

**Open Surgical Robotic  
Research:  
a Global Network**

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Rob. [uni-obuda.hu](http://uni-obuda.hu)

Intl. ERC & Bejczy Bay, 03.03.2017.

Minimally Invasive  
Surgery (MIS) brings us  
**reduced trauma**

**Future outlook**

"There will be a robot in  
every household by 2020"

SAMSUNG, 2009

- Global MedRob market to reach \$11.4 bn by 2020
- Still long way to go
- Society consensus and standards are missing
- Ethics must become a cornerstone of R&D

# Thanks for your attention!

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# Open Surgical Robotic Research: a Global Network

**Tamás Haidegger, PhD**

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**Prezi Intl. ERC & Bejczy Day, 03.03.2017.**





# Óbuda University Antal Bejczy Center for Intelligent Robotics



Apologies

# Apologies



<http://polaris.salemstate.edu/profile/ldicksteinfisc/>

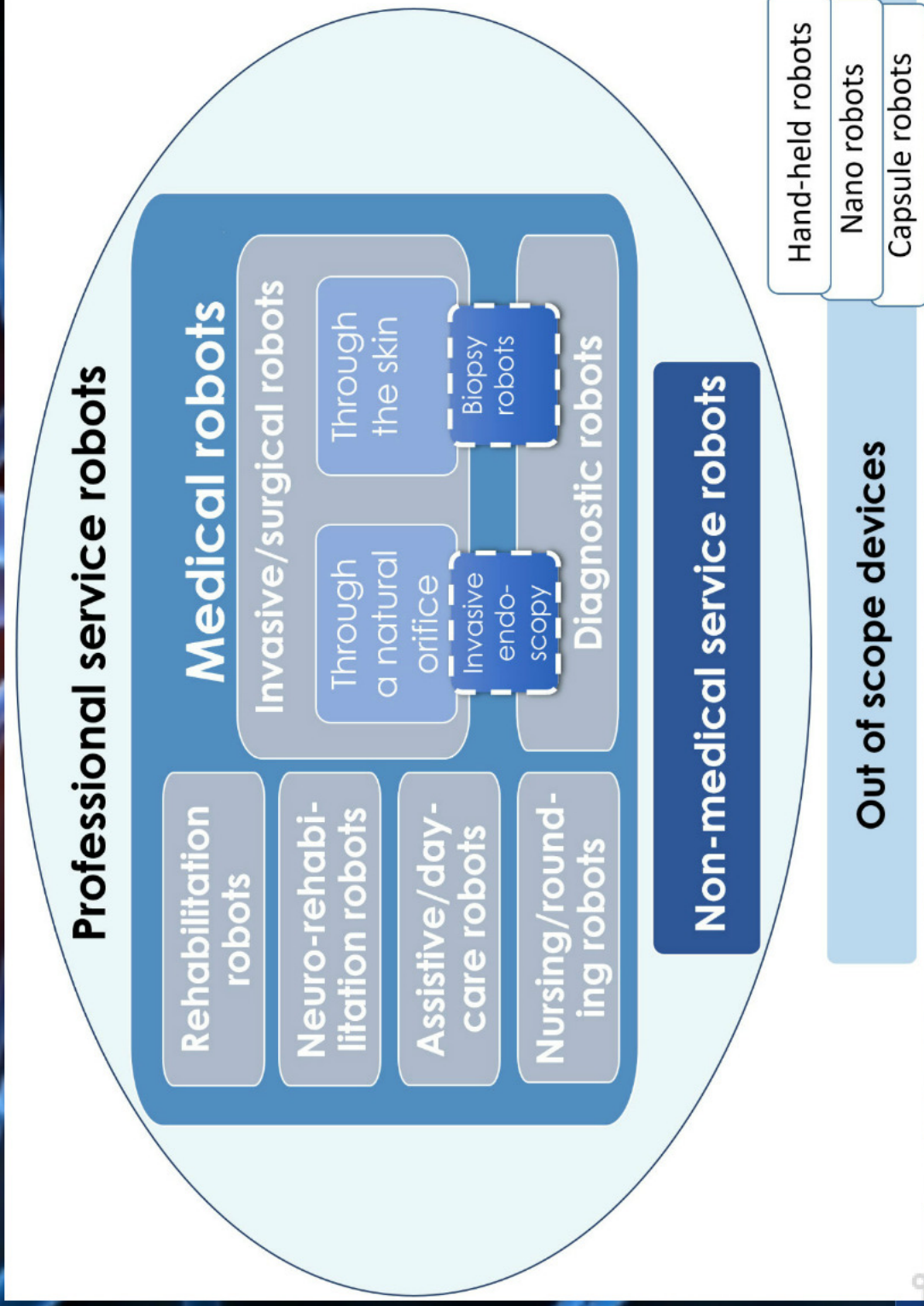
[ldicksteinfisc/](http://aimlab.wpi.edu)



<http://aimlab.wpi.edu>

# A rising domain

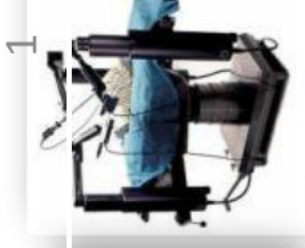
## Service robotic systems according to ISO



