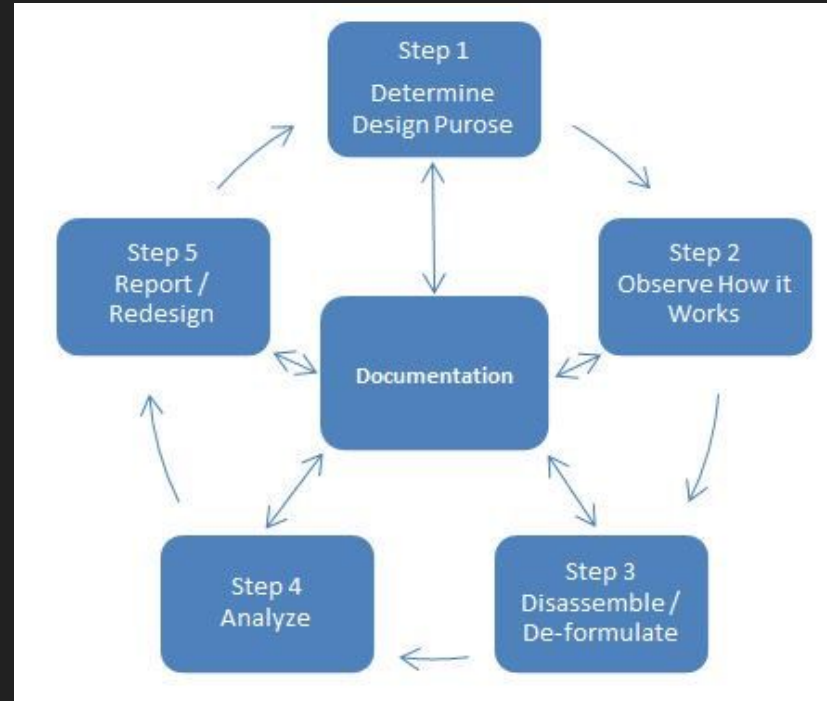


# Reverse Engineering: Nerf Blaster

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# Our Process

1. Determine Design Purpose
2. Observe How It Works
  - a. Sketches
  - b. Flow Chart
3. Disassemble
4. Analyze
  - a. Functions of Individual Parts
5. Redesign
  - a. Modifications, How to Rebuild



# Step 1: Determine Design Purpose

Device Model: Nerf Nite Finder Ex-30

Purpose of Blaster: The device was made because it is a fun but safe gun. Problem- need toy gun that kids can play with → Solution- Nerf blasters

Purpose of the LED: show where the dart is targeted. Problem- users don't know where dart will land → Solution- add an LED

## Step 2: Observe How It Works

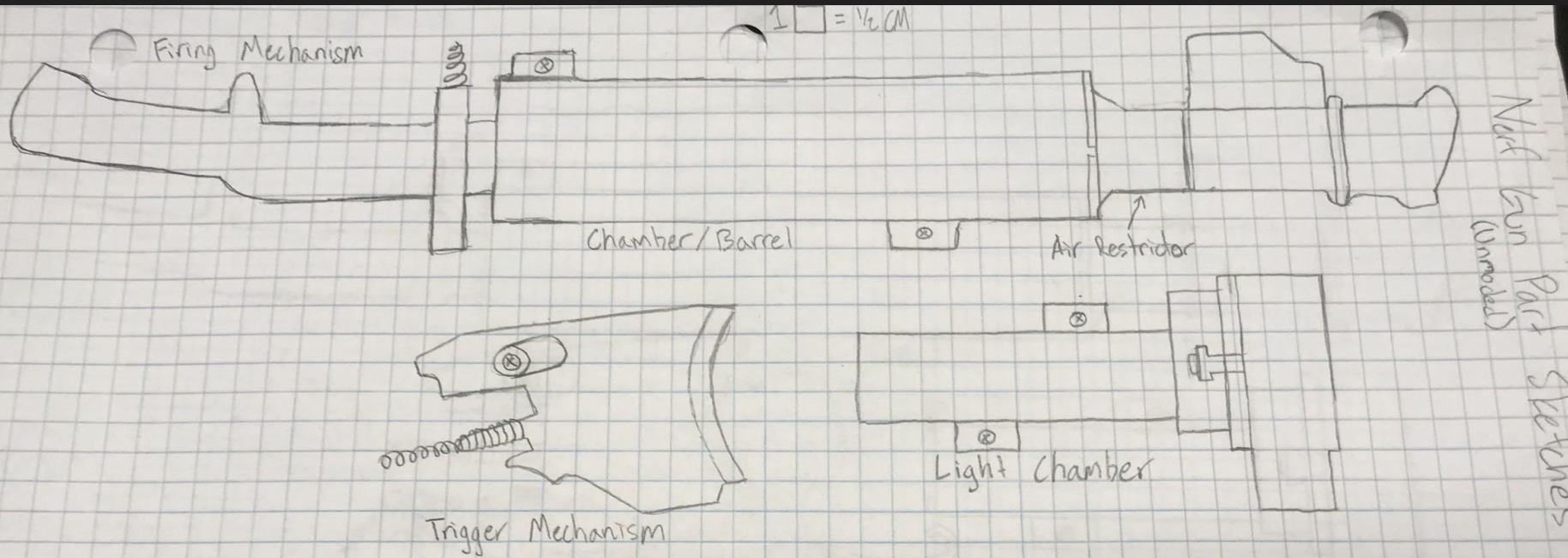
- Dart Firing: air and spring powered
  - Plunger is pulled back, allowing trigger to be pulled
  - Catch is released, allowing spring to push plunger back into gun and push air through chamber to dart
  - Force of air accelerates the dart out of barrel



