TEAMATHENA

BY: KATHERINE LIAO, GISELLE CARAMES, DYLAN CHENG, NATHAN TOSOC, JEFFREY THI, MEGAN SWEENEY

Interview Count: 90

TASK: DEVISE A SOLUTION TO AID IN FPV AND SHAHED DRONE MITIGATION AND INTERCEPTION.

Giselle Carames
Cogsci ML

Dylan Cheng
Data Science

Jeffrey Thi
Math-Computer Science

Nathan Tosoc
Computer Science

Megan Sweeney
Communication

Katherine Liao
Political Science

HOW DID WE START TACKLING OUR PROBLEM STATEMENT?

MMC V.1

Key Partners

Mentor & Problem Sponsor: Ping Wang @ Forward Horizon Group

-BRAVE 1
-Ukrainian Armed Forces
-Ministry of Digital Transformation

Key Activities

-Research of current problem with countering drones
-Research on how drones operate

Key Resources

-Advisors who know how drones operate & countermeasures
-Builders who will implement our ideas
-Users of the technology

Value Propositions

Preventing drone units from reaching their targets in Ukraine.

Buy-In & Support

-Problem Sponsor
-Maintaining a relationship of constant communication

Deployment

-Unknown until research progresses

Beneficiaries

-Ukraine Ministry of Defense
-Ukraine Army
-Private sector defense companies

Mission Budget/Cost

-Unknown as of now
-Expected to calculate budget / cost by week 3 or 4

Mission Accomplishment/Impact Factors

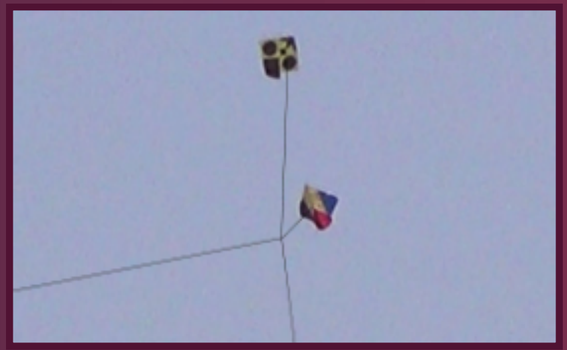
Enforcing an effective anti-drone system for preventing successful attacks by suicide drones.

MVP EVOLUTION

WEEK 3

WEEK 4

WEEK 5



WEEK 6

WEEK 7

THROUGH THE 90 INTERVIEWS WE CONDUCTED, WE WERE ABLE TO HONE DOWN OUR MMC.

MMC FINAL

Key Partners

Mentor & Problem Sponsor: Ping Wang @ Forward Horizon Group

-BRAVE 1
-Ukrainian Armed Forces
-Ministry of Digital Transformation

Key Activities

-Interview Ukrainian front-line soldiers, anti-drone startups
-Research more into detection system options (acoustic & RF)

Key Resources

-Advisors who know how drones operate & countermeasures
-Builders who will implement our ideas
-Users of the technology

Value Propositions

Enhance detection systems to provide better range assessment for incoming drones.

Improve Ukrainian National Defense against FPV drones.

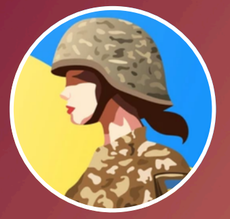
Buy-In & Support

-Problem Sponsor, Ping Wang
-Expects constant updates, communication

Deployment

-Connections in Eastern Europe have offered to assist us in testing and deploying MVP on the front line.

Beneficiaries



Ukrainian Front-line Soldier

Ukrainian Military Commander

Mission Budget/Cost

Average cost per unit for RF signal: $555
Average cost per unit for accoustic: $650

