
NASA LIVE
JAMES WEBB SPACE TELESCOPE LAUNCH
#UnfoldTheUniverse

1
00:02:13,729 --> 00:02:11,809
we have uncovered Wonders undripped by

2
00:02:15,229 --> 00:02:13,739
our ancestors who first speculated on

3
00:02:17,270 --> 00:02:15,239
the nature

4
00:02:18,100 --> 00:02:17,280
of those wandering lights in the night

5
00:02:21,830 --> 00:02:18,110
sky

6
00:02:24,650 --> 00:02:21,840
[Music]

7
00:02:26,810 --> 00:02:24,660
we've crossed the solar system

8
00:02:31,970 --> 00:02:26,820
and sent ships to the Stars

9
00:02:31,980 --> 00:02:34,670
the search

10
00:02:42,170 --> 00:02:36,850
can't help it

11
00:02:42,180 --> 00:02:51,360
lies far beyond the Earth

12
00:03:11,750 --> 00:02:57,500
[Music]

13
00:03:17,900 --> 00:03:14,690

We crave some Cosmic purpose then let us

14
00:03:20,449 --> 00:03:17,910
find ourselves a worthy goal

15
00:03:28,670 --> 00:03:20,459
[Music]

16
00:03:33,410 --> 00:03:30,350
you're looking at live footage of an

17
00:03:35,509 --> 00:03:33,420
Ariane 5 rocket in karoo French Guiana

18
00:03:37,850 --> 00:03:35,519
at the very top of that Extraordinary

19
00:03:38,690 --> 00:03:37,860
Machine one of the largest rockets in

20
00:03:40,490 --> 00:03:38,700
the world

21
00:03:43,009 --> 00:03:40,500
we find the most ambitious space

22
00:03:46,670 --> 00:03:43,019
Observatory ever built

23
00:03:49,729 --> 00:03:46,680
the James Webb Space Telescope

24
00:03:52,130 --> 00:03:49,739
and today is launch day

25
00:03:54,050 --> 00:03:52,140
from all of the people all around the

26
00:03:57,530 --> 00:03:54,060
world working on today's launch good

27
00:03:59,990 --> 00:03:57,540
morning bonjour buenos dias

28
00:04:02,690 --> 00:04:00,000
this is live coverage of the historic

29
00:04:04,369 --> 00:04:02,700
launch of the James Webb Space Telescope

30
00:04:05,990 --> 00:04:04,379
I'm Michelle Thaller speaking to you

31
00:04:07,789 --> 00:04:06,000
from NASA's Goddard space flight center

32
00:04:09,890 --> 00:04:07,799
in Greenbelt Maryland

33
00:04:10,850 --> 00:04:09,900
and I am very excited to be with you

34
00:04:13,190 --> 00:04:10,860
today

35
00:04:15,289 --> 00:04:13,200
the James Webb Space Telescope begins

36
00:04:17,810 --> 00:04:15,299
its journey to explore the edge of our

37
00:04:20,330 --> 00:04:17,820
observable universe and its journey into

38
00:04:22,370 --> 00:04:20,340

history as well this launch has been

39
00:04:23,870 --> 00:04:22,380
years in the making and the world has

40
00:04:25,909 --> 00:04:23,880
turned out to watch

41
00:04:27,710 --> 00:04:25,919
we'll have a lot to discuss both before

42
00:04:29,930 --> 00:04:27,720
and after launch but let me set the

43
00:04:31,850 --> 00:04:29,940
scene for what's going on around us

44
00:04:34,189 --> 00:04:31,860
well I'll be anchoring coverage from

45
00:04:35,629 --> 00:04:34,199
here at Nasa Goddard the big stuff

46
00:04:36,590 --> 00:04:35,639
happens today

47
00:04:39,530 --> 00:04:36,600
here

48
00:04:41,870 --> 00:04:39,540
at the Santa special guiones the guilla

49
00:04:43,430 --> 00:04:41,880
Space Center in French Guiana

50
00:04:45,650 --> 00:04:43,440
this is the main launch site for the

51
00:04:47,629 --> 00:04:45,660
European Space Agency a close partner in

52
00:04:50,510 --> 00:04:47,639
this once in a generation Mission and

53
00:04:52,189 --> 00:04:50,520
the home of all Ariane launches

54
00:04:53,990 --> 00:04:52,199
Katie Haswell is there at the launch

55
00:04:56,030 --> 00:04:54,000
facility and joins me now live via

56
00:05:02,090 --> 00:04:56,040
satellite okay how are things in Peru

57
00:05:07,670 --> 00:05:05,150
Michelle things are looking really good

58
00:05:11,570 --> 00:05:07,680
the boards are green the mission

59
00:05:13,430 --> 00:05:11,580
controllers are focusing hard the uh we

60
00:05:15,050 --> 00:05:13,440
are go for launch we've had our eye on

61
00:05:16,310 --> 00:05:15,060
the weather last couple of days the

62
00:05:18,050 --> 00:05:16,320
weather's been a little bit in in

63
00:05:19,430 --> 00:05:18,060

Clement so we're keeping an eye on that

64
00:05:21,409 --> 00:05:19,440
but otherwise everything's looking

65
00:05:24,050 --> 00:05:21,419
absolutely great and I have to tell you

66
00:05:26,090 --> 00:05:24,060
there is just such a buzz of excitement

67
00:05:28,909 --> 00:05:26,100
here in the mission control center it's

68
00:05:30,650 --> 00:05:28,919
an unremarkable feeling

69
00:05:33,350 --> 00:05:30,660
um right now we're topping up the tanks

70
00:05:35,029 --> 00:05:33,360
on the upper stage of the vehicle so

71
00:05:37,010 --> 00:05:35,039
we've got two great big arms called

72
00:05:38,330 --> 00:05:37,020
cryogenic arms and they clamp onto the

73
00:05:40,189 --> 00:05:38,340
upper stage

74
00:05:42,350 --> 00:05:40,199
um and they pump in the cryogenic fuel

75
00:05:44,510 --> 00:05:42,360
which has to be kept very very cold so

76
00:05:46,310 --> 00:05:44,520
it has to be topped up right until the

77
00:05:48,350 --> 00:05:46,320
last minute because it can evaporate

78
00:05:50,870 --> 00:05:48,360
you'll see those arms kind of

79
00:05:54,230 --> 00:05:50,880
falling away just before launch in the

80
00:05:55,430 --> 00:05:54,240
last couple of seconds so up here

81
00:05:59,809 --> 00:05:55,440
here it's guy booth in the mission

82
00:06:05,270 --> 00:06:02,809
and the European space agency's loose

83
00:06:08,749 --> 00:06:05,280
fabregate they're standing by hi guys

84
00:06:11,150 --> 00:06:08,759
standing by to take on the commentary

85
00:06:13,249 --> 00:06:11,160
when we get to about 15 minutes to

86
00:06:15,050 --> 00:06:13,259
launch but right now Michelle all the

87
00:06:17,510 --> 00:06:15,060
boards are green we're go for launch

88
00:06:19,010 --> 00:06:17,520

back to you Michelle

89
00:06:20,510 --> 00:06:19,020
we'll be coming back to Katie for the

90
00:06:22,129 --> 00:06:20,520
final phases of the countdown in just a

91
00:06:25,309 --> 00:06:22,139
little bit

92
00:06:27,290 --> 00:06:25,319
so I'm an astronomer and this launch is

93
00:06:29,809 --> 00:06:27,300
a huge deal for me I am personally

94
00:06:31,969 --> 00:06:29,819
really really excited but why is this

95
00:06:34,249 --> 00:06:31,979
such a big event for everyone

96
00:06:36,409 --> 00:06:34,259
the web telescope is nothing less than

97
00:06:38,689 --> 00:06:36,419
Humanity's next effort to move closer to

98
00:06:40,430 --> 00:06:38,699
understanding some of the biggest

99
00:06:42,890 --> 00:06:40,440
questions about the origin of our

100
00:06:45,290 --> 00:06:42,900
universe it is not just the origins of

101
00:06:49,909 --> 00:06:45,300
distant stars and galaxies but it's the

102
00:06:51,770 --> 00:06:49,919
story of us you and me how we got here

103
00:06:54,230 --> 00:06:51,780
and speaking of questions we'd like to

104
00:06:55,550 --> 00:06:54,240
include yours in this historic event on

105
00:06:57,110 --> 00:06:55,560
whatever platform you're watching our

106
00:06:59,870 --> 00:06:57,120
coverage drop your questions with the

107
00:07:03,350 --> 00:06:59,880
hashtag asknasa later in the broadcast

108
00:07:05,330 --> 00:07:03,360
we'll answer some of them live on air

109
00:07:07,129 --> 00:07:05,340
it can't be said enough that this is a

110
00:07:09,650 --> 00:07:07,139
mission for anyone who's ever looked up

111
00:07:11,210 --> 00:07:09,660
at the night sky and wonder people all

112
00:07:13,670 --> 00:07:11,220
over the world are sending in their best

113
00:07:17,640 --> 00:07:13,680

wishes for the success of Webb and let's

114
00:07:17,650 --> 00:07:27,010
[Music]

115
00:07:27,020 --> 00:07:33,850
feel success web

116
00:07:44,230 --> 00:07:36,650
[Music]

117
00:07:50,029 --> 00:07:47,629
track for launch at 7 20 a.m eastern U.S

118
00:07:52,369 --> 00:07:50,039
time two days ago the rocket rolled out

119
00:07:53,689 --> 00:07:52,379
to its launch pad in Peru

120
00:07:55,670 --> 00:07:53,699
of course there's already been a lot of

121
00:07:57,230 --> 00:07:55,680
activity in the launch sites primary

122
00:07:59,749 --> 00:07:57,240
feeling procedures were completed early

123
00:08:00,950 --> 00:07:59,759
this morning repairing the giant Arion 5

124
00:08:03,000 --> 00:08:00,960
rocket for flight

125
00:08:23,930 --> 00:08:03,010
let's watch the scene for a moment

126
00:08:44,769 --> 00:08:23,940
[Music]

127
00:08:50,269 --> 00:08:47,449
begins its next bold adventure to extend

128
00:08:52,130 --> 00:08:50,279
ourselves out into the cosmos this is

129
00:08:53,329 --> 00:08:52,140
something we do as a whole planet all of

130
00:08:55,490 --> 00:08:53,339
us together

131
00:08:57,110 --> 00:08:55,500
be fitting the global importance of this

132
00:08:59,210 --> 00:08:57,120
initiative let's review some of the

133
00:09:01,430 --> 00:08:59,220
basic facts about the observatory shared

134
00:09:05,210 --> 00:09:01,440
by people all over the world who are

135
00:09:09,290 --> 00:09:07,370
the entire world is looking forward to

136
00:09:10,790 --> 00:09:09,300
the launch of the James Webb Space

137
00:09:12,769 --> 00:09:10,800
Telescope

138
00:09:15,650 --> 00:09:12,779

let's hear more from a people around the

139
00:09:19,310 --> 00:09:15,660
globe about what makes Webb a scientific

140
00:09:19,320 --> 00:09:31,130
series

141
00:10:04,610 --> 00:09:58,250
foreign

142
00:10:04,620 --> 00:10:11,949
is

143
00:10:11,959 --> 00:10:21,930
infrared sensitivity cases

144
00:10:21,940 --> 00:10:37,670
[Music]