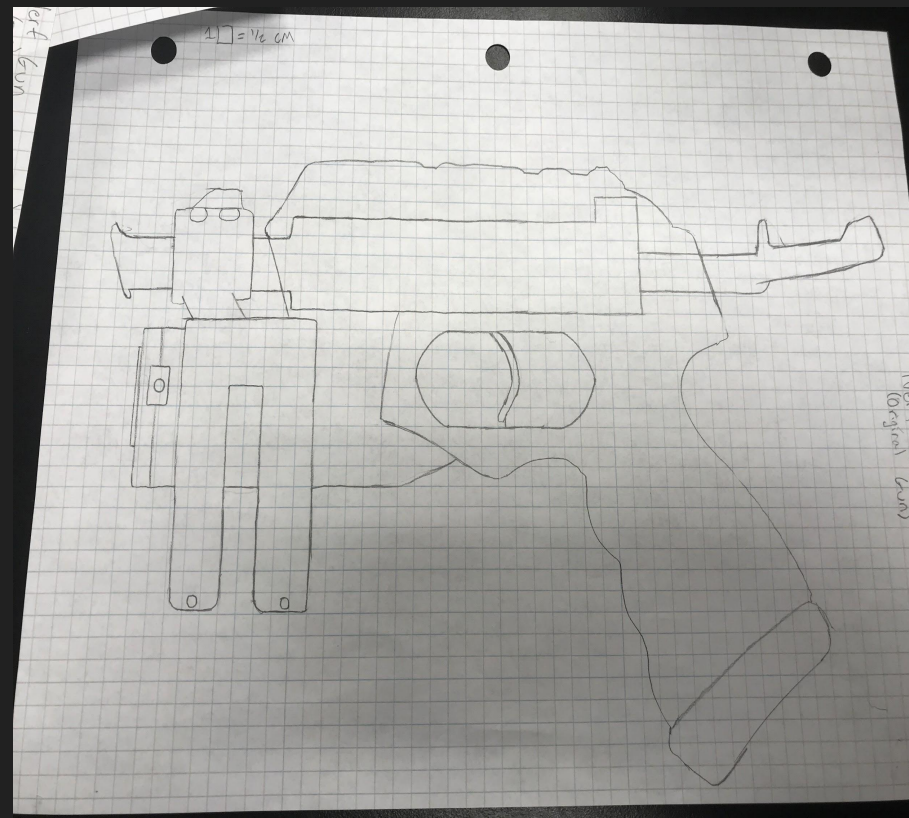
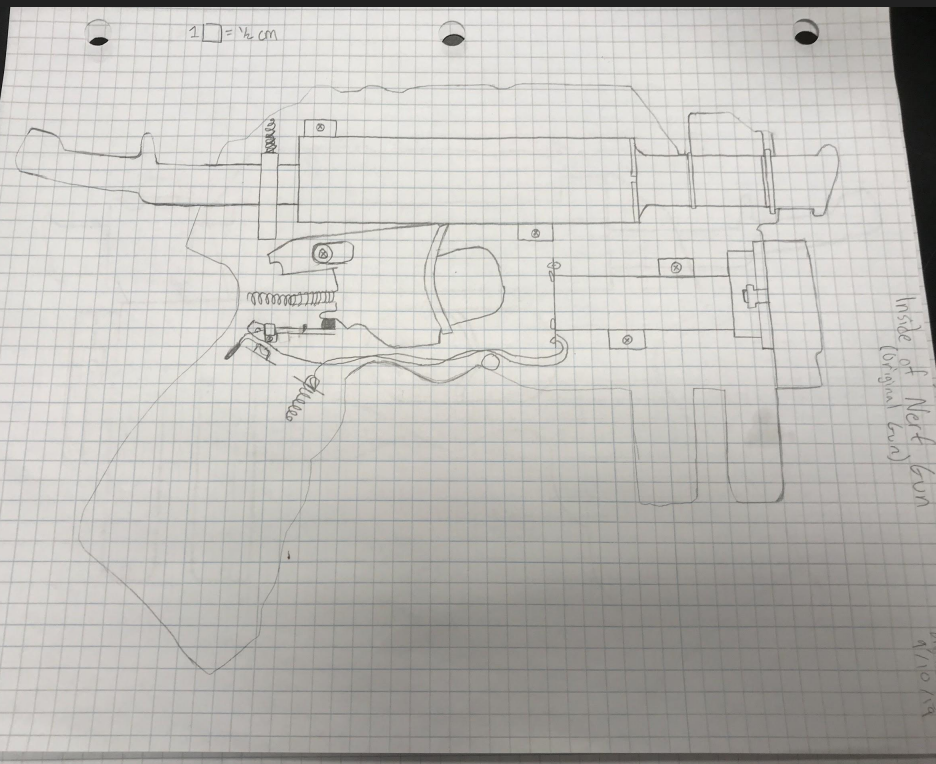
## Step 2: Observe How It Works (continued)

