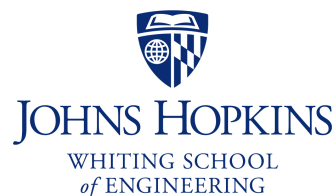# *da Vinci* Research Kit

Anton Deguet

Peter Kazanzides

Laboratory for Computational Sensing and Robotics

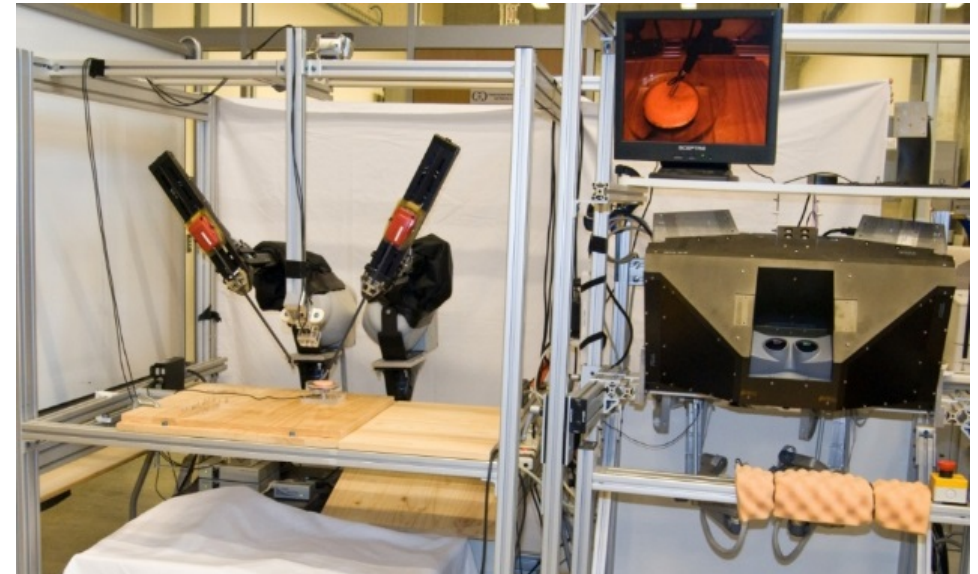Johns Hopkins University

The real *da Vinci*

- Who: Intuitive Surgical
- What:
  - Tele operated robotic system for minimally invasive surgery
    - 2 master arms with force feedback
    - 3 Patient side manipulator with interchangeable tools
    - 1 Endoscope manipulator (4 DOFs)
    - 4 Passive arms on the patient side
  - Commercial product, FDA approved
  - Mostly closed system!
- When:
  - Multiple iterations since mid 90s: Classic, S, Si, Xi, …
  - ***First generation commercialized in 1999 and is being retired…***

The dVRK, *da Vinci* Research Kit

- What:
  - Arms from retired *da Vinci* Classic gifted by ISI or local hospital, eBay…
  - Not commercial: NSF, NIH and other grants
  - **NOT FDA approved**, not for patients**, research ONLY!**
  - Started about 4 years ago
- **What's new?**
  - Custom controllers developed at JHU and WPI
  - Software stack running on a Linux PC:
       from IO to applications
  - All Open Source and on github:
       board design, firmware, software, models
- Who:
  - Johns Hopkins University (JHU)
  - Worcester Polytechnic Institute (WPI)
  - Intuitive Surgical (ISI)
  - Community (32 systems on 28 sites in the world)

