

Gaining InSight on NASA with Code.gov

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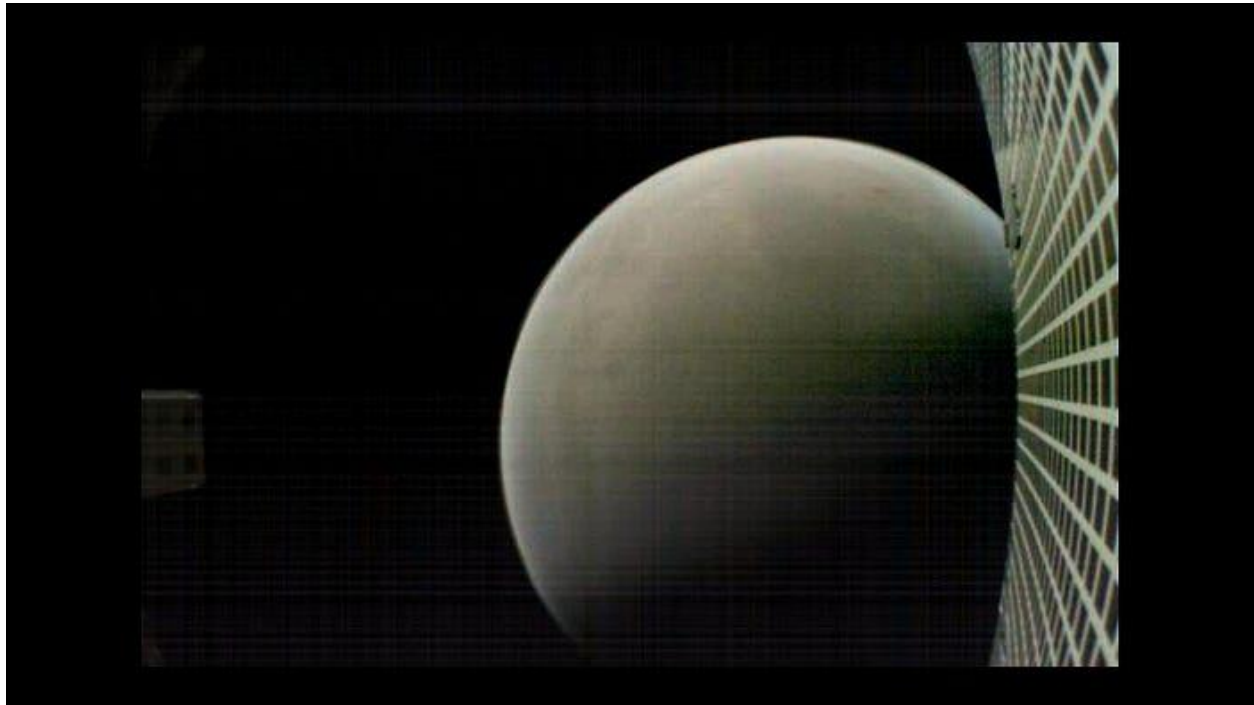


Image of Mars from about 4,700 miles (6,000 kilometers) away, taken by the MarCO-B, one of the experimental Mars Cube One (MarCO) CubeSats, during its flyby of the Red Planet on Nov. 26, 2018

The National Aeronautics and Space Administration (NASA) has what could be the coolest job in the solar system: Explore space. NASA has a lot of different missions and purposes, but perhaps their biggest job is to make *Star Trek* a reality. The thing is, space exploration is not easy. It really is rocket science, and a lot of other sciences involved as well. There is also a lot of ingenuity and imagination involved in getting from here to there. To best illustrate that, here is a breakdown of exactly what NASA successfully pulled off yesterday with their InSight probe:

- The InSight probe covered 300 million miles in six months at speeds estimated around 13,000 miles per hour (or 20,000 kilometers per hour, for our metric friends)
- NASA had to make certain the probe hit the Martian atmosphere at precisely 12 degrees of an entry angle. Too steep, and the probe would burn up in the atmosphere. Too shallow, it will bounce off the atmosphere and into deep space.
- InSight, provided the entry would be at 12 degrees, decelerated so quickly, it pulled 12 Gs (or gravity force) within a two-minute span. To give you an idea of how intense that

is, 1 G is just another day on planet Earth. Riding a roller coaster puts your body through an average of 3.5–6 Gs. So take the experience of a roller coaster, and *double* it.

