The device primarily operates based on two essential functions: activation and transmission. Its purpose is to aid in locating trafficking activities once triggered. The activation process is similar to existing technologies, enabling the device to transmit a signal to the relevant authorities. This transmission includes the location where the device was activated, as well as a tracking system that monitors the device's movement. The information is then relayed to the authorities, allowing them to track the device's location and take appropriate action to intercept the trafficking operation.

1.4 Target Summary

1.4.1 Introduction

After the functions of our device were determined, the targets and metrics were taken from the functional decomposition and the hierarchy chart. The target represents the value that each function is required to satisfy while the metric is how each of the targets will be measured. The critical targets for our device were decided based on which targets are most important to satisfy the key goals of our product. A full list of the targets and metrics for this project can be found in Appendix C: Target Catalog.

1.4.2 Derivation of Critical Targets

Targets were first determined with no priority given to importance or criticality. Then, the primary functions of the device were considered, namely, tracking and transmitting. The goals most directly related to these are considered mission critical.

Determine Location

To satisfy the need to determine location, our device will need to be within a fifty-meter range of its exact location. Determining a correct location is crucial to the device as incorrect or inconsistent readings will throw off the tracking route. A buffer to the exact

location was given as pinpointing the exact location without error may be challenging if the device is hidden away and obstructed from a strong signal. To test the method of determining location, we will take our device out into areas with different environments and obstructed by different materials. We will then attempt to track the location of the device multiple times and determine how close are readings are. If the device fails these tests, steps to improve the signal from our device will be taken. This target is beneficial as it helps meet additional needs such as the need for a variety of signals to be considered, the need for different environmental conditions to considered, and the need for different materials that can withstand different temperatures to be considered.

Transmit Location

Transmitting the device's location involves data communication between the user and the device's geographical position. The transmission must be a discrete signal that is secure enough not to be intercepted by the targeted suspects. It is critical that the transmission of location data is both accurate and secure for operational success. To validate this function, the device must be able to be located entirely through communication between the user and the device; and the device must also be immune to reasonable attempts of signal interception and counter-tracking. Testing these functions will be done in a similar manner to the determine location function. The device will be challenged in various environments and conditions, and it must still be able to meet the above requirements in these locations. Therefore, this target also helps meet the needs to allow the operator to have control over the device, considering a variety of signals for tracking, and considering different existing systems to build off of.

Manage Power Throughout Operation

For the battery to last as long as needed, it will need to manage its power usage throughout operation. If the battery stays on for the entire course of operation at a max power setting, the battery life will not be sustainable. The amount of power the device needs to operate should be supplied at all times, but no more than that. A method of charging the battery may be implemented into the device such as solar power or wind power. By managing the power of the battery, the needs for a long battery life, a reliable signal, and maintaining discretion by allowing for a smaller casing of the tracking components due to a reduced battery size. The process for testing battery life will be to record how long the battery can withstand certain levels of output charge. In between recording those values, the battery will be recharged to full power. The charge life after consecutive recharges will be recorded to measure the fall off of the battery life after usage.

Activate Power

When the user is ready to activate the device and begin tracking location, the device may need to be turned on from a large or small proximity. The device will need to readily respond to activation when it is needed. Failure to activate when needed may cause a loss of data results and incorrectly track the suspect. This target will depend on the method of activation chosen. To test distance activation, we will attempt to activate the device from a range of distances. If the device does respond to activation in an immediate manner, we will take steps to increase the device's response time. This target additionally satisfies the needs for the operator to have some control over the technology, for the user interface to be catered to front line human trafficking correspondents, and for different types of signals to be considered

1.4.3 Critical Targets and Metrics Table

System	Function	Target	Metric
Track Location	Determine Location	Less than or equal to 50 m	Error in Transmitted Location
Transmit Location	Transmit Location	Span of less than five seconds to less than an hour	Transmission Time
Battery	Manage Power Throughout Operation	1-12 months of recharging	Potential Recharges
User Interface	Activate Power	<1 percent failure rate	Failure Rate

1.5 Concept Generation

1.5.1 Introduction

Team 503 collaborated to generate concepts to accomplish the goals of the project. The team met as a group to ideate designs while considering all of the parameters including customer needs, targets, and functions. Different tools were used to create ideas which are discussed below. The full list of generated concepts can be found in Appendix B: Figures and Tables.

1.5.2 Concept Generation Tools

To aid with the team generating one-hundred concepts, Team 503 used a handful of concept generation methods to influence creativity.

The first method that was used was rapid ideation. The team completed this method individually to set some groundwork for the concept generation. Each member