145
00:10:37,680 --> 00:10:40,990
foreign

146
00:10:44,449 --> 00:10:42,829
thousands of people all over the world

147
00:10:47,210 --> 00:10:44,459
have worked for years to get us to

148
00:10:49,009 --> 00:10:47,220
today's launch the core Partners NASA

149
00:10:50,750 --> 00:10:49,019
the European space agency and the

150
00:10:51,650 --> 00:10:50,760
Canadian space agency are the principal

151
00:10:54,410 --> 00:10:51,660
players

152
00:10:56,569 --> 00:10:54,420
but a vast core of engineers scientists

153
00:10:58,069 --> 00:10:56,579
private companies and more have had a

154
00:10:59,690 --> 00:10:58,079
hand in building this one-of-a-kind

155
00:11:01,790 --> 00:10:59,700
scientific platform

156
00:11:04,490 --> 00:11:01,800
without a doubt this is the most complex

157
00:11:07,490 --> 00:11:04,500
spacecraft ever built with revolutionary

158
00:11:08,930 --> 00:11:07,500
Technologies daring Mission goals and a

159
00:11:10,009 --> 00:11:08,940
whole lot of personal passion and

160
00:11:11,750 --> 00:11:10,019
commitment

161
00:11:13,490 --> 00:11:11,760
well here's my partners later in the

162
00:11:14,509 --> 00:11:13,500
broadcast but first let's hear from

163
00:11:16,610 --> 00:11:14,519

someone representing the science

164
00:11:19,370 --> 00:11:16,620
Community with a rare perspective about

165
00:11:22,850 --> 00:11:19,380
space exploration

166
00:11:24,350 --> 00:11:22,860
hello I'm is Mother currently living and

167
00:11:26,990 --> 00:11:24,360
working on the International Space

168
00:11:29,030 --> 00:11:27,000
Station Isis I'm very excited to follow

169
00:11:32,090 --> 00:11:29,040
the James Webb Space telescopes launch

170
00:11:34,430 --> 00:11:32,100
with you all from space even with the

171
00:11:36,470 --> 00:11:34,440
naked eye we astronauts see that the

172
00:11:38,810 --> 00:11:36,480
stars are incredibly sharp and Brilliant

173
00:11:41,210 --> 00:11:38,820
once we are outside of the Earth's

174
00:11:43,790 --> 00:11:41,220
atmosphere James Webb Space Telescope

175
00:11:46,670 --> 00:11:43,800
will be the largest and most powerful

176
00:11:48,949 --> 00:11:46,680
telescope in space yet and it was built

177
00:11:51,650 --> 00:11:48,959
to study the big questions questions

178
00:11:54,530 --> 00:11:51,660
like where do we come from how did

179
00:11:57,590 --> 00:11:54,540
galaxies form like our Milky Way Our

180
00:11:58,850 --> 00:11:57,600
Stars in Planet spawn like the Sun and

181
00:12:01,910 --> 00:11:58,860
the Earth

182
00:12:04,009 --> 00:12:01,920
but there even be lives on other planets

183
00:12:06,410 --> 00:12:04,019
the James Webb Space Telescope is a

184
00:12:08,990 --> 00:12:06,420
joint project between NASA the European

185
00:12:11,269 --> 00:12:09,000
and the Canadian space agencies and by

186
00:12:14,210 --> 00:12:11,279
tens of thousands of people with origins

187
00:12:17,960 --> 00:12:14,220
in many countries and it will be used by

188
00:12:22,550 --> 00:12:17,970

scientists everywhere on Earth

189
00:12:26,509 --> 00:12:24,350
NASA Goddard is the home of the web

190
00:12:28,790 --> 00:12:26,519
telescope with big sections designed and

191
00:12:30,829 --> 00:12:28,800
built here but actual Mission operations

192
00:12:32,990 --> 00:12:30,839
take place here

193
00:12:34,850 --> 00:12:33,000
this is the mission operations center or

194
00:12:37,370 --> 00:12:34,860
mock at the Space Telescope Science

195
00:12:38,870 --> 00:12:37,380
Institute in Baltimore after launch this

196
00:12:40,850 --> 00:12:38,880
facility will command and control web

197
00:12:42,170 --> 00:12:40,860
for the duration of the mission we'll be

198
00:12:43,550 --> 00:12:42,180
looking at the mock at Key moments

199
00:12:45,230 --> 00:12:43,560
throughout the broadcast and this will

200
00:12:46,970 --> 00:12:45,240
become a familiar location for viewers

201
00:12:49,009 --> 00:12:46,980
in the weeks ahead as the web team

202
00:12:52,129 --> 00:12:49,019
begins to set up the telescope for work

203
00:12:55,910 --> 00:12:54,650
so as we move closer to launch we'll

204
00:12:57,710 --> 00:12:55,920
actually keep a picture of the launch

205
00:12:59,269 --> 00:12:57,720
facility right here on the screen but

206
00:13:00,470 --> 00:12:59,279
for the next 10 minutes or so we're

207
00:13:02,329 --> 00:13:00,480
going to talk about some of Webb's

208
00:13:04,490 --> 00:13:02,339
principal science goals

209
00:13:07,069 --> 00:13:04,500
if you've ever seen a telescope before

210
00:13:08,210 --> 00:13:07,079
I'm certain it didn't look like this of

211
00:13:10,250 --> 00:13:08,220
course the look of this particular

212
00:13:12,889 --> 00:13:10,260
machine is a direct result of the

213
00:13:14,750 --> 00:13:12,899

scientific questions that's been built

214
00:13:16,009 --> 00:13:14,760
so fortunately we've got an expert pair

215
00:13:17,750 --> 00:13:16,019
of guests with me this morning to help

216
00:13:20,930 --> 00:13:17,760
explain those science goals and much

217
00:13:22,550 --> 00:13:20,940
more so I'm joined now on the set by

218
00:13:25,550 --> 00:13:22,560
NASA's Deputy project scientist for

219
00:13:27,949 --> 00:13:25,560
exoplanet science Nicole colon and also

220
00:13:29,030 --> 00:13:27,959
um with macarita Macarena Garcia Marie

221
00:13:30,829 --> 00:13:29,040
and the instrument and calibration

222
00:13:32,210 --> 00:13:30,839
scientist for Webb's mirroring

223
00:13:34,129 --> 00:13:32,220
instrument from the European Space

224
00:13:36,050 --> 00:13:34,139
Agency so welcome to you both thank you

225
00:13:37,730 --> 00:13:36,060
thank you so this is our chance to kind

226
00:13:39,410 --> 00:13:37,740
of step back and talk about the science

227
00:13:41,210 --> 00:13:39,420
goals of web you know this is the part

228
00:13:44,150 --> 00:13:41,220
that really excites astronomers like all

229
00:13:46,189 --> 00:13:44,160
of us and I know that there's unusual

230
00:13:47,629 --> 00:13:46,199
things about being an infrared telescope

231
00:13:49,970 --> 00:13:47,639
there are specific science schools

232
00:13:51,889 --> 00:13:49,980
infrared answers so maybe you could

233
00:13:53,930 --> 00:13:51,899
start us out Nicole with uh you're an

234
00:13:56,389 --> 00:13:53,940
expert on exoplanets how is the infrared

235
00:13:59,329 --> 00:13:56,399
really important for your study sure

236
00:14:01,250 --> 00:13:59,339
well with exoplanets we want to study

237
00:14:03,110 --> 00:14:01,260
their atmospheres and as a reminder

238
00:14:05,629 --> 00:14:03,120

exoplanets are planets that orbit

239
00:14:08,030 --> 00:14:05,639
distant Stars so we're looking for very

240
00:14:11,030 --> 00:14:08,040
small signals when we study their

241
00:14:13,129 --> 00:14:11,040
atmospheres and Webb is this giant

242
00:14:16,030 --> 00:14:13,139
telescope that we're able to use to

243
00:14:18,650 --> 00:14:16,040
collect these small signals and look for

244
00:14:19,730 --> 00:14:18,660
infrared signatures chemical signatures

245
00:14:22,250 --> 00:14:19,740
of

246
00:14:24,170 --> 00:14:22,260
water and methane and carbon dioxide

247
00:14:27,110 --> 00:14:24,180
those types of molecules in their

248
00:14:30,110 --> 00:14:27,120
atmospheres and why the infrared you

249
00:14:31,670 --> 00:14:30,120
know that's really because those

250
00:14:33,829 --> 00:14:31,680
signatures are the strongest in the

251
00:14:35,930 --> 00:14:33,839
infrared we know that they exist there

252
00:14:37,850 --> 00:14:35,940
and so that's why we want to use web to

253
00:14:39,769 --> 00:14:37,860
look there it seems an amazing idea so

254
00:14:41,230 --> 00:14:39,779
exoplanets planets around other stars

255
00:14:43,550 --> 00:14:41,240
are light years away from us

256
00:14:45,829 --> 00:14:43,560
tremendously distant so how do we know

257
00:14:47,689 --> 00:14:45,839
if it's water methane I mean how can we

258
00:14:50,090 --> 00:14:47,699
probe an atmosphere so far away

259
00:14:51,889 --> 00:14:50,100
well with web there's a couple different

260
00:14:54,470 --> 00:14:51,899
ways but one of the main ways is

261
00:14:56,870 --> 00:14:54,480
actually using the transit technique and

262
00:14:58,970 --> 00:14:56,880
this is an indirect method where we

263
00:15:01,670 --> 00:14:58,980

actually detected the decrease in

264
00:15:03,829 --> 00:15:01,680
Starlight that happens as a planet goes

265
00:15:05,930 --> 00:15:03,839
in front of its star but then imagine

266
00:15:07,730 --> 00:15:05,940
the planet has an atmosphere well

267
00:15:09,769 --> 00:15:07,740
there's an additional decrease in the

268
00:15:11,689 --> 00:15:09,779
Starlight because the atmosphere blocks

269
00:15:13,069 --> 00:15:11,699
some light from our point of view and

270
00:15:15,290 --> 00:15:13,079
why it blocks the light is because

271
00:15:17,569 --> 00:15:15,300
there's usually a molecule or something

272
00:15:19,970 --> 00:15:17,579
in there like water and methane like I

273
00:15:21,829 --> 00:15:19,980
mentioned that is acting as an absorber

274
00:15:23,750 --> 00:15:21,839
and blocking the light from our

275
00:15:25,490 --> 00:15:23,760
telescope in this case web

276
00:15:27,710 --> 00:15:25,500
so going from you know the relatively

277
00:15:29,210 --> 00:15:27,720
nearby nearby stars and planets Macarena

278
00:15:31,189 --> 00:15:29,220
you're an expert on very distant things

279
00:15:33,410 --> 00:15:31,199
distant galaxies so how does infrared

280
00:15:35,329 --> 00:15:33,420
contribute to your field of study

281
00:15:37,370 --> 00:15:35,339
so with web we're going to be able to

282
00:15:38,810 --> 00:15:37,380
observe the very first galaxies in

283
00:15:40,850 --> 00:15:38,820
itself we're talking about three and a

284
00:15:42,590 --> 00:15:40,860
half billion years ago so it's a really

285
00:15:44,509 --> 00:15:42,600
mind-blowing if you think about it and

286
00:15:46,490 --> 00:15:44,519
why infrared well those galaxies

287
00:15:48,530 --> 00:15:46,500
submitted their visible light

288
00:15:50,449 --> 00:15:48,540

many many millions of years ago and that

289
00:15:51,889 --> 00:15:50,459
life travels over us at the same time

290
00:15:54,650 --> 00:15:51,899
and at the same time the universe

291
00:15:56,810 --> 00:15:54,660
expands so in that process of travel and

292
00:15:58,970 --> 00:15:56,820
expansion the light shifters from the

293
00:16:01,009 --> 00:15:58,980
visible to the infrared and so where

294
00:16:01,910 --> 00:16:01,019
we'll be able to actually observe those

295
00:16:04,189 --> 00:16:01,920
very

296
00:16:05,509 --> 00:16:04,199
original primeval Galaxy so not only

297
00:16:07,370 --> 00:16:05,519
those but it will also allow us to

298
00:16:09,530 --> 00:16:07,380
observe everything in between so we can

299
00:16:11,329 --> 00:16:09,540
understand the evolution of our galaxies

300
00:16:13,550 --> 00:16:11,339
from the first ones to the ones we see

301
00:16:15,650 --> 00:16:13,560
today this is something kind of amazing

302
00:16:17,150 --> 00:16:15,660
so our eyes interpret different energies

303
00:16:18,710 --> 00:16:17,160
of light as different colors and

304
00:16:20,389 --> 00:16:18,720
infrared light is a color that our eyes

305
00:16:21,889 --> 00:16:20,399
are not sensitive to but like you said

306
00:16:23,689 --> 00:16:21,899
it's actually just the space of the

307
00:16:25,129 --> 00:16:23,699
universe stretching out the light and

308
00:16:27,410 --> 00:16:25,139
changing it from visible light into

309
00:16:29,090 --> 00:16:27,420
information right exactly so how are

310
00:16:31,670 --> 00:16:29,100
these first galaxies different from

311
00:16:33,410 --> 00:16:31,680
galaxies today well when you look at the

312
00:16:35,509 --> 00:16:33,420
images we have of the oldest galaxies

313
00:16:37,970 --> 00:16:35,519

we've seen they look like fluffier and

314
00:16:39,590 --> 00:16:37,980
clampier we know they have a lot of

315
00:16:41,030 --> 00:16:39,600
stuff formation so that they are

316
00:16:43,730 --> 00:16:41,040
actually that's a really good signature

317
00:16:46,310 --> 00:16:43,740
to to measure them and they they are

318
00:16:49,009 --> 00:16:46,320
like little seeds that afterwards they

319
00:16:50,689 --> 00:16:49,019
emerged and and got together and evolved

320
00:16:53,509 --> 00:16:50,699
until the ones we see today which are

321
00:16:55,009 --> 00:16:53,519
like spirals analytical galaxies so from

322
00:16:56,689 --> 00:16:55,019
you know the the near Universe to the

323
00:16:58,790 --> 00:16:56,699
far um one of the things that infrared

324
00:17:00,470 --> 00:16:58,800
is very good is seeing through dust it's

325
00:17:01,850 --> 00:17:00,480
another huge Advantage I mean maybe

326
00:17:04,610 --> 00:17:01,860
Nicole could you sort of take us through

327
00:17:06,230 --> 00:17:04,620
that story sure you know with dust

328
00:17:08,870 --> 00:17:06,240
there's well first there's a lot of dust

329
00:17:10,490 --> 00:17:08,880
in the universe and but how stars and

330
00:17:12,289 --> 00:17:10,500
planets form in the first place they are

331
00:17:14,210 --> 00:17:12,299
forming in these very dense

332
00:17:16,429 --> 00:17:14,220
clouds of gas and dust that come

333
00:17:18,710 --> 00:17:16,439
together and it's very difficult to see

334
00:17:21,409 --> 00:17:18,720
through them with normal visible light

335
00:17:22,970 --> 00:17:21,419
and so the infrared is actually able to

336
00:17:24,829 --> 00:17:22,980
see through that almost like an x-ray

337
00:17:26,809 --> 00:17:24,839
you know sees your bones

338
00:17:28,970 --> 00:17:26,819

um sees through our skin you can use the

339
00:17:31,070 --> 00:17:28,980
telescope like web to see through the

340
00:17:33,169 --> 00:17:31,080
dust and see the inner Stars forming or

341
00:17:35,990 --> 00:17:33,179
see some newly formed planets that are

342
00:17:37,850 --> 00:17:36,000
also very warm from having just formed

343
00:17:39,710 --> 00:17:37,860
and there's even a possibility of seeing

344
00:17:41,210 --> 00:17:39,720
some of the the very first stars or at

345
00:17:42,529 --> 00:17:41,220
least some evidence of the first stars

346
00:17:43,490 --> 00:17:42,539
that might have existed but could you

347
00:17:46,970 --> 00:17:43,500
tell us a little bit about that Macarena

348
00:17:48,590 --> 00:17:46,980
yeah so the very first sisters they form

349
00:17:50,390 --> 00:17:48,600
right around the time of the very first

350
00:17:52,190 --> 00:17:50,400
galaxies even before that and so we'll

351
00:17:53,510 --> 00:17:52,200
be able to to measure that maybe not the

352
00:17:55,549 --> 00:17:53,520
very first one but the first population

353
00:17:57,650 --> 00:17:55,559
of the Stars which is really interesting

354
00:17:59,870 --> 00:17:57,660
because they were formed out of a very

355
00:18:02,750 --> 00:17:59,880
pristine material and then from there

356
00:18:04,310 --> 00:18:02,760
they evolved into more of all the stars

357
00:18:06,950 --> 00:18:04,320
I created all the elements we know today

358
00:18:08,930 --> 00:18:06,960
things like gold Platinum carbon

359
00:18:11,150 --> 00:18:08,940
everything us we're from out of those

360
00:18:12,890 --> 00:18:11,160
original Stars so it's a really it's a

361
00:18:15,409 --> 00:18:12,900
really amazing adventure to observe all

362
00:18:17,090 --> 00:18:15,419
these objects and understand them better

363
00:18:18,529 --> 00:18:17,100

yeah there's so many wonders in the

364
00:18:19,789 --> 00:18:18,539
universe and one of the things that I

365
00:18:21,710 --> 00:18:19,799
would never have believed was real

366
00:18:23,810 --> 00:18:21,720
unless I'd seen it the data with my own

367
00:18:24,770 --> 00:18:23,820
eyes is the trappist-1 system and this

368
00:18:26,450 --> 00:18:24,780
is actually going to be one of the

369
00:18:28,250 --> 00:18:26,460
targets for website right tell us a

370
00:18:30,230 --> 00:18:28,260
little bit about Travis sure Trappist

371
00:18:32,330 --> 00:18:30,240
one is like you said it's going to be a

372
00:18:34,669 --> 00:18:32,340
Target um there's seven planets in the

373
00:18:37,010 --> 00:18:34,679
system and they're all small around the

374
00:18:38,810 --> 00:18:37,020
size of Earth actually so it's also very

375
00:18:40,610 --> 00:18:38,820
compact system so it's not just that

376
00:18:42,049 --> 00:18:40,620
there's a lot of planets and that web is

377
00:18:44,750 --> 00:18:42,059
going to observe every single one of

378
00:18:47,510 --> 00:18:44,760
them but it's the compact nature that's

379
00:18:50,090 --> 00:18:47,520
just really fascinating because the the

380
00:18:51,789 --> 00:18:50,100
entire orbit of the planetary systems

381
00:18:54,890 --> 00:18:51,799
like all seven planets they fit inside

382
00:18:56,570 --> 00:18:54,900
our orbit of mercury around the Sun and

383
00:18:58,730 --> 00:18:56,580
Mercury is our closest planet to the Sun

384
00:19:00,350 --> 00:18:58,740
so imagine seven planets in there and

385
00:19:01,909 --> 00:19:00,360
you know there's a lot going on but it's

386
00:19:04,549 --> 00:19:01,919
very exciting because we'll get to learn

387
00:19:05,990 --> 00:19:04,559
and do comparative science and see are

388
00:19:07,190 --> 00:19:06,000

all these planets

389
00:19:08,990 --> 00:19:07,200
do they have the same chemical

390
00:19:11,270 --> 00:19:09,000
signatures in their atmosphere you know

391
00:19:12,950 --> 00:19:11,280
do they all have same amount of water or

392
00:19:14,029 --> 00:19:12,960
carbon dioxide things like that well

393
00:19:15,049 --> 00:19:14,039
thank you so much we're gonna be back to

394
00:19:17,690 --> 00:19:15,059
talk to you more but thank you for

395
00:19:19,310 --> 00:19:17,700
joining me thank you thank you okay so

396
00:19:20,750 --> 00:19:19,320
we'll be back in some more minutes to uh

397
00:19:22,549 --> 00:19:20,760
to talk with them and remember that

398
00:19:24,770 --> 00:19:22,559
we're taking your questions so use the

399
00:19:26,690 --> 00:19:24,780
hashtag asknasa

400
00:19:28,549 --> 00:19:26,700
web looks like nothing that's come

401
00:19:30,350 --> 00:19:28,559
before because it's pursuing scientific

402
00:19:32,570 --> 00:19:30,360
goals like none that have come before

403
00:19:34,669 --> 00:19:32,580
it's taken years to prepare it for

404
00:19:36,590 --> 00:19:34,679
flight and as you might imagine plans of

405
00:19:38,270 --> 00:19:36,600
this scope and scale inevitably run into

406
00:19:40,430 --> 00:19:38,280
unexpected challenges

407
00:19:42,289 --> 00:19:40,440
along the way just like any of us it

408
00:19:44,710 --> 00:19:42,299
encountered things like snowstorms in

409
00:19:47,090 --> 00:19:44,720
the East wildfires in California

410
00:19:49,310 --> 00:19:47,100
hurricanes that deluged Houston Texas

411
00:19:51,230 --> 00:19:49,320
and of course the global covid-19

412
00:19:53,390 --> 00:19:51,240
pandemic which added its own profound

413
00:19:55,430 --> 00:19:53,400

challenges to the whole team this story

414
00:19:56,890 --> 00:19:55,440
really warrants a recap so check this

415
00:19:59,690 --> 00:19:56,900
out

416
00:20:01,970 --> 00:19:59,700
the web Space Telescope presented many

417
00:20:03,830 --> 00:20:01,980
engineering challenges but engineering

418
00:20:06,049 --> 00:20:03,840
hasn't been the only obstacle the team

419
00:20:08,990 --> 00:20:06,059
had to overcome

420
00:20:10,789 --> 00:20:09,000
in 2011 an outbreak of tornadoes cut

421
00:20:12,950 --> 00:20:10,799
electricity to the Marshall space flight

422
00:20:14,510 --> 00:20:12,960
center in Alabama for nearly a week

423
00:20:16,909 --> 00:20:14,520
while the team rushed to finish

424
00:20:18,830 --> 00:20:16,919
cryogenic testing on the primary mirror

425
00:20:21,529 --> 00:20:18,840
segments using power from diesel

426
00:20:23,510 --> 00:20:21,539
generators Engineers had to endure a

427
00:20:25,549 --> 00:20:23,520
large snowstorm known locally as

428
00:20:27,230 --> 00:20:25,559
snowmageddon while testing the

429
00:20:29,510 --> 00:20:27,240
Integrated Science instrument module at

430
00:20:31,310 --> 00:20:29,520
The Goddard space flight center

431
00:20:33,529 --> 00:20:31,320
and of course everyone has had to

432
00:20:36,230 --> 00:20:33,539
contend with the global pandemic

433
00:20:37,909 --> 00:20:36,240
one particularly memorable challenge was

434
00:20:41,570 --> 00:20:37,919
working through hurricane Harvey in

435
00:20:43,430 --> 00:20:41,580
2017. this massive Cyclone dumped 40 to

436
00:20:46,130 --> 00:20:43,440
60 inches of rain across the Houston

437
00:20:48,529 --> 00:20:46,140
area over a four-day period causing

438
00:20:50,810 --> 00:20:48,539

catastrophic flooding and 125 billion

439
00:20:52,730 --> 00:20:50,820
dollars of damage all while the

440
00:20:55,450 --> 00:20:52,740
telescope was undergoing cryogenic

441
00:20:58,010 --> 00:20:55,460
testing and nasus Johnson Space Center

442
00:21:00,350 --> 00:20:58,020
though the telescope remains safe inside

443
00:21:01,669 --> 00:21:00,360
the test chamber water leaked through

444
00:21:03,649 --> 00:21:01,679
the ceilings

445
00:21:06,350 --> 00:21:03,659
people had to cover workstations and

446
00:21:08,870 --> 00:21:06,360
plastic tarps food was in short supply

447
00:21:11,570 --> 00:21:08,880
and a few team members trapped by flood

448
00:21:14,090 --> 00:21:11,580
waters had to be rescued by boat

449
00:21:16,010 --> 00:21:14,100
it was rough to say the least but the

450
00:21:19,490 --> 00:21:16,020
team and the telescope survived the

451
00:21:22,310 --> 00:21:19,500
storm despite winds and snow and endless

452
00:21:24,590 --> 00:21:22,320
rain the team got it done and Webb is

453
00:21:26,900 --> 00:21:24,600
now ready for its final Journey Atop A

454
00:21:30,950 --> 00:21:26,910
Rocket into space

455
00:21:34,549 --> 00:21:32,570
while the web telescope is a

456
00:21:37,010 --> 00:21:34,559
technological Marvel everything here

457
00:21:38,810 --> 00:21:37,020
began with questions questions about how

458
00:21:40,789 --> 00:21:38,820
the first stars and galaxies came to be

459
00:21:42,590 --> 00:21:40,799
questions about whether planets around

460
00:21:44,750 --> 00:21:42,600
other stars might have environments that

461
00:21:46,070 --> 00:21:44,760
can sustain life and of course the

462
00:21:47,510 --> 00:21:46,080
promise of discoveries we can't even

463
00:21:49,370 --> 00:21:47,520

predict yet

464
00:21:50,690 --> 00:21:49,380
a few days ago I had a chance to speak

465
00:21:52,310 --> 00:21:50,700
with someone who's probably the best

466
00:21:54,710 --> 00:21:52,320
person on Earth to help us understand

467
00:21:59,510 --> 00:21:54,720
what we know what we don't know and how

468
00:22:03,409 --> 00:22:01,669
Dr John Mather is a Nobel Prize winner

469
00:22:05,750 --> 00:22:03,419
who measured the big bang with an

470
00:22:07,669 --> 00:22:05,760
observatory built here at Nasa Goddard

471
00:22:09,169 --> 00:22:07,679
