



## **UAS (Drone) Peer Exchange FINAL REPORT**

September 2019

Submitted by

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<b>16. Abstract</b> The 2017 NJDOT Peer Exchange was held on October 3-5th in Trenton, New Jersey. The panelists included state DOT UAS leaders from Delaware, Kansas, Massachusetts, New Jersey, North Carolina, and Pennsylvania, as well as UAS leaders from the FAA, New Jersey State Police, and the NJ State Forest Fire Service. The Peer Exchange was intended to share UAS experiences, research, and best practices among the panelists. Each state presented an overview of their UAS initiatives and explained the rationale and "lessons learned" in developing their program.					
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## **EXECUTIVE SUMMARY**

The 2017 NJDOT Peer Exchange was held on October 3-5<sup>th</sup> in Trenton, New Jersey. The panelists included state DOT UAS leaders from Delaware, Kansas, Massachusetts, New Jersey, North Carolina, and Pennsylvania, as well as UAS leaders from the FAA, New Jersey State Police, and the NJ State Forest Fire Service. The Peer Exchange was intended to share UAS experiences, research, and best practices among the panelists. Each state presented an overview of their UAS initiatives and explained the rationale and “lessons learned” in developing their program.

## **LIST OF ACRONYMS**

- AC - FAA Advisory Circular
- AGL - Above Ground Level
- ADS-B - Automatic Dependent Surveillance-Broadcast
- ATC - Air Traffic Control
- CFR - Code of Federal Regulations
- COA - Certificate of Waiver or Authorization
- FAA - Federal Aviation Administration
- FSDO - Flight Standards District Office
- ICAO - International Civil Aviation Organization
- METAR - Meteorological Terminal Aviation Routine Weather Report
- NAS - National Airspace System
- NOTAM - Notice to Airmen
- RP - Remote Pilot
- PIC - Pilot in Command
- TAF - Terminal Area Forecast
- TFR - Temporary Flight Restriction
- TSA - Transportation Security Administration
- UAS - Unmanned Aircraft System

## **INTRODUCTION**

The use of drones by public sector agencies such as the NJDOT is progressing at an exponential rate. Each state has funded ground breaking research and is expanding their UAS programs with limited funding and guidance.

Our peer exchange for successful policies, procedures, and practices for drone technology in transportation was designed to leverage the quality and effectiveness of research efforts by sharing best practices and management innovations.

The basic approach was to invite an outside panel of UAS leaders to meet at the host agency to discuss and review its process for a specific focus area. The host agency shares policies and procedures prior to the meeting. During the peer exchange, panel members met with managers, staff, stakeholders, and customers to gain further insight into the host agency's program.

Peer exchanges, an eligible activity for Division T2 deployment funds, served as an excellent opportunity to share experience and successful practices in the area of drone use in transportation.

The information gathered from the exchange was documented in this final report and was presented to agency management.

## **GOALS AND OBJECTIVES**

To share policies, procedures, and best practices in the use of drone technology for transportation.

## **NJDOT UAS PEER EXCHANGE PANELIST BIOGRAPHIES**

**Dr. Anil Agrawal**, Professor of Civil Engineering, City College of New York

Dr. Anil Agrawal is currently a Professor of Civil Engineering at the City College of New York and the Chief Editor of the ASCE Journal of Bridge Engineering. He has been the past-chair of ASCE Committee on Bridge Inspection, Rehabilitation and Monitoring. His research interests include inspection and deterioration of bridge elements, robotic inspection of bridge components, post-hazard assessment using drones, behavior of bridges during extreme hazards such as earthquakes, blast, fire, and vehicular impacts on highway bridges, redundancy of long span cable supported bridges and advanced geophysical methods on foundation characterization.

**Merrill Eisenhower Atwater**, Director of Aviation, Kansas DOT

Merrill Eisenhower Atwater, a Kansas native, graduated from Valley Forge Military Academy. He received his Bachelor of Science in History at Missouri Western State University and a Master's in Business Administration from Baker University. From his prior professional experiences as a government relations specialist for Vehicle-Infrastructure Integration (VII) and Intelligent Transportation Systems (ITS) America at Econolite, president of New Business Development at Fox Energy Corporation, and National Director at Housby Inc.; Merrill, has spoken nationally and internationally over transportation and energy.

Currently, Merrill works as the Director of Aviation for the State of Kansas Department of Transportation. Overseeing a system of 137 airports and an aviation industry cluster which represents an economic impact of 20.6 billion dollars for the state.

He currently is a member of the Executive staff of the Kansas Department of Transportation, Kansas Freight Advisory Committee, and Technology Committee. He currently sits on several boards including: The Transportation Research Board committee on Airfield and Airspace Capacity and Delay, TRB subcommittee on UAS, AASHTO's Aviation Committee, The NASAO board of directors (Secretary), the NASAO's Airspace Committee, NASAO's Committee on UAS and the NASAO's committee on finance. In 2016, Merrill was appointed to Kansas State Polytechnic Dean's Advisory Council and in July 2017 he was appointed to the Eisenhower Memorial Commission.

**Scott Gibson**, Senior Planner, NJ Office of Homeland Security

Scott Gibson, Senior Planner, joined the Preparedness Bureau in the New Jersey Office of Homeland Security and Preparedness (NJOHSP) in 2015. Through partner engagement, trend analysis, and strategic planning, Scott is responsible for developing policies and projects aimed at strengthening resiliency in New Jersey. He assists in coordinating the Infrastructure Advisory Committee, the State's primary platform to engage the private sector on preparedness and resiliency. He also coordinates the development and release of NJOHSP's Bulletin, a publication reaching nearly 5000 subscribers highlighting initiatives and resources relevant to homeland security in New Jersey. Prior to joining NJOHSP, Scott worked as a Fellow for the Subcommittee on the Western Hemisphere of the House Committee on Foreign Affairs.

Scott holds a Bachelor of Arts in Psychology, Sociology, and Anthropology from Washington and Lee University, and a Master of Arts in International Relations from Johns Hopkins University.

**Robert Gill, Jr.**, NJ Forest Fire Service Aviation Officer, NJ Environmental Protection

Rob started with the NJFFS as a forest fire crewmember in 1989 in Atlantic County. He started college at Atlantic Community College, transferred to and graduated from Pikes Peak College in Colorado with an Associates Degree in Science, Fire Science Technology. Since joining the NJFFS, Rob has held the titles of; Fire Observer, Forest Fire Control Technician, and currently Section Forest Firewarden. He is in charge of the aviation program, overseeing both state operated and contracted fixed wing and rotor wing aircraft. Rob sits as a representative on the Northeastern Area States aviation Committee as well as the Northeastern Area Interagency Unmanned Aircraft Systems Working Group. He has traveled all over the country for both training and fire assignments dealing with aviation. Rob is assigned to the NJFFS IMT as an Air Operations Branch Director.

**Sergeant First Class Ronald (Ron) Leach, UAS Team Lead, NJ State Police**

Sergeant First Class Ronald (Ron) Leach is a 22 year veteran of the New Jersey State Police. He graduated from the New Jersey State Police Academy as part of the 115th State Police Class in April 1995.

