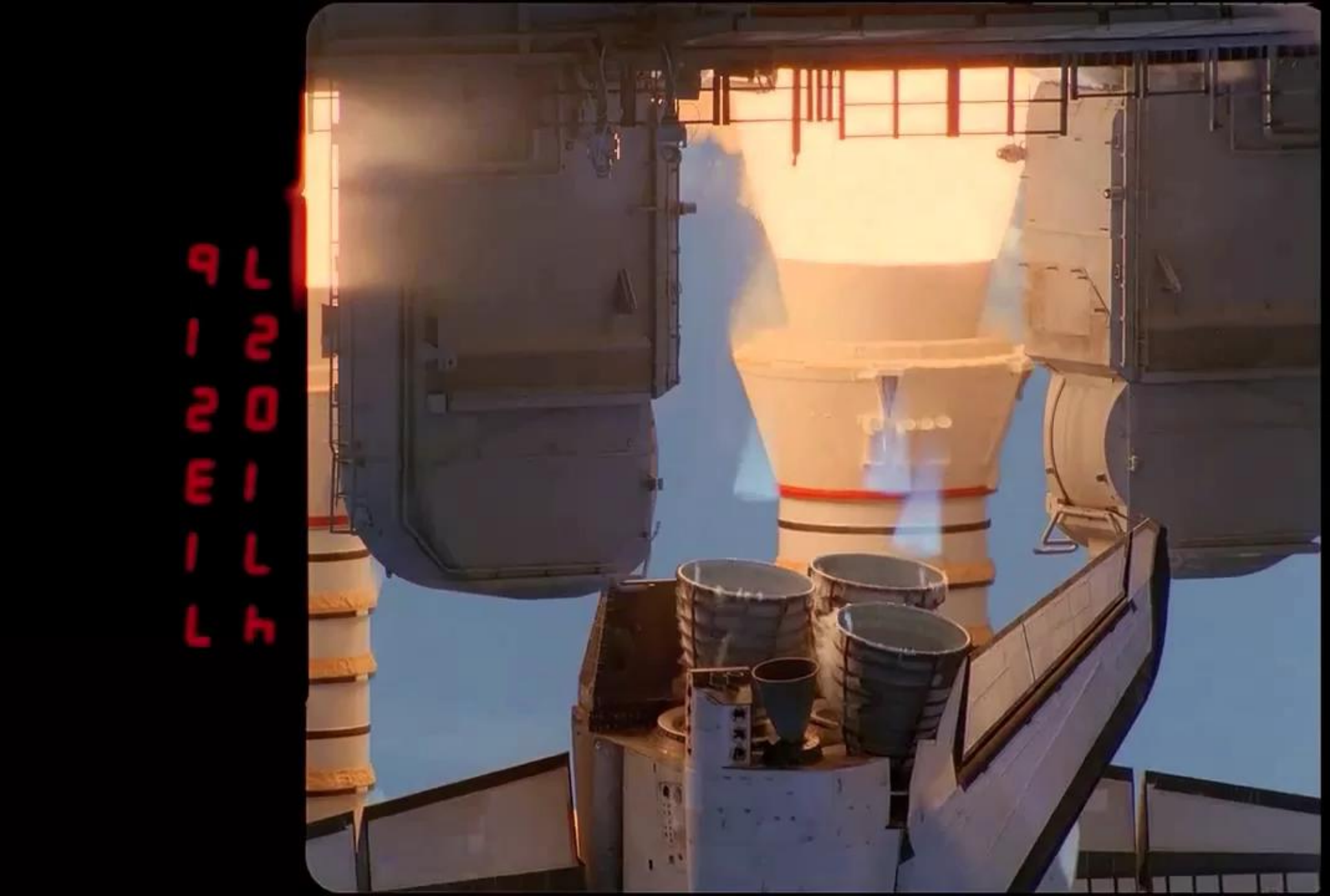
9L
12
2O
EI
IL
LH

1
00:00:04,309 --> 00:00:02,550
hi i'm matt melis i'm an aerospace

2
00:00:06,309 --> 00:00:04,319
engineer for nasa and i worked on the

3
00:00:07,269 --> 00:00:06,319
shuttle program for a good number of

4
00:00:09,430 --> 00:00:07,279
years

5
00:00:11,509 --> 00:00:09,440
and i'm here with my

6
00:00:13,350 --> 00:00:11,519
colleague today kevin burke who

7
00:00:15,110 --> 00:00:13,360
participated in the acquisition and

8
00:00:16,790 --> 00:00:15,120
deployment

9
00:00:19,189 --> 00:00:16,800
uh the 30 or so clips that you're going

10
00:00:20,630 --> 00:00:19,199
to see in just a few minutes

11
00:00:22,230 --> 00:00:20,640
now um

12
00:00:23,830 --> 00:00:22,240
and kevin thanks for being here today

13
00:00:26,550 --> 00:00:23,840

glad to be here matt

14
00:00:28,150 --> 00:00:26,560
uh what what you're going to see is uh

15
00:00:30,310 --> 00:00:28,160
what i consider to be the best of the

16
00:00:32,630 --> 00:00:30,320
best state-of-the-art imagery on both

17
00:00:34,069 --> 00:00:32,640
film and high definition video

18
00:00:36,150 --> 00:00:34,079
that the space shuttle program is

19
00:00:37,990 --> 00:00:36,160
capable of producing today

20
00:00:40,150 --> 00:00:38,000
and uh not only does it serve a

21
00:00:41,830 --> 00:00:40,160
technical purpose um and we'll get into

22
00:00:42,869 --> 00:00:41,840
a lot of that detail as we get into the

23
00:00:45,750 --> 00:00:42,879
uh

24
00:00:47,750 --> 00:00:45,760
the movies here but it also serves as an

25
00:00:49,350 --> 00:00:47,760
enormous inspirational and educational

26
00:00:50,229 --> 00:00:49,360
aspect

27
00:00:56,310 --> 00:00:50,239
for

28
00:00:59,750 --> 00:00:57,830
there's a number of intents that we have

29
00:01:00,709 --> 00:00:59,760
for this production and one of them is

30
00:01:02,150 --> 00:01:00,719
to

31
00:01:04,549 --> 00:01:02,160
pay tribute

32
00:01:06,149 --> 00:01:04,559
and commemorate the

33
00:01:08,070 --> 00:01:06,159
shuttle program which has essentially

34
00:01:09,910 --> 00:01:08,080
been a 30-year program and it's nearing

35
00:01:13,109 --> 00:01:09,920
completion as we

36
00:01:15,429 --> 00:01:13,119
go to final print with this production

37
00:01:17,109 --> 00:01:15,439
we also want to pay tribute to the men

38
00:01:19,109 --> 00:01:17,119

and women that made all of this imagery

39
00:01:22,149 --> 00:01:19,119
possible over the years of different

40
00:01:24,230 --> 00:01:22,159
missions and launches that we've had

41
00:01:26,710 --> 00:01:24,240
and

42
00:01:28,390 --> 00:01:26,720
also to

43
00:01:30,550 --> 00:01:28,400
give a view that not very many people

44
00:01:32,550 --> 00:01:30,560
see outside the nasa family of these

45
00:01:34,469 --> 00:01:32,560
fantastic pictures that are used largely

46
00:01:37,190 --> 00:01:34,479
for engineering purposes

47
00:01:39,190 --> 00:01:37,200
uh and to let everyone on the outside of

48
00:01:41,670 --> 00:01:39,200
the nasa family

49
00:01:43,109 --> 00:01:41,680
have insight as to

50
00:01:45,910 --> 00:01:43,119
to what goes on with the shuttle when it

51
00:01:49,910 --> 00:01:45,920
launches i think this is a very moving

52
00:01:53,510 --> 00:01:51,830
we're opening here with this

53
00:01:55,109 --> 00:01:53,520
somewhat stylized view of one of the

54
00:01:58,310 --> 00:01:55,119
launch sequences that actually is going

55
00:02:00,469 --> 00:01:58,320
to play out in the in the upcoming clips

56
00:02:01,990 --> 00:02:00,479
and i've got a little soft focus on it

57
00:02:03,910 --> 00:02:02,000
and i thought

58
00:02:05,590 --> 00:02:03,920
we would open it up with a

59
00:02:06,870 --> 00:02:05,600
a couple of fun facts about the shuttle

60
00:02:09,270 --> 00:02:06,880
it really is an amazing piece of

61
00:02:12,070 --> 00:02:09,280
equipment has phenomenal amount of fuel

62
00:02:14,630 --> 00:02:12,080
that it burns over the eight minutes

63
00:02:16,550 --> 00:02:14,640

during its trip to orbit

64
00:02:17,910 --> 00:02:16,560
and when they get up there

65
00:02:19,110 --> 00:02:17,920
um

66
00:02:21,030 --> 00:02:19,120
in that short eight minutes they're

67
00:02:22,470 --> 00:02:21,040
going about five miles a second which is

68
00:02:25,910 --> 00:02:22,480
a pretty spectacular

69
00:02:27,670 --> 00:02:25,920
achievement for a piece of machinery

70
00:02:29,350 --> 00:02:27,680
so uh

71
00:02:30,150 --> 00:02:29,360
this is how it all happens this is how

72
00:02:36,470 --> 00:02:30,160
the

73
00:02:47,830 --> 00:02:36,480
speaks

74
00:02:53,990 --> 00:02:50,869
this is camera view e19

75
00:02:55,990 --> 00:02:54,000
we commonly refer to this as echo 19 and

76
00:02:57,110 --> 00:02:56,000
it's a 16 millimeter camera with a 10

77
00:02:59,030 --> 00:02:57,120
millimeter

78
00:03:00,949 --> 00:02:59,040
field of view for the lens the focal

79
00:03:03,589 --> 00:03:00,959
length of the lens and it's running at

80
00:03:05,990 --> 00:03:03,599
400 frames a second

81
00:03:08,790 --> 00:03:06,000
so the effective shutter speed is really

82
00:03:10,470 --> 00:03:08,800
1 1 1200th of a second

83
00:03:12,550 --> 00:03:10,480
yeah that's it's pretty amazing i mean

84
00:03:14,309 --> 00:03:12,560
this is all a slow motion event

85
00:03:16,550 --> 00:03:14,319
uh and basically you're going to see the

86
00:03:18,790 --> 00:03:16,560
six seconds prior to launch of the

87
00:03:20,470 --> 00:03:18,800
vehicle uh as the space shuttle main

88
00:03:22,470 --> 00:03:20,480

engines turn on now the purpose of this

89
00:03:24,309 --> 00:03:22,480
camera they all have different purposes

90
00:03:25,430 --> 00:03:24,319
these most of these uh if not all of

91
00:03:27,750 --> 00:03:25,440
these cameras that you're gonna see in

92
00:03:29,030 --> 00:03:27,760
this production are engineering uh

93
00:03:31,190 --> 00:03:29,040
cameras to look for different

94
00:03:33,430 --> 00:03:31,200
engineering aspects of of the launch

95
00:03:34,869 --> 00:03:33,440
process and so the purpose of this one

96
00:03:36,229 --> 00:03:34,879
is to check to make sure ignition is

97
00:03:37,750 --> 00:03:36,239
going off okay which is what you're

98
00:03:39,350 --> 00:03:37,760
seeing here main engine start is just

99
00:03:41,110 --> 00:03:39,360
happening and you can see the engines

100
00:03:43,430 --> 00:03:41,120
are starting one at a time

101
00:03:45,270 --> 00:03:43,440
uh this particular camera looks at uh

102
00:03:47,910 --> 00:03:45,280
engines number one and three right is

103
00:03:49,110 --> 00:03:47,920
that what this is yep and um

104
00:03:51,430 --> 00:03:49,120
and so you can see them they're starting

105
00:03:53,350 --> 00:03:51,440
to fire up uh those sparkers that you

106
00:03:55,270 --> 00:03:53,360
see are are there to make sure that any

107
00:03:57,270 --> 00:03:55,280
unburned hydrogen gets ignited before it

108
00:03:58,830 --> 00:03:57,280
floats around and collects in some place

109
00:04:00,869 --> 00:03:58,840
where it can ignite later and cause

110
00:04:03,589 --> 00:04:00,879
problems again you're seeing the engines

111
00:04:06,070 --> 00:04:03,599
sort of turn on here and so uh we're

112
00:04:08,149 --> 00:04:06,080
roughly coming into about five seconds

113
00:04:09,350 --> 00:04:08,159

before liftoff the computers are

114
00:04:10,869 --> 00:04:09,360
checking and validating that

115
00:04:13,670 --> 00:04:10,879
everything's a-okay

116
00:04:15,350 --> 00:04:13,680
and uh there's a little bit of a of a

117
00:04:17,509 --> 00:04:15,360
pitch over that the whole vehicle does

118
00:04:19,830 --> 00:04:17,519
as a consequence of these these engines

119
00:04:21,590 --> 00:04:19,840
thrusting off the center of gravity and

120
00:04:23,110 --> 00:04:21,600
when the whole vehicle snaps back and is

121
00:04:25,350 --> 00:04:23,120
straight up in the air

122
00:04:27,110 --> 00:04:25,360
the engines or the boosters ignite and

123
00:04:28,870 --> 00:04:27,120
the whole thing takes off

124
00:04:30,550 --> 00:04:28,880
great great photography here i mean you

125
00:04:32,070 --> 00:04:30,560
can see all this flow phenomenon going

126
00:04:33,510 --> 00:04:32,080
on inside the engines now the spatial

127
00:04:35,749 --> 00:04:33,520
main engines are burning hydrogen and

128
00:04:37,510 --> 00:04:35,759
oxygen and i'll talk about some of the

129
00:04:38,629 --> 00:04:37,520
fun facts about that later on and some

130
00:04:40,150 --> 00:04:38,639
of the other clips that you're going to

131
00:04:42,070 --> 00:04:40,160
see but here you can see the engines

132
00:04:43,110 --> 00:04:42,080
have stabilized and uh everything is

133
00:04:44,950 --> 00:04:43,120
a-okay

134
00:04:46,870 --> 00:04:44,960
and uh in just a few moments you'll see

135
00:04:48,469 --> 00:04:46,880
the boosters fire off

136
00:04:49,990 --> 00:04:48,479
um did we talk about the time code i

137
00:04:51,670 --> 00:04:50,000
can't remember so

138
00:04:53,990 --> 00:04:51,680

no we haven't talked about the time code

139
00:04:55,909 --> 00:04:54,000
the time code that you'll see the led

140
00:04:57,350 --> 00:04:55,919
display in the right-hand side is

141
00:05:00,629 --> 00:04:57,360
actually positioned between the two

142
00:05:02,870 --> 00:05:00,639
sprockets um on the 16 millimeter frame

143
00:05:05,189 --> 00:05:02,880
and uh the time code is utc timecode

144
00:05:09,430 --> 00:05:05,199
it's an irigb format and you'll see that

145
00:05:10,950 --> 00:05:09,440
it's uh 21 hours so being utc at 502pm

146
00:05:14,390 --> 00:05:10,960
local time

147
00:05:15,990 --> 00:05:14,400
two minutes 11 seconds and the three

148
00:05:17,510 --> 00:05:16,000
digits that are moving in the upper

149
00:05:19,189 --> 00:05:17,520
right hand corner

150
00:05:21,990 --> 00:05:19,199
would be representing a thousandth of a

151
00:05:24,310 --> 00:05:22,000
second the solid number one on the

152
00:05:26,230 --> 00:05:24,320
second digit from the top is indicating

153
00:05:28,790 --> 00:05:26,240
the synchronization of the cameras is

154
00:05:30,070 --> 00:05:28,800
more of a technical parameter

155
00:05:31,670 --> 00:05:30,080
and that is uh

156
00:05:33,830 --> 00:05:31,680
on every camera to synchronize the field

157
00:05:35,590 --> 00:05:33,840
of view they've synchronized the time

158
00:05:37,670 --> 00:05:35,600
this is pretty cool you can see some of

159
00:05:39,749 --> 00:05:37,680
the oxygen that that cloud of vapor

160
00:05:41,909 --> 00:05:39,759
there was from the oxygen uh fuel

161
00:05:43,990 --> 00:05:41,919
umbilical uh of course the solid rocket

162
00:05:44,790 --> 00:05:44,000
boosters have now uh ignited their the

163
00:05:46,870 --> 00:05:44,800

whole

164
00:05:49,510 --> 00:05:46,880
vehicle is lifting off the pad

165
00:05:50,950 --> 00:05:49,520
