

**Design Graphics Team Project**  
**Fall 2020**

**Reverse Engineering a Toy Nerf Gun**

**Nerf Rebelle**

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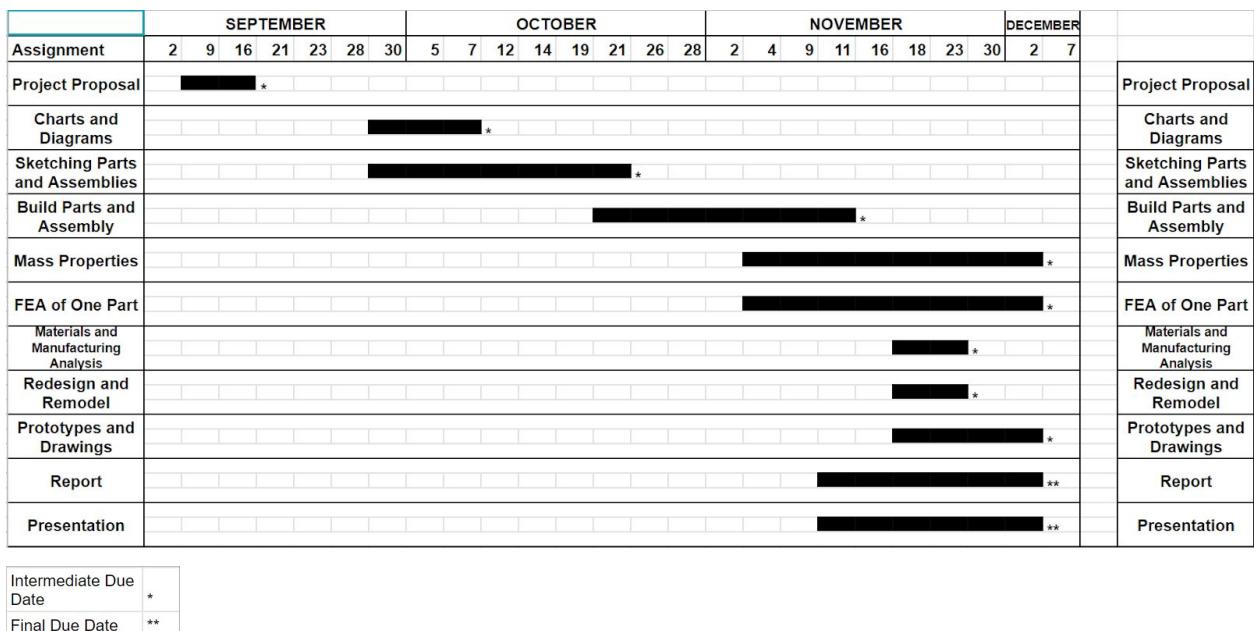
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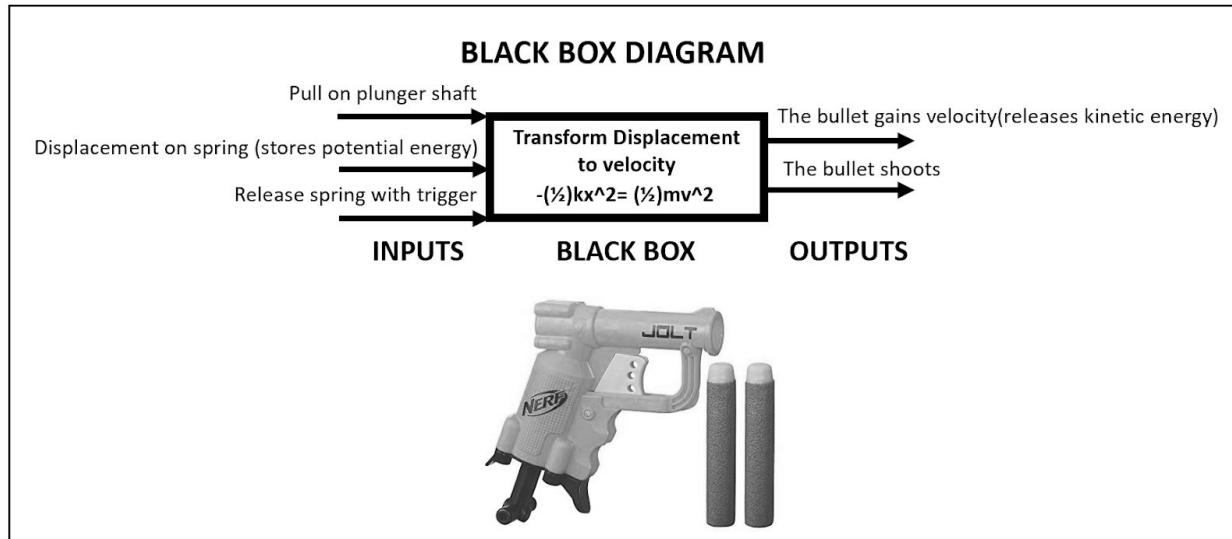
Lab Instructor: Mark Chiarello

