



Pacific International Space Center for Exploration Systems



# NEWSLETTER

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17th Journey Through the Universe education program features a packed virtual schedule



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## NASA's Perseverance Rover: Operations and Testing From Launch to Landing on Mars

By: Heather Bottom, Systems Engineer at NASA-JPL

Some leapt out of their seats and others had tears in their eyes after touchdown was confirmed. Never-before-seen landing videos, sounds from the Martian surface and the initial surface images have made the work evermore worthwhile. The Perseverance rover has now begun commissioning and initial science operations on the Red Planet. However, the 6.5 month-long journey from Earth to Mars was not without its challenges, and I was along for the ride as one of the many spacecraft operators during the mission's "cruise" phase.

As the vehicle traveled to Mars, it underwent all sorts of activities to keep it healthy and fit for entry, descent and landing (EDL), and surface operations. There were a number of



Above: NASA's Perseverance rover is lowered to the Martian surface from a jet-powered sky-crane on Feb. 18. Image credit: NASA-JPL.

engineering and instrument check-outs, helicopter (aptly named, Ingenuity) maintenance events, trajectory correction maneuvers and turns.

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## Message from the Director

Last month, we watched with great anticipation as NASA's Perseverance rover attempted to land on Mars. Watching video of the sky-crane gently lowering its precious cargo to the Martian surface was an inspirational moment for me. The engineering behind such a feat is truly remarkable.

Here in Hilo, we have two notable connections with the Mars 2020 mission. Heather Bottom, a NASA-JPL systems engineer and friend of PISCES, helped guide Perseverance to its destination over the last six-and-a-half months.

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Rodrigo Romo

## WiSE Talks Series for Youth Returns March 15-19



**Above (L-R, top to bottom):** Heather Bottom, NASA-JPL; Yajaira Sierra, NASA Glenn Research Center; Veronica Bindi, UH Manoa & TedEd; Tracey Prater, NASA Marshall Spaceflight Center; Jane Poynter, The Space Perspective; Miriam Fuchs, WiSE Talks host and astronomy grad student.  
*Courtesy photos.*

The second WiSE (Women in Space Exploration) Talks series organized by PISCES is bringing another group of exceptional women who work in science and engineering careers related to space exploration. The free virtual talk series is scheduled March 15 – 19, and will feature one talk per day at 11 a.m. HST. Each talk will be 30 minutes followed by a 30-minute Q&A session.

Though the event is intended to engage and pique the interest of young women interested in STEM, WiSE Talks is a public event and open for anyone to attend. Registration links will soon be available at [bit.ly/wisetalks](http://bit.ly/wisetalks). An open link to view the event will be provided each day of the talk series.

This year's featured speakers include: Yajaira Sierra, engineering project manager at NASA's Glenn Research Center; Tracie Prater, aerospace engineer at NASA's Marshall

Spaceflight Center; Veronica Bindi, a TedEd speaker and professor of physics and astronomy at the University of Hawaii at Manoa; Heather Bottom, systems engineer at NASA-JPL; and Jane Poynter, serial entrepreneur and co-founder of The Space Perspective.

Their topics will span the realm of the recent Perseverance rover landing on Mars, protecting humans against solar radiation for space travel, manufacturing materials in space, and the emerging industry of space tourism.

The event is being made possible through the support of Hawaii Science & Technology Museum (a Hawaii island nonprofit) and Microsoft. Learn more at [bit.ly/wisetalks](http://bit.ly/wisetalks).



## Cont: Perseverance Lands on Mars: Behind the Scenes



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The operations team included those on the uplink side, planning, testing and generating the commands and files for each activity; and those on the downlink side, analyzing the data received from the spacecraft and verifying its health and safety. Then there were those hunting down any anomalous behavior.

Even after years of exploration, the vacuum of space still has many uncertainties—which is what makes it so exciting, but also so hard. The cold temperatures that come from the void and the ionizing particle events that come from cosmic rays cause hard-

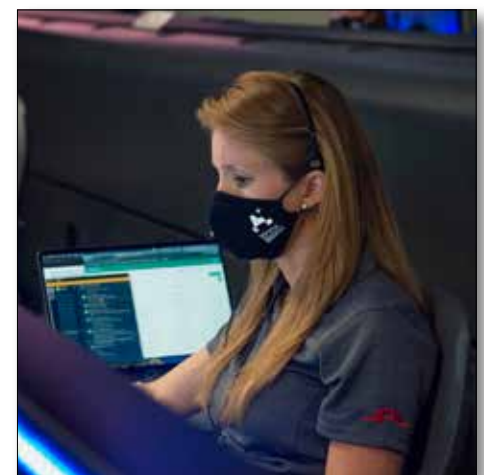
**Above:** *The team at NASA headquarters rejoices as they receive confirmation of a successful landing.*

ware to function slightly different than expected. Unplanned events became part of normal operations, and the team was prepared for anything. Even moving into the sequences for EDL, hundreds of commands were prepared for contingency purposes in case anything went wrong. Luckily for Mars 2020, none were used.

