1
00:05:33,100 --> 00:05:41,499
[Music]

2
00:05:46,249 --> 00:05:43,700
from Vandenberg Air Force Base in

3
00:05:48,230 --> 00:05:46,259
central California you're watching live

4
00:05:51,140 --> 00:05:48,240
launch coverage of NASA's interior

5
00:05:54,499 --> 00:05:51,150
exploration using seismic investigations

6
00:05:59,019 --> 00:05:54,509
geodesy and heat transport or insight

7
00:06:01,610 --> 00:05:59,029
spacecraft to study the interior of Mars

8
00:06:02,329 --> 00:06:01,620
hi I'm Stephanie Martin and thanks for

9
00:06:04,879 --> 00:06:02,339
joining us

10
00:06:07,549 --> 00:06:04,889
NASA's insight mission is the 20th

11
00:06:09,320 --> 00:06:07,559
mission to Mars previous missions have

12
00:06:13,399 --> 00:06:09,330
taught us a lot about the planet's

13
00:06:15,709 --> 00:06:13,409

surface atmosphere and ionosphere inside

14
00:06:18,649 --> 00:06:15,719
however will teach us about what goes on

15
00:06:21,890 --> 00:06:18,659
a mile or even 2,000 miles below the

16
00:06:24,170 --> 00:06:21,900
surface this will help us understand how

17
00:06:26,480 --> 00:06:24,180
rocky planets like Mars and Earth were

18
00:06:30,649 --> 00:06:26,490
formed and why the two planets are so

19
00:06:33,200 --> 00:06:30,659
different 4.5 billion years later today

20
00:06:36,379 --> 00:06:33,210
we have team coverage from NASA's Joshua

21
00:06:39,110 --> 00:06:36,389
Finch Torrey McClendon Blair Allen Chris

22
00:06:41,059 --> 00:06:39,120
Gersh and Franklin Fitzgerald who are

23
00:06:45,439 --> 00:06:41,069
with launch teams across the Air Force

24
00:06:48,529 --> 00:06:45,449
Base insight is flying on United Launch

25
00:06:51,499 --> 00:06:48,539
alliances Atlas five 401 configuration

26
00:06:54,920 --> 00:06:51,509
and has a to our launch window starting

27
00:06:57,320 --> 00:06:54,930
at 405 this morning Pacific time or 7:05

28
00:06:59,600 --> 00:06:57,330
Eastern Time this means that launch

29
00:07:01,999 --> 00:06:59,610
teams have two hours from to liftoff

30
00:07:05,600 --> 00:07:02,009
from Space Launch Complex 3 at

31
00:07:07,939 --> 00:07:05,610
Vandenberg Air Force Base in sight is

32
00:07:11,540 --> 00:07:07,949
set to land on November 26 in the

33
00:07:14,469 --> 00:07:11,550
Elysium Lanisha region of Mars which is

34
00:07:17,329 --> 00:07:14,479
about 373 miles from the Gale Crater

35
00:07:21,589 --> 00:07:17,339
where NASA's Curiosity rover touched

36
00:07:23,239 --> 00:07:21,599
down in August 2012 after insight lands

37
00:07:25,339 --> 00:07:23,249
it will spend seven hundred and twenty

38
00:07:27,939 --> 00:07:25,349

eight days or a little over a Martian

39
00:07:30,469 --> 00:07:27,949
year studying the planets interior

40
00:07:33,469 --> 00:07:30,479
insight will be the red planet's first

41
00:07:36,409 --> 00:07:33,479
thorough checkup since it formed 4.5

42
00:07:38,749 --> 00:07:36,419
billion years ago insight will take the

43
00:07:41,920 --> 00:07:38,759
vital signs of Mars specifically its

44
00:07:44,839 --> 00:07:41,930
pulse its temperature and its reflexes

45
00:07:46,909 --> 00:07:44,849
after the spacecraft's roughly six month

46
00:07:50,360 --> 00:07:46,919
journey to Mars it will begin its

47
00:07:52,730 --> 00:07:50,370
landing phase insight enters the Martian

48
00:07:55,490 --> 00:07:52,740
atmosphere traveling at 13,000

49
00:07:58,310 --> 00:07:55,500
200 miles per hour and deploys its

50
00:07:59,780 --> 00:07:58,320
parachute and ultimately slows down to

51
00:08:02,690 --> 00:07:59,790
about 5 miles per hour

52
00:08:04,010 --> 00:08:02,700
for touchdown one minute later insight

53
00:08:06,410 --> 00:08:04,020
will begin its surface operations

54
00:08:08,990 --> 00:08:06,420
checking out the Landers health

55
00:08:12,170 --> 00:08:09,000
indicators and then deploying its solar

56
00:08:13,910 --> 00:08:12,180
arrays it will take about ten weeks to

57
00:08:17,300 --> 00:08:13,920
place all the instruments on the ground

58
00:08:20,750 --> 00:08:17,310
about seven weeks later it will sink

59
00:08:23,990 --> 00:08:20,760
itself hammering heat probe about 10 to

60
00:08:27,050 --> 00:08:24,000
16 feet into the Martian soil there are

61
00:08:29,960 --> 00:08:27,060
also two briefcase sized cube sets known

62
00:08:32,090 --> 00:08:29,970
as Mars cube one or Marco hitching a

63
00:08:34,180 --> 00:08:32,100

ride on today's mission as a part of a

64
00:08:37,670 --> 00:08:34,190
NASA technology demonstration mission

65
00:08:40,040 --> 00:08:37,680
Marco a and Marco B will deploy from the

66
00:08:42,530 --> 00:08:40,050
second stage of the Atlas 5 about a

67
00:08:47,480 --> 00:08:42,540
minute after insight separates and will

68
00:08:49,550 --> 00:08:47,490
then fly toward Mars we are now about 30

69
00:08:51,770 --> 00:08:49,560
minutes away from today's launch let's

70
00:08:53,660 --> 00:08:51,780
check in with NASA's Joshua Finch in the

71
00:08:55,840 --> 00:08:53,670
mission director Center for a status on

72
00:08:58,040 --> 00:08:55,850
today's launch and a weather update Josh

73
00:08:59,840 --> 00:08:58,050
thank you very much Stephanie I'm in the

74
00:09:02,030 --> 00:08:59,850
mission directors Center at Vandenberg

75
00:09:03,530 --> 00:09:02,040
Air Force Base inside of that last

76
00:09:05,360 --> 00:09:03,540
launch control at the remote launch

77
00:09:07,250 --> 00:09:05,370
control center NASA launch manager Tim

78
00:09:09,530 --> 00:09:07,260
Dunn and United Launch Alliance launch

79
00:09:11,360 --> 00:09:09,540
director luma and Jerry are working

80
00:09:13,310 --> 00:09:11,370
through their step stay with the

81
00:09:15,410 --> 00:09:13,320
countdown toward liftoff the entire

82
00:09:17,090 --> 00:09:15,420
launch team began on riving on console a

83
00:09:19,640 --> 00:09:17,100
few hours ago and are working through

84
00:09:21,500 --> 00:09:19,650
the necessary steps we are expecting to

85
00:09:23,690 --> 00:09:21,510
receive a weather report from the US Air

86
00:09:26,510 --> 00:09:23,700
Force a 30th Space Wing located at

87
00:09:28,880 --> 00:09:26,520
Vandenberg in just about 30 seconds and

88
00:09:31,010 --> 00:09:28,890

we'll bring that to you the weather team

89
00:09:32,570 --> 00:09:31,020
looks into a hole in sight a hole inside

90
00:09:34,490 --> 00:09:32,580
of weather related details such as wind

91
00:09:35,720 --> 00:09:34,500
speed cloud coverage potential for

92
00:09:37,520 --> 00:09:35,730
lightning in the surrounding area and

93
00:09:40,660 --> 00:09:37,530
even solar weather which launch teams

94
00:09:42,350 --> 00:09:40,670
need to know before committing to launch

95
00:09:44,330 --> 00:09:42,360
tonight's launch is a collaborative

96
00:09:46,630 --> 00:09:44,340
effort between NASA United Launch

97
00:09:50,660 --> 00:09:46,640
Alliance and the United States Air Force

98
00:09:57,080 --> 00:09:50,670
and that briefings in about five seconds

99
00:09:58,790 --> 00:09:57,090
and we'll listen in attention on the

100
00:09:59,450 --> 00:09:58,800
weather conference set standby for the

101
00:10:03,740 --> 00:09:59,460
weather briefing

102
00:10:05,220 --> 00:10:03,750
all stations acknowledge elbow L RC RC

103
00:10:15,780 --> 00:10:05,230
LD LD

104
00:10:19,650 --> 00:10:15,790
nlm in elimb FLD OD OD but look we

105
00:10:21,570 --> 00:10:19,660
pulling a s LD nothing heard l well

106
00:10:22,890 --> 00:10:21,580
provides latest l 0 status for safety

107
00:10:25,560 --> 00:10:22,900
and launch agency constraints with

108
00:10:28,560 --> 00:10:25,570
probabilities of violations this is the

109
00:10:33,360 --> 00:10:28,570
elbow for Range Safety weather is green

110
00:10:36,300 --> 00:10:33,370
with the T 0 POV of 0% with no areas of

111
00:10:40,260 --> 00:10:36,310
concern the launch agency weather is

112
00:10:44,280 --> 00:10:40,270
green with the T 0 POV of 0% with no

113
00:10:47,970 --> 00:10:44,290

areas of concern the overall POV is 0%

114
00:10:51,630 --> 00:10:47,980
with no areas of concern the POV for the

115
00:10:53,880 --> 00:10:51,640
scrub day t0 is 80% with an area of

116
00:10:57,630 --> 00:10:53,890
concern for Range Safety launch

117
00:10:59,520 --> 00:10:57,640
visibility this concludes my brief ello

118
00:11:01,800 --> 00:10:59,530
indicates clear to proceed all stations

119
00:11:09,780 --> 00:11:01,810
report questions or acknowledged elbow

120
00:11:14,340 --> 00:11:09,790
elbow RC RC LD LD n LM in Olympia AFL d

121
00:11:19,740 --> 00:11:14,350
OD OD flick but with her conference that

122
00:11:21,420 --> 00:11:19,750
clear and as you just heard that was the

123
00:11:23,430 --> 00:11:21,430
launch weather officer from the 30th

124
00:11:24,660 --> 00:11:23,440
Space Wing lieutenant Williams giving

125
00:11:26,610 --> 00:11:24,670
launch teams that our final weather

126
00:11:28,560 --> 00:11:26,620
briefing before tonight's launch there

127
00:11:30,960 --> 00:11:28,570
is a zero percent probability of

128
00:11:32,130 --> 00:11:30,970
violation for tonight's launch the only

129
00:11:35,250 --> 00:11:32,140
concerns initially were a launch

130
00:11:36,540 --> 00:11:35,260
visibility as you can see on your screen

131
00:11:38,700 --> 00:11:36,550
when showing the rocket there is a lot

132
00:11:40,380 --> 00:11:38,710
of fog in the area an area of marine fog

133
00:11:41,640 --> 00:11:40,390
sort of settling around the paddle

134
00:11:44,730 --> 00:11:41,650
though that's not a constraint for

135
00:11:47,730 --> 00:11:44,740
launch tonight so good news for the

136
00:11:49,560 --> 00:11:47,740
launch teams as I mentioned this is a

137
00:11:51,330 --> 00:11:49,570
collaborative effort between NASA United

138
00:11:52,950 --> 00:11:51,340

Launch Alliance and the US Air Force the

139
00:11:54,210 --> 00:11:52,960
Air Force not only briefs the launch

140
00:11:56,040 --> 00:11:54,220
teams of weather which could impact

141
00:11:57,810 --> 00:11:56,050
launch but they also keep the launch

142
00:11:59,460 --> 00:11:57,820
team aware of other considerations on

143
00:12:02,460 --> 00:11:59,470
the western range including telemetry

144
00:12:05,400 --> 00:12:02,470
Public Safety and update teams about

145
00:12:07,200 --> 00:12:05,410
colas Kohl's is in reference to

146
00:12:08,730 --> 00:12:07,210
collision avoidance analysis done by the

147
00:12:10,920 --> 00:12:08,740
US Air Force team one of the

148
00:12:12,360 --> 00:12:10,930
considerations is objects in space for

149
00:12:13,650 --> 00:12:12,370
example other satellites around Earth

150
00:12:15,540 --> 00:12:13,660
that could be in the flight path of

151
00:12:16,800 --> 00:12:15,550
Atlas within this to our launch window

152
00:12:18,210 --> 00:12:16,810
there could have been cutouts

153
00:12:18,930 --> 00:12:18,220
we're launch teams would not have been

154
00:12:21,570 --> 00:12:18,940
able to live

155
00:12:23,790 --> 00:12:21,580
however this analysis is complete and we

156
00:12:26,130 --> 00:12:23,800
have no cut outs due to colas during our

157
00:12:27,570 --> 00:12:26,140
launch window tonight right now you're

158
00:12:30,840 --> 00:12:27,580
looking at a live view of the launchpad

159
00:12:33,690 --> 00:12:30,850
Space Launch Complex 3e and the Atlas 5

160
00:12:35,850 --> 00:12:33,700
and its 401 configuration the Atlas 5 is

161
00:12:37,950 --> 00:12:35,860
a two-stage rocket and the number 401

162
00:12:39,660 --> 00:12:37,960
indicates a couple of key features about

163
00:12:42,810 --> 00:12:39,670

the rocket that will power NASA's

164
00:12:44,850 --> 00:12:42,820
insight on its journey to Mars the 4

165
00:12:46,470 --> 00:12:44,860
indicates a four meter fairing inside

166
00:12:48,450 --> 00:12:46,480
that protective cover at the top of the

167
00:12:50,130 --> 00:12:48,460
rocket is where the spacecraft destined

168
00:12:52,470 --> 00:12:50,140
to study the interior of Mars is tucked

169
00:12:54,720 --> 00:12:52,480
away the zero indicates the number of

170
00:12:56,130 --> 00:12:54,730
solid rocket motors in this case there

171
00:12:58,170 --> 00:12:56,140
are no solid rocket boosters for this

172
00:13:01,610 --> 00:12:58,180
mission and the one indicates a single

173
00:13:04,380 --> 00:13:01,620
engine centaur upper stage thus the 401

174
00:13:06,000 --> 00:13:04,390
Space Launch Complex 3 is United Launch

175
00:13:08,790 --> 00:13:06,010
Alliance is at West Coast launch pad for

176
00:13:10,590 --> 00:13:08,800
the Atlas 5 at Space Launch Complex 3

177
00:13:12,480 --> 00:13:10,600
launch vehicle integration testing

178
00:13:14,280 --> 00:13:12,490
spacecraft mate and integration

179
00:13:17,430 --> 00:13:14,290
operations happen in a mobile service

180
00:13:18,810 --> 00:13:17,440
tower just beyond midnight the mobile

181
00:13:21,480 --> 00:13:18,820
service tower was rolled back to its

182
00:13:23,430 --> 00:13:21,490
parking position approximately 250 feet

183
00:13:25,980 --> 00:13:23,440
southeast of the rocket this will be the

184
00:13:30,390 --> 00:13:25,990
15th Atlas 5 launch from Space Launch

185
00:13:32,790 --> 00:13:30,400
Complex 3 right now we're at t-minus 11

186
00:13:34,800 --> 00:13:32,800
minutes 27 seconds all fueling

187
00:13:36,180 --> 00:13:34,810
operations are underway the house 5

188
00:13:38,850 --> 00:13:36,190

booster is being filled with liquid

189
00:13:40,860 --> 00:13:38,860
oxygen and rp1 a rocket great kerosene

190
00:13:43,410 --> 00:13:40,870
that field will power the first stages

191
00:13:45,540 --> 00:13:43,420
rd-180 engine producing more than eight

192
00:13:47,490 --> 00:13:45,550
hundred and sixty thousand pounds of

193
00:13:49,050 --> 00:13:47,500
thrust of theft off the Centaur upper

194
00:13:51,210 --> 00:13:49,060
stage is also being filled with liquid

195
00:13:52,500 --> 00:13:51,220
oxygen and liquid hydrogen the Centaur

196
00:13:55,860 --> 00:13:52,510
upper stage is powered by a single

197
00:13:57,900 --> 00:13:55,870
Aerojet Rocketdyne RL 10 C engine things

198
00:14:00,090 --> 00:13:57,910
are progressing toward liftoff for 405

199
00:14:01,530 --> 00:14:00,100
a.m. Pacific we do have a two-hour

200
00:14:03,510 --> 00:14:01,540
window for tonight's launch attempt

201
00:14:05,760 --> 00:14:03,520
should launch attempts for the teams

202
00:14:07,560 --> 00:14:05,770
need more time liftoff times are

203
00:14:10,050 --> 00:14:07,570
available in 5 min increments throughout

204
00:14:11,400 --> 00:14:10,060
the window so what's going on and while

205
00:14:12,210 --> 00:14:11,410
we follow the action here from Atlas

206
00:14:14,760 --> 00:14:12,220
launch control

207
00:14:17,790 --> 00:14:14,770
we'll go back to you Stephanie thanks

208
00:14:19,680 --> 00:14:17,800
Josh exploring Mars helps us understand

209
00:14:22,830 --> 00:14:19,690
how our solar system was created and how

210
00:14:25,050 --> 00:14:22,840
planets evolve joining us now is NASA's

211
00:14:27,570 --> 00:14:25,060
Chris Kirsch he's standing by with NASA

212
00:14:29,930 --> 00:14:27,580
chief scientist Jim green who can tell

213
00:14:32,060 --> 00:14:29,940

us more about why we study Mars Chris

214
00:14:33,620 --> 00:14:32,070
thanks Stephanie

215
00:14:35,930 --> 00:14:33,630
Jim we're here at Vandenberg Air Force

216
00:14:37,610 --> 00:14:35,940
Base on the west coast and the cool

217
00:14:40,310 --> 00:14:37,620
thing is we're talking about a Mars

218
00:14:42,560 --> 00:14:40,320
mission now that an interplanetary

219
00:14:44,720 --> 00:14:42,570
mission something that's going to leave

220
00:14:47,270 --> 00:14:44,730
the gravity of the earth now what

221
00:14:50,720 --> 00:14:47,280
happens is Vandenberg's great for

222
00:14:53,300 --> 00:14:50,730
putting spacecraft into polar orbit we

223
00:14:56,390 --> 00:14:53,310
fire straight south and that way it goes

224
00:14:58,430 --> 00:14:56,400
over the ocean goes under the South Pole

225
00:15:01,730 --> 00:14:58,440
comes up on the other side of the earth

226
00:15:04,340 --> 00:15:01,740
and then takes this me left and heads on

227
00:15:06,200 --> 00:15:04,350
out to Mars how cool is that that is

228
00:15:08,690 --> 00:15:06,210
cool you know and you've been you've

229
00:15:11,300 --> 00:15:08,700
been studying Mars for a long time used

230
00:15:13,430 --> 00:15:11,310
to be the marsh program manager and now

231
00:15:14,810 --> 00:15:13,440
we have insight and for the first time

232
00:15:16,580 --> 00:15:14,820
we're going to be looking at the vital

233
00:15:18,500 --> 00:15:16,590
signs underneath the planet right a

234
00:15:21,890 --> 00:15:18,510
little bit more about that well indeed

235
00:15:24,050 --> 00:15:21,900
it has some spectacular instruments you

236
00:15:27,890 --> 00:15:24,060
know like the size set of magnets

237
00:15:30,110 --> 00:15:27,900
sorry size a set of seismic measurements

238
00:15:32,390 --> 00:15:30,120

it's already late for me it's a blob but

239
00:15:34,910 --> 00:15:32,400
you flop it down on the surface and and

240
00:15:37,340 --> 00:15:34,920
you measure them you know some of the

241
00:15:40,180 --> 00:15:37,350
most sensitive marsquakes around now we

242
00:15:44,000 --> 00:15:40,190
know Mars is quaking not only do we see

243
00:15:47,840 --> 00:15:44,010
avalanches from orbit like with MRO but

244
00:15:50,120 --> 00:15:47,850
also craters new craters come up and and

245
00:15:52,850 --> 00:15:50,130
when Mars gets hammered like that it's

246
00:15:55,310 --> 00:15:52,860
got to be quaking so seismic waves will

247
00:15:57,260 --> 00:15:55,320
be seen that's for sure and then we'll

248
00:15:59,720 --> 00:15:57,270
tease out what the structure of the

249
00:16:02,960 --> 00:15:59,730
interior structure of Mars is how big is

250
00:16:05,090 --> 00:16:02,970
it its core whether that core is liquid

251
00:16:08,150 --> 00:16:05,100
or at least an outer layer how big is

252
00:16:10,010 --> 00:16:08,160
the mantle and the crust how do you take

253
00:16:10,430 --> 00:16:10,020
all that data we're looking at the vital

254
00:16:12,620 --> 00:16:10,440
signs

255
00:16:14,030 --> 00:16:12,630
we have maven who's studying the you

256
00:16:16,400 --> 00:16:14,040
know the solar wind hitting atmosphere

257
00:16:18,680 --> 00:16:16,410
we have the no curiosity on a plant we

258
00:16:20,450 --> 00:16:18,690
have the satellites orbiting Mars all

259
00:16:23,360 --> 00:16:20,460
that data that we have it sounds like we

260
00:16:26,450 --> 00:16:23,370
know a lot about Mars we do and much of

261
00:16:29,090 --> 00:16:26,460
that we have to connect between these

262
00:16:32,600 --> 00:16:29,100
missions for instance there's a

263
00:16:36,110 --> 00:16:32,610

magnetometer you know an instrument that

264
00:16:38,420 --> 00:16:36,120
measures magnetic fields on insight now

265
00:16:41,840 --> 00:16:38,430
Mars doesn't have a magnetic field right

266
00:16:44,660 --> 00:16:41,850
however the solar wind when it hits the

267
00:16:45,260 --> 00:16:44,670
planet hits the ionosphere causes this

268
00:16:48,290 --> 00:16:45,270
huge

269
00:16:50,780 --> 00:16:48,300
current to occur it can be measured on

270
00:16:53,000 --> 00:16:50,790
the surface by that magnetometer and

271
00:16:55,430 --> 00:16:53,010
someone really hefty solar wind hits

272
00:16:57,500 --> 00:16:55,440
Mars we're gonna see that and that's

273
00:17:00,260 --> 00:16:57,510
going to be really fantastic that that

274
00:17:02,270 --> 00:17:00,270
current will be connected with the maven

275
00:17:04,400 --> 00:17:02,280
mission so we'll understand better the

276
00:17:06,380 --> 00:17:04,410
stripping mechanism that's going on now

277
00:17:07,790 --> 00:17:06,390
I understand on this particular mission

278
00:17:10,460 --> 00:17:07,800
we have something special and I think

279
00:17:14,000 --> 00:17:10,470
you have something in your pocket we do

280
00:17:16,840 --> 00:17:14,010
let's share that with our viewers it's a

281
00:17:22,520 --> 00:17:16,850
little chip let's say I'll go this way

282
00:17:25,670 --> 00:17:22,530
yep and and this little chip has got 2.4

283
00:17:28,280 --> 00:17:25,680
million names on it you know we had a

284
00:17:32,000 --> 00:17:28,290
website we opened the opportunity up for

285
00:17:35,060 --> 00:17:32,010
people to indeed submit their name my

286
00:17:36,770 --> 00:17:35,070
name is onerous okay and so you got to

287
00:17:40,190 --> 00:17:36,780
give me a little time to run out and

288
00:17:42,200 --> 00:17:40,200

weld it to the deck you know I'd say on

289
00:17:43,490 --> 00:17:42,210
that note thank you so much Jim we're

290
00:17:45,860 --> 00:17:43,500
looking forward to the launched in less

291
00:17:47,140 --> 00:17:45,870
than a half hour and I'm sure you got a

292
00:17:50,090 --> 00:17:47,150
pretty good spot to see their lunch

293
00:17:51,130 --> 00:17:50,100
absolutely and of course as we say go

294
00:17:54,110 --> 00:17:51,140
inside

295
00:17:56,240 --> 00:17:54,120
Stefon jim has a ton of energy he's been

296
00:17:57,860 --> 00:17:56,250
up over 24 hours let's take it back to

297
00:18:00,380 --> 00:17:57,870
you thanks so much

298
00:18:02,600 --> 00:18:00,390
the journey to today's launch has been a

299
00:18:04,190 --> 00:18:02,610
long time in the making here's a

300
00:18:05,960 --> 00:18:04,200
highlight reel of all of the work that

301
00:18:07,940 --> 00:18:05,970
the teams here at Vandenberg Air Force

302
00:18:10,680 --> 00:18:07,950
Base have done to prepare for today's

303
00:19:41,390 --> 00:18:17,030
[Music]

