



LOCATING IMMINENT THREATS

By: Dominic Adams, Mehul Sen, Dan Lynch, Aslan Cronister





The Challenge

On-site security personnel at U.S. Government overseas offices need a way to quickly identify the location of imminent danger when the emergency notification system is triggered in order to create an escape plan or diffuse the threat before it causes harm to human lives and property.



The Problem Statement

Original

Triangulating the location of an imminent danger accurate to 20 feet when an emergency notification system is triggered within 15 seconds or less.

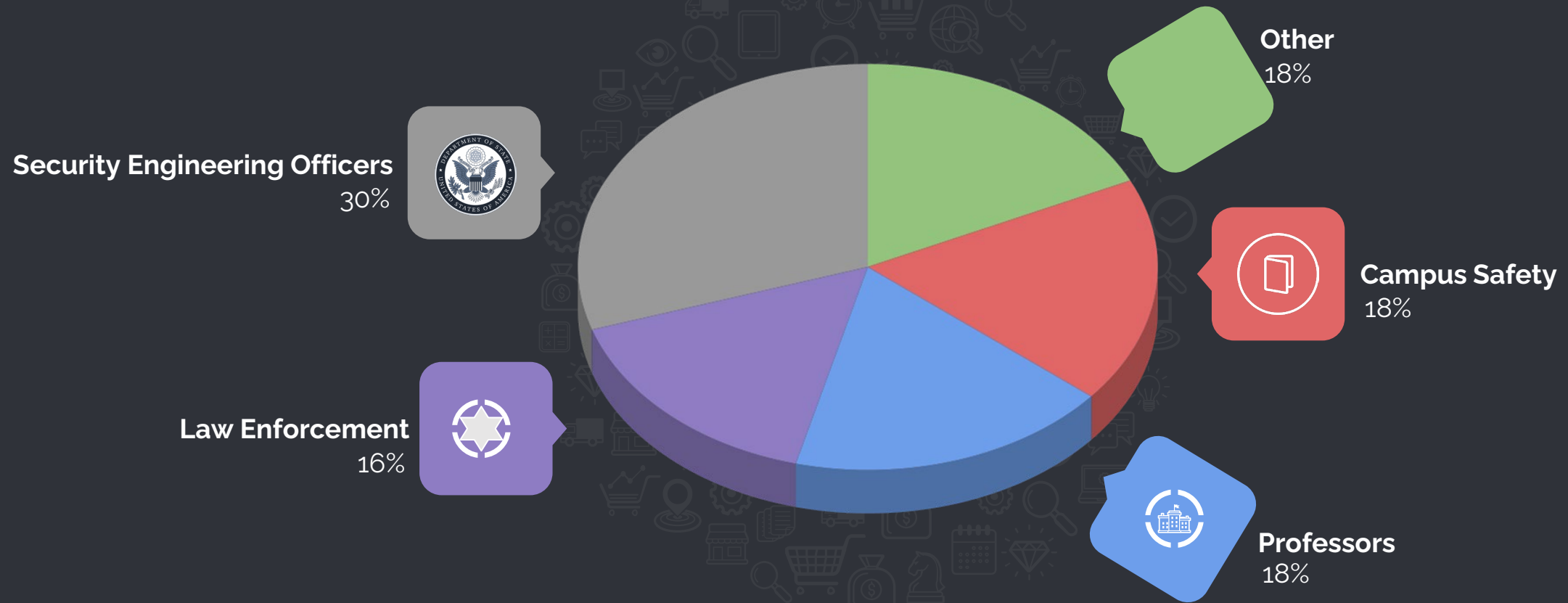


