1
00:00:00,000 --> 00:00:00,267
>> Woman: Welcome and
thank you for standing by

2
00:00:00,267 --> 00:00:00,934
at this time.

3
00:00:00,934 --> 00:00:02,936
All participants are
in a listen-only mode

4
00:00:02,936 --> 00:00:05,706
until the question and answer
portion of the program.

5
00:00:05,706 --> 00:00:07,774
I'd now like to turn the call
over to the Jet Propulsion

6
00:00:07,774 --> 00:00:10,077
Laboratory, thank you.

7
00:00:10,077 --> 00:00:13,714
>> Jane: Thank you and welcome
everybody and apologies

8
00:00:13,714 --> 00:00:15,315
for that slight delay.

9
00:00:15,315 --> 00:00:18,118
We have everything
ready to go now.

10
00:00:18,118 --> 00:00:20,554
I'm Jane Platt from NASA's
Jet Propulsion Laboratory

11
00:00:20,554 --> 00:00:22,289
in Pasadena, California.

12
00:00:22,289 --> 00:00:26,526
After 13 years of exploring
Saturn, its moons,

13
00:00:26,526 --> 00:00:29,863
and its rings, NASA's Cassini
Mission is wrapping up

14
00:00:29,863 --> 00:00:32,900
its long journey with
a series of orbits

15
00:00:32,900 --> 00:00:36,904
leading up to a dramatic
finale on September 15.

16
00:00:36,904 --> 00:00:39,806
Today we'll hear a recap
of some mission highlights

17
00:00:39,806 --> 00:00:42,576
and we'll get a preview
of what to expect

18
00:00:42,576 --> 00:00:44,378
in this final phase.

19
00:00:44,378 --> 00:00:47,047
We're gonna hear three brief
presentations from speakers

20
00:00:47,047 --> 00:00:48,515
and then take some questions.

21
00:00:48,515 --> 00:00:51,084
If you do have a
question press star one

22

00:00:51,084 --> 00:00:52,319
to be placed in the queue.

23
00:00:52,319 --> 00:00:55,789
And the visuals to
follow along with are

24
00:00:55,789 --> 00:00:59,293
at www.nasa.gov/Cassinitelecon,

25
00:01:02,629 --> 00:01:06,199
www.nasa.gov/Cassinitelecon.

26
00:01:06,199 --> 00:01:10,070
Quick intro of today's
speakers, we have Curt Niebur,

27
00:01:10,070 --> 00:01:13,040
the Cassini program scientist
at NASA head quarters

28
00:01:13,040 --> 00:01:14,508
in Washington.

29
00:01:14,508 --> 00:01:18,612
Earl Maize, the Cassini
project manager here at JPL.

30
00:01:18,612 --> 00:01:22,783
Linda Spilker, the Cassini
project scientist at JPL.

31
00:01:22,783 --> 00:01:26,920
First we will hear
from Curt Niebur, Curt.

32
00:01:26,920 --> 00:01:28,622
>> Curt: Thank you Jane.

33

00:01:28,622 --> 00:01:32,359
As Jane mentioned, the
Cassini Mission is coming

34
00:01:32,359 --> 00:01:35,329
to an amazing end
after our adventure

35
00:01:35,329 --> 00:01:38,432
and this has been a
very long adventure.

36
00:01:38,432 --> 00:01:41,301
The first thing I want to
do is congratulate the team

37
00:01:41,301 --> 00:01:43,637
for building such
remarkable space craft

38
00:01:43,637 --> 00:01:46,740
and operating it so masterfully
for all these years.

39
00:01:46,740 --> 00:01:49,609
Their work as been
absolutely extraordinary

40
00:01:49,609 --> 00:01:52,279
and I'd like to put their
commitment and their skill

41
00:01:52,279 --> 00:01:55,182
into just a little
bit of context.

42
00:01:55,182 --> 00:01:58,452
Work on the Cassini Mission
began in the late 1980s,

43

00:01:58,452 --> 00:01:59,953
about 30 years ago.

44
00:01:59,953 --> 00:02:02,823
That was a few years before
the internet became available

45
00:02:02,823 --> 00:02:05,225
to the general public
as the world wide web.

46
00:02:05,225 --> 00:02:08,161
Desktop computers
were exactly that.

47
00:02:08,161 --> 00:02:10,263
They covered your entire desk.

48
00:02:10,263 --> 00:02:12,699
A cell phone was
the size of a brick.

49
00:02:12,699 --> 00:02:15,202
It cost $8000 in today's money

50
00:02:16,403 --> 00:02:18,605
and all it did was
make phone calls.

51
00:02:18,605 --> 00:02:21,341
No email, no Angry Birds,
and streaming video

52
00:02:21,341 --> 00:02:24,177
meant that your VCR was
broken and spitting out

53
00:02:24,177 --> 00:02:27,314
magnetic tape into a
tangled pile on the floor.

54
00:02:27,314 --> 00:02:30,751
This is the level of technology
that the team worked with

55
00:02:30,751 --> 00:02:32,953
while building and
operating this mission

56
00:02:32,953 --> 00:02:35,122
and they did a superb job.

57
00:02:36,490 --> 00:02:38,892
It's been a absolute privilege
to work with all of them

58
00:02:38,892 --> 00:02:40,360
on this mission.

59
00:02:40,360 --> 00:02:44,598
And the mission has exceeded
all of our expectations.

60
00:02:44,598 --> 00:02:47,501
Done better than we
could have ever dreamed.

61
00:02:47,501 --> 00:02:51,838
The Saturn system is absolutely
chock full of amazing

62
00:02:51,838 --> 00:02:56,543
worlds of all sizes and
Cassini has been exploring them

63
00:02:56,543 --> 00:02:58,111
for the past 13 years.

64
00:02:58,111 --> 00:03:02,115

Since our arrival in 2004,
we've watched the seasons

65
00:03:02,115 --> 00:03:05,719
change on Saturn, which is
just an incredible opportunity,

66
00:03:05,719 --> 00:03:10,357
considering a year on
Saturn lasts 29 Earth years.

67
00:03:10,357 --> 00:03:13,160
We've watched the particles
in the rings around Saturn

68
00:03:13,160 --> 00:03:15,162
collide and glide during
their gravitational dance,

69
00:03:15,162 --> 00:03:18,799
and we've confirmed things
that we've suspected

70
00:03:18,799 --> 00:03:20,734
might exist in the Saturn system

71
00:03:20,734 --> 00:03:24,237
but even more pleasantly,
we've been shocked by things

72
00:03:24,237 --> 00:03:27,474
that we never predicted
we would find.

73
00:03:27,474 --> 00:03:30,210
You can bring up the
first graphic Niebur one.

74
00:03:30,210 --> 00:03:32,479
In the top right corner there,

75
00:03:32,479 --> 00:03:34,748
you see a picture of
Saturn and its rings.

76
00:03:34,748 --> 00:03:38,718
We watched a massive
storm near the upper part

77
00:03:38,718 --> 00:03:42,122
of Saturn just erupt in
what we expected to be

78
00:03:42,122 --> 00:03:46,359
a relatively easy going and
quiescent Saturn atmosphere.

79
00:03:46,359 --> 00:03:50,430
And that storm traveled
around the entire planet,

80
00:03:50,430 --> 00:03:54,601
eventually bumping into itself
and eating its own tail.

81
00:03:55,735 --> 00:03:58,538
We saw in the
lower right corner,

82
00:03:58,538 --> 00:04:02,976
one of the truly weirdest
features in the solar system,

83
00:04:02,976 --> 00:04:06,947
a long lived hexagonal
storm, or cloud feature,

84
00:04:06,947 --> 00:04:09,483
that's the size of the Earth

85
00:04:09,483 --> 00:04:13,520
and weirdly centered
on Saturn's north pole.

86
00:04:13,520 --> 00:04:17,691
And that hexagon has been
there for decades upon decades.

87
00:04:19,860 --> 00:04:22,829
We confirmed the presence
of methane lakes on Titan,

88
00:04:22,829 --> 00:04:24,498
in the top left corner.

89
00:04:24,498 --> 00:04:25,999
But more importantly,

90
00:04:25,999 --> 00:04:29,002
what we learned is that
this huge moon is in fact,

91
00:04:29,002 --> 00:04:33,940
a dynamic world with methane
seas and rain and rivers

92
00:04:33,940 --> 00:04:35,475
on its surface.

93
00:04:35,475 --> 00:04:39,646
And we were absolutely shocked
to learn that tiny, tiny

94
00:04:41,081 --> 00:04:44,484
Enceladus has a global
global liquid water ocean

95
00:04:44,484 --> 00:04:46,953
underneath the

relatively thin ice crust

96
00:04:46,953 --> 00:04:50,190
that's warmed by hydrothermal
activity at the bottom

97
00:04:50,190 --> 00:04:55,061
of the ocean and has jets
of the water from that ocean

98
00:04:55,061 --> 00:04:59,366
shooting out into space through
cracks in the south pole.

99
00:04:59,366 --> 00:05:02,169
Enceladus may have all
of the ingredients needed

100
00:05:02,169 --> 00:05:06,039
for life as we know
it to currently exist,

101
00:05:06,039 --> 00:05:07,941
right now at this very second.

102
00:05:07,941 --> 00:05:11,344
These two new worlds,
Titan and Enceladus,

103
00:05:11,344 --> 00:05:14,414
that were so completely
revealed to us by Cassini,

104
00:05:14,414 --> 00:05:18,952
have changed the idea ocean
worlds like Earth and Europa

105
00:05:18,952 --> 00:05:23,723
are rare in the universe, and
this in turn is changing

106
00:05:23,723 --> 00:05:27,928
our views about finding
and about how prevalent

107
00:05:27,928 --> 00:05:31,164
and common habitable
environments and even life

108
00:05:31,164 --> 00:05:33,934
beyond Earth might truly be.

109
00:05:33,934 --> 00:05:37,938
This is just a taste of
Cassini's discoveries.

110
00:05:37,938 --> 00:05:39,306
The list goes on and on.

111
00:05:39,306 --> 00:05:43,276
The mission has been
insanely, wildly, beautifully,

112
00:05:44,678 --> 00:05:48,915
successful and it's coming
to an end in about two weeks.

113
00:05:48,915 --> 00:05:51,885
But Cassini will not go quietly.

114
00:05:51,885 --> 00:05:53,787
As our propellant
supply dwindled,

115
00:05:53,787 --> 00:05:56,590
the team put forth, a
frankly brilliant idea,

116
00:05:56,590 --> 00:05:59,492

to dive the space
craft over and over

117
00:05:59,492 --> 00:06:02,229
between the narrow space
separating the rings

118
00:06:02,229 --> 00:06:04,965
and the cloud tops
of the planet.

119
00:06:04,965 --> 00:06:07,534
These dives, the Grand Finale
that you've been hearing about

120
00:06:07,534 --> 00:06:11,271
have used the remaining
dregs of fuel that we have

121
00:06:11,271 --> 00:06:15,041
to pursue questions that
we never expected Cassini

122
00:06:15,041 --> 00:06:17,244
would have the
opportunity to answer.

123
00:06:17,244 --> 00:06:20,247
Completely new science
that we're going after.

124
00:06:20,247 --> 00:06:23,650
The Cassini Mission has
taught us so very much

125
00:06:23,650 --> 00:06:25,318
and to me, personally,

126
00:06:25,318 --> 00:06:29,055
I find great comfort in

the fact that Cassini

127
00:06:29,055 --> 00:06:32,492
will continue teaching us
up to the very last second

128
00:06:32,492 --> 00:06:33,760
on September 15

129
00:06:35,462 --> 00:06:37,998
and at this point I'd like to
turn it over to Earl Maize,

130
00:06:37,998 --> 00:06:40,233
who is the project manager.

131
00:06:41,401 --> 00:06:42,636
>> Earl: Alright,
thank you Curt.

132
00:06:42,636 --> 00:06:44,104
Before we jump into
the Grand Finale,

133
00:06:44,104 --> 00:06:46,473
I'd like to take just
a moment to look back

134
00:06:46,473 --> 00:06:48,742
at some of the mission's
really amazing statistics.

135
00:06:48,742 --> 00:06:51,544
So if you could bring up
Earl Maize number one,

136
00:06:51,544 --> 00:06:54,681
it's a Cassini-Huygens
by the numbers graphic,

137
00:06:54,681 --> 00:06:58,251
and for nearly 20
years, this space craft

138
00:06:58,251 --> 00:07:01,721
has now logged almost
five billion miles

139
00:07:01,721 --> 00:07:04,524
and has put in 294
orbits around Saturn

140
00:07:04,524 --> 00:07:07,027
and another two around the sun.

141
00:07:07,027 --> 00:07:11,298
Absolutely phenomenal space
craft and a phenomenal mission.

142
00:07:11,298 --> 00:07:16,002
There have been nearly 4,000
scientific papers written,

143
00:07:16,002 --> 00:07:17,537
peer reviewed papers,

144
00:07:17,537 --> 00:07:21,708
written by developers and
researchers in 27 nations.

145
00:07:23,176 --> 00:07:25,779
I can't emphasize enough
how truly international

146
00:07:25,779 --> 00:07:28,281
a collaboration this mission is.

147
00:07:28,281 --> 00:07:33,086
27 nations participated, 19

were participating at launch.

148
00:07:33,086 --> 00:07:34,854
We added another eight.

149
00:07:34,854 --> 00:07:37,691
The thing I'd like to emphasize,

150
00:07:37,691 --> 00:07:40,593
well maybe Curt
caught it already,

151
00:07:40,593 --> 00:07:42,996
our computer stats
might be a little modest

152
00:07:42,996 --> 00:07:44,197
by today's standards,

153
00:07:44,197 --> 00:07:48,268
but remember we were
using 1980's technology.

154
00:07:48,268 --> 00:07:52,272
So 635 gigabytes in 1987
was pretty tall cotton.

155
00:07:53,873 --> 00:07:55,475
So we're pretty proud
of that even if that--

156
00:07:55,475 --> 00:07:56,910
And also keep in mind
it was, you know,

157
00:07:56,910 --> 00:08:00,213
a billion miles away
and it took a long time

158

00:08:00,213 --> 00:08:01,748
for that stuff to
get back down here.

159
00:08:01,748 --> 00:08:03,683
So the one other thing
I want to emphasize,

160
00:08:03,683 --> 00:08:07,320
just quickly, is the
162 targeted fly bys

161
00:08:07,320 --> 00:08:09,322
of Saturn's moons.

162
00:08:09,322 --> 00:08:12,325
That's Titan, you know the
large ones, Titan, Mimas,

163
00:08:12,325 --> 00:08:14,761
Rhea, Dione, Tethys,

164
00:08:14,761 --> 00:08:16,796
and a lot of the
small ones as well,

165
00:08:16,796 --> 00:08:19,232
but I want to particularly
emphasize Titan.