304
00:19:46,200 --> 00:19:43,890
we are now about 20 minutes away from

305
00:19:47,730 --> 00:19:46,210
today's launch let's go back to NASA's

306
00:19:50,100 --> 00:19:47,740
Joshua Finch in the mission director

307
00:19:51,660 --> 00:19:50,110
Center for an update Josh Thank You

308
00:19:54,270 --> 00:19:51,670
Stephanie things still progress toward

309
00:19:56,040 --> 00:19:54,280
at liftoff at 4:05 a.m. Pacific time

310
00:19:57,510 --> 00:19:56,050
again I'm in the mission directors

311
00:19:59,460 --> 00:19:57,520
Center on Vandenberg Air Force Base

312
00:20:00,810 --> 00:19:59,470
listening in to the launch teams as they

313
00:20:04,500 --> 00:20:00,820

move through the necessary steps to

314
00:20:06,540 --> 00:20:04,510
bring us to liftoff we're getting about

315
00:20:08,730 --> 00:20:06,550
just a minute away from a hole in the

316
00:20:10,290 --> 00:20:08,740
team - account for about 50 seconds away

317
00:20:12,990 --> 00:20:10,300
from that hole in the count

318
00:20:14,130 --> 00:20:13,000
although the t clock stops or pauses

319
00:20:16,049 --> 00:20:14,140
launch team to continue to work

320
00:20:17,760 --> 00:20:16,059
diligently toward lift off the t clock

321
00:20:19,350 --> 00:20:17,770
is the official countdown clock and is

322
00:20:22,049 --> 00:20:19,360
stopped at the t-minus four mark in the

323
00:20:24,270 --> 00:20:22,059
count and holds for 15 minutes at the

324
00:20:26,010 --> 00:20:24,280
end of the hole the team - and L -

325
00:20:28,650 --> 00:20:26,020
counts will be synced and only four

326
00:20:31,140 --> 00:20:28,660
minutes will remain until launch we have

327
00:20:40,420 --> 00:20:31,150
about 30 seconds left till we hit that

328
00:20:44,650 --> 00:20:42,430
I'll see this is my control go for

329
00:20:46,990 --> 00:20:44,660
control yeah I have a series of yellow

330
00:20:51,760 --> 00:20:47,000
alarms for our school switch miss

331
00:20:55,170 --> 00:20:51,770
compares we think we understand what the

332
00:20:58,780 --> 00:20:55,180
cause of it was sounds like there was a

333
00:21:00,220 --> 00:20:58,790
witch on when they switched to attempted

334
00:21:02,170 --> 00:21:00,230
to switch the secondary decom and we

335
00:21:04,390 --> 00:21:02,180
have now entered the hold in the team -

336
00:21:05,980 --> 00:21:04,400
count the L o'clock still continues so

337
00:21:10,180 --> 00:21:05,990
what they launch - o'clock were at 18

338
00:21:11,950 --> 00:21:10,190

minutes 50 seconds until liftoff this is

339
00:21:13,600 --> 00:21:11,960
the first interplanetary launch for NASA

340
00:21:15,669 --> 00:21:13,610
from the west coast but NASA is no

341
00:21:17,680 --> 00:21:15,679
stranger to the Atlas 5 rocket which you

342
00:21:20,230 --> 00:21:17,690
see on the screen in fact this launch of

343
00:21:22,840 --> 00:21:20,240
insight on the Atlas 5 will be the 17th

344
00:21:25,270 --> 00:21:22,850
time NASA has flown a spacecraft on this

345
00:21:26,500 --> 00:21:25,280
rocket all previous NASA interplanetary

346
00:21:28,120 --> 00:21:26,510
missions have launched from Florida's

347
00:21:30,490 --> 00:21:28,130
Atlantic coast at either Cape Canaveral

348
00:21:32,350 --> 00:21:30,500
Air Force Station or the adjacent NASA's

349
00:21:33,880 --> 00:21:32,360
Kennedy Space Center launching toward

350
00:21:35,680 --> 00:21:33,890
the east as the momentum of Earth's

351
00:21:38,850 --> 00:21:35,690
eastward rotation - the launch vehicles

352
00:21:40,930 --> 00:21:38,860
on thrust for insight the Atlas 401

353
00:21:42,820 --> 00:21:40,940
offers enough performance to enable

354
00:21:44,650 --> 00:21:42,830
launching a mission to Mars southward

355
00:21:46,480 --> 00:21:44,660
from Vandenberg the propulsion for

356
00:21:48,010 --> 00:21:46,490
pushing insight from Earth to Mars comes

357
00:21:50,830 --> 00:21:48,020
from the launch vehicle rather than the

358
00:21:53,230 --> 00:21:50,840
spacecraft itself at liftoff NASA's in

359
00:21:56,140 --> 00:21:53,240
speights insight spacecraft will begin

360
00:21:57,970 --> 00:21:56,150
its six-month journey the Atlas in just

361
00:22:00,310 --> 00:21:57,980
over a minute is traveling faster than

362
00:22:01,570 --> 00:22:00,320
the speed of sound after liftoff at two

363
00:22:03,070 --> 00:22:01,580

and a half minutes into flight the

364
00:22:05,290 --> 00:22:03,080
rocket weighs less than half of its

365
00:22:07,030 --> 00:22:05,300
original weight and liftoff and the

366
00:22:09,070 --> 00:22:07,040
first stage engine birds all of its

367
00:22:10,390 --> 00:22:09,080
propellant or fuel by about four and a

368
00:22:13,000 --> 00:22:10,400
half minutes after the Rockets first

369
00:22:14,560 --> 00:22:13,010
stage has jettison the second stage

370
00:22:17,140 --> 00:22:14,570
engine ignites for the first of two

371
00:22:18,669 --> 00:22:17,150
burns and the protective payload fairing

372
00:22:20,410 --> 00:22:18,679
at the top of the rocket will have been

373
00:22:22,900 --> 00:22:20,420
jettisoned at one-and-a-half minutes

374
00:22:24,940 --> 00:22:22,910
after liftoff the insight spacecraft and

375
00:22:26,890 --> 00:22:24,950
two cubes apps called Marco hitching a

376
00:22:29,049 --> 00:22:26,900
ride to Mars will have separated the

377
00:22:30,549 --> 00:22:29,059
Centaur second stage here's a detailed

378
00:22:37,540 --> 00:22:30,559
look after United Launch Alliance Atlas

379
00:22:41,130 --> 00:22:37,550
5 mission profile 5 4 3 2 we have

380
00:22:43,260 --> 00:22:41,140
ignition of the rd-180 main engine 1

381
00:22:47,600 --> 00:22:43,270
liftoff of the United Launch Alliance

382
00:22:52,490 --> 00:22:50,840
the Atlas 5 rd-180 main engine ignites

383
00:22:55,190 --> 00:22:52,500
that generates more than eight hundred

384
00:22:58,010 --> 00:22:55,200
sixty thousand pounds of thrust and lift

385
00:23:00,860 --> 00:22:58,020
the rocket away from the pad shortly

386
00:23:02,780 --> 00:23:00,870
after liftoff Atlas begins a pitcher to

387
00:23:04,460 --> 00:23:02,790
attain the proper flight path while

388
00:23:07,240 --> 00:23:04,470

minimizing the pressure the vehicle

389
00:23:10,120 --> 00:23:07,250
experiences during flight

390
00:23:13,450 --> 00:23:10,130
the Atlas 5 reaches Mach 1 the speed of

391
00:23:15,730 --> 00:23:13,460
sound at 1 minutes 17 seconds

392
00:23:17,500 --> 00:23:15,740
at four minutes four seconds for pallet

393
00:23:20,649 --> 00:23:17,510
bubbles deplete and the main engine

394
00:23:23,080 --> 00:23:20,659
shuts down six seconds later the Atlas

395
00:23:25,180 --> 00:23:23,090
centaur separation system activates to

396
00:23:27,850 --> 00:23:25,190
release the booster stage the vehicle

397
00:23:30,940 --> 00:23:27,860
now weighs a little more than 7% of what

398
00:23:31,539 --> 00:23:30,950
it did liftoff at four minutes 20

399
00:23:33,519 --> 00:23:31,549
seconds

400
00:23:35,740 --> 00:23:33,529
the first centaur main engine burn

401
00:23:38,830 --> 00:23:35,750
begins sending the Centaur it was

402
00:23:40,870 --> 00:23:38,840
circular orbit approaching payload

403
00:23:43,029 --> 00:23:40,880
fairing jettison the Centaur is burning

404
00:23:45,340 --> 00:23:43,039
propellant at a rate of 51 pounds per

405
00:23:47,980 --> 00:23:45,350
second traveling at more than 10,000

406
00:23:52,600 --> 00:23:47,990
miles per hour and located 79 miles in

407
00:23:54,789 --> 00:23:52,610
altitude and 252 miles downrange during

408
00:23:57,010 --> 00:23:54,799
ascent insight is protected inside a

409
00:23:59,470 --> 00:23:57,020
four meter diameter payload fairing and

410
00:24:02,740 --> 00:23:59,480
approximately four minutes 28 seconds

411
00:24:05,049 --> 00:24:02,750
the payload fairing is jettisoned at 13

412
00:24:07,539 --> 00:24:05,059
minutes 16 seconds cut off of the

413
00:24:10,539 --> 00:24:07,549

Centaur main engine or Miko one occurs

414
00:24:11,920 --> 00:24:10,549
the mission now enters in our long coast

415
00:24:14,650 --> 00:24:11,930
bays

416
00:24:16,900 --> 00:24:14,660
at nearly 1 hour and 15 minutes the

417
00:24:19,990 --> 00:24:16,910
centaur main engine is restarted for the

418
00:24:23,049 --> 00:24:20,000
second and final bird placing Center on

419
00:24:25,060 --> 00:24:23,059
its path to spacecraft separation

420
00:24:27,430 --> 00:24:25,070
approximately four minutes and 49

421
00:24:30,040 --> 00:24:27,440
seconds later final cutoff of the

422
00:24:32,410 --> 00:24:30,050
Centaur main engine occurs

423
00:24:35,140 --> 00:24:32,420
at one hour twenty-eight minutes and 40

424
00:24:37,710 --> 00:24:35,150
seconds centaur releases NASA's insight

425
00:24:40,210 --> 00:24:37,720
spacecraft on its journey to Mars

426
00:24:42,700 --> 00:24:40,220
deploying from dispensers mounted on the

427
00:24:46,060 --> 00:24:42,710
aft bulkhead carrier on centaur the Mars

428
00:24:48,460 --> 00:24:46,070
cube one or Marco cube sets will provide

429
00:24:51,010 --> 00:24:48,470
real-time communication relay covering

430
00:24:54,700 --> 00:24:51,020
the entry descent and landing of insight

431
00:24:56,890 --> 00:24:54,710
on Mars Marco a separates one hour

432
00:24:59,590 --> 00:24:56,900
twenty nine minutes into flight follow

433
00:25:08,729 --> 00:24:59,600
48 seconds later by the separation of

434
00:25:13,180 --> 00:25:10,899
from the mission director center we're

435
00:25:16,749 --> 00:25:13,190
about t-minus four minutes and holding

436
00:25:18,999 --> 00:25:16,759
we have about 14 minutes 40 seconds left

437
00:25:19,959 --> 00:25:19,009
before a liftoff with that we'll go back

438
00:25:23,379 --> 00:25:19,969

to Stephanie Martin

439
00:25:25,060 --> 00:25:23,389
it's definitely hi I'm Stephanie Martin

440
00:25:26,979 --> 00:25:25,070
for those of you just joining us on

441
00:25:28,749 --> 00:25:26,989
social media we'd like to welcome to

442
00:25:31,389 --> 00:25:28,759
welcome you to launch coverage of

443
00:25:33,519 --> 00:25:31,399
insight which will MIT will give Mars

444
00:25:36,029 --> 00:25:33,529
its first thorough checkup since it

445
00:25:38,169 --> 00:25:36,039
formed four and a half billion years ago

446
00:25:40,329 --> 00:25:38,179
insight will take the vital signs of

447
00:25:43,810 --> 00:25:40,339
Mars including its pulse its temperature

448
00:25:46,509 --> 00:25:43,820
and its reflexes insight is flying on

449
00:25:48,849 --> 00:25:46,519
United Launch alliances Atlas 5 401

450
00:25:51,759 --> 00:25:48,859
configuration and has a to our launch

451
00:25:54,969 --> 00:25:51,769
window starting at 405 this morning

452
00:25:56,979 --> 00:25:54,979
Pacific time or 7:05 Eastern Time this

453
00:25:59,109 --> 00:25:56,989
means that the launch team has two hours

454
00:26:02,109 --> 00:25:59,119
to liftoff from Space Launch Complex 3

455
00:26:04,180 --> 00:26:02,119
at Vandenberg Air Force Base in sight is

456
00:26:06,969 --> 00:26:04,190
set to land on November 26th in the

457
00:26:10,209 --> 00:26:06,979
Elysium Tunisia region of Mars which is

458
00:26:12,789 --> 00:26:10,219
about 373 miles than we get from the

459
00:26:16,539 --> 00:26:12,799
Gale Crater where NASA's Curiosity rover

460
00:26:19,719 --> 00:26:16,549
landed in August 2012 after insight

461
00:26:21,609 --> 00:26:19,729
lands it will spend 728 Earth days or a

462
00:26:24,879 --> 00:26:21,619
little over a Martian year studying the

463
00:26:27,399 --> 00:26:24,889

planets interior after the spacecraft's

464
00:26:30,339 --> 00:26:27,409
roughly six-month journey to Mars it

465
00:26:32,139 --> 00:26:30,349
will begin its landing phase insight

466
00:26:34,209 --> 00:26:32,149
will be the red planet's first thorough

467
00:26:37,539 --> 00:26:34,219
checkup since it formed four and a half

468
00:26:39,519 --> 00:26:37,549
billion years ago insight will take the

469
00:26:48,240 --> 00:26:39,529
vital signs of Mars its pulse its

470
00:26:52,330 --> 00:26:50,470
after insight enters the Martian

471
00:26:54,430 --> 00:26:52,340
atmosphere traveling thirteen thousand

472
00:26:56,740 --> 00:26:54,440
two hundred miles per hour it deploys

473
00:27:00,190 --> 00:26:56,750
its parachute and ultimately slows down

474
00:27:01,930 --> 00:27:00,200
to five miles per hour for touchdown one

475
00:27:03,790 --> 00:27:01,940
minute later insight will begin surface

476
00:27:06,010 --> 00:27:03,800
operations checking out the Landers

477
00:27:08,470 --> 00:27:06,020
health indicators then deploying its two

478
00:27:10,390 --> 00:27:08,480
solar arrays it will take about ten

479
00:27:12,250 --> 00:27:10,400
weeks to place all the instruments onto

480
00:27:14,800 --> 00:27:12,260
the ground and about seven weeks later

481
00:27:16,960 --> 00:27:14,810
this self hammering heat probe will

482
00:27:20,170 --> 00:27:16,970
reach ten to sixteen feet into the

483
00:27:21,880 --> 00:27:20,180
Martian soil there are about two brief

484
00:27:24,370 --> 00:27:21,890
case sized cubes ATS

485
00:27:27,730 --> 00:27:24,380
known as Mars cube one or Marco hitching

486
00:27:30,370 --> 00:27:27,740
a ride on today's mission now with that

487
00:27:40,090 --> 00:27:30,380
let's go back to NASA's Joshua Finch and

488
00:27:41,950 --> 00:27:40,100

the mission directors Center I take that

489
00:27:43,750 --> 00:27:41,960
back NASA's new administrator Jim

490
00:27:46,330 --> 00:27:43,760
bridenstine shares his thoughts on

491
00:27:49,330 --> 00:27:46,340
NASA's insight mission the future

492
00:27:54,160 --> 00:27:49,340
missions for human exploration plans and

493
00:27:56,110 --> 00:27:54,170
what NASA's impact is on the world so

494
00:27:59,560 --> 00:27:56,120
what Mars insight Lander is gonna allow

495
00:28:02,380 --> 00:27:59,570
us to do is really map the inside of

496
00:28:03,670 --> 00:28:02,390
Mars this is an important mission not

497
00:28:04,960 --> 00:28:03,680
just for the United States but an

498
00:28:07,780 --> 00:28:04,970
important mission for the world so we

499
00:28:09,940 --> 00:28:07,790
can better understand why planets change

500
00:28:11,620 --> 00:28:09,950
and ultimately understand even more

501
00:28:14,500 --> 00:28:11,630
about our own planet I think the one

502
00:28:16,480 --> 00:28:14,510
thing that really excites everybody is a

503
00:28:20,080 --> 00:28:16,490
question that we ask ourselves over and

504
00:28:23,560 --> 00:28:20,090
over again which is are we alone in the

505
00:28:25,630 --> 00:28:23,570
universe is there potential for life on

506
00:28:26,920 --> 00:28:25,640
a planet that's not our own and one of

507
00:28:29,440 --> 00:28:26,930
the things that we want to do with Mars

508
00:28:31,600 --> 00:28:29,450
2020 which is going to launch during the

509
00:28:34,720 --> 00:28:31,610
next window we have to go to Mars is

510
00:28:37,210 --> 00:28:34,730
understand if there was a potential or

511
00:28:39,610 --> 00:28:37,220
maybe even Mars might have at one time

512
00:28:42,430 --> 00:28:39,620
hosted life if we want to get as much

513
00:28:44,320 --> 00:28:42,440

science as we can as fast as we can

514
00:28:46,270 --> 00:28:44,330
we need to get really good at using

515
00:28:48,220 --> 00:28:46,280
robots we're gonna have robotic missions

516
00:28:49,840 --> 00:28:48,230
to the moon before we have humans go to

517
00:28:51,970 --> 00:28:49,850
the moon so that we can get the most out

518
00:28:54,310 --> 00:28:51,980
of our human science missions and that's

519
00:28:56,110 --> 00:28:54,320
true on Mars as well this president and

520
00:28:58,030 --> 00:28:56,120
vice president are very committed to

521
00:29:02,890 --> 00:28:58,040
getting America back to the surface of

522
00:29:07,460 --> 00:29:05,900
earth because we live here and it's the

523
00:29:13,880 --> 00:29:07,470
only planet we know that can host life

524
00:29:15,590 --> 00:29:13,890
so we better take care of it when I was

525
00:29:17,750 --> 00:29:15,600
five years old

526
00:29:19,280 --> 00:29:17,760
they made us draw what we wanted to be

527
00:29:21,380 --> 00:29:19,290
when we grew up and I drove I drew a

528
00:29:23,540 --> 00:29:21,390
picture of an airplane I had a picture

529
00:29:26,150 --> 00:29:23,550
of myself there wearing a hat that I

530
00:29:28,640 --> 00:29:26,160
thought airline pilots wore as a pilot

531
00:29:30,950 --> 00:29:28,650
in the Navy I became very dependent on

532
00:29:32,990 --> 00:29:30,960
space-related capability and a lot of

533
00:29:36,470 --> 00:29:33,000
the technologies that come from NASA

534
00:29:40,130 --> 00:29:36,480
have multiple uses and have transformed

535
00:29:42,350 --> 00:29:40,140
the way we live our lives so people say

536
00:29:44,480 --> 00:29:42,360
what why are you interested in space I

537
00:29:47,030 --> 00:29:44,490
think the question is why wouldn't you

538
00:29:54,410 --> 00:29:47,040

be interested in space it's critical to

539
00:29:56,000 --> 00:29:54,420
our everyday lives so this is this is a

540
00:29:58,310 --> 00:29:56,010
critical mission for our country it's a

541
00:29:59,870 --> 00:29:58,320
critical mission for the world these are

542
00:30:01,370 --> 00:29:59,880
some of the brightest minds that our

543
00:30:04,520 --> 00:30:01,380
country has we've got great

544
00:30:05,840 --> 00:30:04,530