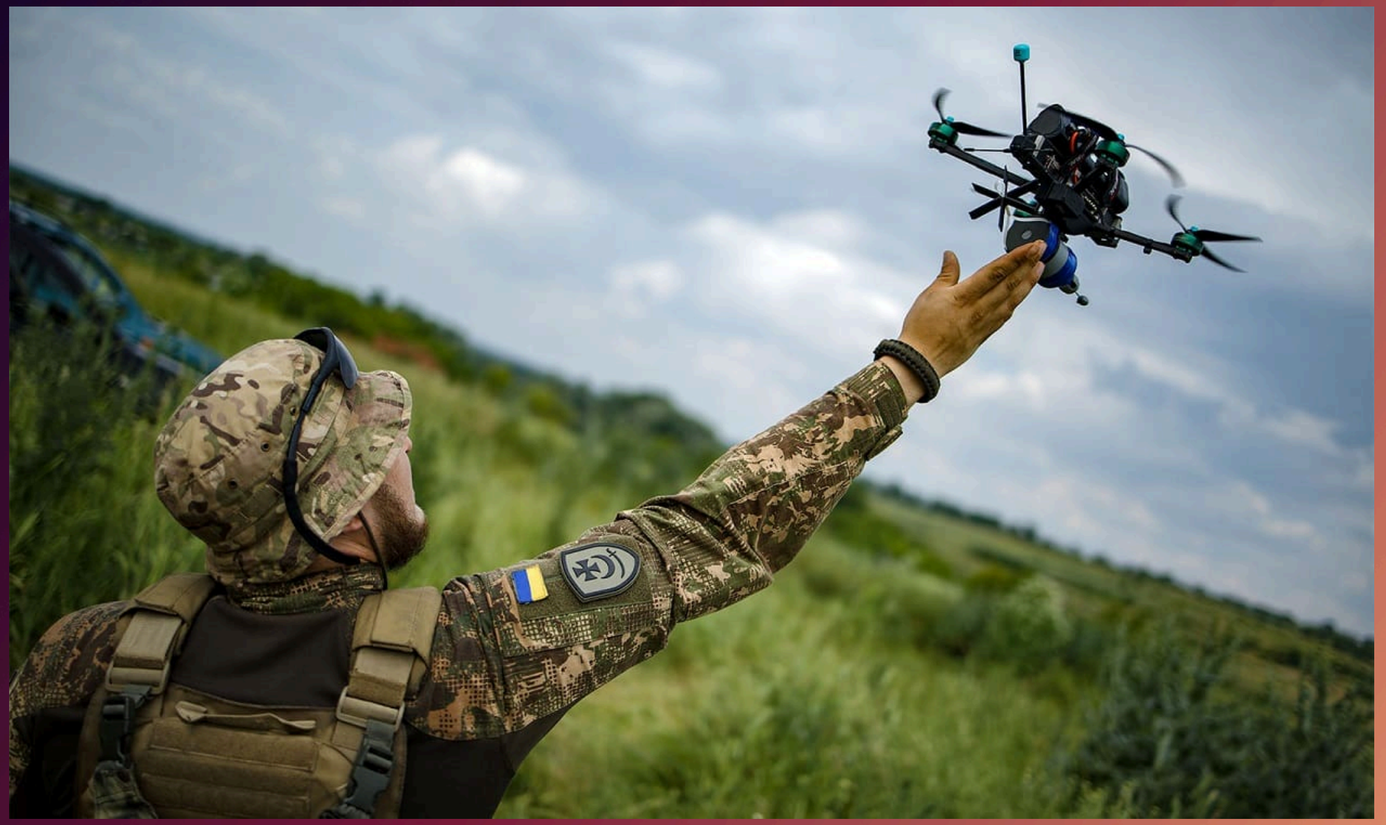
Mission Accomplishment/Impact Factors

-Enforcing an effective anti-drone system for preventing successful attacks by suicide drones (FPV)
-They would be the ones paying for experiments

WHAT EXACTLY ARE WE ADDRESSING?

PROBLEM STATEMENT.

As the use of drone systems evolves in the Russia-Ukraine war, Ukrainian forces are having issues with determining the **distance** of the approaching **FPV drones**.



WHAT IS THE SOLUTION WE ARE PROPOSING?

