DS-27
Critical Communication

H4DIPLOMACY

+

RIT

DEPARTMENT OF STATE · DIPLOMATIC SECURITY SERVICE · SPECIAL AGENT · US

Agenda

Meet the Team

DS Organizational Chart

Problem Statement

Bottom Line Up Front

Project Timeline

Minimum Viable Product

Beneficiary Discovery

Project Support

Questions

Meet the Team

Ryan Cheevers-Brown

5th Year
BS Cybersecurity

William Joslin

5th Year
BS/MS Cybersecurity

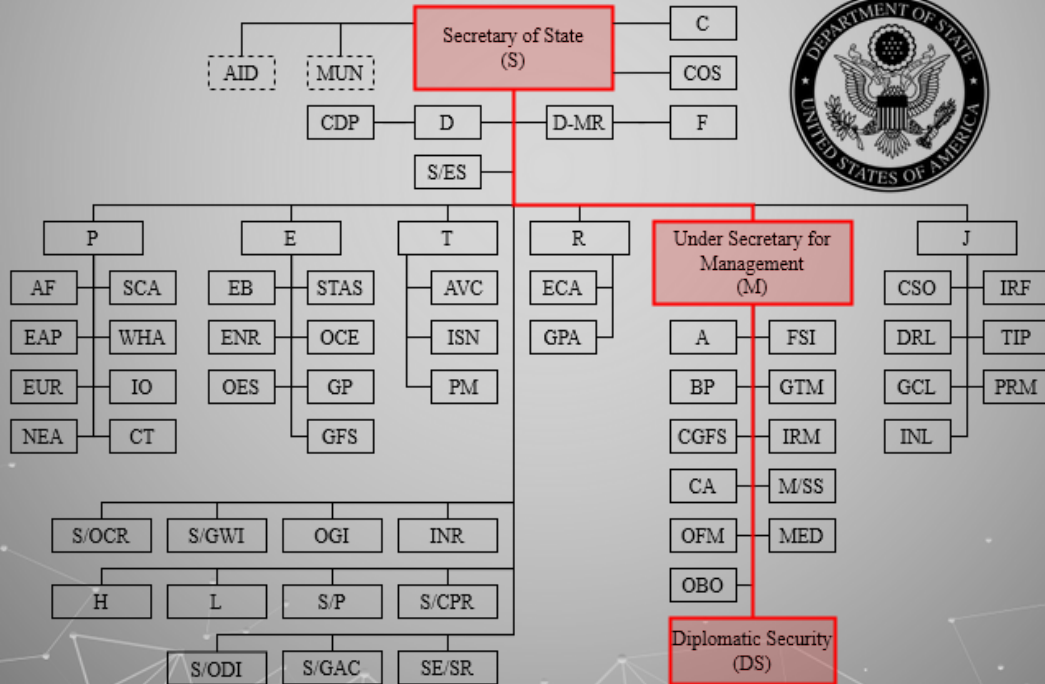**Vishal Pranav**

2nd Year
MS Cybersecurity

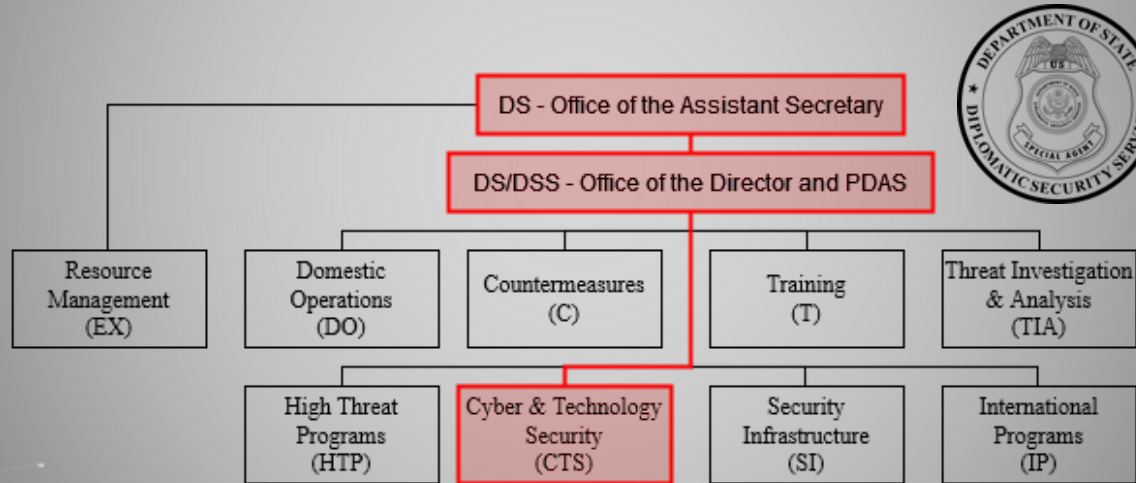**Brian Rich**

2nd Year
MS Cybersecurity

Department of State

Bureau of Diplomatic Security

Problem Statement

Security response teams at U.S. government diplomatic and consular facilities need to have simultaneous secure, reliable, and mobile routes of communication during threat incidents in order toavoid misunderstandings and confusion to avoid lost lives.

"Radios Are Reliably Unreliable."
-Diplomatic Security Agent

Bottom Line Up Front
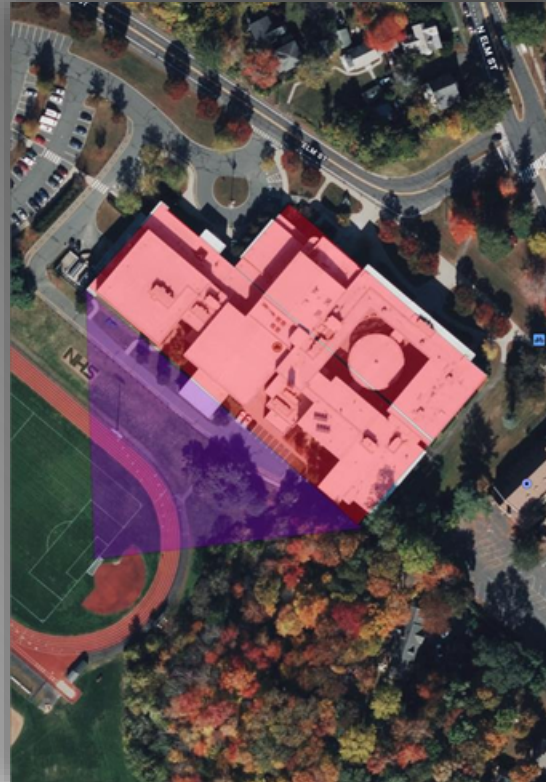
→ Problem ←
→ Impact ←
→ Solution ←

Problem

What is the Issue?

- Dead zones outdoors
- Unreliable indoor coverage
- Garbled messages
- Talk-over
- Limited capacity

Dead Zones Indoors
Dead Zones Outdoors

Impact

What is the Effect?