- LED: battery powered
  - If trigger is slightly pulled back, switch will close circuit
  - Electrical current flows from batteries to LED
  - Electron holes allow electrons to drop to lower orbitals
    - Light energy (as photons) is released

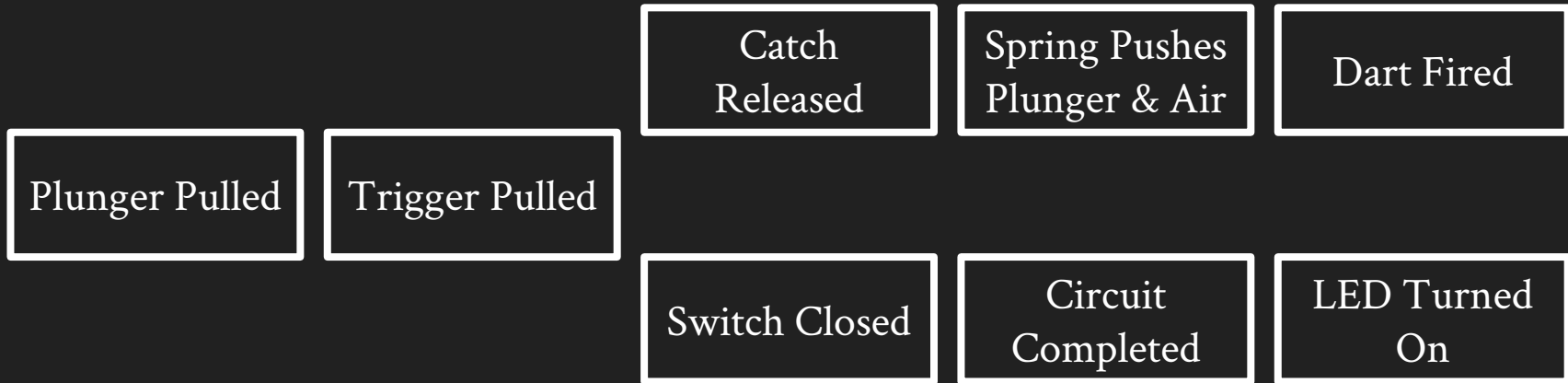
# Step 2: Device Model



# Step 2: Device Model (continued)



# Step 2: Flow Chart





## Step 3: Disassemble



Plunger and Barrel



Trigger, Shell, Part of Circuit

# Step 4: Analyze

Air restrictor: Restricts force of air

Plunger: Released to restore spring to equilibrium and push air

Barrel: Holds part of plunger and dart together

Trigger: Activates the LED and releases the catch

Catch: Holds the plunger back, released when trigger pulled

LED: lights up target

Shell: Holds pieces together

## Step 5: Redesign

We removed the air restrictor from the barrel of the gun

The air restrictor restricts the force of the air by adding another spring for the plunger to compress (another transfer of energy)



