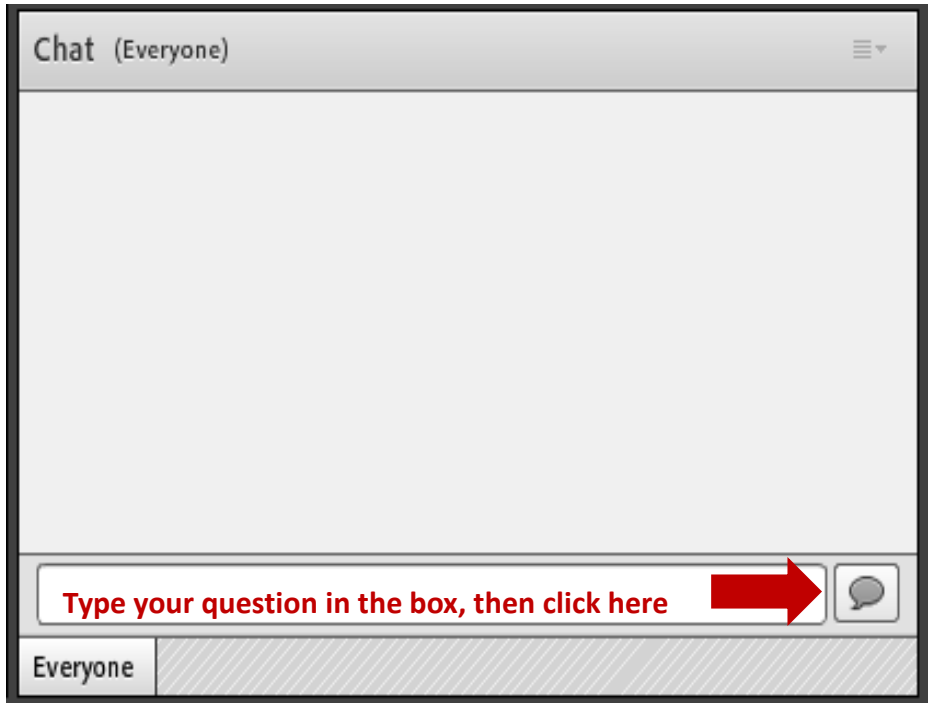
A Webinar on the Why and How of Setting up a State Unmanned Aircraft System (UAS) Program: *Experiences from DE and MA*

March 21, 2019

I - 95 CORRIDOR COALITION

Asking Questions

- Please pose your questions using the chat box
- Questions will be monitored then answered by the speakers either following the presentation or at the end of the webinar



Welcome & Introductions

Ginna Reeder, I-95 Corridor Coalition

Participants

Agencies			
City of Biddeford (ME)	I-95 Corridor Coalition	MetroPlan Orlando	South Carolina DOT
Connecticut DOT	Kissimmee Gateway Airport (FL)	Missouri DOT	Southern Maine Planning & Dev Commission
DCHC MPO (NC)	Maine DOT	MWCOG	Tennessee DOT
Delaware DOT	Maryland Department of State Police	New Jersey DOT	USDOT/FHWA
District DOT	Maryland DOT - Aviation Administration	New York State DOT	USDOT/FHWA NJ Division
DVRPC	Maryland DOT - SHA	New York State Thruway Authority	Vermont AOT
FHWA	Maryland Environmental Service	PA Turnpike Commission	Virginia DOT
Florida DOT	Massachusetts DOT	Pennsylvania DOT	
Georgia DOT	MassDOT - Aviation Administration	Rhode Island DOT	

Other Participants			
Florida International University	INRIX	New Jersey Institute of Technology	Wolverton Inc.
HNTB	Jacobs Engineering	Virginia Tech Transportation Institute	

Agenda

10:30 am to 10:40 am	Introductions and Welcome Polling Questions	Led by Ginna Reeder, I-95 Corridor Coalition
10:40 am to 11:05 am	Unmanned Aerial Vehicles in Delaware	Dwayne Day, Delaware DOT
11:05 am to 11:30 am	Massachusetts Drone Program: Expansion and Innovation	Jeffrey DeCarlo, Massachusetts DOT Scott Uebelhart, Massachusetts DOT Consultant
11:30 am to 11:55 am	Question & Answer Session	Led by Ginna Reeder, I-95 Corridor Coalition
11:55 am to 12:00 pm	Wrap Up	Ginna Reeder, I-95 Corridor Coalition

Speakers

Dwayne Day

Delaware DOT

Homeland Security Planner

Jeff DeCarlo, EdD, PMP

Massachusetts DOT

Administrator, Aeronautics Division

Scott Uebelhart, PhD

Massachusetts DOT Consultant

Chief Scientist, Drone Program

Poll Question #1

1 What type of agency do you represent?

___ State DOT
___ Other State agency
___ Turnpike authority
___ Federal agency
___ Law Enforcement
___ MPO/Planning
___ University
___ Consultant

Poll Question #2

2 How would you classify your state drone program?

___ Up and running
___ Operational but working on aspects
___ Currently getting set up
___ Planning stages
___ No specific plans yet

Poll Question #3

3

What would help your agency take your program to the next level ? *(note all that apply)*

___ More staff resources
___ More resources for equipment
___ Training for existing staff
___ Buy-in from our leaders
___ Other

Unmanned Aerial Vehicles (UAVs) in Delaware

Dwayne Day, Delaware DOT

Unmanned Aerial Vehicles (UAVs) in Delaware

Dwayne Day, Homeland Security Planner, DelDOT

UAVs and DelDOT: How it Began

- Punkin Chunkin 2014
- DJI Phantom 3
- Downlink to Smart Phone

Security Concerns

- UAS pose a potential threat to security. Small UAS can be used by criminals and terrorists for espionage, surveillance, and intelligence gathering at critical government and industrial facilities.
- Criminals are also using unmanned aircraft to smuggle drugs and contraband across U.S. borders and over prison walls and fences.
- Somewhat larger UAS could be used to carry out terrorist attacks by serving as platforms to deliver explosives or chemical, biological, radiological, or nuclear weapons. Chemical and biological agents pose a particular concern, as UAS used for aerial pesticide applications could readily serve as platforms to carry out attacks.
- Small UAS could similarly be used to disperse small amounts of certain agents that may be lethal in minute quantities. Even a hoax attack—for example, releasing a powdery substance and making false claims that it contains anthrax virus—could cause widespread panic.
- UAS could also be used as platforms for firearms or other weapons.

- Homeland Security Advisory Council HSAC is briefed.

- Decision is based to create a UAV Sub-committee to further investigate the use of UAVs in Delaware and keep the HSAC informed.

- Dwayne Day was elected the Chairman of the Committee.

HSAC UAV Committee Membership

- Delaware Department of Transportation
- Delaware State Fire School
- Delaware Department of Agriculture
- University of Delaware
- Delaware State Police
- Delaware Department of Safety and Homeland Security
- Delaware National Guard
- Dover Air Force Base
- Wilmington Police Department
- Private Hobbyist

UAS Committees

- The HSAC UAS Committee splits into three more defined UAS Committees.

1. Delaware UAV Task Force - January 2016
   - Focus was on the Economic Development of UAS into Delaware.

2. UAS Training and Certification Steering committee.
   - Develop a UAS training and certification program for state agency pilots.

3. Homeland Security Advisory Councils UAS committee shifted the focus to the nefarious use of UAS….Counter UAS.

UAS Training and Certification Steering Committee.

UAS Academy out of Virginia provided the initial UAS Training for the committee members.

Membership:

- Delaware Department of Transportation
- Delaware Emergency Management Agency
- Delaware State Police
- Delaware State Fire School
- Wilmington Police Department
- Dover Police Department
- Department of Corrections
- Ocean View Police Department

UAS Training and Certification Committee “Focus”

- The committee focuses on four areas of UAS flying.
  - Maintenance
  - Operations
  - Safety
  - Training

Maintenance, Operation, Safety, and Training (MOST)

- Expands on Federal/State requirements
  - Developing flight training standards
  - Conduct training programs/classes for State Agencies
- State Agency Coordination
  - Mission Collaboration
  - Standards Development
  - Best practices
  - Aircraft troubleshooting

UAS Training and Certification Committee “Focus”

- All Public Agency pilots that are part of the program are trained to the same level.
- All Public Agencies fly the same DJI Operating System Platform.
- This ensures that the pilots and aircraft are interchangeable between agencies.
- A core group of pilots have had additional training from UAS Academy in Tactical Operations and fly together routinely. This has become a small tactical team available for call out by Emergency Managers.

DelDOT's UAV Program

DelDOT UAV Operational Policy

DelDOT has developed an UAV Operating Policy for flying UAVs that identifies;

1) Program Oversight along with Operational Directives
2) Division Participation
3) Equipment
4) Training & Certification,
5) Flight Planning & Operations.

The policy requires a two-manned approach with a pilot and visual observer for each flight, even though the FAA 107 rule only requires a pilot.

All UAS missions whether they are flown by DelDOT or a hired contractor, if flying on a DelDOT project require a pre-flight plan to be filed with the TMC in advance of the mission.

DelDOT Pilot Qualification

Once the pilot has a remote pilot certificate they will have to attend a Pilot Qualification course that teaches basic UAV maneuvers for their particular aircraft.

Before the pilot can have their training records signed off as a DelDOT Certified UAV pilot they will need to show their ability to fly ten basic maneuvers.

UAV Pilots will be required to fly 3 flights within a 90 day period for proficiency.

DelDOT sUAV Pilots

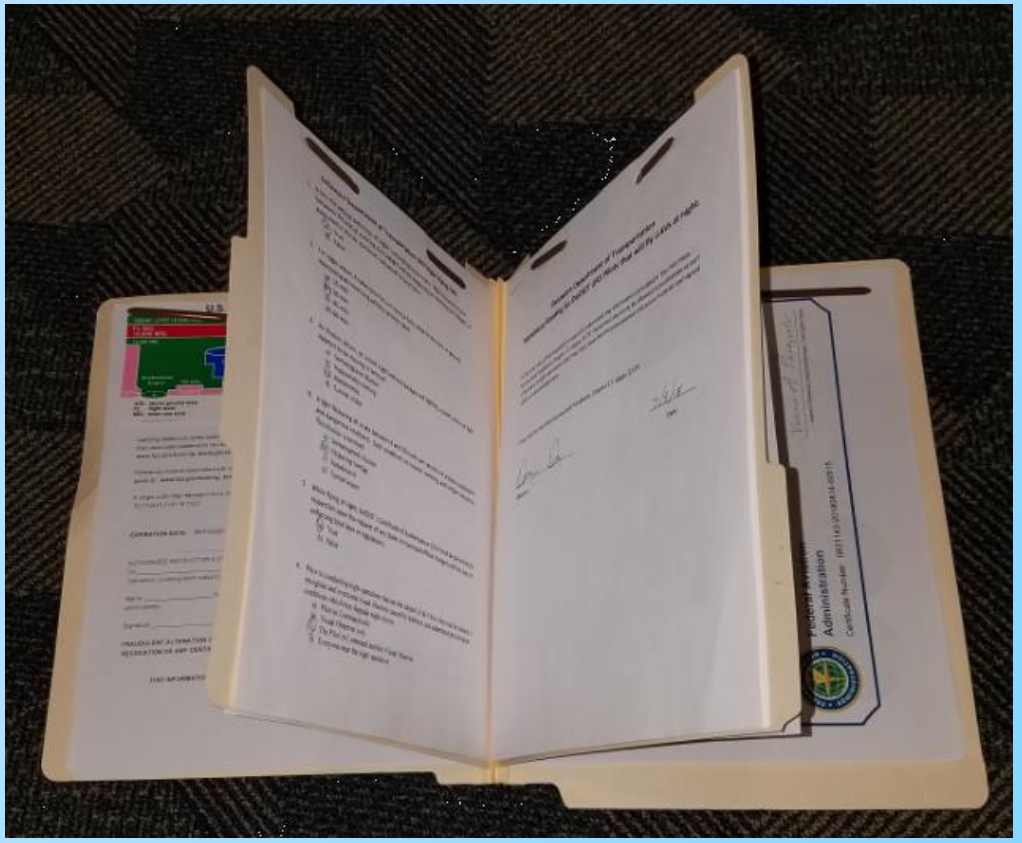
Nine DelDOT FAA 107 Pilots.

- District Engineer (M&O)
- Surveyor (M&O)
- Project Manager (M&O) (Commercial Pilot)
- Safety Officer (Traffic)
- Special Events Manager (Traffic)
- Assistant Director (Finance) (Female)
- Homeland Security Planner (UAS Program Manager)
- TMC Supervisor
- Right of Way Agent

- 6 more individuals are starting their 107 training this month.

