MassDOT Highway and MassDOT Aeronautics **Drone Program**

Integration of Drone Technology and Data Solutions for Wetland Monitoring

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Outline

Introduction

- MassDOT Highway Environmental Compliance for Construction Section
- MassDOT Drone Program

Project Overview

- Objective
- Traditional Methods
- Drone Collection Methods

Data

- Finished Products
- Benefits

MassDOT Environmental Compliance for Construction

- Provide environmental compliance support during Highway Division construction projects
- Assist with wetland mitigation site management and monitoring
- Maintain compliance with environmental permits
- Advise the district on environmental compliance issues

MassDOT Drone Program

A comprehensive, transportation-focused, end-to-end, multi-year pilot program

Leverage UAS for a variety of applications such as inspections, asset management, and incident response

Span across all DOT modes of transportation including Highway, Rail and Transit, Aeronautics, and the MBTA

- ↑ Increase safety
- ↓ Decrease inspection time
- ↑ Improve data quality
- ↓ Reduce taxpayer costs
  - ☛ Advise, assist, and share UAS policy, procedures, and best practices with other Commonwealth agencies

Meeting a Diversity of Operational Needs

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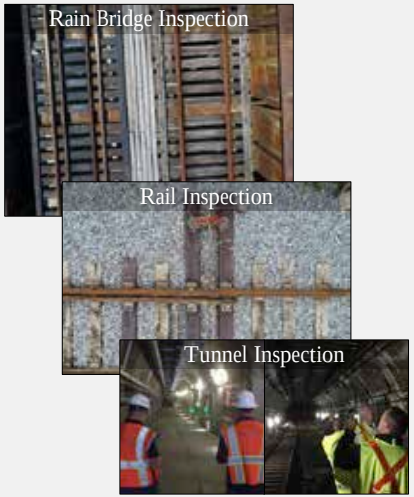
HIGHWAYS

- Bridge inspection
- Asset monitoring

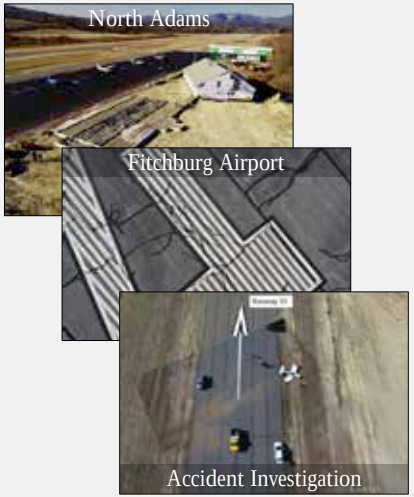
RAIL & TRANSIT + THE MBTA

- Rail inspection
- Subway tunnel inspection



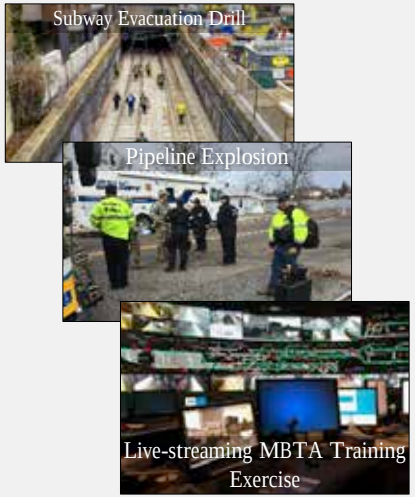
AERONAUTICS

- Airport inspection
- Accident investigation



EMERGENCY MANAGEMENT

- Incident response
- Asset allocation



Drone Pilot Program developed to meet real, user-defined needs across MassDOT and the MBTA

Drone Pilot Program Fleet

massDOT
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Aeronautics Division








