> 01:19:57,679
else i don't know but lagrange points

1997
01:20:02,550 --> 01:19:59,679
where the uh where the trojan asteroids

1998
01:20:04,070 --> 01:20:02,560
are in l4 and l5 um and you know that's

1999
01:20:05,910 --> 01:20:04,080
that's a very important i mean this team

2000
01:20:08,470 --> 01:20:05,920
did an excellent job in this trajectory

2001
01:20:11,350 --> 01:20:08,480
design and centaur is on target to

2002
01:20:12,950 --> 01:20:11,360
deliver lucy on that uh that path yeah

2003
01:20:15,110 --> 01:20:12,960
so the garage points a little

2004
01:20:17,110 --> 01:20:15,120
explanation there so for every pair of

2005
01:20:19,189 --> 01:20:17,120
planetary bodies that are interacting

2006
01:20:21,750 --> 01:20:19,199
that are kind of engaged uh there are

2007
01:20:23,270 --> 01:20:21,760
five lagrange points uh and those five

2008
01:20:25,590 --> 01:20:23,280
lagrange points are in very consistent

2009
01:20:27,510 --> 01:20:25,600
places and what that means is that a lot

2010
01:20:28,790 --> 01:20:27,520
of people have this uh notion that if

2011
01:20:30,550 --> 01:20:28,800
you're in low earth orbit the space

2012
01:20:32,229 --> 01:20:30,560
station for instance that you are in

2013
01:20:33,990 --> 01:20:32,239

zero gravity this is actually a

2014
01:20:36,950 --> 01:20:34,000
misconception you're in what we call

2015
01:20:39,270 --> 01:20:36,960
microgravity yes uh and so

2016
01:20:41,669 --> 01:20:39,280
as you're uh in orbit you're essentially

2017
01:20:44,149 --> 01:20:41,679
falling around the earth uh and so

2018
01:20:46,149 --> 01:20:44,159
gravity is still about 98 of what it is

2019
01:20:48,390 --> 01:20:46,159
right here now uh and so when you're at

2020
01:20:50,870 --> 01:20:48,400
a lagrange point there's actually a

2021
01:20:52,310 --> 01:20:50,880
balance of gravitational forces where

2022
01:20:54,390 --> 01:20:52,320
you're able to essentially sit there and

2023
01:20:55,350 --> 01:20:54,400
what really is a zero gravity uh that's

2024
01:20:57,189 --> 01:20:55,360
probably a more perfect place to

2025
01:20:58,709 --> 01:20:57,199
describe zero gravity uh again you

2026
01:21:00,870 --> 01:20:58,719
mentioned the garage points four and

2027
01:21:03,110 --> 01:21:00,880
five uh that's where these two groups of

2028
01:21:05,430 --> 01:21:03,120
trojan asteroids hang out uh and these

2029
01:21:08,229 --> 01:21:05,440
are actually nowhere near jupiter uh so

2030
01:21:11,350 --> 01:21:09,590
they're jupiter's sorry we're getting

2031
01:21:12,870 --> 01:21:11,360
calls here uh good performance here on

2032
01:21:15,910 --> 01:21:12,880
the centaur still as they're about to

2033
01:21:30,629 --> 01:21:15,920
wrap up this uh this second burn again

2034
01:21:33,590 --> 01:21:32,310
and we have mika ii

2035
01:21:35,510 --> 01:21:33,600
that's a good sign right there main

2036
01:21:37,350 --> 01:21:35,520
engine cutoff two that means uh centaur

2037
01:21:38,629 --> 01:21:37,360
has done its job performed

2038
01:21:40,950 --> 01:21:38,639

and uh 100

2039
01:21:42,709 --> 01:21:40,960
will be uh

2040
01:21:44,229 --> 01:21:42,719
coasting for just a few minutes as we

2041
01:21:45,990 --> 01:21:44,239
get ready for spacecraft separation

2042
01:21:47,990 --> 01:21:46,000
centaur make sure she's pointing the

2043
01:21:49,510 --> 01:21:48,000
right direction that's right uh and so

2044
01:21:50,790 --> 01:21:49,520
just finishing that thought the lagrange

2045
01:21:53,990 --> 01:21:50,800
points four and five

2046
01:21:56,470 --> 01:21:54,000
are roughly equidistant uh from the the

2047
01:21:58,390 --> 01:21:56,480
sun and jupiter making isosceles or

2048
01:22:01,110 --> 01:21:58,400
equilateral triangles uh if you've if

2049
01:22:02,870 --> 01:22:01,120
you're ready for your math at 6am uh or

2050
01:22:05,270 --> 01:22:02,880
whatever time it is right now uh we're

2051
01:22:07,270 --> 01:22:05,280
watching our our mission clock here uh

2052
01:22:10,550 --> 01:22:07,280
and so essentially they're the same

2053
01:22:13,270 --> 01:22:10,560
distance from jupiter as jupiter is from

2054
01:22:15,189 --> 01:22:13,280
the sun which is roughly 465 million

2055
01:22:16,950 --> 01:22:15,199
miles so these points are very far from

2056
01:22:20,229 --> 01:22:16,960
jupiter very far from the sun uh but

2057
01:22:21,990 --> 01:22:20,239
pretty exciting and and mick uh lsp no

2058
01:22:24,070 --> 01:22:22,000
stranger to exploring the solar system

2059
01:22:25,430 --> 01:22:24,080
no stranger to mission success with

2060
01:22:26,790 --> 01:22:25,440
science missions yeah you know we are

2061
01:22:28,310 --> 01:22:26,800
very happy to be working with united

2062
01:22:31,110 --> 01:22:28,320
launch alliance our commercial partner

2063
01:22:33,030 --> 01:22:31,120

today with this atlas 5 401 uh you know

2064
01:22:35,350 --> 01:22:33,040
this mission started seven years ago for

2065
01:22:37,750 --> 01:22:35,360
some of these folks uh some longer and

2066
01:22:39,510 --> 01:22:37,760
as uh the atlas 5401 was selected for

2067
01:22:40,709 --> 01:22:39,520
this mission lsp took all those

2068
01:22:43,270 --> 01:22:40,719
requirements from our spacecraft

2069
01:22:44,709 --> 01:22:43,280
customer and we looked at those and we

2070
01:22:46,790 --> 01:22:44,719
decided what needed to be done and we

2071
01:22:49,110 --> 01:22:46,800
selected the atlas v for this mission

2072
01:22:50,149 --> 01:22:49,120
our in team of engineers scientists and

2073
01:22:51,990 --> 01:22:50,159
analysts

2074
01:22:53,910 --> 01:22:52,000
worked very closely with the spacecraft

2075
01:22:56,709 --> 01:22:53,920
customer and united launch alliance and

2076
01:22:59,189 --> 01:22:56,719
uh as a result we had a successful

2077
01:23:00,790 --> 01:22:59,199
liftoff at 5 34 a.m today the very

2078
01:23:03,430 --> 01:23:00,800
beginning of our window in the beginning

2079
01:23:05,430 --> 01:23:03,440
of our science period uh so very happy

2080
01:23:07,189 --> 01:23:05,440
so far uh still waiting for that

2081
01:23:09,830 --> 01:23:07,199
spacecraft separation and making sure

2082
01:23:11,910 --> 01:23:09,840
the spacecraft's healthy healthy but uh

2083
01:23:13,350 --> 01:23:11,920
so far everything has been going just as

2084
01:23:15,590 --> 01:23:13,360
we had predicted

2085
01:23:17,910 --> 01:23:15,600
yeah very good uh a reminder coming up

2086
01:23:19,110 --> 01:23:17,920
ahead we have spacecraft separation

2087
01:23:20,709 --> 01:23:19,120
as you see there a countdown to when

2088
01:23:22,390 --> 01:23:20,719

we're expecting to see that happen uh

2089
01:23:24,470 --> 01:23:22,400
what you're seeing on screen is a

2090
01:23:26,550 --> 01:23:24,480
graphical representation based on real

2091
01:23:27,750 --> 01:23:26,560
telemetry data so we believe this is we

2092
01:23:29,189 --> 01:23:27,760
are confident this is what's happening

2093
01:23:31,430 --> 01:23:29,199
in space right now that's not actually a

2094
01:23:33,030 --> 01:23:31,440
live video stabilized at the coast

2095
01:23:34,709 --> 01:23:33,040
attitude

2096
01:23:36,870 --> 01:23:34,719
uh and so again on your time we're

2097
01:23:39,750 --> 01:23:36,880
expecting that spacecraft separation in

2098
01:23:42,950 --> 01:23:39,760
about nine minutes from now so uh after

2099
01:23:45,189 --> 01:23:42,960
that uh we will have a brief period

2100
01:23:47,510 --> 01:23:45,199
where we'll be we'll wait to start solar

2101
01:23:48,950 --> 01:23:47,520
array deploy uh then we'll have that

2102
01:23:51,270 --> 01:23:48,960
takes about 20 minutes to deploy the

2103
01:23:53,030 --> 01:23:51,280
solar rays big beautiful solar rays and

2104
01:23:54,790 --> 01:23:53,040
then we will once those are up and

2105
01:23:56,229 --> 01:23:54,800
powered we would expect a couple minutes

2106
01:23:57,990 --> 01:23:56,239
later to be able to get that acquisition

2107
01:23:59,669 --> 01:23:58,000
signal that's a very scary time for the

2108
01:24:02,310 --> 01:23:59,679
spacecraft team they'll be waiting for

2109
01:24:04,629 --> 01:24:02,320
that for sure yeah absolutely all right

2110
01:24:07,110 --> 01:24:04,639
i think we are ready now to send you uh

2111
01:24:10,229 --> 01:24:07,120
upstairs uh to nasa edges franklin with

2112
01:24:13,110 --> 01:24:10,239
the lucy program manager

2113
01:24:15,510 --> 01:24:13,120

thanks guys yes i'm here with uh donut

2114
01:24:17,590 --> 01:24:15,520
douglas bradshaw who is the lucy project

2115
01:24:20,149 --> 01:24:17,600
manager donya how you doing today i'm

2116
01:24:23,270 --> 01:24:20,159
doing awesome great um

2117
01:24:25,669 --> 01:24:23,280
how do you prepare for a mission like

2118
01:24:27,270 --> 01:24:25,679
lucy when nothing quite like this has

2119
01:24:29,669 --> 01:24:27,280
been done before

2120
01:24:31,110 --> 01:24:29,679
well it certainly takes a team of

2121
01:24:32,790 --> 01:24:31,120
engineers

2122
01:24:33,910 --> 01:24:32,800
scientists

2123
01:24:36,950 --> 01:24:33,920
everyone

2124
01:24:37,990 --> 01:24:36,960
you know dr hal levinson who is the lucy

2125
01:24:39,270 --> 01:24:38,000
pi

2126
01:24:42,070 --> 01:24:39,280
has a vision

2127
01:24:44,950 --> 01:24:42,080
and it takes a team of hundreds to bring

2128
01:24:46,629 --> 01:24:44,960
that vision to fruition

2129
01:24:48,790 --> 01:24:46,639
how long have you

2130
01:24:51,189 --> 01:24:48,800
been working on this project

2131
01:24:53,590 --> 01:24:51,199
so i joined lucy about three years ago

2132
01:24:56,629 --> 01:24:53,600
uh joined the team as a deputy project

2133
01:24:58,790 --> 01:24:56,639
manager and then about two years ago

2134
01:24:59,669 --> 01:24:58,800
became the project manager

2135
01:25:02,390 --> 01:24:59,679
now

2136
01:25:04,629 --> 01:25:02,400
do you have any like

2137
01:25:07,110 --> 01:25:04,639
exciting stories to tell about this

2138
01:25:09,270 --> 01:25:07,120

mission because you know you all had to

2139
01:25:10,709 --> 01:25:09,280
work through covet to get this thing up

2140
01:25:13,510 --> 01:25:10,719
and running

2141
01:25:16,950 --> 01:25:13,520
yeah it uh you know cove it happened in

2142
01:25:20,149 --> 01:25:16,960
march 2020 unexpectedly and um there was

2143
01:25:21,189 --> 01:25:20,159
a lot of uncertainty around that and um

2144
01:25:22,629 --> 01:25:21,199
but

2145
01:25:25,030 --> 01:25:22,639
this team

2146
01:25:27,350 --> 01:25:25,040
um and this spacecraft development led

2147
01:25:29,669 --> 01:25:27,360
by lockheed martin

2148
01:25:33,110 --> 01:25:29,679
quickly rapidly without missing a beat

2149
01:25:35,830 --> 01:25:33,120
put together a plan to enable us to um

2150
01:25:37,030 --> 01:25:35,840
re-engineer the the integration and test

2151
01:25:39,910 --> 01:25:37,040
program

2152
01:25:41,189 --> 01:25:39,920
i know with within like the last two

2153
01:25:44,070 --> 01:25:41,199
years the

2154
01:25:46,310 --> 01:25:44,080
uh components for the spacecraft were uh

2155
01:25:48,870 --> 01:25:46,320
you know compiled but it wasn't even put

2156
01:25:50,629 --> 01:25:48,880
together how did you get that all up and

2157
01:25:53,990 --> 01:25:50,639
running basically

2158
01:25:56,470 --> 01:25:54,000
in a little over a year yeah so i mean

2159
01:25:59,110 --> 01:25:56,480
the the plan you're right when when the

2160
01:26:02,310 --> 01:25:59,120
pandemic happened we were about six five

2161
01:26:05,350 --> 01:26:02,320
or six months away from the start of our

2162
01:26:08,229 --> 01:26:05,360
spacecraft integration and test program

2163
01:26:10,870 --> 01:26:08,239

um and so there was a lot of uncertainty

2164
01:26:11,910 --> 01:26:10,880
uh but the team the entire team came

2165
01:26:15,110 --> 01:26:11,920
together

2166
01:26:17,110 --> 01:26:15,120
and really devised a way to

2167
01:26:20,310 --> 01:26:17,120
uh keep people safe

2168
01:26:23,510 --> 01:26:20,320
do social distinct social distancing

2169
01:26:24,709 --> 01:26:23,520
adding the capability for folks to

2170
01:26:27,510 --> 01:26:24,719
monitor

2171
01:26:30,790 --> 01:26:27,520
the integration and testing remotely

2172
01:26:33,910 --> 01:26:30,800
um using collaboration tools online

2173
01:26:36,070 --> 01:26:33,920
tools um just different techniques that

2174
01:26:38,470 --> 01:26:36,080
were available to us and so we were able

2175
01:26:40,550 --> 01:26:38,480
to do that certainly there were some

2176
01:26:42,390 --> 01:26:40,560
inefficiencies

2177
01:26:43,990 --> 01:26:42,400
but we were able to compress our

2178
01:26:45,110 --> 01:26:44,000
schedule so that we could stick to this

2179
01:26:47,830 --> 01:26:45,120
launch date

2180
01:26:48,870 --> 01:26:47,840
great donya thanks for joining us this

2181
01:26:50,790 --> 01:26:48,880
morning

2182
01:26:53,350 --> 01:26:50,800
and continued success thank you very

2183
01:26:55,430 --> 01:26:53,360
much all right daryl back to you all

2184
01:26:56,310 --> 01:26:55,440
right franklin and donya thank you so

2185
01:26:58,070 --> 01:26:56,320
much

2186
01:27:00,629 --> 01:26:58,080
earlier you heard a little bit about the

2187
01:27:03,030 --> 01:27:00,639
lagrange points i got a primer from mick

2188
01:27:06,149 --> 01:27:03,040

and joshua and so now

2189
01:27:09,270 --> 01:27:06,159
let's revisit that lagrange points are

2190
01:27:12,709 --> 01:27:09,280
two gravitationally protected zones that

2191
01:27:15,590 --> 01:27:12,719
are around the orbit of jupiter here's

2192
01:27:18,470 --> 01:27:15,600
principal investigator hal levison and

2193
01:27:19,910 --> 01:27:18,480
lucy to help explain

2194
01:27:22,390 --> 01:27:19,920
the trojan asteroids are found in

2195
01:27:24,709 --> 01:27:22,400
lagrange points which are these special

2196
01:27:27,110 --> 01:27:24,719
places that leader follow planet in its

2197
01:27:28,070 --> 01:27:27,120
orbit by 60 degrees and it's sort of

2198
01:27:30,229 --> 01:27:28,080
where

2199
01:27:32,470 --> 01:27:30,239
the gravitational force of the planet

2200
01:27:34,950 --> 01:27:32,480
and the gravitational force of the sun

2201
01:27:37,189 --> 01:27:34,960
all cancel out so if you put an object

2202
01:27:39,270 --> 01:27:37,199
there it will stay there for a long

2203
01:27:41,430 --> 01:27:39,280
period of time basically forever so when

2204
01:27:43,590 --> 01:27:41,440
we see objects there

2205
01:27:44,629 --> 01:27:43,600
these are objects that we know were in

2206
01:27:48,149 --> 01:27:44,639
place

2207
01:27:52,310 --> 01:27:50,790
so if you just take a random asteroid

2208
01:27:54,709 --> 01:27:52,320
and just put it in the outer solar

2209
01:27:56,709 --> 01:27:54,719
system the gravitational force of the

2210
01:27:58,950 --> 01:27:56,719