international partners and our nation is

545
00:30:09,740 --> 00:30:05,850
grateful and in fact the world is

546
00:30:11,480 --> 00:30:09,750
grateful for their service it is great

547
00:30:13,580 --> 00:30:11,490
to hear from our new NASA Administrator

548
00:30:18,320 --> 00:30:13,590
now remember you can follow him on

549
00:30:20,180 --> 00:30:18,330
twitter using at ridin Stein we're now a

550
00:30:22,460 --> 00:30:20,190
little more than nine minutes away from

551
00:30:23,870 --> 00:30:22,470
today's launch let's go to NASA's Joshua

552
00:30:25,580 --> 00:30:23,880
Finch in the mission director Center for

553
00:30:29,270 --> 00:30:25,590
the final countdown of today's launch

554
00:30:30,740 --> 00:30:29,280
Josh thank you very much Stephanie and

555
00:30:32,900 --> 00:30:30,750
I'm actually being joined by Alisa

556
00:30:33,830 --> 00:30:32,910
Macbeth from United Launch Alliance well

557
00:30:36,170 --> 00:30:33,840
this is gonna give us a little more

558
00:30:38,390 --> 00:30:36,180
insight in today's mission Alisa can you

559
00:30:39,590 --> 00:30:38,400
tell me about your role at ula and what

560
00:30:41,600 --> 00:30:39,600
it's like to work for insight yeah

561
00:30:44,060 --> 00:30:41,610
thanks for having me here so I work at

562
00:30:46,700 --> 00:30:44,070
the launch site I'm an systems engineer

563
00:30:48,590 --> 00:30:46,710

for launch operations mainly in the

564
00:30:50,600 --> 00:30:48,600
avionics department so that covers

565
00:30:53,240 --> 00:30:50,610
everything from batteries to harnessing

566
00:30:54,860 --> 00:30:53,250
to the flight boxes that takes the

567
00:30:58,340 --> 00:30:54,870
rocket to where it needs to go in the in

568
00:31:00,230 --> 00:30:58,350
outer space my personal role I'm also

569
00:31:01,880 --> 00:31:00,240
involved with ordnance so installing all

570
00:31:05,330 --> 00:31:01,890
the pyrotechnics that separate the

571
00:31:08,450 --> 00:31:05,340
stages separate the spacecraft from the

572
00:31:10,490 --> 00:31:08,460
vehicle on-orbit those kinds of things

573
00:31:12,529 --> 00:31:10,500
so that's mainly what I'm involved with

574
00:31:16,909 --> 00:31:12,539
and on inside I was able

575
00:31:18,259 --> 00:31:16,919
- it's my first West Coast launch and on

576
00:31:20,299 --> 00:31:18,269
inside I was able to come out here for

577
00:31:22,459 --> 00:31:20,309
the past couple weeks and do just that

578
00:31:25,039 --> 00:31:22,469
install batteries install some ordnance

579
00:31:27,229 --> 00:31:25,049
and do some final connections so you're

580
00:31:28,430 --> 00:31:27,239
often on console for ula launches can

581
00:31:31,159 --> 00:31:28,440
you tell us what it's like to be on

582
00:31:33,969 --> 00:31:31,169
console absolutely yeah so on console is

583
00:31:36,829 --> 00:31:33,979
it's an experience it's very exciting

584
00:31:39,769 --> 00:31:36,839
the the adrenaline in the room you can

585
00:31:42,079 --> 00:31:39,779
feel the energy there's a lot of system

586
00:31:44,209 --> 00:31:42,089
testing happening just to prepare the

587
00:31:46,009 --> 00:31:44,219
the rocket for launch and verify that

588
00:31:49,519 --> 00:31:46,019

everything is in configuration and

589
00:31:52,489 --> 00:31:49,529
nominal we fuel the rocket at that point

590
00:31:56,809 --> 00:31:52,499
t-minus two hours and Counting and then

591
00:31:58,459 --> 00:31:56,819
it's really just a some final checks to

592
00:32:00,799 --> 00:31:58,469
verify that everything is good we've got

593
00:32:03,680 --> 00:32:00,809
us a team of people at the launch site

594
00:32:05,659 --> 00:32:03,690
on sitting on console as well as our our

595
00:32:07,879 --> 00:32:05,669
certified responsible engineers in

596
00:32:11,089 --> 00:32:07,889
Denver who are also having a second set

597
00:32:12,589 --> 00:32:11,099
of eyes on the systems as well and so

598
00:32:14,029 --> 00:32:12,599
can you tell me what's happened up to

599
00:32:16,159 --> 00:32:14,039
this point of the countdown and what we

600
00:32:18,169 --> 00:32:16,169
can expect before launch yeah so we're

601
00:32:20,329 --> 00:32:18,179
getting up to the terminal count now so

602
00:32:21,979 --> 00:32:20,339
this is terminal count as t-minus four

603
00:32:24,949 --> 00:32:21,989
minutes and Counting so up to this point

604
00:32:27,469 --> 00:32:24,959
the rocket is fully fueled we're doing

605
00:32:28,999 --> 00:32:27,479
some final system checks all of the all

606
00:32:32,029 --> 00:32:29,009
of the testing that I had talked about

607
00:32:35,509 --> 00:32:32,039
earlier is completed and we are doing

608
00:32:38,509 --> 00:32:35,519
our final we're ready to go so we'll get

609
00:32:40,189 --> 00:32:38,519
into a status here soon and all the

610
00:32:43,459 --> 00:32:40,199
systems will go through and say yep

611
00:32:45,109 --> 00:32:43,469
we're good to go and what were you ready

612
00:32:54,710 --> 00:32:45,119
and we're about ten seconds away from

613
00:33:01,440 --> 00:32:59,430

lcac all 97 minutes go easy confirmation

614
00:33:06,470 --> 00:33:01,450
from OS that we are in the correct RF

615
00:33:10,619 --> 00:33:08,249
status check to proceed with terminal

616
00:33:11,700 --> 00:33:10,629
count Atlas systems propulsion go

617
00:33:16,139 --> 00:33:11,710
hydraulics

618
00:33:18,840 --> 00:33:16,149
go pneumatics go hello to go water go

619
00:33:23,729 --> 00:33:18,850
centaur systems propulsion go pneumatics

620
00:33:27,899 --> 00:33:23,739
go hello to go LH to go has gas go

621
00:33:32,129 --> 00:33:27,909
electrical systems airborne go round go

622
00:33:38,759 --> 00:33:32,139
facility go RSF - yes go flight control

623
00:33:43,499 --> 00:33:38,769
go TC cubed go calm go umbilicals go yes

624
00:33:46,739 --> 00:33:43,509
go redline monitor go quality so op

625
00:33:50,220 --> 00:33:46,749
safety manager go ula safety officer go

626
00:33:53,070 --> 00:33:50,230
vehicle system engineer go anomaly chief

627
00:33:53,399 --> 00:33:53,080
ACS go range coordinator clear to

628
00:33:56,310 --> 00:33:53,409
proceed

629
00:33:57,320 --> 00:33:56,320
launch director LC you have permission

630
00:33:59,609 --> 00:33:57,330
to launch

631
00:34:02,549 --> 00:33:59,619
proceeding with the count hey LC you

632
00:34:07,909 --> 00:34:02,559
verify to zero is set for 11:05 Zulu

633
00:34:10,200 --> 00:34:07,919
verified OS start list data capture and

634
00:34:11,819 --> 00:34:10,210
as you've heard that pole is now

635
00:34:14,970 --> 00:34:11,829
complete we are still within the hold

636
00:34:17,039 --> 00:34:14,980
the team - for mark but with the L clock

637
00:34:18,899 --> 00:34:17,049
were about 5 minutes 40 seconds away

638
00:34:20,250 --> 00:34:18,909

from launch well this is one last

639
00:34:21,809 --> 00:34:20,260
question for you you have teams working

640
00:34:23,460 --> 00:34:21,819
at this launch site and then you have

641
00:34:24,059 --> 00:34:23,470
teams and you had company headquarters

642
00:34:25,649 --> 00:34:24,069
in Colorado

643
00:34:28,169 --> 00:34:25,659
can you tell them tell me about how they

644
00:34:30,210 --> 00:34:28,179
are working together yeah definitely so

645
00:34:32,039 --> 00:34:30,220
in Denver like I said those are our

646
00:34:33,990 --> 00:34:32,049
certified so responsible engineers so

647
00:34:36,629 --> 00:34:34,000
these are the experts in the system they

648
00:34:39,059 --> 00:34:36,639
know everything down to the to the minut

649
00:34:41,369 --> 00:34:39,069
detail so they were looking at the data

650
00:34:43,319 --> 00:34:41,379
as an overall system but also digging

651
00:34:45,270 --> 00:34:43,329
into the details at the launch site

652
00:34:47,879 --> 00:34:45,280
where we're in the countdown so we're

653
00:34:49,109 --> 00:34:47,889
running the tests we're sending commands

654
00:34:51,539 --> 00:34:49,119
we're doing the button we're pressing

655
00:34:55,169 --> 00:34:51,549
buttons and doing those kinds of things

656
00:34:58,500 --> 00:34:55,179
and working together with them as a full

657
00:35:00,150 --> 00:34:58,510
team ula team to get it ready

658
00:35:01,890 --> 00:35:00,160
sounds great and thank you very much for

659
00:35:03,539 --> 00:35:01,900
being with us today for the launch and

660
00:35:03,780 --> 00:35:03,549
we'll continue the countdown Thank you

661
00:35:07,559 --> 00:35:03,790
very

662
00:35:08,460 --> 00:35:07,569
thanks so much and with that we'll

663
00:35:09,900 --> 00:35:08,470

continue

664
00:35:12,060 --> 00:35:09,910
keeping track of all the things that are

665
00:35:13,830 --> 00:35:12,070
happening as we lead toward liftoff so

666
00:35:15,680 --> 00:35:13,840
let's get you up to speed at first

667
00:35:19,230 --> 00:35:15,690
welcome to those who are just joining us

668
00:35:20,790 --> 00:35:19,240
on social media as you can see we have a

669
00:35:22,680 --> 00:35:20,800
little bit of fog in the area today you

670
00:35:24,210 --> 00:35:22,690
can see the Atlas 5 and its 401

671
00:35:26,790 --> 00:35:24,220
configuration and it's stacked on a

672
00:35:28,680 --> 00:35:26,800
launch site at Space Launch Complex 30

673
00:35:30,810 --> 00:35:28,690
the West Coast launch site for the Atlas

674
00:35:32,790 --> 00:35:30,820
5 the Atlas 5 has many different

675
00:35:35,130 --> 00:35:32,800
configurations but this 401

676
00:35:37,080 --> 00:35:35,140
configuration means that we have a four

677
00:35:38,730 --> 00:35:37,090
meter payload fairing at the top the

678
00:35:40,500 --> 00:35:38,740
zero indicates there are no solid rocket

679
00:35:41,730 --> 00:35:40,510
motors for this mission and the one

680
00:35:45,839 --> 00:35:41,740
indicates we have a single engine

681
00:35:49,020 --> 00:35:45,849
centaur upper stage we are about 10

682
00:35:59,310 --> 00:35:49,030
seconds away from coming out of the hold

683
00:36:03,960 --> 00:35:59,320
in our count 4 3 2 1 and we are at

684
00:36:05,130 --> 00:36:03,970
t-minus four minutes and Counting the

685
00:36:06,570 --> 00:36:05,140
United States Air Force has been

686
00:36:08,400 --> 00:36:06,580
monitoring weather for us and as you can

687
00:36:10,320 --> 00:36:08,410
see some fog on your screen some

688
00:36:11,609 --> 00:36:10,330

visibility issues but that's not a

689
00:36:13,920 --> 00:36:11,619
constraint for launch today so we are

690
00:36:16,170 --> 00:36:13,930
green on the range in terms of whether

691
00:36:17,790 --> 00:36:16,180
the air force range is also responsible

692
00:36:18,780 --> 00:36:17,800
public safety during launches from here

693
00:36:20,099 --> 00:36:18,790
on the west coast and has been

694
00:36:22,170 --> 00:36:20,109
coordinating with United Launch Alliance

695
00:36:23,520 --> 00:36:22,180
and the NASA teams and showing that

696
00:36:25,020 --> 00:36:23,530
launch area and the flight path are

697
00:36:26,970 --> 00:36:25,030
clear for the launch of the Atlas 5

698
00:36:28,859 --> 00:36:26,980
rocket and we have no collision

699
00:36:30,450 --> 00:36:28,869
avoidance cutouts or colas during the

700
00:36:35,540 --> 00:36:30,460
window today but right now we're

701
00:36:41,060 --> 00:36:38,670
we're at t-minus three minutes 20

702
00:36:43,410 --> 00:36:41,070
seconds and counting

703
00:36:45,540 --> 00:36:43,420
the Atlas boosters and centaur liquid

704
00:36:47,130 --> 00:36:45,550
oxygen tanks for flight levels the NASA

705
00:36:50,849 --> 00:36:47,140
launch manager Tim Dunn has pulled his

706
00:36:52,200 --> 00:36:50,859
launch team the United States launched

707
00:36:54,480 --> 00:36:52,210
the United Launch Alliance the launch

708
00:36:57,390 --> 00:36:54,490
conductor lumen Jerry brief lock teams

709
00:36:58,800 --> 00:36:57,400
ahead of the terminal count the launch

710
00:37:00,270 --> 00:36:58,810
character is also verified with a range

711
00:37:06,920 --> 00:37:00,280
controller that solar radiation is

712
00:37:06,930 --> 00:37:11,739
thanks to pressure

713
00:37:11,749 --> 00:37:17,259

we're two minutes 45 seconds to launch

714
00:37:53,240 --> 00:37:19,430
the flight termination system on the

715
00:38:02,599 --> 00:37:55,849
or at just about t-minus two minutes and

716
00:38:08,330 --> 00:38:02,609
Counting you go internal 1:55 watch

717
00:38:18,339 --> 00:38:08,340
sequencer start 150 securing centaur LHC

718
00:38:30,790 --> 00:38:18,349
to their infant rlo to 140 watching Abel

719
00:38:35,050 --> 00:38:32,620
you're looking at a live shot the

720
00:38:37,510 --> 00:38:35,060
encapsulated spacecraft on top of the

721
00:38:40,120 --> 00:38:37,520
rocket at Space Launch Complex 3 well do

722
00:38:41,560 --> 00:38:40,130
you harm John Smith or flight path

723
00:38:43,150 --> 00:38:41,570
tonight will be a south eastern

724
00:38:51,100 --> 00:38:43,160
direction hugging the coast of Southern

725
00:38:52,720 --> 00:38:51,110
California in Mexico el bloque we're

726
00:38:57,280 --> 00:38:52,730
about one minute five seconds away from

727
00:39:02,830 --> 00:38:57,290
launch you - one minute rock report

728
00:39:04,000 --> 00:39:02,840
range status rock rainbow green and we

729
00:39:06,400 --> 00:39:04,010
have just heard confirmation that the

730
00:39:07,690 --> 00:39:06,410
range is green after launch we'll be

731
00:39:09,990 --> 00:39:07,700
hearing the voice of United Launch

732
00:39:12,370 --> 00:39:10,000
alliances Marty Malinowski

733
00:39:17,050 --> 00:39:12,380
status of the flight of the Atlas 5 and

734
00:39:18,220 --> 00:39:17,060
NASA's insight - forty second we are

735
00:39:26,790 --> 00:39:18,230
listening in to they've landed in a

736
00:39:42,450 --> 00:39:33,900
- 28 seconds 25 gotta check go atlas go

737
00:39:58,510 --> 00:39:42,460
Center go insight we're at t-minus 15

738
00:40:03,880 --> 00:40:02,080

liftoff of the Atlas 5 launching a first

739
00:40:06,520 --> 00:40:03,890
interplanetary mission from the west

740
00:40:07,150 --> 00:40:06,530
coast and NASA's insight the first outer

741
00:40:09,040 --> 00:40:07,160
space

742
00:40:29,010 --> 00:40:09,050
robotic Explorer to study the interior

743
00:40:32,140 --> 00:40:31,510
rd-180 continues look at this point

744
00:40:34,960 --> 00:40:32,150
mission

745
00:40:38,440 --> 00:40:34,970
deck refreshes pump speeds expected

746
00:40:44,670 --> 00:40:38,450
regions to ratio controlling within

747
00:40:52,020 --> 00:40:48,510
the rd-180 and 180 engine providing 860

748
00:41:02,280 --> 00:40:52,030
thousand pounds of thrust the compadre

749
00:41:13,890 --> 00:41:05,040
all booster systems look nominal at this

750
00:41:22,490 --> 00:41:17,160
Marquand the rocket is now traveling

751
00:41:28,290 --> 00:41:26,360
coming up the rocky internet excu

752
00:41:29,580 --> 00:41:28,300
this is the point where mechanical

753
00:41:31,380 --> 00:41:29,590
stress in the rocket reaches its peak

754
00:41:33,440 --> 00:41:31,390
because of the Rockets velocity and

755
00:41:38,250 --> 00:41:33,450
resistance created by Earth's atmosphere

756
00:41:39,810 --> 00:41:38,260
coming up on the throttle down grass

757
00:41:42,480 --> 00:41:39,820
rattled back right on schedule

758
00:41:43,800 --> 00:41:42,490
signatures look good pump speeds and

759
00:41:47,640 --> 00:41:43,810
check the pressures continue to look

760
00:41:51,330 --> 00:41:47,650
pregnant and are you rates controlling

761
00:41:53,370 --> 00:41:51,340
down the middle earn altitude is 13

762
00:41:55,470 --> 00:41:53,380
miles downrange distance seven miles

763
00:42:08,200 --> 00:41:55,480

current velocity nineteen hundred and

764
00:42:14,620 --> 00:42:13,420
well loop guidance has begun the first

765
00:42:16,359 --> 00:42:14,630
part of the flight was pre-programmed

766
00:42:19,150 --> 00:42:16,369
trajectory now the rocket is giving

767
00:42:20,589 --> 00:42:19,160
itself feedback on his flight path and Q

768
00:42:24,609 --> 00:42:20,599
alpha Stern has begun

769
00:42:33,130 --> 00:42:24,619
are you rich look good pump speeds and

770
00:42:39,160 --> 00:42:37,600
Arceus pyrovile has been fired system is

771
00:42:46,540 --> 00:42:39,170
now pressurized in flight level

772
00:42:49,000 --> 00:42:46,550
signatures look good burn altitude is

773
00:42:51,280 --> 00:42:49,010
thirty miles downrange distance 43 miles

774
00:42:56,200 --> 00:42:51,290
current velocity four thousand five

775
00:42:58,240 --> 00:42:56,210
hundred forty two miles per hour you're

776
00:43:00,700 --> 00:42:58,250
looking at a live view from the Atlas

777
00:43:03,850 --> 00:43:00,710
five rocket the rd-180 engine continues

778
00:43:08,610 --> 00:43:03,860
to burn look good already 180 still

779
00:43:23,430 --> 00:43:08,620
performing well you off the steering has

780
00:43:31,109 --> 00:43:25,620
rooster is now one-quarter if it's

781
00:43:37,319 --> 00:43:31,119
liftoff weight currently flying at four

782
00:43:44,000 --> 00:43:37,329
G's acceleration whose phase cooldown

783
00:43:49,950 --> 00:43:47,910
moving the throttle to five g's later

784
00:43:51,599 --> 00:43:49,960
three minutes 50 seconds into flight and

785
00:43:54,960 --> 00:43:51,609
we're nearing booster engine cutoff or

786
00:44:01,740 --> 00:43:54,970
Pico G's in preparation for Pico boost

787
00:44:07,020 --> 00:44:01,750
phase cooldown has completed and we hit