DelDOT Training Records

- All DelDOT Pilots have a training record.
- FAA test results
- UAV Pilot Training and Certification Checklist
- DelDOT Pilot Application
- UAV Mandatory Reading for Night Flying
- UAV Night Flying Quiz
- UAV Training Certificates



The DelDOT Qualification Checklist

- UAV Pilot Training and Certification Checklist

☐	Ground School for FAA Remote Pilot Certificate (Optional)	Date:
☐	Pass FAA Unmanned Aircraft General Exam (Required)	Date:
☐	Pilot Qualification Course (Required)	Date:
☐	Tactical Operations Training Course (Optional)	Date:
☐	Indoor Flying Course (Optional)	Date:

Required Maneuvers

☐	Minimum Obstacle Clearance Altitude (MOCA)	Date:	Evaluator Initials:_____
☐	Accuracy Landing	Date:	Evaluator Initials:_____
☐	Complex Figure 8	Date:	Evaluator Initials:_____
☐	Blind Landing	Date:	Evaluator Initials:_____
☐	Road Course	Date:	Evaluator Initials:_____
☐	Point of Interest	Date:	Evaluator Initials:_____
☐	Waypoint	Date:	Evaluator Initials:_____
☐	Reveal	Date:	Evaluator Initials:_____
☐	Standoff Distance	Date:	Evaluator Initials:_____
☐	Long Distance Orientation	Date:	Evaluator Initials:_____
☐	ATTI Mode Flying	Date:	Evaluator Initials:_____

I certify that the above named UAV Pilot has meet all the requirements required by DelDOT's UAV Training and Certification Program and is authorized to fly DelDOT UAVs.

_____ Date:_____

Dwayne Day
DelDOT UAS Program Manager

sUAS Specialized Training

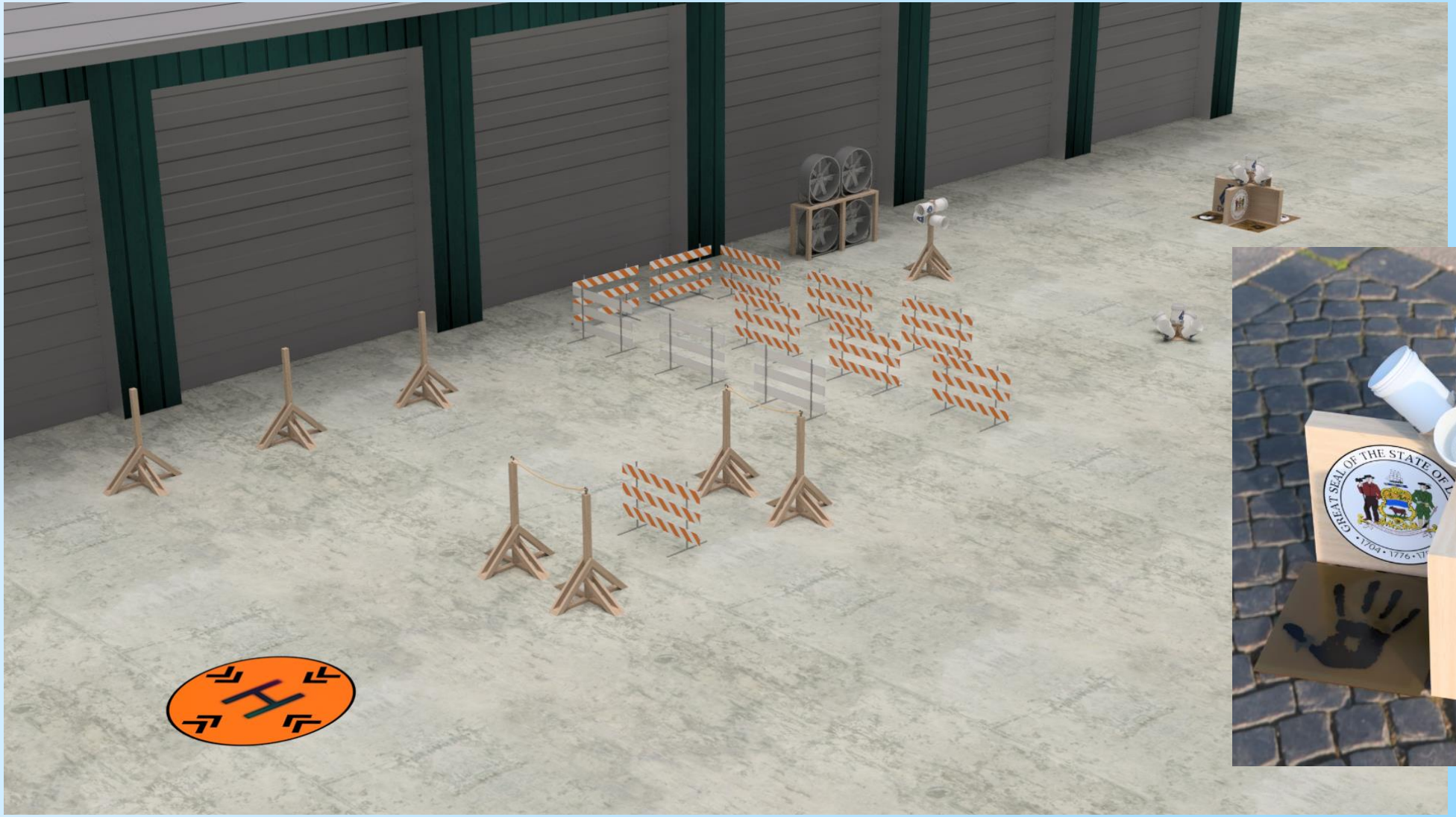
- Tactical Operations – UAS Academy
- Indoor Flying – UAS Academy
- Search & Rescue, FLIR, Night Ops – DartDrones
- Night Flying Qualified – DelDOT
- 8 Pilots are Level 1 Thermography Certified – FLIR
- Drone HAZMAT Course – Magda International (in development)

- Every year we try to send 4 – 5 UAS Pilots to conferences to learn the latest UAS Technology.
  - AUVSI - 2015
  - National Public Safety UAS Conference - 2016
  - InterDrone - 2017 & 2018
  - AUVSI Exponential 2019

DelDOT Advance sUAS Pilot Training (Being Developed)

- Based off of the National Fire Protection Association (NFPA) 2400; Standard for Small Unmanned Aircraft Systems (sUAS) for Public Safety Operations.
- Applying the concept of using props while testing the pilots ability to perform aerial maneuvers.

Advanced Course Rendering



DelDOT Training Facility

DelDOT pilots are trained on how to fly UAVs at the State Fire School. Courses are taught by members of the Training and Certification Steering committee.

DelDOT sUAS Inventory

- DJI Inspire 1 Pro 4
- DJI Phantom 4 Pro 5
- DJI Mavic Air 1
- DJI Mavic Pro 1
- DJI Mavic 2 Enterprise 2
- DJI M210 3

Total 16

Different tools in the tool box

DelDOT sUAS Inventory…Cont.

- Primary drones used
  - DJI Phantom 4 Pro

  - DJI M210
    - 30X Zoom Camera
    - Thermal Camera

FAA Registration

- All of our drones are registered under the traditional Aircraft Registration under 14 CFR Part 47.
  - An original Aircraft Registration Application; AC Form 8050-1
  - A Notarized Affidavit; AC Form 8050-88
  - A copy of the original receipt.
  - No charge for Government (State) agencies.

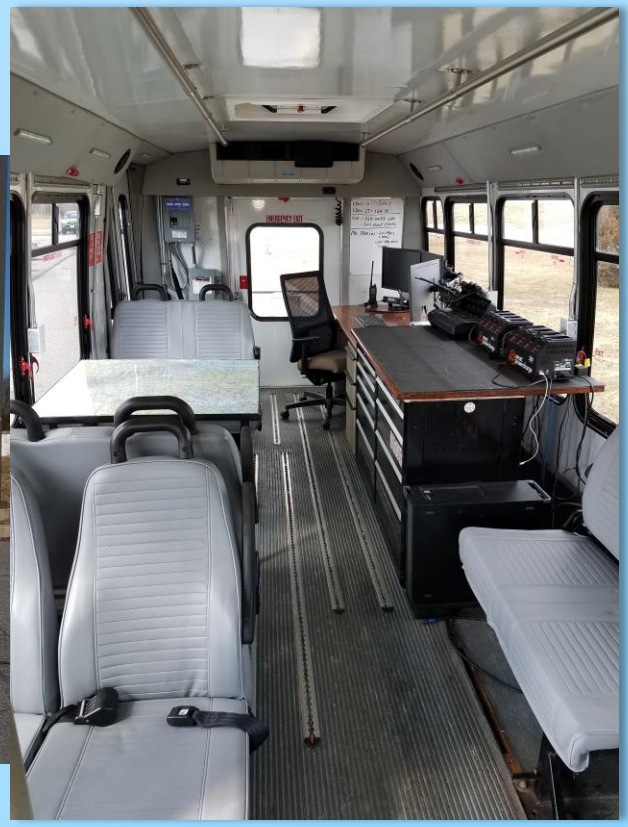
  - Send everything to Oklahoma City and wait about 6 weeks for your registration and N-number.
  - You can still fly your drone as long as you have a copy of your registration application with you.

Insurance

- We met with the State Insurance Coverage Administrator and she advised us that drone pilots from state agencies are covered under the state.
- County Public agencies had to get their own insurance policy.
- We had to provide all the registration numbers, pilot licenses, and a copy of the training program.

DelDOT Drone Bus

- Video downlink capability into the Transportation Management Center.
- Mobile TMC is used for long duration UAS operations



FAA Waivers

January 2016 - 1st Certificate of Authorization (COA)

June 2016 - FAA released Part 107

Government agencies have two options for operating drones under 55 pounds.

1. Fly under 14 CFR part 107.
2. Operate with a Certificate of Waiver or Authorization (COA) to be able to self-certify UAS and operators for flights performing governmental functions. (A FAA Remote Pilots License meets this requirement)

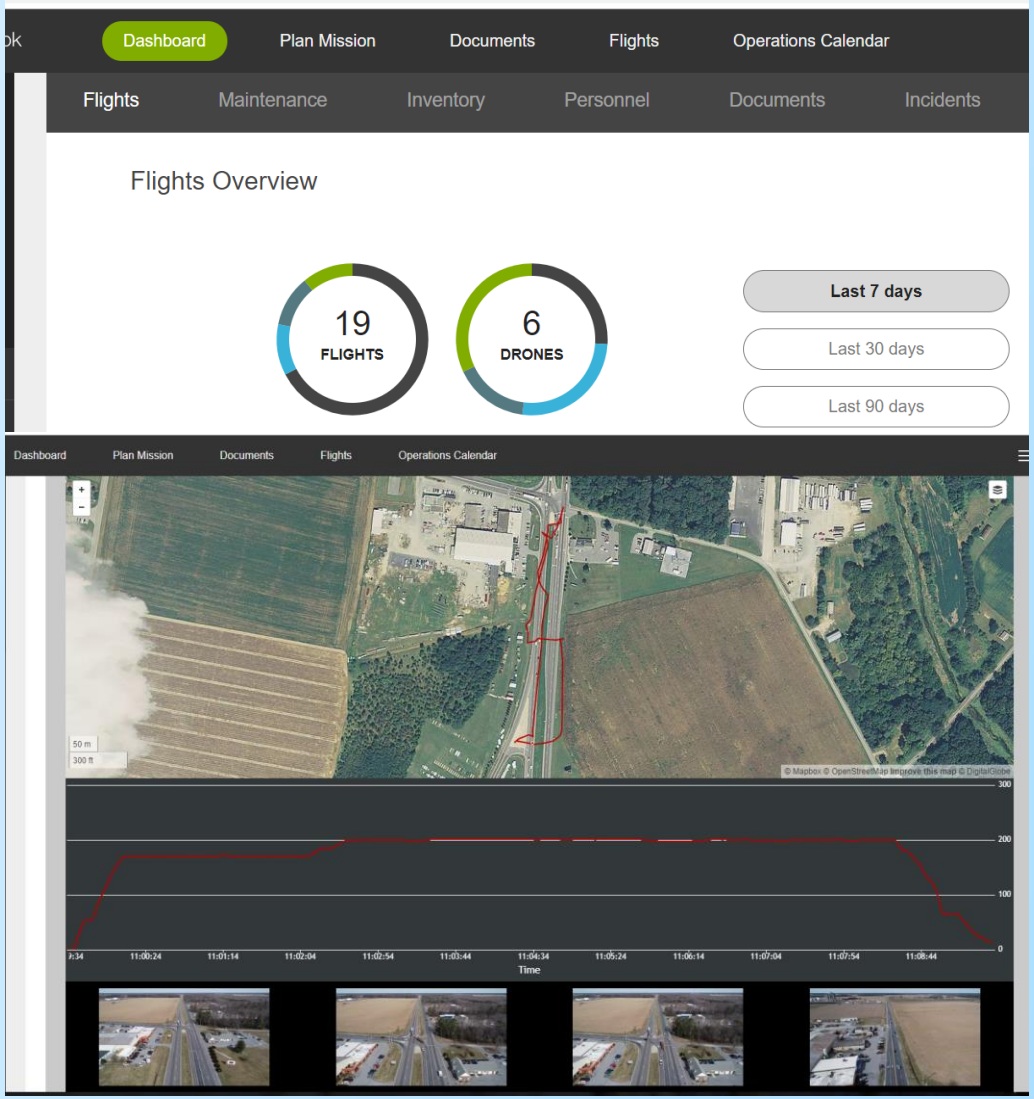
April 2018 – 2nd Certificate of Authorization (COA)

Fly within Class D airspace at ILG and KDOV

April 2018 – 107 Waiver for Night Operations

August 2018 – 107 Waiver for Class D airspace around Dover AFB

Drone LogBook



Operations Report
08 March 2019

Delaware Department of Transportation
169 Brickstore Landing Rd

Period: 2019-02-01 to 2019-03-08
Name: Dwayne Day **Email:** dwayne.day@state.de.us