four genoplanets will just clear them

2211
01:28:01,350 --> 01:27:58,960
out in a very short period of time

2212
01:28:03,270 --> 01:28:01,360
so they'll basically be gone so the only

2213
01:28:05,110 --> 01:28:03,280

places it turns out

2214
01:28:08,070 --> 01:28:05,120
in the outer solar system where you can

2215
01:28:10,629 --> 01:28:08,080
find stable regions are these lagrange

2216
01:28:11,510 --> 01:28:10,639
points lucy in particular is going to go

2217
01:28:15,189 --> 01:28:11,520
after

2218
01:28:18,550 --> 01:28:15,199
the jupiter trojans we're trying to see

2219
01:28:20,470 --> 01:28:18,560
a type of object that represents

2220
01:28:21,910 --> 01:28:20,480
and constrains the formation of the

2221
01:28:22,709 --> 01:28:21,920
outer planets

2222
01:28:24,629 --> 01:28:22,719
and

2223
01:28:26,830 --> 01:28:24,639
you need to go to these lagrange points

2224
01:28:31,110 --> 01:28:26,840
in order to see that kind

2225
01:28:34,629 --> 01:28:31,120
of one of the really groovy aspects

2226
01:28:37,030 --> 01:28:34,639
of our mission is its trajectory because

2227
01:28:39,910 --> 01:28:37,040
we're visiting a record number of

2228
01:28:41,510 --> 01:28:39,920
objects like these trojans

2229
01:28:43,430 --> 01:28:41,520
and we do that with this very

2230
01:28:47,430 --> 01:28:43,440
complicated dance particularly in the

2231
01:28:50,070 --> 01:28:47,440
beginning where we are using the earth

2232
01:28:52,550 --> 01:28:50,080
actually as a gravitational slingshot so

2233
01:28:54,629 --> 01:28:52,560
lucy will start off in an orbit very

2234
01:28:57,030 --> 01:28:54,639
similar to the earth and then

2235
01:29:00,149 --> 01:28:57,040
gravitational encounters with the earth

2236
01:29:02,149 --> 01:29:00,159
will actually pump it up so it gets out

2237
01:29:03,270 --> 01:29:02,159
to the lagrange points near jupiter's

2238
01:29:05,510 --> 01:29:03,280

orbit

2239
01:29:08,070 --> 01:29:05,520
so if you're going to understand how

2240
01:29:10,229 --> 01:29:08,080
planets like the earth forms you have to

2241
01:29:12,550 --> 01:29:10,239
understand how the bigger planets which

2242
01:29:15,110 --> 01:29:12,560
sort of dominated the whole process

2243
01:29:16,790 --> 01:29:15,120
came to be and that's what lucy is going

2244
01:29:19,110 --> 01:29:16,800
to do

2245
01:29:21,750 --> 01:29:19,120
well that was how on tape let's join hal

2246
01:29:24,709 --> 01:29:21,760
live now who is with blair from nasa

2247
01:29:27,669 --> 01:29:24,719
edge guys take it away

2248
01:29:29,990 --> 01:29:27,679
thanks so much daryl uh how obviously an

2249
01:29:31,990 --> 01:29:30,000
incredible launch you've been very

2250
01:29:33,910 --> 01:29:32,000
involved and very important to the lucy

2251
01:29:35,990 --> 01:29:33,920
mentioned but tell us about the

2252
01:29:37,830 --> 01:29:36,000
experience of being on console and

2253
01:29:40,070 --> 01:29:37,840
seeing the launch this morning it was

2254
01:29:42,310 --> 01:29:40,080
one of the most exciting experiences of

2255
01:29:44,950 --> 01:29:42,320
my life it was

2256
01:29:47,350 --> 01:29:44,960
truly awesome in the old-fashioned

2257
01:29:49,110 --> 01:29:47,360
uh meaning of that word right well i

2258
01:29:50,229 --> 01:29:49,120
mean you've carried this mission for so

2259
01:29:51,750 --> 01:29:50,239
long so

2260
01:29:53,430 --> 01:29:51,760
seeing this happen

2261
01:29:55,350 --> 01:29:53,440
what a great moment not just for you but

2262
01:29:57,110 --> 01:29:55,360
for the whole team well it's been a team

2263
01:29:58,550 --> 01:29:57,120

effort there's no doubt don you talked a

2264
01:30:01,189 --> 01:29:58,560
lot about how

2265
01:30:04,709 --> 01:30:01,199
it took a really village to build this

2266
01:30:07,990 --> 01:30:04,719
spacecraft right and uh under some very

2267
01:30:11,430 --> 01:30:08,000
difficult um conditions so

2268
01:30:14,709 --> 01:30:13,030
sorry

2269
01:30:17,350 --> 01:30:14,719
no it's an emotional moment i mean this

2270
01:30:19,510 --> 01:30:17,360
is a big deal it is and it's been the

2271
01:30:22,149 --> 01:30:19,520
last 24 hours has just been a roller

2272
01:30:24,390 --> 01:30:22,159
coaster of excitement and build up

2273
01:30:26,310 --> 01:30:24,400
and everything was a success

2274
01:30:28,629 --> 01:30:26,320
tell us a little bit about your history

2275
01:30:29,350 --> 01:30:28,639
with with lucy how did it all start for

2276
01:30:33,110 --> 01:30:29,360
you

2277
01:30:35,590 --> 01:30:33,120
oh we started this project back in 2014

2278
01:30:38,229 --> 01:30:35,600
i think the first email that i have that

2279
01:30:40,470 --> 01:30:38,239
had the word lucy in the subject was in

2280
01:30:42,629 --> 01:30:40,480
march of that year and we've been

2281
01:30:44,390 --> 01:30:42,639
working and competing against other

2282
01:30:45,669 --> 01:30:44,400
missions since then

2283
01:30:47,270 --> 01:30:45,679
it's been a

2284
01:30:49,270 --> 01:30:47,280
haul and you know the amazing thing

2285
01:30:52,310 --> 01:30:49,280
about doing something like this

2286
01:30:54,629 --> 01:30:52,320
is that it was all paper and powerpoint

2287
01:30:57,110 --> 01:30:54,639
until about a year and a half ago and

2288
01:30:59,430 --> 01:30:57,120

then the folks at lockheed took these

2289
01:31:01,270 --> 01:30:59,440
concepts and built a spacecraft you know

2290
01:31:03,590 --> 01:31:01,280
what's amazing too is you had a very

2291
01:31:05,910 --> 01:31:03,600
interesting window you really needed to

2292
01:31:07,669 --> 01:31:05,920
launch today or you'd have to wait a

2293
01:31:09,990 --> 01:31:07,679
long time before you could try again

2294
01:31:11,669 --> 01:31:10,000
well we have a spectacular trajectory i

2295
01:31:13,590 --> 01:31:11,679
think you've been talking about that all

2296
01:31:16,310 --> 01:31:13,600
day we're going um

2297
01:31:17,830 --> 01:31:16,320
past an amazing collection of objects

2298
01:31:20,709 --> 01:31:17,840
and um

2299
01:31:23,430 --> 01:31:20,719
we have one chance really to do this uh

2300
01:31:25,910 --> 01:31:23,440
the planets are literally aligning in

2301
01:31:28,070 --> 01:31:25,920
order to make uh this trajectory

2302
01:31:32,149 --> 01:31:28,080
happening happen so we either launch

2303
01:31:34,310 --> 01:31:32,159
today or a year from now we do an ega an

2304
01:31:36,550 --> 01:31:34,320
earth gravity assist we could launch

2305
01:31:37,750 --> 01:31:36,560
directly at that time too so we had two

2306
01:31:41,270 --> 01:31:37,760
chances

2307
01:31:43,669 --> 01:31:41,280
and luckily we got it off and it's

2308
01:31:45,830 --> 01:31:43,679
it's going and you were able to actually

2309
01:31:47,990 --> 01:31:45,840
you were on console but you came up and

2310
01:31:50,390 --> 01:31:48,000
actually saw the launch personally i was

2311
01:31:52,629 --> 01:31:50,400
not going to miss that right it's like

2312
01:31:54,070 --> 01:31:52,639
uh witnessing a birth of a child right

2313
01:31:55,990 --> 01:31:54,080

that you just

2314
01:31:58,390 --> 01:31:56,000
really had to see it and now you watch

2315
01:31:59,510 --> 01:31:58,400
the child being raised that's right

2316
01:32:02,149 --> 01:31:59,520
right i mean

2317
01:32:04,629 --> 01:32:02,159
the the analogy of pregnancy and then a

2318
01:32:06,229 --> 01:32:04,639
birth and then raising a child is really

2319
01:32:07,030 --> 01:32:06,239
good for what we've been going through

2320
01:32:09,110 --> 01:32:07,040
here

2321
01:32:10,790 --> 01:32:09,120
great metaphor thanks so much hal we

2322
01:32:16,310 --> 01:32:10,800
really are excited for you in the lucy

2323
01:32:21,030 --> 01:32:18,629
hey yeah go lucy indeed uh we're

2324
01:32:22,470 --> 01:32:21,040
standing by for tumblecheck in just 30

2325
01:32:24,070 --> 01:32:22,480
seconds we're continuing to hear those

2326
01:32:27,270 --> 01:32:24,080
calls that we are on

2327
01:32:28,629 --> 01:32:27,280
at 20 percent

2328
01:32:30,550 --> 01:32:28,639
so obviously a big moment especially for

2329
01:32:32,790 --> 01:32:30,560
the for the ula team this would be the

2330
01:32:36,390 --> 01:32:32,800
end of their their is now spinning up in

2331
01:32:41,590 --> 01:32:36,400
anticipation of spacecraft separation

2332
01:32:45,350 --> 01:32:43,189
huge moment here for all the teams

2333
01:32:48,629 --> 01:32:45,360
actually uh successful launches that's

2334
01:32:52,149 --> 01:32:50,629
spacecraft set we have indication of

2335
01:32:53,990 --> 01:32:52,159
successful separation of the lucy

2336
01:32:56,229 --> 01:32:54,000
spacecraft so we're hearing some

2337
01:32:58,950 --> 01:32:56,239
clapping here in the in the mdc here at

2338
01:33:00,870 --> 01:32:58,960

the a soccer joshua uh and that is a

2339
01:33:03,510 --> 01:33:00,880
that is a huge moment for all of the

2340
01:33:04,950 --> 01:33:03,520
teams we still have quite a bit to go uh

2341
01:33:06,390 --> 01:33:04,960
solar ray deployment we talked about

2342
01:33:08,629 --> 01:33:06,400
those earlier those

2343
01:33:11,270 --> 01:33:08,639
big huge solar arrays that are needed

2344
01:33:14,470 --> 01:33:11,280
and uh the team spacecraft team will be

2345
01:33:16,629 --> 01:33:14,480
awaiting uh to to get confirmation that

2346
01:33:18,790 --> 01:33:16,639
that has started and then there'll be 22

2347
01:33:20,550 --> 01:33:18,800
minutes what they refer to as 22 minutes

2348
01:33:22,470 --> 01:33:20,560
of terror

2349
01:33:23,590 --> 01:33:22,480
waiting for those solar arrays to deploy

2350
01:33:25,990 --> 01:33:23,600
and of course they have to get

2351
01:33:28,470 --> 01:33:26,000
acquisition of signal to verify all that

2352
01:33:29,990 --> 01:33:28,480
uh slightly after that so the next few

2353
01:33:32,550 --> 01:33:30,000
minutes as we get through this is going

2354
01:33:34,070 --> 01:33:32,560
to be a spacecraft team will be uh kind

2355
01:33:37,030 --> 01:33:34,080
of sitting around waiting to see what

2356
01:33:39,510 --> 01:33:37,040
happens and making sure lucy is healthy

2357
01:33:41,750 --> 01:33:39,520
and doing well but spacecraft separation

2358
01:33:43,910 --> 01:33:41,760
huge milestone for the teams working the

2359
01:33:45,830 --> 01:33:43,920
launch vehicle today yeah i mean mick i

2360
01:33:47,830 --> 01:33:45,840
mean even here uh i got some goosebumps

2361
01:33:49,350 --> 01:33:47,840
like it's chills in that moment of just

2362
01:33:50,870 --> 01:33:49,360
like you can feel the energy of the

2363
01:33:52,870 --> 01:33:50,880

people around you just like so excited

2364
01:33:55,110 --> 01:33:52,880
and obviously uh that applause is very

2365
01:33:56,550 --> 01:33:55,120
genuine uh this is a heart this is a

2366
01:33:59,110 --> 01:33:56,560
serious moment but it's also like a

2367
01:34:01,110 --> 01:33:59,120
really joyous moment um and you'll see

2368
01:34:03,270 --> 01:34:01,120
uh the ula team obviously this is the

2369
01:34:05,750 --> 01:34:03,280
end of their major task for today but

2370
01:34:07,430 --> 01:34:05,760
nasa launch manager and the nasa lsp

2371
01:34:09,750 --> 01:34:07,440
team they will continue to stay with us

2372
01:34:11,990 --> 01:34:09,760
because uh for you guys getting the

2373
01:34:13,430 --> 01:34:12,000
spacecraft healthy is the mission it's

2374
01:34:15,350 --> 01:34:13,440
not just the launch it's making sure

2375
01:34:17,030 --> 01:34:15,360
that they get on their way successfully

2376
01:34:18,950 --> 01:34:17,040
that's correct we want to deliver

2377
01:34:20,629 --> 01:34:18,960
mission success as dr z talked about

2378
01:34:22,470 --> 01:34:20,639
earlier in the show right one of the

2379
01:34:23,830 --> 01:34:22,480
things we want here at nasa is mission

2380
01:34:25,430 --> 01:34:23,840
success and that's all the way through

2381
01:34:26,310 --> 01:34:25,440
making sure our spacecraft customer

2382
01:34:28,950 --> 01:34:26,320
knows what's going on with their

2383
01:34:30,390 --> 01:34:28,960
spacecraft and and everything is well so

2384
01:34:32,870 --> 01:34:30,400
we'll be standing around waiting for

2385
01:34:35,350 --> 01:34:32,880
solar ray deployment uh that will begin

2386
01:34:36,950 --> 01:34:35,360
uh here about four minutes after the uh

2387
01:34:38,950 --> 01:34:36,960
uh you know about an hour and four

2388
01:34:41,350 --> 01:34:38,960

minutes after launch about six minutes

2389
01:34:43,350 --> 01:34:41,360
from now and uh we'll uh we'll go from

2390
01:34:45,590 --> 01:34:43,360
there yeah so again it's going to be a

2391
01:34:49,109 --> 01:34:45,600
process that will start at roughly l

2392
01:34:51,669 --> 01:34:49,119
plus 104 30 and then from there we will

2393
01:34:53,590 --> 01:34:51,679
wait uh about 22 minutes is the expected

2394
01:34:56,629 --> 01:34:53,600
time to complete solar array deploy

2395
01:34:59,669 --> 01:34:56,639
those 24 foot diameter beautiful solar

2396
01:35:01,910 --> 01:34:59,679
rays taking up most of the size the the

2397
01:35:03,109 --> 01:35:01,920
physical length of the the spacecraft

2398
01:35:05,350 --> 01:35:03,119
and then we will actually get

2399
01:35:07,189 --> 01:35:05,360
confirmation of that for a couple more

2400
01:35:08,950 --> 01:35:07,199
minutes uh because those are designed to

2401
01:35:11,350 --> 01:35:08,960
power the spacecraft uh all the way

2402
01:35:13,750 --> 01:35:11,360
through its mission and so there will be

2403
01:35:15,270 --> 01:35:13,760
a couple of minutes where the the

2404
01:35:17,510 --> 01:35:15,280
communication is being established

2405
01:35:19,030 --> 01:35:17,520
between the spacecraft and the ground uh

2406
01:35:21,270 --> 01:35:19,040
not a simple process we'll talk that in

2407
01:35:22,470 --> 01:35:21,280
a few more minutes uh once we get closer

2408
01:35:24,390 --> 01:35:22,480
to to that

2409
01:35:25,910 --> 01:35:24,400
acquisition of signal moment milestone

2410
01:35:28,870 --> 01:35:25,920
uh we'll kind of talk through how we're

2411
01:35:30,870 --> 01:35:28,880
doing interaction i think i know there's

2412
01:35:32,790 --> 01:35:30,880
a chance we could potentially pick up

2413
01:35:34,229 --> 01:35:32,800

the actual live video it wouldn't be

2414
01:35:35,669 --> 01:35:34,239
live at the moment the actual video from

2415
01:35:38,390 --> 01:35:35,679
spacecraft separation if we do catch

2416
01:35:40,629 --> 01:35:38,400
that we'll bring you that um yeah ula

2417
01:35:42,629 --> 01:35:40,639
recorded that on board and as they get

2418
01:35:44,229 --> 01:35:42,639
closer to their download point they'll

2419
01:35:45,910 --> 01:35:44,239
be able to download that i don't know if

2420
01:35:48,229 --> 01:35:45,920
we'll get that right away or not but it