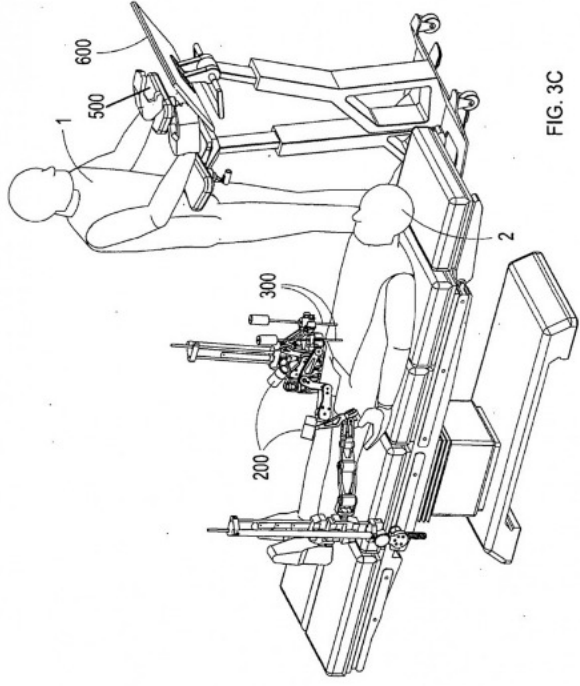
# Exciting times

## Surgical robot sales

- NeuroMate: ~30 sold (16 by ISS)
- Zeus: 50 (2002, discontinued 2003)
- ROBODOC: ~50 (37 before 2000)
- CASPAR: ~93 (discontinued in 2003)
- MAKO RIO: ~250 systems sold (2015)
- SpineAssist: ~50 (2015)
- Renaissance: 70+ (03.2014.)
- CyberKnife: 240 (2013)
- Hansen Sensei: ~200 (2015)
- ATRAS: 100+ (2014Q4)
- EndoAssist: ~100 (-2005)
- PathFinder: ~10
- Niobe: ~100?
- ROSA 55+ (2015)
- Zeego: 500+ (2014)
- **da Vinci: 3500+ robots (Q2 2016)**



# Betting on surgical robotics



# Big investments

## Virtual Incision

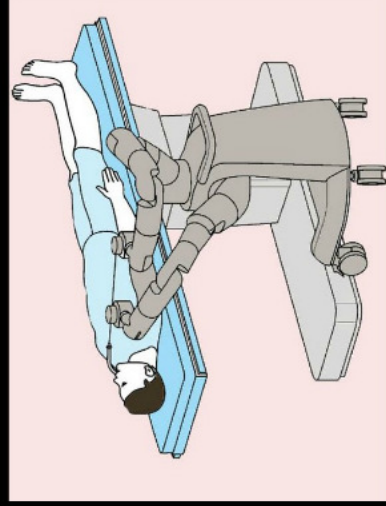
- University of Nebraska spin-off
- Received over \$80 m investment

## Auris

- \$235 m investment
- Bought Hansen Medical for \$80 m

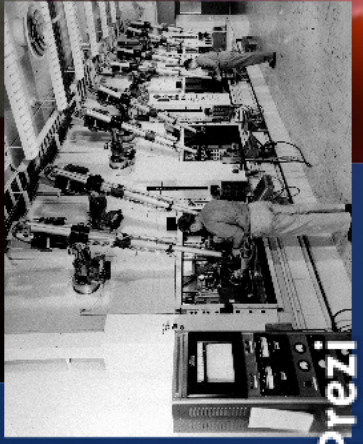
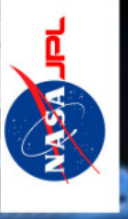
## Alf-X