- Radios don't work reliably
    - Transition down the PACE plan
    - Use of landlines & runners
        - Inconvenient modes of communication
- Loss of mission-critical information
- Injury & loss of life

Primary

Alternate

Contingency

Emergency

Solution

What is the Solution?
- Short-range repeaters
- Digital radio protocol

Project Goals:
- 100% radio coverage outdoors on embassy/consulate grounds
- 100% elimination of talk-over
- 95% radio coverage in mission-critical indoor areas
- 99% reduction in garbled transmissions

Project Timeline

Week 1-6

Number of
Interviews: 19

Pivot #1

Week 1: MMC

The Mission Model Canvas

Mission/Problem Description: Critical Communication
Designed By: DS-27
Date: 9/19/2023
Version: #1

Buy-in & Support
- DoS
- Various Contracted Engineering/Design Companies
- Various Contracted Manufacturing/Logistics Companies
- Bureau of Diplomatic Security
- CTS
- CISA

Key Activities
- Stakeholder Interviews
- Problem Development & Refinement
- Network Architecture Design
- Data Encryption/Encoding Scheme
- Power Efficiency Design

Key Resources
- Software Developers
- Hardware Engineers
- Beneficiaries
- Industry Experts
- DoS

Value Propositions
- Enhances Security
- Lives Saved
- Operational Continuity
- Cost Efficiency
- Public Trust & Reputation
- Adaptability
- Technological Advancement
- International Cooperation
- Universality

Buy-in & Support
- Outreach to Local & Government Beneficiaries
- POF/MVP
- Define Problem & Impact
- Address Relevance

Deployment
- Training
- Scalability
- Compatibility
- Reliability
- Availability

Beneficiaries
- Security Response Teams
- Embassy PACE Teams
- DS Agents
- Local Law Enforcement
- Public Safety
- Disaster Relief/AID Organizations
- Personnel Families/Friends
- DoS Leadership
- Diplomats
- Marine Security Guards
- Regional Security Officers

Mission Budget/Cost
- Unknown

Mission Achievement/Impact Factors
- Fewer human resources involved in crisis situations.
- Significant reduction in loss of life.
- Increased frequency of updates to security personnel back in DC.
- Better situational detail in updated to personnel involved; local and remote.
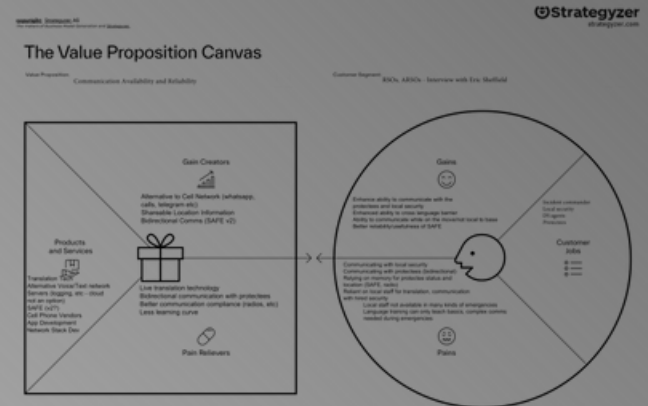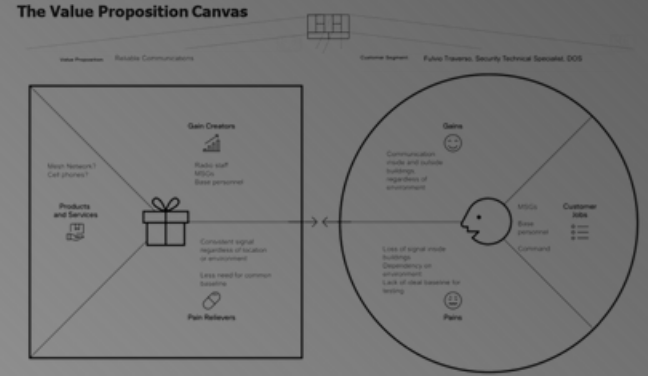
Strategyzer
strategyzer.com

11

Week 1-6: Interviews

Diplomatic Security Service: R&D Security Engineering Officer

- Discussed procedures for embassy radio checks, limitations to said procedures.
- Wi-Fi, IoT restrictions in DoS facilities (SAAs)
- Voice-to-text transcription, GUI, acknowledgement indicator all suggested

Week 1-6: Overview

Discovery:

- Poor Reception & Quality Indoors (Floor-to-Floor)
- Lack of Documentation (Site Specific Procedures)
- Language & Local Government Barrier

Challenges:

- Long Interview Request Response Times
- Very Large Problem Scope
- Multiple Highly Complex Issues

Trajectory:

- Scope Reduction & Better Problem Definition
- Research into Real-Time Transcription & UI/UX
- Research into Simultaneous Communication Methods

Project Pivot #1

Pivot-Week6

Security teams within U.S. Embassy/Consulate facilities require robust forms of communication between all personnel at all times.

- Scope narrowed down from 'communication' encompassing:

Security & Non-Security Personnel Inside & Outside Compound → Security Personnel Inside Con

- Definition of robust required:

This entails the need to maintain consistent, reliable, and secure communication at all times.

- High Fidelity Audio Communication
- Location Tracking
- Audio Transcription/*Real-Time Translation*
- *Node/AP Based Mesh Coverage*

14

Week 6 -MMC

The Mission Model Canvas

Mission/Problem Description: Critical Communication
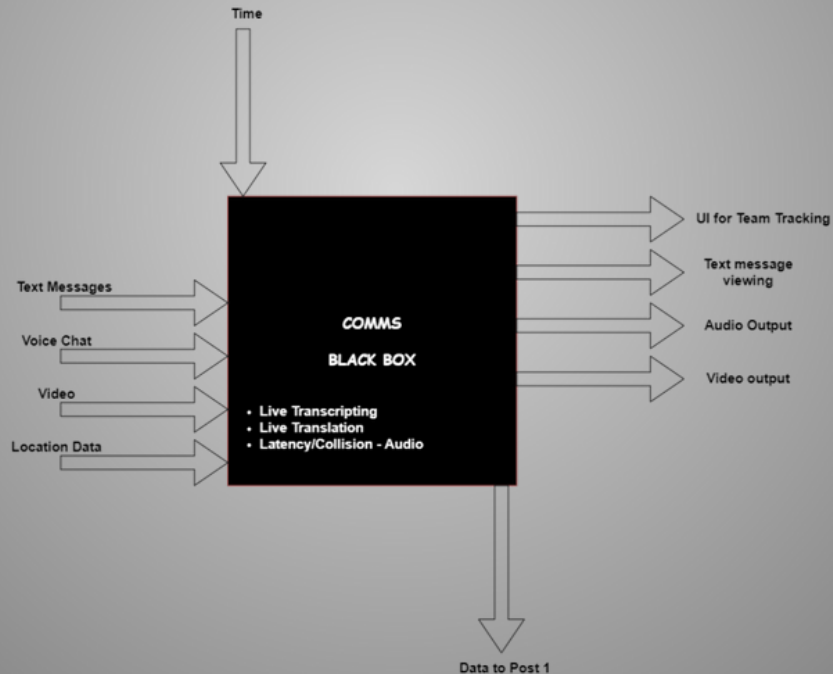Designed By: DS-27
Date: 10/03/2023
Version: #5