PROPOSED SOLUTION

- MULTI-SENSOR DETECTION SYSTEM (RF & ACOUSTIC)
- FIBER-OPTIC CONNECTED
- CARRIED AND DROPPED BY FPV DR

MVP SPECIFICATIONS

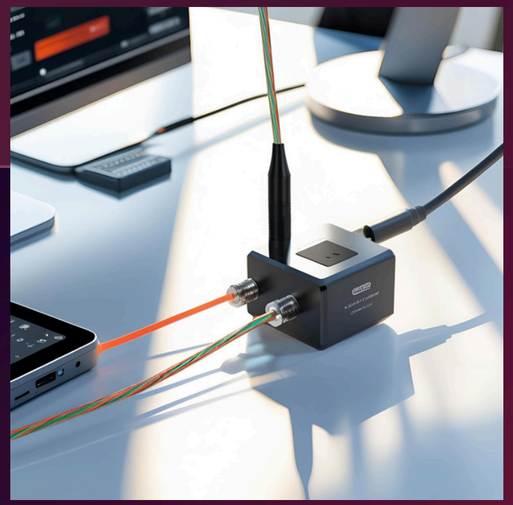
ACOUSTIC SENSOR

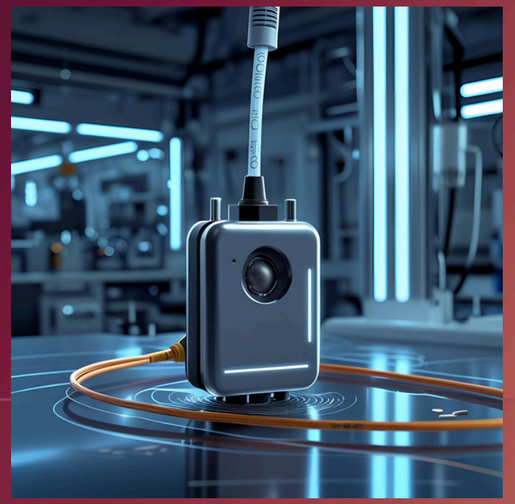
Features

1. Frequency (20Hz - 20kHz)
2. High sensitivity & low self-noise
3. Omnidirectional
4. Durable

Potential issues

1. Exterior noises/disruptions
2. Timely Setup
3. Small range





RF SENSOR

Features

1. Omni-directional antenna
2. Covers frequency range of 900MHz - 5.8GHz
3. Size/Weight considerations
4. Passive

Potential issues

1. Line of Sight
2. Limited vertical detection
3. Terrain / Obstruction

WHO BENEFITS FROM THIS?

BENEFICIARIES

UKRAINIAN FRONT-LINE SOLDIER

Background: Experienced in serving on the front lines of Ukraine defense.

- Regularly encounters FPV drones

Main Priority: Neutralize Drone Threats

- Consistent, effective, efficient

Needs: Practical solution for detecting and disabling FPV drones.

UKRAINIAN MILITARY COMMANDER

Background: Oversees frontline operations and strategic planning.

