

Party at Alden Middle School!

*Relax and blow off some steam
at STEAM Night!*

CSE 453

SUNY University at Buffalo

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1 Objective

On April 10th, Alden Middle School is hosting a STEAM Night event. The event will feature a bottle rocket launcher designed and built by none other than us. The bottles to be used in the launcher will be designed by the students of Alden Middle School. Optionally, the launcher can serve as an educational experience for the students, allowing for adjustments to trajectory and observing the results.

1.1 Notes on what client requested

The client wasn't very demanding, or even specific. They only requested a few things.

- Big button for students to press to fire.
- Safe and easy for students to use.
- Launch approximately 16 oz. bottles
- Update: Now using paper rockets instead.

2 The Rocket Launcher

The rocket launcher's firing mechanism will utilize compressed air to propel 16 oz. plastic bottles. Should design allow it, the bottles will be launched in an attempt to hit some form of target. Safety should be the number one priority when designing the launcher, for children as young as 10 could be looking closely at and even participating in its use. They will not be holding the launcher, it will be mounted onto a surface, so technically its more like a mortar.

2.1 Main Components

- **Air Compressor**
 - Means of obtaining compressed air.
 - Functions as a pump that fills the reservoir with compressed air at a desired pressure.
- **Air Reservoir**
 - Will likely be constructed with a network of PVC pipe-lining.
 - Acts as a chamber that holds air at a pressure we want to use to launch the bottle.
 - Holds 3 solenoids, pressure gauge, and transmitter.
- **Firing Chamber**
 - Chamber where the bottle is launched.
 - Preferably has means of checking to see if a bottle is loaded, perhaps by using transparency.
 - Bottle will be mounted on a thin pipe that will be inserted into them.
 - With a larger cylinder or cover surrounding the bottle, acting as a barrel and providing protection in the event of shrapnel.
 - Should be designed so that barrel angle is adjustable for aiming purposes (Vertical).
 - UPDATE: Firing chamber is now a single pipe on which rockets will be mounted.
 - Pipe mount will help guide rocket firing and provides more visibility.
- **Control Panel**
 - Composed of the firing controls.
 - Joystick to control firing angle.
 - Big'ol firing button

-Located a safe distance away from launcher.

2.2 Other parts and electronics

- **Power Supply (SLA Battery)**

- Powers electronics.
- 12V DC
- For consistency, all electronics should utilize DC voltage.

- **3 Solenoid Valves**

- The Valve for firing mechanism will be normally closed, opened when firing.
- Another Valve will serve as a drain valve, letting air out of reservoir when launcher is not powered.
- A third valve (either normally open or normally closed) will lead from the air pump to the reservoir.
- As the

- **Pressure Transducer**

- Will allow for measuring the pressure inside reservoir.
- The pressure reading can be used for programming functions and safety measures.

- **Arduino Mega**

- Micro-controller where device control will be programmed.
- Powers electronics

- **LCD Screen**

- Will display angle of firing chamber.
- Shows pressure value in reservoir in PSI.

- **Relays**

- Functions as a switch.
- Controlled by Arduino.

3 Safety Measures

- **Dead Man Switch**

- Launcher will be unable to fire unless this switch is on when firing.

- **Kill Switch**

- In the event of a malfunction, launcher will be power down immediately.

- **Bleed Valve**

- In the event of a power failure, or launcher is powered off, all compressed air in reservoir will drain out through this valve.

- **Entry Valve**

- One solenoid will be used between the air compressor and reservoir. This valve should be open while the air compressor is pressurizing the reservoir, when our desired pressure is reached, this valve should close.

- **Ultrasonic Sensors**
 - Launcher will not fire if someone is standing within unsafe proximity.
 - UPDATE: This feature has been scrapped as there was no good placement.
- **Alarm Buzzer**
 - Will emit loud noise when important function are happening as a warning.

4 Optional Features Worth Considering

- **Allowing students to adjust pressure.**
 - As previously stated, this can potentially be a valuable educational experience for the students of Alden Middle School. Allowing students to adjust pressure along with the launcher's angle will allow them to observe the effects of adjusting the trajectory.
 - In addition to the controls required this would also come with a display allowing the user to see the angle and pressure they are using to fire.
- **Horizontal Aiming**
 - As only vertical aiming is planned, access to full 3D aim would make things a little more interesting.