
ARTEMIS I
RETURN LUNAR FLYBY

1
00:00:02,930 --> 00:00:16,090
[Music]

2
00:00:16,100 --> 00:00:21,470
thank you

3
00:00:21,480 --> 00:00:32,030
[Music]

4
00:00:37,910 --> 00:00:34,729
good morning and welcome to the Johnson

5
00:00:40,250 --> 00:00:37,920
Space Center in Houston Texas I'm NASA's

6
00:00:42,650 --> 00:00:40,260
Sandra Jones and we're bringing you live

7
00:00:45,830 --> 00:00:42,660
coverage from Mission Control Houston of

8
00:00:48,410 --> 00:00:45,840
the upcoming return powered flyby in

9
00:00:50,690 --> 00:00:48,420
which Orion will fly behind the moon and

10
00:00:53,090 --> 00:00:50,700
perform a burn utilizing the orbital

11
00:00:55,430 --> 00:00:53,100
maneuvering system to send it on a

12
00:00:57,470 --> 00:00:55,440
trajectory back towards Earth this

13
00:00:59,569 --> 00:00:57,480

engine has been used numerous times

14
00:01:02,750 --> 00:00:59,579
throughout Orion's Journey thus far

15
00:01:05,690 --> 00:01:02,760
following Orion's launch atop the space

16
00:01:07,850 --> 00:01:05,700
launch system on November 26th all

17
00:01:10,429 --> 00:01:07,860
spacecraft systems are performing well

18
00:01:12,530 --> 00:01:10,439
now 20 days into the flight of Artemis

19
00:01:14,929 --> 00:01:12,540
1. today we're in the white flight

20
00:01:17,149 --> 00:01:14,939
control room where flight director Judd

21
00:01:20,330 --> 00:01:17,159
freeling is leading the team on console

22
00:01:23,270 --> 00:01:20,340
for today's flyby and burn we do expect

23
00:01:25,550 --> 00:01:23,280
to lose signal of Orion as it travels

24
00:01:27,530 --> 00:01:25,560
behind the back side of the moon as the

25
00:01:29,870 --> 00:01:27,540
moon will be blocking the direct site to

26
00:01:32,870 --> 00:01:29,880
the deep space Network we're tracking

27
00:01:35,390 --> 00:01:32,880
that loss of signal to begin at 10 1 41

28
00:01:38,030 --> 00:01:35,400
am Central this morning and will last 30

29
00:01:40,490 --> 00:01:38,040
minutes while in the loss of signal The

30
00:01:42,170 --> 00:01:40,500
Returned powered flyby burn will take

31
00:01:45,590 --> 00:01:42,180
place with the orbital maneuvering

32
00:01:47,630 --> 00:01:45,600
system engine at 10 43 am Central this

33
00:01:50,990 --> 00:01:47,640
will be the longest burn of the mission

34
00:01:53,270 --> 00:01:51,000
so far the burn will be 3 minutes and 27

35
00:01:55,429 --> 00:01:53,280
seconds long about one minute longer

36
00:01:57,710 --> 00:01:55,439
than the outbound powered flyby where

37
00:01:59,210 --> 00:01:57,720
Orion was placed in a trajectory to head

38
00:02:01,670 --> 00:01:59,220

out to deep space

39
00:02:04,310 --> 00:02:01,680
that burn occurred successfully on

40
00:02:06,469 --> 00:02:04,320
November 21st and the outbound powered

41
00:02:08,749 --> 00:02:06,479
flyby sent Orion close enough to the

42
00:02:10,969 --> 00:02:08,759
lunar surface to leverage the moon's

43
00:02:12,949 --> 00:02:10,979
gravitational force and swing the

44
00:02:15,110 --> 00:02:12,959
spacecraft once around the Moon toward

45
00:02:17,690 --> 00:02:15,120
entry into distant retrograde orbit

46
00:02:19,970 --> 00:02:17,700
following this Orion remained in the

47
00:02:22,670 --> 00:02:19,980
distant retrograde orbit for one long

48
00:02:29,690 --> 00:02:22,680
elliptical orbit around the Moon lasting

49
00:02:35,390 --> 00:02:32,869
we're now on the return journey of our

50
00:02:37,910 --> 00:02:35,400
trip and this last big push will bring

51
00:02:42,290 --> 00:02:37,920
Orion on the trajectory to head towards

52
00:02:47,690 --> 00:02:46,009
you are looking at a view of the Moon a

53
00:02:50,949 --> 00:02:47,700
live view as well as the Orion

54
00:02:54,830 --> 00:02:50,959
spacecraft right now Orion is

55
00:02:57,949 --> 00:02:54,840
5680 miles away from the Moon

56
00:03:01,790 --> 00:02:57,959
Orion is traveling at 3 800 miles per

57
00:03:06,490 --> 00:03:01,800
hour and Orion is over 230

58
00:03:11,509 --> 00:03:08,930
at the closest approach this morning

59
00:03:14,990 --> 00:03:11,519
Orion will be about 80 miles above the

60
00:03:19,490 --> 00:03:17,089
that closest approach will occur when we

61
00:03:44,809 --> 00:03:19,500
are behind the moon in that period of a

62
00:03:54,670 --> 00:03:47,570
we're about 2 hours and 38 minutes away

63
00:03:59,869 --> 00:03:57,949

again this burn will occur with the

64
00:04:03,110 --> 00:03:59,879
orbital maneuvering system engine or

65
00:04:13,490 --> 00:04:05,449
this burn this engine has been used for

66
00:04:18,530 --> 00:04:15,589
and you're looking at a view here on

67
00:04:21,349 --> 00:04:18,540
your screen of the Orion spacecraft that

68
00:04:23,330 --> 00:04:21,359
large engine on the very bottom of the

69
00:04:26,770 --> 00:04:23,340
European service module is the orbital

70
00:04:29,990 --> 00:04:26,780
maneuvering system or ohms engine

71
00:04:31,550 --> 00:04:30,000
this main engine is a repurposed space

72
00:04:33,530 --> 00:04:31,560
shuttle orbital maneuvering system

73
00:04:35,090 --> 00:04:33,540
engine that has flown in space many

74
00:04:37,730 --> 00:04:35,100
times before

75
00:04:40,370 --> 00:04:37,740
it actually flew on 19 space shuttle

76
00:04:44,390 --> 00:04:40,380
flights beginning with sts-41g in

77
00:04:47,390 --> 00:04:44,400
October of 1984 and ending with sts-112

78
00:04:49,490 --> 00:04:47,400
in October of 2002.

79
00:04:52,249 --> 00:04:49,500
now the ohms engine is not the only

80
00:04:54,469 --> 00:04:52,259
engine on board Orion there's also eight

81
00:04:56,870 --> 00:04:54,479
auxiliary engines which you see a few of

82
00:04:58,730 --> 00:04:56,880
here those are also like located on the

83
00:05:01,570 --> 00:04:58,740
bottom of the service module in four

84
00:05:06,409 --> 00:05:04,189
each of these engines can provide about

85
00:05:09,530 --> 00:05:06,419
100 pounds of thrust

86
00:06:43,689 --> 00:05:09,540
and these engines provide steering and

87
00:06:50,529 --> 00:06:47,390
again this is a live view from the Orion

88
00:06:57,950 --> 00:06:54,950

Orion is 5 500 miles away from the moon

89
00:07:00,590 --> 00:06:57,960
but closing in at closest approach later

90
00:07:05,629 --> 00:07:00,600
this morning Orion will be just 80 miles

91
00:07:11,330 --> 00:07:08,210
Orion has had quite the journey now 20

92
00:07:13,610 --> 00:07:11,340
days in to this 25 and a half day

93
00:07:17,150 --> 00:07:13,620
mission

94
00:07:19,909 --> 00:07:17,160
notably during this flight Orion beat

95
00:07:22,249 --> 00:07:19,919
the longest distance ever traveled for a

96
00:07:23,809 --> 00:07:22,259
human rated spacecraft meant to return

97
00:07:26,390 --> 00:07:23,819
home

98
00:07:28,809 --> 00:07:26,400
at its furthest point from Earth Orion

99
00:09:27,550 --> 00:07:28,819
was 268

100
00:09:32,930 --> 00:09:30,410
the views you're looking at right now of

101
00:09:37,490 --> 00:09:32,940
the Moon are being gathered with the saw

102
00:09:40,310 --> 00:09:37,500
cameras or solar array Wing camera

103
00:09:42,050 --> 00:09:40,320
the solar array wings are those x-shaped

104
00:09:43,730 --> 00:09:42,060
wings that stick out of the bottom of

105
00:09:46,009 --> 00:09:43,740
the Orion vehicle

106
00:09:48,410 --> 00:09:46,019
and they are used to collect solar power

107
00:09:54,410 --> 00:09:48,420
and distribute to the vehicle

108
00:10:00,590 --> 00:09:56,210
on the very edge of These Wings Are

109
00:10:05,210 --> 00:10:02,990
as you rotate the solar array Wings you

110
00:10:08,210 --> 00:10:05,220
are able to capture different views of

111
00:10:10,910 --> 00:10:08,220
not only the vehicle itself but also of

112
00:11:27,170 --> 00:10:10,920
both the moon and earlier on in the

113
00:11:31,370 --> 00:11:29,389

if you're just joining us this morning

114
00:11:34,310 --> 00:11:31,380
we are bringing you live coverage of

115
00:11:37,370 --> 00:11:34,320
today's outbound powered flyby burn this

116
00:11:40,190 --> 00:11:37,380
burn will bring Orion in a trajectory to

117
00:11:41,449 --> 00:11:40,200
head back home for a Splashdown on

118
00:11:43,730 --> 00:11:41,459
Sunday

119
00:11:46,490 --> 00:11:43,740
December 11th

120
00:11:50,030 --> 00:11:46,500
we are anticipating that burn to begin

121
00:11:51,949 --> 00:11:50,040
at 10 43 a.m Central Time

122
00:11:54,410 --> 00:11:51,959
but while we look ahead to the return

123
00:11:56,030 --> 00:11:54,420
powered flyby let's take a look back at

124
00:12:02,090 --> 00:11:56,040
some of the highlights from this

125
00:12:07,190 --> 00:12:04,550
first up we have the space launch system

126
00:12:09,769 --> 00:12:07,200
launching from pad 39b at the Kennedy

127
00:12:13,550 --> 00:12:09,779
Space Center in Florida with its sights

128
00:12:17,090 --> 00:12:13,560
set on the moon SLS blasted off at 12 47

129
00:12:19,970 --> 00:12:17,100
a.m Central on November 16th

130
00:12:24,790 --> 00:12:19,980
here you see the four rs-25 engines

131
00:12:30,350 --> 00:12:28,250
and this video shows SLS and Orion's

132
00:12:32,389 --> 00:12:30,360
climb to orbit from the perspective of a

133
00:12:34,610 --> 00:12:32,399
camera on the rocket

134
00:12:45,730 --> 00:12:34,620
it was about an eight and a half minute

135
00:12:51,110 --> 00:12:48,889
and following liftoff and that climb to

136
00:12:53,030 --> 00:12:51,120
orbit the translunar injection burn took

137
00:12:55,490 --> 00:12:53,040
place for Artemis one

138
00:12:57,290 --> 00:12:55,500

the tli maneuver took place as the upper

139
00:13:00,110 --> 00:12:57,300
part of the rocket officially named the

140
00:13:03,730 --> 00:13:00,120
interim cryogenic propulsion stage-fired

141
00:13:06,829 --> 00:13:03,740
one rl-10 engine producing 24

142
00:13:10,490 --> 00:13:06,839
750 pounds of thrust to accelerate the

143
00:13:12,590 --> 00:13:10,500
vehicle to more than 22 600 miles per

144
00:13:14,870 --> 00:13:12,600
hour a velocity fast enough to overcome

145
00:13:17,030 --> 00:13:14,880
the pull of Earth's gravity and Propel

146
00:13:18,650 --> 00:13:17,040
Orion out of low earth orbit to send the

147
00:13:21,949 --> 00:13:18,660
spacecraft to the Moon

148
00:13:24,110 --> 00:13:21,959
the tli maneuver precisely targeted a

149
00:13:26,449 --> 00:13:24,120
point above the Moon that will guide

150
00:13:28,910 --> 00:13:26,459
Orion close enough to be captured by the

151
00:13:30,829 --> 00:13:28,920
moon's gravity and right after that tli

152
00:13:33,050 --> 00:13:30,839
burn the interim cryogenic propulsion

153
00:13:35,329 --> 00:13:33,060
stage separated from Orion which you did

154
00:13:39,490 --> 00:13:35,339
just see a video of that on your screen

155
00:13:44,990 --> 00:13:42,410
later that day we received our very

156
00:13:46,910 --> 00:13:45,000
first imagery of Earth as well as

157
00:13:48,889 --> 00:13:46,920
completed the first checkout of the

158
00:13:51,829 --> 00:13:48,899
orbital maneuvering system engine or

159
00:13:53,750 --> 00:13:51,839
Ohm's engine which went smoothly Orion

160
00:13:56,509 --> 00:13:53,760
was officially on the way to the moon

161
00:13:58,970 --> 00:13:56,519
and again that Ohm's engine is the same

162
00:14:03,350 --> 00:13:58,980
engine that will be utilized today as we

163
00:14:08,329 --> 00:14:05,930

now several days later on November 21st

164
00:14:11,210 --> 00:14:08,339
Orion performed the outbound powered

165
00:14:13,129 --> 00:14:11,220
flyby burn with the orbital maneuvering

166
00:14:16,310 --> 00:14:13,139
engine as well

167
00:14:26,769 --> 00:14:16,320
this video shows Orion as it approaches

168
00:14:32,569 --> 00:14:30,769
and following that burn Orion completed

169
00:14:34,250 --> 00:14:32,579
its closest approach to the lunar

170
00:14:37,150 --> 00:14:34,260
surface where it was just about 80 miles

171
00:14:40,129 --> 00:14:37,160
above the lunar surface

172
00:14:44,689 --> 00:14:40,139
and then Orion completed the distant

173
00:14:54,530 --> 00:14:47,509
which enabled Orion to head out into

174
00:14:59,689 --> 00:14:57,949
now this video that your this photo that

175
00:15:02,750 --> 00:14:59,699
you're looking at on your screen was

176
00:15:08,930 --> 00:15:02,760
taken while Orion was in that distant

177
00:15:14,750 --> 00:15:11,930
and this was the furthest point that

178
00:15:16,870 --> 00:15:14,760
Orion reached during its Mission Orion

179
00:15:19,910 --> 00:15:16,880
was 268

180
00:15:23,389 --> 00:15:19,920
563 miles from our home planet when this

181
00:15:26,090 --> 00:15:23,399
photo was taken on November 28th

182
00:15:28,129 --> 00:15:26,100
Orion has now traveled further than any

183
00:15:35,090 --> 00:15:28,139
spacecraft built for humans meant to

184
00:15:40,069 --> 00:15:38,269
and in this photo Orion solar rays split

185
00:15:42,949 --> 00:15:40,079
the difference between the Earth and the

186
00:15:45,470 --> 00:15:42,959
moon on flight day 14.