- Sold first commercial system
- Bought by TransEnterix for \$ 100 m



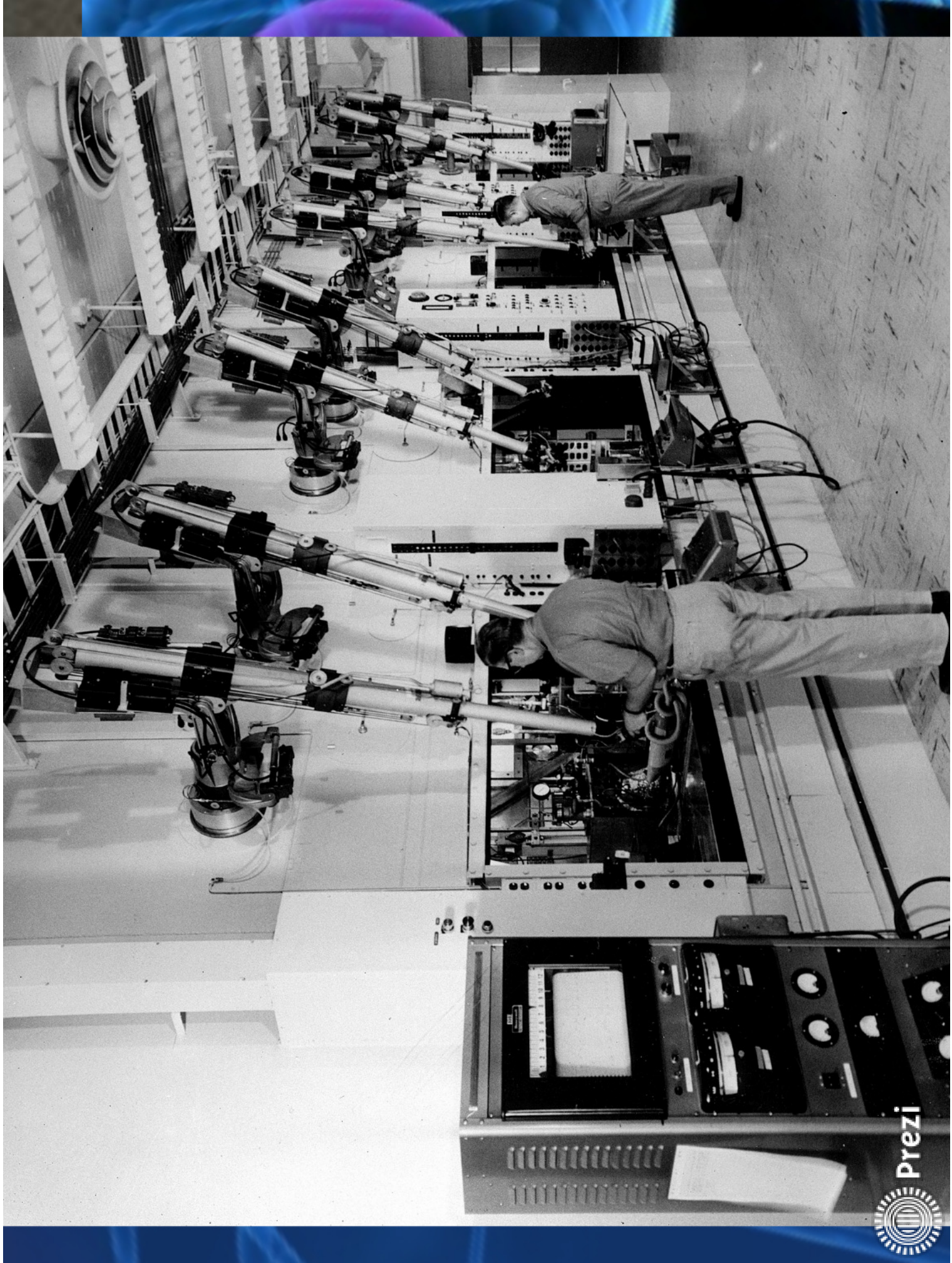


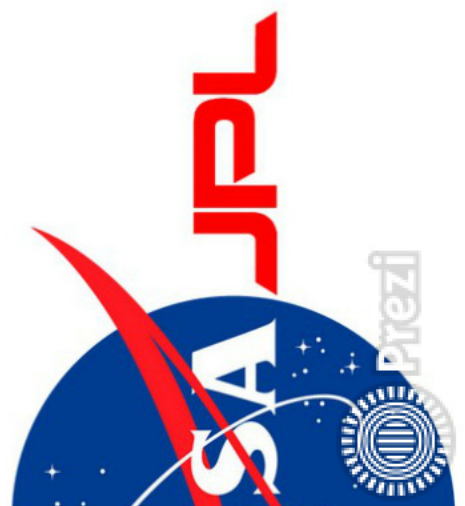
# How it all started



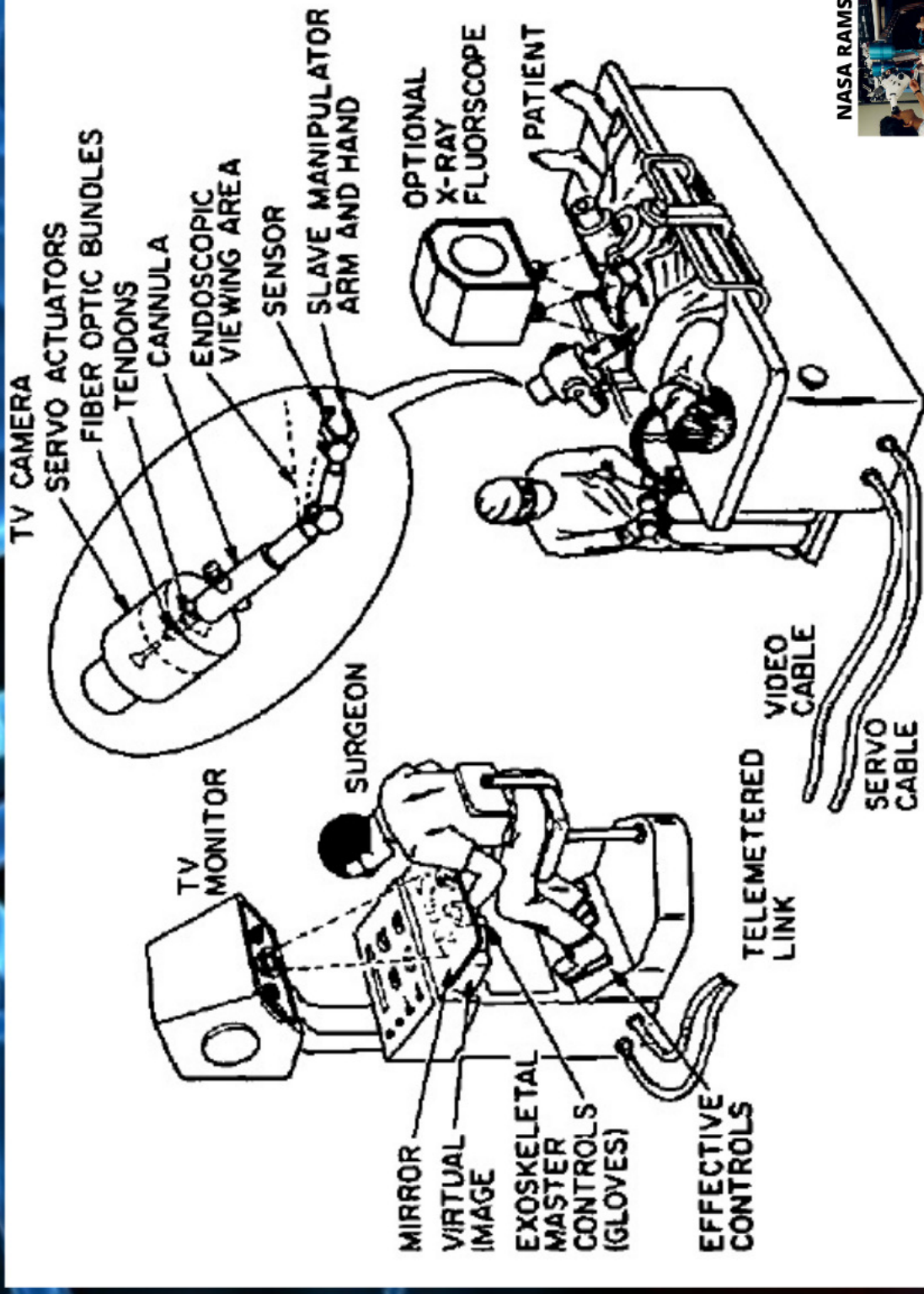
Prezi



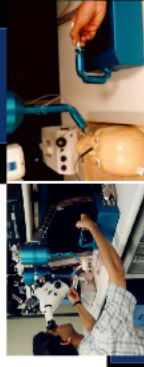