John is Webb senior project scientist

472
00:22:10,789 --> 00:22:09,179
and we're so pleased to have you here

473
00:22:11,630 --> 00:22:10,799
today John good to be here with you

474
00:22:14,630 --> 00:22:11,640
Michelle

475
00:22:16,490 --> 00:22:14,640
so to start this incredible story of

476
00:22:18,590 --> 00:22:16,500
Webb let's start with something that's

477
00:22:20,810 --> 00:22:18,600
deceptively simple gravity something

478
00:22:23,390 --> 00:22:20,820
special about gravity gravity is special

479
00:22:25,370 --> 00:22:23,400
gravity always pulls it's the only force

480
00:22:27,710 --> 00:22:25,380
of nature that always pulls

481
00:22:29,750 --> 00:22:27,720
so that's special and what makes that

482
00:22:31,730 --> 00:22:29,760
special is it gravity although it's very

483
00:22:34,130 --> 00:22:31,740
weak is very long range it can reach

484
00:22:35,810 --> 00:22:34,140
Across the Universe and slow down the

485
00:22:37,850 --> 00:22:35,820
expansion of the material that came from

486
00:22:40,130 --> 00:22:37,860
The Big Bang turn it around pull it back

487
00:22:42,470 --> 00:22:40,140
together turn it into galaxies and stars

488
00:22:44,690 --> 00:22:42,480

and eventually planets and a place we

489
00:22:46,610 --> 00:22:44,700
could live so that's what makes gravity

490
00:22:47,810 --> 00:22:46,620
special among all the forces of nature

491
00:22:49,430 --> 00:22:47,820
and

492
00:22:51,830 --> 00:22:49,440
oh I just the idea that it's always

493
00:22:54,049 --> 00:22:51,840
pulling together that Simplicity leads

494
00:22:55,850 --> 00:22:54,059
to wonderful complexity doesn't it yes

495
00:22:58,130 --> 00:22:55,860
because it's always pulling it's

496
00:23:00,350 --> 00:22:58,140
possible for gravitational energy to be

497
00:23:03,230 --> 00:23:00,360
converted into kinetic energy that just

498
00:23:05,090 --> 00:23:03,240
just heat and as the universe becomes

499
00:23:06,890 --> 00:23:05,100
self-heating which is not something

500
00:23:09,890 --> 00:23:06,900
other forces could do all by themselves

501
00:23:11,810 --> 00:23:09,900
clouds of gas can be compressed by the

502
00:23:14,149 --> 00:23:11,820
gravity until they get big enough and

503
00:23:16,070 --> 00:23:14,159
hot enough to light up and have the

504
00:23:18,230 --> 00:23:16,080
nuclear reactions inside that turn

505
00:23:20,510 --> 00:23:18,240
hydrogen and helium into that chemical

506
00:23:23,690 --> 00:23:20,520
elements you see around you here in the

507
00:23:25,909 --> 00:23:23,700
house here on the set so carbon oxygen

508
00:23:27,890 --> 00:23:25,919
nitrogen everything we have that we

509
00:23:30,890 --> 00:23:27,900
think of as ordinary came from inside

510
00:23:32,990 --> 00:23:30,900
Stars so we are Stardust as Carl Sagan

511
00:23:34,970 --> 00:23:33,000
told us but there wasn't any Stardust in

512
00:23:36,710 --> 00:23:34,980
the Big Bang so we need this part of the

513
00:23:39,230 --> 00:23:36,720

story to be figured out how did we come

514
00:23:41,390 --> 00:23:39,240
to be able to live here on our little

515
00:23:43,610 --> 00:23:41,400
planet when the universe started out

516
00:23:45,169 --> 00:23:43,620
without all of these goody things

517
00:23:47,149 --> 00:23:45,179
so you mentioned these planets around

518
00:23:48,409 --> 00:23:47,159
other stars so we're almost sort of

519
00:23:50,810 --> 00:23:48,419
going through all these amazing science

520
00:23:52,850 --> 00:23:50,820
goals of the web what can what can Webb

521
00:23:55,070 --> 00:23:52,860
tell us about planets around other stars

522
00:23:56,750 --> 00:23:55,080
well once in a while a planet goes in

523
00:23:58,430 --> 00:23:56,760
front of the star and some of the

524
00:24:00,169 --> 00:23:58,440
Starlight goes through the atmosphere of

525
00:24:01,909 --> 00:24:00,179
the planet if it has an atmosphere on

526
00:24:04,970 --> 00:24:01,919
its way to the telescope we will spread

527
00:24:06,649 --> 00:24:04,980
out that light into a spectrum or what

528
00:24:08,570 --> 00:24:06,659
you would call a rainbow and we'll

529
00:24:11,149 --> 00:24:08,580
analyze it to see what are the chemicals

530
00:24:13,250 --> 00:24:11,159
that are in that atmosphere uh so we

531
00:24:15,350 --> 00:24:13,260
will be able to tell you that maybe

532
00:24:17,149 --> 00:24:15,360
that's the plan whether those little

533
00:24:19,310 --> 00:24:17,159
planets that might be like Earth

534
00:24:21,230 --> 00:24:19,320
actually could have for instance water

535
00:24:22,789 --> 00:24:21,240
in their atmosphere and maybe enough

536
00:24:24,769 --> 00:24:22,799
water so there could be a liquid ocean

537
00:24:27,409 --> 00:24:24,779
under that atmosphere one of the great

538
00:24:29,510 --> 00:24:27,419

questions so we know they're planets now

539
00:24:30,890 --> 00:24:29,520
we know when we should look we just

540
00:24:33,590 --> 00:24:30,900
don't know what we're going to see

541
00:24:34,669 --> 00:24:33,600
so I after the web launches one of my

542
00:24:36,470 --> 00:24:34,679
dreams is I'm going to be standing

543
00:24:37,730 --> 00:24:36,480
outside of my backyard and point to a

544
00:24:40,010 --> 00:24:37,740
star and say there's a planet around

545
00:24:43,310 --> 00:24:40,020
that star that we know has water vapor

546
00:24:44,810 --> 00:24:43,320
oxygen perhaps methane carbon dioxide so

547
00:24:46,909 --> 00:24:44,820
what is web going to also do in the

548
00:24:48,950 --> 00:24:46,919
search for Life closer to home our own

549
00:24:50,390 --> 00:24:48,960
backyard well here in our own solar

550
00:24:52,850 --> 00:24:50,400
system we will be looking at everything

551
00:24:56,090 --> 00:24:52,860
from Mars on outwards to the farthest we

552
00:24:58,370 --> 00:24:56,100
can see uh satellites comets asteroids

553
00:24:59,690 --> 00:24:58,380
and the planets themselves and some of

554
00:25:03,230 --> 00:24:59,700
them are really interesting and special

555
00:25:04,310 --> 00:25:03,240
because we know they're possible homes

556
00:25:09,409 --> 00:25:04,320
of life

557
00:25:12,110 --> 00:25:09,419
well if it's wet that's a good clue so

558
00:25:13,970 --> 00:25:12,120
the satellite Europa which orbits around

559
00:25:16,610 --> 00:25:13,980
Jupiter was discovered by Galileo

560
00:25:18,649 --> 00:25:16,620
himself and we know now that it has an

561
00:25:20,390 --> 00:25:18,659
ocean that's covered with ice there's

562
00:25:22,909 --> 00:25:20,400
there are cracks in the ice where water

563
00:25:24,409 --> 00:25:22,919

comes spitting out we NASA are going to

564
00:25:26,090 --> 00:25:24,419
send a probe over there to fly through

565
00:25:28,070 --> 00:25:26,100
those plumes we're also going to point

566
00:25:30,289 --> 00:25:28,080
over there with a web telescope to see

567
00:25:32,149 --> 00:25:30,299
what can see about that atmosphere and

568
00:25:34,370 --> 00:25:32,159
those plumes of water we'll be looking

569
00:25:35,810 --> 00:25:34,380
at Titan which is a satellite of Saturn

570
00:25:37,909 --> 00:25:35,820
which is so big that it has an

571
00:25:40,909 --> 00:25:37,919
atmosphere enough to fly a helicopter

572
00:25:43,970 --> 00:25:40,919
and it is cold out there so that what

573
00:25:46,850 --> 00:25:43,980
they have what is on the surface is

574
00:25:48,350 --> 00:25:46,860
solid ice and over that are liquid

575
00:25:51,590 --> 00:25:48,360
hydrocarbons which you would use for

576
00:25:54,409 --> 00:25:51,600
fuel here in here in our home but over

577
00:25:56,630 --> 00:25:54,419
there it's liquid rain lakes and rivers

578
00:25:58,549 --> 00:25:56,640
and we will be looking at the geology of

579
00:25:59,690 --> 00:25:58,559
that before we send the helicopter out

580
00:26:01,610 --> 00:25:59,700
there

581
00:26:03,409 --> 00:26:01,620
so you're on this amazing journey from

582
00:26:04,970 --> 00:26:03,419
the very distant early Universe all the

583
00:26:07,070 --> 00:26:04,980
way to our own solar system but this

584
00:26:08,269 --> 00:26:07,080
also been a journey for you you've been

585
00:26:09,830 --> 00:26:08,279
working on web since the very beginning

586
00:26:11,990 --> 00:26:09,840
of the mission is that correct I have

587
00:26:14,390 --> 00:26:12,000
since 95 we had our first conversation

588
00:26:17,090 --> 00:26:14,400

but people were even dreaming and

589
00:26:19,130 --> 00:26:17,100
imagining way before that what we needed

590
00:26:20,570 --> 00:26:19,140
and you could tell even before that we

591
00:26:22,370 --> 00:26:20,580
launched the Hubble what were the

592
00:26:24,409 --> 00:26:22,380
possibilities and we learned that we

593
00:26:26,690 --> 00:26:24,419
would need an infrared telescope that

594
00:26:28,669 --> 00:26:26,700
could do things that Hubble could not do

595
00:26:30,470 --> 00:26:28,679
well John I've been admire of yours for

596
00:26:31,789 --> 00:26:30,480
many decades now and it's an honor to be

597
00:26:33,769 --> 00:26:31,799
with you on this part of the mission so

598
00:26:35,390 --> 00:26:33,779
thank you so much for joining us best of

599
00:26:37,130 --> 00:26:35,400
luck on the launch and the mission ahead

600
00:26:41,870 --> 00:26:37,140
thank you for asking all these great

601
00:26:46,130 --> 00:26:44,210
the Hubble Space Telescope delivered

602
00:26:48,350 --> 00:26:46,140
profound insights about our place in the

603
00:26:50,390 --> 00:26:48,360
cosmos but perhaps the biggest takeaway

604
00:26:52,070 --> 00:26:50,400
from Hubble Is that we've only just

605
00:26:54,350 --> 00:26:52,080
scratched the surface

606
00:26:56,510 --> 00:26:54,360
Hubble gave us the best ever views of

607
00:26:59,090 --> 00:26:56,520
stars and planets forming inside vast

608
00:27:00,950 --> 00:26:59,100
dark clouds of dust but as soon as we

609
00:27:02,149 --> 00:27:00,960
had that data we were asking new

610
00:27:04,730 --> 00:27:02,159
questions that needed better

611
00:27:06,649 --> 00:27:04,740
measurements clearer images

612
00:27:09,470 --> 00:27:06,659
Hubble was also able to capture images

613
00:27:12,710 --> 00:27:09,480

from galaxies so far away their light

614
00:27:14,870 --> 00:27:12,720
took 13 billion years to travel to us

615
00:27:16,330 --> 00:27:14,880
these distant galaxies are just tiny

616
00:27:18,529 --> 00:27:16,340
dots and Hubble's images

617
00:27:20,570 --> 00:27:18,539
tantalizing scientists with clues about

618
00:27:21,889 --> 00:27:20,580
how the first galaxies formed

619
00:27:23,450 --> 00:27:21,899
in order to pursue a better

620
00:27:25,010 --> 00:27:23,460
understanding about the earliest days of

621
00:27:27,350 --> 00:27:25,020
the universe we needed to build a better

622
00:27:29,090 --> 00:27:27,360
time machine and that's web

623
00:27:31,130 --> 00:27:29,100
so I'm going to be rejoined here by

624
00:27:33,230 --> 00:27:31,140
Nicola Macarena and this is our chance

625
00:27:35,210 --> 00:27:33,240
to talk a bit about building that better

626
00:27:38,269 --> 00:27:35,220
time machine what about the technology

627
00:27:40,669 --> 00:27:38,279
of web so there's so many aspects of web

628
00:27:42,769 --> 00:27:40,679
to start off with but but maybe again

629
00:27:44,510 --> 00:27:42,779
going back to the theme of infrared the

630
00:27:46,789 --> 00:27:44,520
design of this telescope is so different

631
00:27:48,950 --> 00:27:46,799
because we had to use infrared light

632
00:27:51,230 --> 00:27:48,960
heat light so tell us about some of the

633
00:27:53,149 --> 00:27:51,240
challenges of you know for example why

634
00:27:55,190 --> 00:27:53,159
does it have to be so cool to tell us

635
00:27:57,110 --> 00:27:55,200
about infrared light in the design right

636
00:27:58,789 --> 00:27:57,120
well I think we've heard already just

637
00:28:01,750 --> 00:27:58,799
how cool it has to be you know it's

638
00:28:04,610 --> 00:28:01,760

around or below 50 Kelvin and that's

639
00:28:06,769 --> 00:28:04,620
minus 370 degrees Fahrenheit actually

640
00:28:09,110 --> 00:28:06,779
below that is what it operates at and

641
00:28:11,029 --> 00:28:09,120
that's very cold and the reason we need

642
00:28:13,850 --> 00:28:11,039
it so cool is because we don't want the

643
00:28:16,430 --> 00:28:13,860
telescope itself to detect itself

644
00:28:17,630 --> 00:28:16,440
because there's there's several

645
00:28:19,490 --> 00:28:17,640
instruments on board there's four

646
00:28:21,529 --> 00:28:19,500
different instruments and you know

647
00:28:24,350 --> 00:28:21,539
there's some moving parts and so you

648
00:28:26,690 --> 00:28:24,360
need things to be cool because you want

649
00:28:29,090 --> 00:28:26,700
to detect these faint signatures from

650
00:28:31,669 --> 00:28:29,100
either an exoplanet atmosphere or you

651
00:28:34,070 --> 00:28:31,679
know faint light from the earliest stars

652
00:28:36,470 --> 00:28:34,080
and galaxies so you just don't want to

653
00:28:37,490 --> 00:28:36,480
detect your own telescope now the

654
00:28:39,830 --> 00:28:37,500
Macarena you are the instrument

655
00:28:41,950 --> 00:28:39,840
calibration scientist for the coolest

656
00:28:44,090 --> 00:28:41,960
instruments

657
00:28:46,370 --> 00:28:44,100
tell us a bit about Mary and why it

658
00:28:48,110 --> 00:28:46,380
needs to be so cold so maybe it's a

659
00:28:50,090 --> 00:28:48,120
really unique instrument and it's a

660
00:28:51,289 --> 00:28:50,100
great example of this collaboration we

661
00:28:54,049 --> 00:28:51,299
have in this Mission because it's half

662
00:28:55,610 --> 00:28:54,059
European half U.S and so Mary is still

663
00:28:57,230 --> 00:28:55,620

an instrument on board that uses the

664
00:29:00,169 --> 00:28:57,240
meat in front of the light and the

665
00:29:02,990 --> 00:29:00,179
medical light is a bit rather a bit

666
00:29:05,269 --> 00:29:03,000
cooler than the near River Light also

667
00:29:07,490 --> 00:29:05,279
because of that meaning is to be colder

668
00:29:10,010 --> 00:29:07,500
in order to detect that very faint

669
00:29:13,430 --> 00:29:10,020
signal from hydroseed galaxies or

670
00:29:14,930 --> 00:29:13,440
protocol disks Etc so because of that it

671
00:29:18,049 --> 00:29:14,940
has it's the only instrumental board

672
00:29:19,730 --> 00:29:18,059
that has a cryo cooler so it is not only

673
00:29:22,370 --> 00:29:19,740
the passive cooling from the sun shield

674
00:29:25,250 --> 00:29:22,380
it is active Cooling and it brings that

675
00:29:28,250 --> 00:29:25,260
it brings it down to about minus 450

676
00:29:31,549 --> 00:29:28,260
Fahrenheit so it's really extremely cold

677
00:29:32,990 --> 00:29:31,559
a few degrees above the absolute zero

678
00:29:34,549 --> 00:29:33,000
and we were talking about you don't want

679
00:29:36,590 --> 00:29:34,559
the telescope to be so hot that it's

680
00:29:37,850 --> 00:29:36,600
basically giving off its own signal its

681
00:29:40,310 --> 00:29:37,860
own radiation and that leads us to why

682
00:29:41,389 --> 00:29:40,320
it needs to be in space right so tell us

683
00:29:42,769 --> 00:29:41,399
a bit about Widow why do we need to

684
00:29:45,649 --> 00:29:42,779
launch this thing into space to see

685
00:29:47,810 --> 00:29:45,659
these wavelengths well again it kind of

686
00:29:49,850 --> 00:29:47,820
goes back to atmospheres because Earth

687
00:29:51,769 --> 00:29:49,860
has an atmosphere and there's water in

688
00:29:53,389 --> 00:29:51,779

Earth's atmosphere as one example I mean

689
00:29:55,490 --> 00:29:53,399
there's a lot of other molecules but

690
00:29:57,649 --> 00:29:55,500
basically in the infrared at the

691
00:29:59,930 --> 00:29:57,659
wavelengths that we want to observe some

692
00:30:02,389 --> 00:29:59,940
of these stars and and planets and

693
00:30:04,610 --> 00:30:02,399
galaxies those wavelengths are actually

694
00:30:07,669 --> 00:30:04,620
where Earth's atmosphere is opaque so

695
00:30:09,710 --> 00:30:07,679
with telescopes located on Earth even in

696
00:30:11,029 --> 00:30:09,720
at higher mountains where they try to

697
00:30:13,010 --> 00:30:11,039
get above the clouds or atmospheres

698
00:30:14,510 --> 00:30:13,020
sometimes there's still residual

699
00:30:16,549 --> 00:30:14,520
atmosphere that we're trying to look

700
00:30:18,649 --> 00:30:16,559
through and peer through so

701
00:30:20,510 --> 00:30:18,659
in order to see the full infrared

702
00:30:22,730 --> 00:30:20,520
wavelength range at a very high

703
00:30:25,130 --> 00:30:22,740
sensitivity as well we need to go to

704
00:30:26,870 --> 00:30:25,140
space absolutely so we talked a bit

705
00:30:28,310 --> 00:30:26,880
about some of the power of techniques

706
00:30:30,590 --> 00:30:28,320
like spectroscopy we've heard we've

707
00:30:32,630 --> 00:30:30,600
heard Dr John Mather talk about it so

708
00:30:34,370 --> 00:30:32,640
let's go a little bit more into the

709
00:30:37,010 --> 00:30:34,380
details of how spectroscopy works and

710
00:30:39,830 --> 00:30:37,020
why it's so powerful

711
00:30:43,010 --> 00:30:39,840
sure yeah I can keep going you know well

712
00:30:45,710 --> 00:30:43,020
with microscopy um we heard so visible

713
00:30:48,289 --> 00:30:45,720

light again is kind of it's a rainbow of

714
00:30:50,029 --> 00:30:48,299
colors that we don't see naturally but

715
00:30:52,370 --> 00:30:50,039
if you use something like a prism you

716
00:30:54,289 --> 00:30:52,380
can separate out that light and see all

717
00:30:55,909 --> 00:30:54,299
the colors from you know blue to red but

718
00:30:58,310 --> 00:30:55,919
then the infrared is redder than the

719
00:31:01,630 --> 00:30:58,320
human eyes can see but you can still do

720
00:31:04,490 --> 00:31:01,640
the same technique where you have a

721
00:31:07,190 --> 00:31:04,500
spectroscopy tools or instruments like

722
00:31:08,990 --> 00:31:07,200
web halves all these spectroscopic tools

723
00:31:11,750 --> 00:31:09,000
so that we can break up the infrared

724
00:31:12,470 --> 00:31:11,760
light and look at certain colors if you

725
00:31:14,750 --> 00:31:12,480
will

726
00:31:17,750 --> 00:31:14,760
so that we can see certain features that

727
00:31:19,570 --> 00:31:17,760
we are looking for whether it's the

728
00:31:22,669 --> 00:31:19,580
right wavelength where you know a Galaxy

729
00:31:26,149 --> 00:31:22,679
might be bright or where water is

730
00:31:26,159 --> 00:31:31,730
many different capability

731
00:31:34,549 --> 00:31:33,230
well yes talk a little bit about all

732
00:31:35,930 --> 00:31:34,559
these ways that we're going to detect

733
00:31:38,149 --> 00:31:35,940
you know different signatures from

734
00:31:39,590 --> 00:31:38,159
planets also chronography it's an

735
00:31:42,230 --> 00:31:39,600
amazing technique but essentially it

736
00:31:44,210 --> 00:31:42,240
simulates an eclipse so we have a very

737
00:31:46,610 --> 00:31:44,220
bright star with planets around for

738
00:31:49,250 --> 00:31:46,620

instance usually when you take any much

739
00:31:51,409 --> 00:31:49,260
the Stars outshines the light of the

740
00:31:53,269 --> 00:31:51,419
planet so you don't see them but with

741
00:31:55,130 --> 00:31:53,279
midi and with other instrument income as

742
00:31:57,470 --> 00:31:55,140
well you can actually block the light of

743
00:31:58,970 --> 00:31:57,480
the star and dim it and then you see the

744
00:32:01,490 --> 00:31:58,980
planets around I see that they need

745
00:32:03,409 --> 00:32:01,500
there's going to be very much used and

746
00:32:05,690 --> 00:32:03,419
to do like in the same much direct

747
00:32:06,889 --> 00:32:05,700
Imaging of Planet well thank you so much

748
00:32:08,269 --> 00:32:06,899
we'll be back to talk to you more with

749
00:32:09,710 --> 00:32:08,279
some social media questions thank you

750
00:32:11,810 --> 00:32:09,720
very much thank you

751
00:32:14,210 --> 00:32:11,820
NASA and its Partners began developing

752
00:32:16,370 --> 00:32:14,220
the web telescope years ago growing from

753
00:32:19,430 --> 00:32:16,380
an initial inspiration to a design then

754
00:32:21,289 --> 00:32:19,440
schematics and finally reality what

755
00:32:23,090 --> 00:32:21,299
started as a big dream of studying the

756
00:32:25,490 --> 00:32:23,100
origins of the universe required

757
00:32:27,590 --> 00:32:25,500
best-in-class engineering expertise to

758
00:32:28,610 --> 00:32:27,600
transform into something real let's take

759
00:33:08,690 --> 00:32:28,620
a

760
00:33:10,669 --> 00:33:08,700
new science instruments in the U.S

761
00:33:12,889 --> 00:33:10,679
Europe and Canada

762
00:33:15,529 --> 00:33:12,899
every step of the way there were reviews

763
00:33:18,169 --> 00:33:15,539

and tests to make sure each part could

764
00:33:20,690 --> 00:33:18,179
withstand the rigors of space lights

765
00:33:22,250 --> 00:33:20,700
by the early 2010s the team began

766
00:33:24,289 --> 00:33:22,260
bringing individual components together

767
00:33:26,149 --> 00:33:24,299
at NASA's Goddard space flight center in

768
00:33:27,889 --> 00:33:26,159
Greenbelt Maryland

769
00:33:29,930 --> 00:33:27,899
it was there that the mirrors and

770
00:33:34,970 --> 00:33:29,940
instruments began to coalesce into the

771
00:33:38,509 --> 00:33:37,009
we've said before that the James Webb

772
00:33:40,909 --> 00:33:38,519
Space Telescope is an incredibly

773
00:33:42,769 --> 00:33:40,919
ambitious Mission big Ambitions come

774
00:33:44,810 --> 00:33:42,779
with big challenges and that's certainly

775
00:33:46,430 --> 00:33:44,820
been the story of Webb from the

776
00:33:48,649 --> 00:33:46,440
beginning the design of this Observatory

777
00:33:50,269 --> 00:33:48,659
has been a balance between the boldest

778
00:33:52,669 --> 00:33:50,279
question the scientists have dared to

779
00:33:54,950 --> 00:33:52,679
ask and The Cutting Edge technology that

780
00:33:57,049 --> 00:33:54,960
our best Engineers could offer

781
00:33:58,730 --> 00:33:57,059
the design for web evolved from earlier

782
00:34:00,649 --> 00:33:58,740
ideas of what a telescope could be

783
00:34:03,470 --> 00:34:00,659
another example of a delicate balance

784
00:34:05,029 --> 00:34:03,480
between desire versus capability

785
00:34:06,649 --> 00:34:05,039
to get a better understanding not only

786
00:34:08,329 --> 00:34:06,659
of the mission's goals but also the

787
00:34:10,369 --> 00:34:08,339
mechanical guts of the observatory

788
00:34:11,990 --> 00:34:10,379

itself I recently got a chance to speak

789
00:34:13,909 --> 00:34:12,000
with a pair of Engineers who know the

790
00:34:19,730 --> 00:34:13,919
anatomy of the web telescope better than

791
00:34:23,089 --> 00:34:21,409
I'm here with Keith Parrish a senior

792
00:34:24,349 --> 00:34:23,099
engineer on the web Mission and Keith

793
00:34:26,869 --> 00:34:24,359
you brought something to show us today

794
00:34:28,970 --> 00:34:26,879
yeah yes I did so uh the conceptually

795
00:34:31,609 --> 00:34:28,980
web sun shield is actually quite simple

796
00:34:34,310 --> 00:34:31,619