187
00:15:47,269 --> 00:15:45,480
this image was captured by a camera on

188
00:15:56,110 --> 00:15:47,279

the tip of one of the spacecraft's four

189
00:16:00,530 --> 00:15:58,370
and just last week the distant

190
00:16:03,170 --> 00:16:00,540
retrograde departure burn occurred which

191
00:16:05,210 --> 00:16:03,180
placed Orion in a trajectory to exit

192
00:16:07,610 --> 00:16:05,220
distant retrograde orbit and head back

193
00:16:09,470 --> 00:16:07,620
toward the moon ahead of RPF today which

194
00:16:12,050 --> 00:16:09,480
we are awaiting and looking forward to

195
00:16:15,410 --> 00:16:12,060
and here's some video just prior to that

196
00:16:20,389 --> 00:16:18,710
and you can see Earth there in the

197
00:16:31,250 --> 00:16:20,399
almost Center of your screen right

198
00:16:36,590 --> 00:16:34,370
so as you can see Orion has had an

199
00:16:39,050 --> 00:16:36,600
exciting Journey so far but still a few

200
00:16:42,009 --> 00:16:39,060
days left in this mission

201
00:16:46,850 --> 00:16:42,019
at this time Orion is

202
00:16:49,970 --> 00:16:46,860
5191 miles away from the lunar surface

203
00:16:52,249 --> 00:16:49,980
and we're under two hours and 30 minutes

204
00:16:54,530 --> 00:16:52,259
away from today's return power flyby

205
00:16:59,810 --> 00:16:54,540
burn

206
00:17:02,509 --> 00:16:59,820
43 a.m Central

207
00:21:28,190 --> 00:17:02,519
and will be a three minute 27 second

208
00:21:33,649 --> 00:21:31,130
again you're looking at a live view of

209
00:21:37,610 --> 00:21:33,659
the Moon as it continues to close as

210
00:21:40,610 --> 00:21:37,620
Orion continues to close in now 5058

211
00:21:43,630 --> 00:21:40,620
miles above the lunar surface

212
00:21:46,070 --> 00:21:43,640
Orion is traveling at a velocity of

213
00:22:18,970 --> 00:21:46,080

3933 miles per hour

214
00:22:25,909 --> 00:22:22,789
now in this image of Earth right now we

215
00:22:28,610 --> 00:22:25,919
actually are able to view several Apollo

216
00:22:30,590 --> 00:22:28,620
sites Apollo Landing sites rather of

217
00:22:33,049 --> 00:22:30,600
course we are a bit too far away to make

218
00:22:35,390 --> 00:22:33,059
out any distinct features but you are

219
00:23:10,149 --> 00:22:35,400
looking at the Landing sites for Apollo

220
00:23:14,149 --> 00:23:12,590
and you are looking at a graphic here

221
00:23:17,210 --> 00:23:14,159
that shows a little more clearly those

222
00:23:20,570 --> 00:23:17,220
Landing sites in Orion's path as

223
00:23:22,850 --> 00:23:20,580
it flies around it again Orion is about

224
00:23:24,529 --> 00:23:22,860
5 000 miles away from the lunar surface

225
00:23:26,930 --> 00:23:24,539
so we won't be able to make out any

226
00:23:29,029 --> 00:23:26,940
details

227
00:23:31,010 --> 00:23:29,039
and at its closest approach Orion will

228
00:23:32,990 --> 00:23:31,020
be 80 miles above the lunar surface

229
00:23:55,130 --> 00:23:33,000
still a little too far to make out any

230
00:23:55,140 --> 00:24:20,149
know

231
00:24:20,159 --> 00:24:22,789
s

232
00:24:22,799 --> 00:25:17,169
foreign

233
00:25:22,430 --> 00:25:20,090
as we continue to get these great views

234
00:25:24,230 --> 00:25:22,440
of the Moon we did mention that NASA

235
00:25:26,029 --> 00:25:24,240
flight director Rick labrode is leading

236
00:25:28,490 --> 00:25:26,039
the team here in Mission Control Houston

237
00:25:30,710 --> 00:25:28,500
inside the white flight control room

238
00:25:32,570 --> 00:25:30,720

during today's burn

239
00:25:35,269 --> 00:25:32,580
but let's take a quick look at this

240
00:25:37,190 --> 00:25:35,279
video which discusses the various flight

241
00:25:42,049 --> 00:25:37,200
directors of Artemis in a little bit

242
00:25:47,810 --> 00:25:44,990
for cooling status Quantico AOS good for

243
00:25:51,710 --> 00:25:47,820
happy flight controllers generally focus

244
00:25:54,169 --> 00:25:51,720
on systems subsystems of the vehicle and

245
00:25:56,510 --> 00:25:54,179
they they're more in tune with the

246
00:26:00,070 --> 00:25:56,520
detailed workings of their particular

247
00:26:03,110 --> 00:26:00,080
system that they're responsible for

248
00:26:04,850 --> 00:26:03,120
flight directors on the other hand are

249
00:26:06,769 --> 00:26:04,860
more in tune with what is the

250
00:26:08,990 --> 00:26:06,779
integration between all of the

251
00:26:10,610 --> 00:26:09,000
subsystems what are we all marching

252
00:26:12,950 --> 00:26:10,620
towards what's our mission objective

253
00:26:15,649 --> 00:26:12,960
prop flight has the RCs holding together

254
00:26:17,510 --> 00:26:15,659
with the brakes really your training

255
00:26:19,909 --> 00:26:17,520
starts when you become a flight

256
00:26:22,669 --> 00:26:19,919
controller you know you you learn a lot

257
00:26:24,950 --> 00:26:22,679
by osmosis and you kind of get a sense

258
00:26:27,350 --> 00:26:24,960
of a little bit of the job but once you

259
00:26:29,269 --> 00:26:27,360
become a flight director the amount of

260
00:26:31,250 --> 00:26:29,279
learning you do is exponential you don't

261
00:26:32,810 --> 00:26:31,260
become an expert but you have to

262
00:26:34,490 --> 00:26:32,820
understand at a depth where you could

263
00:26:35,990 --> 00:26:34,500

have the good conversation ask the right

264
00:26:37,669 --> 00:26:36,000
questions to The Experts who are the

265
00:26:40,010 --> 00:26:37,679
flight controllers they spent a lot of

266
00:26:41,690 --> 00:26:40,020
time studying and then training getting

267
00:26:44,330 --> 00:26:41,700
in simulations and running through all

268
00:26:46,490 --> 00:26:44,340
the motions and practicing the real time

269
00:26:47,529 --> 00:26:46,500
situation scenarios in the training

270
00:26:50,390 --> 00:26:47,539
environment

271
00:26:53,149 --> 00:26:50,400
I am the ascent and entry flight

272
00:26:56,269 --> 00:26:53,159
director for Artemis one I will pick

273
00:26:58,370 --> 00:26:56,279
responsibility of the vehicle after it

274
00:27:00,230 --> 00:26:58,380
launches also be the entry flight

275
00:27:03,590 --> 00:27:00,240
director so once we come back to earth

276
00:27:05,630 --> 00:27:03,600
I'll have a team that will Monitor and

277
00:27:08,330 --> 00:27:05,640
control the vehicle once it splashes

278
00:27:10,330 --> 00:27:08,340
down and we hand that over to Melissa

279
00:27:13,909 --> 00:27:10,340
Jones who is the NASA recovery director

280
00:27:14,990 --> 00:27:13,919
Splashtown touchdown verify copy I'm the

281
00:27:16,730 --> 00:27:15,000
lead flight director for the mission

282
00:27:19,430 --> 00:27:16,740
really responsible for the overall

283
00:27:22,190 --> 00:27:19,440
development of the mission we work

284
00:27:24,710 --> 00:27:22,200
directly with the programs they provide

285
00:27:26,029 --> 00:27:24,720
us the mission priorities and we build a

286
00:27:27,350 --> 00:27:26,039
timeline that's going to accomplish

287
00:27:28,610 --> 00:27:27,360
those mission objectives we're

288
00:27:30,890 --> 00:27:28,620

responsible for building their team

289
00:27:32,750 --> 00:27:30,900
getting our team trained and certified

290
00:27:34,669 --> 00:27:32,760
we have a training team that helps us

291
00:27:36,169 --> 00:27:34,679
but we have the overall responsibility

292
00:27:38,149 --> 00:27:36,179
for putting together the team that's

293
00:27:39,850 --> 00:27:38,159
going to execute the mission

294
00:27:43,549 --> 00:27:39,860
foreign

295
00:27:46,130 --> 00:27:43,559
ER injection burn cutoff when you go to

296
00:27:49,010 --> 00:27:46,140
a place like the moon or Mars

297
00:27:51,710 --> 00:27:49,020
you really have to be explorers it

298
00:27:53,330 --> 00:27:51,720
pushes the boundaries of civilization we

299
00:27:54,950 --> 00:27:53,340
are having to develop new technology

300
00:27:56,870 --> 00:27:54,960
that's going to have to sustain the

301
00:27:58,669 --> 00:27:56,880
astronauts for these very very long

302
00:28:00,409 --> 00:27:58,679
trips and it just makes sense to test

303
00:28:01,970 --> 00:28:00,419
that and go into the moon where you're

304
00:28:03,950 --> 00:28:01,980
in a similar environment but you're much

305
00:28:05,690 --> 00:28:03,960
closer in the event of an emergency type

306
00:28:06,649 --> 00:28:05,700
scenario we can bring them safely back

307
00:28:10,010 --> 00:28:06,659
home

308
00:28:12,169 --> 00:28:10,020
station this is Houston we've we've had

309
00:28:15,169 --> 00:28:12,179
a lot of experience now in low earth

310
00:28:17,450 --> 00:28:15,179
orbit you know over 50 60 years of

311
00:28:19,549 --> 00:28:17,460
experience and we've learned how to do

312
00:28:21,470 --> 00:28:19,559
that pretty well we've learned what the

313
00:28:23,870 --> 00:28:21,480

effects of the body are in low Earth are

314
00:28:25,909 --> 00:28:23,880
but there's still things that we need to

315
00:28:27,130 --> 00:28:25,919
practice and we need to be able to

316
00:28:30,470 --> 00:28:27,140
understand

317
00:28:32,350 --> 00:28:30,480
how you sustain life further and further

318
00:28:37,490 --> 00:28:32,360
and further away from our planet

319
00:28:39,769 --> 00:28:37,500
[Music]

