THE GRAVITY OF INFRASTRUCTURE
QUANTUM TECHNOLOGIES AT LEIDOS

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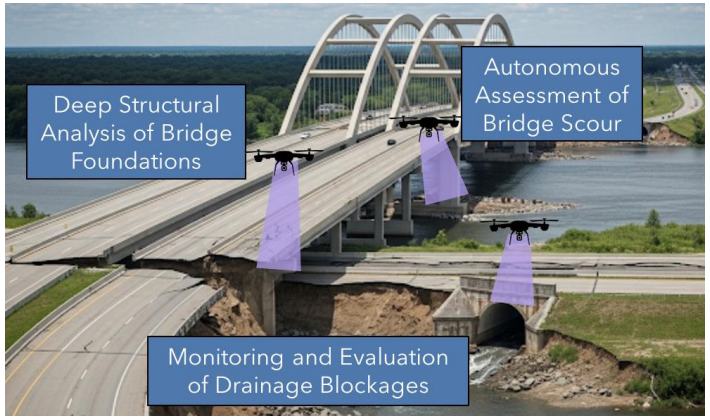
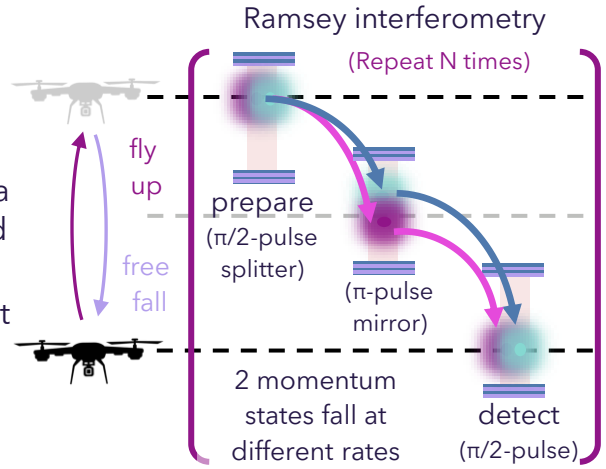
Concept

- Automating inspection of hard-to-reach assets remains difficult/costly
- We propose a sensor fusion on a **drone** combining **LiDAR** (Light Detection and Ranging) for target identification and **a quantum gravimeter for depth-resolved imaging**



Approach

- Fieldable quantum gravimeter that measures cold atom-drop interferometry during a drone's free-fall for subsurface imaging.
- Coherent control of cold-atoms in a cavity and optical pulses generated by integrated photonics.
- An array of sensors on a drone fleet to automate inspection, reduce integration time, suppress noise, and enhance spatial resolution.



Comparison

- Sensitivity of quantum gravimeters offer **~km depths** with **~meter resolution**, making it comparable to expensive seismic methods
- In contrast, micro-electromechanical (MEMS) gravimeters are fieldable, but must be recalibrated often, and offer lower sensitivity (~0.1km depths)

Technology	Depth	Resolution	Limitations
Atom interferometer	0.1 – 1 km	0.5 – 10 m	Leidos innovations improve on size, weight, and power to achieve fieldable sensor
MEMS gravimeter	10 – 100 m	0.5 – 10 m	Frequent recalibrations; many noise sources; complex analysis

Rationale

- Since gravity penetrates all matter, quantum gravimeters can measure bulk density variations in any environment and for any material
- We aim to bridge the gap between bulk anomaly detection with currently available quantum gravimeters to fine-scale structural imaging
- DOT use-cases of gravity imaging/tomography:
  - routine assessment of bridge foundations and scour
  - drainage/culvert/ground water monitoring
  - autonomous infrastructure assessment during natural disasters
- Integrated photonics is an enabling technology that miniaturizes room-sized atom-interferometer systems to deployable devices on drones