# Origins of telerobotic surgery



NASA RAMS



Robot-Assisted Microsurgery System

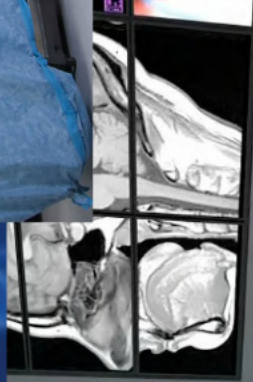
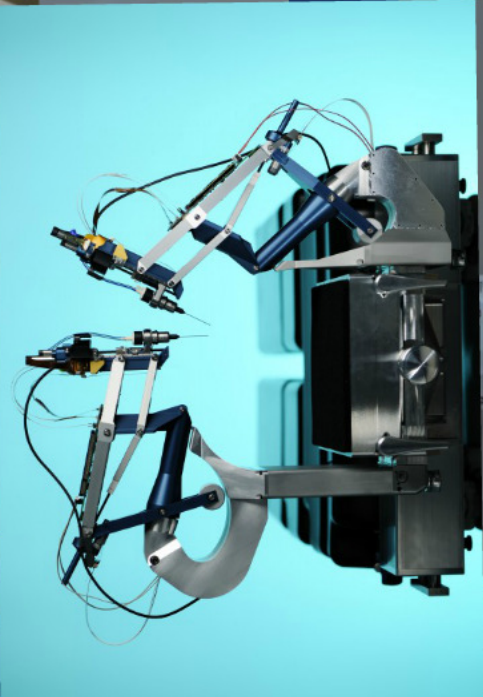
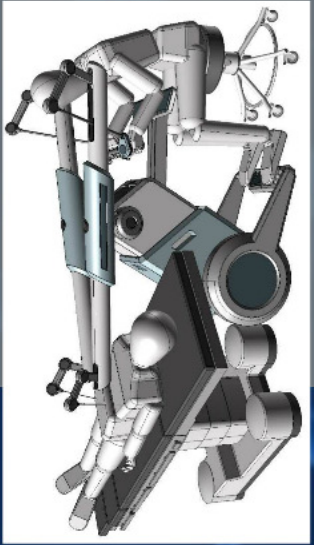
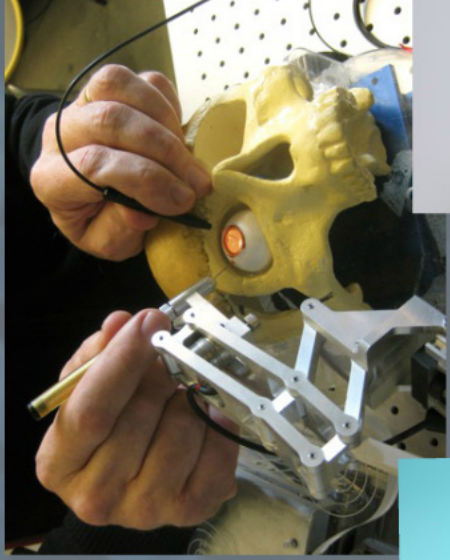


