PISCES HAWAII'S PORTAL TO SPACE NEWSLETTER

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NASA's Perseverance Rover Begins Journey to Seek Out Life on Mars

Above: *NASA's Perseverance Mars rover launches aboard a ULA Atlas V rocket on July 30 from Cape Canaveral Air Force Station in Florida. Credit: United Launch Alliance.*

The most advanced planetary rover ever built is on its way to Mars. NASA's Perseverance rover successfully lifted off from Cape Canaveral Air Force Station in Florida atop a United Launch Alliance (ULA) Atlas V rocket on July 30 along with its sidekick Ingenuity, a prototype Mars helicopter.

Perseverance has a big mission ahead: collecting Martian surface samples to send back to Earth, searching for signs of ancient life, and conducting next-level scientific research. The car-sized rover will also be deploying the first planetary helicopter for a test flight and testing experimental technologies that could pave the way for crewed surface missions in the coming decades.

"The spacecraft is on it's way to Mars with all subsystems operating nominally," said Heather Bottom, a NASA JPL spaceflight engineer who lives in Hilo, Hawaii.

> *Continued on* **Page 2**

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Letter from the Director

Rodrigo Romo

Aloha kākou,

Despite a pandemic that continues to cause serious damage to human health, lives and economies across the world, July was quite a month for Aerospace milestones. On July 19, the United Arab Emirates launched from Japan the "Amal" (Hope) space probe to Mars aboard a H-IIA rocket. Just days later on July 22, China launched its first rover to Mars. If their mission goes as planned, China will have a solar-powered spacecraft the size of a golf cart on the surface of the Red Planet. And on July 30, NASA launched its Perseverance rover to Mars from Kennedy Space Center aboard an Atlas V rocket. Perseverance is the most advanced spacecraft to be sent to Mars yet. Part of the rover's mission is to collect rock and soil samples that will later be returned to Earth for closer study, especially for bio-signatures that could indicate if life once thrived on the Red Planet.

> *Continued on* **Page 5**

Cont: NASA Mars Rover...

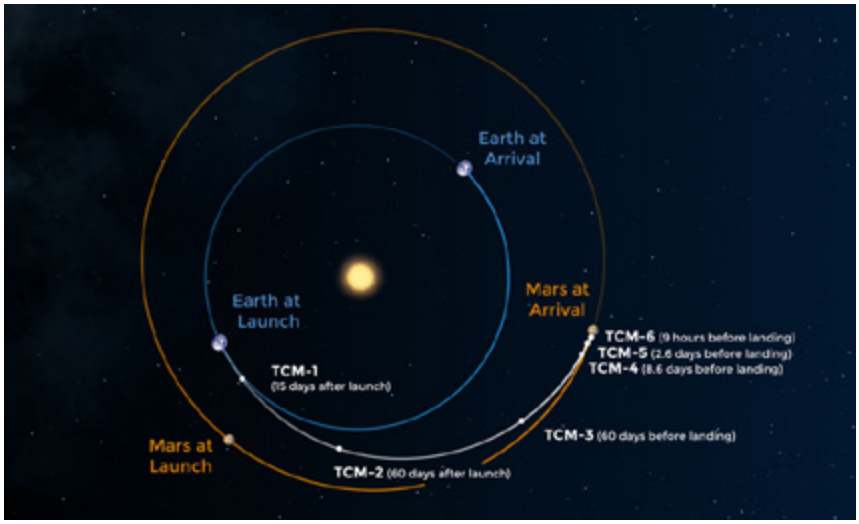
> Continued from Page 1

"It's completed over one percent of its six-month journey with two-way communication over the Deep Space Network. We're now preparing for a handful of hardware check-outs, turns and planned trajectory correction maneuvers that will occur before landing on Mars."

Before the surface mission begins, Percy must overcome the next big challenge of a successful landing. When it arrives in seven months, NASA engineers will endure the "seven minutes of terror" when the rover will be out of contact during entry, descent and landing. Like its predecessor Curiosity, Percy will touch down using a rocket-powered sky crane—a proven technology still reminiscent of a sci-fi film.

NASA has targeted Jezero Crater as the landing site, a region believed to have once held a lake and river delta. While Percy's predecessors Curiosity and Opportunity assessed the geological characteristics of the Martian surface, Percy will dig deeper to analyze the chemical makeup of the surface and look for possible carbon-based molecules—signatures of life as we know it. It will also gather rock and soil samples to return to Earth. NASA and the ESA are planning a joint mission to return the samples for closer study on Earth as early as 2031.

Percy's sidekick, Ingenuity, will be the first planetary helicopter to fly the Martian skies. Over the course of one Earth month, the copter will attempt five flights to assess its capabilities and lay the groundwork for future airborne vehicles. Small helicopters could provide aerial views for rovers and human crews, transport for small cargo loads and access to hard-to-reach areas.