Buy-in & Support
- DoS
- Contracted Engineering/Design
- Contracted Manufacturing/Logistics
- Bureau of Diplomatic Security
  o Sponsor (Brian)
- CTS
- CISA
- IRM

Key Activities
- Stakeholder Interviews
- Problem Statement Refinement
- Technology Determination
- Data Encryption/Encoding Scheme
- Power Efficiency Design

Key Resources
- Software Developers
- Hardware Engineers
- Beneficiaries
- Industry Experts
- International Law Experts
- DoS

Value Propositions
- High Fidelity Audio
- Language Translation
- Location Tracking
- Audio Transcription
  o Loggability
  o Low-Bandwidth
- Operational Continuity
  o Reliability
  o Better POST1 Information
  o Domain Awareness
- Use of Deployed Devices
- Non-Region Specific
  o Spectrum Management
- Peace of Mind
- Consolidation of Existing Communications Methods
- Improved Training
  o Situational Awareness
  o Equipment Use
  o Security Posture

Buy-in & Support
- Outreach
- POF/MVP
- Address Concerns
- Address Relevance

Deployment
- Training
  o Frequency of Drills
  o In-person Training
  o Drill w/ Random Location/Time
- Policy Enforcement
- Staffing
- Compatibility
  o ATAC Update
- Reliability
- Availability

Beneficiaries
- Bureau of Diplomatic Security
  o Marine Security Guards
  o Regional Security Officers
  o Diplomatic Security Agents
  o Sponsor (Brian)
  o ARSOs
- Local Law Enforcement
- Public Safety (RIT PS)
- Disaster Relief/AID
  o FEMA
- Connected Assets
  o Local Workforce
  o US Personnel Families
- Regional/Contracted Guard Forces

Mission Budget/Cost
- Unknown

Mission Achievement/Impact Factors
- 90% Reduction in the use of the 'E' in the PACE plan. (Runners)
- Measurable improvement in the clarity of audio and backup communication channels.
- Improves situational awareness for C2 personnel.
- Improvement on DoS audits regarding security posture.
- Improved frequency and response behavior by non-security personnel.
- Fewer human resources involved in crisis situations.

Strategyzer
strategyzer.com

15

Week 6: MVP

Project Timeline

Week 1-6

Number of Pivot #2

Interviews: 19

Pivot #1

Number of
Interviews: 30

Week 7-10

Other Important VPCs

Internal Resource Management (IRM): Information Management Technical Specialist, Chennai, India
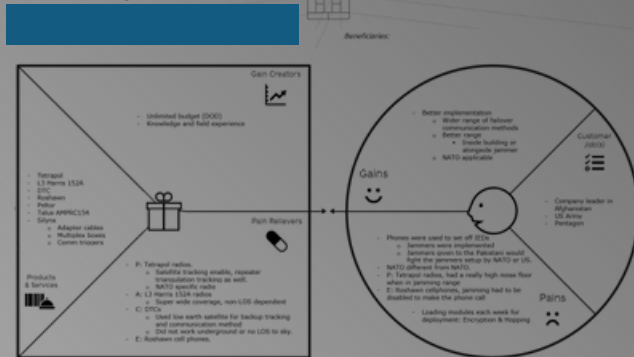
- Provided details on internal compound (non-classified) network infrastructure
- Described how procurement is done and the paperwork associated with radios specifically
- Host nation specific red tape
  ○ Regional Cellular Requirements
  ○ Radio Communication Limitations

The Value Proposition Canvas
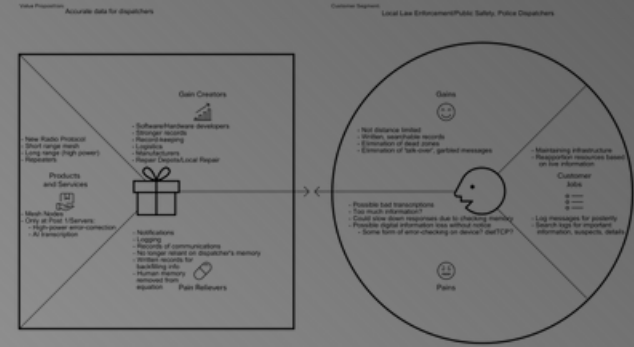
The Value Proposition Canvas

Week 7-10: Overview

Discovery:

- Technical Implementation of Feature Set on Mobile Phones
- Financial Feasibility of Advanced Radio Devices
- Compound Networking Backbone/Infrastructure

Challenges:

- Understanding the Use-Case for Mobile Phones
- Navigating Government Red Tape Associated with Product Development
- Navigating Local Government Spectrum Allocation

Trajectory:

- Developing a Practical Solution
- Utilizing Existing Infrastructure & Devices
- Understanding Financial & Technical Feasibility

Project Pivot #2

Pivot -Week 10

Security teams within U.S. Embassy/Consulary facilities require secure, mobile, and robust forms of communication between all security personnel and Post 1 at all times.

-
- Re-Addition of 'secure' and 'mobile' to define focus on handheld radio communications and security methods.
- Definition of robust modified:
  - Refinement of audio communication requirements (*Quality Audio Communication: 16 kbps full duplex or better*)
  - Removal of real-time translation
  - Confirmation of node-based mesh networking
  - Addition of message integrity checking
  - Addition of existing/permanent infrastructure utilization

The Mission Model Canvas

Mission/Problem Description: Critical Communication
Designed By: DS-27
Date: 10/31/2023
Version: #9

Buy-in & Support
- Contracted Engineering/Design
- Contracted Manufacturing/Logistics
- Bureau of Diplomatic Security
  - EX
  - Diplomatic Security Service
    - Cyber & Technology Service
      - Sponsor (Brian)
    - International Programs
    - Training
- Internal Resource Management
- ATAC Development Team
- Contracted Guard Force
- Local Law Enforcement

Key Activities
- Stakeholder Interviews
- Refine Problem Statement
- Define Specification
  - Minimum Audio Bit-Rate (16kbps Full Duplex)
  - Minimum Bandwidth (32kbps Full Duplex)
  - Wireless Method to Use (Mesh Protocol)
- Define Audio Processing

Key Resources
- Software Developers
- UI/UX Engineers
- Wireless Protocol Engineers
- Beneficiaries
- International Spectrum & Law Experts
- Communication Specialists
  - Multiplexer Communication Vehicles
  - COW/COLT Systems

Value Propositions
- Better Audio Quality
- Location Tracking
- Audio Transcription
  - Low-Bandwidth
- Operational Continuity
  - Communication Reliability
  - Improved Coverage
  - Better Domain Awareness
  - Command & Control
  - Response Personnel
- Use of Existing Technology
  - Use Deployed Devices
  - Use Existing Infrastructure
- Configurability
  - Spectrum Management
  - Encryption Method
  - Wireless Method
- Consolidation of Existing Communications Methods
- Improved Training
  - Equipment Use
  - Drill Efficiency