The Problem Statement

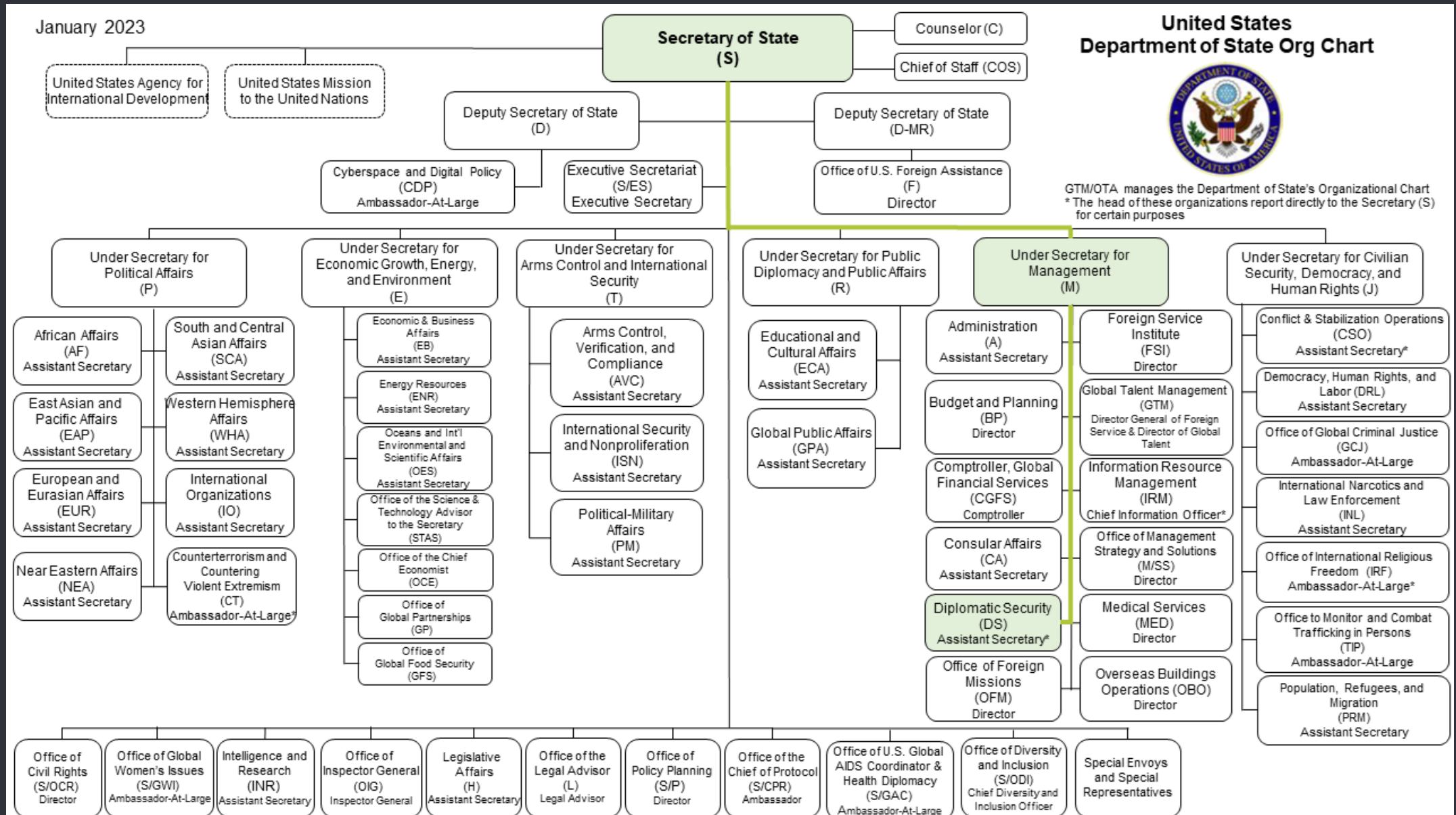
Pivot

Identify the best solution for triangulating the location of an imminent danger, accurate to 20 feet, when an emergency notification system is triggered within 15 seconds or less.

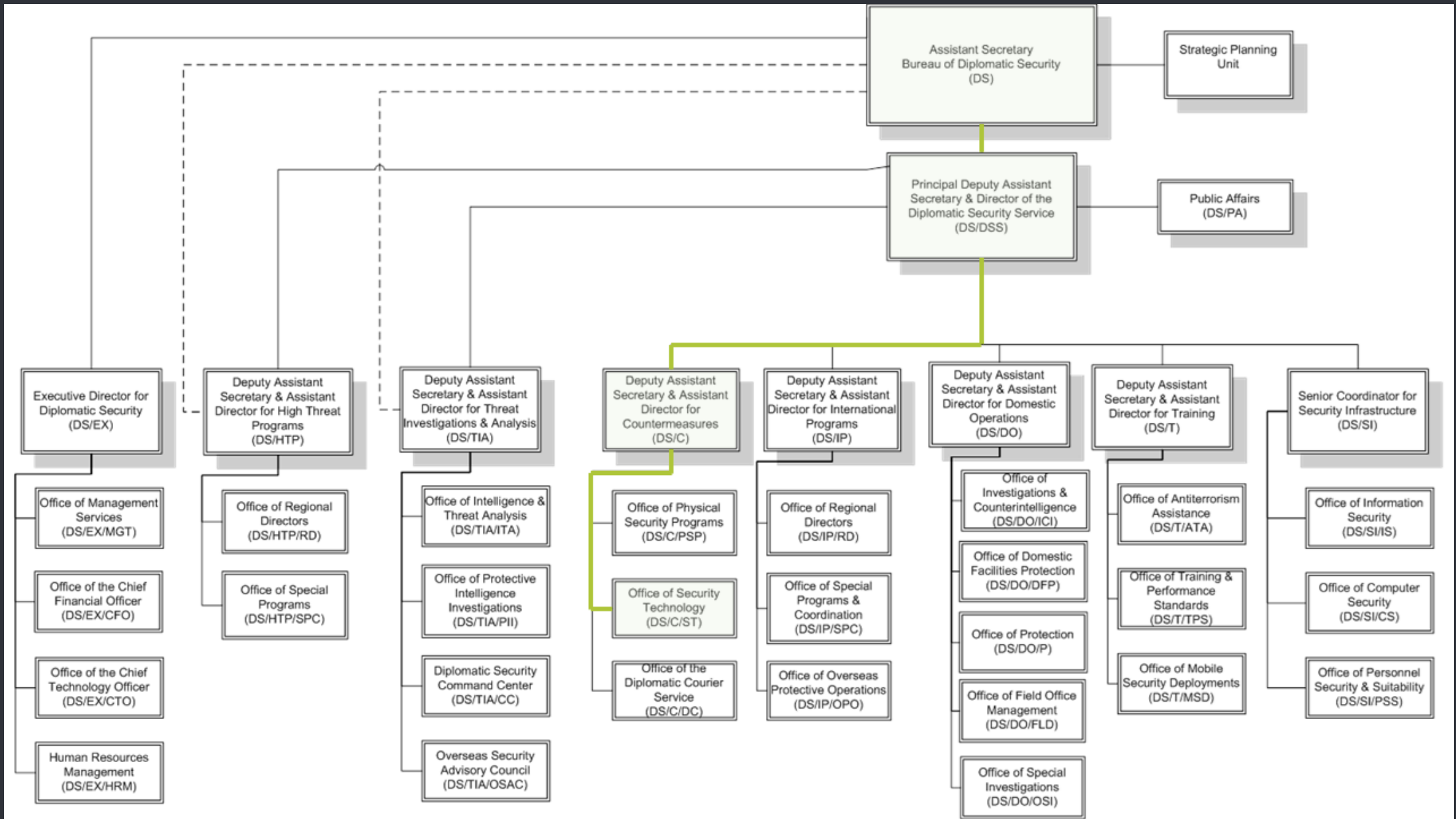
Interviewee Breakdown



Where We Are in the DoS



Where We Are in the DoS





Our Journey

January

February

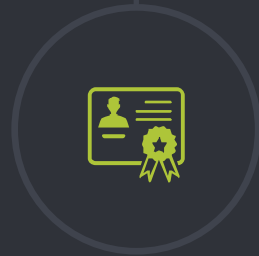
March

April

May



We investigate The Challenge and developed a list of knowns and unknowns. A draft of our Problem Statement was made.