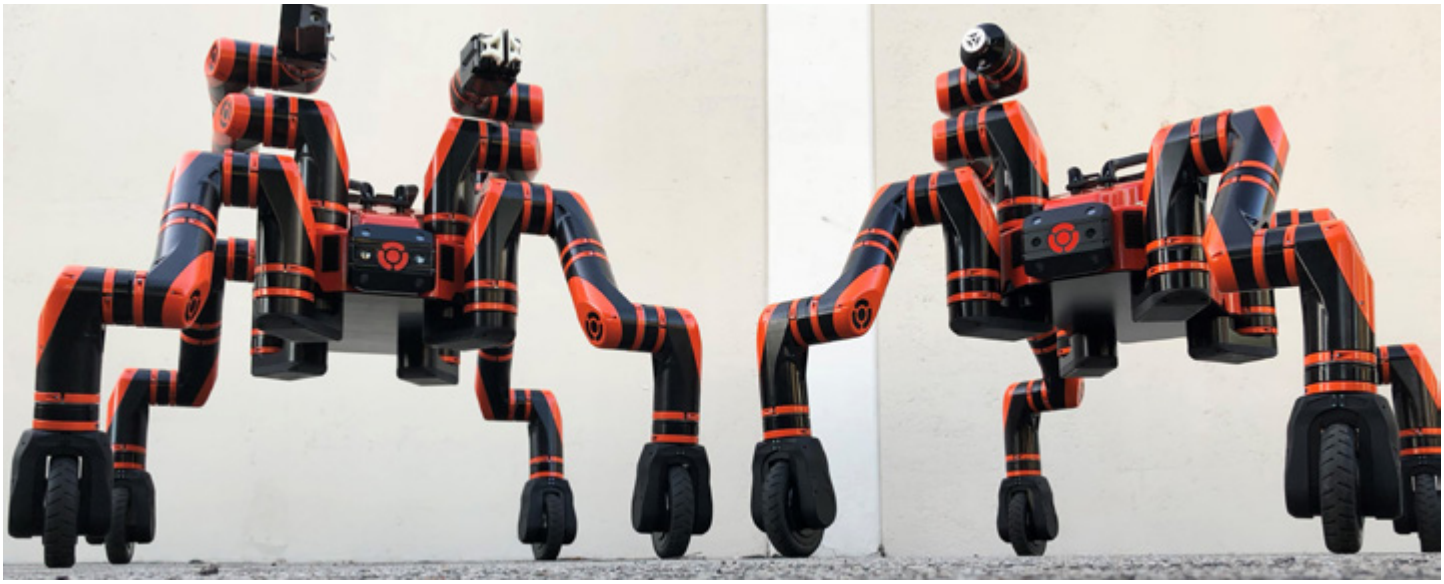
Above: *Illustration of the route Mars 2020 takes to the Red Planet, including several trajectory correction maneuvers (TCMs) to adjust its flight path. Credit: NASA/ JPL-Caltech.*

In addition to seven scientific instruments and two dozen cameras, Percy is also outfitted with a machine called MOXIE, or Mars Oxygen In-Situ Resource Utilization. As the name suggests, it is designed to generate oxygen from Mars' carbon dioxide-rich atmosphere to—hopefully—produce breathable air for astronauts and rocket fuel one day.

Perseverance is not alone on its 350 million-mile trip to Mars. On July 19, the UAE launched its first-ever interplanetary mission, sending a Mar probe called Hope to the Red Planet. Four days later, China launched its first Mars orbiter, lander and rover mission, called Tianwen-1. The three spacecrafts are all slated for arrival in February next year.

Perseverance is part of the U.S.'s larger moon and Mars exploration strategy which aims to prepare the way for human exploration. Percy has been eight years in the making since NASA announced it would build a new rover based on Curiosity back in 2012.

From Earth to Mars: Motiv's Path to Commercialize Space



Above: *Motiv's RoboMantis with dual manipulators (left) and a single manipulator (right). Credit: Motiv Space Systems.*

By: Chris McQuin - Chief Robotics Engineer, Motiv Space Systems

There is a coming gold rush in space, both literal and figurative, as the promise of lower cost access to space couples with the ever-increasing capabilities of robotics to enable new enterprises. These developments in the field of robotics are well aligned with the interest at the national level for increased responsiveness, flexibility and capabilities for flight missions. Additionally, significant and growing commercial interest in activities such as on-orbit manufacturing and assembly, satellite servicing, and in-situ resource utilization of valuable resources (such as water and precious metals on the Moon, asteroids and beyond) are enabled by robust and accessible space robotics.

Motiv was founded in 2014 to address these current and future needs for systems integrating electronics, motion control and robotic hardware that can survive the challenges of space and subsequently enable next generation capabilities. In parallel, Motiv also set out to apply best practices, from our collective experience building and sending systems to other planets to mobile ground robots here on Earth to similarly enable new capabilities in smaller, lighter, more capable packages.