## Gantt Chart



**Figure 2.2** A visualization of the intermediate and final due dates for the assignment. Each Intermediary design check is listed, along with when it will be assigned and when it is due. The final due date of the cumulative report and presentation is also included.

## Black Box Diagram



**Figure 2.3** The Black Box Diagram displays the function of the nerf gun. It has three parts: a. the inputs (pull on the plunger shaft, displacement on spring, and release with trigger) that go into the gun; b. the black box that shows the transformation  $(-\frac{1}{2})kx^2 = (\frac{1}{2})mv^2$  or in other words, transform displacement to velocity) of inputs to outputs; and c. the outputs (the bullet gains velocity, and the bullet shoots) that go out of the gun.

### **Dissection Notes**

- 1) To fully dissect the nerf gun, the plunger assembly (consisting of parts 1-8) was first removed from the plastic casing by unscrewing the four stainless steel screws connecting the baseplate to the plastic casing.
- 2) A flathead tool was then used to remove the rubber o-ring, rubber seal, and steel rivet on the top of the plastic shaft head of the plunger.
- 3) This, in turn, allowed for three remaining pieces of the plunger assembly, (plastic shaft head, plastic shaft, and plunger assembly spring) to be disassembled.
- 4) Next, a hacksaw was used to split the plastic casing of the gun into two equal parts, and allowed for the removal of the plastic trigger from the housing assembly.
- 5) The segment of the plastic casing with the barrel was then disassembled by removing the barrel spring by hand from its two fixed supports, which in turn, allowed for the barrel back panel to be removed. The last remaining part in the housing assembly, the bullet holder is fixed at one end, and free to rotate into and out of the barrel at the other.

Views of the plunger and housing assemblies along with their associated components in the order in which they are disassembled will be provided in detail below.

## Full Dissection



Figure 1: Full Dissection of the Nerf Gun

## Plunger Assembly



Figure 2: Plunger Assembly (Front View)

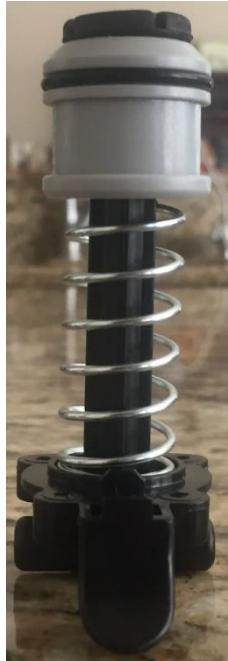


Figure 3: Plunger Assembly (Back View)



Figure 4: Plunger Assembly (Left View)



Figure 5: Plunger Assembly (Right View)

