**Benchmarking – Mini Bone-Attached Robotic System (MBARS)**

**Overview**

MBARS was developed to provide a computer-assisted robotic tool that will “enable less and minimally invasive surgical techniques for orthopaedic surgery” while also providing more precision during bone shaping. MBARS is attached to the operated bone and shapes the bone according to a pre-operative plan that was devised to fit the implant to the patient. MBARS is rigidly attached to the bone, which is stated as “eliminating the need to compute relative motions from individually tracked entities” and allegedly results in greater precision. This precision comes from the “one-time registration” of the robot’s location on the patient’s bone. Additionally, with computer aid, more intricate designs can be implemented.

"Robotics Institute: Mini Bone-Attached Robotic System." *The Robotics Institute*. Web. 26 Oct. 2009. <http://www.ri.cmu.edu/research_project_detail.html?project_id=587&menu_id=261>.

**Functions**

User Interaction:

* Installation/Mounting- robot mounts on femur, attached by what appears (by photographic evidence only) to be 3 long threaded rods
* Model Input- not sure; merely states that the robot contains a library of patellofemoral implant models
* User Connection- device is not user operated; cutting is completely automated, like a CNC machine
* Tool Connection- not specified
* Device Motion- controlled by six separate microcontrollers connected to their own actuator; once an applicable bone model is selected, the device plans a ‘path’ to cut along, and the microcontrollers and actuators are responsible for movement. Movement can be tracked using a notebook computer
* On/Off Functionality- yes
* Sterilization- not specified
* Maintenance- not specified
* Positioning Calibration- surgeon pilots robot equipped with a force sensor along patellar tracking line on the femur—robot then automatically traces the surface of the bone with its force sensor to build a model of the articular surface
* Positioning Awareness- tracked/assumed with microcontroller/actuator pairs

Autonomous:

* Provides tool-position constraint- unclear from photos/information provided how the tool is constrained, or even what the tool looks like
* Monitoring/Awareness of Tool Position- does not appear to monitor positioning save for the calibration at the beginning of the procedure
  + What if patient moves during operation?
* Method of 3D Movement- six separate actuator/microcontroller pairs located circularly around the tool (see photo)
* Conversion of Input into Traceable Surface- there is no input, other than the calibration tracing—the device uses this path to select an appropriate model for cutting/shaping from its library



Modes of Operation

* On- yes
* Off- yes
* Idle- not specified

"Mini Bone-Attached Robot System | Sensor Based Planning Laboratory." *SCHOOL OF COMPUTER SCIENCE, Carnegie Mellon*. Web. 27 Oct. 2009. <http://www.cs.cmu.edu/~biorobotics//mbars/>.