# Range Tests

Before Modifications:

Trial 1 - 149 in

Trial 2 - 141 in

Trial 3 - 131 in

Trial 4 - 113 in

Trial 5 - 138 in

**Average - 134.4 in**

After Modifications:

Trial 1- 214.5 in

Trial 2- 236.5 in

Trial 3- 223 in

Trial 4- 239 in

Trial 5- 190 in

**Average- 220.6 in**

Significant Improvement!

# Step 5: How to Rebuild

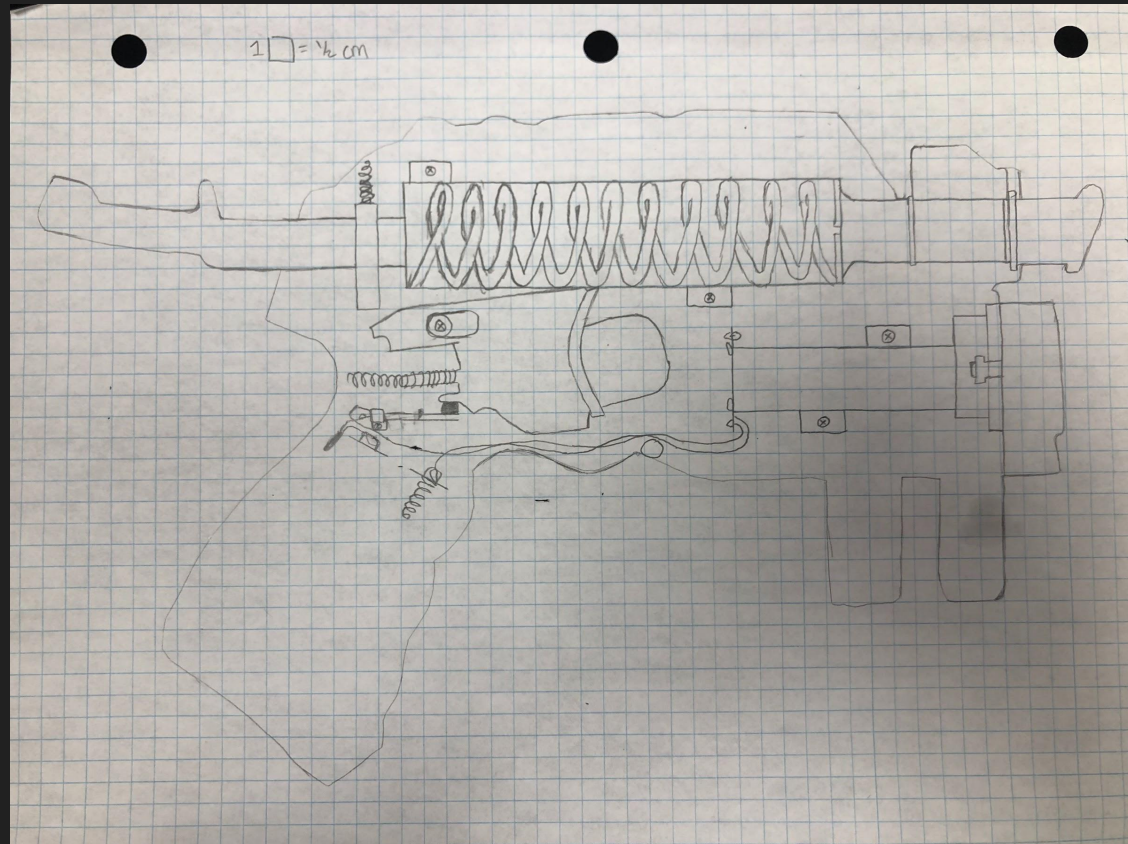
How to Rebuild After Modifications:

1. Reattach the barrel together
2. Put plunger back into the barrel
3. Put barrel back into body of the gun, (make sure to keep catch in small compartment); the spring attached to catch should fit into the compartment
4. Screw the other half on the shell
5. Test fire

# Conclusion

- What Went Well
  - Removing the air restrictor increased the range
- What Didn't Go Well
  - Time management- did most work in the past two days
- Improvements/Next Time
  - Spring replacement
  - Dart redesign

# Spring Replacement Sketch



**End.**