FLIGHTS for : Dwayne Day as Pilot

Total flying time for this pilot: 03:05:57

Date	Flight name	Drone	Duration	Location
2019-03-07 09:50:51 14:50:51 UTC	**Flight 2019-03-07** **09:50:51**	TMC - N808WL DJI/Phantom 4 Pro	00:02:43	US 301 Toll, New Castle County US 301 Toll Delaware 19709 US (39.425684440505, -75.76264151274)
Landing Time:14:53:34 UTC **Flight Type:** Commercial - Photo/Video				
Operation Type: VLOS **Sunset / Sunrise:** Day **Personnel:** Dwayne Day [Pilot], Richard Christopher Marsh [Visual Observer] **Pilot info:** **Equipment onboard:** B13 **Nb landing:** 1 **Distance:** 761.15 feet **Max altitude:** 226.38 feet **Conditions:** **Cloud cover:** 100 % **Temperature:** 32 F **Wind:** 8.79 miles/hour (270°) **Humidity:** 45 % **Notes:**				
IGC File			KML File	

Date	Flight name	Drone	Duration	Location
2019-03-01 01:41:20 06:41:20 UTC	**Flight 2019-03-01** **01:41:20**	TMC - N862QG DJI/Matrice 210	00:08:53	TMC 169 Brick Store Landing Road Smyrna DE 19977 US (39.31867281396407, -75.60641126848742)
Landing Time:06:50:13 UTC **Flight Type:** Test Flight				
Operation Type: VLOS **Sunset / Sunrise:** Night **Personnel:** Dwayne Day [Pilot], Richard Christopher Marsh [Visual Observer] **Pilot info:** **Equipment onboard:** XT2 (TMC), TMC 1 B, TMC 1 A **Nb landing:** 1 **Distance:** 1837.27 feet **Max altitude:** 190.29 feet **Conditions:** **Cloud cover:** 100 % **Temperature:** 35 F **Wind:** 4.43 miles/hour (93°) **Humidity:** 60 % **Notes:**				
IGC File			KML File	

Date	Flight name	Drone	Duration	Location
2019-02-21 15:52:25 20:52:25 UTC	**Flight 2019-02-21** **15:52:25**	TMC - N862QG DJI/Matrice 210	00:03:28	TMC 169 Brick Store Landing Road Smyrna DE 19977 US (39.31867281396407, -75.60641126848742)
Landing Time:20:55:53 UTC **Flight Type:** Test Flight				
Operation Type: VLOS **Sunset / Sunrise:** Day **Personnel:** Dwayne Day [Pilot], Zachary Lawson [Visual Observer] **Pilot info:** **Equipment onboard:** TMC 4 B, TMC 4 A, Z30 (TMC) **Nb landing:** 1 **Distance:** 4215.88 feet **Max altitude:** 187.01 feet **Conditions:** **Cloud cover:** 0 % **Temperature:** 53 F **Wind:** 6.34 miles/hour (298°) **Humidity:** 54 % **Notes:**				
IGC File			KML File	

Funding

Training courses were paid for through the Homeland Security grant. Approximately $80K

Drones were bought by DelDOT through various funding streams.

- State Funds
- Special Event Funds
- State Transportation Innovation Councils (STIC) Funds 80/20

Modifications on the Drone bus were done in-house by DelDOT employees.

Thermal cameras and Zoom cameras were purchased through the Homeland Security grant.

Video and Photo Processing

- Your going to think you are taking fantastic videos…reality is your first couple of videos will probably make someone motion sick.
- We use Adobe Premiere 15 to process the videos.
- Only about 3 pictures can be sent through the state email system. No videos, they are much too large.
- We have used Drop Box, flash drives, SD cards, in-house drives on our servers.
- IT folks might get upset with the amount of space that you will use to save your videos.

Uses for DelDOT

- Situational Awareness
- Debris Assessments
- Traffic Mitigation
- Stock Pile Estimations
- Bridge Inspections
- Aerial photography of traffic projects
- Archeological inspections/photos
- Dune Erosion pre and post storm

Royal Farms in Milford, Rt. 1

Route 1 & 16 Intersection

2016.11.16

SR 1 AT SR 16 BRIDGE RENDERING

Delaware Department of Transportation

SR 1 AND SR 16 GRADE SEPARATED INTERSECTION

Firefly Festival Lot 18…Tent Campers

Tanker Rollover Rt 1

Future DelDOT UAVs

Tethered Drones

Unmanned Maritime Drones

Questions or Comments

Delaware Department of Transportation (DelDOT)

Dwayne Day

dwayne.day@state.de.us

(302) 659-4604

Massachusetts Drone Program: Expansion and Innovation

Jeff DeCarlo

Massachusetts DOT

Scott Uebelhart

Massachusetts DOT Consultant

massDOT
Massachusetts Department of Transportation
Aeronautics Division

Massachusetts Drone Program:
Expansion and Innovation

I-95 Coalition Webinar
March 21, 2019

Dr. Jeff DeCarlo, MassDOT Aeronautics Administrator
Dr. Scott A. Uebelhart, Drone Program Chief Scientist

Massachusetts Department of Transportation (MassDOT)

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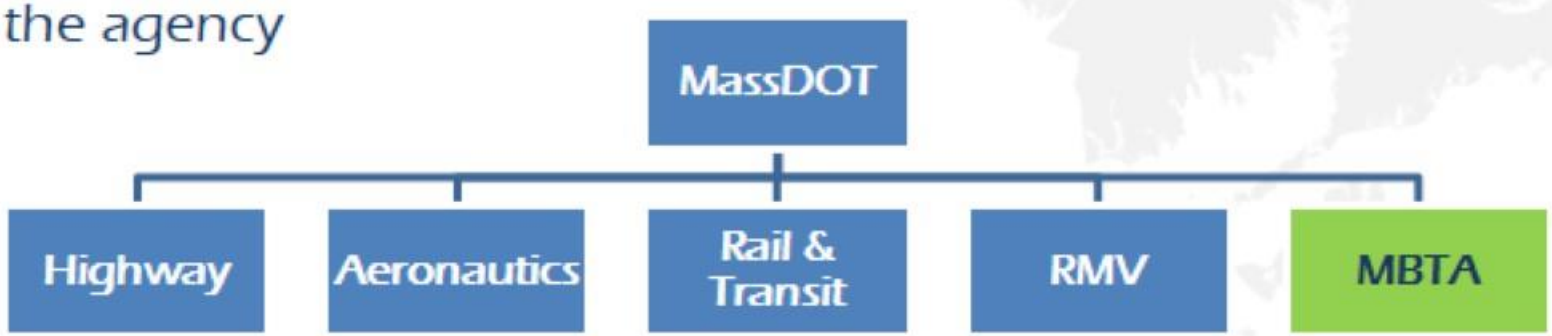
- November 1, 2009. The Commonwealth integrated its transportation agencies and authorities into a new streamlined Massachusetts Department of Transportation (MassDOT)
- MassDOT is an organization with over 10,000 employees working to simplify and streamline the transportation system while making it more accountable and accessible
- MassDOT is responsible for the oversight of four divisions and the Office of Programs and Planning
- In 2015, Massachusetts Governor Charlie Baker created a financial control board to oversee the MBTA. The Fiscal and Management Control Board reports to the Massachusetts Secretary of Transportation and is charged with bringing financial stability to the agency



Bringing Together a Great Team

MassDOT Drone Team combines strong military aviation heritage with MIT engineering expertise and first responders experience

Statement of Purpose

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Aeronautics Division

- Facilitate the adoption of drones across MassDOT in a manner that is:
  - Safe
  - Cost effective
  - Secure
- Incentivize applied research to enable UAS operations and develop counter-UAS solutions

APPROACH

Agenda

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Developing a **Comprehensive** program

Assembling significant **Incident Response** and **Emergency Management** experience

Promoting **Innovation** to integrate UAS into the Massachusetts economy

Comprehensive Program

Focusing on laying the foundation for a scalable program that meets rapidly expanding needs for operators, operations, and data, and that identifies how to turn drone-collected data into actionable information

Comprehensive Program

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Aeronautics Division

OPERATIONS

Focusing on laying the foundation for a scalable program that meets rapidly expanding needs for operators, operations, and data, and that identifies how to turn drone-collected data into actionable information

Comprehensive Program

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Massachusetts Department of Transportation
Aeronautics Division

PREPARATION

OPERATIONS

Focusing on laying the foundation for a scalable program that meets rapidly expanding needs for operators, operations, and data, and that identifies how to turn drone-collected data into actionable information

Comprehensive Program

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Focusing on laying the foundation for a scalable program that meets rapidly expanding needs for operators, operations, and data, and that identifies how to turn drone-collected data into actionable information

First Step in Development a Drone Program: Identify and Classify UAS Use Cases

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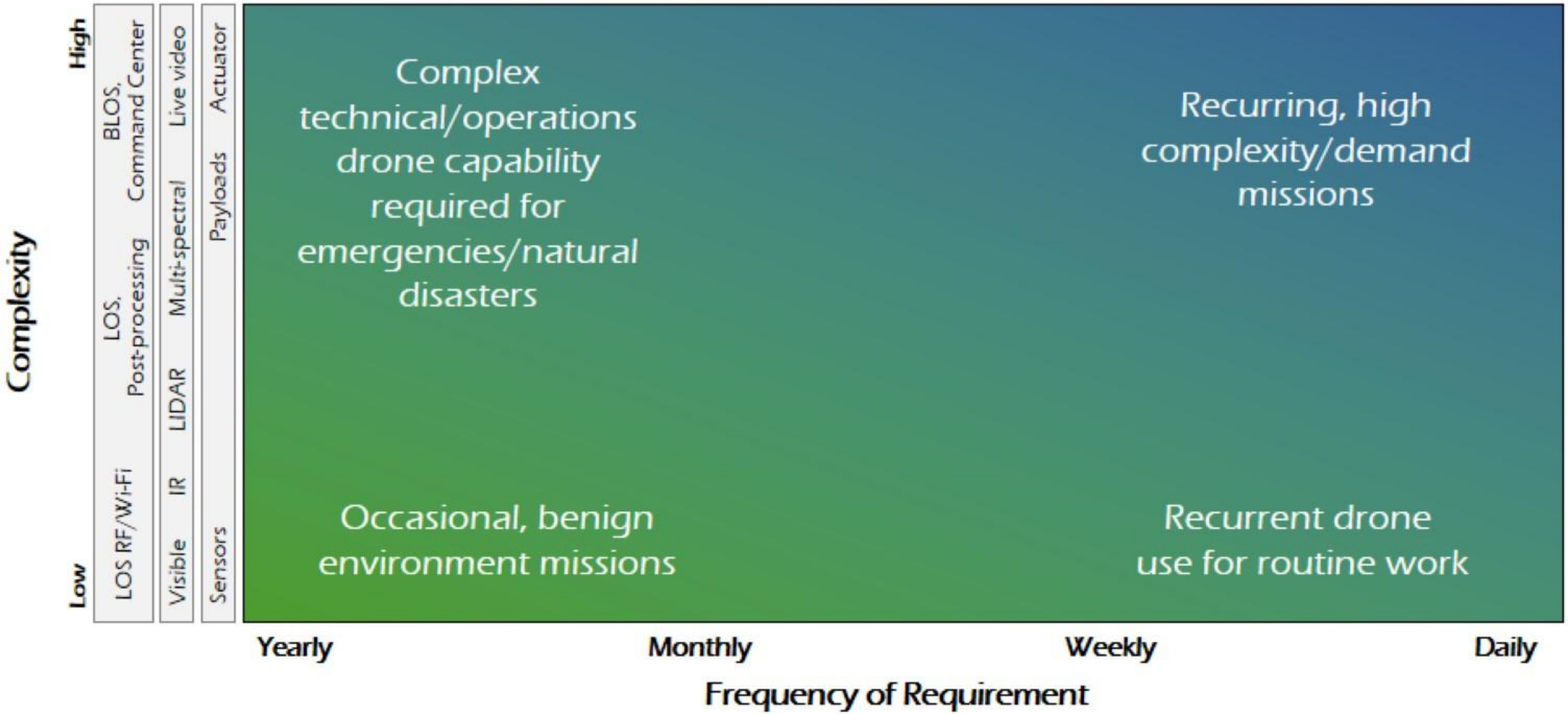