788
00:44:08,910 --> 00:44:07,030

Pico shut down looks good and the rd-180

789
00:44:11,870 --> 00:44:08,920
180 engine on the first stage of the

790
00:44:15,180 --> 00:44:11,880
Atlas 5 has shut down stage separation

791
00:44:18,839 --> 00:44:15,190
they have box and fuel chrisberg between

792
00:44:21,510 --> 00:44:18,849
to purge burned the RCS is underway we

793
00:44:25,829 --> 00:44:21,520
have ignition and full thrust on the RL

794
00:44:29,490 --> 00:44:25,839
10 and the second stage stage engine

795
00:44:30,890 --> 00:44:29,500
that are Elton has ignited and we have

796
00:44:34,950 --> 00:44:30,900
indication of payload fairing jettison

797
00:44:36,750 --> 00:44:34,960
such a good step and the payload fairing

798
00:44:40,079 --> 00:44:36,760
that was encapsulating the inside

799
00:44:42,000 --> 00:44:40,089
spacecraft has been jettisoned the RL 10

800
00:44:46,200 --> 00:44:42,010
C engine the second stage of the centaur

801
00:44:50,640 --> 00:44:46,210
continues to burn you're looking at live

802
00:44:52,279 --> 00:44:50,650
animation telemetry very good of the

803
00:44:53,730 --> 00:44:52,289
Centaur second stage on its flight path

804
00:44:59,279 --> 00:44:53,740
/ GN

805
00:45:00,750 --> 00:44:59,289
to perch ferns underway as you can see

806
00:45:16,980 --> 00:45:00,760
to the bottom right of your screen the

807
00:45:23,230 --> 00:45:20,470
and some tire has gone to closed-loop

808
00:45:39,470 --> 00:45:23,240
view control in a slightly fuel-rich

809
00:45:53,710 --> 00:45:42,260
and a quick look at the booster stage

810
00:45:57,340 --> 00:45:55,390
for those of you that are just joining

811
00:46:00,010 --> 00:45:57,350
us we had an on-time liftoff of the

812
00:46:03,250 --> 00:46:00,020
Atlas 5 rocket carrying NASA's inside

813
00:46:10,120 --> 00:46:03,260

spacecraft as well as two small cube

814
00:46:23,480 --> 00:46:10,130
sets called Marco burn is scheduled for

815
00:46:28,520 --> 00:46:25,550
you are looking at a live shot of the

816
00:46:32,570 --> 00:46:28,530
Centaur second stage the RL 10 C engine

817
00:46:34,850 --> 00:46:32,580
providing thrust and the RCS flying

818
00:46:48,840 --> 00:46:34,860
temperatures are warming bottle tempters

819
00:47:00,790 --> 00:46:51,330
Center Nelkin going just slightly feel

820
00:47:13,420 --> 00:47:02,680
chamber pressures locks pump discharge

821
00:47:21,580 --> 00:47:17,020
weird seven minutes 15 seconds into the

822
00:47:24,160 --> 00:47:21,590
flight inside being taken to his

823
00:47:26,980 --> 00:47:24,170
trajectory this will be the first of two

824
00:47:34,120 --> 00:47:26,990
burns of the second stage systems look

825
00:47:42,809 --> 00:47:34,130
very good this portion of burn up on the

826
00:48:10,600 --> 00:47:45,419
and teacher ceased as a tracking data

827
00:48:16,210 --> 00:48:13,360
and the rl10 again continues perform

828
00:48:18,850 --> 00:48:16,220
very well in requesting a fuel rich

829
00:48:20,920 --> 00:48:18,860
condition at this point burn chamber

830
00:48:25,060 --> 00:48:20,930
pressures flux pump discharge and fuel

831
00:48:27,010 --> 00:48:25,070
venturi all parameter RCS line

832
00:48:30,550 --> 00:48:27,020
temperatures have early achieved bottle

833
00:48:37,690 --> 00:48:30,560
temperatures you need to see our thermal

834
00:48:40,750 --> 00:48:37,700
conditioning firings on the RCS thank

835
00:48:59,040 --> 00:48:40,760
pressures are stable higher eights look

836
00:49:11,779 --> 00:49:01,980
we are just over nine minutes into the

837
00:49:28,789 --> 00:49:27,229
and central view is you continue to see

838
00:49:29,389 --> 00:49:28,799

the flight path on the bottom right of

839
00:49:31,749 --> 00:49:29,399
your screen

840
00:49:34,669 --> 00:49:31,759
Centaurus currently fine an altitude of

841
00:49:36,559 --> 00:49:34,679
136 miles downrange distance is twelve

842
00:49:38,809 --> 00:49:36,569
hundred and sixty one miles current

843
00:49:42,289 --> 00:49:38,819
velocity fourteen thousand sixty six

844
00:49:44,689 --> 00:49:42,299
miles per hour this trajectory of the

845
00:49:46,459 --> 00:49:44,699
flight path will put the spacecraft in

846
00:49:48,679 --> 00:49:46,469
the centaur in a park orbit before

847
00:49:51,109 --> 00:49:48,689
crossing the equator it will go around

848
00:49:52,219 --> 00:49:51,119
the southern tip of South America it

849
00:49:54,499 --> 00:49:52,229
will cross the southern edge of the

850
00:49:56,359 --> 00:49:54,509
Atlantic Ocean come up over the Indian

851
00:50:21,510 --> 00:49:56,369
Ocean to the east of Africa and cross

852
00:50:27,240 --> 00:50:24,930
centaurs currently at an altitude of 131

853
00:50:30,060 --> 00:50:27,250
miles downrange distance fourteen

854
00:50:32,010 --> 00:50:30,070
hundred and sixty one miles burned boss

855
00:50:58,060 --> 00:50:32,020
T fourteen thousand seven hundred and

856
00:51:08,200 --> 00:51:00,430
we are 11 minutes into the flight of

857
00:51:10,330 --> 00:51:08,210
insight we have about two more minutes

858
00:51:24,310 --> 00:51:10,340
left in the first burn of the second

859
00:52:06,010 --> 00:51:24,320
stage rl10 engine body rates auto

860
00:52:09,700 --> 00:52:07,720
we're coming up on about one minute left

861
00:52:13,810 --> 00:52:09,710
in the burn of the oral ten of the

862
00:52:17,079 --> 00:52:13,820
second stage one minute remains in this

863
00:52:20,170 --> 00:52:17,089

first Burn Center key you can go on

864
00:52:22,150 --> 00:52:20,180
their nominal Carleton chamber pressure

865
00:52:24,900 --> 00:52:22,160
LOX pump discharge and fueled in theory

866
00:52:28,990 --> 00:52:24,910
all appropriate for the said I'm armed

867
00:52:59,210 --> 00:52:29,000
RCS line temperatures look good it'll

868
00:53:04,220 --> 00:53:01,040
and we are now 13 minutes into flight

869
00:53:06,050 --> 00:53:04,230
very close to the second stage engine

870
00:53:16,780 --> 00:53:06,060
cutting off for the first time for one

871
00:53:23,500 --> 00:53:19,150
and we have Miko and shut down looks

872
00:53:25,180 --> 00:53:23,510
good we have four s7 motors on and you

873
00:53:27,460 --> 00:53:25,190
just heard confirmation from United

874
00:53:29,320 --> 00:53:27,470
Launch Alliance Marty Malinowski that

875
00:53:31,360 --> 00:53:29,330
we've had Miko the second stage engine

876
00:53:33,520 --> 00:53:31,370
has cut off for the first time the first

877
00:53:35,470 --> 00:53:33,530
burn of the second stage are Elton being

878
00:53:36,460 --> 00:53:35,480
complete we now begin the long coast

879
00:53:38,380 --> 00:53:36,470
phase of this mission

880
00:53:40,390 --> 00:53:38,390
the Coast phase will end when the are

881
00:53:42,850 --> 00:53:40,400
elton engine ignites for the second time

882
00:53:45,760 --> 00:53:42,860
for five minutes started a second

883
00:53:47,560 --> 00:53:45,770
centaur burn will begin over northeast

884
00:53:50,110 --> 00:53:47,570
Russia the end of the second centaur

885
00:53:53,470 --> 00:53:50,120
burn will be completed over the Northern

886
00:53:55,930 --> 00:53:53,480
Pacific Ocean after the end of the

887
00:53:58,510 --> 00:53:55,940
second burn will Coast for about nine

888
00:54:00,040 --> 00:53:58,520

minutes so that the Goldstone Deep Space

889
00:54:02,290 --> 00:54:00,050
Network is in view for the separation

890
00:54:03,700 --> 00:54:02,300
events of the inside spacecraft and the

891
00:54:06,330 --> 00:54:03,710
two Marco spacecraft that are traveling

892
00:54:08,530 --> 00:54:06,340
along and that will happen over

893
00:54:12,010 --> 00:54:08,540
northeastern Pacific Ocean off the coast

894
00:54:13,030 --> 00:54:12,020
of Oregon so with the long coast phase

895
00:54:15,100 --> 00:54:13,040
underway

896
00:54:18,010 --> 00:54:15,110
we'll now go back to Stephanie Martin

897
00:54:19,840 --> 00:54:18,020
Stephanie thanks Josh for missions to

898
00:54:21,760 --> 00:54:19,850
other planets the flight path has to be

899
00:54:24,070 --> 00:54:21,770
extremely precise to ensure the

900
00:54:25,050 --> 00:54:24,080
spacecraft lands or orbits in the

901
00:54:27,400 --> 00:54:25,060
correct direction

902
00:54:29,470 --> 00:54:27,410
NASA's Amanda Griffin sat down with

903
00:54:31,900 --> 00:54:29,480
Callie Burke the trajectory analysis

904
00:54:35,220 --> 00:54:31,910
analyst for the insight mission to learn

905
00:54:37,270 --> 00:54:35,230
more about her work for today's mission

906
00:54:39,970 --> 00:54:37,280
so Callie tell us a little bit about

907
00:54:41,590 --> 00:54:39,980
your role for insight my role is the

908
00:54:44,170 --> 00:54:41,600
trajectory analyst here at the launch

909
00:54:45,610 --> 00:54:44,180
services program and so my job is to

910
00:54:47,500 --> 00:54:45,620
make sure that the rocket drops the

911
00:54:50,020 --> 00:54:47,510
spacecraft off at the right place and

912
00:54:51,610 --> 00:54:50,030
time in space we have to consider these

913
00:54:54,160 --> 00:54:51,620

really complex journeys you know it's

914
00:54:55,570 --> 00:54:54,170
it's not just doing an equation once the

915
00:54:57,100 --> 00:54:55,580
Jet Propulsion lab they do these things

916
00:54:59,560 --> 00:54:57,110
called pork chop plots and so they

917
00:55:01,510 --> 00:54:59,570
consider multi many months they could

918
00:55:04,060 --> 00:55:01,520
launch in many months they could land on

919
00:55:05,410 --> 00:55:04,070
Mars what's the weather conditions gonna

920
00:55:06,940 --> 00:55:05,420
be like when they get there do we have

921
00:55:08,980 --> 00:55:06,950
we want to get communication during

922
00:55:10,990 --> 00:55:08,990
landing so are the right satellites in

923
00:55:12,610 --> 00:55:11,000
place or are we looking back at earth at

924
00:55:16,060 --> 00:55:12,620
that time in the line in sight there's

925
00:55:18,340 --> 00:55:16,070
all these considerations and so we have

926
00:55:20,170 --> 00:55:18,350
35 days we're looking at that we're

927
00:55:22,930 --> 00:55:20,180
launching but only one day that we're

928
00:55:24,970 --> 00:55:22,940
gonna land we actually have a two-hour

929
00:55:27,730 --> 00:55:24,980
window that we're able to do on each day

930
00:55:31,120 --> 00:55:27,740
and so that's 25 opportunities so

931
00:55:34,450 --> 00:55:31,130
there's 875 possible ones we and

932
00:55:36,400 --> 00:55:34,460
Wow yeah so to launch from California

933
00:55:38,170 --> 00:55:36,410
what's different here from Florida we

934
00:55:39,489 --> 00:55:38,180
launched east safely and we can go so

935
00:55:42,249 --> 00:55:39,499
much to the north and somewhat from the

936
00:55:44,620 --> 00:55:42,259
south but from Vandenberg if they launch

937
00:55:46,059 --> 00:55:44,630
East they're flying over people and so

938
00:55:48,730 --> 00:55:46,069

we don't want that so we can launch to

939
00:55:51,569 --> 00:55:48,740
the southeast as we are for insight and

940
00:55:53,980 --> 00:55:51,579
then we can continue going west and

941
00:55:56,650 --> 00:55:53,990
launch safely so we've heard a lot about

942
00:55:58,569 --> 00:55:56,660
planetary protection so what is that and

943
00:56:00,400 --> 00:55:58,579
what is your team doing to try to help

944
00:56:02,259 --> 00:56:00,410
mitigate that it Mars so we have

945
00:56:05,739 --> 00:56:02,269
somebody here at NASA who's called the

946
00:56:07,269 --> 00:56:05,749
planetary protection officer which after

947
00:56:10,210 --> 00:56:07,279
a nine-year-old applied I now joking

948
00:56:11,980 --> 00:56:10,220
that's the guardian the galaxy that's

949
00:56:15,009 --> 00:56:11,990
why you said he'd be great but the

950
00:56:17,079 --> 00:56:15,019
planetary protection officer looks to

951
00:56:19,210 --> 00:56:17,089
both protect Earth from any microbes we

952
00:56:21,130 --> 00:56:19,220
bring from space and then we also

953
00:56:22,809 --> 00:56:21,140
consider Mars in Europa where we think

954
00:56:25,450 --> 00:56:22,819
there might be life we want to protect

955
00:56:27,460 --> 00:56:25,460
them forming earth bugs and basically

956
00:56:29,799 --> 00:56:27,470
creating life somewhere as opposed to

957
00:56:31,900 --> 00:56:29,809
finding it the spacecraft which we we

958
00:56:34,359 --> 00:56:31,910
plan to have land on Mars have been very

959
00:56:36,160 --> 00:56:34,369
specially clean there's a whole team but

960
00:56:38,289 --> 00:56:36,170
we don't do that with a rocket we

961
00:56:39,849 --> 00:56:38,299
actually aim the trajectory a little bit

962
00:56:43,690 --> 00:56:39,859
away from Mars we don't aim it straight

963
00:56:45,460 --> 00:56:43,700

at Mars so that we don't pollute Mars

964
00:56:48,339 --> 00:56:45,470
well here's wishing you all nominal

965
00:56:54,249 --> 00:56:48,349
calls launch day thank you successful

966
00:56:55,989 --> 00:56:54,259
flight thanks to Kelly we are 17 minutes

967
00:56:59,079 --> 00:56:55,999
into the flight of NASA's insight

968
00:57:01,630 --> 00:56:59,089
spacecraft on its way to Mars our own

969
00:57:04,029 --> 00:57:01,640
tour in the Clendon is in the remote

970
00:57:05,650 --> 00:57:04,039
launch control center with Scott Messer

971
00:57:07,960 --> 00:57:05,660
the United Launch Alliance program

972
00:57:14,870 --> 00:57:07,970
manager for NASA missions to get an

973
00:57:18,360 --> 00:57:17,670
thank you so Scott tell us how it's

974
00:57:20,400 --> 00:57:18,370
going so far

975
00:57:23,100 --> 00:57:20,410
well so far Tory things are really good

976
00:57:25,140 --> 00:57:23,110
it's a very nominal account and it's a

977
00:57:28,130 --> 00:57:25,150
beautiful beautiful launch little foggy

978
00:57:31,890 --> 00:57:28,140
out there but well and right on track

979
00:57:33,060 --> 00:57:31,900
all right so as we all know United

980
00:57:34,410 --> 00:57:33,070
Launch Alliance is definitely no

981
00:57:36,750 --> 00:57:34,420
stranger to Mars missions you've

982
00:57:39,090 --> 00:57:36,760
launched the spirit and opportunity and

983
00:57:41,970 --> 00:57:39,100
the curiosity Rover's so what is it like

984
00:57:45,000 --> 00:57:41,980
to now have sent insight on its way to

985
00:57:47,400 --> 00:57:45,010
Mars yeah so you're right we're very

986
00:57:50,430 --> 00:57:47,410
excited we've have actually launched

987
00:57:52,920 --> 00:57:50,440
every Mars mission since 1960 so we're

988
00:57:54,510 --> 00:57:52,930

know we've done a lot of them and that

989
00:57:57,720 --> 00:57:54,520
but this one is super exciting obviously

990
00:57:59,670 --> 00:57:57,730
because we first launched from the west

991
00:58:02,610 --> 00:57:59,680
coast of a planetary mission onto Mars

992
00:58:04,910 --> 00:58:02,620
so it's very exciting and anytime we go

993
00:58:08,160 --> 00:58:04,920
to Mars it's very exciting for us to

994
00:58:09,930 --> 00:58:08,170
give our customer a great ride and great

995
00:58:11,700 --> 00:58:09,940
mission success so that the insight

996
00:58:15,120 --> 00:58:11,710
mission can do what it needs to do when

997
00:58:17,640 --> 00:58:15,130
it gets to Mars so this has have been a

998
00:58:19,980 --> 00:58:17,650
very busy year for you guys so far let's

999
00:58:21,960 --> 00:58:19,990
see this is the fifth launch for United

1000
00:58:24,030 --> 00:58:21,970
Launch Alliance in so far in 2018 at the

1001
00:58:26,760 --> 00:58:24,040
second NASA mission all right so what's

1002
00:58:29,340 --> 00:58:26,770
up next for the team so I've still got

1003
00:58:32,070 --> 00:58:29,350
two more missions left to go we've got

1004
00:58:34,110 --> 00:58:32,080
the Parker Solar Probe mission going to

1005
00:58:36,870 --> 00:58:34,120
the Sun which launches in July and then

1006
00:58:39,170 --> 00:58:36,880
of course our last Delta 2 mission which

1007
00:58:42,090 --> 00:58:39,180
launches in September from out here in

1008
00:58:46,110 --> 00:58:42,100
Vandenberg so a busy year for us with

1009
00:58:48,180 --> 00:58:46,120
four missions and very excited No thank

1010
00:58:50,120 --> 00:58:48,190
you very much we're looking forward to

1011
00:58:54,330 --> 00:58:50,130
the rest of the year the rest of today

1012
00:58:56,700 --> 00:58:54,340
thanks Stephanie back to you thanks

1013
00:58:58,260 --> 00:58:56,710

story with many scientific missions NASA

1014
00:59:00,390 --> 00:58:58,270
partners with international space

1015
00:59:04,050 --> 00:59:00,400
agencies to explore and discover new

1016
00:59:06,180 --> 00:59:04,060
science in fact insight has instruments

1017
00:59:08,430 --> 00:59:06,190
from France's national space agency

1018
00:59:13,470 --> 00:59:08,440
called knez and the German Aerospace

1019
00:59:18,370 --> 00:59:13,480
Center known as DLR NASA's Blair Allen

1020
00:59:23,089 --> 00:59:21,019
thanks so much Stephanie yes it's very

1021
00:59:25,430 --> 00:59:23,099
exciting we just witnessed an incredible

1022
00:59:28,190 --> 00:59:25,440
launch and we're here with two very

1023
00:59:30,740 --> 00:59:28,200
important members of the space community

1024
00:59:33,859 --> 00:59:30,750
Jean Yves and Pascal thanks for being on

1025
00:59:35,410 --> 00:59:33,869
the show thank you so I'll start with

1026
00:59:37,849 --> 00:59:35,420
you Jenny

1027
00:59:39,799 --> 00:59:37,859
just thinking about the significance of