# NASA RAMS



Robot-Assisted Microsurgery System

# Building the future



# Da Vinci Surgical System

1999



2014



Intuitive Surgical Inc., Sunnyvale, CA



YouTube

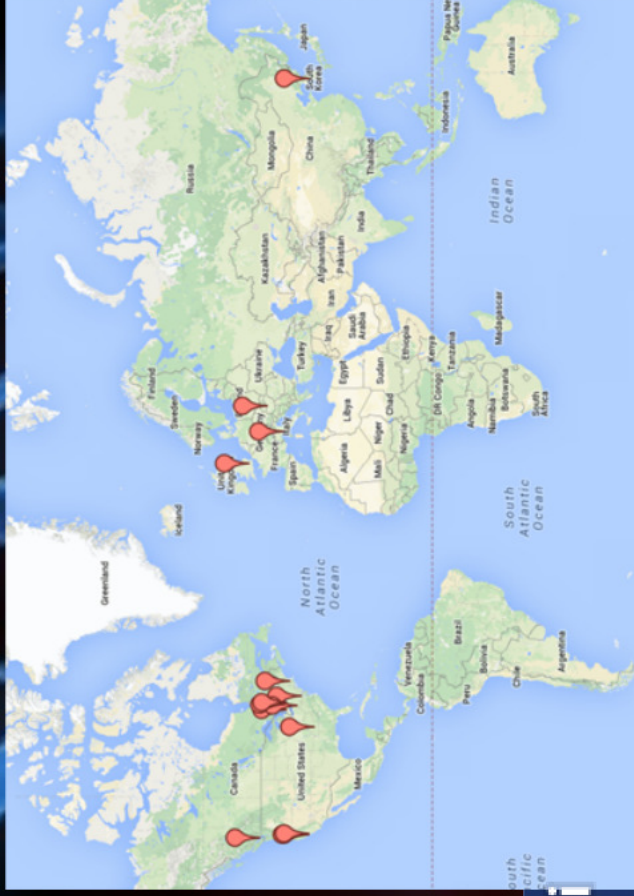
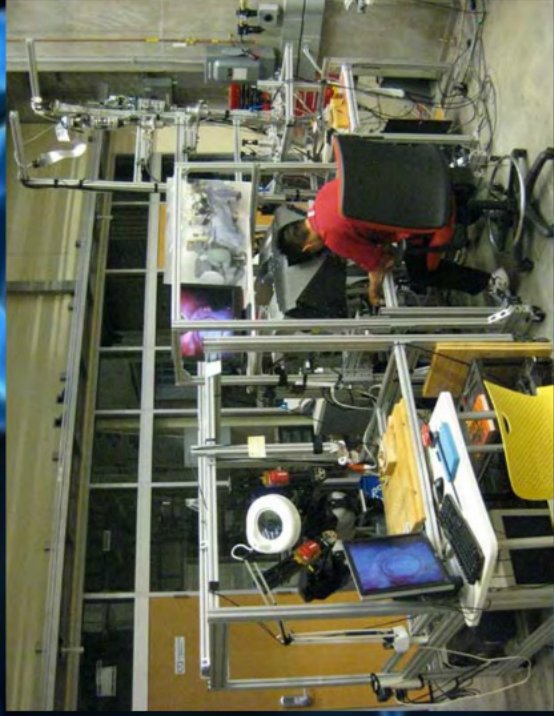


