



# Orthopedic Drill Stop Device

## Team Members

Alex Bloomquist – Team Leader

Kara Murphy – Communicator

Andy Lacroix – BWIG

Graham Bousley – BSAC

## Advisor

Professor Naomi Chesler  
Department of Biomedical  
Engineering

## Client

Tim O'Connor  
Resident in the Department of  
Orthopedic Surgery

# Overview

- Problem Statement
- Background
- Prototype - Fall 2010
- Design Improvements
- Testing
- Future Work
- References
- Questions



# Problem Statement



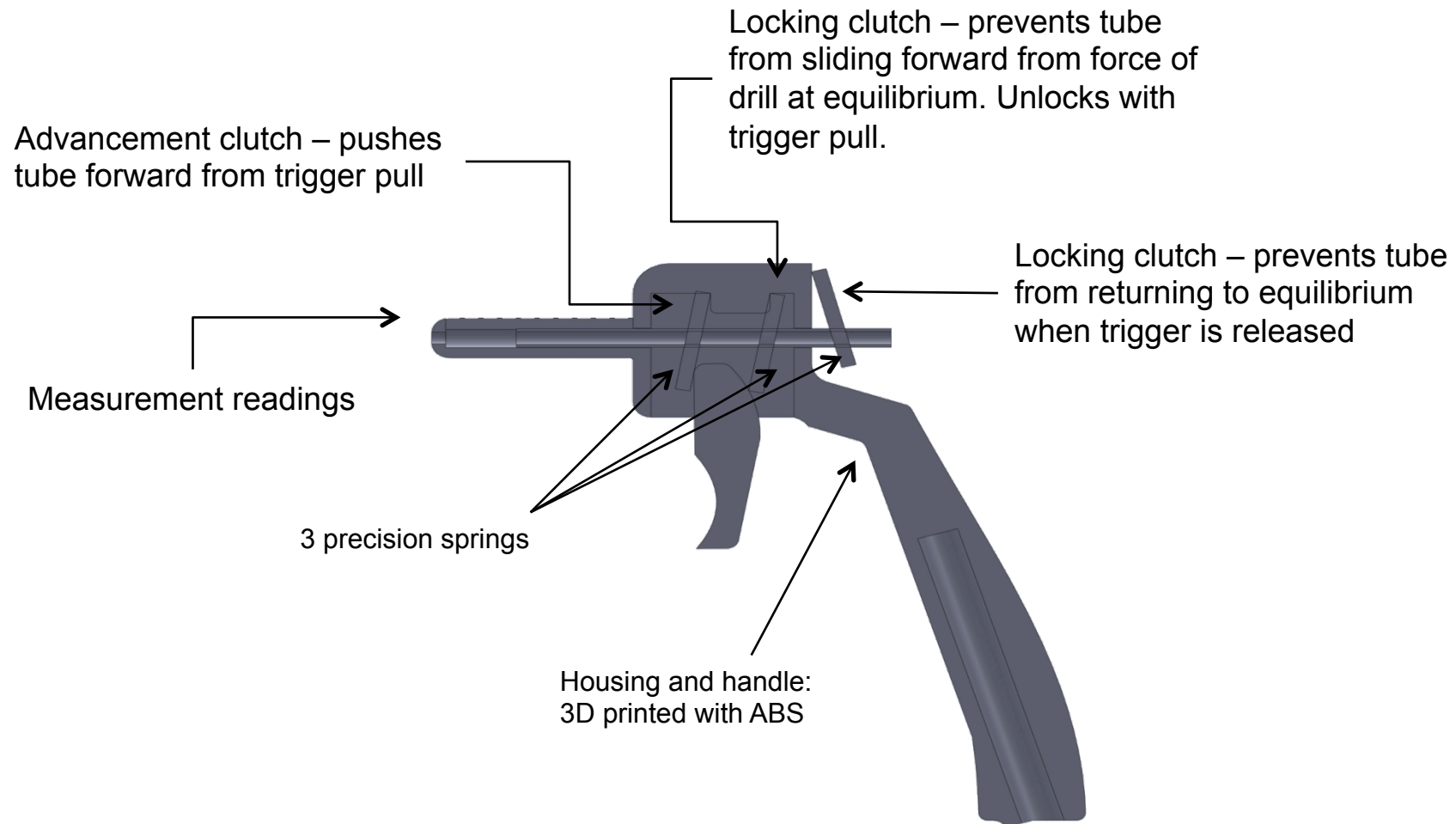
Our client is concerned about over penetration of the drill bit into soft tissue during bicortical drilling in orthopedic surgery. For most surgeries the current methods of preventing over-penetration is based solely on sensory skills of the surgeon. Our team has been asked to create a design that minimizes the plunge depth of the bit after penetrating the far side of the bone to prevent injury to soft-tissue.

