
JUSTIN TREPTOW
NASA's Launch Services Program

1
00:00:00,000 --> 00:00:03,600
[Status check to proceed with terminal count.]
There is a moment at the start of every

2
00:00:03,600 --> 00:00:09,540
mission when everything comes together. A moment when years of preparation and

3
00:00:09,540 --> 00:00:15,590
planning are put to the test. [Clear to proceed.] There are no second chances. [You have permission to launch.

4
00:00:15,590 --> 00:00:21,840
Success or failure is just a heartbeat
away.

5
00:00:21,840 --> 00:00:29,460
A spacecraft and it's rocket on the pad fully fueled and ready to launch. [Status check. Go Atlas. Go Centaur.]

6
00:00:29,460 --> 00:00:34,380
In that moment a controlled explosion
released with such an intense power

7
00:00:34,380 --> 00:00:40,740
it can propel a spacecraft off the
earth and into space for the benefit of all.

8
00:00:40,740 --> 00:00:47,660
We call this moment T-Zero, this is its
story.

9
00:00:55,240 --> 00:01:00,960
NASA is about to do something we've
never done before. Nestled along the

10
00:01:00,960 --> 00:01:06,240
mountains on California's Central Coast
is a little talked about Space Launch

11
00:01:07,780 --> 00:01:14,860
Center known as Vandenberg Air Force

Base. From here history is about to be made.

12
00:01:14,860 --> 00:01:18,100
This is the first time we've had an
interplanetary launch from Vandenberg

13
00:01:18,100 --> 00:01:21,620
Air Force Base in California. The cool
thing about this launch is that we've

14
00:01:21,630 --> 00:01:27,270
got such a capable rocket the Atlas 5, we
don't have to launch from Florida.

15
00:01:27,270 --> 00:01:30,630
InSight is gonna be the first time we've
had a spacecraft leave Earth's orbit

16
00:01:30,630 --> 00:01:35,340
launching from California. We've actually
done studies for it even up two decades

17
00:01:35,340 --> 00:01:39,840
ago but it just comes down to whether or
not the mission I had extra propellant

18
00:01:39,840 --> 00:01:43,080
left over and whether there was an
operational reason to switch from an

19
00:01:43,080 --> 00:01:47,400
East Coast launch to West Coast. This is
just the first time all of it came together.

20
00:01:47,400 --> 00:01:50,000
What we're gonna do is we're
gonna unload the spacecraft really

21
00:01:50,009 --> 00:01:53,729
really carefully and then we're going to

drive it a couple of miles to the

22
00:01:53,729 --> 00:01:57,840
Astrotech facility where they have a
clean room all set up for us. We've got

23
00:01:57,840 --> 00:02:03,300
about two months here. All we got to do
is clean it up test it out put the fuel

24
00:02:03,300 --> 00:02:08,280
in the tanks and bolt it on the rocket
and off we go to Mars. InSight is NASA's

25
00:02:08,280 --> 00:02:14,459
next groundbreaking mission, literally
designed to break ground on Mars using

26
00:02:14,459 --> 00:02:20,520
probes and seismometers insight will
listen for Mars quakes and measure how

27
00:02:20,520 --> 00:02:26,130
much heat the planets interior gives off.
If we're going to truly understand how

28
00:02:26,130 --> 00:02:31,890
rocky planets like Mars and Earth were
created we need to look inside.