# da Vinci at OU



Prezi

# The da Vinci Research Kit




ÓBUDA UNIVERSITY



**Antal Bejczy Center for  
Intelligent Robotics**

DATE	TIME	STATUS

Proprietary  
mechanical  
hardware, with  
documentation

Open source  
electronics  
(schematics, PCB  
layout, and FPGA  
firmware)

Open source  
software



da Vinci  
Research Kit



FPGA, I/O, and  
Amplifiers



Control PC  
(Linux)

Interfaces

Motors,  
encoders,  
pots, switches



IEEE-1394a  
(Firewire)



ROS

# Force sensing



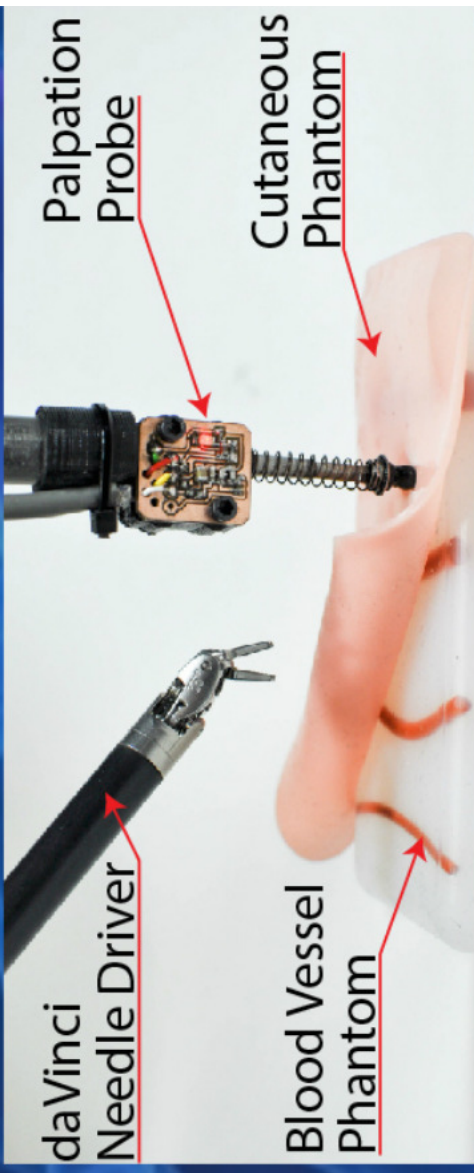
ObudaU

UPenn: VerroTouch



Johns Hopkins University

UC Berkeley



# New haptic interfaces



Novint Falcon

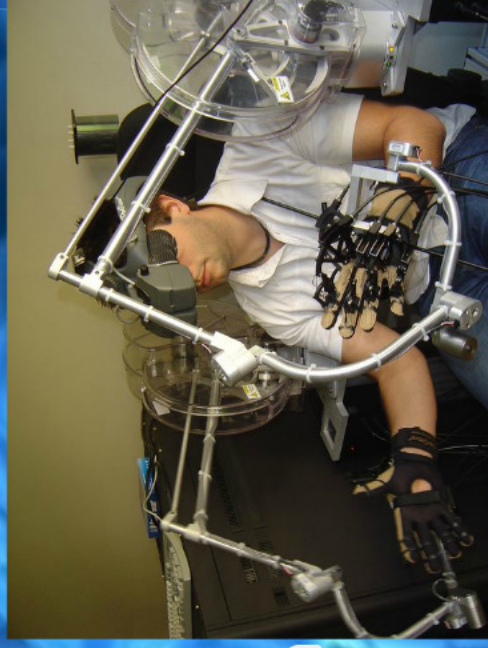
Phantom Desktop

Force Dimension Omega

3D Systems Geomagic Touch

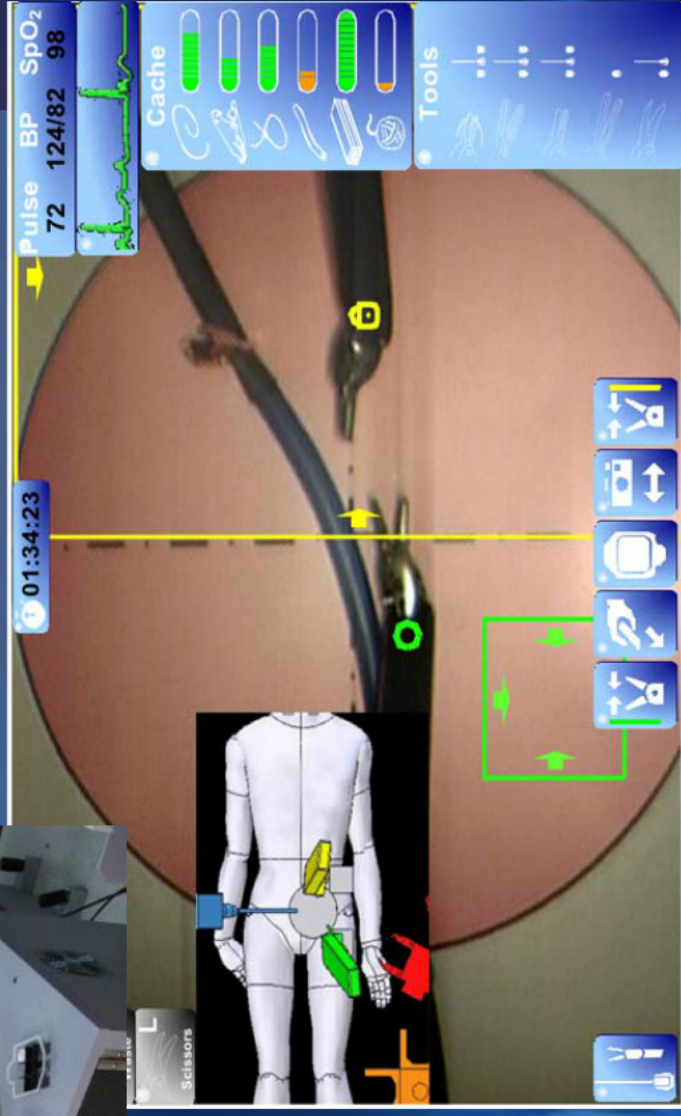
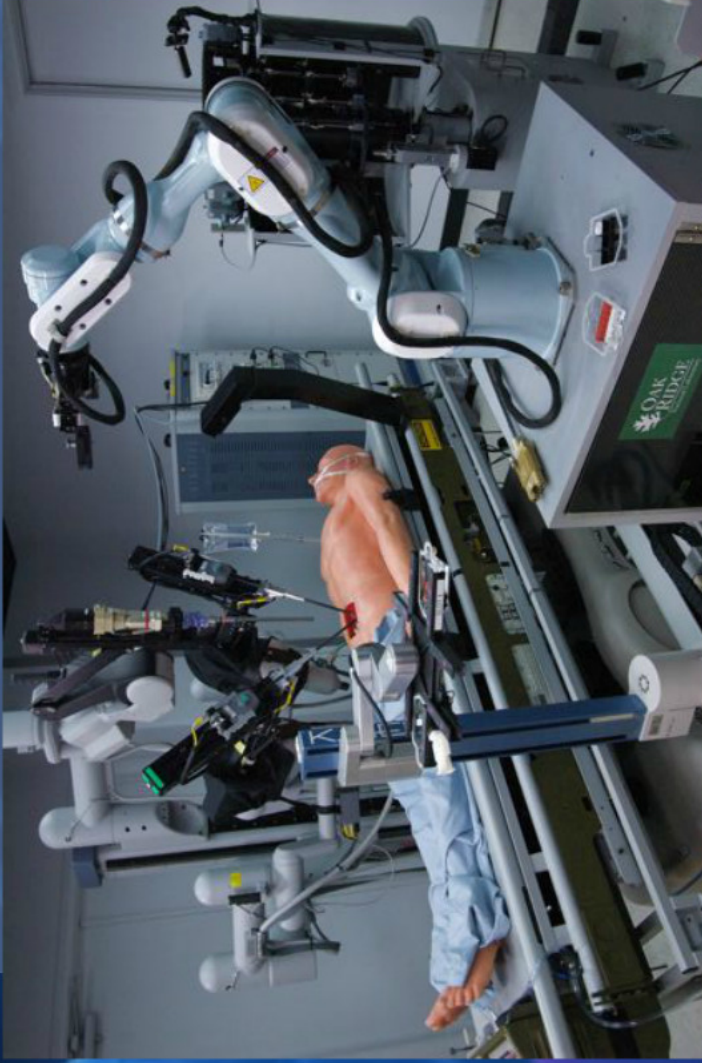
3D Systems Geomagic