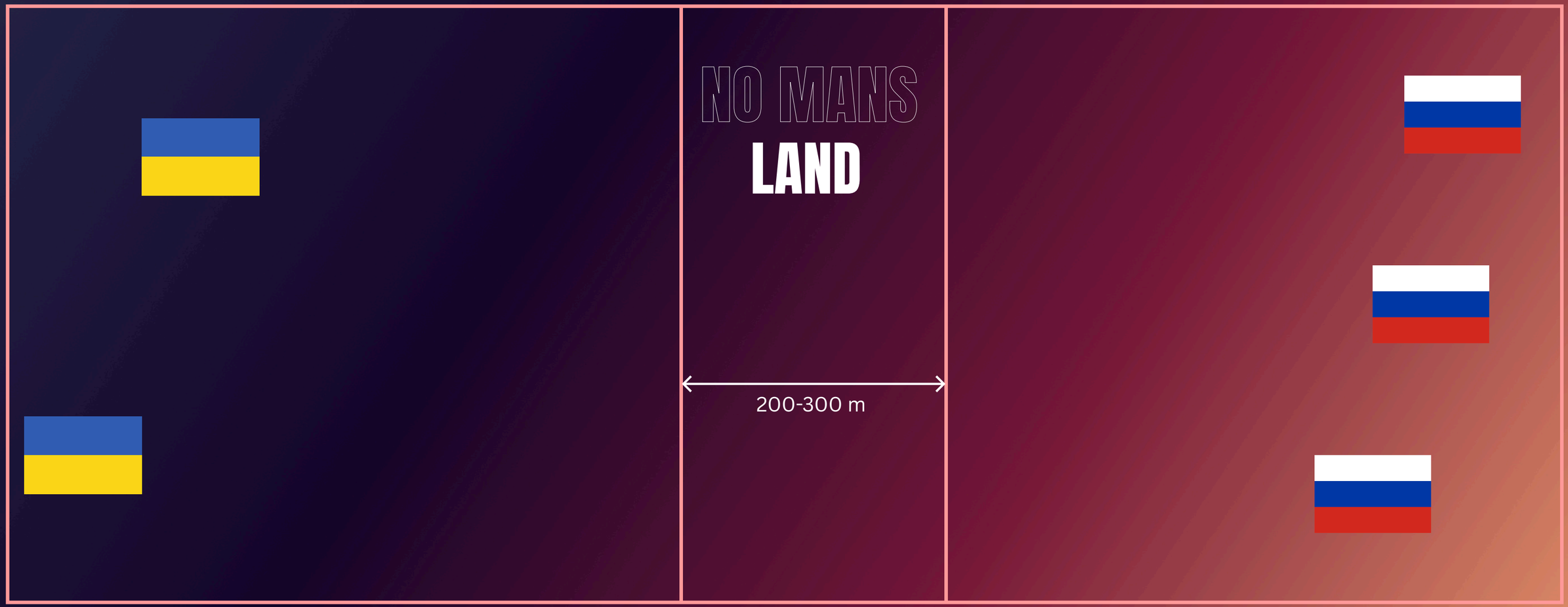
Main Priority: National Defense

- Enhance countermeasures

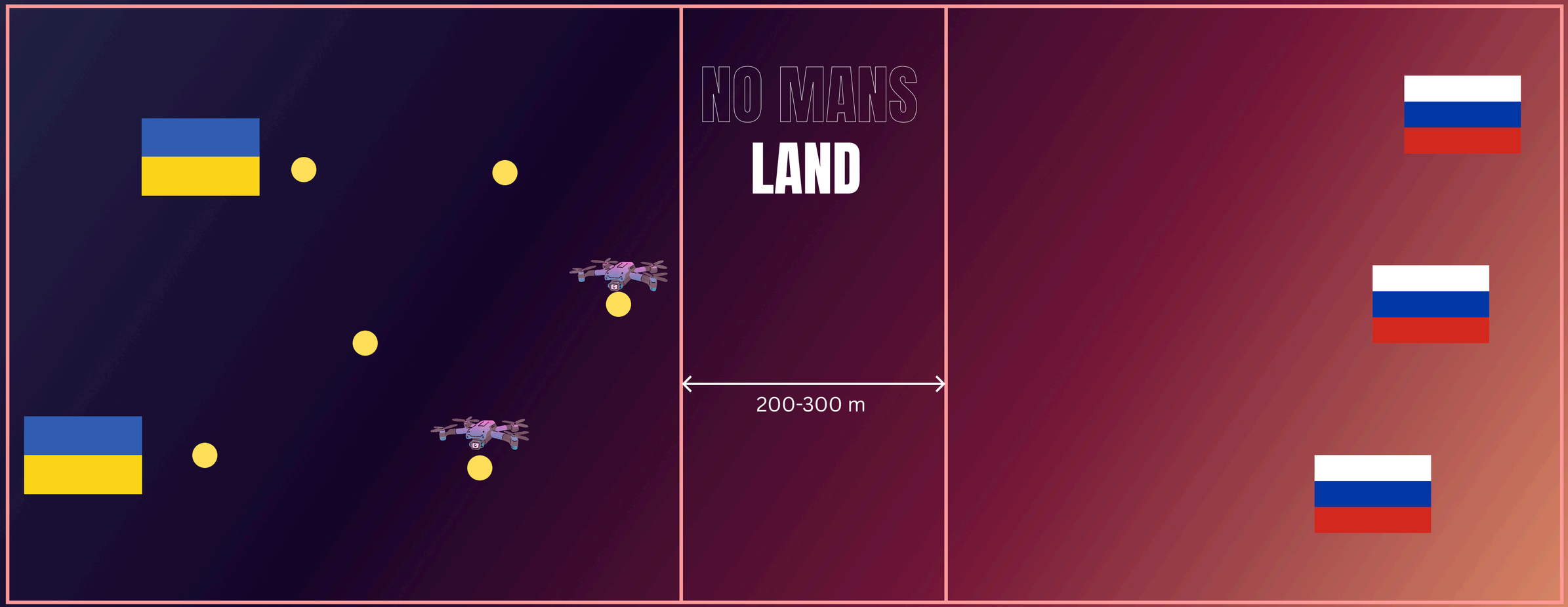
Needs: Effective counter for enemy FPV drone, to protect soldiers and friendly FPV pilots.