1028
00:59:41,359 --> 00:59:39,809
insight and the partnership tell us a

1029
00:59:43,910 --> 00:59:41,369
little bit about what it means for the

1030
00:59:47,000 --> 00:59:43,920
French Space Agency to launch and see a

1031
00:59:48,319 --> 00:59:47,010
launch of the insight mission in fact as

1032
00:59:50,720 --> 00:59:48,329
you know we have a very strong

1033
00:59:53,599 --> 00:59:50,730
scientific community in France which is

1034
00:59:56,779 --> 00:59:53,609
totally devoted to Mars and this is why

1035
00:59:59,990 --> 00:59:56,789
we are on number of mass missions and

1036
01:00:01,940 --> 01:00:00,000
for us inside his perhaps not view

1037
01:00:04,549 --> 01:00:01,950
teammate about a very very important

1038
01:00:07,069 --> 01:00:04,559

mission because we are going to ear to

1039
01:00:09,859 --> 01:00:07,079
beat the art of mass with the Seas no

1040
01:00:12,859 --> 01:00:09,869
matter that we put a lot of insight and

1041
01:00:14,779 --> 01:00:12,869
obviously the that's that instrument is

1042
01:00:16,970 --> 01:00:14,789
very important to the data that we'll

1043
01:00:19,849 --> 01:00:16,980
get back so we're very appreciative that

1044
01:00:22,670 --> 01:00:19,859
you're participating as well yes and as

1045
01:00:24,559 --> 01:00:22,680
you know NASA is very selective in the

1046
01:00:27,260 --> 01:00:24,569
choice which are made and we are very

1047
01:00:29,750 --> 01:00:27,270
proud to have been selected and to have

1048
01:00:32,690 --> 01:00:29,760
a very strong partnership with NASA and

1049
01:00:34,279 --> 01:00:32,700
JPL during the last 10 years and I am

1050
01:00:36,880 --> 01:00:34,289
sure that we will have a tremendous

1051
01:00:39,380 --> 01:00:36,890
success so once we receive the data

1052
01:00:41,299 --> 01:00:39,390
absolutely absolutely in Pascal how

1053
01:00:42,829 --> 01:00:41,309
about for you in the German Space Agency

1054
01:00:45,349 --> 01:00:42,839
tell us a little bit about what it means

1055
01:00:48,890 --> 01:00:45,359
to see the significant mission start

1056
01:00:51,160 --> 01:00:48,900
today well Germany is active in Mars

1057
01:00:54,319 --> 01:00:51,170
exploration since more than two decades

1058
01:00:56,720 --> 01:00:54,329
just do you remember Mars Express and a

1059
01:00:59,660 --> 01:00:56,730
high-resolution stereo come a scanning

1060
01:01:02,150 --> 01:00:59,670
still the surface of Mars and also

1061
01:01:04,010 --> 01:01:02,160
contributing to many other u.s. missions

1062
01:01:07,880 --> 01:01:04,020
to Mars and we are very very excited

1063
01:01:11,240 --> 01:01:07,890

today that you know our instrument the

1064
01:01:14,109 --> 01:01:11,250
heat flow and surface properties

1065
01:01:17,630 --> 01:01:14,119
packages hp3 much easier to remember

1066
01:01:20,990 --> 01:01:17,640
will you know is onboard is on the way

1067
01:01:24,049 --> 01:01:21,000
to Mars and will really reveal new

1068
01:01:25,760 --> 01:01:24,059
insights about the interior of Mars yeah

1069
01:01:29,089 --> 01:01:25,770
and this is really exciting here tonight

1070
01:01:30,050 --> 01:01:29,099
because we have a scientist by

1071
01:01:32,990 --> 01:01:30,060
profession

1072
01:01:34,430 --> 01:01:33,000
an engineer tell me Pascal a little bit

1073
01:01:36,620 --> 01:01:34,440
about what it means for you as an

1074
01:01:38,960 --> 01:01:36,630
astrophysicist from that perspective

1075
01:01:41,960 --> 01:01:38,970
what it means for you to Siemens insight

1076
01:01:45,230 --> 01:01:41,970
launch well I think we want to

1077
01:01:48,560 --> 01:01:45,240
understand our neighbor planet Mars it

1078
01:01:50,930 --> 01:01:48,570
had a very similar history in 4.5

1079
01:01:53,360 --> 01:01:50,940
billion years ago we want to understand

1080
01:01:55,250 --> 01:01:53,370
how the planet evolved and developed

1081
01:01:58,850 --> 01:01:55,260
it's important to understand how

1082
01:02:01,340 --> 01:01:58,860
terrestrial planets evolved and we learn

1083
01:02:03,140 --> 01:02:01,350
from the experiments on inside about

1084
01:02:05,240 --> 01:02:03,150
that and I think one of the important

1085
01:02:08,570 --> 01:02:05,250
things is also that is really linked to

1086
01:02:11,960 --> 01:02:08,580
you know how life actually originated on

1087
01:02:14,930 --> 01:02:11,970
earth and eventually on Mars and that is

1088
01:02:17,870 --> 01:02:14,940

a very important aspect absolutely

1089
01:02:19,970 --> 01:02:17,880
thanks so much and Johnny an engineering

1090
01:02:24,200 --> 01:02:19,980
perspective how it feel for you as a

1091
01:02:26,990 --> 01:02:24,210
former engineer to launching to Mark's

1092
01:02:29,480 --> 01:02:27,000
is probably the ultimate on she's it's

1093
01:02:32,960 --> 01:02:29,490
my firm launch to Mars I was in Baikonur

1094
01:02:36,320 --> 01:02:32,970
in June 2003 for mass express I was also

1095
01:02:38,900 --> 01:02:36,330
in Baikonur in March 2016 for the first

1096
01:02:40,940 --> 01:02:38,910
exam marks and tonight but vo so long

1097
01:02:42,770 --> 01:02:40,950
she's finally are very simple you have

1098
01:02:45,650 --> 01:02:42,780
to launch yeah you have to launch to

1099
01:02:48,440 --> 01:02:45,660
who's to land and to discover and this

1100
01:02:50,420 --> 01:02:48,450
is probably the ultimate omission for an

1101
01:02:51,770 --> 01:02:50,430
engineer well said and thank you both

1102
01:02:54,140 --> 01:02:51,780
for being on the show we really

1103
01:02:56,240 --> 01:02:54,150
appreciate it and we're as excited as

1104
01:02:58,640 --> 01:02:56,250
you guys are to see Mars insight land

1105
01:03:01,610 --> 01:02:58,650
and start getting inside the Martian

1106
01:03:03,650 --> 01:03:01,620
surface so back to you Stephanie it's

1107
01:03:06,110 --> 01:03:03,660
very exciting I hope that you can sense

1108
01:03:08,840 --> 01:03:06,120
the excitement of myself and the

1109
01:03:10,670 --> 01:03:08,850
international community here Thank You

1110
01:03:12,920 --> 01:03:10,680
Blair we're so excited here in the

1111
01:03:14,420 --> 01:03:12,930
studio as well now we want to test your

1112
01:03:17,030 --> 01:03:14,430
knowledge for those of you tuned in

1113
01:03:20,480 --> 01:03:17,040

online we've got some insight trivia do

1114
01:05:51,460 --> 01:03:58,200
[Music]

1115
01:06:06,400 --> 01:05:51,470
you

1116
01:06:06,410 --> 01:06:20,890
[Music]

1117
01:06:25,340 --> 01:06:23,270
understanding the complex geological

1118
01:06:27,470 --> 01:06:25,350
formation of Mars is an essential part

1119
01:06:30,710 --> 01:06:27,480
of helping us discover how our own

1120
01:06:32,540 --> 01:06:30,720
planets future could unfold soos Mercker

1121
01:06:35,420 --> 01:06:32,550
the deputy principal investigator for

1122
01:06:37,520 --> 01:06:35,430
insight is onset with Blaire Allen from

1123
01:06:40,810 --> 01:06:37,530
NASA edge to talk about what's happening

1124
01:06:44,359 --> 01:06:40,820
beneath the Martian surface Blaire

1125
01:06:46,130 --> 01:06:44,369
thanks so much Stephanie sue I gotta

1126
01:06:49,460 --> 01:06:46,140
tell you before we get started about the

1127
01:06:53,359 --> 01:06:49,470
interior of Mars tell me what was your

1128
01:06:56,660 --> 01:06:53,369
experience during the launch it was

1129
01:06:59,420 --> 01:06:56,670
fantastic it was physical I could feel

1130
01:07:03,400 --> 01:06:59,430
the ground vibrating the car alarms are

1131
01:07:06,170 --> 01:07:03,410
going off and I saw a little spark

1132
01:07:11,150 --> 01:07:06,180
but that's about it but it was you know

1133
01:07:13,010 --> 01:07:11,160
it was just as emotional as if we if

1134
01:07:16,730 --> 01:07:13,020
there was no fog in the way so it's on

1135
01:07:18,980 --> 01:07:16,740
its way and it was really well I'm so

1136
01:07:22,280 --> 01:07:18,990
glad I felt the same way I didn't see it

1137
01:07:24,050 --> 01:07:22,290
obviously but did feel it and I tell you

1138
01:07:26,660 --> 01:07:24,060

it really is exciting and now we're

1139
01:07:28,970 --> 01:07:26,670
underway and so let's talk a little bit

1140
01:07:31,220 --> 01:07:28,980
about what's gonna happen once insight

1141
01:07:33,020 --> 01:07:31,230
gets there because the big objective is

1142
01:07:34,760 --> 01:07:33,030
to get under the surface so tell us a

1143
01:07:37,480 --> 01:07:34,770
little bit about the science of getting

1144
01:07:40,430 --> 01:07:37,490
underneath the surface of Mars okay so

1145
01:07:43,070 --> 01:07:40,440
our main instrument is a seismometer and

1146
01:07:45,980 --> 01:07:43,080
so we use that to image the interior of

1147
01:07:48,950 --> 01:07:45,990
the planet basically anytime a quake

1148
01:07:51,290 --> 01:07:48,960
goes off it'll travel through the

1149
01:07:54,410 --> 01:07:51,300
interior Mars it'll bounce off different

1150
01:07:56,300 --> 01:07:54,420
density layers and so you know it's it's

1151
01:07:59,630 --> 01:07:56,310
like like a sonogram it'll bounce off

1152
01:08:02,030 --> 01:07:59,640
when a change in the density of the

1153
01:08:04,390 --> 01:08:02,040
planet so we're gonna measure the

1154
01:08:07,220 --> 01:08:04,400
thickness of the crust we're going to

1155
01:08:08,450 --> 01:08:07,230
determine the seismic velocity the

1156
01:08:10,760 --> 01:08:08,460
mantle which tells us about its

1157
01:08:12,830 --> 01:08:10,770
temperature and we're going to determine

1158
01:08:15,020 --> 01:08:12,840
the size of the core so all that

1159
01:08:17,240 --> 01:08:15,030
structure now I'm wondering the

1160
01:08:20,690 --> 01:08:17,250
particular location that insight where

1161
01:08:24,140 --> 01:08:20,700
it lands was that chosen based on

1162
01:08:26,030 --> 01:08:24,150
geological activity or or tell me a

1163
01:08:28,340 --> 01:08:26,040

little bit about the region you're

1164
01:08:29,849 --> 01:08:28,350
landing it so we're going to Elysium

1165
01:08:33,090 --> 01:08:29,859
Planitia

1166
01:08:35,640 --> 01:08:33,100
and you know we are a competed mission

1167
01:08:38,910 --> 01:08:35,650
so we are trying to do things on a

1168
01:08:41,130 --> 01:08:38,920
budget and with the lander it's a it's a

1169
01:08:42,360 --> 01:08:41,140
copy if you will of the Phoenix lander

1170
01:08:44,790 --> 01:08:42,370
so it had already kind of had some

1171
01:08:47,670 --> 01:08:44,800
engineering constraints that man we can

1172
01:08:49,829 --> 01:08:47,680
only land at a certain altitude on Mars

1173
01:08:53,250 --> 01:08:49,839
you know we go and we don't want to

1174
01:08:55,170 --> 01:08:53,260
crash we don't want to you know and we

1175
01:08:57,200 --> 01:08:55,180
also are solar powers we need to be near

1176
01:09:00,810 --> 01:08:57,210
the equator right so that actually

1177
01:09:03,450 --> 01:09:00,820
narrows it down a lot and then the last

1178
01:09:06,360 --> 01:09:03,460
thing that we wanted is someplace where

1179
01:09:09,390 --> 01:09:06,370
we can burrow our mole yeah for the heat

1180
01:09:13,260 --> 01:09:09,400
flow under the ground and happily Mars

1181
01:09:16,500 --> 01:09:13,270
provides a window into its subsurface

1182
01:09:19,770 --> 01:09:16,510
via impact craters so our landing site

1183
01:09:23,040 --> 01:09:19,780
lead Matt galumbeck and many many

1184
01:09:25,470 --> 01:09:23,050
students mapped hundreds of impact

1185
01:09:27,630 --> 01:09:25,480
craters and determined the depth at

1186
01:09:29,310 --> 01:09:27,640
which there's a competent rock layer so

1187
01:09:31,260 --> 01:09:29,320
we found a place where we get them all

1188
01:09:33,390 --> 01:09:31,270

down without worrying about that rock

1189
01:09:35,220 --> 01:09:33,400
layer depth well I guess that's going to

1190
01:09:37,230 --> 01:09:35,230
be pretty pretty important for the

1191
01:09:40,560 --> 01:09:37,240
mission because it's going down pretty

1192
01:09:43,140 --> 01:09:40,570
deep I understand yeah up to 16 feet so

1193
01:09:45,060 --> 01:09:43,150
we think the first 30 feet or so should

1194
01:09:46,530 --> 01:09:45,070
be should be okay in our region that

1195
01:09:48,870 --> 01:09:46,540
well that's incredible now tell me a

1196
01:09:50,730 --> 01:09:48,880
little bit about this mole what kind of

1197
01:09:54,630 --> 01:09:50,740
data are you actually getting with that

1198
01:09:56,970 --> 01:09:54,640
sensitive instrument yeah so it hammers

1199
01:09:59,250 --> 01:09:56,980
itself down and stops every about a foot

1200
01:10:01,020 --> 01:09:59,260
and a half and it sends out a heat pulse

1201
01:10:03,480 --> 01:10:01,030
which tells us about the thermal

1202
01:10:07,050 --> 01:10:03,490
conductivity of the soil and then it

1203
01:10:10,260 --> 01:10:07,060
keeps on hammering and in steps down to

1204
01:10:12,260 --> 01:10:10,270
about 16 feet at that depth we're away

1205
01:10:15,630 --> 01:10:12,270
from temperature changes due to

1206
01:10:17,370 --> 01:10:15,640
day/night changes seasonal changes and

1207
01:10:18,450 --> 01:10:17,380
we're just getting the the heat coming

1208
01:10:21,000 --> 01:10:18,460
out of the planet so we actually measure

1209
01:10:22,650 --> 01:10:21,010
the thermal gradient with a string of

1210
01:10:25,470 --> 01:10:22,660
temperature sensors that the mole pulls

1211
01:10:27,630 --> 01:10:25,480
behind it so with that thermal gradient

1212
01:10:28,860 --> 01:10:27,640
and and thermal conductivity we get the

1213
01:10:31,350 --> 01:10:28,870

heat coming out of the interior of the

1214
01:10:33,300 --> 01:10:31,360
planet so I tell you it sounds like

1215
01:10:35,070 --> 01:10:33,310
you've got the bases covered

1216
01:10:36,870 --> 01:10:35,080
well listen thanks so much for being on

1217
01:10:39,150 --> 01:10:36,880
the show and good luck to you and the

1218
01:10:41,160 --> 01:10:39,160
rest of the insight team Stephanie we're

1219
01:10:43,470 --> 01:10:41,170
learning a ton about what's going on

1220
01:10:45,270 --> 01:10:43,480
with insight thank you so much take care

1221
01:10:47,640 --> 01:10:45,280
back in the studio and keep giving us

1222
01:10:50,720 --> 01:10:47,650
good information on the progress of the

1223
01:10:53,610 --> 01:10:50,730
Atlas 5 and centaur as they head to Mars

1224
01:10:56,130 --> 01:10:53,620
thank you so much we're about 31 minutes

1225
01:10:58,500 --> 01:10:56,140
into today's flight of NASA's insights

1226
01:11:00,360 --> 01:10:58,510
spacecraft on its way to Mars let's

1227
01:11:01,800 --> 01:11:00,370
check back in with Joshua Finch in the

1228
01:11:05,310 --> 01:11:01,810
mission director Center for an update on

1229
01:11:08,220 --> 01:11:05,320
the flight Thank You Stephanie we had an

1230
01:11:10,860 --> 01:11:08,230
on-time lift off today at 405 Pacific

1231
01:11:13,020 --> 01:11:10,870
the Atlas 5 rocket roared to life with

1232
01:11:15,060 --> 01:11:13,030
the insight spacecraft the insight

1233
01:11:17,850 --> 01:11:15,070
spacecraft is now as you see on your

1234
01:11:19,380 --> 01:11:17,860
screen to this animation is traveling

1235
01:11:21,770 --> 01:11:19,390
with the second stage the second stage

1236
01:11:24,120 --> 01:11:21,780
is on a Coast phase the rl10 engine

1237
01:11:26,370 --> 01:11:24,130
ignited for the first time and did its

1238
01:11:27,600 --> 01:11:26,380

burn and has now shut off and we're in a

1239
01:11:28,740 --> 01:11:27,610
Coast phase as you can see from the

1240
01:11:31,170 --> 01:11:28,750
bottom right of your screen we're

1241
01:11:34,500 --> 01:11:31,180
traveling just over the southern tip of

1242
01:11:36,930 --> 01:11:34,510
South America and this burn will be the

1243
01:11:39,960 --> 01:11:36,940
first bernal was the first of two that

1244
01:11:41,600 --> 01:11:39,970
will do the second burn we'll put the

1245
01:11:44,880 --> 01:11:41,610
spacecraft in the proper proper proper

1246
01:11:46,800 --> 01:11:44,890
trajectory and it will Coast for about

1247
01:11:48,450 --> 01:11:46,810
nine minutes after this completion of

1248
01:11:50,490 --> 01:11:48,460
that second stage burn and then it will

1249
01:11:52,080 --> 01:11:50,500
released the inside spacecraft and then

1250
01:11:55,229 --> 01:11:52,090
a few moments later released the two

1251
01:11:56,550 --> 01:11:55,239
Marco spacecraft at the bottom but a

1252
01:11:58,260 --> 01:11:56,560
beautiful beautiful liftoff in the

1253
01:12:00,120 --> 01:11:58,270
pre-dawn sky at Vandenberg Air Force

1254
01:12:02,940 --> 01:12:00,130
Base on the Central Coast of California

1255
01:12:05,250 --> 01:12:02,950
it was fog in the area yet no constraint

1256
01:14:34,760 --> 01:12:05,260
to launch and speaking of watch let's

1257
01:14:39,270 --> 01:14:37,320
and on your screen you can see some

1258
01:14:42,120 --> 01:14:39,280
animation of the second stage centaur

1259
01:14:44,100 --> 01:14:42,130
with the inside spacecraft atop and at

1260
01:14:47,310 --> 01:14:44,110
the bottom of the Centaur the two Marco

1261
01:14:49,650 --> 01:14:47,320
spacecraft we're in the long coast phase

1262
01:14:51,600 --> 01:14:49,660
of our mission and for right now we've

1263
01:14:54,330 --> 01:14:51,610

got some more Mars trivia for you and

1264
01:15:32,670 --> 01:14:54,340
we'll bring that to you right now

1265
01:17:52,779 --> 01:15:49,650
[Music]