Buy-in & Support
- Internal Resource Management
  - Information Management Technical Specialist
- Bureau of Diplomatic Security
  - Regional Security Officers

Deployment
- Equipment Usability & Familiarization Training
- Internal Resource Management
  - Vendor Contract
  - Logistical Deployment
- ATAC Update

Beneficiaries
- Bureau of Diplomatic Security
  - Marine Security Guards
  - Regional Security Officers
  - Diplomatic Security Agents
  - Sponsor (Brian)
  - ARSOs
- Local Law Enforcement
- Public Safety (RIT PS)

Mission Budget/Cost
- Radios Cost ~$2,000
- Radio Repeaters Cost ~$20,000

Mission Achievement/Impact Factors
- 90% Reduction in the use of the 'E' in the PACE plan. (Runners)
- Measurable improvement in communication reliability. (Reduction in Dead Zone Count)
- Measurable improvement in the clarity of audio.
- Measurable improvement in operation efficiency. (Time, Energy, Resources)
- Improved situational awareness for C2 and domain awareness for response personnel.
- Usage of already deployed resources.

Strategyzer
strategyzer.com

Week 10: MVP

Transcription
Signal Multiplexing
Location Tracking

Non-Brand Specific Node

Project Timeline

Week 1-6Week 11-14

Number of Pivot #2Number of

Interviews: 19Number of Interviews: 50

Pivot #1Interviews: 30Pivot #3

Week 7-10

Week 11-14: Overview

Discovery:

- Training imposes insurmountable obstacles
- Solutions must be customized
- Mesh-capable radios are too expensive

Challenges:

- Monsoon season in Chennai
- FAMs/FAHs classified

Trajectory:

- Investigate specific protocols & equipment
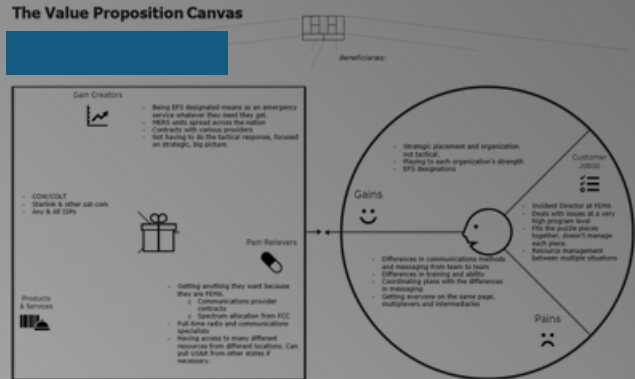- MVP deployment strategy & phases

Other Important VPCs

Northampton Police Department Representative:

- NPD faces similar radio problems and needs
- NPD is currently implementing new radio equipment
  ○ Several repeater sites
  ○ Digital radio protocol
  ○ 'Backpack' repeaters for schools & crises
       -Uplink into primary repeater network
  ○   Indoor coverage

The Value Proposition Canvas

Value Proposition — Adapting to different stations

Customer Segment — DSS Agents, RSOs, Local Guard Forces

Scott Schonauer, RSO Chennai, India

The Value Proposition Canvas
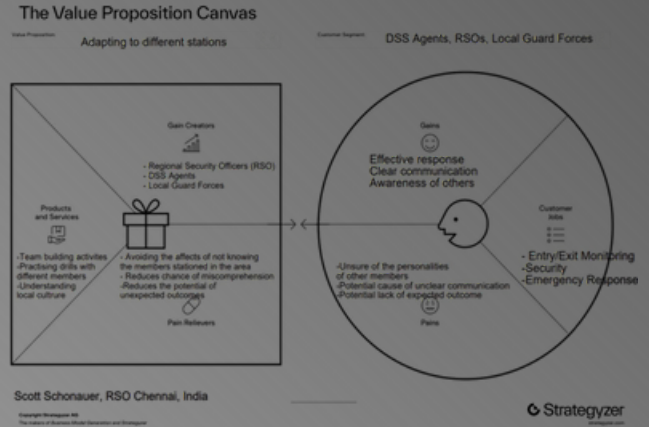
Project Pivot #3

Pivot -Week 14

Security personnel within U.S. Embassy/Consulate facilities require secure, mobile, and robust tactical communication over EAC, MSG, and APD networks at all times that are compatible with currently deployed radio technology.

1. Scope of networks narrowed further to EAC, MSG, and APD only.
   - 5 FAH-2 H-730, 12 FAM 420
   - Removes unnecessary groups and users
2. Intercompatibility requirement added
   - No new training requirement
   - Cost reduction

Week 14: MVP

Infrastructure (Non-Classified)

Wide-Area Repeater-Wide-area Repeater
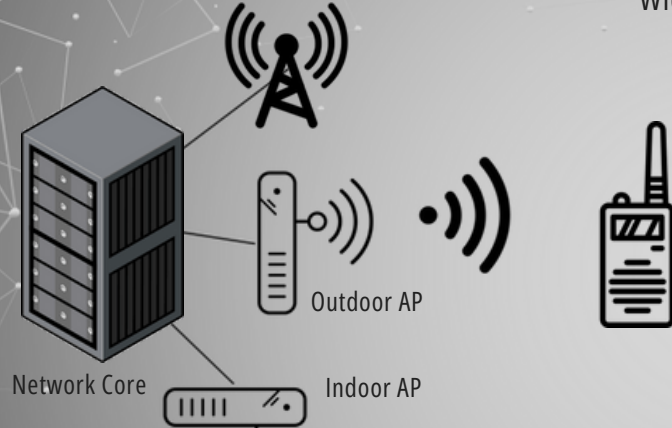
- ○ Backhaul: Ethernet, fiber, coaxial
- ○ High tolerance, Ruggedized
- ○ Primarily custom protocol over UHF
- ○ Secondary UHF
- ○ Tertiary VHF
- Indoor Repeater
  - ○ Covers an indoor room
  - ○ Similar to a wifi access point.
- Outdoor Small Repeater
  - ○ For external dead zones
  - ○ Similar in size to an outdoor wifi dish.
  - ○ Necessary to be ruggedized.
  - ○ Can use same ethernet cables as IP Cameras

Outdoor AP

Network Core

Indoor AP

- Motorola P25 System -800MHz
  - ○ $3000-5000/handheld
  - ○ $3000-5000/short-range repeater
  - ○ $30,000+ for wide-area repeaters
  - ○ $30,000+ for networking & servers

- Other Benefits
  - ○ Trunking network
  - ○ Distribution groups
  - ○ Emergency broadcast priority
  - ○ Multiple channels & control

Handheld Unit (APX Next XN All-Band P25)

- Supports VHF, UHF (100mhz, 400mhz, 800mhz), Mesh
- Cellular (3g, 4g, 5g), wifi options
- Ruggedized but serviceable
- Trunking protocol, 4+ comms channels