166
00:08:19,232 --> 00:08:21,000
127 fly-bys of Titan.

167
00:08:22,135 --> 00:08:25,338
Cassini's had a long
distance, you might say,

168
00:08:25,338 --> 00:08:26,973
long term relationship
with Titan.

169
00:08:26,973 --> 00:08:31,311
Each of these fly-bys, Titan
has shared some of its secrets

170
00:08:31,311 --> 00:08:35,648
with us and at the same time,
shaped Cassini's trajectory.

171
00:08:35,648 --> 00:08:39,018
We've used that Titan fly-
by, which is equivalent

172
00:08:39,018 --> 00:08:42,622
of over 1000 pounds of
propellant every time.

173
00:08:42,622 --> 00:08:46,292
We had 127,000 extra pounds
of propellant on board

174
00:08:46,292 --> 00:08:48,061
the space craft that
we were able to use

175
00:08:48,061 --> 00:08:50,964
to investigate
the entire system.

176
00:08:50,964 --> 00:08:55,135
April 24 of this year, our
127th and final close fly-by

177
00:08:56,503 --> 00:08:59,272
of Titan put us into what
we're calling the Grand Finale.

178
00:08:59,272 --> 00:09:01,207
Let's just go to
the next graphic

179
00:09:01,207 --> 00:09:05,979
to see Earl Maize number
two if you wouldn't mind.

180
00:09:05,979 --> 00:09:09,682
This is what we have been
doing for the last four months.

181
00:09:09,682 --> 00:09:12,318
That graphic conveys
the entire 22 orbits

182
00:09:12,318 --> 00:09:14,320
of the Grand Finale mission.

183
00:09:14,320 --> 00:09:16,222
As I said, on April 24,

184
00:09:18,158 --> 00:09:21,294
the fly-by of Titan
slowed us down just enough

185
00:09:21,294 --> 00:09:25,965
to get in between the rings
of Saturn and the atmosphere.

186
00:09:25,965 --> 00:09:28,201
Not too deep, not too far away.

187
00:09:28,201 --> 00:09:29,636
It's been a perfect shot

188
00:09:29,636 --> 00:09:32,906
and great kudos to the mission
designers and navigators

189
00:09:32,906 --> 00:09:35,809
that found and operated

this trajectory.

190
00:09:35,809 --> 00:09:40,246
So this is the two million
mile view of the entire finale.

191
00:09:40,246 --> 00:09:43,216
22 orbits, each of them
six and a half days long,

192
00:09:43,216 --> 00:09:45,952
racing between that gap
between the rings and planet,

193
00:09:45,952 --> 00:09:47,954
about 75,000 miles per hour.

194
00:09:47,954 --> 00:09:51,758
We completed 20 of those
orbits, two more to go

195
00:09:51,758 --> 00:09:54,394
and every instrument on the
spacecraft has been active

196
00:09:54,394 --> 00:09:56,963
and most have been
prime at some point.

197
00:09:56,963 --> 00:10:00,300
It couldn't be
better at this point.

198
00:10:00,300 --> 00:10:02,469
We have had
exceptional performance

199
00:10:02,469 --> 00:10:03,703
and we could not
ask for much more.

200
00:10:03,703 --> 00:10:05,839
It has just been
a phenomenal ride.

201
00:10:05,839 --> 00:10:08,775
I want to zoom in on
the gap and show you

202
00:10:08,775 --> 00:10:11,144
some of the challenges we've
had with going into this

203
00:10:11,144 --> 00:10:12,846
unexplored territory,

204
00:10:12,846 --> 00:10:15,348
and I should say unexplored,
no spacecraft has ever gone

205
00:10:15,348 --> 00:10:17,083
in this region before.

206
00:10:17,083 --> 00:10:20,153
So go to slide Earl
Maize number three.

207
00:10:20,153 --> 00:10:24,290
This is a graphic of
our final 22 orbits.

208
00:10:24,290 --> 00:10:26,226
Actually, you'll see
on the far right, 23rd,

209
00:10:26,226 --> 00:10:29,996
but that's the entry
into Saturn's atmosphere.

210

00:10:29,996 --> 00:10:31,731
You see what's happening here,

211
00:10:31,731 --> 00:10:34,534
on the bottom is our time scale.

212
00:10:34,534 --> 00:10:38,304
Each of those dots represents
the distance between

213
00:10:38,304 --> 00:10:41,007
the D ring, the
innermost ring of Saturn,

214
00:10:41,007 --> 00:10:43,109
and the atmosphere,
where Cassini's gone.

215
00:10:43,109 --> 00:10:44,477
They are more or
less approximations.

216
00:10:44,477 --> 00:10:47,580
You can see we had four
right in the middle

217
00:10:47,580 --> 00:10:50,049
and then two up in the
dust, three down, two up,

218
00:10:50,049 --> 00:10:51,551
and then five down again.

219
00:10:51,551 --> 00:10:54,287
Each of those jumps,
well guess what?

220
00:10:54,287 --> 00:10:55,855
That's Titan again.

221
00:10:55,855 --> 00:10:58,525
Not so close, but giving us
little nudges back and forth

222
00:10:58,525 --> 00:11:00,627
and we've been able to
exploit those ranges

223
00:11:00,627 --> 00:11:02,095
in order to accommodate

224
00:11:02,095 --> 00:11:03,930
different scientific
investigations,

225
00:11:03,930 --> 00:11:07,433
but as I said, this is
unexplored territory.

226
00:11:07,433 --> 00:11:09,602
So the first thing
the flight team did,

227
00:11:09,602 --> 00:11:11,604
we thought, we weren't sure
we were gonna make this

228
00:11:11,604 --> 00:11:13,306
first plunge, and I
have to back up and say

229
00:11:13,306 --> 00:11:15,542
we would never have done
this at any other time

230
00:11:15,542 --> 00:11:17,710
in the mission when we knew
we were going to run out

231

00:11:17,710 --> 00:11:19,879
of fuel and crash, because
there's just so many

232
00:11:19,879 --> 00:11:22,982
uncertainties in
this environment.

233
00:11:22,982 --> 00:11:24,450
However, they've
come out quite well.

234
00:11:24,450 --> 00:11:27,453
So for the first
fly-by, we used the

235
00:11:29,822 --> 00:11:31,791
high-gain antenna of the
spacecraft as a shield

236
00:11:31,791 --> 00:11:33,526
to protect us from the dust.

237
00:11:33,526 --> 00:11:35,228
Not quite certain we
were gonna survive.

238
00:11:35,228 --> 00:11:37,764
As it turned out, the
dust we thought was there,

239
00:11:37,764 --> 00:11:40,233
is remarkably missing.

240
00:11:40,233 --> 00:11:42,669
We were able to actually

241
00:11:42,669 --> 00:11:44,671
relax our shielding policy

242
00:11:44,671 --> 00:11:48,007
on some of these other fly-bys
in order to take advantage of

243
00:11:48,007 --> 00:11:50,510
more advantageous orientation.

244
00:11:52,011 --> 00:11:55,515
For example, the two, well
actually the four fly-bys

245
00:11:55,515 --> 00:11:57,083
in the inner ring boundary,
had planned to use the

246
00:11:57,083 --> 00:11:59,118
high-gain antenna as a
shield for those as well

247
00:11:59,118 --> 00:12:01,120
and were able to
relax one of those.

248
00:12:01,120 --> 00:12:03,356
The other three, right
there in the middle,

249
00:12:03,356 --> 00:12:06,626
were fine and again
the next five,

250
00:12:06,626 --> 00:12:09,128
after Titan pushed us
back down out of the dust,

251
00:12:09,128 --> 00:12:10,663
were also quite fine.

252
00:12:10,663 --> 00:12:12,265

Each time we were
alternating instruments

253
00:12:12,265 --> 00:12:13,499
and investigations.

254
00:12:13,499 --> 00:12:15,702
Then, another Titan fly
by pushed us down into

255
00:12:15,702 --> 00:12:18,204
the outer edge of
the atmosphere.

256
00:12:18,204 --> 00:12:22,375
Again, we're relying only
on models and observations

257
00:12:22,609 --> 00:12:24,477
to guess the environment.

258
00:12:24,477 --> 00:12:26,145
So we weren't sure if it
was gonna be too thick

259
00:12:26,145 --> 00:12:28,181
and it would turn
us out of control,

260
00:12:28,181 --> 00:12:30,516
push us out of
control or too thin

261
00:12:30,516 --> 00:12:32,552
and the instrument that wanted
to sample the atmosphere

262
00:12:32,552 --> 00:12:35,188
weren't going to be
able to be effective.

263
00:12:35,188 --> 00:12:37,624
So we had three different
contingency maneuvers there.

264
00:12:37,624 --> 00:12:39,092
We had a pop up.

265
00:12:39,092 --> 00:12:40,827
If the atmosphere was too
thick and was going to effect

266
00:12:40,827 --> 00:12:42,262
the spacecraft adversely,

267
00:12:42,262 --> 00:12:43,963
we would pop up out
of the atmosphere.

268
00:12:43,963 --> 00:12:46,265
It were too thin we
could pop down in.

269
00:12:46,265 --> 00:12:49,669
With apologies to Robert Southey

270
00:12:49,669 --> 00:12:52,138
and to the exoplanet people,

271
00:12:52,138 --> 00:12:53,973
we are in the Goldilocks Zone.

272
00:12:53,973 --> 00:12:56,576
We have hit the perfect spot.

273
00:12:56,576 --> 00:12:59,912
We are getting duty cycles on
our thrusters for about 40%.

274
00:12:59,912 --> 00:13:01,547
Up to 100% is fine.

275
00:13:01,547 --> 00:13:05,084
So we are seeing
atmosphere, lots of it,

276
00:13:05,084 --> 00:13:08,154
that the mass
spectrometer can sample

277
00:13:08,154 --> 00:13:10,023
but the spacecraft can handle.

278
00:13:10,023 --> 00:13:12,558
So, the pop ups, the pop
down, all those contingency

279
00:13:12,558 --> 00:13:14,994
maneuvers are now
back on the shelf.

280
00:13:14,994 --> 00:13:18,931
We've declared, as of
yesterday, no more OTMs

281
00:13:18,931 --> 00:13:21,634
or trajectory changes
for the spacecraft.

282
00:13:21,634 --> 00:13:24,437
Our final maneuver is behind us.

283
00:13:24,437 --> 00:13:26,105
So, with those
final five orbits,

284
00:13:26,105 --> 00:13:29,776
we are now on our way

into the Grand Finale.

285
00:13:31,210 --> 00:13:34,347
So, I also just want to take
a brief moment to explain.

286
00:13:34,347 --> 00:13:38,951
Atmosphere drag, we've been
publishing a lot of different

287
00:13:38,951 --> 00:13:40,320
end of mission times.

288
00:13:40,320 --> 00:13:42,155
I think if you look
back at our history,

289
00:13:42,155 --> 00:13:43,489
we're at 5:08.

290
00:13:43,489 --> 00:13:46,125
I think we're at 4:54,
now we're at 4:55.

291
00:13:46,125 --> 00:13:48,161
This is all because of
our uncertainties with

292
00:13:48,161 --> 00:13:50,029
Saturn's atmosphere.

293
00:13:50,029 --> 00:13:53,032
You're watching engineering
and science in action

294
00:13:53,032 --> 00:13:56,269
as we modify our estimates
and get better and better.

295

00:13:56,269 --> 00:13:58,204
Now we're pretty confident now.

296
00:13:58,204 --> 00:14:00,173
We think we've got it down to
within a few tens of seconds,

297
00:14:00,173 --> 00:14:03,876
but Saturn continues to surprise
us, over and over again.

298
00:14:03,876 --> 00:14:05,578
When we think we
know what's going on,

299
00:14:05,578 --> 00:14:08,715
there is neither no dust
where there should be,

300
00:14:08,715 --> 00:14:10,516
there's atmosphere that's
heavier than we thought

301
00:14:10,516 --> 00:14:11,984
and thinner.

302
00:14:11,984 --> 00:14:13,519
So stay tuned, we'll have
a good number for you

303
00:14:13,519 --> 00:14:14,520
on September 13.

304
00:14:14,520 --> 00:14:16,756
Let me go to the
next trajectory,

305
00:14:16,756 --> 00:14:18,791
just to show the final day.

306
00:14:18,791 --> 00:14:20,226
This is an animation.

307
00:14:20,226 --> 00:14:22,962
This is the last two
orbits and if you play it,

308
00:14:22,962 --> 00:14:25,698
you will see Titan coming
along one last time.

309
00:14:25,698 --> 00:14:28,434
As I said, we've had a long
term relationship with Titan,

310
00:14:28,434 --> 00:14:31,637
and I don't mean to be too
romantic about all of this,

311
00:14:31,637 --> 00:14:36,476
but what you'll see after
the spacecraft goes through

312
00:14:36,476 --> 00:14:38,077
a couple of orbits,

313
00:14:38,077 --> 00:14:39,145
is Titan coming
in from the bottom

314
00:14:39,145 --> 00:14:41,414
and actually deflecting Cassini

315
00:14:41,414 --> 00:14:44,584
into its final
trajectory into Saturn.

316
00:14:46,285 --> 00:14:49,455
And this thing will

loop a couple of times

317
00:14:49,455 --> 00:14:51,591
and if it goes by too fast you
can play it again and again.

318
00:14:51,591 --> 00:14:55,528
But that final fly-by of
Titan on September 11,

319
00:14:56,696 --> 00:14:59,499
will put Cassini on an
impacting trajectory

320
00:14:59,499 --> 00:15:03,536
and there is absolutely no
coming out of it on this one.

321
00:15:03,536 --> 00:15:05,338
We are going so deep
into the atmosphere

322
00:15:05,338 --> 00:15:08,608
that you just don't
have a chance,

323
00:15:08,608 --> 00:15:11,444
the spacecraft doesn't
have a chance of coming out.

324
00:15:11,444 --> 00:15:14,781
So, that final kiss
goodbye from Titan,

325
00:15:14,781 --> 00:15:16,983
as I said, I don't want to
get too romantic about it,

326
00:15:16,983 --> 00:15:18,384
but that really

is our last fly-by

327
00:15:18,384 --> 00:15:20,553
and we will start to enter

328
00:15:23,422 --> 00:15:26,626
Saturn's atmosphere very
early on the morning

329
00:15:26,626 --> 00:15:27,827
of September 15.

330
00:15:27,827 --> 00:15:29,328
It'll be California time,

331
00:15:29,328 --> 00:15:30,863
it'll be a little bit more
reasonable for those of you

332
00:15:30,863 --> 00:15:32,131
on the East Coast
than in Europe.