1266
01:17:58,149 --> 01:17:55,359
and you can see the insight spacecraft

1267
01:18:00,819 --> 01:17:58,159
atop this second stage centaur of the

1268
01:18:03,490 --> 01:18:00,829
Atlas 5 rocket continuing on its flight

1269
01:18:07,089 --> 01:18:03,500
path we do have an on-time liftoff at

1270
01:18:08,589 --> 01:18:07,099
4:05 a.m. Pacific time a nice launch in

1271
01:18:11,470 --> 01:18:08,599
the pre-dawn sky at Vandenberg Air Force

1272
01:18:13,779 --> 01:18:11,480
Base we're still in our long coast phase

1273
01:18:16,000 --> 01:18:13,789
for this mission before the second burn

1274
01:18:17,229 --> 01:18:16,010
at the second stage engine and while

1275
01:18:19,410 --> 01:18:17,239
we're waiting we'll now go back to

1276
01:18:22,509 --> 01:18:19,420
Stephanie Martin for more Stephanie

1277
01:18:24,399 --> 01:18:22,519
thanks Josh the twin Marco cube SATs

1278
01:18:26,589 --> 01:18:24,409
will be the first small satellites to

1279
01:18:28,870 --> 01:18:26,599
leave Earth's orbit if the technology

1280
01:18:30,279 --> 01:18:28,880
demonstration is successful they hold a

1281
01:18:33,279 --> 01:18:30,289
lot of promise for the scientific

1282
01:18:35,979 --> 01:18:33,289
community NASA's Chris Gerst is with

1283
01:18:37,750 --> 01:18:35,989
with joel the marco lead mechanical

1284
01:18:41,560 --> 01:18:37,760
engineer at NASA's Jet Propulsion

1285
01:18:43,990 --> 01:18:41,570
Laboratory Chris hey thanks defi to Joe

1286
01:18:44,819 --> 01:18:44,000
tell me about the watch oh it was

1287
01:18:47,109 --> 01:18:44,829
fantastic

1288
01:18:50,189 --> 01:18:47,119

even through the fog you could feel the

1289
01:18:52,209 --> 01:18:50,199
Rockets out lifting off of the pad and

1290
01:18:54,609 --> 01:18:52,219
successfully clearing the tower and

1291
01:18:56,680 --> 01:18:54,619
getting on its voyage a really exciting

1292
01:18:59,470 --> 01:18:56,690
time now take us through the next phases

1293
01:19:03,339 --> 01:18:59,480
for from Marco a.m. be sure so after

1294
01:19:05,859 --> 01:19:03,349
about 90 minutes the insight spacecraft

1295
01:19:08,439 --> 01:19:05,869
will deploy 60 seconds after that the

1296
01:19:11,229 --> 01:19:08,449
first Marco spacecraft will also deploy

1297
01:19:13,029 --> 01:19:11,239
off the second stage stage will roll 180

1298
01:19:15,700 --> 01:19:13,039
degrees and then the second Marco will

1299
01:19:17,589 --> 01:19:15,710
deploy okay so that's that's interesting

1300
01:19:19,689 --> 01:19:17,599
because you're gonna what you're gonna

1301
01:19:21,279 --> 01:19:19,699
let the insight spacecraft go first

1302
01:19:23,979 --> 01:19:21,289
absolutely and you guys are gonna be

1303
01:19:25,959 --> 01:19:23,989
trailing correct yeah we we all deploy

1304
01:19:28,029 --> 01:19:25,969
off in slightly different directions and

1305
01:19:30,520 --> 01:19:28,039
then we fly as a loose cluster together

1306
01:19:32,770 --> 01:19:30,530
over our six-month trip to Mars now how

1307
01:19:34,990 --> 01:19:32,780
do you think Marco a and B how they

1308
01:19:37,120 --> 01:19:35,000
gonna feel following insight all the way

1309
01:19:39,609 --> 01:19:37,130
to Mars sure well that's it's exactly

1310
01:19:42,250 --> 01:19:39,619
our point we are we are there to trail

1311
01:19:44,919 --> 01:19:42,260
inside and we're or we're eagerly

1312
01:19:47,080 --> 01:19:44,929
awaiting our chance to fly over and and

1313
01:19:49,810 --> 01:19:47,090

catch up with them as they go through

1314
01:19:51,580 --> 01:19:49,820
entry descent and landing and we fly

1315
01:19:53,560 --> 01:19:51,590
over and are able to relay their message

1316
01:19:55,810 --> 01:19:53,570
back to the eagerly awaiting ears here

1317
01:19:57,160 --> 01:19:55,820
on earth now this is this is pretty cool

1318
01:19:59,649 --> 01:19:57,170
because this is the first time we're

1319
01:20:01,569 --> 01:19:59,659
taking a cube set that's traveling you

1320
01:20:03,939 --> 01:20:01,579
know out of low Earth orbit and going to

1321
01:20:05,620 --> 01:20:03,949
another planet kind of take us through

1322
01:20:06,670 --> 01:20:05,630
that process I mean what are some of the

1323
01:20:09,210 --> 01:20:06,680
challenges of actually

1324
01:20:11,050 --> 01:20:09,220
designing a CubeSat you know

1325
01:20:13,780 --> 01:20:11,060
constructing it and getting it ready for

1326
01:20:17,500 --> 01:20:13,790
her flight absolutely

1327
01:20:19,270 --> 01:20:17,510
space is hard that's one of the

1328
01:20:21,130 --> 01:20:19,280
difficulties with with any type of

1329
01:20:22,900 --> 01:20:21,140
satellite and with the Marco CubeSat

1330
01:20:24,610 --> 01:20:22,910
there's nothing any difference

1331
01:20:27,220 --> 01:20:24,620
traditionally cube sets in low-earth

1332
01:20:29,890 --> 01:20:27,230
orbit you're close to home you have a

1333
01:20:32,200 --> 01:20:29,900
lot of opportunities to talk to to your

1334
01:20:34,090 --> 01:20:32,210
spacecraft you're in an environment that

1335
01:20:36,880 --> 01:20:34,100
repeats itself since you're orbiting the

1336
01:20:37,780 --> 01:20:36,890
same body over and over as you get into

1337
01:20:39,790 --> 01:20:37,790
deep space

1338
01:20:42,010 --> 01:20:39,800

you're in a much different environment

1339
01:20:44,080 --> 01:20:42,020
you're perpetually moving further and

1340
01:20:45,940 --> 01:20:44,090
further away from the Sun you get less

1341
01:20:49,000 --> 01:20:45,950
and less power every day your

1342
01:20:50,770 --> 01:20:49,010
environment is changing additionally you

1343
01:20:53,230 --> 01:20:50,780
are very far from everything that is

1344
01:20:56,200 --> 01:20:53,240
familiar there's no GPS there's no ways

1345
01:20:58,420 --> 01:20:56,210
that can help you navigate that's the

1346
01:21:01,030 --> 01:20:58,430
deep space network is your only way to

1347
01:21:02,740 --> 01:21:01,040
phone home okay one of the technologies

1348
01:21:05,530 --> 01:21:02,750
that Marco is demonstrating on this

1349
01:21:07,600 --> 01:21:05,540
mission is a brand new radio very

1350
01:21:09,340 --> 01:21:07,610
similar to what is flown on these larger

1351
01:21:12,550 --> 01:21:09,350
spacecrafts about a quarter of the size

1352
01:21:14,890 --> 01:21:12,560
this softball-sized radio allows us to

1353
01:21:16,960 --> 01:21:14,900
communicate with the DSN radio in order

1354
01:21:19,150 --> 01:21:16,970
to do things like navigate on our way to

1355
01:21:20,650 --> 01:21:19,160
Mars and in order to communicate with

1356
01:21:22,750 --> 01:21:20,660
the Deep Space Network and understand

1357
01:21:25,390 --> 01:21:22,760
how our satellites are doing now once

1358
01:21:27,130 --> 01:21:25,400
Marco and we're all assuming it's gonna

1359
01:21:28,480 --> 01:21:27,140
do its job beautifully once it gets to

1360
01:21:30,430 --> 01:21:28,490
Mars and it's gonna help out the inside

1361
01:21:33,670 --> 01:21:30,440
spacecraft when it's once that is done

1362
01:21:36,550 --> 01:21:33,680
where did the Marco cube sets go sure so

1363
01:21:37,960 --> 01:21:36,560

Marcos primary mission is a technology

1364
01:21:38,860 --> 01:21:37,970
demonstration to learn about these

1365
01:21:41,200 --> 01:21:38,870
technologies

1366
01:21:43,600 --> 01:21:41,210
if we survive our six-month voyage and

1367
01:21:46,360 --> 01:21:43,610
learn all of about these technologies

1368
01:21:48,100 --> 01:21:46,370
throughout that trip will do entry

1369
01:21:50,350 --> 01:21:48,110
descent and landing relay of insights

1370
01:21:52,680 --> 01:21:50,360
information after that the to Marco's

1371
01:21:55,390 --> 01:21:52,690
missions is complete we'll finish

1372
01:21:57,820 --> 01:21:55,400
relaying down data and engineering data

1373
01:21:59,680 --> 01:21:57,830
to sort of see exactly how we performed

1374
01:22:02,110 --> 01:21:59,690
when relaying insights data for entry

1375
01:22:04,750 --> 01:22:02,120
descent and landing and after that we'll

1376
01:22:07,960 --> 01:22:04,760
sail off into the sunset and sort of be

1377
01:22:10,210 --> 01:22:07,970
in a heliocentric orbit for forever

1378
01:22:12,880 --> 01:22:10,220
that's it's incredible in fact you know

1379
01:22:15,400 --> 01:22:12,890
it's really you're laying the foundation

1380
01:22:17,380 --> 01:22:15,410
for future Cube sets to be launched to

1381
01:22:20,470 --> 01:22:17,390
other planets absolutely it's a it's a

1382
01:22:24,610 --> 01:22:20,480
real honor and an exciting time

1383
01:22:26,979 --> 01:22:24,620
to be involved in this investment into

1384
01:22:31,080 --> 01:22:26,989
the future of small satellites and

1385
01:22:34,330 --> 01:22:31,090
satellites in general it's it's a really

1386
01:22:36,220 --> 01:22:34,340
surreal experience to have worked on

1387
01:22:38,020 --> 01:22:36,230
this over the past several years and to

1388
01:22:39,910 --> 01:22:38,030

be here to see the launch and experience

1389
01:22:42,490 --> 01:22:39,920
everything that all of these teams have

1390
01:22:43,960 --> 01:22:42,500
put into their satellites together now a

1391
01:22:46,120 --> 01:22:43,970
little bit it's a piece of trivia for

1392
01:22:48,670 --> 01:22:46,130
the audience I believe correct me if I'm

1393
01:22:51,760 --> 01:22:48,680
wrong that Marko a and B have special

1394
01:22:54,970 --> 01:22:51,770
names absolutely so so Marko a and B

1395
01:22:57,790 --> 01:22:54,980
were given the names by the team of

1396
01:23:00,400 --> 01:22:57,800
Wally and Eva after the the Disney

1397
01:23:03,490 --> 01:23:00,410
character from the movie wall-e and that

1398
01:23:06,640 --> 01:23:03,500
actually has some basis in in what Marco

1399
01:23:08,410 --> 01:23:06,650
actually is so the Marco's are

1400
01:23:12,430 --> 01:23:08,420
demonstrating a coal gas propulsion

1401
01:23:14,680 --> 01:23:12,440
system which allows us to fly to allows

1402
01:23:17,590 --> 01:23:14,690
us to correct our trajectory on our trip

1403
01:23:19,510 --> 01:23:17,600
to Mars in the movie wall-e there's a

1404
01:23:21,729 --> 01:23:19,520
scene where where wall-e jumps out of

1405
01:23:25,170 --> 01:23:21,739
the space station and it's flying around

1406
01:23:28,120 --> 01:23:25,180
with a with a fire extinguisher

1407
01:23:29,860 --> 01:23:28,130
our prop systems are filled with the

1408
01:23:32,470 --> 01:23:29,870
same propellant that is in common fire

1409
01:23:34,570 --> 01:23:32,480
extinguishers so we're in in essence our

1410
01:23:36,220 --> 01:23:34,580
wall-e flying through space powered by

1411
01:23:38,920 --> 01:23:36,230
our fire extinguisher how cool is that

1412
01:23:40,450 --> 01:23:38,930
it's it's really it's very cool well Joe

1413
01:23:42,580 --> 01:23:40,460

thank you so much for joining us today

1414
01:23:45,130 --> 01:23:42,590
we I can't wait to see Marco in action

1415
01:23:46,630 --> 01:23:45,140
and and perform admirably and helping

1416
01:23:48,820 --> 01:23:46,640
out the inside spacecraft thank you

1417
01:23:50,140 --> 01:23:48,830
Chris Steffi how about you but we got to

1418
01:23:51,729 --> 01:23:50,150
come up with a special name for us

1419
01:23:53,530 --> 01:23:51,739
because that's pretty cool having to

1420
01:23:56,500 --> 01:23:53,540
cube SAS with special names back to you

1421
01:23:59,260 --> 01:23:56,510
thank you so much Chris now if you love

1422
01:24:01,180 --> 01:23:59,270
that they are named after Wally would

1423
01:24:05,110 --> 01:24:01,190
get some more insight and Marco trivia

1424
01:25:54,470 --> 01:25:00,430
[Music]