Analytical Framework for Assessing Use Cases

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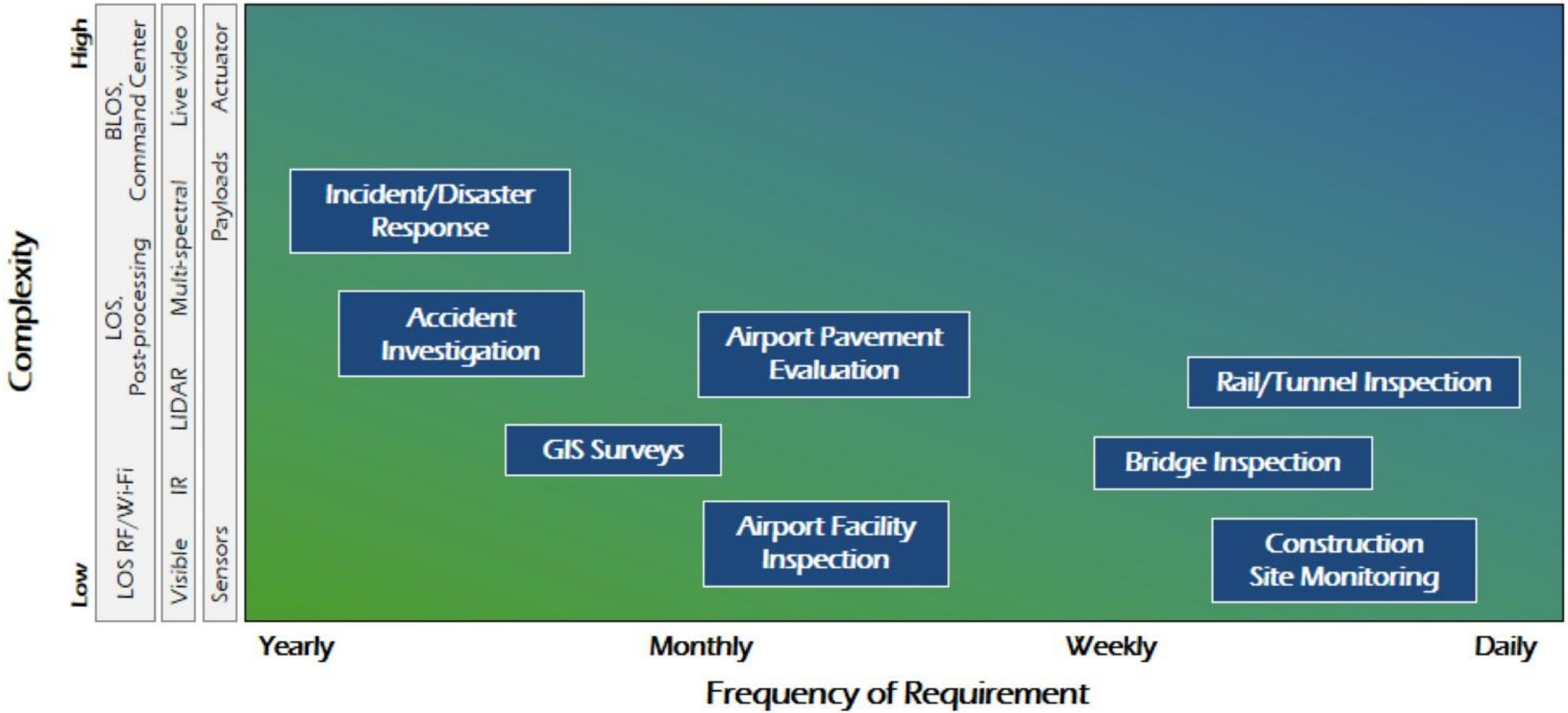

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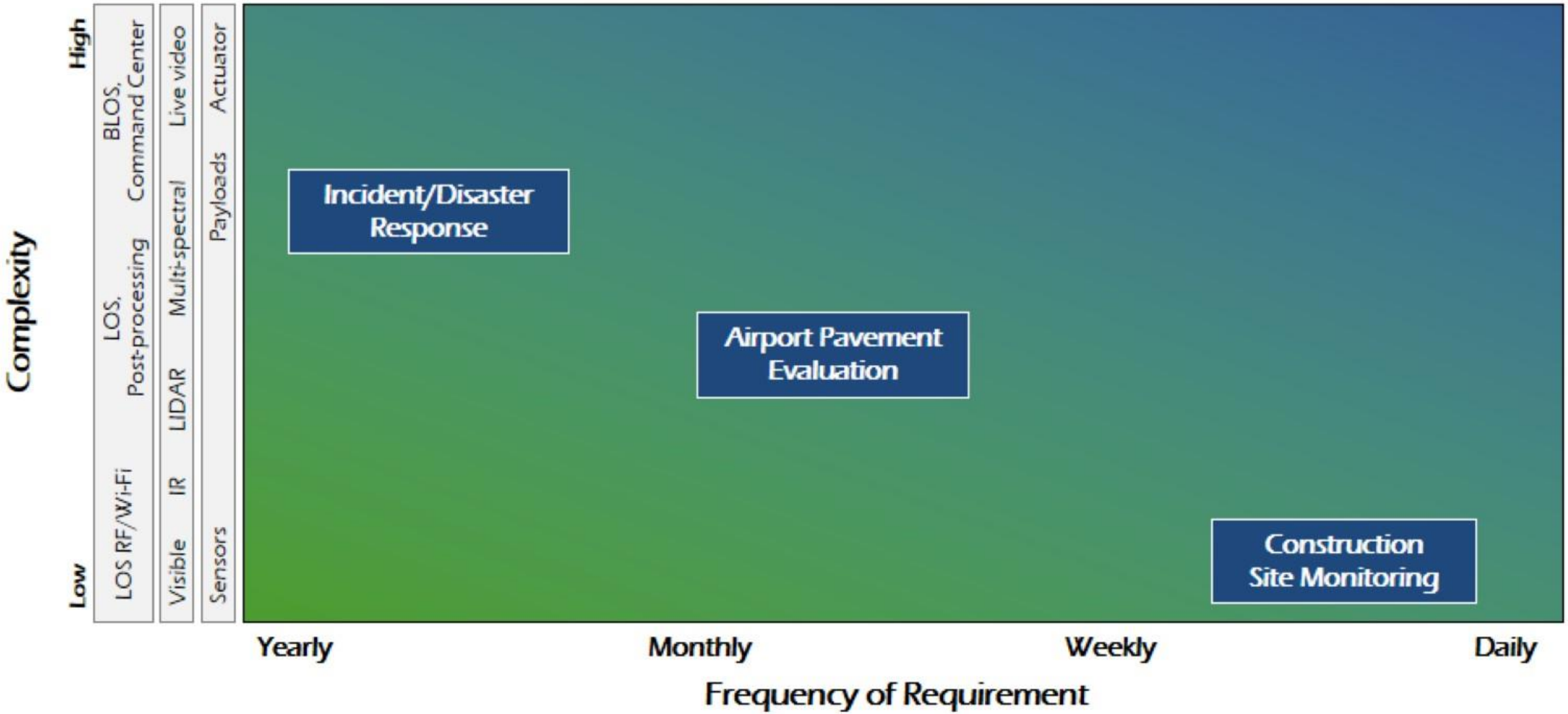

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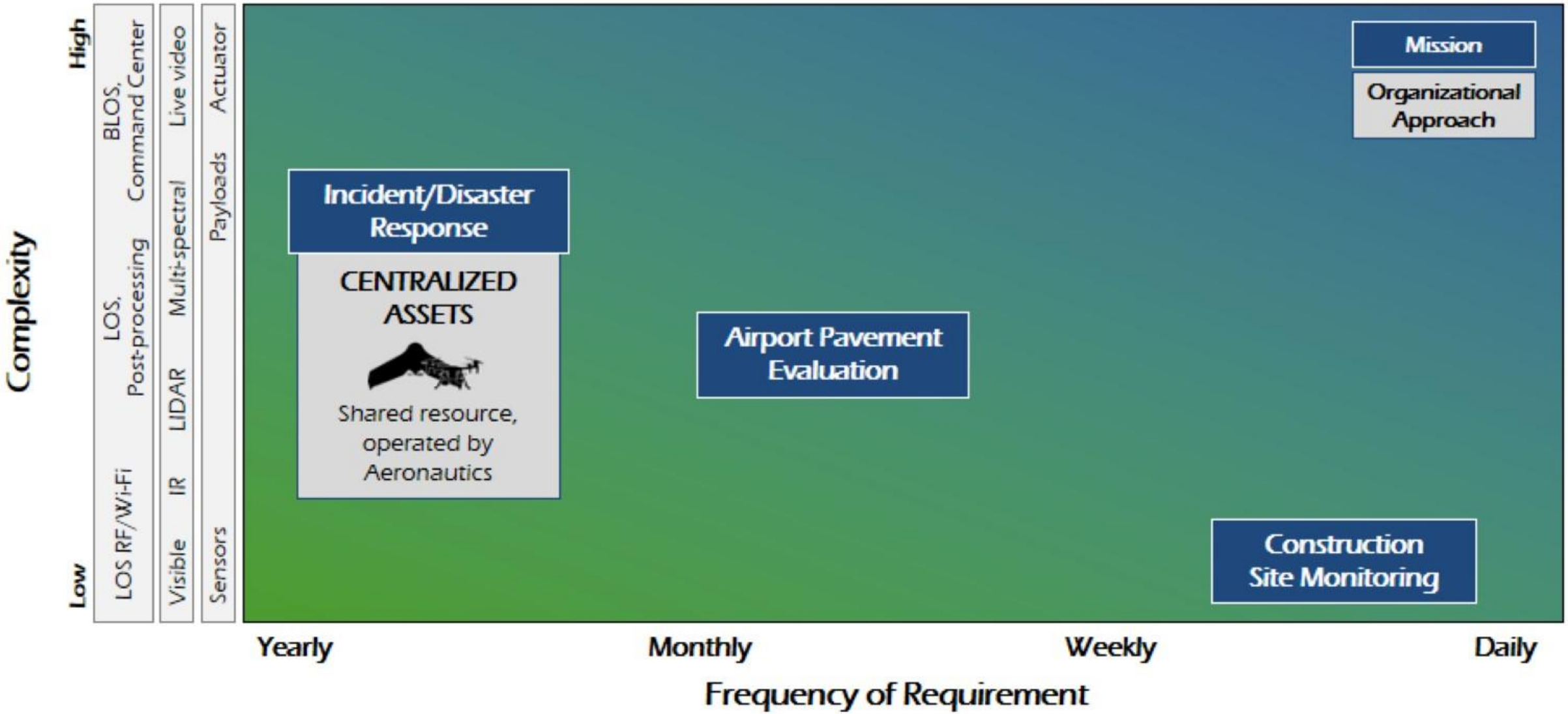

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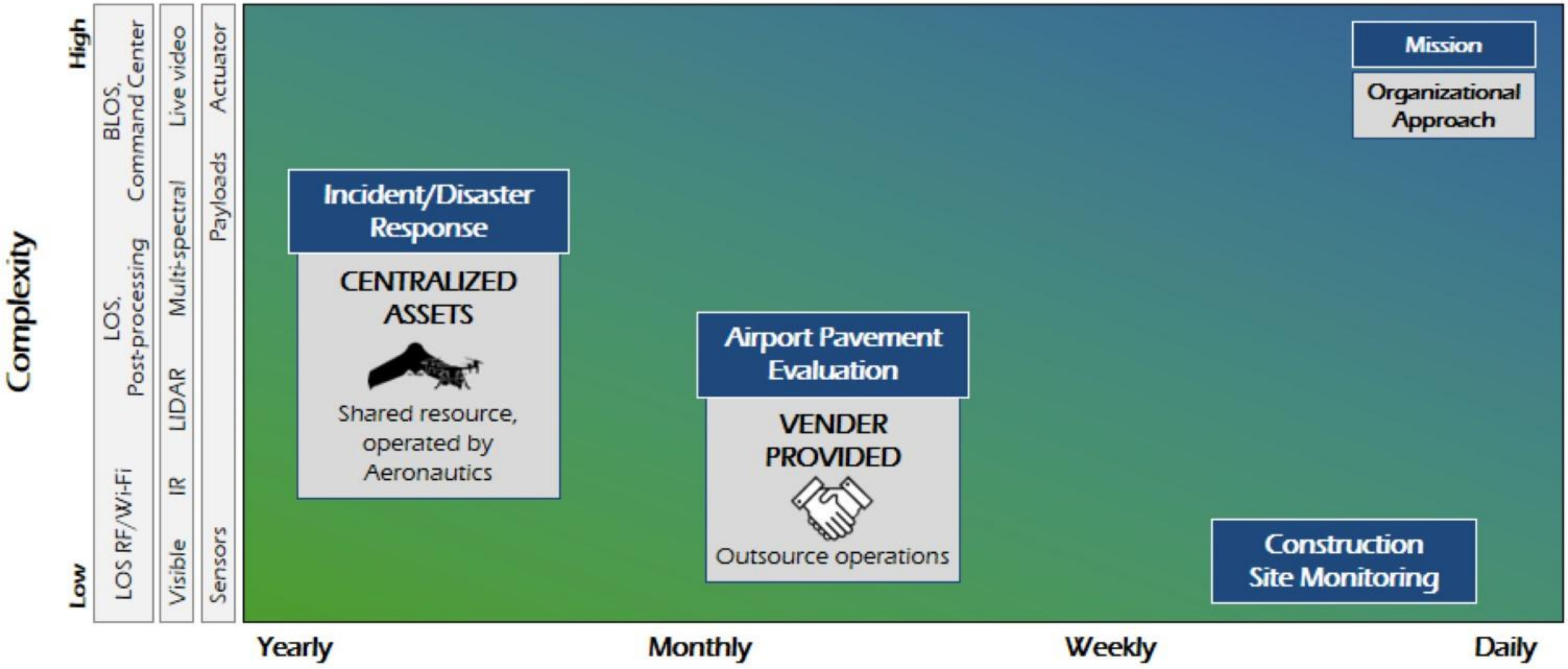