Beneficiary discovery was started, our MVP was drafted, and our problem statement was refined.



Beneficiary discovery continued, multiple MVPs were developed, and a timeline was devolved.












Beneficiary discovery continued, a single MVP was decided upon, and our group met with our Sponsor, Mario May, in DC.



Suggestions and future improvements on our MVP were recommended.

Mission Model Canvas










Original MMC

Key Partners  Which of these activities can your company outsource to others - Security Personnel (for maintaining, monitoring, decision making and action taking)	Key Activities  What are the unique activities your company needs to deliver the value proposition? - Provide the location of the transmitter to the control center in a short duration of time Key Resources  Which of these activities does your company need to own? Transmitter Receiver	Value Propositions  What problem pain/gain does this solve for them? - locating threats quickly - provide a conceptual transmitter and receiver	Buy-in & Support  For each beneficiary, how does the team get "Buy-in" Lives will be saved Deployment  What will it take to deploy the MVP to widespread use? Transmitter is deployed to all the required personnel and the Receiver is able to successfully communicate with the transmitter What constitutes a successful deployment? Receiver is able to successfully triangulate the transmitter location within 20 feet when activated.	Beneficiaries  Who are the individuals, we are creating for? What is their archetype? Security Guards Sponsor Local Law Enforcement Embassy Personnel Office Personnel Responders Defenders
Mission Budget/Cost  What are the costs to deliver the value proposition?		Mission Achievement/Impact Factors  For each beneficiary, how does the team know they succeeded? Location of threat is known within 15 seconds Technology is simple to use		

Week 1
(01/31/2023)

Mission Model Canvas

Final MMC

Key Partners  <ul style="list-style-type: none"> > Mario May (Sponsor) > Michelle Saks (Mentor) > Neil Pendleton (INOVONICS Contact) > Justin Ronning (Former Marine) > Andrey Soloviev (QuNav Contact) 	Key Activities  <ul style="list-style-type: none"> > Research & Development > Mapping the location of the embassy > Hiring and Training Guards > Installation of Repeaters & Pendants 	Value Propositions  <ul style="list-style-type: none"> > Provide a Conceptual Transmitter and Receiver > Provide instructions on what to do until first responders arrive > Locate pendant within 15 seconds within 20 feet > Provide a visual output on the receiver 	Buy-in & Support  <ul style="list-style-type: none"> > Provide an effective emergency notification system that identifies the location of the pendant within 20 feet within 15 seconds. 	Beneficiaries  <ul style="list-style-type: none"> > Campus Safety/University Police > Security Engineering Officers - Mario May (Sponsor) > Law Enforcement
Key Resources  <ul style="list-style-type: none"> > Our Team > Satellite Imagery > Regional Security Officers > Security Engineering Officers 		Deployment  <ul style="list-style-type: none"> > Phase 1: Remote location Test Embassy in Virginia > Phase 2: Test deployment at an Embassy > Phase 3: Roll out to all US Embassies 		
Mission Budget/Cost  <p>~ \$550,000</p> <ul style="list-style-type: none"> -> \$120k for RDT&E -> \$300k for PROC -> \$180k for O&M 		Mission Achievement/Impact Factors  <ul style="list-style-type: none"> > System is designed to be easy to install, and operate as follows: <ul style="list-style-type: none"> - Single button interaction for guards - System is configured on the appropriate frequency out-of-the-box for engineers > Location is known within 15 seconds and accurate up to 20 feet > Technology preserves anonymity > Visually identify where the transmitter is triggered. 		

Week 13
(04/18/2023)



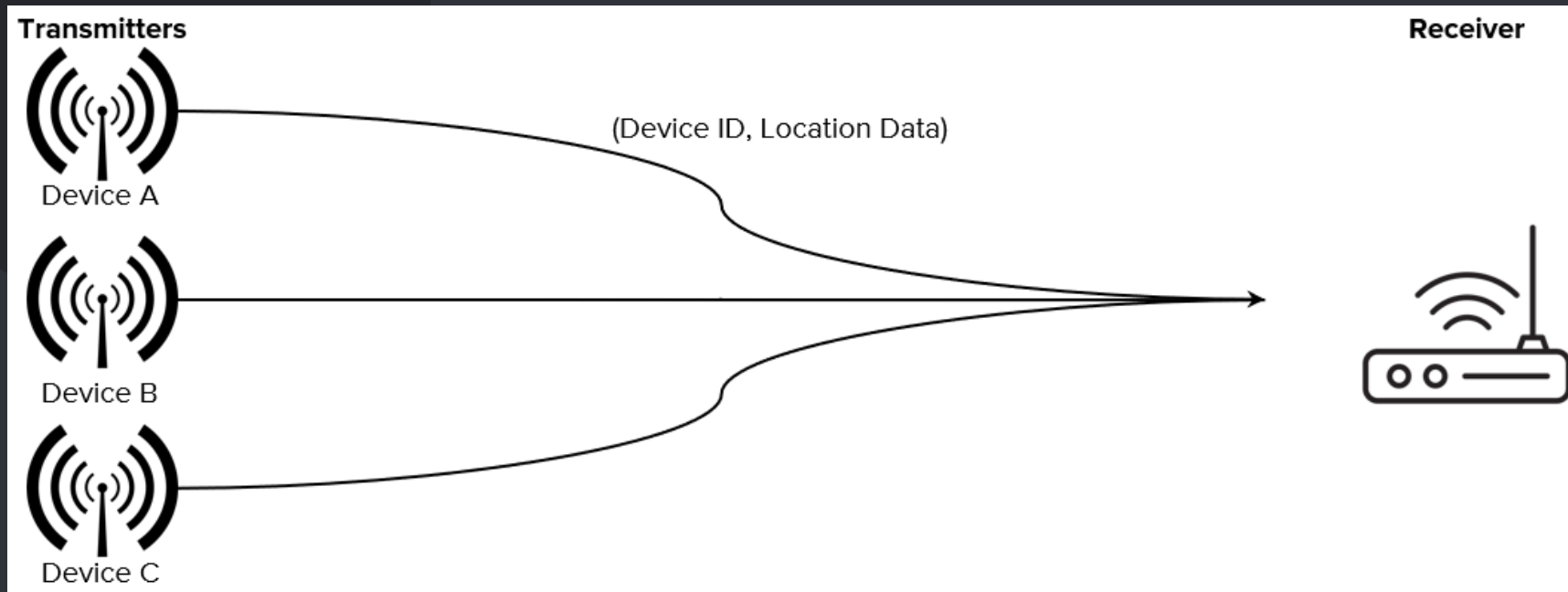
“The more you complicate it,
the riskier is the solution”