- **Current method:** drill sleeve or pre-determined drill stop



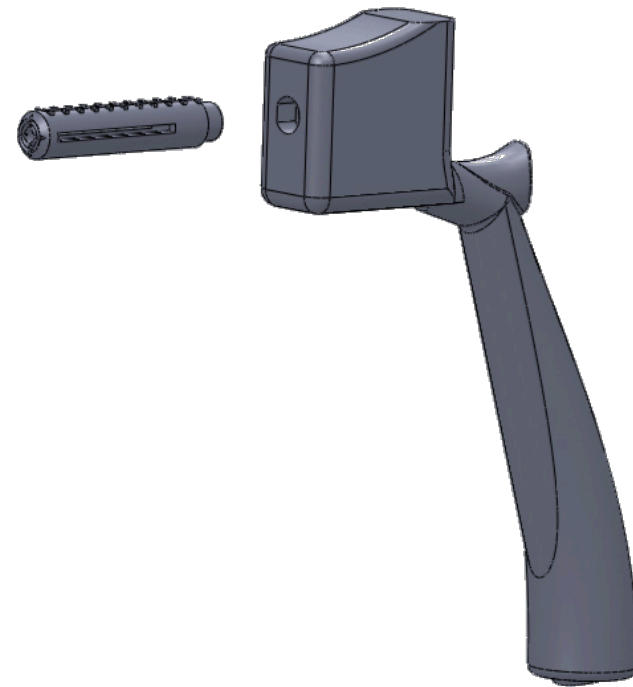
- **Client Requirements:**
  - Reduce plunge depth to  $< 3$  mm
  - Incremental advancement
  - Unobtrusive during surgery
  - Can be operated with one hand

# Prototype – Fall 2010



# Design Improvements

- Prevent slip of inner tube from drill force
  - w/ clutch engaged
  - w/ trigger pulled
- Prevent unintended disassembly
- More ergonomic
- More user friendly
- Prevent bone dust accumulation