Ron's extensive aviation background was developed during his career within the New Jersey State Police Aviation Bureau that spanned more than 14 years. He holds several Federal Aviation Administration (FAA) Pilot Ratings ranging from Airline Transport Pilot to Private Pilot.

Ron was tasked with developing a direction for the New Jersey State Police to explore the use of Unmanned Aerial Systems (UAS) technology as well as counter UAS technology. He is the Chairman of the New Jersey State Police UAS Working Group. Ron has provided guidance to local law enforcement and fire departments in order to establish a working dialog to assist departments with UAS response and deployment. Ron has an Associate in Science degree from Salem Community College (New Jersey), a Bachelor of Science degree from Wilmington University (Delaware), and a Master of Administrative Science degree from Fairleigh Dickinson University (New Jersey).

**Jim McDavitt, Senior Planner, New Jersey Office of Homeland Security**

Jim McDavitt is a Senior Planner at the New Jersey Office of Homeland Security and Preparedness (NJOHSP). As a Senior Homeland Security Planner, Jim works with a number of partners throughout the State to determine gaps, and identify capabilities to enhance the State's preparedness. Through collaborative engagements with partners, Jim assists in formulating strategic planning, and draft policy recommendations to further enhance New Jersey's security and overall resilience. Prior to joining NJOHSP, he worked as an Analyst in Washington DC, supporting a number of federal agencies including US Secret Service and Transportation Security Administration. Jim holds a Bachelor of Science degree from Roger Williams University, where he majored in Criminal Justice and minored in Political Science and Networking and Security.

**Terrance McKenna, UAS Program Manager, MassDOT**

Terrence is a member of the MassDOT Aeronautics team tasked with integrating UAS into all facets of the Commonwealth's operations. Terrence comes from a rich background of both technical and operational UAS development serving as technical and programmatic leads for a variety of programs at Aurora Flight Sciences for close to a decade. He has worked closely with the Air Force Research Lab, DARPA, and NASA to develop autonomous aerial solutions for the needs of the warfighter. Terrence augments extensive UAS experience with work on the manned side of aviation by serving in the U.S. Air Force as a C-5M Super Galaxy Pilot at Westover Air Reserve base with the 337 Airlift Squadron. Terrence has an Aerospace Engineering Degree from the Massachusetts Institute of Technology and holds a Fixed Wing Commercial/Instrument, Seaplane, and Remote Pilot's License.

**John Melville**, Aviation Safety Supervisor, PennDOT

John is an Aviation Safety Supervisor at Pennsylvania Bureau of Aviation. He oversees the licensing and safety inspection program of over 660 public and private airports and heliports in Pennsylvania. He is PennDOT's POC for advancing the department's UAS program. He has over 34 years of professional aviation experience, 21 of those years have been with the Bureau of Aviation. He previously rated fixed- and rotary-wing aviator and was a flight instructor on US Army UH-1 helicopter.

**Andrew Mihaley**, Aeronautical Inspector, MassDOT

Drew Joined the MassDOT Aeronautics Inspector in March of 2012. Drew's background includes 25 years in the U.S. Air Force starting as an Air Traffic Control Specialist in Worcester, Massachusetts. After graduating college with a Bachelors in Aviation Science he was commissioned in the Air Force as an HH-60 Pavehawk Helicopter Pilot with the 102nd Rescue Squadron. He was also an Aircraft Accident Investigation Officer providing expertise as both a fixed wing and helicopter pilot. In 2004 he transferred to Westover Air Reserve base flying the C-5 Galaxy and was a Tactics Officer for the unit. Drew retired from the service in 2016.

Currently he is an MD-500 pilot for the Aeronautics Division, conducts Airport inspections and Aircraft Accident Investigations, and is a member of the Aeronautics drone program. Drew has 5000 hrs of flight time and holds a Rotary and Fixed Wing Commercial/Instrument and Remote Pilots License.

**Glenn Stott**, UAS Coordinator, NJ Department of Transportation

Glenn Stott leads the NJDOT's UAS initiatives and the Peer Exchange. He is a retired Canadian AirForce jet instructor, Test Pilot, and Flight Commander. In the 1980's he flew many Search & Rescue and UN disaster relief operations in Africa and the Middle East. Later he flew corporate jets and became a certified jet instructor in 160 different countries. He served at CAE's NorthEast Training Center as the Training Manager and Chief Instructor Pilot for the Dassault-Falcon Fleet of corporate jets. Glenn is a current FAA designated examiner and authorized to grant the highest level of pilot licenses. The national aviation authorities of Brazil, China, Russia, Canada, Mexico, Saudi Arabia, Australia, and New Zealand have also authorized Glenn to issue pilot licenses.

In addition to his aviation experience, Glenn's understanding of emerging technologies earned him part-time positions as an Adjunct Technology Professor for both Kean and Seton Hall Universities. Glenn's UAS background started over 20 years ago with remote control helicopters. Currently, he serves on the NASAO (National Association of State Aviation Officials) UAS Committee and is a frequent speaker regarding drone technology in the transportation industry.

**Joshua Thomas**, Planning Supervisor/Aeronautics Program Manager, DelDOT

Josh Thomas is a Planning Supervisor with the Delaware Department of Transportation (DelDOT) and has been with the Department for 10 years. Josh manages transportation projects and programs in the areas of local comprehensive planning, Metropolitan Planning Organization (MPO) coordination, freight, and aviation. As DelDOT's Aeronautics Program Manager, Josh coordinates Unmanned Aircraft Systems (UAS) development with DelDOT staff, airport officials, and the aviation community.

**Roy A. "Skip" Wiegand**, UAS Program Manager, Eastern Region, FAA

Roy A. "Skip" Wiegand graduated from U.S. Naval Academy where he received his Bachelor of Science in Physics. His previous Management/Leadership experiences include numerous junior officer managerial and leadership positions including tour at replacement Air Group as Familiarization Stage Schedules Officer; Officer in Charge of VP68 and Operations and Safety/NATOPS Officer and Chief Staff Officer for 7 squadron patrol wing in Norfolk, VA. Over 60 aircraft; Commanding Officer, Patrol Squadron 90, Naval Air Station, Glenview, IL. Directed 400 officers and enlisted personnel with 9 P3 aircraft; Director for Reserve Affairs for Director, Air Warfare (N88R) on the staff of the Chief of Naval Operations in the Pentagon; and Commanding Officer, Naval Air Station Joint Reserve Base Willow Grove, PA. Oversight of more than 8,000 military of all services, 225 civilians, 115 aircraft and \$47 million budget.