320
00:28:41,510 --> 00:28:39,779
it's just so different from everything

321
00:28:43,370 --> 00:28:41,520
you learn when you do low earth orbit

322
00:28:45,649 --> 00:28:43,380
it's and that's what's making it so much

323
00:28:47,510 --> 00:28:45,659
fun everybody is excited about this

324
00:28:50,200 --> 00:28:47,520
Mission as I was the first day I walked

325
00:28:58,990 --> 00:28:50,210
in the doors of Mission Control

326
00:29:03,850 --> 00:29:02,149
Orion is now less than 5 000 miles away

327
00:29:07,250 --> 00:29:03,860
from the Moon

328
00:29:09,250 --> 00:29:07,260
4833 miles away to be exact traveling at

329
00:29:16,130 --> 00:29:09,260
a velocity of

330
00:29:21,950 --> 00:29:19,010
we're two hours and 13 minutes away from

331
00:29:48,769 --> 00:29:24,049
from today's burn we're still targeting

332
00:29:48,779 --> 00:30:52,149
foreign

333
00:31:21,289 --> 00:31:09,470
thank you

334
00:31:25,730 --> 00:31:23,570
everything continuing to proceed

335
00:31:28,850 --> 00:31:25,740
smoothly this morning as we anticipate

336
00:31:34,070 --> 00:31:28,860
the return powered flyby burn in about 2

337
00:31:39,169 --> 00:31:37,130
this burn will last for 3 minutes and 27

338
00:31:46,549 --> 00:31:39,179

seconds and will change the velocity of

339
00:31:53,450 --> 00:31:50,029
and this burn will also Place Orion in a

340
00:31:56,210 --> 00:31:53,460
trajectory to head back home ahead of a

341
00:32:08,269 --> 00:31:56,220
Splashdown in the Pacific Ocean on

342
00:32:13,250 --> 00:32:10,730
the next major Milestone here in Mission

343
00:32:15,769 --> 00:32:13,260
Control Houston is when Flight director

344
00:32:18,649 --> 00:32:15,779
Judd freeling will pull the team of

345
00:32:23,690 --> 00:32:18,659
flight controllers for a go no-go for

346
00:33:53,090 --> 00:32:26,450
we anticipate that poll about an hour

347
00:35:15,109 --> 00:34:10,909
foreign

348
00:35:20,510 --> 00:35:17,569
we're just about an hour away from

349
00:35:23,329 --> 00:35:20,520
today's anticipation anticipated loss of

350
00:35:26,329 --> 00:35:23,339
signal that Los is slated to begin at 10

351
00:35:29,270 --> 00:35:26,339
41 am Central

352
00:35:30,890 --> 00:35:29,280
we will not have signal with the Orion

353
00:35:33,109 --> 00:35:30,900
spacecraft during this time frame

354
00:35:36,950 --> 00:35:33,119
because the moon will be blocking any

355
00:35:40,970 --> 00:35:38,990
it's at this point that Orion will

356
00:35:43,250 --> 00:35:40,980
complete its closest approach to the

357
00:35:47,150 --> 00:35:43,260
lunar surface that closest approach

358
00:35:50,150 --> 00:35:47,160
slated to be at 10 43 am and just

359
00:35:52,790 --> 00:35:50,160
seconds later at 10 43 and 23 seconds am

360
00:35:56,210 --> 00:35:52,800
Central will be today's return powered

361
00:36:47,410 --> 00:35:56,220
flyby burn which commits Orion to a

362
00:36:53,270 --> 00:36:49,870
Orion is now

363
00:36:55,450 --> 00:36:53,280

4571 miles away from the moon traveling

364
00:37:31,010 --> 00:36:55,460
at a velocity of

365
00:37:31,020 --> 00:38:19,210
okay

366
00:38:23,870 --> 00:38:21,890
everything continuing to look good this

367
00:38:27,890 --> 00:38:23,880
morning ahead of the return powered

368
00:38:32,930 --> 00:38:30,890
that burn will take place two hours and

369
00:38:36,349 --> 00:38:32,940
four minutes from now and will last

370
00:38:38,390 --> 00:38:36,359
three minutes and 27 seconds long

371
00:38:40,069 --> 00:38:38,400
the burn will take place with the

372
00:38:43,010 --> 00:38:40,079
orbital maneuvering system engine or

373
00:38:47,810 --> 00:38:43,020
ohms engine located on the bottom of the

374
00:38:53,390 --> 00:38:50,630
this engine is capable of

375
00:39:03,730 --> 00:38:53,400
having burns that last less than one

376
00:39:08,450 --> 00:39:06,650
the ohms engine is the main engine on

377
00:39:11,329 --> 00:39:08,460
the European service module and provides

378
00:39:13,730 --> 00:39:11,339
the primary propulsion for Orion's major

379
00:39:16,250 --> 00:39:13,740
in-space maneuvers

380
00:39:18,109 --> 00:39:16,260
the engine produces 6 000 pounds of

381
00:39:20,750 --> 00:39:18,119
thrust and is equipped to steer the

382
00:39:23,210 --> 00:39:20,760
spacecraft and it can also be used in

383
00:39:27,710 --> 00:39:23,220
some abort cases to safely return Orion

384
00:39:32,089 --> 00:39:30,349
the ohms engine is actually a repurposed

385
00:39:35,210 --> 00:39:32,099
space shuttle orbital maneuvering system

386
00:39:38,290 --> 00:39:35,220
engine that has flown in space before on

387
00:39:42,490 --> 00:39:38,300
19 space shuttle flights beginning with

388
00:39:47,750 --> 00:39:42,500

sts-41g in October 1984 and ending with

389
00:39:52,849 --> 00:39:50,690
there are also eight auxiliary engines

390
00:39:54,950 --> 00:39:52,859
on Orion

391
00:39:56,690 --> 00:39:54,960
these are all also located on the bottom

392
00:40:00,470 --> 00:39:56,700
of the service module and can provide

393
00:40:06,470 --> 00:40:04,190
and there are 24 smaller engines grouped

394
00:40:09,109 --> 00:40:06,480
into six pods which can provide attitude

395
00:40:12,050 --> 00:40:09,119
control as well

396
00:40:14,690 --> 00:40:12,060
so in total the service module has 33

397
00:40:19,310 --> 00:40:17,630
but today for the return power flyby

398
00:40:21,589 --> 00:40:19,320
burn we'll only be using one of those

399
00:41:55,569 --> 00:40:21,599
again the orbital maneuvering system or

400
00:42:01,130 --> 00:41:58,130
everything continuing to look good here

401
00:42:03,290 --> 00:42:01,140
in mission control as Orion closes in on

402
00:42:04,910 --> 00:42:03,300
the moon ahead of today's return power

403
00:42:07,069 --> 00:42:04,920
flyby burn

404
00:42:08,870 --> 00:42:07,079
before enduring the Artemis 1 Mission we

405
00:42:12,470 --> 00:42:08,880
asked the public to share your moon

406
00:42:14,930 --> 00:42:12,480
inspired creations with the hashtag NASA

407
00:42:16,490 --> 00:42:14,940
moonsnap we have received thousands of

408
00:42:20,210 --> 00:42:16,500
submissions but here are just a few of

409
00:42:25,849 --> 00:42:23,810
this is a mural painted by Nikki Adams

410
00:42:27,890 --> 00:42:25,859
you can clearly see the space launch

411
00:42:29,930 --> 00:42:27,900
system rocket as well as the Greek

412
00:42:31,790 --> 00:42:29,940
goddess Artemis after which the Artemis

413
00:42:33,950 --> 00:42:31,800

missions are named

414
00:42:35,569 --> 00:42:33,960
Artemis is the goddess of the moon and

415
00:42:37,790 --> 00:42:35,579
the hunt and I think you can see her

416
00:42:42,310 --> 00:42:37,800
arrows and a deer included in the mural

417
00:42:48,170 --> 00:42:45,050
next up we have a photo submitted by

418
00:42:51,530 --> 00:42:48,180
Jessa Rodriguez the title is Ben and

419
00:42:56,390 --> 00:42:53,870
you can see the inclusion of Snoopy in

420
00:42:59,390 --> 00:42:56,400
his flight suit as well Snoopy is our

421
00:43:00,890 --> 00:42:59,400
zero gravity indicator aboard the Orion

422
00:43:03,950 --> 00:43:00,900
spacecraft

423
00:43:05,930 --> 00:43:03,960
and the Snoopy inside Orion right now is

424
00:43:12,010 --> 00:43:05,940
dressed very similarly to the Snoopy in

425
00:43:17,809 --> 00:43:14,990
what we see here is a 3D printed art

426
00:43:21,410 --> 00:43:17,819
piece from Terra Moto the artist

427
00:43:24,230 --> 00:43:21,420
entitled this piece lunar specimen 001

428
00:43:27,050 --> 00:43:24,240
and used real data from the lunar

429
00:43:29,630 --> 00:43:27,060
reconnaissance Orbiter to create this

430
00:43:31,309 --> 00:43:29,640
lro data is also being used to determine

431
00:43:37,190 --> 00:43:31,319
where astronauts will land on the moon

432
00:43:41,690 --> 00:43:39,410
and the last image we have to show you

433
00:43:44,750 --> 00:43:41,700
today is from stem educator Susie

434
00:43:47,390 --> 00:43:44,760
Bennett she taught her 130 students

435
00:43:50,030 --> 00:43:47,400
about the Artemis 1 Mission and even got

436
00:43:53,030 --> 00:43:50,040
them to fill out boarding passes there

437
00:43:54,589 --> 00:43:53,040
are currently 3.4 million names of the

438
00:43:56,990 --> 00:43:54,599

public flying aboard the Orion

439
00:43:58,309 --> 00:43:57,000
spacecraft safely stowed on a flash

440
00:44:00,710 --> 00:43:58,319
drive

441
00:44:02,990 --> 00:44:00,720
thank you to everyone who shared your

442
00:44:04,849 --> 00:44:03,000
moon inspired creations with us if

443
00:46:35,750 --> 00:44:04,859
you're interested in participating just

444
00:46:40,130 --> 00:46:37,609
we're continuing to get some great

445
00:46:42,069 --> 00:46:40,140
imagery of the lunar surface here as

446
00:46:45,230 --> 00:46:42,079
Orion is

447
00:46:47,329 --> 00:46:45,240
4227 miles away from the moon traveling

448
00:46:48,829 --> 00:46:47,339
at a velocity of over 4 000 miles per

449
00:46:52,550 --> 00:46:48,839
hour

450
00:47:00,109 --> 00:46:52,560
this imagery is coming from a camera on

451
00:47:05,329 --> 00:47:02,569
we expect to continue to get imagery up

452
00:47:07,430 --> 00:47:05,339
until the point that Orion does go

453
00:47:11,569 --> 00:47:07,440
behind the moon and is in that loss of

454
00:47:16,490 --> 00:47:13,730
that will be a 30 minute loss of signal

455
00:47:18,650 --> 00:47:16,500
period beginning at 10 41 am central

456
00:47:20,390 --> 00:47:18,660
time this morning

457
00:47:23,150 --> 00:47:20,400
and just two minutes after the Los

458
00:47:25,250 --> 00:47:23,160
begins or that loss of signal period we

459
00:47:28,849 --> 00:47:25,260
will have the return powered flyby burn

460
00:47:31,670 --> 00:47:28,859
occur at 10 43 a.m Central lasting 3

461
00:49:31,690 --> 00:47:31,680
minutes and 27 seconds utilizing the

462
00:49:36,650 --> 00:49:34,309
this is Mission Control Houston you're

463
00:49:40,430 --> 00:49:36,660

looking at a Telemetry driven animation

464
00:49:43,849 --> 00:49:40,440
of Orion as it travels at 4 000 miles

465
00:49:46,250 --> 00:49:43,859
per hour closing in on the moon now 4131

466
00:49:48,849 --> 00:49:46,260
one miles away

467
00:49:53,030 --> 00:49:48,859
Orion is 234

468
00:49:59,750 --> 00:49:56,510
Orion launched on November 16th and is

469
00:50:03,770 --> 00:49:59,760
in the 20th day of its 25 and a half day

470
00:50:08,930 --> 00:50:06,530
Orion is an uncrewed test flight but is

471
00:50:12,109 --> 00:50:08,940
performing critical checkouts of its

472
00:50:17,390 --> 00:50:12,119
systems ahead of a crude test flight as

473
00:50:22,069 --> 00:50:19,370
throughout this Mission Orion has

474
00:50:24,890 --> 00:50:22,079
completed several Milestones including

475
00:50:26,930 --> 00:50:24,900
flying behind the moon once already as

476
00:50:30,829 --> 00:50:26,940
part of the outbound powered flyby

477
00:50:32,870 --> 00:50:30,839
during that a burn took place which put

478
00:50:35,650 --> 00:50:32,880
Orion in a trajectory to head out to

479
00:50:41,870 --> 00:50:39,650
the distant retrograde orbit burn also

480
00:50:43,609 --> 00:50:41,880
occurred which further propelled Orion

481
00:50:46,430 --> 00:50:43,619
into that trajectory

482
00:50:48,589 --> 00:50:46,440
and Orion remained in deep space for

483
00:50:51,290 --> 00:50:48,599
about six days and broke the distance

484
00:50:53,990 --> 00:50:51,300
record during that time frame for the

485
00:50:56,089 --> 00:50:54,000
farthest distance from Earth traveled by

486
00:50:58,849 --> 00:50:56,099
a human rated spacecraft meant to return

487
00:51:03,609 --> 00:51:01,190
Orion at its furthest point from Earth

488
00:51:09,430 --> 00:51:03,619

was 268

489
00:51:14,329 --> 00:51:12,170
following Matt Orion hung out in deep

490
00:51:16,309 --> 00:51:14,339
space for a little longer and just a few

491
00:51:19,490 --> 00:51:16,319
days ago we had the

492
00:51:22,130 --> 00:51:19,500
Dr D burn or distant retrograde

493
00:51:25,010 --> 00:51:22,140
departure burn

494
00:51:26,930 --> 00:51:25,020
this burn put Orion on a trajectory to

495
00:51:33,890 --> 00:51:26,940
head back towards the moon ahead of

496
00:51:39,950 --> 00:51:36,890
today's burn is critical to ensure that

497
00:52:57,589 --> 00:51:39,960
Orion is on the proper trajectory to

498
00:52:57,599 --> 00:56:18,109
thank you

499
00:56:18,119 --> 00:57:20,950
foreign

500
00:57:26,329 --> 00:57:24,290
we are now one hour and 42 minutes and

501
00:57:29,870 --> 00:57:26,339
Counting away from today's anticipated

502
00:57:32,089 --> 00:57:29,880
loss of signal as Orion flies behind the

503
00:57:34,130 --> 00:57:32,099
moon and performs the return powered

504
00:57:36,770 --> 00:57:34,140
flyby burn which will set us on a

505
00:57:39,530 --> 00:57:36,780
trajectory to return back to Earth and

506
00:57:42,410 --> 00:57:39,540
splash down in the Pacific Ocean on

507
00:57:44,630 --> 00:57:42,420
December 11th but now it as you can

508
00:57:47,270 --> 00:57:44,640
imagine this moment can certainly be a

509
00:57:48,890 --> 00:57:47,280
bit suspenseful as we await Orion to

510
00:57:51,349 --> 00:57:48,900
emerge from the back side of the moon

511
00:57:54,109 --> 00:57:51,359
and regain Communications with the deep

512
00:57:56,030 --> 00:57:54,119
space Network so let's hear from one of

513
00:57:59,450 --> 00:57:56,040

the inco flight controllers about how

514
00:58:01,849 --> 00:57:59,460
much that is the case in this next clip

515
00:58:03,170 --> 00:58:01,859
during each Mission To The Moon we'll

516
00:58:05,329 --> 00:58:03,180
have a period of time where the

517
00:58:07,670 --> 00:58:05,339
spacecraft goes behind the moon and we

518
00:58:10,490 --> 00:58:07,680
lose line of sight with the spacecraft

519
00:58:13,309 --> 00:58:10,500
from the DSN stations

520
00:58:15,650 --> 00:58:13,319
uh that can be quite a nail-biting time

521
00:58:18,530 --> 00:58:15,660
usually we're executing

522
00:58:20,930 --> 00:58:18,540
um an important maneuver or a burn uh

523
00:58:23,750 --> 00:58:20,940
during that time and

524
00:58:26,450 --> 00:58:23,760
we have a predicted time when we should

525
00:58:28,549 --> 00:58:26,460
reacquire the signal and so everybody is

526
00:58:31,370 --> 00:58:28,559
usually staring at that clock

527
00:58:34,430 --> 00:58:31,380
as soon as the signal comes in-house

528
00:58:36,170 --> 00:58:34,440
there's a sigh of relief and we check to

529
00:58:37,789 --> 00:58:36,180
make sure that the burn executed

530
00:58:41,150 --> 00:58:37,799
correctly and that the spacecraft is in

531
00:58:46,010 --> 00:58:43,910
so again we are anticipating that loss

532
00:58:47,990 --> 00:58:46,020
of signal to begin an hour and 41

533
00:58:50,390 --> 00:58:48,000
minutes from now

534
00:58:52,490 --> 00:58:50,400
today's loss of signal will last 30

535
00:58:54,770 --> 00:58:52,500
minutes in length

536
00:58:56,750 --> 00:58:54,780
during which time Orion will complete

537
00:58:58,849 --> 00:58:56,760
its closest approach to the moon and

538
00:59:01,789 --> 00:58:58,859

just seconds later perform the return

539
00:59:04,849 --> 00:59:01,799
powered flyby burn which will last three

540
00:59:08,470 --> 00:59:04,859
minutes and 27 seconds and will change

541
01:00:14,650 --> 00:59:08,480
the velocity of the Orion spacecraft by

542
01:00:19,990 --> 01:00:17,510
Orion is now less than four thousand

543
01:00:23,390 --> 01:00:20,000
miles away from the lunar surface

544
01:00:25,910 --> 01:00:23,400
3780 miles to be exact

545
01:00:32,349 --> 01:00:25,920
and Orion is traveling at four thousand

546
01:00:36,410 --> 01:00:34,370
everything's still continuing to look

547
01:00:39,230 --> 01:00:36,420
good here in Mission Control Houston as

548
01:00:42,410 --> 01:00:39,240
we anticipate the return power flyby

549
01:01:29,210 --> 01:00:42,420
burn occurring at 10 43 a.m Central an

550
01:01:34,130 --> 01:01:32,030
today's return power flyby will send

551
01:01:36,109 --> 01:01:34,140
Orion close enough to the lunar surface

552
01:01:38,990 --> 01:01:36,119
to leverage the moon's gravitational

553
01:01:42,530 --> 01:01:39,000
force and swing the spacecraft into a

554
01:01:45,170 --> 01:01:42,540
trajectory to return back to Earth

555
01:01:46,910 --> 01:01:45,180
during Orion's Mission it surpassed the

556
01:01:49,670 --> 01:01:46,920
furthest distance for a human rated

557
01:01:51,230 --> 01:01:49,680
spacecraft meant to return home at over

558
01:01:53,329 --> 01:01:51,240
268

559
01:02:07,809 --> 01:01:53,339
000 miles from Earth at its furthest

560
01:02:13,069 --> 01:02:10,250
prior to the distant retrograde

561
01:02:15,950 --> 01:02:13,079
departure burn Orion was in deep space

562
01:02:18,950 --> 01:02:15,960
in a distant retrograde orbit

563
01:02:21,170 --> 01:02:18,960

this orbit is called distant due to its

564
01:02:25,549 --> 01:02:21,180
high altitude from the moon it's about

565
01:02:28,250 --> 01:02:25,559
40 000 miles past the moon in its orbit

566
01:02:30,710 --> 01:02:28,260
this orbit is 30 000 miles further than

567
01:02:33,890 --> 01:02:30,720
the previous record set during Apollo 13

568
01:02:36,170 --> 01:02:33,900
and again is the furthest in space any

569
01:02:38,270 --> 01:02:36,180
spacecraft built for humans has ever

570
01:02:40,190 --> 01:02:38,280
flown

571
01:02:42,650 --> 01:02:40,200
the orbit is also called retrograde

572
01:02:44,990 --> 01:02:42,660
because Orion traveled around the Moon

573
01:02:47,530 --> 01:02:45,000
opposite the direction the moon travels

574
01:02:50,270 --> 01:02:47,540
around Earth

575
01:02:52,430 --> 01:02:50,280
distant retrograde orbit provides a

576
01:02:55,069 --> 01:02:52,440
highly stable orbit where little fuel is

577
01:02:57,589 --> 01:02:55,079
required to stay for an extended trip in

578
01:02:59,690 --> 01:02:57,599
deep space in order to put Orion's

579
01:03:03,230 --> 01:02:59,700
systems to the test in an environment

580
01:03:08,030 --> 01:03:06,049
the orbit that Orion completed in this

581
01:03:10,010 --> 01:03:08,040
mission is different from the orbit done

582
01:03:12,049 --> 01:03:10,020
during the Apollo program in which the

583
01:03:15,289 --> 01:03:12,059
spacecraft orbited much closer to the

584
01:03:19,549 --> 01:03:15,299
Lunas lunar surface in a more circular

585
01:03:24,530 --> 01:03:22,430
it's important for us to learn about how

586
01:03:26,750 --> 01:03:24,540
a spacecraft functions in a deep space

587
01:03:29,030 --> 01:03:26,760
environment because as part of the

588
01:03:31,490 --> 01:03:29,040

Artemis program The Gateway program is

589
01:03:33,589 --> 01:03:31,500
building a small human-tended space

590
01:03:35,690 --> 01:03:33,599
station orbiting the Moon that will

591
01:03:40,370 --> 01:03:35,700
provide extensive capabilities to

592
01:03:43,789 --> 01:03:42,470
gate Gateway will be built with