29
00:02:31,890 --> 00:02:35,250
It's unlike other missions that we've done in
Mars we have a number of orbiters a

30
00:02:35,250 --> 00:02:38,370
number of Landers that we've
successfully explored this amazing

31
00:02:38,370 --> 00:02:41,420
planet but this this actually is the

first mission where we're really looking

32
00:02:41,440 --> 00:02:45,520
on the inside the inner space of Mars.
Sending a science mission to the red

33
00:02:45,520 --> 00:02:52,280
planet is never easy. Landing a probe on
the surface is even harder. To accomplish

34
00:02:52,290 --> 00:02:56,000
this, InSight will have to shed its many
components

35
00:02:56,000 --> 00:03:01,940
in a matter of minutes bit by bit like
peeling an orange until only the lander

36
00:03:01,940 --> 00:03:06,770
is left so the crew stage itself is the
critical component that that actually

37
00:03:06,770 --> 00:03:10,760
gets us to Mars there's an aeroshell
that absorbs the heat as we re-enter the

38
00:03:10,760 --> 00:03:14,540
atmosphere that aeroshell enables us to
go through the the atmosphere of Mars

39
00:03:14,540 --> 00:03:18,590
successfully without getting the inside
the lander itself too hot we deploy a

40
00:03:18,590 --> 00:03:23,180
parachute that parachute does two things
it really ensures the stability of the

41
00:03:23,180 --> 00:03:26,990
aeroshell as it started to get closer to

the surface it also slows down the

42
00:03:26,990 --> 00:03:31,790
spacecraft further until finally we drop
out of the combination backshell and

43
00:03:31,790 --> 00:03:35,570
parachute and then we do a propulsive
descent down to the surface. We know

44
00:03:35,570 --> 00:03:41,860
water exists on Mars and where there's
water there could be signs of life but

45
00:03:41,860 --> 00:03:48,160
we must ensure any organisms we discover
weren't simply stowaways from Earth.

46
00:03:48,160 --> 00:03:53,680
This is where the planetary protection team
comes into play. Planetary protection is

47
00:03:53,680 --> 00:03:59,780
what we do to responsibly explore other
planets and moons in

48
00:03:59,780 --> 00:04:04,370
our solar system in order to do that we
need to make sure that we send a clean

49
00:04:04,370 --> 00:04:07,819
spacecraft there. We would hate to get to
another planet or moon and think we

50
00:04:07,819 --> 00:04:11,780
discovered life but it was actually
something that we brought with us. So we

51
00:04:11,780 --> 00:04:15,650
collect our samples on InSight, any part

of inside that's going to land on the

52
00:04:15,650 --> 00:04:19,970
surface of Mars, we bring it back to our
lab and we process it using a NASA

53
00:04:19,970 --> 00:04:24,800
procedure. If we run into a situation
where you take a sample and it comes

54
00:04:24,800 --> 00:04:29,570
back as having higher number of bacteria
than what we want then we make sure that

55
00:04:29,570 --> 00:04:33,919
the engineers go back and clean those
surfaces for the whole idea that we

56
00:04:33,919 --> 00:04:38,419
don't want to cloud our ability to
potentially find life on another planet

57
00:04:38,419 --> 00:04:41,570
or moon.
Lockheed Martin's space of Denver

58
00:04:41,570 --> 00:04:47,780
Colorado built InSight with an extremely
efficient design streamlining what needs

59
00:04:47,780 --> 00:04:53,390
to be done at the launch site. They ship
the spacecraft to Vandenberg with no

60
00:04:53,390 --> 00:05:00,590
assembly required. Simply check it out,
fuel it, test it, encapsulate it and it's

61
00:05:00,590 --> 00:05:06,470
ready for launch. The processing for our

spacecraft has been very smooth a lot of

62
00:05:06,470 --> 00:05:11,060
the processing had to do with fueling
the spacecraft removing some removed

63
00:05:11,060 --> 00:05:15,140
before flight items everything else was
pretty much already installed on the

64
00:05:15,140 --> 00:05:19,220
spacecraft in Denver Colorado before it
was shipped here and that's to call a

65
00:05:19,220 --> 00:05:22,940
ship and shoot, which means there's not
too much to do except for to fuel the

66
00:05:22,940 --> 00:05:28,100
vehicle and do some last-minute power on
checkouts of the onboard computers and

67
00:05:28,100 --> 00:05:32,539
subsystems. These preparations are
crucial everything must be working

68
00:05:32,539 --> 00:05:36,410
perfectly before InSight leaves earth. This effort

