

OBSERVING:
Autumn's Great Edge-on Galaxy

PAGE 28

THE SUN AWAKENS:
Image Our Star

PAGE 58

SHADOW THEATER:
Understanding Lunar Eclipses

PAGE 34

SKY & TELESCOPE

THE ESSENTIAL GUIDE TO ASTRONOMY

NOVEMBER 2022

WEBB TELESCOPE'S Big Debut

Page 12

skyandtelescope.org

\$7.99US \$8.99CAN

A/A
S
11>



0 71896 02207 0

Sending Astronauts to Venus

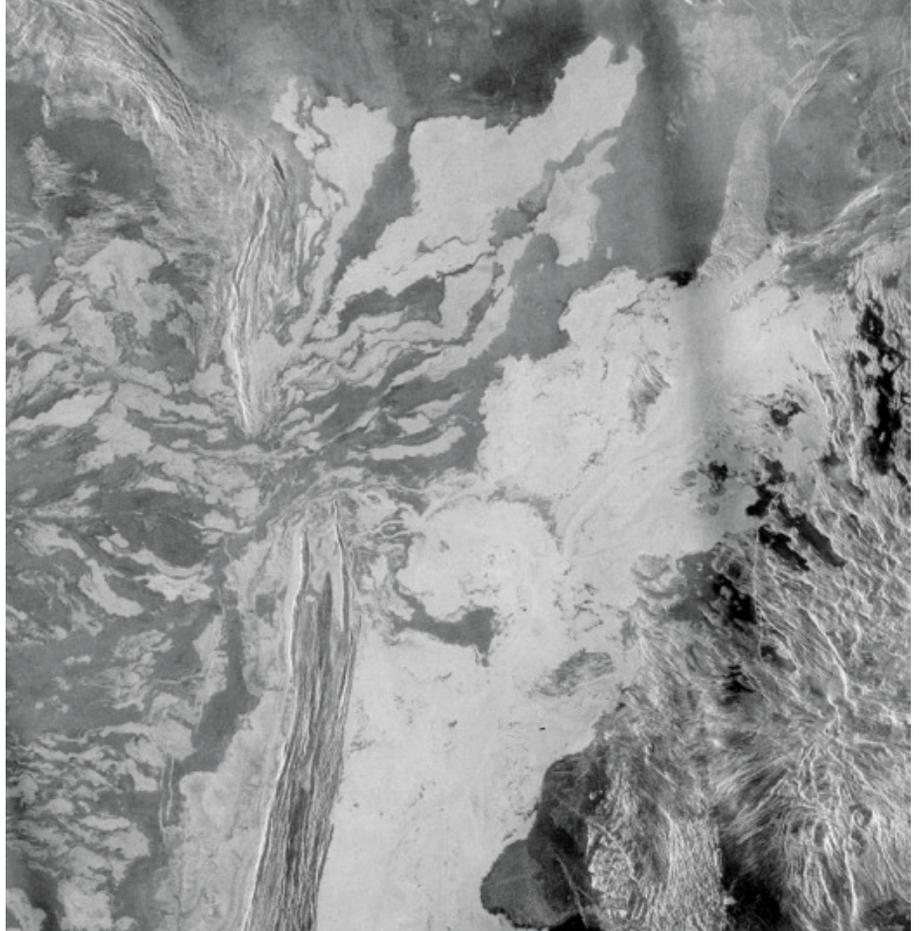
Crazy as it might seem, it's a logical and thrilling prospect.

ASTRONAUTS TO VENUS? It sounds like a joke, delusion, or cruel punishment. Yet recently I spent two days at Caltech in a workshop titled “Venus Science Enabled by Human Proximity.”

Why would bright and apparently sane people gather to discuss such an outlandish thing? We all know that Venus is an oven, about the last place you'd want to send people. Yet it's the closest planet to Earth, rich with mystery and untapped, priceless knowledge. There are important lessons that we'll never learn about our home planet, and therefore about ourselves, until we deeply explore this neighboring world.

These lessons include the origin and fate of Earth and the uniqueness of our biosphere, as well as the mechanics of climate change on Earth-size, geologically active worlds. We need to know answers not only to satisfy our curiosity but to grow into our role as a planet-changing species.

Comparative planetology of Mars, Earth, and Venus can help. Venus is the least explored of the three, but we now have several robotic spacecraft approved for launch over the next decade that will start to close the gap. We already know that Venus is a complex volcanic world sheathed in variable, chemically rich clouds that could possibly even host some kind of organisms today. Current observations and modeling suggest it's also a vibrantly active planet that for much of its history might have had habitable surface oceans. After the upcoming missions, we will need follow-ons to explore in more depth.



▲ Imagine astronauts using remote observation to explore Venusian landscapes in real time (here, a Magellan radar image mosaic of the lava-streaked Lada region). It's an electrifying thought.

But why would we possibly imagine sending humans? Believe it or not, there are several good reasons.

From orbit we can tell the surface is rich in exotic landscapes, with enticing targets for up-close exploration that would be scientifically important and also captivate the public. With current technology, we can't send rovers; they'd quickly fry. Autonomous aircraft couldn't do the complex, real-time navigation and decision making required. But we could send Remotely Operated Vehicles that float near the surface, escaping to higher altitudes to cool off.

We use ROVs now to investigate Earth's deep oceans, with operators on surface ships using teleoperation. On Venus, ROVs couldn't be driven from Earth; the time delay is too great. But astronauts in orbit or passing through near-Venus space could drive them. These explorers would virtually search through enchanting landscapes while an enthralled public looked over their shoulders, safely wandering Venus with their own VR devices.

Human missions are costly, of course. How could we convince NASA or other agencies to make this a priority? Such a mission actually may fit very well into current plans for a Moon-to-Mars architecture. Many optimal Mars trajectories include a flyby of Venus for a gravitational boost to or from Mars.

Then again, maybe a trip straight to Venus is warranted: There's a lot of concern today about the unknown health risks of multi-year, deep-space travel, and a shorter trip to Venus might be a valuable first step to ensure that we can safely send astronauts to other solar system destinations.

So, don't worry, we're not talking about cooking anyone. In fact, keeping humans alive while engaging in breath-taking exploration and crucial science is very much the point. Some of us are getting quite excited about the possibility of making it happen.

■ **DAVID GRINSPOON** is author of *Venus Revealed: A New Look Below the Clouds of Our Mysterious Twin Planet*.