all we need is five tennis court size

797
00:34:35,990 --> 00:34:34,320
pieces of this material outstretched to

798
00:34:38,210 --> 00:34:36,000
protect the telescope from the Sun so

799
00:34:39,710 --> 00:34:38,220
what I have here is an actual sample of

800
00:34:41,750 --> 00:34:39,720
that material this is just capped on

801
00:34:43,909 --> 00:34:41,760
it's so light yeah it's an industrial

802
00:34:46,129 --> 00:34:43,919
you can buy this and on you know it's

803
00:34:48,290 --> 00:34:46,139
commonly used and what we do is we buy

804
00:34:50,869 --> 00:34:48,300
it for web we seem it all together in

805
00:34:52,849 --> 00:34:50,879
small pieces and uh and then we actually

806
00:34:54,770 --> 00:34:52,859
code it with special Coatings to give it

807
00:34:57,290 --> 00:34:54,780
the what we call the thermal properties

808
00:35:00,050 --> 00:34:57,300
we need in orbit so this one has a nice

809
00:35:01,730 --> 00:35:00,060
pink or purplish kind of hue to it and

810
00:35:04,670 --> 00:35:01,740
the reason it's purplish in Hue this we

811
00:35:07,490 --> 00:35:04,680
use this on the sun side and uh we

812
00:35:09,410 --> 00:35:07,500
actually put a silicon material on this

813
00:35:11,089 --> 00:35:09,420

captain and then we actually put a

814
00:35:12,710 --> 00:35:11,099
little bit of a metal in it and what

815
00:35:14,390 --> 00:35:12,720
that metal does is it gives us a nice

816
00:35:17,089 --> 00:35:14,400
electrical conductivity we don't want

817
00:35:19,130 --> 00:35:17,099
any surface charge surface charging

818
00:35:21,589 --> 00:35:19,140
building up and uh the other thing is

819
00:35:23,930 --> 00:35:21,599
this uh silicon coating actually drops

820
00:35:26,329 --> 00:35:23,940
the temperature of this layer so and

821
00:35:28,069 --> 00:35:26,339
also it's very durable and can survive

822
00:35:29,750 --> 00:35:28,079
you know for many many years in space

823
00:35:31,370 --> 00:35:29,760
and then this whole thing has to unfold

824
00:35:32,930 --> 00:35:31,380
some power where we can actually see

825
00:35:34,849 --> 00:35:32,940
exactly right so if you look at that

826
00:35:37,730 --> 00:35:34,859
animation there unfolding there so it's

827
00:35:40,910 --> 00:35:37,740
actually s folded up uh almost like a

828
00:35:43,370 --> 00:35:40,920
like a fan we we call it s folding and

829
00:35:45,290 --> 00:35:43,380
once we get it all folded up we secure

830
00:35:47,569 --> 00:35:45,300
it to a structure by actually pinning it

831
00:35:49,250 --> 00:35:47,579
for launch so you know huge shout out to

832
00:35:51,050 --> 00:35:49,260
our mechanical engineer and our entire

833
00:35:53,210 --> 00:35:51,060
sun shield team because they've come up

834
00:35:55,490 --> 00:35:53,220
with some really clever ways to secure

835
00:35:57,470 --> 00:35:55,500
this for launch unfold it fold it and

836
00:35:59,630 --> 00:35:57,480
then you know ultimately get it safely

837
00:36:01,490 --> 00:35:59,640
deployed in orbit that's wonderful so

838
00:36:03,230 --> 00:36:01,500

speaking of unfolding and all these pins

839
00:36:04,910 --> 00:36:03,240
that need to release let's go over here

840
00:36:07,250 --> 00:36:04,920
and talk to James Cooper you're going to

841
00:36:09,349 --> 00:36:07,260
show us what's going on there yeah hi uh

842
00:36:13,370 --> 00:36:09,359
so I have here an example of a

843
00:36:14,690 --> 00:36:13,380
non-explosive actuator we have 178 of

844
00:36:16,490 --> 00:36:14,700
these these are all these little pins

845
00:36:19,370 --> 00:36:16,500
we're talking about James Webb right 107

846
00:36:23,210 --> 00:36:19,380
of the 178 are the membrane release

847
00:36:25,490 --> 00:36:23,220
devices and we use this type of actuator

848
00:36:26,870 --> 00:36:25,500
because it it produces a very low shock

849
00:36:30,470 --> 00:36:26,880
when it's released

850
00:36:32,569 --> 00:36:30,480
and the animation shows conceptually how

851
00:36:36,170 --> 00:36:32,579
it works we send an electrical signal

852
00:36:38,810 --> 00:36:36,180
through either one of our connectors we

853
00:36:41,150 --> 00:36:38,820
use both but uh either one of them can

854
00:36:43,250 --> 00:36:41,160
cause the release to happen it melts a

855
00:36:46,190 --> 00:36:43,260
small wire inside

856
00:36:48,890 --> 00:36:46,200
and then we have a spring

857
00:36:51,109 --> 00:36:48,900
that unwinds and allows two halves of an

858
00:36:53,870 --> 00:36:51,119
of a split nut to separate and then our

859
00:36:56,810 --> 00:36:53,880
pin can get extracted and so in the case

860
00:36:58,550 --> 00:36:56,820
of the mrds it's a spring-loaded pin

861
00:37:01,490 --> 00:36:58,560
that pulls to release the folded

862
00:37:03,170 --> 00:37:01,500
membranes in other places we would be

863
00:37:05,089 --> 00:37:03,180

bolting two pieces of structure together

864
00:37:07,370 --> 00:37:05,099
and then releasing them so we can deploy

865
00:37:10,430 --> 00:37:07,380
them and the sun shield itself has 107

866
00:37:12,410 --> 00:37:10,440
of these 107 mrds that all have to work

867
00:37:14,109 --> 00:37:12,420
every single one every single one has to

868
00:37:17,390 --> 00:37:14,119
work and

869
00:37:18,950 --> 00:37:17,400
178 of this type of device in various

870
00:37:20,870 --> 00:37:18,960
configurations around the entire

871
00:37:22,250 --> 00:37:20,880
Observatory right well if we go over

872
00:37:25,130 --> 00:37:22,260
here we've got something sort of lovely

873
00:37:27,109 --> 00:37:25,140
waiting for us a big gold hexagon so to

874
00:37:28,849 --> 00:37:27,119
tell us what we're looking at a sort of

875
00:37:32,750 --> 00:37:28,859
a model here of the mirror segment right

876
00:37:35,990 --> 00:37:32,760
of full-scale single segment one of the

877
00:37:37,790 --> 00:37:36,000
18 mirror segments on James Webb the

878
00:37:39,710 --> 00:37:37,800
real ones would be machined out of a

879
00:37:41,270 --> 00:37:39,720
single piece of beryllium to the exact

880
00:37:43,310 --> 00:37:41,280
curvature we need

881
00:37:45,890 --> 00:37:43,320
and then once we're deployed on orbit

882
00:37:48,470 --> 00:37:45,900
each segment can be individually focused

883
00:37:50,390 --> 00:37:48,480
to make it act as a single perfect

884
00:37:52,970 --> 00:37:50,400
mirror now that Cody tell us about this

885
00:37:55,430 --> 00:37:52,980
gold coating here yeah so this is uh you

886
00:37:58,130 --> 00:37:55,440
know coded with a very thin layer of

887
00:37:59,930 --> 00:37:58,140
gold it's only a few hundred atoms thick

888
00:38:01,430 --> 00:37:59,940

of gold and and that gold is really good

889
00:38:03,290 --> 00:38:01,440
because it gives us a reflective

890
00:38:04,970 --> 00:38:03,300
property in the infrared and that's

891
00:38:07,190 --> 00:38:04,980
really what web is is an infrared

892
00:38:10,310 --> 00:38:07,200
telescope and we need that sun shield

893
00:38:12,170 --> 00:38:10,320
exists to to cool this entire telescope

894
00:38:14,870 --> 00:38:12,180
so this mirror actually runs about minus

895
00:38:16,910 --> 00:38:14,880
400 degrees Fahrenheit on orbit if it if

896
00:38:19,609 --> 00:38:16,920
it were warmer than that the infrared

897
00:38:21,710 --> 00:38:19,619
energy coming off of this that that heat

898
00:38:24,170 --> 00:38:21,720
energy would swamp our detector system

899
00:38:26,510 --> 00:38:24,180
in our instrument so that entire sun

900
00:38:28,550 --> 00:38:26,520
shield exists the cool all 18 of these

901
00:38:30,170 --> 00:38:28,560
down and again this this gold coating is

902
00:38:31,910 --> 00:38:30,180
what does helps with all that

903
00:38:34,190 --> 00:38:31,920
reflectivity to make it perform even

904
00:38:36,349 --> 00:38:34,200
better well that's wonderful so you put

905
00:38:38,210 --> 00:38:36,359
it all together and we have a uh a

906
00:38:39,589 --> 00:38:38,220
smaller mock-up here and the sun shield

907
00:38:41,990 --> 00:38:39,599
the mirrored tell us what we're looking

908
00:38:43,730 --> 00:38:42,000
at here much much smaller so uh yeah

909
00:38:45,950 --> 00:38:43,740
this is our entire Observatory fully

910
00:38:47,870 --> 00:38:45,960
deployed on orbit and you can see the

911
00:38:50,030 --> 00:38:47,880
sun shield here is is a large feature

912
00:38:51,770 --> 00:38:50,040
you can see all five layers that I

913
00:38:53,750 --> 00:38:51,780

talked about earlier and it's these

914
00:38:55,970 --> 00:38:53,760
separation of those five layers which

915
00:38:57,829 --> 00:38:55,980
lets heat energy Escape out the space

916
00:39:00,290 --> 00:38:57,839
before it eventually gets to this cold

917
00:39:02,569 --> 00:39:00,300
layer again that entire telescope is

918
00:39:04,730 --> 00:39:02,579
running minus 400 degrees Fahrenheit and

919
00:39:07,250 --> 00:39:04,740
the way we get it that cold is this side

920
00:39:09,470 --> 00:39:07,260
is shaded the telescope is looking to

921
00:39:11,930 --> 00:39:09,480
the Deep Universe which is near absolute

922
00:39:13,849 --> 00:39:11,940
zero and then again this this layer here

923
00:39:16,310 --> 00:39:13,859
we've got about a 500 degree temperature

924
00:39:18,230 --> 00:39:16,320
drop so this telescope is also looking

925
00:39:20,030 --> 00:39:18,240
at this layer here which is nice and

926
00:39:21,890 --> 00:39:20,040
cold so that's what lets us you know

927
00:39:23,450 --> 00:39:21,900
harness thermal physics to cool this

928
00:39:25,069 --> 00:39:23,460
down to those really really cold

929
00:39:27,170 --> 00:39:25,079
temperatures again you can see our booms

930
00:39:29,450 --> 00:39:27,180
which are fully deployed and stretching

931
00:39:31,609 --> 00:39:29,460
this out and then ultimately all folds

932
00:39:34,430 --> 00:39:31,619
up and gets stowed into this structure

933
00:39:37,130 --> 00:39:34,440
for launch right so the membrane release

934
00:39:38,810 --> 00:39:37,140
devices would be along the back side of

935
00:39:40,310 --> 00:39:38,820
these structures on the forward and the

936
00:39:44,510 --> 00:39:40,320
AFT side

937
00:39:46,670 --> 00:39:44,520
and we released them in rows so that we

938
00:39:48,230 --> 00:39:46,680

can sequentially start to unfold the

939
00:39:49,849 --> 00:39:48,240
membrane once those pins are pulled out

940
00:39:51,410 --> 00:39:49,859
of the way well that's wonderful thank

941
00:39:58,089 --> 00:39:51,420
you so much for joining us and best of

942
00:40:02,510 --> 00:40:00,349
okay let's get a live launch status

943
00:40:04,309 --> 00:40:02,520
update from NASA commentator Rob navius

944
00:40:11,150 --> 00:40:04,319
at the launch site Rob how are things in

945
00:40:14,990 --> 00:40:13,490
well thank you Michelle and Merry

946
00:40:18,109 --> 00:40:15,000
Christmas from the Jupiter control

947
00:40:21,050 --> 00:40:18,119
center here in Kuru French Guiana you

948
00:40:23,270 --> 00:40:21,060
are looking live at an Ariane 5 rocket

949
00:40:25,130 --> 00:40:23,280
on its launch pad ready to send the

950
00:40:26,990 --> 00:40:25,140
James Webb Space Telescope on the

951
00:40:29,270 --> 00:40:27,000
initial phase of its Journey

952
00:40:32,630 --> 00:40:29,280
the fueling of the Ariane 5's first and

953
00:40:34,730 --> 00:40:32,640
upper stages began Before Sunrise and in

954
00:40:37,190 --> 00:40:34,740
the last few minutes Mission controllers

955
00:40:38,990 --> 00:40:37,200
here in Peru and at the telescopes

956
00:40:41,809 --> 00:40:39,000
control center of the Space Telescope

957
00:40:44,450 --> 00:40:41,819
Science Institute in Baltimore conducted

958
00:40:46,550 --> 00:40:44,460
polls with all positions reporting they

959
00:40:48,109 --> 00:40:46,560
are go to proceed into the final phase

960
00:40:50,030 --> 00:40:48,119
of the countdown

961
00:40:51,710 --> 00:40:50,040
launch controllers have been monitoring

962
00:40:54,589 --> 00:40:51,720
weather conditions throughout the night

963
00:40:57,050 --> 00:40:54,599

keeping tabs on clouds and wind speeds

964
00:41:00,290 --> 00:40:57,060
both at ground level and in the flight

965
00:41:02,630 --> 00:41:00,300
path of the Ariane 5 ensuring that all

966
00:41:05,329 --> 00:41:02,640
of the precise commit criteria are

967
00:41:08,089 --> 00:41:05,339
acceptable for launch right now we have

968
00:41:10,970 --> 00:41:08,099
a green board no issues as the countdown

969
00:41:13,550 --> 00:41:10,980
proceeds no issues again being tracked

970
00:41:16,370 --> 00:41:13,560
by the flight control team here in Peru

971
00:41:18,890 --> 00:41:16,380
by the way our broadcast today is a

972
00:41:21,650 --> 00:41:18,900
collaborative effort between NASA and

973
00:41:23,690 --> 00:41:21,660
the European Space Agency so that's it

974
00:41:26,270 --> 00:41:23,700
from now from the Ariane 5 Mission

975
00:41:28,309 --> 00:41:26,280
Control here in Peru we'll be back with

976
00:41:29,809 --> 00:41:28,319
you soon for now let's go back to the

977
00:41:32,750 --> 00:41:29,819
Goddard space flight center and Michelle

978
00:41:35,809 --> 00:41:32,760
Fowler thank you very much Rob

979
00:41:38,210 --> 00:41:35,819
so Webb asks big science questions it

980
00:41:40,250 --> 00:41:38,220
demonstrates astounding technology it

981
00:41:41,089 --> 00:41:40,260
inspires and excites people to dream and

982
00:41:43,190 --> 00:41:41,099
wonder

983
00:41:45,890 --> 00:41:43,200
and the spark of inspiration is the

984
00:41:47,690 --> 00:41:45,900
ignition of creativity kids all over the

985
00:41:49,790 --> 00:41:47,700
world have a natural affinity for Webb's

986
00:41:51,349 --> 00:41:49,800
big Pursuits and now we have a

987
00:41:54,470 --> 00:41:51,359
collection of young artists ready to

988
00:41:58,790 --> 00:41:56,630

hi everyone I'm Kelly Girardi and this

989
00:42:00,829 --> 00:41:58,800
is Delta V and we're kicking off the

990
00:42:03,109 --> 00:42:00,839
unfold the universe challenge with NASA

991
00:42:05,089 --> 00:42:03,119
and the James Webb Space Telescope NASA

992
00:42:07,250 --> 00:42:05,099
is hosting and unfolds the universe art

993
00:42:08,930 --> 00:42:07,260
challenge use your imagination to share

994
00:42:15,609 --> 00:42:08,940
what you believe the web telescope will

995
00:42:24,230 --> 00:42:19,790
I believe that the web's telescope will

996
00:42:29,089 --> 00:42:24,240
see galaxies stars planets

997
00:42:32,360 --> 00:42:29,099
the moon and don't forget our stuff

998
00:42:50,950 --> 00:42:46,790
[Music]

999
00:42:52,550 --> 00:42:50,960
up in the sky a really high

1000
00:42:56,569 --> 00:42:52,560
it's

1001
00:42:59,920 --> 00:42:56,579
back ooh space thanks Greta good job

1002
00:43:04,030 --> 00:42:59,930
this is my picture of specs

1003
00:43:08,690 --> 00:43:04,040
[Music]

1004
00:43:13,430 --> 00:43:08,700
hello my name is April I am

1005
00:43:16,849 --> 00:43:13,440
from Romania this is Hawaii imagine

1006
00:43:20,510 --> 00:43:16,859
space hello everyone good morning this

1007
00:43:24,170 --> 00:43:20,520
is the drawing of assistant Galaxy that

1008
00:43:28,730 --> 00:43:24,180
can be seen by James the space to school

1009
00:43:31,309 --> 00:43:28,740
hi my name is Anastasia and this is what

1010
00:43:33,470 --> 00:43:31,319
I do what I think the telescope will

1011
00:43:36,890 --> 00:43:33,480
look like what the telescope will see

1012
00:43:43,849 --> 00:43:36,900
either the Earth the Sun a new planet

1013
00:43:47,030 --> 00:43:45,589

so we've been Fielding social media

1014
00:43:48,530 --> 00:43:47,040
questions for viewers all over the world

1015
00:43:50,630 --> 00:43:48,540
this morning and let's take a couple of

1016
00:43:51,829 --> 00:43:50,640
minutes to share some responses

1017
00:43:53,809 --> 00:43:51,839
um there's been a couple questions about

1018
00:43:55,370 --> 00:43:53,819
how long will it take for images to come

1019
00:43:57,290 --> 00:43:55,380
out and there's a lot of things that

1020
00:43:58,730 --> 00:43:57,300
need to happen before the images are

1021
00:44:00,829 --> 00:43:58,740
coming so Macarena why don't you take us

1022
00:44:03,349 --> 00:44:00,839
through some of that yes so for the

1023
00:44:04,910 --> 00:44:03,359
first scientific beautifully matches to

1024
00:44:07,790 --> 00:44:04,920
share with a public that'll take six

1025
00:44:08,990 --> 00:44:07,800
months the reason is because it is so we

1026
00:44:11,030 --> 00:44:09,000
launched today

1027
00:44:12,950 --> 00:44:11,040
it takes a month to take to the orbit

1028
00:44:14,569 --> 00:44:12,960
place to the LaGrange two point and then

1029
00:44:16,910 --> 00:44:14,579
we have a whole period of cooling down

1030
00:44:18,410 --> 00:44:16,920
the instruments aligning the mirrors and

1031
00:44:19,970 --> 00:44:18,420
making sure that all the instruments are

1032
00:44:23,150 --> 00:44:19,980
ready to decide so the whole process

1033
00:44:25,069 --> 00:44:23,160
takes six months half a year and also

1034
00:44:26,390 --> 00:44:25,079
all of those 18 segments of mirrors

1035
00:44:28,010 --> 00:44:26,400
something needs to happen to get them

1036
00:44:30,589 --> 00:44:28,020
all working together too right exactly

1037
00:44:33,410 --> 00:44:30,599
because initially you launched with 18

1038
00:44:35,270 --> 00:44:33,420

segments and they work separately so you

1039
00:44:38,329 --> 00:44:35,280
will take If You observe one star you

1040
00:44:39,829 --> 00:44:38,339
will get 18 little points so there has

1041
00:44:42,170 --> 00:44:39,839
to be a process where you take images

1042
00:44:43,309 --> 00:44:42,180
with nirca which is one of the cameras

1043
00:44:45,650 --> 00:44:43,319
on board

1044
00:44:47,569 --> 00:44:45,660
start moving the mirrors slightly to to

1045
00:44:49,370 --> 00:44:47,579
make them work as a single one and by

1046
00:44:52,730 --> 00:44:49,380
the end of this iterative process you go

1047
00:44:55,069 --> 00:44:52,740
from 18 points to a very sharp pristine

1048
00:44:56,690 --> 00:44:55,079
single point source so all mirrors act

1049
00:44:58,790 --> 00:44:56,700
as a single one

1050
00:45:00,470 --> 00:44:58,800
so let's see we have a question from LV

1051
00:45:01,790 --> 00:45:00,480
coming in on Twitter

1052
00:45:04,010 --> 00:45:01,800
um will Webb be able to enhance

1053
00:45:05,630 --> 00:45:04,020
detection of comets asteroids or meteors

1054
00:45:06,890 --> 00:45:05,640
that enter our solar system so that's

1055
00:45:09,770 --> 00:45:06,900
things we've got a planetary person

1056
00:45:11,990 --> 00:45:09,780
there yeah well Webb does have a special

1057
00:45:14,270 --> 00:45:12,000
observing mode where it's able to track

1058
00:45:16,190 --> 00:45:14,280
these rapidly moving objects because

1059
00:45:18,410 --> 00:45:16,200
compared to these distant stars and

1060
00:45:20,450 --> 00:45:18,420
galaxies asteroids and comets they move

1061
00:45:23,450 --> 00:45:20,460
pretty quickly and so web will be able

1062
00:45:25,670 --> 00:45:23,460
to do this so that we can study uh

1063
00:45:28,190 --> 00:45:25,680

material that's outgassing from them and

1064
00:45:30,109 --> 00:45:28,200
learn more about what they're made of

1065
00:45:31,309 --> 00:45:30,119
so let's see there's just so many good

1066
00:45:33,770 --> 00:45:31,319
questions so we only have time for a few

1067
00:45:35,870 --> 00:45:33,780
more so what is from uh from Kristen

1068
00:45:37,730 --> 00:45:35,880
Rodriguez on Facebook how long will it

1069
00:45:40,190 --> 00:45:37,740
take James Webb to reach LaGrange point

1070
00:45:43,130 --> 00:45:40,200
two and you might also just explain what

1071
00:45:45,290 --> 00:45:43,140
is lerage point two so it's x a month I

1072
00:45:47,270 --> 00:45:45,300
think it's exactly actually 29 days to

1073
00:45:49,010 --> 00:45:47,280
get there and the largest point is this

1074
00:45:50,870 --> 00:45:49,020
very interesting

1075
00:45:52,910 --> 00:45:50,880
um stable point so the gravitational

1076
00:45:55,430 --> 00:45:52,920
pull between the Sun and the Earth

1077
00:45:58,490 --> 00:45:55,440
create this point where it is a stable

1078
00:46:00,950 --> 00:45:58,500
and you can as you can see there welcome

1079
00:46:02,750 --> 00:46:00,960
orbit around the L2 point in a very

1080
00:46:04,370 --> 00:46:02,760
stable orbit only needs a little bit of

1081
00:46:06,890 --> 00:46:04,380
Corrections once in a while

1082
00:46:08,390 --> 00:46:06,900
and it can always have the sun shield

1083
00:46:11,210 --> 00:46:08,400
protecting the telescope and the

1084
00:46:13,370 --> 00:46:11,220
radiation of the Sun in a year in a full

1085
00:46:15,230 --> 00:46:13,380
year you can observe any object in the

1086
00:46:17,210 --> 00:46:15,240
sky and it's a continuous observation

1087
00:46:18,710 --> 00:46:17,220
well thank you very much we'll come back

1088
00:46:21,230 --> 00:46:18,720

to a few more questions later thank you

1089
00:46:22,790 --> 00:46:21,240
so this is a big mission with a cast of

1090
00:46:25,130 --> 00:46:22,800
thousands to bring it to life all over

1091
00:46:26,450 --> 00:46:25,140
the world as we get closer to launch

1092
00:46:28,370 --> 00:46:26,460
let's take a brief look at the main

1093
00:46:30,470 --> 00:46:28,380
locations where Webb took shape on its

1094
00:46:32,990 --> 00:46:30,480
journey to space

1095
00:46:34,609 --> 00:46:33,000
inside the massive High Bay clean room

1096
00:46:37,430 --> 00:46:34,619
and NASA's Goddard space flight center

1097
00:46:39,290 --> 00:46:37,440
Engineers assembled the 18 gold covered

1098
00:46:41,510 --> 00:46:39,300
mirror segments into the back plane of

1099
00:46:43,190 --> 00:46:41,520
the telescope and integrated the four

1100
00:46:45,650 --> 00:46:43,200
science instruments contributed by

1101
00:46:47,450 --> 00:46:45,660
International Partners to simulate the

1102
00:46:49,609 --> 00:46:47,460
harsh environment of launch they went

1103
00:46:51,530 --> 00:46:49,619
through vibration tests and acoustic

1104
00:46:53,390 --> 00:46:51,540
tests and to simulate a space

1105
00:46:55,430 --> 00:46:53,400
environment the instruments endured

1106
00:46:56,809 --> 00:46:55,440
cryogenic testing in a large thermal

1107
00:46:58,970 --> 00:46:56,819
vacuum chamber

1108
00:47:01,130 --> 00:46:58,980
but it wasn't large enough to hold both

1109
00:47:02,750 --> 00:47:01,140
the instruments and the mirrors so the

1110
00:47:05,329 --> 00:47:02,760
telescope boarded a plane to Houston

1111
00:47:07,130 --> 00:47:05,339
Texas to visit the only thermal vacuum

1112
00:47:08,809 --> 00:47:07,140
chamber in the world big enough to fit

1113
00:47:10,849 --> 00:47:08,819

the entire assembly

1114
00:47:12,950 --> 00:47:10,859
chamber a at the Johnson Space Center

1115
00:47:15,650 --> 00:47:12,960
was originally built to test the Apollo

1116
00:47:17,990 --> 00:47:15,660
spacecraft and half a century later it

1117
00:47:19,100 --> 00:47:18,000
provided a grueling 100-day test for the

1118
00:47:21,650 --> 00:47:19,110
web telescope

1119
00:47:23,750 --> 00:47:21,660
[Music]