UNDERSTANDING OF THE CURRENT BATTLEFIELD.

BATTLEFIELD



BATTLEFIELD



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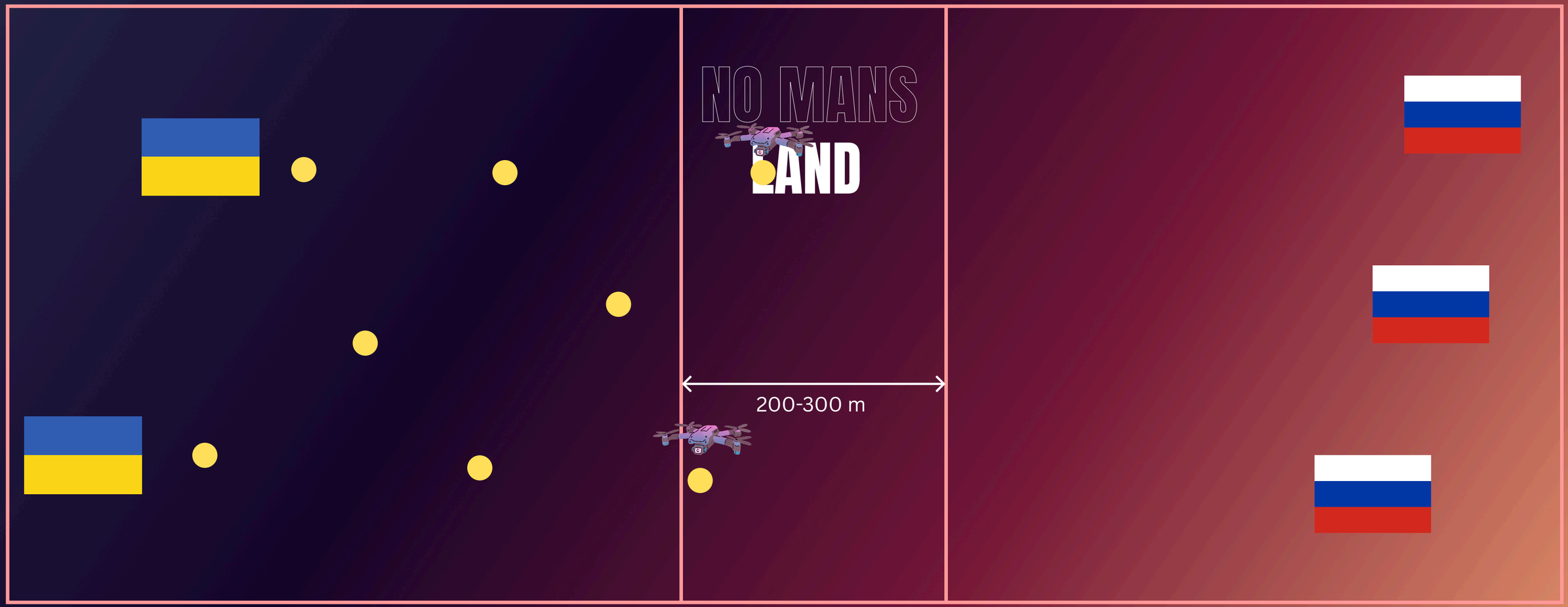

