

**Design Graphics Team Project  
Fall 2020**

**Reverse Engineering a Toy Nerf Gun**

**Nerf Rebelle**

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## **Part Selection & Function**

The part selected for this analysis is the plastic case housing. This is because it is the largest part, and needs to be made in order to house all other parts. Everything needs to fit inside of the plastic case for it to work properly, so it needs to be manufactured with the proper specifications everytime, while also needing to be mass-produced due to its purpose as a toy. It's complex curves as a part of its design, for both aesthetic purposes and for fitting other parts where they belong, have to be made through a process that is easy to reproduce and will be reliable every time. This part's manufacturing process can also easily be observed in the visible lines of flash along the seams, which hints to injection molding.

## **Material Justification**

The material we selected for this case housing was a common thermoplastic polymer called ABS plastic. This material is commonly used for 3D printing and injection molding, and its composition offered compelling design and safety features for use in our nerf gun. In fact, these features were the reason we ultimately selected this material for the case housing. ABS plastic, according to the report, "Beginner's Guide to Machining Plastics", is the standard material for plastic injection modeling, and it's also the most commonly used material for nerf gun cases (NerfHaven, 2007)! Moreover, we selected this plastic because it's tough, impact-resistant, and has a wide operating temperature range with a melting temperature of 392 degrees Fahrenheit which allows the case to remain stable for a long time (Singh & Singh, 2017). In addition, the areas of the plastic that are stressed beyond the elasticity limit discolor before cracking which offers an element of safety perfectly suited for the young population that uses the toy! It is for these numerous reasons we selected ABS plastic for the case housing of our nerf gun.

## **Manufacturing Analysis**

The manufacturing process chosen for the fabrication of the plastic case housing was the plastic injection molding technique. According to the article "Everything You Need to Know

About Injection Molding”, by Tony Rodgers, Injection Molding is a manufacturing process that is used for producing parts (predominantly thermoplastics) in large volume (mass-production) by injection of the material into a closed mold(Rodgers,2015). There are a couple of major advantages to using this technique to mass-produce parts including a low price per unit after high initial costs have been paid(good return on investment for the manufacturer), low scrap (waste) rates of materials in the manufacturing process relative to that produced by other techniques such as CNC machining. Conversely, downsides to using Injection Molding include high initial costs for the design, testing, and tooling required to adhere to the specifications of the part that is to be mass-produced, as well as long “lead” times that are needed to ensure that the design is compatible with the geometric constraints imposed by the tooling equipment(CJ Tool & Mouldings, 2017). Injection Molding, then, was the chosen manufacturing process for the design of the plastic case housing due to the fact that the part is mass-produced on a global scale, and that the material selected for the part, “ABS Plastic”, is a thermoplastic material that is well-suited for injection molding.

## Citations

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