

Taurus Robot

Telesurgery with surgical precision

Mark Baybutt

Senior Research Engineer, Robotics Program

Who We Are

SRI is a world-leading R&D organization



SRI headquarters, Menlo Park, CA



Sarnoff Corporation, Princeton, NJ



India



Taiwan



Tokyo, Japan



St. Petersburg, FL



State College, PA



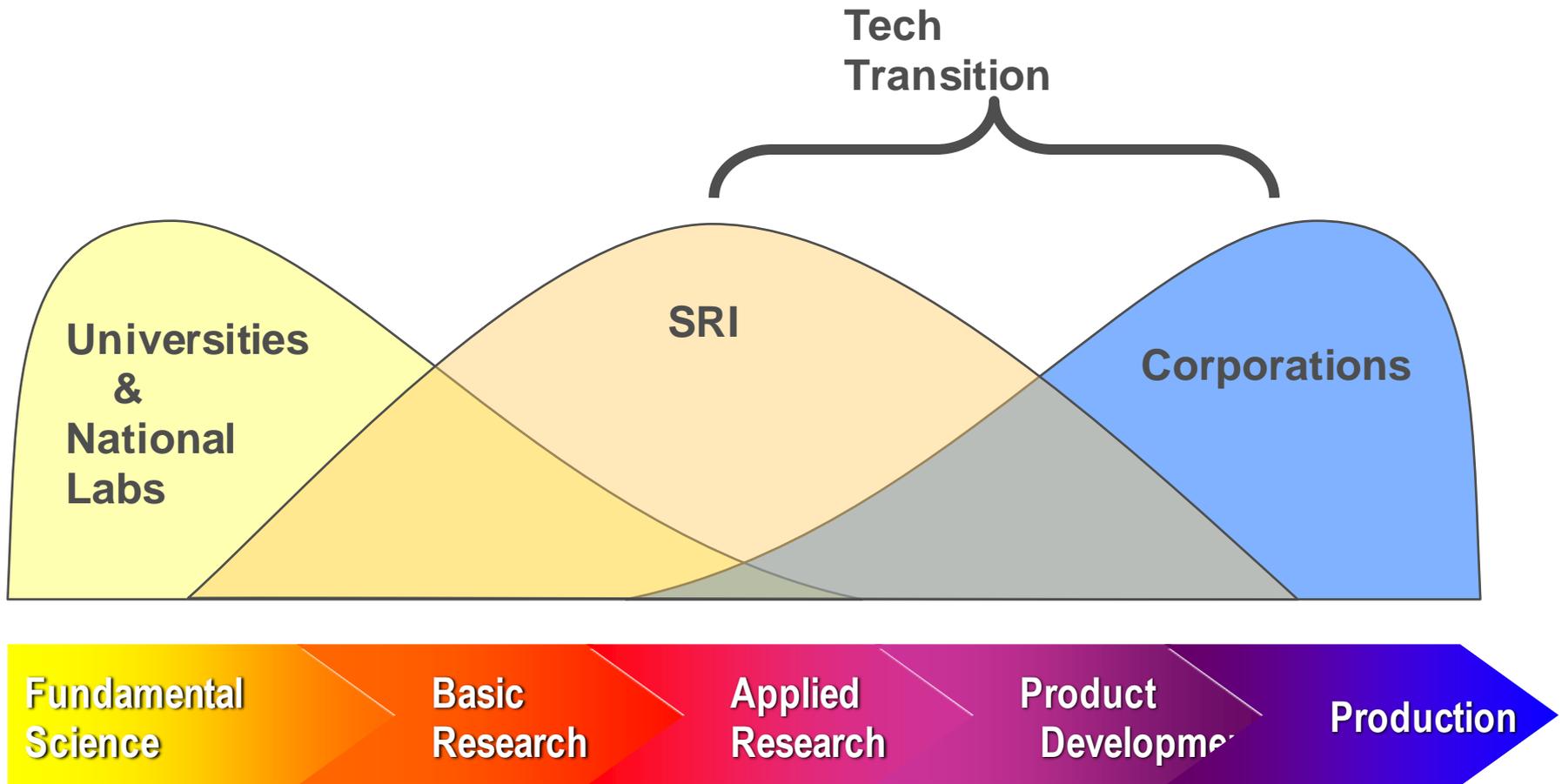
Washington, D.C.