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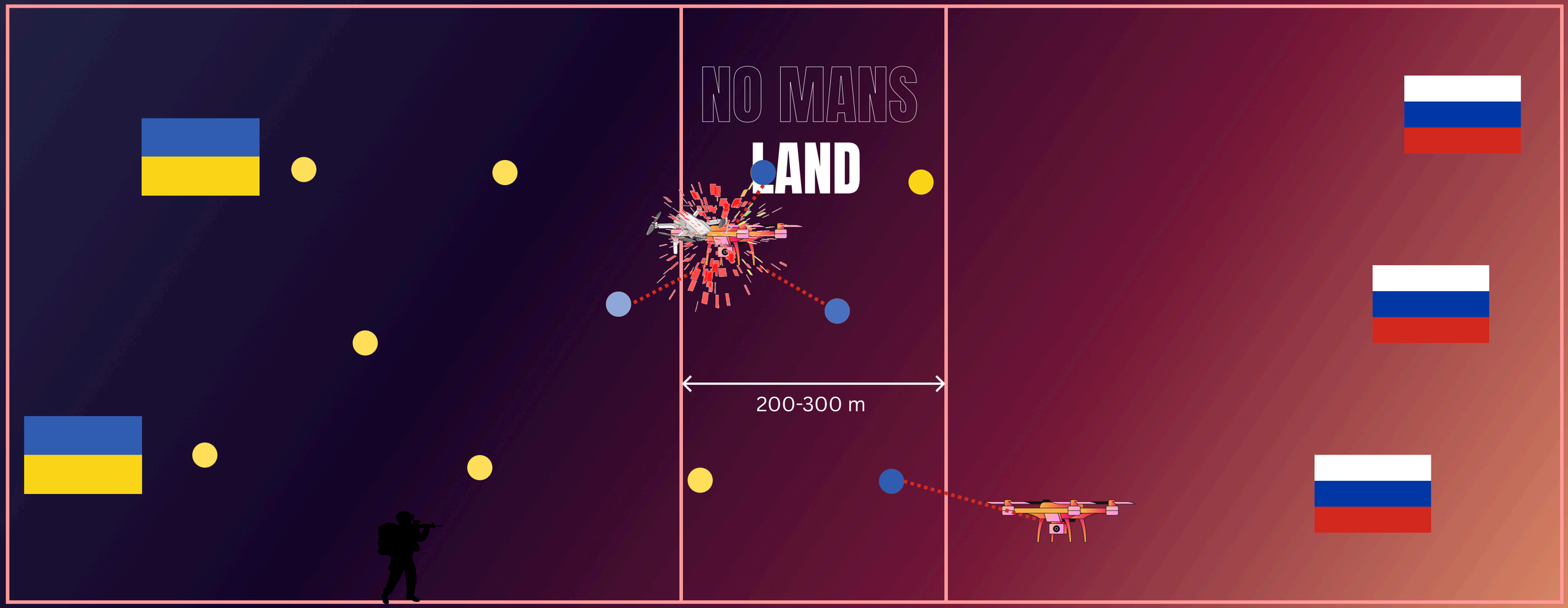

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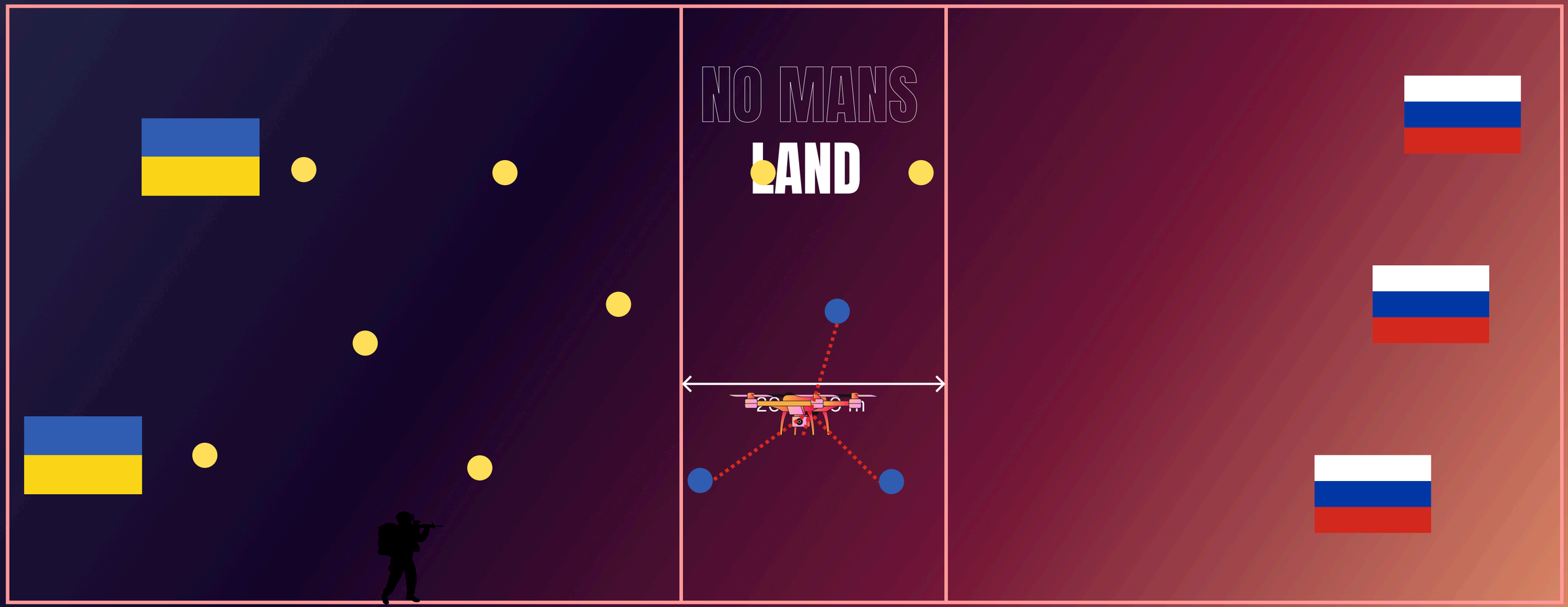

