# Hydraulic Robotic Arm Instructions/Guidelines

VMS Basic Engineering

## The Problem:

Design a device to move as many active mines as possible from an open field, to a safe-zone container within a 3 minute window of time. Before the government finances your design, a working model must be designed and demonstrated in a mock mine field. For the mock demonstration, you will be required to move mines from one area, across the open field, to a safe zone container on the opposite side of the field.

## Guidelines:

1. The mines utilized for the demonstration will be small cylinders**. The cylinders have a diameter of 1 1/2" and have a height of 5/8". They are very light in weight** (the big black plastic co2 car wheels will be used).
2. **The safety cylinder will measure 6" up of the ground in the model There is a 4" gap between the mine field and the container and your robotic arm station. The robotic arm may be moved around inside the station during the competition as long as it stays within the station measurements.**
3. **Each team will be allowed to use 8 hydraulic cylinders.** Remember, two are needed for each control axis.
4. **ALL robotic arm pieces may NOT exceed 12" in length.**
5. Your robotic arm **needs to have a name/title** visible during testing
6. ALL 3 team members can operate the device during the competition
7. If a mine is dropped, bye bye, your competition is over.

## Fabrication of the arm:

As the designer of this model, you can use cardboard for the prototype and corrugated plastic, hardboard, wood, plastic, and acrylic for the actual working model. There will be rubber bands, fasteners, hot glue, and other material available as well.

1. You need to fabricate a hydraulic robotic arm which has a claw that can grasp something and release, an arm that bends at the elbow and shoulder, and a base that can swivel.
2. For the base to swivel, you will need to research, design, and fabricate your own gear system consisting of a rack and pinion.
3. Before beginning you and your partner(s) will need to EACH make a hand drawing of your robotic arm system. **This process is used to brainstorm ideas**. Use thumbnail sketches and rough drawings while brainstorming ideas.
4. While brainstorming, think of the size of each of the components… What are the minimum size requirements? Maximum? **You will need measurements in mind when you start your Autodesk Inventor Designs.**
5. **Once you have your hand drawings, and a SOLID idea of how to solve the problem,** you may begin your Autodesk Inventor drawings which will be EXACTLY how the robotic arm will look when you are finished fabricating it. Your group will need drawings of a **base** that swivels (with a gear

system), a **mainframe** that attaches to the base, a **shoulder piece(s)** that attach to the mainframe, an **elbow piece(s)** that attach to the shoulder, and a **claw** that attaches to the elbow.. NO CONSTRUCTION CAN BEGIN WITHOUT GETTING YOUR INVENTOR DRAWINGS OKAYED.

6. **Your group should split up the pieces: each member designs a component.** Communicate with your group members what the sizes need to be while designing, so when you go to put it together everything fits!
7. **Build in STEPS.** Start with the base and move upward (base, mainframe, shoulder, elbow, claw).

**Using the FAB LAB:**

1. **You MUST use** the laser cutter/engraver, the 3D Printer, and the Vinyl Cutter for at least ONE component of your robotic arm.
2. **Staying safe by following safety rules, keeping a clean lab, and respecting the equipment are expected. Not adhering to these will result in the loss of FAB LAB use.**