Daniel Krebs

Deputy Director of
Cybersecurity/Information
Systems, Monroe County

Minimum Viable Product

Initial MVP



Week 2
(02/07/2023)



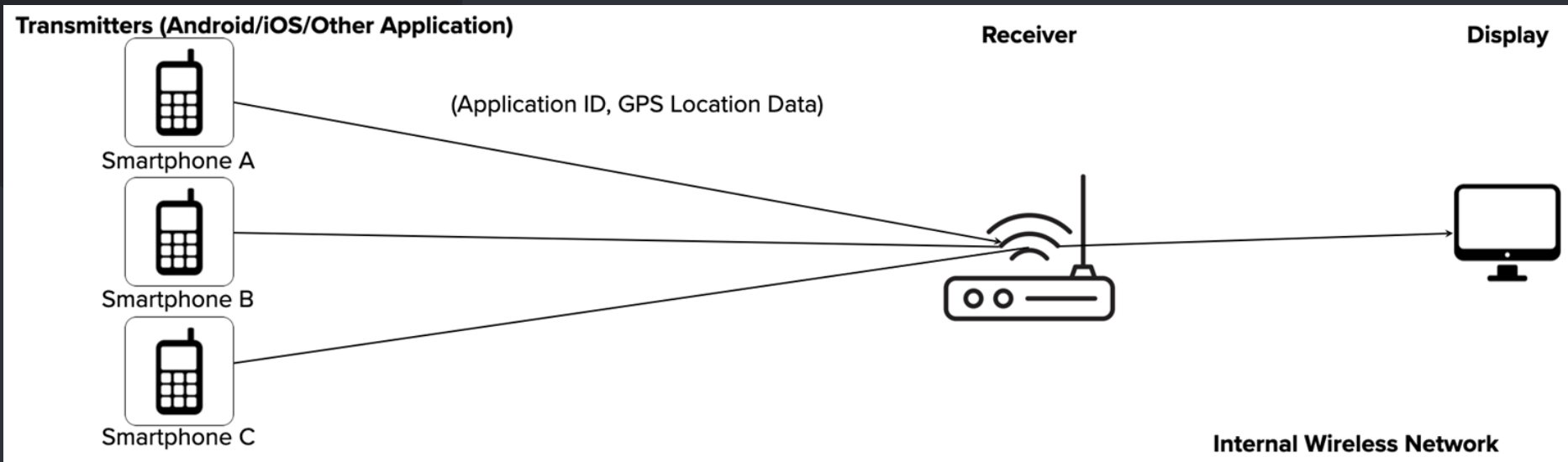
“Redundancy is key”