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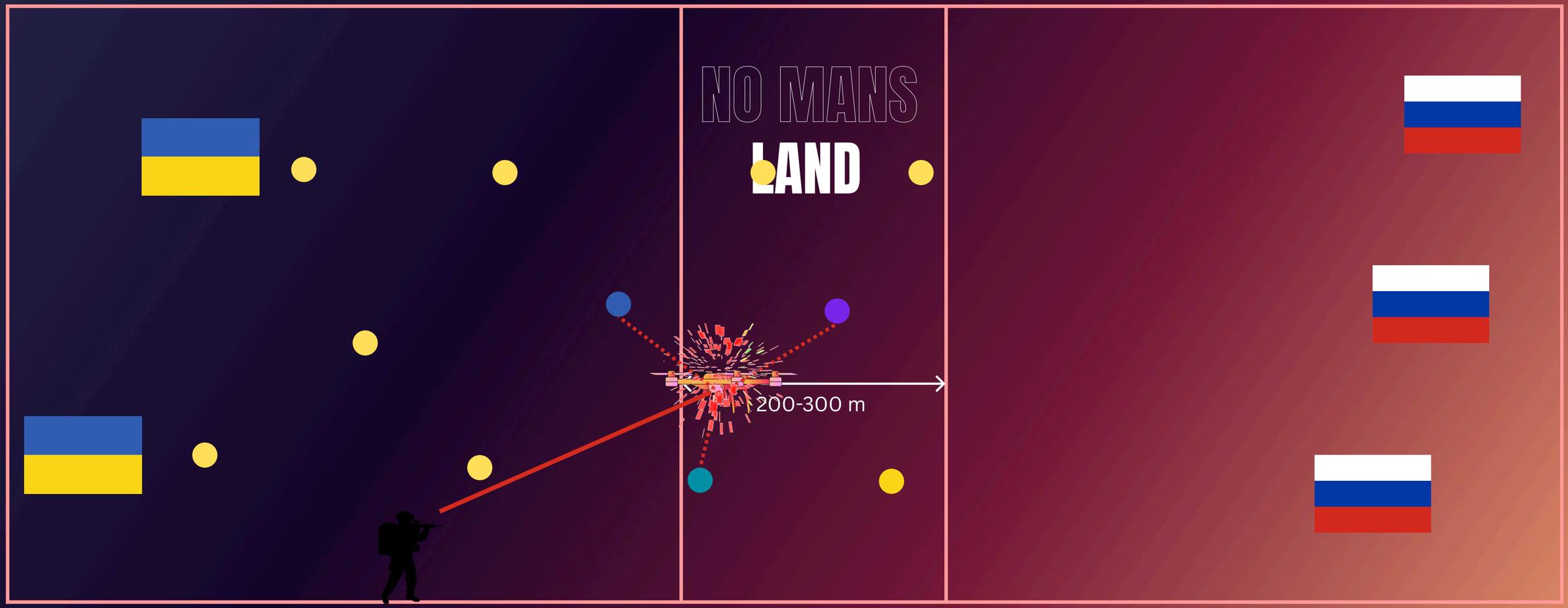

NOW THAT WE UNDERSTAND THE CONTEXT, HOW DO WE MOVE FOWARD WITH R&D?