Phantom Premium



Prezi

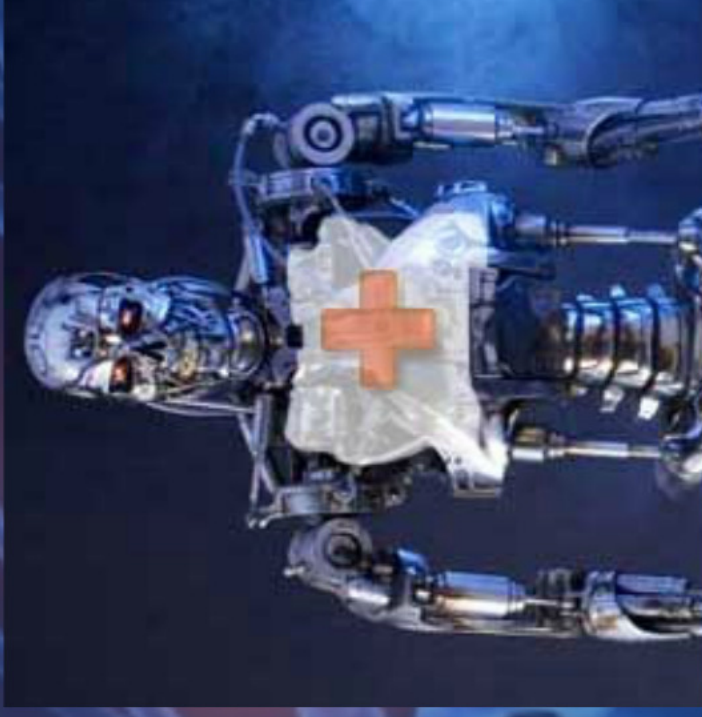
# Towards autonomy



Trauma Pod, DARPA



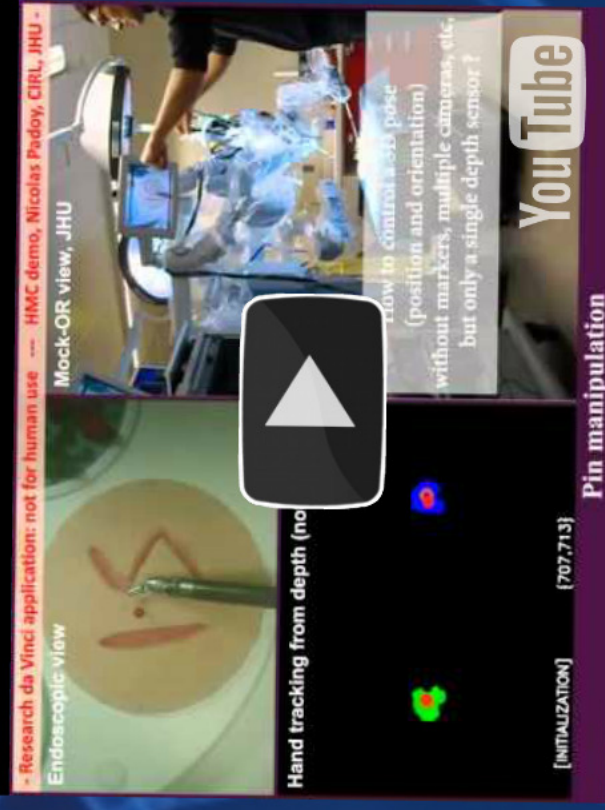
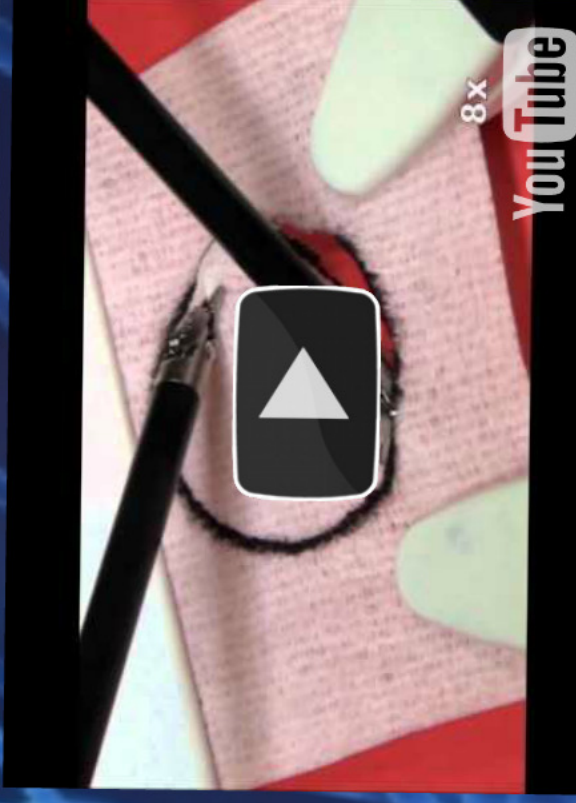
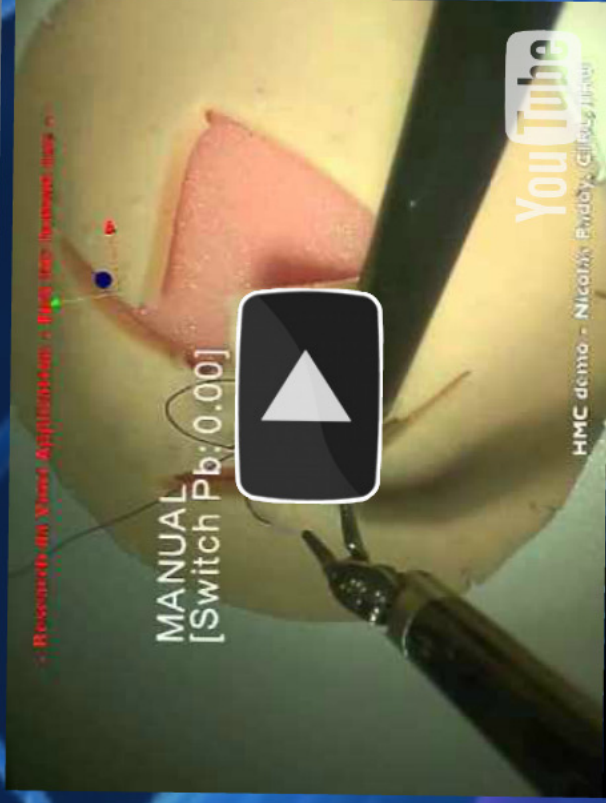
# The MD v.s. the Machine