Frederick J. Rion

Emergency Manager, SUNY
Brockport

Minimum Viable Product

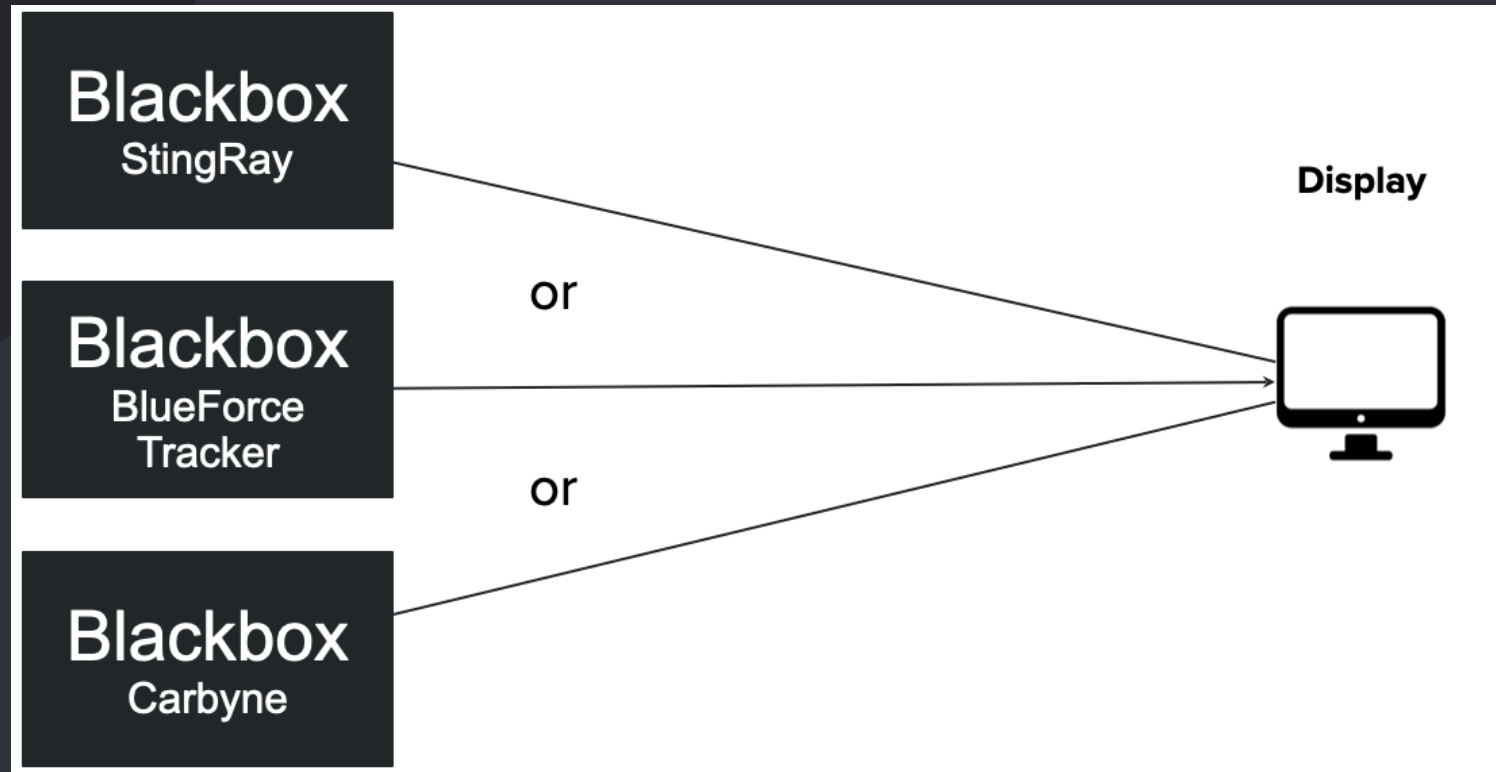
Intermediate MVPs



Week 7
(02/28/2023)

Minimum Viable Product

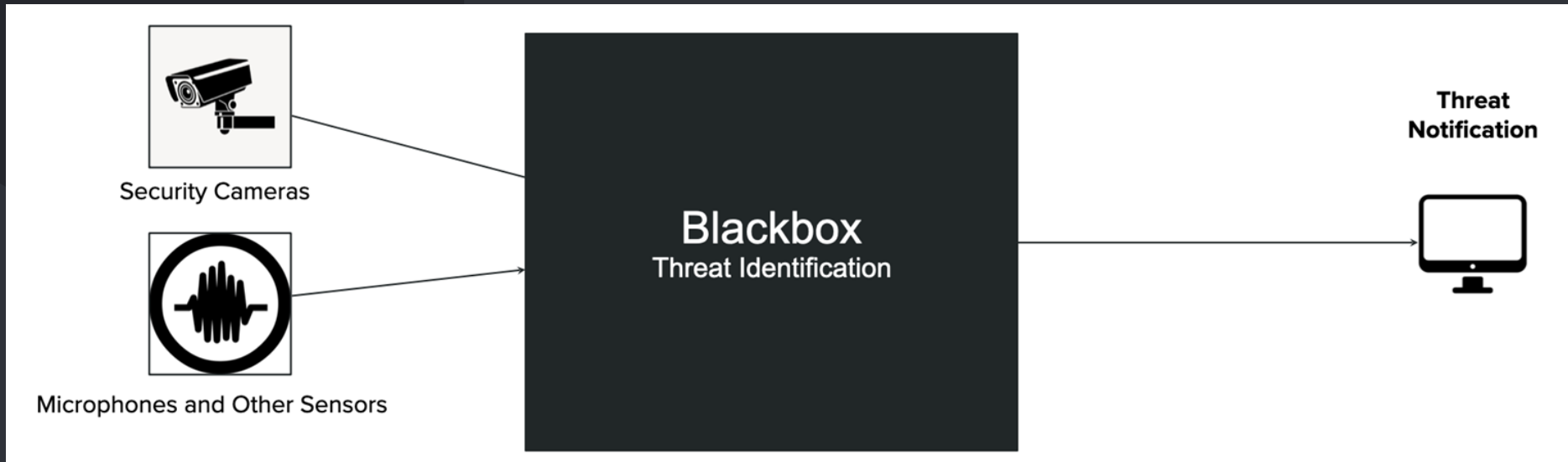
Intermediate MVPs



Week 7
(02/28/2023)