and uh you can see sort of the glory of

166
00:05:53,270 --> 00:05:50,960
this moment i mean there's an enormous

167
00:05:55,270 --> 00:05:53,280
amount of fuel being burned uh one

168
00:05:57,510 --> 00:05:55,280
little thing that i love is if you look

169
00:05:59,670 --> 00:05:57,520
at the sky in the background

170
00:06:02,070 --> 00:05:59,680
this was a very clear day these pictures

171
00:06:04,070 --> 00:06:02,080
were selected or these

172
00:06:05,830 --> 00:06:04,080
movies were selected because of the

173
00:06:07,350 --> 00:06:05,840
the wonderful photography that we got in

174
00:06:09,749 --> 00:06:07,360
the state and you can see the sky deep

175
00:06:12,230 --> 00:06:09,759
into this dark blue and that's because

176
00:06:14,390 --> 00:06:12,240
as uh as kevin will talk later on that

177
00:06:17,270 --> 00:06:14,400
we got into uh color correction that we

178
00:06:19,110 --> 00:06:17,280
do post uh post launch to make sure that

179
00:06:21,189 --> 00:06:19,120
we're capturing all of this

180
00:06:22,629 --> 00:06:21,199
uh

181
00:06:24,710 --> 00:06:22,639
the events that are going on all of the

182
00:06:26,870 --> 00:06:24,720
flow events so here the vehicles

183
00:06:30,710 --> 00:06:26,880
clearing the pad and

184
00:06:35,270 --> 00:06:32,790
this view that you're seeing here is

185
00:06:37,830 --> 00:06:35,280
camera e8 or echo 8 and it's a 16

186
00:06:39,590 --> 00:06:37,840
millimeter camera with a 10 millimeter

187
00:06:41,670 --> 00:06:39,600
lens yeah you can see the boosters now

188
00:06:43,350 --> 00:06:41,680

coming off the pad and uh one of the

189
00:06:45,110 --> 00:06:43,360
amazing things that a lot of folks don't

190
00:06:47,270 --> 00:06:45,120
know about the shuttle is bolted to the

191
00:06:49,189 --> 00:06:47,280
mobile launch platform is it's basically

192
00:06:51,670 --> 00:06:49,199
through four bolts on each solid rocket

193
00:06:53,270 --> 00:06:51,680
booster and the intent of these cameras

194
00:06:57,029 --> 00:06:53,280
is to watch that bolt which is an

195
00:06:58,870 --> 00:06:57,039
explosive uh nut bolt arrangement

196
00:06:59,909 --> 00:06:58,880
and the bolt weighs about 100 pounds i

197
00:07:02,230 --> 00:06:59,919
should say

198
00:07:03,749 --> 00:07:02,240
and these nuts fracture and the bolts uh

199
00:07:04,629 --> 00:07:03,759
slap down into a holder that you're

200
00:07:06,629 --> 00:07:04,639
actually sort of seeing in the

201
00:07:08,309 --> 00:07:06,639
foreground here and they literally

202
00:07:11,110 --> 00:07:08,319
release the vehicle from the pad and

203
00:07:12,870 --> 00:07:11,120
allow it to uh to take off so for

204
00:07:14,070 --> 00:07:12,880
obvious reasons we have a camera on each

205
00:07:16,870 --> 00:07:14,080
one of these

206
00:07:18,070 --> 00:07:16,880
explosive hold down posts

207
00:07:19,990 --> 00:07:18,080
and uh to make sure that they're

208
00:07:21,350 --> 00:07:20,000
operating uh they're a critical aspect

209
00:07:22,469 --> 00:07:21,360
to the launch process we wanna make sure

210
00:07:24,390 --> 00:07:22,479
that they're operating good so you can

211
00:07:27,270 --> 00:07:24,400
see that puff of smoke coming out and

212
00:07:30,870 --> 00:07:27,280
actually if you wanna put the uh

213
00:07:32,629 --> 00:07:30,880

remote on a frame by frame uh stop

214
00:07:35,029 --> 00:07:32,639
action you can actually see the flash as

215
00:07:36,790 --> 00:07:35,039
it explodes uh now kevin here here's

216
00:07:39,110 --> 00:07:36,800
where you guys really did a fantastic

217
00:07:40,550 --> 00:07:39,120
job of of uh

218
00:07:42,150 --> 00:07:40,560
capturing the the

219
00:07:43,670 --> 00:07:42,160
detail in the plume through this

220
00:07:46,150 --> 00:07:43,680
automatic aperture on the cameras you

221
00:07:48,230 --> 00:07:46,160
want to talk about that a bit sure uh

222
00:07:50,710 --> 00:07:48,240
many of the 60 millimeter cameras that

223
00:07:52,869 --> 00:07:50,720
are on the mlp and pad structure have a

224
00:07:55,430 --> 00:07:52,879
an automatic exposure control it's the

225
00:07:58,070 --> 00:07:55,440
only real way to to keep the the

226
00:08:00,790 --> 00:07:58,080
exposure the high dynamic range exposure

227
00:08:02,790 --> 00:08:00,800
from uh pre-ignition of the srbs uh

228
00:08:05,029 --> 00:08:02,800
through through the uh the liftoff out

229
00:08:06,710 --> 00:08:05,039
of the frame of view

230
00:08:08,390 --> 00:08:06,720
so the camera has a basically an

231
00:08:10,550 --> 00:08:08,400
automatic exposure right now look at

232
00:08:11,990 --> 00:08:10,560
this sky on the left uh thing and see

233
00:08:13,589 --> 00:08:12,000
how it gets dark actually on both sides

234
00:08:15,350 --> 00:08:13,599
you can see how it turns that deep blue

235
00:08:16,950 --> 00:08:15,360
that's the automatic aperture in action

236
00:08:19,110 --> 00:08:16,960
right there right allowing us to see the

237
00:08:21,350 --> 00:08:19,120
detail in the in the pad structure and

238
00:08:23,029 --> 00:08:21,360

also in the flame yeah i mean when you

239
00:08:24,469 --> 00:08:23,039
see a launch in real life you the you

240
00:08:25,749 --> 00:08:24,479
can't see any detail with the naked eye

241
00:08:26,469 --> 00:08:25,759
in the plume it's just like looking into

242
00:08:32,630 --> 00:08:26,479
the

243
00:08:35,190 --> 00:08:32,640
we'll talk about that later that's

244
00:08:36,709 --> 00:08:35,200
splashing onto this quartz uh protective

245
00:08:37,750 --> 00:08:36,719
glass that the camera's behind of course

246
00:08:40,709 --> 00:08:37,760
they're in these

247
00:08:43,110 --> 00:08:40,719
explosion pool proof containers right to

248
00:08:44,630 --> 00:08:43,120
keep the cameras safe and sound that no

249
00:08:46,310 --> 00:08:44,640
cameras were harmed in this in the

250
00:08:48,790 --> 00:08:46,320
making of this movie that's right the

251
00:08:51,190 --> 00:08:48,800
cameras are in an explosion-proof box uh

252
00:08:52,790 --> 00:08:51,200
which is nitrogen purged and uh the

253
00:08:54,870 --> 00:08:52,800
quartz glass on the front protects the

254
00:08:56,949 --> 00:08:54,880
lens in in most cases there are some

255
00:08:58,710 --> 00:08:56,959
cases where there's damage and if that's

256
00:09:00,949 --> 00:08:58,720
the case the lenses will be re-polished

257
00:09:04,949 --> 00:09:00,959
re-ground or or whatever is necessary to

258
00:09:09,750 --> 00:09:07,430
well at this next view coming up is uh

259
00:09:11,990 --> 00:09:09,760
echo 18 or camera 18 and it's a 10

260
00:09:14,949 --> 00:09:12,000
millimeter lens uh and looking at the

261
00:09:17,750 --> 00:09:14,959
tsm or the tail service mast carrier

262
00:09:19,269 --> 00:09:17,760
disconnect yeah the umbilicals there's

263
00:09:20,949 --> 00:09:19,279

one on each side of the orbiter one for

264
00:09:22,870 --> 00:09:20,959
the liquid oxygen fueling and one for

265
00:09:24,150 --> 00:09:22,880
the liquid hydrogen feeling those are

266
00:09:25,590 --> 00:09:24,160
primary purposes you can see there's a

267
00:09:27,910 --> 00:09:25,600
lot of other instrumentation on these

268
00:09:29,829 --> 00:09:27,920
things uh in feed lines

269
00:09:31,350 --> 00:09:29,839
but these cameras their intention is to

270
00:09:32,710 --> 00:09:31,360
make sure we get good retraction of this

271
00:09:35,350 --> 00:09:32,720
there's actually

272
00:09:36,949 --> 00:09:35,360
a huge 20 000 pound mass that pulls

273
00:09:39,430 --> 00:09:36,959
these things inside the tail service

274
00:09:40,630 --> 00:09:39,440
mast uh for the door to slam shut and

275
00:09:43,190 --> 00:09:40,640
protect them

276
00:09:45,269 --> 00:09:43,200
from the um the hostile environment on

277
00:09:47,590 --> 00:09:45,279
the outside now these umbilicals are

278
00:09:48,949 --> 00:09:47,600
about four feet wide by six foot tall so

279
00:09:50,070 --> 00:09:48,959
you don't really get a sense of scale

280
00:09:51,190 --> 00:09:50,080
when you're looking at these in these

281
00:09:52,870 --> 00:09:51,200
movies

282
00:09:54,710 --> 00:09:52,880
but they're as big as a as an average

283
00:09:56,389 --> 00:09:54,720
size human being so they're

284
00:09:58,150 --> 00:09:56,399
quite large

285
00:09:59,990 --> 00:09:58,160
one of the interesting photographic

286
00:10:01,670 --> 00:10:00,000
challenges that we run into in

287
00:10:02,389 --> 00:10:01,680
photographing

288
00:10:24,310 --> 00:10:02,399

the

289
00:10:26,150 --> 00:10:24,320
from having those bulbs break is has

290
00:10:27,750 --> 00:10:26,160
been quite a challenge in fact

291
00:10:30,150 --> 00:10:27,760
they are in the process of changing

292
00:10:31,190 --> 00:10:30,160
those lights over to the new led arrays

293
00:10:32,790 --> 00:10:31,200
that provide

294
00:10:35,430 --> 00:10:32,800
more stability and

295
00:10:37,590 --> 00:10:35,440
less uh frequency of um having the bulbs

296
00:10:43,269 --> 00:10:37,600
go out before the film they're a lot

297
00:10:48,310 --> 00:10:46,310
okay matt this is uh echo001

298
00:10:50,230 --> 00:10:48,320
um and this is uh one of the four

299
00:10:51,990 --> 00:10:50,240
cameras on the edges of the mlp deck

300
00:10:54,230 --> 00:10:52,000
this is on the this camera happens to be

301
00:10:56,630 --> 00:10:54,240
on the northeast corner of the mlp deck

302
00:10:58,470 --> 00:10:56,640
and it's a 16 millimeter camera as all

303
00:11:00,550 --> 00:10:58,480
the ones on the mlpr and 10 millimeter

304
00:11:02,230 --> 00:11:00,560
focal length it's a wide angle view

305
00:11:04,949 --> 00:11:02,240
and the effect of shutter speed is about

306
00:11:07,269 --> 00:11:04,959
1 1200 of a second

307
00:11:08,710 --> 00:11:07,279
for our viewers uh

308
00:11:09,590 --> 00:11:08,720
you can see that we pulled a little bit

309
00:11:11,030 --> 00:11:09,600
away

310
00:11:12,870 --> 00:11:11,040
back from the vehicle now we're taking a

311
00:11:14,710 --> 00:11:12,880
little bit of a wider view there's the

312
00:11:16,550 --> 00:11:14,720
ssmes just firing off there and you can

313
00:11:18,790 --> 00:11:16,560

see the plume in the background

314
00:11:20,310 --> 00:11:18,800
uh growing in fact if you look carefully

315
00:11:22,630 --> 00:11:20,320
uh against the plume there you can see a

316
00:11:24,389 --> 00:11:22,640
couple of cameras um once you mention

317
00:11:26,310 --> 00:11:24,399
what those are those are some motv

318
00:11:28,069 --> 00:11:26,320
cameras operational television cameras

319
00:11:30,069 --> 00:11:28,079
that are used for surveillance of the of

320
00:11:32,230 --> 00:11:30,079
the vehicle they're the uh

321
00:11:33,829 --> 00:11:32,240
and are piped back live to the launch

322
00:11:36,790 --> 00:11:33,839
control complex

323
00:11:37,910 --> 00:11:36,800