As of January 2020	DJI Phantom 4	DJI Inspire 2	DJI Matrice 210	DJI Matrice 600	DJI Mavic 2	Yuneec H520	SenseFly ebee	Delair UX11
# in fleet	5	2	3	1	2	1	1	1
Sensors	HD camera	HD camera: •6K	HD camera: • 30x optical zoom • IR (thermal)	• MicaSense Altum • Slantrange multispectral	HD camera	HD camera	S.O.D.A. RGB sensor[1]	HD camera: • High resolution • Low/no distortion
Features	Familiar to users	Dual operator mode	• All-weather • Upward gimbal • Dual lower gimbals	• Heavy lift • Dual operator mode	• Small • Portable	• All-weather • 6 rotors • 360° view	• RTK/PPK accuracy[2] • 20-mile range	• PPK accuracy[2] • 33-mile range
Flight time	30 min	27 min	25 min	16-35 min	27 min	25 min	50 min	59 min

§ Aircraft fleet and associated sensors selected based on missions needs

§ Continue to build expansive fleet with new aircraft purchases and specialized hardware

1: Sensor Optimized for Drone Ops – RGB broad color array
2: Real Time Kinetic/Post-Processed Kinetic

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Project Overview

A partnership between the MassDOT Highway Environmental Compliance for Construction Section and the MassDOT Aeronautics Drone Team
that supplements traditional inspection of active wetland mitigation areas

Inspection Data

Provide data to support inspection and performance standards in following areas:

- Illegal dumping
- Invasive / non-native plant species
- Stream functionality / soil saturation
- Soil elevations
- Wildlife use / corridors

Stitched Images

Create a stitched image of each site, allowing Environmental Compliance Group to monitor the progress of wetland mitigation sites

MassDOT Environmental Compliance for Construction

Traditional inspection methods

Inland wetland systems inspection

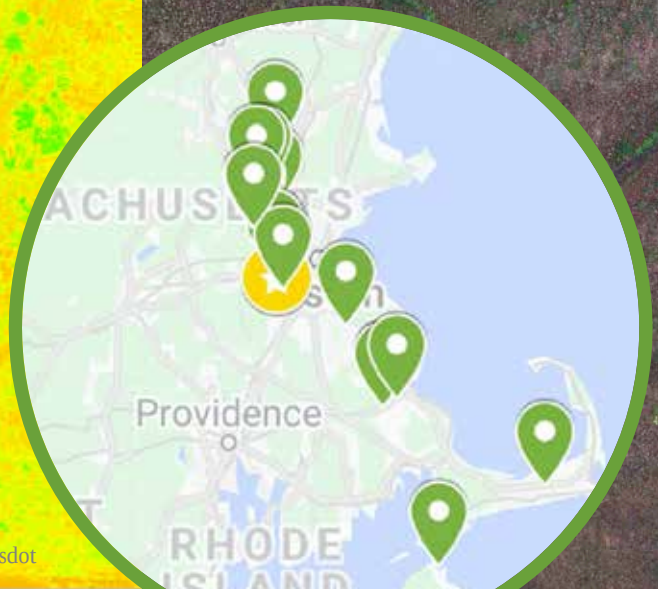
- Assessed annually
- Long-term monitoring

Assessment includes documentation of:

- Vegetative cover – establishing and collecting data from sample plots
- Hydrology – installation of monitoring wells or soil tests with auger
- Plant health including recruitment, mortality, herbivory by wildlife, and area of coverage
- Invasive/non-native plant species infestations, wildlife use/corridors, and stream functionality
- Signs of illegal dumping

UAS Data Collection and Dissemination

- Data Collection
  - 16 sites
  - 20-30 minutes per site
  - Multiple sites per day
  - Monitor each site 2-3 times yearly
- Data Processing
  - Processed data using multispectral technology
  - Supplied stitched image of each site
- Data Delivery
  - Shared via cloud services
  - ArcGIS
  - Produced maps showing vegetation health, hydrology, and site elevation



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Finished Products

Multispectral Data

Benefits: Produces advanced imagery utilized for plant health, plant classification, invasive species detection, and elevation models

Orthomosaic Data

Benefits: Detailed, accurate, georectified, interactive, high resolution photographic representation of an area – enabling accurate measurement and volumetrics

Qualitative and Quantitative Benefits

- **Increased safety**
- **Considerable decrease in inspection time- up to 40%**
- **Improved data quality-**
  - Access areas inaccessible by foot
- **Improved site documentation**
- **Historical record- enable change detection**

Potential Savings per Inspection	*$3-5k*

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Thank you!