Minimum Viable Product

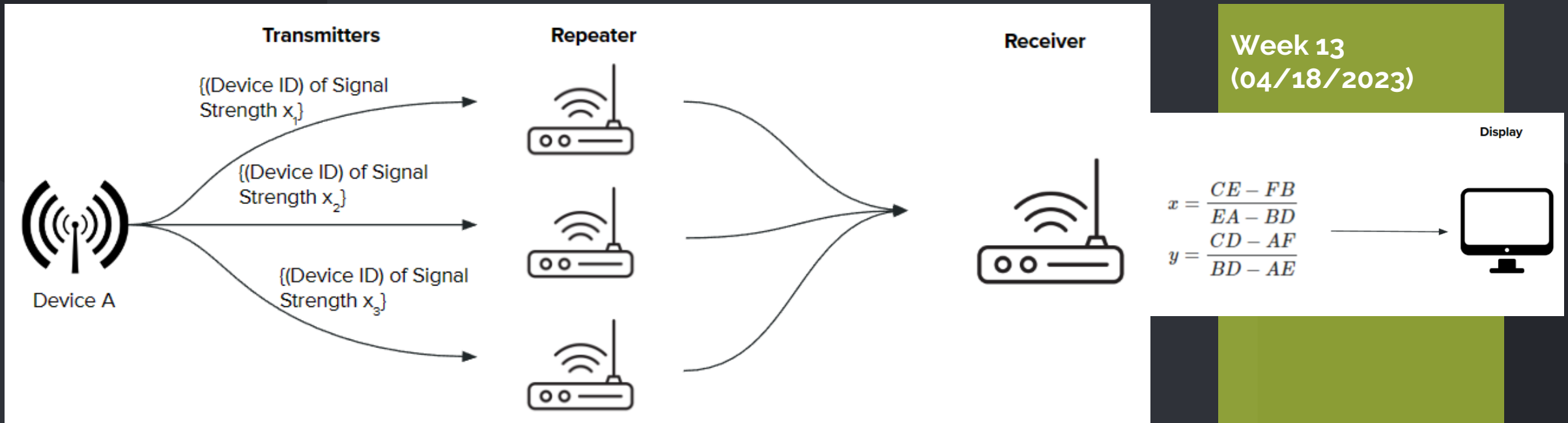
Intermediate MVPs



Week 7
(02/28/2023)

Minimum Viable Product

Final MVP

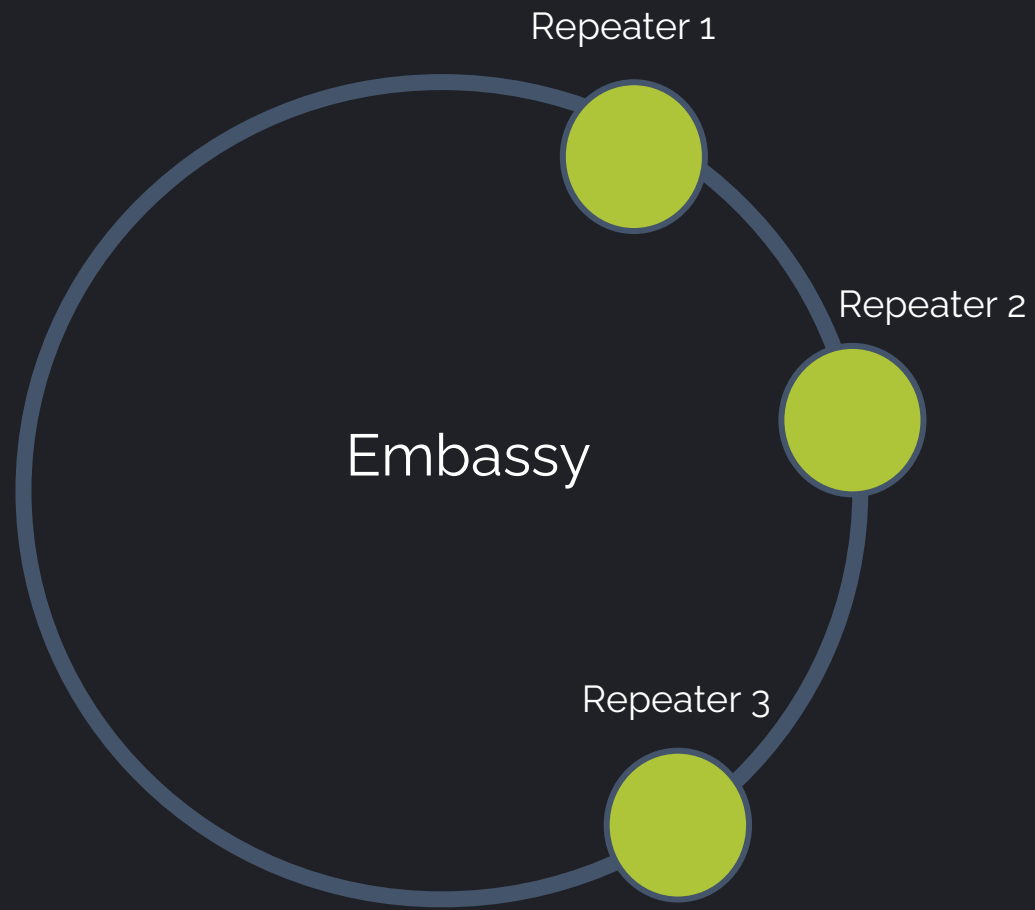


Week 13
(04/18/2023)

