

# PATROL: Pavement & Airfield Tactical Robotic On-site Locator

Develop autonomous, AI-enabled quadruped robotic systems that continuously detect and diagnose airfield hazards (e.g., foreign object detection (FOD) and pavement anomalies) in real-time, delivering GPS-tagged, classified alerts with actionable recommendations to radically enhance safety, efficiency, and operational continuity.

## Problem Definition

FOD are a persistent, high-cost threat to aviation safety.

**\$22.7 Billion**  
Annual Estimated Cost  
to Global Aviation

Current manual and automated inspections are inefficient, costly, and fail to provide the continuous, real-time monitoring needed.

## Technical Approach

### Phase 1

Sensor integration & baseline AI development.  
*Metric:*  $\geq 85\%$  detection accuracy (controlled).

### Phase 2

Prototype & human-machine interface development.  
*Metric:*  $\geq 90\%$  detection,  $\geq 75\%$  classification (field).

### Phase 3

Extended pilot testing at Christman Airfield.  
*Metric:*  $\geq 90\%$  detection,  $\geq 80\%$  classification (stress conditions).

### Phase 4

Final system refinement & full demonstration.  
*Metric:* Robust, ready-to-deploy prototype.

## Impact & Benefits

**Safety:** Reduced FOD-related risks for aircraft & personnel. Reduced human exposure to hazardous environments.

**Operational Efficiency:** Increased runway and taxiway availability by minimizing downtime for manual inspections and runway closures. Proactive maintenance and optimized scheduling.

**Cost Savings:** Prevent costly aircraft repairs from engine ingestion or tire damage. Lower long-term infrastructure maintenance costs through early detection.

**Scalability:** Broader applications across transportation systems (e.g., seaports).

## Commercialization & Transition Plan

**Scalable Pathway:** 4-year, \$300K phased development using off-the-shelf, affordable hardware to ensure cost-effective deployment. Modular design enables rapid transition and scale.  
**Testbed:** CSU's Christman Airfield, a decommissioned airfield providing a controlled yet realistic environment for diverse data collection, training, and extended field testing.

**End-Users:** Airports (regional to major), airlines, air traffic control.