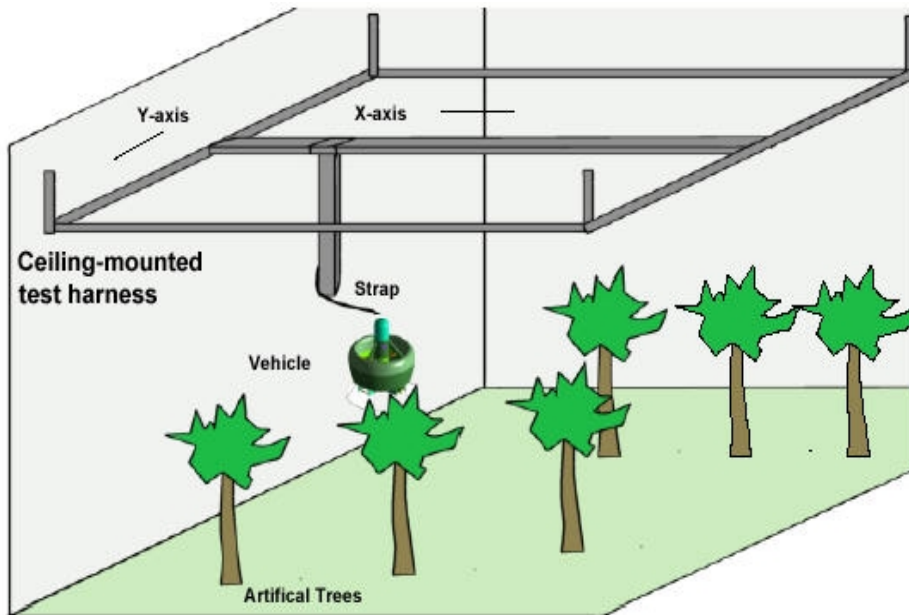


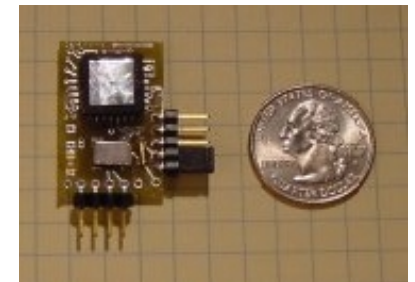
**Title: MAV Test Rig and Sensor Suite for Autonomy in Near-Earth Environments**



**Operational Capability to be Provided:**

A sensor suite that combines optic flow microsensors, collision avoidance algorithms and fault-tolerant control to enable MAVs to autonomously fly in near-Earth environments like forests, in and around buildings and tunnels and caves.

Sensor suite will enable vehicle to fly stably in spite of gust, poor lighting, GPS dropout or degraded communications. All processing is local - distributed computing resources will not be needed



5 gram optic flow microsensor

**Proposed Technical Approach:**

Indoor MAV Test Rig to collect metrics and safely flight test

- Workspace resembles near-Earth environment. Fans, lamps and noise generators emulate gust, lighting and communication signal levels.
- Test Rig: XYZ Gantry + gripper or harness.
- Non-flying MAV mockup fits on roll-pitch-yaw gripper.
- Flying MAV tethers to compliant harness to permit safe flight testing within workspace.

Collision Avoidance and Fault-tolerant Control

- Optic flow microsensors (5 g, 1 kHz, min. 0.1 Lux, 2D)
- Reactive path planning and real-time sensor management

**Rough Order of Magnitude Cost & Schedule:**

Tasks/Year after start	Y1	Y2	Y3	Y4	Y5
<b>Phase 1</b> Test Rig and MAV Mockup	█	█			
Sensor Metrics (open loop)		█			
Collision avoidance (closed loop)		█	█		
MAV dynamic model		█	█		
Sensor management system		█	█		
<b>Phase 2</b> Model-Coupled Test Rig			█		
Sensor Metrics (closed loop)			█	█	
Collision avoidance (model-coupled control)			█	█	
<b>Phase 3</b> Compliant Harness Test Rig				█	
Sensor Metrics (MAV in tethered flight)				█	
Collision avoidance (cul-de-sacs)				█	█
Outdoor MAV free flight tests					█

**ROM Cost:** \$300K to \$1M per year for 5 years

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