333
00:15:32,131 --> 00:15:34,567
Now if I can go to
the last graphic,

334
00:15:34,567 --> 00:15:37,170
I'll just quickly walk
you through the final,

335
00:15:37,170 --> 00:15:38,771
final day's events.

336
00:15:40,106 --> 00:15:42,875
What we've got on September
11, as I mentioned,

337
00:15:42,875 --> 00:15:45,711

that's the fly-by of
Titan that will take us

338
00:15:45,711 --> 00:15:48,114
on to our final
plunge trajectory.

339
00:15:48,114 --> 00:15:49,916
Then there's some
other observations.

340
00:15:49,916 --> 00:15:53,019
We'll play back the Titan
data and then we will begin

341
00:15:53,019 --> 00:15:54,687
to start to examine
what we're calling,

342
00:15:54,687 --> 00:15:57,256
the last picture show.

343
00:15:57,256 --> 00:16:00,393
A final set of images of
some of the selected targets

344
00:16:00,393 --> 00:16:03,029
in the Saturn system
and that's gonna go on

345
00:16:03,029 --> 00:16:06,399
until 12:58, nearly one
o'clock in the afternoon here,

346
00:16:06,399 --> 00:16:08,768
when our last image
will be taken.

347
00:16:08,768 --> 00:16:10,937
Cassini spacecraft

will turn back to Earth

348
00:16:10,937 --> 00:16:14,440
for the very final time, and
for the next 11 or so hours,

349
00:16:14,440 --> 00:16:17,009
begin to play that
data back down.

350
00:16:17,009 --> 00:16:19,745
There'll be a lot of images,
also all fields and particles

351
00:16:19,745 --> 00:16:21,447
in pictures from the data,

352
00:16:21,447 --> 00:16:23,249
we will make those
images available to you

353
00:16:23,249 --> 00:16:26,485
and to the world as soon
as we possibly can.

354
00:16:26,485 --> 00:16:29,555
At about 1:37 that evening,

355
00:16:29,555 --> 00:16:32,325
actually the next
morning our time,

356
00:16:32,325 --> 00:16:35,561
Cassini's gonna reconfigure
for its final plunge.

357
00:16:35,561 --> 00:16:36,963
What we've been able to do,

358

00:16:36,963 --> 00:16:39,065
and this is great kudos
to the spacecraft team,

359
00:16:39,065 --> 00:16:42,168
is turn Cassini into
an atmospheric probe.

360
00:16:42,168 --> 00:16:44,871
As the data is measured,
rather than being stored

361
00:16:44,871 --> 00:16:46,539
on our recorders and
played back later,

362
00:16:46,539 --> 00:16:48,541
it will be sent to the
Earth almost immediately.

363
00:16:48,541 --> 00:16:51,878
A two or three second latency
is all we're expecting.

364
00:16:51,878 --> 00:16:53,913
So we will have repurposed
Cassini into an atmospheric

365
00:16:53,913 --> 00:16:58,584
probe and we'll have it
broadcasting data back down

366
00:16:58,584 --> 00:17:00,453
to the very very last minute.

367
00:17:00,453 --> 00:17:02,321
So for the last three hours,

368
00:17:02,321 --> 00:17:06,158
we will be essentially

pointing at the Earth,

369
00:17:06,158 --> 00:17:10,263
rapidly approaching Saturn
and as the spacecraft

370
00:17:11,697 --> 00:17:14,433
loses control and eventually
burns up in the atmosphere,

371
00:17:14,433 --> 00:17:16,636
we'll get data as long
as we possibly can.

372
00:17:16,636 --> 00:17:20,006
That's the Grand
Finale in a nut shell.

373
00:17:20,006 --> 00:17:22,875
I do want to take just a couple
of moments to acknowledge

374
00:17:22,875 --> 00:17:25,745
that not only is this an
incredible engineering

375
00:17:25,745 --> 00:17:28,014
and scientific achievement,

376
00:17:29,482 --> 00:17:32,051
it is a human achievement, and
particularly the human effort

377
00:17:32,051 --> 00:17:36,422
that has accompanied it with
the operation of the mission.

378
00:17:36,422 --> 00:17:39,592
The engineering and science
and navigation teams

379
00:17:39,592 --> 00:17:41,494
have just done a phenomenal job

380
00:17:41,494 --> 00:17:44,497
in getting absolutely
everything they possibly

381
00:17:44,497 --> 00:17:45,698
could out of this mission.

382
00:17:45,698 --> 00:17:47,633
This spacecraft has
been used to its fullest

383
00:17:47,633 --> 00:17:50,970
and I can't say enough
about the operators

384
00:17:50,970 --> 00:17:54,040
and the scientists that have
been interpreting this data

385
00:17:54,040 --> 00:17:55,841
and shared it with the world.

386
00:17:55,841 --> 00:17:57,343
And with that, I turn it
over to Linda Spilker,

387
00:17:57,343 --> 00:17:59,745
to talk about the science.

388
00:17:59,745 --> 00:18:01,314
>> Linda: Great, thank you Earl.

389
00:18:01,314 --> 00:18:04,150
I worked on Cassini since 1988

390
00:18:04,150 --> 00:18:08,487
and in those early days, I
gave most of my presentations

391
00:18:08,487 --> 00:18:11,924
using an overhead
projector and viewgraphs.

392
00:18:11,924 --> 00:18:13,826
How times have changed.

393
00:18:15,127 --> 00:18:16,929
Well, as it has been mentioned,
Cassini's Grand Finale

394
00:18:16,929 --> 00:18:19,665
has been every bit as
rewarding scientifically

395
00:18:19,665 --> 00:18:21,300
as we had hoped.

396
00:18:21,300 --> 00:18:25,771
Now you can only go some
place once for the first time.

397
00:18:25,771 --> 00:18:28,374
And for Cassini, that
place is the region

398
00:18:28,374 --> 00:18:30,743
between the rings and Saturn

399
00:18:30,743 --> 00:18:33,913
and this is the first time
that any spacecraft has flown

400
00:18:33,913 --> 00:18:36,882
through this region so

close to the planet.

401
00:18:36,882 --> 00:18:40,052
For comparison, last
week I just experienced

402
00:18:40,052 --> 00:18:41,921
my first total eclipse.

403
00:18:41,921 --> 00:18:45,324
It was so much more
incredible than I had imagined

404
00:18:45,324 --> 00:18:46,993
and in the same way,

405
00:18:46,993 --> 00:18:51,163
Cassini's Grand Finale is just
as amazing and fascinating.

406
00:18:52,298 --> 00:18:53,699
If we go to Spilker one

407
00:18:53,699 --> 00:18:56,068
it shows an interior
cut away of Saturn.

408
00:18:56,068 --> 00:18:59,372
Some of our key science
goals during the Grand Finale

409
00:18:59,372 --> 00:19:03,242
are trying to understand
Saturn from the inside out,

410
00:19:03,242 --> 00:19:06,078
to figure out the length
of the Saturn day,

411

00:19:06,078 --> 00:19:07,813
and to determine the
mass of the rings

412
00:19:07,813 --> 00:19:11,117
and the composition of
Saturn's atmosphere.

413
00:19:11,117 --> 00:19:14,220
Our understanding of
this fascinating new data

414
00:19:14,220 --> 00:19:17,523
is still evolving for me
and the science teams.

415
00:19:17,523 --> 00:19:19,892
There are so many
puzzles at Saturn.

416
00:19:19,892 --> 00:19:23,095
I just want to give
an update on a few.

417
00:19:23,095 --> 00:19:26,766
The interior of Saturn, the
lack of a tilted magnetic field,

418
00:19:26,766 --> 00:19:28,534
is a great puzzle.

419
00:19:28,534 --> 00:19:31,170
Our models tell us
that you need an offset

420
00:19:31,170 --> 00:19:35,341
to keep the currents flowing
that create the magnetic field.

421
00:19:35,341 --> 00:19:37,843

And if you look at the other
planets in our solar system

422
00:19:37,843 --> 00:19:41,147
with magnetic field, all
of their magnetic axes

423
00:19:41,147 --> 00:19:44,417
are tilted with respect
to the rotation axis.

424
00:19:44,417 --> 00:19:47,620
Now this lack of a tilt
is making it tricky

425
00:19:47,620 --> 00:19:50,990
to determine the rotation rate
of Saturn for its interior

426
00:19:50,990 --> 00:19:54,360
and that's key to understanding
the circulation models

427
00:19:54,360 --> 00:19:55,261
for Saturn.

428
00:19:56,896 --> 00:19:58,230
The gravity field of Saturn

429
00:19:58,230 --> 00:19:59,999
does not match
our models either.

430
00:19:59,999 --> 00:20:02,935
Saturn's gravity field
is much more different

431
00:20:02,935 --> 00:20:05,704
from Jupiter's than
we initially thought.

432
00:20:05,704 --> 00:20:09,241
Perhaps its source
might be deep winds

433
00:20:09,241 --> 00:20:11,610
or strong differential rotation

434
00:20:11,610 --> 00:20:14,847
or the top of the atmosphere
is rotating more quickly

435
00:20:14,847 --> 00:20:18,484
than the lower atmosphere,
or it could be so much more.

436
00:20:18,484 --> 00:20:20,219
The first estimates of ring mass

437
00:20:20,219 --> 00:20:22,421
point to less massive rings.

438
00:20:22,421 --> 00:20:25,324
However, we must sort
out Saturn's gravity

439
00:20:25,324 --> 00:20:28,327
and interior first,
before we can determine

440
00:20:28,327 --> 00:20:31,764
the mass and the age
of Saturn's rings.

441
00:20:31,764 --> 00:20:33,432
We've been sampling
the composition

442
00:20:33,432 --> 00:20:34,934

of the upper atmosphere,

443
00:20:34,934 --> 00:20:36,602
particularly in the
last couple of orbits

444
00:20:36,602 --> 00:20:38,137
with our mass spectrometer

445
00:20:38,137 --> 00:20:40,539
and we're observing
a more complex,

446
00:20:40,539 --> 00:20:42,808
both chemical and
dynamical interaction,

447
00:20:42,808 --> 00:20:45,244
of Saturn's atmosphere
with the rings

448
00:20:45,244 --> 00:20:47,179
than we had anticipated.

449
00:20:47,179 --> 00:20:50,149
The dynamical interaction
involves both the ionosphere

450
00:20:50,149 --> 00:20:52,384
and the neutral atmosphere.

451
00:20:53,786 --> 00:20:56,188
The chemical interaction
involves both water molecules

452
00:20:56,188 --> 00:20:57,623
and hydrocarbons.

453
00:20:58,858 --> 00:21:01,460

Now, all of this is
actually good news.

454
00:21:01,460 --> 00:21:05,531
Scientists love mysteries
and the Grand Finale

455
00:21:05,531 --> 00:21:08,901
is providing mysteries
for everyone.

456
00:21:08,901 --> 00:21:10,202
Over the next two weeks,

457
00:21:10,202 --> 00:21:12,138
we're doing the kinds of
things we've always done

458
00:21:12,138 --> 00:21:15,774
but of course, there's
nothing ordinary about

459
00:21:15,774 --> 00:21:19,578
exploring Saturn or our
Grand Finale region.

460
00:21:19,578 --> 00:21:22,648
As Earl mentioned,
Cassini's final images

461
00:21:22,648 --> 00:21:25,651
will be our last look
around the Saturn system.

462
00:21:25,651 --> 00:21:29,455
We go to Spilker two, that's a
montage of our final targets.

463
00:21:29,455 --> 00:21:33,425
These images will be taken

on September 13th and 14th

464
00:21:33,425 --> 00:21:37,630
and returned to the
Earth on September 14th.

465
00:21:37,630 --> 00:21:39,632
These final images are
sort of like taking

466
00:21:39,632 --> 00:21:41,934
a last look around
your house or apartment

467
00:21:41,934 --> 00:21:44,436
just before you move out.

468
00:21:44,436 --> 00:21:47,139
You walk around the
downstairs, as you go upstairs,

469
00:21:47,139 --> 00:21:49,508
you run your fingers
along the banister.

470
00:21:49,508 --> 00:21:51,076
You look at your old room,

471
00:21:51,076 --> 00:21:54,847
and memories across the
years come flooding back.

472
00:21:54,847 --> 00:21:56,348
And in the same way,

473
00:21:56,348 --> 00:22:00,319
Cassini is taking a last look
around the Saturn system,

474

00:22:00,319 --> 00:22:03,422
Cassini's home for
the last 13 years.

475
00:22:04,823 --> 00:22:07,593
And with those pictures
come heart warming memories.

476
00:22:07,593 --> 00:22:09,528
In the upper right hand corner,

477
00:22:09,528 --> 00:22:11,597
upper left hand
corner, there's Titan.

478
00:22:11,597 --> 00:22:15,067
We're gonna be taking our
last look for Titan's weather.

479
00:22:15,067 --> 00:22:18,604
The upper right hand
corner is Enceladus.

480
00:22:18,604 --> 00:22:21,373
We're actually gonna watch
as Enceladus sets behind

481
00:22:21,373 --> 00:22:24,243
the northern rim of Saturn.

482
00:22:24,243 --> 00:22:28,380
On the bottom left is a
feature created by this tiny

483
00:22:28,380 --> 00:22:30,482
particle Peggy,
this tiny moonlet.

484
00:22:30,482 --> 00:22:33,519
We'll be looking to see if

perhaps Peggy has broken free

485
00:22:33,519 --> 00:22:37,356
from the rings and becoming
a moonlet in her own right.

486
00:22:37,356 --> 00:22:40,593
In the center bottom, there's
a view of the propellor.

487
00:22:40,593 --> 00:22:42,728
That propellor is
created by an object

488
00:22:42,728 --> 00:22:43,963
a little smaller than Peggy,

489
00:22:43,963 --> 00:22:46,498
trying to open up
a gap in the rings.

490
00:22:46,498 --> 00:22:48,400
And finally, on the lower right,

491
00:22:48,400 --> 00:22:52,371
we'll be taking a color montage
of Saturn plus the rings

492
00:22:52,371 --> 00:22:55,174
and also getting
information about

493
00:22:55,174 --> 00:22:58,377
the aurora around the
north pole of Saturn.

494
00:22:58,377 --> 00:23:00,512
So our final look,
our final memories,

495
00:23:00,512 --> 00:23:02,281
coming back with these pictures.

496
00:23:02,281 --> 00:23:05,351
Because you see, Cassini
is not taking any images

497
00:23:05,351 --> 00:23:08,887
during the final plunge because
we don't have the data rate

498
00:23:08,887 --> 00:23:11,290
to send them back in real time.

499
00:23:11,290 --> 00:23:14,760
So our focus is going to be
using all of our instruments

500
00:23:14,760 --> 00:23:17,763
to sample the
atmosphere of Saturn.

501
00:23:17,763 --> 00:23:20,199
So let me tell you a
little bit about science

502
00:23:20,199 --> 00:23:21,333
during the final plunge.