1120
00:47:25,609 --> 00:47:23,760
next the telescope traveled to north of

1121
00:47:27,470 --> 00:47:25,619
grumman's facilities in Redondo Beach

1122
00:47:31,010 --> 00:47:27,480
California to meet up with its other

1123
00:47:33,470 --> 00:47:31,020
half the sun shield and spacecraft bus

1124
00:47:35,690 --> 00:47:33,480
fully assembled at last the entire

1125
00:47:38,150 --> 00:47:35,700
Observatory went through yet more tests

1126
00:47:40,250 --> 00:47:38,160
many focus on making sure the spacecraft

1127
00:47:42,049 --> 00:47:40,260
could properly fold up for launch and

1128
00:47:44,990 --> 00:47:42,059
unfold in space

1129
00:47:47,150 --> 00:47:45,000
then in September 2021 Webb caught a

1130
00:47:49,730 --> 00:47:47,160
ride on a specialized cargo ship and set

1131
00:47:52,309 --> 00:47:49,740
out on a 16-day Voyage to the European

1132
00:47:54,950 --> 00:47:52,319
space agency's Spaceport in karoo French

1133
00:48:02,510 --> 00:47:54,960
Guiana according to its travel itinerary

1134
00:48:05,809 --> 00:48:04,490
once Webb gets into space we're going to

1135
00:48:07,670 --> 00:48:05,819
have some exciting things to tell you

1136
00:48:09,589 --> 00:48:07,680
about what happens next from its

1137
00:48:10,970 --> 00:48:09,599
extraordinary engineering to the

1138
00:48:12,950 --> 00:48:10,980

thrilling scientific Adventure it's

1139
00:48:14,990 --> 00:48:12,960
about to enable us to undertake

1140
00:48:16,430 --> 00:48:15,000
but launch comes first and for that I'm

1141
00:48:18,650 --> 00:48:16,440
going to turn it over to Katie Haswell

1142
00:48:20,870 --> 00:48:18,660
our host at the launch site and one of

1143
00:48:23,270 --> 00:48:20,880
NASA's most recognizable voices launch

1144
00:48:29,569 --> 00:48:23,280
commentator Rob navis it's all yours

1145
00:48:34,370 --> 00:48:31,730
thanks very much indeed Michelle well

1146
00:48:37,190 --> 00:48:34,380
it's all looking very good here at the

1147
00:48:39,410 --> 00:48:37,200
Spaceport for a Christmas Day launch

1148
00:48:42,109 --> 00:48:39,420
operations running smoothly the

1149
00:48:44,450 --> 00:48:42,119
countdown ticking over nicely all the

1150
00:48:46,910 --> 00:48:44,460
systems are green and we are go for

1151
00:48:49,309 --> 00:48:46,920
launch you can see there the we're

1152
00:48:52,609 --> 00:48:49,319
looking at Launchpad number three the

1153
00:48:55,130 --> 00:48:52,619
James Webb Space Telescope inside the

1154
00:48:57,049 --> 00:48:55,140
very top of the rocket in first class

1155
00:48:59,089 --> 00:48:57,059
with its seat belt on

1156
00:49:02,270 --> 00:48:59,099
waiting patiently for liftoff that's

1157
00:49:05,089 --> 00:49:02,280
scheduled in about 32 minutes time

1158
00:49:07,130 --> 00:49:05,099
I'm in the mission control center here

1159
00:49:09,349 --> 00:49:07,140
at the Spaceport the nerve center of

1160
00:49:11,990 --> 00:49:09,359
operations we're about 10 kilometers

1161
00:49:16,190 --> 00:49:12,000
from that pad and behind me you can see

1162
00:49:18,589 --> 00:49:16,200
uh it's a laser focus here in the

1163
00:49:21,290 --> 00:49:18,599

control center with the mission control

1164
00:49:24,950 --> 00:49:21,300
centers all on Console there as we get

1165
00:49:28,490 --> 00:49:24,960
closer to launch we call this uh the

1166
00:49:30,950 --> 00:49:28,500
Fishbowl behind this protected glass and

1167
00:49:34,549 --> 00:49:30,960
up in their Sky Box here in Mission

1168
00:49:38,030 --> 00:49:34,559
Control are NASA's rovnavius and the

1169
00:49:41,210 --> 00:49:38,040
European space agencies loose fabregate

1170
00:49:44,210 --> 00:49:41,220
are now standing by to take over the

1171
00:49:46,549 --> 00:49:44,220
commentary about 15 minutes as we get

1172
00:49:48,650 --> 00:49:46,559
closer to launch first of all though

1173
00:49:50,569 --> 00:49:48,660
let's check in on the countdown and

1174
00:49:54,650 --> 00:49:50,579
let's see how things are progressing

1175
00:49:56,530 --> 00:49:54,660
with Stefan Israel Stefan is the CEO of

1176
00:50:00,170 --> 00:49:56,540
Aryan space Aaron space is the company

1177
00:50:02,750 --> 00:50:00,180
responsible for getting our telescope

1178
00:50:05,210 --> 00:50:02,760
into space today Stefan

1179
00:50:07,730 --> 00:50:05,220
thanks for joining us no pressure good

1180
00:50:11,089 --> 00:50:07,740
morning how are things looking so we are

1181
00:50:13,190 --> 00:50:11,099
now 31 minutes before liftoff so far so

1182
00:50:16,130 --> 00:50:13,200
good Iron 5 is ready

1183
00:50:20,510 --> 00:50:16,140
web is ready the range is ready and the

1184
00:50:25,430 --> 00:50:23,329
so in the 30 coming minutes we will make

1185
00:50:26,870 --> 00:50:25,440
the final operations 10 minutes before

1186
00:50:29,569 --> 00:50:26,880
liftoff we will have the final

1187
00:50:31,490 --> 00:50:29,579
authorization of the weather and seven

1188
00:50:34,490 --> 00:50:31,500

minutes before liftoff we will enter in

1189
00:50:35,750 --> 00:50:34,500
the famous synchronized sequence and I

1190
00:50:38,030 --> 00:50:35,760
mean how's everyone feeling I'm guess

1191
00:50:40,010 --> 00:50:38,040
missing everyone's we launched for

1192
00:50:42,290 --> 00:50:40,020
Humanity this morning from the Guyana

1193
00:50:45,290 --> 00:50:42,300
Space Center you know what web is about

1194
00:50:47,390 --> 00:50:45,300
after well we will never see the skies

1195
00:50:48,890 --> 00:50:47,400
in quite the same way it's an important

1196
00:50:50,390 --> 00:50:48,900
project isn't it for everyone it's a

1197
00:50:53,690 --> 00:50:50,400
very special Mission but we have

1198
00:50:56,750 --> 00:50:53,700
delivered already 111 times with iron

1199
00:50:59,450 --> 00:50:56,760
this is a 112 iron5 so we will deliver

1200
00:51:02,270 --> 00:50:59,460
this morning and everybody there in the

1201
00:51:04,430 --> 00:51:02,280
the control center cool calm and

1202
00:51:06,049 --> 00:51:04,440
collected Stefan thank you very much for

1203
00:51:08,569 --> 00:51:06,059
having taken time to step out of the

1204
00:51:10,370 --> 00:51:08,579
Fishbowl for us so you can head back now

1205
00:51:12,230 --> 00:51:10,380
into the Fishbowl and take up your

1206
00:51:15,710 --> 00:51:12,240
position Stefan Israel thank you very

1207
00:51:18,049 --> 00:51:15,720
much indeed Stefan of course heads up

1208
00:51:21,829 --> 00:51:18,059
what we call the flight desk which is

1209
00:51:24,290 --> 00:51:21,839
the um the the authority that takes all

1210
00:51:28,069 --> 00:51:24,300
the final decisions in the events of

1211
00:51:30,290 --> 00:51:28,079
unplanned situations now we are in

1212
00:51:33,589 --> 00:51:30,300
French Guiana we're on the northeastern

1213
00:51:36,470 --> 00:51:33,599

coast of South America we're in Amazonia

1214
00:51:38,329 --> 00:51:36,480
it's hot it can get a little bit sweaty

1215
00:51:40,430 --> 00:51:38,339
sometimes and there are lots and lots of

1216
00:51:42,410 --> 00:51:40,440
mosquitoes but somebody know who knows

1217
00:51:45,290 --> 00:51:42,420
it very very well is Rafael chevir

1218
00:51:47,030 --> 00:51:45,300
Raphael is a rocket science scientist or

1219
00:51:49,010 --> 00:51:47,040
a rocket expert at least from Aryan

1220
00:51:50,270 --> 00:51:49,020
space thanks for joining us Raphael tell

1221
00:51:52,130 --> 00:51:50,280
us a little bit more about French Guyana

1222
00:51:54,470 --> 00:51:52,140
I but French Guiana is a French

1223
00:51:58,849 --> 00:51:54,480
territory that borders Brazil it's

1224
00:52:01,130 --> 00:51:58,859
located in the Amazon rainforest 97 of

1225
00:52:03,890 --> 00:52:01,140
the land is covered in trees so that's

1226
00:52:05,569 --> 00:52:03,900
why it's so green and beautiful and you

1227
00:52:08,030 --> 00:52:05,579
can totally imagine that the wildlife

1228
00:52:10,010 --> 00:52:08,040
there is absolutely incredible this is

1229
00:52:13,370 --> 00:52:10,020
actually one of the best preserved

1230
00:52:16,130 --> 00:52:13,380
habitat in the world and of course it is

1231
00:52:19,069 --> 00:52:16,140
in the jungle and yet it is actually the

1232
00:52:21,470 --> 00:52:19,079
European Spaceport so what makes this

1233
00:52:24,049 --> 00:52:21,480
location in South America so important

1234
00:52:26,569 --> 00:52:24,059
and so relevant well there are several

1235
00:52:28,790 --> 00:52:26,579
reasons for this first we are on the

1236
00:52:30,950 --> 00:52:28,800
coast it means that we can launch over

1237
00:52:33,349 --> 00:52:30,960
the sea from North to East without

1238
00:52:34,849 --> 00:52:33,359

having to fly over inhibited area so

1239
00:52:37,430 --> 00:52:34,859
this is very convenient to reach any

1240
00:52:39,770 --> 00:52:37,440
kind of orbits there is no hurricane

1241
00:52:42,349 --> 00:52:39,780
here big tropical storm there is no

1242
00:52:44,990 --> 00:52:42,359
earthquake but more importantly we are

1243
00:52:46,849 --> 00:52:45,000
very close to the equator so that we can

1244
00:52:49,190 --> 00:52:46,859
benefit from what we call the slingshot

1245
00:52:52,549 --> 00:52:49,200
effect given by the rotation of the

1246
00:52:55,010 --> 00:52:52,559
earth so let me take this girl basically

1247
00:52:58,370 --> 00:52:55,020
here on the equator we are all traveling

1248
00:53:00,410 --> 00:52:58,380
at roughly 1 000 miles per hour that's

1249
00:53:02,990 --> 00:53:00,420
very convenient or of course we don't

1250
00:53:05,089 --> 00:53:03,000
feel it if we were on the poles that

1251
00:53:08,150 --> 00:53:05,099
speed would be very very close to zero

1252
00:53:10,250 --> 00:53:08,160
it means that when web is right now on

1253
00:53:13,849 --> 00:53:10,260
the launch pad inside the frame of the

1254
00:53:15,650 --> 00:53:13,859
rm5 it's already traveling in the right

1255
00:53:18,710 --> 00:53:15,660
direction and we can use this extra

1256
00:53:20,450 --> 00:53:18,720
boost to get us into space that's also

1257
00:53:23,750 --> 00:53:20,460
very convenient for wet because doing so

1258
00:53:26,630 --> 00:53:23,760
it can save its Fuel and increase its

1259
00:53:28,730 --> 00:53:26,640
operational life in orbit at one and a

1260
00:53:30,470 --> 00:53:28,740
half million kilometers from here and

1261
00:53:32,270 --> 00:53:30,480
that really is important a million miles

1262
00:53:35,630 --> 00:53:32,280
isn't it and so there's a real proper

1263
00:53:37,609 --> 00:53:35,640

slingshot effect and um the facilities

1264
00:53:39,589 --> 00:53:37,619
here are are Ultra high-tech and that's

1265
00:53:41,510 --> 00:53:39,599
exactly what web needs isn't it yeah

1266
00:53:44,990 --> 00:53:41,520
that's very convenient for web it's also

1267
00:53:47,450 --> 00:53:45,000
located in a nature reserve so this is

1268
00:53:49,670 --> 00:53:47,460
the perfect meeting between nature and

1269
00:53:52,370 --> 00:53:49,680
technology and people come from all over

1270
00:53:55,089 --> 00:53:52,380
the world to work here but one thing

1271
00:53:57,589 --> 00:53:55,099
that's been very important for web is

1272
00:54:00,230 --> 00:53:57,599
cleanliness because you know that one

1273
00:54:03,109 --> 00:54:00,240
Speck of dust could alter the vision of

1274
00:54:05,990 --> 00:54:03,119
the observatory in space that's why we

1275
00:54:08,329 --> 00:54:06,000
have been extremely careful in keeping a

1276
00:54:10,910 --> 00:54:08,339
pristine environment in all our

1277
00:54:15,410 --> 00:54:10,920
facilities from Rams arrival in French

1278
00:54:17,990 --> 00:54:15,420
Vienna to sealing it inside the Rockets

1279
00:54:20,329 --> 00:54:18,000
so let's talk a little bit now about the

1280
00:54:23,809 --> 00:54:20,339
web Space Telescope I really don't think

1281
00:54:26,990 --> 00:54:23,819
you need me to tell you that it is the

1282
00:54:30,470 --> 00:54:27,000
product of eight feet of human Ingenuity

1283
00:54:33,829 --> 00:54:30,480
and you don't get to make a telescope as

1284
00:54:37,490 --> 00:54:33,839
complex as the James Webb Telescope and

1285
00:54:40,309 --> 00:54:37,500
as remarkable without tremendous amount

1286
00:54:42,890 --> 00:54:40,319
of collaboration and the James Webb

1287
00:54:44,930 --> 00:54:42,900
Space Telescope is indeed the product of

1288
00:54:47,829 --> 00:54:44,940

a partnership between three space

1289
00:54:51,170 --> 00:54:47,839
agencies who came together to create it

1290
00:54:53,750 --> 00:54:51,180
NASA the European space agency and also

1291
00:54:55,910 --> 00:54:53,760
the Canadian space agency so here to

1292
00:54:58,010 --> 00:54:55,920
talk about that now is Greg Robinson

1293
00:54:59,870 --> 00:54:58,020
from NASA Greg thank you very much for

1294
00:55:02,630 --> 00:54:59,880
coming to the floor out of the Fishbowl

1295
00:55:05,750 --> 00:55:02,640
as well for us and we're talking serious

1296
00:55:07,609 --> 00:55:05,760
teamwork here aren't we uh yes Katie uh

1297
00:55:09,289 --> 00:55:07,619
We've benefited from an amazing

1298
00:55:11,210 --> 00:55:09,299
partnership with the Canadian space

1299
00:55:13,730 --> 00:55:11,220
agency and the European Space Agency

1300
00:55:15,349 --> 00:55:13,740
over the life of the development we've

1301
00:55:19,010 --> 00:55:15,359
had more than 10 000 people actually

1302
00:55:22,010 --> 00:55:19,020
touchweb 29 states in the U.S and 14

1303
00:55:24,470 --> 00:55:22,020
countries across the globe and not to

1304
00:55:26,089 --> 00:55:24,480
mention the the amazing industrial base

1305
00:55:28,490 --> 00:55:26,099
across the globe that have benefited

1306
00:55:30,650 --> 00:55:28,500
here in order to do bold missions like

1307
00:55:33,410 --> 00:55:30,660
this it takes lots of resources and lots

1308
00:55:34,670 --> 00:55:33,420
of expertise so we maximize everyone's

1309
00:55:41,809 --> 00:55:34,680
expertise

1310
00:55:45,589 --> 00:55:43,789
so as part of the partnership the

1311
00:55:47,870 --> 00:55:45,599
Canadian space agency contributed

1312
00:55:49,730 --> 00:55:47,880
science instruments and they're

1313
00:55:52,430 --> 00:55:49,740

incredibly important for this Mission

1314
00:55:55,490 --> 00:55:52,440
and so did Issa

1315
00:55:57,410 --> 00:55:55,500
science instruments and the amazing rbn

1316
00:55:58,970 --> 00:55:57,420
5 that we will see take us on this

1317
00:56:00,589 --> 00:55:58,980
journey and put us in the right

1318
00:56:02,569 --> 00:56:00,599
direction to get to LaGrange Point too

1319
00:56:04,309 --> 00:56:02,579
and we're looking forward to that it's a

1320
00:56:05,750 --> 00:56:04,319
tremendous atmosphere here isn't it in

1321
00:56:08,450 --> 00:56:05,760
the in the mission control center

1322
00:56:10,910 --> 00:56:08,460
there's a real Buzz here today I I

1323
00:56:12,650 --> 00:56:10,920
wonder how you must be feeling Greg I

1324
00:56:14,390 --> 00:56:12,660
mean it's got to be a very very

1325
00:56:16,730 --> 00:56:14,400
emotional time knowing that your

1326
00:56:18,829 --> 00:56:16,740
telescope is sitting there on top of the

1327
00:56:20,990 --> 00:56:18,839
rocket getting closer to launch it's

1328
00:56:23,089 --> 00:56:21,000
really amazing I often talk about the

1329
00:56:24,770 --> 00:56:23,099
butterflies and people keep asking me

1330
00:56:27,170 --> 00:56:24,780
have they started have they started and

1331
00:56:30,710 --> 00:56:27,180
yes they're starting and when we get to

1332
00:56:34,329 --> 00:56:30,720
about 20 minutes out they will start

1333
00:56:39,410 --> 00:56:36,890
the excitement is building and of course

1334
00:56:41,870 --> 00:56:39,420
everyone very cool calm and collected

1335
00:56:43,670 --> 00:56:41,880
thank you Greg Ronson you can take your

1336
00:56:44,750 --> 00:56:43,680
position back in the Fishbowl now

1337
00:56:46,370 --> 00:56:44,760
because I know you've got a lot of work

1338
00:56:49,370 --> 00:56:46,380

to do in there Greg Robinson thank you

1339
00:56:54,109 --> 00:56:49,380
very much indeed for joining us

1340
00:56:58,130 --> 00:56:54,119
um so the Ariane 5 launch uh vehicle is

1341
00:57:01,250 --> 00:56:58,140
the heaviest lifter in the ariant 5 fam

1342
00:57:03,230 --> 00:57:01,260
in the Iran family of launchers and uh

1343
00:57:05,510 --> 00:57:03,240
Raphael she has got an incredible track

1344
00:57:07,190 --> 00:57:05,520
record hasn't she of success yeah this

1345
00:57:10,630 --> 00:57:07,200
is a very reliable and successful

1346
00:57:14,270 --> 00:57:10,640
successful rocket web is going to be the

1347
00:57:16,630 --> 00:57:14,280
112th Aryan 5 to be launched and the

1348
00:57:20,510 --> 00:57:16,640
very first Aryan the Aryan one took off

1349
00:57:24,049 --> 00:57:20,520
exactly 42 years ago yesterday this was

1350
00:57:25,910 --> 00:57:24,059
on Christmas Eve 1979 good symbol yeah

1351
00:57:28,789 --> 00:57:25,920
and hopefully we're going to get a good

1352
00:57:30,770 --> 00:57:28,799
Christmas present today as well and I

1353
00:57:32,630 --> 00:57:30,780
mean the rocket is also you don't get to

1354
00:57:34,849 --> 00:57:32,640
build a a rocket like this without

1355
00:57:37,490 --> 00:57:34,859
collaboration either do you of course

1356
00:57:39,109 --> 00:57:37,500
just like web actually uh in fact 12

1357
00:57:41,809 --> 00:57:39,119
different countries have been

1358
00:57:43,670 --> 00:57:41,819
participating in the development of grn5

1359
00:57:45,410 --> 00:57:43,680
with Aryan group now being the

1360
00:57:46,730 --> 00:57:45,420
industrial Prime

1361
00:57:48,589 --> 00:57:46,740
scale model

1362
00:57:50,809 --> 00:57:48,599
right next to you Raphael why don't you

1363
00:57:52,910 --> 00:57:50,819

talk us through it the rocket is made of

1364
00:57:54,950 --> 00:57:52,920
sections and we often call those stages

1365
00:57:57,289 --> 00:57:54,960
which is what you might hear during the

1366
00:57:59,210 --> 00:57:57,299
commentary exactly so first you have the

1367
00:58:02,030 --> 00:57:59,220
two boosters solid boosters that are

1368
00:58:04,609 --> 00:58:02,040
located on each side of the rocket they

1369
00:58:07,069 --> 00:58:04,619
will provide the main thrust in order to

1370
00:58:09,589 --> 00:58:07,079
literally push the rocket against the

1371
00:58:12,049 --> 00:58:09,599
gravity of the earth then you have these

1372
00:58:14,690 --> 00:58:12,059
big things that form the um main

1373
00:58:17,569 --> 00:58:14,700
cryogenic stage with the main engine

1374
00:58:19,809 --> 00:58:17,579
Vulcan at the bottom and then you have

1375
00:58:22,670 --> 00:58:19,819
the web telescope right at the top

1376
00:58:25,069 --> 00:58:22,680
inside the fairing it is right there on

1377
00:58:27,950 --> 00:58:25,079
the Launchpad and together they are put

1378
00:58:30,530 --> 00:58:27,960
on top of the third stage a cryogenic

1379
00:58:34,069 --> 00:58:30,540
stage and it is this upper stage that is

1380
00:58:35,450 --> 00:58:34,079
going to place web into orbit and what

1381
00:58:36,829 --> 00:58:35,460
the engines what are we going to say at

1382
00:58:40,910 --> 00:58:36,839
liftoff

1383
00:58:43,250 --> 00:58:40,920
first see the main Vulcan engine ignite

1384
00:58:44,930 --> 00:58:43,260
first we do this because we want to

1385
00:58:48,289 --> 00:58:44,940
check it's prop it's working properly

1386
00:58:52,490 --> 00:58:48,299
before we switch on the solid boosters

1387
00:58:55,069 --> 00:58:52,500
seven seconds later once it's done there

1388
00:58:58,970 --> 00:58:55,079

is no turning back the rocket is going

1389
00:59:01,730 --> 00:58:58,980
to lift off and so yeah that's a very uh

1390
00:59:04,010 --> 00:59:01,740
don't be surprised don't be surprised if

1391
00:59:06,349 --> 00:59:04,020
you don't see the rocket lifting up for

1392
00:59:08,870 --> 00:59:06,359
seven seconds that's time for the rocket

1393
00:59:11,569 --> 00:59:08,880
to actually warm up before throwing into

1394
00:59:14,329 --> 00:59:11,579
the sky so once we like the touch paper

1395
00:59:16,370 --> 00:59:14,339
you can count to seven uh before it

1396
00:59:19,190 --> 00:59:16,380
actually lifts off now one of the

1397
00:59:21,410 --> 00:59:19,200
advantages of the Aria N5 vehicle is

1398
00:59:23,690 --> 00:59:21,420
that it can be modified and that's

1399
00:59:26,210 --> 00:59:23,700
exactly what we've done for today's

1400
00:59:28,670 --> 00:59:26,220
launch we've had to make some changes

1401
00:59:30,890 --> 00:59:28,680
for it to be able to host the web

1402
00:59:32,990 --> 00:59:30,900
satellite and joining me to talk about

1403
00:59:34,430 --> 00:59:33,000
that is somebody who the right person

1404
00:59:36,109 --> 00:59:34,440
for the job Indeed because he was in

1405
00:59:37,970 --> 00:59:36,119
charge of those changes Daniel de

1406
00:59:39,829 --> 00:59:37,980
Chamber from the European Space Agency

1407
00:59:41,210 --> 00:59:39,839
thanks for joining us Daniel what did

1408
00:59:43,670 --> 00:59:41,220
you have to do

1409
00:59:45,829 --> 00:59:43,680
first we need to recall that web will be

1410
00:59:48,650 --> 00:59:45,839
the largest payload to be ever

1411
00:59:50,750 --> 00:59:48,660
accommodated on our own i5

1412
00:59:53,390 --> 00:59:50,760
it fully occupies the volume of the

1413
00:59:55,910 --> 00:59:53,400

fairing with gaps as small as 10

1414
00:59:57,770 --> 00:59:55,920
centimeter for diameter 5 meter it is

1415
01:00:00,710 --> 00:59:57,780
the reason why we had to develop a

1416
01:00:02,630 --> 01:00:00,720
specific integration procedure to ensure

1417
01:00:05,390 --> 01:00:02,640
that there is no contact with them

1418
01:00:08,089 --> 01:00:05,400
after separation

1419
01:00:11,210 --> 01:00:08,099
during separation sorry the advancing

1420
01:00:13,789 --> 01:00:11,220
system of of the launcher has been

1421
01:00:15,890 --> 01:00:13,799
improved in order to balance as much as

1422
01:00:18,950 --> 01:00:15,900
possible the inside and the outside

1423
01:00:22,910 --> 01:00:18,960
pressure of the Fairing and this is to

1424
01:00:25,130 --> 01:00:22,920
to due to the fear of depressive

1425
01:00:28,010 --> 01:00:25,140
depressed resistant shock which could

1426
01:00:29,030 --> 01:00:28,020
damage the delicate layers of web server

1427
01:00:31,870 --> 01:00:29,040
essential

1428
01:00:36,230 --> 01:00:31,880
after separation

1429
01:00:38,390 --> 01:00:36,240
the due to the fact that web some

1430
01:00:40,930 --> 01:00:38,400
equipment of web are very sensitive to

1431
01:00:44,030 --> 01:00:40,940
sun exposure the

1432
01:00:46,370 --> 01:00:44,040
role control of the launcher will be

1433
01:00:48,710 --> 01:00:46,380
tuned in order to make sure that web is

1434
01:00:51,710 --> 01:00:48,720
always oriented only one phase two to

1435
01:00:55,250 --> 01:00:51,720
the center and in addition to avoiding

1436
01:00:57,710 --> 01:00:55,260
your spot the launcher will be create

1437
01:01:00,530 --> 01:00:57,720
will create some oscillating movements

1438
01:01:04,069 --> 01:01:00,540

like a barbecue mode to avoid any over

1439
01:01:05,270 --> 01:01:04,079
overeating and after after web

1440
01:01:07,730 --> 01:01:05,280
separation

1441
01:01:09,410 --> 01:01:07,740
uh there will be a specific end of

1442
01:01:12,650 --> 01:01:09,420
flight maneuver

1443
01:01:14,870 --> 01:01:12,660
to to be applied on the upper stage in

1444
01:01:16,970 --> 01:01:14,880
order to put it on the Liberation orbits

1445
01:01:19,309 --> 01:01:16,980
around the Sun in order to avoid

1446
01:01:20,690 --> 01:01:19,319
Collision in the in the long term thank

1447
01:01:23,930 --> 01:01:20,700
you very much indeed Daniel so we'll

1448
01:01:26,510 --> 01:01:23,940
hopefully see the uh upper stage Rocking

1449
01:01:28,370 --> 01:01:26,520
In Space not quite all the way around

1450
01:01:30,589 --> 01:01:28,380
like the familiar barbecue but it's

1451
01:01:31,970 --> 01:01:30,599
slightly different movement this and

1452
01:01:33,770 --> 01:01:31,980
gentlemen thank you very much indeed for

1453
01:01:35,990 --> 01:01:33,780
being with us today I know that you're

1454
01:01:37,370 --> 01:01:36,000
busy you've got jobs to do inside the

1455
01:01:39,530 --> 01:01:37,380
Fishbowl so I'm going to send you right

1456
01:01:41,690 --> 01:01:39,540
back there now and very best wishes for

1457
01:01:45,230 --> 01:01:41,700
the launch thank you thank you

1458
01:01:47,030 --> 01:01:45,240
our telescope has a long journey ahead

1459
01:01:50,089 --> 01:01:47,040
of it it's got to try to travel a

1460
01:01:52,670 --> 01:01:50,099
million miles to its destination in

1461
01:01:54,829 --> 01:01:52,680
space its working Zone where it's going

1462
01:01:57,770 --> 01:01:54,839
to start telling us all about our

1463
01:02:01,370 --> 01:01:57,780

universe it's already started that

1464
01:02:03,410 --> 01:02:01,380
Journey because it's traveled to the

1465
01:02:06,589 --> 01:02:03,420
launch pad from Los Angeles

1466
01:02:07,490 --> 01:02:06,599
after final tests were concluded in Los

1467
01:02:11,930 --> 01:02:07,500
Angeles

1468
01:02:14,990 --> 01:02:11,940
web was packed into a special container

1469
01:02:17,329 --> 01:02:15,000
and transported along the LA

1470
01:02:22,590 --> 01:02:17,339
405 freeway which had to be closed

1471
01:02:28,789 --> 01:02:25,490
[Music]

