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Project Statement: Autonomous Kinetic Point Defense System (AKPDS) Testbed

Mission Objective:

To design, develop, and evaluate a cyber-physical testbed capable of autonomous threat detection, discrimination, and kinetic neutralization. This project serves as a proof-of-concept for a layered defense system, integrating real-time computer vision, predictive kinematics, and hardware-level cybersecurity to model the complexities of National Missile Defense.

System Capabilities and Functional Requirements:

1. Autonomous Acquisition: Perform real-time, high-frame-rate tracking of a dynamic target within the sensor's Field of View (FOV).
2. Target Discrimination: Implement Non-Cooperative Target Recognition (NCTR) to differentiate between hostile tracks and friendly assets based on visual signatures.
3. Kinematic Estimation: Quantify target location and 3D trajectory through multi-sensor data fusion.
4. Predictive Intercept Logic: Develop and implement algorithms to calculate firing solutions that account for target velocity, target location, and projectile flight time.
5. Precision Actuation: Execute automated, multi-axis platform aiming through low-level hardware control and real-time guidance laws.
6. Engagement Execution: Initiate a kinetic interceptor launch upon validation of a high-confidence firing solution.
7. Real-Time Performance: Optimize system-wide latency to ensure threat neutralization occurs before the target exits the engagement zone (ground impact).
8. Cyber-Resilient Command & Control (C2): Incorporate a fail-safe "Kill Switch" secured by a cryptographic key to prevent unauthorized system override or malicious spoofing.
9. Mission Telemetry & Logging: Maintain data integrity through the comprehensive logging of sensor telemetry and engagement decisions for post-mission diagnostic analysis.