Display

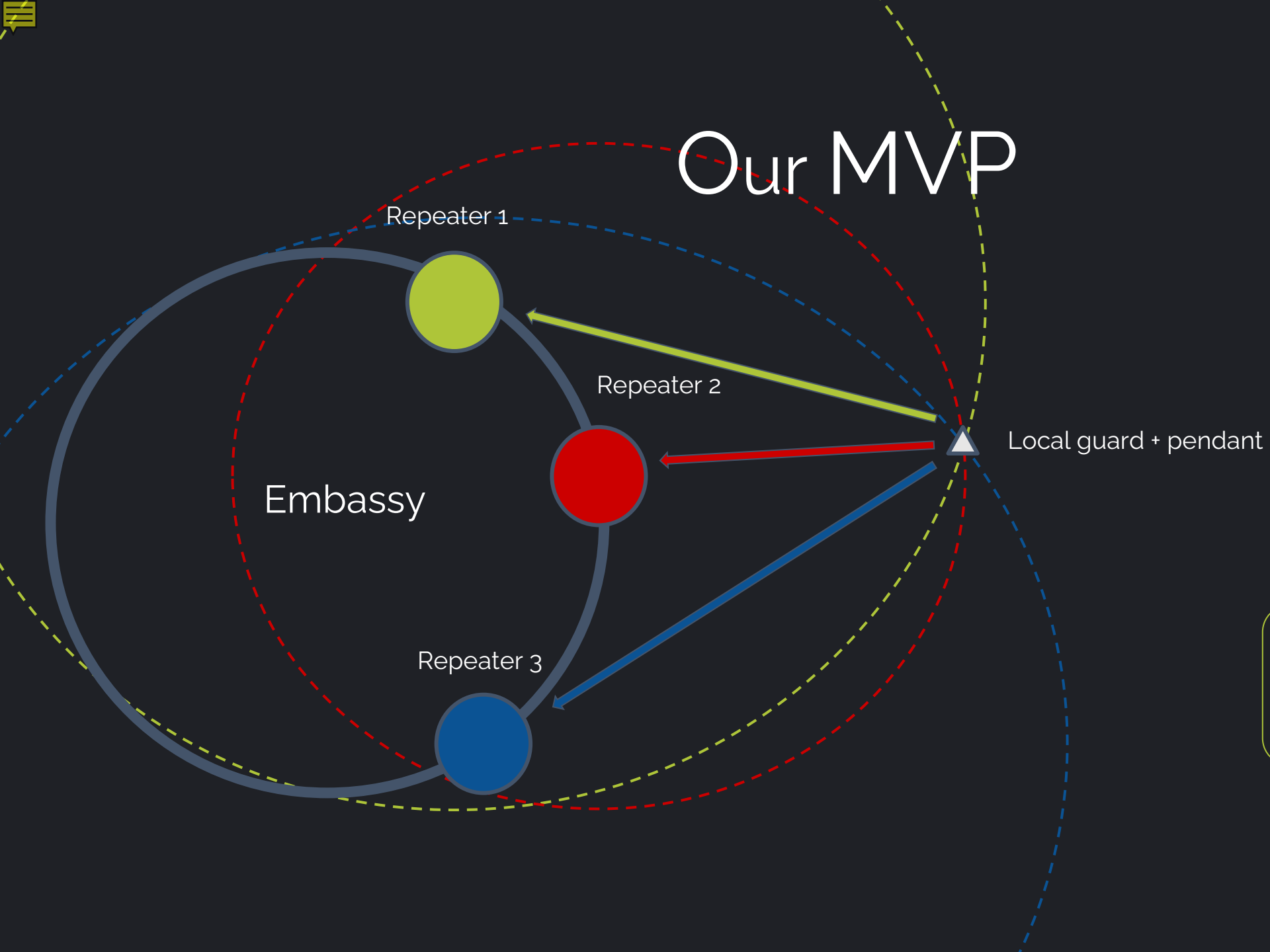


Our MVP



Local guard + pendant

Our MVP



$$\begin{cases} x = \frac{CE - FB}{EA - BD} \\ y = \frac{CD - AF}{BD - AE} \end{cases}$$



What Informed Our MVP?

- ❖ 67 interviews
 - 50 unique touchpoints
- ❖ Rigorous academic research
- ❖ Beneficiary & product discovery
- ❖ On-site lab visit
- ❖ Validated by Inovonics

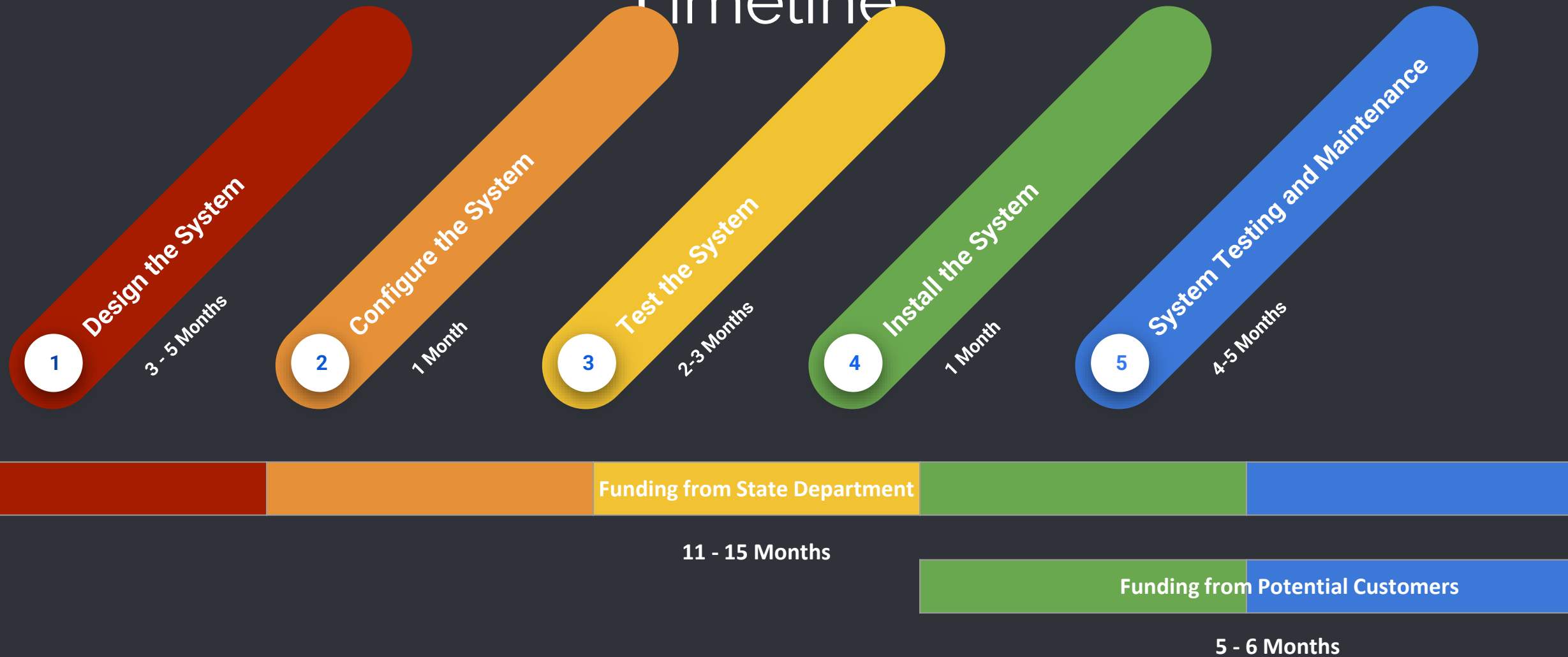
Potential Testing Site



US Baghdad Embassy



Deployment Timeline





“We will investigate it”

