



## **Targets and Metrics**

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## Targets

**Reach:** The device can reach switches that are at a height up to 40 feet.

**Collapsibility:** The device can collapse to under 8 feet in length.

**Lightweight:** The device weighs no more than 40 pounds.

**Reduces Strain:** The force required to keep the end of the stick in place when at a 60 degree angle with the ground is reduced by at least 20%.

**Withstands weather:** The material repels water and the electrical connections are protected from water falling from above.

**Closing the switch:** The device can apply 5 pounds of force necessary to close the fuse switch.

**User approval:** At least 7 out of 10 users agree that the device is easier to use than the current method of closing the switches.

## Method of Validation

**Reach:** We can use a measuring device to ensure that the device can reach a switch at a height of up to 40 feet.

**Collapsibility:** We can again use a measuring device to ensure that the device is under 8 feet long.

**Lightweight:** We can use a weight measuring device to make sure the device weighs less than 40 pounds.

**Reduces strain:** To measure the moment, we will take the weight of our stick, and calculate its center of mass, and the length of the stick when reaching a vertical height of 40 feet at an angle of 60 degrees from the ground, which is 46.18 feet. We will also take these values from the current hookstick and calculate the moments, and make sure ours is less than 80% of what the current solution is.

***Withstands weather:*** We can mimic light rain conditions with a spray bottle, and if our conductors are properly protected, then they will work after the device is sprayed.

***Closing the Switch:*** We can again use a force measuring device to measure the force the device is using when closing the switch.

## **Derivation of Targets**

***Reach:*** We have determined that our device must have a vertical reach of up to 40 feet since that is the maximum height of the switches that we are working with according to our sponsors.

***Collapsibility:*** Our device must collapse down to a length of under 8 feet long. This length was selected since it is one that will reasonably fit in the truck bed of a Ford F-150, which FPL uses as their work vehicle.

***Lightweight:*** Our device may have to be carried up to 100 yards to a pole before it is being put into use. This means that a single person must be able to reasonably carry it this far. Because of this, we have determined that we want our device to weigh 40 pounds or less, since that is a weight we have reasonably determined to be around the limit for an average person to carry this distance.

***Reduces strain:*** Our project was given to us because FPL wants to reduce strain on their workers while using hooksticks. Because of this, we have to make enough difference to the necessary moment to perform the task of closing the switch. The maximum angle and height we will have to use to close the switch is 60 degrees and 40 feet, and the difference in force to feel a definite difference is 20%.

***Withstands weather:*** Our device will be used often after inclement weather, when there have been a lot of outages. Because of this, there may often be light rain still when our device is being used. For our device to be implemented successfully in the field, it must be able to withstand these conditions.

## **Discussion of Measurement**

The tool that we will need to validate our first target which is “Reach” will be a laser measurer. The second tool we will use to measure our second target which is collapsibility will be a tape measure.

Our next tool that we will use to measure how lightweight our design will be is a scale. Next we will do some mathematical calculations to ensure that our design is reducing strain on the user. To measure how our design will endure light weather we will use a spray bottle representing rain that has a certain amount of water inside. For our final target we will be using some sort of force measurement device to ensure that enough force can be applied to close the switch.

## Critical Targets

***Reach:*** The device will offer robotic aid to the user in extending the “Hookstick” to a maximum height of 40 feet to reach the fuses.

***Portability:*** The device will be able to fit in the 8-foot bed of a standard work truck and be carried at least 100 yards to the work site.

***Fuse Switch Closing:*** The device will give the user enough leverage in order to close the fuse switch.

***Durability:*** The device must be robust and durable enough to function effectively after being transported, on challenging terrain, and in inclement weather.

***High-Voltage Resistance:*** The device must have some level of voltage resistance as to keep the user safe, and not interfere with the high-voltage power lines.

## Summary of Catalog

Appendix A: Target Catalog offers a complete list of targets and metrics dictating the groups’ project. These targets and metrics were derived from the group's functional decomposition charts’ lowest tier. The interpreted needs of the sponsor were also considered.

These defined targets and metrics shall be met in order to propagate the successful development, implementation, and operation of the product. A few of these targets and metrics were unconditional and therefore not open to interpretive definition. One such example of this is our needed length or ***reach***. The fuse switch will always be 35 to 40 feet above the ground, meaning the final product must conform to and be capable of achieving this metric.

Given the innate nature of the design method, the groups targets and metrics are expected to change due simply to the iterative nature of the process. As the project progresses, it is feasible to anticipate targets and metrics changing based on the needs, direction, and findings of the project. This is especially the case as a prototype is brought to a real world application and tested. We intend this catalog to serve as a guideline to begin the design process but not as a binding manual that discourages the limitation of innovation.

#### Appendix A: Target Catalog

<b>Functions</b>	<b>Targets</b>	<b>Metrics</b>
Reach	40 [Feet]	Distance
Collapsibility	$\leq 8$ [Feet]	Length
Lightweight	40.0 [lbs]	Weight
Reduces Strain	$\leq 80\%$ of previous design [%]	Moment
Withstands Weather	$\pm 0.05$ [Miles]	Distance
Closing the Switch	$>50$ [Newtons]	Force