503
00:23:21,333 --> 00:23:23,702
If we go to Spilker three,

504
00:23:23,702 --> 00:23:26,372
there you see that eight
Cassini instruments

505
00:23:26,372 --> 00:23:27,840
are on at the time.

506
00:23:27,840 --> 00:23:30,242
All five of our fields
and particles instruments,

507
00:23:30,242 --> 00:23:32,011
including INMS and MIMI,

508
00:23:32,011 --> 00:23:34,146
the Radio and Plasma
Wave Antennas,

509
00:23:34,146 --> 00:23:36,882
Cosmic Dust Analyzers as
well as the Magnetometer.

510
00:23:36,882 --> 00:23:39,985
Our Infrared and Ultraviolet
Spectrometers will be on

511
00:23:39,985 --> 00:23:44,089
and taking data as will
our Radio Science system.

512
00:23:45,257 --> 00:23:47,926
Now the highest science
priority is to sample

513
00:23:47,926 --> 00:23:49,728
the atmosphere, as all
of these instruments

514
00:23:49,728 --> 00:23:50,863
will be doing together.

515
00:23:50,863 --> 00:23:52,731
And has been noted previously,

516
00:23:52,731 --> 00:23:57,336
this new science is making

Cassini Saturn's first

517
00:23:57,336 --> 00:24:00,272
atmospheric probe, although
Cassini will only sample

518
00:24:00,272 --> 00:24:03,676
the very top of
Saturn's atmosphere

519
00:24:03,676 --> 00:24:07,980
and will be sending back data
until the very last second.

520
00:24:07,980 --> 00:24:10,783
We stand to gain fundamental
insights into Saturn's

521
00:24:10,783 --> 00:24:12,217
formation and evolution,

522
00:24:12,217 --> 00:24:16,789
as well as the processes
that occur in the atmosphere.

523
00:24:16,789 --> 00:24:19,458
Well, during this
time with Cassini,

524
00:24:19,458 --> 00:24:22,594
many of the scientists and
I have worked on Cassini

525
00:24:22,594 --> 00:24:24,263
for almost a full Saturn orbit

526
00:24:24,263 --> 00:24:27,099
and that's almost 30 years

527

00:24:27,099 --> 00:24:29,802
and there's been an incredible
effort by the scientists

528
00:24:29,802 --> 00:24:32,204
to both build the instruments,

529
00:24:32,204 --> 00:24:36,041
and then to now analyze
the final science.

530
00:24:36,041 --> 00:24:38,744
We've watched Cassini
being built, launched,

531
00:24:38,744 --> 00:24:43,282
flown to Saturn, and
orbiting Saturn for 13 years

532
00:24:43,282 --> 00:24:46,418
and our families have
gotten to know each other.

533
00:24:46,418 --> 00:24:47,853
We've taken vacations together.

534
00:24:47,853 --> 00:24:50,689
In some cases, our children
have grown up together

535
00:24:50,689 --> 00:24:52,858
and now, in the final two weeks,

536
00:24:52,858 --> 00:24:56,929
we're sharing the end of
this incredible mission.

537
00:24:56,929 --> 00:24:59,131
In the Grand Finale
Cassini has been giving

538
00:24:59,131 --> 00:25:03,035
the scientists surprising
new mysteries to be solved.

539
00:25:03,035 --> 00:25:06,939
The equivalent of
gift wrapped presents.

540
00:25:06,939 --> 00:25:09,508
Who knows what knew
mysteries the next two weeks

541
00:25:09,508 --> 00:25:13,045
will bring and the answers
to some of these scientific

542
00:25:13,045 --> 00:25:16,615
puzzles may turn out to
be some of the very best

543
00:25:16,615 --> 00:25:18,517
science of the mission.

544
00:25:19,818 --> 00:25:21,587
These final days
of the Grand Finale

545
00:25:21,587 --> 00:25:25,157
are all a part of
Cassini's grand good bye.

546
00:25:27,292 --> 00:25:31,463
>> Jane: Alright, thank
you, Linda, Earl and Curt.

547
00:25:32,631 --> 00:25:34,867
And you mentioned what
a family Cassini is.

548
00:25:34,867 --> 00:25:38,203
I should point out that
we have three other people

549
00:25:38,203 --> 00:25:40,572
from the team in the
room with us today

550
00:25:40,572 --> 00:25:42,908
in case there are any
questions that would be

551
00:25:42,908 --> 00:25:44,710
more appropriate for them.

552
00:25:44,710 --> 00:25:47,513
We've got Julie Webster, the
spacecraft operations manager.

553
00:25:47,513 --> 00:25:50,048
We have Eric Sterm,
the mission planner,

554
00:25:50,048 --> 00:25:53,452
and Scott Edgington, the
deputy project scientist,

555
00:25:53,452 --> 00:25:56,121
and to have you
all here with us.

556
00:25:56,121 --> 00:25:58,857
Alright, we're gonna go
over reporter questions now.

557
00:25:58,857 --> 00:26:00,759
And again, if you
do have a question,

558

00:26:00,759 --> 00:26:02,928
please press star one,
tell the operator your name

559
00:26:02,928 --> 00:26:04,229
and affiliation.

560
00:26:04,229 --> 00:26:07,332
We do have quite a few
reporters on the line,

561
00:26:07,332 --> 00:26:10,002
so we're going to limit
ourselves to one question

562
00:26:10,002 --> 00:26:12,671
and one brief follow
up on the first round

563
00:26:12,671 --> 00:26:15,374
and then if we have time
we'll go back to others.

564
00:26:15,374 --> 00:26:18,010
We also are taking a few
questions from social media.

565
00:26:18,010 --> 00:26:22,147
Alright, let's take our first
question from Calla Cofield

566
00:26:22,147 --> 00:26:23,215
of space.com.

567
00:26:24,650 --> 00:26:26,118
Calla?

568
00:26:26,118 --> 00:26:28,520
>> Calla: Hi, I have a
question for Dr. Spilker.

569
00:26:28,520 --> 00:26:30,022
I was wondering if you
could talk a little bit more

570
00:26:30,022 --> 00:26:32,624
about what exactly
you're hoping to Cassini

571
00:26:32,624 --> 00:26:36,628
will tell you about the
composition of the atmosphere

572
00:26:36,628 --> 00:26:39,798
that you haven't been able to
learn using space spectroscopy

573
00:26:39,798 --> 00:26:41,233
or other methods.

574
00:26:42,801 --> 00:26:45,070
>> Linda: Well, by
having in situ sampling

575
00:26:45,070 --> 00:26:48,006
of the atmosphere, we can
directly measure things like

576
00:26:48,006 --> 00:26:50,542
the hydrogen to helium ratio.

577
00:26:50,542 --> 00:26:52,778
We can directly
measure composition,

578
00:26:52,778 --> 00:26:57,216
perhaps constituents at
a very very low level

579

00:26:57,216 --> 00:26:59,585
in the atmosphere, things
that would be much harder

580
00:26:59,585 --> 00:27:01,987
to see from a distance
with remote sensing

581
00:27:01,987 --> 00:27:03,755
and spectroscopy.

582
00:27:03,755 --> 00:27:05,524
Now all of this
will tell us about

583
00:27:05,524 --> 00:27:08,527
the evolution of
Saturn's atmosphere,

584
00:27:08,527 --> 00:27:11,296
especially we will get a
handle on some of those

585
00:27:11,296 --> 00:27:12,731
seasonal changes.

586
00:27:15,868 --> 00:27:18,570
>> Jane: Okay, and our next
question is from Marcia Dunn,

587
00:27:18,570 --> 00:27:19,571
of the Associated Press.

588
00:27:19,571 --> 00:27:20,405
Marcia?

589
00:27:25,644 --> 00:27:27,713
Marcia can you hear us?

590

00:27:27,713 --> 00:27:31,083
Are you ready with
your question?

591
00:27:31,083 --> 00:27:34,219
If not, let's go ahead and
take the next question,

592
00:27:34,219 --> 00:27:35,821
which is USA Today.

593
00:27:41,326 --> 00:27:42,928
>> Marcia: Hello,
can you hear me?

594
00:27:42,928 --> 00:27:44,363
>> Jane: Yes, I'm
sorry is this Marcia?

595
00:27:44,363 --> 00:27:45,664
>> Marcia: Yes it is, I'm sorry.

596
00:27:45,664 --> 00:27:47,299
Yes, can you hear me now?

597
00:27:47,299 --> 00:27:49,801
>> Jane: Yes, we can
definitely hear you so go ahead

598
00:27:49,801 --> 00:27:51,036
with your question, thank you.

599
00:27:51,036 --> 00:27:52,938
>> Marcia: Thank
you, Dr. Spilker,

600
00:27:52,938 --> 00:27:55,974
I see that Cassini is
discovered six named moons,

601
00:27:55,974 --> 00:27:58,710
how many moons all together
has Cassini discovered,

602
00:27:58,710 --> 00:28:03,048
named and unnamed, and
do you have any idea

603
00:28:03,048 --> 00:28:07,219
what the very last photo
taken Cassini will be of?

604
00:28:09,454 --> 00:28:10,923
>> Linda: I'll start
with the last question.

605
00:28:10,923 --> 00:28:13,225
The very last photo of Cassini
will be of the propellors

606
00:28:13,225 --> 00:28:15,561
in the Saturn system.

607
00:28:15,561 --> 00:28:18,063
As far as the unnamed
moons, they're not named

608
00:28:18,063 --> 00:28:21,934
because these moons may not
stick around for a long time.

609
00:28:21,934 --> 00:28:26,038
A good example of those
are the tiny objects

610
00:28:26,038 --> 00:28:28,540
that are associated
with Saturn's F ring.

611

00:28:28,540 --> 00:28:30,976
We've given them sometimes
names with the year

612
00:28:30,976 --> 00:28:32,778
and the time that we've
actually seen them.

613
00:28:32,778 --> 00:28:36,682
So we just have six named
and then these other objects

614
00:28:36,682 --> 00:28:38,116
that we're not
sure what they are,

615
00:28:38,116 --> 00:28:41,687
in the case of Peggy,
that's just an informal name

616
00:28:41,687 --> 00:28:44,890
for an object that may or
may not come out of the edge

617
00:28:44,890 --> 00:28:46,058
of the A ring.

618
00:28:48,193 --> 00:28:49,595
>> Jane: Okay, and a
reminder to reporters

619
00:28:49,595 --> 00:28:52,631
that if you do have a question,
we do need you to press

620
00:28:52,631 --> 00:28:54,900
star one so the
operator can put you

621
00:28:54,900 --> 00:28:58,437

into the queueand we
can get your question.

622
00:28:58,437 --> 00:29:01,640
In the meantime, we're
gonna take a question or two

623
00:29:01,640 --> 00:29:03,175
from social media

624
00:29:03,175 --> 00:29:06,345
and that is from
Lars Home on Twitter,

625
00:29:07,746 --> 00:29:11,383
what is the distance of
Cassini from the cloud tops?

626
00:29:11,383 --> 00:29:13,885
Who would like to answer that?

627
00:29:13,885 --> 00:29:15,287
>> Man: Probably
give that to Eric.

628
00:29:15,287 --> 00:29:17,522
>> Jane: Okay, Eric Sturm,
the mission planner.

629
00:29:17,522 --> 00:29:19,024
Eric?

630
00:29:19,024 --> 00:29:22,260
>> Eric: Yeah, the closest
it gets to the clouds--

631
00:29:22,260 --> 00:29:23,829
Well, in some respects,
it's flying through

632
00:29:23,829 --> 00:29:28,166
the very upper atmosphere,
so it is in clouds.

633
00:29:28,166 --> 00:29:31,536
The closest it gets to the
deepest it could possibly go

634
00:29:31,536 --> 00:29:33,639
in the atmosphere, is about

635
00:29:33,639 --> 00:29:38,010
200 kilometers or 120 miles.

636
00:29:38,010 --> 00:29:41,913
What we consider the
"surface of Saturn,"

637
00:29:42,781 --> 00:29:44,816
which is the one bar altitude,

638
00:29:44,816 --> 00:29:47,285
which is the equivalent
pressure that the surface

639
00:29:47,285 --> 00:29:51,456
of Earth has, it's several
thousand kilometers above that.

640
00:29:54,059 --> 00:29:56,261
>> Jane: Okay, thank you.

641
00:29:56,261 --> 00:29:59,698
And now we have Irish
TV, Leo Enright.

642
00:29:59,698 --> 00:30:00,532
Hello Leo.

643
00:30:05,437 --> 00:30:08,974
Okay, we seem to be having
couple of little issues here.

644
00:30:08,974 --> 00:30:10,475
We'll try to clear that up.

645
00:30:10,475 --> 00:30:12,277
In the meantime, let's
take a question from--

646
00:30:12,277 --> 00:30:13,278
>> Leo: Can you hear me Jane?

647
00:30:13,278 --> 00:30:15,881
>> Jane: Hello, is that you Leo?

648
00:30:15,881 --> 00:30:16,948
>> Leo: Jane can you hear me?

649
00:30:16,948 --> 00:30:18,483
>> Jane: Yes.

650
00:30:18,483 --> 00:30:21,887
>> Leo: Okay, thanks Jane,
I'll keep it simple then.

651
00:30:21,887 --> 00:30:25,524
I'm a TV guy but
I'm also a radio guy

652
00:30:25,524 --> 00:30:27,793
so this question obviously
is for Linda Spilker,

653
00:30:27,793 --> 00:30:30,762
the Radio and Plasma
Wave experiment,

654
00:30:30,762 --> 00:30:34,366
is that going to
produce something

655
00:30:34,366 --> 00:30:38,470
during those end
of mission moments

656
00:30:38,837 --> 00:30:41,840
that we're going
to be able to hear?

657
00:30:43,008 --> 00:30:44,376
>> Linda: One of the
things that we can hear

658
00:30:44,376 --> 00:30:46,478
with our radio and
plasma wave antennas--

659
00:30:46,478 --> 00:30:49,614
>> Woman: If you'd
like to ask a question,

660
00:30:49,614 --> 00:30:51,416
please press star one.

661
00:30:51,416 --> 00:31:07,699
[silence]

662
00:31:07,699 --> 00:31:09,301
>> Linda: ...back to us
through those antennas.

663
00:31:09,301 --> 00:31:11,470
And also sometimes there
are other phenomena

664
00:31:11,470 --> 00:31:13,305

that are present around Saturn,

665
00:31:13,305 --> 00:31:15,607
things that create whistlers,
where the frequency--

666
00:31:15,607 --> 00:31:18,610
Imagine a train going
by and how the frequency

667
00:31:18,610 --> 00:31:20,245
of the train
whistle will change.