69
00:05:36,410 --> 00:05:41,900
is designed to ensure a safe arrival and
landing following the six-month trip

70
00:05:41,900 --> 00:05:49,720
from Earth to Mars. In the meantime,
United Launch Alliance or ULA is busy

71
00:05:49,720 --> 00:05:54,440
at their Launchpad, slick-three,
assembling the world's most successful

72
00:05:54,450 --> 00:05:59,500
rocket the Atlas 5. Well I mean we're
building a rocket what's not

73
00:05:59,500 --> 00:06:04,330
exciting about that. I'm really excited
to be able to launch the first planetary

74
00:06:04,330 --> 00:06:09,190
mission from the west coast
first ula stacks their Atlas 5 booster

75
00:06:09,190 --> 00:06:15,640
onto the launch platform. Atlas 5 is
powered by the mighty rd-180 rocket

76
00:06:15,640 --> 00:06:21,730
engine. The rd-180 is a powerhouse
burning highly refined kerosene known as

77
00:06:21,730 --> 00:06:28,690
RP 1 and liquid oxygen for thrust. For
this mission the rd-180 has more than

78
00:06:28,690 --> 00:06:36,160
enough power to get insight off of Earth
and heading towards Mars. When the

79
00:06:36,160 --> 00:06:41,710
Boosters fuel is spent the Centaur's
second stage kicks in and finishes the

80
00:06:41,710 --> 00:06:49,360
job. Centaur won't actually hit Mars it
will fly just past it. Final course

81
00:06:49,360 --> 00:06:53,380
corrections will be done by InSight
itself to enter the Martian atmosphere

82
00:06:53,380 --> 00:07:02,590
and land on the surface. Once fueling and
testing is complete the team from United

83
00:07:02,590 --> 00:07:08,350
Launch Alliance will encapsulate InSight
inside its payload fairing, the shell

84
00:07:08,350 --> 00:07:13,720
that keeps InSight clean and safe
during its dangerous ascent to Earth's

85
00:07:13,720 --> 00:07:17,919
atmosphere. We're at the face of the
mission where we're encapsulating with

86
00:07:17,919 --> 00:07:22,960
the launch vehicle and the ula team with
their fairings now come in and they take

87
00:07:22,960 --> 00:07:25,720
the two halves of the fairings and they
make a clamshell

88
00:07:25,720 --> 00:07:29,440
around the spacecraft to help protect it
for the environments that we see during

89
00:07:29,440 --> 00:07:32,980
launch and we do that because as we
leave the Earth's atmosphere the air and

90
00:07:32,980 --> 00:07:35,530
the molecules in the atmosphere would
tear up our spacecraft otherwise the

91
00:07:35,530 --> 00:07:39,900
fairing is there to protect us.
With InSight encapsulated in its fairing

92
00:07:39,900 --> 00:07:45,960
it's time to move the payload out to
slick-three but this California

93
00:07:45,960 --> 00:07:48,960
coastline comes with its own set of
challenges

94
00:07:48,960 --> 00:07:53,270
the surrounding marine layer can swallow
up a launch pad

95
00:07:53,270 --> 00:07:58,860
reducing visibility to under a couple
hundred feet. So right now it's on the

96
00:07:58,860 --> 00:08:04,320
transport vehicle and it's ready to roll
and we'll be rolling out around to a

97
00:08:04,320 --> 00:08:09,690
2:00 a.m. at that point we'll have a
convoy that drives very slowly from the

98
00:08:09,690 --> 00:08:15,600
payload processing facility out to the
slick-three Atlas 5 facility, and once it

99
00:08:15,600 --> 00:08:20,880
arrives we'll hoist the encapsulated
spacecraft up to the top of the mobile

100
00:08:20,880 --> 00:08:25,200
service tower and place it on the launch
vehicle. This morning when it was sitting

101
00:08:25,200 --> 00:08:28,300
on the truck and they put the crane on
it they started lifted up that's the

102
00:08:28,300 --> 00:08:32,580
last time this the spacecraft's ever
going to feel the ground of Earth.

