

From Nebraska To NASA: MIRA Robot Revolutionizes Surgery With Pocket-Sized Precision

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The day has come for a patient to gown up for a surgical procedure without leaving a suburban urgent care clinic...or the understaffed and underfunded small-town hospital in the wilds of the Midwest...or by climbing aboard a rocket destined for Mars.

All three scenarios can have the same, highest standard of care, and none will require a huge robotics platform that takes up the better part of an entire operating room.

Virtual Incision, a startup company founded on a University of Nebraska collaboration, has developed a miniaturized robotics platform that is now FDA-approved and available on the open market. Called MIRA—short for Miniature In vivo Robotic Assistant— the technology is the result of a cross-campus collaboration between University of Nebraska-Lincoln robotics professor, Shane Farritor, PhD, and former University of Nebraska Medical Center (UNMC) surgeon Dmitry Oleynikov, MD.

Other surgical robotic options exist, but they are massive, main-frame units that take up an entire room and reach into the body from outside the patient. MIRA, however, is a small, self-contained surgical device that is inserted through a single midline umbilical incision in the patient's abdomen. It does not require a dedicated operating room or specialized infrastructure, so it is expected to be significantly less expensive than existing robotic alternatives for laparoscopic surgery. Virtual Incision's technology promises to enable a minimally invasive approach to surgeries performed today with a large open incision.

Virtual Incision's platform technology is founded on more than 200 patents and applications with the first invention disclosures dating back to the early 2000s. Michael Dixon, PhD, the President and CEO of UNeMed, UNMC's tech transfer office, was part of the licensing team that worked with Drs. Farritor and Oleynikov to help establish Virtual Incision as a startup back in 2008.

"It's good to remember that it's a marathon and not a sprint," said Dixon. "The continued collaboration of engineering and surgical expertise has led this team to continue to build on their innovative ideas. As a successful venture capitalist once told me, 'All my overnight successes took 10 years.' There have been a few bumps along the road, but the product that is in the clinic now is amazing."

Initially, MIRA will be limited to colectomies, also referred to as colon resections. Considered a major surgery, colon resections are among treatment options for patients with lower gastrointestinal diseases including diverticulitis, colon lesions, and inflammatory bowel disease. Colon resections often involve a large incision so the surgeon may remove the damaged or diseased portion of the bowel.

It may take months to recover fully from such an open procedure, but recovery would be significantly reduced when the same procedure is performed laparoscopically. A surgical robot like MIRA can provide that option to more patients.

NASA also recently tested the MIRA platform aboard the International Space Station, opening the door to potential non-terrestrial uses as well.

"NASA has ambitious plans for long-duration space travel, and it's important to test the capabilities that may be beneficial during missions measured in months and years," said Farritor. "MIRA continues to push the boundaries of what's possible in Robotic-Assisted Surgery (RAS), and we are pleased with its performance so far during clinical trials. We're excited to take it a step further and help identify what could be possible as space travel is becoming a reality for humankind."

UNeMed has managed the intellectual property portfolio for Virtual Incision since the beginning, which includes filing the first patents, helping to form the startup company, and creating the licensing agreements. UNeMed continues to support additional grant applications and perform diligence on a lot of Virtual Incision's venture capital fund raising. The TTO's support allows the inventors to do what they do best: invent, revise, improve, and focus on making their ideas a reality.

Virtual Incision has raised more than \$100 million in various fund-raising rounds and plans to commercialize MIRA in select centers across the United States. Virtual Incision also plans to seek additional approval for uses in other

conditions related to gynecology, general surgery, urology, and other soft tissue and solid organ surgery.

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