2421
01:35:50,149 --> 01:35:48,239
was recorded and eventually that will be

2422
01:35:51,510 --> 01:35:50,159
shared with the spacecraft customer

2423
01:35:53,189 --> 01:35:51,520
another unique thing you were taught we

2424
01:35:55,830 --> 01:35:53,199
were talking about those solar rays why

2425
01:35:57,270 --> 01:35:55,840
it's so important is i heard earlier

2426
01:35:58,950 --> 01:35:57,280
today that you know those things

2427
01:36:00,629 --> 01:35:58,960
generate about 5 000 watts that's all

2428
01:36:02,310 --> 01:36:00,639
that the spacecraft uses i mean that's

2429
01:36:03,430 --> 01:36:02,320
not even enough to run a microwave here

2430
01:36:05,270 --> 01:36:03,440
right so

2431
01:36:07,430 --> 01:36:05,280
that just shows you how efficient the

2432
01:36:08,550 --> 01:36:07,440
spacecraft is yeah very good uh getting

2433
01:36:11,189 --> 01:36:08,560
a few views there from around the

2434
01:36:13,590 --> 01:36:11,199
country we had one from ula headquarters

2435
01:36:15,669 --> 01:36:13,600
in uh colorado that there in hangar ae

2436
01:36:16,790 --> 01:36:15,679
with some spacecraft folks uh but for

2437
01:36:19,910 --> 01:36:16,800
now daryl we're gonna send it back to

2438
01:36:21,910 --> 01:36:19,920

you i'm sorry to marie

2439
01:36:24,550 --> 01:36:21,920
all right thank you joshua time to catch

2440
01:36:26,709 --> 01:36:24,560
back up with our lucy cartoon character

2441
01:36:29,030 --> 01:36:26,719
and in this next episode lucy wants to

2442
01:36:35,750 --> 01:36:29,040
show you where she's going and why she's

2443
01:36:41,430 --> 01:36:37,189
you might be wondering

2444
01:36:46,709 --> 01:36:44,550
ah yes the trojan asteroids these are a

2445
01:36:50,870 --> 01:36:46,719
population of asteroids in orbit around

2446
01:36:53,910 --> 01:36:50,880
the sun about as far away as jupiter

2447
01:36:56,709 --> 01:36:53,920
it may seem far away to you but our lucy

2448
01:36:59,109 --> 01:36:56,719
spacecraft is a capable explorer and

2449
01:37:01,270 --> 01:36:59,119
ready to make the trek to her targets

2450
01:37:03,270 --> 01:37:01,280
lucy is aiming to visit asteroids in

2451
01:37:05,910 --> 01:37:03,280
both of these trojan swarms on her

2452
01:37:08,550 --> 01:37:05,920
12-year mission the pull of gravity from

2453
01:37:10,629 --> 01:37:08,560
the sun balances the pull from jupiter

2454
01:37:11,830 --> 01:37:10,639
to keep the trojan asteroids in these

2455
01:37:13,990 --> 01:37:11,840
two groups

2456
01:37:15,510 --> 01:37:14,000
due to the gravitational balancing act

2457
01:37:18,790 --> 01:37:15,520
these asteroids have been in these

2458
01:37:20,390 --> 01:37:18,800
orbits for billions of years it's still

2459
01:37:23,669 --> 01:37:20,400
quite the challenge to explore these

2460
01:37:26,790 --> 01:37:23,679
targets however our intrepid explorer is

2461
01:37:29,109 --> 01:37:26,800
ready for her mission aren't you lucy

2462
01:37:31,350 --> 01:37:29,119
ah of course you'll be the first

2463
01:37:33,830 --> 01:37:31,360

spacecraft to visit these asteroids i

2464
01:37:36,709 --> 01:37:33,840
can't help but wonder though why choose

2465
01:37:37,910 --> 01:37:36,719
these asteroids in particular

2466
01:37:40,229 --> 01:37:37,920
i see

2467
01:37:42,629 --> 01:37:40,239
the scientific evidence says the trojan

2468
01:37:47,750 --> 01:37:42,639
asteroids are leftover material from the

2469
01:37:51,109 --> 01:37:48,709
right

2470
01:37:53,510 --> 01:37:51,119
these asteroids hold vital clues to

2471
01:37:54,470 --> 01:37:53,520
understanding the history of our solar

2472
01:37:55,270 --> 01:37:54,480
system

2473
01:37:57,189 --> 01:37:55,280
it's

2474
01:37:59,590 --> 01:37:57,199
just like a treasure hunt

2475
01:38:01,750 --> 01:37:59,600
what you discover could teach us about

2476
01:38:04,470 --> 01:38:01,760
the history of the solar system and how

2477
01:38:07,350 --> 01:38:04,480
the planets including earth came to be

2478
01:38:13,430 --> 01:38:10,629
i won't hold you up any longer

2479
01:38:15,189 --> 01:38:13,440
safe travels on your journey

2480
01:38:16,360 --> 01:38:15,199
be sure to write home and tell us all

2481
01:38:20,470 --> 01:38:16,370
about it

2482
01:38:24,629 --> 01:38:22,550
welcome back out here to the broadcast

2483
01:38:27,510 --> 01:38:24,639
area and now we'd like to introduce you

2484
01:38:29,750 --> 01:38:27,520
to a special guest audrey martin she's a

2485
01:38:32,229 --> 01:38:29,760
graduate student at northern arizona

2486
01:38:34,870 --> 01:38:32,239
university and played a role in today's

2487
01:38:37,270 --> 01:38:34,880
launch audrey you're a student and you

2488
01:38:40,550 --> 01:38:37,280

were involved with the lucy science team

2489
01:38:45,669 --> 01:38:40,560
how unique is that it's incredibly

2490
01:38:47,750 --> 01:38:45,679
unique i feel very very privileged to

2491
01:38:49,990 --> 01:38:47,760
have been able to

2492
01:38:52,709 --> 01:38:50,000
work with the science team and also be

2493
01:38:54,550 --> 01:38:52,719
here for the launch it's

2494
01:38:56,550 --> 01:38:54,560
it's absolutely amazing what

2495
01:38:59,030 --> 01:38:56,560
specifically did you work on

2496
01:39:02,550 --> 01:38:59,040
i have been working with the science

2497
01:39:05,189 --> 01:39:02,560
team so i do surface composition

2498
01:39:06,470 --> 01:39:05,199
spectral analysis stuff and i've been

2499
01:39:09,669 --> 01:39:06,480
working with the surface composition

2500
01:39:12,070 --> 01:39:09,679
working group to really understand

2501
01:39:14,470 --> 01:39:12,080
everything that we can understand now

2502
01:39:16,629 --> 01:39:14,480
about the surface of trojan asteroids so

2503
01:39:18,629 --> 01:39:16,639
that when we get there we can learn even

2504
01:39:19,910 --> 01:39:18,639
more and we can be really prepared for

2505
01:39:21,030 --> 01:39:19,920
what we're going to see and what we're

2506
01:39:23,109 --> 01:39:21,040
going to discover

2507
01:39:25,189 --> 01:39:23,119
you've seen the successful launch we all

2508
01:39:27,669 --> 01:39:25,199
watched it here that was pretty cool

2509
01:39:29,990 --> 01:39:27,679
yeah we just saw successful spacecraft

2510
01:39:32,709 --> 01:39:30,000
separation but now we're entering that

2511
01:39:35,750 --> 01:39:32,719
that tense moment where lucy's unfurling

2512
01:39:38,070 --> 01:39:35,760
those gigantic solar arrays

2513
01:39:42,629 --> 01:39:38,080

what's that like for you right now

2514
01:39:43,830 --> 01:39:42,639
i mean i'm um very optimistic so far

2515
01:39:46,790 --> 01:39:43,840
everything

2516
01:39:49,590 --> 01:39:46,800
that has gotten in the way of lucy and

2517
01:39:51,109 --> 01:39:49,600
the success of the mission um everyone

2518
01:39:53,830 --> 01:39:51,119
has come together in a very

2519
01:39:54,629 --> 01:39:53,840
collaborative way to overcome that and

2520
01:39:55,590 --> 01:39:54,639
so

2521
01:40:03,750 --> 01:39:55,600
i'm

2522
01:40:07,830 --> 01:40:05,430
and it will

2523
01:40:09,910 --> 01:40:07,840
other students if other students want to

2524
01:40:11,910 --> 01:40:09,920
do something similar how do other

2525
01:40:14,229 --> 01:40:11,920
students team up with nasa like you did

2526
01:40:18,070 --> 01:40:14,239
yeah great question um so there's this

2527
01:40:19,750 --> 01:40:18,080
program that the lucy mission has

2528
01:40:21,990 --> 01:40:19,760
put together

2529
01:40:25,430 --> 01:40:22,000
with arizona state university it's

2530
01:40:28,950 --> 01:40:25,440
called le space l apostrophe space how

2531
01:40:31,189 --> 01:40:28,960
fitting yeah it's perfect super cute um

2532
01:40:33,590 --> 01:40:31,199
and it's for undergraduate students who

2533
01:40:35,109 --> 01:40:33,600
are interested in working with nasa and

2534
01:40:39,350 --> 01:40:35,119
working

2535
01:40:41,109 --> 01:40:39,360
on you know designing missions and stuff

2536
01:40:42,870 --> 01:40:41,119
like that um

2537
01:40:44,390 --> 01:40:42,880
that is really exciting and it's new

2538
01:40:46,709 --> 01:40:44,400

it's something that i didn't get to

2539
01:40:50,390 --> 01:40:46,719
experience in undergrad and i would have

2540
01:40:51,590 --> 01:40:50,400
absolutely loved it um so if anyone out

2541
01:40:52,709 --> 01:40:51,600
there is interested in it you should

2542
01:40:53,750 --> 01:40:52,719
definitely

2543
01:40:56,390 --> 01:40:53,760
look up

2544
01:40:58,149 --> 01:40:56,400
the space program all right thank you so

2545
01:40:59,750 --> 01:40:58,159
much audrey thanks for being here all

2546
01:41:01,830 --> 01:40:59,760
right very good and as you look at the

2547
01:41:04,629 --> 01:41:01,840
bottom of the screen there you can keep

2548
01:41:07,270 --> 01:41:04,639
track as we are watching solar array

2549
01:41:09,109 --> 01:41:07,280
deploy you can see the timer is at 20

2550
01:41:11,350 --> 01:41:09,119
minutes and counting down and we of

2551
01:41:13,669 --> 01:41:11,360
course are monitoring the spacecraft

2552
01:41:15,669 --> 01:41:13,679
team to find out the latest now let's

2553
01:41:17,830 --> 01:41:15,679
get back to that cartoon lucy right yeah

2554
01:41:20,149 --> 01:41:17,840
she's kind of ahead yes and in the next

2555
01:41:22,310 --> 01:41:20,159
episode we hear from lucy's flight

2556
01:41:24,310 --> 01:41:22,320
navigator who discusses how the team

2557
01:41:27,270 --> 01:41:24,320
directs lucy on its journey to the

2558
01:41:29,430 --> 01:41:27,280
trojan asteroids

2559
01:41:32,310 --> 01:41:29,440
so to steer a spacecraft from millions

2560
01:41:34,550 --> 01:41:32,320
of miles away we have to first track its

2561
01:41:37,350 --> 01:41:34,560
trajectory so we have to determine where

2562
01:41:39,830 --> 01:41:37,360
in the solar system the spacecraft is

2563
01:41:41,590 --> 01:41:39,840

predict where it's heading and compare

2564
01:41:43,669 --> 01:41:41,600
that to where we want it to go so the

2565
01:41:45,669 --> 01:41:43,679
navigation team ensures lucy's on the

2566
01:41:47,350 --> 01:41:45,679
right trajectory by tracking lucy's

2567
01:41:50,149 --> 01:41:47,360
position and velocity in the solar

2568
01:41:53,189 --> 01:41:50,159
system predicting where it's headed and

2569
01:41:54,950 --> 01:41:53,199
adjusting its course so that it aces the

2570
01:41:56,870 --> 01:41:54,960
flyby

2571
01:41:59,669 --> 01:41:56,880
so once lucy starts approaching one of

2572
01:42:02,470 --> 01:41:59,679
its asteroid targets the navigation team

2573
01:42:04,709 --> 01:42:02,480
utilizes the instruments the cameras on

2574
01:42:07,430 --> 01:42:04,719
board to take pictures of the asteroid

2575
01:42:11,990 --> 01:42:07,440
and background stars and that helps us

2576
01:42:14,629 --> 01:42:12,000
hone in on targeting this close flyby

2577
01:42:16,870 --> 01:42:14,639
so commands travel at the speed of light

2578
01:42:19,189 --> 01:42:16,880
and over the course of lucy's trajectory

2579
01:42:22,390 --> 01:42:19,199
its position from earth is varying

2580
01:42:24,709 --> 01:42:22,400
substantially when lucy is near earth

2581
01:42:27,590 --> 01:42:24,719
during our earth gravity assists it

2582
01:42:28,950 --> 01:42:27,600
takes a mere seconds for the data

2583
01:42:30,390 --> 01:42:28,960
commands to

2584
01:42:32,310 --> 01:42:30,400
be received by the spacecraft and for

2585
01:42:34,149 --> 01:42:32,320
the spacecraft to send data back to us

2586
01:42:35,990 --> 01:42:34,159
but at the farthest end of lucy's

2587
01:42:38,229 --> 01:42:36,000
trajectory and the farthest distance

2588
01:42:41,109 --> 01:42:38,239

from earth it can take up to an hour for

2589
01:42:42,870 --> 01:42:41,119
our commands to be received traveling at

2590
01:42:44,790 --> 01:42:42,880
the speed of light

2591
01:42:46,870 --> 01:42:44,800
it's not only the data encoded in the

2592
01:42:48,310 --> 01:42:46,880
signals but it's the properties of the

2593
01:42:51,270 --> 01:42:48,320
signals itself

2594
01:42:53,030 --> 01:42:51,280
we know what time the spacecraft sent

2595
01:42:55,590 --> 01:42:53,040
the data and we know what time it was

2596
01:42:57,750 --> 01:42:55,600
received on earth so we can calculate

2597
01:42:59,430 --> 01:42:57,760
how long it took the signal to travel at

2598
01:43:02,070 --> 01:42:59,440
the speed of light and that gives us

2599
01:43:02,950 --> 01:43:02,080
information about how far lucy is from

2600
01:43:05,430 --> 01:43:02,960
earth

2601
01:43:07,669 --> 01:43:05,440
and then we also can get velocity

2602
01:43:09,270 --> 01:43:07,679
information because the spacecraft is

2603
01:43:11,109 --> 01:43:09,280
moving away from the earth as it's

2604
01:43:13,990 --> 01:43:11,119
sending those signals and so there's a

2605
01:43:15,750 --> 01:43:14,000
change in the frequency of the sig radio

2606
01:43:17,030 --> 01:43:15,760
signal and that gives us information

2607
01:43:19,430 --> 01:43:17,040
about velocity

2608
01:43:22,070 --> 01:43:19,440
so like all nasa missions lucy is

2609
01:43:24,229 --> 01:43:22,080
designed to be robust to anomalies or

2610
01:43:26,149 --> 01:43:24,239
surprises but in the event that

2611
01:43:28,950 --> 01:43:26,159
something unexpected happens there's

2612
01:43:31,750 --> 01:43:28,960
either a contingency plan on the shelf

2613
01:43:34,310 --> 01:43:31,760

or a group of relevant mission experts

2614
01:43:38,110 --> 01:43:34,320
are brought in to come up with the best

2615
01:43:41,590 --> 01:43:38,120
solution to solve the problem

2616
01:43:46,149 --> 01:43:43,910
a little less than six years from now

2617
01:43:48,870 --> 01:43:46,159
lucy will fly by the first trojan

2618
01:43:51,910 --> 01:43:48,880
asteroids in the mission eurybites and

2619
01:43:54,070 --> 01:43:51,920
its small moon keta this next episode of

2620
01:43:58,090 --> 01:43:54,080
the lucy cartoon series shows us an

2621
01:44:01,510 --> 01:43:59,669
[Music]

2622
01:44:06,629 --> 01:44:01,520
there it is lucy

2623
01:44:06,639 --> 01:44:11,510
euripides with its small moon ketta

2624
01:44:15,430 --> 01:44:13,030
earth to lucy

2625
01:44:17,830 --> 01:44:15,440
remember you need to take a lot of

2626
01:44:19,830 --> 01:44:17,840
images of euripides and keta in not a

2627
01:44:21,510 --> 01:44:19,840
lot of time before you're zooming off to

2628
01:44:23,510 --> 01:44:21,520
your next target

2629
01:44:25,250 --> 01:44:23,520
make sure you get all those images for

2630
01:44:51,270 --> 01:44:25,260
us

2631
01:44:56,709 --> 01:44:54,149
and go past

2632
01:45:00,149 --> 01:44:56,719
that was quick right

2633
01:45:03,590 --> 01:45:01,590
that's great to hear

2634
01:45:06,970 --> 01:45:03,600
can't wait to see them just send them

2635
01:45:06,980 --> 01:45:15,750
[Music]