Mario May

Security Engineering Officer
Office of Security Technology,
Technology Development
Branch, DoS

The image features a dark blue-grey background. In the top-left corner, there is a yellow geometric shape resembling a stylized 'L' or a corner bracket. In the bottom-right corner, there is a larger yellow geometric shape resembling a stylized 'P' or a corner bracket. The text 'With A Special Thanks To' is centered in the middle of the image in a white, sans-serif font.

With A Special Thanks To



Mario May

Security Engineering Officer

Our project sponsor





Michelle Saks

Our project mentor





Dr. James Santa

Adjunct professor at RIT

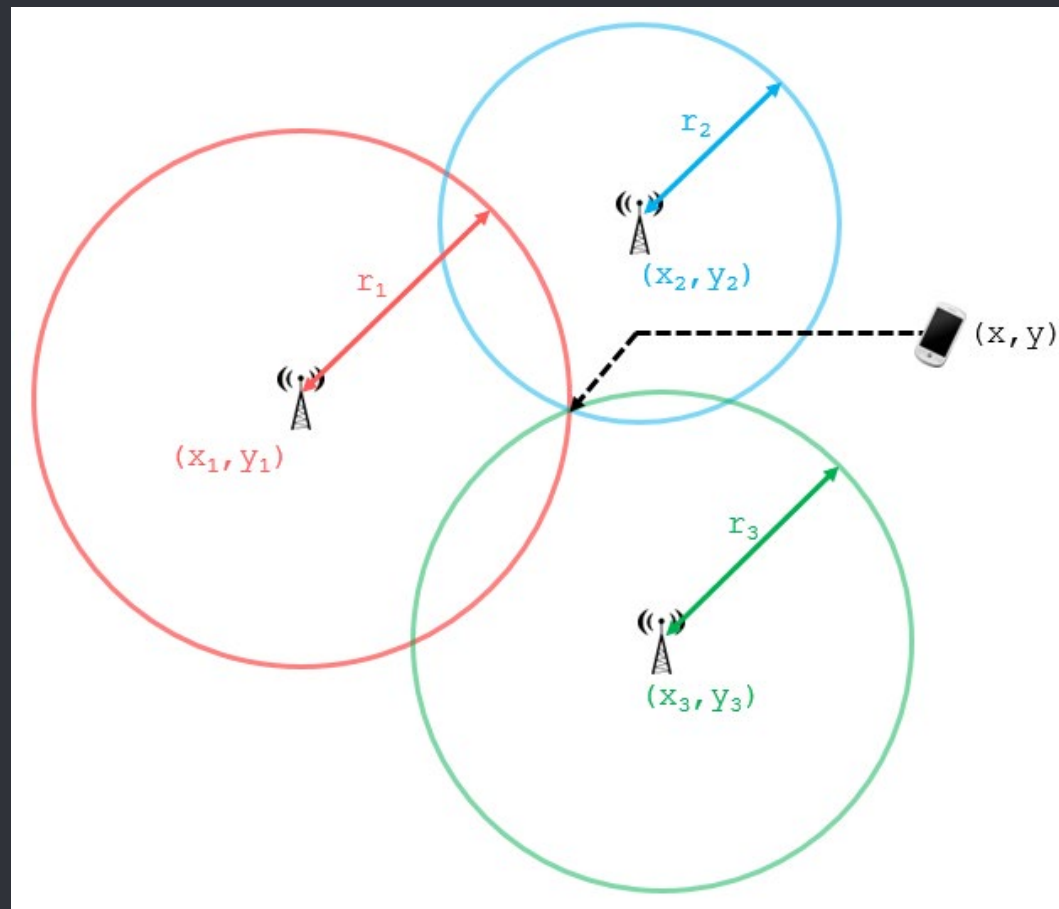
Our professor





THANK YOU

Trilateration Calculations



Trilateration Calculations

$$\begin{aligned}(x - x_1)^2 + (y - y_1)^2 &= r_1^2 \\ (x - x_2)^2 + (y - y_2)^2 &= r_2^2 \\ (x - x_3)^2 + (y - y_3)^2 &= r_3^2\end{aligned}$$

$$\begin{aligned}x^2 - 2x_1x + x_1^2 + y^2 - 2y_1y + y_1^2 &= r_1^2 \\ x^2 - 2x_2x + x_2^2 + y^2 - 2y_2y + y_2^2 &= r_2^2 \\ x^2 - 2x_3x + x_3^2 + y^2 - 2y_3y + y_3^2 &= r_3^2\end{aligned}$$

Euclidean Distance for all points

$$\begin{aligned}(-2x_1 + 2x_2)x + (-2y_1 + 2y_2)y &= r_1^2 - r_2^2 - x_1^2 + x_2^2 - y_1^2 + y_2^2 \\ (-2x_2 + 2x_3)x + (-2y_2 + 2y_3)y &= r_2^2 - r_3^2 - x_2^2 + x_3^2 - y_2^2 + y_3^2\end{aligned}$$

Subtract 2nd eq. from 1st

Subtract 3rd eq from 2nd

$$\begin{aligned}Ax + By &= C \\ Dx + Ey &= F\end{aligned}$$

Rewritten two equations

$$\begin{aligned}x &= \frac{CE - FB}{EA - BD} \\ y &= \frac{CD - AF}{BD - AE}\end{aligned}$$