signals so the ssmes are firing you can

324
00:11:39,829 --> 00:11:37,920
actually see the launch tower on the

325
00:11:41,750 --> 00:11:39,839
right hand side of the screen

326
00:11:43,190 --> 00:11:41,760
and again they go on for about six

327
00:11:44,790 --> 00:11:43,200
seconds computers are making sure that

328
00:11:47,509 --> 00:11:44,800
everything's working

329
00:11:49,670 --> 00:11:47,519
and at uh t-minus zero those boosters

330
00:11:51,590 --> 00:11:49,680
are gonna fire and yeah you'll see a big

331
00:11:53,190 --> 00:11:51,600
puff of smoke come out of the flame

332
00:11:54,230 --> 00:11:53,200
trench there and it'll get sucked back

333
00:11:57,030 --> 00:11:54,240
down in

334
00:11:58,310 --> 00:11:57,040
uh as the boosters come off the pad

335
00:12:00,629 --> 00:11:58,320
and these two

336
00:12:02,310 --> 00:12:00,639
sort of uh structures uh one standing

337
00:12:03,590 --> 00:12:02,320
just to the left of the left booster and

338
00:12:06,470 --> 00:12:03,600

one standing just to the right of the

339
00:12:08,790 --> 00:12:06,480
right booster are called rain birds

340
00:12:10,710 --> 00:12:08,800
and uh there's some piping uh sort of

341
00:12:12,230 --> 00:12:10,720
flat against the launch pad as well that

342
00:12:15,269 --> 00:12:12,240
sort of connect all these things

343
00:12:18,069 --> 00:12:15,279
together there go the boosters firing

344
00:12:20,310 --> 00:12:18,079
and uh all of this fresh water 300 000

345
00:12:21,829 --> 00:12:20,320
gallons to be exact comes pouring out of

346
00:12:22,790 --> 00:12:21,839
those rain birds

347
00:12:24,150 --> 00:12:22,800
and

348
00:12:26,150 --> 00:12:24,160
onto the launch pad to deaden the

349
00:12:27,430 --> 00:12:26,160
acoustic noise and cool the pad down so

350
00:12:29,509 --> 00:12:27,440
that's where the water comes from some

351
00:12:32,069 --> 00:12:29,519
of these camera shots

352
00:12:33,829 --> 00:12:32,079
and here you can see the uh the aec um

353
00:12:36,230 --> 00:12:33,839
the automatic exposure control on the

354
00:12:38,949 --> 00:12:36,240
camera's taking over as the

355
00:12:41,670 --> 00:12:38,959
booster plume comes into view

356
00:12:43,990 --> 00:12:41,680
and allows to see the aec allows you to

357
00:12:46,230 --> 00:12:44,000
see the the detail both in the plume as

358
00:12:48,310 --> 00:12:46,240
well as in the vehicle and structure

359
00:12:51,190 --> 00:12:48,320
itself and you can also see very good

360
00:12:52,629 --> 00:12:51,200
detail on the the deck of the mlp

361
00:12:55,030 --> 00:12:52,639
now we talk a little bit about the

362
00:12:56,550 --> 00:12:55,040
purpose of each one of these cameras and

363
00:12:57,829 --> 00:12:56,560

this one is to look for some structural

364
00:13:00,150 --> 00:12:57,839
anomalies

365
00:13:01,750 --> 00:13:00,160
on the vehicle some thermal insulation

366
00:13:03,430 --> 00:13:01,760
failures we might have on the tiles or

367
00:13:05,509 --> 00:13:03,440
the blankets etc

368
00:13:07,269 --> 00:13:05,519
and how the water is getting dispersed

369
00:13:09,269 --> 00:13:07,279
on the pad and also we're looking at

370
00:13:10,710 --> 00:13:09,279
debris and actually you can see here

371
00:13:12,710 --> 00:13:10,720
that we've got quite a bit of debris in

372
00:13:14,069 --> 00:13:12,720
the field and debris is a big concern

373
00:13:15,430 --> 00:13:14,079
for the shuttle folks and we want to

374
00:13:16,389 --> 00:13:15,440
keep an eye on it to make sure we don't

375
00:13:17,910 --> 00:13:16,399
have anything that's going to threaten

376
00:13:19,750 --> 00:13:17,920
the vehicle

377
00:13:22,870 --> 00:13:19,760
now matt you can see that this is uh

378
00:13:23,829 --> 00:13:22,880
well this is camera echo 4. uh e004 it's

379
00:13:26,470 --> 00:13:23,839
on the

380
00:13:28,550 --> 00:13:26,480
corner of the mlp deck and uh very

381
00:13:30,230 --> 00:13:28,560
similar in field of view to the camera

382
00:13:31,750 --> 00:13:30,240
we just looked at

383
00:13:33,350 --> 00:13:31,760
what one of the things i like to point

384
00:13:34,470 --> 00:13:33,360
out is you can see one of the camera box

385
00:13:36,550 --> 00:13:34,480
enclosures we were talking about a

386
00:13:38,150 --> 00:13:36,560
little bit earlier uh in the left-hand

387
00:13:41,670 --> 00:13:38,160
side of the frame right in front of the

388
00:13:44,389 --> 00:13:41,680

uh the left srb yeah and in fact uh

389
00:13:46,790 --> 00:13:44,399
uh as we mentioned earlier in the uh

390
00:13:48,870 --> 00:13:46,800
in the piece there's about 125 cameras

391
00:13:52,470 --> 00:13:48,880
or so actually more

392
00:13:54,230 --> 00:13:52,480
uh that document any given launch and so

393
00:13:56,069 --> 00:13:54,240
for brevity in this piece and to make it

394
00:13:57,509 --> 00:13:56,079
watchable we had to have a lot of a lot

395
00:13:59,990 --> 00:13:57,519
of film hit the cutting room floor and

396
00:14:01,590 --> 00:14:00,000
it was really difficult for me to

397
00:14:03,509 --> 00:14:01,600
to cut a lot of it out because i loved

398
00:14:05,509 --> 00:14:03,519
all of the footage i i'm a fan of each

399
00:14:07,590 --> 00:14:05,519
and every camera uh but that little

400
00:14:09,430 --> 00:14:07,600
camera there didn't get its uh it'd stay

401
00:14:12,310 --> 00:14:09,440
in the shade that that

402
00:14:13,509 --> 00:14:12,320
that film of the booster had to uh

403
00:14:15,110 --> 00:14:13,519
we have to have that for the director's

404
00:14:17,350 --> 00:14:15,120
cut in the future

405
00:14:19,509 --> 00:14:17,360
and uh just to give you a perspective um

406
00:14:22,470 --> 00:14:19,519
this camera uh originally captured the

407
00:14:25,030 --> 00:14:22,480
scene at uh 400 frames a second so it's

408
00:14:27,670 --> 00:14:25,040
being played back at 24 frames so it's

409
00:14:29,750 --> 00:14:27,680
about 1 16

410
00:14:31,189 --> 00:14:29,760
of the speed um that it was actually

411
00:14:33,670 --> 00:14:31,199
captured at

412
00:14:35,590 --> 00:14:33,680
to give us a real-time view now you can

413
00:14:37,670 --> 00:14:35,600

see here

414
00:14:39,350 --> 00:14:37,680
how absolutely gorgeous the day was and

415
00:14:41,269 --> 00:14:39,360
as we mentioned earlier it was about

416
00:14:43,269 --> 00:14:41,279
five o'clock in the afternoon

417
00:14:45,750 --> 00:14:43,279
so in the film industry they call this

418
00:14:47,030 --> 00:14:45,760
magic hour and and there's no

419
00:14:48,230 --> 00:14:47,040
question about it that this is one of

420
00:14:49,430 --> 00:14:48,240
the best times of day to take

421
00:14:50,629 --> 00:14:49,440
photographs of the shuttle you have

422
00:14:54,310 --> 00:14:50,639
these rich

423
00:14:56,710 --> 00:14:54,320
colors and uh just a beautiful blue sky

424
00:14:59,189 --> 00:14:56,720
to sort of highlight all of this so i

425
00:15:00,629 --> 00:14:59,199
find these pictures second to none in

426
00:15:03,430 --> 00:15:00,639
all of the launch imagery that's been

427
00:15:07,990 --> 00:15:05,750
i should say that these boosters uh shed

428
00:15:09,590 --> 00:15:08,000
about 10 000 pounds of mass per second

429
00:15:11,509 --> 00:15:09,600
once they're lit up

430
00:15:12,470 --> 00:15:11,519
and that's each so it's 20 000 pounds

431
00:15:15,269 --> 00:15:12,480
combined

432
00:15:16,949 --> 00:15:15,279
and you can really get the feel of of

433
00:15:20,550 --> 00:15:16,959
that awesome magnitude by looking at

434
00:15:24,870 --> 00:15:22,150
you see a piece of debris on the right

435
00:15:26,949 --> 00:15:24,880
sort of doing a ballet and

436
00:15:28,470 --> 00:15:26,959
in slow motion there

437
00:15:30,069 --> 00:15:28,480
this is some tie-down string from some

438
00:15:31,749 --> 00:15:30,079

water membranes under the srbs that

439
00:15:33,829 --> 00:15:31,759
we'll talk about in a few moments you

440
00:15:35,189 --> 00:15:33,839
know teams go through this uh this is

441
00:15:36,389 --> 00:15:35,199
engineering footage and the teams go

442
00:15:39,430 --> 00:15:36,399
through this and identify everything

443
00:15:44,310 --> 00:15:42,230
okay this uh this is a camera echo 36

444
00:15:46,670 --> 00:15:44,320
and this is uh this camera is located on

445
00:15:48,870 --> 00:15:46,680
the fixed service structure at the

446
00:15:50,550 --> 00:15:48,880
255 foot level

447
00:15:55,269 --> 00:15:50,560
we refer to the fixed service structure

448
00:16:01,189 --> 00:15:58,230
it's a 16 millimeter camera uh with a

449
00:16:03,030 --> 00:16:01,199
16 millimeter focal length lens and the

450
00:16:04,550 --> 00:16:03,040
effect of shutter speed is about a 1200

451
00:16:07,269 --> 00:16:04,560
of a second similar to some of the other

452
00:16:09,829 --> 00:16:07,279
ones that we've seen

453
00:16:12,150 --> 00:16:09,839
this is a long clip um in fact this is

454
00:16:13,430 --> 00:16:12,160
probably the longest clip

455
00:16:14,790 --> 00:16:13,440
uh

456
00:16:17,350 --> 00:16:14,800
that that i

457
00:16:18,949 --> 00:16:17,360
sort of chose for the the production

458
00:16:20,230 --> 00:16:18,959
there's a lot going on in here but it

459
00:16:21,670 --> 00:16:20,240
looks a little boring for a while

460
00:16:23,509 --> 00:16:21,680
because those engines are on for a long

461
00:16:25,829 --> 00:16:23,519
time so we're still at 400 frames a

462
00:16:27,350 --> 00:16:25,839
second here right yes yeah okay so there

463
00:16:29,030 --> 00:16:27,360

you see the main engines igniting you

464
00:16:31,829 --> 00:16:29,040
can see all of this water pouring into

465
00:16:34,710 --> 00:16:31,839
the flame trench there's a big flash uh

466
00:16:36,470 --> 00:16:34,720
the hydrogen and the oxygen lighting up

467
00:16:38,069 --> 00:16:36,480
i should tell you that uh coming out of

468
00:16:39,670 --> 00:16:38,079
that external tank

469
00:16:41,189 --> 00:16:39,680
uh inside there the cryogenic

470
00:16:44,230 --> 00:16:41,199
propellants liquid oxygen liquid

471
00:16:45,829 --> 00:16:44,240
hydrogen 750 gallons a second of liquid

472
00:16:47,749 --> 00:16:45,839
hydrogen is pouring into that engine

473
00:16:50,629 --> 00:16:47,759
cluster and 280 gallons a second of

474
00:16:53,350 --> 00:16:50,639
liquid oxygen all of these

475
00:16:55,590 --> 00:16:53,360
things being combined uh instantly

476
00:16:58,150 --> 00:16:55,600
effectively instantly to

477
00:17:01,350 --> 00:16:58,160
to create this fantastic combustion

478
00:17:03,030 --> 00:17:01,360
process burning 3000 pounds of

479
00:17:04,549 --> 00:17:03,040
propellants to turn it into water vapor

480
00:17:06,309 --> 00:17:04,559
every second and it's almost invisible

481
00:17:08,069 --> 00:17:06,319
when it comes out of the engines

482
00:17:09,669 --> 00:17:08,079
so the engines are turning on now you

483
00:17:11,429 --> 00:17:09,679