2636
01:45:19,510 --> 01:45:17,590
we have so much to learn from what

2637
01:45:25,030 --> 01:45:19,520
you've already sent back to us and

2638
01:45:29,830 --> 01:45:27,510

so remember it will take lucy 12 years

2639
01:45:31,910 --> 01:45:29,840
to visit all eight asteroids on her

2640
01:45:34,310 --> 01:45:31,920
journey and the next group of trojan

2641
01:45:36,870 --> 01:45:34,320
asteroids lucy will visit each has its

2642
01:45:39,430 --> 01:45:36,880
own unique characteristics and lessons

2643
01:45:41,910 --> 01:45:39,440
to reveal

2644
01:45:44,390 --> 01:45:41,920
there's still five more trojan asteroids

2645
01:45:46,629 --> 01:45:44,400
to explore on your 12-year journey each

2646
01:45:49,030 --> 01:45:46,639
one has a different story to tell about

2647
01:45:52,629 --> 01:45:49,040
the history of our solar system

2648
01:45:54,950 --> 01:45:52,639
next up is pali a mere 21 kilometers or

2649
01:45:57,189 --> 01:45:54,960
13 miles in diameter

2650
01:45:59,910 --> 01:45:57,199
afterwards you'll be zooming by lucas

2651
01:46:03,189 --> 01:45:59,920
which rotates at an extremely slow rate

2652
01:46:04,550 --> 01:46:03,199
with each day being about 18.5 earth

2653
01:46:06,870 --> 01:46:04,560
days long

2654
01:46:11,590 --> 01:46:06,880
afterwards you'll be on to aurus which

2655
01:46:16,629 --> 01:46:13,510
lastly you'll be on your way to a twin

2656
01:46:19,270 --> 01:46:16,639
pair of asteroids patroclus and meniscus

2657
01:46:21,750 --> 01:46:19,280
these asteroids relatively unchanged

2658
01:46:24,149 --> 01:46:21,760
over 4 billion years will give us a

2659
01:46:25,350 --> 01:46:24,159
glimpse of our solar system's distant

2660
01:46:27,750 --> 01:46:25,360
past

2661
01:46:29,830 --> 01:46:27,760
with each flyby of a trojan asteroid

2662
01:46:32,390 --> 01:46:29,840
you'll be looking at time capsules from

2663
01:46:34,310 --> 01:46:32,400

the birth of our solar system over 4

2664
01:46:36,550 --> 01:46:34,320
billion years ago

2665
01:46:38,550 --> 01:46:36,560
lucy what your observations tell us

2666
01:46:40,870 --> 01:46:38,560
about the composition and properties of

2667
01:46:45,590 --> 01:46:40,880
the trojan asteroids could give us clues

2668
01:46:49,669 --> 01:46:47,030
absolutely

2669
01:46:51,750 --> 01:46:49,679
carry on your journey lucy and don't

2670
01:46:55,350 --> 01:46:51,760
forget to call and show us what you find

2671
01:46:57,910 --> 01:46:55,360
out there we'll be waiting good luck

2672
01:47:00,550 --> 01:46:57,920
thank you lucy the trojan asteroids have

2673
01:47:02,550 --> 01:47:00,560
been called ancient time capsules so you

2674
01:47:05,590 --> 01:47:02,560
know what we've got a challenge for you

2675
01:47:08,550 --> 01:47:05,600
to create your own time capsule to open

2676
01:47:12,790 --> 01:47:08,560
when lucy completes the mission in 12

2677
01:47:16,229 --> 01:47:12,800
years here's how you can get involved

2678
01:47:18,470 --> 01:47:16,239
march 2nd 2033 where will you be

2679
01:47:20,390 --> 01:47:18,480
the lucy spacecraft will be right here

2680
01:47:23,030 --> 01:47:20,400
but what about you

2681
01:47:25,430 --> 01:47:23,040
over the next 12 years nasa's lucy

2682
01:47:28,070 --> 01:47:25,440
mission will explore more asteroids than

2683
01:47:31,270 --> 01:47:28,080
any previous mission flying by one main

2684
01:47:33,430 --> 01:47:31,280
belt asteroid and seven trojan asteroids

2685
01:47:35,430 --> 01:47:33,440
these ancient time capsules will allow

2686
01:47:36,390 --> 01:47:35,440
us to trace the origins of our solar

2687
01:47:38,709 --> 01:47:36,400
system

2688
01:47:40,629 --> 01:47:38,719

we invite you to accompany lucy on its

2689
01:47:43,750 --> 01:47:40,639
12-year journey by creating your own

2690
01:47:45,990 --> 01:47:43,760
time capsule set aside a box of mementos

2691
01:47:48,709 --> 01:47:46,000
create a digital file or simply write a

2692
01:47:50,950 --> 01:47:48,719
letter to yourself get creative we

2693
01:47:52,870 --> 01:47:50,960
encourage you to post a photo drawing

2694
01:47:55,350 --> 01:47:52,880
video or other description on social

2695
01:47:57,910 --> 01:47:55,360
media using the hashtag lucy time

2696
01:47:59,830 --> 01:47:57,920
capsule at each major mission milestone

2697
01:48:02,310 --> 01:47:59,840
we'll remind you to revisit and add to

2698
01:48:04,470 --> 01:48:02,320
your time capsule consider what would

2699
01:48:06,470 --> 01:48:04,480
you tell your future self in what ways

2700
01:48:09,109 --> 01:48:06,480
will you grow how do you want to mark

2701
01:48:11,030 --> 01:48:09,119
this current moment in your life

2702
01:48:12,070 --> 01:48:11,040
lucy carries her own time capsule into

2703
01:48:13,910 --> 01:48:12,080
space

2704
01:48:15,669 --> 01:48:13,920
a plaque with words of wisdom for our

2705
01:48:17,750 --> 01:48:15,679
descendants who may one day come across

2706
01:48:18,950 --> 01:48:17,760
the spacecraft long after its primary

2707
01:48:21,430 --> 01:48:18,960
mission ends

2708
01:48:24,149 --> 01:48:21,440
the messages encourage hope and humility

2709
01:48:27,510 --> 01:48:24,159
knowledge and curiosity appreciation of

2710
01:48:30,070 --> 01:48:27,520
humanity and exploration of the cosmos

2711
01:48:32,149 --> 01:48:30,080
we hope you'll join us and lucy as we

2712
01:48:33,350 --> 01:48:32,159
look with anticipation upon the unknown

2713
01:48:39,669 --> 01:48:33,360

of our future

2714
01:48:44,870 --> 01:48:42,629
and remember to use the hashtag lucytime

2715
01:48:47,109 --> 01:48:44,880
capsule when you are sharing your videos

2716
01:48:50,070 --> 01:48:47,119
and photos on social media and we can't

2717
01:48:52,709 --> 01:48:50,080
wait to see what you come up with and

2718
01:48:54,550 --> 01:48:52,719
what marie comes up with what's here i i

2719
01:48:57,109 --> 01:48:54,560
heard about this project and i got so

2720
01:48:58,709 --> 01:48:57,119
excited so i came prepared with my own

2721
01:49:00,870 --> 01:48:58,719
little time capsule items i have a

2722
01:49:02,310 --> 01:49:00,880
picture of my kids they're both under

2723
01:49:04,070 --> 01:49:02,320
sick so they're going to look so much

2724
01:49:05,910 --> 01:49:04,080
different when lucy gets done in 12

2725
01:49:07,189 --> 01:49:05,920
years they might not like me as much

2726
01:49:08,790 --> 01:49:07,199
then either but

2727
01:49:10,310 --> 01:49:08,800
so we got to remember this moment i've

2728
01:49:13,510 --> 01:49:10,320
got that one of their favorite toys a

2729
01:49:15,189 --> 01:49:13,520
unicorn some some patches from missions

2730
01:49:17,350 --> 01:49:15,199
this year the crew 2 one they launched

2731
01:49:19,990 --> 01:49:17,360
earlier this year and the lucy mission

2732
01:49:22,310 --> 01:49:20,000
patch of course a pair of my kids shoes

2733
01:49:25,109 --> 01:49:22,320
because i'm sentimental a mask

2734
01:49:27,270 --> 01:49:25,119
because it's a face mask i mean it will

2735
01:49:30,709 --> 01:49:27,280
remember the times and my first plane

2736
01:49:33,030 --> 01:49:30,719
tickets from my first post-quarantine

2737
01:49:34,550 --> 01:49:33,040
trip on an airplane so how about you

2738
01:49:36,070 --> 01:49:34,560

daryl what do you have

2739
01:49:38,550 --> 01:49:36,080
well i don't have all that but you know

2740
01:49:41,030 --> 01:49:38,560
what i wore some socks that are my plans

2741
01:49:42,629 --> 01:49:41,040
you wore socks you see that i mean don't

2742
01:49:44,470 --> 01:49:42,639
want to show you

2743
01:49:46,470 --> 01:49:44,480
he's taking off i'm going to take off

2744
01:49:48,790 --> 01:49:46,480
but this is great because you know why

2745
01:49:51,189 --> 01:49:48,800
that's jupiter on my sock right all

2746
01:49:52,950 --> 01:49:51,199
right well and so on the other side

2747
01:49:54,550 --> 01:49:52,960
what's that marie i don't know maybe

2748
01:49:56,550 --> 01:49:54,560
some asteroids looks like your ribbities

2749
01:49:57,910 --> 01:49:56,560
maybe you know but you know what i was

2750
01:49:59,350 --> 01:49:57,920
going to share this with you but you

2751
01:50:02,070 --> 01:49:59,360
just took that off your foot so you can

2752
01:50:03,589 --> 01:50:02,080
get your own time capsule box

2753
01:50:05,109 --> 01:50:03,599
i can't put it in the little girl's shoe

2754
01:50:06,470 --> 01:50:05,119
right you can put it in my baby shoe

2755
01:50:08,149 --> 01:50:06,480
sure yeah right

2756
01:50:09,990 --> 01:50:08,159
all right and we have first light right

2757
01:50:11,750 --> 01:50:10,000
behind us you can start to see uh

2758
01:50:13,669 --> 01:50:11,760
sunrise hasn't happened yet this is just

2759
01:50:15,750 --> 01:50:13,679
beautiful this is a beautiful view this

2760
01:50:17,830 --> 01:50:15,760
is the kennedy turn basin where we

2761
01:50:20,310 --> 01:50:17,840
brought in the shuttle main external

2762
01:50:23,270 --> 01:50:20,320
tank and also uh brought in the core

2763
01:50:25,589 --> 01:50:23,280

stage for the artemis uh mission and uh

2764
01:50:28,229 --> 01:50:25,599
that's gonna be a great one yeah so much

2765
01:50:29,830 --> 01:50:28,239
coming up here on the space coast uh we

2766
01:50:32,470 --> 01:50:29,840
heard a little earlier from lucy's

2767
01:50:35,030 --> 01:50:32,480
project manager now here's a recap in

2768
01:50:37,830 --> 01:50:35,040
her own words about the work it took to

2769
01:50:40,629 --> 01:50:37,840
get lucy into the sky

2770
01:50:41,510 --> 01:50:40,639
the lucy mission is a planetary mission

2771
01:50:44,149 --> 01:50:41,520
to

2772
01:50:46,470 --> 01:50:44,159
the trojan asteroids that are around

2773
01:50:49,430 --> 01:50:46,480
jupiter it's going to survey

2774
01:50:51,750 --> 01:50:49,440
actually a total of eight targets seven

2775
01:50:54,550 --> 01:50:51,760
asteroids around jupiter and one

2776
01:50:56,310 --> 01:50:54,560
asteroid in the main asteroid belt once

2777
01:50:57,990 --> 01:50:56,320
you know where you're going and the type

2778
01:50:59,910 --> 01:50:58,000
of science that you want to take one of

2779
01:51:02,950 --> 01:50:59,920
the things that you start looking at is

2780
01:51:05,350 --> 01:51:02,960
the spacecraft

2781
01:51:08,229 --> 01:51:05,360
what size spacecraft where is it going

2782
01:51:10,390 --> 01:51:08,239
how much power does it need to carry

2783
01:51:12,790 --> 01:51:10,400
does it need solar rays what type of

2784
01:51:15,430 --> 01:51:12,800
solar rays what type of vehicle is going

2785
01:51:18,229 --> 01:51:15,440
to be used to launch it in the space

2786
01:51:20,229 --> 01:51:18,239
so that dictates how much mass you can

2787
01:51:24,149 --> 01:51:20,239
carry and one things i do as a project

2788
01:51:26,790 --> 01:51:24,159

manager is to assemble a team of

2789
01:51:29,189 --> 01:51:26,800
scientists and engineers and technicians

2790
01:51:31,189 --> 01:51:29,199
and business people to design that

2791
01:51:33,350 --> 01:51:31,199
overall spacecraft to achieve your

2792
01:51:35,750 --> 01:51:33,360
mission

2793
01:51:37,990 --> 01:51:35,760
in designing the spacecraft you are

2794
01:51:40,070 --> 01:51:38,000
always thinking about what type of

2795
01:51:43,350 --> 01:51:40,080
environment is it going to be subjected

2796
01:51:46,709 --> 01:51:43,360
to is it going to orbit around earth is

2797
01:51:50,310 --> 01:51:46,719
it going into deep space is it going to

2798
01:51:52,790 --> 01:51:50,320
mars is it going close to the sun and so

2799
01:51:56,070 --> 01:51:52,800
as engineers one of the things that

2800
01:51:59,270 --> 01:51:56,080
you're thinking about very early on is

2801
01:52:01,910 --> 01:51:59,280
how can you design this system and test

2802
01:52:03,589 --> 01:52:01,920
the system in order to verify and

2803
01:52:07,030 --> 01:52:03,599
convince yourself that it's going to

2804
01:52:09,830 --> 01:52:07,040
survive in space and as part of that it

2805
01:52:12,550 --> 01:52:09,840
goes through a very rigorous test

2806
01:52:14,470 --> 01:52:12,560
program and so we call it

2807
01:52:17,510 --> 01:52:14,480
shaking and baking

2808
01:52:19,830 --> 01:52:17,520
and so we actually put it through what

2809
01:52:22,390 --> 01:52:19,840
we call a thermal vac chamber in which

2810
01:52:25,669 --> 01:52:22,400
we simulate the space environment we

2811
01:52:28,470 --> 01:52:25,679
also put it on what we call a vibe table

2812
01:52:30,470 --> 01:52:28,480
in which we vibrate it so we shake it

2813
01:52:32,470 --> 01:52:30,480

and one of the important things that you

2814
01:52:34,229 --> 01:52:32,480
have to do in order to be convinced that

2815
01:52:35,750 --> 01:52:34,239
it's going to survive is to make sure

2816
01:52:38,470 --> 01:52:35,760
that the environment in which you're

2817
01:52:40,390 --> 01:52:38,480
testing it in the simulate environment

2818
01:52:43,270 --> 01:52:40,400
is harsher than what it's going to see

2819
01:52:45,350 --> 01:52:43,280
in space so once you subject that

2820
01:52:48,070 --> 01:52:45,360
spacecraft or that instrument to that

2821
01:52:50,149 --> 01:52:48,080
environment then you can have confidence

2822
01:52:53,910 --> 01:52:50,159
that it's going to last the lifetime

2823
01:52:57,430 --> 01:52:55,910
all right thank you very much ladies as

2824
01:53:00,070 --> 01:52:57,440
you can see at the bottom of your screen

2825
01:53:01,990 --> 01:53:00,080
we are counting down to confirmation of

2826
01:53:04,870 --> 01:53:02,000
solar ray deploy and acquisition of

2827
01:53:07,430 --> 01:53:04,880
signal just about eight minutes to go in

2828
01:53:09,589 --> 01:53:07,440
that now many of nasa's unique science

2829
01:53:12,149 --> 01:53:09,599
missions have one thing in common and

2830
01:53:15,510 --> 01:53:12,159
that is the launch services program that

2831
01:53:23,990 --> 01:53:15,520
helps each mission take flight lsp is

2832
01:53:28,550 --> 01:53:26,550
since the dawn of humanity

2833
01:53:31,350 --> 01:53:28,560
we have looked to the stars and dreamed

2834
01:53:32,340 --> 01:53:31,360
of bridging the gap between the earth

2835
01:53:34,149 --> 01:53:32,350
and the cosmos

2836
01:53:36,149 --> 01:53:34,159
[Music]

2837
01:53:38,870 --> 01:53:36,159
in the 20th century

2838
01:53:41,430 --> 01:53:38,880

nasa turned that dream into a reality by

2839
01:53:43,669 --> 01:53:41,440
launching humanity into a bold era of

2840
01:53:46,790 --> 01:53:43,679
scientific discovery

2841
01:53:49,109 --> 01:53:46,800
as pioneers of space travel our best and

2842
01:53:51,669 --> 01:53:49,119
brightest designed and built everything

2843
01:53:53,510 --> 01:53:51,679
from the ground up from launch pads to

2844
01:53:55,109 --> 01:53:53,520
rockets all of which were government

2845
01:53:57,750 --> 01:53:55,119
owned and operated

2846
01:53:59,589 --> 01:53:57,760
as nasa's science and robotics evolved

2847
01:54:02,709 --> 01:53:59,599
we encouraged a competitive launch

2848
01:54:04,310 --> 01:54:02,719
market to develop ushering in a new way

2849
01:54:06,310 --> 01:54:04,320
to explore and discover through

2850
01:54:08,310 --> 01:54:06,320
commercial space flight

2851
01:54:10,790 --> 01:54:08,320
spacecraft customers from around the

2852
01:54:12,550 --> 01:54:10,800
world all with the same desire reached

2853
01:54:13,669 --> 01:54:12,560
out to find an expert at nasa for

2854
01:54:16,550 --> 01:54:13,679
support

2855
01:54:17,100 --> 01:54:16,560
thus nasa's launch services program was

2856
01:54:20,790 --> 01:54:17,110
born

2857
01:54:23,189 --> 01:54:20,800
[Music]

