SBIR PHASE I APPLICATION

Intelligent Home Protection (I.H.P.)

Multi-Peril Correlation Platform for Residential Loss Prevention

Applicant: Cielo Azul LLC

Principal Investigator: Eric De Loera

Address: 4801 N Blackwelder Ave, Oklahoma City, OK 73118

Requested Amount: $274,363

Project Duration: 6 Months

Target Agencies: DOE / NSF / DHS

SECTION 1: TECHNICAL ABSTRACT

The Intelligent Home Protection (I.H.P.) platform addresses the $150 billion annual property insurance loss crisis through an innovative multi-peril correlation monitoring system. Unlike existing single-peril solutions (water-only, fire-only), I.H.P. integrates five sensor modules—water, electrical, structural, HVAC, and environmental—into a unified Matter 1.4-compliant platform that detects cross-peril failure cascades before catastrophic loss occurs. Current competitors achieve 70-99% claim reduction for individual perils but miss correlated failures (e.g., electrical faults causing water pump failures, HVAC strain indicating electrical degradation). I.H.P.'s proprietary correlation engine analyzes multi-sensor data streams to predict compound failures, reducing false positives while increasing actionable prevention alerts. Phase I will develop and validate the correlation algorithm using simulated multi-peril scenarios, design the sensor module architecture using Nordic nRF5340 MCUs with Thread mesh networking, and establish baseline detection accuracy metrics. Successful completion positions I.H.P. for Phase II hardware prototyping and pilot deployment with insurance carrier partners. The platform's Tesla Powerwall integration capability and Matter 1.4 compliance enable seamless adoption within the 5,000+ device smart home ecosystem, addressing a market projected to reach $13.47 billion by 2033.

SECTION 2: IDENTIFICATION AND SIGNIFICANCE OF PROBLEM

2.1 The Problem: Annual Property Losses

Metric	Annual Value
Total Property Insurance Claims	$150 billion
Water Damage Claims	$15 billion
Fire Damage Claims	$13 billion
Water Damage Incidents	14,000 per day
House Fires	344,600 annually
Average Water Damage Claim	$14,000 - $15,400

2.2 Current Solution Limitations

Existing smart home protection solutions address only single perils:

Competitor	Peril Coverage	Limitation
Flo by Moen	Water only	Misses electrical-water correlations
Ting / Whisker Labs	Electrical only	No water or structural monitoring

LeakBot	Water only	No predictive capabilities
Phyn	Water only	No multi-peril correlation
Nest Protect	Smoke/CO only	Reactive, not preventive

2.3 The Gap

No existing platform correlates multiple perils to detect compound failure cascades. Example: An HVAC compressor drawing excess current (electrical anomaly) may indicate bearing failure, which can cause refrigerant leak (environmental), which can lead to water condensation backup (water damage), which can cause foundation moisture (structural). I.H.P. is the first platform designed to detect these cross-peril correlations before catastrophic loss occurs.

2.4 Market Validation

Competitor results prove market demand:

- Flo by Moen: 96% reduction in water claims (LexisNexis study)
- Ting: 80% of electrical fires predicted and prevented
- LeakBot: 70% reduction in water damage claim costs
- Phyn: 99% less likely to experience water leak claim

Insurance carriers actively investing in smart home loss prevention:

- Nationwide: Ting, LeakBot, Phyn partnerships
- State Farm: ADT, Ting partnerships
- Liberty Mutual: Flo by Moen partnership
- USAA, Chubb, Allstate: Multiple smart home programs

SECTION 3: TECHNICAL OBJECTIVES

3.1 Phase I Objectives

Obj	Description	Success Metric
O1	Develop multi-peril correlation algorithm	85%+ accuracy on 3+ compound scenarios
O2	Design sensor module architecture	Complete schematics for 5 modules
O3	Validate Matter 1.4 protocol integration	Communication with 2+ Matter controllers
O4	Establish detection baseline	<5% false positive, <30s latency
O5	Complete insurance data integration spec	API specification document

3.2 Sensor Module Architecture

Module	Sensors	Key Measurements
WTR-X1 (Water)	Pressure, flow, moisture	PSI, GPM, humidity %
ELC-X1 (Electrical)	Arc fault, power quality	Voltage, current, harmonics
STR-X1 (Structural)	Accelerometer, tilt	Vibration, settlement
HVC-X1 (HVAC)	Current, temperature	Compressor health, efficiency
ENV-X1 (Environmental)	Smoke, CO, temp, humidity	PPM, °F, RH%

3.3 Technical Approach

Hardware Platform: Nordic nRF5340 dual-core MCU with dedicated application and network processors. Thread mesh networking provides resilience and self-healing connectivity. Matter 1.4 native compliance ensures interoperability with Apple HomeKit, Google Home, Amazon Alexa, and Samsung SmartThings. **Correlation Algorithm:** Multi-sensor data fusion using time-series analysis with machine learning models for anomaly correlation. Rule-based logic handles known failure cascades while ML detects novel patterns. Confidence scoring prioritizes actionable alerts. **Power Design:** Ultra-low-power operation targeting 3+ year battery life for wireless sensors. Solar charging option for outdoor modules.