can sort of see them glowing against the

484
00:17:12,710 --> 00:17:11,439
water pouring into the flame trench that

485
00:17:14,470 --> 00:17:12,720
water's there

486
00:17:17,270 --> 00:17:14,480
primarily to deaden the acoustic noise

487
00:17:18,630 --> 00:17:17,280
and keep things cool

488
00:17:20,069 --> 00:17:18,640

and you've got a good look at the belly

489
00:17:21,590 --> 00:17:20,079
of the orbiter here one of the purposes

490
00:17:23,029 --> 00:17:21,600
of this camera is to look to see if we

491
00:17:25,270 --> 00:17:23,039
lose any tiles

492
00:17:27,189 --> 00:17:25,280
uh due to the shock of ignition of the

493
00:17:28,630 --> 00:17:27,199
solid rocket boosters now you can see

494
00:17:30,870 --> 00:17:28,640
the boosters around just a couple of

495
00:17:33,430 --> 00:17:30,880
minutes and you see those red sort of

496
00:17:35,750 --> 00:17:33,440
ribbed uh

497
00:17:37,430 --> 00:17:35,760
surfaces there inside the flame trench

498
00:17:40,310 --> 00:17:37,440
those are actually

499
00:17:41,669 --> 00:17:40,320
um membranes to hold water

500
00:17:42,950 --> 00:17:41,679
and those will get burned away and

501
00:17:44,789 --> 00:17:42,960
you'll sort of see that in the film when

502
00:17:46,230 --> 00:17:44,799
the boosters fire

503
00:17:47,990 --> 00:17:46,240
there you see them right there and

504
00:17:49,430 --> 00:17:48,000
there's water in there that's sort of uh

505
00:17:52,310 --> 00:17:49,440
that's sort of getting jarred loose and

506
00:17:54,150 --> 00:17:52,320
turning into steam uh and and i'm

507
00:17:56,549 --> 00:17:54,160
assuming i don't know for sure that it

508
00:17:58,789 --> 00:17:56,559
prevents uh sort of a recirculation of

509
00:18:00,950 --> 00:17:58,799
the exhaust at liftoff probably again

510
00:18:02,310 --> 00:18:00,960
acoustic deadening noise

511
00:18:04,310 --> 00:18:02,320
and there you see those boosters firing

512
00:18:07,110 --> 00:18:04,320
off if you look in the upper left-hand

513
00:18:10,549 --> 00:18:07,120

corner you see the um

514
00:18:12,390 --> 00:18:10,559
the umbilical uh falling backwards there

515
00:18:13,990 --> 00:18:12,400
and then look at how the spatial main

516
00:18:15,909 --> 00:18:14,000
engines are punching through that that

517
00:18:17,190 --> 00:18:15,919
uh that water in the flame trench that's

518
00:18:19,590 --> 00:18:17,200
really cool

519
00:18:21,909 --> 00:18:19,600
yeah this is quite a dramatic shot and

520
00:18:23,830 --> 00:18:21,919
the uh you can see the uh auto exposure

521
00:18:25,430 --> 00:18:23,840
control on the on the lens as we've

522
00:18:26,870 --> 00:18:25,440
talked about

523
00:18:28,390 --> 00:18:26,880
on some of the other views really

524
00:18:31,430 --> 00:18:28,400
helping to be able to see

525
00:18:33,270 --> 00:18:31,440
the detail on the uh the ssmes punching

526
00:18:36,390 --> 00:18:33,280
that hole as well as looking at the

527
00:18:38,789 --> 00:18:36,400
plume from the for the from the srb

528
00:18:40,390 --> 00:18:38,799
and seeing the the edge of the uh

529
00:18:43,029 --> 00:18:40,400
the belly of the orbiter too see the

530
00:18:44,470 --> 00:18:43,039
ssmes aim a little bit off uh kilt there

531
00:18:46,310 --> 00:18:44,480
and you can see them hitting the the

532
00:18:47,750 --> 00:18:46,320
upper part of the mobile launch platform

533
00:18:49,350 --> 00:18:47,760
as they rise off

534
00:18:52,070 --> 00:18:49,360
amazing that they capture all that

535
00:19:01,110 --> 00:18:52,080
detail in the uh the srb plumes

536
00:19:08,630 --> 00:19:03,350
it's a fantastic clip it

537
00:19:13,110 --> 00:19:11,350
this is a camera echo 41 this is on the

538
00:19:15,669 --> 00:19:13,120

fixed service structure on the fss at

539
00:19:17,750 --> 00:19:15,679
the 255 foot level

540
00:19:19,029 --> 00:19:17,760
it's a 10 millimeter focal length on the

541
00:19:20,789 --> 00:19:19,039
16 millimeter camera it's a really

542
00:19:22,630 --> 00:19:20,799
interesting view and you know matt you

543
00:19:23,830 --> 00:19:22,640
want to provide some more details about

544
00:19:25,830 --> 00:19:23,840
what we're seeing yeah you can see the

545
00:19:28,070 --> 00:19:25,840
boosters have already fired and this big

546
00:19:29,510 --> 00:19:28,080
uh umbilical structure that you see

547
00:19:31,590 --> 00:19:29,520
swinging back

548
00:19:32,870 --> 00:19:31,600
uh is actually very massive the plate on

549
00:19:35,350 --> 00:19:32,880
the end of that is about a foot and a

550
00:19:37,029 --> 00:19:35,360
half by three foot uh square you'll see

551
00:19:39,110 --> 00:19:37,039
a close-up of that a little bit

552
00:19:41,190 --> 00:19:39,120
that's the um

553
00:19:43,270 --> 00:19:41,200
the uh

554
00:19:45,270 --> 00:19:43,280
ground umbilical to uh

555
00:19:47,430 --> 00:19:45,280
hook up to the uh the venting for the

556
00:19:49,430 --> 00:19:47,440
hydrogen tank and and it's got some

557
00:19:51,510 --> 00:19:49,440
nitrogen and helium purge lines and some

558
00:19:52,950 --> 00:19:51,520
instrumentation to go with it a pretty

559
00:19:54,150 --> 00:19:52,960
complicated structure you get a picture

560
00:19:55,990 --> 00:19:54,160
of that in a minute if you look at the

561
00:19:57,510 --> 00:19:56,000
mlp or the mobile launch platform you

562
00:19:59,590 --> 00:19:57,520
see all the water coming out of the rain

563
00:20:01,350 --> 00:19:59,600

birds under the launch pad

564
00:20:03,430 --> 00:20:01,360
again our active

565
00:20:04,950 --> 00:20:03,440
exposure kicking in there and giving us

566
00:20:06,470 --> 00:20:04,960
a great shot of the plumes as the

567
00:20:08,310 --> 00:20:06,480
vehicle clears the tower

568
00:20:10,549 --> 00:20:08,320
look on the right you can just see a tad

569
00:20:12,870 --> 00:20:10,559
of the ssme

570
00:20:14,870 --> 00:20:12,880
burning there that little blue cone

571
00:20:40,870 --> 00:20:14,880
fantastic detail there isn't it yeah

572
00:20:45,590 --> 00:20:43,430
echo 40 is one of my my favorite shots

573
00:20:48,310 --> 00:20:45,600
matt and this is on the fixed service

574
00:20:50,149 --> 00:20:48,320
structure on the fss at the 275 foot

575
00:20:51,590 --> 00:20:50,159
level just a bit higher than the two

576
00:20:54,310 --> 00:20:51,600
previous

577
00:20:56,549 --> 00:20:54,320
views we we saw and this is uh really an

578
00:20:57,830 --> 00:20:56,559
incredible view of not only the orbiter

579
00:20:59,590 --> 00:20:57,840
but the

580
00:21:01,909 --> 00:20:59,600
beautiful ocean the late

581
00:21:04,310 --> 00:21:01,919
spring day in florida and very nice

582
00:21:05,590 --> 00:21:04,320
lighting uh on the tank and

583
00:21:06,870 --> 00:21:05,600
as well as you'll see on the orbiter

584
00:21:09,830 --> 00:21:06,880
surfaces

585
00:21:11,750 --> 00:21:09,840
yeah it truly is a magic hour on this

586
00:21:12,789 --> 00:21:11,760
uh that orange tank for those that

587
00:21:14,630 --> 00:21:12,799
aren't all that familiar with the

588
00:21:16,630 --> 00:21:14,640

shuttle that's foam it's insulating foam

589
00:21:18,870 --> 00:21:16,640
on the tank to keep the cryogenic

590
00:21:20,789 --> 00:21:18,880
propellants cold on the inside

591
00:21:22,310 --> 00:21:20,799
uh liquid oxygen liquid hydrogen are

592
00:21:23,990 --> 00:21:22,320
pretty chilly when they get into their

593
00:21:26,230 --> 00:21:24,000
liquid state

594
00:21:27,590 --> 00:21:26,240
you can actually virtually look into the

595
00:21:28,950 --> 00:21:27,600
cockpit here if you look carefully you

596
00:21:31,510 --> 00:21:28,960
can see the ocean right through the

597
00:21:32,789 --> 00:21:31,520
window just briefly there for a moment

598
00:21:34,470 --> 00:21:32,799
kind of fun

599
00:21:35,909 --> 00:21:34,480
there's discovery in all its glory this

600
00:21:38,470 --> 00:21:35,919
this uh

601
00:21:40,310 --> 00:21:38,480
engineering view is to look at uh any

602
00:21:43,029 --> 00:21:40,320
possible issues with the tiles or the

603
00:21:45,190 --> 00:21:43,039
thermal protection system on the vehicle

604
00:21:46,630 --> 00:21:45,200
and look at that absolutely gorgeous you

605
00:21:48,149 --> 00:21:46,640
can see some of the flakes of ice sort

606
00:21:53,510 --> 00:21:48,159
of tracking the vehicle as it moves

607
00:21:57,510 --> 00:21:55,830
remember uh as we mentioned earlier that

608
00:21:59,750 --> 00:21:57,520
three thousand pounds of water vapor a

609
00:22:01,190 --> 00:21:59,760
second is coming out of the spatial main

610
00:22:28,070 --> 00:22:01,200
engines on the back it's pretty

611
00:22:32,470 --> 00:22:30,149
all right this view is of of a structure

612
00:22:34,310 --> 00:22:32,480
we call the gup which is the uh ground

613
00:22:36,470 --> 00:22:34,320

umbilical carrier plate which attaches

614
00:22:38,789 --> 00:22:36,480
to the ground umbilical carrier assembly

615
00:22:40,950 --> 00:22:38,799
sometimes called the gucker that plate

616
00:22:43,430 --> 00:22:40,960
is about a foot and a half

617
00:22:44,950 --> 00:22:43,440
by uh three foot it's a sizable plate

618
00:22:46,789 --> 00:22:44,960
you don't really capture the scale in

619
00:22:48,149 --> 00:22:46,799
this and you can see the vehicle is now

620
00:22:50,549 --> 00:22:48,159
lifted up and it's taking off that

621
00:22:52,630 --> 00:22:50,559
umbilical peels back right at uh solid

622
00:22:55,990 --> 00:22:52,640
rocket booster separation her

623
00:22:59,350 --> 00:22:56,000
detonation and matt this is a camera 33

624
00:23:00,470 --> 00:22:59,360
and this is a on the fss it's at the 235

625
00:23:03,270 --> 00:23:00,480
foot level

626
00:23:05,270 --> 00:23:03,280
um and is using a fairly long focal

627
00:23:06,710 --> 00:23:05,280
length lens it's and you can tell by the

628
00:23:09,350 --> 00:23:06,720
field of view that it is a long focal

629
00:23:10,549 --> 00:23:09,360
length lens and it's 75 millimeters

630
00:23:12,789 --> 00:23:10,559
now if you look you can see the

631
00:23:16,070 --> 00:23:12,799
booster's kind of surging it's not a

632
00:23:18,070 --> 00:23:16,080
continuous pass it sort of pushes and

633
00:23:19,350 --> 00:23:18,080
then slows down a little bit and what

634
00:23:22,470 --> 00:23:19,360
you're seeing there is the natural

635
00:23:24,070 --> 00:23:22,480
frequency of the booster thrust um

636
00:23:24,950 --> 00:23:24,080
i believe it was on the order of about

637
00:23:29,430 --> 00:23:24,960
seven

638
00:23:31,190 --> 00:23:29,440

can see that go by and hear the uh the

639
00:23:33,669 --> 00:23:31,200
aft skirt of the boosters going by with

640
00:23:43,830 --> 00:23:33,679
a really nice tight shot of the uh the

641
00:23:48,149 --> 00:23:45,990
this camera view is uh on the pad

642
00:23:51,510 --> 00:23:48,159
perimeter it's located at camera site 3.

