Top 10 Surgical Robotics Companies
Meet Tech, Regulatory Challenges for Commercial Success

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Editor’s Note
by Eugene Demaitre, Senior Editor

The healthcare robotics market has unique challenges, including reluctant surgeons, cost-conscious insurers, and strict safety regulations. However, the promise of greater precision, more consistent treatment, and competitive technologies has led to a growing market.

Currently, surgical robots are fairly bulky and expensive, often costing more than $1 million apiece. The range of procedures they can assist is widening, from abdominal to minimally invasive, neurological, and orthopedic.

The surgical robotics market will grow from $4 billion in 2015 to $20.8 billion by 2024, predicts Grand View Research. For a second (and somewhat more conservative) opinion, Markets and Markets expects surgical robotics to grow from $4.9 billion last year to $12.8 billion by 2021. Meanwhile, Stratistics MRC forecasts a market size of $8.1 billion by 2022.

Here, in alphabetical order, is our first Top 10 breakout of surgical robotics companies:

**Auris Surgical Robotics Inc.**
San Carlos, Calif.-based Auris Surgical Robotics has been developing robots for eye surgery, and last year, it bought Hansen Medical Inc., for $80 million. Hansen’s Magellan and Sensei systems are already in use for cardiac catheter procedures.

Both Auris and Hansen, as well as Intuitive Surgical (see below), were co-founded by Dr. Fred Moll. Auris has gotten Food and Drug Administration (FDA) approval for its Auris Robotic Endoscopy System, or ARES, which is designed to be tele-operated and can enter through the mouth.

**Corindus Vascular Robotics Inc.**
The CorPath system from Corindus Vascular Robotics is designed to help surgeons place stents during percutaneous coronary interventions (PCI).

Waltham, Mass.-based Corindus recently sold $45 million in stock. The Fu Wai Hospital, the largest in China, was the first to use its CorPath CRX system in Asia.

**Intuitive Surgical Inc.**
The da Vinci Surgical System is one of the best-known product lines for robot-assisted surgery. Sunnyvale, Calif.-based Intuitive Surgical is widely considered the industry leader, taking part in more than 3 million procedures so far. It was the only surgical robotics company on our RBR50 list for 2017.

Despite slowed growth from questions around the Affordable Care Act and reimbursement for hysterectomies, the company has been careful to invest in research and development and experienced renewed sales and strong earnings. The company shipped 133 da Vinci systems in the first quarter of 2017.
The Flex system includes a flexible tool and a variety of end effectors for access to hard-to-reach areas of the human anatomy, such as the ear, nose, and throat. Flex combines features of a laparoscope and an endoscope for greater maneuverability and shorter recovery times. It has approval in the U.S. and Europe.

Mazor Robotics Ltd.
Last summer, Medtronic PLC made a deal worth up to $50 million for a 15% stake in Mazor Robotics. The world's largest medical technology development company is the product of Metronic Inc.'s 2015 acquisition of Covidien PLC.

Mazor's Renaissance system in more than 16,000 spinal surgeries.

Medtronic's decision to become the exclusive distributor of Caesarea, Israel-based Mazor's products is as strong a vote of confidence as any robotics provider could ask for.

In addition, Mazor recently got FDA clearance for its Mazor X Align software, which is intended to guide surgeons as they conduct spinal operations. Surgeons have used Mazor's Renaissance system in more than 16,000 spinal surgeries.

Medrobotics Corp.
Raynham, Mass.-based Medrobotics is a pioneer in minimally invasive, or keyhole, surgery. Its technology is licensed from Carnegie Mellon University and the University of Pittsburgh.

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Stryker
Stryker makes products for orthopedic, reconstructive, and neurological operations. One of its goals is to "help patients get back to living" normal lives. Stryker made $11.3 billion in sales last year.

In 2013, Kalamazoo, Mich.-based Stryker acquired MAKO Surgical Corp. for $1.65 billion. MAKO's robotic arm has assisted in more than 50,000 hip and knee procedures since 2006, and it can now be used in total knee replacements.

Think Surgical Inc.
Lakeview, Calif.-based Think Surgical specializes in robot-assisted hip- and knee-replacement surgery in response to osteoarthritis. Its systems include the Orthodoc 3D workstation for preoperative planning and the Robodoc computer-assisted tool for cavity and surface preparation. A prototype of Robodoc is even in the Smithsonian Institution as the first of its kind.

Think Surgical's systems have been used in thousands of joint replacements worldwide. The company is owned by South Korean medical supplier Curexo Inc. and has filed for European approval.

Titan Medical Inc.
Toronto-based Titan Medical's Sport surgical system is designed for minimally invasive procedures and is aimed at the European and U.S. markets. Although it's at an earlier stage than some of the other companies on this list, it has already raised $45 million and conducted demonstrations at a conference in Boston.

According to Titan, Sport was designed in response to "voice of the customer feedback" from surgeons and administrators. The company expects to make its system available in the U.S. soon.

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TransEnterix Inc.

One promise of robotic-assisted surgery is that it will “democratize” care by providing the tools for average surgeons to perform at a higher level of precision and efficiency. TransEnterix has embraced that mission with its Senhance Surgery combination of robotics, ergonomics, and haptics.

Virtual Incision Corp.

The number of colorectal and lower gastrointestinal procedures is growing faster than other operations in the U.S., so two University of Nebraska researchers developed Virtual Incision to meet that need. The company holds more than 90 patents and won an RBR Game Changer Award in 2015.

Last year, surgeons conducted the first successful colon resection in a live patient using Pleasanton, Calif.-based Virtual Incision’s miniaturized Robotic Assisted Surgical Device.

The surgical robotics will likely experience continued refinements and consolidation as the technology finds still wider demand.

Congratulations to the companies on this year’s list, and we’ll be watching them and other surgical robotics players in the coming year!

The Morrisville, N.C.-based company’s SurgiBot is designed to use familiar laparoscopic controls but have a smaller footprint in the operating room. It’s also intended to be more affordable than competing systems.

Despite delays in getting FDA approval, the company is marketing Senhance for hernia repairs in Europe and the U.S. In January, TransEnterix received an investment of $5.2 million from Italy-based SOFAR SpA.

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Minimally invasive surgery offers faster recovery times, enabling shorter hospital stays, saving patients pain and insurers money, as well as increasing hospital efficiency. Robotic-assisted surgery could make such procedures even more precise and productive.

Robot Surgeon as Good as a Human, but Still an Aide

This past spring, a team at the Children’s National Medical Center in Washington, D.C., compared surgery performed by a robot with a procedure performed by a human to attach a pig’s bowel during an open procedure. It found that a robot surgeon can do just as good a job as a trained human. But many people in the medical community would be quick to say that while surgical robots are a magnificent technological breakthrough, they are still meant to complement rather than replace human surgeons.

The Essential Interview: Jacob Rosen, Surgical Robotics Pioneer

Joanne Pransky, associate editor of Industrial Robot, recently sat down with Jacob Rosen, a professor of medical robotics at the University of California, Los Angeles. The surgical robotics pioneer has developed systems for minimally invasive surgery, telesurgery, and exoskeletons.

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