2858
01:54:24,709 --> 01:54:23,199
our mission is to centralize nasa's

2859
01:54:26,709 --> 01:54:24,719
launch services and address

2860
01:54:28,629 --> 01:54:26,719
state-of-the-art customer needs when

2861
01:54:31,750 --> 01:54:28,639
placing their spacecraft in orbit around

2862
01:54:33,510 --> 01:54:31,760
the earth the sun or destinations deeper

2863
01:54:36,070 --> 01:54:33,520

into the solar system

2864
01:54:37,910 --> 01:54:36,080
the lsp family is made up of a diverse

2865
01:54:40,629 --> 01:54:37,920
tapestry of government and contractor

2866
01:54:43,189 --> 01:54:40,639
engineers analysts operation experts and

2867
01:54:44,070 --> 01:54:43,199
business advisors all united by a common

2868
01:54:46,470 --> 01:54:44,080
goal

2869
01:54:49,109 --> 01:54:46,480
to get your spacecraft off the ground on

2870
01:54:50,390 --> 01:54:49,119
time on budget and successfully to its

2871
01:54:52,470 --> 01:54:50,400
final destination

2872
01:54:54,310 --> 01:54:52,480
wherever that may be

2873
01:54:57,990 --> 01:54:54,320
we match scientific and robotic

2874
01:54:59,750 --> 01:54:58,000
spacecraft with the appropriate rocket

2875
01:55:01,669 --> 01:54:59,760
and certify rocket performance and

2876
01:55:03,669 --> 01:55:01,679
reliability

2877
01:55:05,990 --> 01:55:03,679
we support full-service missions

2878
01:55:07,589 --> 01:55:06,000
advisory services and one-of-a-kind

2879
01:55:09,910 --> 01:55:07,599
contracts

2880
01:55:11,910 --> 01:55:09,920
the launch services program is the

2881
01:55:13,990 --> 01:55:11,920
common thread that bridges the

2882
01:55:15,350 --> 01:55:14,000
spacecraft organization to the rocket

2883
01:55:16,870 --> 01:55:15,360
designer

2884
01:55:19,510 --> 01:55:16,880
and the spacecraft

2885
01:55:23,189 --> 01:55:21,430
we provide long-term technical

2886
01:55:24,790 --> 01:55:23,199
leadership and expertise from

2887
01:55:27,430 --> 01:55:24,800
pre-mission planning

2888
01:55:30,070 --> 01:55:27,440

to system verification and validation

2889
01:55:32,310 --> 01:55:30,080
all the way through launch

2890
01:55:34,629 --> 01:55:32,320
whatever the vision or requirements our

2891
01:55:36,390 --> 01:55:34,639
team will be there guiding our customers

2892
01:55:38,709 --> 01:55:36,400
every step of the way on their journey

2893
01:55:41,350 --> 01:55:38,719
through space

2894
01:55:43,589 --> 01:55:41,360
we are the common thread that connects

2895
01:55:45,510 --> 01:55:43,599
the science world to the physical world

2896
01:55:46,870 --> 01:55:45,520
by putting the necessary instruments in

2897
01:55:48,550 --> 01:55:46,880
place

2898
01:55:51,030 --> 01:55:48,560
the thread that weaves nasa's

2899
01:55:52,950 --> 01:55:51,040
industry-leading knowledge and support

2900
01:55:54,790 --> 01:55:52,960
into the fabric of the commercial space

2901
01:55:57,589 --> 01:55:54,800
market

2902
01:55:59,990 --> 01:55:57,599
we unite customers capabilities and

2903
01:56:02,510 --> 01:56:00,000
culture to explore space through

2904
01:56:04,070 --> 01:56:02,520
unparalleled launch services

2905
01:56:06,390 --> 01:56:04,080
[Music]

2906
01:56:09,360 --> 01:56:06,400
nasa's launch services program

2907
01:56:12,149 --> 01:56:09,370
we are earth's bridge to space

2908
01:56:14,709 --> 01:56:12,159
[Music]