643
00:23:53,510 --> 00:23:51,520
it's about 1270 feet away from the from

644
00:23:55,350 --> 00:23:53,520
the vehicle and it's the first in a

645
00:23:56,870 --> 00:23:55,360
series of the 35 millimeter cameras

646
00:23:58,230 --> 00:23:56,880
which will be seeing the upcoming uh

647
00:24:00,230 --> 00:23:58,240
sequences

648
00:24:01,110 --> 00:24:00,240
there's a lens on here the focal length

649
00:24:02,950 --> 00:24:01,120
is

650
00:24:06,789 --> 00:24:02,960
500 millimeters or so

651
00:24:08,630 --> 00:24:06,799
and the effective exposure is a 1 450th

652
00:24:10,870 --> 00:24:08,640
of a second and the camera's running at

653
00:24:13,510 --> 00:24:10,880
180 frames per second

654
00:24:15,669 --> 00:24:13,520
yeah it's a beautiful shot and uh this

655
00:24:17,190 --> 00:24:15,679
is going to as kevin says first in the

656
00:24:18,630 --> 00:24:17,200
35 millimeter shots they're a little

657
00:24:20,390 --> 00:24:18,640
better quality

658
00:24:21,990 --> 00:24:20,400
uh because they've just got more surface

659
00:24:25,110 --> 00:24:22,000
area to put an image on

660
00:24:27,430 --> 00:24:25,120
um you can see the ssmes firing and uh

661
00:24:29,110 --> 00:24:27,440
all in nominal operation here

662
00:24:30,830 --> 00:24:29,120
and as soon as they pull away from the

663
00:24:32,710 --> 00:24:30,840

pad you'll see the left booster in the

664
00:24:36,230 --> 00:24:32,720
background centered between the two

665
00:24:37,750 --> 00:24:36,240
service tail masts and just a gorgeous

666
00:24:39,590 --> 00:24:37,760
shot right there looking at the steam

667
00:24:43,110 --> 00:24:39,600
coming off the ssmes

668
00:24:45,269 --> 00:24:43,120
and this is a fantastic

669
00:24:47,190 --> 00:24:45,279
capture of what what remains behind

670
00:24:49,990 --> 00:24:47,200
after the vehicle clears the tower is

671
00:24:52,630 --> 00:24:50,000
you have all of this water and steam uh

672
00:24:54,870 --> 00:24:52,640
being pushed around in this amazing

673
00:24:56,630 --> 00:24:54,880
uh hostile acoustic environment i mean

674
00:24:59,350 --> 00:24:56,640
look at what's going on there this is

675
00:25:05,350 --> 00:24:59,360
all acoustic noise and shock

676
00:25:08,789 --> 00:25:07,590
camera 63 is located on the pad

677
00:25:10,669 --> 00:25:08,799
perimeter

678
00:25:12,630 --> 00:25:10,679
one of the camera sites it's

679
00:25:14,310 --> 00:25:12,640
1270 feet

680
00:25:15,269 --> 00:25:14,320
from the vehicle and it's using a

681
00:25:18,710 --> 00:25:15,279
hundred and

682
00:25:21,190 --> 00:25:18,720
105 millimeter lens the camera's running

683
00:25:23,590 --> 00:25:21,200
at 180 frames a second and that's

684
00:25:26,549 --> 00:25:23,600
pushing about 630 feet of film through

685
00:25:28,390 --> 00:25:26,559
the camera uh per minute uh quite quite

686
00:25:30,549 --> 00:25:28,400
quite a fast rate

687
00:25:31,909 --> 00:25:30,559
especially for 35 millimeter

688
00:25:33,750 --> 00:25:31,919

yeah you can see the sparkers going

689
00:25:35,350 --> 00:25:33,760
there just getting ready to turn

690
00:25:37,190 --> 00:25:35,360
the main engines on

691
00:25:38,630 --> 00:25:37,200
and in the background you see the water

692
00:25:41,110 --> 00:25:38,640
tower that's where all that fresh water

693
00:25:42,549 --> 00:25:41,120
comes from to flood the pad to keep it

694
00:25:44,390 --> 00:25:42,559
chilled and

695
00:25:46,230 --> 00:25:44,400
deaden a lot of that acoustic noise that

696
00:25:49,350 --> 00:25:46,240
we've already seen

697
00:25:50,390 --> 00:25:49,360
what it looks like in the plume

698
00:25:52,390 --> 00:25:50,400
uh

699
00:25:54,470 --> 00:25:52,400
absolutely gorgeous day really

700
00:25:55,990 --> 00:25:54,480
accentuated by this shot blue sky in the

701
00:25:58,070 --> 00:25:56,000
background

702
00:26:00,390 --> 00:25:58,080
goes great with the uh the white exhaust

703
00:26:01,669 --> 00:26:00,400
plume coming out there

704
00:26:04,789 --> 00:26:01,679
and uh

705
00:26:06,390 --> 00:26:04,799
you can see a lot of splashing and

706
00:26:07,830 --> 00:26:06,400
stuff jetting out from all different

707
00:26:10,630 --> 00:26:07,840
directions at the bottom you'll see more

708
00:26:12,870 --> 00:26:10,640
of that shots that are coming up

709
00:26:15,190 --> 00:26:12,880
this shot is going to be the first uh of

710
00:26:17,830 --> 00:26:15,200
a bunch of different views as we march

711
00:26:20,789 --> 00:26:17,840
counterclockwise around the pad

712
00:26:22,310 --> 00:26:20,799
to look at it from different angles

713
00:26:23,750 --> 00:26:22,320

and there you can see the boosters have

714
00:26:26,149 --> 00:26:23,760
fired and you see it all coming out the

715
00:26:29,669 --> 00:26:26,159
other side of the flame trench

716
00:26:29,679 --> 00:26:33,830
beautiful shot of it coming off the pad

717
00:26:38,149 --> 00:26:35,750
and the lighting at five o'clock in the

718
00:26:40,549 --> 00:26:38,159
afternoon on this late spring day is

719
00:26:42,390 --> 00:26:40,559
just about perfect from this camera view

720
00:26:44,549 --> 00:26:42,400
of course it won't be perfect for all

721
00:26:46,549 --> 00:26:44,559
the views but uh certainly is a nice

722
00:26:49,909 --> 00:26:46,559
angle and really eliminates the vehicle

723
00:26:51,750 --> 00:26:49,919
as well as the structure very nicely

724
00:26:54,070 --> 00:26:51,760
yeah i like when uh

725
00:26:56,310 --> 00:26:54,080
when the vehicle leaves

726
00:26:57,669 --> 00:26:56,320
uh i left a lot of these shots run long

727
00:26:59,269 --> 00:26:57,679
because i thought it was kind of neat to

728
00:27:01,590 --> 00:26:59,279
see what happens afterwards and you can

729
00:27:03,510 --> 00:27:01,600
just see the the whole

730
00:27:06,070 --> 00:27:03,520
service structure here being engulfed in

731
00:27:07,510 --> 00:27:06,080
steam and exhaust from the solid rocket

732
00:27:09,430 --> 00:27:07,520
motors

733
00:27:11,669 --> 00:27:09,440
now one interesting thing about the 30

734
00:27:13,750 --> 00:27:11,679
this particular 35 millimeter format is

735
00:27:16,470 --> 00:27:13,760
uh earlier we mentioned about the time

736
00:27:18,710 --> 00:27:16,480
code and the irig time code is uh burned

737
00:27:20,389 --> 00:27:18,720
in with an led display and on the 35

738
00:27:23,430 --> 00:27:20,399

millimeter format it's actually in part

739
00:27:25,909 --> 00:27:23,440
of the the image area because the 35

740
00:27:26,789 --> 00:27:25,919
millimeter format has four sprockets per

741
00:27:28,950 --> 00:27:26,799
frame

742
00:27:30,149 --> 00:27:28,960
uh so there's no way to position the uh

743
00:27:32,310 --> 00:27:30,159
the led

744
00:27:34,710 --> 00:27:32,320
time code in between the sprockets like

745
00:27:36,710 --> 00:27:34,720
we can on the 16 millimeter right so so

746
00:27:38,389 --> 00:27:36,720
if you looked at the the 16 millimeter

747
00:27:40,310 --> 00:27:38,399
you could actually see the the sprockets

748
00:27:42,710 --> 00:27:40,320
at the top and the bottom of each frame

749
00:27:44,230 --> 00:27:42,720
and those aren't visible in the 35 as

750
00:27:47,350 --> 00:27:44,240
you see here

751
00:27:49,110 --> 00:27:47,360
the uh the camera number uh is on the

752
00:27:51,430 --> 00:27:49,120
lower right hand uh on the lower

753
00:27:53,190 --> 00:27:51,440
right-hand display of the led time code

754
00:27:56,310 --> 00:27:53,200
and it's in this case it's camera number

755
00:27:58,389 --> 00:27:56,320
62 so the uh the 35 millimeter format

756
00:28:00,789 --> 00:27:58,399
also allows us to put a

757
00:28:02,789 --> 00:28:00,799
camera designated number that's uh

758
00:28:05,350 --> 00:28:02,799
fairly often used

759
00:28:08,630 --> 00:28:05,360
just to help for viewing purposes and

760
00:28:10,389 --> 00:28:08,640
tracking purposes this again is a 105

761
00:28:11,750 --> 00:28:10,399
millimeter lens

762
00:28:14,230 --> 00:28:11,760
and is on the pad perimeter

763
00:28:17,269 --> 00:28:14,240

approximately 1270 feet

764
00:28:19,590 --> 00:28:17,279
from the the vehicle look at look at the

765
00:28:21,990 --> 00:28:19,600
the uh

766
00:28:23,590 --> 00:28:22,000
the the absolute force that all of this

767
00:28:24,870 --> 00:28:23,600
stuff is coming out of there i i've

768
00:28:26,549 --> 00:28:24,880
talked uh

769
00:28:28,389 --> 00:28:26,559
earlier in the piece about how much is

770
00:28:30,950 --> 00:28:28,399
coming out of the solid rocket boosters

771
00:28:33,750 --> 00:28:30,960
twenty thousand pounds uh combined and

772
00:28:34,870 --> 00:28:33,760
then the ssmes are losing three thousand

773
00:28:36,710 --> 00:28:34,880
pounds of

774
00:28:38,549 --> 00:28:36,720
liquid propellants a second

775
00:28:40,149 --> 00:28:38,559
and that really shows up here when

776
00:28:41,750 --> 00:28:40,159
you're looking underneath the launch

777
00:28:43,269 --> 00:28:41,760
platform you can see

778
00:28:44,470 --> 00:28:43,279
uh that all that stuff doesn't have

779
00:28:46,549 --> 00:28:44,480
anywhere to go which is why it's

780
00:28:49,029 --> 00:28:46,559
vectored out on both sides

781
00:28:50,310 --> 00:28:49,039
uh so it can be um

782
00:28:51,750 --> 00:28:50,320
sort of safely

783
00:28:54,710 --> 00:28:51,760
directed away from the vehicle so

784
00:28:57,110 --> 00:28:54,720
there's no uh rebounding or

785
00:28:58,789 --> 00:28:57,120
or sort of backflow so to speak and one

786