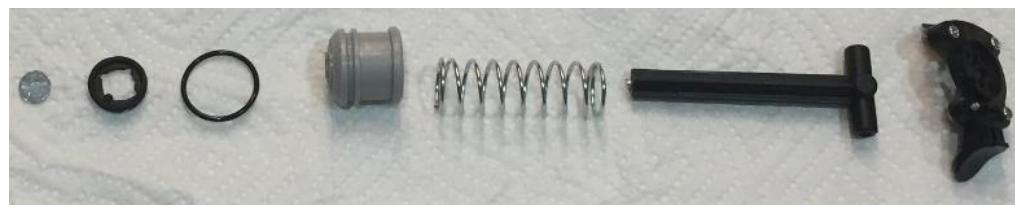


Figure 6: Plunger Assembly (Top View)



Figure 7: Plunger Assembly (Bottom View)

### **Plunger Disassembly**



*Figure 8: Disassembly of the Plunger*

### Baseplate



Figure 9: Plunger Assembly Baseplate (Front View)



Figure 10: Plunger Assembly Baseplate (Back View)



Figure 11: Plunger Assembly Baseplate (Left View)

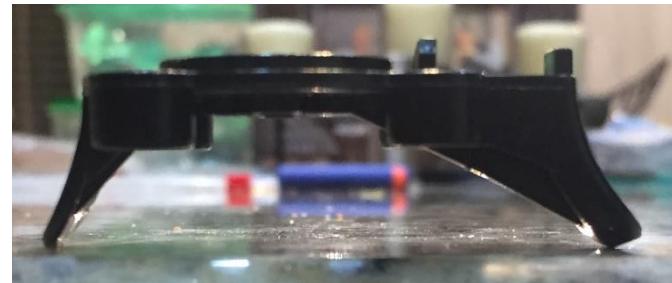


Figure 12: Plunger Assembly Baseplate (Right View)



Figure 13: Plunger Assembly Baseplate (Top View)



Figure 14: Plunger Assembly Baseplate (Bottom View)

## **Phillips Screws**



*Figure 15: Phillips Screws*

## Plunger Assembly Shaft



Figure 16: Plunger Assembly Shaft (Front View)



Figure 17: Plunger Assembly Shaft (Back View)



Figure 18: Plunger Assembly Shaft (Left View)



Figure 19: Plunger Assembly Shaft (Right View)



Figure 20: Plunger Assembly Shaft (Top View)



Figure 21: Plunger Assembly Shaft (Bottom View)

## Plunger Assembly Spring



Figure 22: Plunger Assembly Spring (Top View)

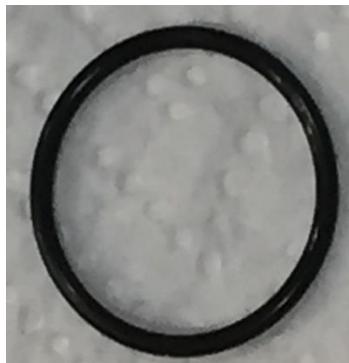


Figure 22: Plunger Assembly Spring (Bottom View)



Figure 22: Plunger Assembly Spring (Side View)

### **Plunger Assembly Rubber O-Ring**



*Figure 23: Plunger Assembly  
Rubber O-Ring (Top View)*



*Figure 24: Plunger Assembly Rubber O-Ring (Side View)*

## Plunger Assembly Rubber Seal



Figure 25: Plunger Assembly Rubber Seal  
(Top View)



Figure 25: Plunger Assembly Rubber Seal  
(Bottom View)

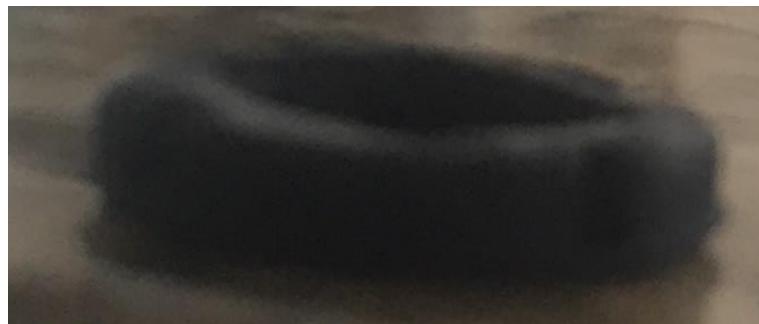


Figure 26: Plunger Assembly Rubber Seal (Side View)