593
01:03:45,770 --> 01:03:43,799
International and Commercial

594
01:03:48,470 --> 01:03:45,780
Partnerships

595
01:03:51,289 --> 01:03:48,480
and will support sustained exploration

596
01:03:53,390 --> 01:03:51,299
and research in deep space and will

597
01:03:55,309 --> 01:03:53,400
include docking ports for a variety of

598
01:03:57,349 --> 01:03:55,319
visiting spacecraft

599
01:03:59,930 --> 01:03:57,359
as well as space for crew to live and

600
01:04:03,349 --> 01:03:59,940
work and onboard science investigations

601
01:04:07,609 --> 01:04:03,359
to study heliophysics human health and

602
01:04:12,289 --> 01:04:10,010
Gateway will beat Humanity's first space

603
01:04:25,309 --> 01:04:12,299
station in lunar orbit to support NASA's

604
01:04:31,549 --> 01:04:28,549
but before we get to that point we are

605
01:04:34,069 --> 01:04:31,559
testing out the Orion spacecraft as part

606
01:04:45,730 --> 01:04:34,079
of the Artemis 1 Mission again we're 20

607
01:04:52,130 --> 01:04:48,950
and today's return powered flyby is the

608
01:04:54,530 --> 01:04:52,140
next major milestone in Orion's 25 and a

609
01:04:57,170 --> 01:04:54,540
half day mission

610
01:04:59,870 --> 01:04:57,180
this burn will slingshot Orion around

611
01:05:02,690 --> 01:04:59,880
the moon and place it on a trajectory to

612
01:07:14,690 --> 01:05:02,700
splash down in the Pacific Ocean on

613
01:07:20,809 --> 01:07:17,750

we're now one hour and 35 minutes away

614
01:07:23,349 --> 01:07:20,819
from today's return powered flyby burn

615
01:07:26,710 --> 01:07:23,359
Orion is currently traveling at

616
01:07:34,270 --> 01:07:26,720
4157 miles per hour and is

617
01:07:40,490 --> 01:07:38,089
just prior to today's return power flyby

618
01:07:45,670 --> 01:07:40,500
burn Orion will complete its closest

619
01:07:53,990 --> 01:07:49,069
at closest approach Orion will be 79

620
01:07:59,390 --> 01:07:56,510
this closest approach as well as the

621
01:08:01,370 --> 01:07:59,400
burn will occur in our anticipated loss

622
01:08:03,529 --> 01:08:01,380
of signal period

623
01:08:05,690 --> 01:08:03,539
that loss of signal slated to begin an

624
01:08:07,730 --> 01:08:05,700
hour and 32 minutes from now and will

625
01:08:10,370 --> 01:08:07,740
last 30 minutes long

626
01:08:12,950 --> 01:08:10,380
the reason we will not have signal with

627
01:08:15,950 --> 01:08:12,960
the Orion spacecraft is because the Moon

628
01:08:19,789 --> 01:08:15,960
is blocking the connection to the deep

629
01:08:22,729 --> 01:08:19,799
space Network during that time period

630
01:08:25,070 --> 01:08:22,739
again today's loss will be a 30 minute

631
01:08:26,990 --> 01:08:25,080
long loss of signal but we are

632
01:08:29,510 --> 01:08:27,000
anticipating to regain Communications

633
01:08:31,249 --> 01:08:29,520
with the Orion spacecraft once it comes

634
01:08:33,410 --> 01:08:31,259
around to the other side of the moon and

635
01:08:36,070 --> 01:08:33,420
is able to regain Communications with

636
01:08:38,870 --> 01:08:36,080
the deep space Network

637
01:08:40,729 --> 01:08:38,880
at that point flight controllers here in

638
01:08:43,669 --> 01:08:40,739

Mission Control Houston will be able to

639
01:08:46,669 --> 01:08:43,679
analyze today's 3 minute and 20 SEC

640
01:10:19,310 --> 01:08:46,679
seven second return power flyby and make

641
01:10:23,870 --> 01:10:21,649
if you're just joining us this morning

642
01:10:27,110 --> 01:10:23,880
we are bringing you live coverage of

643
01:10:29,870 --> 01:10:27,120
today's return power flyby of the Orion

644
01:10:33,610 --> 01:10:29,880
spacecraft and uncrewed test flight as

645
01:10:40,070 --> 01:10:37,910
today is flight day 24 Orion and there

646
01:10:43,610 --> 01:10:40,080
are about five and a half days left in

647
01:10:48,169 --> 01:10:46,430
leading up to this event today the

648
01:10:50,689 --> 01:10:48,179
return powered flyby there have been

649
01:10:53,689 --> 01:10:50,699
several other key Milestones that Orion

650
01:10:56,330 --> 01:10:53,699
has reached so let's take a look back at

651
01:10:58,669 --> 01:10:56,340
the past 20 days

652
01:11:01,610 --> 01:10:58,679
first up we have the space launch system

653
01:11:04,010 --> 01:11:01,620
launching from pad 39b at the Kennedy

654
01:11:05,390 --> 01:11:04,020
Space Center in Florida with its sights

655
01:11:09,590 --> 01:11:05,400
set on the moon

656
01:11:11,270 --> 01:11:09,600
SLS blasted off at 12 47 a.m Central on

657
01:11:14,209 --> 01:11:11,280
November 16th

658
01:11:17,810 --> 01:11:14,219
and here you see those four rs-25

659
01:11:20,209 --> 01:11:17,820
engines lighting up the Florida sky

660
01:11:22,850 --> 01:11:20,219
you can also see the orange core stage

661
01:11:25,070 --> 01:11:22,860
as well as one of the two solid rocket

662
01:11:27,169 --> 01:11:25,080
boosters in this View

663
01:11:29,209 --> 01:11:27,179

on the very top of the vehicle is the

664
01:11:31,729 --> 01:11:29,219
launch abort system and of course the

665
01:11:33,649 --> 01:11:31,739
Orion spacecraft which is now closing in

666
01:11:36,649 --> 01:11:33,659
on the moon ahead of today's return

667
01:11:40,610 --> 01:11:36,659
powered flyby burn

668
01:11:43,250 --> 01:11:40,620
now in this video you have a launch from

669
01:11:45,590 --> 01:11:43,260
the perspective of a camera located on

670
01:11:48,590 --> 01:11:45,600
the space launch system rocket

671
01:11:49,910 --> 01:11:48,600
this video shows SLS and Orion's climb

672
01:11:52,250 --> 01:11:49,920
to orbit

673
01:11:54,470 --> 01:11:52,260
it was about eight and a half minute

674
01:12:02,709 --> 01:11:54,480
climb to orbit you can see the rocket

675
01:12:10,270 --> 01:12:05,390
following liftoff and the climb to orbit

676
01:12:14,390 --> 01:12:12,830
the translunar injection maneuver took

677
01:12:16,910 --> 01:12:14,400
place as the upper part of the rocket

678
01:12:19,990 --> 01:12:16,920
officially named the interim cryogenic

679
01:12:21,910 --> 01:12:20,000
propulsion sage-fired one rl-10 engine

680
01:12:25,370 --> 01:12:21,920
producing 24

681
01:12:29,209 --> 01:12:25,380
750 pounds of thrust to accelerate the

682
01:12:31,970 --> 01:12:29,219
vehicle to more than 22 600 miles per

683
01:12:34,550 --> 01:12:31,980
hour which is a velocity fast enough to

684
01:12:36,770 --> 01:12:34,560
overcome the pull of Earth's gravity and

685
01:12:39,110 --> 01:12:36,780
Propel Orion out of low earth orbit to

686
01:12:41,330 --> 01:12:39,120
send the spacecraft to the moon the

687
01:12:44,030 --> 01:12:41,340
translunar injection maneuver precisely

688
01:12:46,070 --> 01:12:44,040

targeted a point on the moon that helped

689
01:12:48,410 --> 01:12:46,080
guide Orion close enough to be captured

690
01:12:50,870 --> 01:12:48,420
by the moon's gravity and right after

691
01:12:53,209 --> 01:12:50,880
the tli burned the interim cryogenic

692
01:12:55,910 --> 01:12:53,219
propulsion Sage separated from the Orion

693
01:12:58,010 --> 01:12:55,920
spacecraft which you did see in this

694
01:13:00,490 --> 01:12:58,020
video here you see it floating away in

695
01:13:06,110 --> 01:13:03,470
later that day we received our first

696
01:13:08,090 --> 01:13:06,120
imagery of Earth as well

697
01:13:09,890 --> 01:13:08,100
as completed the first checkout of the

698
01:13:12,649 --> 01:13:09,900
orbital maneuvering system or Ohm's

699
01:13:14,930 --> 01:13:12,659
engine which all went smoothly Orion was

700
01:13:17,570 --> 01:13:14,940
officially on the way to the moon and

701
01:13:20,810 --> 01:13:17,580
then several days later on November 21st

702
01:13:23,810 --> 01:13:20,820
Orion performed the outbound powered fly

703
01:13:26,330 --> 01:13:23,820
by also with the maneuver the orbital

704
01:13:28,850 --> 01:13:26,340
maneuvering engine rather

705
01:13:30,890 --> 01:13:28,860
the outbound powered flyby is the sister

706
01:13:32,810 --> 01:13:30,900
to the return powered flyby which will

707
01:13:35,510 --> 01:13:32,820
occur today the outbound powered flyby

708
01:13:38,270 --> 01:13:35,520
as the name suggests takes place on the

709
01:13:40,370 --> 01:13:38,280
outbound portion of the trip whereas the

710
01:13:42,709 --> 01:13:40,380
return powered flyby takes place on the

711
01:13:44,689 --> 01:13:42,719
return Journey as Orion is anticipating

712
01:13:48,890 --> 01:13:44,699
its return home

713
01:13:51,110 --> 01:13:48,900

in this video here you can see Orion

714
01:13:53,390 --> 01:13:51,120
Space the Orion spacecraft as well as

715
01:13:55,729 --> 01:13:53,400
the Earth in the distance and the moon

716
01:13:58,250 --> 01:13:55,739
off to the left

717
01:13:59,930 --> 01:13:58,260
this was just before Orion flew behind

718
01:14:05,229 --> 01:13:59,940
the moon as part of that outbound

719
01:14:12,050 --> 01:14:08,630
after this Orion was

720
01:14:14,450 --> 01:14:12,060
placed in a deep space trajectory where

721
01:14:17,810 --> 01:14:14,460
it completed a

722
01:14:21,410 --> 01:14:17,820
distant retrograde orbit

723
01:14:23,209 --> 01:14:21,420
during that time frame Orion traveled

724
01:14:25,550 --> 01:14:23,219
the furthest distance than any human

725
01:14:27,530 --> 01:14:25,560
rated spacecraft meant to return back to

726
01:14:30,950 --> 01:14:27,540
Earth had ever traveled and in this

727
01:14:34,010 --> 01:14:30,960
photo here you see Orion take a photo of

728
01:14:42,610 --> 01:14:34,020
planet Earth from over 268 thousand

729
01:14:47,390 --> 01:14:45,229
and in this photo here you can see

730
01:14:49,490 --> 01:14:47,400
Orion's solar rays split the difference

731
01:14:52,450 --> 01:14:49,500
between Earth and the Moon on flight day

732
01:14:56,570 --> 01:14:52,460
14 of the Artemis 1 mission

733
01:14:58,550 --> 01:14:56,580
this imagery was captured by one of the

734
01:14:59,810 --> 01:14:58,560
cameras on the tip of one of the solar

735
01:15:02,450 --> 01:14:59,820
arrays

736
01:15:07,689 --> 01:15:02,460
uh what the spacecraft's four solar

737
01:15:12,290 --> 01:15:10,669
and just last week on December 1st the

738
01:15:14,450 --> 01:15:12,300

distant retrograde departure burn

739
01:15:16,610 --> 01:15:14,460
occurred which placed Orion in a

740
01:15:18,770 --> 01:15:16,620
trajectory to exit the distant

741
01:15:20,630 --> 01:15:18,780
retrograde orbit and head back toward

742
01:15:23,630 --> 01:15:20,640
the moon ahead of the return powered

743
01:15:26,450 --> 01:15:23,640
flyby which we're looking forward today

744
01:15:28,910 --> 01:15:26,460
in this view here you can see the solar

745
01:15:30,890 --> 01:15:28,920
array flexing as well as an earth in the

746
01:15:37,610 --> 01:15:30,900
distance there

747
01:15:42,410 --> 01:15:40,370
so it's been a busy Journey for the

748
01:15:45,410 --> 01:15:42,420
Orion spacecraft

749
01:15:48,470 --> 01:15:45,420
again we're on flight day 20 of a 25 and

750
01:15:49,510 --> 01:15:48,480
a half day test flight Mission Orion is

751
01:15:55,250 --> 01:15:49,520
now

752
01:16:01,790 --> 01:15:58,310
and we are just one hour and 26 minutes

753
01:16:03,830 --> 01:16:01,800
away from today's outbound powered flyby

754
01:16:06,770 --> 01:16:03,840
burn which will last three minutes and

755
01:16:54,890 --> 01:16:06,780
27 seconds and place Orion in a

756
01:17:30,970 --> 01:17:04,910
foreign

757
01:17:34,550 --> 01:17:33,110
Milestone that we are tracking this

758
01:17:36,590 --> 01:17:34,560
morning here from Mission Control

759
01:17:39,229 --> 01:17:36,600
Houston will take place in about an hour

760
01:17:40,910 --> 01:17:39,239
from now when NASA flight director Judd

761
01:17:44,090 --> 01:17:40,920
freeling will pull the team inside

762
01:19:13,870 --> 01:17:44,100
mission control for a go no-go for

763
01:19:20,330 --> 01:19:16,970

we're continuing to bring you live

764
01:19:23,149 --> 01:19:20,340
imagery of the lunar surface from the

765
01:19:24,830 --> 01:19:23,159
Orion spacecraft as it continues to

766
01:19:29,149 --> 01:19:24,840
close in

767
01:19:32,050 --> 01:19:29,159
Orion is currently 3091 miles away from

768
01:20:51,050 --> 01:19:32,060
the moon traveling at a velocity of

769
01:20:51,060 --> 01:21:30,110
thank you

770
01:24:06,370 --> 01:21:40,130
foreign

771
01:24:11,689 --> 01:24:08,810
if you're just joining us this morning

772
01:24:13,790 --> 01:24:11,699
we are one hour and 18 minutes away from

773
01:24:17,090 --> 01:24:13,800
today's Outback found power to fly by

774
01:24:19,910 --> 01:24:17,100
burn this burn will be 3 minutes and 27

775
01:24:22,669 --> 01:24:19,920
seconds long and will Propel Orion

776
01:24:25,250 --> 01:24:22,679
around the moon in anticipation of a

777
01:24:29,209 --> 01:24:25,260
splash down off the coast of California

778
01:24:34,070 --> 01:24:31,250
leading the team here in Mission Control

779
01:24:36,290 --> 01:24:34,080
Houston during today's burn is NASA

780
01:24:38,630 --> 01:24:36,300
flight director Judd freeling

781
01:24:41,450 --> 01:24:38,640
but Judd is not the only flight director

782
01:24:43,970 --> 01:24:41,460
here at the Johnson Space Center in

783
01:24:45,890 --> 01:24:43,980
Houston Texas that is working the

784
01:24:49,010 --> 01:24:45,900
Artemis Mission so let's take a look at

785
01:24:51,169 --> 01:24:49,020
a few of the other flight directors

786
01:24:53,870 --> 01:24:51,179
fly CTO and slightly but he Comfort

787
01:24:56,630 --> 01:24:53,880
cooling status Quantico AOS good core

788
01:25:00,470 --> 01:24:56,640

happy flight controllers generally focus

789
01:25:02,930 --> 01:25:00,480
on systems subsystems of the vehicle and

790
01:25:05,270 --> 01:25:02,940
they they're more in tune with the

791
01:25:08,830 --> 01:25:05,280
detailed workings of their particular

792
01:25:11,870 --> 01:25:08,840
system that they're responsible for

793
01:25:13,610 --> 01:25:11,880
flight directors on the other hand are

794
01:25:15,530 --> 01:25:13,620
more in tune with what is the

795
01:25:17,750 --> 01:25:15,540
integration between all of the

796
01:25:19,310 --> 01:25:17,760
subsystems what are we all marching

797
01:25:21,649 --> 01:25:19,320
towards what's our mission objective

798
01:25:23,149 --> 01:25:21,659
prop flight has the RCs holding together

799
01:25:25,790 --> 01:25:23,159
with the brakes

800
01:25:27,649 --> 01:25:25,800
really your training starts when you

801
01:25:30,770 --> 01:25:27,659
become a flight controller you know you

802
01:25:32,510 --> 01:25:30,780
you learn a lot by osmosis and you kind

803
01:25:34,310 --> 01:25:32,520
of get a sense of a little bit of the

804
01:25:36,709 --> 01:25:34,320
job but once you become a flight

805
01:25:38,270 --> 01:25:36,719
director the amount of learning you do

806
01:25:40,910 --> 01:25:38,280
is exponential you don't become an

807
01:25:42,169 --> 01:25:40,920
expert but you have to understand at a

808
01:25:43,790 --> 01:25:42,179
depth where you could have the good

809
01:25:44,810 --> 01:25:43,800
conversation ask the right questions to

810
01:25:46,430 --> 01:25:44,820
The Experts who are the flight

811
01:25:48,950 --> 01:25:46,440
controllers they spend a lot of time

812
01:25:50,630 --> 01:25:48,960
studying and then training getting in

813
01:25:52,970 --> 01:25:50,640

simulations and running through all the

814
01:25:55,130 --> 01:25:52,980
motions and practicing the real time

815
01:25:56,229 --> 01:25:55,140
situation scenarios in the training

816
01:25:59,030 --> 01:25:56,239
environment

817
01:26:01,850 --> 01:25:59,040
I am the ascent and entry flight

818
01:26:05,090 --> 01:26:01,860
director for Artemis one I will pick

819
01:26:07,070 --> 01:26:05,100
responsibility of the vehicle after it

820
01:26:08,930 --> 01:26:07,080
launches also be the entry flight

821
01:26:12,350 --> 01:26:08,940
director so once we come back to earth

822
01:26:14,390 --> 01:26:12,360
I'll have a team that will Monitor and

823
01:26:17,030 --> 01:26:14,400
control the vehicle once it splashes

824
01:26:18,950 --> 01:26:17,040
down and we hand that over to Melissa

825
01:26:22,430 --> 01:26:18,960
Jones who is the NASA recovery director

826
01:26:23,750 --> 01:26:22,440
splash down touchdown verified copy I'm

827
01:26:25,490 --> 01:26:23,760
the lead select director for the mission

828
01:26:28,129 --> 01:26:25,500
really responsible for the overall

829
01:26:30,890 --> 01:26:28,139
development of the mission we work

830
01:26:33,410 --> 01:26:30,900
directly with the programs they provide

831
01:26:34,729 --> 01:26:33,420
us the mission priorities and we build a

832
01:26:35,990 --> 01:26:34,739
timeline that's going to accomplish

833
01:26:37,250 --> 01:26:36,000
those mission objectives we're

834
01:26:39,530 --> 01:26:37,260
responsible for building their team

835
01:26:41,450 --> 01:26:39,540
getting our team trained and certified

836
01:26:43,310 --> 01:26:41,460
we have a training team that helps us

837
01:26:44,870 --> 01:26:43,320
but we have the overall responsibility

838
01:26:47,870 --> 01:26:44,880

for putting together the team that's

839
01:26:52,729 --> 01:26:49,729
confirmation of trans lunar injection

840
01:26:54,770 --> 01:26:52,739
burn cutoff when you go to a place like

841
01:26:57,830 --> 01:26:54,780
the moon or Mars

842
01:26:59,990 --> 01:26:57,840
you really have to be explorers it

843
01:27:02,149 --> 01:27:00,000
pushes the boundaries of civilization

844
01:27:03,770 --> 01:27:02,159
we are having to develop new technology

845
01:27:05,629 --> 01:27:03,780
it's going to have to sustain the

846
01:27:07,430 --> 01:27:05,639
astronauts for these very very long

847
01:27:09,110 --> 01:27:07,440
trips and it just makes sense to test

848
01:27:10,669 --> 01:27:09,120
that and go into the moon where you're

849
01:27:12,709 --> 01:27:10,679
in a similar environment but you're much

850
01:27:14,450 --> 01:27:12,719
closer in the event of an emergency type

851
01:27:15,410 --> 01:27:14,460
scenario we can bring them safely back

852
01:27:18,590 --> 01:27:15,420
home

853
01:27:20,870 --> 01:27:18,600
station this is Houston we've we've had

854
01:27:23,870 --> 01:27:20,880
a lot of experience now in low earth

855
01:27:26,149 --> 01:27:23,880
orbit you know over 50 60 years of

856
01:27:28,250 --> 01:27:26,159
experience and we've learned how to do

857
01:27:30,290 --> 01:27:28,260
that pretty well we've learned what the

858
01:27:32,390 --> 01:27:30,300
effects of the body are in low Earth are

859
01:27:34,850 --> 01:27:32,400
but there are still things that we need

860
01:27:35,890 --> 01:27:34,860
to practice and we need to be able to

861
01:27:39,229 --> 01:27:35,900
understand

862
01:27:41,090 --> 01:27:39,239
how you sustain life further and further

863
01:27:45,910 --> 01:27:41,100

and further away from our planet

864
01:27:48,410 --> 01:27:45,920
[Music]