27

The Mission Model Canvas

Mission/Problem Description: Critical Communication
Designed By: DS-27
Date: 11/21/2023
Version: #13

Buy-in & Support
- Bureau of Diplomatic Security
  - EX
  - Diplomatic Security Service
    - ❖ Cyber & Technology Service
      - Sponsor (Brian)
    - ❖ International Programs
    - ❖ Training
- Internal Resource Management
- Dos Spectrum Management
- DoS Procurement
  - Sylinx
  - Motorola
  - Kenwood
- DoS IT Infrastructure
- DoS Security Engineering
- Radio Spectrum Engineer
  - Spectrum Analysis
  - Signal Survey

Key Activities
- Stakeholder Interviews
- Define Specification
  - 16kbps Audio Dedication
  - Total 32kbps Full Duplex
  - Wireless Protocols
- Define Implementation
  - Timeline & Phase Breakdown
  - Product Specification/MPNs
  - Installation Guidance & Recommendations

Key Resources
- Software Developers
- Wireless Protocol Engineers
- International Spectrum & Law Experts
- Communication Specialists
  - Multiplexer Communication Vehicles
  - COW/COLT Systems

Value Propositions
- Better Audio Quality
- Location Tracking
- Operational Continuity
  - Communication Reliability
    - ❖ Improved Coverage
  - Better Domain Awareness
    - ❖ Command & Control
    - ❖ Response Personnel
- Use of Existing Technology
  - Use Deployed Devices
  - Use Existing Infrastructure
- Configurability
  - Spectrum Management
  - Encryption Method
  - Wireless Method
- Consolidation of Existing Communications Methods
- Improved Training
  - Equipment Use
  - Drill Efficiency

Buy-in & Support
- Internal Resource Management
  - Information Management Technical Specialist
- Bureau of Diplomatic Security
  - Regional Security Officers

Deployment
- Equipment Usability & Familiarization Training
- Internal Resource Management
  - Vendor Contract
  - Logistical Deployment

Beneficiaries
- Bureau of Diplomatic Security
  - Marine Security Guards
  - Regional Security Officers
  - Diplomatic Security Agents
  - Sponsor (Brian)
  - ARSOs
- Local Law Enforcement
- Public Safety (RIT PS)

Mission Budget/Cost
- Radios (Civilian Equivalent) cost ~$3,000 to ~$5,000
- Long Range Radio Repeaters (Civilian Equivalent) cost ~$30,000 to ~$40,000
- Short Range/Indoor Radio Repeaters (Civilian equivalent) cost ~$3,000 to ~$5,000
- Initial ~$3,000 from RDT&E for Testing & Benchmarking
  - Alpha Testing in One Location
  - Potential Funding from EOY ICAS Budget
- $400,000 from OPA to Outfit a Mid-Sized Embassy with Infrastructure and Radios
- $130,000 yearly from OMA for IT & Radio Engineers to Manage Network (2 Personnel)

Mission Achievement/Impact Factors
- 100% Reduction in the use of the 'E' in the PACE plan. (Runners)
- 100% reduction in radio dead zones.
- 50% reduction in retransmission due to noise/loss/attenuation.
- Elimination of talk-over.
- Measurable improvement in operation efficiency. (Time, Energy, Resources)
- Improved situational awareness for C2 and domain awareness for response personnel.

Strategyzer
strategyzer.com

Project Timeline

Week 1-6Week 11-14

Number of Pivot #2Number of MVP

Interviews: 19Number of Interviews: 50Number of

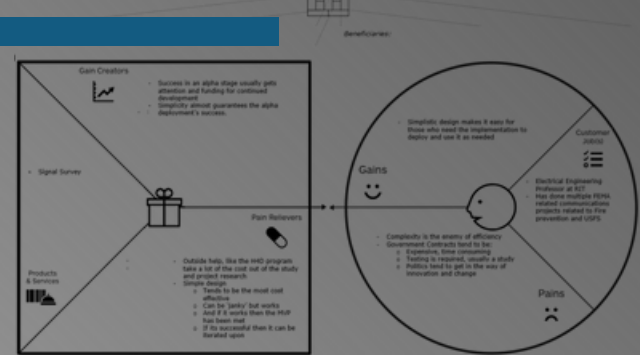Pivot #1Interviews: 30Pivot #3Interviews: 63

Week 7-10Week 15

Other Important VPCs

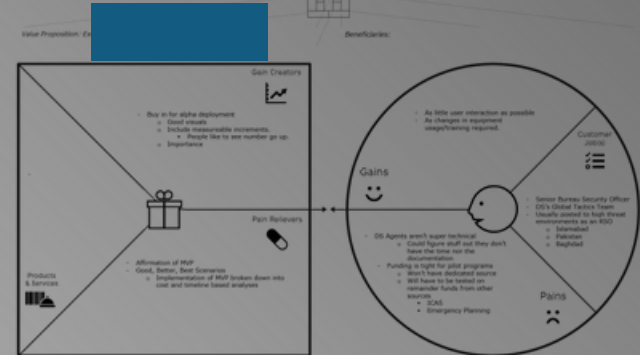**Chief Growth Officer, privatesector:**

- Working off the assumption of leadership buy-in:
  - Skill Set Necessity
  - Cost
  - Measurable Progress Checkpoints
- Provide Static Example
  - Use existing projects with similar scope
- Do not include references to:
  - Existing Contracts
  - SOW or Procurement
  - Obtaining Funding Sources

Week 15: Overview

Discovery:

- Good, Better, Best Scenarios
- 'Stay in Your Lane'

Challenges:

- Creating a Baseline
- Time Frameless Deployment
- Understandability

Trajectory:

-Future Implementations:
Transcription (Whisper AI), Translation (Navy Program), & Location Tracking (Radio Feature)

The Mission Model Canvas

Mission/Problem Description: Critical Communication
Designed By: DS-27
Date: 12/5/2023
Version: #14

Buy-in & Support
- Bureau of Diplomatic Security
  - EX
  - Diplomatic Security Service
    - Cyber & Technology Service
      - Sponsor (Brian)
    - International Programs
    - Training
- Internal Resource Management
- DoS Procurement
  - Sylinx
  - Motorola
  - Kenwood
- DoS IT & Infrastructure
- DoS RDT/RIMC
  - Maintenance
  - Spectrum Management
- DoS RPB
  - Spectrum Analysis
  - Spectrum Management
  - Signal Survey
  - Installation

Key Activities
- Define Specifications
  - P25-Compatible Voice Protocol
- Model Driven Implementation
  - Timeline & Phase Breakdown
  - Technical Specifications
  - Available Vendors/MPNs
  - Installation Guidance /Recommendations
  - Cost Based Analysis

Key Resources
- Software Developers
- Wircless Protocol Engineers
- International Spectrum & Law Experts
- Government Vendor Contacts