2909
01:56:17,910 --> 01:56:14,719
all right we are now at launch plus one

2910
01:56:20,310 --> 01:56:17,920
hour 21 minutes and just under five

2911
01:56:21,030 --> 01:56:20,320
minutes away uh from what we hope will

2912
01:56:23,430 --> 01:56:21,040
be

2913
01:56:25,589 --> 01:56:23,440

acquisition of signal we're still inside

2914
01:56:27,510 --> 01:56:25,599
that 22 minutes of terror when we don't

2915
01:56:28,870 --> 01:56:27,520
know that yet that's why i say we hope

2916
01:56:31,270 --> 01:56:28,880
we'll find out

2917
01:56:32,790 --> 01:56:31,280
in about four minutes now we will be

2918
01:56:35,189 --> 01:56:32,800
checking in with the launch team in just

2919
01:56:37,350 --> 01:56:35,199
a minute but before we do that nasa's

2920
01:56:40,070 --> 01:56:37,360
launch services program has a really

2921
01:56:43,430 --> 01:56:40,080
busy rest of 2021 planned here's a

2922
01:56:46,390 --> 01:56:43,440
preview of what's ahead

2923
01:56:49,430 --> 01:56:46,400
since 1998 nasa's launch services

2924
01:56:50,870 --> 01:56:49,440
program or lsp has served as earth's

2925
01:56:52,870 --> 01:56:50,880
bridge to space

2926
01:56:55,430 --> 01:56:52,880
based at nasa's kennedy space center in

2927
01:56:57,589 --> 01:56:55,440
florida the program matches scientific

2928
01:56:59,750 --> 01:56:57,599
and robotic spacecraft with launch

2929
01:57:02,070 --> 01:56:59,760
vehicles for some of america's most

2930
01:57:04,070 --> 01:57:02,080
inspiring space missions

2931
01:57:06,629 --> 01:57:04,080
our mission to successfully place

2932
01:57:09,030 --> 01:57:06,639
spacecraft in orbit around the earth the

2933
01:57:11,030 --> 01:57:09,040
sun and destinations deeper into the

2934
01:57:13,430 --> 01:57:11,040
solar system

2935
01:57:14,950 --> 01:57:13,440
we centralize nasa's launch services

2936
01:57:16,709 --> 01:57:14,960
while addressing state-of-the-art

2937
01:57:19,430 --> 01:57:16,719
customer needs

2938
01:57:21,910 --> 01:57:19,440

but lsp does more than pair spacecraft

2939
01:57:23,669 --> 01:57:21,920
with the appropriate rocket the diverse

2940
01:57:26,629 --> 01:57:23,679
group of government and contractor

2941
01:57:29,189 --> 01:57:26,639
engineers analysts and advisors certify

2942
01:57:31,270 --> 01:57:29,199
rocket performance and reliability

2943
01:57:33,350 --> 01:57:31,280
the team provides long-term technical

2944
01:57:36,550 --> 01:57:33,360
expertise and support to spacecraft

2945
01:57:38,790 --> 01:57:36,560
customers from around the world

2946
01:57:41,109 --> 01:57:38,800
the team manages launches from multiple

2947
01:57:43,589 --> 01:57:41,119
sites depending on customer and mission

2948
01:57:46,229 --> 01:57:43,599
needs cape canaveral space force station

2949
01:57:47,750 --> 01:57:46,239
in florida vandenberg space force base

2950
01:57:50,070 --> 01:57:47,760
in california

2951
01:57:52,310 --> 01:57:50,080
reagan test site at kwajalein atoll in

2952
01:57:54,950 --> 01:57:52,320
the republic of the marshall islands and

2953
01:57:56,229 --> 01:57:54,960
the pacific spaceport complex in kodiak

2954
01:57:59,510 --> 01:57:56,239
alaska

2955
01:58:02,070 --> 01:57:59,520
building off of past success lsp forges

2956
01:58:04,390 --> 01:58:02,080
ahead to support nasa's future

2957
01:58:07,109 --> 01:58:04,400
lucy will be the first mission to study

2958
01:58:09,430 --> 01:58:07,119
jupiter's trojan asteroids which may be

2959
01:58:11,510 --> 01:58:09,440
remnants of the primordial material that

2960
01:58:12,709 --> 01:58:11,520
formed the outer planets of our solar

2961
01:58:14,790 --> 01:58:12,719
system

2962
01:58:18,390 --> 01:58:14,800
it's then back to the west coast for

2963
01:58:21,589 --> 01:58:18,400

double asteroid redirection test or dart

2964
01:58:24,070 --> 01:58:21,599
nasa's first planetary defense mission

2965
01:58:27,589 --> 01:58:24,080
that will be followed by imaging x-ray

2966
01:58:30,229 --> 01:58:27,599
polarimetry explorer or xp launching

2967
01:58:32,229 --> 01:58:30,239
from kennedy bixby will expand our

2968
01:58:34,709 --> 01:58:32,239
understanding of x-ray production in

2969
01:58:35,830 --> 01:58:34,719
objects such as neutron stars and black

2970
01:58:38,310 --> 01:58:35,840
holes

2971
01:58:41,350 --> 01:58:38,320
years of testing determination and

2972
01:58:44,070 --> 01:58:41,360
dedication working as one

2973
01:58:48,629 --> 01:58:44,080
nasa's launch services program is

2974
01:58:53,030 --> 01:58:50,149
all right just about two and a half

2975
01:58:55,109 --> 01:58:53,040
minutes until we hopefully finish solar

2976
01:58:57,109 --> 01:58:55,119
array deploy two minutes after that

2977
01:59:00,470 --> 01:58:57,119
we're expecting to get the acquisition

2978
01:59:03,510 --> 01:59:00,480
of signal as we dawn here the beautiful

2979
01:59:04,950 --> 01:59:03,520
shot behind us marie of uh the sun

2980
01:59:06,790 --> 01:59:04,960
getting ready to rise here at the

2981
01:59:08,950 --> 01:59:06,800
kennedy space center the kennedy turn

2982
01:59:11,669 --> 01:59:08,960
basin behind us what a beautiful sight

2983
01:59:12,950 --> 01:59:11,679
yeah storybook picture behind us uh and

2984
01:59:14,709 --> 01:59:12,960
as you saw in that video the next

2985
01:59:16,550 --> 01:59:14,719
mission for nasa's launch services

2986
01:59:19,189 --> 01:59:16,560
program is the double asteroid

2987
01:59:20,870 --> 01:59:19,199
redirection test we call that dart um

2988
01:59:22,950 --> 01:59:20,880

that's currently scheduled to lift off

2989
01:59:25,189 --> 01:59:22,960
november 23rd i think it's uh

2990
01:59:27,990 --> 01:59:25,199
thanksgiving eve uh over on the west

2991
01:59:29,350 --> 01:59:28,000
coast vandenberg space force base so uh

2992
01:59:31,589 --> 01:59:29,360
we're really excited for that one and

2993
01:59:34,709 --> 01:59:31,599
more details you can find on that at

2994
01:59:37,270 --> 01:59:34,719
nasa.gov forward slash dart

2995
01:59:40,229 --> 01:59:37,280
and so while we stand by to find out

2996
01:59:42,790 --> 01:59:40,239
more information about the situation

2997
01:59:45,350 --> 01:59:42,800
with lucy we want to say hey this is a

2998
01:59:47,510 --> 01:59:45,360
long journey ahead of her but these

2999
01:59:49,750 --> 01:59:47,520
moments right here are very critical

3000
01:59:51,990 --> 01:59:49,760
especially that confirming of that solar

3001
01:59:54,070 --> 01:59:52,000
array deploy so let's toss it over to

3002
01:59:56,310 --> 01:59:54,080
joshua and mick over at the asoc who

3003
01:59:58,070 --> 01:59:56,320
will talk us through it guys

3004
02:00:00,310 --> 01:59:58,080
yeah thanks daryl uh man what an

3005
02:00:01,589 --> 02:00:00,320
exciting year ahead uh obviously we'd

3006
02:00:03,669 --> 02:00:01,599
love to talk about that but we need to

3007
02:00:05,430 --> 02:00:03,679
focus on what's at hand uh one minute

3008
02:00:07,669 --> 02:00:05,440
left again this is the anticipated time

3009
02:00:09,030 --> 02:00:07,679
to complete the solar ray deploy uh nick

3010
02:00:11,109 --> 02:00:09,040
i think we did hear that there is a good

3011
02:00:12,790 --> 02:00:11,119
call on beginning that process

3012
02:00:15,109 --> 02:00:12,800
yeah the team is getting some low rate

3013
02:00:16,790 --> 02:00:15,119

data and we did hear from the spacecraft

3014
02:00:19,669 --> 02:00:16,800
project that they had begun that project

3015
02:00:23,109 --> 02:00:19,679
on time so as you said we're hoping here

3016
02:00:25,189 --> 02:00:23,119
in about 50 seconds to hear that solar

3017
02:00:26,950 --> 02:00:25,199
ray deploy is complete and as daryl

3018
02:00:28,870 --> 02:00:26,960
mentioned two minutes after that we get

3019
02:00:29,669 --> 02:00:28,880
full acquisition of signal to check out

3020
02:00:31,589 --> 02:00:29,679
the

3021
02:00:34,870 --> 02:00:31,599
health of lucy and we should hear that

3022
02:00:37,589 --> 02:00:34,880
uh come in from uh spacecraft uh project

3023
02:00:40,550 --> 02:00:37,599
manager to our nasa launch manager uh to

3024
02:00:41,830 --> 02:00:40,560
make sure that lucy is is good yeah we

3025
02:00:43,270 --> 02:00:41,840
did get that call we weren't sure if we

3026
02:00:45,189 --> 02:00:43,280
would hear a call for beginning solar

3027
02:00:46,629 --> 02:00:45,199
array deploy yeah because we were we did

3028
02:00:48,310 --> 02:00:46,639
kind of i don't know i don't think

3029
02:00:50,229 --> 02:00:48,320
lucked out because there's no luck here

3030
02:00:52,390 --> 02:00:50,239
but we we were fortunate to get that

3031
02:00:53,669 --> 02:00:52,400
blu-ray data we may not get full

3032
02:00:55,270 --> 02:00:53,679
confirmation until we do get that

3033
02:00:56,790 --> 02:00:55,280
acquisition of signal which although

3034
02:00:59,430 --> 02:00:56,800
that clock is almost at zero may not be

3035
02:01:02,229 --> 02:00:59,440
for a couple more minutes um as we wait

3036
02:01:03,830 --> 02:01:02,239
here mick uh communicating back to earth

3037
02:01:05,750 --> 02:01:03,840
is a challenge and we kind of saw a

3038
02:01:06,950 --> 02:01:05,760

little about that from one of our guests

3039
02:01:09,350 --> 02:01:06,960
talking about when you're close to earth

3040
02:01:10,470 --> 02:01:09,360
it's speed of light uh but ultimately

3041
02:01:12,470 --> 02:01:10,480
it's always speed of light but that's a

3042
02:01:13,430 --> 02:01:12,480
lot easier when you're close to earth

3043
02:01:15,430 --> 02:01:13,440
there's different communication

3044
02:01:17,669 --> 02:01:15,440
mechanisms yeah so for today's mission

3045
02:01:19,750 --> 02:01:17,679
we actually utilize the tdrs network the

3046
02:01:21,669 --> 02:01:19,760
telemetry data relay satellite network

3047
02:01:23,910 --> 02:01:21,679
that nasa owns uh for the vehicle

3048
02:01:25,589 --> 02:01:23,920
telemetry and for some of the spacecraft

3049
02:01:28,470 --> 02:01:25,599
data that we've started

3050
02:01:30,709 --> 02:01:28,480
excuse me um and as lucy moves on its

3051
02:01:32,709 --> 02:01:30,719
way uh out towards the asteroids we'll

3052
02:01:34,790 --> 02:01:32,719
take advantage of the deep space network

3053
02:01:37,669 --> 02:01:34,800
or the set of ground stations here on

3054
02:01:39,750 --> 02:01:37,679
earth that have huge huge satellites

3055
02:01:42,629 --> 02:01:39,760
that can pick up the smallest and

3056
02:01:45,270 --> 02:01:42,639
faintest sound from space so that is a

3057
02:01:47,830 --> 02:01:45,280
huge asset that we have within the nasa

3058
02:01:50,070 --> 02:01:47,840
and aerospace industry to be able to

3059
02:01:52,390 --> 02:01:50,080
work with satellites that travel this

3060
02:01:53,589 --> 02:01:52,400
far as as lucy is doing yeah again

3061
02:01:55,510 --> 02:01:53,599
hoping now within a couple minutes to

3062
02:01:57,270 --> 02:01:55,520
hear from lucy i want to emphasize that

3063
02:01:59,109 --> 02:01:57,280

just because we if we don't hear that

3064
02:02:00,950 --> 02:01:59,119
quickly that's not necessarily a bad

3065
02:02:02,790 --> 02:02:00,960
sign uh there's a big window here when