865
01:27:50,209 --> 01:27:48,420
it's just so different from everything

866
01:27:52,070 --> 01:27:50,219
you learn when you do low earth orbit

867
01:27:54,290 --> 01:27:52,080
it's and that's what's making it so much

868
01:27:56,149 --> 01:27:54,300
fun I'm everybody as excited about this

869
01:27:58,790 --> 01:27:56,159
Mission as I was the first day I walked

870
01:28:08,649 --> 01:27:58,800
in the doors of Mission Control

871
01:28:15,169 --> 01:28:12,610
continuing to close in on the moon now

872
01:28:18,050 --> 01:28:15,179
2774 miles away

873
01:28:31,729 --> 01:28:18,060
traveling at a velocity of 4 300 miles

874
01:28:44,110 --> 01:28:34,490
and you are looking at a view of the

875
01:28:48,410 --> 01:28:46,669
you are looking at a view of the

876
01:28:49,669 --> 01:28:48,420
European service module the very bottom

877
01:28:51,649 --> 01:28:49,679
of it there

878
01:28:53,750 --> 01:28:51,659
and you are seeing the large engine

879
01:28:55,250 --> 01:28:53,760
there in the center of the European

880
01:28:58,010 --> 01:28:55,260
service module that's the orbital

881
01:29:00,590 --> 01:28:58,020
maneuvering system engine or ohms engine

882
01:29:04,970 --> 01:29:00,600
that's the engine that will be utilized

883
01:29:08,270 --> 01:29:04,980
during today's return power flyby burn

884
01:29:10,610 --> 01:29:08,280
this is the main engine on the European

885
01:29:12,169 --> 01:29:10,620
service module and is a repurposed space

886
01:29:15,410 --> 01:29:12,179
shuttle orbital maneuvering system

887
01:29:17,629 --> 01:29:15,420
engine that has flown in space 19 times

888
01:29:21,530 --> 01:29:17,639

before all on Space Shuttle flights

889
01:29:28,430 --> 01:29:21,540
beginning with sts-41g in October 1984

890
01:29:34,250 --> 01:29:31,310
we are now one hour and 13 minutes away

891
01:29:36,890 --> 01:29:34,260
from today's return powered flyby burn

892
01:29:39,890 --> 01:29:36,900
that burn will last three out three

893
01:29:41,510 --> 01:29:39,900
minutes rather and 27 seconds and will

894
01:29:53,149 --> 01:29:41,520
change the velocity of the Orion

895
01:30:06,490 --> 01:29:55,370
you're also getting a great view of the

896
01:30:13,850 --> 01:30:09,649
and again Orion can continues to close

897
01:30:16,189 --> 01:30:13,860
in on the moon now only 202 680 miles

898
01:30:19,010 --> 01:30:16,199
away from the lunar surface

899
01:30:22,370 --> 01:30:19,020
following today's closest Approach To

900
01:32:53,030 --> 01:30:22,380
The Moon Orion will be only 79.2 miles

901
01:32:53,040 --> 01:34:28,910
foreign

902
01:34:33,350 --> 01:34:31,129
we're now one hour and eight minutes

903
01:34:36,350 --> 01:34:33,360
away from today's return powered flyby

904
01:34:41,149 --> 01:34:36,360
burn everything continuing to move

905
01:34:46,669 --> 01:34:44,270
as a reminder we will lose signal when

906
01:34:48,410 --> 01:34:46,679
Orion crosses behind the moon that's

907
01:34:51,470 --> 01:34:48,420
because the moon will be blocking the

908
01:34:53,510 --> 01:34:51,480
signal to the deep space Network

909
01:34:55,550 --> 01:34:53,520
we are anticipating that loss of signal

910
01:34:59,930 --> 01:34:55,560
one hour and five minutes from now that

911
01:35:03,950 --> 01:35:01,729
during this loss of signal period is

912
01:35:07,010 --> 01:35:03,960
when Orion will complete the return

913
01:35:09,530 --> 01:35:07,020

powered flyby burn that 3 minute and 27

914
01:35:11,450 --> 01:35:09,540
second burn that will send Orion on a

915
01:35:13,310 --> 01:35:11,460
trajectory to head back home ahead of a

916
01:36:23,649 --> 01:35:13,320
Splashdown in the Pacific Ocean on

917
01:36:28,010 --> 01:36:26,450
and if you are just joining us this

918
01:36:30,470 --> 01:36:28,020
morning we are bringing you live

919
01:36:32,209 --> 01:36:30,480
coverage of today's return powered flyby

920
01:36:34,790 --> 01:36:32,219
burn here in Mission Control Houston

921
01:36:36,709 --> 01:36:34,800
that burn is an hour and six minutes

922
01:36:39,890 --> 01:36:36,719
away from now and will be a three minute

923
01:36:42,709 --> 01:36:39,900
27 second burn that will slingshot Orion

924
01:36:45,410 --> 01:36:42,719
around the moon in a trajectory to head

925
01:36:47,750 --> 01:36:45,420
back to Earth and a Splashdown on

926
01:36:50,510 --> 01:36:47,760
December 11th but we have been getting

927
01:36:52,370 --> 01:36:50,520
some beautiful views of the Moon and I

928
01:36:54,950 --> 01:36:52,380
have a very special guest with me this

929
01:36:57,169 --> 01:36:54,960
morning this is Yuliana gross she's the

930
01:36:58,970 --> 01:36:57,179
deputy Apollo curator and she's going to

931
01:37:00,830 --> 01:36:58,980
point out some of these amazing features

932
01:37:02,930 --> 01:37:00,840
that we have been seeing on the lunar

933
01:37:04,430 --> 01:37:02,940
surface in some of the shots that we

934
01:37:05,930 --> 01:37:04,440
have been getting so thank you so much

935
01:37:07,189 --> 01:37:05,940
for joining I really appreciate you

936
01:37:09,050 --> 01:37:07,199
taking the time

937
01:37:10,129 --> 01:37:09,060
you're very welcome I'm very excited to

938
01:37:12,169 --> 01:37:10,139

be here

939
01:37:13,850 --> 01:37:12,179
yes absolutely

940
01:37:16,189 --> 01:37:13,860
um so can you talk a little bit about

941
01:37:18,229 --> 01:37:16,199
some of the features that we are seeing

942
01:37:21,290 --> 01:37:18,239
on the lunar surface here

943
01:37:24,729 --> 01:37:21,300
yeah absolutely so if you look

944
01:37:29,090 --> 01:37:24,739
um on the on the moon right now to the

945
01:37:30,350 --> 01:37:29,100
left uh middle area of the Moon there

946
01:37:32,510 --> 01:37:30,360
the bright spot that you see there

947
01:37:35,149 --> 01:37:32,520
that's Copernicus crater

948
01:37:36,590 --> 01:37:35,159
um the dark region uh that is sort of

949
01:37:38,390 --> 01:37:36,600
like right in front in the middle center

950
01:37:41,570 --> 01:37:38,400
of the moon right now that's the imbrium

951
01:37:43,550 --> 01:37:41,580
Basin and so these impact features um

952
01:37:45,410 --> 01:37:43,560
that we have on the moon so when the

953
01:37:48,410 --> 01:37:45,420
moon formed throughout its history

954
01:37:50,330 --> 01:37:48,420
um over its 4.5 billion years has been

955
01:37:52,270 --> 01:37:50,340
bombarded by meteorites and and

956
01:37:56,390 --> 01:37:52,280
asteroids uh

957
01:37:59,770 --> 01:37:56,400
and uh for the embryo that's the darker

958
01:38:02,330 --> 01:37:59,780
round uh area that you can see there

959
01:38:04,250 --> 01:38:02,340
will happen is it's a massive crater and

960
01:38:05,990 --> 01:38:04,260
so we call these a basin

961
01:38:07,850 --> 01:38:06,000
um and melt from the interior of the

962
01:38:10,669 --> 01:38:07,860
Moon came up through cracks and then

963
01:38:13,550 --> 01:38:10,679

filled that that Basin crater you can

964
01:38:15,649 --> 01:38:13,560
imagine that as a as a big lava lake and

965
01:38:17,629 --> 01:38:15,659
then a cool to form Basalt the same

966
01:38:19,850 --> 01:38:17,639
thing happens at the moment on Earth um

967
01:38:22,850 --> 01:38:19,860
Hawaii is erupting and that brings back

968
01:38:24,830 --> 01:38:22,860
brings up Basalt from the from the

969
01:38:27,229 --> 01:38:24,840
interior of Earth so these Basalt

970
01:38:29,450 --> 01:38:27,239
samples when we analyze them and we look

971
01:38:31,430 --> 01:38:29,460
at these we can learn something about

972
01:38:35,030 --> 01:38:31,440
the interior of the Moon

973
01:38:38,689 --> 01:38:35,040
uh I see that we lost our actual live

974
01:38:40,669 --> 01:38:38,699
view but in this beautiful uh view that

975
01:38:44,209 --> 01:38:40,679
we can see here uh you can really nicely

976
01:38:46,850 --> 01:38:44,219
see Copernicus uh uh right in the in the

977
01:38:49,250 --> 01:38:46,860
center the and that's brighter

978
01:38:51,770 --> 01:38:49,260
um because it excavates uh Crystal

979
01:38:53,570 --> 01:38:51,780
material which is white or or bright

980
01:38:55,070 --> 01:38:53,580
compared to the mare which of the song

981
01:38:57,709 --> 01:38:55,080
which is dark

982
01:39:01,729 --> 01:38:57,719
um oh there we are back so Copernicus is

983
01:39:04,129 --> 01:39:01,739
now in the what lower right corner of

984
01:39:06,169 --> 01:39:04,139
that image that's a fairly young crater

985
01:39:08,810 --> 01:39:06,179
and that's why it's still appears fairly

986
01:39:11,330 --> 01:39:08,820
bright because over time uh when the sun

987
01:39:14,209 --> 01:39:11,340
interacts with lunar rocks it darkens

988
01:39:15,890 --> 01:39:14,219

over time so we call it space weathering

989
01:39:19,189 --> 01:39:15,900
um yeah

990
01:39:20,990 --> 01:39:19,199
and so we are flying fairly close to

991
01:39:22,610 --> 01:39:21,000
some of the Apollo Landing sites now

992
01:39:24,229 --> 01:39:22,620
we're a little too high above we're

993
01:39:26,689 --> 01:39:24,239
about 2 000 miles away from the Moon

994
01:39:28,669 --> 01:39:26,699
still to make out any features but can

995
01:39:31,250 --> 01:39:28,679
you talk about a little bit about what

996
01:39:33,350 --> 01:39:31,260
the Apollo program studied in those

997
01:39:34,790 --> 01:39:33,360
Landing zones and maybe touch on how

998
01:39:37,189 --> 01:39:34,800
Artemis is going to be different because

999
01:39:39,490 --> 01:39:37,199
we're going to be landing an entirely

1000
01:39:41,990 --> 01:39:39,500
different spot right yeah absolutely

1001
01:39:43,430 --> 01:39:42,000
Apollo wasn't so much about science it

1002
01:39:44,990 --> 01:39:43,440
was more about like Hey we're actually

1003
01:39:46,850 --> 01:39:45,000
going to the moon and we can do it and

1004
01:39:47,870 --> 01:39:46,860
like the technology to to show that we

1005
01:39:51,229 --> 01:39:47,880
can do it

1006
01:39:53,810 --> 01:39:51,239
um Apollo 14 and 12 sort of landed

1007
01:39:55,189 --> 01:39:53,820
um like south of of where copanicus

1008
01:39:56,870 --> 01:39:55,199
crater is right now that I pointed out

1009
01:40:01,850 --> 01:39:56,880
in that region

1010
01:40:05,090 --> 01:40:01,860
um and so uh Apollo 14

1011
01:40:07,010 --> 01:40:05,100
um landed there in 1971 uh right above

1012
01:40:08,750 --> 01:40:07,020
the framora region which is kind of like

1013
01:40:11,330 --> 01:40:08,760

south of Copernicus and it's right at

1014
01:40:13,370 --> 01:40:11,340
the edge of that big imbrium Basin that

1015
01:40:15,830 --> 01:40:13,380
that I talked about

1016
01:40:17,930 --> 01:40:15,840
um they brought back a lot of rocks we

1017
01:40:20,330 --> 01:40:17,940
were interested in the rocks that were

1018
01:40:21,950 --> 01:40:20,340
excavated from imbrium so there's a lot

1019
01:40:25,070 --> 01:40:21,960
of impact melted so we call them our

1020
01:40:27,410 --> 01:40:25,080
breaches and every time a rock gets

1021
01:40:29,570 --> 01:40:27,420
exposed to like heat and pressure and

1022
01:40:32,090 --> 01:40:29,580
started to remelt in like an impact

1023
01:40:35,090 --> 01:40:32,100
event like that it resets the internal

1024
01:40:36,649 --> 01:40:35,100
clock so when rocks form they record the

1025
01:40:39,290 --> 01:40:36,659
condition from which they formed

1026
01:40:41,149 --> 01:40:39,300
including the H like the time when they

1027
01:40:42,830 --> 01:40:41,159
formed but every time there's an impact

1028
01:40:44,930 --> 01:40:42,840
event and it gets re-melted that

1029
01:40:47,689 --> 01:40:44,940
internal clock resets now we can take

1030
01:40:50,570 --> 01:40:47,699
these rocks and then measure the ages of

1031
01:40:53,330 --> 01:40:50,580
them and so every time the clock got

1032
01:40:54,890 --> 01:40:53,340
reset we now have the age of that impact

1033
01:40:56,750 --> 01:40:54,900
event

1034
01:40:58,790 --> 01:40:56,760
um and so we want to know when imbrium

1035
01:41:00,590 --> 01:40:58,800
form because it's such a big event that

1036
01:41:03,290 --> 01:41:00,600
happened on the moon that we can put

1037
01:41:04,070 --> 01:41:03,300
everything else in relative age to each

1038
01:41:05,689 --> 01:41:04,080

other

1039
01:41:09,169 --> 01:41:05,699
so that that way that mission was

1040
01:41:12,430 --> 01:41:09,179
important Apollo 12 uh landed in the uh

1041
01:41:15,590 --> 01:41:12,440
oceana's uh procolarium region which um

1042
01:41:17,149 --> 01:41:15,600
is sort of to the lower left and then

1043
01:41:18,950 --> 01:41:17,159
going up it's kind of like where that

1044
01:41:21,110 --> 01:41:18,960
shaded like where you kind of stop

1045
01:41:23,629 --> 01:41:21,120
seeing the moon you know the boundary of

1046
01:41:25,310 --> 01:41:23,639
the shade and the sunlight lit area

1047
01:41:28,310 --> 01:41:25,320
um the little bright spot that comes up

1048
01:41:31,250 --> 01:41:28,320
on the what is that lower left third of

1049
01:41:32,990 --> 01:41:31,260
the Moon that is our starkist crater um

1050
01:41:35,209 --> 01:41:33,000
so that's a super bright crater in that

1051
01:41:37,250 --> 01:41:35,219
procolarium region which we announced

1052
01:41:38,930 --> 01:41:37,260
see more and more of so that's sort of

1053
01:41:42,229 --> 01:41:38,940
the area

1054
01:41:46,850 --> 01:41:42,239
um where Apollo 12 landed

1055
01:41:48,350 --> 01:41:46,860
um that that Landing was to sort of show

1056
01:41:50,870 --> 01:41:48,360
that we can do a Pinpoint Landing so

1057
01:41:52,729 --> 01:41:50,880
they landed 200 meters away from the

1058
01:41:55,310 --> 01:41:52,739
surveyor three Lander and they actually

1059
01:41:57,050 --> 01:41:55,320
brought a piece from surveyor 3 back to

1060
01:42:00,410 --> 01:41:57,060
Earth to like really show and that then

1061
01:42:01,790 --> 01:42:00,420
Pace paced away for future missions to

1062
01:42:03,530 --> 01:42:01,800
like really like hey we can do a

1063
01:42:04,250 --> 01:42:03,540

pinpoint lining so we can go to like a

1064
01:42:06,890 --> 01:42:04,260
more

1065
01:42:08,270 --> 01:42:06,900
difficult terrain Norwegian language

1066
01:42:10,850 --> 01:42:08,280
more ruggedy

1067
01:42:12,950 --> 01:42:10,860
um and so so that's uh where we went

1068
01:42:14,629 --> 01:42:12,960
there and so now you can see even more

1069
01:42:18,410 --> 01:42:14,639
of the procolorium

1070
01:42:20,930 --> 01:42:18,420
um region most of that is dark gray as

1071
01:42:23,510 --> 01:42:20,940
you can see and so these are the basalts

1072
01:42:25,910 --> 01:42:23,520
um and that that mission brought back a

1073
01:42:27,410 --> 01:42:25,920
lot of these basaltic materials and then

1074
01:42:29,149 --> 01:42:27,420
we can look at the Aegis and it turns

1075
01:42:32,030 --> 01:42:29,159
out that those basalts were very

1076
01:42:35,030 --> 01:42:32,040
different and they were younger than the

1077
01:42:36,350 --> 01:42:35,040
Apollo 11 Mission then the rocks that

1078
01:42:37,189 --> 01:42:36,360
they brought back the basalts that they

1079
01:42:39,649 --> 01:42:37,199
brought back

1080
01:42:41,750 --> 01:42:39,659
now Artemis is going to be super

1081
01:42:43,310 --> 01:42:41,760
exciting because we're going to a very

1082
01:42:44,570 --> 01:42:43,320
different region so if you look at the

1083
01:42:46,729 --> 01:42:44,580
surface here and you can see that's

1084
01:42:48,530 --> 01:42:46,739
mostly dark gray so it's mostly basalts

1085
01:42:50,750 --> 01:42:48,540
you can see in the upper part of the

1086
01:42:52,550 --> 01:42:50,760
Moon that's still bright that's the what

1087
01:42:54,590 --> 01:42:52,560
we call the Highland crust so that's the

1088
01:42:56,810 --> 01:42:54,600

very old crust so when the moon formed

1089
01:42:59,090 --> 01:42:56,820
there was a giant impact between two

1090
01:43:01,010 --> 01:42:59,100
protoplanets it collided created a lot

1091
01:43:03,890 --> 01:43:01,020
of heat everything melted the center

1092
01:43:06,169 --> 01:43:03,900
part formed and became Earth and then

1093
01:43:08,270 --> 01:43:06,179
the debris Cloud that surrounded it

1094
01:43:11,450 --> 01:43:08,280
coalesced and then became the moon so a

1095
01:43:13,430 --> 01:43:11,460
Once Upon a Time the moon was covered in

1096
01:43:16,129 --> 01:43:13,440
a global magma ocean so it was fully

1097
01:43:17,750 --> 01:43:16,139
molten right and if you have a a global

1098
01:43:20,030 --> 01:43:17,760
magma ocean you start crystallizing

1099
01:43:22,609 --> 01:43:20,040
things so now when you crystallize stuff

1100
01:43:24,890 --> 01:43:22,619
that is denser than the mouth that sinks

1101
01:43:26,510 --> 01:43:24,900
right and if you crystallize things that

1102
01:43:28,609 --> 01:43:26,520
are less dense than the male that starts

1103
01:43:31,129 --> 01:43:28,619
to float like ice is floating on water

1104
01:43:33,050 --> 01:43:31,139
right and so now we have these crystals

1105
01:43:34,430 --> 01:43:33,060
crystallizing these minerals and they

1106
01:43:36,229 --> 01:43:34,440
are less dense so they flow to the

1107
01:43:38,390 --> 01:43:36,239
surface and they build the crust these

1108
01:43:41,030 --> 01:43:38,400
crystals are called plagioclase they're

1109
01:43:42,890 --> 01:43:41,040
white and so your your crust that then

1110
01:43:44,390 --> 01:43:42,900
forms on the moon is white and that's

1111
01:43:46,669 --> 01:43:44,400
why the Moon looks so bright when you

1112
01:43:49,010 --> 01:43:46,679
look at this image or in the night sky

1113
01:43:50,689 --> 01:43:49,020

because that's the old crust of you know

1114
01:43:52,729 --> 01:43:50,699
the oldest rocks we have and they're

1115
01:43:54,649 --> 01:43:52,739
white in color and so that's why this is

1116
01:43:56,689 --> 01:43:54,659
so bright

1117
01:43:58,010 --> 01:43:56,699
now the near sides of the side that we

1118
01:44:00,229 --> 01:43:58,020
see right now

1119
01:44:02,510 --> 01:44:00,239
we see these dark patches which then are

1120
01:44:04,790 --> 01:44:02,520
the younger basalts that came to the

1121
01:44:06,590 --> 01:44:04,800
surface once you start impacting and you

1122
01:44:08,810 --> 01:44:06,600
know you take stuff away you make these

1123
01:44:11,209 --> 01:44:08,820
Big Basins and then the interior remelts

1124
01:44:12,830 --> 01:44:11,219
and that melt comes up to forms uh to

1125
01:44:14,810 --> 01:44:12,840
fill these craters

1126
01:44:17,090 --> 01:44:14,820
that's very special so it turns out that

1127
01:44:19,910 --> 01:44:17,100
this procolareum region where imbrium

1128
01:44:21,530 --> 01:44:19,920
sits in where Apollo a 12th Planet where

1129
01:44:22,550 --> 01:44:21,540
Apollo 14 planet

1130
01:44:25,250 --> 01:44:22,560
um

1131
01:44:28,129 --> 01:44:25,260
all these rocks that were brought back

1132
01:44:31,310 --> 01:44:28,139
they have a weird component that we call

1133
01:44:33,050 --> 01:44:31,320
creep and it's spelled k r e e p and

1134
01:44:36,169 --> 01:44:33,060
Central potassium Rare Earth elements

1135
01:44:38,570 --> 01:44:36,179
and phosphor that entire martyr regions

1136
01:44:40,370 --> 01:44:38,580
that you can see here is also has iron

1137
01:44:42,169 --> 01:44:40,380
in it lots of iron and lots of titanium

1138
01:44:44,870 --> 01:44:42,179

but the rest of the Moon doesn't really

1139
01:44:46,490 --> 01:44:44,880
have that and So geologically speaking

1140
01:44:48,229 --> 01:44:46,500
all the Apollo rocks are really really

1141
01:44:49,850 --> 01:44:48,239
cool because they're very special right

1142
01:44:52,189 --> 01:44:49,860
so if I would give you six Mission and

1143
01:44:55,550 --> 01:44:52,199
you land them on Earth and you land them

1144
01:44:56,990 --> 01:44:55,560
all in Yellowstone National Park and you

1145
01:44:58,790 --> 01:44:57,000
collect all your rocks right you get

1146
01:45:00,709 --> 01:44:58,800
geologically speaking really interesting

1147
01:45:02,270 --> 01:45:00,719
rocks but they're not representative for

1148
01:45:04,550 --> 01:45:02,280
the United States or the rest of the

1149
01:45:06,890 --> 01:45:04,560
world right so same happens with Apollo

1150
01:45:09,169 --> 01:45:06,900
really cool rocks geologically speaking

1151
01:45:11,450 --> 01:45:09,179
very interesting lots of basalts right

1152
01:45:13,790 --> 01:45:11,460
they all have this weird component

1153
01:45:15,649 --> 01:45:13,800
so they're all creepy

1154
01:45:16,970 --> 01:45:15,659
um but the rest of the moon is very

1155
01:45:18,890 --> 01:45:16,980
different so they're not representative

1156
01:45:20,990 --> 01:45:18,900
now with Artemis we're going to go to

1157
01:45:22,609 --> 01:45:21,000
the South polar region so that region is

1158
01:45:24,530 --> 01:45:22,619
more representative

1159
01:45:26,689 --> 01:45:24,540
um compared to Apollo we don't really

1160
01:45:29,330 --> 01:45:26,699
expect a lot of uh basalts there so

1161
01:45:31,570 --> 01:45:29,340
that's more like Highland region the

1162
01:45:34,310 --> 01:45:31,580
South polar region also has the largest

1163
01:45:36,229 --> 01:45:34,320

impact Basin that we have on the moon

1164
01:45:38,450 --> 01:45:36,239
and also the oldest so if we can bring

1165
01:45:40,609 --> 01:45:38,460
back rocks from there we can date

1166
01:45:44,090 --> 01:45:40,619
hopefully date that really really old

1167
01:45:46,250 --> 01:45:44,100
impact region and then get a better idea

1168
01:45:48,229 --> 01:45:46,260
of when things happened on the moon and

1169
01:45:49,550 --> 01:45:48,239
establish your timeline now we also know

1170
01:45:51,169 --> 01:45:49,560
that the polar regions I believe really

1171
01:45:54,410 --> 01:45:51,179