668
00:31:20,245 --> 00:31:22,414
So be looking for
those phenomena

669
00:31:22,414 --> 00:31:25,450
and perhaps something new
that we haven't thought of.

670
00:31:25,450 --> 00:31:28,820
>> Leo: And can I
ask a follow up?

671
00:31:28,820 --> 00:31:30,522
>> Jane: Yes.

672
00:31:30,522 --> 00:31:32,591
>> Leo: So Linda, if
you wouldn't mind,

673
00:31:32,591 --> 00:31:35,560
you've talked about
Saturn's rotation

674
00:31:35,560 --> 00:31:38,663
and everyone does a
lot of arm waving.

675
00:31:38,663 --> 00:31:41,900
What is it about this
end of mission period

676
00:31:41,900 --> 00:31:46,571
that makes you more
confident, as I understand it,

677
00:31:46,571 --> 00:31:50,642
that you will actually be
able to nail the rotation?

678
00:31:50,642 --> 00:31:52,711
>> Linda: Well, this
end of mission will not

679
00:31:52,711 --> 00:31:55,380
necessarily help us
nail the rotation period

680
00:31:55,380 --> 00:31:58,784
because we'll have had
22 orbits to try and look

681
00:31:58,784 --> 00:32:01,119
for this very tiny offset.

682
00:32:01,119 --> 00:32:03,622
We were hoping, perhaps
getting closer to Saturn

683
00:32:03,622 --> 00:32:06,358
would give us a better
look at that tilt

684
00:32:06,358 --> 00:32:09,561
and we now know that the tilt
between the magnetic field

685
00:32:09,561 --> 00:32:13,732
axis and the rotation axis
is less than .06 degrees,

686
00:32:14,900 --> 00:32:16,701
and so we're still
trying to tease out

687
00:32:16,701 --> 00:32:18,770
what might be a
very subtle tilt,

688
00:32:18,770 --> 00:32:22,541
which would produce a wobble
leading to the rotation rate

689
00:32:22,541 --> 00:32:24,342
for Saturn's interior.

690
00:32:24,342 --> 00:32:26,111
And it's important
to know that because

691
00:32:26,111 --> 00:32:28,480
that's where the ground truth
from which we can measure

692
00:32:28,480 --> 00:32:30,415
the wind speeds
and wind directions

693
00:32:30,415 --> 00:32:33,552
and will tell us more
about the circulation model

694
00:32:33,552 --> 00:32:35,420
for Saturn itself.

695
00:32:35,420 --> 00:32:38,223

But that final orbit
may not provide sort of

696
00:32:38,223 --> 00:32:41,560
the smoking gun for
the rotation period.

697
00:32:44,262 --> 00:32:47,032
>> Jane: Okay, the next
question is from Tracy Watson

698
00:32:47,032 --> 00:32:48,767
at USA Today.

699
00:32:48,767 --> 00:32:52,470
>> Tracy: Thank you,
just wondering how low

700
00:32:52,470 --> 00:32:55,407
below the "surface"
of Saturn

701
00:32:55,407 --> 00:32:57,809
you expect the probe to
go before it breaks up

702
00:32:57,809 --> 00:33:00,245
and also I'm wondering whether

703
00:33:01,680 --> 00:33:05,383
Cassini has set any kind
of longevity missions for

704
00:33:07,252 --> 00:33:10,188
a spacecraft outer
planet, thanks.

705
00:33:11,756 --> 00:33:14,459
>> Earl: This is Earl Maize
I'm gonna toss that over to

706
00:33:14,459 --> 00:33:16,528
Julie Webster, who has
a pretty good time line

707
00:33:16,528 --> 00:33:18,330
for what's happening
to the spacecraft

708
00:33:18,330 --> 00:33:21,867
as it starts to go
into the atmosphere.

709
00:33:21,867 --> 00:33:26,638
>> Julie: We'll actually,
basically, disintegrate.

710
00:33:26,638 --> 00:33:30,475
We'll melt long before
we hit any real surface

711
00:33:31,877 --> 00:33:36,248
of Saturn, whatever it is,
in the atmosphere in the gas.

712
00:33:36,248 --> 00:33:39,217
Not too long after
we lose signal,

713
00:33:39,217 --> 00:33:43,388
we'll have already started
to be two to 500 degrees

714
00:33:44,356 --> 00:33:47,125
centigrade within seconds.

715
00:33:47,125 --> 00:33:50,362
So we'll start to
melt all parts of it.

716
00:33:52,530 --> 00:33:55,333
>> Earl: I think we
have, this is Earl again,

717
00:33:55,333 --> 00:33:58,770
probably we've got to
give the nod to Voyager

718
00:33:58,770 --> 00:34:00,839
for planetary mission
with a long life,

719
00:34:00,839 --> 00:34:03,642
and on the inner planets,

720
00:34:03,642 --> 00:34:06,711
we have some very long
lived Mars missions.

721
00:34:06,711 --> 00:34:10,282
But I think, do we
have the edge on them?

722
00:34:10,282 --> 00:34:11,750
Okay, we're second then.

723
00:34:11,750 --> 00:34:15,887
But we've got a long ways,
we don't have a long--

724
00:34:15,887 --> 00:34:17,289
yeah, we're not gonna make it.

725
00:34:17,289 --> 00:34:20,625
>> Linda: Voyager just
celebrated its 40th anniversary

726
00:34:20,625 --> 00:34:24,462
since launch, so for

outer planets right now,

727
00:34:24,462 --> 00:34:25,864
Voyager holds the record.

728
00:34:25,864 --> 00:34:29,401
>> Earl: But at a
planet, we're a contender.

729
00:34:31,636 --> 00:34:33,204
>> Jane: Okay, the next
question is from the BBC

730
00:34:33,204 --> 00:34:34,839
and Jonathan Amos.

731
00:34:34,839 --> 00:34:37,108
>> Jonathan: Hello Jane,

732
00:34:37,108 --> 00:34:38,810
I hope you can hear
us from England.

733
00:34:38,810 --> 00:34:40,478
>> Jane: We hear you perfectly.

734
00:34:40,478 --> 00:34:42,347
>> Jonathan: Excellent,
that's very good.

735
00:34:42,347 --> 00:34:44,349
Quick one for Earl, if I may,

736
00:34:44,349 --> 00:34:48,720
what is the separation distance
for the kiss with Titan

737
00:34:48,720 --> 00:34:51,056
and then the second

one for Linda,

738
00:34:51,056 --> 00:34:53,358
cause my line was
breaking up slightly,

739
00:34:53,358 --> 00:34:56,995
did I hear you say that you
thought the rings were lighter

740
00:34:56,995 --> 00:34:58,863
than expected?

741
00:34:58,863 --> 00:35:00,699
Because obviously that
speaks to their age.

742
00:35:00,699 --> 00:35:03,168
>> Earl: This is Earl,

743
00:35:03,168 --> 00:35:06,338
the distance is about
120,000 kilometers.

744
00:35:06,338 --> 00:35:08,039
It's not a targeted fly-by,

745
00:35:08,039 --> 00:35:10,275
so we're kinda
letting that float,

746
00:35:10,275 --> 00:35:13,578
but regardless of any
errors we might have,

747
00:35:13,578 --> 00:35:15,981
it's close enough and it's
in the right direction.

748

00:35:15,981 --> 00:35:18,750
Cassini's going
to not come back.

749
00:35:20,552 --> 00:35:22,620
>> Linda: This is Linda
for the mass of the rings,

750
00:35:22,620 --> 00:35:25,623
our very first estimates
are for rings that are

751
00:35:25,623 --> 00:35:27,726
less massive than we
initially thought,

752
00:35:27,726 --> 00:35:30,895
which would indeed point
to a young ring age.

753
00:35:30,895 --> 00:35:35,000
However, that initial estimate
has very large error bars

754
00:35:35,000 --> 00:35:39,304
so we first need to really
understand and get those numbers

755
00:35:39,304 --> 00:35:42,073
down for the Saturn mass itself

756
00:35:42,073 --> 00:35:45,076
and then from that get the
left over mass of the rings.

757
00:35:45,076 --> 00:35:48,146
But so far, the direction
that we're headed is for

758
00:35:48,146 --> 00:35:49,681

less massive rings.

759
00:35:49,681 --> 00:35:52,817
>> Jonathan: Okay, now the
implication for that then,

760
00:35:52,817 --> 00:35:54,352
if they are

761
00:35:54,352 --> 00:35:58,256
less, they're not as old
as perhaps we thought,

762
00:36:00,792 --> 00:36:02,293
I mean, what?

763
00:36:02,293 --> 00:36:05,363
A moon that's been broken up
at some point in the past?

764
00:36:05,363 --> 00:36:07,599
What do the scenarios
that give rise

765
00:36:07,599 --> 00:36:10,235
to a young set of rings
that we get to see

766
00:36:10,235 --> 00:36:13,805
at this special time
in the solar system?

767
00:36:13,805 --> 00:36:15,740
>> Linda: Well,
you're exactly right.

768
00:36:15,740 --> 00:36:18,643
For younger rings, it
would require a comet

769
00:36:18,643 --> 00:36:21,613
or a centaur or
perhaps even a moon,

770
00:36:21,613 --> 00:36:23,548
moving too close to Saturn.

771
00:36:23,548 --> 00:36:26,384
Saturn's gravity would
break apart that object

772
00:36:26,384 --> 00:36:29,988
and then the remaining bits
would go on to form rings.

773
00:36:29,988 --> 00:36:31,956
Perhaps that's happened
more than once.

774
00:36:31,956 --> 00:36:34,359
Maybe some of the differences
we see in the rings

775
00:36:34,359 --> 00:36:36,728
are from different objects
that were broken apart.

776
00:36:36,728 --> 00:36:39,097
But if the rings
are less massive,

777
00:36:39,097 --> 00:36:41,666
that means that they
won't have had the mass

778
00:36:41,666 --> 00:36:44,469
to survive the micrometeor
bombardment that we estimate

779

00:36:44,469 --> 00:36:47,138
and to have been formed at
the same time as the planet.

780
00:36:47,138 --> 00:36:50,175
So we're heading in
the direction of rings,

781
00:36:50,175 --> 00:36:52,844
perhaps a hundred
million years old or so,

782
00:36:52,844 --> 00:36:54,546
which is quite young compared

783
00:36:54,546 --> 00:36:57,115
to the age of the solar system.

784
00:36:58,683 --> 00:37:03,421
>> Jane: Okay, we're gonna
jump, okay thank you Jonathan.

785
00:37:03,421 --> 00:37:05,490
We're gonna go over to Dave
Marsher of Business Insider.

786
00:37:05,490 --> 00:37:06,324
Dave?

787
00:37:07,459 --> 00:37:08,660
>> Dave: Thank you
Jane, can you hear me?

788
00:37:08,660 --> 00:37:11,529
>> Jane: Yep, hear
you perfectly, thanks.

789
00:37:11,529 --> 00:37:12,597
>> Dave: Great, I have
a hypothetical here

790
00:37:12,597 --> 00:37:14,365
with a follow up.

791
00:37:14,365 --> 00:37:18,603
So, I suppose this is
for either Linda or Earl,

792
00:37:18,603 --> 00:37:21,106
or perhaps both of you since
you've been on the mission

793
00:37:21,106 --> 00:37:22,574
the longest,

794
00:37:22,574 --> 00:37:24,843
if you could call
all of the shots

795
00:37:24,843 --> 00:37:28,880
and choose another mission
to launch that's on the scale

796
00:37:28,880 --> 00:37:31,850
and sort of cost
level of Cassini,

797
00:37:31,850 --> 00:37:33,918
what would it be
and what would it do

798
00:37:33,918 --> 00:37:36,855
and I have a follow
up after that?

799
00:37:36,855 --> 00:37:39,524
>> Linda: So let me
take a stab at that.

800

00:37:39,524 --> 00:37:42,894
I think we've learned so
much about the Saturn system

801
00:37:42,894 --> 00:37:46,264
that if I could create a new
mission, I'd want to go back.

802
00:37:46,264 --> 00:37:49,701
I'd want to go back and
explore and try to answer

803
00:37:49,701 --> 00:37:51,336
the questions about
Enceladus' ocean,

804
00:37:51,336 --> 00:37:54,172
also carry some instruments
to further explore Titan,

805
00:37:54,172 --> 00:37:56,107
maybe a Saturn probe.

806
00:37:56,107 --> 00:37:59,110
If you had a mission on
the scale of Cassini,

807
00:37:59,110 --> 00:38:01,713
you could go back
with modern technology

808
00:38:01,713 --> 00:38:04,082
and modern instruments
and start to address

809
00:38:04,082 --> 00:38:06,651
a whole list of
questions for Cassini.

810
00:38:06,651 --> 00:38:09,287

And of course, also,
if you look at the

811
00:38:09,287 --> 00:38:11,890
planets that Voyager flew by,

812
00:38:11,890 --> 00:38:14,025
there are two other
worlds, Uranus and Neptune.

813
00:38:14,025 --> 00:38:16,995
So perhaps, a pair of
Cassini-like orbiters

814
00:38:16,995 --> 00:38:20,465
each carrying an atmospheric
probe to each of those worlds

815
00:38:20,465 --> 00:38:23,334
as well might be
very very appealing

816
00:38:23,334 --> 00:38:25,069
because there's so little.

817
00:38:25,069 --> 00:38:27,539
We just know a little bit
from those two Voyager

818
00:38:27,539 --> 00:38:29,574
fly-bys, one of Uranus
and one of Neptune,

819
00:38:29,574 --> 00:38:32,944
so those are interesting
targets for me personally

820
00:38:32,944 --> 00:38:34,679
to go back to as well.

821
00:38:34,679 --> 00:38:36,848
>> Earl: Yeah, I
think, this is Earl,

822
00:38:36,848 --> 00:38:38,216
just to pile on to
what Linda just said,

823
00:38:38,216 --> 00:38:39,717
I don't argue with any of that,

824
00:38:39,717 --> 00:38:41,686
but I think the strategic
vision has always been,

825
00:38:41,686 --> 00:38:45,023
you know, we try to first
we would crash into things

826
00:38:45,023 --> 00:38:47,091
because we weren't good
enough to fly by them.

827
00:38:47,091 --> 00:38:48,793
Finally, we began
reconnaissance.

828
00:38:48,793 --> 00:38:50,895
And Voyager did the
great reconnaissance

829
00:38:50,895 --> 00:38:54,532
and we've since gone back
to Jupiter and Saturn

830
00:38:54,532 --> 00:38:56,167
with orbiters and probes.

831
00:38:56,167 --> 00:39:00,538

And Uranus and Neptune, I
expect, to yield as many

832
00:39:00,538 --> 00:39:03,308
surprises and mysteries and
answers as the other two

833
00:39:03,308 --> 00:39:06,678
so we need to keep our eye
on that long term plan.