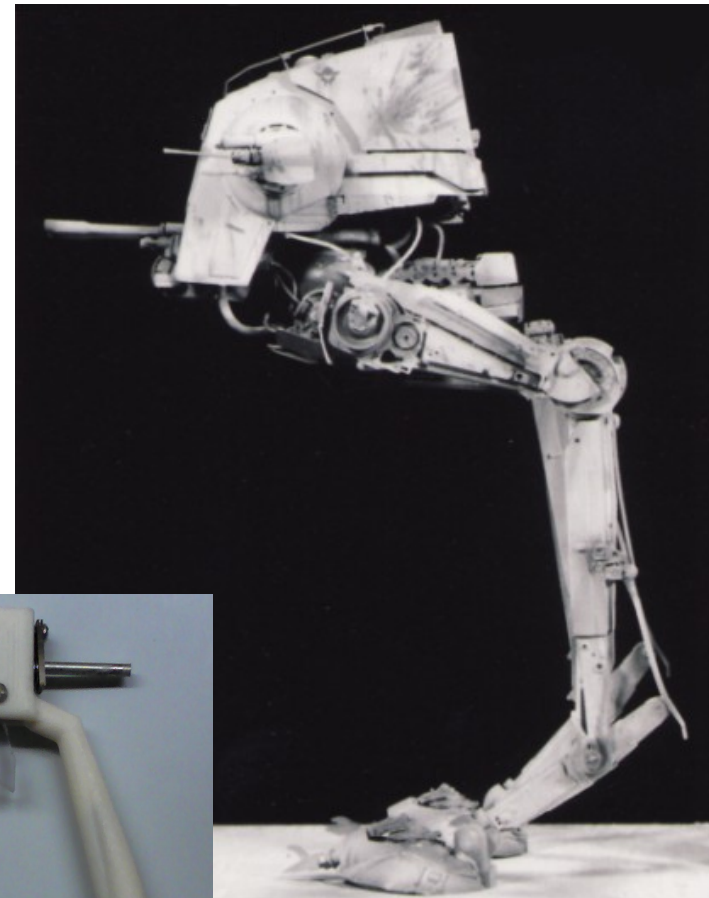


- **Plunge Depth/Time test**
  - Set up: Attach bone on top of foam. Place cover over bone to reduce visibility.
  - Procedure: Run test with chosen device.
    - ♦ Place device on bone
    - ♦ Drill the bit into bone
    - ♦ Once far cortex is penetrated, stop drill
    - ♦ Measure the length of the hole through bone
  - Results:
    - ♦ Measure distance that bit has plunged into foam
    - ♦ Time entire procedure

\* Repeat procedure for both devices to compare results

# Future Work

- Finish trigger design
- Build prototype #3
- Conduct plunge depth/time test





# References



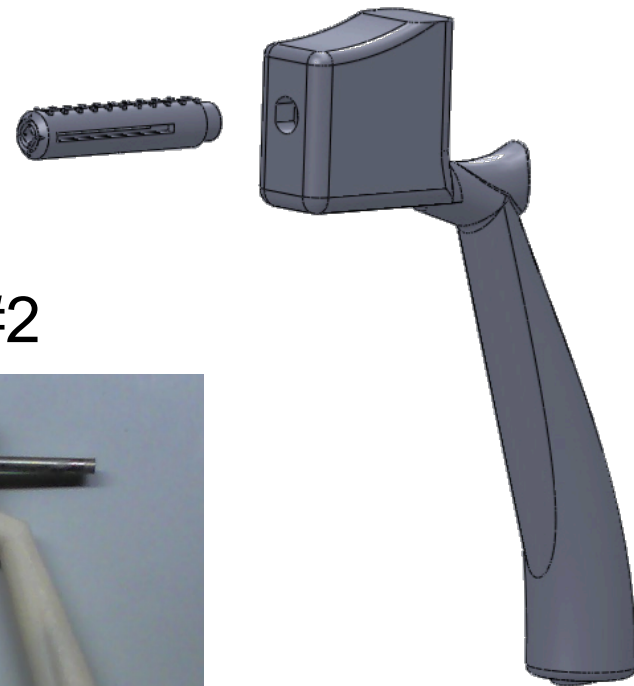
- Allotta, Benedetto. (1997) A Hand-Held Drilling Tool for Orthopedic Surgery. *IEEE/ASME Transactions on Mechatronics*. 2 (4), 218-229.
- Dubrowski A, Backstein D. (2004) The contributions to kinesiology to surgical education. *Journal of Bone and Joint Surgery*. 86 (2), 2778-81.
- Darvish, K., Shafieian, M., Rehman, S. (2009) The effect of tip geometry on the mechanical performance of unused and reprocessed orthopaedic drill bits. *Journal of Engineering in Medicine*. 223 (5), 625-635
- Greenburg A, inventor, 2003 Dec. 30. Sleeved stop for a drill bit. United States patent US 7,210,881.
- Ryan C, inventor, 2004 Mar. 30. Adjustable depth drill bit. United States patent US 7,163,542.

# Questions?

Prototype #1



Prototype #3



Prototype #2

