

BLACK HOLES:
Our Galaxy's Heart Revealed

PAGE 12

RED PLANET DELIGHT:
Mars Reaches Opposition

PAGE 48

ASTROPHOTOGRAPHY:
How to Capture Light Echoes

PAGE 60

SKY & TELESCOPE

THE ESSENTIAL GUIDE TO ASTRONOMY

DECEMBER 2022

The First White Dwarf Discovery

Page 28

skyandtelescope.org

\$7.99US \$8.99CAN

A/A
S
1 2 >



0 71896 02207 0

Soul of a New Machine

THE END OF ASTRONAUTS: *Why Robots Are the Future of Exploration*

Donald Goldsmith and Martin Rees
 The Belknap Press of Harvard
 University Press, 2022
 185 pages, ISBN 9780674257726
 US\$25.95, hardcover

“**THE ARGUMENTS IN** this book point to one striking conclusion,” write the authors of *The End of Astronauts*. “We do not need astronauts as space explorers.” Their reasoning for using robots over people is rational, sane, and authoritative — what you’d expect from the U.K.’s Astronomer Royal (Rees) and a well-respected astrophysicist-author (Goldsmith). So it’s worth hearing them out, even if your initial reaction to the title is, “No more astronauts? What are you thinking?”

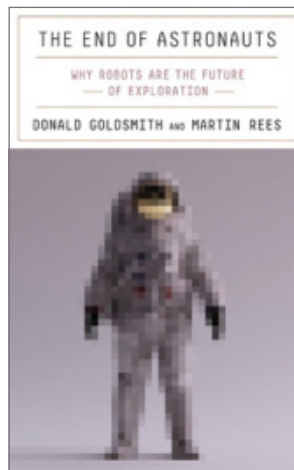
Goldsmith and Rees answer that question methodically. For starters, they claim that machines’ abilities are rapidly converging on ours. In the coming decades, they write, “robots and artificial intelligence will grow vastly more capable, closing the gap with human capabilities and surpassing them in ever more domains.” (Curiously, elsewhere in the book they conclude, “Although our robots will continue to increase their artificial intelligence, no one knows when, if ever, they can match us humans . . .” Such uncertainty, though understandable, undermines their case.)

Another reason for androids over humanoids: Using inanimate explorers lessens the chance that we’ll inadvertently contaminate another world. Even people-less missions carry risks if we’re not careful. The authors cite the fate of Israel’s Beresheet spacecraft, which failed on approach and crashed into the Moon — along with a few thousand tardigrades it held. What if those micro-animals, one of Earth’s hardiest organisms, somehow established themselves?

The authors are succinct when it comes to their two primary reasons to use automations over us: “We cost far more than robots to maintain, and we expect to return home.” Astronaut missions to Mars, at least over the next two decades, will cost roughly 50 times more than if we rely on rovers and other non-human explorers, they estimate. Missions beyond Mars have always used machines, and we’ve seen spectacular results from Cassini at Saturn, New Horizons at Pluto, and many other mechanical missions.

Safety concerns may loom largest of all. As the authors observe, when it comes to radiation dose, one day in space equals a year on Earth, and myriad other potential dangers threaten our fragile bodies out there. Psychological threats are even harder to gauge. In pondering the human-vs-machine question, we need to consider not only the physical challenges of long journeys, the authors state, “but also the human psyche, in some ways a more difficult proposition.” At about six months, a Mars trip is 50 times longer than one to the Moon — and that’s just one-way. Until we actually undertake such an extended mission, we can’t reliably gauge how astronauts will respond to the increased isolation and monotony, much less to what some have called the “Earth-out-of-view” effect. Robots, of course, couldn’t care less.

This brings us to what many will deem the principal argument against the authors’ stance: the emotional component. Rees and Goldsmith acknowl-



edge that astronaut missions “make us feel better, more connected, and more engaged in our success as a country, perhaps as a civilization.” They admit that the first Moon landing, as well as the Space Shuttle disasters of 1986 and 2003, moved us much more deeply than the success or loss of any automated missions have.

The authors do make an interesting point that

younger generations might be more accepting than older ones of robotic missions, given their greater familiarity with virtual reality and corresponding enhanced ability to “project themselves mentally to other worlds without losing sight of where they are.” They also remind us that we may soon be entering an era of “technological evolution of intelligent beings.” Operating a thousand times faster than Darwinian selection, designing certain robotic elements into people will generate diverse varieties of “post-humans” — developments they consider “entirely likely” within the next few centuries.

Thus, not only may robots be converging on us, but we on them. Yet when it comes to impassioned feedback during exploration, like Apollo 17 astronaut Harrison Schmitt’s radioed response the moment he discovered orange soil on the Moon — “It’s all over! Orange!” — most would likely agree that never the twain shall meet.

■ Editor in Chief **PETER TYSON** admits a bias toward hoping one day to hear the reaction of the first human being to step onto the surface of Mars.