834
00:39:06,678 --> 00:39:11,416
At the same time, Cassini
has turned everyone's head

835
00:39:11,416 --> 00:39:13,017
about ocean worlds.

836
00:39:13,017 --> 00:39:15,286
We have to not ignore that.

837
00:39:16,487 --> 00:39:18,323
So I'm a little bit
selfish about this,

838
00:39:18,323 --> 00:39:19,824
but I think we need to do both.

839
00:39:19,824 --> 00:39:24,195
We can't ignore the rest
of the solar system,

840
00:39:24,195 --> 00:39:26,598
it's just too compelling.

841
00:39:26,598 --> 00:39:28,833
>> Jane: Okay, and
reminder to reporters

842

00:39:28,833 --> 00:39:31,269
that you can still press
star one if you would like

843
00:39:31,269 --> 00:39:32,770
to ask a question.

844
00:39:32,770 --> 00:39:34,439
In the meantime, I'm gonna
go to a couple of people

845
00:39:34,439 --> 00:39:36,241
on social media.

846
00:39:36,241 --> 00:39:38,343
Grant on YouTube asks,

847
00:39:38,343 --> 00:39:40,511
"Even with the success
of the spacecraft,

848
00:39:40,511 --> 00:39:42,380
is there any part of
the mission you wish

849
00:39:42,380 --> 00:39:45,884
you could have
had more time with

850
00:39:45,884 --> 00:39:49,520
and will this become
part of a next mission?"

851
00:39:49,520 --> 00:39:51,723
>> Linda: Oh, I got a
great answer for that.

852
00:39:51,723 --> 00:39:55,693
I think we could easily
use another 22 or 44

853
00:39:55,693 --> 00:39:57,929
Grand Finale orbits,

854
00:39:57,929 --> 00:40:01,366
that there are so many
surprises and questions

855
00:40:01,366 --> 00:40:05,069
that if I could pick any part
of the mission to last longer

856
00:40:05,069 --> 00:40:07,906
I'd choose the
Grand Finale phase.

857
00:40:10,642 --> 00:40:11,976
>> Earl: Well, I, this is Earl,

858
00:40:11,976 --> 00:40:13,945
I wouldn't disagree
with that except that

859
00:40:13,945 --> 00:40:17,915
Enceladus is still
appealing and calling back

860
00:40:17,915 --> 00:40:19,317
for more as well.

861
00:40:19,317 --> 00:40:20,852
There's as many questions
as answers there,

862
00:40:20,852 --> 00:40:24,022
but the Grand Finale,
given how benign

863
00:40:25,356 --> 00:40:28,993

this environment is,
it is in hindsight,

864
00:40:28,993 --> 00:40:31,296
something we could have
jumped into much sooner

865
00:40:31,296 --> 00:40:33,231
in the mission.

866
00:40:33,231 --> 00:40:35,933
Now, we didn't know
that and I'm not feeling

867
00:40:35,933 --> 00:40:37,535
too regretful of the decision,

868
00:40:37,535 --> 00:40:39,337
because now that we know,

869
00:40:39,337 --> 00:40:42,907
it's a place we would be very
happy to spend more time.

870
00:40:42,907 --> 00:40:46,010
>> Linda: Right, if we had
more fuel, perhaps another

871
00:40:46,010 --> 00:40:49,747
10 years at Saturn would
be just about right.

872
00:40:51,516 --> 00:40:52,884
>> Jane: Alright,
the next question,

873
00:40:52,884 --> 00:40:55,687
and you may possibly all
want to jump in on this,

874
00:40:55,687 --> 00:40:57,755
so Curt if you have
a thought on this,

875
00:40:57,755 --> 00:40:59,557
Mike on YouTube is asking,

876
00:40:59,557 --> 00:41:02,960
what has been the most
exciting discovery

877
00:41:02,960 --> 00:41:06,130
according to those
of you on the team?

878
00:41:09,467 --> 00:41:09,867
>> Linda: I think
for me personally,

879
00:41:09,867 --> 00:41:12,036
it must be Enceladus.

880
00:41:12,036 --> 00:41:15,907
To actually see this
plume of water vapor

881
00:41:15,907 --> 00:41:18,509
and water-ice particles
coming out of the south pole

882
00:41:18,509 --> 00:41:21,512
of a moon that's
only 300 miles across

883
00:41:21,512 --> 00:41:23,715
was absolutely astonishing.

884
00:41:23,715 --> 00:41:26,784
And then to take instruments

built for other purposes

885
00:41:26,784 --> 00:41:30,221
and turn them toward
sampling and flying through

886
00:41:30,221 --> 00:41:32,857
the plume and actually
measuring the constituents,

887
00:41:32,857 --> 00:41:37,295
finding a salty global
ocean containing organics,

888
00:41:37,295 --> 00:41:39,130
the possibility of
hydrothermal vents,

889
00:41:39,130 --> 00:41:42,133
and just revealing a
world that we thought

890
00:41:42,133 --> 00:41:46,304
was completely frozen solid
when we first got to Saturn.

891
00:41:47,772 --> 00:41:50,141
>> Earl: Yeah, I would say
this is less a discovery

892
00:41:50,141 --> 00:41:51,609
than an accomplishment,

893
00:41:51,609 --> 00:41:55,113
and for me seeing those first
images from the surfaces

894
00:41:55,113 --> 00:41:59,183
of Titan that Huygen's
probe played back in 2005.

895
00:42:01,519 --> 00:42:05,690
The collaboration of both
internationally and mechanically

896
00:42:07,692 --> 00:42:09,293
and electrically,
everything else between

897
00:42:09,293 --> 00:42:12,663
two space agencies, three
space agencies actually,

898
00:42:12,663 --> 00:42:15,500
and all these thousands
of people on the ground

899
00:42:15,500 --> 00:42:19,237
to put a probe on to Titan,
capture signal on the way down,

900
00:42:19,237 --> 00:42:21,672
land it softly on the surface
and play those images back,

901
00:42:21,672 --> 00:42:24,342
I still give myself goose bumps

902
00:42:24,342 --> 00:42:26,077
just seeing that first image.

903
00:42:26,077 --> 00:42:27,812
I'll never forget it.

904
00:42:30,515 --> 00:42:34,318
>> Curt: This is Curt, I
would agree with Linda.

905
00:42:34,318 --> 00:42:37,155

Enceladus has no
business existing

906
00:42:38,656 --> 00:42:42,727
and yet there it is,
practically screaming at us,

907
00:42:42,727 --> 00:42:46,197
look at me I completely
invalidate all of

908
00:42:46,197 --> 00:42:49,267
your assumptions about
the solar system,

909
00:42:49,267 --> 00:42:51,702
and it's just been a
remarkable opportunity

910
00:42:51,702 --> 00:42:56,207
to study Enceladus and
to unveil the secrets

911
00:42:56,207 --> 00:42:57,308
that it's been keeping.

912
00:42:57,308 --> 00:42:59,644
It's an amazing destination.

913
00:42:59,644 --> 00:43:03,648
>> Jane: Alright, thanks all
of you for those insights.

914
00:43:03,648 --> 00:43:06,317
We're going to now take a
question from Irene Klotz

915
00:43:06,317 --> 00:43:07,752
of Aviation Week.

916
00:43:11,622 --> 00:43:14,392
Irene Klotz are you there?

917
00:43:14,392 --> 00:43:15,626
>> Irene: Yes, can you hear me?

918
00:43:15,626 --> 00:43:17,528
>> Jane: Yep, we can
hear you, thanks.

919
00:43:17,528 --> 00:43:19,597
>> Irene: Thank you,
I have two questions.

920
00:43:19,597 --> 00:43:23,601
The first is for Earl,
beginning from when after

921
00:43:24,769 --> 00:43:28,005
Cassini entered
Saturn's orbit in 2004,

922
00:43:29,774 --> 00:43:32,076
how much fuel was
aboard at that time

923
00:43:32,076 --> 00:43:35,746
and how much will be
left, if anything,

924
00:43:35,746 --> 00:43:37,482
at the end of mission

925
00:43:39,517 --> 00:43:42,120
and I have a question
for Linda as well.

926
00:43:42,120 --> 00:43:44,755
>> Earl: Okay, hi Irene,

I'm gonna turn that into

927
00:43:44,755 --> 00:43:46,557
a two part question because
we've got two different

928
00:43:46,557 --> 00:43:50,328
rocket systems on board,
as I think you know.

929
00:43:52,697 --> 00:43:56,334
Actually, we started with
3,132 kilograms of propellant.

930
00:43:56,334 --> 00:43:57,869
Divided between the two systems.

931
00:43:57,869 --> 00:44:00,304
3,000 for one 132 for the other.

932
00:44:00,304 --> 00:44:03,641
We are down to about
10 kilograms in one

933
00:44:04,909 --> 00:44:06,911
and probably, Julie what
do we got, about 50?

934
00:44:06,911 --> 00:44:08,412
30, 30 on the other.

935
00:44:08,412 --> 00:44:12,316
So we're about 40 kilograms
out of about 3,132 loaded.

936
00:44:13,417 --> 00:44:16,053
The main engine is just empty.

937
00:44:16,053 --> 00:44:18,923

We could run out the
next time we fired it,

938
00:44:18,923 --> 00:44:20,591
but we still have plenty
of propellant left

939
00:44:20,591 --> 00:44:24,362
for the attitude
control system.

940
00:44:25,997 --> 00:44:28,132
>> Irene: Okay and will
anything be left at the end

941
00:44:28,132 --> 00:44:32,270
of the mission or will
all the remaining fuel be

942
00:44:32,270 --> 00:44:35,506
used by the thrusters
to kind of battle

943
00:44:36,440 --> 00:44:39,510
against the atmosphere's pull?

944
00:44:39,510 --> 00:44:40,978
>> Earl: Go ahead, Joy's gonna--

945
00:44:40,978 --> 00:44:43,981
>> Joy: Yeah, Irene,
we'll probably use about

946
00:44:43,981 --> 00:44:46,817
three more kilograms
of hydrazine,

947
00:44:48,319 --> 00:44:51,989
maybe four total
depending on how long

948
00:44:51,989 --> 00:44:55,059
we can fight that last entry,

949
00:44:55,059 --> 00:44:59,330
but I expect to go in with
about 27 kilos of hydrazine,

950
00:44:59,330 --> 00:45:01,232
and again, as Earl says,

951
00:45:01,232 --> 00:45:04,468
we've already determined
that we would not fire

952
00:45:04,468 --> 00:45:06,370
the main engine again

953
00:45:06,370 --> 00:45:10,107
and I expect that there's
almost nothing in there.

954
00:45:10,107 --> 00:45:12,843
>> Irene: Thanks, and then
just a quick one for Linda,

955
00:45:12,843 --> 00:45:16,781
what is the difference
between the in situ sampling

956
00:45:17,982 --> 00:45:20,217
of the atmosphere that
you're looking to take

957
00:45:20,217 --> 00:45:23,054
at the very last
data from Cassini

958
00:45:24,522 --> 00:45:28,359

versus what's being taken now
during these final ring dives.

959
00:45:30,761 --> 00:45:31,996
>> Linda: Well right now,

960
00:45:31,996 --> 00:45:33,831
we'll be getting
very similar data

961
00:45:33,831 --> 00:45:36,267
to what we're doing with
the dives between the rings.

962
00:45:36,267 --> 00:45:38,970
We'll just be sampling
deeper in the atmosphere.

963
00:45:38,970 --> 00:45:41,372
So if you will, these
final five orbits are like

964
00:45:41,372 --> 00:45:44,075
dipping our toe in
Saturn's atmosphere

965
00:45:44,075 --> 00:45:46,944
and that's in preparation
for the final plunge,

966
00:45:46,944 --> 00:45:49,947
where we'll send back data
till the very last second

967
00:45:49,947 --> 00:45:52,683
until the atmosphere
grows too thick.

968
00:45:52,683 --> 00:45:54,418
So we'll get a much

deeper profile

969
00:45:54,418 --> 00:45:56,120
in the very
final plunge,

970
00:45:56,120 --> 00:45:58,122
but we are getting
some incredible,

971
00:45:58,122 --> 00:45:59,824
intriguing information back.

972
00:45:59,824 --> 00:46:02,994
By these first looks, we're
getting good salient to noise

973
00:46:02,994 --> 00:46:05,096
for our mass spectrometers

974
00:46:05,096 --> 00:46:07,898
to allow us to tease
out some information

975
00:46:07,898 --> 00:46:10,301
about this atmosphere
and then this complex

976
00:46:10,301 --> 00:46:12,703
interaction between the ring
particles that are coming in

977
00:46:12,703 --> 00:46:15,006
to the atmosphere and how
they mix and how their

978
00:46:15,006 --> 00:46:17,541
chemistry and
dynamics play a role.

979
00:46:17,541 --> 00:46:20,578
So we've just had a few orbits
and are just sorting out

980
00:46:20,578 --> 00:46:22,780
some of that information.

981
00:46:22,780 --> 00:46:25,216
>> Irene: Thanks, do you
have a number of kilometers

982
00:46:25,216 --> 00:46:27,918
on the difference
between the final data

983
00:46:27,918 --> 00:46:30,655
take and what
you're getting now?

984
00:46:32,023 --> 00:46:33,891
>> Linda: Looks like, Julie's
showing me a plot here,

985
00:46:33,891 --> 00:46:35,993
looks like it's about
1,500 kilometers between

986
00:46:35,993 --> 00:46:38,629
where we're flying today,

987
00:46:38,629 --> 00:46:41,032
where we're flying now
at our closest approach

988
00:46:41,032 --> 00:46:43,501
and when we think we'll
start to lose control

989
00:46:43,501 --> 00:46:44,835

of the spacecraft,

990
00:46:44,835 --> 00:46:47,071
lose the signal
and lose the data.

991
00:46:47,071 --> 00:46:48,572
>> Irene: Thanks so much.

992
00:46:48,572 --> 00:46:51,642
>> Jane: Okay and because we
did get a bit of a late start,

993
00:46:51,642 --> 00:46:54,345
we'll go past the top of
the hour with a few more

994
00:46:54,345 --> 00:46:55,813
reporter questions.

995
00:46:55,813 --> 00:46:57,314
We'll try to take one or
two more from social media.

996
00:46:57,314 --> 00:47:01,552
I guess this would be a
last call if any reporters

997
00:47:01,552 --> 00:47:04,755
do have a question, press
star one to get in the queue.

998
00:47:04,755 --> 00:47:08,926
Our next question comes
from Rebecca Boyle at 538.

999
00:47:10,094 --> 00:47:11,996
>> Rebecca: Hi, can
you guys hear me?

1000
00:47:11,996 --> 00:47:13,764
>> Jane: Yes, we can.