3066
02:02:04,870 --> 02:02:02,800
we know that that acquisition of signal

3067
02:02:06,709 --> 02:02:04,880
might take place so we will kind of try

3068
02:02:08,470 --> 02:02:06,719
and stay with you as long as it makes

3069
02:02:10,310 --> 02:02:08,480
sense uh but again that's kind of the

3070
02:02:11,910 --> 02:02:10,320
nature of space flight again it's not

3071
02:02:13,589 --> 02:02:11,920
about luck it is it is about science and

3072
02:02:15,109 --> 02:02:13,599
there's lots of factors at play yeah

3073
02:02:16,550 --> 02:02:15,119
like i said earlier the team has done a

3074
02:02:17,750 --> 02:02:16,560
great job of designing the trajectory

3075
02:02:20,310 --> 02:02:17,760
and working and so far all the

3076
02:02:22,310 --> 02:02:20,320
predictions have been right on on target

3077
02:02:24,950 --> 02:02:22,320
so as the spacecraft team works through

3078
02:02:27,910 --> 02:02:24,960
their thing uh there's their steps um

3079
02:02:30,470 --> 02:02:27,920
there is this another 20 minutes roughly

3080
02:02:33,669 --> 02:02:30,480
uh that we could get signal or it could

3081
02:02:36,149 --> 02:02:33,679
go as late as uh you know hour 55 after

3082
02:02:37,910 --> 02:02:36,159
after uh liftoff so we'll stay around

3083
02:02:39,990 --> 02:02:37,920
and look at what's going on but the team

3084
02:02:42,149 --> 02:02:40,000
is definitely still looking at that and

3085
02:02:43,830 --> 02:02:42,159
working it um you know joshua i did want

3086
02:02:45,510 --> 02:02:43,840
to go back you had asked me earlier when

3087
02:02:48,070 --> 02:02:45,520
we were off air about spacecraft

3088
02:02:49,430 --> 02:02:48,080

separation and how simple that was and

3089
02:02:51,669 --> 02:02:49,440
it was you know basically it looks

3090
02:02:53,669 --> 02:02:51,679
simple it looks simple but it's very

3091
02:02:55,350 --> 02:02:53,679
it's very uh it's an engineering feat

3092
02:02:57,830 --> 02:02:55,360
and it uses a marmon clamp that's been

3093
02:02:59,830 --> 02:02:57,840
around for years and the marmon clamp

3094
02:03:02,070 --> 02:02:59,840
has a has an explosive bolt that is

3095
02:03:04,390 --> 02:03:02,080
released and the marmon clamp releases

3096
02:03:06,950 --> 02:03:04,400
and lucy was actually pushed off the

3097
02:03:09,109 --> 02:03:06,960
front end of centaur with six separation

3098
02:03:10,870 --> 02:03:09,119
springs uh so that's that's a you know

3099
02:03:12,390 --> 02:03:10,880
it sounds very easy but it's actually a

3100
02:03:14,950 --> 02:03:12,400
cool it's actually a very cool

3101
02:03:16,470 --> 02:03:14,960
engineering design that allows us to be

3102
02:03:18,790 --> 02:03:16,480
able to keep the spacecraft on there for

3103
02:03:20,629 --> 02:03:18,800
the ride and then separate uh where they

3104
02:03:22,229 --> 02:03:20,639
need to go so i wanted to bring that

3105
02:03:23,669 --> 02:03:22,239
back for the folks on on that are

3106
02:03:25,589 --> 02:03:23,679
watching us so i think that's just a

3107
02:03:27,109 --> 02:03:25,599
cool engineering thing that happened in

3108
02:03:28,629 --> 02:03:27,119
the mission today

3109
02:03:30,229 --> 02:03:28,639
yeah appreciate those tuning in again we

3110
02:03:32,629 --> 02:03:30,239
had successful lift off on time this

3111
02:03:34,470 --> 02:03:32,639
morning at 5 34 a.m eastern time and we

3112
02:03:35,270 --> 02:03:34,480
are standing by now hoping any second to

3113
02:03:37,510 --> 02:03:35,280

hear

3114
02:03:40,550 --> 02:03:37,520
that lucy is alive and well

3115
02:03:42,310 --> 02:03:40,560
but as we we wait um

3116
02:03:44,390 --> 02:03:42,320
thinking ahead to what's to come lucy

3117
02:03:46,709 --> 02:03:44,400
again headed to eight asteroids around

3118
02:03:49,750 --> 02:03:46,719
the solar system one main asteroid belt

3119
02:03:51,270 --> 02:03:49,760
uh and then seven trojan asteroids

3120
02:03:52,790 --> 02:03:51,280
yeah and this is and this is just the

3121
02:03:54,470 --> 02:03:52,800
beginning as we've said earlier right

3122
02:03:56,229 --> 02:03:54,480
the team will get the solar rays out

3123
02:03:58,950 --> 02:03:56,239
they'll get acquisition signal they've

3124
02:04:00,790 --> 02:03:58,960
got a lot of work to do on orbit testing

3125
02:04:02,149 --> 02:04:00,800
out the systems making sure that their

3126
02:04:03,430 --> 02:04:02,159
batteries are charged making sure

3127
02:04:05,189 --> 02:04:03,440
everything's working as i mentioned

3128
02:04:07,750 --> 02:04:05,199
earlier you know they're very efficient

3129
02:04:09,589 --> 02:04:07,760
power usage 5000 watts so they want to

3130
02:04:11,510 --> 02:04:09,599
make sure all that's working as they're

3131
02:04:13,350 --> 02:04:11,520
traveling towards these asteroids so

3132
02:04:14,950 --> 02:04:13,360
that when they get there that everything

3133
02:04:16,390 --> 02:04:14,960
works in the sciences so they'll do

3134
02:04:18,470 --> 02:04:16,400
checkouts of all the instruments that we

3135
02:04:20,629 --> 02:04:18,480
talked about on the show today and the

3136
02:04:22,950 --> 02:04:20,639
team the the spacecraft team still has a

3137
02:04:25,669 --> 02:04:22,960
lot of work uh over the next few months

3138
02:04:27,350 --> 02:04:25,679

and years 12 12 years right yeah so uh

3139
02:04:29,589 --> 02:04:27,360
that's that's that's what's up coming

3140
02:04:31,510 --> 02:04:29,599
for the spacecraft team um we just saw a

3141
02:04:35,030 --> 02:04:31,520
little bit ago you know we're still

3142
02:04:36,629 --> 02:04:35,040
focused on lucy but uh the lsp team

3143
02:04:38,870 --> 02:04:36,639
is beginning to work with our other

3144
02:04:41,350 --> 02:04:38,880
commercial partners on some missions

3145
02:04:43,350 --> 02:04:41,360
another asteroid mission dart which is a

3146
02:04:44,709 --> 02:04:43,360
cool i just think a very cool mission

3147
02:04:46,629 --> 02:04:44,719
that we're going to send a

3148
02:04:48,709 --> 02:04:46,639
spacecraft to an asteroid and try to

3149
02:04:50,310 --> 02:04:48,719
impact its trajectory a little bit so

3150
02:04:52,950 --> 02:04:50,320
that's that's looking forward to that

3151
02:04:54,950 --> 02:04:52,960
mission coming up here very soon so

3152
02:04:57,669 --> 02:04:54,960
yeah and uh

3153
02:04:59,109 --> 02:04:57,679
looking ahead to lucy's journey she's if

3154
02:05:01,510 --> 02:04:59,119
you're ever frustrated by your cell

3155
02:05:03,350 --> 02:05:01,520
phone not working in a timely fashion

3156
02:05:06,069 --> 02:05:03,360
and you're kind of anxious to hear us

3157
02:05:07,589 --> 02:05:06,079
get this call a reminder that lucy's now

3158
02:05:09,990 --> 02:05:07,599
hurtling away from earth at greater than

3159
02:05:12,709 --> 02:05:10,000
escape velocity which means more than 25

3160
02:05:14,470 --> 02:05:12,719
000 miles per hour away from earth so

3161
02:05:15,830 --> 02:05:14,480
this is this is much more complicated

3162
02:05:17,189 --> 02:05:15,840
than even a simple text message that you

3163
02:05:18,709 --> 02:05:17,199

just can't get to

3164
02:05:20,390 --> 02:05:18,719
yeah no the teams the teams are

3165
02:05:22,069 --> 02:05:20,400
definitely paying attention

3166
02:05:24,629 --> 02:05:22,079
uh looking at all the

3167
02:05:26,310 --> 02:05:24,639
the stuff they've got and watching that

3168
02:05:28,870 --> 02:05:26,320
the automation on the spacecraft is

3169
02:05:31,030 --> 02:05:28,880
working uh definitely uh can tell you

3170
02:05:33,109 --> 02:05:31,040
that there's probably a little tense

3171
02:05:36,310 --> 02:05:33,119
moments going on right now

3172
02:05:38,870 --> 02:05:36,320
um from that aspect um

3173
02:05:41,750 --> 02:05:38,880
but we are still waiting to hear

3174
02:05:43,270 --> 02:05:41,760
uh if uh we we hear around us some

3175
02:05:45,430 --> 02:05:43,280
clapping but i'm not sure what that's

3176
02:05:47,109 --> 02:05:45,440
for yet um but we are waiting to hear

3177
02:05:51,510 --> 02:05:47,119
from the spacecraft project manager to

3178
02:05:53,990 --> 02:05:51,520
the nlm on on acquisition of signal so

3179
02:05:55,189 --> 02:05:54,000
hopefully we'll hear that soon from from

3180
02:05:57,030 --> 02:05:55,199
the team

3181
02:05:58,790 --> 02:05:57,040
but definitely something is going on

3182
02:05:59,589 --> 02:05:58,800
there's some happy and clapping going on

3183
02:06:01,109 --> 02:05:59,599
here

3184
02:06:02,629 --> 02:06:01,119
i feel like i feel like i'm a little in

3185
02:06:04,470 --> 02:06:02,639
the dark right so that's right that's

3186
02:06:21,109 --> 02:06:04,480
good but we'll hear that hopefully very

3187
02:06:25,350 --> 02:06:23,750
so mick as we look ahead to uh to this

3188
02:06:26,870 --> 02:06:25,360

process uh again the speeds we're

3189
02:06:29,910 --> 02:06:26,880
talking about here pretty

3190
02:06:32,069 --> 02:06:29,920
uh exceptional um lucy will get up to a

3191
02:06:33,910 --> 02:06:32,079
maximum speed about 400 000 miles per

3192
02:06:35,430 --> 02:06:33,920
hour uh a lot of that has to do with

3193
02:06:37,830 --> 02:06:35,440
these gravity assists that they'll

3194
02:06:40,470 --> 02:06:37,840
they'll get uh the slingshot effect from

3195
02:06:42,550 --> 02:06:40,480
earth uh hurtling towards the trojan

3196
02:06:46,149 --> 02:06:42,560
asteroids which are in the same orbit

3197
02:06:47,589 --> 02:06:46,159
that jupiter follows uh all right so i'm

3198
02:06:49,189 --> 02:06:47,599
seeing some of i'm seeing lots of

3199
02:06:50,950 --> 02:06:49,199
applause uh i'm hoping that's a good

3200
02:06:53,669 --> 02:06:50,960
time we haven't heard the the word come

3201
02:06:56,470 --> 02:06:53,679
in yet so um so yeah i just i just saw

3202
02:06:58,870 --> 02:06:56,480
some a movement that soul rings

3203
02:07:00,790 --> 02:06:58,880
are completely deployed so that's a good

3204
02:07:03,030 --> 02:07:00,800
thing for the spacecraft team solar rays

3205
02:07:05,910 --> 02:07:03,040
are completely out and so now we're just

3206
02:07:08,629 --> 02:07:05,920
waiting on acquisition of signal uh from

3207
02:07:09,830 --> 02:07:08,639
the uh from the team and you know joshua

3208
02:07:12,390 --> 02:07:09,840
as we said

3209
02:07:13,750 --> 02:07:12,400
these things they ran some analysis and

3210
02:07:15,589 --> 02:07:13,760
there was some time frame here and

3211
02:07:17,669 --> 02:07:15,599
they're within their time frame so not

3212
02:07:20,069 --> 02:07:17,679
not necessarily anything happen uh bad

3213
02:07:21,589 --> 02:07:20,079

here but it's uh going well so far for

3214
02:07:23,510 --> 02:07:21,599
the lucy spacecraft so we'll wait to

3215
02:07:26,470 --> 02:07:23,520
hear that they get that acquisition

3216
02:07:28,229 --> 02:07:26,480
signal and determine the final health of

3217
02:07:30,709 --> 02:07:28,239
the lucy spacecraft

3218
02:07:33,430 --> 02:07:30,719
yeah the uh the orbit that we're taking

3219
02:07:35,270 --> 02:07:33,440
is a very uh high elliptical where it

3220
02:07:37,189 --> 02:07:35,280
will come around

3221
02:07:39,270 --> 02:07:37,199