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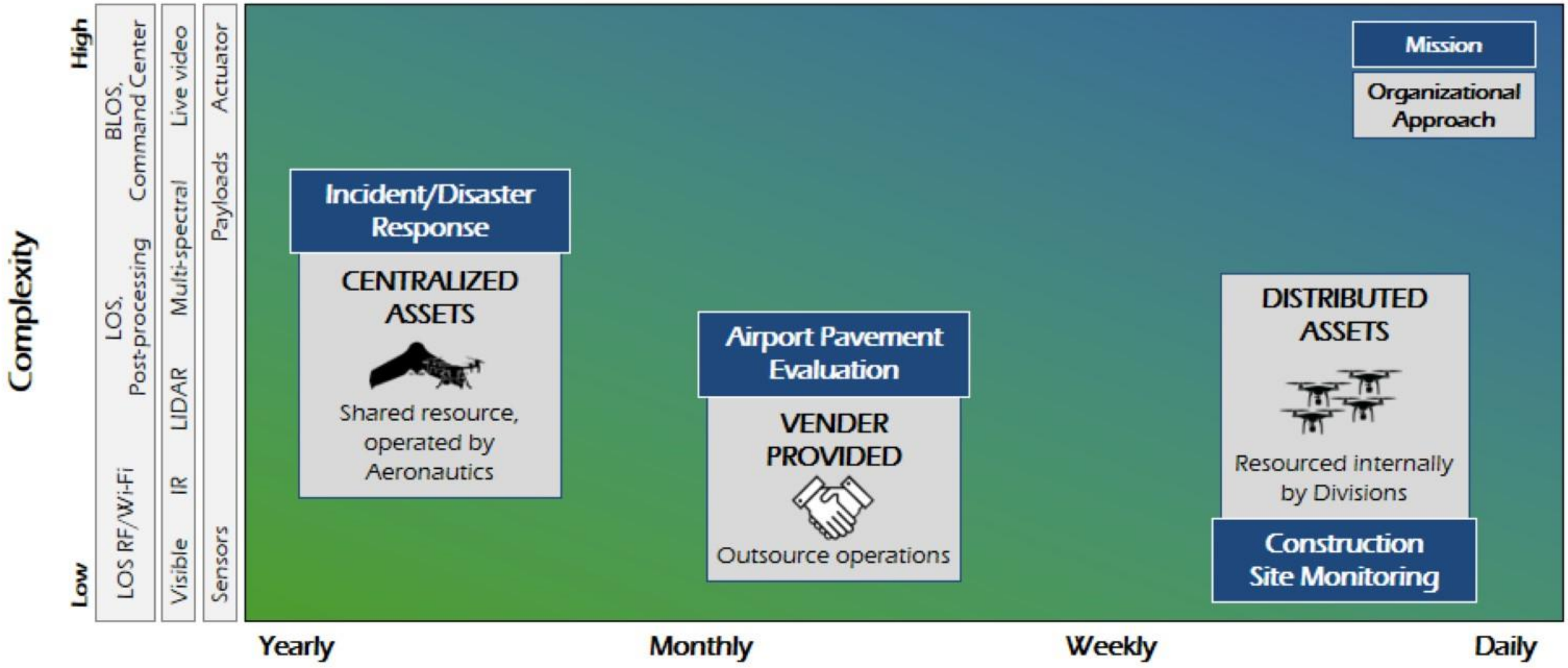

Policy, Procedures, and Checklists

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Massachusetts Department of Transportation
Aeronautics Division

Interim MassDOT UAS Policy

Interim (Internal) Policy for the Use of Unmanned Aircraft Systems (UAS)
(As of September 6, 2017)

I. **Overview**

Unmanned Aircraft Systems ("UAS"), also known as drones, when employed safely and with due respect for privacy, offer an effective means to improve certain Massachusetts Department of Transportation (MassDOT) operations or reduce their costs.

The Interim Policy for the Use of Unmanned Aircraft Systems (UAS) (the "Interim Policy") is intended to guide MassDOT employees, supervisors, managers, and contracting staff in considering whether, and determining how, to use UAS for MassDOT purposes. The Interim Policy will help the Secretary of Transportation and her Administrators better understand in advance how UAS are used in different parts of the organization and how their use can be optimized to best serve the mission of the organization.

To ensure that use of UAS consistently meets the standards set by the Interim Policy, MassDOT will centralize development of the MassDOT UAS Use Program under the leadership of the Aeronautics Division ("MassDOT Aeronautics"). MassDOT Aeronautics has been working with a team of experts who have studied the use of UAS and can provide resources to help MassDOT employees and contractors adopt best practices for UAS use.

MassDOT Aeronautics will exercise authority over, and bear primary oversight responsibility for, all use of UAS by, or on behalf of, any MassDOT or MBTA division. **No employee or contractor may use UAS for MassDOT or MBTA purposes without prior notification to MassDOT Aeronautics and compliance with this policy.**

II. **Scope and Applicability**

The Interim Policy applies to all use of UAS to further a MassDOT or MBTA purpose, whether the UAS is operated by an employee, manager, supervisor, consultant, agent, contractor, or otherwise. If you are aware of any contract signed prior to the effective date of the policy that calls for the use of UAS, you are expected to bring that contract to the attention of MassDOT Aeronautics immediately.

III. **Policy Statement**

The use of UAS for MassDOT or MBTA purposes is permitted only when such use is consistent with the following principles, is conducted in accordance with the specific processes and procedures set forth below, and complies with all other applicable MassDOT and MBTA policies.

A. **Purpose**

MassDOT shall use UAS to perform MassDOT functions safely, effectively, and efficiently. Use of UAS for any other purpose is strictly prohibited.

Policy, Procedures, and Checklists

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Interim MassDOT UAS Policy

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MassDOT Aeronautics will exercise authority over, and bear primary oversight responsibility for, all use of UAS by, or on behalf of, any MassDOT or MBTA division. **No employee or contractor may use UAS for MassDOT or MBTA purposes without prior notification to MassDOT Aeronautics and compliance with this policy.**

II. **Scope and Applicability**

The Interim Policy applies to all use of UAS to further a MassDOT or MBTA purpose, whether the UAS is operated by an employee, manager, supervisor, consultant, agent, contractor, or otherwise. If you are aware of any contract signed prior to the effective date of the policy that calls for the use of UAS, you are expected to bring that contract to the attention of MassDOT Aeronautics immediately.

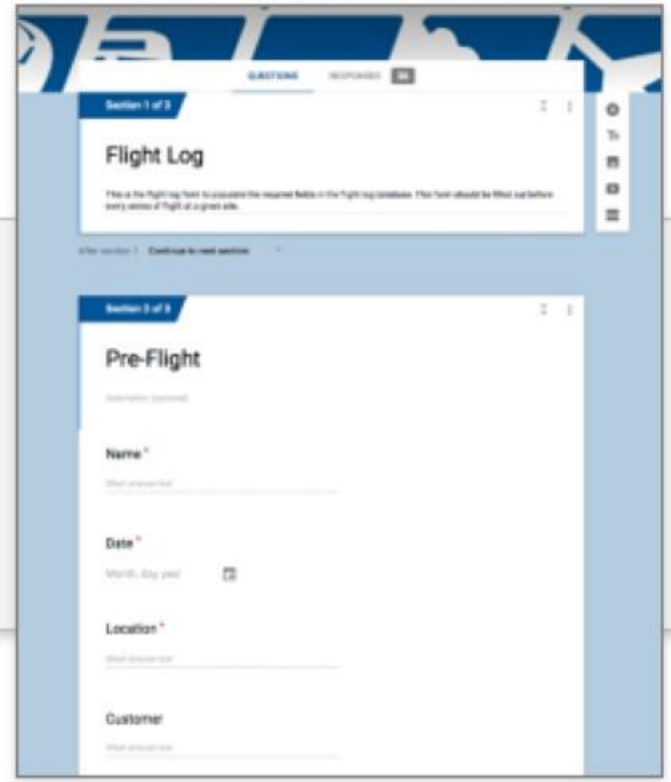
III. **Policy Statement**

The use of UAS for MassDOT or MBTA purposes is permitted only when such use is consistent with the following principles, is conducted in accordance with the specific processes and procedures set forth below, and complies with all other applicable MassDOT and MBTA policies.

A. **Purpose**

MassDOT shall use UAS to perform MassDOT functions safely, effectively, and efficiently. Use of UAS for any other purpose is strictly prohibited.

Operating Procedures



Policy, Procedures, and Checklists

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Aeronautics Division

Interim MassDOT UAS Policy

massDOT

Interim (Internal) Policy for the Use of Unmanned Aircraft Systems (UAS)
(As of September 6, 2017)

I. **Overview**

Unmanned Aircraft Systems ("UAS"), also known as drones, when employed safely and with due respect for privacy, offer an effective means to improve certain Massachusetts Department of Transportation (MassDOT) operations or reduce their costs.

The Interim Policy for the Use of Unmanned Aircraft Systems (UAS) (the "Interim Policy") is intended to guide MassDOT employees, supervisors, managers, and contracting staff in considering whether, and determining how, to use UAS for MassDOT purposes. The Interim Policy will help the Secretary of Transportation and her Administration better understand in advance how UAS are used in different parts of the organization and how their use can be optimized to best serve the mission of the organization.

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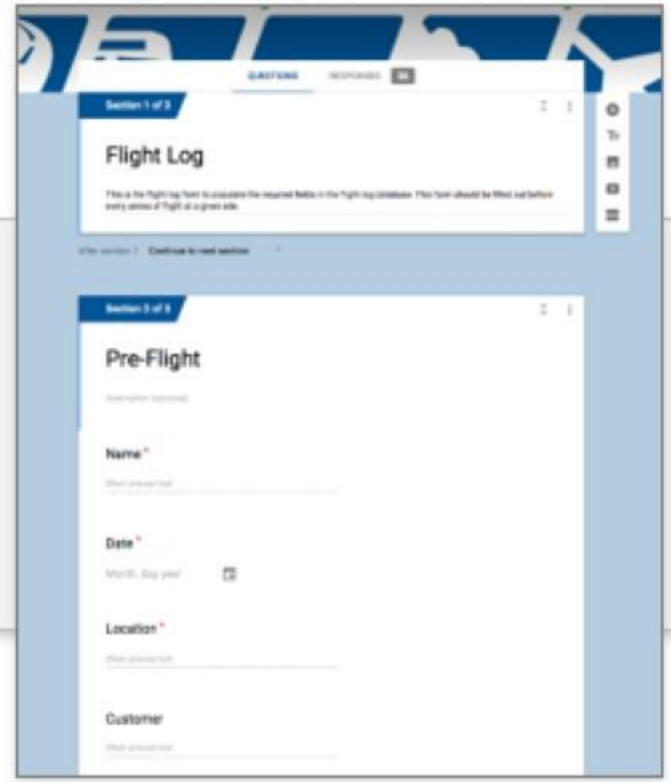


QUESTIONS RESPONSES 26

Section 1 of 3

Flight Log

Section 2 of 3

Pre-Flight

Name *

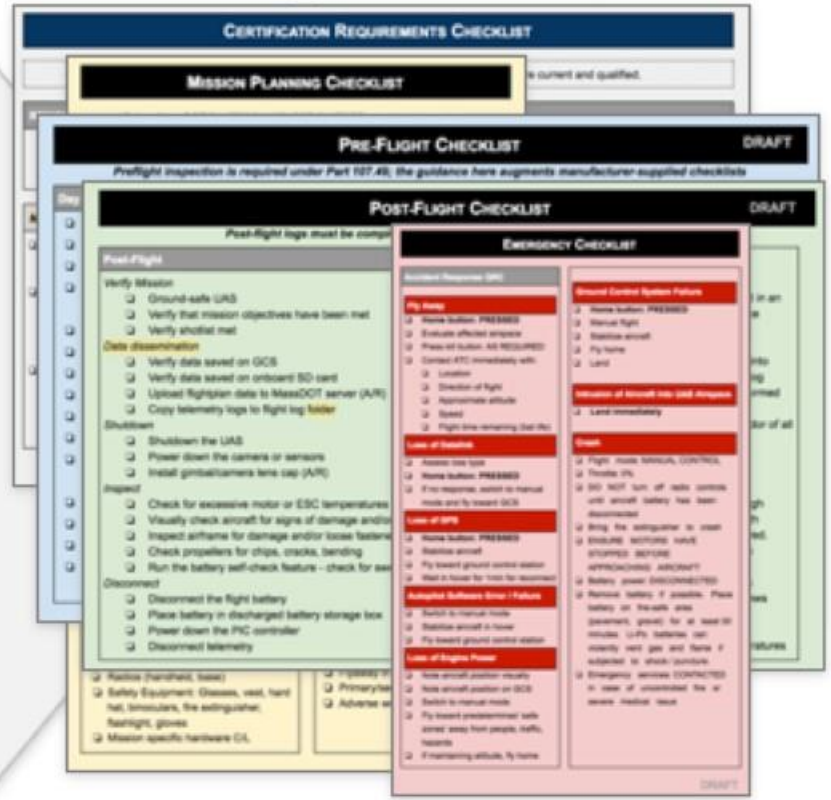
Date *

Month, day, year

Location *

Customer

Flight Checklists



CERTIFICATION REQUIREMENTS CHECKLIST

MISSION PLANNING CHECKLIST

PRE-FLIGHT CHECKLIST DRAFT

Preflight inspection is required under Part 107.49; the guidance here augments manufacturer-supplied checklists

