

## Advanced Sensing Technologies for Practical UAV-Based Condition Assessment

### PROJECT TITLE

Advanced Sensing Technologies for Practical UAV-Based Condition Assessment  
TIDC Project C20.2020

### STUDY TIMELINE

April 2021 – September 2023

### INVESTIGATORS

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### KEYWORDS

Bridge deck bottom, inspection, acoustic, microwave, UAV, concrete

More information about the VTrans Research Program, including additional Fact Sheets, can be found at: <http://vtrans.vermont.gov/planning/research>

### Introduction or Problem Statement

The goal is to research and use unmanned aerial vehicles (UAVs) with innovative active acoustic sensing (AAS) and synthetic aperture radar (SAR) to inspect the underside inspection of bridge decks. Employing UAV-AAS-SAR systems may i) reduce inspection cost by more than 50%, ii) improve inspectors' safety, and iii) mitigate traffic interference and the need for traffic control measures.



Delaminated bridge deck bottom



Custom UAV with protective cage



10 GHz Microwave Radar



Acoustic spectra of concrete with and without subsurface void

### Methodology or Action Taken

This is a collaborative research project with the University of Vermont, University of Maine, and University of Massachusetts Lowell. Progress to date includes: 1. Evaluation of acoustic sensing techniques for concrete quality assessment with a high-frequency (100 kHz) sensor served as a prototype pickup for air-coupled acoustic tapping response signals; 2. Assembly of a UAV with protective cage for possible underside bridge deck inspection; and 3. Examination of microwave transceiver for use on a UAV.

### Conclusions or Next Steps

The plan is to develop a UAV acoustic and radar sensors for detecting delaminations of bridge decks from underneath, placing them on a custom UAV, and evaluate, verify, and improve performance with laboratory and field tests.

### Potential Impacts and VTrans Benefits

The project will expand the capability of unmanned aerial vehicle (UAVs) structural inspection systems to enable safer, rapid, low cost, measurements of the condition of bridge deck bottoms for improved maintenance planning.