1425
01:25:58,739 --> 01:25:57,359
NASA edge spoke to several insight team

1426
01:26:01,589 --> 01:25:58,749
members at NASA's Jet Propulsion

1427
01:26:04,140 --> 01:26:01,599
Laboratory recently to expand upon

1428
01:26:06,259 --> 01:26:04,150
NASA's goal to understand the interior

1429
01:26:08,879 --> 01:26:06,269
of Mars

1430
01:26:10,410 --> 01:26:08,889
we're here at Tom Hoffman Project

1431
01:26:11,879 --> 01:26:10,420
Manager for insight I do it Tom

1432
01:26:13,589 --> 01:26:11,889
I'm doing great Chris you get pretty

1433
01:26:15,569 --> 01:26:13,599
excited I'm very excited we're getting

1434
01:26:17,489 --> 01:26:15,579
really close I can't wait to go hey tell

1435
01:26:19,259 --> 01:26:17,499
us what is insight insight is a

1436
01:26:21,810 --> 01:26:19,269
geophysical lander that's gonna go to

1437
01:26:23,220 --> 01:26:21,820
Mars it's gonna land on Mars it's going

1438
01:26:25,830 --> 01:26:23,230

to deploy some geophysical instruments

1439
01:26:27,509 --> 01:26:25,840
specifically a seismometer and a heat

1440
01:26:29,609 --> 01:26:27,519
flow and physical properties probe and

1441
01:26:31,859 --> 01:26:29,619
it's gonna probe into the interior of

1442
01:26:33,540 --> 01:26:31,869
Mars to understand what the makeup is

1443
01:26:35,489 --> 01:26:33,550
you can think of it kind of as a checkup

1444
01:26:37,649 --> 01:26:35,499
for Mars this is a pretty cool mission

1445
01:26:39,000 --> 01:26:37,659
because it's not like any other Mars

1446
01:26:41,040 --> 01:26:39,010
mission that we've had to the surface

1447
01:26:42,750 --> 01:26:41,050
before that's right so in the past we've

1448
01:26:44,250 --> 01:26:42,760
only gone a few centimeters into the

1449
01:26:46,109 --> 01:26:44,260
surface of Mars it's basically scrape

1450
01:26:49,200 --> 01:26:46,119
the surface in this mission we're gonna

1451
01:26:51,509 --> 01:26:49,210
literally hammer in five meters about 15

1452
01:26:53,399 --> 01:26:51,519
feet into the regular to Mars so that we

1453
01:26:55,109 --> 01:26:53,409
can put down a physical properties probe

1454
01:26:56,520 --> 01:26:55,119
what it's going to do as it goes in it's

1455
01:26:59,160 --> 01:26:56,530
going to take measurements of the

1456
01:27:01,319 --> 01:26:59,170
properties of the regolith as a soil and

1457
01:27:03,149 --> 01:27:01,329
at different intervals and finally when

1458
01:27:05,540 --> 01:27:03,159
it gets down to its final resting spot

1459
01:27:07,220 --> 01:27:05,550
about that five meters 15 feet down

1460
01:27:09,650 --> 01:27:07,230
it's going to be able to measure how

1461
01:27:10,850 --> 01:27:09,660
much heat is coming out from the core to

1462
01:27:13,190 --> 01:27:10,860
the surface and the reason that matters

1463
01:27:14,570 --> 01:27:13,200

is because with a hot core we know that

1464
01:27:15,770 --> 01:27:14,580
that's what basically keeps the whole

1465
01:27:17,750 --> 01:27:15,780
planet alive

1466
01:27:19,430 --> 01:27:17,760
right that hot pork so understand how

1467
01:27:21,050 --> 01:27:19,440
hot it still is and how much energy is

1468
01:27:22,550 --> 01:27:21,060
still coming out from the core we're

1469
01:27:25,400 --> 01:27:22,560
really giving us a good idea about how

1470
01:27:27,590 --> 01:27:25,410
alive is Mars still today Bruce it's

1471
01:27:29,990 --> 01:27:27,600
absolutely fascinating to think of Mars

1472
01:27:30,440 --> 01:27:30,000
as a living planet but how do you do

1473
01:27:34,040 --> 01:27:30,450
that

1474
01:27:35,540 --> 01:27:34,050
scientifically well a planet is really

1475
01:27:37,160 --> 01:27:35,550
it's like a heat engine you have the

1476
01:27:38,420 --> 01:27:37,170
heat of the court is trying to get out

1477
01:27:40,370 --> 01:27:38,430
and that's what's driving all the

1478
01:27:43,130 --> 01:27:40,380
geology on the planet and so what we

1479
01:27:46,010 --> 01:27:43,140
need to measure are both the heat coming

1480
01:27:47,570 --> 01:27:46,020
out which is its energy balance and sort

1481
01:27:49,370 --> 01:27:47,580
of the motions that are going on and we

1482
01:27:52,150 --> 01:27:49,380
measure those with our three

1483
01:27:54,800 --> 01:27:52,160
investigations how does that help you

1484
01:27:56,750 --> 01:27:54,810
determine that information about the

1485
01:27:59,210 --> 01:27:56,760
composition of the planet that you guys

1486
01:28:00,890 --> 01:27:59,220
are looking at well the different parts

1487
01:28:03,020 --> 01:28:00,900
of the planet have different masses so

1488
01:28:05,000 --> 01:28:03,030

the iron core is very dense and very

1489
01:28:07,460 --> 01:28:05,010
heavy and so what we'd like to know is

1490
01:28:09,890 --> 01:28:07,470
how big that core is and the size of the

1491
01:28:11,210 --> 01:28:09,900
core is going to determine its effect on

1492
01:28:13,430 --> 01:28:11,220
the wobble of the planet so we can

1493
01:28:15,410 --> 01:28:13,440
measure the size of the wobble the speed

1494
01:28:16,790 --> 01:28:15,420
of the wobble and also the frequency

1495
01:28:19,490 --> 01:28:16,800
because it wobbles at different

1496
01:28:22,010 --> 01:28:19,500
frequencies and so all those things we

1497
01:28:25,610 --> 01:28:22,020
can then sort of trace back to the size

1498
01:28:27,740 --> 01:28:25,620
and the density and state of the core do

1499
01:28:30,200 --> 01:28:27,750
we have any indication so far that

1500
01:28:33,440 --> 01:28:30,210
there's either a lot of seismic activity

1501
01:28:35,810 --> 01:28:33,450
or rather enough seismic activity to get

1502
01:28:38,240 --> 01:28:35,820
the data that you're looking for well we

1503
01:28:39,830 --> 01:28:38,250
have some information we have images

1504
01:28:41,600 --> 01:28:39,840
from orbit that show us faults on the

1505
01:28:44,120 --> 01:28:41,610
surface of the planet and most those

1506
01:28:45,620 --> 01:28:44,130
faults are billions of years old but we

1507
01:28:47,690 --> 01:28:45,630
actually can see some that are younger

1508
01:28:50,030 --> 01:28:47,700
and by counting up the faults as a

1509
01:28:51,620 --> 01:28:50,040
function of time extrapolating it to the

1510
01:28:54,470 --> 01:28:51,630
present we can come up with an estimate

1511
01:28:55,880 --> 01:28:54,480
of the Mars activity we also have sort

1512
01:28:57,590 --> 01:28:55,890
of bounding cases we know that the earth

1513
01:28:59,570 --> 01:28:57,600

is gonna be a lot more active than Mars

1514
01:29:02,300 --> 01:28:59,580
we know that the moon is a much deader

1515
01:29:04,520 --> 01:29:02,310
planet we measured the seismic activity

1516
01:29:06,230 --> 01:29:04,530
on the moon during the Apollo age so we

1517
01:29:07,700 --> 01:29:06,240
know that Mars should be more active

1518
01:29:10,130 --> 01:29:07,710
than that and the numbers that we

1519
01:29:12,440 --> 01:29:10,140
estimate do come out between those two

1520
01:29:14,120 --> 01:29:12,450
bounds and so we have a good expectation

1521
01:29:15,070 --> 01:29:14,130
that we'll see Mars quakes but of course

1522
01:29:18,700 --> 01:29:15,080
we won't really know

1523
01:29:21,130 --> 01:29:18,710
we get there so drop a a insight

1524
01:29:23,470 --> 01:29:21,140
has landed everybody's looking forward

1525
01:29:25,090 --> 01:29:23,480
to start collecting science but before

1526
01:29:27,820 --> 01:29:25,100
you can start collecting sentence you

1527
01:29:30,040 --> 01:29:27,830
have to start deploying your instruments

1528
01:29:31,780 --> 01:29:30,050
tell me a little bit about that so the

1529
01:29:33,880 --> 01:29:31,790
first thing we'll do is we document our

1530
01:29:37,210 --> 01:29:33,890
workspace using our camera on our arm

1531
01:29:39,010 --> 01:29:37,220
will take about roughly 56 images that

1532
01:29:41,380 --> 01:29:39,020
have to be downlink it could take a few

1533
01:29:43,600 --> 01:29:41,390
Sol's a couple of Sol's to download them

1534
01:29:45,820 --> 01:29:43,610
once those images arrive their downlink

1535
01:29:47,470 --> 01:29:45,830
will be processed on the ground to build

1536
01:29:49,510 --> 01:29:47,480
a digital elevation map of our workspace

1537
01:29:52,060 --> 01:29:49,520
the scientists and engineers are now

1538
01:29:54,040 --> 01:29:52,070

going to work together very closely to

1539
01:29:56,530 --> 01:29:54,050
select the two places the one who plays

1540
01:29:58,240 --> 01:29:56,540
the instruments so once those sites have

1541
01:30:00,520 --> 01:29:58,250
been selected then we go on our merry

1542
01:30:01,750 --> 01:30:00,530
ways to build sequences to actually pick

1543
01:30:03,700 --> 01:30:01,760
different strains and put them on the

1544
01:30:05,530 --> 01:30:03,710
surface of Mars the first one is the

1545
01:30:07,180 --> 01:30:05,540
seismometer and then once you dump

1546
01:30:09,790 --> 01:30:07,190
placing the seismometer on the ground

1547
01:30:11,830 --> 01:30:09,800
this seismometer is very very sensitive

1548
01:30:15,640 --> 01:30:11,840
if the butterfly sits on top of it and

1549
01:30:17,860 --> 01:30:15,650
flaps its wings it can detect it so you

1550
01:30:19,270 --> 01:30:17,870
can imagine if you have wind or any

1551
01:30:20,650 --> 01:30:19,280
other disturbance going over the sides

1552
01:30:23,140 --> 01:30:20,660
one meter you're going to get noise on

1553
01:30:24,730 --> 01:30:23,150
your signal so we have to put over it

1554
01:30:26,890 --> 01:30:24,740
what we call a winning thermal shield

1555
01:30:28,660 --> 01:30:26,900
basically it provides the seismometer it

1556
01:30:31,420 --> 01:30:28,670
was a constant thermal environment and

1557
01:30:33,700 --> 01:30:31,430
also protects it from the wind now when

1558
01:30:36,490 --> 01:30:33,710
you put your heat probe down once that

1559
01:30:38,950 --> 01:30:36,500
starts drilling into the surface of Mars

1560
01:30:41,050 --> 01:30:38,960
that is you're done with that right that

1561
01:30:42,760 --> 01:30:41,060
cannot be moved yes that is correct so

1562
01:30:44,440 --> 01:30:42,770
while we do all the heat probe is what

1563
01:30:46,630 --> 01:30:44,450

we go through the same process what the

1564
01:30:49,150 --> 01:30:46,640
scientists we select a site once we've

1565
01:30:50,860 --> 01:30:49,160
done with that we take our robotic arm

1566
01:30:52,840 --> 01:30:50,870
which is basically a fishing pole with a

1567
01:30:54,940 --> 01:30:52,850
hook on it you pick up the heat probe

1568
01:30:57,760 --> 01:30:54,950
it's gotta is gone what we call it

1569
01:30:59,470 --> 01:30:57,770
tether or cable because it's all made it

1570
01:31:01,540 --> 01:30:59,480
to the land I guess it's power and data

1571
01:31:03,850 --> 01:31:01,550
and computing power from the from the

1572
01:31:07,060 --> 01:31:03,860
lander will pick it up and as we move it

1573
01:31:09,310 --> 01:31:07,070
the tether is inside the heat probe and

1574
01:31:10,630 --> 01:31:09,320
we pull it out and then we slowly bring

1575
01:31:12,550 --> 01:31:10,640
it to the ground it's very light

1576
01:31:14,230 --> 01:31:12,560
and we have to also be precise to place

1577
01:31:17,050 --> 01:31:14,240
it at a position where there will not be

1578
01:31:19,180 --> 01:31:17,060
any obstacles that would block what we

1579
01:31:21,029 --> 01:31:19,190
call the mall from getting to the ground

1580
01:31:23,279 --> 01:31:21,039
from digging into the ground

1581
01:31:25,649 --> 01:31:23,289
the seismometer is on the surface of

1582
01:31:28,890 --> 01:31:25,659
Mars the heat probe has dug down into

1583
01:31:34,319 --> 01:31:28,900
the surface what if you find out that

1584
01:31:37,680 --> 01:31:34,329
the center of of Mars is solid that it

1585
01:31:40,020 --> 01:31:37,690
isn't molten isn't hot what does it tell

1586
01:31:43,589 --> 01:31:40,030
you its houses we've got some good signs

1587
01:31:46,520 --> 01:31:43,599
right because whether it's molten what

1588
01:31:48,689 --> 01:31:46,530

is solid or liquid is the right answer

1589
01:31:50,790 --> 01:31:48,699
so that means we have the right answer

1590
01:31:54,839 --> 01:31:50,800
we have the better model for Mars so

1591
01:31:57,569 --> 01:31:54,849
it's a win win at this time we're about

1592
01:32:00,239 --> 01:31:57,579
52 minutes into the flight of the

1593
01:32:03,629 --> 01:32:00,249
insight spacecraft and I understand that

1594
01:32:05,430 --> 01:32:03,639
NASA is Chris has found Jim Green chief

1595
01:32:07,259 --> 01:32:05,440
scientist again because he's full of

1596
01:32:11,189 --> 01:32:07,269
energy and he just can't get enough of

1597
01:32:14,370 --> 01:32:11,199
this you can't get enough of Jim Green I

1598
01:32:17,279 --> 01:32:14,380
got a I could listen to him for an all

1599
01:32:19,919 --> 01:32:17,289
day Jim tell me I know there's a lot of

1600
01:32:23,699 --> 01:32:19,929
fog but we heard quite a bit of yeah

1601
01:32:26,609 --> 01:32:23,709
yeah yeah so I you know sort of hedge my

1602
01:32:29,729 --> 01:32:26,619
bets and I turned on you know the iPhone

1603
01:32:33,600 --> 01:32:29,739
app for sound okay you know just like a

1604
01:32:36,660 --> 01:32:33,610
size instrument you know Mars quakes I

1605
01:32:39,870 --> 01:32:36,670
was looking for Atlas quakes and we

1606
01:32:42,949 --> 01:32:39,880
heard it we really heard it car alarms

1607
01:32:45,180 --> 01:32:42,959
went off in the parking lot that's right

1608
01:32:47,819 --> 01:32:45,190
believe that I heard at least two or

1609
01:32:48,930 --> 01:32:47,829
three car alarms going on it was mine

1610
01:32:51,270 --> 01:32:48,940
but I didn't care

1611
01:32:53,040 --> 01:32:51,280
now we know we talked earlier but it's

1612
01:32:54,719 --> 01:32:53,050
going into a pole orbit so it's on its

1613
01:32:58,770 --> 01:32:54,729

way now we saw the track heading south

1614
01:33:02,549 --> 01:32:58,780
and so tell me how difficult it is to

1615
01:33:04,529 --> 01:33:02,559
send a spacecraft to to Mars well you

1616
01:33:06,930 --> 01:33:04,539
know we've got to escape the gravity of

1617
01:33:12,870 --> 01:33:06,940
the earth that requires a certain

1618
01:33:16,770 --> 01:33:12,880
velocity and you know so the so the ula

1619
01:33:18,859 --> 01:33:16,780
does a fabulous job you know figuring

1620
01:33:22,469 --> 01:33:18,869
out what the trajectories are the

1621
01:33:25,709 --> 01:33:22,479
sequences of the firing and for insight

1622
01:33:28,379 --> 01:33:25,719
we have one more one more big event to

1623
01:33:30,239 --> 01:33:28,389
give us that last push and then send us

1624
01:33:31,850 --> 01:33:30,249
on our way to Mars now this is really

1625
01:33:34,020 --> 01:33:31,860
cool we're gonna spacecraft separation

1626
01:33:34,350 --> 01:33:34,030
insights going to be heading out then we

1627
01:33:36,810 --> 01:33:34,360
have

1628
01:33:39,419 --> 01:33:36,820
- Markos cube SATs are going to be

1629
01:33:41,000 --> 01:33:39,429
deployed following insight to the planet

1630
01:33:45,240 --> 01:33:41,010
and then we have to wait

1631
01:33:48,090 --> 01:33:45,250
well fell November 26 so that's only

1632
01:33:50,790 --> 01:33:48,100
about six months you know some of these

1633
01:33:53,669 --> 01:33:50,800
windows that we have are actually longer

1634
01:33:55,800 --> 01:33:53,679
you know 10 months 11 months and the

1635
01:33:58,830 --> 01:33:55,810
reason why is you know Mars is an

1636
01:34:01,290 --> 01:33:58,840
elliptical orbit in every 26 months

1637
01:34:04,919 --> 01:34:01,300
there's an alignment where we can send a

1638
01:34:07,649 --> 01:34:04,929

spacecraft to Mars and so it's a matter

1639
01:34:09,300 --> 01:34:07,659
of where that alignment occurs in Mars

1640
01:34:11,430 --> 01:34:09,310
is elliptical orbit because the Earth's

1641
01:34:14,879 --> 01:34:11,440
orbit is far more circular and that's

1642
01:34:17,640 --> 01:34:14,889
why we had a launch window between now

1643
01:34:20,879 --> 01:34:17,650
and June 8th to make that right right

1644
01:34:23,550 --> 01:34:20,889
indeed now this is just like as they say

1645
01:34:25,229 --> 01:34:23,560
hitting a golf ball in New York and you

1646
01:34:28,470 --> 01:34:25,239
know putting a hole in one out here in

1647
01:34:30,359 --> 01:34:28,480
Vandenberg and so we started Vandenberg

1648
01:34:31,790 --> 01:34:30,369
but but the hole in one's gonna be at

1649
01:34:35,010 --> 01:34:31,800
Mars so this is on a ballistic

1650
01:34:37,140 --> 01:34:35,020
trajectory which means it goes straight

1651
01:34:39,810 --> 01:34:37,150
to the planet and then doesn't get into

1652
01:34:42,419 --> 01:34:39,820
orbit just goes right down to the

1653
01:34:44,459 --> 01:34:42,429
surface that's pretty quick yeah it's uh

1654
01:34:47,129 --> 01:34:44,469
it's unbelievable when you think about

1655
01:34:48,780 --> 01:34:47,139
what we can do these days now what we've

1656
01:34:51,930 --> 01:34:48,790
been talk a little bit about these fun

1657
01:34:53,609 --> 01:34:51,940
facts tonight and so is there any cool

1658
01:34:53,970 --> 01:34:53,619
Mars trivia you like to share with the

1659
01:34:57,060 --> 01:34:53,980
audience

1660
01:35:02,640 --> 01:34:57,070
Mars trip yeah okay sure there's always

1661
01:35:05,340 --> 01:35:02,650
Mars trivia you know we use relays to

1662
01:35:07,830 --> 01:35:05,350
communicate and as the spacecraft comes

1663
01:35:09,840 --> 01:35:07,840

down it actually is going to be sent in

1664
01:35:12,240 --> 01:35:09,850
this information okay you know it has

1665
01:35:14,580 --> 01:35:12,250
three phases the entry part right we use

1666
01:35:16,680 --> 01:35:14,590
a heat shield then we pop the chute

1667
01:35:20,280 --> 01:35:16,690
after we slow it down to a few hundred

1668
01:35:22,350 --> 01:35:20,290
miles per hour from you know like 10,000

1669
01:35:25,470 --> 01:35:22,360
miles per hour right it hits the top of

1670
01:35:28,379 --> 01:35:25,480
the atmosphere and and then after the

1671
01:35:29,729 --> 01:35:28,389
chute gets it down to you know well

1672
01:35:32,189 --> 01:35:29,739
below a hundred miles an hour and then

1673
01:35:35,879 --> 01:35:32,199
you have the retrorockets fire and then

1674
01:35:37,950 --> 01:35:35,889
it safely puts down so we have to

1675
01:35:41,220 --> 01:35:37,960
communicate that information and it goes

1676
01:35:43,919 --> 01:35:41,230
through the orbiters and Marco the to

1677
01:35:47,040 --> 01:35:43,929
Marco spacecraft indeed are those that

1678
01:35:48,150 --> 01:35:47,050
are helping us out and so the trivia

1679
01:35:51,360 --> 01:35:48,160
question is

1680
01:35:53,880 --> 01:35:51,370
in the future how will we be doing this

1681
01:35:55,890 --> 01:35:53,890
for other missions that that that's a

1682
01:35:58,050 --> 01:35:55,900
great question so if the Marco

1683
01:36:02,310 --> 01:35:58,060
spacecraft work out for us then that

1684
01:36:04,770 --> 01:36:02,320
gives us a completely open opportunity

1685
01:36:07,620 --> 01:36:04,780
for us to be able to use that same basic

1686
01:36:10,410 --> 01:36:07,630
concept for other landed missions and

1687
01:36:12,720 --> 01:36:10,420
and now a that but nowhere the CubeSat

1688
01:36:14,160 --> 01:36:12,730

we talked to more students around this

1689
01:36:15,870 --> 01:36:14,170
country who are getting involved in the

1690
01:36:18,120 --> 01:36:15,880
CubeSat yeah and there were also

1691
01:36:20,700 --> 01:36:18,130
students involved with Marco Lambie I

1692
01:36:22,860 --> 01:36:20,710
mean it's incredible how you're seeing

1693
01:36:24,450 --> 01:36:22,870
these young engineers these future

1694
01:36:25,710 --> 01:36:24,460
engineers they're coming out of college

1695
01:36:27,600 --> 01:36:25,720
and they're going up to their first

1696
01:36:31,170 --> 01:36:27,610
interview and saying I have a satellite

1697
01:36:33,420 --> 01:36:31,180
in space right but you know planetary

1698
01:36:35,940 --> 01:36:33,430
cube SATs are really tough and the

1699
01:36:38,550 --> 01:36:35,950
reason why is the further you are away

1700
01:36:40,350 --> 01:36:38,560
from the earth the harder it is to

1701
01:36:43,770 --> 01:36:40,360
communicate you need a bigger and bigger

1702
01:36:45,390 --> 01:36:43,780
dish okay so if you wanted a CubeSat out

1703
01:36:47,520 --> 01:36:45,400
at Saturn you know you have to have a

1704
01:36:50,610 --> 01:36:47,530
dish you know that's five foot big you

1705
01:36:51,330 --> 01:36:50,620
know how would you even deploy that

1706
01:36:53,790 --> 01:36:51,340
right that's right

1707
01:36:55,770 --> 01:36:53,800
so but at Mars because we have this

1708
01:36:58,260 --> 01:36:55,780
communication capability with the

1709
01:37:00,690 --> 01:36:58,270
surface assets we're now thinking about

1710
01:37:03,540 --> 01:37:00,700
how we can use that to communicate with

1711
01:37:05,460 --> 01:37:03,550
cube SATs so the cube SATs could be in

1712
01:37:07,550 --> 01:37:05,470
orbit around Mars communicate through

1713
01:37:10,860 --> 01:37:07,560

the orbiters and then send the data back

1714
01:37:13,230 --> 01:37:10,870
so the relay concept is really important

1715
01:37:14,940 --> 01:37:13,240
and in Mars helps us with that one so

1716
01:37:16,530 --> 01:37:14,950
one day when we have humans on the

1717
01:37:18,840 --> 01:37:16,540
surface of Mars we may have a fleet of

1718
01:37:21,480 --> 01:37:18,850
cube sets that's they're orbiting oh I'm

1719
01:37:24,300 --> 01:37:21,490
sure we will I'm sure we will it

1720
01:37:26,880 --> 01:37:24,310
provides us a framework that allows us

1721
01:37:29,760 --> 01:37:26,890
to make a variety of very focused

1722
01:37:31,440 --> 01:37:29,770
measurements and potentially take a lot

1723
01:37:34,080 --> 01:37:31,450
of data particularly if we can use a

1724
01:37:36,060 --> 01:37:34,090
network aspect of it Jim thank you for

1725
01:37:38,250 --> 01:37:36,070
coming back for a second time really

1726
01:37:40,050 --> 01:37:38,260
appreciate it and stephy he is still

1727
01:37:42,120 --> 01:37:40,060
filled with energy even though that know

1728
01:37:44,310 --> 01:37:42,130
the launch has occurred he can go all

1729
01:37:46,770 --> 01:37:44,320
day back to you Stephanie thank you so

1730
01:37:48,630 --> 01:37:46,780
much now that you've heard a little bit

1731
01:37:51,570 --> 01:37:48,640
of a teaser about those Marcos missions

1732
01:37:53,730 --> 01:37:51,580
why don't we look take this opportunity

1733
01:37:57,510 --> 01:37:53,740
to take a fun look at the Martian Marco

1734
01:37:59,190 --> 01:37:57,520
mission communicating between Mars and

1735
01:38:00,360 --> 01:37:59,200
Earth requires a complicated

1736
01:38:02,010 --> 01:38:00,370
choreography

1737
01:38:05,010 --> 01:38:02,020
with everything in the right place at

1738
01:38:06,780 --> 01:38:05,020

the right time sometimes hours can pass

1739
01:38:08,880 --> 01:38:06,790
before information is relayed from one

1740
01:38:10,920 --> 01:38:08,890
planet to the other that's why when

1741
01:38:12,750 --> 01:38:10,930
NASA's Mars insight Lander launches this

1742
01:38:15,120 --> 01:38:12,760
year the rocket will carry two tiny

1743
01:38:18,840 --> 01:38:15,130
satellites on a technology test of their

1744
01:38:21,270 --> 01:38:18,850
own meet Mars Cube one Marco NASA's

1745
01:38:23,430 --> 01:38:21,280
first CubeSat missions to deep space

1746
01:38:24,840 --> 01:38:23,440
these briefcase sized satellites will

1747
01:38:26,250 --> 01:38:24,850
travel separately from the insight

1748
01:38:28,710 --> 01:38:26,260
Lander while they test out new

1749
01:38:30,300 --> 01:38:28,720