- Founded by Stanford University in 1946
 - A nonprofit corporation
 - Independent since 1970; changed name from Stanford Research Institute to SRI International in 1977
 - Sarnoff (RCA Labs) acquired in 1987; integrated into SRI in 2011
- 2,500+ staff members
 - 1,000+ with advanced degrees
 - More than 20 offices worldwide
- 2013 revenue: \$500+ million



Where We Fit

Bridging the entire R&D Spectrum



SRI Robotics Program

Invent, apply, commercialize

- Customers
 - Premier DARPA performer
 - Fortune 100 commercial clients
 - Early stage market
- Focus on 'New' Robotics
 - Economical, work side by side with people to bring new value
 - Emerging service robot markets



Founding Member
Silicon Valley Robotics



Ventures & Licensing



1995 NASDAQ: ISRG



2003 Acquired: Bayer
Material Sciences



2012 Acquired: Google



2013 Series A: Formation8
Nike, ABB

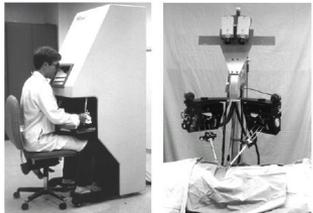
A leader in enabling technologies for robotics

- Fieldable dexterous telemanipulation
- Low cost robotic manipulation systems
- Wearable robotics
- Medical/consumer/industrial markets

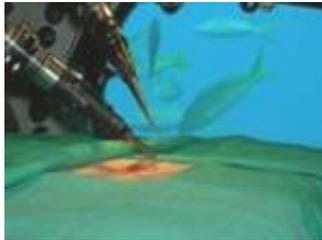
Lineage of Telepresence and Dexterous Manipulation Programs

More than 20 years of applied R&D and commercialization

4-DOF Tele-operated Surgical Robot



Extreme Environment Tele-robotics



Surgical Telementoring System



7DOF Remote Open Surgery System



Taurus Portable Telemanipulator



1992

2013



daVinci Laparoscopic Surgical Robot



Microsurgery System



Robotic Laser Tissue Welding



Integrated Robotic Operating Room



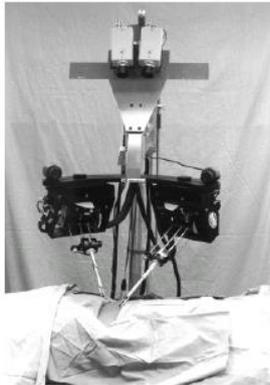
Low Cost Dexterous Robot Hands

SRI Telem Manipulation

Intuitive Dexterous Telem Manipulation



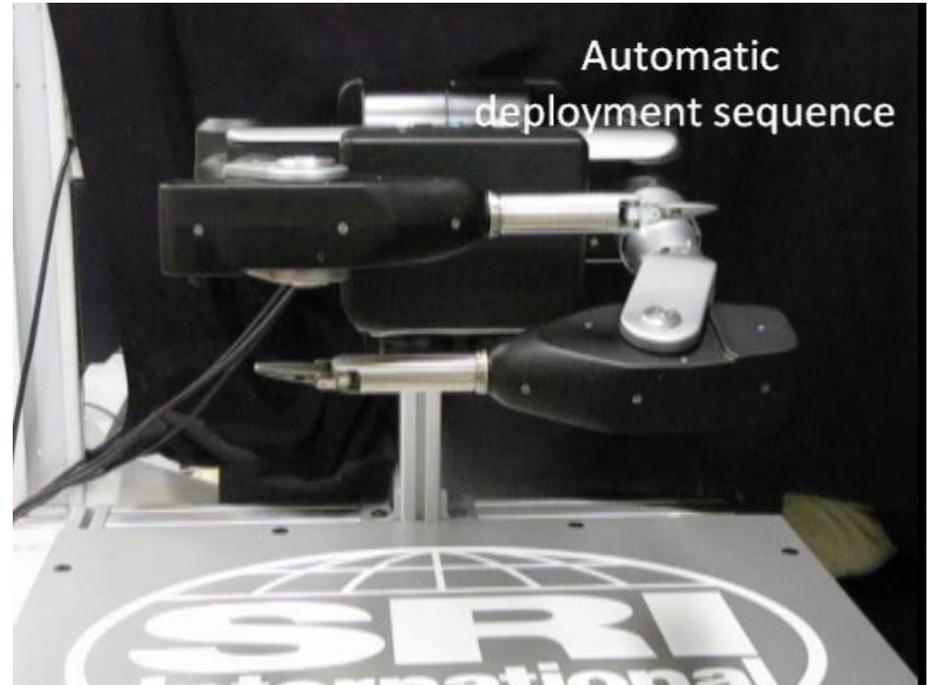
Workstation



Remote Surgical Unit



Thousands of systems sold. 100's of thousands of procedures a year.