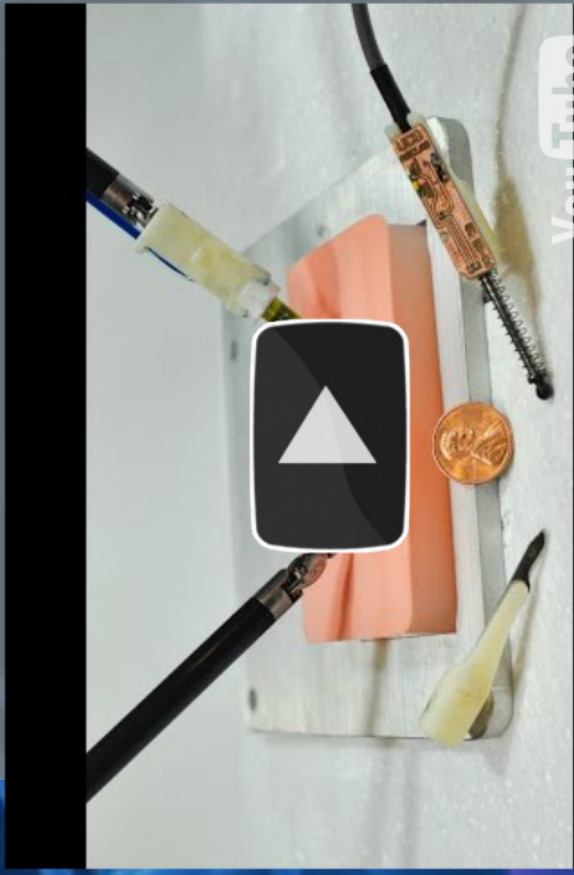
Decision making is the key



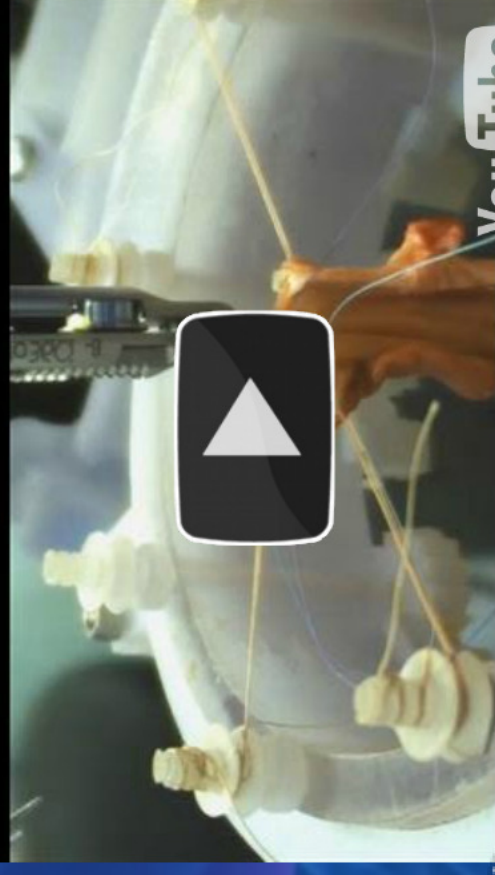
# Sub-task automation



# Autonomy in surgery



YouTube



YouTube



# Minimally Invasive Surgery (MIS) brings us: **reduced trauma**

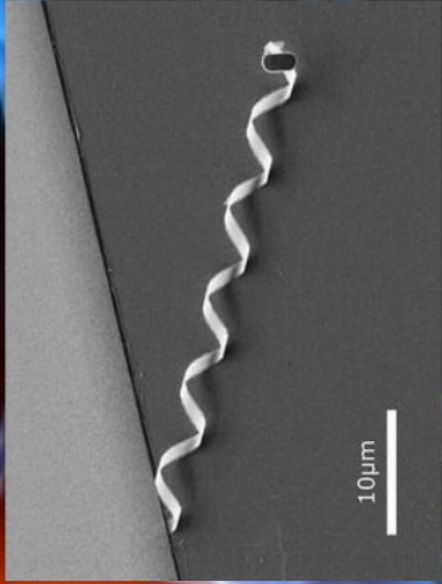
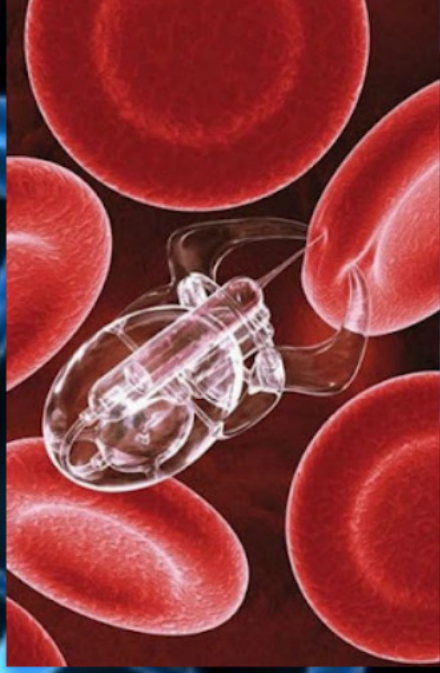
[Johnson&Rogers, 2012]



# Micro-scale robots



• Personalized medicine  
• Genetic profiling



# Nanorobots

"Surgery is an art"  
"The final frontier of  
surgery is to avoid  
surgery"



- Personalized medicine
- Genetic profiling

"Surgery is an art"  
"The final frontier of  
surgery is to avoid  
surgery"

# Future outlook

"There will be a robot in every household by 2020"

SAMSUNG, 2009



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# SurgRob

## SurgRob

Surgical Robotics here and there

"The future of surgery is not about blood and pain. The future of surgery is about data and eyes."

Dr. Richard Sweeney

Wednesday, October 15, 2014

Medical Robotics Technologies Inc.



Medical Robotics Technologies Inc. is a leading provider of surgical robotics solutions. The company's products are used in a wide range of surgical procedures, including orthopedic, urologic, and gynecologic. The company's products are designed to be used in a variety of surgical settings, including hospitals, ambulatory surgical centers, and academic medical centers. The company's products are designed to be used by surgeons and other healthcare professionals to improve patient outcomes and reduce the risk of complications. The company's products are also designed to be used in a variety of surgical settings, including hospitals, ambulatory surgical centers, and academic medical centers. The company's products are designed to be used by surgeons and other healthcare professionals to improve patient outcomes and reduce the risk of complications.

Monday, October 13, 2014

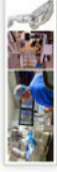
Robotic Surgery



Robotic surgery is a type of minimally invasive surgery that uses a robot to perform the procedure. The robot is controlled by a surgeon who is sitting at a console. The robot has three arms, each with a different tool. The robot can perform a wide range of surgical procedures, including prostatectomy, hysterectomy, and bariatric surgery. Robotic surgery is often used for minimally invasive surgery because it allows the surgeon to make smaller incisions and to see the surgical site through a video screen. This can result in less pain, less scarring, and a faster recovery time for the patient.

Friday, October 10, 2014

Robotic Surgery



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Monday, October 6, 2014

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<http://surgrob.blogspot.com>

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