Value Propositions
- Better Audio Quality
- Operational Continuity
  - Communication Reliability
    - Improved Coverage
  - Better Domain Awareness
    - Command & Control
    - Response Personnel
- Use of Existing Technology
  - Use Deployed Devices
  - Use Existing Infrastructure
- Configurability
  - Spectrum Management
  - Encryption Method
  - Wireless Method
- Consolidation of Existing Communications Methods
- Improved Training
  - Equipment Use
  - Drill Efficiency

Buy-in & Support
- Internal Resource Management
  - Information Management Technical Specialist
- Bureau of Diplomatic Security
  - Regional Security Officers

Deployment
- Equipment Usability & Familiarization Training
- Internal Resource Management
  - Vendor Contract
  - Logistical Deployment

Beneficiaries
- Bureau of Diplomatic Security
  - Marine Security Guards
  - Regional Security Officers
  - Diplomatic Security Agents
  - Sponsor (Brian)
  - ARSOs
- Local Law Enforcement
- Public Safety (RIT PS)

Mission Budget/Cost
- EAC Radios cost $1,400-5,000 (OPA)
- Repeaters cost $30,000-$40,000 (OPA)
- Short Range Repeaters cost $3000-5000 (OPA)
- Initial ~$200,000 (RDT&E) for testing, benchmarking, and initial installation
  - Alpha test in one (non-HTA/HTP) location.
  - Potential funding from EOY ICAS Budget (discretionary spending)
  - Most of this is personnel funding for configuration and testing, less than $50,000 for new equipment
- $100,000 OPA to outfit mid-sized embassy as of 11/28/2023
- $75,000 on top of other OPA to outfit a mid-sized embassy with additional infra
  - Propagation studies already exist for most compounds, otherwise $10,000+ OMA
- Maintenance budget already existing within RIMC/RDT, potential small increase in OMA needed due to additional maintenance

Mission Achievement/Impact Factors
- 95% Reduction in the use of the 'E' in the PACE plan. (Runners)
- 95% reduction in radio dead zones within DoS compounds.
- 100% Reduction in retransmission due to noise/loss/attenuation.
- 100% Elimination of talk-over.
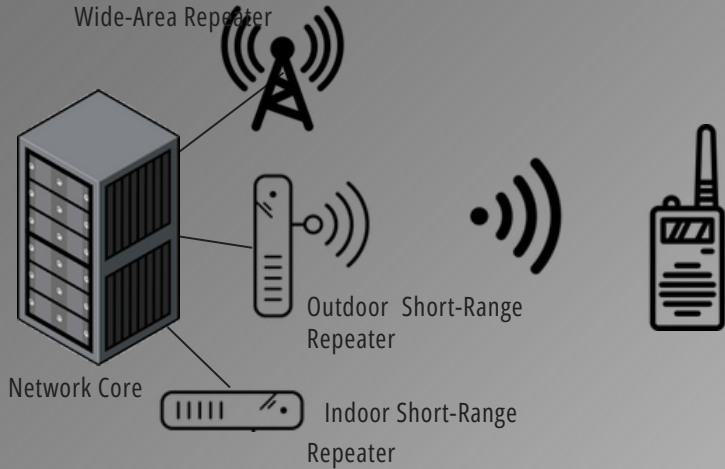- Measurable improvement in operation efficiency. (Time, Energy, Resources)

Strategyzer

Week 15: Minimum Viable Product

→ Disclaimer ←

Minimum Viable Product

Current Infrastructure

Wide-Area Repeater

Outdoor Short-Range Repeater

Network Core

Indoor Short-Range Repeater

- Wide-area repeaters (~100w)
- Duplexers
- Networking infrastructure
- Handheld radios

New Infrastructure
- Upgraded Networking Infrastructure
  ○ Extra network drops
    ○ Private network for duplexers & short-range repeaters
- Short-Range Repeaters
  ○ Outdoor
  ○ Indoor
- New Duplexers
    ○ May not be necessary, depends on current equipment

Takeaways:
-Short-range repeaters fill dead zones
-Duplexer & Network upgrades to support the short-range repeaters -No training for end users