1001
00:47:13,764 --> 00:47:16,734
>> Rebecca: I wanted to ask,

1002
00:47:16,734 --> 00:47:18,235
I guess anyone who
wants to answer,

1003
00:47:18,235 --> 00:47:20,905
if you could talk about what
we've learned from the images

1004
00:47:20,905 --> 00:47:24,809
that we've seen, if you have
maybe a favorite picture.

1005
00:47:24,809 --> 00:47:27,712
I mean, I know the
spectrometer and instruments

1006
00:47:27,712 --> 00:47:29,880
are very important
for science purposes,

1007
00:47:29,880 --> 00:47:32,383
but the images themselves
have also taught us a lot

1008
00:47:32,383 --> 00:47:35,453
about Saturn and all
these moons and all these

1009
00:47:35,453 --> 00:47:36,620
strange worlds,

1010
00:47:36,620 --> 00:47:38,723
so I'm hoping you could

all speak to that.

1011
00:47:38,723 --> 00:47:42,727
Just what the value of images
versus data that we would

1012
00:47:42,727 --> 00:47:43,894
put on a plot?

1013
00:47:45,029 --> 00:47:46,530
>> Linda: Well, I can
talk in particular

1014
00:47:46,530 --> 00:47:48,399
about the Grand Finale images.

1015
00:47:48,399 --> 00:47:50,534
In this particular
set of orbits,

1016
00:47:50,534 --> 00:47:53,704
we're getting closer to
the rings and to Saturn

1017
00:47:53,704 --> 00:47:55,372
than we've ever been before.

1018
00:47:55,372 --> 00:47:58,609
And the rings are
absolutely incredible.

1019
00:47:58,609 --> 00:48:00,311
As we look at some
of those pictures,

1020
00:48:00,311 --> 00:48:02,012
especially in Saturn's B ring,

1021
00:48:02,012 --> 00:48:05,916

we just see more and more
detail as we get closer

1022
00:48:05,916 --> 00:48:07,651
and go to higher resolution

1023
00:48:07,651 --> 00:48:10,121
that those individual ringlets
are trying to split up

1024
00:48:10,121 --> 00:48:12,223
into more ringlets and
additional ringlets

1025
00:48:12,223 --> 00:48:15,126
down to the limits
of our resolution.

1026
00:48:15,126 --> 00:48:18,028
And then we're seeing two kinds
of clumpiness in the rings,

1027
00:48:18,028 --> 00:48:20,998
kind of what we call a
streakiness and a clumpiness

1028
00:48:20,998 --> 00:48:23,834
and somehow those particles
are sticking together

1029
00:48:23,834 --> 00:48:26,303
in to long clumps that we
can now see in the pictures

1030
00:48:26,303 --> 00:48:29,106
and what's so intriguing
is you have region

1031
00:48:29,106 --> 00:48:31,976
with clumpiness and then

a region where it looks

1032
00:48:31,976 --> 00:48:34,145
like everything, the
particles are not clumping,

1033
00:48:34,145 --> 00:48:35,646
and back and forth

1034
00:48:37,114 --> 00:48:40,251
and so in a very short radial
scale, you're getting changes.

1035
00:48:40,251 --> 00:48:42,153
And then the clouds
in the atmosphere,

1036
00:48:42,153 --> 00:48:44,088
to see the detail of
those clouds

1037
00:48:44,088 --> 00:48:46,490
at much
higher resolution,

1038
00:48:46,490 --> 00:48:48,592
some a little fluffy clouds,
some look like little

1039
00:48:48,592 --> 00:48:50,728
dark holes in the atmosphere.

1040
00:48:50,728 --> 00:48:52,563
Just getting these
close up views provide

1041
00:48:52,563 --> 00:48:56,867
unique information and we
are also gonna get some,

1042
00:48:56,867 --> 00:49:00,204
not only, we're gonna get
some radar data on the rings

1043
00:49:00,204 --> 00:49:03,908
and can also perhaps have
radar maps and radar images

1044
00:49:03,908 --> 00:49:05,309
of the rings as well

1045
00:49:05,309 --> 00:49:08,045
and our visual and infrared
mapping spectrometer

1046
00:49:08,045 --> 00:49:10,047
also creates images
in the infrared

1047
00:49:10,047 --> 00:49:12,616
at longer wave lengths
than the camera.

1048
00:49:12,616 --> 00:49:14,418
So a whole host of images

1049
00:49:14,418 --> 00:49:16,220
and not only are they
scientifically interesting,

1050
00:49:16,220 --> 00:49:18,622
but these images are
incredibly beautiful.

1051
00:49:18,622 --> 00:49:22,159
Whether you're looking
at the hurricane

1052
00:49:22,159 --> 00:49:24,461

at the north pole or at
the rings themselves,

1053
00:49:24,461 --> 00:49:26,964
or even these montages
of the planets,

1054
00:49:26,964 --> 00:49:28,499
one of my favorites is
the back-lit Saturn,

1055
00:49:28,499 --> 00:49:32,236
so much detail coming
back from Cassini.

1056
00:49:32,236 --> 00:49:34,038
>> Earl: You know, it's
also important to remember

1057
00:49:34,038 --> 00:49:35,606
that we have an imaging radar.

1058
00:49:35,606 --> 00:49:39,176
So this isn't visual
imaging, but the radar has

1059
00:49:39,176 --> 00:49:42,079
pierced through the
clouds of Titan,

1060
00:49:42,079 --> 00:49:44,481
mapped the lakes, the
rivers, the plains,

1061
00:49:44,481 --> 00:49:47,251
in a way that we could
not possibly have done

1062
00:49:47,251 --> 00:49:50,754
without something

along those lines.

1063
00:49:50,754 --> 00:49:53,791
So we always throw radar
into the mix with our imaging

1064
00:49:53,791 --> 00:49:56,827
system because of the
remarkable images they have

1065
00:49:56,827 --> 00:50:00,998
of the lakes and all of
the methanologic cycle

1066
00:50:00,998 --> 00:50:03,567
that's going on on Titan.

1067
00:50:03,567 --> 00:50:05,569
>> Jane: Okay, and
there was one question

1068
00:50:05,569 --> 00:50:08,939
that ties in, and that's
from Lauries on Facebook,

1069
00:50:08,939 --> 00:50:11,809
does the Grand Finale
specifically shed light

1070
00:50:11,809 --> 00:50:14,144
on the origins of the rings?

1071
00:50:15,546 --> 00:50:18,215
>> Linda: Yes, the Grand
Finale data will ultimately

1072
00:50:18,215 --> 00:50:22,419
shed light on the origin
by determining their mass.

1073
00:50:22,419 --> 00:50:23,721
We'll get a hint
about their age.

1074
00:50:23,721 --> 00:50:26,891
If they're more
massive than we expect,

1075
00:50:26,891 --> 00:50:29,193
then perhaps they could be
as old as Saturn itself.

1076
00:50:29,193 --> 00:50:31,495
We're headed in the
less massive direction,

1077
00:50:31,495 --> 00:50:33,397
and so that means
that some object,

1078
00:50:33,397 --> 00:50:36,233
a comet, a moon, got
too close to Saturn

1079
00:50:36,233 --> 00:50:37,835
and was broken apart.

1080
00:50:37,835 --> 00:50:41,839
So yes, one of the key
goals of the Grand Finale

1081
00:50:41,839 --> 00:50:44,975
is to address the
question of the ring mass.

1082
00:50:44,975 --> 00:50:47,678
You can do that once
you're now inside

1083

00:50:47,678 --> 00:50:49,313
between the rings and Saturn.

1084
00:50:49,313 --> 00:50:52,283
>> Jane: Alright, we're
going to loop back

1085
00:50:52,283 --> 00:50:56,086
with a couple of more follow
up from media on the line,

1086
00:50:56,086 --> 00:50:59,623
let's take Leo Enright
of Irish Television.

1087
00:51:02,026 --> 00:51:02,960
>> Leo: Thanks Jane,

1088
00:51:02,960 --> 00:51:05,629
sorry to Earl Maize for this,

1089
00:51:05,629 --> 00:51:07,831
but I gotta ask a
political question,

1090
00:51:07,831 --> 00:51:10,467
but with a very small p.

1091
00:51:10,467 --> 00:51:14,338
Earl, you talked earlier
about Huygens, obviously,

1092
00:51:14,338 --> 00:51:18,976
and this is probably a
question better pitched

1093
00:51:18,976 --> 00:51:23,781
to John Casani, but I just
wonder if you wouldn't mind

1094
00:51:23,781 --> 00:51:26,984
talking a little bit
about how important

1095
00:51:26,984 --> 00:51:29,887
the international
collaboration was

1096
00:51:29,887 --> 00:51:33,190
and when I say a
political question,

1097
00:51:33,190 --> 00:51:34,558
I actually mean that.

1098
00:51:34,558 --> 00:51:36,760
I mean, would you be
prepared to venture into

1099
00:51:36,760 --> 00:51:40,364
how important this was
in terms of you know,

1100
00:51:40,364 --> 00:51:42,099
the State Department,

1101
00:51:44,635 --> 00:51:47,571
the deal that was done with
the State Department and so on

1102
00:51:47,571 --> 00:51:49,740
that meant that
NASA had to proceed.

1103
00:51:49,740 --> 00:51:51,542
I don't know how far--

1104
00:51:51,542 --> 00:51:53,344
>> Earl: Yeah, I think

it's in the public record

1105
00:51:53,344 --> 00:51:56,680
that Cassini was
facing cancellation

1106
00:51:56,680 --> 00:51:59,450
and Huygens came to the rescue.

1107
00:51:59,450 --> 00:52:03,954
We were really under
tremendous budget pressure,

1108
00:52:03,954 --> 00:52:05,723
the entire agency was,

1109
00:52:05,723 --> 00:52:08,525
and we have letters, I
have copies of letters

1110
00:52:08,525 --> 00:52:11,395
coming from very high
dignitaries on both sides

1111
00:52:11,395 --> 00:52:15,566
of the pond advocating
that Cassini remain funded.

1112
00:52:17,468 --> 00:52:20,104
Of course, Huygens had
no way to get to Titan

1113
00:52:20,104 --> 00:52:22,272
without Cassini.

1114
00:52:22,272 --> 00:52:25,376
You know, we on the other
hand, reciprocated when

1115

00:52:25,376 --> 00:52:27,244
Huygens had some
technical difficulties.

1116
00:52:27,244 --> 00:52:30,080
We at Cassini were
able to solve those.

1117
00:52:30,080 --> 00:52:31,081
So I think it's
been a tremendous

1118
00:52:31,081 --> 00:52:34,585
cooperative agreement,

1119
00:52:34,585 --> 00:52:35,886
but yeah, there have
been some politics

1120
00:52:35,886 --> 00:52:37,454
and both sides of--

1121
00:52:38,589 --> 00:52:42,359
We very much appreciate
the Huygens argument

1122
00:52:42,359 --> 00:52:44,561
on our behalf in the mid '90s.

1123
00:52:44,561 --> 00:52:47,898
>> Leo: Yeah, I actually
sat with John Casani

1124
00:52:47,898 --> 00:52:52,503
on a plane from LA to
Washington, so [laughs]

1125
00:52:52,503 --> 00:52:53,937
I know a bit about it.

1126
00:52:53,937 --> 00:52:55,172
Thanks very much.

1127
00:52:55,172 --> 00:52:56,440
>> Earl: It was
quite a tense time,

1128
00:52:56,440 --> 00:52:59,543
but it came out fine,
but we needed help.

1129
00:53:01,412 --> 00:53:03,047
>> Jane: Alright, we're gonna
take a question now from

1130
00:53:03,047 --> 00:53:05,315
Brian Reznick at Vox. Brian?

1131
00:53:07,284 --> 00:53:09,019
>> Brian: Hey, just a question,

1132
00:53:09,019 --> 00:53:13,090
one of you mentioned
Cassini will ultimately melt

1133
00:53:14,158 --> 00:53:15,559
in the atmosphere.

1134
00:53:15,559 --> 00:53:18,896
Does this happen in an
instant or do some components,

1135
00:53:18,896 --> 00:53:23,067
do some of the instruments
are they expected to fail

1136
00:53:24,635 --> 00:53:27,538
before others are
there [voice cuts out]?

1137
00:53:27,538 --> 00:53:31,008
Will its final demise take place

1138
00:53:31,008 --> 00:53:33,577
over any measurable time frame?

1139
00:53:34,711 --> 00:53:37,214
>> Jane: Brian, let
me jump in here.

1140
00:53:37,214 --> 00:53:38,982
We're having a little
trouble hearing you.

1141
00:53:38,982 --> 00:53:40,084
Would you mind?

1142
00:53:40,084 --> 00:53:42,219
>> Brian: Is this better?

1143
00:53:42,219 --> 00:53:43,387
I'm sorry.

1144
00:53:43,387 --> 00:53:44,888
>> Jane: Yes,
that's much better.

1145
00:53:44,888 --> 00:53:48,725
>> Brian: Great, yeah so one
of you mentioned that Cassini

1146
00:53:48,725 --> 00:53:52,663
will finally be broken
apart when it melts.

1147
00:53:52,663 --> 00:53:55,032
I was wondering does that
basically just happen

1148
00:53:55,032 --> 00:53:57,167
in an instant or
is that drawn out?

1149
00:53:57,167 --> 00:54:00,137
Will there be some
components of Cassini

1150
00:54:00,137 --> 00:54:04,174
that stay on longer than others
or is this just you know,

1151
00:54:04,174 --> 00:54:05,442
like a piece of

1152
00:54:07,144 --> 00:54:10,013
like flint or a piece
of lint in a fire.

1153
00:54:10,013 --> 00:54:12,716
And then I'm also
wondering does then Cassini

1154
00:54:12,716 --> 00:54:15,619
leave any permanent
trace on Saturn?

1155
00:54:15,619 --> 00:54:17,454
Like is it introducing
some elements

1156
00:54:17,454 --> 00:54:19,656
that never existed there?

1157
00:54:19,656 --> 00:54:22,993
Will there be any discernible
mark it makes on this planet

1158

00:54:22,993 --> 00:54:25,395
after it's all disintegrated?

1159
00:54:27,397 --> 00:54:29,299
>> Earl: Well, that's
a question, first part,

1160
00:54:29,299 --> 00:54:31,001
clearly for Julie.

1161
00:54:31,001 --> 00:54:32,503
Have you got that time
line memorized? [laughs]

1162
00:54:32,503 --> 00:54:35,005
>> Julie: Yeah, I got the time
line pretty well memorized.

1163
00:54:35,005 --> 00:54:36,673
It goes really fast.