103
00:08:32,580 --> 00:08:36,680
I'm just just kind of jumping out of my
skin this is so exciting we're getting

104
00:08:36,680 --> 00:08:41,720
so close to launch and it's been a long
long road. This has been a challenging

105
00:08:41,729 --> 00:08:45,540
program I mean we've had a lot of
technical issues to overcome so we

106
00:08:45,540 --> 00:08:51,360
actually had to stand down back in 2015
but since then we've gotten it all

107
00:08:51,360 --> 00:08:55,460
together and things been going so
smoothly the last year we really feel

108
00:08:55,460 --> 00:08:58,820
really confident about this launch. We
got it on top of the rocket

109
00:08:58,830 --> 00:09:03,060
we're going to blast it off in just a
few days and when it gets to Mars and

110
00:09:03,060 --> 00:09:06,720
lands finally we'll have solid ground
under its feet again and get to work on

111
00:09:06,720 --> 00:09:12,180
probing the depths of Mars. But InSight
won't be traveling alone hitching a ride

112
00:09:12,180 --> 00:09:18,810
to the Red Planet are a pair of CubeSats, twin satellites called Marco A and

113
00:09:18,810 --> 00:09:23,090
Marco B.
So Marco is a dual payload riding as a

114
00:09:23,090 --> 00:09:28,400
secondary mission on its way to Mars. So
Marco is a pair of CubeSats and CubeSats

115
00:09:28,400 --> 00:09:32,300
are really small spacecraft they're
essentially the size of a large cereal

116
00:09:32,300 --> 00:09:35,900
box about this big. It's going to be
relaying telemetry from the entry

117
00:09:35,900 --> 00:09:40,220
descent and landing of InSight back to
earth in near real time. After InSight is

118
00:09:40,220 --> 00:09:44,450
deployed on orbit and is heading to Mars
Centaur, which is behind me, injects Marco A

119
00:09:44,450 --> 00:09:49,730
into orbit and it will slowly rotate
itself so that Marco B ejects 180

120
00:09:49,730 --> 00:09:53,000
degrees on the other side of the vehicle.
But Marco is a technology demonstration

121
00:09:53,000 --> 00:09:56,090
mission it's actually one of the
smallest spacecraft we've ever launched

122
00:09:56,090 --> 00:10:00,920
interplanetary space it's the first
interplanetary CubeSat so in of itself

123
00:10:00,920 --> 00:10:04,460
it has all of these technology that
we've never tested in deep space before.

124
00:10:04,460 --> 00:10:08,240
So if Marco works this time one of the
cool things that we could do is actually

125
00:10:08,240 --> 00:10:13,160
replicate that system and fly it with
other missions in the future and whether

126
00:10:13,160 --> 00:10:17,210
you go into Mars or Venus or it may be
even further away to an asteroid and you

127
00:10:17,210 --> 00:10:20,750
could think of it as bring your own
telecom relay. So everything went well

128
00:10:20,750 --> 00:10:24,710
today with the lift of the spacecraft
and mate onto the rocket it started off

129
00:10:24,710 --> 00:10:28,560
very foggy and windy
and right now it's a beautiful day this

130
00:10:28,560 --> 00:10:32,780
typical California weather and now we're
ready to go to Mars.

131
00:10:35,480 --> 00:10:41,640
But just as Twilight falls across the
base the fog returns cloaking the coast

132
00:10:41,640 --> 00:10:47,750
with a bone-chilling mist that will last
until daybreak. As we get closer to T-Zero

133
00:10:47,750 --> 00:10:53,060
liftoff time a number of activities have
to happen. There's a mobile service tower

134
00:10:53,060 --> 00:10:57,480
around the Atlas five rocket and the
InSight spacecraft is on top of the

135
00:10:57,480 --> 00:11:01,620
rocket enclosed in the payload fairing
so we're gonna back that mobile service

136
00:11:01,620 --> 00:11:07,770
tower away from the rocket to leave it
exposed just beside the umbilical tower.