Minimum Viable Product

Wide-Area Repeater

Outdoor Dead Zones

Minimum Viable Product

Wide-Area Repeater

Outdoor Dead Zones

Short-Range Repeater

New Outdoor Coverage

Minimum Viable Product

Indoor Dead Zones

Minimum Viable Product

Short-Range Repeater

New Indoor Coverage

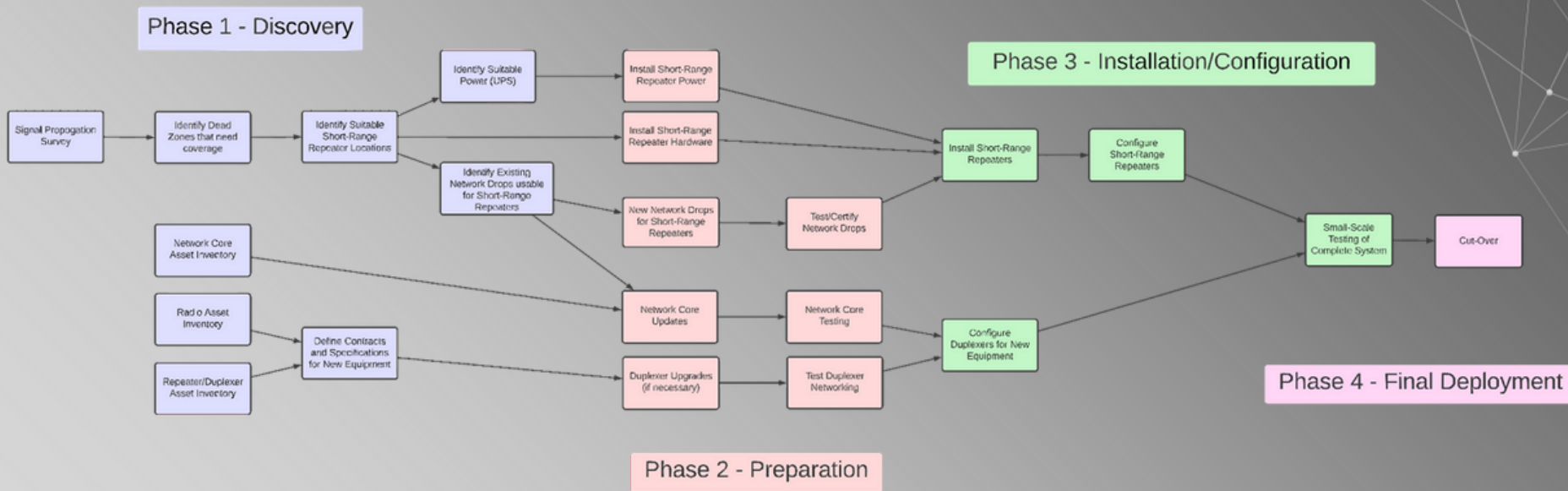# Minimum Viable Product

Wide-Area Repeater

Short-Range Repeater

Outdoor Dead Zones

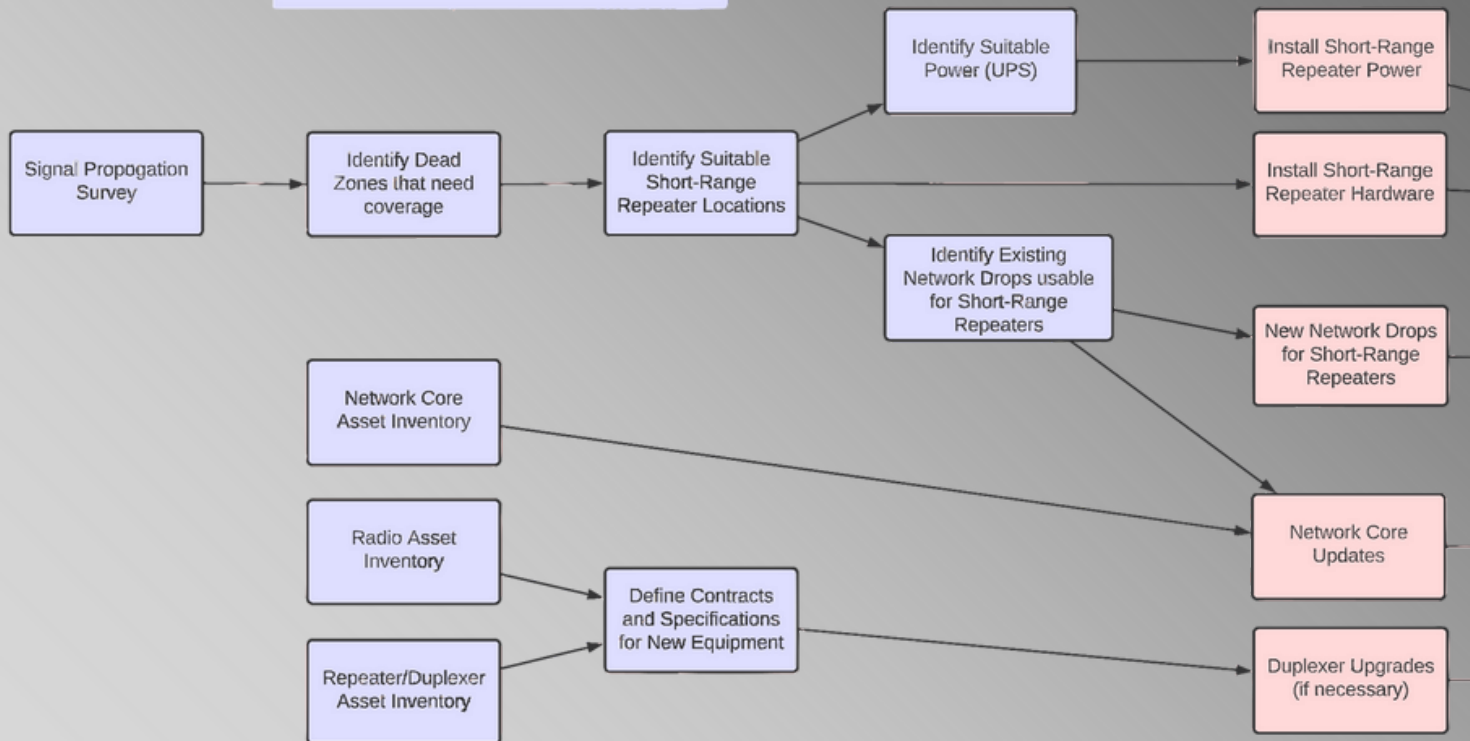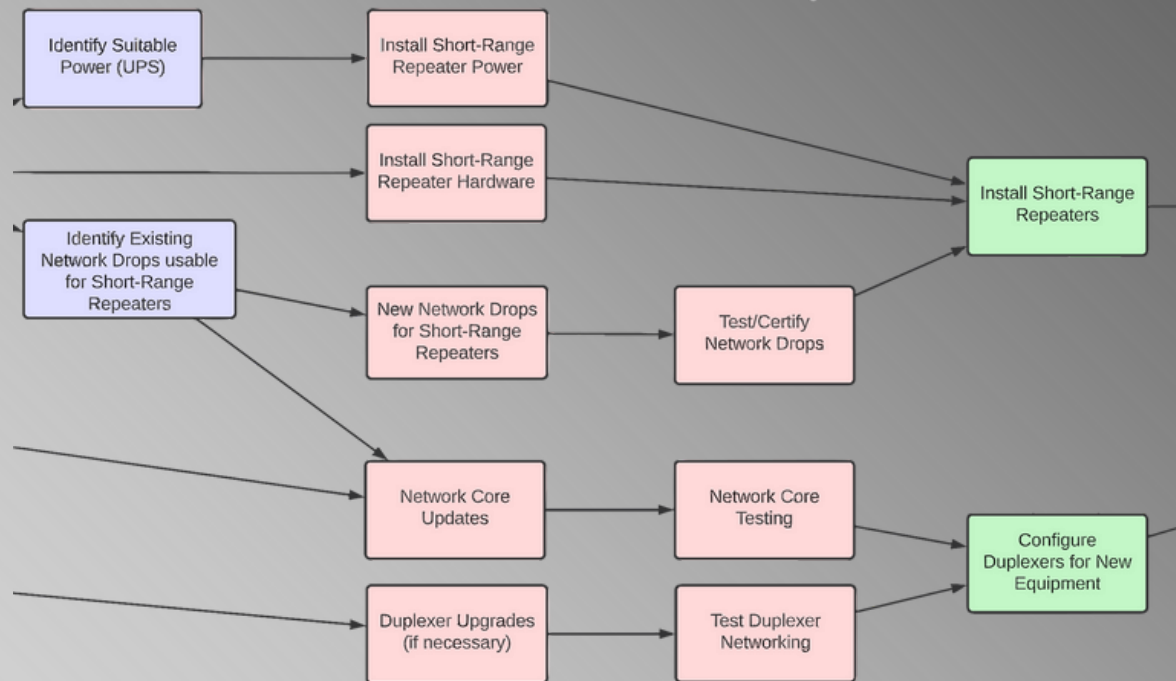New Indoor Coverage

New Outdoor Coverage

MVP: Phased Deployment

40

MVP: Phased Deployment

Phase 1 - Discovery

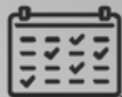Signal Propogation Survey → Identify Dead Zones that need coverage → Identify Suitable Short-Range Repeater Locations → Identify Suitable Power (UPS) → Install Short-Range Repeater Power

Install Short-Range Repeater Hardware

Identify Existing Network Drops usable for Short-Range Repeaters → New Network Drops for Short-Range Repeaters

Network Core Asset Inventory

Radio Asset Inventory → Define Contracts and Specifications for New Equipment

Repeater/Duplexer Asset Inventory

Network Core Updates

Duplexer Upgrades (if necessary)