cold

1172
01:45:55,910 --> 01:45:54,420
um and so ices or volatiles and gases on

1173
01:45:57,709 --> 01:45:55,920
the moon they freeze out in the polar

1174
01:45:59,870 --> 01:45:57,719
region so when we go there and collect

1175
01:46:01,970 --> 01:45:59,880
rocks we can also bring back these

1176
01:46:03,709 --> 01:46:01,980
Frozen samples and then learn something

1177
01:46:05,270 --> 01:46:03,719
about where the water is coming from

1178
01:46:06,950 --> 01:46:05,280
whether it's moon or you know there was

1179
01:46:08,689 --> 01:46:06,960
there was lots of asteroids and comets

1180
01:46:10,310 --> 01:46:08,699
that impacted the moon and then so we

1181
01:46:11,990 --> 01:46:10,320
can also learn about something about the

1182
01:46:14,030 --> 01:46:12,000
water that was delivered to the Earth

1183
01:46:15,950 --> 01:46:14,040
Moon system which most likely also ended

1184
01:46:18,410 --> 01:46:15,960
up on Earth and so we can learn

1185
01:46:20,270 --> 01:46:18,420
something about our own history

1186
01:46:22,550 --> 01:46:20,280
um and how the moon formed and evolved

1187
01:46:23,870 --> 01:46:22,560
over time better than we can with Apollo

1188
01:46:25,550 --> 01:46:23,880

we're missing a lot of rocks and

1189
01:46:28,310 --> 01:46:25,560
processes with Apollo and hopefully we

1190
01:46:30,890 --> 01:46:28,320
can fill these gifts with Artemis

1191
01:46:32,330 --> 01:46:30,900
you are a wealth of knowledge thank you

1192
01:46:34,790 --> 01:46:32,340
so much for sharing all of that

1193
01:46:36,950 --> 01:46:34,800
information now as we continue to get

1194
01:46:38,570 --> 01:46:36,960
closer and closer to the lunar surface

1195
01:46:41,030 --> 01:46:38,580
of course these features are going to

1196
01:46:43,430 --> 01:46:41,040
become more and more clear Orion is now

1197
01:46:45,350 --> 01:46:43,440
2 000 miles away from the moon but at

1198
01:46:47,629 --> 01:46:45,360
closest approach today it will be just

1199
01:46:50,030 --> 01:46:47,639
about 80 miles above the lunar surface

1200
01:46:52,010 --> 01:46:50,040
so before you go for the day it looks

1201
01:46:54,530 --> 01:46:52,020
like we are starting to get um some

1202
01:46:57,290 --> 01:46:54,540
better views of that area that you were

1203
01:46:59,750 --> 01:46:57,300
discussing uh before is there any other

1204
01:47:01,310 --> 01:46:59,760
items or areas that have come into view

1205
01:47:03,530 --> 01:47:01,320
since we've been chit chatting that you

1206
01:47:06,649 --> 01:47:03,540
think would be helpful to point out

1207
01:47:08,510 --> 01:47:06,659
yeah so we see Kepler uh Kepler crater

1208
01:47:11,450 --> 01:47:08,520
which is um

1209
01:47:13,669 --> 01:47:11,460
sort of to the left and lower lower left

1210
01:47:15,649 --> 01:47:13,679
of copanic is what I just um pointed out

1211
01:47:17,330 --> 01:47:15,659
so it's this like grayish area with a

1212
01:47:19,370 --> 01:47:17,340
little dot in the center and then if you

1213
01:47:22,370 --> 01:47:19,380

go from there further to the left right

1214
01:47:23,990 --> 01:47:22,380
at where the moon's shades are so so

1215
01:47:25,370 --> 01:47:24,000
there's the lower left that really

1216
01:47:27,770 --> 01:47:25,380
bright area

1217
01:47:29,030 --> 01:47:27,780
um there that's our starkist crater and

1218
01:47:30,410 --> 01:47:29,040
that's a really young crater and it's

1219
01:47:33,290 --> 01:47:30,420
really bright because it brought up

1220
01:47:36,290 --> 01:47:33,300
material from that crust that I sat and

1221
01:47:38,169 --> 01:47:36,300
that's this White Rock it turns out we

1222
01:47:40,370 --> 01:47:38,179
have um orbital

1223
01:47:42,169 --> 01:47:40,380
reflectance data so when we look at the

1224
01:47:44,750 --> 01:47:42,179
light the sunlight that gets reflected

1225
01:47:46,490 --> 01:47:44,760
off the surface we can make uh

1226
01:47:47,570 --> 01:47:46,500
assumptions about the chemistry in that

1227
01:47:50,629 --> 01:47:47,580
region

1228
01:47:53,750 --> 01:47:50,639
geologically speaking really really

1229
01:47:56,330 --> 01:47:53,760
complicated so it brought back up

1230
01:47:59,209 --> 01:47:56,340
um old Crystal material but it also we

1231
01:48:01,250 --> 01:47:59,219
also see some basaltic material and in

1232
01:48:03,050 --> 01:48:01,260
the central Peak we see material that is

1233
01:48:05,390 --> 01:48:03,060
solicit so it's really really high in

1234
01:48:07,310 --> 01:48:05,400
silica and that usually means some kind

1235
01:48:09,830 --> 01:48:07,320
of evolved Rock and when we say evolved

1236
01:48:11,870 --> 01:48:09,840
on Earth that usually means like

1237
01:48:15,169 --> 01:48:11,880
granites and stuff like that we don't

1238
01:48:18,050 --> 01:48:15,179

really mean it that way here but it has

1239
01:48:19,729 --> 01:48:18,060
more silica content in it when I say

1240
01:48:23,390 --> 01:48:19,739
Central Peak so what happens when you

1241
01:48:25,550 --> 01:48:23,400
have a big impact into the crust the

1242
01:48:27,050 --> 01:48:25,560
crust rebounds and brings uh Central

1243
01:48:28,910 --> 01:48:27,060
Park comes up if you think about it

1244
01:48:30,169 --> 01:48:28,920
throwing a rock into water right it

1245
01:48:31,970 --> 01:48:30,179
makes a splash and then the water

1246
01:48:33,530 --> 01:48:31,980
rebounds and brings a kind of like a

1247
01:48:35,510 --> 01:48:33,540
central thing up and then pops back down

1248
01:48:37,250 --> 01:48:35,520
so if you read freeze that water you

1249
01:48:40,609 --> 01:48:37,260
know it would stand up in the center

1250
01:48:41,990 --> 01:48:40,619
so that happens uh on on the moon or on

1251
01:48:44,689 --> 01:48:42,000
Earth as well where like the crust

1252
01:48:47,030 --> 01:48:44,699
rebounds and so the central Peak is the

1253
01:48:49,129 --> 01:48:47,040
area that is that the deepest material

1254
01:48:52,609 --> 01:48:49,139
that got brought back to the surface so

1255
01:48:54,590 --> 01:48:52,619
that is of of importance and and special

1256
01:48:56,270 --> 01:48:54,600
interest to scientists because now we

1257
01:48:58,010 --> 01:48:56,280
have another window into the interior of

1258
01:48:59,810 --> 01:48:58,020
the Moon to study these things and it

1259
01:49:01,729 --> 01:48:59,820
turns out specifically for that little

1260
01:49:03,709 --> 01:49:01,739
bright crater there

1261
01:49:04,790 --> 01:49:03,719
um it's super complicated and then we're

1262
01:49:06,229 --> 01:49:04,800
still trying to figure out what we're

1263
01:49:08,030 --> 01:49:06,239

seeing

1264
01:49:10,189 --> 01:49:08,040
so it sounds like there's definitely

1265
01:49:12,530 --> 01:49:10,199
much to be learned from the Moon

1266
01:49:14,510 --> 01:49:12,540
especially through the Artemis program

1267
01:49:16,070 --> 01:49:14,520
and I'm sure you're looking forward to

1268
01:49:19,010 --> 01:49:16,080
getting some of those samples back to be

1269
01:49:21,109 --> 01:49:19,020
able to study in depth oh absolutely

1270
01:49:23,149 --> 01:49:21,119
well thank you so much Juliana for

1271
01:49:25,490 --> 01:49:23,159
taking time out of your day to chat with

1272
01:49:27,109 --> 01:49:25,500
us I really appreciate it I hope you

1273
01:49:28,430 --> 01:49:27,119
have a good rest of your day thank you

1274
01:51:43,629 --> 01:49:28,440
so much and thank you for having me this

1275
01:51:51,890 --> 01:51:46,310
we're now 50 minutes away from today's

1276
01:51:56,570 --> 01:51:54,470
this Fern will slingshot Orion around

1277
01:51:58,790 --> 01:51:56,580
the lunar surface

1278
01:52:00,950 --> 01:51:58,800
and put it in a trajectory ahead of a

1279
01:52:11,229 --> 01:52:00,960
Splashdown on December 11th back on

1280
01:52:16,490 --> 01:52:14,270
this Fern will be a 3 minute and 27

1281
01:52:19,609 --> 01:52:16,500
second long burn and will be the longest

1282
01:52:21,470 --> 01:52:19,619
burn of the mission utilizing the

1283
01:52:23,510 --> 01:52:21,480
orbital maneuvering system or ohms

1284
01:52:25,729 --> 01:52:23,520
engine

1285
01:52:27,530 --> 01:52:25,739
you are getting a view of the ohms

1286
01:52:29,629 --> 01:52:27,540
engine on your screen it's in the very

1287
01:53:21,070 --> 01:52:29,639
top left the largest engine on your

1288
01:53:25,370 --> 01:53:23,390

the next major Milestone that we're

1289
01:53:28,970 --> 01:53:25,380
tracking here in Mission Control Houston

1290
01:53:31,070 --> 01:53:28,980
is the go no-go poll

1291
01:53:32,870 --> 01:53:31,080
during this poll NASA flight director

1292
01:53:35,570 --> 01:53:32,880
Judd freeling will go around the room

1293
01:53:37,370 --> 01:53:35,580
and pull each of the flight console

1294
01:53:39,649 --> 01:53:37,380
positions

1295
01:54:02,890 --> 01:53:39,659
to ensure that all is looking good ahead

1296
01:54:07,750 --> 01:54:06,109
Orion is now less than 2 000 miles away

1297
01:54:12,430 --> 01:54:07,760
from the Moon

1298
01:54:16,370 --> 01:54:12,440
1756 miles moving at a velocity of

1299
01:54:20,390 --> 01:54:16,380
4563 miles per hour

1300
01:58:24,229 --> 01:54:20,400
at this time Orion is over 237

1301
01:58:24,239 --> 01:58:31,129
Factory

1302
01:58:31,139 --> 01:59:10,790
one two four five

1303
01:59:16,790 --> 01:59:13,250
and if you're just joining us Orion is

1304
01:59:19,010 --> 01:59:16,800
now 1550 miles away from the Moon we are

1305
01:59:21,589 --> 01:59:19,020
anticipating today's return powered

1306
01:59:24,470 --> 01:59:21,599
flyby burn to begin 43 minutes from now

1307
01:59:26,209 --> 01:59:24,480
this burn will last three minutes and 27

1308
01:59:28,430 --> 01:59:26,219
seconds

1309
01:59:31,129 --> 01:59:28,440
during the time period that the burn

1310
01:59:33,109 --> 01:59:31,139
takes place Orion will be in a loss of

1311
01:59:34,609 --> 01:59:33,119
signal period because it will be

1312
01:59:36,229 --> 01:59:34,619
directly behind the moon and the moon

1313
01:59:38,209 --> 01:59:36,239

will be blocking the signal with the

1314
01:59:40,609 --> 01:59:38,219
deep space Network

1315
01:59:42,890 --> 01:59:40,619
today's loss of signal will last for 30

1316
01:59:44,930 --> 01:59:42,900
minutes after we come back around to the

1317
01:59:46,850 --> 01:59:44,940
other side of the moon we anticipate

1318
01:59:48,950 --> 01:59:46,860
regaining Communications with the Orion

1319
01:59:50,570 --> 01:59:48,960
spacecraft and that's when the team here

1320
01:59:52,910 --> 01:59:50,580
in Mission Control will be able to

1321
01:59:54,890 --> 01:59:52,920
analyze the return powered flyby burn

1322
01:59:58,250 --> 01:59:54,900
and make sure everything went as

1323
02:00:03,589 --> 02:00:00,950
this burn is critical as we look ahead

1324
02:00:06,229 --> 02:00:03,599
to a return and Splashdown of the Orion

1325
02:00:08,209 --> 02:00:06,239
spacecraft on December 11th

1326
02:00:52,850 --> 02:00:08,219
today's burn will put us in a trajectory

1327
02:00:52,860 --> 02:01:29,870
you know

1328
02:01:34,310 --> 02:01:32,270
and on your screen right now you are

1329
02:01:36,890 --> 02:01:34,320
seeing some movement here this is taking

1330
02:01:38,629 --> 02:01:36,900
place as the solar array Wings get into

1331
02:01:45,830 --> 02:01:38,639
the right configuration ahead of today's

1332
02:01:50,030 --> 02:01:48,290
a great view of the orbital maneuvering

1333
02:01:52,010 --> 02:01:50,040
system engine or Ohm's engine coming

1334
02:01:53,870 --> 02:01:52,020
into view on the European service module

1335
02:01:55,790 --> 02:01:53,880
that's that large engine on the very

1336
02:01:57,770 --> 02:01:55,800
bottom of the European service module

1337
02:02:00,169 --> 02:01:57,780
and is the engine that will be used

1338
02:02:01,729 --> 02:02:00,179

during today's 3 minute and 27 second

1339
02:02:07,010 --> 02:02:01,739
burn

1340
02:02:09,290 --> 02:02:07,020
by the ohms engine so far

1341
02:02:19,910 --> 02:02:09,300
but the ohms engine can actually fire

1342
02:02:25,750 --> 02:02:22,250
you're also getting a view of the eight

1343
02:02:28,669 --> 02:02:25,760
auxiliary engines on Orion

1344
02:02:33,530 --> 02:02:28,679
these engines can fire for less than one

1345
02:02:40,129 --> 02:02:36,109
and these engines are used more for

1346
02:02:45,050 --> 02:02:42,770
each engine provides about 100 pounds of

1347
02:03:46,089 --> 02:02:45,060
thrust and can provide steering during

1348
02:03:51,830 --> 02:03:48,890
Orion continuing to get in a proper

1349
02:04:01,430 --> 02:03:51,840
orientation ahead of today's burn we are

1350
02:04:07,129 --> 02:04:03,830
and again during that burn we will lose

1351
02:04:09,530 --> 02:04:07,139
signal with the Orion spacecraft

1352
02:04:31,990 --> 02:04:09,540
the loss of signal will be 36 minutes

1353
02:04:37,430 --> 02:04:35,149
you're looking at a view from our data

1354
02:04:40,609 --> 02:04:37,440
driven animation of the Orion spacecraft

1355
02:04:43,129 --> 02:04:40,619
as you can see we're now 1 317 miles

1356
02:04:47,629 --> 02:04:43,139
away from the Moon Orion moving at over

1357
02:06:01,850 --> 02:04:50,629
at this time Orion is over 238

1358
02:06:06,109 --> 02:06:04,129
everything continuing to move smoothly

1359
02:06:18,350 --> 02:06:06,119
this morning as we anticipate the return

1360
02:06:22,250 --> 02:06:20,149
we are hearing that the Orion's

1361
02:06:30,290 --> 02:06:22,260
spacecraft is now in the proper attitude

1362
02:06:34,250 --> 02:06:32,330
from this view you can see that orbital

1363
02:06:36,589 --> 02:06:34,260

maneuvering system engine on the left of

1364
02:06:38,570 --> 02:06:36,599
your screen that large engine on the

1365
02:06:39,950 --> 02:06:38,580
European service module that's the

1366
02:06:42,410 --> 02:06:39,960
engine that will be utilized during

1367
02:06:45,470 --> 02:06:42,420
today's burn you also see two of the

1368
02:06:48,310 --> 02:06:45,480
auxiliary engines as well as two of the

1369
02:06:54,410 --> 02:06:48,320
solar arrays

1370
02:06:58,490 --> 02:06:54,420
on the the wings of the solar rays are

1371
02:07:00,229 --> 02:06:58,500
the saw or solar over a wing cameras

1372
02:07:02,870 --> 02:07:00,239
those are the cameras which are

1373
02:09:10,689 --> 02:07:02,880
capturing the imagery that you see right

1374
02:09:17,149 --> 02:09:13,790
Orion continuing to close in on the moon

1375
02:09:19,310 --> 02:09:17,159
now 1 100 miles above the surface of the

1376
02:09:21,589 --> 02:09:19,320
Moon during today's closest approach

1377
02:09:37,010 --> 02:09:21,599
Orion will be just 80 miles above the

1378
02:09:41,270 --> 02:09:39,470
here in just a couple of minutes we do

1379
02:09:42,830 --> 02:09:41,280
expect NASA flight director Judd

1380
02:09:45,830 --> 02:09:42,840
freeling to

1381
02:09:49,510 --> 02:09:45,840
give a go no go Poll for today's return

1382
02:09:56,030 --> 02:09:53,270
if the team polls go

1383
02:10:00,050 --> 02:09:56,040
and we are anticipating the burn to

1384
02:10:04,850 --> 02:10:00,060
begin at 10 43 a.m Central and lasts 3

1385
02:10:11,330 --> 02:10:07,550
this burn will slingshot us around the

1386
02:10:13,970 --> 02:10:11,340
moon and get Orion into a trajectory to

1387
02:10:26,209 --> 02:10:13,980
return back to Earth and splash down off

1388
02:10:31,070 --> 02:10:29,330

while Orion is behind the moon today we

1389
02:10:32,870 --> 02:10:31,080
will not have communication with the

1390
02:10:34,790 --> 02:10:32,880
vehicle because the moon will be

1391
02:10:38,450 --> 02:10:34,800
blocking the

1392
02:10:41,149 --> 02:10:38,460
connection to the deep space Network

1393
02:10:43,250 --> 02:10:41,159
however once Orion swings back around on

1394
02:10:44,750 --> 02:10:43,260
the other side of the moon and regains

1395
02:10:47,510 --> 02:10:44,760
Communications with the deep space

1396
02:10:49,430 --> 02:10:47,520
Network we do anticipate to be able to

1397
02:10:51,950 --> 02:10:49,440
communicate with the vehicle

1398
02:10:56,570 --> 02:10:51,960
today's loss of signal is slated to last

1399
02:11:02,109 --> 02:10:59,209
and at this time period we are now one

1400
02:11:05,750 --> 02:11:02,119
hour away from

1401
02:11:08,570 --> 02:11:05,760
we are now 29 minutes rather away from

1402
02:12:08,109 --> 02:11:08,580
the loss of signal and about an hour

1403
02:12:12,530 --> 02:12:10,490
if you're just joining us this morning

1404
02:12:15,350 --> 02:12:12,540
we are bringing you live coverage of

1405
02:12:18,350 --> 02:12:15,360
today's return powered flyby

1406
02:12:21,109 --> 02:12:18,360
of the Orion spacecraft which is now 20

1407
02:12:23,930 --> 02:12:21,119
days into its 25 and a half day test

1408
02:12:30,109 --> 02:12:27,229
while this Orion spacecraft is uncrewed

1409
02:12:35,570 --> 02:12:30,119
as part of Artemis 2 we will have crew

1410
02:12:41,689 --> 02:12:38,030
today's return powered flyby will begin

1411
02:12:44,990 --> 02:12:41,699
at 10 43 a.m Central and will last 3

1412
02:12:47,089 --> 02:12:45,000
minutes and 27 seconds

1413
02:12:49,069 --> 02:12:47,099

this burn will slingshot Orion around

1414
02:12:51,229 --> 02:12:49,079
the back side of the moon and put it in

1415
02:12:53,569 --> 02:12:51,239
a trajectory ahead of a Splashdown off

1416
02:13:08,810 --> 02:12:53,579
the coast of California just a few days

1417
02:13:14,810 --> 02:13:12,410
during Orion's Mission it broke the

1418
02:13:16,850 --> 02:13:14,820
record for longest distance traveled

1419
02:13:20,689 --> 02:13:16,860
away from Earth for a human rated

1420
02:13:23,450 --> 02:13:20,699
spacecraft meant to return back to Earth

1421
02:13:26,290 --> 02:13:23,460
on November 28th Orion broke that record

1422
02:13:37,250 --> 02:13:26,300
having traveled 268

1423
02:13:43,790 --> 02:13:40,250
during this time period Orion was in the

1424
02:13:45,770 --> 02:13:43,800
distant retrograde orbit

1425
02:13:48,470 --> 02:13:45,780
Orion remained in this distant

1426
02:13:50,810 --> 02:13:48,480
retrograde orbit for about six days in

1427
02:13:55,310 --> 02:13:50,820
which we tested out the systems of the

1428
02:14:00,109 --> 02:13:57,470
last week the distant retrograde

1429
02:14:02,330 --> 02:14:00,119
departure burn took place which brought

1430
02:14:06,229 --> 02:14:02,340
Orion back towards the moon which we are

1431
02:14:09,109 --> 02:14:06,239
now less than a thousand miles away from

1432
02:14:12,229 --> 02:14:09,119
the drd burned set us up for today's

1433
02:14:14,689 --> 02:14:12,239
return powered flyby burn

1434
02:14:51,229 --> 02:14:14,699
and this burn again sets us up for

1435
02:14:56,330 --> 02:14:54,830
and here is the view of the Moon as

1436
02:14:58,310 --> 02:14:56,340
mentioned less than a thousand miles

1437
02:15:00,589 --> 02:14:58,320
away

1438
02:15:02,450 --> 02:15:00,599

still a little ways to go to get to our

1439
02:15:04,550 --> 02:15:02,460
closest approach of the day at which

1440
02:15:14,450 --> 02:15:04,560
point Orion will be just 80 miles above

1441
02:15:19,609 --> 02:15:16,910
but we are getting closer to today's

1442
02:15:21,290 --> 02:15:19,619
anticipated burn now 27 minutes away

1443
02:15:24,169 --> 02:15:21,300
from that burn

1444
02:16:09,189 --> 02:15:24,179
in just 24 minutes away from the

1445
02:16:16,010 --> 02:16:13,010
Orion continuing to pick up speed as it

1446
02:16:20,750 --> 02:16:16,020
closes in on the lunar surface

1447
02:16:24,350 --> 02:16:20,760
now traveling at 4 852 miles per hour

1448
02:16:29,350 --> 02:16:24,360
and now just 846 miles away from the

1449
02:16:34,190 --> 02:16:31,970
we're continuing to get a shot of the

1450
02:16:35,810 --> 02:16:34,200
Orion spacecraft namely the European

1451
02:16:37,969 --> 02:16:35,820
service module and the orbital

1452
02:16:40,129 --> 02:16:37,979
maneuvering system or Ohm's engine on

1453
02:16:41,810 --> 02:16:40,139
the left hand of your screen there the

1454
02:16:43,969 --> 02:16:41,820
largest engine shown

1455
02:16:52,929 --> 02:16:43,979
that's actually the largest engine on

1456
02:16:57,709 --> 02:16:56,150
the ohms engine is a repurposed space

1457
02:17:00,530 --> 02:16:57,719
shuttle orbital maneuvering system

1458
02:17:03,709 --> 02:17:00,540
engine that has flown on 19 space

1459
02:17:10,790 --> 02:17:06,650
the first flight was sts-41g in October

1460
02:18:41,990 --> 02:17:10,800
1984 and the last was sts-112 in October

1461
02:18:53,209 --> 02:18:44,810
and the go no go Poll for the return

1462
02:18:58,190 --> 02:18:55,310
and the team here in Mission Control

1463
02:19:00,410 --> 02:18:58,200

Houston did pull go for today's return

1464
02:20:10,570 --> 02:19:00,420
powered flyby burn that burn will take

1465
02:20:15,230 --> 02:20:13,429
and with the go from the team here in

1466
02:20:16,910 --> 02:20:15,240
Mission Control Houston for the return

1467
02:20:18,770 --> 02:20:16,920
powered flyby burn we're now just

1468
02:20:20,690 --> 02:20:18,780
counting down the minutes until the

1469
02:20:22,910 --> 02:20:20,700
start of that burn again 22 minutes away

1470
02:20:26,570 --> 02:20:22,920
from today's burn this burn will last

1471
02:20:28,849 --> 02:20:26,580
three minutes and 27 seconds

1472
02:20:31,550 --> 02:20:28,859
but just prior to the burn we will lose

1473
02:20:33,889 --> 02:20:31,560
signal with the Orion spacecraft that

1474
02:20:36,349 --> 02:20:33,899
loss of signal is anticipated in 19

1475
02:20:38,990 --> 02:20:36,359
minutes from now

1476
02:20:40,610 --> 02:20:39,000
the reason we do lose communication with

1477
02:20:43,010 --> 02:20:40,620
the spacecraft is because it will be

1478
02:20:45,110 --> 02:20:43,020