137
00:11:07,770 --> 00:11:12,900
[Engineer proceed with roll to park position. Roger MST shall be

138
00:11:12,900 --> 00:11:16,220
closed in park position. Roger.]

139
00:11:24,970 --> 00:11:30,399
The final launchpad preparation is
underway once the mobile service tower

140
00:11:30,399 --> 00:11:38,709
is rolled back InSight and Atlas 5 are
just hours away from T-Zero. Basking in the

141
00:11:38,709 --> 00:11:43,269
searchlights of the West Coast facility
they are presented with the glamour of a

142
00:11:43,269 --> 00:11:49,860

Hollywood premier fitting treatment for
such an historical mission

143
00:11:51,320 --> 00:11:56,120
So there's a lot of excitement within
the NASA launch team about the InSight

144
00:11:56,120 --> 00:12:00,350
mission first time we're going to launch
from the California coast going to Mars

145
00:12:00,350 --> 00:12:06,230
and what is really exciting to the team
is this is the culmination of a lot of

146
00:12:06,230 --> 00:12:13,190
work. The teams have been working on this
mission for over five years and today is

147
00:12:13,190 --> 00:12:16,370
the day that they will see all of their
hard work rewarded.

148
00:12:16,370 --> 00:12:19,790
[Status check to proceed with terminal
count Atlas systems propulsion go

149
00:12:19,790 --> 00:12:26,990
hydraulics go pneumatics go
water go Centaur systems propulsion go

150
00:12:26,990 --> 00:12:32,779
pneumatics go LH-2 go facility go
reigns coordinator clear to proceed

151
00:12:32,779 --> 00:12:39,139
launch director. LC you have permission
to launch go Atlas go Center go InSight.

152
00:12:39,139 --> 00:12:46,480

Proceeding with the count. We're at
t-minus eight seven six five four three

153
00:12:46,480 --> 00:12:49,480
two, one, zero.

154
00:12:51,440 --> 00:12:58,900
And liftoff of the Atlas-5 launching the first interplanetary mission on the west coast and NASA's

155
00:12:58,900 --> 00:13:05,190
InSight the first outer space robotic
explorer to study the interior of Mars.

156
00:13:07,050 --> 00:13:12,550
Seconds after liftoff the rocket punches
through the marine layer lighting the

157
00:13:12,550 --> 00:13:20,370
night sky for miles visible all the way
down to Los Angeles. An infrared camera

158
00:13:20,370 --> 00:13:25,510
showing the long tail of the exhaust
plume captures some of the ascent as

159
00:13:25,510 --> 00:13:30,040
well as an onboard ascent camera. And
we're nearing booster engine cutoff.

160
00:13:30,040 --> 00:13:36,700
We're back to 4.6 G's in preparation blue space cooldown has completed.

161
00:13:36,700 --> 00:13:46,510
Shutdown looks good. Stage
separation. We have box and fuel prestart

162
00:13:46,510 --> 00:13:52,480
between two purge firing, the RCS is
underway. We have ignition and full

163
00:13:52,480 --> 00:13:55,950
thrust
and we have indication of payload

164
00:13:55,950 --> 00:14:00,800
fairing jettison it looks like a good sep.
And the payload fairing that was

165
00:14:00,800 --> 00:14:06,390
encapsulating the InSight spacecraft has
been jettisoned. The RL10C engine the

166
00:14:06,390 --> 00:14:12,210
second stage of the Centaur continues to
burn. An hour and 28 minutes into the

167
00:14:12,210 --> 00:14:17,790
mission the InSight spacecraft and the
Marco twins are deployed from the Centaur

168
00:14:17,790 --> 00:14:23,910
upper stage beginning the long
voyage to Mars where InSight will go to