1472
01:02:30,109 --> 01:02:28,799
it traveled on a special ship

1473
01:02:32,569 --> 01:02:30,119
a lot of

1474
01:02:36,109 --> 01:02:32,579
spacecraft will come to the French

1475
01:02:37,849 --> 01:02:36,119
Guyana launch sites by plane but Webb

1476
01:02:39,650 --> 01:02:37,859
was too big for that so it had to travel

1477
01:02:48,190 --> 01:02:39,660
by ship and it went through the Panama

1478
01:02:48,200 --> 01:02:55,910
up through the locks

1479
01:03:00,529 --> 01:02:58,549
and it took 16 days

1480
01:03:02,510 --> 01:03:00,539
to get to the port

1481
01:03:05,510 --> 01:03:02,520
in Kuru

1482
01:03:07,849 --> 01:03:05,520
where it was unloaded

1483
01:03:09,890 --> 01:03:07,859
and traveled to the Spaceport

1484
01:03:10,970 --> 01:03:09,900
that's not the real Ariane 5 that's a

1485
01:03:12,650 --> 01:03:10,980
model

1486
01:03:15,650 --> 01:03:12,660
just outside the Jupiter control center

1487
01:03:20,210 --> 01:03:17,510
it was unpacked

1488
01:03:23,150 --> 01:03:20,220

very carefully in the facilities that

1489
01:03:26,329 --> 01:03:23,160
Raphael was talking about

1490
01:03:28,190 --> 01:03:26,339
and then fueling started and of course

1491
01:03:31,130 --> 01:03:28,200
the teens had to wear special suits

1492
01:03:34,670 --> 01:03:31,140
because that's a dangerous job and then

1493
01:03:37,360 --> 01:03:34,680
it was placed all the way on top

1494
01:03:52,690 --> 01:03:37,370
of the Ariane 5 rocket

1495
01:03:52,700 --> 01:03:57,010
foreign

1496
01:04:02,930 --> 01:04:00,410
and sealed

1497
01:04:07,250 --> 01:04:02,940
and then it was rolled out to the launch

1498
01:04:13,370 --> 01:04:09,349
from the Vehicle Assembly Building to

1499
01:04:16,190 --> 01:04:13,380
the pad along very special rails

1500
01:04:18,890 --> 01:04:16,200
very very slowly through the Amazon

1501
01:04:21,770 --> 01:04:18,900
rainforest

1502
01:04:23,870 --> 01:04:21,780
it was raining at the time

1503
01:04:25,010 --> 01:04:23,880
and that was two days ago and here we

1504
01:04:29,750 --> 01:04:25,020
are now

1505
01:04:33,470 --> 01:04:29,760
17 minutes and 46 seconds to launch and

1506
01:04:36,589 --> 01:04:33,480
counting all systems are go here at the

1507
01:04:38,870 --> 01:04:36,599
European Spaceport in French Guiana we

1508
01:04:41,450 --> 01:04:38,880
have three control centers on the job

1509
01:04:43,670 --> 01:04:41,460
today we have the mission control center

1510
01:04:45,829 --> 01:04:43,680
here we also have the launch control

1511
01:04:49,309 --> 01:04:45,839
center which is about a mile from the

1512
01:04:51,950 --> 01:04:49,319
pad and then we also have the telescope

1513
01:04:54,170 --> 01:04:51,960

control center Mission Control in

1514
01:04:57,410 --> 01:04:54,180
Baltimore in the US and that's where the

1515
01:05:01,010 --> 01:04:57,420
operational teams are standing by to

1516
01:05:02,809 --> 01:05:01,020
take over the telescope operations

1517
01:05:05,990 --> 01:05:02,819
once it's released from the mothership

1518
01:05:08,390 --> 01:05:06,000
that will be about 27 minutes after

1519
01:05:10,250 --> 01:05:08,400
launch

1520
01:05:12,950 --> 01:05:10,260
and they'll be controlling the web

1521
01:05:22,069 --> 01:05:12,960
telescope for the rest of its life

1522
01:05:29,630 --> 01:05:25,910
the James Webb Space Telescope is a

1523
01:05:32,510 --> 01:05:29,640
truly remarkable Observatory

1524
01:05:34,849 --> 01:05:32,520
people have been working on it for

1525
01:05:37,309 --> 01:05:34,859
over two decades some people have been

1526
01:05:40,789 --> 01:05:37,319
working on it for the whole professional

1527
01:05:44,990 --> 01:05:40,799
lives uh Thomas the brooken is the head

1528
01:05:48,109 --> 01:05:45,000
of science at Nasa and he's joining me

1529
01:05:53,150 --> 01:05:48,119
now just to talk about it Thomas I mean

1530
01:05:55,190 --> 01:05:53,160
or Dr Z as we can also call you

1531
01:05:57,829 --> 01:05:55,200
the day has come

1532
01:05:59,089 --> 01:05:57,839
all these decades all this time all

1533
01:06:01,910 --> 01:05:59,099
these people working on the spell

1534
01:06:05,150 --> 01:06:01,920
telescope and here we are 16 minutes and

1535
01:06:07,990 --> 01:06:05,160
counting to launch it's a big day huh oh

1536
01:06:10,549 --> 01:06:08,000
I'm so am I amazed right we have this

1537
01:06:13,730 --> 01:06:10,559
telescope on top of this rocket a

1538
01:06:16,069 --> 01:06:13,740

telescope that 10 000 plus people have

1539
01:06:17,990 --> 01:06:16,079
worked on in many ways and together with

1540
01:06:20,510 --> 01:06:18,000
that telescope all the hopes and dreams

1541
01:06:22,250 --> 01:06:20,520
of those individuals and also tens of

1542
01:06:24,890 --> 01:06:22,260
thousands of scientists some of them not

1543
01:06:27,049 --> 01:06:24,900
even born that will benefit from these

1544
01:06:29,210 --> 01:06:27,059
data are dare with them waiting for

1545
01:06:31,250 --> 01:06:29,220
these last minutes of countdown for its

1546
01:06:32,990 --> 01:06:31,260
journey to to space I'm guessing people

1547
01:06:35,210 --> 01:06:33,000
are feeling a combination of emotional

1548
01:06:37,010 --> 01:06:35,220
excitement

1549
01:06:38,450 --> 01:06:37,020
what's going through people's minds do

1550
01:06:39,710 --> 01:06:38,460
you think oh I think there's a

1551
01:06:41,870 --> 01:06:39,720
tremendous sense of accomplishment

1552
01:06:43,490 --> 01:06:41,880
whenever you're on top of a rocket many

1553
01:06:45,470 --> 01:06:43,500
things went really really well there's

1554
01:06:48,289 --> 01:06:45,480
tremendous Pride there's always a little

1555
01:06:50,450 --> 01:06:48,299
bit of anxiety we know launching is hard

1556
01:06:52,250 --> 01:06:50,460
uh we have one of the absolute best

1557
01:06:54,770 --> 01:06:52,260
teams in the world working on this right

1558
01:06:57,770 --> 01:06:54,780
now so I'm confident in that we're super

1559
01:06:59,990 --> 01:06:57,780
excited I mean I just an amazing day

1560
01:07:03,410 --> 01:07:00,000
today and what are you most excited

1561
01:07:06,289 --> 01:07:03,420
about Dr Z well I'm a scientist or for

1562
01:07:08,870 --> 01:07:06,299
me besides the technology that really is

1563
01:07:11,270 --> 01:07:08,880

a Marvel I mean it's really the best we

1564
01:07:13,549 --> 01:07:11,280
can do what I'm thinking about is really

1565
01:07:15,470 --> 01:07:13,559
looking at the universe in New Light we

1566
01:07:17,690 --> 01:07:15,480
have never seen the universe how we will

1567
01:07:20,270 --> 01:07:17,700
show it to us and can you just imagine

1568
01:07:22,490 --> 01:07:20,280
going back in time 13 and a half billion

1569
01:07:24,829 --> 01:07:22,500
years it boggles your mind even as a

1570
01:07:26,569 --> 01:07:24,839
professional astrophysicist kind of just

1571
01:07:28,370 --> 01:07:26,579
think about all the new things we're

1572
01:07:29,569 --> 01:07:28,380
going to learn about our most beautiful

1573
01:07:31,910 --> 01:07:29,579
universe

1574
01:07:33,710 --> 01:07:31,920
Dr Z thank you very very much for for

1575
01:07:35,809 --> 01:07:33,720
joining us and I want to wish you and

1576
01:07:39,470 --> 01:07:35,819
all the teams everybody the very best

1577
01:07:43,309 --> 01:07:39,480
for for today's launch thank you so yes

1578
01:07:46,370 --> 01:07:43,319
indeed go web so we are now 14 minutes

1579
01:07:48,289 --> 01:07:46,380
and 30 seconds to launch uh we're

1580
01:07:50,630 --> 01:07:48,299
getting really close now everything's

1581
01:07:52,250 --> 01:07:50,640
going well all systems are green for

1582
01:07:55,970 --> 01:07:52,260
launch and I'm gonna

1583
01:07:59,569 --> 01:07:55,980
um hand you over now to NASA's Rob

1584
01:08:02,329 --> 01:07:59,579
naviers in the Sky Box alongside the

1585
01:08:04,010 --> 01:08:02,339
European space agency's loose fabregate

1586
01:08:07,609 --> 01:08:04,020
who are going to take on the commentary

1587
01:08:10,010 --> 01:08:07,619
from here on in over to you guys Rob

1588
01:08:11,990 --> 01:08:10,020

well thank you Katie Merry Christmas to

1589
01:08:13,910 --> 01:08:12,000
our worldwide audience from our

1590
01:08:17,329 --> 01:08:13,920
broadcast Booth I Atop The Jupiter

1591
01:08:19,610 --> 01:08:17,339
control center here in Peru joining me

1592
01:08:21,769 --> 01:08:19,620
today for this historic launch my

1593
01:08:23,749 --> 01:08:21,779
colleague Luz fabergat the head of

1594
01:08:26,390 --> 01:08:23,759
infrastructure and value chain for the

1595
01:08:28,010 --> 01:08:26,400
European space agency Lewis good morning

1596
01:08:30,590 --> 01:08:28,020
good great to be with you great to be

1597
01:08:32,930 --> 01:08:30,600
with you today very pleased to be here

1598
01:08:35,390 --> 01:08:32,940
with you and all of you watching us for

1599
01:08:37,610 --> 01:08:35,400
this very special event

1600
01:08:39,950 --> 01:08:37,620
well at this hour countdown clocks are

1601
01:08:43,189 --> 01:08:39,960
ticking backward we are at T minus 13

1602
01:08:45,169 --> 01:08:43,199
minutes 32 seconds and counting out on

1603
01:08:47,630 --> 01:08:45,179
the launch pad everything is in great

1604
01:08:49,789 --> 01:08:47,640
shape don't let those clouds fool you we

1605
01:08:52,550 --> 01:08:49,799
are go for launch the latest weather

1606
01:08:55,309 --> 01:08:52,560
briefing just completed indicated that

1607
01:08:57,430 --> 01:08:55,319
all weather parameters are green we have

1608
01:09:00,169 --> 01:08:57,440
a green board here in the control center

1609
01:09:02,870 --> 01:09:00,179
and everything has gone extremely

1610
01:09:06,229 --> 01:09:02,880
smoothly in the countdown about nine

1611
01:09:08,630 --> 01:09:06,239
minutes ago a major Milestone passed as

1612
01:09:11,030 --> 01:09:08,640
the James Webb Space Telescope began the

1613
01:09:13,370 --> 01:09:11,040

process and completed the process of

1614
01:09:15,490 --> 01:09:13,380
receiving commands to transition from

1615
01:09:17,809 --> 01:09:15,500
external power to internal battery power

1616
01:09:20,329 --> 01:09:17,819
following the latest in the series of

1617
01:09:22,970 --> 01:09:20,339
those weather briefings Webb will remain

1618
01:09:25,370 --> 01:09:22,980
on internal battery power until its

1619
01:09:28,729 --> 01:09:25,380
singular solar array unfurls about 30

1620
01:09:31,130 --> 01:09:28,739
minutes after launch earlier telescope

1621
01:09:33,970 --> 01:09:31,140
controllers reported good environmental

1622
01:09:36,410 --> 01:09:33,980
readings from sensors inside the fairing

1623
01:09:39,709 --> 01:09:36,420
encapsulating the tele telescope Atop

1624
01:09:41,990 --> 01:09:39,719
The Upper stage of the Ariane 5 rocket

1625
01:09:43,669 --> 01:09:42,000
and loose as we enter the most critical

1626
01:09:45,950 --> 01:09:43,679
phase of the countdown can you outline

1627
01:09:48,169 --> 01:09:45,960
some of the upcoming critical activities

1628
01:09:59,450 --> 01:09:48,179
as we head into the phase called

1629
01:10:05,870 --> 01:10:02,570
stems here I've been prepared for final

1630
01:10:09,050 --> 01:10:05,880
launch operations and I time being it's

1631
01:10:11,330 --> 01:10:09,060
quite it's it's rather quiet now inside

1632
01:10:13,970 --> 01:10:11,340
the launch table and also inside the

1633
01:10:16,310 --> 01:10:13,980
launcher we were told a few minutes ago

1634
01:10:18,890 --> 01:10:16,320
by the launch control center here that

1635
01:10:20,570 --> 01:10:18,900
the launcher freeze and electric systems

1636
01:10:23,990 --> 01:10:20,580
are ready for the final automated

1637
01:10:26,689 --> 01:10:24,000
sequence they are on hold now waiting

1638
01:10:28,070 --> 01:10:26,699

for the last weather report at minus 10

1639
01:10:30,709 --> 01:10:28,080
minutes

1640
01:10:32,990 --> 01:10:30,719
after this weather report

1641
01:10:35,149 --> 01:10:33,000
three minutes later we will at the

1642
01:10:37,970 --> 01:10:35,159
beginning of this famous synchronized

1643
01:10:40,729 --> 01:10:37,980
sequence when all systems will be made

1644
01:10:43,729 --> 01:10:40,739
ready for the liftoff

1645
01:10:46,910 --> 01:10:43,739
this sequence will first be run by the

1646
01:10:49,790 --> 01:10:46,920
ground calculator and then the onboard

1647
01:10:52,070 --> 01:10:49,800
computer will take the lead step by step

1648
01:10:56,149 --> 01:10:52,080
and the launch vehicle will be made

1649
01:10:58,090 --> 01:10:56,159
autonomous from the ground system

1650
01:11:01,430 --> 01:10:58,100
you know that we have two tanks in each

1651
01:11:03,169 --> 01:11:01,440
cryogenic stage at the stage and Main

1652
01:11:06,410 --> 01:11:03,179
stage

1653
01:11:09,110 --> 01:11:06,420
all four tanks are of course thermally

1654
01:11:11,810 --> 01:11:09,120
insulated from the hot environment where

1655
01:11:14,750 --> 01:11:11,820
we are here in French Guyana

1656
01:11:16,910 --> 01:11:14,760
however this liquid propellants are at

1657
01:11:18,830 --> 01:11:16,920
very low temperature and because of that

1658
01:11:22,010 --> 01:11:18,840
slightly evaporate

1659
01:11:24,350 --> 01:11:22,020
and to ensure they are perfectly loaded

1660
01:11:27,169 --> 01:11:24,360
at gift of their Final loading and

1661
01:11:29,270 --> 01:11:27,179
Topping up will last up to four minutes

1662
01:11:31,550 --> 01:11:29,280
before the launch so that will be the

1663
01:11:35,030 --> 01:11:31,560

beginning of the synchronized sequence

1664
01:11:35,990 --> 01:11:35,040
run by the ground calculators then we

1665
01:11:40,130 --> 01:11:36,000
will have

1666
01:11:42,110 --> 01:11:40,140
on the feet side the end of the the

1667
01:11:45,290 --> 01:11:42,120
topping up the Final loading and the

1668
01:11:47,870 --> 01:11:45,300
topping up of the of the different tanks

1669
01:11:49,910 --> 01:11:47,880
and on the electrical side we will add

1670
01:11:52,149 --> 01:11:49,920
the onboard computer getting prepared

1671
01:11:56,390 --> 01:11:52,159
for the launch also and it will be

1672
01:11:59,110 --> 01:11:56,400
uploaded with the h0 with the h0 time

1673
01:12:01,850 --> 01:11:59,120
the time for the for the liftoff

1674
01:12:05,990 --> 01:12:01,860
which is today at nine at the beginning

1675
01:12:10,430 --> 01:12:06,000
of the window 9 20 local time 7 20

1676
01:12:15,649 --> 01:12:12,010
foreign

1677
01:12:18,890 --> 01:12:15,659
up on that final weather report we

1678
01:12:21,050 --> 01:12:18,900
expect all systems to remain green we'll

1679
01:12:23,450 --> 01:12:21,060
be going down to the Fishbowl to confirm

1680
01:12:27,169 --> 01:12:23,460
that just a moment or two from now

1681
01:12:30,709 --> 01:12:27,179
it's a 27 minute ride to orbit from

1682
01:12:33,410 --> 01:12:30,719
liftoff until the time that the web

1683
01:12:36,050 --> 01:12:33,420
Observatory is separated from the upper

1684
01:12:37,970 --> 01:12:36,060
stage of the Ariane 5 rocket several

1685
01:12:40,370 --> 01:12:37,980
minutes later the commands will be given

1686
01:12:42,530 --> 01:12:40,380
to unfurl its solar array followed by

1687
01:12:45,410 --> 01:12:42,540
the confirmation from the telescope

1688
01:12:47,630 --> 01:12:45,420

controllers in Baltimore that we are

1689
01:12:49,970 --> 01:12:47,640
power positive meaning that electrical

1690
01:12:52,910 --> 01:12:49,980
current is flowing through that solar

1691
01:12:55,310 --> 01:12:52,920
array with us today inside the so-called

1692
01:12:57,470 --> 01:12:55,320
Fishbowl seated with Mission controllers

1693
01:13:00,649 --> 01:12:57,480
on the floor of the control room as

1694
01:13:02,090 --> 01:13:00,659
Rafael Chevrolet of Ariane Spas Rafael

1695
01:13:03,590 --> 01:13:02,100
how's everything looking what's being

1696
01:13:06,530 --> 01:13:03,600
discussed down there

1697
01:13:09,290 --> 01:13:06,540
hi Rob well so far so good we just

1698
01:13:12,290 --> 01:13:09,300
received the last weather forecast it's

1699
01:13:15,530 --> 01:13:12,300
all green for the h0 that is forecast

1700
01:13:17,750 --> 01:13:15,540
right now what we checked was altitude

1701
01:13:20,149 --> 01:13:17,760
winds winds in the vicinity of the

1702
01:13:23,030 --> 01:13:20,159
launch pad and risk of lightning so

1703
01:13:25,850 --> 01:13:23,040
right now uh it's a relief because the

1704
01:13:27,830 --> 01:13:25,860
the weather was a bit tough in the last

1705
01:13:31,729 --> 01:13:27,840
couple of days but right now everybody

1706
01:13:33,890 --> 01:13:31,739
is very focused on the next steps the

1707
01:13:36,649 --> 01:13:33,900
start of the synchronized sequence at

1708
01:13:38,990 --> 01:13:36,659
seven minutes before liftoff last

1709
01:13:42,410 --> 01:13:39,000
operations that Ruth described earlier

1710
01:13:46,550 --> 01:13:42,420
before web and the Iron 5 are going to

1711
01:13:48,709 --> 01:13:46,560
lift off and soar into the sky

1712
01:13:50,930 --> 01:13:48,719
thanks Rafael we'll be back with you and

1713
01:13:52,910 --> 01:13:50,940

loose here shortly that we now have

1714
01:13:56,330 --> 01:13:52,920
confirmation from Baltimore that James

1715
01:13:58,610 --> 01:13:56,340
Webb is on internal power amidst all of

1716
01:14:01,490 --> 01:13:58,620
this activity we cannot forget that it

1717
01:14:04,070 --> 01:14:01,500
is Christmas Day 53 years ago the

1718
01:14:06,410 --> 01:14:04,080
astronauts of Apollo 8 completed their

1719
01:14:08,630 --> 01:14:06,420
10th and final orbit of the moon after

1720
01:14:10,850 --> 01:14:08,640
reading from The Book of Genesis on

1721
01:14:12,770 --> 01:14:10,860
Christmas Eve to billions of people

1722
01:14:15,110 --> 01:14:12,780
watching with wrapped attention back on

1723
01:14:17,510 --> 01:14:15,120
our planet the astronauts then headed

1724
01:14:19,970 --> 01:14:17,520
for home following their spacecraft's

1725
01:14:22,189 --> 01:14:19,980
trans Earth injection burn

1726
01:14:24,590 --> 01:14:22,199
today more than a half century later

1727
01:14:28,370 --> 01:14:24,600
we're just minutes away from another

1728
01:14:30,709 --> 01:14:28,380
Genesis the Genesis of New Era of

1729
01:14:34,550 --> 01:14:30,719
Discovery the launch of the James Webb

1730
01:14:37,130 --> 01:14:34,560
Space Telescope is at hand we're just 38

1731
01:14:39,530 --> 01:14:37,140
seconds away from entering the critical

1732
01:14:42,470 --> 01:14:39,540
synchronized sequence you're going to be

1733
01:14:46,010 --> 01:14:42,480
hearing uh all the critical calls from

1734
01:14:49,490 --> 01:14:46,020
the DDO the range operations manager who

1735
01:14:51,470 --> 01:14:49,500
is Jean-Luc Voyer here in the launch in

1736
01:14:53,810 --> 01:14:51,480
the mission control center there he is

1737
01:14:55,669 --> 01:14:53,820
he will be calling the start of

1738
01:14:58,669 --> 01:14:55,679

synchronized sequence all of the

1739
01:15:01,130 --> 01:14:58,679
critical countdown milestones and we

1740
01:15:04,729 --> 01:15:01,140
will be listening very intently for his

1741
01:15:16,370 --> 01:15:04,739
calls let's stand by

1742
01:15:21,890 --> 01:15:18,530
and with that we've entered the period

1743
01:15:24,890 --> 01:15:21,900
of synchronized sequence you heard loose

1744
01:15:26,930 --> 01:15:24,900
fabberget just a moment or two ago uh

1745
01:15:29,030 --> 01:15:26,940
explain some of the critical activities

1746
01:15:31,070 --> 01:15:29,040
uh the first one coming up just a few

1747
01:15:34,610 --> 01:15:31,080
seconds from now which will be the

1748
01:15:37,130 --> 01:15:34,620
topping off of the main stage tanks uh

1749
01:15:40,669 --> 01:15:37,140
the first or core stage was loaded

1750
01:15:45,709 --> 01:15:40,679
earlier this morning with 175 tons of

1751
01:15:48,590 --> 01:15:45,719
propellant 150 tons of liquid oxygen and

1752
01:15:51,110 --> 01:15:48,600
25 tons of liquid hydrogen the upper

1753
01:15:53,810 --> 01:15:51,120
stage loaded with 15 Tons of propellant

1754
01:15:56,990 --> 01:15:53,820
that will be the Workhorse for a 16

1755
01:16:00,590 --> 01:15:57,000
minute burn to lift James Webb to its

1756
01:16:02,570 --> 01:16:00,600
final orbit at separation some 27

1757
01:16:04,910 --> 01:16:02,580
minutes and seven seconds after launch

1758
01:16:08,750 --> 01:16:04,920
James Webb will be at an altitude of

1759
01:16:11,050 --> 01:16:08,760
about 864 statute miles to put that into

1760
01:16:13,850 --> 01:16:11,060
perspective some

1761
01:16:17,270 --> 01:16:13,860
520 miles higher than the Hubble Space

1762
01:16:19,130 --> 01:16:17,280
Telescope and more than 600 miles higher

1763
01:16:21,709 --> 01:16:19,140

than the International Space Station

1764
01:16:24,770 --> 01:16:21,719
where at that point we'll be traveling

1765
01:16:27,229 --> 01:16:24,780
about 21 000 miles an hour as it heads

1766
01:16:29,750 --> 01:16:27,239
out to a highly elliptical halo-like

1767
01:16:32,450 --> 01:16:29,760
racetrack orbit some 1 million miles

1768
01:16:40,610 --> 01:16:32,460
from Earth to begin its scientific

1769
01:16:46,250 --> 01:16:43,430
four tanks pressurized at the flight

1770
01:16:49,130 --> 01:16:46,260
level for the last tests before the

1771
01:16:51,950 --> 01:16:49,140
ignition of the volcano Gene

1772
01:16:53,689 --> 01:16:51,960
and in parallel the Electric System are

1773
01:16:55,910 --> 01:16:53,699
also set in Flight configurations or

1774
01:16:58,430 --> 01:16:55,920
what computer the electrical power as

1775
01:17:00,770 --> 01:16:58,440
for the telescope it was switched from

1776
01:17:02,750 --> 01:17:00,780
ground to internal power one minute

1777
01:17:04,430 --> 01:17:02,760
before the launch one minute and five

1778
01:17:08,390 --> 01:17:04,440
seconds before the launch

1779
01:17:10,729 --> 01:17:08,400
and we are going to see -6 second

1780
01:17:12,770 --> 01:17:10,739
at minus six seconds we will see the

1781
01:17:15,350 --> 01:17:12,780
disconnection of the upper stage this

1782
01:17:17,870 --> 01:17:15,360
big cryo the Technic arms you can see on

1783
01:17:21,350 --> 01:17:17,880
this on this picture

1784
01:17:23,390 --> 01:17:21,360
then three seconds before the h0 the

1785
01:17:25,310 --> 01:17:23,400
inertial platform that will give all the

1786
01:17:26,990 --> 01:17:25,320
information about where it is to the

1787
01:17:30,590 --> 01:17:27,000
launcher will be released

1788
01:17:33,290 --> 01:17:30,600

and at age zero the seven second

1789
01:17:36,290 --> 01:17:33,300
sequence to ignite the Volcan and Gene

1790
01:17:38,689 --> 01:17:36,300
of the main starch stage will start

1791
01:17:40,970 --> 01:17:38,699
that will take seven seconds a little

1792
01:17:44,090 --> 01:17:40,980
less than seven seconds where the engine

1793
01:17:46,070 --> 01:17:44,100
will start up to its flight regime

1794
01:17:48,470 --> 01:17:46,080
once the computer has checked that the

1795
01:17:50,630 --> 01:17:48,480
Vulcan engine is running normally

1796
01:17:53,750 --> 01:17:50,640
and you will see at that point the flame

1797
01:17:56,330 --> 01:17:53,760
going stable at the outlet of the nozzle

1798
01:17:58,970 --> 01:17:56,340
and at that point the onboard computer

1799
01:18:03,950 --> 01:17:58,980
will ignite the two boosters that will

1800
01:18:05,450 --> 01:18:03,960
enable to move the 770 tons of Aryan and

1801
01:18:07,430 --> 01:18:05,460
well

1802
01:18:09,890 --> 01:18:07,440
coming up on the T-minus four minute

1803
01:18:12,410 --> 01:18:09,900
Mark right now uh just a couple of

1804
01:18:14,990 --> 01:18:12,420
Milestones real quick at the one minute

1805
01:18:16,850 --> 01:18:15,000
five second Mark into the flight Ariane

1806
01:18:20,209 --> 01:18:16,860
5 will go through the period of Maximum

1807
01:18:22,550 --> 01:18:20,219
Dynamic pressure Max Q as it's known uh

1808
01:18:25,970 --> 01:18:22,560
that will be uh the period of Maximum

1809
01:18:28,850 --> 01:18:25,980
aerodynamic forces on the rocket itself

1810
01:18:30,830 --> 01:18:28,860
the solid rocket boosters which will

1811
01:18:33,709 --> 01:18:30,840
provide about 90 percent of the initial

1812
01:18:36,110 --> 01:18:33,719
thrust off the launch pad will shut down

1813
01:18:38,209 --> 01:18:36,120

and separate at the two minute 21 second

1814
01:18:40,669 --> 01:18:38,219
Mark into the flight followed a minute

1815
01:18:43,130 --> 01:18:40,679
and five seconds after that by fairing

1816
01:18:46,070 --> 01:18:43,140
jettison that will expose the James Webb

1817
01:18:48,470 --> 01:18:46,080
Space Telescope to the environment of

1818
01:18:50,390 --> 01:18:48,480
flight for the first time the main stage

1819
01:18:53,390 --> 01:18:50,400
separation or the first stage separation

1820
01:18:56,149 --> 01:18:53,400
comes at the T-minus at the eight minute

1821
01:18:59,209 --> 01:18:56,159
47 second marked into the flight and

1822
01:19:01,729 --> 01:18:59,219
that will be about a 16 minute burn of

1823
01:19:05,209 --> 01:19:01,739
that upper stage engine it will cut off

1824
01:19:07,250 --> 01:19:05,219
at about 24 minutes 51 seconds into the

1825
01:19:09,590 --> 01:19:07,260
flight and then we'll go into a coast

1826
01:19:11,630 --> 01:19:09,600
phase of about two and a half minutes to

1827
01:19:13,790 --> 01:19:11,640
allow any oscillations to dampen out

1828
01:19:16,310 --> 01:19:13,800
provide the most pristine environment

1829
01:19:20,149 --> 01:19:16,320
for the James Webb Telescope before

1830
01:19:25,250 --> 01:19:23,149
we're coming up on the two minute 52nd

1831
01:19:27,050 --> 01:19:25,260
Mark into the flight again you're going

1832
01:19:29,630 --> 01:19:27,060
to be hearing critical calls down the

1833
01:19:36,290 --> 01:19:29,640
stretch here from the DDO or the range

1834
01:19:41,630 --> 01:19:38,810
the weather is go we have a green board

1835
01:19:44,149 --> 01:19:41,640
no issues being worked

1836
01:19:46,490 --> 01:19:44,159
NASA officials including Greg Robinson

1837
01:19:48,290 --> 01:19:46,500
on the right uh carefully uh watching

1838
01:19:50,810 --> 01:19:48,300

the telemetry

1839
01:19:52,850 --> 01:19:50,820
looking intently at the final couple of

1840
01:19:55,550 --> 01:19:52,860
minutes of the countdown lives have been

1841
01:19:57,649 --> 01:19:55,560
spent in the preparation of the James

1842
01:20:07,850 --> 01:19:57,659
Webb Space Telescope that is about to

1843
01:20:13,010 --> 01:20:10,370
and that is the DDO the range operations

1844
01:20:26,330 --> 01:20:13,020
manager Jean-Luc Voyer as we have hit

1845
01:20:29,930 --> 01:20:28,550
the flight will be in two phases you

1846
01:20:32,390 --> 01:20:29,940
will see the first part of the flight

1847
01:20:35,149 --> 01:20:32,400
join the solid rocket boosters phase

1848
01:20:37,669 --> 01:20:35,159
that will be the atmospheric part of the

1849
01:20:39,890 --> 01:20:37,679
flight the atmospheric flight and the

1850
01:20:43,610 --> 01:20:39,900
trajectory will be driven by your very

1851
01:20:45,709 --> 01:20:43,620
to reducing iodine mixed clothes and we

1852
01:20:48,229 --> 01:20:45,719
will have a very different EXO

1853
01:20:50,990 --> 01:20:48,239
atmospheric flight after that

1854
01:20:53,510 --> 01:20:51,000
and and you were watching a number of

1855
01:20:56,030 --> 01:20:53,520
people uh VIPs and invited guests moving

1856
01:20:59,149 --> 01:20:56,040
out to the observation platform that is

1857
01:21:01,010 --> 01:20:59,159
right next to the Jupiter control center

1858
01:21:15,110 --> 01:21:01,020
as we stand by for the one minute call

1859
01:21:19,250 --> 01:21:17,270
thumbs up from Jean-Luc Boyer all

1860
01:21:22,250 --> 01:21:19,260
systems are go we're inside a minute now

1861
01:21:25,189 --> 01:21:22,260
T-minus 50 seconds and counting

1862
01:21:28,010 --> 01:21:25,199
as you heard earlier the Vulcan 2 engine

1863
01:21:29,930 --> 01:21:28,020

will ignite turbo pumps will come up to

1864
01:21:31,430 --> 01:21:29,940
flight speed for 7 seconds and the

1865
01:21:33,830 --> 01:21:31,440
command will be issued to ignite the

1866
01:21:41,689 --> 01:21:33,840
solid rocket boosters the James Webb

1867
01:21:41,699 --> 01:21:51,890
T-minus 30 seconds and counting

1868
01:21:51,900 --> 01:21:57,229
standing by for terminal count

1869
01:21:57,239 --> 01:22:01,669
final

1870
01:22:11,629 --> 01:22:09,350
this Nerf read set this sank get caught

1871
01:22:15,430 --> 01:22:11,639
the unity

1872
01:22:15,440 --> 01:22:19,610
and we have engine start

1873
01:22:19,620 --> 01:22:23,590
Ed

1874
01:22:29,090 --> 01:22:26,390
liftoff from a tropical rainforest to

1875
01:22:31,310 --> 01:22:29,100
the Edge of Time itself James Webb

1876
01:22:34,910 --> 01:22:31,320
begins a voyage back to the birth of the

1877
01:22:39,530 --> 01:22:37,669
punching a hole through the clouds 20

1878
01:22:41,650 --> 01:22:39,540
seconds into the flight good pitch

1879
01:22:49,550 --> 01:22:41,660
program reported

1880
01:22:57,470 --> 01:22:52,930
vehicle performance is nominal

1881
01:23:01,070 --> 01:22:57,480
[Music]

1882
01:23:05,260 --> 01:23:01,080
the Ariane 5 rocket continues to fly

1883
01:23:10,129 --> 01:23:06,890
[Music]

1884
01:23:13,490 --> 01:23:10,139
the rumble of the powerful now being

1885
01:23:13,500 --> 01:23:16,970
3D animation

1886
01:23:20,810 --> 01:23:18,950
we can hear the noise and feed the

1887
01:23:22,250 --> 01:23:20,820
vibrations here your right throat yeah

1888
01:23:24,470 --> 01:23:22,260

impressive

1889
01:23:26,689 --> 01:23:24,480
13 kilometers in altitude seven

1890
01:23:31,250 --> 01:23:26,699
kilometers downrange

1891
01:23:36,350 --> 01:23:31,260
traveling uh about uh 0.6 kilometers per

1892
01:23:41,090 --> 01:23:38,990
the trajectory reported to be nominal by

1893
01:23:43,010 --> 01:23:41,100
Jean-Luc Voyer the range operations

1894
01:23:44,689 --> 01:23:43,020
manager

1895
01:23:47,450 --> 01:23:44,699
you can see at the bottom of your screen

1896
01:23:49,850 --> 01:23:47,460
the yellow line is the trajectory plot

1897
01:23:53,030 --> 01:23:49,860
perfectly overlaid over the green line

1898
01:23:55,370 --> 01:23:53,040
which was the pre-launch trajectory

1899
01:23:58,729 --> 01:23:55,380
one minute 41 seconds into the flight

1900
01:24:06,410 --> 01:23:58,739
about 40 seconds away from shutdown of

1901
01:24:13,570 --> 01:24:08,330
coming up on the two-minute Mark into

1902
01:24:17,689 --> 01:24:15,830
when it detects the threshold on

1903
01:24:20,149 --> 01:24:17,699
acceleration this not to this direction

1904
01:24:23,590 --> 01:24:20,159
but uh

1905
01:24:30,649 --> 01:24:26,930
everything is okay everything is no more

1906
01:24:33,290 --> 01:24:30,659
two minutes 15 seconds into the flight

1907
01:24:35,390 --> 01:24:33,300
and the computer detects this threshold

1908
01:24:37,090 --> 01:24:35,400
it will separate

1909
01:24:39,590 --> 01:24:37,100
separation

1910
01:24:41,750 --> 01:24:39,600
we have confirmation of solid rocket

1911
01:24:45,410 --> 01:24:41,760
booster separation from Jean-Luc Warrior

1912
01:24:47,810 --> 01:24:45,420
this coming at an altitude of 44 miles

1913
01:24:51,350 --> 01:24:47,820

the Ariane 5 and James Webb traveling

1914
01:24:53,930 --> 01:24:51,360
almost 5 000 miles an hour

1915
01:24:56,209 --> 01:24:53,940
we have about one minute five seconds to

1916
01:25:00,110 --> 01:24:56,219
go before fairing jettison that'll be

1917
01:25:04,189 --> 01:25:02,209
the fairing is there to avoid a

1918
01:25:07,729 --> 01:25:04,199
satellite being exposed to high

1919
01:25:10,310 --> 01:25:07,739
temperatures and also high air flows and

1920
01:25:12,890 --> 01:25:10,320
as soon as the launcher leaves yet was

1921
01:25:14,629 --> 01:25:12,900
here as is now the case the satellite

1922
01:25:18,290 --> 01:25:14,639
does not need anymore to be protected

1923
01:25:21,410 --> 01:25:18,300
and web does not need anymore so no more

1924
01:25:23,629 --> 01:25:21,420
so each kilogram being very important

1925
01:25:26,030 --> 01:25:23,639
for the performance of the launch we are

1926
01:25:29,390 --> 01:25:26,040
going to eject this no more useful

1927
01:25:33,649 --> 01:25:31,610
and let's go down to the floor in the

1928
01:25:36,050 --> 01:25:33,659
Jupiter control center to Raphael

1929
01:25:37,070 --> 01:25:36,060
Chevrolet of Ariane Spas Rafael so far

1930
01:25:42,110 --> 01:25:37,080
so good

1931
01:25:44,990 --> 01:25:42,120
nominal as we say when attitude and

1932
01:25:47,090 --> 01:25:45,000
trajectory of the rn5 is going perfectly

1933
01:25:49,850 --> 01:25:47,100
well as you can see also on the little

1934
01:25:52,370 --> 01:25:49,860
yellow on the screen we had the

1935
01:25:55,189 --> 01:25:52,380
confirmation of the separation of the

1936
01:25:57,410 --> 01:25:55,199
two seat boosters and now of the fairing

1937
01:25:59,830 --> 01:25:57,420
meaning that we have crossed the limits

1938
01:26:02,689 --> 01:25:59,840

of the atmosphere so everything is

1939
01:26:05,330 --> 01:26:02,699
normal and did you just said that all

1940
01:26:08,930 --> 01:26:05,340
parameters are going perfectly perfectly

1941
01:26:11,570 --> 01:26:08,940
smoothly so let's continue the mission

1942
01:26:14,090 --> 01:26:11,580
and Raphael This Is A View From the

1943
01:26:16,370 --> 01:26:14,100
upper stage camera called the Vicki cam

1944
01:26:18,410 --> 01:26:16,380
looking back at the James Webb Space

1945
01:26:20,450 --> 01:26:18,420
Telescope this is on about a 20 second

1946
01:26:22,910 --> 01:26:20,460
delay or so because of the way the

1947
01:26:25,729 --> 01:26:22,920
imagery is processed here in the control

1948
01:26:30,410 --> 01:26:25,739
room there's your telescope ready to

1949
01:26:33,470 --> 01:26:30,420
unfurl its wings basically and begin its

1950
01:26:35,870 --> 01:26:33,480
journey to it the LaGrange point the L2

1951
01:26:40,070 --> 01:26:35,880
point about a million miles away from

1952
01:26:44,390 --> 01:26:42,050
the projector nominal

1953
01:26:52,910 --> 01:26:44,400
trajectory is nominal the report from

1954
01:26:56,870 --> 01:26:55,189
the liftoff time confirmed here in the

1955
01:27:01,490 --> 01:26:56,880
mission control center at 12 20

1956
01:27:06,110 --> 01:27:01,500
Greenwich Mean Time 9 20 a.m Peru time 7

1957
01:27:12,669 --> 01:27:09,169
the Ariane 5 and James Webb 181

1958
01:27:15,290 --> 01:27:12,679
kilometers in altitude

1959
01:27:20,390 --> 01:27:15,300
400.50 kilometers downrange from the

1960
01:27:20,400 --> 01:27:24,590
flight control is very smooth

1961
01:27:29,689 --> 01:27:27,890
five minutes 12 seconds into the flight

1962
01:27:32,750 --> 01:27:29,699
we have about three and a half minutes

1963
01:27:34,189 --> 01:27:32,760

to go in main stage or first stage

1964
01:27:36,050 --> 01:27:34,199
performance

1965
01:27:38,209 --> 01:27:36,060
and again you can see at the bottom of

1966
01:27:41,510 --> 01:27:38,219
your screen the yellow plot line

1967
01:27:43,610 --> 01:27:41,520
overlaid over the green line meaning we

1968
01:27:46,250 --> 01:27:43,620
are right on course right down the pike

1969
01:27:52,850 --> 01:27:46,260
in a perfect trajectory so far for the

1970
01:27:52,860 --> 01:27:57,610
foreign

1971
01:28:03,290 --> 01:28:00,590
which is close to here where we are

1972
01:28:06,770 --> 01:28:03,300
in Kuru

1973
01:28:09,550 --> 01:28:06,780
it will track the launcher advertising

1974
01:28:12,649 --> 01:28:09,560
ignition of its upper stage

1975
01:28:14,510 --> 01:28:12,659
and then we'll we will have the data

1976
01:28:17,090 --> 01:28:14,520
station in Brazil

1977
01:28:19,610 --> 01:28:17,100
as also in the as you can see on the map

1978
01:28:22,910 --> 01:28:19,620
in the middle of the ocean and the two

1979
01:28:25,010 --> 01:28:22,920
last stations in Africa libreville and

1980
01:28:27,350 --> 01:28:25,020
malindi one on the east coast the other

1981
01:28:29,570 --> 01:28:27,360
one on the west coast and the one on the

1982
01:28:31,430 --> 01:28:29,580
west coast malindi you can see that the

1983
01:28:34,430 --> 01:28:31,440
satellite will be the telescope will be

1984
01:28:36,410 --> 01:28:34,440
separated moreover more or less over

1985
01:28:39,050 --> 01:28:36,420
this Malinda station and this Marine

1986
01:28:40,669 --> 01:28:39,060
station will also acquire the Telemetry

1987
01:28:43,490 --> 01:28:40,679
data from the telescope

1988
01:28:45,950 --> 01:28:43,500

you can see both are green and that's

1989
01:28:48,890 --> 01:28:45,960
along this animation it means they are

1990
01:28:51,770 --> 01:28:48,900
expected to receive so that the data and

1991
01:28:57,709 --> 01:28:51,780
it was confirmed right now by the launch

1992
01:29:01,790 --> 01:28:59,870
just confirming now that Telemetry is

1993
01:29:04,629 --> 01:29:01,800
being processed through the Brazilian

1994
01:29:06,649 --> 01:29:04,639
tracking station the telescope is also

1995
01:29:08,510 --> 01:29:06,659
processing Telemetry through the

1996
01:29:11,209 --> 01:29:08,520
tracking and data relay satellite system

1997
01:29:13,610 --> 01:29:11,219
as it moves further and further out into

1998
01:29:15,709 --> 01:29:13,620
deep space all of the telescopes

1999
01:29:17,990 --> 01:29:15,719
Telemetry and its imagery ultimately

2000
01:29:20,930 --> 01:29:18,000
will be processed through the deep space

2001
01:29:22,610 --> 01:29:20,940
Network in Goldstone California would

2002
01:29:25,669 --> 01:29:22,620
pass the seven minute Mark into the

2003
01:29:28,510 --> 01:29:25,679
flight a perfect ride so far on the

2004
01:29:31,610 --> 01:29:28,520
Ariane 5.