flying directly behind the moon and the

1479
02:20:47,450 --> 02:20:45,120
Moon is blocking the signal to the deep

1480
02:20:49,190 --> 02:20:47,460
space Network however once the

1481
02:20:50,990 --> 02:20:49,200
spacecraft travels back to the other

1482
02:20:52,969 --> 02:20:51,000
side of the moon we do expect to regain

1483
02:20:57,849 --> 02:20:52,979
Communications with the vehicle at that

1484
02:21:03,230 --> 02:21:01,610
Orion is now only 687 miles away from

1485
02:21:05,630 --> 02:21:03,240
the Moon

1486
02:22:17,950 --> 02:21:05,640
my closest approach today Orion will be

1487
02:22:23,330 --> 02:22:20,690
now just 20 minutes away from today's

1488
02:22:26,630 --> 02:22:23,340

return powered flyby

1489
02:22:28,969 --> 02:22:26,640
this burn will commit Orion to a

1490
02:22:32,510 --> 02:22:28,979
trajectory to head back to planet Earth

1491
02:22:35,389 --> 02:22:32,520
after its 20-day Mission so far

1492
02:22:37,429 --> 02:22:35,399
by the time Orion splashes down in the

1493
02:22:59,990 --> 02:22:37,439
Pacific Ocean it will have been in space

1494
02:23:05,570 --> 02:23:03,349
during its Journey Orion has broken the

1495
02:23:07,610 --> 02:23:05,580
record for longest distance traveled by

1496
02:23:11,710 --> 02:23:07,620
a human rated spacecraft meant to return

1497
02:23:13,690 --> 02:23:11,720
back to Earth on November 28th Orion was

1498
02:23:20,270 --> 02:23:13,700
268

1499
02:23:27,770 --> 02:23:23,650
right now Orion is 239

1500
02:23:30,349 --> 02:23:27,780
364 miles away from Earth but only 570

1501
02:23:32,750 --> 02:23:30,359
miles away from the Moon

1502
02:24:13,790 --> 02:23:32,760
at our closest approach today Orion will

1503
02:24:18,830 --> 02:24:16,490
our next set of events will take place

1504
02:24:20,690 --> 02:24:18,840
in Rapid succession first we will lose

1505
02:24:22,910 --> 02:24:20,700
signal with the Orion spacecraft after

1506
02:24:25,070 --> 02:24:22,920
it trout as it travels behind the Moon

1507
02:24:27,469 --> 02:24:25,080
that loss of signal will be just 15

1508
02:24:29,570 --> 02:24:27,479
minutes from now then three minutes

1509
02:24:32,270 --> 02:24:29,580
after we lose signal with Orion the

1510
02:24:34,670 --> 02:24:32,280
return powered flyby burn or RPF will

1511
02:24:36,830 --> 02:24:34,680
take place this burn will last three

1512
02:24:38,570 --> 02:24:36,840
minutes and 27 seconds and will be

1513
02:24:40,790 --> 02:24:38,580

completed with the orbital maneuvering

1514
02:24:43,190 --> 02:24:40,800
system or ohms engine which you see

1515
02:24:45,650 --> 02:24:43,200
there on your screen to the left on the

1516
02:24:50,630 --> 02:24:45,660
European service module it's the largest

1517
02:24:55,849 --> 02:24:53,450
and today's 3 minute and 27 second burn

1518
02:24:58,130 --> 02:24:55,859
will be the longest burn that the Ohm's

1519
02:25:59,750 --> 02:24:58,140
engine will have completed on

1520
02:26:04,010 --> 02:26:01,490
and we're continuing to get some great

1521
02:26:07,849 --> 02:26:04,020
views of the lunar surface as we fly

1522
02:26:09,650 --> 02:26:07,859
Just 5 100 miles overhead

1523
02:26:11,809 --> 02:26:09,660
this view coming from one of the solar

1524
02:26:13,910 --> 02:26:11,819
array wings or saw cameras

1525
02:26:32,290 --> 02:26:13,920
as it gets into the proper position for

1526
02:26:37,429 --> 02:26:35,270
coincidentally eight years ago to the

1527
02:26:40,730 --> 02:26:37,439
day was the launch of the expert

1528
02:26:42,770 --> 02:26:40,740
exploration flight test one or eft-1

1529
02:26:44,570 --> 02:26:42,780
this was the first test flight of the

1530
02:26:46,670 --> 02:26:44,580
crew module portion of the Orion

1531
02:26:48,830 --> 02:26:46,680
multi-purpose crew vehicle

1532
02:26:50,690 --> 02:26:48,840
this was an uncrewed test flight that

1533
02:26:54,170 --> 02:26:50,700
orbited the Earth two times before

1534
02:27:20,270 --> 02:26:57,590
eight years later later Orion is about

1535
02:27:20,280 --> 02:27:42,490
we're 15 minutes away from today's Barn

1536
02:27:42,500 --> 02:28:28,910
thank you

1537
02:28:28,920 --> 02:29:37,690
foreign

1538
02:29:44,870 --> 02:29:42,050

powered flyby burn or Ryan is 365 miles

1539
02:29:46,090 --> 02:29:44,880
above the lunar surface traveling at a

1540
02:29:49,190 --> 02:29:46,100
speed of

1541
02:29:50,929 --> 02:29:49,200
4963 miles per hour

1542
02:29:53,389 --> 02:29:50,939
just 10 minutes from now we do

1543
02:29:55,790 --> 02:29:53,399
anticipate losing signal with Orion as

1544
02:30:10,750 --> 02:29:55,800
it begins its trip around the back side

1545
02:30:15,950 --> 02:30:13,250
on the bottom of your screen in the left

1546
02:30:20,330 --> 02:30:15,960
there you can see the solar array as it

1547
02:30:25,490 --> 02:30:23,210
you're also looking at the Orion capsule

1548
02:30:27,110 --> 02:30:25,500
itself there taking up the majority of

1549
02:30:30,170 --> 02:30:27,120
your screen you can see the kind of

1550
02:30:32,929 --> 02:30:30,180
silver coloring of the capsule

1551
02:30:34,969 --> 02:30:32,939
this is the portion that when we have a

1552
02:30:37,190 --> 02:30:34,979
crew on board as part of Artemis 2 that

1553
02:30:48,349 --> 02:30:37,200
they will be living and working in

1554
02:30:53,990 --> 02:30:51,110
and in the top left of your screen there

1555
02:30:56,809 --> 02:30:54,000
you can see the moon as Orion Glides

1556
02:30:59,210 --> 02:30:56,819
over it again 335 miles above the

1557
02:31:01,010 --> 02:30:59,220
surface but at the closest approach

1558
02:31:03,590 --> 02:31:01,020
during today's

1559
02:31:15,410 --> 02:31:03,600
return powered flyby burn Orion will be

1560
02:31:57,410 --> 02:31:17,870
we are hearing that the solar arrays are

1561
02:32:02,570 --> 02:32:00,710
Orion is now moving to the proper burn

1562
02:32:04,910 --> 02:32:02,580
attitude

1563
02:32:06,830 --> 02:32:04,920

we're now 10 minutes and 30 seconds away

1564
02:32:10,849 --> 02:32:06,840
from the start of today's 3 minute and

1565
02:32:38,929 --> 02:32:13,250
and we expect to lose signal with Orion

1566
02:32:43,849 --> 02:32:40,610
today's outbound

1567
02:32:46,250 --> 02:32:43,859
today's return powered flyby burn sets

1568
02:32:47,990 --> 02:32:46,260
us up on a trajectory to splash down off

1569
02:33:00,349 --> 02:32:48,000
the coast of California just a few days

1570
02:33:04,309 --> 02:33:01,969
and you were seeing some Thruster

1571
02:33:48,469 --> 02:33:04,319
firings there as Orion Maneuvers to the

1572
02:33:54,910 --> 02:33:51,830
now less than 6 minutes 30 seconds until

1573
02:33:58,010 --> 02:33:54,920
we lose signal with Orion

1574
02:34:05,030 --> 02:33:58,020
the burn will start in 8 minutes and 40

1575
02:34:42,830 --> 02:34:08,389
Orion is currently 253 miles above the

1576
02:34:48,349 --> 02:34:46,610
today's 3 minute and 27 second burn will

1577
02:34:50,090 --> 02:34:48,359
take place with the orbital maneuvering

1578
02:34:51,889 --> 02:34:50,100
system or Ohm's engine that's the

1579
02:34:55,010 --> 02:34:51,899
largest engine on the European service

1580
02:34:57,950 --> 02:34:55,020
module today's burn will change the

1581
02:35:00,469 --> 02:34:57,960
velocity of the spacecraft by 960 feet

1582
02:35:04,730 --> 02:35:00,479
per second during its three minute 27

1583
02:35:14,510 --> 02:35:07,130
closing in on five minutes away from our

1584
02:35:19,070 --> 02:35:16,309
we will not have signal with Orion

1585
02:35:20,510 --> 02:35:19,080
because the moon will be blocking out

1586
02:35:27,290 --> 02:35:20,520
the

1587
02:35:47,770 --> 02:35:27,300
regain

1588
02:35:53,210 --> 02:35:50,990

and we are hearing that Orion is in the

1589
02:35:55,730 --> 02:35:53,220
proper burn attitude

1590
02:35:57,770 --> 02:35:55,740
6 minutes and 40 seconds away from the

1591
02:35:58,670 --> 02:35:57,780
start of today's three minute 27 second

1592
02:36:01,130 --> 02:35:58,680
burn

1593
02:36:12,290 --> 02:36:01,140
just four minutes until today's loss of

1594
02:36:17,809 --> 02:36:14,389
as you can see from this Telemetry

1595
02:36:49,130 --> 02:36:17,819
driven animation Orion is now 202 miles

1596
02:36:53,750 --> 02:36:51,950
and you're looking at a live view inside

1597
02:36:55,250 --> 02:36:53,760
the white flight control room here at

1598
02:36:59,030 --> 02:36:55,260
the Johnson Space Center in Houston

1599
02:37:29,510 --> 02:37:01,190
NASA flight director Judd frieling is

1600
02:37:34,370 --> 02:37:32,090
we were tracking a loss of signal about

1601
02:37:36,830 --> 02:37:34,380
2 minutes and 40 seconds from now but we

1602
02:37:38,450 --> 02:37:36,840
are hearing that we did get that loss of

1603
02:37:40,790 --> 02:37:38,460
signal a little earlier than expected

1604
02:37:42,230 --> 02:37:40,800
but that is to be anticipated from time

1605
02:37:44,330 --> 02:37:42,240
to time

1606
02:37:46,130 --> 02:37:44,340
so now the next major Milestone that

1607
02:37:48,170 --> 02:37:46,140
we'll look ahead towards is the return

1608
02:37:50,750 --> 02:37:48,180
powered flyby burn less than five

1609
02:37:52,670 --> 02:37:50,760
minutes from now

1610
02:37:55,190 --> 02:37:52,680
while we are traveling behind the moon

1611
02:37:57,530 --> 02:37:55,200
we do not have signal width with the

1612
02:38:00,530 --> 02:37:57,540
spacecraft because the Moon is blocking

1613
02:38:02,630 --> 02:38:00,540

the connection to the deep space Network

1614
02:39:10,190 --> 02:38:02,640
we anticipate that loss of signal to

1615
02:39:15,230 --> 02:39:12,650
and our counterparts here in this shot

1616
02:39:18,889 --> 02:39:15,240
here and the European Space Agency

1617
02:39:21,370 --> 02:39:18,899
control center at in Nord bike in the

1618
02:39:24,230 --> 02:39:21,380
Netherlands the European Space Agency

1619
02:39:25,790 --> 02:39:24,240
contribution to Artemis is of course the

1620
02:39:27,590 --> 02:39:25,800
European service module where the

1621
02:39:29,870 --> 02:39:27,600
orbital maneuvering system or ohms

1622
02:39:32,270 --> 02:39:29,880
engine is located that's the engine that

1623
02:39:35,150 --> 02:39:32,280
will be used for today's 3 minute and 27

1624
02:39:37,790 --> 02:39:35,160
second burn to propel us around the back

1625
02:39:40,250 --> 02:39:37,800
side of the moon and commit us to a

1626
02:39:42,650 --> 02:39:40,260
trajectory back to Earth ahead of a

1627
02:39:44,210 --> 02:39:42,660
Splashdown on December 11th we're now

1628
02:39:47,690 --> 02:39:44,220
less than three minutes away from the

1629
02:39:50,030 --> 02:39:47,700
start of that 3 minute 27 second burn

1630
02:39:52,610 --> 02:39:50,040
right now we do not have signal with the

1631
02:39:59,690 --> 02:39:52,620
Orion spacecraft that is expected as the

1632
02:40:04,250 --> 02:40:02,570
this loss of signal will last about 30

1633
02:40:06,290 --> 02:40:04,260
minutes

1634
02:40:07,849 --> 02:40:06,300
and as Orion comes back around the other

1635
02:40:38,690 --> 02:40:07,859
side of the moon we will be able to

1636
02:40:43,610 --> 02:40:41,030
now less than two minutes from today's

1637
02:40:50,050 --> 02:40:43,620
return powered flyby burn

1638
02:40:54,650 --> 02:40:52,429

and you do see the team here in Mission

1639
02:40:55,670 --> 02:40:54,660
Control stand up and stretch their legs

1640
02:40:57,590 --> 02:40:55,680
right now

1641
02:40:59,630 --> 02:40:57,600
oftentimes they'll use this time to

1642
02:41:03,110 --> 02:40:59,640
catch a quick break while the vehicle is

1643
02:41:36,830 --> 02:41:05,510
again today's loss of signal is expected

1644
02:41:41,389 --> 02:41:38,870
one minute until the start of today's

1645
02:42:04,750 --> 02:41:41,399
return powered flyby burn

1646
02:42:10,370 --> 02:42:07,610
seconds until the start of today's 3

1647
02:42:21,110 --> 02:42:10,380
minute 27 second long burn committing

1648
02:42:21,120 --> 02:42:37,190
15 seconds until burn start

1649
02:42:42,950 --> 02:42:40,130
and we do expect the burn to be underway

1650
02:42:44,990 --> 02:42:42,960
again this is a three minute 27 second

1651
02:42:47,630 --> 02:42:45,000
long burn

1652
02:42:49,250 --> 02:42:47,640
because Orion is behind the moon and we

1653
02:42:51,290 --> 02:42:49,260
do not have signal with the vehicle we

1654
02:42:53,150 --> 02:42:51,300
will not be able to confirm that the

1655
02:42:54,950 --> 02:42:53,160
burn has began or the results of that

1656
02:42:57,230 --> 02:42:54,960
burn until we come back around to the

1657
02:43:15,650 --> 02:42:57,240
other side and regain Communications on

1658
02:43:20,630 --> 02:43:18,650
today's burn is being completed with the

1659
02:43:23,150 --> 02:43:20,640
orbital maneuvering system or ohms

1660
02:43:32,990 --> 02:43:23,160
engine that's the largest engine on the

1661
02:43:38,690 --> 02:43:36,110
today's 3 minute and 27 second long burn

1662
02:43:41,510 --> 02:43:38,700
will be the longest during the Artemis 1

1663
02:43:43,730 --> 02:43:41,520

Mission used by the ohms engine but the

1664
02:44:31,389 --> 02:43:43,740
ohms engine can fire for up to 16

1665
02:44:36,889 --> 02:44:34,250
now approaching the two minute Mark into

1666
02:45:17,870 --> 02:44:36,899
today's return powered flyby burn 1

1667
02:45:24,230 --> 02:45:20,570
we're approaching this three minute Mark

1668
02:45:28,250 --> 02:45:26,270
again this burn is critical as it will

1669
02:45:30,590 --> 02:45:28,260
slingshot us around the back side of the

1670
02:45:32,330 --> 02:45:30,600
moon and place us on a trajectory ahead

1671
02:45:37,490 --> 02:45:32,340
of a splash down off the coast of

1672
02:46:04,450 --> 02:45:39,770
three minutes into the burn 27 seconds

1673
02:46:09,770 --> 02:46:07,550
and we do expect the burn to be complete

1674
02:46:11,270 --> 02:46:09,780
at this time again because we are behind

1675
02:46:13,130 --> 02:46:11,280
the moon and do not have a signal with

1676
02:46:14,929 --> 02:46:13,140
the spacecraft we will not be able to

1677
02:46:16,849 --> 02:46:14,939
confirm until Orion comes back around

1678
02:46:19,309 --> 02:46:16,859
the other side of the moon we are

1679
02:47:05,510 --> 02:46:19,319
anticipating that acquisition of signal

1680
02:47:11,090 --> 02:47:08,450
and if you're just joining us the return

1681
02:47:13,010 --> 02:47:11,100
powered flyby burn the burn that is

1682
02:47:15,050 --> 02:47:13,020
going to send Orion back around the

1683
02:47:17,630 --> 02:47:15,060
other side of the moon in anticipation

1684
02:47:20,210 --> 02:47:17,640
of a Splashdown next week off the coast

1685
02:47:22,070 --> 02:47:20,220
of California has completed Orion is

1686
02:47:23,990 --> 02:47:22,080
still behind the moon at this hour and

1687
02:47:25,969 --> 02:47:24,000
we are in a period of a loss of signal

1688
02:47:27,950 --> 02:47:25,979

with the vehicle we're anticipating to

1689
02:47:30,770 --> 02:47:27,960
get that acquisition of signal back less

1690
02:47:33,230 --> 02:47:30,780
than 24 minutes from now but while Orion

1691
02:47:35,090 --> 02:47:33,240
continues its Journey around the Moon I

1692
02:47:38,450 --> 02:47:35,100
do have a very special guest joining me

1693
02:47:40,070 --> 02:47:38,460
today this is najud moransi she is the

1694
02:47:41,450 --> 02:47:40,080
chief of the exploration Mission

1695
02:47:43,730 --> 02:47:41,460
planning office here at the Johnson

1696
02:47:45,710 --> 02:47:43,740
Space Center in Houston Texas so thank

1697
02:47:47,270 --> 02:47:45,720
you so much for joining us today najoud

1698
02:47:49,910 --> 02:47:47,280
thank you glad to be here super special

1699
02:47:52,190 --> 02:47:49,920
to be here for RPF yeah absolutely it's

1700
02:47:54,710 --> 02:47:52,200
an exciting moment indeed this burn

1701
02:47:56,990 --> 02:47:54,720
really commits Orion to a return journey

1702
02:47:58,790 --> 02:47:57,000
home but before we talk about that I do

1703
02:48:01,250 --> 02:47:58,800
want to talk a little bit about some of

1704
02:48:03,410 --> 02:48:01,260
the work that your group is doing as

1705
02:48:06,770 --> 02:48:03,420
part of the Artemis program now this is

1706
02:48:08,510 --> 02:48:06,780
an uncrewed test flight of of uh the

1707
02:48:10,790 --> 02:48:08,520
Orion spacecraft but there's other

1708
02:48:12,710 --> 02:48:10,800
components of Orion including some

1709
02:48:14,330 --> 02:48:12,720
robotics work that your group is working

1710
02:48:16,730 --> 02:48:14,340
on can you talk a little bit about that

1711
02:48:17,929 --> 02:48:16,740
and how it helps contribute to Artemis

1712
02:48:19,670 --> 02:48:17,939
yeah there's a lot of different

1713
02:48:22,309 --> 02:48:19,680

components to the Artemis as an

1714
02:48:23,750 --> 02:48:22,319
Enterprise right you know Orion SLS this

1715
02:48:25,250 --> 02:48:23,760
is our crude vehicle to the moon but

1716
02:48:26,990 --> 02:48:25,260
we're also working on systems like

1717
02:48:28,790 --> 02:48:27,000
commercial lunar payload service which

1718
02:48:31,070 --> 02:48:28,800
is delivering science payloads to the

1719
02:48:32,809 --> 02:48:31,080
Moon very soon in the next year or so

1720
02:48:34,370 --> 02:48:32,819
hopefully starting those launches and

1721
02:48:35,929 --> 02:48:34,380
that's really the precursor for all of

1722
02:48:37,250 --> 02:48:35,939
the logistics and the elements we're

1723
02:48:39,530 --> 02:48:37,260
going to need as we build out a whole

1724
02:48:41,090 --> 02:48:39,540
exploration Enterprise on the surface of

1725
02:48:42,770 --> 02:48:41,100
the Moon

1726
02:48:44,990 --> 02:48:42,780
that's great I'm looking forward to

1727
02:48:47,929 --> 02:48:45,000
seeing those land soon and another

1728
02:48:50,750 --> 02:48:47,939
aspect of your group is Astro materials

1729
02:48:52,969 --> 02:48:50,760
so during Apollo many lunar samples were

1730
02:48:54,230 --> 02:48:52,979
brought back to study but during Artemis

1731
02:48:57,050 --> 02:48:54,240
we're going to be landing in a different

1732
02:48:59,090 --> 02:48:57,060
location on the lunar South Pole so how

1733
02:49:01,309 --> 02:48:59,100
will our studies be different and what

1734
02:49:03,469 --> 02:49:01,319
will we be looking for this time around

1735
02:49:05,870 --> 02:49:03,479
yeah part of our directors includes the

1736
02:49:07,849 --> 02:49:05,880
Astro materials and and the curation of

1737
02:49:09,410 --> 02:49:07,859
those materials so all of the Apollo

1738
02:49:11,030 --> 02:49:09,420

samples that came home came here to

1739
02:49:13,010 --> 02:49:11,040
Johnson Space Center and we have a

1740
02:49:15,290 --> 02:49:13,020
dedicated facility that maintains them

1741
02:49:17,030 --> 02:49:15,300
uh manages the samples to send out to

1742
02:49:19,130 --> 02:49:17,040
the science Community for investigations

1743
02:49:20,690 --> 02:49:19,140
and that will also happen they already

1744
02:49:22,070 --> 02:49:20,700
do that for other samples like the

1745
02:49:25,490 --> 02:49:22,080
comment samples that come back from

1746
02:49:27,230 --> 02:49:25,500
Hayabusa and Genesis and as well we

1747
02:49:29,630 --> 02:49:27,240
bring Artemis samples home they'll also

1748
02:49:31,130 --> 02:49:29,640
be managing those and curating them and

1749
02:49:32,870 --> 02:49:31,140
really some of the advances in the

1750
02:49:34,370 --> 02:49:32,880
science and measurements that we can

1751
02:49:37,490 --> 02:49:34,380
make today that we did not have an

1752
02:49:39,469 --> 02:49:37,500
Apollo are already getting prepared

1753
02:49:41,870 --> 02:49:39,479
great and the very last thing I wanted

1754
02:49:43,190 --> 02:49:41,880
to chat with you about today was the

1755
02:49:45,170 --> 02:49:43,200
moment we've all been waiting for today

1756
02:49:47,270 --> 02:49:45,180
the return powered flyby burn that

1757
02:49:49,790 --> 02:49:47,280
occurred just seven minutes and nine

1758
02:49:51,590 --> 02:49:49,800
seconds ago so you had talked a little

1759
02:49:53,630 --> 02:49:51,600
bit about this burn and why the timing

1760
02:49:55,790 --> 02:49:53,640
of it was important on a Twitter post

1761
02:49:57,530 --> 02:49:55,800
that you had shared so can you talk a

1762
02:49:59,210 --> 02:49:57,540
little bit more about that for the folks

1763
02:50:01,670 --> 02:49:59,220

who maybe didn't see that

1764
02:50:02,870 --> 02:50:01,680
yeah so all of the burns are very well

1765
02:50:04,670 --> 02:50:02,880
calculated

1766
02:50:06,410 --> 02:50:04,680
um for specific reasons so these Burns

1767
02:50:08,270 --> 02:50:06,420
have to be executed within moments of

1768
02:50:11,330 --> 02:50:08,280
the timing but really what it's doing is

1769
02:50:13,309 --> 02:50:11,340
it's timing the return trip to Earth and

1770
02:50:15,469 --> 02:50:13,319
then targeting so that when

1771
02:50:16,910 --> 02:50:15,479
Orion travels behind the Earth that's

1772
02:50:19,429 --> 02:50:16,920
when the Pacific Ocean will be

1773
02:50:21,410 --> 02:50:19,439
underneath the entry Corridor so we're

1774
02:50:23,389 --> 02:50:21,420
targeting for a very thin slice of

1775
02:50:25,190 --> 02:50:23,399
atmosphere and that's where we do our

1776
02:50:27,469 --> 02:50:25,200
Arrow capture so the atmosphere actually

1777
02:50:29,570 --> 02:50:27,479
slows Orion down and we need to make

1778
02:50:31,550 --> 02:50:29,580
sure all of that is set up precisely so

1779
02:50:33,469 --> 02:50:31,560
that we can enter the atmosphere while

1780
02:50:35,210 --> 02:50:33,479
the Pacific is where the entry targeting

1781
02:50:37,429 --> 02:50:35,220
is so that we can be landing right where

1782
02:50:39,469 --> 02:50:37,439
the recovery forces are so there's a lot