R&D STEPS

Research and Development

GATHERING MATERIALS - $12000 (2-14 days)

Collaborate with government contractors and manufacturers to source materials.

DEVELOPING PRODUCT - $1000 (2-7 days)

Building the RF and acoustic sensor, utilizing references from already-made products.

TESTING PRODUCT- $5000 (5-7 days)

Test product with FPV drones (can set up behind the zero-line) to ensure that sensors can detect + transmit information back.

TOTAL COST - $18,000

HERE'S A BREAKDOWN OF THE COSTS.

CUSTOM SENSORS COST

ACOUSTIC SENSOR

Component	Approximate Cost
Omnidirectional Mic	$400
Acoustic Vents	$50
Micocontroller/SBC	$75
ADC + preamp board	$30
Fiber Converter Module	Free
Software (ML)	Free
Total	$555

RANGE: 100-300M

RADIO FREQUENCY SENSOR

Component	Approximate Cost
Software Defined Radio	$350
Omnidirectional Antenna	$60
Low-Noise Amplifier	$35
Embedded Controller	$55
Weatherproof Enclosure	$50
Power	$100
Fiber Optic Converter	Free
Software (ML)	Free
Total	$650

RANGE: 500-1000M

CUSTOM SENSORS COST

ACOUSTIC SENSOR

Component	Approximate Cost
Omnidirectional Mic	$400
Acoustic Vents	$50
Micocontroller/SBC	$75
ADC + preamp board	$30
Fiber Converter Module	Free
Software (ML)	Free
Total	$555

CUSTOM SENSORS COST

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Fiber Optic Converter	Free
Software (ML)	Free
Total	$650

WHAT HAS OUR JOURNEY BEEN LIKE?

Project Timeline

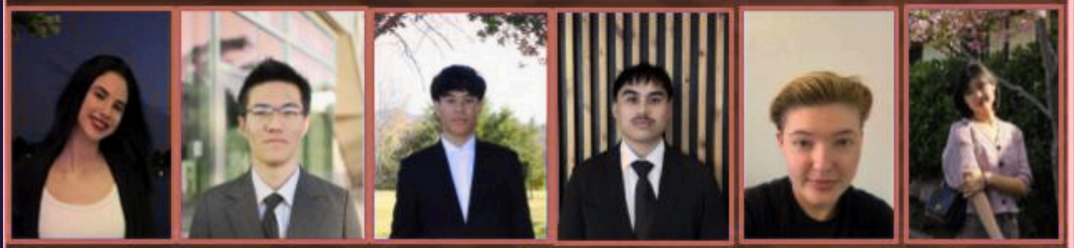
LOOKING FORWARD

We will be proposing our solution to Ukrainian forces and, if it is accepted, looking for builders who are capable and knowledgeable regarding sensor hardware.

INNOVATING 4 NATIONAL SECURITY

UC San Diego

Our Team



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Problem Statement

Original Problem Statement: As the use of drone systems evolves in the Russia-Ukraine war, Ukrainian forces are having issues **identifying**, **targeting**, and **downing FPV** and **Shahed** drones.

Final Problem Statement: As the use of drone systems evolves in the Russia-Ukraine war, Ukrainian forces are having issues with determining the **distance** of approaching **FPV** drones.

MVP

Multi-Sensor Detection System

- -RF & acoustic sensors
- -Connected by fiber-optic cables
- -Omni-directional antenna

Future Prospects

Benefits

- -FPV mitigation
- -Troop safety
- -Defensive advantage
- -Easy deployment
- -Limited training
- -Inexpensive

Looking

- -Operational validation
- Compliance & regulation verification
- -Industry partnerships