### **Plastic Shaft Head**



Figure 27: Plunger Assembly Plastic Shaft Head (Top View)



Figure 28: Plunger Assembly Rubber Seal (Bottom View)



Figure 29: Plunger Assembly Rubber Seal (Side View)

### **Plunger Assembly Plastic Shaft Head Rivet**



*Figure 30: Plunger Assembly Plastic Shaft Head Rivet (Top View)*



*Figure 31: Plunger Assembly Plastic Shaft Head Rivet (Bottom View)*

## Housing Disassembly



Figure 32: Disassembly of Housing

## Housing Assembly Trigger



Figure 33: Housing Assembly Trigger (Front View)



Figure 34: Housing Assembly Trigger (Back View)



Figure 35: Housing Assembly Trigger (Left View)



Figure 36: Housing Assembly Trigger (Right View)



Figure 37: Housing Assembly Trigger (Top View)



Figure 38: Housing Assembly Trigger (Bottom View)

## Housing Assembly Trigger Rivet



Figure 39: Housing Assembly Trigger Rivet Void (As it appears on Plastic left view of plastic casing)



Figure 40: Housing Assembly Trigger Rivet (As it appears on right view of plastic casing)



Figure 41: Housing Assembly Trigger Rivet (As it appears on left and right views of trigger)

## Housing Assembly Plastic Case



Figure 42: Housing Assembly Plastic Case (Front View)



Figure 43: Housing Assembly Plastic Case (Back View)



Figure 44: Housing Assembly Plastic Case (Left View)



Figure 45: Housing Assembly Plastic Case (Right View)



Figure 46: Housing Assembly Plastic Case (Top View)



Figure 47: Housing Assembly Plastic Case (Bottom View)



Figure 48: Housing Assembly Plastic Case  
(View of Inside of Left Segment)



Figure 49: Housing Assembly Plastic Case (View  
of Inside of Right Segment)

## Housing Assembly Barrell Spring



Figure 50: Housing Assembly Barrel Spring (Top View)



Figure 51: Housing Assembly Barrel Spring (Bottom View)



Figure 52: Housing Assembly Barrel Spring (Side View)

## Housing Assembly Barrell Back Panel



Figure 53: Housing Assembly Barrel Back Panel (Front View)



Figure 54: Housing Assembly Barrel Back Panel (Back View)



Figure 55: Housing Assembly Barrel Back Panel (Side View)

## Housing Assembly Bullet Holder



Figure 56: Housing Assembly Bullet Holder (Front View)

