

COUNTDOWN
TO
T-ZERO



InSight

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 its 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

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00:04:33,919 --> 00:04:38,419

don't want to cloud our ability to potentially find life on another planet

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00:04:38,419 --> 00:04:41,570

or moon.

Lockheed Martin's space of Denver

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00:04:41,570 --> 00:04:47,780

Colorado built InSight with an extremely efficient design streamlining what needs

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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