Skip graduated at the top of his class and his previous Aviation/Instructor experience includes basic/Advanced Flight Training. Completed assignments with VP24 and VP30 as Flight Instructor and Simulator Instructor in the P3. NATOPS Pilot Evaluator and Instructor Pilot (IUT) Coordinator at the P3 Replacement Air Group (RAG). Simulator evaluator; Air Florida, B737 and DC9 First Officer. Scheduled air transport and charter under FAR Part 121. Domestic and international flight operations; Extensive experience as a P3 Patrol Plane Commander, Maintenance Check Pilot, Simulator Instructor and Head Instructor Pilot; C12 Transport Aircraft Commander, Instrument/CRM Evaluator, Simulator Instructor and Instructor Pilot; Airborne Express (ABX Air), DC9 First Officer. Scheduled air transport and charter under FAR Part 121. Domestic and international flight operations.

Skip's is currently working with the Federal Aviation Administration serving as regional UAS Program Manager at AEA-220, NextGen Branch of Eastern Region. He has been the Aviation Safety Inspector - AFS-820 - General Aviation and Commercial Division and Aviation Safety Inspector – AFS-407(AFS-80) - Operations Lead for Unmanned Aircraft Program Office (UAPO).

**Basil Yap**, UAS Program Manager, NCDOT Division of Aviation

Basil Yap is currently serving as the Unmanned Aircraft Systems Program Manager with the Division of Aviation which is found within the North Carolina Department of Transportation (NCDOT). The Division of Aviation is responsible for all aviation functions regarding state system planning, airport and aviation system development, aviation safety



and education, and Unmanned Aircraft Systems (UAS) integration.

The NCDOT UAS Program Office is the state UAS authority and is leading the statewide integration of UAS. Mr. Yap graduated with a Civil Engineering degree from North Carolina State University and has held a variety of positions within the NCDOT, from highway construction to airport development. Mr. Yap is a UAS pilot and manages one of the largest UAS fleets as a state agency.

## **PRESENTATIONS BY PANELISTS**

### **Skip Wiegand, FAA Eastern Region UAS Manager Overview of Regulatory Environment for UAS Public Sector**

#### **1. A certified Remote Pilot:**

- Must be 16 years old or older.
- Must read, write, speak English.
- Must pass an aeronautical knowledge exam at an FAA-approved Knowledge Testing Center.
- Part 61 certificate holders can take online training at [faasafety.gov](http://faasafety.gov) instead of the knowledge exam.
- Must undergo TSA background security screening.

#### **2. Public operations:**

- Are governed by statute – 49 USC 40125, Qualification for Public Aircraft status.
- Allows flexibility for certification & airworthiness.
- Online application process – COA Online.
- John Meehan – AUS/Steve Pansky – ATO – National Coordinators.

#### **3. UAS Registration:**

- Applies to small UAS > 0.55 lbs. flown outside.
- Operator must provide name, address and email (Non-hobby operators must provide make, model, and serial number (if available) of each sUAS).

#### **4. What is a TFR?**

- Many classes of airspace. Each with specific requirements for operations.
- Title 49 USC gives FAA sole authority to apply additional restrictions in any US sovereign airspace.
- A TFR is a short term directive, issued by FAA, that applies new operating restrictions on a particular piece of airspace for a defined period.
- TFRs can be any size or shape.
- The restrictions can include:
  - i. Only certain types of flights (LEO, DoD, firefighting, Air Carriers),
  - ii. Requiring certain equipment; e.g. a transponder,

- iii. Requirements to maintain ATC communications,
- iv. Outright prohibition of any and all flight operations.

5. Why does FAA restrict airspace?

- Safety
- National security and classified operations
- Law enforcement activities
- Airspace Efficiency
- Natural disasters
- The FAA does not / will not issue TFRs to prevent media from operating

IMPORTANT NOTE: The law requires the FAA to maximize access and minimize restrictions. Permanent restrictions are rare ... examples: airspace over the National Mall, certain military facilities, some Department of Energy sites, etc.

**New Jersey DOT (Glenn Stott:** HMLP Structural Inspections, Roadway Photogrammetry, & Maritime Projects)

1. How does Aeronautics Provide UAS Assistance?

- Provides leadership, guidance, and coordination for flight operations to NJDOT Divisions.
- Ensures compliance with State and Federal Aviation Regulations.
- Coordinates FAA Airspace Waivers and ATC Authorizations.
- Develops Implementation and Staff Training Plans .
- Assists with the drafting of RFP's for consultants.
- Has FAA certificated pilots, each with decades of aviation experience.
- Keeps NJDOT informed of public perception and liability.

2. How does NJDOT select UAS Projects? The Bureau of Aeronautics leads the department's UAS initiatives. Projects must have the potential to meet one or more of the following criteria to be considered for Aeronautics support:

- Increased Safety
- Increased Efficiency
- Save time
- Save Money

3. Current UAS Projects at NJDOT:

- Traffic Incident Management
- Structural Inspection
- Aerial 3D Corridor Mapping
- Emergency Response Assessment

- Real-time Construction Project Monitoring
- Landfill Volume Calculations

#### 4. What Have We Been Doing?

- Created a “UAS Coordinator” within the Division of Multi Modal, Bureau of Aeronautics to lead NJDOT’s UAS initiatives.
- Researched, applied for, and was awarded grant funding assistance through:
- FHWA State Transportation Innovation Council (STIC) Incentive program for equipment & training.
- FHWA T2 Peer Exchange on Best Practices.
- NJDOT Bureau of Research Policies and Procedures Grant.

#### 5. High Mast Light Pole Inspection Project:

- NJDOT owns and operates 250 HMLP near NJ roadways.
- Traditionally inspected with binoculars or bucket trucks.
- UAS are less disruptive to traffic, more efficient, and costs less.
- UAS allow an inspector to view the entire pole in high definition.
- Provides a photo record of potential problem areas for review.
- NJDOT was the first UAS operator granted an FAA Authorization Letter to fly in Newark’s Class Bravo airspace.
- Only 241 out of 250 HMLP inspections could be completed with UAS. The nine HMLP sites that could not be completed had the following issues:
  - i. Five due to airspace issues
  - ii. Two due to dense vegetation
  - iii. One was too close to the roadway
  - iv. One had poor communication with the UAS (strong RFI)

#### 6. Newark Class B Mitigations:

- Tethered operation mandatory.
- Maximum radius 700 feet.
- Weekend flights only.
- Dawn until 11:00 am.
- Maximum operating altitude 100 feet AGL.
- Emergency two way communication
- Additional crewmember to operate the tether.

#### 7. Challenges for Public Sector Use:

- Slowly evolving FAA Regulations and Standards.
- The “Cool vs Creepy” factor of public perception.
- Local “Drone Bans” creating a confusing patchwork of regulations.
- Privacy and data security concerns.

- Compliance with Federal Airspace Regulations in congested airspace.
- Risk Management concerns operating near roadways and critical infrastructure.