Where is the dVRK? – over 32 systems at 28 sites

The Johns Hopkins University
Worcester Polytechnic Institute
Stanford University
University of British Columbia
Vanderbilt University
UC Berkeley
Carnegie Mellon University
Toronto Sick Kids
SSSA, Pisa
Western University
Seoul National University
Óbuda University
Wayne State University
Università di Verona
Imperial College London
University College London
Children's National Medical Center
Case Western Reserve University
Università degli Studi di Napoli
Ben-Gurion University
University of San Diego
Politecnico di Milano
Chinese University of Hong Kong
University of Leeds
University of Texas, Dallas
University of Innsbruck
Reutlingen University
Clemson University
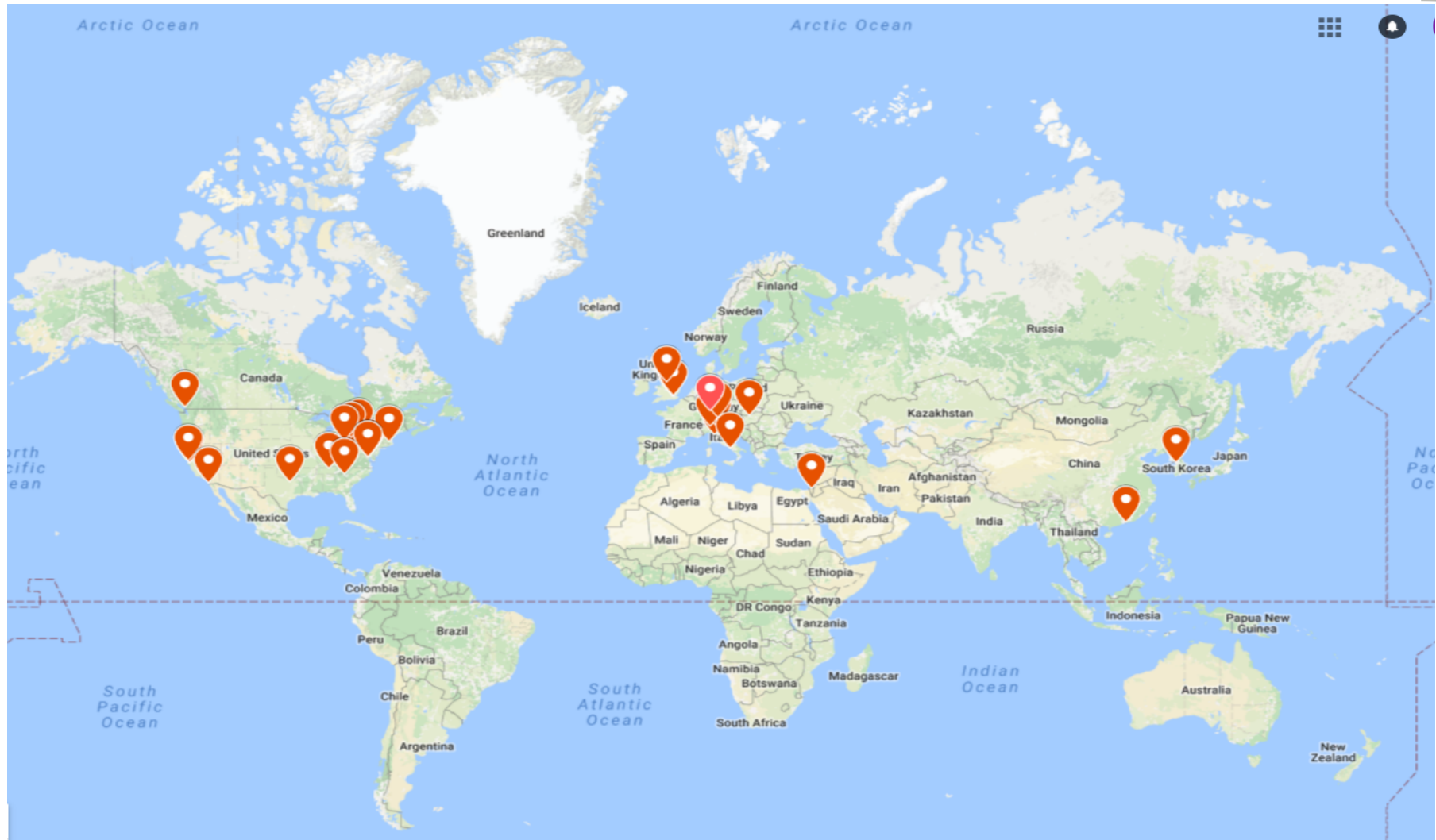
How we use ROS

- Python catkin build tools!
- ROS topics for everything we can
- Python and Matlab wrappers for students (hides topics and messages)
- rosbag for debugging, user studies
- rviz, gazebo models (thanks to WPI)
- Stereo video pipeline: frame grabbers (gscam!), calibration, 3D display with rviz and augmented reality

Why ROSCon?

- Meet the (medical) robotics community to share software and hardware information

- Standardized APIs for joint/cartesian motions, force feedback, masters, slaves…
  - Raven, UR5, UR3, Kuka, custom robots
  - Novint Falcon, 3D Touch/Sensable Omni, ForceDimension Sigma/Omega, hand trackers

- Side events:
  - Raven/dVRK community user group on Saturday
  - IROS'17 Workshop on Sunday, "Shared Platforms for Medical Robotics Research"