00:28:59,590 --> 00:28:58,799
thing we haven't had a chance to talk

787
00:29:01,029 --> 00:28:59,600
about

788
00:29:03,029 --> 00:29:01,039

earlier is the

789
00:29:04,230 --> 00:29:03,039
how the cameras are triggered

790
00:29:06,389 --> 00:29:04,240
currently the

791
00:29:08,630 --> 00:29:06,399
camera's all triggered using the pox for

792
00:29:10,149 --> 00:29:08,640
the photo optical control system which

793
00:29:12,710 --> 00:29:10,159
triggers all the cameras on the pad

794
00:29:15,110 --> 00:29:12,720
perimeter on the fixed service structure

795
00:29:17,750 --> 00:29:15,120
as well as the the mlp

796
00:29:20,630 --> 00:29:17,760
and it's quite a sophisticated system to

797
00:29:22,230 --> 00:29:20,640
synchronize and trigger all the cameras

798
00:29:25,430 --> 00:29:22,240
based on the launch clock

799
00:29:27,350 --> 00:29:25,440
yeah it's undoubtedly a very complex

800
00:29:29,110 --> 00:29:27,360
system to have all these cameras operate

801
00:29:31,190 --> 00:29:29,120
uh flawlessly for each launch they're

802
00:29:33,510 --> 00:29:31,200
very important if not critical for

803
00:29:35,909 --> 00:29:33,520
for shuttle launches and um

804
00:29:38,549 --> 00:29:35,919
it's an amazing achievement

805
00:29:40,710 --> 00:29:38,559
that uh all the men and women who work

806
00:29:41,669 --> 00:29:40,720
on this are able to

807
00:29:43,510 --> 00:29:41,679
do it

808
00:29:46,310 --> 00:29:43,520
with such a degree of reliability every

809
00:29:49,830 --> 00:29:48,310
another shot here is as i said moving

810
00:29:51,669 --> 00:29:49,840
around counterclockwise you see the

811
00:29:54,070 --> 00:29:51,679
ssmes or the boosters are just firing

812
00:29:55,830 --> 00:29:54,080
excuse me and there you see the the gup

813
00:29:57,750 --> 00:29:55,840

falling back as we talked about earlier

814
00:30:03,669 --> 00:29:57,760
the umbilical

815
00:30:08,070 --> 00:30:05,510
this view is using the same 105

816
00:30:09,990 --> 00:30:08,080
millimeter focal length lens that the uh

817
00:30:12,710 --> 00:30:10,000
the other two views we just looked at

818
00:30:14,389 --> 00:30:12,720
and again is about 1200 feet from the

819
00:30:16,549 --> 00:30:14,399
from the vehicles where the camera site

820
00:30:17,909 --> 00:30:16,559
is located you know this was a really

821
00:30:20,149 --> 00:30:17,919
unusual day because you just mentioned

822
00:30:21,669 --> 00:30:20,159
earlier that you know from not from all

823
00:30:23,669 --> 00:30:21,679
views is the lighting going to be as

824
00:30:24,870 --> 00:30:23,679
good but this is about as good as it

825
00:30:26,470 --> 00:30:24,880
gets i mean

826
00:30:28,870 --> 00:30:26,480
each and every one of these camera views

827
00:30:30,789 --> 00:30:28,880
is well exposed uh both from an

828
00:30:33,110 --> 00:30:30,799
engineering and a beauty standpoint

829
00:30:35,590 --> 00:30:33,120
they're all very very nice shots

830
00:30:39,669 --> 00:30:35,600
and it's why we selected 124 to be the

831
00:30:42,149 --> 00:30:40,710
there's the

832
00:30:43,430 --> 00:30:42,159
the water tower by the way in the

833
00:30:46,149 --> 00:30:43,440
foreground it's just about to get

834
00:30:54,630 --> 00:30:46,159
engulfed with the

835
00:31:00,389 --> 00:30:57,669
this is a dog 68 it's a 35 millimeter

836
00:31:02,310 --> 00:31:00,399
camera and it's really uh uh intended to

837
00:31:03,110 --> 00:31:02,320
be a documentary camera so it's running

838
00:31:05,430 --> 00:31:03,120

at

839
00:31:07,430 --> 00:31:05,440
28 frames per second

840
00:31:09,590 --> 00:31:07,440
not really a high speed camera so it's

841
00:31:10,389 --> 00:31:09,600
it's almost real time a real time camera

842
00:31:13,110 --> 00:31:10,399
view

843
00:31:14,789 --> 00:31:13,120
it's a just a really beautiful shot and

844
00:31:15,909 --> 00:31:14,799
because it's a documentary camera we're

845
00:31:17,909 --> 00:31:15,919
able to

846
00:31:20,389 --> 00:31:17,919
enlarge the aperture so the timing block

847
00:31:22,149 --> 00:31:20,399
isn't taking up image area and present

848
00:31:24,470 --> 00:31:22,159
it in its widescreen view and i think

849
00:31:26,230 --> 00:31:24,480
it's quite dramatic yeah from a from a

850
00:31:27,990 --> 00:31:26,240
beauty standpoint

851
00:31:30,310 --> 00:31:28,000
this is probably at the top of my list

852
00:31:32,630 --> 00:31:30,320
for favorites

853
00:31:35,590 --> 00:31:32,640
it's just gorgeous quality

854
00:31:36,870 --> 00:31:35,600
fantastic color saturation and very

855
00:31:37,750 --> 00:31:36,880
unusual

856
00:31:40,470 --> 00:31:37,760
for

857
00:31:53,509 --> 00:31:40,480
shuttle photography to be so beautiful

858
00:31:59,590 --> 00:31:56,710
so echo 55 begins our series of tracking

859
00:32:00,789 --> 00:31:59,600
cameras echo 55 is mounted on a kineto

860
00:32:04,070 --> 00:32:00,799
tracking mount

861
00:32:07,110 --> 00:32:04,080
or ktm which we commonly refer to it as

862
00:32:08,470 --> 00:32:07,120
and it's located at cs1 about 1200 feet

863
00:32:10,470 --> 00:32:08,480

from the vehicle

864
00:32:12,230 --> 00:32:10,480
this is a nice shot because you can see

865
00:32:13,350 --> 00:32:12,240
uh there's a bit of a distortion cloud

866
00:32:14,549 --> 00:32:13,360
here that we're shooting through and

867
00:32:16,630 --> 00:32:14,559
what that is

868
00:32:18,549 --> 00:32:16,640
is hydrogen being burned off

869
00:32:20,149 --> 00:32:18,559
from the fueling system they burn off

870
00:32:21,590 --> 00:32:20,159
any excess hydrogen

871
00:32:22,950 --> 00:32:21,600
to safely combust it and so that's what

872
00:32:24,870 --> 00:32:22,960
we're seeing here and it's really

873
00:32:26,310 --> 00:32:24,880
gorgeous as the vehicle sort of comes

874
00:32:27,509 --> 00:32:26,320
out of that and goes into its roll

875
00:32:29,509 --> 00:32:27,519
program

876
00:32:31,750 --> 00:32:29,519
clearing the tower

877
00:32:34,470 --> 00:32:31,760
again just a fantastically

878
00:32:35,669 --> 00:32:34,480
well lit photograph on this on this day

879
00:32:37,430 --> 00:32:35,679
some of the white things that you see

880
00:32:38,950 --> 00:32:37,440
falling off there are paper covers which

881
00:32:40,630 --> 00:32:38,960
protect some of the

882
00:32:42,630 --> 00:32:40,640
order maneuvering system engines we'll

883
00:32:44,389 --> 00:32:42,640
talk about those later but kevin the

884
00:32:45,909 --> 00:32:44,399
these are all manually operated right i

885
00:32:48,470 --> 00:32:45,919
mean there are human beings behind the

886
00:32:49,990 --> 00:32:48,480
scenes doing this tracking now

887
00:32:52,470 --> 00:32:50,000
yes this uh

888
00:32:55,269 --> 00:32:52,480

ktm or the kinetic tracking mount has

889
00:32:58,630 --> 00:32:55,279
about four cameras that are mounted on

890
00:33:00,789 --> 00:32:58,640
it and this particular camera echo 55 is

891
00:33:03,269 --> 00:33:00,799
one of a pair of cameras

892
00:33:05,830 --> 00:33:03,279
and is intended to look at the top half

893
00:33:07,509 --> 00:33:05,840
of the vehicle while the other camera is

894
00:33:08,950 --> 00:33:07,519
intended to look at the bottom portion

895
00:33:10,470 --> 00:33:08,960
of the vehicle right and we'll see that

896
00:33:11,350 --> 00:33:10,480
in the next shot we'll have one of the

897
00:33:13,350 --> 00:33:11,360
uh

898
00:33:15,350 --> 00:33:13,360
one of the views from the bottom of the

899
00:33:18,070 --> 00:33:15,360
stack on the next one in fact our intent

900
00:33:20,149 --> 00:33:18,080
is uh to have in the deleted scenes on

901
00:33:22,710 --> 00:33:20,159
this disc um

902
00:33:24,070 --> 00:33:22,720
a set of camera pair views sort of

903
00:33:25,830 --> 00:33:24,080
pieced together so you can see them

904
00:33:28,070 --> 00:33:25,840
simultaneously so look for that in the

905
00:33:30,149 --> 00:33:28,080
extra features

906
00:33:32,710 --> 00:33:30,159
this is this is a fantastic now they're

907
00:33:35,909 --> 00:33:32,720
completely done with their roll program

908
00:33:37,269 --> 00:33:35,919
and uh sort of on their way yeah the the

909
00:33:39,350 --> 00:33:37,279
intent of that

910
00:33:40,230 --> 00:33:39,360
camera shot is only for the first 1200

911
00:33:43,269 --> 00:33:40,240
feet

912
00:33:45,909 --> 00:33:43,279
uh of the ascent is really the uh

913
00:33:48,630 --> 00:33:45,919

the intention of that that view and that

914
00:33:50,870 --> 00:33:48,640
takes about 18 to 20 seconds i believe

915
00:33:52,389 --> 00:33:50,880
okay now this is camera 52

916
00:33:54,149 --> 00:33:52,399
and this of course is at the bottom of

917
00:33:55,990 --> 00:33:54,159
the stack now so it's a little different

918
00:33:59,029 --> 00:33:56,000
view and uh but part of a camera pair

919
00:34:01,590 --> 00:33:59,039
again right this is this camera is uh as

920
00:34:04,149 --> 00:34:01,600
you said is 52 and this is located on

921
00:34:06,630 --> 00:34:04,159
camera site uh two

922
00:34:10,869 --> 00:34:06,640
and is about the same distance 1200 feet

923
00:34:16,950 --> 00:34:14,389
nice shot of the ssmes there

924
00:34:18,550 --> 00:34:16,960
it always amazes me how

925
00:34:20,470 --> 00:34:18,560
transparent the exhaust coming out of

926
00:34:22,790 --> 00:34:20,480
the ssmes is

927
00:34:24,629 --> 00:34:22,800
now this uh conetto tracking mount is uh

928
00:34:26,869 --> 00:34:24,639
is controlled by an operator manually

929
00:34:29,909 --> 00:34:26,879