The Taurus Dexterous Telem Manipulator
(Video)

Wide range of emerging solutions for “manipulation drones.”

Taurus Technical Description and Specifications

- Two high dexterity, 7-DoF, force-feedback manipulators
 - Integrated stereoscopic video
 - Intuitive man-machine interface
 - Enabling complex remote manipulation tasks to be performed with ease
- Interchangeable powered tools (grinders, drills, abrasive wheels, wire cutters) deployed on Taurus grasper
 - Universal dovetail tool adapter design enables quick and remote tool changes
- Taurus mobile manipulator powered from host mobile PCU or shore power

Specs	
Robot Weight	15 lbs
Payload Weight	4 lb (full extension)
Min. Porthole Entry	14 in x 5.2 in
Operating Workspace	42 in x 33 in x 33in
Robot Width, Compact	15 in
Cutting Force	24 AWG
Avg. Power	60W (36VDC nominal input)
Battery Life	6 hrs
Communication Link	Copper, fiber optic, IP



*Mobile Power
Control Unit (PCU)*

*Taurus Mobile
Manipulator*

Taurus Configurations



Fixed Location or Vehicle based OCU



Connectivity through R/F, copper or fiber



Man Portable OCU with or without force feedback (haptic) option



Powered Interchangeable tools

Taurus Live Demo!

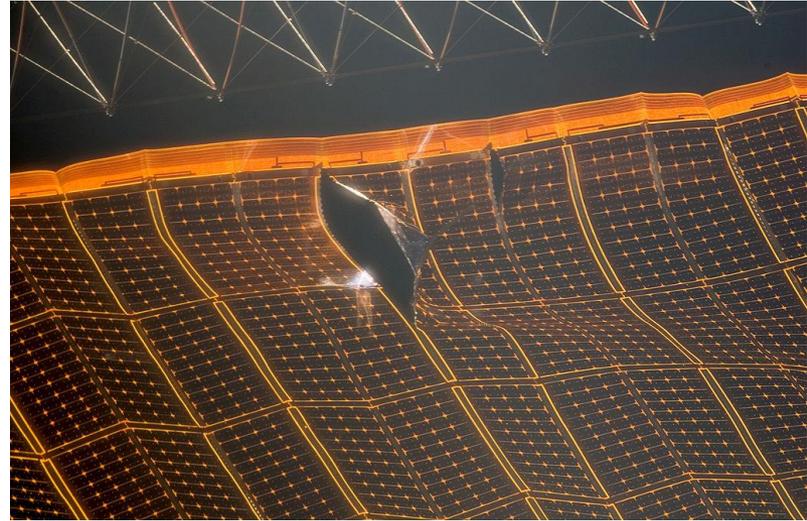
Potential Space Applications



Reduction / assistance in EVAs



**Thermal Blanket
Inspection and repair**



Solar Array Inspection and repair



Other emerging needs



M7

Other Dexterous Telemanipulation Programs

Unmanned Manipulation Platforms

Consumer Grade Dexterous Robot Hands



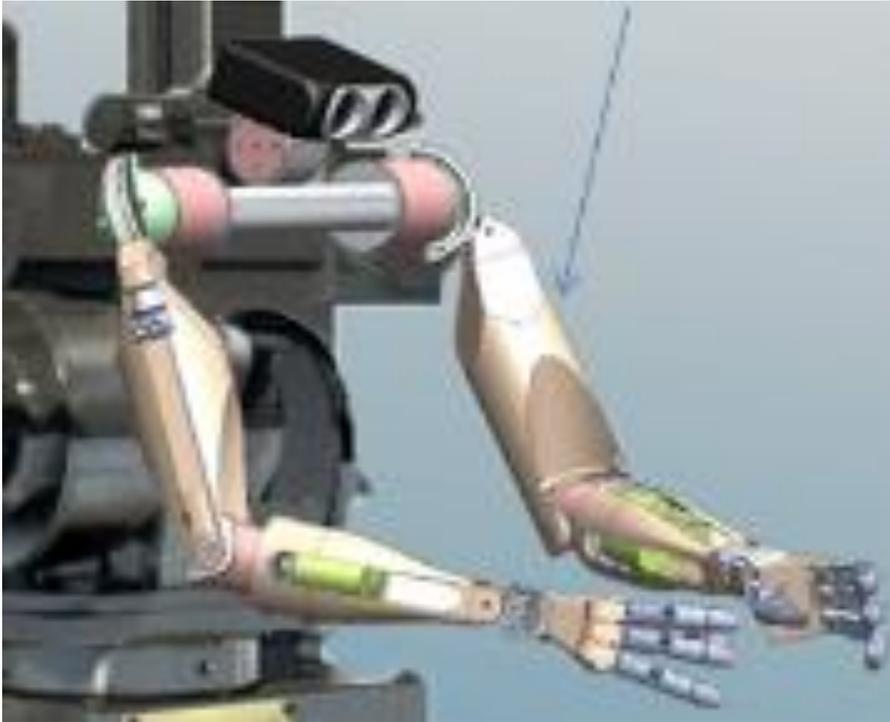
(Video)