- On entry, InSight deployed a supersonic parachute at Mach 1.
- As the probe glided to the ground, six explosive charges released the craft's heat shield and deployed landing gear.
- The probe, tucked inside the hull, began a free fall from its housing seconds later.
- Retro boosters fired during descent, slowing the probe down.
- InSight touched down on the surface of Mars at 5 miles per hour, as if it were the Eagle itself touching down in our Moon's Sea of Tranquility.
- InSight performed all these functions using its own onboard "autopilot" as commands from Earth to Mars would take too long to reach it.
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"Hold on," you might think, *"this entire process sounds like something Wile E Coyote would do to catch the Road Runner. Why can't Mission Control, you know, just control the landing?"* The above-outlined process to land InSight safely on Mars all happens within seven minutes. Commands from Earth to Mars takes eight minutes. And did I mention the odds of this happening without a hitch? Forty-three missions have been sent to the Red Planet from various space organizations. Eighteen have succeeded. Twenty-five have not. Hence, why NASA calls this series of events the *Seven Minutes of Terror*.

And yesterday, NASA pulled this off flawlessly.

How did they *do* this?

Here's the cool thing about that above question — the kind of software NASA uses to run such missions, is only a click away from this blogpost. It's not THE software used on InSight, but it is software that inspired operating systems and projects leading up to the InSight mission. As these inspirational projects are open source, you can offer up a pull request to add your own touch or influence to them. Take a look at what NASA has waiting for you at Code.gov:

[Open Mission Control Demo](#) — This open source project is a functional demo of the Open MCT mission operations framework using a combination of real and mock data. The real data is historical weather data taken from the REMS instrument on the Curiosity rover, which is kindly made available via a web service provided by the [Centro de Astrobiología of the Spanish National Research Council](#), to whom NASA is eternally grateful.

[Mission Simulation Toolkit](#) — The Mission Simulation Toolkit (MST) is a simulation framework, supporting the development of autonomy technology for planetary exploration vehicles. The MST provides a software test bed which includes simulated robotic platforms, sensors, and environments, developed as part of the Mission Simulation Facility (MSF) project. Autonomy is a key enabling factor for robotic exploration. At present, there is a large gap between autonomy software (at the research level) and software that is ready for insertion into near-term space missions. The MST bridges this gap by providing a simulation framework and a suite of tools to support research and maturation of autonomy. This simulation capability is

applicable to a wide range of robotic applications, ranging from early concept studies through the evaluation of mature technology.

Livingstone 2 and Skunkworks — *Livingstone 2* is a reusable Artificial Intelligence (AI) software system designed to assist spacecraft, life support systems, chemical plants, or other complex systems in operating robustly with minimal human supervision, even in the face of hardware failures or unexpected events (such as the earlier described Seven Minutes of Terror). The technology diagnoses the current state of a spacecraft or other system and recommends commands or repair actions that will allow the system to continue operations. *Skunkworks* is a suite of software tools that support the rapid deployment of model-based representations of complex systems for *Livingstone 2* via a visual model and two graphical user interface tools that provide status information during testing.



Martian Sunset (image courtesy of NASA)

Whether you are looking to just do a little exploration in your neighborhood, or if you are aiming for the final frontier, projects that Code.gov has indexed can inspire you to do bigger

and better things, or your pull request could inspire the next giant leap in space exploration. If you want to find out more about what you can do with America's Code, join us on [November 28th for a meetup with the Elastic DC Group](#). We are looking to introduce you to the opportunities we offer, some of which could take you to infinity and beyond. You can also visit us on [Twitter](#) or [LinkedIn](#), and share with us your own innovations or ask questions about what other kinds of projects we have indexed. We can't wait to meet you online, or at one of our events, to answer whatever questions you may have; and to offer you a chance to make a difference, to innovate, and to create. You never know what new opportunities, here or out in the Black, you could explore through us.

Code on. And prosper.