SECTION 4: WORK PLAN AND SCHEDULE

4.1 Phase I Timeline (6 Months)

Month	Tasks	Deliverables

1-2	Algorithm design, literature review, failure mode analysis	Technical specification document
3-4	Algorithm development, simulation environment setup	Working correlation engine (software)
5	Hardware architecture design, component selection	Sensor module schematics
6	Integration testing, Matter 1.4 validation, reporting	Final report, Phase II proposal

4.2 Milestones

Milestone	Month	Success Criteria
M1: Algorithm Spec Complete	2	Documented correlation logic for 10+ failure scenarios
M2: Simulation Environment	3	Functional test bed for multi-sensor data
M3: Correlation Engine v1.0	4	85%+ detection accuracy on test data
M4: Hardware Design Complete	5	PCB schematics for all 5 modules
M5: Matter Validation	6	Successful interop with Apple/Google/Amazon

SECTION 5: COMMERCIALIZATION PLAN

5.1 Market Opportunity

Segment	2024 Value	2033 Value	CAGR
Smart Home Insurance	$3.67B	$13.47B	18.25%
Smart Home Security	$35.02B	$145.54B	15.31%
Total Home Insurance	$234.6B	$576B	7.6%

5.2 Target Customers

Primary: Insurance Carriers

Tier 1 (Already Investing): Nationwide, State Farm, Liberty Mutual, USAA, Chubb

Tier 2 (Open to Partnerships): Allstate, American Family, Farmers, Amica

Tier 3 (Specialty): PURE, VYRD, Hippo, SageSure

Secondary: Homeowners (Direct-to-Consumer)

94 million US households with security systems. 50%+ homes with security cameras.

Tertiary: Contractors (LUXX BUILDZ Tech Platform)

Multi-job site monitoring, labor/material tracking, Procore/Buildertrend integration.

5.3 Business Model

Revenue Stream	Model	Target Price
Hardware Sales	One-time purchase	$500-800 per home
Monitoring Subscription	Monthly recurring	$15-25/month
Insurance Data Licensing	Per-home fee from carriers	$3-5/month per home
Contractor Platform	SaaS subscription	$99-299/month

5.4 Competitive Advantages

Feature	Competitors	I.H.P.
Multi-peril correlation	✗	✓
Insurance-grade data	✗	✓
Matter 1.4 native	Partial	✓

Tesla integration ready	✗	✓
Contractor platform	✗	✓

SECTION 6: BUDGET SUMMARY

Phase I Budget (6 Months) - Total: $274,363

Category	Amount	% of Total
PERSONNEL	$150,000	55%
Principal Investigator	$60,000	
Hardware Engineer (contract)	$50,000	
Software Engineer (contract)	$40,000	
EQUIPMENT	$30,000	11%
Dev kits, components	$15,000	
Test equipment	$10,000	
Prototyping materials	$5,000	
SUPPLIES	$10,000	4%
CONSULTANTS	$25,000	9%
Matter/Thread expert	$15,000	
Insurance industry advisor	$10,000	
OTHER DIRECT COSTS	$20,000	7%
Cloud computing	$8,000	
Software licenses	$7,000	
Travel (conferences)	$5,000	
INDIRECT COSTS	$39,363	14%
TOTAL	**$274,363**	**100%**

SECTION 7: AGENCY-SPECIFIC TARGETING

7.1 DOE (Department of Energy) - PRIMARY TARGET

Topic Area: Buildings / Smart Grid / Energy Efficiency

Pitch Angle: I.H.P. HVAC monitoring reduces energy waste by detecting inefficient operation. Tesla Powerwall integration enables grid-responsive home energy management. HVAC accounts for 50%+ of home energy use; early detection = 10-30% energy savings.

7.2 NSF (National Science Foundation)

Topic Area: IoT / Cyber-Physical Systems / Machine Learning

Pitch Angle: Novel multi-sensor correlation algorithm using ML for predictive failure detection. First platform to correlate 5 perils in residential setting. Broader impacts: home safety, insurance affordability.

7.3 DHS (Department of Homeland Security)

Topic Area: Critical Infrastructure / Resilience

Pitch Angle: Residential resilience against fire, water, electrical hazards. Mass casualty prevention through early fire/CO detection. I.H.P. provides 10-15 minute early warning vs. smoke detectors.

SECTION 8: SUBMISSION CHECKLIST

Required Registrations

- ■ SBIR.gov account
- ■ Grants.gov account
- ■ SAM.gov registration (REQUIRED)
- ■ D-U-N-S number verified ✓

Required Documents

- ■ Cielo Azul LLC Articles of Organization
- ■ EIN Letter
- ■ Principal Investigator Resume/CV
- ■ Key Personnel Resumes
- ■ Facilities Description
- ■ Letters of Support (insurance carriers)
- ■ Commercialization Letters of Intent
- ■ Subcontractor Quotes (if applicable)

Submission Timeline

DOE SBIR Solicitations: May-August and September-January

NSF SBIR Solicitations: January-April and June-August

Check weekly: sbir.gov for open opportunities