**Massachusetts DOT (Andrew Mihaley):** Showcase of UAS Pilot Projects, Highway Bridge, Tunnel Inspection, Runway Inspection, Rail & Bridge, Public Safety at Boston Marathon)

#### 1. An Opportunity:

- Drone technologies are widely available.
- Drones represent an opportunity for MassDOT, the MBTA, and other agencies as potentially cost effective, useful tools to support missions (e.g., MassDOT/MBTA transportation asset management, and infrastructure inspections; and MSP automobile accident investigation, and Search and Rescue) .
- Drones will NOT be used for surveillance or intentional collection of Personally Identifiable Information. MassDOT and the MBTA are paying special attention to respect for privacy, as guided by our interim policy & planned SOPs.
- MassDOT and MBTA stakeholders need:
  - Legal, standardized methods to access drones, and
  - Support and oversight to operate drones safely and effectively.
- Drone use will bring a significant data challenge.
  - Analytics and security for drone data is a critical, unmet requirement...
  - Privacy concerns drive approach to data .
- Commonwealth drone efforts (agency use and test site activities) to-date have appeared to lag roughly one-third of other states.
- Several state agencies (incl. DOTs) started to use drones even before the FAA finalized the regulatory rules in Aug of 2016. These states have focused on specific use cases that vary state-by-state, to include both employee and vendor use of drones for emergency management, bridge inspections and airport runway obstruction analysis.
- Support and commitment has been robust in several states for drone test sites and Centers of Excellence (COEs).
- In 2012, congress mandated that the FAA formally address the integration of drones into the national airspace system (NAS). In 2013, MA and NY created a partnership, the Northeast UAS Airspace Integration Research Alliance (NUAIR) that won the designation as one of the nation's six (later seven) FAA UAS Test Sites. The MA UAS Test Center (MA UASTC) is located at Joint Base Cape Cod (JBCC).
- NY State has invested heavily in their central NY test site at Griffiss Int'l Airport in Rome, NY. Upwards of \$40M has already been committed as part of \$250M of potential state investment in central NY. Several drone COEs sites, such as in MS have received significant FAA funding.
- The MassDOT drone use plan may be among the most comprehensive state-wide approaches to state agency use of drones in concert with the FAA Test site activities

## 2. The Response:

- Interim Internal Drone Policy for the Use of Unmanned Aerial Systems.
- A policy is needed to set ground rules for MassDOT's implementation of drone technologies.
- The policy should be revised iteratively as MassDOT gains experience using drone technologies.
- Using pilot programs to systematically implement and evaluate drone applications will help MassDOT develop safer, cost effective, widely adopted solutions.
- Communicate and collaborate with other Commonwealth agencies.
- MassDOT Internal Drone Policy may be a model for other agencies.
- MassDOT Aeronautics is available to provide drone program guidance to other agencies.

## 3. Regulatory Framework:

- FAA Preemption:<sup>1</sup> Limits to what we can do at a state level.
- FAA owns the airspace.
- States and municipalities have traditionally regulated land use, zoning, privacy, trespass, and law enforcement operations.
- Due to FAA Preemption, the Commonwealth and its municipalities are limited as to the areas that they are permitted to create drone laws and regulations.
- Police must obtain a warrant prior to using a UAS for surveillance.
- UAS may not be used for voyeurism.
- UAS may not be used for hunting or fishing, or to interfere with or harass individuals hunting or fishing.
- May not attach firearms or similar weapons to UAS.
- Caution: Recent Decision Overturning Newton, MA Regulations.
- Federal UAS Regulations.
- The FAA Part 107 Regulation sets the guidelines for use of small UAS (<55#) by hobbyists, non-hobbyists, and commercial users of small drone aircraft.
- Waiver: Most operational restrictions can be waived by showing that proposed operations can be conducted safely.

## 4. MA Laws & Regulations:

- No current MA drone laws
- Four bills currently proposed:
  - H3496 - An Act relative to unmanned aerial vehicles (in the Judiciary Committee);
  - H3581 - An Act to regulate the use of unmanned aerial vehicles (in the Judiciary Committee);
  - S1348 - An Act relative to the use of unmanned aerial systems (in the Public Safety and Homeland Security Committee); and
  - S1349 - An Act to regulate the use of unmanned aerial vehicles (in the Public Safety and Homeland Security Committee).

## MassDOT Aeronautics Regulation (To be Promulgated):

- 702 CMR
- 8.00: Regulation of Unmanned Aerial Vehicles
- Any rule, regulation, ordinance or by-law enacted by a city or town relative to the use and operation of unmanned aerial vehicles shall be submitted to the Division and shall not take effect until approved by the Division.
- Drone Laws and Regs in Other States: Approaches vary widely.
- VA appears to be leveraging existing laws and regulations to cover drones, while NC appears to be creating many new laws and regulations for drones.

## 5. MassDOT Drone Interim Policy Development

- Scope: Applies broadly to both employees and contractors performing MassDOT work.
  - Commitments:
    - i. Safety: MassDOT will prioritize safety and develop Safety Management Systems to minimize risk.
    - ii. Respect for Privacy: MassDOT will be guided by utmost respect for privacy, including constitutional requirements, state and federal laws, regulations, and norms protecting privacy. As a precautionary measure, MassDOT will not use UAS to intentionally collect images over private property without prior authorization from the Secretary of Transportation or express permission from the property owner.
    - iii. Data Retention and Usage: MassDOT will:
      - 1. Avoid gathering more information than is needed to meet its documented purposes.
      - 2. Comply with the requirements of the Public Records Law and the requirements for record retention, and
      - 3. Take care to protect against unintentional or unauthorized disclosure of information.
      - 4. Cooperation with Law Enforcement: MassDOT will cooperate with law enforcement by sharing information gained from the use of UAS in limited emergency situations involving imminent and immediate threat to the safety, health, and well-being of an individual or the public based on specific, reasonable intelligence sufficient to necessitate the need to provide such information to law enforcement.
      - 5. Collection of Personally Identified UAS Data (UAS data in which a specific person is recognizable or that is linked to an individual's name or other personally identifiable information).
- b. Procedural Requirements:
- No use of employee-owned UAS.
  - UAS use must comply with state and federal law (including FAA regulations and guidance).

- UAS must be lawfully manufactured and sold, as well as properly registered.
- Operators must be FAA licensed.
- Waivers, permits, approvals, and authorizations for flight must be obtained in advance.
- Notifications of flight and data gathering must be provided on a timely basis, if required.
- UAS flights must be logged.

c. Responsibilities of MassDOT Aeronautics:

- Confirm compliance with law and policy prior to UAS use
- Approve all procurement of UAS or UAS services
- In isolation or as part of a broader project
- Unless the Secretary of Transportation directs otherwise in writing

d. Oversee operator certification and training requirements

6. MassDOT Drone Program Objectives:

- Demonstrate drone capabilities to support MassDOT and MBTA missions, and document best practices and lessons learned
- Develop MassDOT and MBTA policies and processes for acquiring and using drone assets, and for analyzing and securing data acquired from drones
- Conduct cost-benefit analyses to include:
  - Drone methods vs. traditional non-drone methods for each use-case
  - Determine the optimum drone-use business model: Employee vs. vendor (or blend)
- Develop MassDOT Aeronautics knowledge base to support MassDOT divisions in solving problems using drones
- Develop a process to advise and assist other Commonwealth agencies with their drone programs

7. Airspace & Drones: MA Recent Ruling

## Judge shoots down Newton drone ban

By [adamg](#) on Thu, 09/21/2017 - 2:34pm

A federal judge ruled today that Newton went too far in banning drones from flying over the city without the prior permission of landowners whose property the drones might pass over.