Meanwhile, as Perseverance traveled to Mars, back on Earth the surface operations team was preparing for the rover's first days on the Red Planet—verifying and validating the remaining hardware and software functionality with a rover identical to Perseverance (also appropriately named, Optimism) in a sand pit replicating the Martian surface at JPL. Since the launch

window to Mars only occurs every two years, the project had to launch in 2020 and the surface operations team continued working during the journey to complete all remaining testing.

One of the main goals of the mission is to collect and cache samples of the Martian soil to be returned to Earth via a future mission called Mars Sample Return. If Perseverance lives up to its name, it will not only get those samples but also perform science experiments. These include producing oxygen from the Martian atmosphere, or possibly discovering signs of previous life via its seven different instruments. Even though it's already been away from Earth for many months, Perseverance's mission is just beginning.



*Heather Bottom. Courtesy photo.*

## Cont: Message from the Director

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Aaron Roth, a Waiakea High School alumnus and two-time robotics intern with PISCES, also works at NASA-JPL as part of a team of software engineers. We wish a warm congratulations to the entire team at NASA-JPL for their incredible accomplishment!

In outreach this month we are hosting our second WiSE (Women in Space Exploration) Talks series to highlight the lives and work of women working in space related careers. This free virtual event is intended to engage and inspire

young women, but all our welcome to attend. The schedule is March 15 - 19. Heather Bottom will be among the five featured presenters.

In economic development efforts, we are continuing to work with the Hawai'i Space Flight Laboratory (HSFL) on two Unmanned Aerial Systems (UAS) projects. One involves establishing a center of operations for a Japan-based company to launch high-altitude telecommunications technology using UAS. The second project involves a half-day seminar to present the

benefits and potential opportunities for generating added jobs and revenue for the State.

In the world of legislation, we are closely tracking two bills: one each in the House and Senate that could change the way PISCES and Aerospace work are organized in the Hawai'i. While some uncertainty remains for the outcome of these bills—as well as the future of our funding—we are working closely with lawmakers who have expressed strong support to continue our programs.

As we continue to build new partnerships and strengthen our existing ones within the State, I hope to ensure our continued operation while demonstrating the value that PISCES brings to Hawai'i. Moreover, it is important—especially in our current economic situation—that the Aerospace industry helps pave the road to Hawai'i's economic recovery.

A hui hou,

Rodrigo Romo  
 Program Director  
 PISCES



[Learn more and register here >>](#)

value and capabilities that a UAS operations center in Hawai'i could bring to the State. We are working with members of NASA, the USGS, the Alaska Center for UAS Integration and the University of Hawai'i at Hilo's Aeronautical Science program. The seminar is planned for late March or early April. It will primarily aim to create local interest in a UAS operations center by demonstrating the

## JTTU Program Returns with Packed Virtual Schedule

Journey Through the Universe is returning during the first week of March this year, marking the 17th anniversary for the week-long education and outreach program. This year the program is being held virtually, focusing on astronomy-centered research and technology to inspire youth in STEM fields. The online format is designed to recreate the inspiration of past years while reducing potential health risks to educators and participants.

“It has been a challenge to adapt Journey’s usual face-to-face format to the demands of the pandemic,” said Janice Harvey, Hawai’i education and engagement manager at NOIRLab. “But the Journey team and our volunteer educators have put together an outstanding program and we’re looking forward to inspiring more students to learn about astronomy and our place in the Universe.”

In addition to classroom activities, educators will also offer career panels throughout the week to inform students about astronomy-related education and career opportunities at local observatories.

“This is an important opportunity to make contact with kids at an earlier age, exposing them to the opportunities that exist in their local community, and encouraging them to aim high,” said John Vierra, safety coordinator at Gemini Observatory and

a career panel participant. “The panels are planned to inspire students to think outside the box and about what they want to accomplish later in life.”

JTTU was first introduced in 2004 on Hawai’i island and has expanded significantly. Last year, the program reached more than 8,800 students in 300 classrooms through the efforts of more than 80 astronomy educators, as well as support from local and national sponsors.



**JOURNEY THROUGH THE UNIVERSE PRESENTS:**  
**EXCITING REVOLUTION AHEAD**  
**GROUND-BASED ASTRONOMY**

**MARCH '21**  
**03**  
7-8:30 pm HST  
Watch on YouTube:  
NOIRLabAstro

OVER THE PAST DECADE, discoveries have been made with "messengers" from space that go beyond light: particles from distant galaxies, neutrinos from the Sun and supernovae, and most recently gravitational waves. These Messengers and the Universe's dynamic nature are two of the most rapidly advancing areas of astronomy, and will likely redefine modern astronomy.

**LARS LINDBERG CHRISTENSEN**  
RESEARCH SCIENTIST, NSF'S HAWAII  
TELESCOPE SYSTEM OBSERVATORY

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