controlled by an operator who's sitting

930
00:34:32,710 --> 00:34:29,919
in the lcc on the second floor

931
00:34:35,750 --> 00:34:32,720
below the firing room and the person he

932
00:34:38,550 --> 00:34:35,760
or she is using a trackball to track

933
00:34:39,510 --> 00:34:38,560
um the the vehicle and it's uh it's

934
00:34:41,510 --> 00:34:39,520
pretty tricky because they're just

935
00:34:44,149 --> 00:34:41,520
looking at a little video monitor

936
00:34:45,589 --> 00:34:44,159
and uh the vehicle is moving much faster

937
00:34:47,750 --> 00:34:45,599
in real time than we're seeing we're

938
00:34:50,310 --> 00:34:47,760

seeing it at uh you know one-fifth the

939
00:34:51,909 --> 00:34:50,320
speed in this particular case of uh what

940
00:34:54,389 --> 00:34:51,919
it is in real time

941
00:34:56,710 --> 00:34:54,399
this conetto tracking mount also has uh

942
00:34:58,390 --> 00:34:56,720
hdtv cameras that are mounted that are

943
00:35:00,069 --> 00:34:58,400
used for what we'll call quick look

944
00:35:02,069 --> 00:35:00,079
what's called quick look

945
00:35:03,829 --> 00:35:02,079
to look at the these views in real time

946
00:35:06,790 --> 00:35:03,839
and then in near real time uh you know

947
00:35:08,310 --> 00:35:06,800
when they start the uh image analysis uh

948
00:35:10,790 --> 00:35:08,320
this is done while the film is getting

949
00:35:13,270 --> 00:35:10,800
processed and transferred

950
00:35:14,870 --> 00:35:13,280
that was a fantastic shot

951
00:35:16,950 --> 00:35:14,880
seeing the sun go right in between the

952
00:35:18,790 --> 00:35:16,960
two plumes and in fact it gives you an

953
00:35:20,470 --> 00:35:18,800
idea how bright these plumes are to the

954
00:35:21,910 --> 00:35:20,480
naked eye because

955
00:35:23,750 --> 00:35:21,920
the sun as it passed through there

956
00:35:26,470 --> 00:35:23,760
wasn't much brighter than

957
00:35:28,069 --> 00:35:26,480
the plumes that you saw

958
00:35:30,550 --> 00:35:28,079
wonderful shot showing the column of

959
00:35:33,750 --> 00:35:30,560
fire that the vehicle rises on and it

960
00:35:36,790 --> 00:35:33,760
really contrasts nicely with the blue

961
00:35:38,710 --> 00:35:36,800
again highlighting why sts-124 was was

962
00:35:40,470 --> 00:35:38,720
really the correct mission to

963
00:35:48,550 --> 00:35:40,480

to sort of springboard off of to show

964
00:35:52,470 --> 00:35:51,190
this is a camera 57 this is at

965
00:35:55,670 --> 00:35:52,480
cs6

966
00:35:57,990 --> 00:35:55,680
again 1200 feet from the pad or so

967
00:35:59,430 --> 00:35:58,000
and we're looking at the bottom half of

968
00:36:01,349 --> 00:35:59,440
the vehicle

969
00:36:04,069 --> 00:36:01,359
as i mentioned earlier the camera is

970
00:36:05,190 --> 00:36:04,079
mounted on a tracker a ktm tracker has

971
00:36:06,550 --> 00:36:05,200
four or five

972
00:36:08,390 --> 00:36:06,560
different cameras on there and this is

973
00:36:10,470 --> 00:36:08,400
the lower half

974
00:36:18,390 --> 00:36:10,480
film camera looking at the bottom of the

975
00:36:21,430 --> 00:36:20,069
you can see the paper covers come off

976
00:36:23,829 --> 00:36:21,440
the

977
00:36:25,510 --> 00:36:23,839
rcs engines those are tieback covers

978
00:36:28,069 --> 00:36:25,520
just same same kind of material that you

979
00:36:29,510 --> 00:36:28,079
put on your house when building it

980
00:36:30,870 --> 00:36:29,520
and uh

981
00:36:32,870 --> 00:36:30,880
those covers are there in case they get

982
00:36:34,550 --> 00:36:32,880
a squall or a little storm why the

983
00:36:36,470 --> 00:36:34,560
shuttle's out on the pad not uncommon in

984
00:36:37,910 --> 00:36:36,480
florida and we can't afford to have

985
00:36:39,109 --> 00:36:37,920
water inside those engines so we put

986
00:36:40,950 --> 00:36:39,119
those paper covers on there and they

987
00:36:42,630 --> 00:36:40,960
have these little pair of foils that

988
00:36:45,109 --> 00:36:42,640

inflate sort of tear the cover off

989
00:36:46,150 --> 00:36:45,119
they're just adhered with an adhesive of

990
00:36:48,230 --> 00:36:46,160
some kind

991
00:36:51,750 --> 00:36:48,240
so you'll see a lot of that white paper

992
00:36:57,829 --> 00:36:53,349
beautiful shot looking up the tail end

993
00:37:01,750 --> 00:36:59,270
and uh

994
00:37:03,750 --> 00:37:01,760
possibly on the deleted features or the

995
00:37:07,109 --> 00:37:03,760
deleted scenes on this disc we're going

996
00:37:09,190 --> 00:37:07,119
to try to edit a

997
00:37:10,550 --> 00:37:09,200
a piece together showing this the camera

998
00:37:12,069 --> 00:37:10,560
pair the views from the camera pairs

999
00:37:14,310 --> 00:37:12,079
pieced together and it should look

1000
00:37:17,430 --> 00:37:14,320
pretty nice to look at that on our

1001
00:37:20,310 --> 00:37:17,440
our deleted scenes uh feature on the

1002
00:37:24,950 --> 00:37:22,790
this is uh echo 225 as you can see it's

1003
00:37:27,109 --> 00:37:24,960
already in flight it's a really

1004
00:37:29,750 --> 00:37:27,119
interesting view it's a medium range

1005
00:37:32,069 --> 00:37:29,760
tracking camera

1006
00:37:34,270 --> 00:37:32,079
the mount and the camera are located at

1007
00:37:37,510 --> 00:37:34,280
ucs4 which is about

1008
00:37:39,510 --> 00:37:37,520
2.4 miles north of the pad

1009
00:37:41,910 --> 00:37:39,520
one of the reasons i selected this shot

1010
00:37:42,790 --> 00:37:41,920
uh to be included on the dvd is because

1011
00:37:44,550 --> 00:37:42,800
um

1012
00:37:46,310 --> 00:37:44,560
i thought it was really striking and

1013
00:37:48,470 --> 00:37:46,320

really beautiful how in their role

1014
00:37:50,470 --> 00:37:48,480
program as they went into their role the

1015
00:37:52,470 --> 00:37:50,480
the sun sort of peaks over like it does

1016
00:37:53,270 --> 00:37:52,480
here and then you can see the name pop

1017
00:37:56,790 --> 00:37:53,280
out

1018
00:37:59,270 --> 00:37:56,800
and uh slowly the whole orbiter becomes

1019
00:38:01,349 --> 00:37:59,280
lit with the uh with the evening sun

1020
00:38:02,950 --> 00:38:01,359
and the textures are fantastic here you

1021
00:38:05,109 --> 00:38:02,960
can see the thermal blankets you can see

1022
00:38:06,790 --> 00:38:05,119
some of the thermal

1023
00:38:08,230 --> 00:38:06,800
exposure to the thermal blankets you see

1024
00:38:09,349 --> 00:38:08,240
some variation in color and you can see

1025
00:38:11,030 --> 00:38:09,359
the tiles

1026
00:38:12,550 --> 00:38:11,040
literally make out the the boundaries of

1027
00:38:15,349 --> 00:38:12,560
the tiles there

1028
00:38:17,190 --> 00:38:15,359
so uh really a wonderful uh piece of

1029
00:38:20,230 --> 00:38:17,200
footage and and

1030
00:38:22,390 --> 00:38:20,240
a remarkable contribution to the dvd

1031
00:38:25,030 --> 00:38:22,400
from a photography standpoint

1032
00:38:27,510 --> 00:38:25,040
the lens that's on the camera is a 150

1033
00:38:28,710 --> 00:38:27,520
inch uh brashear lens it's a cat eye

1034
00:38:31,349 --> 00:38:28,720
dioptic

1035
00:38:33,990 --> 00:38:31,359
lens so it's got a mirror surface

1036
00:38:36,150 --> 00:38:34,000
and it's about 4 000 millimeters uh

1037
00:38:37,430 --> 00:38:36,160
focal length if you converted the inches

1038
00:38:39,750 --> 00:38:37,440

to millimeters

1039
00:38:43,750 --> 00:38:39,760
just to give it perspective matt the

1040
00:38:46,470 --> 00:38:43,760
weight of this lens is about 250 pounds

1041
00:38:48,790 --> 00:38:46,480
just the lens itself it's a huge lens

1042
00:38:50,150 --> 00:38:48,800
and a really unbelievable piece of

1043
00:38:51,270 --> 00:38:50,160
optics

1044
00:38:53,750 --> 00:38:51,280
you can really see a lot of nice

1045
00:38:55,670 --> 00:38:53,760
textures on this shot too on the on the

1046
00:38:56,950 --> 00:38:55,680
booster if you look at the the forward

1047
00:38:59,030 --> 00:38:56,960
part of the booster you can see the

1048
00:39:01,030 --> 00:38:59,040
access panels and

1049
00:39:02,950 --> 00:39:01,040
that big line coming off the external

1050
00:39:04,710 --> 00:39:02,960
tank that's actually the oxygen feed

1051
00:39:07,109 --> 00:39:04,720
line on the external tank that's where

1052
00:39:09,109 --> 00:39:07,119
that 280 gallons a second of liquid

1053
00:39:11,510 --> 00:39:09,119
oxygen are flowing through to the main

1054
00:39:13,510 --> 00:39:11,520
engines that feed lines about 17 inches

1055
00:39:14,710 --> 00:39:13,520
in diameter so it's a pretty beefy uh

1056
00:39:16,150 --> 00:39:14,720
system

1057
00:39:17,589 --> 00:39:16,160
and i think another thing to point out

1058
00:39:20,630 --> 00:39:17,599
here is that

1059
00:39:22,230 --> 00:39:20,640
this camera mount is manually tracked so

1060
00:39:24,310 --> 00:39:22,240
the operator is looking through a bore

1061
00:39:26,870 --> 00:39:24,320
sight at the camera site launch

1062
00:39:30,710 --> 00:39:26,880
vibrations going on all around uh

1063
00:39:32,950 --> 00:39:30,720

hammerhead and keeping that vehicle dead

1064
00:39:34,790 --> 00:39:32,960
center in the frame and it's a quite

1065
00:39:36,710 --> 00:39:34,800
amazing um

1066
00:39:38,630 --> 00:39:36,720
feat to be able to do that so quite so

1067
00:39:40,550 --> 00:39:38,640
accurately yeah they they've done a

1068
00:39:42,310 --> 00:39:40,560
great job of keeping on target every

1069
00:39:43,990 --> 00:39:42,320
step of the way now they're getting a

1070