US District Court Judge William Young's ruling is a victory for Michael Singer, a local doctor and drone aficionado [who'd filed the suit](#) earlier this year. In his ruling, Young wrote:

*Newton's choice to restrict any drone use below [400 feet] thus works to eliminate any drone use in the confines of the city, absent prior permission. This thwarts not only the FAA's objectives, but also those of Congress for the FAA to integrate drones into the national airspace. Although Congress and the FAA may have contemplated co-regulation of drones to a certain extent, ... this hardly permits an interpretation that essentially constitutes a wholesale ban on drone use in Newton.*

Figure 1. Judge shoots Down Drone Ban

## 8. Drone Demonstration Takeaways:

- Far more potential missions / use cases than expected!
- Users need help finding and using the correct drone tools for the job
- Data collection, analysis and protection is the “Long Pole” for majority of missions

## 9. Pilot Program Candidates

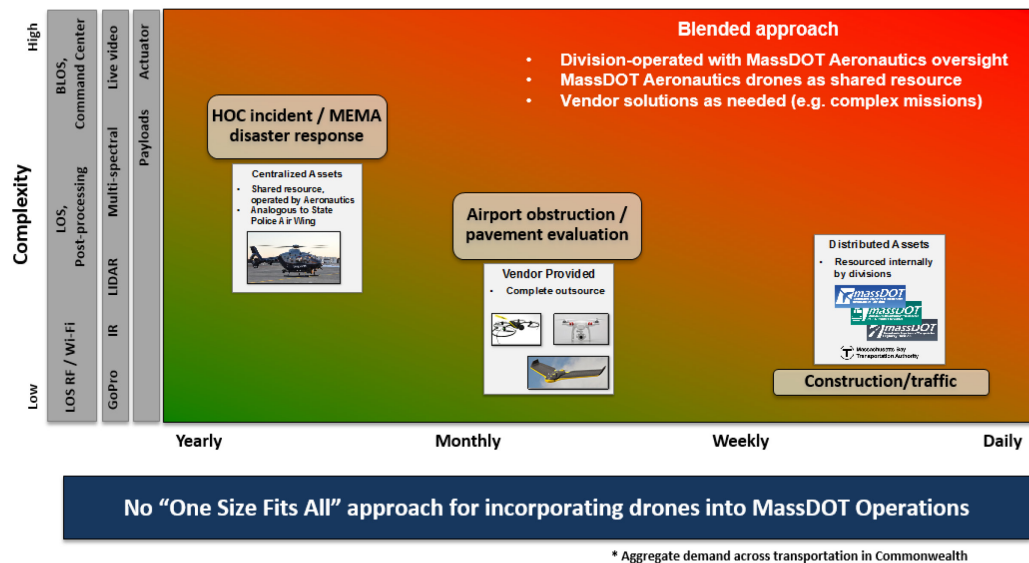


Figure 2. Pilot Program Candidates



## 10. Pilot Program: Use Cases & Models

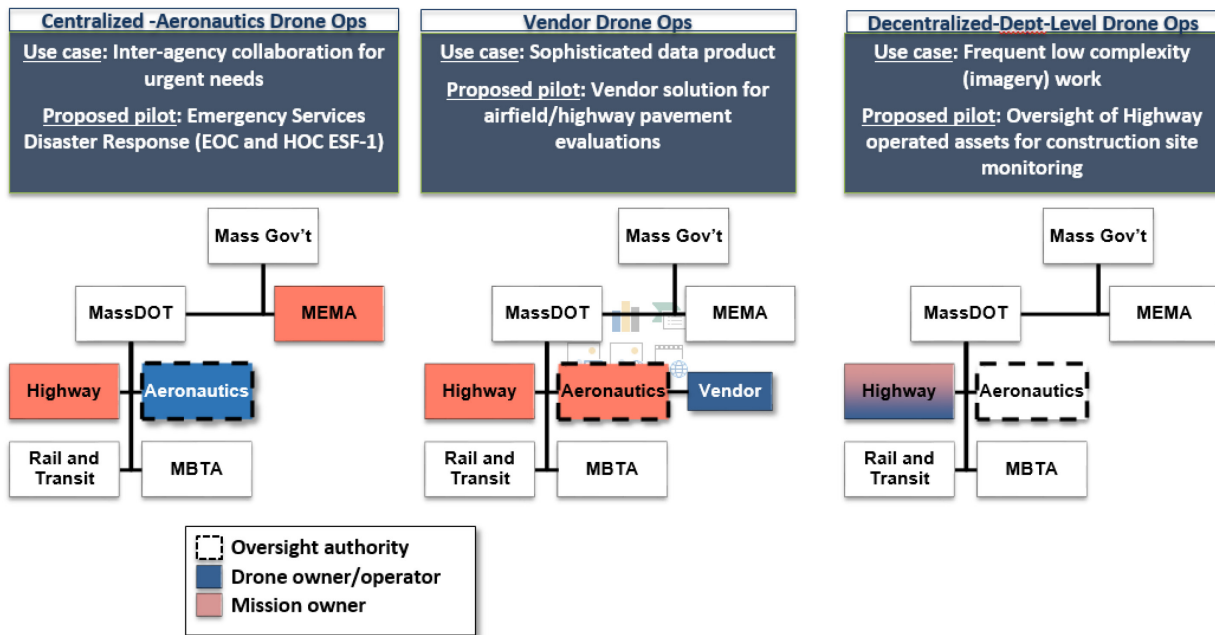


Figure 3. Pilot Program: Use Cases and Models

## 11. Drone Pilot Program Schedule: Phase 1 (Six Tracks)

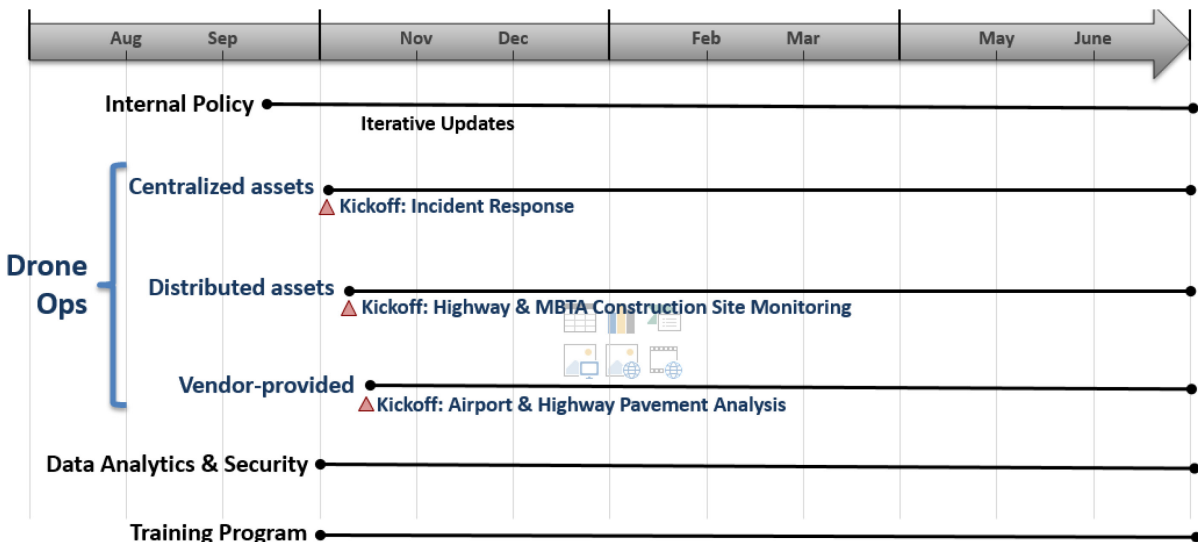


Figure 4. Drone Pilot Program Schedule: Phase 1 (Six Tracks)

