



## Team H.A.N.D. (Haptic Actuation with Naval Devices) Haptic Controller for Use with EOD Robot End Effectors



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### Project Sponsor

LT Allen (EOD Community)

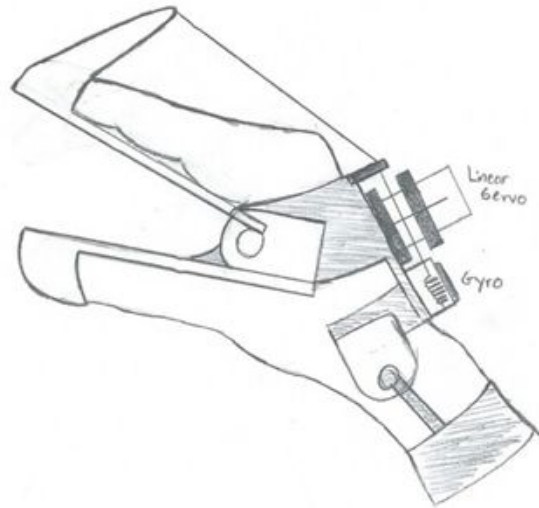
**Background:** Current robots are controlled through an Xbox controller or similar joystick. These controllers are not intuitive to use which requires a large learning curve. Operating with only a controller and a camera from a remote location makes it difficult to achieve depth perception. Because of the lack of spatial awareness, EOD operators miss grabbing objects or drop objects from the robot hand while they are operating in the field. Tactile feedback to the user's hand would be useful to know if there is an object in the robot hand and how much force the user is exerting upon it. Application of current EOD robots is unearthing, cutting, drilling. In order to do this, they have to bring the robot back from the field and change the fittings and send it back out. Achieving tactile feedback to the user might allow greater remote object manipulation in the field. This would allow multiple tools to be used when the robot is sent out.

**Objectives:** The goal of this project is to build a controller for a robot arm that is intuitive to the user and allows a sense of touch, haptic feedback, to the user.

**Results:** The H.A.N.D. Team interviewed the lead EOD officer on the Naval Academy yard in order to develop a list of customer requirements that would make the controller useful and intuitive for EOD operators. The interview developed a sense of how the controller would be used and what types of situations the user would find themselves manipulating objects in.

Important customer requirements that were determined through interviews with the customers mentioned above include the ability for the controller to translate tactile input into force feedback on the user's hand, be quick and easy to use in the field, and not be so bulky that the user tires from prolonged use of the controller.

The team identified different technologies and implementations and compared their predicted performances to design the controller. A combination of Shaft encoders will be used to measure joint positions to controller the EOD arm positioning. A tensioning cable with a brake will be used to apply force against the user's motion.



**Figure 1: Design Drawing of Controller with Feedback. The Elbow Joint is Not Shown**

In the final testing stages, the user should be able to apply a finite amount of force on an object and manipulate an object's position. The design will be tested by placing a graspable object inside of the claw. The user will have to grab the object with enough force to hold it, but not damage the object. The early objects will be stiff and hard to break to get the user acquainted with the feedback. The test will then proceed through to more delicate objects. In the first round of tests, the user will be able to view the claw and objects. The second round will have the objects hidden from the users view to determine if the user can grab the object with appropriate force based off of the feedback alone. A final stage of testing will have the user grab a delicate object and move it to a predetermined location to see if they can apply a constant force while moving the object.

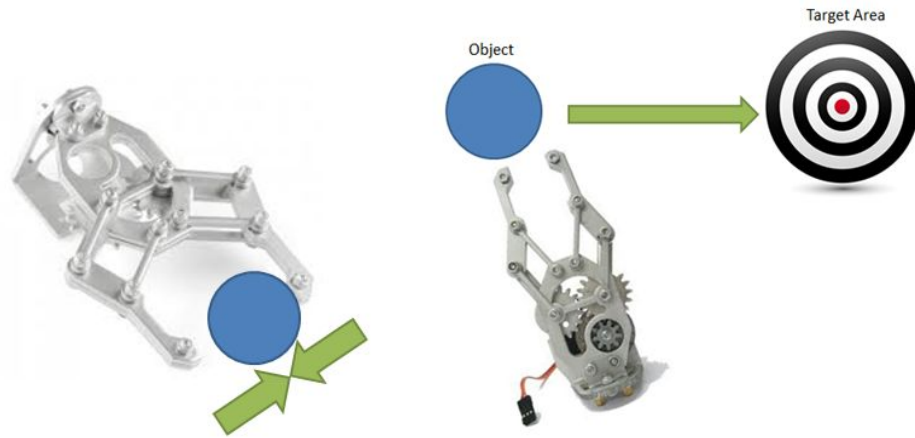


Figure 2: Force and position manipulation test



Figure 3: Team H.A.N.D. excited to begin work!