00:39:45,910 --> 00:39:44,000
little further away obviously and you

1071
00:39:47,750 --> 00:39:45,920
can see uh sort of the glow of those

1072
00:39:49,990 --> 00:39:47,760
engines starting to come up against the

1073
00:39:53,109 --> 00:39:50,000
bottom part of the uh

1074
00:39:54,470 --> 00:39:53,119
the stack there as they call it and um

1075
00:39:57,910 --> 00:39:54,480
lets you know that something's going on

1076
00:40:03,270 --> 00:39:59,829
so the next series of shots we're going

1077
00:40:05,430 --> 00:40:03,280
to see is the views from the hd cameras

1078
00:40:08,790 --> 00:40:05,440
and in this particular view this is uh

1079
00:40:12,390 --> 00:40:08,800
from sts-114 return to flights this was

1080
00:40:15,030 --> 00:40:12,400
in july 26 of 2005

1081
00:40:17,990 --> 00:40:15,040
and we're about one about two miles from

1082
00:40:21,430 --> 00:40:18,000
the pad just south of uh pad 39b here

1083
00:40:23,990 --> 00:40:21,440
and the camera is uh is cocked at a 45

1084
00:40:27,190 --> 00:40:24,000
degree angle to enable maximum use of

1085
00:40:30,630 --> 00:40:27,200
the 16x9 aspect ratio that

1086
00:40:32,309 --> 00:40:30,640
is available with the hd tv cameras now

1087
00:40:33,910 --> 00:40:32,319
it's important our viewers take a good

1088
00:40:35,190 --> 00:40:33,920

look into the

1089
00:40:36,790 --> 00:40:35,200
left window there you can actually see

1090
00:40:38,950 --> 00:40:36,800
eileen collins who commanded this

1091
00:40:39,990 --> 00:40:38,960
mission you can see your suit inside the

1092
00:40:41,750 --> 00:40:40,000
window

1093
00:40:43,510 --> 00:40:41,760
absolutely amazing

1094
00:40:45,750 --> 00:40:43,520
and this is a first right this is a

1095
00:40:48,230 --> 00:40:45,760
first in the program we started using

1096
00:40:50,630 --> 00:40:48,240
high definition video after columbia

1097
00:40:52,630 --> 00:40:50,640
and that was

1098
00:40:54,710 --> 00:40:52,640
one of the first times we saw this level

1099
00:40:59,510 --> 00:40:54,720
of detail in photography that's that is

1100
00:41:05,430 --> 00:41:02,630
so this particular camera view is ehb225

1101
00:41:07,430 --> 00:41:05,440
this was recorded on sts-117 it was in

1102
00:41:08,150 --> 00:41:07,440
june 2006

1103
00:41:10,390 --> 00:41:08,160
and

1104
00:41:13,910 --> 00:41:10,400
the camera is running at 60 frames a

1105
00:41:16,630 --> 00:41:13,920
second as all the hdtv cameras do

1106
00:41:19,349 --> 00:41:16,640
the the orientation of the camera is is

1107
00:41:23,030 --> 00:41:19,359
cocked at 45 degrees to make maximum use

1108
00:41:25,109 --> 00:41:23,040
of the aspect ratio of the 16 by 9 frame

1109
00:41:27,829 --> 00:41:25,119
to get as much of the vehicle space

1110
00:41:30,630 --> 00:41:27,839
shuttle vehicle in the frame as possible

1111
00:41:33,190 --> 00:41:30,640
this particular shot i chose because

1112
00:41:34,630 --> 00:41:33,200
um it's well exposed and it shows a

1113
00:41:36,790 --> 00:41:34,640

beautiful

1114
00:41:39,109 --> 00:41:36,800
sequence in the roll program but you

1115
00:41:40,790 --> 00:41:39,119
also get this really nice uh

1116
00:41:43,430 --> 00:41:40,800
vapor phenomenon as the vehicle

1117
00:41:46,630 --> 00:41:43,440
accelerates uh to higher speeds

1118
00:41:48,790 --> 00:41:46,640
and this is not always visible to the

1119
00:41:50,790 --> 00:41:48,800
for every launch is a it's a consequence

1120
00:41:53,109 --> 00:41:50,800
of atmospheric conditions dew point

1121
00:41:54,790 --> 00:41:53,119
humidity etc so

1122
00:42:05,430 --> 00:41:54,800
i thought it was kind of a nice nice

1123
00:42:08,950 --> 00:42:07,190
this is the only long-range camera that

1124
00:42:10,390 --> 00:42:08,960
made the final cut and kevin will give

1125
00:42:11,670 --> 00:42:10,400
you the details about that in a moment

1126
00:42:13,190 --> 00:42:11,680
but i want you to look at the bottom of

1127
00:42:15,349 --> 00:42:13,200
the tank there

1128
00:42:17,589 --> 00:42:15,359
as you saw it just sort of

1129
00:42:18,950 --> 00:42:17,599
became engulfed in flames

1130
00:42:20,710 --> 00:42:18,960
and

1131
00:42:23,349 --> 00:42:20,720
you should know that this is a

1132
00:42:25,270 --> 00:42:23,359
normal phenomenon in a shuttle launch

1133
00:42:27,829 --> 00:42:25,280
what's effectively occurring here is the

1134
00:42:28,870 --> 00:42:27,839
exhaust gases coming out of the srbs and

1135
00:42:37,109 --> 00:42:28,880
the

1136
00:42:38,630 --> 00:42:37,119
plumes becomes high enough to ignite

1137
00:42:40,710 --> 00:42:38,640
some volatile gases that are caught up

1138
00:42:42,150 --> 00:42:40,720

in this aerodynamic dead zone so to

1139
00:42:44,550 --> 00:42:42,160
speak at the rear of the tank for a

1140
00:42:46,069 --> 00:42:44,560
couple of moments during flight

1141
00:42:47,670 --> 00:42:46,079
but this is an amazing shot kevin

1142
00:42:49,670 --> 00:42:47,680
because it's from so far away so why

1143
00:42:50,790 --> 00:42:49,680
don't you explain uh what we're looking

1144
00:42:53,430 --> 00:42:50,800
at here

1145
00:42:55,589 --> 00:42:53,440
yeah matt the camera here is located at

1146
00:42:57,750 --> 00:42:55,599
a place called apollo beach it's within

1147
00:42:59,990 --> 00:42:57,760
cape canaveral national seashore

1148
00:43:01,430 --> 00:43:00,000
and the camera mount is about 20 miles

1149
00:43:02,790 --> 00:43:01,440
north of the pad so it's quite a

1150
00:43:06,230 --> 00:43:02,800
distance away

1151
00:43:08,790 --> 00:43:06,240
this is a brashear 150 inch lens again

1152
00:43:10,630 --> 00:43:08,800
about 4 000 millimeters

1153
00:43:12,550 --> 00:43:10,640
so quite quite a distance in the

1154
00:43:14,069 --> 00:43:12,560
trackers as we've mentioned earlier is

1155
00:43:15,589 --> 00:43:14,079
manually

1156
00:43:18,390 --> 00:43:15,599
operated says an operator looking

1157
00:43:20,150 --> 00:43:18,400
through a uh a scope and uh using a

1158
00:43:22,230 --> 00:43:20,160
trackball to keep the uh the vehicle in

1159
00:43:23,990 --> 00:43:22,240
the field of view yeah

1160
00:43:25,510 --> 00:43:24,000
it's also difficult for the operator

1161
00:43:26,390 --> 00:43:25,520
because of the distance to see the

1162
00:43:28,470 --> 00:43:26,400
vehicle

1163
00:43:30,710 --> 00:43:28,480

at launch to sight the pad yeah it's

1164
00:43:32,950 --> 00:43:30,720
just she has to tighten the light right

1165
00:43:34,630 --> 00:43:32,960
so so he or she grabs it on the fly and

1166
00:43:36,390 --> 00:43:34,640
it's it's quite a quite a skill level

1167
00:43:37,990 --> 00:43:36,400
that's uh that needs to be developed in

1168
00:43:39,589 --> 00:43:38,000
order to do that

1169
00:43:42,150 --> 00:43:39,599
well and of course we watched our solid

1170
00:43:44,069 --> 00:43:42,160
rocket boosters separate um

1171
00:43:46,150 --> 00:43:44,079
which is uh sort of at the tail end of

1172
00:43:47,829 --> 00:43:46,160
what we can see with with all of the

1173
00:43:50,230 --> 00:43:47,839
tracking cameras

1174
00:43:52,790 --> 00:43:50,240
and um there you see our boosters coming

1175
00:43:54,470 --> 00:43:52,800
off and uh they separated about 29 miles

1176
00:43:56,710 --> 00:43:54,480
in altitude about two minutes into

1177
00:43:58,390 --> 00:43:56,720
flight and they are recovered by divers

1178
00:43:59,990 --> 00:43:58,400
out in the atlantic ocean

1179
00:44:02,630 --> 00:44:00,000
and uh although they appear to be

1180
00:44:05,109 --> 00:44:02,640
falling back here they're actually

1181
00:44:06,950 --> 00:44:05,119
traveling another 15 miles or so up just

1182
00:44:08,630 --> 00:44:06,960
tumbling on their own forward momentum

1183
00:44:10,470 --> 00:44:08,640
before they peak and then come back down

1184
00:44:12,550 --> 00:44:10,480
in the atlantic about 150 miles out

1185
00:44:15,430 --> 00:44:12,560
where the diving things pick them up and

1186
00:44:17,109 --> 00:44:15,440
bring them back for refurbishment

1187
00:44:19,190 --> 00:44:17,119
so this sort of brings us to the end of

1188
00:44:20,390 --> 00:44:19,200

our production um

1189
00:44:22,950 --> 00:44:20,400
i hope you guys have enjoyed the

1190
00:44:24,069 --> 00:44:22,960
commentary kevin and i have enjoyed

1191
00:44:26,870 --> 00:44:24,079
doing it

1192
00:44:29,670 --> 00:44:26,880
today for you and uh

1193
00:44:31,270 --> 00:44:29,680
as the boosters sort of fade out and the

1194
00:44:33,190 --> 00:44:31,280
external tank and the orbiter continue

1195
00:44:36,470 --> 00:44:33,200
on their way to orbit

1196
00:44:38,550 --> 00:44:36,480
we want to dedicate this movie to all of

1197
00:44:41,030 --> 00:44:38,560
the men and women over the

1198
00:44:42,790 --> 00:44:41,040
30 years of the program or so that have

1199
00:44:44,309 --> 00:44:42,800
committed themselves to capturing all of

1200
00:44:46,950 --> 00:44:44,319
these fine images

1201
00:44:48,710 --> 00:44:46,960
it's uh amazing work it takes a lot of

1202
00:44:51,030 --> 00:44:48,720
commitment and it's extraordinarily

1203
00:44:52,790 --> 00:44:51,040
tough to do so and

1204
00:44:55,030 --> 00:44:52,800
our hats off to them so kevin thanks for

1205
00:44:57,829 --> 00:44:55,040
doing this with me thank you um

1206
00:44:59,589 --> 00:44:57,839
it's been a wonderful endeavor and

1207
00:45:01,510 --> 00:44:59,599
hopefully

1208
00:45:03,510 --> 00:45:01,520
we'll see each other again on the next

1209
00:45:04,470 --> 00:45:03,520
space program