



Case study: telerobotics

SRI is developing the first mobile telerobotic surgical system.

We are a community of innovation.

design. integrate. apply.



SRI International researchers have pioneered robotics technology for more than 40 years. Today, we are spearheading innovations in wall-climbing robots, robotic scouts, security inspection robots, and self-organizing, networked robots.

“SRI has a vision, cross-disciplinary expertise, and the ability to lead and integrate a terrific team of innovators.”

—Thomas Low, Program Director, Medical Devices and Robotics

In the area of robotic surgery, SRI is the lead integrator on a collaborative program for the U.S. Defense Advanced Research Projects Agency (DARPA) to develop an unmanned medical/surgical treatment system dubbed the Trauma Pod. This rapidly deployable system could stabilize injured soldiers or civilians within minutes of an acute injury and administer life-saving care before and during transport to a hospital.

operating in hospitals across the U.S. and around the world.

Telepresence technology could help military medical units deliver care inside a combat zone, too. Early treatment of critically wounded soldiers and civilians may dramatically increase their chances for survival. The Trauma Pod, a battlefield-based trauma care system, could be controlled by a surgeon miles away from the front lines.

SRI first developed robotic surgery technology for the U.S. Army in the 1980s. Combining advances in stereo imaging, telerobotics, video, telecommunications, and haptics (the technology of touch), surgeons are given the sensory experience of conventional open surgery, but they operate through buttonhole-size incisions. In this “telepresence” approach, the surgeon sits comfortably at a console a few feet from the patient. Through the console, the surgeon sees a three-dimensional image of the surgical field while operating robotics-enhanced surgical instruments within the patient. The less-invasive nature of the surgery means the patient experiences less pain and has a shorter recovery time.

In the project’s first phase, DARPA awarded SRI a multi-million dollar contract to lead a multi-organization team in developing a proof-of-concept system. The team includes technology and expertise from Intuitive Surgical Inc., General Dynamics Robotic Systems, Oak Ridge National Laboratory, Robotic Surgical Tech, Inc., and the Universities of Texas, Washington, and Maryland.

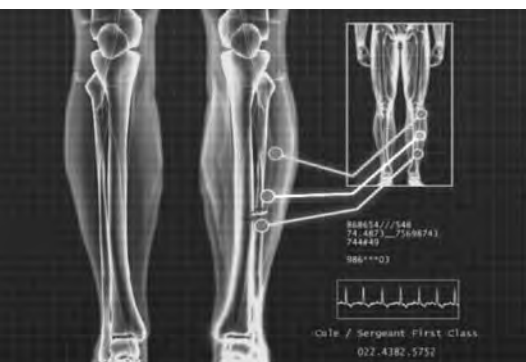
The project’s success draws on SRI’s experience in medical robotics, and on our ability to identify needs, manage large teams, and integrate technology through a flexible approach to systems design.

In Phase 1, the team worked closely with physicians to understand traumatic injury and the most critical initial procedures. Researchers focused on process



Control room for proof-of-concept testing.

Conceptual representation: A wounded soldier is scanned, evaluated, and treated in the Trauma Pod.



In 1995, Intuitive Surgical was formed to commercialize this revolutionary technology. Today, the company’s da Vinci® Surgical System is

flow and the architecture needed to accomplish these specific surgical tasks. Unique skills of robot and human were leveraged: robots are adept at imaging, recording, and executing complex and precise movements, while surgeons excel at thinking, judgment, and planning.

The Trauma Pod prototype, constructed in an operating suite at SRI using a simulation mannequin, consists of 13 subsystems with both off-the-shelf and custom components. A modified da Vinci system is a key module. A glass wall separates the cell where surgery is performed and the cell from which surgery is monitored. In real-world applications, the cells might be thousands of miles apart and

communicate wirelessly. For transport, the surgical cell’s 8-foot by 18-foot size allows it to fit within a standard cargo container.

The system has successfully captured 3D patient scans, viewed simulated CT images to diagnose the injury, sutured a simulated section of bowel, and placed a shunt in the groin of the simulated patient. With 100-percent accuracy, it retrieved, unpackaged, and presented tools and supplies to the surgical robot, all without the aid of a scrub nurse. A surgeon controlled the tool and supply-retrieval robot using spoken commands, similar to direction of nurses and medical technicians in a traditional operating room.

In future project phases, researchers will address critical functions such as anesthesia and sterilization, miniaturization, field deployment, operation during transport, more nimble endoscopic tools, and development of custom modules that can perform critical life-saving procedures when assisted by someone without high-level medical skills.

The technology also has the potential to deliver emergency medical and surgical care in extreme environments, such as for astronauts during space flights and for people living in remote regions on Earth where there are no physicians or surgeons.

SRI is applying its expertise in telepresence and medical robotics to a variety of challenges, including care for the elderly and surgery in space. Here is a look at some of the work we're doing.

Telerobotics Assistance for the Elderly and Disabled

SRI researchers are developing robot-based solutions to help manage the care of the elderly and the disabled.

Robots built on SRI's telepresence technology could provide real-time remote monitoring, physical support, assistance, and rehabilitative therapies while enhancing communication among patient, caregiver, and clinic.

Medical Automation Robots for NASA

In collaboration with NASA, SRI's M7 robot performed the first-ever acceleration-compensated surgical procedure in zero-gravity flight. The M7 was also the first robot successfully deployed in an undersea habitat that simulated the rigors of outer space, demonstrating a surgery conducted remotely over the Internet from 1,200 miles away.

KARTO™ Robot Mapping Technology

KARTO software enables developers of mobile robot solutions to integrate navigation and mapping intelligence into their software. It works with a wide range of mobile robot platforms, simulation environments, operating systems, and middleware.

Wall-climbing Robots

From military and urban reconnaissance missions to inspecting bridges, pipes, and buildings, even to cleaning windows and painting aircraft, SRI's surface-climbing robots—which use electroadhesion to scale vertical surfaces and other obstacles—are adaptable to an eclectic array of applications.

About SRI International

Silicon Valley-based SRI International is one of the world's leading independent research and technology development organizations. SRI, which was founded by Stanford University as Stanford Research Institute in 1946 and became independent in 1970, has been meeting the strategic needs of clients and partners for more than 60 years.

Perhaps best known for its invention of the computer mouse and interactive computing, SRI has also been responsible for major advances in networking and communications, robotics, drug discovery and development, advanced materials, atmospheric research, education research, economic development, national security, and more. The nonprofit institute performs client-sponsored research and development for government agencies, businesses, and foundations. SRI also licenses its technologies, forms strategic alliances, and creates spin-off companies.



Menlo Park Headquarters

SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025-3493
650.859.2000

Washington, D.C.

SRI International
1100 Wilson Blvd., Suite 2800
Arlington, VA 22209-3915
703.524.2053

Additional U.S. Locations

Ann Arbor, Michigan
Harrisonburg, Virginia
Helena, Montana
Lexington Park, Maryland
Orlando, Florida
San Antonio, Texas
San Luis Obispo, California
Shrewsbury, New Jersey
St. Petersburg, Florida
State College, Pennsylvania

International Locations

Sharjah, United Arab Emirates
Sondrestrom, Greenland
Tokyo, Japan

Discover more about SRI, our people, and our innovations at www.sri.com

Printed on FSC-certified paper with soy inks.

KARTO is a trademark, and SRI International is a registered trademark of SRI International. All other trademarks are the property of their respective owners. Photos: Robotic surgery pg. 1 courtesy of Intuitive Surgical, conceptual images pg. 2 courtesy of DARPA/XVIVO.

Copyright 2008 SRI International. All rights reserved. 12/08