2005
01:29:34,310 --> 01:29:31,620
one and a half minutes to go in the

2006
01:29:36,890 --> 01:29:34,320
first stage performance once the main

2007
01:29:39,890 --> 01:29:36,900
stage uh engine is commanded to cut off

2008
01:29:41,510 --> 01:29:39,900
it will be jettisoned and just a few

2009
01:29:44,330 --> 01:29:41,520
seconds after that the upper stage

2010
01:29:47,450 --> 01:29:44,340
engine will will ignite and it will be

2011
01:29:49,790 --> 01:29:47,460
the Workhorse for a 16 minute burn that

2012
01:30:02,450 --> 01:29:49,800
will put James Webb into its preliminary

2013
01:30:07,310 --> 01:30:05,090

about 11 minutes from now a telescope

2014
01:30:09,410 --> 01:30:07,320
controllers at the Space Telescope

2015
01:30:12,050 --> 01:30:09,420
Science Institute will be sending

2016
01:30:13,910 --> 01:30:12,060
commands to prepare James Webb for the

2017
01:30:16,610 --> 01:30:13,920
initial series of commissioning

2018
01:30:19,669 --> 01:30:16,620
activities that will lead to to the

2019
01:30:21,530 --> 01:30:19,679
deployment of its solar energy and the

2020
01:30:24,649 --> 01:30:21,540
initiation of generation of electrical

2021
01:30:27,410 --> 01:30:24,659
power for the telescope

2022
01:30:37,550 --> 01:30:27,420
about 30 seconds away from Main engine

2023
01:30:42,770 --> 01:30:40,370
nominal trajectory continues to be the

2024
01:30:46,310 --> 01:30:42,780
watchword for the day from the range

2025
01:30:48,709 --> 01:30:46,320
operations manager Jean-Luc Voyer

2026
01:31:06,669 --> 01:30:48,719
as we stand by for main engine shutdown

2027
01:31:10,850 --> 01:31:08,570
OPC

2028
01:31:12,410 --> 01:31:10,860
and we have main stage shutdown and

2029
01:31:14,570 --> 01:31:12,420
separation confirmed here on the Mission

2030
01:31:18,050 --> 01:31:14,580
Control Center and the ignition of that

2031
01:31:21,830 --> 01:31:18,060
project and Raphael Chevrolet down in

2032
01:31:23,990 --> 01:31:21,840
the Fishbowl uh so far so good

2033
01:31:26,090 --> 01:31:24,000
yes Rob we have the confirmation of the

2034
01:31:27,370 --> 01:31:26,100
separation of the main stage and the

2035
01:31:30,410 --> 01:31:27,380
ignition

2036
01:31:32,570 --> 01:31:30,420
the trajectory is perfectly nominal this

2037
01:31:35,270 --> 01:31:32,580
is very important moment for us because

2038
01:31:37,790 --> 01:31:35,280

it's always a challenge to switch on a

2039
01:31:39,970 --> 01:31:37,800
cryogenic engine in space condition and

2040
01:31:44,390 --> 01:31:39,980
we are now at

2041
01:31:46,189 --> 01:31:44,400
220 kilometers of altitude speed is a

2042
01:31:48,950 --> 01:31:46,199
bit more than seven kilometers per

2043
01:31:52,850 --> 01:31:48,960
second as we enter now the second stage

2044
01:31:55,510 --> 01:31:52,860
of the second phase of the flight the

2045
01:31:58,610 --> 01:31:55,520
appreciate is going to power for

2046
01:32:00,290 --> 01:31:58,620
for about 16 minutes to place web onions

2047
01:32:05,390 --> 01:32:00,300
transfer orbits and right now everything

2048
01:32:11,149 --> 01:32:07,970
and a short time from now uh the

2049
01:32:13,729 --> 01:32:11,159
so-called Sawtooth maneuver uh will get

2050
01:32:16,129 --> 01:32:13,739
underway the again like rocking a baby

2051
01:32:19,370 --> 01:32:16,139
in a cradle this will be a maneuver to

2052
01:32:22,790 --> 01:32:19,380
keep website from overheating loose

2053
01:32:25,790 --> 01:32:22,800
exactly like a baby in a trailer you can

2054
01:32:28,189 --> 01:32:25,800
see here wet attached on top of Iron 5

2055
01:32:29,750 --> 01:32:28,199
upper stage with a very specific

2056
01:32:31,669 --> 01:32:29,760
configuration of course it will be

2057
01:32:34,030 --> 01:32:31,679
different during its lifetime but for

2058
01:32:37,310 --> 01:32:34,040
the time being it's uh it's it's

2059
01:32:43,450 --> 01:32:37,320
sunshield is folded and not yet

2060
01:32:49,669 --> 01:32:46,370
have been performed by the mission teams

2061
01:32:52,189 --> 01:32:49,679
in in Europe in the US on thermal

2062
01:32:54,229 --> 01:32:52,199
conditioning inside the telescope and

2063
01:32:57,229 --> 01:32:54,239

the way the Rays of the sun would

2064
01:33:00,410 --> 01:32:57,239
propagate and interact with sensitive

2065
01:33:02,629 --> 01:33:00,420
equipment inside the telescope the

2066
01:33:05,930 --> 01:33:02,639
maintain this thermal conditioning is

2067
01:33:08,030 --> 01:33:05,940
really key before separating this this

2068
01:33:10,490 --> 01:33:08,040
telescope and in particular we know that

2069
01:33:13,250 --> 01:33:10,500
one phase of the telescope cannot face

2070
01:33:15,770 --> 01:33:13,260
the sun that's why

2071
01:33:19,070 --> 01:33:15,780
do and to produce this right thermal

2072
01:33:21,590 --> 01:33:19,080
conditions inside the web specific role

2073
01:33:23,689 --> 01:33:21,600
has been designed what we call the sotus

2074
01:33:26,570 --> 01:33:23,699
approach and if you are if you are

2075
01:33:28,790 --> 01:33:26,580
watching carefully to these images you

2076
01:33:31,189 --> 01:33:28,800
can show this animation you can see that

2077
01:33:32,270 --> 01:33:31,199
the upper stage is going 30 degrees on

2078
01:33:34,729 --> 01:33:32,280
one side

2079
01:33:38,689 --> 01:33:34,739
that 30 degrees on the other side going

2080
01:33:41,450 --> 01:33:38,699
back and forth this way to to maintain

2081
01:33:44,750 --> 01:33:41,460
this perfect thermal conditioning for

2082
01:33:51,830 --> 01:33:47,750
it's a worthwhile noting that after

2083
01:33:53,810 --> 01:33:51,840
events from the upper stage of the

2084
01:33:56,510 --> 01:33:53,820
Ariane 5 rocket which continues to

2085
01:33:58,370 --> 01:33:56,520
perform in excellent fashion at coming

2086
01:34:01,790 --> 01:33:58,380
up on the 12-minute mark into the flight

2087
01:34:03,830 --> 01:34:01,800
uh the telescope controllers uh will be

2088
01:34:06,530 --> 01:34:03,840

taking the Baton if you will from the

2089
01:34:08,209 --> 01:34:06,540
mission controllers here in Peru the

2090
01:34:10,490 --> 01:34:08,219
first steps will be the opening of fuel

2091
01:34:13,209 --> 01:34:10,500
valves a pair of fuel valves to start

2092
01:34:15,890 --> 01:34:13,219
flowing fuel to Webb's onboard thrusters

2093
01:34:18,290 --> 01:34:15,900
they then will power on the valve Drive

2094
01:34:20,090 --> 01:34:18,300
Electronics those are powered on in

2095
01:34:22,310 --> 01:34:20,100
preparation to control and fire those

2096
01:34:24,709 --> 01:34:22,320
thrusters when required

2097
01:34:28,689 --> 01:34:24,719
Webb's solar array is scheduled to be

2098
01:34:31,310 --> 01:34:28,699
deployed at approximately the 33 minutes

2099
01:34:33,950 --> 01:34:31,320
once it is locked in place we'll get the

2100
01:34:36,530 --> 01:34:33,960
call that electricity is flowing through

2101
01:34:39,229 --> 01:34:36,540
the array that call will come from the

2102
01:34:41,390 --> 01:34:39,239
mission operations manager Carl Starr

2103
01:34:43,629 --> 01:34:41,400
who's at the Space Telescope Science

2104
01:34:46,669 --> 01:34:43,639
Institute at Johns Hopkins in Baltimore

2105
01:34:50,030 --> 01:34:46,679
uh seated right behind him in that

2106
01:34:52,970 --> 01:34:50,040
control room is Alicia star a pair of

2107
01:34:55,310 --> 01:34:52,980
stars are helping to guide James Webb on

2108
01:34:58,250 --> 01:34:55,320
its discovery of the Stars Alicia star

2109
01:35:03,850 --> 01:34:58,260
is the lead engineer for launch and

2110
01:35:08,810 --> 01:35:06,890
then a three out of the four hold Downs

2111
01:35:11,209 --> 01:35:08,820
for the AFT deployed radiator will be

2112
01:35:13,129 --> 01:35:11,219
released to prevent binding due to the

2113
01:35:15,470 --> 01:35:13,139

cooldown of the telescope's composite

2114
01:35:17,689 --> 01:35:15,480
structure the contamination control

2115
01:35:20,390 --> 01:35:17,699
heaters will be enabled to protect

2116
01:35:22,790 --> 01:35:20,400
instrument Optics on web from any water

2117
01:35:25,250 --> 01:35:22,800
ice condensation as they cool down down

2118
01:35:27,950 --> 01:35:25,260
the actuator Drive Unit will be powered

2119
01:35:31,270 --> 01:35:27,960
on this particular mechanism helps with

2120
01:35:36,770 --> 01:35:34,010
preventing water ice can condensation

2121
01:35:39,890 --> 01:35:36,780
later to be used to position each of the

2122
01:35:41,750 --> 01:35:39,900
mirror's segments all six reaction

2123
01:35:44,090 --> 01:35:41,760
wheels in the wheel drive Electronics

2124
01:35:46,430 --> 01:35:44,100
will be powered on for web and that will

2125
01:35:49,189 --> 01:35:46,440
be the precursor to the attitude control

2126
01:35:51,350 --> 01:35:49,199
system using those reaction Wheels to

2127
01:35:53,330 --> 01:35:51,360
maintain the proper orientation with the

2128
01:35:56,689 --> 01:35:53,340
Sun as opposed to using onboard

2129
01:35:59,209 --> 01:35:56,699
thrusters of course fuel in those

2130
01:36:00,950 --> 01:35:59,219
thrusters very valuable it's a limited

2131
01:36:06,890 --> 01:36:00,960
commodity for the lifetime of James

2132
01:36:06,900 --> 01:36:12,470
we're 13 minutes 55 seconds

2133
01:36:18,169 --> 01:36:15,590
Jean-Luc uh Voyer the range operations

2134
01:36:23,270 --> 01:36:18,179
manager continues to report a nominal

2135
01:36:27,410 --> 01:36:25,189
and again loose faberg yet from the

2136
01:36:30,530 --> 01:36:27,420
European Space Agency uh how is this

2137
01:36:33,649 --> 01:36:30,540
trajectory uh being carefully and

2138
01:36:35,930 --> 01:36:33,659

methodically adjusted to provide the

2139
01:36:38,629 --> 01:36:35,940
correct parameters in the final stages

2140
01:36:41,629 --> 01:36:38,639
of ascent yes rub as you can see on this

2141
01:36:43,910 --> 01:36:41,639
plot the the attitude is slightly going

2142
01:36:46,790 --> 01:36:43,920
down it's perfectly normal the large

2143
01:36:50,030 --> 01:36:46,800
vehicle is really on the on the line

2144
01:36:52,209 --> 01:36:50,040
where it should be this decrease of its

2145
01:36:55,250 --> 01:36:52,219
altitude slight decrease of its altitude

2146
01:36:57,530 --> 01:36:55,260
will allows the launcher to benefit and

2147
01:37:00,350 --> 01:36:57,540
the upper stage to benefit quality

2148
01:37:02,990 --> 01:37:00,360
effect and to increase its velocity

2149
01:37:05,050 --> 01:37:03,000
until it reaches a thermal threshold

2150
01:37:08,209 --> 01:37:05,060
it's about to reach it or even already

2151
01:37:10,729 --> 01:37:08,219
reached it out and it will go up and now

2152
01:37:14,629 --> 01:37:10,739
it will go up and up up to the

2153
01:37:17,689 --> 01:37:14,639
separation of the web telescope

2154
01:37:19,910 --> 01:37:17,699
it will separate the web's telescope on

2155
01:37:22,070 --> 01:37:19,920
a highly elliptic orbit but still around

2156
01:37:25,189 --> 01:37:22,080
the earth the satellite the telescope

2157
01:37:28,010 --> 01:37:25,199
will be released inserted on the update

2158
01:37:32,330 --> 01:37:28,020
around the earth with an apology a very

2159
01:37:38,109 --> 01:37:34,729
trajectory nominal as reported by

2160
01:37:42,530 --> 01:37:38,119
Jean-Luc Voyer you see him in that view

2161
01:37:44,330 --> 01:37:42,540
185 kilometers in altitude uh some 4 500

2162
01:37:47,030 --> 01:37:44,340
kilometers downrange from the launch

2163
01:37:50,030 --> 01:37:47,040

site here in Peru moving at more than

2164
01:37:51,830 --> 01:37:50,040
eight kilometers per second right on the

2165
01:37:56,090 --> 01:37:51,840
plot right on the trajectory everything

2166
01:37:58,250 --> 01:37:56,100
looking great we are are about uh nine

2167
01:38:01,310 --> 01:37:58,260
minutes away from the completion of

2168
01:38:02,649 --> 01:38:01,320
upper stage ignition it's shut down and

2169
01:38:05,990 --> 01:38:02,659
then about a two and a half minutes

2170
01:38:08,090 --> 01:38:06,000
before Webb will separate Observatory

2171
01:38:10,129 --> 01:38:08,100
separation will be called out you'll be

2172
01:38:12,410 --> 01:38:10,139
hearing those calls and the initial

2173
01:38:14,510 --> 01:38:12,420
calls from Carl Starr the mission

2174
01:38:16,790 --> 01:38:14,520
operations manager at the Space

2175
01:38:18,890 --> 01:38:16,800
Telescope Science Institute at Johns

2176
01:38:21,109 --> 01:38:18,900
Hopkins through solar array deploy in

2177
01:38:23,810 --> 01:38:21,119
the Declaration of a power positive

2178
01:38:25,550 --> 01:38:23,820
spacecraft uh you know James Webb of

2179
01:38:28,189 --> 01:38:25,560
course will be traveling well beyond the

2180
01:38:30,950 --> 01:38:28,199
moon to a distance of about a million

2181
01:38:33,070 --> 01:38:30,960
miles away from Earth settling into a

2182
01:38:36,470 --> 01:38:33,080
highly elliptical Halo like

2183
01:38:38,870 --> 01:38:36,480
it's astronomical observations

2184
01:38:41,629 --> 01:38:38,880
and again as we mentioned earlier at the

2185
01:38:44,330 --> 01:38:41,639
time of Observatory separation Webb will

2186
01:38:48,050 --> 01:38:44,340
be at an altitude of approximately 864

2187
01:39:01,250 --> 01:38:48,060
miles statute miles traveling some 21

2188
01:39:06,109 --> 01:39:03,890

we're about eight minutes away from

2189
01:39:10,070 --> 01:39:06,119
upper stage a shutdown

2190
01:39:12,890 --> 01:39:10,080
the stage has performed as planned

2191
01:39:16,129 --> 01:39:12,900
no issues reported the launch occurring

2192
01:39:19,129 --> 01:39:16,139
at 12 20 Greenwich Mean Time 9 20 karoo

2193
01:39:25,850 --> 01:39:19,139
time 7 20 a.m eastern time on this

2194
01:39:29,810 --> 01:39:28,129
the velocity you just mentioned is very

2195
01:39:31,729 --> 01:39:29,820
important for absor velocity you just

2196
01:39:33,950 --> 01:39:31,739
mentioned at separation of the telescope

2197
01:39:36,109 --> 01:39:33,960
is very important it will be slightly

2198
01:39:38,570 --> 01:39:36,119
below okay give it in a kilometer per

2199
01:39:40,490 --> 01:39:38,580
second but it will be slightly below 10

2200
01:39:42,770 --> 01:39:40,500
kilometers per second because it's

2201
01:39:45,229 --> 01:39:42,780
important that the satellite the

2202
01:39:47,930 --> 01:39:45,239
telescope is not inserted on an escape

2203
01:39:50,870 --> 01:39:47,940
orbit it will be placed on a terrestrial

2204
01:39:52,930 --> 01:39:50,880
orbit so that there will be time for the

2205
01:39:56,209 --> 01:39:52,940
relationship

2206
01:39:58,729 --> 01:39:56,219
operations on the and the commissioning

2207
01:40:01,609 --> 01:39:58,739
of the telescope and that will be in

2208
01:40:04,430 --> 01:40:01,619
fact the other stage that we leave this

2209
01:40:06,830 --> 01:40:04,440
orbit and goes toward an escape

2210
01:40:09,109 --> 01:40:06,840
liberation of it

2211
01:40:12,350 --> 01:40:09,119
and of course even though we're still in

2212
01:40:14,330 --> 01:40:12,360
powered flight the trajectory the

2213
01:40:16,550 --> 01:40:14,340

acceleration the speed at which James

2214
01:40:20,270 --> 01:40:16,560
Webb is going towards its preliminary

2215
01:40:23,149 --> 01:40:20,280
orbit all modeled and advanced uh in

2216
01:40:25,970 --> 01:40:23,159
advance and carefully choreographed and

2217
01:40:28,790 --> 01:40:25,980
maintain as a quiescent an atmosphere

2218
01:40:31,189 --> 01:40:28,800
and environment around the telescope for

2219
01:40:33,709 --> 01:40:31,199
its ultimate separation from the upper

2220
01:40:42,830 --> 01:40:33,719
stage of the Ariane 5 rocket which is

2221
01:40:48,890 --> 01:40:46,430
18 and a half minutes into the flight

2222
01:40:55,070 --> 01:40:48,900
it's very quiet now here in the control

2223
01:41:00,590 --> 01:40:57,350
NASA officials European Space Agency

2224
01:41:19,189 --> 01:41:00,600
officials officials

2225
01:41:25,669 --> 01:41:22,189
and as the upper stage continues to burn

2226
01:41:28,010 --> 01:41:25,679
anomaly and sheds fuel the acceleration

2227
01:41:30,830 --> 01:41:28,020
uphill for the James Webb Space

2228
01:41:33,470 --> 01:41:30,840
Telescope continues to increase as we

2229
01:41:36,290 --> 01:41:33,480
approach the 20-minute Mark into the

2230
01:41:39,290 --> 01:41:36,300
flight again upper stage cutoff is

2231
01:41:41,570 --> 01:41:39,300
scheduled at 24 minute 51 second Mark

2232
01:41:47,090 --> 01:41:41,580
into the flight about five and a half

2233
01:41:52,790 --> 01:41:50,390
after the cutoff of this main engine

2234
01:41:55,010 --> 01:41:52,800
as you say the Rob we will have a short

2235
01:41:57,890 --> 01:41:55,020
ballistic phase a short casting phase

2236
01:42:00,410 --> 01:41:57,900
that will uh when when the upper stage

2237
01:42:03,229 --> 01:42:00,420
will rely fully on its at what we call

2238
01:42:07,129 --> 01:42:03,239

the attitude and roll control system and

2239
01:42:10,250 --> 01:42:07,139
it will adjust its its attitude

2240
01:42:12,590 --> 01:42:10,260
so that during this so small ballistic

2241
01:42:16,070 --> 01:42:12,600
phase all the requirements from the

2242
01:42:18,109 --> 01:42:16,080
telescope are fully met and that adds a

2243
01:42:20,990 --> 01:42:18,119
separation when when there will be the

2244
01:42:23,750 --> 01:42:21,000
separation the conditions will be very

2245
01:42:29,270 --> 01:42:23,760
smooth and as requested for the

2246
01:42:35,689 --> 01:42:32,450
today's countdown was as Flawless as you

2247
01:42:37,209 --> 01:42:35,699
can imagine the weather was perfect all

2248
01:42:40,310 --> 01:42:37,219
the way through the early morning hours

2249
01:42:42,109 --> 01:42:40,320
uh through the fueling process of the

2250
01:42:44,689 --> 01:42:42,119
vehicle the weather's been a bit dicey

2251
01:42:46,250 --> 01:42:44,699
here in crew over the past few days but

2252
01:42:49,430 --> 01:42:46,260
everything fell together on this

2253
01:42:51,649 --> 01:42:49,440
Christmas day to send a new present to

2254
01:42:59,350 --> 01:42:51,659
the world's astronomer

2255
01:43:04,189 --> 01:43:02,209
all parameters nominal as reported by

2256
01:43:09,530 --> 01:43:04,199
Jean-Luc Boyer the range operations

2257
01:43:09,540 --> 01:43:47,270
four minutes of powered flight remaining

2258
01:43:50,930 --> 01:43:49,490
the Telemetry of the launch vehicle is

2259
01:43:53,750 --> 01:43:50,940
acquired for the time being by the

2260
01:43:56,930 --> 01:43:53,760
libreville tracking station on the

2261
01:44:02,330 --> 01:43:59,629
flight control is knowing all the

2262
01:44:04,310 --> 01:44:02,340
trajectories fully normal fully as

2263
01:44:07,129 --> 01:44:04,320

expected as you can see on the on the

2264
01:44:12,290 --> 01:44:07,139
plot with the red with the yellow plot

2265
01:44:12,300 --> 01:44:16,669
22 minutes into the flight

2266
01:44:21,109 --> 01:44:18,290
less than three minutes of powered

2267
01:44:21,119 --> 01:44:29,030
smooth flight control

2268
01:44:29,040 --> 01:44:33,590
and again as we've mentioned uh before

2269
01:44:37,790 --> 01:44:35,930
everything nominal reported by the range

2270
01:44:41,209 --> 01:44:37,800
operations manager as we've mentioned

2271
01:44:43,189 --> 01:44:41,219
before this is a long ride uphill for

2272
01:44:46,189 --> 01:44:43,199
the James Webb Space Telescope to put it

2273
01:44:47,629 --> 01:44:46,199
at the proper position in the sky so

2274
01:44:50,570 --> 01:44:47,639
that it can escape from the earth

2275
01:44:53,570 --> 01:44:50,580
basically head beyond the moon towards

2276
01:44:55,310 --> 01:44:53,580
its final orbit for its commissioning

2277
01:44:58,189 --> 01:44:55,320
activities that will be the dominant

2278
01:45:00,050 --> 01:44:58,199
feature of uh all of the operations from

2279
01:45:01,970 --> 01:45:00,060
the Space Telescope Science Institute

2280
01:45:03,649 --> 01:45:01,980
over the course of the next several

2281
01:45:05,810 --> 01:45:03,659
weeks

2282
01:45:09,250 --> 01:45:05,820
and the launch operations manager

2283
01:45:14,209 --> 01:45:12,010
foreign

2284
01:45:16,850 --> 01:45:14,219
as expected

2285
01:45:19,850 --> 01:45:16,860
for the last for the end of the flight

2286
01:45:21,649 --> 01:45:19,860
and the last part of the upper stage

2287
01:45:22,790 --> 01:45:21,659
flight and the separation of the

2288
01:45:24,830 --> 01:45:22,800

telescope

2289
01:45:28,129 --> 01:45:24,840
James Webb is about four minutes away

2290
01:45:30,470 --> 01:45:28,139
from separating from the upper stage

2291
01:45:33,350 --> 01:45:30,480
and again at that point

2292
01:45:35,209 --> 01:45:33,360
it will be on its own

2293
01:45:37,070 --> 01:45:35,219
and again those Milestones that we

2294
01:45:40,970 --> 01:45:37,080
discussed a bit earlier in the broadcast

2295
01:45:43,609 --> 01:45:40,980
will begin to be followed carefully by

2296
01:45:46,609 --> 01:45:43,619
the telescope controllers at the mission

2297
01:45:48,649 --> 01:45:46,619
operations center the mock as it's

2298
01:45:59,390 --> 01:45:48,659
called at the Space Telescope Science

2299
01:45:59,400 --> 01:46:07,970
one minute of powered flight remaining

2300
01:46:12,770 --> 01:46:10,250
the upper stage continues to function

2301
01:46:30,890 --> 01:46:12,780
perfectly it's been a smooth ride for

2302
01:46:36,590 --> 01:46:33,590
that upper stage was loaded pre-flight

2303
01:46:39,950 --> 01:46:36,600
this morning with 15 Tons of propellant

2304
01:46:42,890 --> 01:46:39,960
for this long 16 minute burn

2305
01:46:58,490 --> 01:46:42,900
now about 30 seconds away from upper

2306
01:47:03,590 --> 01:47:00,530
and we're standing by for upper stage

2307
01:47:10,629 --> 01:47:03,600
shutdown and the cutoff of the upper

2308
01:47:10,639 --> 01:47:18,350
let's see

2309
01:47:23,390 --> 01:47:20,930
normal

2310
01:47:26,209 --> 01:47:23,400
the extinction of the shutoff of the

2311
01:47:29,570 --> 01:47:26,219
cutoff of the engine was confirmed

2312
01:47:30,890 --> 01:47:29,580
exactly as expected

2313
01:47:32,510 --> 01:47:30,900

we do

2314
01:47:37,970 --> 01:47:32,520
exactly

2315
01:47:43,430 --> 01:47:41,209
so now we are we have entered the

2316
01:47:45,770 --> 01:47:43,440
coasting phase the ballistic phase that

2317
01:47:51,530 --> 01:47:45,780
will last for a little more than two

2318
01:47:56,870 --> 01:47:53,990
and the telescope controllers uh in

2319
01:48:00,290 --> 01:47:56,880
Baltimore are confirming that uh all of

2320
01:48:02,330 --> 01:48:00,300
the function uh parameters for the James

2321
01:48:05,629 --> 01:48:02,340
Webb Space Telescope have been loaded on

2322
01:48:09,410 --> 01:48:05,639
board the telescope we are expecting uh

2323
01:48:12,770 --> 01:48:09,420
web separation at the 27 minute seven

2324
01:48:15,590 --> 01:48:12,780
second Mark here into the flight

2325
01:48:17,570 --> 01:48:15,600
just over a minute from now Springs will

2326
01:48:20,570 --> 01:48:17,580
gently push Webb away from the upper

2327
01:48:23,270 --> 01:48:20,580
stage of the Ariane 5. as it moves

2328
01:48:26,629 --> 01:48:23,280
further and further away from the upper

2329
01:48:37,129 --> 01:48:26,639
stage there'll be what we refer to as a

2330
01:48:42,470 --> 01:48:40,310
and then the upper stage will leave the

2331
01:48:45,890 --> 01:48:42,480
trajectory of the stethoscope and makes

2332
01:48:49,609 --> 01:48:45,900
a special maneuver to pass the telescope

2333
01:48:51,530 --> 01:48:49,619
and heads towards a Liberation orbit and

2334
01:48:56,390 --> 01:48:51,540
leaves the telescope

2335
01:48:58,550 --> 01:48:56,400
on its on its orbit without any risk of

2336
01:49:02,810 --> 01:48:58,560
collision and without any risk of

2337
01:49:19,669 --> 01:49:06,350
and we're about 17 seconds away from web

2338
01:49:19,679 --> 01:49:29,580

foreign

2339
01:49:29,590 --> 01:49:39,950
[Applause]

2340
01:49:43,669 --> 01:49:42,410
we do have confirmation of Observatory

2341
01:49:46,370 --> 01:49:43,679
separation

2342
01:49:48,530 --> 01:49:46,380
the James Webb Space Telescope emits the

2343
01:49:51,530 --> 01:49:48,540
plaus here in the mission control center

2344
01:49:57,050 --> 01:49:51,540
now taking its first steps in pursuit of

2345
01:49:57,060 --> 01:50:03,169
it was a perfect ride to orbit

2346
01:50:07,729 --> 01:50:05,810
and all of the separation sequence

2347
01:50:13,729 --> 01:50:07,739
events are running in good fashion

2348
01:50:18,649 --> 01:50:15,950
and there is the view from the upper

2349
01:50:21,229 --> 01:50:18,659
stage camera on the Ariane 5 looking at

2350
01:50:24,890 --> 01:50:21,239
the James Webb Space Telescope as it

2351
01:50:25,650 --> 01:50:24,900
moves uh gently away from its launch

2352
01:50:33,830 --> 01:50:25,660
vehicle

2353
01:50:33,840 --> 01:50:38,410
foreign

2354
01:50:38,420 --> 01:50:43,310
yes go away

2355
01:50:47,930 --> 01:50:46,250
ironically enough as we Marvel on this

2356
01:50:50,570 --> 01:50:47,940
view from the upper stage camera this

2357
01:50:52,669 --> 01:50:50,580
will be Humanity's last view of the

2358
01:50:55,490 --> 01:50:52,679
James Webb type Space Telescope as it

2359
01:50:57,770 --> 01:50:55,500
moves to its work place about a million

2360
01:50:59,950 --> 01:50:57,780
miles away from Earth yes that's all

2361
01:51:03,050 --> 01:50:59,960
right Rob

2362
01:51:04,609 --> 01:51:03,060
impressive fantastic pictures yeah now

2363
01:51:06,410 --> 01:51:04,619

we'll be hearing shortly from the

2364
01:51:09,709 --> 01:51:06,420
mission operations manager at the Space

2365
01:51:12,589 --> 01:51:09,719
Telescope Science Institute Carl Starr

2366
01:51:15,350 --> 01:51:12,599
who will be calling out the procedures

2367
01:51:30,010 --> 01:51:15,360
that will lead to the deployment of

2368
01:51:35,810 --> 01:51:33,050
and down in the Fishbowl where there is

2369
01:51:39,850 --> 01:51:35,820
Jubilation let's go to Raphael chevrier

2370
01:51:45,709 --> 01:51:43,850
and before we do that Raphael uh a bit

2371
01:51:47,750 --> 01:51:45,719
earlier than planned but there is the

2372
01:51:51,050 --> 01:51:47,760
solar array having been deployed

2373
01:51:53,030 --> 01:51:51,060
James Webb now uh has its array out as

2374
01:51:58,790 --> 01:51:53,040
we stand by for a confirmation that it

2375
01:52:06,370 --> 01:51:59,760
hey Rob

2376
01:52:06,380 --> 01:52:11,149
that's it

2377
01:52:11,159 --> 01:52:19,310
foreign

2378
01:52:24,050 --> 01:52:21,229
and there it is there's your critical

2379
01:52:27,229 --> 01:52:24,060
call James Webb not only has legs but it

2380
01:52:28,910 --> 01:52:27,239
has power as it begins its journey and

2381
01:52:31,310 --> 01:52:28,920
the commissioning activities to follow

2382
01:52:34,189 --> 01:52:31,320
and with that let's go down to the floor

2383
01:52:36,589 --> 01:52:34,199
uh in the Fishbowl and Rafael chevrier

2384
01:52:40,129 --> 01:52:36,599
of Ariane spas

2385
01:52:42,530 --> 01:52:40,139
this is it we have witnessed and the

2386
01:52:44,990 --> 01:52:42,540
confirmation that Aryan 5 have safely

2387
01:52:46,430 --> 01:52:45,000
delivered wave into space the upper

2388
01:52:48,530 --> 01:52:46,440

stage is now being placed on a safe

2389
01:52:50,930 --> 01:52:48,540
Escape orbit around this side but

2390
01:52:53,930 --> 01:52:50,940
honestly I've got to tell you that these

2391
01:52:55,910 --> 01:52:53,940
images are absolutely incredible and

2392
01:52:58,129 --> 01:52:55,920
well it may be the end of the mission

2393
01:53:00,830 --> 01:52:58,139
Far in space but it's only the beginning

2394
01:53:02,229 --> 01:53:00,840
of the journey for web it's now on its

2395
01:53:04,550 --> 01:53:02,239
way to the lagrance point

2396
01:53:06,589 --> 01:53:04,560
congratulations to all the team involved

2397
01:53:09,050 --> 01:53:06,599
in the flight really there is no words

2398
01:53:11,709 --> 01:53:09,060
to describe the immersion that is

2399
01:53:14,689 --> 01:53:11,719
happening right now in the fish bowl so

2400
01:53:17,629 --> 01:53:14,699
all I can say is good luck web and bring

2401
01:53:21,950 --> 01:53:17,639
us incredible data from the deep

2402
01:53:27,890 --> 01:53:25,189
well Rafael congratulations on a perfect

2403
01:53:31,070 --> 01:53:27,900
ride to orbit from the Ariane 5 out of

2404
01:53:33,649 --> 01:53:31,080
Peru here today A View here in the Space

2405
01:53:36,589 --> 01:53:33,659
Telescope Science Institute their work

2406
01:53:39,649 --> 01:53:36,599
just beginning on a new era of

2407
01:53:42,649 --> 01:53:39,659
scientific observations uh loose

2408
01:53:44,570 --> 01:53:42,659
fabricet it was a smooth ride to orbit

2409
01:53:46,669 --> 01:53:44,580
everything went to buy the book almost

2410
01:53:49,189 --> 01:53:46,679
like a simulation without any problems

2411
01:53:51,109 --> 01:53:49,199
and we thank you for all of your Insight

2412
01:53:53,510 --> 01:53:51,119
throughout the course of the day

2413
01:53:55,609 --> 01:53:53,520

thanks to Europe and a really great

2414
01:53:58,010 --> 01:53:55,619
achievement I have many faces and names

2415
01:54:00,050 --> 01:53:58,020
now coming up to my mind and really you

2416
01:54:02,990 --> 01:54:00,060
can be proud of what what was achieved

2417
01:54:05,330 --> 01:54:03,000
on both sides of the Atlantic Ocean

2418
01:54:07,609 --> 01:54:05,340
thanks a lot to you tremendous

2419
01:54:09,950 --> 01:54:07,619
Jubilation here in the control center

2420
01:54:13,430 --> 01:54:09,960
you're looking at Jean-Luc Voyer the

2421
01:54:15,169 --> 01:54:13,440
range operations manager

2422
01:54:17,270 --> 01:54:15,179
quite a Christmas present for the

2423
01:54:20,930 --> 01:54:17,280
world's astronomers as the James Webb

2424
01:54:23,450 --> 01:54:20,940
Space Telescope begins its life heading

2425
01:54:25,550 --> 01:54:23,460
towards deep space

2426
01:54:28,850 --> 01:54:25,560
with that we're going to go back to the

2427
01:54:31,669 --> 01:54:28,860
floor now uh to uh Katie Haswell Katie

2428
01:54:34,669 --> 01:54:31,679
we did our thing it's up to you now

2429
01:54:38,030 --> 01:54:34,679
oh my goodness I just can't tell you

2430
01:54:39,189 --> 01:54:38,040
it's such utter Jubilation here on the

2431
01:54:42,470 --> 01:54:39,199
floor in the Gym

2432
01:54:45,530 --> 01:54:42,480
Center everybody has been grouping with

2433
01:54:51,830 --> 01:54:48,410
jumping up clapping whooping with joy

2434
01:54:54,589 --> 01:54:51,840
people hugging and I have to say I

2435
01:54:57,169 --> 01:54:54,599
my throat was caught as I saw the the

2436
01:55:00,290 --> 01:54:57,179
glimpse of sunshine

2437
01:55:02,990 --> 01:55:00,300
um on web solar panels as we watched it

2438
01:55:04,609 --> 01:55:03,000

heading out into space on its journey to

2439
01:55:07,669 --> 01:55:04,619
its working Zone it's going to take

2440
01:55:10,310 --> 01:55:07,679
about six months before we start getting

2441
01:55:12,709 --> 01:55:10,320
um our deep space observations from

2442
01:55:16,490 --> 01:55:12,719
where because the teams have got a huge

2443
01:55:18,410 --> 01:55:16,500
amount to do before we get to that and

2444
01:55:20,209 --> 01:55:18,420
our best wishes with all those teams in

2445
01:55:22,189 --> 01:55:20,219
Baltimore I want to get some reaction

2446
01:55:23,390 --> 01:55:22,199
right now everybody's talking and

2447
01:55:25,070 --> 01:55:23,400
hugging each other because they're

2448
01:55:27,169 --> 01:55:25,080
feeling so excited and I totally

2449
01:55:31,030 --> 01:55:27,179
understand that let's start though by

2450
01:55:37,250 --> 01:55:31,040
going over to the NASA administrator

2451
01:55:37,260 --> 01:55:43,970
Sophia

2452
01:55:43,980 --> 01:55:58,790
okay here you go can you go on right now

2453
01:55:58,800 --> 01:56:07,930
okay

2454
01:56:13,189 --> 01:56:10,850
illustrator Bill Nelson right now

2455
01:56:16,129 --> 01:56:13,199
looking at these jubilant Sailors here

2456
01:56:20,149 --> 01:56:16,139
in the mission control center in Kuru

2457
01:56:22,370 --> 01:56:20,159
the European Spaceport in South America

2458
01:56:25,729 --> 01:56:22,380
there are the teams the mission

2459
01:56:29,990 --> 01:56:25,739
controllers have done a fantastic job it

2460
01:56:37,370 --> 01:56:33,770
from the European Spaceport here on the

2461
01:56:40,330 --> 01:56:37,380
equator in the Amazon rainforest

2462
01:56:44,209 --> 01:56:40,340
hoping to go over now to NASA

2463
01:56:52,330 --> 01:56:44,219

administrator Bill Nelson to get some

2464
01:56:57,229 --> 01:56:54,589
our station seven and a half minutes

2465
01:57:00,890 --> 01:56:57,239
give or take and subsequence continues

2466
01:57:02,870 --> 01:57:00,900
that are adir released part one and our

2467
01:57:22,810 --> 01:57:02,880
TCF configurations

2468
01:57:34,129 --> 01:57:27,190
not feeling the aw6 config

2469
01:58:27,669 --> 01:57:34,139
[Music]