MVP: Phased Deployment

MVP: Phased Deployment

Phase 3 - Installation/Configuration

Install Short-Range Repeaters → Configure Short-Range Repeaters

Test/Certify Network Drops

Network Core Testing

Configure Duplexers for New Equipment

Test Duplexer Networking

Small-Scale Testing of Complete System → Cut-Over
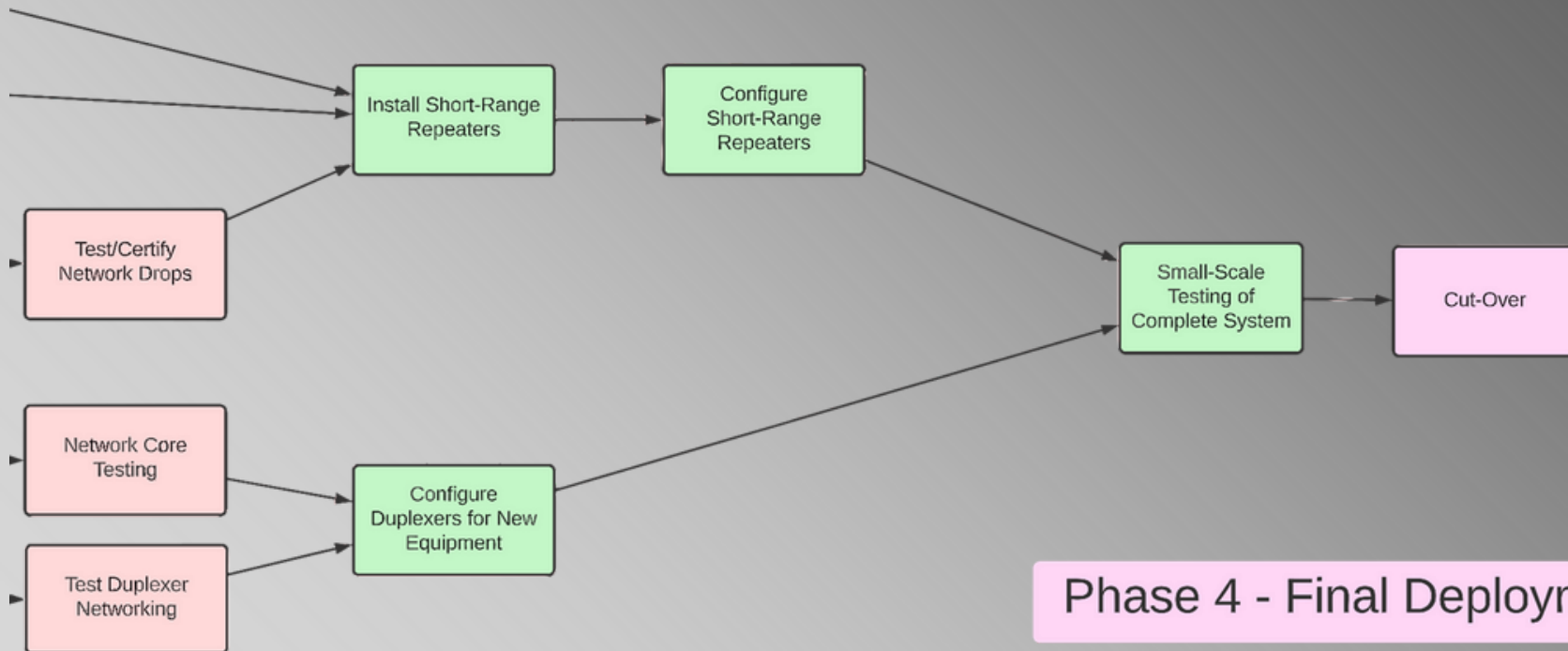
Phase 4 - Final Deployment
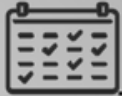
MVP: Cost Breakdown

Item Number Short-Range		Unit Price	Total	Notes
Repeaters	9	$3,599	$32,391	Motorola SLR1000
Hardware	9	$199	$1,791	Mounting Brackets, Bolts, etc.
Power Supply	9	$299	$2,691	
UPS	3	$259	$777	
Network Switch	1	$1,199	$1,199	
Mini-Switch	4	$59	$236	
Network Cabling	1	$250	$250	1000ft roll
Network Accessories	1	$100	$100	Keystone jacks, patch cables, etc.
Total			$39,435	

Panama City Embassy
- 9x Short-range repeaters
- Up-to-date network core
- Up-to-date duplexers
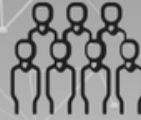
Beneficiary Discovery
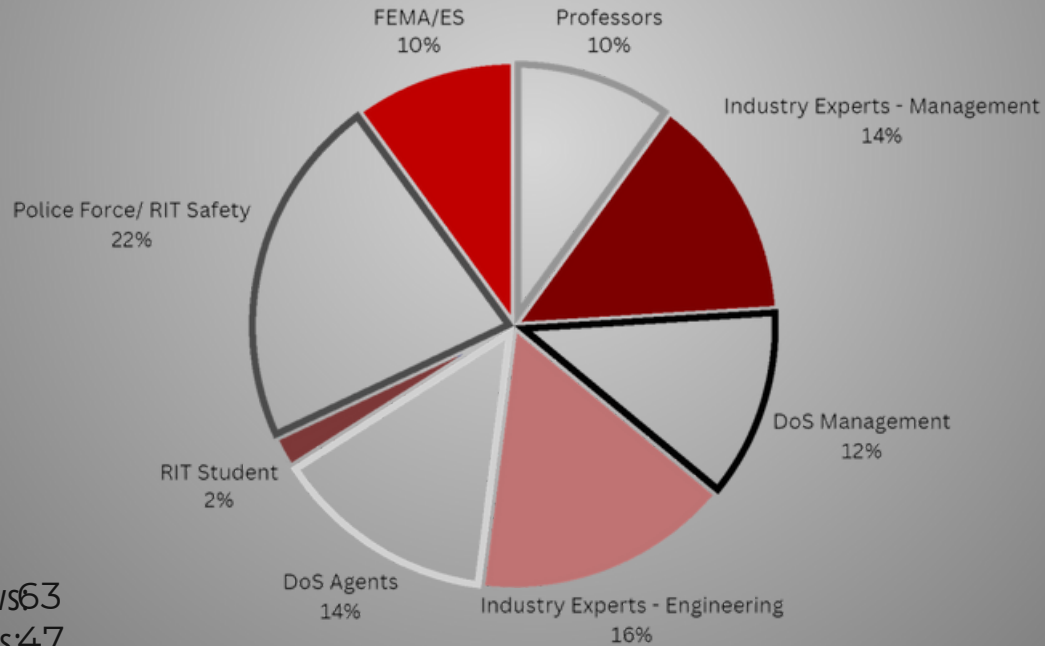
Total Interviews: 63
Unique Interviews: 47

Project Support

Brian
Rapier

DoS DS Sponsor

Frank
Reyes

Mentor

Rob
Mennell

Mentor

Project Support

Dr. Jim
Santa

H4D Professor

Suvam
Barui

Graduate
Assistant

⑦Questions?