## 12. Commonwealth Agency Drone Collaboration

Agency	Current Uses & Activities	Policy	Benefits & Outcomes	Planned Uses
DFS (EOPSS)	Fire Support	Complete	Safe Operations, Directed Resources	Support Municipalities
EOEEA	EEA is currently considering a limited drone program initially using contractors	If agency use is approved ,EEA to develop policy & SOP	TBD	Planning Policy and Vendor Use; Aerial surveys of nesting bald eagles (DFW); Remote “gull harassment” in Quabbin Reservoir (DCR); Eelgrass bed mapping along coastline (DMF); Deferring broader uses for time being
Homeland Security	Collaborate with MSP	Collaborate with MSP	Mission-specific	Continue to collaborate with MSP
MassDOT & MBTA	Aeronautics Airport Inspection	Interim Internal	Up to two-orders of magnitude (Time & Cost)	Cross-Divisional & MBTA; Drone Pilot Program use-cases
MSP (EOPSS)	Traffic Accident Investigation	Complete	Traditional 2-3 hours+; Drone-use <10min <sup>1</sup>	All Weather Drone for use cases such as Search and Rescue
MWRA	Facility Inspection (to be confirmed)	Unknown	TBD	TBD

Figure 5. Commonwealth Agency Drone Collaboration

## 13. Commonwealth Agency Drone Collaboration: MSP – UAS applications – CARS Unit

### Capabilities:

- First responder and motoring public safety
- Safe Quick Clearance without sacrificing the quality of the investigation
- Reduction in wait time at accident scenes for the motoring public



### Results:

- Two UAS have been deployed since June 2017
- Approximately 20 missions have been flown at fatal/serious injury crash scenes and large crime scenes.
- Average reduced lane or road closure time of 60 minutes at each scene. (In some cases there was little to no interruption to the motoring public by returning to the crash scene during off peak hours and using rolling road blocks).
- Two additional drones are being placed into service October 2017 further increasing the efficiency of the CARS unit.

Adobe DNG RAW

Figure 6. Commonwealth Agency Drone Collaboration

## 14. Commonwealth Agency Drone Collaboration: MSP – Future Applications of UAS with Aeryon Skyranger

### Capabilities:

- Extreme / All-Weather Capabilities
- Extended Flight Time
- High-Definition / 60X Zoom Camera
- Forward-Looking Infrared (FLIR) System
- Pix 4D Mapping Software Compatible
- High-Definition Downlink Video Capabilities



aeryon

### Expected Results:

- The capabilities of this UAS will greatly enhance the MSP in Search & Rescue and Tactical missions.
- It will be quickly deployed in any weather, day or night to provide an aerial overview of critical incidents to first responders and Command Staff.

Adobe DNG RAW

Figure 7. Future Applications of UAS with Aeryon Skyranger

## 15. Data Analytics and Security Pilot

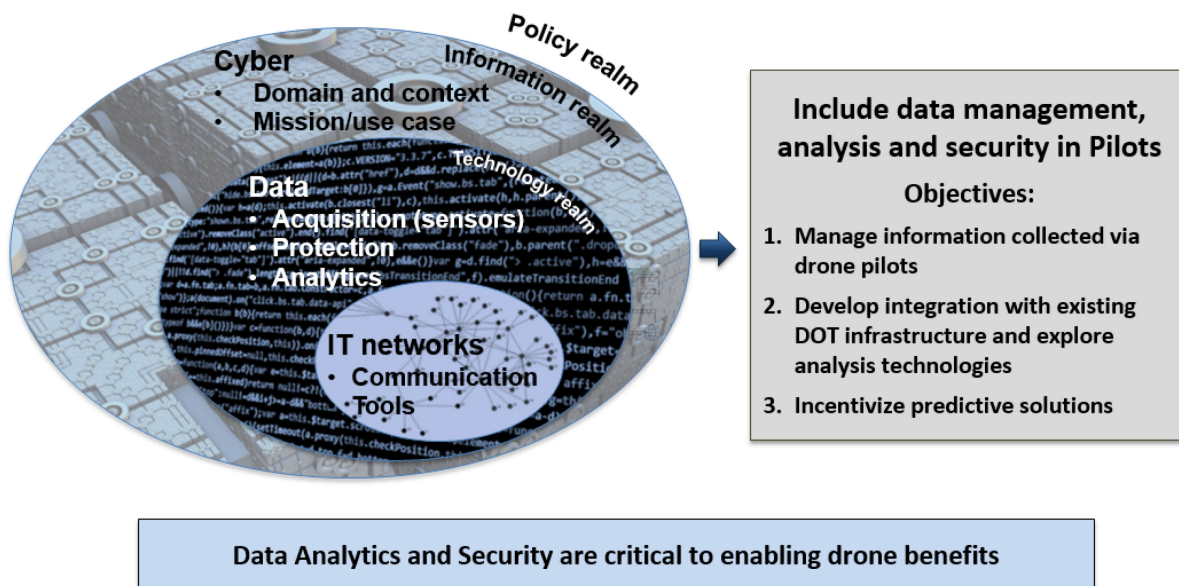


Figure 8. Data Analytics and Security Pilot

## 16. Technology: Small UAS Types

**Rotary Wing  
(Hover Capability)**



**Fixed Wing  
(Range)**



**Tethered Drone  
(Persistence)**



Figure 9. Technology: Small UAS Types

## 17. Technology: Sensors

**HD Camera**



**Infrared**



**Multispectral**



**LIDAR**

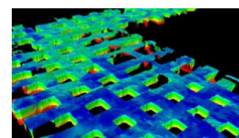
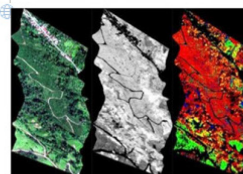
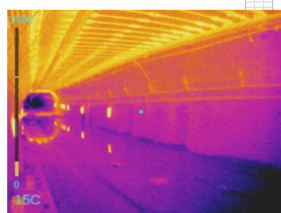
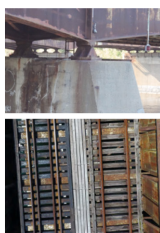