2470
01:58:33,410 --> 01:58:31,010
in the range operations manager has been

2471
01:58:37,310 --> 01:58:33,420
calling out the Milestones throughout

2472
01:58:45,350 --> 01:58:42,109
and the esa teams responsible for so

2473
01:58:47,089 --> 01:58:45,360
much fabulous work great teamwork here

2474
01:58:49,850 --> 01:58:47,099
to get the web

2475
01:58:52,010 --> 01:58:49,860
telescope into space and Webb is now

2476
01:58:54,050 --> 01:58:52,020
heading out on its Journey

2477
01:58:55,729 --> 01:58:54,060
on its own

2478
01:58:57,229 --> 01:58:55,739
with the mission controllers the

2479
01:59:00,050 --> 01:58:57,239
telescope mission control is in

2480
01:59:02,709 --> 01:59:00,060
Baltimore following those

2481
01:59:06,709 --> 01:59:02,719
incredibly important first

2482
01:59:09,709 --> 01:59:06,719
actions and first operations

2483
01:59:12,589 --> 01:59:09,719
Charlotte besco there who's responsible

2484
01:59:14,570 --> 01:59:12,599
for the eser operations here at the

2485
01:59:16,669 --> 01:59:14,580
Spaceport

2486
01:59:18,770 --> 01:59:16,679
we're hanging in there waiting and

2487
01:59:21,290 --> 01:59:18,780
hoping to hear from the NASA

2488
01:59:25,010 --> 01:59:21,300

administrator Bill Nelson who I have

2489
01:59:27,410 --> 01:59:25,020
absolutely no doubt will be as jubilant

2490
01:59:30,410 --> 01:59:27,420
as everybody here at the piano Space

2491
01:59:36,709 --> 01:59:33,430
Charlotte besco

2492
01:59:38,390 --> 01:59:36,719
who has been working for I think most of

2493
01:59:40,310 --> 01:59:38,400
her professional life in human space

2494
01:59:42,169 --> 01:59:40,320
flight and now heading up the Easter

2495
01:59:45,290 --> 01:59:42,179
operations here at the European

2496
01:59:45,300 --> 01:59:56,390
foreign

2497
02:00:19,490 --> 02:00:04,810
[Music]

2498
02:00:19,500 --> 02:00:22,520
yeah

2499
02:00:29,290 --> 02:00:25,149
[Music]

2500
02:00:34,010 --> 02:00:29,300
okay Katie thank you very much

2501
02:00:37,629 --> 02:00:34,020
this is a great life not only for

2502
02:00:39,310 --> 02:00:37,639
America for our European and Canadian

2503
02:00:42,709 --> 02:00:39,320
Partners

2504
02:00:45,550 --> 02:00:42,719
but it's a great day

2505
02:00:48,910 --> 02:00:45,560
for planet Earth

2506
02:00:52,729 --> 02:00:48,920
uh thanks to the team

2507
02:00:57,649 --> 02:00:52,739
uh you all have just been incredible

2508
02:01:01,310 --> 02:00:57,659
and over three decades you produced this

2509
02:01:04,550 --> 02:01:01,320
telescope that is now going to take us

2510
02:01:07,669 --> 02:01:04,560
back in time it's a time machine

2511
02:01:11,810 --> 02:01:07,679
it's going to take us back to the very

2512
02:01:15,109 --> 02:01:11,820
beginnings of the universe

2513
02:01:18,770 --> 02:01:15,119

we are going to discover incredible

2514
02:01:22,910 --> 02:01:18,780
things that we never imagined

2515
02:01:25,910 --> 02:01:22,920
and isn't that typical of this team

2516
02:01:29,689 --> 02:01:25,920
where the impossible

2517
02:01:33,770 --> 02:01:29,699
comes possible

2518
02:01:37,729 --> 02:01:33,780
I can't thank you enough on on behalf of

2519
02:01:41,030 --> 02:01:37,739
a grateful United States government

2520
02:01:44,089 --> 02:01:41,040
I can't thank our our partners in Europe

2521
02:01:47,450 --> 02:01:44,099
and Canada enough

2522
02:01:48,890 --> 02:01:47,460
uh the French launch Team the Aryan

2523
02:01:51,250 --> 02:01:48,900
spice

2524
02:01:54,709 --> 02:01:51,260
the Flawless

2525
02:01:55,850 --> 02:01:54,719
Perfection of the vehicle

2526
02:01:58,669 --> 02:01:55,860
foreign

2527
02:02:00,050 --> 02:01:58,679
and now we have to realize there there

2528
02:02:03,109 --> 02:02:00,060
are still

2529
02:02:05,410 --> 02:02:03,119
uh innumerable things that have to work

2530
02:02:08,629 --> 02:02:05,420
and they have to work perfectly

2531
02:02:10,790 --> 02:02:08,639
344 of them

2532
02:02:13,669 --> 02:02:10,800
but we know

2533
02:02:16,850 --> 02:02:13,679
that in great reward

2534
02:02:20,149 --> 02:02:16,860
there is great risk

2535
02:02:23,030 --> 02:02:20,159
and that's what this business is all

2536
02:02:26,570 --> 02:02:23,040
about and that's why we dare

2537
02:02:35,750 --> 02:02:30,770
the James Webb Space Telescope is

2538
02:02:39,350 --> 02:02:35,760

very much a part of that expiration

2539
02:02:42,410 --> 02:02:39,360
it's significant that we had the delays

2540
02:02:45,290 --> 02:02:42,420
and it kept us all the way to today

2541
02:02:48,229 --> 02:02:45,300
Christmas Day

2542
02:02:52,490 --> 02:02:48,239
when others long ago

2543
02:02:55,250 --> 02:02:52,500
peered up into the sky and saw

2544
02:02:59,629 --> 02:02:55,260
Stars

2545
02:03:00,709 --> 02:02:59,639
but it's also another Millennia before

2546
02:03:05,990 --> 02:03:00,719
that

2547
02:03:07,850 --> 02:03:06,000
grazing his sheep would look up at the

2548
02:03:11,149 --> 02:03:07,860
night sky

2549
02:03:15,649 --> 02:03:11,159
he became a poet

2550
02:03:20,209 --> 02:03:15,659
and he pinned the words

2551
02:03:25,430 --> 02:03:20,219
the heavens declare the glory of God

2552
02:03:28,550 --> 02:03:25,440
the firmament shows his handiwork

2553
02:03:32,169 --> 02:03:28,560
that Shepherd that poet

2554
02:03:39,770 --> 02:03:36,589
and those Immortal words in Psalm 19

2555
02:03:47,990 --> 02:03:44,450
the Expressions that we have today

2556
02:03:49,430 --> 02:03:48,000
the handiwork of God as WE peer back in

2557
02:03:53,149 --> 02:03:49,440
time

2558
02:03:56,510 --> 02:03:53,159
over 13 billion years ago capture the

2559
02:03:59,930 --> 02:03:56,520
light from the very beginning of the

2560
02:04:08,169 --> 02:04:04,010
my congratulations to the team

2561
02:04:12,010 --> 02:04:08,179
my congratulations to NASA

2562
02:04:19,370 --> 02:04:17,629
go James Webb Space Telescope

2563
02:04:27,470 --> 02:04:19,380

God bless you

2564
02:04:27,480 --> 02:04:31,370
back to you Katie

2565
02:04:41,530 --> 02:04:34,430
Nelson

2566
02:04:44,089 --> 02:04:41,540
for those incredibly moving words

2567
02:04:46,910 --> 02:04:44,099
indeed we're heading out to look at the

2568
02:04:49,609 --> 02:04:46,920
first light of the universe and Bill

2569
02:04:51,830 --> 02:04:49,619
Nelson there we have Stefan Israel with

2570
02:04:54,229 --> 02:04:51,840
us from Aryan space Bill Nelson there

2571
02:04:56,990 --> 02:04:54,239
being so complimentary about the

2572
02:04:59,089 --> 02:04:57,000
Partnerships the teamwork and and thanks

2573
02:05:01,910 --> 02:04:59,099
as well to to you guys for this

2574
02:05:06,229 --> 02:05:01,920
fantastic launch what a day Stefan

2575
02:05:09,109 --> 02:05:06,239
indeed what a Christmas gift today from

2576
02:05:12,350 --> 02:05:09,119
the Guyana Space Center we really want

2577
02:05:14,330 --> 02:05:12,360
to thank NASA for its trust the

2578
02:05:17,030 --> 02:05:14,340
administrator or Bill Nelson we have

2579
02:05:20,530 --> 02:05:17,040
with us Thomas zubon and all his team

2580
02:05:26,689 --> 02:05:23,510
a journey of 20 years we have met

2581
02:05:28,310 --> 02:05:26,699
together we have worked as air I would

2582
02:05:31,729 --> 02:05:28,320
say to make this happen and now it's

2583
02:05:34,069 --> 02:05:31,739
done I want to thank as well uh Isa who

2584
02:05:36,830 --> 02:05:34,079
is formerly our contractor for this

2585
02:05:37,629 --> 02:05:36,840
launch we have Joseph with us we have

2586
02:05:41,149 --> 02:05:37,639
Daniel

2587
02:05:44,290 --> 02:05:41,159
we have worked End by end to make it

2588
02:05:47,510 --> 02:05:44,300

happen I want to thankless

2589
02:05:49,689 --> 02:05:47,520
iron5 design Authority and our daily

2590
02:05:52,430 --> 02:05:49,699
partner here in the green aspect Center

2591
02:05:53,770 --> 02:05:52,440
Philippines with us Brian Claire is with

2592
02:05:57,589 --> 02:05:53,780
us thank you very much

2593
02:05:59,930 --> 02:05:57,599
for sure I want to pay my tribute to

2594
02:06:05,030 --> 02:05:59,940
iron Group which is a prime contractor

2595
02:06:07,370 --> 02:06:05,040
of iron5 mention order of iron space and

2596
02:06:10,490 --> 02:06:07,380
which has delivered so don't show up to

2597
02:06:13,250 --> 02:06:10,500
this stuff and doing so I paired so my

2598
02:06:15,950 --> 02:06:13,260
tribute to iron Space Team the iron

2599
02:06:19,189 --> 02:06:15,960
Space Team I've worked all this year to

2600
02:06:21,709 --> 02:06:19,199
make this 14th launch of the year and

2601
02:06:24,950 --> 02:06:21,719
this very special Mission your

2602
02:06:28,010 --> 02:06:24,960
dedication your professionalism has made

2603
02:06:31,010 --> 02:06:28,020
the success of Tonight Tonight is a

2604
02:06:32,689 --> 02:06:31,020
great step for the space journey it is

2605
02:06:35,109 --> 02:06:32,699
also a great step for the friendship

2606
02:06:38,149 --> 02:06:35,119
between the United States of America

2607
02:06:41,390 --> 02:06:38,159
Europe and France so thank you very much

2608
02:06:43,490 --> 02:06:41,400
to all of us and now I think we can take

2609
02:06:46,310 --> 02:06:43,500
a little bit of a rest but we are going

2610
02:06:48,649 --> 02:06:46,320
now to live with web up to its final

2611
02:06:50,209 --> 02:06:48,659
destination to the regardian point thank

2612
02:06:52,189 --> 02:06:50,219
you very much thanks a lot thank you

2613
02:06:55,010 --> 02:06:52,199

very much Stefan and the director

2614
02:07:01,370 --> 02:06:55,020
general of the European Space Agency is

2615
02:07:01,380 --> 02:07:07,689
foreign

2616
02:07:14,209 --> 02:07:11,450
a Christmas gift today to humanity to

2617
02:07:15,890 --> 02:07:14,219
people to NASA but also to all the

2618
02:07:18,470 --> 02:07:15,900
people in this world because with this

2619
02:07:21,410 --> 02:07:18,480
change web Space Telescope we are really

2620
02:07:23,149 --> 02:07:21,420
enabling new science new excitement but

2621
02:07:25,069 --> 02:07:23,159
also really rewarding all the

2622
02:07:27,290 --> 02:07:25,079
engineering and all the effort that has

2623
02:07:30,530 --> 02:07:27,300
gone into it and I'm really grateful for

2624
02:07:32,689 --> 02:07:30,540
this success where we have delivered a

2625
02:07:34,850 --> 02:07:32,699
mission into space it's power positive

2626
02:07:37,010 --> 02:07:34,860
everything is nominal and I'm very

2627
02:07:39,470 --> 02:07:37,020
grateful to Aaron's pass and all our

2628
02:07:41,689 --> 02:07:39,480
partners for all this work Stefan Israel

2629
02:07:43,910 --> 02:07:41,699
has already thanked all our partners but

2630
02:07:46,069 --> 02:07:43,920
let me also just very briefly recall

2631
02:07:48,589 --> 02:07:46,079
that this was really a team effort it

2632
02:07:50,870 --> 02:07:48,599
was a team effort of the European team

2633
02:07:52,910 --> 02:07:50,880
we call it the team Europe the European

2634
02:07:55,609 --> 02:07:52,920
Space Agency obviously providing the

2635
02:07:58,609 --> 02:07:55,619
launcher with uh aryan's pass witness

2636
02:08:00,169 --> 02:07:58,619
with Aryan group with all our partners

2637
02:08:01,850 --> 02:08:00,179
which we have to make this possible and

2638
02:08:03,770 --> 02:08:01,860

everybody would like to to spend a

2639
02:08:05,990 --> 02:08:03,780
minute to thank all the people involved

2640
02:08:08,810 --> 02:08:06,000
in this today is Christmas some of them

2641
02:08:11,270 --> 02:08:08,820
are here have been spent weeks here in

2642
02:08:12,830 --> 02:08:11,280
French Guyana or at the site sir where

2643
02:08:14,569 --> 02:08:12,840
they've been working it's a special

2644
02:08:16,310 --> 02:08:14,579
moment I know we have made sacrifices

2645
02:08:18,470 --> 02:08:16,320
but it's a special moment and really

2646
02:08:21,109 --> 02:08:18,480
thank you for my help but also thank you

2647
02:08:24,229 --> 02:08:21,119
NASA Will Nelson was speaking before

2648
02:08:26,750 --> 02:08:24,239
Thomas here with his team fantastic

2649
02:08:29,330 --> 02:08:26,760
cooperation and this cooperation between

2650
02:08:32,390 --> 02:08:29,340
NASA and European team is really

2651
02:08:34,729 --> 02:08:32,400
exemplary and a big big thank you Thomas

2652
02:08:36,589 --> 02:08:34,739
and your people for what you have done

2653
02:08:39,410 --> 02:08:36,599
together with us that you have entrusted

2654
02:08:41,390 --> 02:08:39,420
this precious spacecraft to us which we

2655
02:08:42,890 --> 02:08:41,400
could deliver and I'm so happy today I

2656
02:08:44,750 --> 02:08:42,900
can tell you this is a very special

2657
02:08:46,189 --> 02:08:44,760
moment it's very nerve-wracking I

2658
02:08:48,109 --> 02:08:46,199
couldn't do launches every single day

2659
02:08:50,390 --> 02:08:48,119
this would not be good for my life

2660
02:08:53,030 --> 02:08:50,400
expectancy but I can tell you this was

2661
02:08:54,950 --> 02:08:53,040
very exciting very nerve-wracking but

2662
02:08:57,830 --> 02:08:54,960
really really very successful and thank

2663
02:08:59,930 --> 02:08:57,840

you for my side and congratulations NASA

2664
02:09:01,729 --> 02:08:59,940
congratulations science Community big

2665
02:09:06,970 --> 02:09:01,739
Sciences to come and really really happy

2666
02:09:13,729 --> 02:09:10,970
so the president of the kness which is

2667
02:09:15,830 --> 02:09:13,739
the French space agency is Philip batis

2668
02:09:17,930 --> 02:09:15,840
and he joins us now Philippe thank you

2669
02:09:19,669 --> 02:09:17,940
very much well as everybody here in the

2670
02:09:21,109 --> 02:09:19,679
room I'm very very happy to see that

2671
02:09:23,750 --> 02:09:21,119
everything was fine everything is

2672
02:09:26,990 --> 02:09:23,760
nominal it's great news great news for

2673
02:09:28,850 --> 02:09:27,000
Nazar for Iza for all of us I just want

2674
02:09:30,890 --> 02:09:28,860
to thank all the people who will be

2675
02:09:33,410 --> 02:09:30,900
working over the last 20 years on this

2676
02:09:35,569 --> 02:09:33,420
on this incredible instrument on this

2677
02:09:37,609 --> 02:09:35,579
telescope but also people who have been

2678
02:09:40,010 --> 02:09:37,619
working on the lounge I'm thinking

2679
02:09:42,470 --> 02:09:40,020
especially on the 500 people who have

2680
02:09:44,689 --> 02:09:42,480
been working yesterday yesterday during

2681
02:09:46,129 --> 02:09:44,699
Christmas eve two to three person to

2682
02:09:48,169 --> 02:09:46,139
prepare the round to prepare the

2683
02:09:50,870 --> 02:09:48,179
successful launch and I really want to

2684
02:09:54,470 --> 02:09:50,880
thank you to thank them very much people

2685
02:09:56,689 --> 02:09:54,480
from kness from from Iza from NASA from

2686
02:09:59,030 --> 02:09:56,699
ins pass and from all the partners we're

2687
02:10:02,209 --> 02:09:59,040
around I also want to to give a special

2688
02:10:04,790 --> 02:10:02,219

thanks to the French Armed Force of

2689
02:10:06,649 --> 02:10:04,800
glian who make who made these Lounge

2690
02:10:09,229 --> 02:10:06,659
possible they were monitoring everything

2691
02:10:11,390 --> 02:10:09,239
and without them nothing would be

2692
02:10:13,490 --> 02:10:11,400
possible here on this side so thank you

2693
02:10:16,550 --> 02:10:13,500
very much for all of them and thanks

2694
02:10:19,310 --> 02:10:16,560
also to all people from Guyana who are

2695
02:10:21,229 --> 02:10:19,320
supporting uh this incredible European

2696
02:10:22,960 --> 02:10:21,239
Spaceport that we have here today thank

2697
02:10:26,810 --> 02:10:22,970
you very much

2698
02:10:30,470 --> 02:10:26,820
[Applause]

2699
02:10:32,810 --> 02:10:30,480
a pre-recorded message from Lisa

2700
02:10:35,270 --> 02:10:32,820
Campbell who is the president of the

2701
02:10:36,410 --> 02:10:35,280
Canadian space agency

2702
02:10:38,810 --> 02:10:36,420
thank you

2703
02:10:40,669 --> 02:10:38,820
I am so proud to witness the highly

2704
02:10:44,229 --> 02:10:40,679
anticipated launch of this extraordinary

2705
02:10:49,310 --> 02:10:46,910
it's a remarkable feat of international

2706
02:10:50,870 --> 02:10:49,320
collaboration to think of all the

2707
02:10:53,450 --> 02:10:50,880
scientific and Engineering coordination

2708
02:10:56,209 --> 02:10:53,460
that made today's events possible

2709
02:10:58,189 --> 02:10:56,219
in fact Webb is the result of close to

2710
02:10:59,450 --> 02:10:58,199
25 years of Planning and Development

2711
02:11:08,209 --> 02:10:59,460
with our International Partners

2712
02:11:12,229 --> 02:11:09,890
we're playing a big role in the world

2713
02:11:15,530 --> 02:11:12,239

stage Canadian Excellence has helped

2714
02:11:17,390 --> 02:11:15,540
make this Flagship telescope reality our

2715
02:11:19,609 --> 02:11:17,400
participation in web is extremely

2716
02:11:21,530 --> 02:11:19,619
significant it's the largest space

2717
02:11:23,750 --> 02:11:21,540
science project in the 60-year history

2718
02:11:31,910 --> 02:11:23,760
of our space program

2719
02:11:35,510 --> 02:11:33,770
the successful launch of this

2720
02:11:37,729 --> 02:11:35,520
groundbreaking telescope bolsters

2721
02:11:40,069 --> 02:11:37,739
Humanity's quest for knowledge of the

2722
02:11:41,870 --> 02:11:40,079
cosmos and ignites interest in astronomy

2723
02:11:44,510 --> 02:11:41,880
for a new generation

2724
02:11:46,669 --> 02:11:44,520
the Canadian space agency is proud to

2725
02:11:48,290 --> 02:11:46,679
have contributed critical instruments to

2726
02:11:50,750 --> 02:11:48,300
this large-scale partnership as part of

2727
02:11:52,430 --> 02:11:50,760
a global effort to Spur the next great

2728
02:11:54,350 --> 02:11:52,440
scientific leap

2729
02:12:00,770 --> 02:11:54,360
we're thrilled to take part in a mission

2730
02:12:04,910 --> 02:12:02,990
Canadian astronomers are excited to use

2731
02:12:07,189 --> 02:12:04,920
Webb's data and benefit from the

2732
02:12:09,830 --> 02:12:07,199
tremendous science opportunities offered

2733
02:12:11,930 --> 02:12:09,840
by this one-of-a-kind Observatory we

2734
02:12:14,470 --> 02:12:11,940
congratulate the Fantastic Team of over

2735
02:12:16,850 --> 02:12:14,480
10 000 people who put all their skills

2736
02:12:20,770 --> 02:12:16,860
Ingenuity and effort into developing the

2737
02:12:23,030 --> 02:12:20,780
telescope for more than two decades

2738
02:12:26,330 --> 02:12:23,040

Canadians will follow your journey with

2739
02:12:32,629 --> 02:12:29,030
and now I'd like to hand you over to

2740
02:12:34,850 --> 02:12:32,639
Thomas the brooken who is the head of

2741
02:12:37,669 --> 02:12:34,860
science at Nasa Thomas

2742
02:12:40,069 --> 02:12:37,679
well Katie what an emotional day what an

2743
02:12:42,589 --> 02:12:40,079
emotional time we're here all of us who

2744
02:12:44,990 --> 02:12:42,599
have been working together for so many

2745
02:12:47,149 --> 02:12:45,000
weeks months and years and more

2746
02:12:50,089 --> 02:12:47,159
importantly our teams are taking Team

2747
02:12:53,030 --> 02:12:50,099
images behind us who have put in front

2748
02:12:55,250 --> 02:12:53,040
of their lives as a highest priority for

2749
02:12:57,410 --> 02:12:55,260
so many of them to actually get this

2750
02:12:59,870 --> 02:12:57,420
done and get it done here working even

2751
02:13:02,330 --> 02:12:59,880
during the holiday times I just couldn't

2752
02:13:05,330 --> 02:13:02,340
be more grateful to the many uh whether

2753
02:13:07,550 --> 02:13:05,340
it's arianspas the European Space Agency

2754
02:13:10,910 --> 02:13:07,560
all the amazing people around the French

2755
02:13:13,550 --> 02:13:10,920
Guiana the the forces that are here all

2756
02:13:16,609 --> 02:13:13,560
the good people that have been such

2757
02:13:18,649 --> 02:13:16,619
great hosts to our teams uh all of them

2758
02:13:21,350 --> 02:13:18,659
I want to thank you know whenever we

2759
02:13:23,750 --> 02:13:21,360
look at launches they're both an ending

2760
02:13:25,729 --> 02:13:23,760
and a beginning they're an ending of an

2761
02:13:30,470 --> 02:13:25,739
engineering project on the ground

2762
02:13:32,149 --> 02:13:30,480
and uh with many uh amazing hours and

2763
02:13:34,129 --> 02:13:32,159

challenges that are there

2764
02:13:36,830 --> 02:13:34,139
but they're a beginning they're a

2765
02:13:39,350 --> 02:13:36,840
beginning of one of the most amazing

2766
02:13:42,950 --> 02:13:39,360
missions that Humanity has conceived and

2767
02:13:45,169 --> 02:13:42,960
I'm so excited uh to look forward to the

2768
02:13:47,990 --> 02:13:45,179
next setup of this telescope and all the

2769
02:13:49,810 --> 02:13:48,000
signs to come thanks to everybody this

2770
02:13:52,490 --> 02:13:49,820
is what we can do when we come together

2771
02:13:55,729 --> 02:13:52,500
kds1 humans it's just absolutely

2772
02:13:58,550 --> 02:13:55,739
incredible it's wonderful and Dr Z thank

2773
02:14:01,129 --> 02:13:58,560
you very much massive congratulations to

2774
02:14:03,709 --> 02:14:01,139
you all to everybody who's involved in

2775
02:14:06,050 --> 02:14:03,719
today huge congratulations from

2776
02:14:09,109 --> 02:14:06,060
everybody here at the Guyana Space

2777
02:14:11,330 --> 02:14:09,119
Center and also our very best wishes to

2778
02:14:13,490 --> 02:14:11,340
all the teams in Baltimore who are now

2779
02:14:16,609 --> 02:14:13,500
monitoring those early operations of the

2780
02:14:19,850 --> 02:14:16,619
telescope as it starts to unfold I'm

2781
02:14:21,830 --> 02:14:19,860
going to hand you back now to um to

2782
02:14:24,109 --> 02:14:21,840
Goddard but before I do I just want to

2783
02:14:25,490 --> 02:14:24,119
say from all of us here at the Guyana

2784
02:14:31,069 --> 02:14:25,500
Space Center

2785
02:14:34,629 --> 02:14:32,990
thank you Katie I can tell you that here

2786
02:14:36,709 --> 02:14:34,639
it feels like the dawn of a new age

2787
02:14:38,870 --> 02:14:36,719
historians of the future will divide our

2788
02:14:41,689 --> 02:14:38,880

understanding of the cosmos into eras

2789
02:14:43,370 --> 02:14:41,699
before web and after web web is this

2790
02:14:45,770 --> 02:14:43,380
Milestone that marks a bold effort to

2791
02:14:48,649 --> 02:14:45,780
look backwards in time to the mysterious

2792
02:14:50,810 --> 02:14:48,659
origins of everything

2793
02:14:52,490 --> 02:14:50,820
of course we move at human time scale so

2794
02:14:54,290 --> 02:14:52,500
here's what's coming up in the next few

2795
02:14:56,089 --> 02:14:54,300
weeks Engineers will unfold Webb's

2796
02:14:57,890 --> 02:14:56,099
critical sun shield to begin chilling

2797
02:15:00,589 --> 02:14:57,900
the telescope to unimaginably cold

2798
02:15:02,689 --> 02:15:00,599
temperatures they'll extend the DTA the

2799
02:15:04,669 --> 02:15:02,699
Deployable Tower assembly the structure

2800
02:15:06,770 --> 02:15:04,679
that supports the great golden mirror

2801
02:15:08,390 --> 02:15:06,780
and then finally they'll unfold that

2802
02:15:10,669 --> 02:15:08,400
mirror and begin the process of

2803
02:15:12,530 --> 02:15:10,679
fine-tuning the system for work

2804
02:15:14,149 --> 02:15:12,540
through it all we intend to bring you

2805
02:15:15,589 --> 02:15:14,159
live coverage of all the important

2806
02:15:17,629 --> 02:15:15,599
events that are happening as long as

2807
02:15:19,069 --> 02:15:17,639
along with expert commentary and

2808
02:15:20,930 --> 02:15:19,079
extraordinary images from the mission

2809
02:15:23,330 --> 02:15:20,940
operations center and our own broadcast

2810
02:15:25,250 --> 02:15:23,340
headquarters here at Webb's home the

2811
02:15:26,870 --> 02:15:25,260
NASA Goddard space flight center

2812
02:15:28,370 --> 02:15:26,880
stay with us over the next few weeks

2813
02:15:29,510 --> 02:15:28,380

because the adventure is just getting

2814
02:15:31,850 --> 02:15:29,520
started

2815
02:15:33,649 --> 02:15:31,860
speaking for everyone on the team it's

2816
02:15:35,930 --> 02:15:33,659
been a great pleasure to be with you

2817
02:15:36,950 --> 02:15:35,940
here today I'm Michelle Thaller and

2818
02:15:39,229 --> 02:15:36,960
you've been watching special live

2819
02:15:41,330 --> 02:15:39,239
coverage of the historic launch of the