near earth and then slingshot out into

3222
02:07:41,589 --> 02:07:39,280
the trojan asteroids

3223
02:07:43,830 --> 02:07:41,599
in the same orbit as jupiter so that the

3224
02:07:46,470 --> 02:07:43,840
apogee of that orbit uh would end up

3225
02:07:48,390 --> 02:07:46,480
being kind of the slowest point uh of of

3226
02:07:50,229 --> 02:07:48,400
lucy's motion and jupiter and the

3227
02:07:52,310 --> 02:07:50,239
trojans move at a speed of roughly 29

3228
02:07:53,990 --> 02:07:52,320
000 miles per hour in their orbit around

3229
02:07:55,510 --> 02:07:54,000
the sun so that kind of gives you a

3230
02:07:57,510 --> 02:07:55,520
sense of the incredible speed that you

3231
02:08:00,390 --> 02:07:57,520
have to build up so that at your slowest

3232
02:08:01,750 --> 02:08:00,400
point you're doing that um so again an

3233
02:08:04,149 --> 02:08:01,760
incredible

3234
02:08:07,109 --> 02:08:04,159
just uh trajectory and engineering feat

3235
02:08:09,270 --> 02:08:07,119
to be prepared uh to to rely on lucy to

3236
02:08:10,629 --> 02:08:09,280
fly freely for 12 years that's something

3237
02:08:12,149 --> 02:08:10,639
that a lot of people might have a

3238
02:08:14,229 --> 02:08:12,159

misconception about is that lucy's not

3239
02:08:16,229 --> 02:08:14,239
under powered flight for 12 years yeah

3240
02:08:18,709 --> 02:08:16,239
that's true i mean it's not like they

3241
02:08:21,189 --> 02:08:18,719
can change trajectory during this time

3242
02:08:22,790 --> 02:08:21,199
right we have put them on a uh where

3243
02:08:25,189 --> 02:08:22,800
they needed to be by the specific

3244
02:08:27,030 --> 02:08:25,199
designed trajectory it needs to be and

3245
02:08:29,510 --> 02:08:27,040
with those massive solar arrays out

3246
02:08:31,990 --> 02:08:29,520
there they can't make very many uh they

3247
02:08:34,069 --> 02:08:32,000
can't make any maneuvers out there so

3248
02:08:35,189 --> 02:08:34,079
lucy is on her way with solar rays

3249
02:08:37,990 --> 02:08:35,199
deployed

3250
02:08:39,910 --> 02:08:38,000
and uh things are going well uh so far

3251
02:08:41,510 --> 02:08:39,920
we're just still waiting to hear like i

3252
02:08:43,109 --> 02:08:41,520
said we keep hearing some clapping in

3253
02:08:45,030 --> 02:08:43,119
the background that we know that some of

3254
02:08:46,390 --> 02:08:45,040
that is solar array deployment and we're

3255
02:08:47,910 --> 02:08:46,400
just waiting to hear that they've

3256
02:08:50,229 --> 02:08:47,920
acquired signal

3257
02:08:52,229 --> 02:08:50,239
of the spacecraft and uh we'll go from

3258
02:08:53,589 --> 02:08:52,239
there

3259
02:08:55,510 --> 02:08:53,599
yeah and it's

3260
02:08:57,030 --> 02:08:55,520
it's looking like that word is in uh i

3261
02:08:58,550 --> 02:08:57,040
noticed there the folks in in that room

3262
02:08:59,750 --> 02:08:58,560
that you're seeing on screen have taken

3263
02:09:02,229 --> 02:08:59,760

off their headsets that is usually a

3264
02:09:03,750 --> 02:09:02,239
sign that we are good to go here uh so

3265
02:09:05,270 --> 02:09:03,760
uh i believe we're we're good we're

3266
02:09:06,629 --> 02:09:05,280
gonna send this out to daryl now um so

3267
02:09:08,310 --> 02:09:06,639
mick that's gonna do it for you and me

3268
02:09:10,709 --> 02:09:08,320
here appreciate you riding along with me

3269
02:09:12,790 --> 02:09:10,719
mick uh until next time yeah joshua

3270
02:09:14,470 --> 02:09:12,800
thank you this was an exciting mission

3271
02:09:15,990 --> 02:09:14,480
very happy for the spacecraft team so

3272
02:09:18,229 --> 02:09:16,000
far and the launch

3273
02:09:20,069 --> 02:09:18,239
lsp and united launch alliance teams

3274
02:09:21,910 --> 02:09:20,079
looking forward to our next mission dart

3275
02:09:23,830 --> 02:09:21,920
awesome signing off from the asoc daryl

3276
02:09:25,270 --> 02:09:23,840
back to you thank you joshua and mick

3277
02:09:27,030 --> 02:09:25,280
and in the upper right hand part of that

3278
02:09:29,430 --> 02:09:27,040
picture was nice to see how leveson and

3279
02:09:31,430 --> 02:09:29,440
donya douglas bradshaw celebrating the

3280
02:09:34,310 --> 02:09:31,440
big moment of acquisition of signal yeah

3281
02:09:36,390 --> 02:09:34,320
finally able to breathe a sigh of relief

3282
02:09:38,870 --> 02:09:36,400
and now here's a special preview of

3283
02:09:41,030 --> 02:09:38,880
nasa's next launch services program

3284
02:09:43,589 --> 02:09:41,040
science mission launching next month

3285
02:09:45,990 --> 02:09:43,599
it's the double asteroid redirection

3286
02:10:05,270 --> 02:09:46,000
test

3287
02:10:17,750 --> 02:10:05,280
[Music]

3288
02:10:17,760 --> 02:10:22,840

so

3289
02:10:22,850 --> 02:10:54,310
[Music]

3290
02:10:57,830 --> 02:10:56,390
looking forward to the dart mission got

3291
02:10:59,830 --> 02:10:57,840
to make those travel plans out to

3292
02:11:01,910 --> 02:10:59,840
california we'll have it for you here on

3293
02:11:04,950 --> 02:11:01,920
nasa tv for now though we want to go

3294
02:11:08,790 --> 02:11:04,960
back to the nasa launch manager and he

3295
02:11:11,030 --> 02:11:08,800
is with our own franklin fitzgerald

3296
02:11:13,430 --> 02:11:11,040
yes i'm here with uh omar baez who's the

3297
02:11:15,750 --> 02:11:13,440
senior launch director for the lucy

3298
02:11:17,430 --> 02:11:15,760
mission uh omar

3299
02:11:19,189 --> 02:11:17,440
how did things go this morning

3300
02:11:21,030 --> 02:11:19,199
things were splendid today everything

3301
02:11:23,350 --> 02:11:21,040
went on time

3302
02:11:25,910 --> 02:11:23,360
as predicted and

3303
02:11:28,790 --> 02:11:25,920
i couldn't ask for for a better count it

3304
02:11:30,629 --> 02:11:28,800
uh just clicked off the way it should

3305
02:11:31,510 --> 02:11:30,639
um and

3306
02:11:35,430 --> 02:11:31,520
we

3307
02:11:36,629 --> 02:11:35,440
able to hit the window at the very

3308
02:11:38,390 --> 02:11:36,639
beginning

3309
02:11:41,750 --> 02:11:38,400
on the very first day

3310
02:11:43,910 --> 02:11:41,760
of the short window for lucy so we're

3311
02:11:45,430 --> 02:11:43,920
we're happy to be here at this point i

3312
02:11:47,750 --> 02:11:45,440
understand you were wrapping up a few

3313
02:11:48,709 --> 02:11:47,760

things before you were able to come up

3314
02:11:50,069 --> 02:11:48,719
um

3315
02:11:52,149 --> 02:11:50,079
everybody just got up and left what does

3316
02:11:55,750 --> 02:11:52,159
that mean that means things are really

3317
02:11:58,950 --> 02:11:55,760
good so what that means is both uh

3318
02:12:01,350 --> 02:11:58,960
solar arrays have deployed and we did

3319
02:12:04,390 --> 02:12:01,360
lock on to the acquisition

3320
02:12:07,109 --> 02:12:04,400
signal from the spacecraft so

3321
02:12:09,669 --> 02:12:07,119
the folks at goddard and lockheed martin

3322
02:12:12,069 --> 02:12:09,679
denver are controlling now

3323
02:12:15,270 --> 02:12:12,079
and have positive uh control over the

3324
02:12:16,709 --> 02:12:15,280
spacecraft so uh that's the best uh

3325
02:12:18,870 --> 02:12:16,719
shape you want to be in

3326
02:12:20,950 --> 02:12:18,880
uh right before you came on they rolled

3327
02:12:22,790 --> 02:12:20,960
a package talking about dark that's the

3328
02:12:24,950 --> 02:12:22,800
next mission for lsp can you tell us a

3329
02:12:28,950 --> 02:12:24,960
little bit more about it so that one is

3330
02:12:31,750 --> 02:12:28,960
so cool for us uh dart is going to

3331
02:12:35,830 --> 02:12:31,760
um kinetically hit

3332
02:12:38,390 --> 02:12:35,840
an asteroid and uh it's our second

3333
02:12:41,589 --> 02:12:38,400
planetary mission from the west coast or

3334
02:12:43,990 --> 02:12:41,599
vandenberg so super exciting uh just

3335
02:12:46,229 --> 02:12:44,000
another a different way of

3336
02:12:48,709 --> 02:12:46,239
spotting an asteroid and this time we're

3337
02:12:50,310 --> 02:12:48,719
trying to to go in the aspect of not

3338
02:12:53,589 --> 02:12:50,320

studying it but

3339
02:12:55,830 --> 02:12:53,599
uh planetary defense could we move uh

3340
02:12:58,709 --> 02:12:55,840
an asteroid if we needed to and so this

3341
02:13:00,629 --> 02:12:58,719
is super cool and a whole different uh

3342
02:13:04,069 --> 02:13:00,639
way of operating for us so

3343
02:13:06,790 --> 02:13:04,079
we love it omar baez congratulations on

3344
02:13:08,550 --> 02:13:06,800
a successful launch and uh are you going

3345
02:13:10,629 --> 02:13:08,560
to be the launch director in uh i will

3346
02:13:14,229 --> 02:13:10,639
be the launch director for dart and

3347
02:13:15,910 --> 02:13:14,239
after dart we have xp from this coast

3348
02:13:18,149 --> 02:13:15,920
and that's going to be a cool one for

3349
02:13:20,149 --> 02:13:18,159
launch services program also because

3350
02:13:22,790 --> 02:13:20,159
it's our first

3351
02:13:24,790 --> 02:13:22,800
ksc launch

3352
02:13:26,870 --> 02:13:24,800
we're a program that's been at ksc for

3353
02:13:29,109 --> 02:13:26,880
23 years and we've never launched

3354
02:13:32,310 --> 02:13:29,119
anything from the kennedy space center

3355
02:13:33,910 --> 02:13:32,320
our very first from complex 39a oh

3356
02:13:35,750 --> 02:13:33,920
that's going to be awesome we'll be

3357
02:13:39,350 --> 02:13:35,760
there for that hopefully we'll have you

3358
02:13:41,510 --> 02:13:39,360
on the show then again as well okay

3359
02:13:42,629 --> 02:13:41,520
thanks for being with us today guys back

3360
02:13:44,470 --> 02:13:42,639
to you

3361
02:13:47,669 --> 02:13:44,480
franklin thank you and as you look

3362
02:13:49,669 --> 02:13:47,679
behind us you see the dawn of a new day

3363
02:13:52,470 --> 02:13:49,679

and there's the dawn of lucy and her

3364
02:13:55,189 --> 02:13:52,480
journey to the trojan asteroids seems

3365
02:13:58,390 --> 02:13:55,199
very fitting yeah what a nice tribute

3366
02:14:00,790 --> 02:13:58,400
from mother earth to lucy the fossil and

3367
02:14:03,030 --> 02:14:00,800
the spacecraft now about to uncover uh

3368
02:14:04,950 --> 02:14:03,040
secrets of our beginnings indeed so

3369
02:14:07,189 --> 02:14:04,960
we're going to leave you with a replay

3370
02:14:09,109 --> 02:14:07,199
of this morning's liftoff

3371
02:14:11,589 --> 02:14:09,119
and you can also follow along live

3372
02:14:14,149 --> 02:14:11,599
mission updates online at nasa.gov

3373
02:14:17,830 --> 02:14:14,159
forward slash lucy have a great weekend

3374
02:14:17,840 --> 02:14:29,669
that's my line

3375
02:14:31,430 --> 02:14:30,550
seven

3376
02:14:32,390 --> 02:14:31,440
six

3377
02:14:33,350 --> 02:14:32,400
five

3378
02:14:34,390 --> 02:14:33,360
four

3379
02:14:35,430 --> 02:14:34,400
three

3380
02:14:36,229 --> 02:14:35,440
two

3381
02:14:38,950 --> 02:14:36,239
one

3382
02:14:44,709 --> 02:14:41,990
liftoff atlas 5 takes flight sending

3383
02:14:55,510 --> 02:14:44,719
lucy to uncover the fossils of our solar

3384
02:14:55,520 --> 02:15:47,990
utilization

3385
02:15:52,069 --> 02:15:51,109
i have a feather and my right hand a

3386
02:15:53,910 --> 02:15:52,079
hammer