1164
00:54:37,841 --> 00:54:40,410
It depends on what
you call an instant,

1165
00:54:40,410 --> 00:54:44,848
but it's 30 seconds to
a minute to get from--

1166
00:54:44,848 --> 00:54:46,583
First the blankets
will burn off,

1167
00:54:46,583 --> 00:54:49,286
just like you see when
you reenter the atmosphere

1168
00:54:49,286 --> 00:54:51,688
on Earth, the ablative shield

1169
00:54:51,688 --> 00:54:55,359
and then we'll reach the
aluminum melting point

1170
00:54:55,359 --> 00:54:57,261
within about 20 seconds

1171
00:54:59,496 --> 00:55:01,598
and then we'll hit

1172
00:55:01,598 --> 00:55:05,602
the iridium will be
the last thing to melt.

1173
00:55:05,602 --> 00:55:09,039
It will go about 30
seconds after the aluminum.

1174
00:55:09,039 --> 00:55:11,975
It goes within,
you know, a minute.

1175
00:55:16,280 --> 00:55:19,449
>> Brian: And then does
Cassini then leave anything

1176
00:55:19,449 --> 00:55:22,920
any permanent mark
on the planet or any

1177
00:55:22,920 --> 00:55:24,421
thing left behind?

1178
00:55:26,623 --> 00:55:30,127
>> Julie: Yeah, I think that's
a good question for Linda

1179
00:55:30,127 --> 00:55:31,461
but I think all the

elements of the universe

1180
00:55:31,461 --> 00:55:33,630
should be there right?

1181
00:55:33,630 --> 00:55:35,365
>> Linda: Right, I think
the mass of Cassini

1182
00:55:35,365 --> 00:55:38,936
is so small, relative
to the mass of Saturn,

1183
00:55:38,936 --> 00:55:42,339
we will have some ground
based observers watching

1184
00:55:42,339 --> 00:55:45,042
to see if there might be a
flash or something discernible,

1185
00:55:45,042 --> 00:55:49,012
but the plunge is actually
on the day side of Saturn

1186
00:55:49,012 --> 00:55:50,447
near local noon.

1187
00:55:50,447 --> 00:55:52,549
It's about nine
degrees north latitude,

1188
00:55:52,549 --> 00:55:55,552
but I think the mass
of Cassini is so small

1189
00:55:55,552 --> 00:55:59,022
that those molecules of
Cassini will spread out

1190
00:55:59,022 --> 00:56:00,924
around Saturn's atmosphere

1191
00:56:00,924 --> 00:56:04,561
and then probably the most
unusual might be the plutonium.

1192
00:56:04,561 --> 00:56:06,763
I don't think that Saturn
naturally has much in the way

1193
00:56:06,763 --> 00:56:08,298
of plutonium.

1194
00:56:08,298 --> 00:56:11,902
>> Jane: Okay, we have time
for a couple more questions.

1195
00:56:11,902 --> 00:56:14,738
Let's go to Dave Mosher
of Business Insider

1196
00:56:14,738 --> 00:56:16,240
for a follow up, Dave?

1197
00:56:16,240 --> 00:56:17,741
>> Dave: Yeah, thank you.

1198
00:56:17,741 --> 00:56:20,377
You could have make a better
segway because I wanted to get

1199
00:56:20,377 --> 00:56:22,746
to this question
earlier when addressing

1200
00:56:22,746 --> 00:56:23,981
my hypothetical,

1201
00:56:23,981 --> 00:56:26,016
I understand that the
Department of Energy

1202
00:56:26,016 --> 00:56:29,786
won't reach full scale
production of plutonium 238

1203
00:56:29,786 --> 00:56:32,122
for another six,
maybe seven years,

1204
00:56:32,122 --> 00:56:36,393
and I'm curious with
its sort of imperative

1205
00:56:36,393 --> 00:56:38,195
or big idea that go out
to Uranus and Neptune

1206
00:56:38,195 --> 00:56:40,197
and perhaps orbit Pluto,

1207
00:56:42,866 --> 00:56:45,269
are all of you I guess,
confident that there will be

1208
00:56:45,269 --> 00:56:48,338
enough plutonium
to make a mission

1209
00:56:48,338 --> 00:56:50,974
or missions like that
possible when the time comes

1210
00:56:50,974 --> 00:56:52,476
to launch them?

1211
00:56:52,476 --> 00:56:56,313

Because right now, there's
a pretty small supply

1212
00:56:56,313 --> 00:56:59,549
in the storehouse and
it's decaying every year.

1213
00:56:59,549 --> 00:57:02,986
>> Curt: Yeah, this is
Curt, I can answer that.

1214
00:57:02,986 --> 00:57:05,889
NASA's actually working with
the Department of Energy

1215
00:57:05,889 --> 00:57:08,125
to restart, in fact
we have restarted,

1216
00:57:08,125 --> 00:57:10,327
domestic production
of plutonium,

1217
00:57:10,327 --> 00:57:13,463
albeit on a small
scale with the ability

1218
00:57:13,463 --> 00:57:18,402
to ramp that up if we need,
to fuel any future missions

1219
00:57:18,402 --> 00:57:21,805
we have and we
actually have plutonium

1220
00:57:21,805 --> 00:57:24,908
already in hand that we
could use for our nuclear

1221
00:57:24,908 --> 00:57:26,376

power sources as well.

1222
00:57:26,376 --> 00:57:29,112
And in fact, the mission
competition that's currently

1223
00:57:29,112 --> 00:57:31,815
underway to select the
fourth new frontier's mission

1224
00:57:31,815 --> 00:57:35,519
offers up nuclear power
sources for the mission

1225
00:57:35,519 --> 00:57:38,121
proposers to use and
it offers up to three

1226
00:57:38,121 --> 00:57:41,658
of those power sources
to be available for

1227
00:57:41,658 --> 00:57:43,493
a 2024 to 2025 launch.

1228
00:57:45,829 --> 00:57:47,564
>> Linda: Also, just to
add that the plutonium

1229
00:57:47,564 --> 00:57:50,734
that we carry onboard
Cassini isn't dangerous.

1230
00:57:50,734 --> 00:57:52,769
Basically, we use the
decay of the plutonium,

1231
00:57:52,769 --> 00:57:56,873
the heat it generates, to
generate the electricity.

1232
00:57:56,873 --> 00:58:00,544
>> Jane: Okay, and I
guess we're gonna take

1233
00:58:00,544 --> 00:58:04,181
our final question form Marcia
Dunn of Associated Press

1234
00:58:04,181 --> 00:58:05,549
who has as follow up, Marcia?

1235
00:58:05,549 --> 00:58:08,285
>> Marcia: Yes,
hello, thank you.

1236
00:58:08,285 --> 00:58:10,887
I'm just wondering will
the plutonium on board

1237
00:58:10,887 --> 00:58:14,624
make for a slightly bigger
flash as it's dive bombing

1238
00:58:14,624 --> 00:58:16,526
into the atmosphere

1239
00:58:16,526 --> 00:58:20,464
and might any of that
get out to Enceladus

1240
00:58:20,464 --> 00:58:24,468
and any other potentially
habitable moons?

1241
00:58:24,468 --> 00:58:26,937
My second question
is just a general,

1242

00:58:26,937 --> 00:58:29,106
now that we're just
a few weeks away,

1243
00:58:29,106 --> 00:58:31,942
is it finally hitting home
the end of this mission

1244
00:58:31,942 --> 00:58:33,510
for you personally?

1245
00:58:33,510 --> 00:58:37,347
>> Earl: I can address
the plutonium question.

1246
00:58:37,347 --> 00:58:38,949
It probably won't.

1247
00:58:38,949 --> 00:58:41,718
This is not a fissile isotope.

1248
00:58:41,718 --> 00:58:45,322
So it's just going
to melt and it's clad

1249
00:58:45,322 --> 00:58:48,158
in iridium containers
that were to keep it safe

1250
00:58:48,158 --> 00:58:50,727
during any potential
mishaps during launch,

1251
00:58:50,727 --> 00:58:53,096
so the very highest
melting point material

1252
00:58:53,096 --> 00:58:57,267
on the entire spacecraft
is keeping the plutonium

1253
00:58:57,267 --> 00:58:59,669
enclosed so it's just
gonna be a liquid that

1254
00:58:59,669 --> 00:59:02,139
when the iridium finally
melts, just dissipates

1255
00:59:02,139 --> 00:59:03,340
into the atmosphere.

1256
00:59:03,340 --> 00:59:05,942
It is gonna be so hot in Saturn

1257
00:59:06,810 --> 00:59:08,478
that it will quickly dissipate.

1258
00:59:08,478 --> 00:59:10,480
I don't suspect it'll
be anything more.

1259
00:59:10,480 --> 00:59:12,382
The thing is you will
probably see more likely

1260
00:59:12,382 --> 00:59:15,485
would be of the flashing
material early in the demise

1261
00:59:15,485 --> 00:59:17,687
of Cassini as it gets
deep into the atmosphere.

1262
00:59:17,687 --> 00:59:22,125
I think any possibility
of it escaping is nil.

1263
00:59:22,125 --> 00:59:24,227

>> Linda: Yeah, I think Saturn
has a very deep gravity well

1264
00:59:24,227 --> 00:59:26,496
and at the speeds
we're traveling,

1265
00:59:26,496 --> 00:59:30,667
no parts of Cassini will come
out of Saturn essentially.

1266
00:59:32,035 --> 00:59:33,804
And then yeah as the
mission draws to a close,

1267
00:59:33,804 --> 00:59:35,605
you know, this is in many ways,

1268
00:59:35,605 --> 00:59:37,707
a really tough time.

1269
00:59:37,707 --> 00:59:40,844
Looking back over the
course of the mission,

1270
00:59:40,844 --> 00:59:45,482
I think in particular, can
sense sort of the Cassini

1271
00:59:45,482 --> 00:59:48,084
family we're reminiscing about
remember when this happened,

1272
00:59:48,084 --> 00:59:49,619
remember when that happened,

1273
00:59:49,619 --> 00:59:52,789
planning special events around
the time of the final plunge,

1274
00:59:52,789 --> 00:59:55,292
but also along with that,

1275
00:59:55,292 --> 00:59:58,328
I feel a tremendous sense
of pride in all that Cassini

1276
00:59:58,328 --> 00:59:59,763
has accomplished.

1277
00:59:59,763 --> 01:00:03,834
In so many ways, we've really
rewritten the text books

1278
01:00:03,834 --> 01:00:05,802
on Saturn system.

1279
01:00:05,802 --> 01:00:08,839
Literally, we have new books
coming out about Saturn,

1280
01:00:08,839 --> 01:00:12,008
the rings, magnetosphere,
so many new things

1281
01:00:12,008 --> 01:00:14,711
Cassini has discovered
and I'm very very proud

1282
01:00:14,711 --> 01:00:16,179
to have been a part of that.

1283
01:00:16,179 --> 01:00:18,081
You know, Cassini has
been a great mission.

1284
01:00:18,081 --> 01:00:20,050
We planned this end.

1285
01:00:20,050 --> 01:00:23,153
We had the fuel last exactly
the amount of time we needed

1286
01:00:23,153 --> 01:00:25,455
to get to Saturn
summer solstice.

1287
01:00:25,455 --> 01:00:26,556
So it's time,

1288
01:00:27,958 --> 01:00:29,626
it's time to take our
knowledge and information

1289
01:00:29,626 --> 01:00:32,529
and move that out
into future missions

1290
01:00:32,529 --> 01:00:35,398
to the outer planets and beyond.

1291
01:00:35,398 --> 01:00:37,634
>> Marcia: And how fast
will Cassini be going

1292
01:00:37,634 --> 01:00:38,935
at the very end?

1293
01:00:38,935 --> 01:00:41,137
I'm sorry that's my
very last question.

1294
01:00:41,137 --> 01:00:43,740
>> Earl: Are you European or?

1295
01:00:43,740 --> 01:00:45,909
>> Marcia: I'd rather have
it it miles, I'm U.S.,

1296
01:00:45,909 --> 01:00:46,877
but I'll take either.

1297
01:00:46,877 --> 01:00:48,178
>> Earl: 6,000 miles per hour.

1298
01:00:48,178 --> 01:00:51,681
>> Marcia: I'm sorry,
6,000 miles per hour?

1299
01:00:51,681 --> 01:00:53,450
>> Earl: 76,000 miles per hour.

1300
01:00:53,450 --> 01:00:55,886
>> Marcia: 76, thank you.

1301
01:00:55,886 --> 01:00:59,022
>> Jane: Alright,
thank you Marcia.

1302
01:00:59,022 --> 01:01:02,559
Thank you to all of the
panelists who spoke today.

1303
01:01:02,559 --> 01:01:04,060
Thank you to the
reporters for joining us,

1304
01:01:04,060 --> 01:01:07,230
and we have some good social
media questions as well.

1305
01:01:07,230 --> 01:01:09,366
So thanks for those who
follow us along that way.

1306
01:01:09,366 --> 01:01:13,737
Do want to let you know that

this telecon will be archived.

1307
01:01:13,737 --> 01:01:16,773
There are a couple of
ways you can rewatch it

1308
01:01:16,773 --> 01:01:18,041
or relisten to it.

1309
01:01:18,041 --> 01:01:21,811
Within two hours it will
be up on instant replay,

1310
01:01:21,811 --> 01:01:23,914
dialing in a toll free number

1311
01:01:23,914 --> 01:01:25,181
is 888-568-0771

1312
01:01:29,953 --> 01:01:31,288
or 203-369-3482.

1313
01:01:35,759 --> 01:01:37,027
That one is not toll free.

1314
01:01:37,027 --> 01:01:39,129
And a passcode is 882917,

1315
01:01:41,565 --> 01:01:42,399
882917.

1316
01:01:43,600 --> 01:01:45,602
We'll put that up
on the telecon page

1317
01:01:45,602 --> 01:01:47,837
so people can, if you
didn't catch that.

1318
01:01:47,837 --> 01:01:50,307
Also, if you want
to watch it archived

1319
01:01:50,307 --> 01:01:54,244
with visuals, it'll be on
Ustream in a little while,

1320
01:01:54,244 --> 01:01:57,981
and that's
www.ustream.tv/nasajpl2

1321
01:02:01,184 --> 01:02:04,187
and later on it will be
available on YouTube as well.

1322
01:02:04,187 --> 01:02:07,691
So multiple ways to
relive the excitement.

1323
01:02:08,825 --> 01:02:11,928
Okay, so there's lot
more info about Cassini,

1324
01:02:11,928 --> 01:02:14,230
including a brand new press kit

1325
01:02:14,230 --> 01:02:16,299
and information on how
you can follow along

1326
01:02:16,299 --> 01:02:20,136
with Cassini finale event
and that's online at

1327
01:02:21,504 --> 01:02:27,744
saturn.jpl.nasa.gov/grandfinale.

1328
01:02:27,744 --> 01:02:30,714

And we also have the
news release posted there

1329
01:02:30,714 --> 01:02:32,949
that went out in conjunction
with this telecon.