Under \$1000 price,
serving emerging
personal robot
market



Robotic Manipulation for Emerging Service Markets

Low Cost, Lightweight Hands, Arms, and Humanoids



PROXI

*Agile humanoid robotics
for search & rescue*

**The first robot with total
physical awareness**

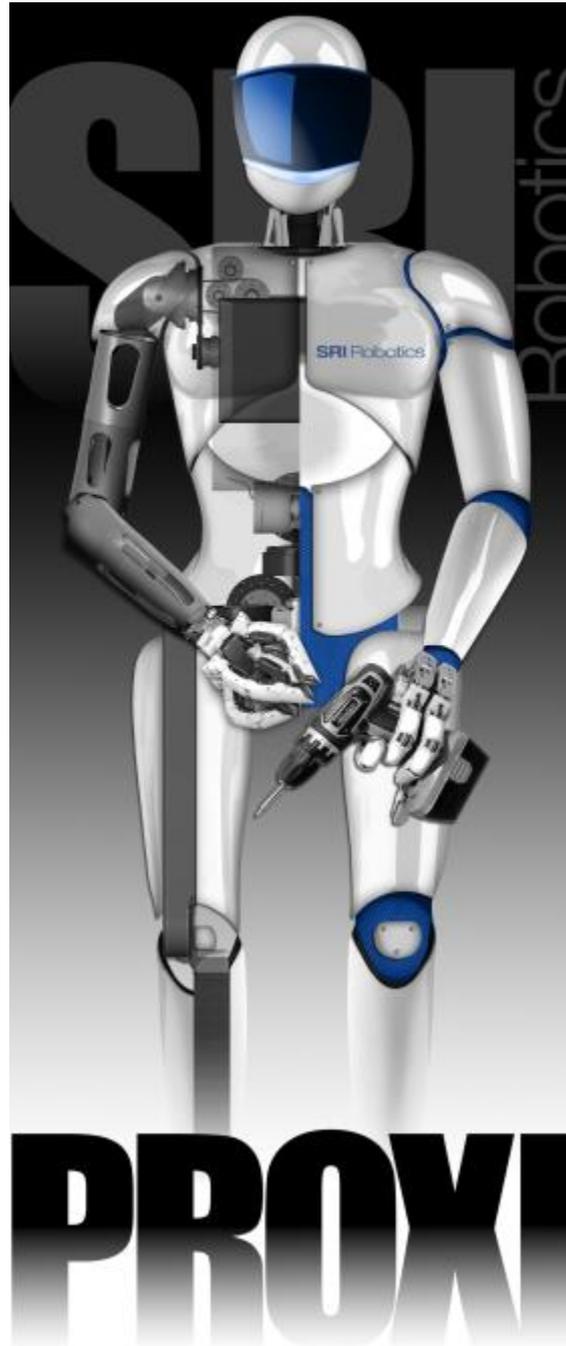
- Whole body dynamic control and stability

**That takes directions like
people do**

- Environment specified task behaviors

**With agile technology ready
for the service robot market**

- 20x power efficiency
- Lightweight,
Low cost



Leveraging SRI Funded Programs

Low Cost Hand
DARPA
2010-2012



Taurus
DHS / FBI
2010-2013



Low Cost Arm
DARPA
2013-2014



**Advanced
Actuators**
DARPA
2013-2014



\$12M+ in funded programs
provides baseline IP and
hardware for this program

Questions?

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