Figure 10. Technology: Sensors

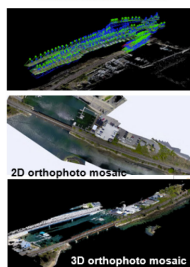
## 18. Technology: Data Products

**Imagery  
& Video**



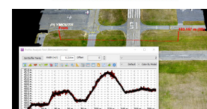
Take imagery of  
hard-to-access  
locations

**2D & 3D  
orthophotos**



Measure distances  
using geometrically  
accurate photomosaics

**Volumetrics**



Measure volumes of  
material

**Advanced  
techniques**



UMass  
Northeastern University  
Massachusetts  
Institute of  
Technology  
BOSTON  
UNIVERSITY

Many active areas  
of research

Figure 11. Technology: Data Products

## 19. Conclusions:

- Drones represent an opportunity for MassDOT and the MBTA as potentially cost effective, useful tools to support missions.
- A written policy is needed to set ground rules for the implementation of drone technologies. The policy should be revised iteratively as MassDOT gains experience using drone technologies.
- Systematically implementing and evaluating drone applications in concert with the MA UASTC will help MassDOT develop safer, cost effective, and widely adopted solutions.
- Drone use will present a significant data challenge.
- MassDOT Aeronautics can play a valuable role in standardizing methods to access drones and providing support and oversight for localized drone operations.
- MassDOT will learn a lot from the drone pilot program, and is available to advise and assist other agencies.

## **Kansas DOT (Merrill Atwater: UAS Legislation, Air Traffic Management Implementation, and the UAS Task Force)**

### 1. Kansas: The Center for Aerospace Excellence

- 1 of 5 great aerospace clusters in the world
- Spirit Aerosystems
- Beechcraft
- Cessna Aircraft Company
- Bombardier Learjet
- Airbus Americas

### 2. Economic Impact Study:

- Updated from 2010
- Final report in production
- \$20.6B in Kansas from Aviation
- \$9B in general aviation
- #1 per Capital in the country

### 3. 137 Public Use Airports:

- Kansas Department of Transportation – Division of Aviation – Aeronautical Chart
- Kansas Airports (FAA) Inspection Program
- Kansas Airport Improvement Program
- Kansas Unmanned Aircraft Systems (UAS) Program
- Kansas Airport Development Program
- FAA Federal Fund Brokerage/Transfers
- Kansas Aviation System Planning Grants (FAA)

- Aviation Research (KTRAN)
- Aviation Education (S.T.A.R Program)
- Stakeholder organization: KAAC, KAA, FAA, AOPA, etc.
- Communications (Newsletter, Social Media, videos)
- Community Outreach (Special Events)
- Airport Directory and Aeronautical Chart
- Kansas Airport Airspace Protection Program

#### 4. UAS Why Here and Now:

- Right Environment for Economic Growth
- Streamline Process to be safer and More efficient
- Emergency Response and Public Safety

#### 5. UAS Joint Task Force:

- KDOT
- Agriculture
- Commerce
- Parks & Wildlife
- KBI
- KHP

#### 6. Other KS Cooperation:

- KDOA
- KS Police Chiefs
- KS Sheriffs
- KS Fire Marshalls
- LE Training Centers
- Kansas Airports

#### 7. Kansas Legislation:

- **HB 2036:** Providing income tax credits for aerospace and aviation program graduates and their employees
- **HB 2037:** Establishing the aviation grant program to develop the aviation industry in Kansas
- **HB 2039:** Making the Kansas airports improvement program independent of the transportation works program

**North Carolina DOT (Basil Yap:** Collision Reconstruction, UAS at Airports, First Responders, Education and Outreach)

#### 1. Quick Drone History Fact:

- Radioplane OQ-2 was the first mass-produced drone in the US
- Used to train Army and Navy anti-aircraft gunners during WW2
- The first instance of “Drone” being associated with remotely piloted vehicle

2. NC Dept. of Transportation:

- Largest state agency
- Responsible for maintaining approximately 80,000 miles of roadway and 18,000 bridges and culverts across the state
- Annual budget of \$4.7 billion (fed. and state)

3. NC Dept. of Transportation – Division:

- Aviation
- Bicycle/Ped.
- Ferry
- Global TransPark
- Highway
- Motor Vehicles
- Ports
- Public Transit
- Rail
- Turnpike

4. Division of Aviation Core Functions – Provide:

- Aviation Safety and Education Programs
- State and Federal Airport Grant Programs
- Air transportation, operations, and support for state agencies
- Management of the state’s Unmanned Aircraft System Program

5. Aviation in North Carolina (as of February 2, 2017)

- Annually:
  - 29.1 million total passenger enplanements
  - 3.2 million total aircraft operations
  - Over 1.4 billion pounds of air cargo
- Pilots and Aircraft:
  - 17,760 Pilots
  - 7,139 Manned Aircraft
  - > 20,253 UAVs\*



6. UAS Program Office Role:

- Regulatory – Permitting commercial N.C. UAS operators
- Education – Safety, opportunity
- Research – Technology benefiting state
- Flight Services – NCDOT, other state agencies, local governments
- Government Agency Integration – UAS program development and support

7. UAS Program Office:

- Online administration of NC UAS Operators Knowledge Test
- Commercial and Government UAS Operator's Permits can be acquired online
- UAS Safety Guide and NC Statutes
- Helpful Link: [ncdot.gov/aviation/uas/](http://ncdot.gov/aviation/uas/)
- Drone Awareness and Education
- Regional Drone Workshops
- NC Community College System
- Best Practices and Resources Online
- Agency Wide Implementation
- Policy and Procedure Development
- Internal Research Projects
- Standardized Training and Support
- Drone Operational Support
- Multiple Pilots and Platforms
- Day or Night Capability
- Statewide Capability

8. Construction Safety Assessment:

- Safety of traveling public
  - I. Temporary traffic control measures
  - II. Temporary markings (alignment/visibility)
  - III. Entrance and exit of work vehicles into traffic
- Safety of contractor
  - i. Potential OSHA violations
  - ii. Improper construction practices
- Capture traffic movement during peak hours
- Capture traffic during temporary traffic control set up and removal
- Review all footage and images



#### 9. Research/Integration: Collision Reconstruction:

- Goals:
  - i. Document critical evidence
  - ii. Reopen roadway
  - iii. Ensure safety at the scene
- Drone vs Laser:
  - iv. 25 mins vs 1 hr 51 mins
  - v. Data requirements met
- Drone Benefits:
  - vi. Cheaper
  - vii. Faster
  - viii. Less Risk

#### 10. Collision Reconstruction – Project Objective:

- Use a drone to capture data to reconstruct an accident scene
- Meet existing accuracy requirements
- Open roads to traffic quicker
- Minimize exposure of accident personnel to traffic

#### 11. Collision Reconstruction – Primary Partners:

- DOT Traffic Management Unit
- DOT Photogrammetry Unit
- NC State Highway Patrol