POST-FLIGHT CHECKLIST DRAFT

EMERGENCY CHECKLIST

- Vetting policy, procedures, and flight checklists through regular flight operations

Process for Mission Planning & Flight Readiness Reviews

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Aeronautics Division

Receive New Request → Review → **Evaluate New Request** → Review → **Plan Flight Operations** → **Flight Readiness Review** → **Perform Flight Operations** → **Deliver Data & After-Action**

- State customers

- Site evaluation
- Privacy concerns
- Cost/benefit
- Capability growth

- Operational constraints
- Flight plans
- Risk mitigation
- Post-flight data plan

- Focus on safety

- Lessons learned

- Overview
- Objectives
- Assets & personnel
- Site description
- Flight operations
- Hazards & risk mitigation
- Data handling

Data Pilot General Process

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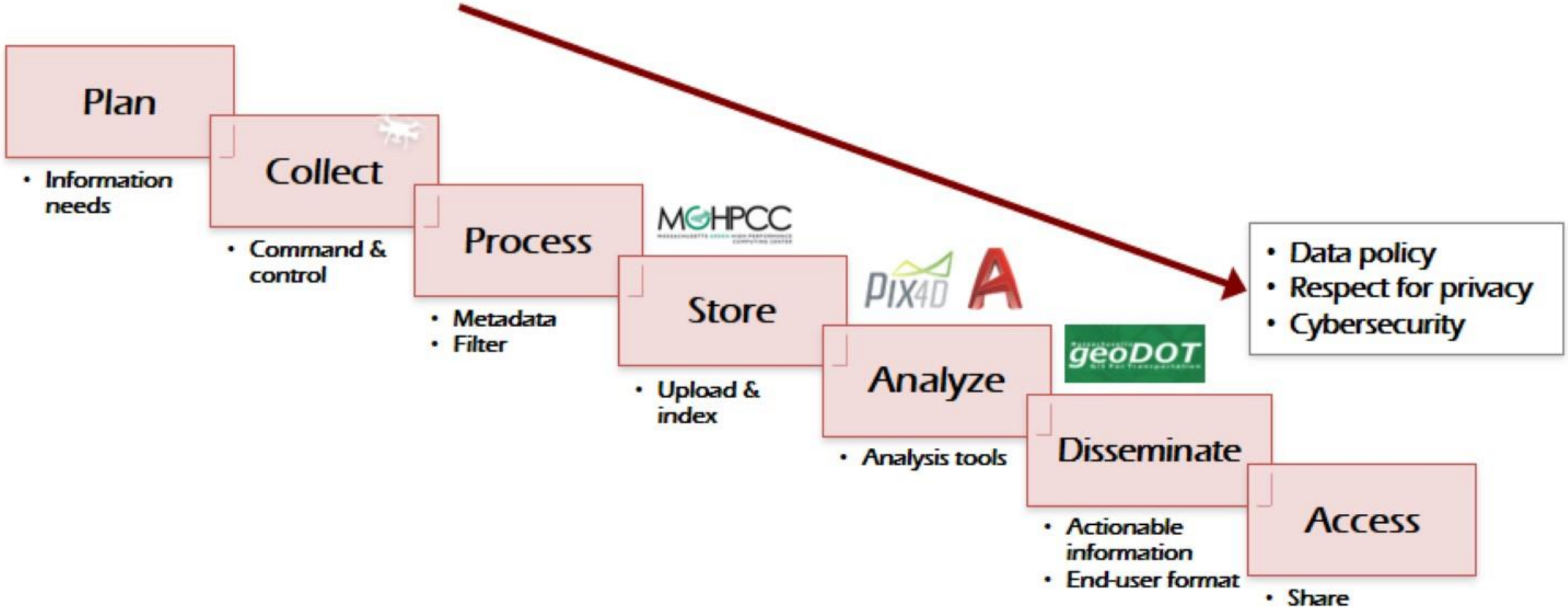
Aeronautics Division



- Building comprehensive approach to data analytics and security necessary to enable drone benefits and ensure mission success

Data Pilot Responding to Identified Needs

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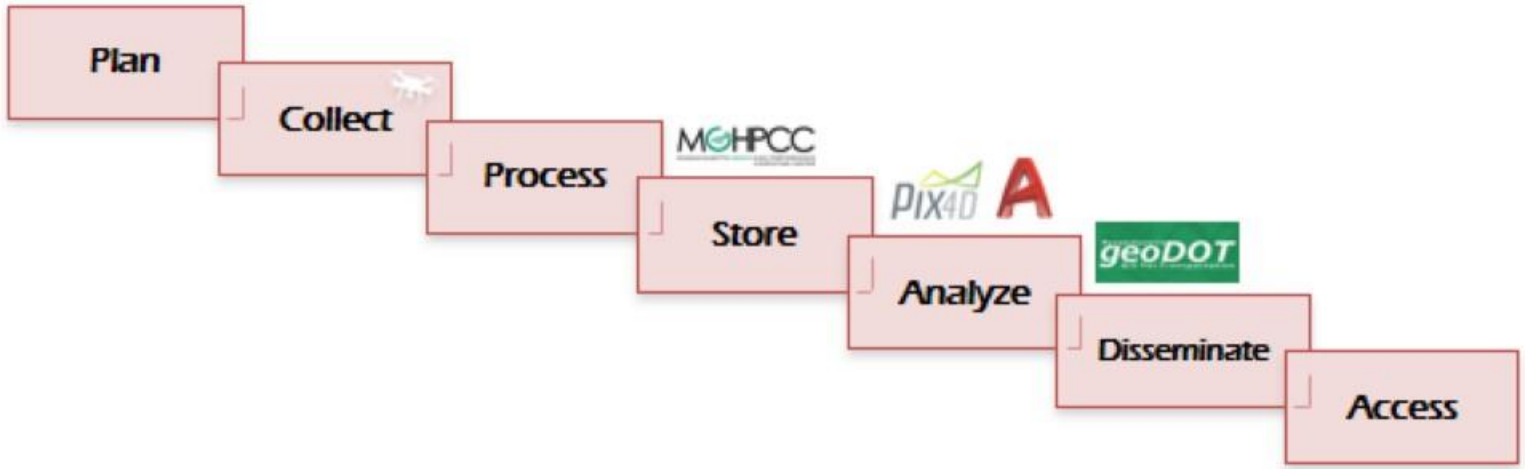
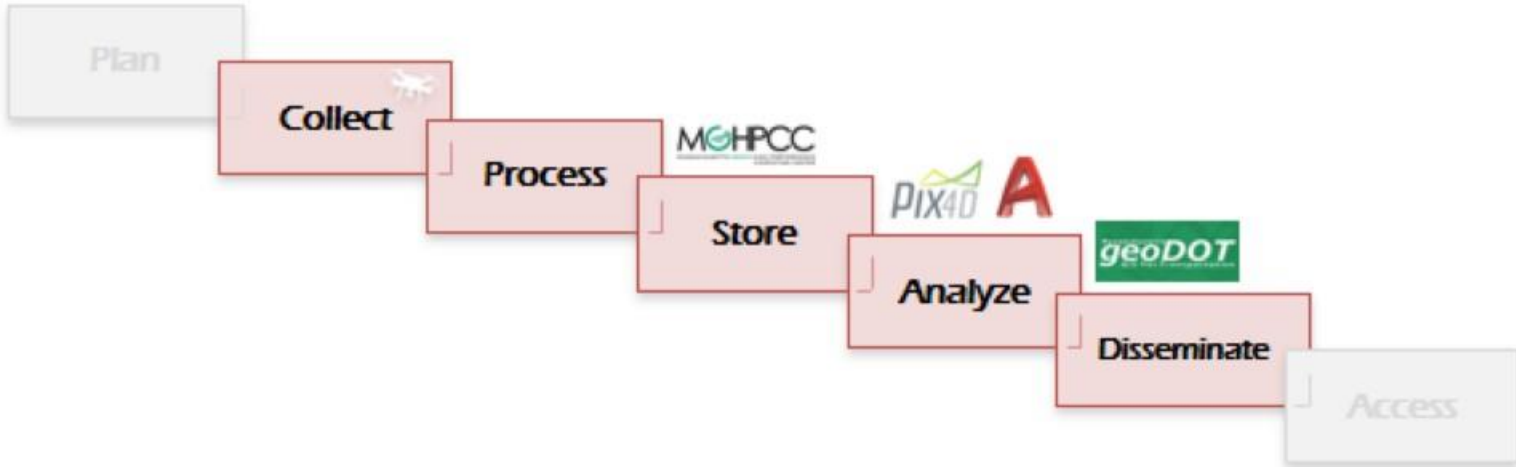


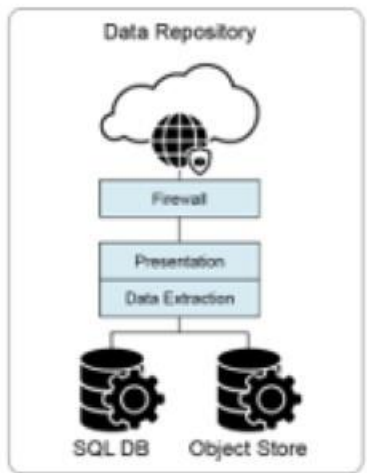
Identified Needs

- Team Coordination
  - Planning and status
  - Flight plan approval
  - Communication
- Data Upload
  - Folder organization
  - Ease and timeliness of upload
- Data Sharing
  - Curating data
  - Dissemination to end-users
- Analysis
  - Employ Advanced tools

Data Pilot Responding to Identified Needs

massDOT Massachusetts Department of Transportation Aeronautics Division





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Data Pilot Responding to Identified Needs

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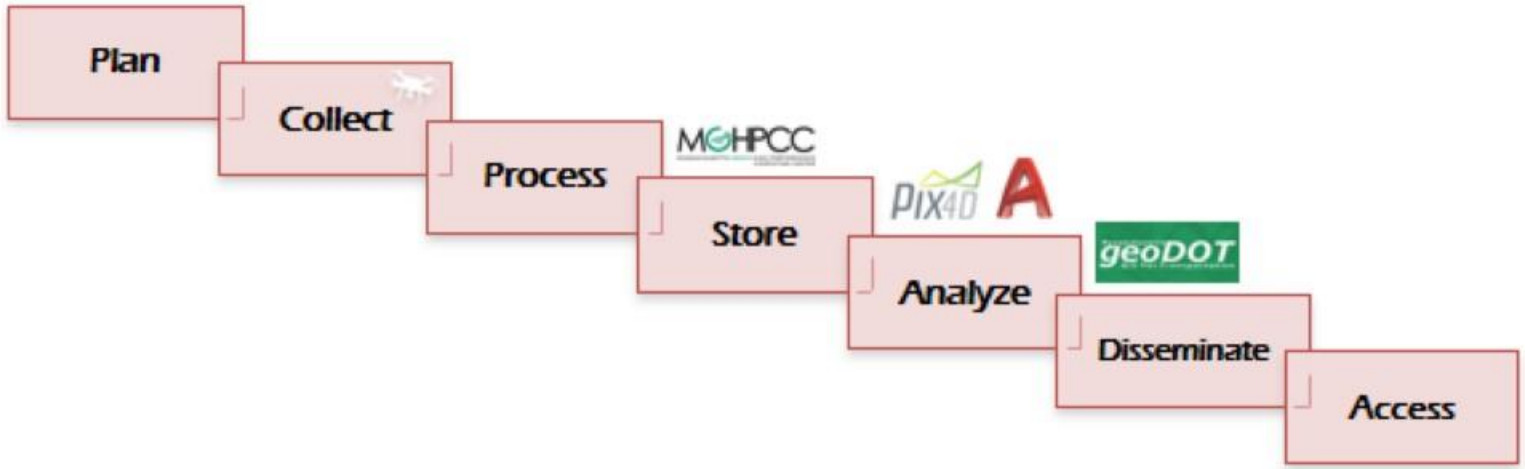
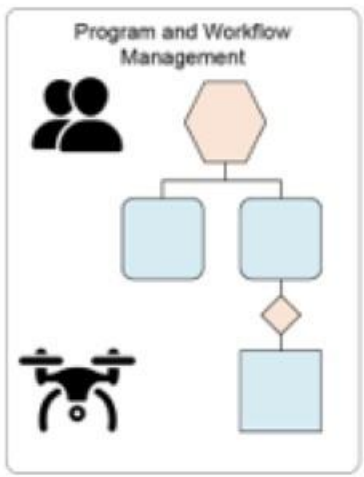
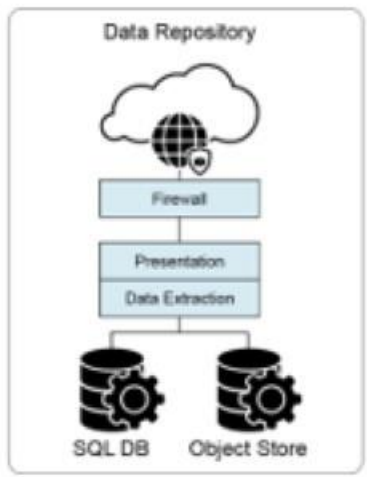
Aeronautics Division