1783
02:50:41,630 --> 02:50:39,479
of calculations that go into it by The

1784
02:50:44,270 --> 02:50:41,640
Wider trajectory team but that this is

1785
02:50:46,010 --> 02:50:44,280
truly our deorbit burn so we are doing a

1786
02:50:48,349 --> 02:50:46,020
major maneuver right now which targets

1787
02:50:50,510 --> 02:50:48,359
our entry in six days

1788
02:50:51,889 --> 02:50:50,520

great thank you for talking through that

1789
02:50:53,929 --> 02:50:51,899
a little bit more again that burn

1790
02:50:55,969 --> 02:50:53,939
occurred eight minutes ago and once we

1791
02:50:57,290 --> 02:50:55,979
acquire signal and we come back around

1792
02:50:59,030 --> 02:50:57,300
on the other side we'll be able to know

1793
02:51:00,469 --> 02:50:59,040
if that burn was successful we're

1794
02:51:02,690 --> 02:51:00,479
looking ahead of that acquisition of

1795
02:51:04,250 --> 02:51:02,700
signal now 20 minutes from now but thank

1796
02:51:05,750 --> 02:51:04,260
you so much ninjut for taking some time

1797
02:51:07,370 --> 02:51:05,760
I know you're very busy so I really

1798
02:51:08,929 --> 02:51:07,380
appreciate you taking a few minutes to

1799
02:51:10,670 --> 02:51:08,939
chat with us thank you for having me

1800
02:51:12,469 --> 02:51:10,680
like I said it's really important what

1801
02:51:13,910 --> 02:51:12,479
is going on and I'm really excited to

1802
02:51:15,349 --> 02:51:13,920
see this burn be successful for the

1803
02:51:37,969 --> 02:51:15,359
conclusion of the mission

1804
02:53:15,830 --> 02:53:07,429
foreign

1805
02:53:15,840 --> 02:53:21,830
thank you

1806
02:53:26,690 --> 02:53:24,769
we're now 17 minutes and 45 seconds away

1807
02:53:28,910 --> 02:53:26,700
from the anticipated acquisition of

1808
02:53:31,250 --> 02:53:28,920
signal following today's return powered

1809
02:53:33,170 --> 02:53:31,260
flyby burn which took place about 11

1810
02:53:35,929 --> 02:53:33,180
minutes ago that burn was three minutes

1811
02:53:38,269 --> 02:53:35,939
and 27 seconds and committed us back to

1812
02:53:40,190 --> 02:53:38,279
a return trajectory headed back to

1813
02:53:42,349 --> 02:53:40,200

planet Earth where Orion will complete

1814
02:53:58,309 --> 02:53:42,359
its 25 and a half day test flight

1815
02:53:58,319 --> 02:54:17,170
on your way

1816
02:54:22,910 --> 02:54:20,389
now the last time NASA made a journey

1817
02:54:24,889 --> 02:54:22,920
around the moon in anticipation of a

1818
02:54:28,370 --> 02:54:24,899
return home to Earth was during the

1819
02:54:31,010 --> 02:54:28,380
final Apollo mission in 1972

1820
02:54:38,030 --> 02:54:31,020
that crew launched nearly 50 years ago

1821
02:54:42,349 --> 02:54:40,250
as part of that flight Commander Gene

1822
02:54:44,630 --> 02:54:42,359
cernan and lunar module pilot Harrison

1823
02:54:50,750 --> 02:54:44,640
Smith walked on the Moon while Command

1824
02:54:55,910 --> 02:54:53,090
the crew splashed down on December 19

1825
02:54:58,490 --> 02:54:55,920
1972

1826
02:55:02,710 --> 02:54:58,500
and completed three spacewalks during

1827
02:55:16,010 --> 02:55:05,809
and during Apollo 17 they orbited the

1828
02:55:20,990 --> 02:55:18,530
now less than 15 minutes until we expect

1829
02:56:09,349 --> 02:55:21,000
to regain communication with the Orion

1830
02:56:15,170 --> 02:56:12,290
if you're just joining us today 13

1831
02:56:17,809 --> 02:56:15,180
minutes and 30 seconds ago the orbital

1832
02:56:20,929 --> 02:56:17,819
maneuvering system onboard Orion fired

1833
02:56:23,510 --> 02:56:20,939
for 3 minutes and 27 seconds propelling

1834
02:56:26,150 --> 02:56:23,520
the spacecraft around the moon and

1835
02:56:27,650 --> 02:56:26,160
placing it into a trajectory ahead of a

1836
02:56:31,190 --> 02:56:27,660
return back to Earth

1837
02:56:34,130 --> 02:56:31,200
Orion will Splash down on December 11th

1838
02:56:36,170 --> 02:56:34,140

completing a 25 and a half day uncrewed

1839
02:56:38,269 --> 02:56:36,180
test flight in which it broke the

1840
02:56:40,910 --> 02:56:38,279
longest distance from Earth by a human

1841
02:56:44,090 --> 02:56:40,920
rated spacecraft meant to return back to

1842
02:56:49,389 --> 02:56:47,269
at its furthest point from Earth Orion

1843
02:57:30,670 --> 02:56:49,399
was 268

1844
02:57:36,349 --> 02:57:33,530
we're about 13 minutes away from our

1845
02:57:39,050 --> 02:57:36,359
anticipated acquisition of signal as

1846
02:57:41,690 --> 02:57:39,060
Orion flies around the back side of the

1847
02:57:44,870 --> 02:57:41,700
moon let's take a look back at what we

1848
02:57:47,090 --> 02:57:44,880
have what has gotten us to this point so

1849
02:57:51,830 --> 02:57:49,429
first up we start with the space launch

1850
02:57:54,469 --> 02:57:51,840
system launching from pad 39b at the

1851
02:57:57,410 --> 02:57:54,479
Kennedy Space Center in Florida with its

1852
02:58:01,070 --> 02:57:57,420
sites set on the moon SLS blasted off at

1853
02:58:04,190 --> 02:58:01,080
12 47 a.m Central on November 16th you

1854
02:58:06,769 --> 02:58:04,200
see those four rs-25 engines lighting up

1855
02:58:09,050 --> 02:58:06,779
the Space Coast the you can also see the

1856
02:58:10,969 --> 02:58:09,060
core stage climb up as well as one of

1857
02:58:13,730 --> 02:58:10,979
the two solid rocket boosters in this

1858
02:58:15,950 --> 02:58:13,740
View and on top of the vehicle is the

1859
02:58:22,550 --> 02:58:15,960
launch abort system and of course the

1860
02:58:27,950 --> 02:58:25,969
this video shows SLS and Orion's climb

1861
02:58:30,469 --> 02:58:27,960
to orbit from the perspective of a

1862
02:58:32,809 --> 02:58:30,479
camera on the rocket it was about an

1863
02:58:35,570 --> 02:58:32,819

eight and a half minute climb into orbit

1864
02:58:38,630 --> 02:58:35,580
you can see the launch pad grow smaller

1865
02:58:43,849 --> 02:58:38,640
and smaller as Ora as the space launch

1866
02:58:48,230 --> 02:58:45,950
following liftoff and the climb to orbit

1867
02:58:50,630 --> 02:58:48,240
the translunar injection burn took place

1868
02:58:52,250 --> 02:58:50,640
the translunar injection maneuver took

1869
02:58:55,010 --> 02:58:52,260
place as the upper part of the rocket

1870
02:58:59,330 --> 02:58:55,020
officially named the interim cryogenic

1871
02:59:03,170 --> 02:58:59,340
propulsion stage or icps fired one rl-10

1872
02:59:05,330 --> 02:59:03,180
engine producing 24 750 pounds of thrust

1873
02:59:09,170 --> 02:59:05,340
to accelerate the vehicle to more than

1874
02:59:11,269 --> 02:59:09,180
22 600 miles per hour a velocity fast

1875
02:59:13,730 --> 02:59:11,279
enough to overcome the pull of Earth's

1876
02:59:16,130 --> 02:59:13,740
gravity and Propel Orion out of low

1877
02:59:18,590 --> 02:59:16,140
earth orbit to send the spacecraft to

1878
02:59:20,750 --> 02:59:18,600
the moon the tli maneuver precisely

1879
02:59:22,849 --> 02:59:20,760
targeted a point on the moon that guided

1880
02:59:25,370 --> 02:59:22,859
Orion close enough to be captured by the

1881
02:59:27,469 --> 02:59:25,380
moon's gravity now right after that tli

1882
02:59:30,170 --> 02:59:27,479
burned the interim cryogenic propulsion

1883
02:59:32,750 --> 02:59:30,180
stage separated from Orion and you do

1884
02:59:36,170 --> 02:59:32,760
see that here in the video as it drifts

1885
02:59:38,750 --> 02:59:36,180
further away from the spacecraft

1886
02:59:41,269 --> 02:59:38,760
later that day we received our first

1887
02:59:43,130 --> 02:59:41,279
imagery of Earth as well as completed

1888
02:59:46,190 --> 02:59:43,140

the first checkout of the orbital

1889
02:59:47,929 --> 02:59:46,200
maneuvering system or Ohm's engine all

1890
02:59:50,690 --> 02:59:47,939
went smoothly and that orbital

1891
02:59:53,690 --> 02:59:50,700
maneuvering system engine was used just

1892
02:59:56,570 --> 02:59:53,700
17 minutes ago for the return powered

1893
02:59:59,750 --> 02:59:56,580
flyby burn which lasted 3 minutes and 27

1894
03:00:04,370 --> 03:00:02,090
several days later on November 21st

1895
03:00:06,650 --> 03:00:04,380
Orion performed the outbound powered

1896
03:00:09,590 --> 03:00:06,660
flyby burn also with that orbiting

1897
03:00:12,110 --> 03:00:09,600
maneuver orbital maneuvering engine this

1898
03:00:14,389 --> 03:00:12,120
is the sister to the return powered

1899
03:00:16,910 --> 03:00:14,399
flyby burn the orbital maneuvering burn

1900
03:00:19,550 --> 03:00:16,920
sets us up in a trajectory to head out

1901
03:00:21,830 --> 03:00:19,560
to deep space the return powered flyby

1902
03:00:25,010 --> 03:00:21,840
burn sets us up on a trajectory to

1903
03:00:33,429 --> 03:00:25,020
return back home this video shows Orion

1904
03:00:39,590 --> 03:00:36,590
and as we mentioned in this broadcast

1905
03:00:41,929 --> 03:00:39,600
several times Orion has traveled further

1906
03:00:44,450 --> 03:00:41,939
than any human rated spacecraft but in

1907
03:00:46,070 --> 03:00:44,460
this view here you that was taken just

1908
03:00:48,830 --> 03:00:46,080
shortly before that you can see an

1909
03:00:50,809 --> 03:00:48,840
eclipse the moon traveling in front of

1910
03:00:54,170 --> 03:00:50,819
the earth of you we don't often see here

1911
03:01:00,290 --> 03:00:56,990
and this photo was taken on flight day

1912
03:01:03,130 --> 03:01:00,300
13 November 28th when Orion reached its

1913
03:01:04,809 --> 03:01:03,140

maximum distance from Earth when it was

1914
03:01:07,929 --> 03:01:04,819
268

1915
03:01:11,150 --> 03:01:07,939
563 miles away from our home planet

1916
03:01:13,250 --> 03:01:11,160
Orion has traveled further than any

1917
03:01:18,070 --> 03:01:13,260
spacecraft built for humans meant to

1918
03:01:23,570 --> 03:01:21,650
and in this video here you see Orion

1919
03:01:26,690 --> 03:01:23,580
solar rays split the difference between

1920
03:01:29,210 --> 03:01:26,700
Earth and the Moon on flight day 14.

1921
03:01:31,190 --> 03:01:29,220
this image is captured by a camera on

1922
03:01:37,490 --> 03:01:31,200
the tip of one of the spacecraft's four

1923
03:01:41,870 --> 03:01:40,190
and just last week on December 1st the

1924
03:01:44,150 --> 03:01:41,880
distant retrograde departure burn

1925
03:01:46,250 --> 03:01:44,160
occurred which placed Orion in a

1926
03:01:48,349 --> 03:01:46,260
trajectory to exit the distant

1927
03:01:50,630 --> 03:01:48,359
retrograde orbit and head back toward

1928
03:01:53,330 --> 03:01:50,640
the moon ahead of today's return powered

1929
03:01:55,070 --> 03:01:53,340
flyby which occurred just 19 minutes 15

1930
03:01:57,469 --> 03:01:55,080
seconds ago

1931
03:02:02,150 --> 03:01:57,479
in this view here you can see the solar

1932
03:02:07,550 --> 03:02:02,160
arrays gimbal as well as a Earth in the

1933
03:02:14,150 --> 03:02:11,389
so as you can see Orion has had a busy

1934
03:02:16,490 --> 03:02:14,160
journey in its 20 days of the mission so

1935
03:02:18,230 --> 03:02:16,500
far but it's not finished yet we have

1936
03:02:20,150 --> 03:02:18,240
about five and a half days to go until

1937
03:02:22,969 --> 03:02:20,160
Splashdown

1938
03:02:25,730 --> 03:02:22,979

but today's return powered flyby burn

1939
03:02:28,210 --> 03:02:25,740
was the first step in in getting us to

1940
03:02:44,710 --> 03:02:28,220
the Splashdown point

1941
03:02:50,030 --> 03:02:47,809
we anticipate regaining Communications

1942
03:03:22,849 --> 03:02:50,040
with the Orion spacecraft about 8

1943
03:03:27,050 --> 03:03:25,190
you're looking at a view inside Mission

1944
03:03:29,870 --> 03:03:27,060
Control Houston this is the white flight

1945
03:03:34,910 --> 03:03:32,090
the flight director during today's shift

1946
03:03:41,450 --> 03:03:34,920
and return powered flyby burn is NASA

1947
03:03:46,490 --> 03:03:43,849
you do see a few of the console

1948
03:03:49,130 --> 03:03:46,500
positions looking a little empty that is

1949
03:03:50,809 --> 03:03:49,140
because we are in that loss of signal

1950
03:03:52,790 --> 03:03:50,819
period this is a great time for the

1951
03:05:17,710 --> 03:03:52,800
flight controllers here in Houston to

1952
03:05:23,030 --> 03:05:20,450
today's return powered flyby burn

1953
03:05:24,110 --> 03:05:23,040
occurred at 22 minutes and 45 seconds

1954
03:05:26,090 --> 03:05:24,120
ago

1955
03:05:27,830 --> 03:05:26,100
that burn utilized the orbital

1956
03:05:30,349 --> 03:05:27,840
maneuvering system or Ohm's engine

1957
03:05:32,990 --> 03:05:30,359
onboard the Orion spacecraft

1958
03:05:35,269 --> 03:05:33,000
at this time the Orion spacecraft is

1959
03:05:37,490 --> 03:05:35,279
continuing to make its way behind the

1960
03:05:40,250 --> 03:05:37,500
backside of the Moon and we do not have

1961
03:05:42,710 --> 03:05:40,260
signal with the vehicle however we do

1962
03:05:44,929 --> 03:05:42,720
anticipate connecting with the vehicle

1963
03:05:47,570 --> 03:05:44,939

now less than five minutes and 30

1964
03:05:49,309 --> 03:05:47,580
seconds from now

1965
03:05:51,650 --> 03:05:49,319
the reason we do not have communication

1966
03:05:53,690 --> 03:05:51,660
with the vehicle is because when we are

1967
03:07:19,990 --> 03:05:53,700
behind the Moon the Moon is blocking the

1968
03:07:24,650 --> 03:07:22,429
we're now less than four minutes away

1969
03:07:26,690 --> 03:07:24,660
from our anticipated acquisition of

1970
03:07:28,370 --> 03:07:26,700
signal with the Orion spacecraft which

1971
03:07:31,010 --> 03:07:28,380
is currently traveling behind the moon

1972
03:07:33,670 --> 03:07:31,020
following the returned powered flyby

1973
03:07:52,250 --> 03:07:37,070
this burn commits Orion to returning

1974
03:07:57,110 --> 03:07:55,130
this return-powered flyby sends Orion

1975
03:07:59,090 --> 03:07:57,120
close enough to the lunar surface to

1976
03:08:01,250 --> 03:07:59,100
leverage the moon's gravitational force

1977
03:08:06,130 --> 03:08:01,260
and swing the spacecraft into a

1978
03:08:12,590 --> 03:08:10,070
now just before the burn began 25 and a

1979
03:08:14,750 --> 03:08:12,600
half minutes ago Orion did complete its

1980
03:08:17,330 --> 03:08:14,760
closest approach to the moon at which

1981
03:08:37,670 --> 03:08:17,340
point it was just under 80 miles away

1982
03:08:42,410 --> 03:08:40,070
beginning to see more folks trickle back

1983
03:08:44,929 --> 03:08:42,420
into the white flight control room as we

1984
03:08:46,790 --> 03:08:44,939
narrow in on our anticipated acquisition

1985
03:08:48,769 --> 03:08:46,800
of signal with the Orion spacecraft

1986
03:09:32,090 --> 03:08:48,779
which is currently traveling behind the

1987
03:09:37,730 --> 03:09:35,090
now one minute and 30 seconds away from

1988
03:09:47,830 --> 03:09:37,740

our anticipated acquisition of signal

1989
03:09:51,769 --> 03:09:50,030
once we acquire a signal with the

1990
03:09:54,349 --> 03:09:51,779
spacecraft the team here in Mission

1991
03:09:56,750 --> 03:09:54,359
Control Houston namely the the flight

1992
03:09:59,150 --> 03:09:56,760
controllers will be able to analyze the

1993
03:10:02,389 --> 03:09:59,160
data that the vehicle is sending back to

1994
03:10:09,290 --> 03:10:04,250
with that data they'll be able to

1995
03:10:13,070 --> 03:10:11,210
less than one minute away from our

1996
03:10:14,809 --> 03:10:13,080
anticipated acquisition of signal with

1997
03:10:36,370 --> 03:10:14,819
the Orion spacecraft

1998
03:11:12,170 --> 03:10:39,110
30 seconds away from anticipated

1999
03:12:00,170 --> 03:11:15,050
and we are standing by for acquisition

2000
03:12:05,090 --> 03:12:02,990
and we do have confirmation of an

2001
03:12:07,969 --> 03:12:05,100
acquisition of signal on the deep space

2002
03:12:15,590 --> 03:12:07,979
Network in Goldstone at 11 12 a.m

2003
03:12:58,190 --> 03:12:17,870
you're getting a view of the lunar

2004
03:13:20,929 --> 03:13:00,530
and we are hearing good confirmation

2005
03:13:26,570 --> 03:13:23,090
if you're just joining us Orion

2006
03:13:29,809 --> 03:13:26,580
completed its return powered flyby burn

2007
03:13:32,990 --> 03:13:29,819
which slung shot it around the moon and

2008
03:13:35,150 --> 03:13:33,000
committed Orion to a return trajectory

2009
03:13:46,630 --> 03:13:35,160
back to planet Earth hearing that that

2010
03:13:55,250 --> 03:13:51,530
you are seeing a view on your screen of

2011
03:13:58,010 --> 03:13:55,260
the lunar surface as well as Earth

2012
03:14:00,170 --> 03:13:58,020
for Orion this is not a good buy but a c

2013
03:14:02,090 --> 03:14:00,180

later to the Moon our nearest Celestial

2014
03:14:04,429 --> 03:14:02,100
neighbor as we begin to get our first

2015
03:14:05,570 --> 03:14:04,439
glimpse of an earth rise coming into

2016
03:14:07,969 --> 03:14:05,580
frame

2017
03:14:10,849 --> 03:14:07,979
in this view we see 8 billion human

2018
03:14:14,030 --> 03:14:10,859
lives all existing Upon Our pale blue

2019
03:14:15,710 --> 03:14:14,040
dot our Blue Marble our very own

2020
03:14:19,070 --> 03:14:15,720
spaceship earth

2021
03:14:57,790 --> 03:14:19,080
and after a long journey Orion is now

2022
03:15:04,130 --> 03:15:01,330
from this view Orion is

2023
03:15:07,010 --> 03:15:04,140
1277 miles above the lunar surface

2024
03:15:09,170 --> 03:15:07,020
following its return powered flyby burn

2025
03:15:13,210 --> 03:15:09,180
which sent it around the back side of

2026
03:15:13,220 --> 03:15:20,929
Orion now has its sights set on home

2027
03:15:27,170 --> 03:15:23,389
Orion will Splash down off the coast of

2028
03:16:02,870 --> 03:15:27,180
California on December 11th

2029
03:16:06,950 --> 03:16:04,510
foreign

2030
03:16:08,809 --> 03:16:06,960
this is a view from inside the white

2031
03:16:10,969 --> 03:16:08,819
flight control room here in Mission

2032
03:16:13,370 --> 03:16:10,979
Control Houston

2033
03:16:18,530 --> 03:16:13,380
the team is being led by NASA flight

2034
03:16:24,530 --> 03:16:20,990
and this view from the Orion spacecraft

2035
03:16:28,010 --> 03:16:24,540
as it looks to its Target planet Earth

2036
03:16:30,590 --> 03:16:28,020
flying over 100 1 200 miles above the

2037
03:16:33,290 --> 03:16:30,600
lunar surface

2038
03:16:35,870 --> 03:16:33,300

at its closest approach following the

2039
03:18:32,050 --> 03:16:35,880
return powered flyby burn Orion was just

2040
03:18:37,849 --> 03:18:35,510
the next time we see such a view we will

2041
03:20:20,830 --> 03:18:37,859
be hearing about it from a cruise

2042
03:20:25,250 --> 03:20:23,030
continuing to hear good performance

2043
03:20:26,990 --> 03:20:25,260
following today's return powered flyby

2044
03:21:04,630 --> 03:20:27,000
burn

2045
03:21:10,849 --> 03:21:07,790
the Orion spacecraft is continuing to

2046
03:21:15,490 --> 03:21:10,859
distance itself from the moon now over 1

2047
03:21:20,030 --> 03:21:17,690
throughout the course of the next few

2048
03:21:23,630 --> 03:21:20,040
days we will see the distance from Earth

2049
03:21:26,450 --> 03:21:23,640
continue to grow smaller and smaller

2050
03:21:29,210 --> 03:21:26,460
Orion is now 242

2051
03:21:31,790 --> 03:21:29,220
000 miles away from planet Earth

2052
03:22:52,309 --> 03:21:31,800
the spacecraft is moving at a velocity

2053
03:22:59,570 --> 03:22:54,830
we're continuing to get some spectacular

2054
03:23:05,510 --> 03:23:01,670
this view is from one of the solar array

2055
03:23:09,410 --> 03:23:05,520
Wing or saw cameras on board the vehicle

2056
03:23:13,370 --> 03:23:09,420
the vehicle now over 1 680 miles away

2057
03:23:19,490 --> 03:23:16,969
and that small sliver towards the bottom

2058
03:23:22,070 --> 03:23:19,500
of your screen that's here that's home

2059
03:25:32,050 --> 03:23:22,080
that's us

2060
03:25:37,729 --> 03:25:35,210
and with today's return powered flyby

2061
03:25:39,769 --> 03:25:37,739
burn now complete and Orion having

2062
03:25:42,050 --> 03:25:39,779
completed its closest approach to the

2063
03:25:44,269 --> 03:25:42,060

moon at a distance of 80 miles above the

2064
03:25:46,370 --> 03:25:44,279
surface that will wrap up our coverage

2065
03:25:48,530 --> 03:25:46,380
for today but we'll continue to post

2066
03:25:50,410 --> 03:25:48,540
daily updates about the mission on the

2067
03:25:53,690 --> 03:25:50,420
Artemis blog at

2068
03:25:55,910 --> 03:25:53,700
blogs.nasa.gov Artemis and we'll also be

2069
03:25:58,130 --> 03:25:55,920
posting updates on our social media

2070
03:26:00,050 --> 03:25:58,140
accounts later today we'll have a

2071
03:26:02,690 --> 03:26:00,060
briefing at 4 pm Central where

2072
03:26:05,090 --> 03:26:02,700
representatives from NASA will discuss

2073
03:26:07,610 --> 03:26:05,100
today's return powered flyby which we

2074
03:26:09,889 --> 03:26:07,620
hope you'll tune in for and we'll also

2075
03:26:12,170 --> 03:26:09,899
be covering Orion's re-entry into the

2076
03:26:15,110 --> 03:26:12,180
into Earth's atmosphere and its

2077
03:26:17,150 --> 03:26:15,120
Splashdown live on air next week but

2078
03:27:02,120 --> 03:26:17,160
until then this is Mission Control

2079
03:27:18,830 --> 03:27:09,250
[Music]

2080
03:27:18,840 --> 03:27:36,530
foreign

2081
03:28:19,590 --> 03:27:43,130
[Music]

2082
03:29:15,240 --> 03:28:19,600
foreign

2083
03:29:15,250 --> 03:29:20,750
[Music]

2084
03:29:20,760 --> 03:29:25,500
foreign

2085
03:29:51,950 --> 03:29:42,330
[Music]

2086
03:29:51,960 --> 03:30:24,590
foreign

2087
03:30:24,600 --> 03:30:38,990
[Music]

2088
03:30:39,000 --> 03:30:48,040

foreign

2089
03:30:48,050 --> 03:31:13,429
[Music]

2090
03:32:24,070 --> 03:31:15,140
foreign

2091
03:32:24,080 --> 03:32:40,980
thank you

2092
03:32:40,990 --> 03:33:10,150
[Music]