miniaturized technologies and if they

1750
01:38:32,250 --> 01:38:30,310
make it to Mars they could relay

1751
01:38:35,130 --> 01:38:32,260
information back to earth about insights

1752
01:38:37,950 --> 01:38:35,140
descent and touchdown and do it in mere

1753
01:38:39,540 --> 01:38:37,960
minutes although this fast communication

1754
01:38:42,000 --> 01:38:39,550
isn't crucial to the success of the

1755
01:38:44,220 --> 01:38:42,010
insight Lander this CubeSat test could

1756
01:38:49,560 --> 01:38:44,230
change the way a future spacecraft bond

1757
01:38:51,450 --> 01:38:49,570
home the insight spacecraft has a

1758
01:38:52,890 --> 01:38:51,460
protective shell that shields the lander

1759
01:38:55,890 --> 01:38:52,900
during its travels between Earth and

1760
01:38:58,650 --> 01:38:55,900
Mars it includes the mechanical units

1761
01:39:00,720 --> 01:38:58,660
that safely maneuver the lander through

1762
01:39:01,640 --> 01:39:00,730
the Martian atmosphere to a landing on

1763
01:39:04,410 --> 01:39:01,650

Mars

1764
01:39:06,960 --> 01:39:04,420
NASA's Franklin Fitzgerald is with the

1765
01:39:08,730 --> 01:39:06,970
spacecraft manager Stuart Spath who

1766
01:39:10,440 --> 01:39:08,740
could tell us more about the major parts

1767
01:39:13,800 --> 01:39:10,450
that make up the insight spacecraft

1768
01:39:16,110 --> 01:39:13,810
Franklin yes thank you Stephanie still

1769
01:39:18,870 --> 01:39:16,120
as Stephanie was talking about there are

1770
01:39:20,730 --> 01:39:18,880
the major parts that make up the insight

1771
01:39:23,610 --> 01:39:20,740
spacecraft he tell us a little bit about

1772
01:39:26,160 --> 01:39:23,620
him yeah I'm glad - there's about three

1773
01:39:27,780 --> 01:39:26,170
major elements on the most notorious one

1774
01:39:30,060 --> 01:39:27,790
of course is the lander which touches

1775
01:39:32,460 --> 01:39:30,070
down but the second part is the

1776
01:39:34,650 --> 01:39:32,470
aeroshell the cocoon the thermal cocoon

1777
01:39:36,570 --> 01:39:34,660
that protects the lander as it enters

1778
01:39:38,610 --> 01:39:36,580
into the atmosphere and in the first

1779
01:39:40,230 --> 01:39:38,620
part that's going to be in charge of

1780
01:39:42,600 --> 01:39:40,240
getting us to the planet is the cruise

1781
01:39:44,970 --> 01:39:42,610
stage we it operates us for the first

1782
01:39:47,520 --> 01:39:44,980
six and a half months now I know we're

1783
01:39:49,530 --> 01:39:47,530
about 30 minutes off of separating from

1784
01:39:52,020 --> 01:39:49,540
the second stage to go into the crew

1785
01:39:54,510 --> 01:39:52,030
stays tell us about that separation in

1786
01:39:56,370 --> 01:39:54,520
the journey on to Mars okay so it's

1787
01:39:58,860 --> 01:39:56,380
definitely gonna be a nail-biting 30

1788
01:40:00,750 --> 01:39:58,870

minutes for us on the spacecraft team as

1789
01:40:02,370 --> 01:40:00,760
you said will separate and then it will

1790
01:40:05,070 --> 01:40:02,380
be on our own to get our own telemetry

1791
01:40:07,530 --> 01:40:05,080
through the Deep Space Network through

1792
01:40:09,360 --> 01:40:07,540
our own spacecraft comm system so once

1793
01:40:11,700 --> 01:40:09,370
we get telemetry we'll do a quick health

1794
01:40:13,140 --> 01:40:11,710
assessment we'll pull all the spacecraft

1795
01:40:13,810 --> 01:40:13,150
subsystems make sure everything's

1796
01:40:15,160 --> 01:40:13,820
nominal

1797
01:40:18,129 --> 01:40:15,170
and then hopefully we're on our way to

1798
01:40:20,589 --> 01:40:18,139
Mars what do you do for six months

1799
01:40:22,180 --> 01:40:20,599
what will insight do for six months what

1800
01:40:24,160 --> 01:40:22,190
kind of operations will go on during

1801
01:40:26,109 --> 01:40:24,170
that time period well the most important

1802
01:40:28,629 --> 01:40:26,119
thing is the trajectory correction

1803
01:40:31,270 --> 01:40:28,639
maneuvers so about roughly two weeks

1804
01:40:33,459 --> 01:40:31,280
after launch we do our first TCM as we

1805
01:40:36,669 --> 01:40:33,469
call them and that will actually bias us

1806
01:40:39,280 --> 01:40:36,679
for a target landing at the planet and

1807
01:40:41,470 --> 01:40:39,290
then the five other TCMS will occur for

1808
01:40:43,479 --> 01:40:41,480
the rest of the six and a half months

1809
01:40:45,310 --> 01:40:43,489
and that will get to prove it precision

1810
01:40:47,109 --> 01:40:45,320
pointing for the rest of the way now

1811
01:40:50,950 --> 01:40:47,119
when you come when it comes to entry

1812
01:40:54,189 --> 01:40:50,960
descent and landing we've seen airbags

1813
01:40:58,300 --> 01:40:54,199

we've seen sky cranes we've seen descent

1814
01:41:01,060 --> 01:40:58,310
engines what factors go into what type

1815
01:41:03,879 --> 01:41:01,070
of entry descent and landing certain

1816
01:41:06,220 --> 01:41:03,889
Rover or Orlando will have yeah

1817
01:41:08,919 --> 01:41:06,230
typically it's depends on how big the

1818
01:41:10,990 --> 01:41:08,929
actual flight system is the lander so in

1819
01:41:13,540 --> 01:41:11,000
our case insight it's based heavily on

1820
01:41:15,970 --> 01:41:13,550
Phoenix and Phoenix was based even

1821
01:41:18,100 --> 01:41:15,980
thirty-five years before on Vikings and

1822
01:41:21,580 --> 01:41:18,110
so both the Viking landers and the

1823
01:41:23,410 --> 01:41:21,590
Phoenix lander just used the propulsive

1824
01:41:26,800 --> 01:41:23,420
landing techniques so that's what we're

1825
01:41:29,649 --> 01:41:26,810
using on insight as well so once insight

1826
01:41:32,109 --> 01:41:29,659
touches down on Mars what will be the

1827
01:41:33,790 --> 01:41:32,119
next move all right well the first move

1828
01:41:36,129 --> 01:41:33,800
is to well let the dust settle

1829
01:41:38,169 --> 01:41:36,139
then we'll deploy the two solar arrays

1830
01:41:40,750 --> 01:41:38,179
you see those in the the wings that

1831
01:41:43,540 --> 01:41:40,760
collect solar power for us and then

1832
01:41:46,359 --> 01:41:43,550
we'll start over the next month or two

1833
01:41:50,530 --> 01:41:46,369
start deploying the instruments and we

1834
01:41:51,250 --> 01:41:50,540
look to get data from insight within you

1835
01:41:53,169 --> 01:41:51,260
say about a month

1836
01:41:55,419 --> 01:41:53,179
well the science day they'll start

1837
01:41:56,890 --> 01:41:55,429
coming in in about a month the actual

1838
01:41:59,770 --> 01:41:56,900

engineering data to make sure we're

1839
01:42:01,780 --> 01:41:59,780
healthy and so forth will come from MRO

1840
01:42:04,330 --> 01:42:01,790
Mars Reconnaissance Orbiter link a

1841
01:42:07,450 --> 01:42:04,340
couple hours after touchdown we also

1842
01:42:09,609 --> 01:42:07,460
have tones directly from insight that

1843
01:42:11,470 --> 01:42:09,619
will give us a rough health and status

1844
01:42:13,479 --> 01:42:11,480
and then you know about the two marco

1845
01:42:16,089 --> 01:42:13,489
cube sets that will also hopefully

1846
01:42:17,740 --> 01:42:16,099
provide real-time telemetry for us Stu

1847
01:42:19,359 --> 01:42:17,750
thanks for coming on the show I know

1848
01:42:20,770 --> 01:42:19,369
you've got to get back and get that

1849
01:42:22,870 --> 01:42:20,780
telemetry data that you were talking

1850
01:42:25,899 --> 01:42:22,880
about we appreciate your time all right

1851
01:42:27,100 --> 01:42:25,909
my pleasure Stephanie back to you thank

1852
01:42:29,260 --> 01:42:27,110
you so much

1853
01:42:31,240 --> 01:42:29,270
not only will Marco be the first CubeSat

1854
01:42:33,580 --> 01:42:31,250
to travel to another planet it will also

1855
01:42:36,460 --> 01:42:33,590
be the first CubeSat to transmit key

1856
01:42:39,280 --> 01:42:36,470
atmospheric entry data for Mars insight

1857
01:42:41,590 --> 01:42:39,290
Blaire Allen with NASA edge spoke with

1858
01:42:46,810 --> 01:42:41,600
marco project manager about the

1859
01:42:48,160 --> 01:42:46,820
spacecraft's role we're here with Joel

1860
01:42:51,010 --> 01:42:48,170
Crowe Jeff's key who's the project

1861
01:42:52,780 --> 01:42:51,020
manager for marco an exciting CubeSat

1862
01:42:55,150 --> 01:42:52,790
mission the first CubeSat mission to

1863
01:42:56,950 --> 01:42:55,160

Mars Joel I'm very curious I've loved

1864
01:42:59,410 --> 01:42:56,960
cube sets I've followed them for a while

1865
01:43:01,390 --> 01:42:59,420
now I can't imagine what goes into

1866
01:43:03,370 --> 01:43:01,400
sending one to Mars tell us about how

1867
01:43:04,660 --> 01:43:03,380
all this came to be so we have a mission

1868
01:43:07,060 --> 01:43:04,670
that's going to Mars it's going to land

1869
01:43:08,350 --> 01:43:07,070
on Mars and as we always do with our

1870
01:43:10,720 --> 01:43:08,360
Mars missions we try to have a

1871
01:43:12,490 --> 01:43:10,730
communications relay while the lander is

1872
01:43:14,410 --> 01:43:12,500
landing going through it's seven minutes

1873
01:43:16,900 --> 01:43:14,420
of Terror through the atmosphere so a

1874
01:43:17,890 --> 01:43:16,910
communications relay can send data back

1875
01:43:19,450 --> 01:43:17,900
to earth we can see what's happening

1876
01:43:21,430 --> 01:43:19,460
while it's happening the inside mission

1877
01:43:24,040 --> 01:43:21,440
then has that with one orbiter called

1878
01:43:26,140 --> 01:43:24,050
MRO we saw an opportunity to send a

1879
01:43:27,610 --> 01:43:26,150
couple of cube sets with it that could

1880
01:43:29,470 --> 01:43:27,620
as a technology demonstration see if

1881
01:43:30,940 --> 01:43:29,480
they also could do the same job it's

1882
01:43:32,800 --> 01:43:30,950
kind of perfect in the sense that if our

1883
01:43:34,090 --> 01:43:32,810
mission succeeds we get data from our

1884
01:43:35,800 --> 01:43:34,100
spacecraft and we've shown it works if

1885
01:43:37,870 --> 01:43:35,810
our mission doesn't quite succeed the

1886
01:43:39,670 --> 01:43:37,880
MRO is there to get the data also that's

1887
01:43:42,910 --> 01:43:39,680
the redundancy then for you actually

1888
01:43:45,070 --> 01:43:42,920

that's a primary for NASA but redundancy

1889
01:43:47,410 --> 01:43:45,080
for for your mission allows it to take

1890
01:43:49,230 --> 01:43:47,420
the risk of trying it out how are you

1891
01:43:52,000 --> 01:43:49,240
gonna get there you're gonna ride on the

1892
01:43:52,870 --> 01:43:52,010
spacecraft er how does this work we're

1893
01:43:54,130 --> 01:43:52,880
not gonna write on the spacecraft

1894
01:43:55,840 --> 01:43:54,140
actually we are a whole separate

1895
01:43:57,550 --> 01:43:55,850
spacecraft the primary payload in this

1896
01:43:59,410 --> 01:43:57,560
case insight is up in the nose of the

1897
01:44:00,400 --> 01:43:59,420
rocket we're kinda used to seeing it we

1898
01:44:01,660 --> 01:44:00,410
look it to be there that's kind of a

1899
01:44:03,940 --> 01:44:01,670
first-class cabin

1900
01:44:06,580 --> 01:44:03,950
we're in steerage there's way at the

1901
01:44:08,830 --> 01:44:06,590
bottom so we're mounted outside of the

1902
01:44:10,570 --> 01:44:08,840
third stage on the back side of the tank

1903
01:44:14,440 --> 01:44:10,580
it's called the F bulkhead carrier

1904
01:44:15,940 --> 01:44:14,450
hanging just a nice way of saying hang

1905
01:44:18,340 --> 01:44:15,950
just about the engine nozzle so it's a

1906
01:44:20,500 --> 01:44:18,350
rough ride it's a it's a shaky ride well

1907
01:44:22,750 --> 01:44:20,510
more you deploy then about a minute

1908
01:44:25,330 --> 01:44:22,760
after the inside vehicle separates from

1909
01:44:27,130 --> 01:44:25,340
the third stage third stage does a small

1910
01:44:28,930 --> 01:44:27,140
four degree maneuver and then spits out

1911
01:44:31,090 --> 01:44:28,940
one of the Marko's and then it does

1912
01:44:33,040 --> 01:44:31,100
180-degree roll and spits out the other

1913
01:44:35,620 --> 01:44:33,050

Marco and that way all three spacecraft

1914
01:44:36,790 --> 01:44:35,630
in sight Marco Marco B are all going in

1915
01:44:38,320 --> 01:44:36,800
different directions they don't bump

1916
01:44:39,750 --> 01:44:38,330
into each other and then they continue

1917
01:44:41,490 --> 01:44:39,760
as a threesome with

1918
01:44:43,259 --> 01:44:41,500
coordinated trajectory correction

1919
01:44:45,660 --> 01:44:43,269
maneuvers set on each maneuver they are

1920
01:44:46,709 --> 01:44:45,670
kind of keeping in lockstep close enough

1921
01:44:51,680 --> 01:44:46,719
to be within a few thousand kilometers

1922
01:45:10,510 --> 01:44:55,200
it's now time for more more insight and

1923
01:45:52,270 --> 01:45:48,230
[Music]

1924
01:46:05,220 --> 01:45:52,280
you

1925
01:46:32,840 --> 01:46:26,840
[Music]

1926
01:46:38,070 --> 01:46:35,880
in addition to Marcos communication role

1927
01:46:41,040 --> 01:46:38,080
it is flying three new innovative

1928
01:46:43,080 --> 01:46:41,050
technologies NASA edges Franklin

1929
01:46:45,630 --> 01:46:43,090
Fitzgerald spoke with Marcos systems

1930
01:46:48,590 --> 01:46:45,640
engineer Andy Meriden about these

1931
01:46:51,270 --> 01:46:48,600
technologies that will be demonstrated

1932
01:46:52,439 --> 01:46:51,280
so Annie there are three new

1933
01:46:53,790 --> 01:46:52,449
technologies that are going to be

1934
01:46:55,620 --> 01:46:53,800
demonstrated on Marco

1935
01:46:57,030 --> 01:46:55,630
tell me what they are so the three

1936
01:46:59,729 --> 01:46:57,040
technologies that Marco will be

1937
01:47:02,100 --> 01:46:59,739
demonstrating are a propellant system

1938
01:47:05,160 --> 01:47:02,110

that uses a fire extinguisher fluid to

1939
01:47:06,570 --> 01:47:05,170
navigate Marco around there is a radio

1940
01:47:09,419 --> 01:47:06,580
that is about the size of a softball

1941
01:47:11,669 --> 01:47:09,429
that was designed at JPL to interface

1942
01:47:12,660 --> 01:47:11,679
with the Deep Space Network and there is

1943
01:47:14,820 --> 01:47:12,670
an antenna

1944
01:47:17,280 --> 01:47:14,830
it's a deployable antenna that's

1945
01:47:19,500 --> 01:47:17,290
completely flat and it can fold up but

1946
01:47:22,020 --> 01:47:19,510
when it operates it actually simulates a

1947
01:47:23,939 --> 01:47:22,030
dish that gets a lot higher gain and

1948
01:47:26,250 --> 01:47:23,949
allows us to send more data back to

1949
01:47:27,810 --> 01:47:26,260
earth tell me a little bit about this

1950
01:47:30,660 --> 01:47:27,820
propulsion system because you know I'm

1951
01:47:32,850 --> 01:47:30,670
I'm thinking about the engines on a

1952
01:47:34,800 --> 01:47:32,860
rocket when it takes off that's not

1953
01:47:36,900 --> 01:47:34,810
what's happening with Marco no so the

1954
01:47:38,760 --> 01:47:36,910
fluid inside the propellant tank is

1955
01:47:40,890 --> 01:47:38,770
essentially what you would find in a

1956
01:47:42,570 --> 01:47:40,900
fire extinguisher so if you you've seen

1957
01:47:44,280 --> 01:47:42,580
the movie wall-e there's this scene

1958
01:47:45,600 --> 01:47:44,290
where well he flies around space do you

1959
01:47:47,010 --> 01:47:45,610
think a fire extinguisher and it propels

1960
01:47:49,320 --> 01:47:47,020
him all the way around it is essentially

1961
01:47:51,570 --> 01:47:49,330
what Marco is doing the thrusters are

1962
01:47:53,580 --> 01:47:51,580
much tinier but we actually nicknamed

1963
01:47:56,729 --> 01:47:53,590

the spacecraft Wally and Eva because of

1964
01:47:58,919 --> 01:47:56,739
that we have 8 total thrusters on the

1965
01:48:01,260 --> 01:47:58,929
spacecraft and we're using them for two

1966
01:48:02,939 --> 01:48:01,270
things one is to do what we call

1967
01:48:05,189 --> 01:48:02,949
trajectory correction maneuvers which

1968
01:48:08,490 --> 01:48:05,199
are basically course corrections so as

1969
01:48:11,550 --> 01:48:08,500
Marco flies we can control its

1970
01:48:12,900 --> 01:48:11,560
trajectory fairly precisely and there

1971
01:48:15,570 --> 01:48:12,910
are thrusters that allow us to change

1972
01:48:17,669 --> 01:48:15,580
the orientation of the Marcos satellite

1973
01:48:18,720 --> 01:48:17,679
while it's in space so basically this is

1974
01:48:21,270 --> 01:48:18,730
going to be kind of kicking out

1975
01:48:22,740 --> 01:48:21,280
compressed air yeah okay now tell me

1976
01:48:25,530 --> 01:48:22,750
about this radio I'm from what I

1977
01:48:27,360 --> 01:48:25,540
understand is something new it's built

1978
01:48:29,340 --> 01:48:27,370
right here at JPL tell me a little bit

1979
01:48:32,100 --> 01:48:29,350
more about that yeah so the group at JPL

1980
01:48:34,080 --> 01:48:32,110
designed this antenna specifically to

1981
01:48:36,180 --> 01:48:34,090
operate with the Deep Space Network and

1982
01:48:38,400 --> 01:48:36,190
Marco is going to be the first mission

1983
01:48:40,770 --> 01:48:38,410
to fly this technology so we've done a

1984
01:48:42,330 --> 01:48:40,780
lot of compatibility testing with the

1985
01:48:44,310 --> 01:48:42,340
Deep Space Network and so we've shown

1986
01:48:44,640 --> 01:48:44,320
that it's configured well and it will

1987
01:48:47,160 --> 01:48:44,650
work

1988
01:48:50,640 --> 01:48:47,170

we just now need to fly it mm-hmm okay

1989
01:48:51,720 --> 01:48:50,650
and then in third is the dish mm-hmm

1990
01:48:54,209 --> 01:48:51,730
this trifold

1991
01:48:57,930 --> 01:48:54,219
its trifold antenna antenna yeah it's

1992
01:49:00,630 --> 01:48:57,940
called a passive phased array and so one

1993
01:49:02,729 --> 01:49:00,640
of the reasons why it's such a cool

1994
01:49:06,780 --> 01:49:02,739
technology is when you launch a cube set

1995
01:49:08,910 --> 01:49:06,790
or any satellite in general volume is a

1996
01:49:10,620 --> 01:49:08,920
hot commodity and so in a CubeSat

1997
01:49:13,890 --> 01:49:10,630
especially because the whole satellite

1998
01:49:15,959 --> 01:49:13,900
has to fit into a box the more box like

1999
01:49:20,399 --> 01:49:15,969
all of your components are the better

2000
01:49:22,260 --> 01:49:20,409
and so this antenna folds into a volume

2001
01:49:24,870 --> 01:49:22,270
about this high when it folds down but

2002
01:49:27,959 --> 01:49:24,880
it opens up it's fairly large and it

2003
01:49:29,669 --> 01:49:27,969
simulates a much larger dish that would

2004
01:49:31,770 --> 01:49:29,679
otherwise have to be curved and would be

2005
01:49:33,720 --> 01:49:31,780
much harder to actually stow in that

2006
01:49:36,780 --> 01:49:33,730
volume so it could enable a lot of

2007
01:49:39,450 --> 01:49:36,790
really cool communications technologies

2008
01:49:42,090 --> 01:49:39,460
in the future tell me about what your

2009
01:49:45,330 --> 01:49:42,100
role will be with the mission as they

2010
01:49:46,830 --> 01:49:45,340
fly to Mars I will be operating one of

2011
01:49:49,620 --> 01:49:46,840
the Marco spacecraft and for this

2012
01:49:52,680 --> 01:49:49,630
mission what that means is we'll be

2013
01:49:54,780 --> 01:49:52,690

sitting on a console computer sending

2014
01:49:57,209 --> 01:49:54,790
commands and receiving data from the

2015
01:49:59,399 --> 01:49:57,219
spacecraft so before every chance we get

2016
01:50:02,780 --> 01:49:59,409
to talk to it we get about one chance

2017
01:50:05,939 --> 01:50:02,790
per day we'll have a set list of

2018
01:50:08,340 --> 01:50:05,949
commands and scripts that we want the

2019
01:50:10,800 --> 01:50:08,350
satellite to execute and so we'll upload

2020
01:50:13,380 --> 01:50:10,810
those via the Deep Space Network all

2021
01:50:15,899 --> 01:50:13,390
remotely and then as it's happening

2022
01:50:17,669 --> 01:50:15,909
we'll get that data back and see what

2023
01:50:19,620 --> 01:50:17,679
the spacecraft is actually doing and

2024
01:50:23,820 --> 01:50:19,630
hopefully it'll be doing exactly what we

2025
01:50:25,590 --> 01:50:23,830
told it to do we are an hour and 10

2026
01:50:28,560 --> 01:50:25,600
minutes into the flight of NASA's

2027
01:50:41,510 --> 01:50:28,570
insight spacecraft at this time let's do

2028
01:52:00,290 --> 01:51:19,270
[Music]

2029
01:52:05,399 --> 01:52:03,299
we are about an hour and 12 minutes into

2030
01:52:08,339 --> 01:52:05,409
the flight of NASA's insight spacecraft

2031
01:52:10,049 --> 01:52:08,349
on its way to Mars let's check in with

2032
01:52:11,939 --> 01:52:10,059
NASA's Joshua Finch in the mission

2033
01:52:15,029 --> 01:52:11,949
directors Center for an update on the

2034
01:52:16,770 --> 01:52:15,039
flight Josh thank you Stephanie very

2035
01:52:18,660 --> 01:52:16,780
much in for those futures joining us I'm

2036
01:52:19,770 --> 01:52:18,670
in the mission directors Center and it

2037
01:52:21,540 --> 01:52:19,780
was paying attention to the launch

2038
01:52:23,669 --> 01:52:21,550

countdown as we proceeded to a liftoff

2039
01:52:28,529 --> 01:52:23,679
and we did have an on-time liftoff at

2040
01:52:30,209 --> 01:52:28,539
405 Pacific time and we had Mach 1 the

2041
01:52:32,339 --> 01:52:30,219
vehicle reached at at 1 minute 18

2042
01:52:34,560 --> 01:52:32,349
seconds it entered through an area of

2043
01:52:36,990 --> 01:52:34,570
maximum dynamic pressure at one minute

2044
01:52:40,379 --> 01:52:37,000
27 seconds though the Atlas booster

2045
01:52:43,830 --> 01:52:40,389
powered by an rd-180 engine had booster

2046
01:52:46,589 --> 01:52:43,840
engine cutoff on time at 4:04 followed

2047
01:52:48,990 --> 01:52:46,599
shortly thereafter by centaur separation

2048
01:52:50,970 --> 01:52:49,000
you're looking at that right now the 2nd

2049
01:52:53,399 --> 01:52:50,980
stage with the inside spacecraft stacked

2050
01:52:56,669 --> 01:52:53,409
on top we had the first burn of the

2051
01:52:58,229 --> 01:52:56,679
second stage which started about 4

2052
01:53:00,359 --> 01:52:58,239
minutes 20 seconds and about eight

2053
01:53:01,560 --> 01:53:00,369
seconds later the payload fairing which

2054
01:53:05,879 --> 01:53:01,570
was originally around the inside

2055
01:53:07,919 --> 01:53:05,889
spacecraft was able to jettison we

2056
01:53:10,290 --> 01:53:07,929
completed our first burn and were now in

2057
01:53:12,779 --> 01:53:10,300
a Coast phase the first burn of the

2058
01:53:14,910 --> 01:53:12,789
Centaur lasted about nine minutes and

2059
01:53:19,580 --> 01:53:14,920
inserted the combined upper stage and

2060
01:53:21,149 --> 01:53:19,590
the spacecraft into a parking orbit

2061
01:53:24,330 --> 01:53:21,159
we're about a minute

2062
01:53:31,040 --> 01:53:24,340
and 25 seconds away from the start of

2063
01:53:33,149 --> 01:53:31,050

the second stage the Centaur stock is

2064
01:53:36,270 --> 01:53:33,159
coasting in its parking orbit until it

2065
01:53:38,040 --> 01:53:36,280
reaches the proper position for start of

2066
01:53:40,439 --> 01:53:38,050
the second burn ah--this sent our second

2067
01:53:44,810 --> 01:53:40,449
stage the second burn will continue for

2068
01:53:51,529 --> 01:53:47,240
the Bernal end with main engine cutoff -

2069
01:53:52,669 --> 01:53:51,539
and nine minutes after that cutoff will

2070
01:53:55,000 --> 01:53:52,679
have the release of the inside

2071
01:53:57,140 --> 01:53:55,010
spacecraft followed shortly thereafter

2072
01:54:03,140 --> 01:53:57,150
with the deployment of the cube sets

2073
01:54:07,040 --> 01:54:03,150
Marco a and B we're about 45 seconds

2074
01:54:11,000 --> 01:54:07,050
away from main engine start to the rl10

2075
01:54:33,340 --> 01:54:11,010
C engine powering the Centaur second

2076
01:54:56,130 --> 01:54:36,970
and 15 seconds away from main engine