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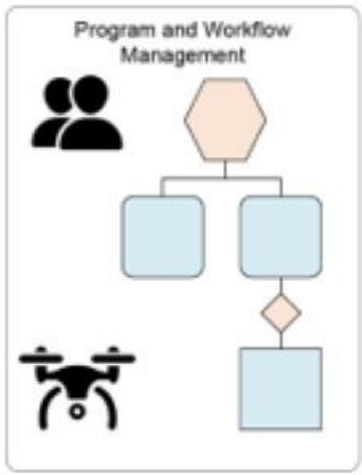

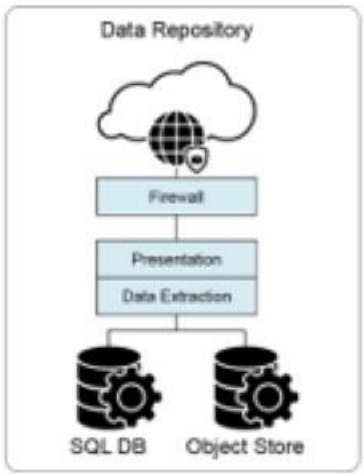

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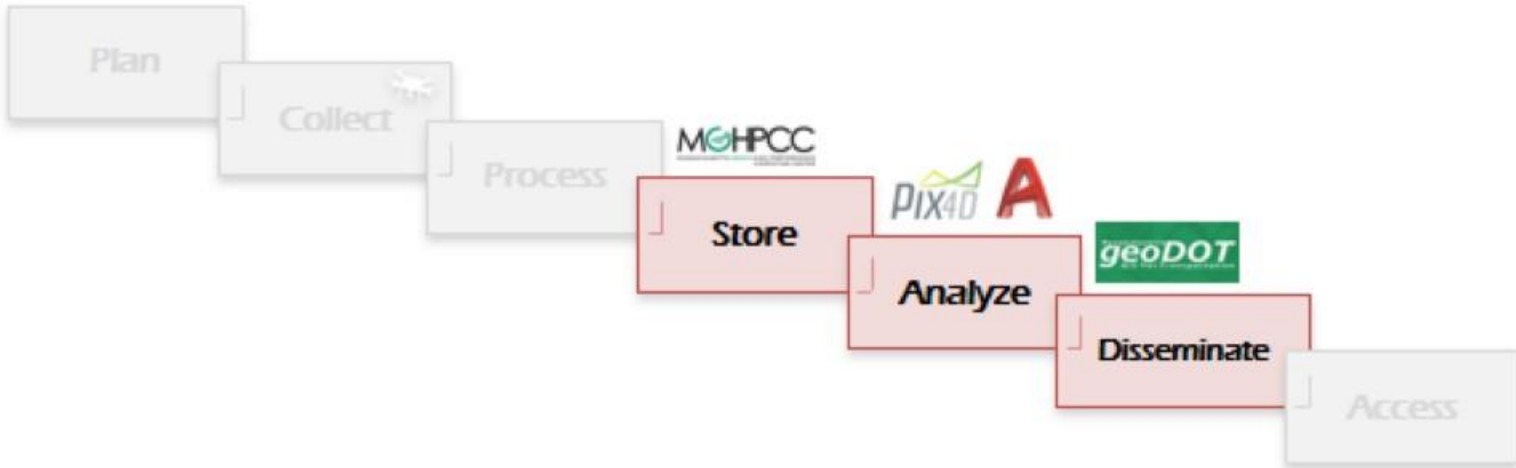

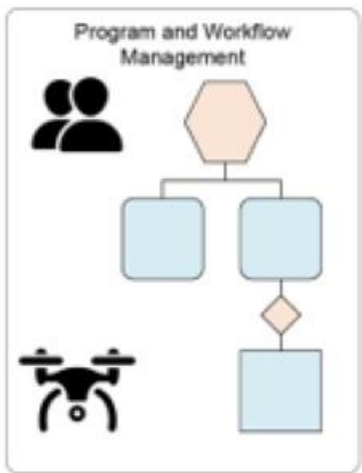

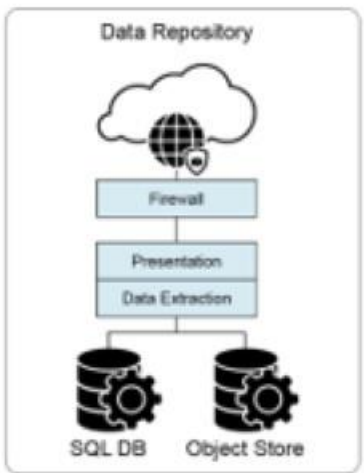

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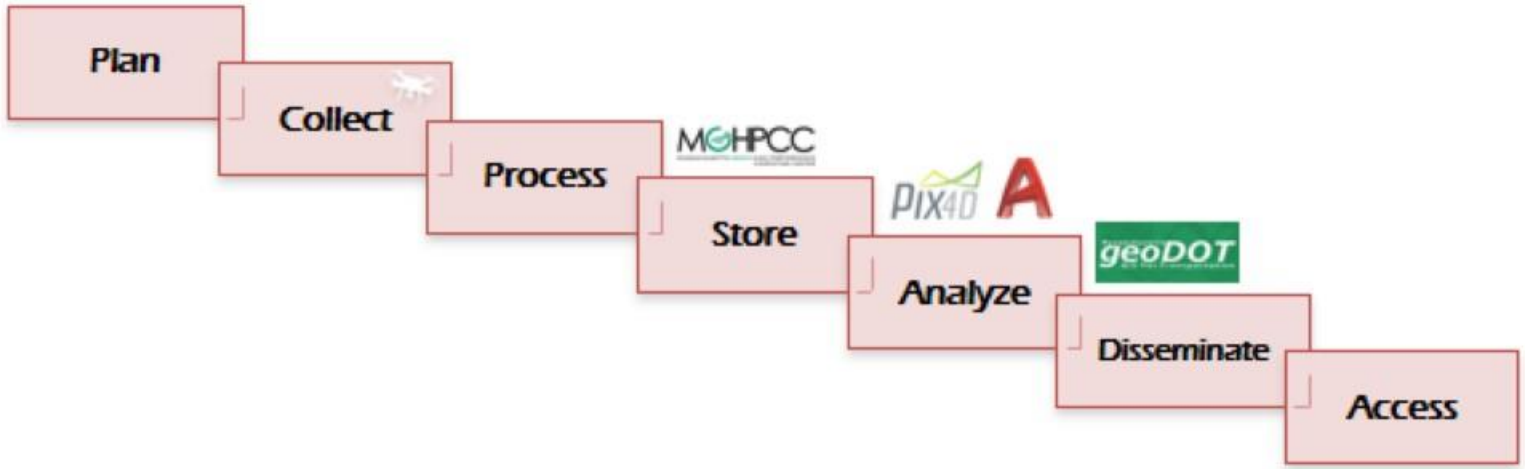

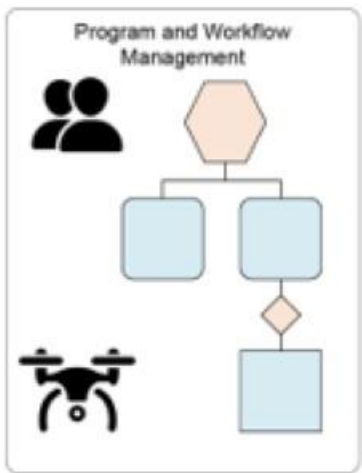

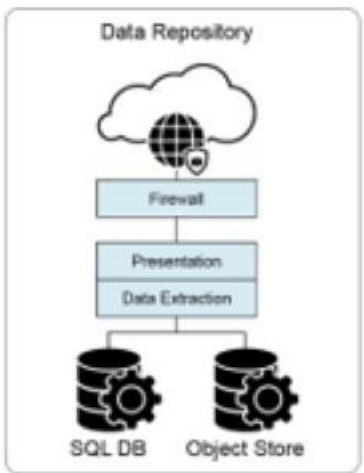

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- Analysis
  - Employ Advanced tools

- Integration across these four areas is needed to enable end-to-end execution of the mission

MassDOT UAS Fleet

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- Fleet selected through evaluation of UAS use cases and analysis of alternatives
- Expanding fleet with new purchases of DJI Mavics & other specialized drones

	 DJI Phantom 4	 DJI Inspire 2	 DJI Matrice 210	 Yuneec H520	 SenseFly ebee	 Delair UX11
# Purchased	5	2	1	1	1	1
Sensors	HD Camera	HD Camera 6K Camera	HD Camera; 30x Optical Zoom; IR (thermal) Camera	HD Camera	S.O.D.A. RGB Sensor[1]	Hi Res, Low/No Distortion
Features	Familiar to users	Dual Operator Mode	All-weather; Upward Gimbal; Dual Lower Gimbals	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	25 min	50 min	59 min

1: Sensor Optimized for Drone Ops – RGB Broad Color Array
2: Real Time Kinetic/Post-Processed Kinetic

Actively Learning from UAS Missions
Use Case: Documenting Bridge Replacement

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- Documented progress of high-profile bridge replacement in downtown Boston
  - Flew 11 missions over 3 weeks: July-August 2018

Actively Learning from UAS Missions
Use Case: Documenting Bridge Replacement

massDOT Massachusetts Department of Transportation Aeronautics Division

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Use Case: Documenting Bridge Replacement

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Aeronautics Division

- Documented progress of high-profile bridge replacement in downtown Boston
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Identified Needs

- Team Coordination
  - Planning and status
  - Flight plan approval
  - Communication
- Data Upload
  - Organizing folder
  - Difficult upload from field
- Data Sharing
  - Curated manually
  - Shared via email
- Analysis
  - HDR* processing

- Constantly identifying needs and feeding back lessons to improve upon and expand Drone Team's capability

* High dynamic range

Growing Capability to Support Multi-Modal Needs Across Commonwealth

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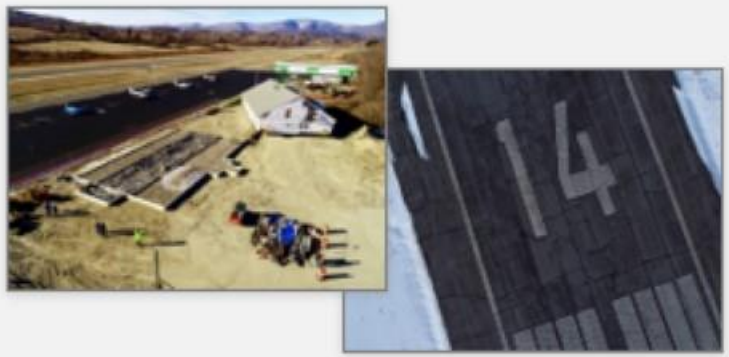
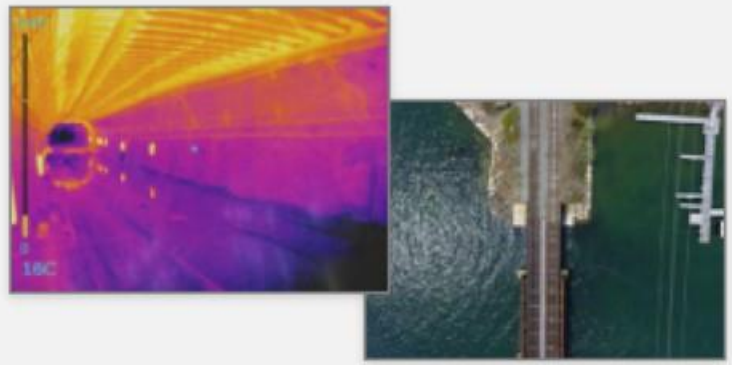
AERONAUTICS

- Runway/taxiway/apron pavement inspection
- General airport inspections
- Obstacle/obstruction analysis to ensure clear approach and departure flight paths



RAIL & TRANSIT/MBTA

- Rail inspection
- Rail obstructions
- 3rd rail inspection
- Tunnel inspection (testing)



HIGHWAY

- Pavement inspection
- Bridge inspection
- Environmental inspection (stormwater management)
- Construction site monitoring
- Incident response
- Asset management

- Addressing multi-modal needs across MassDOT and the MBTA, and becoming a shared service for Commonwealth agencies

Comprehensive Approach Allows UAS Support to Expand Across Commonwealth

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Emergency Response Vigilant Guard Drill

Aeronautics Document Building Move

Highway District 1 Roof Inspection

Highway District 2 Woronocco Bridge

Highway District 2 Agawam Bridge

NORTH ADAMS
CHARLEMONT
LENOX
RUSSELL
WEST SPRINGFIELD
WORCESTER
LAWRENCE
BOSTON
COHASSET
TAUNTON

Highway District 3 MassPike Thermal Imaging

Highway District 3 Headquarters Construction

Highway District 5 I-495 Lobes

Centralized
Distributed

Emergency Response Pipeline Fire

State House Dome

Highway District 6 Comm. Ave. Bridge Replacement

MBTA Subway Drill

Highway District 5 Cohasset Bridge

Agenda

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Developing a **Comprehensive** program

Assembling significant **Incident Response** and **Emergency Management** experience

Promoting **Innovation** to integrate UAS into the Massachusetts economy

Developing Incident Response & Emergency Management Capability

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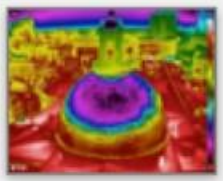
TECHNOLOGY & CAPABILITIES

- All-weather UAS
- IR (thermal) imagers
- Secure live-streaming video feeds into MassDOT & MBTA emergency operations centers
- Goal for BVLOS incident response capability