Over the last few years, Motiv has been busy developing many new and exciting systems. Our first launched payload in 2018 sent motion control avionics to the International Space Station as part of NASA's RRM3 mission, demonstrating robotic refueling technologies for spacecraft. Motiv also developed and delivered the 2m robotic arm for NASA's Perseverance Rover, which launched to Mars on July 30th. Simultaneously with these delivered systems, we designed, built and delivered multiple space-rated motion control systems and mechanisms for other NASA and commercial customers for various destinations in the solar system.

> *Continued on* ***Page 4***

Cont: From Earth to Mars: Motiv's Path...

> Continued from Page 3

While conquering space, Motiv has also focused on developing a modular robotic system capable of feats of strength and dexterity. RoboMantis is Motiv's rugged and modular, general-purpose robotic platform that can be configured for almost any task. Informed by the best practices in aerospace robotics system design, RoboMantis is lighter and more capable than previous generations of robots. It is designed to tackle extreme terrain, access remote and dangerous sites, and be able to physically interact with the environment once there. It is a machine designed to perform tasks on the same scale as a human responder, but with the safety, precision and strength afforded by a robot. Motiv is exploring opportunities for RoboMantis in mining, energy, disaster response, agriculture, construction, and other industries here on Earth. Motiv's robotic systems and integrated tools can make processes more efficient, safer and cost effective by enabling operators to not only inspect, but also react to new information or situations arising during work within these fields.

One of the interesting findings from Motiv's RoboMantis development efforts was the key realization that the same system approach used for our terrestrial robotics could drastically reduce the cost and lead-time of robotic systems for space. As a result, Motiv's modular space robotic arm system, xLink, was born. xLink enables an order of magnitude reduction in cost, and significant improvement in lead-time for space-flight robotic systems without sacrificing the performance or reliability needed for space. Motiv's first xLink launch will be on NASA's OSAM-2 mission.

At Motiv, we are working on extreme systems—both in performance and environmental functionality—for the Earth, Moon, Mars and beyond. These systems are enabling technologies to expand our collective scientific knowledge, create new capabilities and utilize more of the solar system than ever before. To succeed in space, we design and test to the actual mission environments before they launch. We are looking forward to the chance to work with PISCES to test and validate our systems here on Earth in analog testing sites before sending our revolutionary machines into space.

Right: *Motiv's robotic arm on the front of NASA's Perseverance Rover, currently headed to Mars after a successful launch on July 30, 2020. Credit: NASA/ JPL-Caltech*

Cont: Letter from the Director...

Perseverance rover. Credit: NASA/JPL-Caltech.

> *Continued from* **Page 1**

Perseverance has a special meaning to us in Hilo, for it has two direct links with our community. Aaron Roth, a graduate from Waiākea High School and a two-time PISCES intern, works at NASA JPL and is among the many team members working on Perseverance. Heather Bottom, an engineer with JPL and resident of Hilo, is on the team responsible for the transport vehicle delivering Perseverance to Mars.

Aerospace is in our DNA and the possibilities that it can bring to our state's economic recovery are very promising. That is why we continue to work with legislators and industry leaders to develop an Aerospace Industry cluster in Hawaii.

Due to the COVID pandemic, we have sadly decided to cancel the 2020 STARS program scheduled during fall break in October. With the recent spike in cases and uncertainty of the virus' trajectory in the coming months, we did not think it safe to conduct the program as planned. However, we are working with our sponsors to carry the funding over for next summer. We are also planning for a STEM Q&A session during fall break to inspire young women and underrepresented youth in STEM fields. I am grateful to our colleagues at Microsoft for showing support and interest in helping organize a webinar series.

Finally, in non-space related news, House Bill 1912 which modified some of PISCES' statutes and the organization of the board of directors passed both chambers and was sent to the governor to be signed into law. We want to express our gratitude to the leadership team at DBEDT, and the legislative support we received from Rep. Mark Nakashima of Hawai'i Island, Rep. Angus McKelvey on Maui and Sen. Glenn Wakai from O'ahu.

A hui hou,
Rodrigo Romo
Program Director

3rd Annual EMER-GEN Program Goes Virtual

The 2020 EMER-GEN program for young professionals and students interested in space careers will be held as a virtual event this year, beginning Aug. 26. EMER-GEN is a joint initiative of the AMOS (Advanced Maui Optical and Space Surveillance Technologies) Conference and Space Generation Advisory Council (SGAC).

With the help of advisers from industry, government, academia and NGOs, attendees will get mentoring with renowned space specialists, networking opportunities, technical courses and professional development sessions.

EMER-GEN was originally a two-day program but has grown to include pre- and post-event webinars to foster innovation and entrepreneurship. During the program, participants will be challenged to solve a problem that creates new opportunities for space-based technologies.

Registration is available online until Aug. 5 for a reduced fee of $95. Scholarships are available for Hawai'i residents.