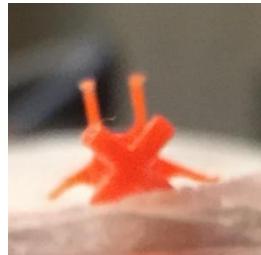
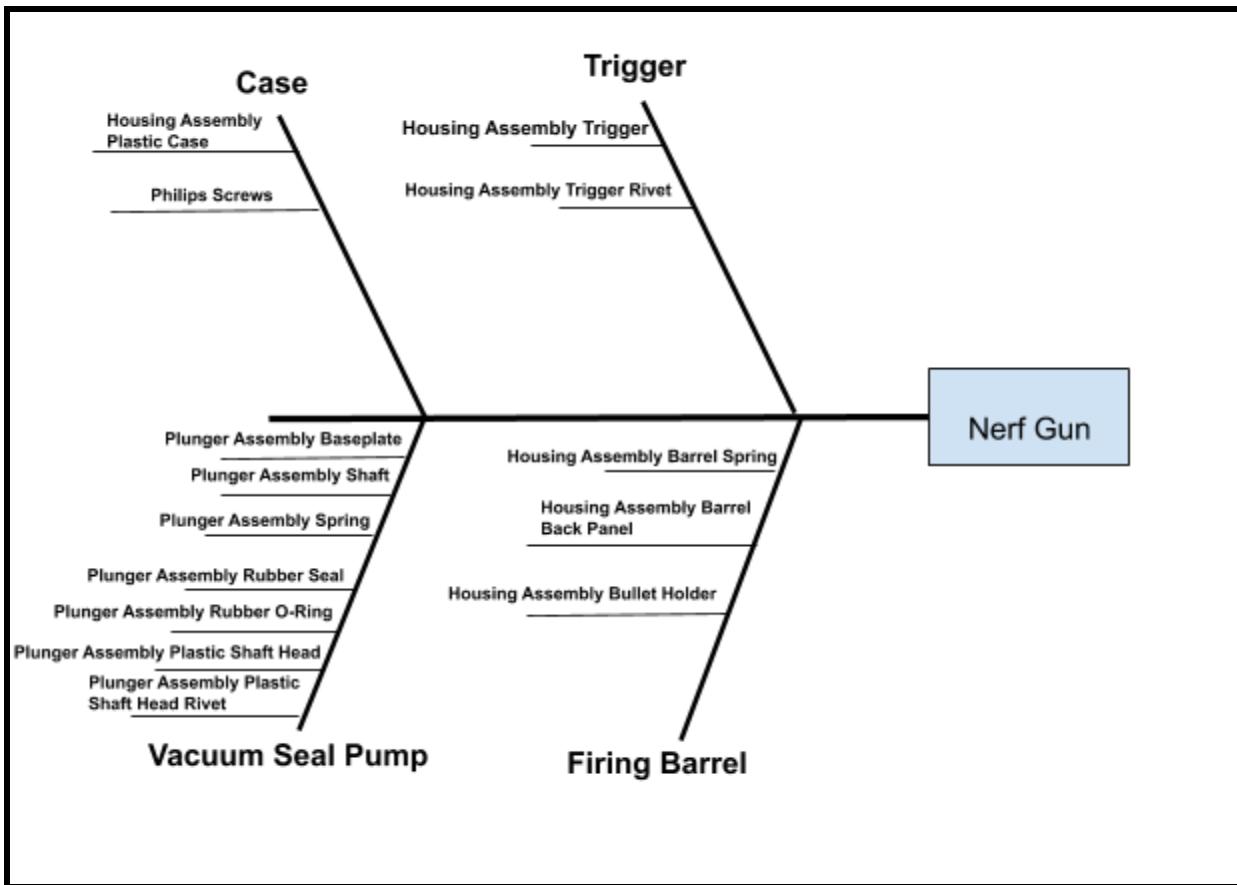


Figure 57: Housing Assembly Bullet Holder (Back View)



Figure 58: Housing Assembly Bullet Holder (Side View)

## Fishbone Diagram



**Figure 2.5:** Fishbone Diagram displaying how our dissected parts are interconnected. The Nerf Gun is presented with its four subsystems off the spine of the diagram along with detailed parts along each spine's fins.

Parts List			
Nerf Gun			
Part No.	Part Name	No. Required	Material
1	Plunger Assembly Baseplate	1	Plastic
2	Phillips Screw	4	Steel
3	Plunger Assembly Shaft	1	Plastic
4	Plunger Assembly Spring	1	Plastic
5	Plunger Assembly Rubber O-Ring	1	Rubber
6	Plunger Assembly Rubber Seal	1	Rubber
7	Plunger Assembly Plastic Shaft Head	1	Plastic
8	Plunger Assembly Plastic Shaft Head Rivet	1	Steel
9	Housing Assembly Trigger	1	Plastic
10	Housing Assembly Trigger Rivet	1	Steel
11	Housing Assembly Plastic Case	1	Plastic
12	Housing Assembly Barrel Spring	1	Copper
13	Housing Assembly Barrel Back Panel	1	Plastic

14	Housing Assembly Bullet Holder	1	Plastic
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**Figure 2.6** Parts List for the Nerf Gun, lists out every part in order of disassembly including how many of them are used and what material they are made of.