PERSONNEL

- 24/7 quick response personnel
- Work closely with MBTA & Highway emergency operations centers
- UAS operators also experienced first responders

PARTNERSHIPS

MSP

MEMA

FEMA

DHS

NTSB

- Bring significant incident response/emergency management experience, including being air operations lead coordinating agency for MEMA

Deploying UAS Resources for Emergency Response Documentation

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AIRCRAFT ACCIDENTS

- MassDOT Aeronautics state lead accident investigator

PIPELINE FIRES

- Documented damage due to gas fires
- Performed operations in conjunction with NTSB

EXERCISES

- Demonstrated operational integration of UAS and deconfliction with crewed aircraft

- Working with FEMA to bring capabilities across state lines (UAS and crewed aircraft)

Agenda

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Developing a **Comprehensive** program

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Commonwealth UAS Integration Program

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- Create an ecosystem within the Commonwealth to:
  - Support technical, commercial, and economic development in unmanned and autonomous vehicles
  - Create a safe, secure, and adaptable framework(s) for integrating unmanned and autonomous vehicles in Massachusetts and beyond
  - Generate unmanned and autonomous transportation solutions across modes and domains
  - Broaden opportunities for STEM programs and workforce development efforts to engage with unmanned and autonomous vehicle technology

Bringing Stakeholders Together to Incentivize Focused Solutions to Transportation Problems

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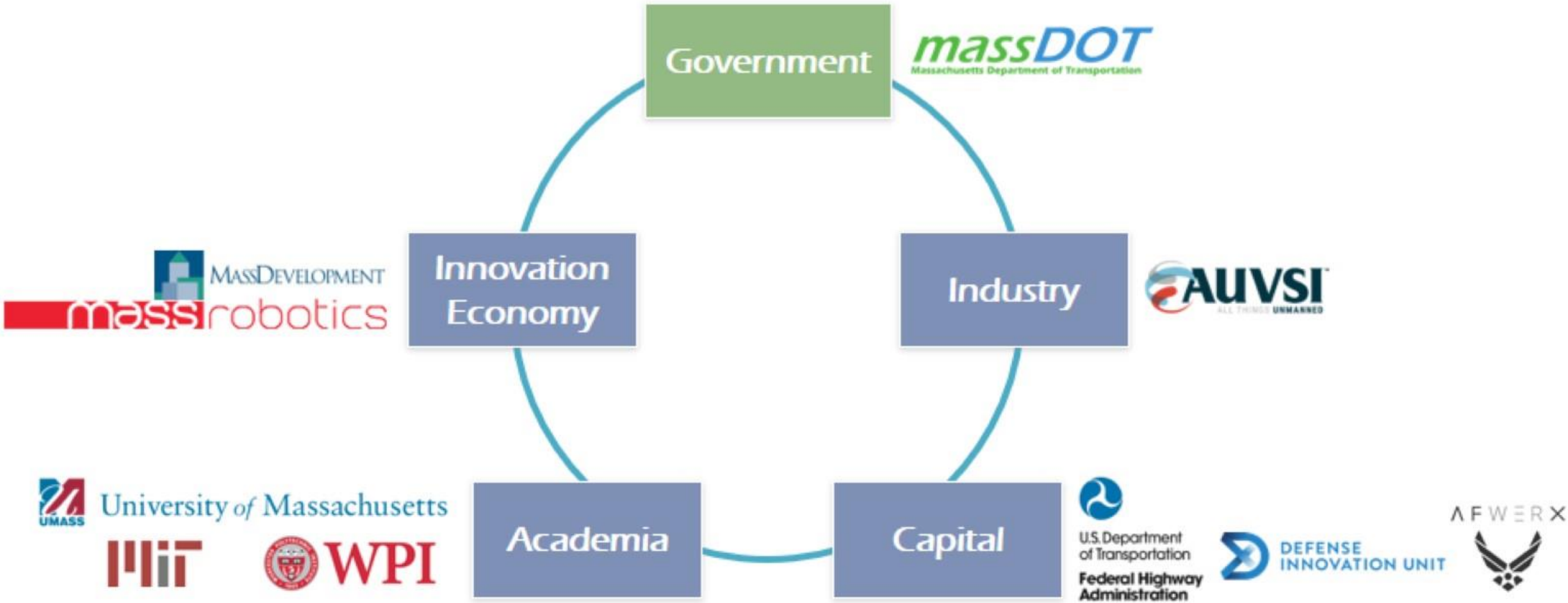

Facilities for Test & Operational Development

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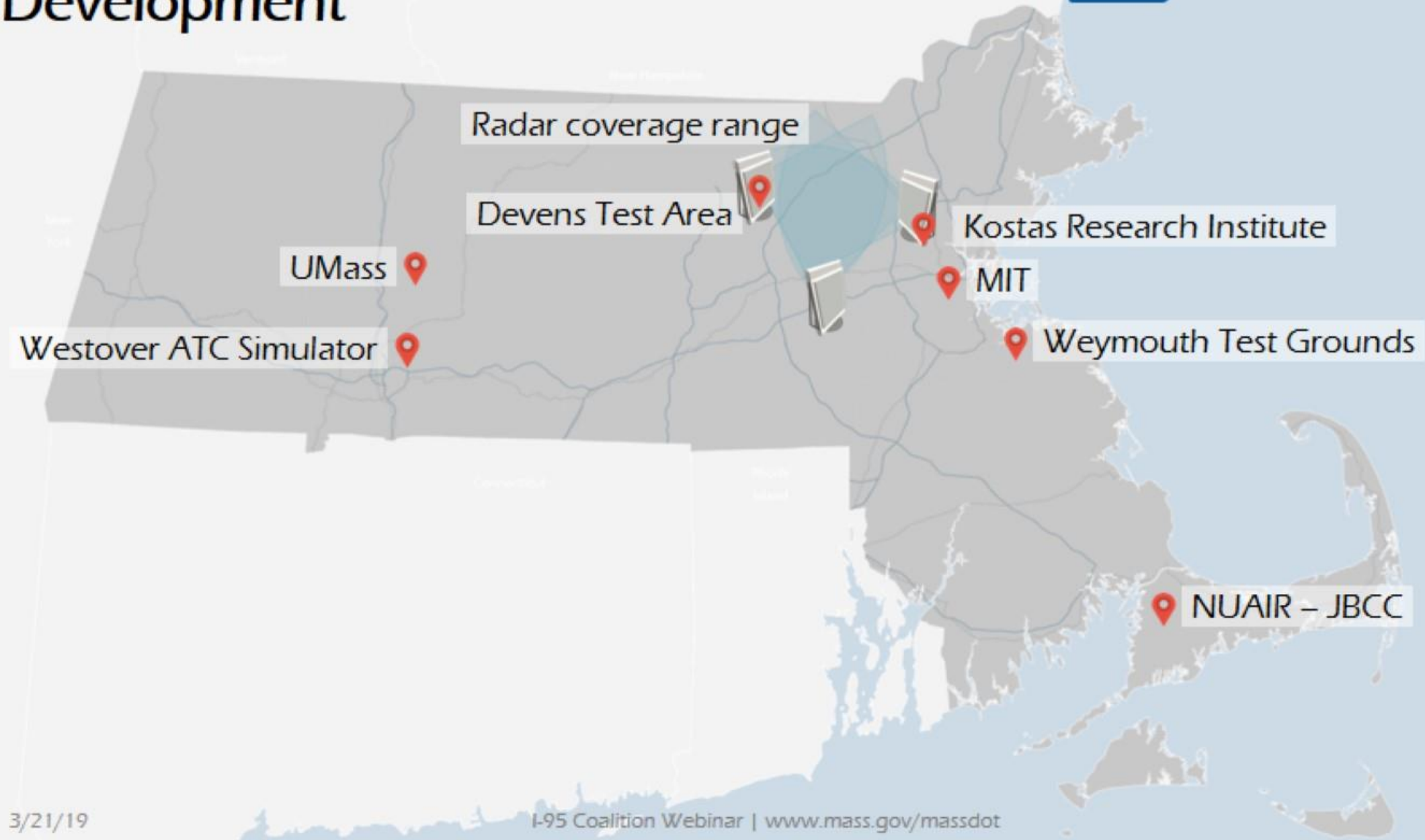
Aeronautics Division



UAS Projects to Support Commonwealth Innovators

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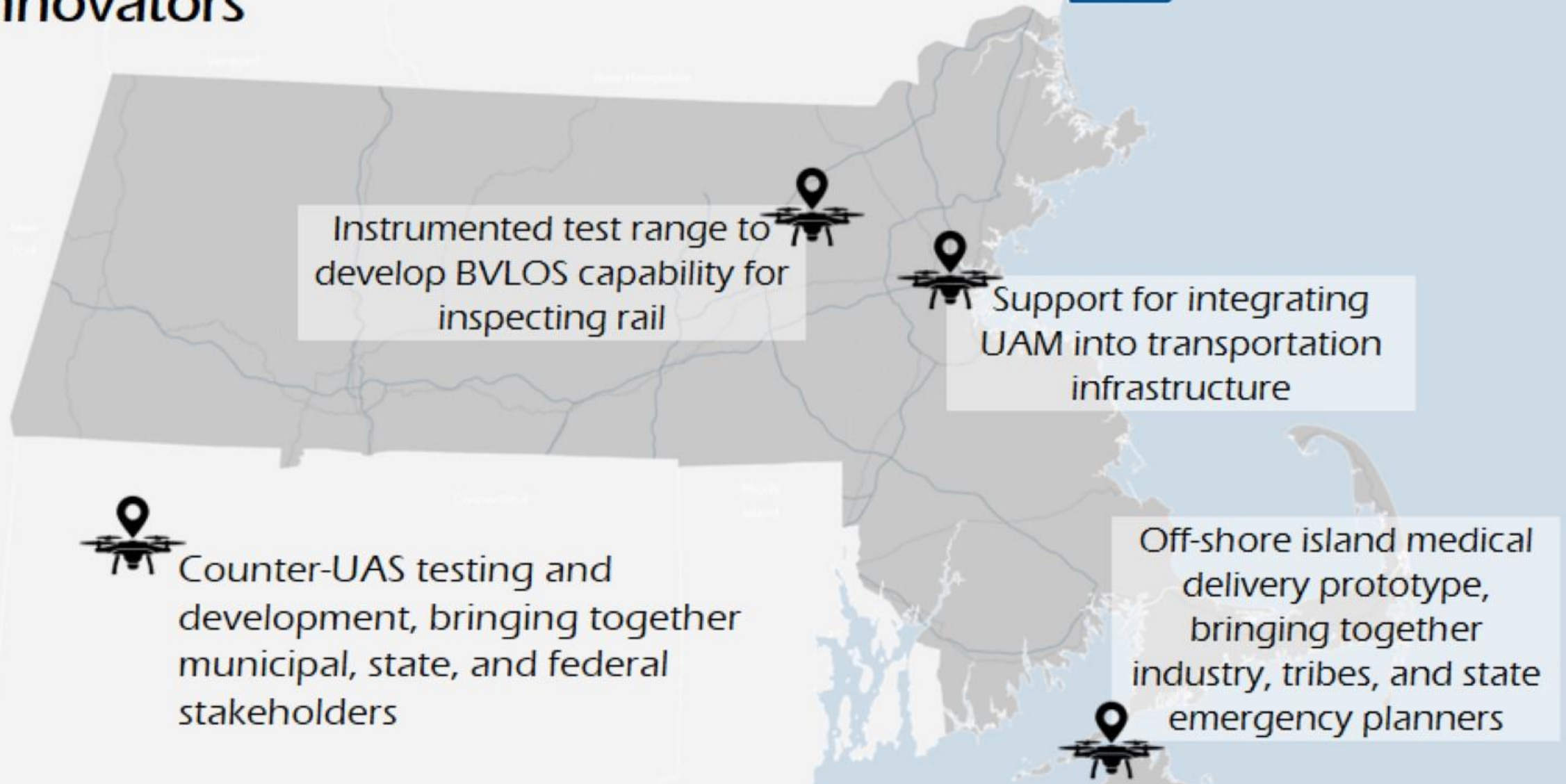

Instrumented test range to develop BVLOS capability for inspecting rail

Support for integrating UAM into transportation infrastructure

Counter-UAS testing and development, bringing together municipal, state, and federal stakeholders

Off-shore island medical delivery prototype, bringing together industry, tribes, and state emergency planners

Counter-UAS Development
Analyzing Solutions Across Continuum of Events

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- MassDOT Aeronautics taking state lead in facilitating and convening stakeholders to identify, develop, and deploy counter-UAS solutions

Summary

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Aeronautics Division

Developing a **Comprehensive** program

Assembling significant **Incident Response** and **Emergency Management** experience

Promoting **Innovation** to integrate UAS into the Massachusetts economy

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Aeronautics Division

Thank You!

Question & Answers

Ginna Reeder, I-95 Corridor Coalition

Wrap Up

Ginna Reeder, I-95 Corridor Coalition

Meeting information & presentations will be posted to the I-95 Corridor Coalition website. Participants will receive a link to the presentations after they are posted.

In Closing….

Thank you for joining today

For Additional Information, please contact:

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  jeffrey.decarlo@state.ma.us

- Scott Uebelhart, Massachusetts DOT Consultant

  suebelhartphd@gmail.com