#### 12. Collision Reconstruction:

- Staged Accident
- Click or Ticket campaign Kick Off
- Location: Buncombe County Training Facility in Asheville, NC

#### 13. Collision Reconstruction – Traditional Methods:

- LiDAR scanner
- Multiple scans
- Longer time to map
- Limited units throughout the state due to cost

#### 14. Collision Reconstruction – Drone Utilization:

- Three platforms tested
- Autonomous flights
- 90-100 feet

- Around 80 images captured per flight
- Total flight time under 25 mins

#### 15. Collision Reconstruction – Drone Benefits:

- Cheaper
- Faster
- Less Risk

#### 16. Mission Objectives

- Current
  - i. Documenting the life of the funded projects
  - ii. Before/After pictures
  - iii. Infrastructure inspection
  - iv. Develop procedures for UAS operations at airports
- Future
  - v. Capture pavement condition data
  - vi. Map approach clearances
  - vii. Wildlife management

#### 17. Airport Environment

- Proper training to understand the airport environment
- Utilize a visual observer(s)
- Work with the Airport Manager
- Understand flight patterns
- Locate helicopter landing areas
- Launch and recover from safe locations (Return to Home)
- Safety vests and properly marked vehicles (flags, strobes, etc...)

#### 18. On Airport Communication

- Most important part of UAS operations on airports
- Communication protocol established with visual observer
- Work with Airport Manager to see if appropriate to make tenants and pilots aware of operation
- Understand limitations of VHF radios (Handheld vs Vehicle)
- Always monitor air traffic
- Communicate when necessary

- Minimize RF interference

#### 19. Understanding Traffic:

- Pilot lingo
  - i. “downwind”
  - ii. “final”
  - iii. “on the 45”
- Type of aircraft:
  - iv. Single piston at 60 knots
  - v. Jet aircraft at 500 knots
  - vi. Helicopter
  - vii. Something Else?

#### 20. Understanding Airspace:

- Geo-fencing issues
- Understanding when to apply for a waiver from the FAA
- Class G - Uncontrolled
- National Security Flight Restrictions
- When are NOTAMs necessary?

#### 21. Future of Airspace Authorizations – Waiver/Airspace:

- Currently
  - viii. Online Portal
  - ix. 90 days or less
- Future
  - x. LAANC should help with Airspace Authorizations
  - xi. 200 Class E Airport Published April 27, 2017

#### 22. Military Airspace

- National Security UAS Flight Restrictions
- FAA and DoD have restricted UAS operations over 132 military facilities.
- The restrictions are up to 400’ AGL, 24 hours a day, 7 days a week.
- Facilities can be found here: <http://uas-faa.opendata.arcgis.com/>
- Other FAA restricted areas for civil operations apply to UAS operators

### 23. ACRP 04-42 Airports and UAS

- development of a UAS research roadmap for ACRP that identifies high-priority issues, needs, and high-value research-deliverables most relevant and useful to airports;
- research to produce one or more deliverables with the highest-priority, i.e., those with the greatest value and usefulness within the available budget, such as guidebooks, manuals, reports, tools, templates, etc.; and
- design for effective means of dissemination and implementation for the airport industry such as public engagement material, training curricula, webinars, videos, and so on.

### 24. Exercise Executive Summary

- North Carolina's Department of Transportation (NCDOT) sponsored.
- Planned and executed by the North Carolina State University's NextGen Air Transportation (NGAT) Consortium.
- Designed to support the transition of UAS capabilities into disaster response
- Exercise play based upon Hurricane Matthew response in Cumberland and Moore Counties.
- 17 – 19 January at the Raleigh Critical Public Safety Facility, Raleigh, NC.

### 25. AI TTX Objectives

- Examine airspace integration issues when UAS are operated in the National Airspace System (NAS) with manned aircraft and other unmanned aircraft.
- Develop policies and procedures to ensure the safe use of airspace.
- Use actual flooding information collected during the aftermath of Hurricane Matthew as the ground scenario basis to examine UAS operations.
- Examine how to best employ UAS to assist public safety agencies in dynamic disaster events.
- Examine the potential to integrate UAS into standard Search and Rescue (SAR) airspace management.
- Develop guidelines for private and commercial UAS use in disaster response and recovery.
- Examine and evaluate draft UAS Best Practices.

### 26. Best Practices Discussion Results

- Recommendations based on feedback from the TTX scenarios, game play, and flight demonstrations.
- Recommendations are categorized by existing Best Practices.

- Suggestions for updating Public Safety Agency Best Practices organizations.

## 27. Standard Operating Procedures:

- Incident Airspace Management
  - i. Positive control of all aircraft
  - ii. Air Boss: when 2 or more aircraft
  - iii. Aircraft Separated
    1. Laterally
    2. Vertically
    3. Time
  - iv. Visual Observers are recommended
  - v. Temporary Flight Restriction (TFR)
  - vi. Aircraft Heading
  - vii. Standard Reporting Altitude
- Communications
  - i. Ground to Ground communications: 800 MHz VIPER Network (UAS crews are ground based).
  - ii. VHF: Ground to Air.
  - iii. Specify UAS Communication Plan.
  - iv. Cell Phones can be used as backup.
  - v. Radio Frequencies should be assigned and documented during preflight planning, including primary, backup and contingency channels.
  - vi. Define standard UAS radio calls.
  - vii. All aircraft are grounded if communications cannot be established with an intruder aircraft.

## 28. Crew Selection

- Part 107 Remote Pilot - sUAS
  - i. NCDOT UAS Permit
  - ii. Local UAS Policies and Procedures.
- Visual Observers are recommended.
- Establish standard Air Boss training.
- Agencies should hold training updates and exercises at least annually

## 29. Program Planning:

- Establish operational thresholds and/or trigger points for UAS asset use and reassignment.
- Develop agency specific UAS Incident Response Pocket Guide.
- Continuously monitor local TFRs and Special Use Airspace (controlling agency, time of use)
- Pre-established COAs and Part 107 waivers for expected operations.
  - i. Special Governmental Interest (SGI) Addendum (formally eCOAs)
  - ii. FAA System Operations Support Center (SOSC) - (202) 267-8276

## 30. External Interaction Policies:

- Have pre-vetted vendors, assets, operators documented to ensure safety and adherence to rules and regulations.
- Establish a “Volunteer Aircraft Policy” for the agency prior to incident.
- Discretion of IC.
- Vetted pilots and aircraft.
- Operate within IMT structure.

## 31. Data Management:

Procedures for data recording, sharing, and storage should be in place before an incident that ensure privacy issues:

- Data quality
- Data storage
- Distribution
- Streaming Video
- Imagery
- Products
- Chain of custody (LEI)
- Projections, coordinate, and file formats

## 32. Public Outreach:

- Run a time-sensitive Public Affairs campaign educating the public on safe operations and consequences of unauthorized interference incident operations.
- Communications channels could include Facebook pages, DOT UAS websites, drone club members.
- Release messages to target audience about rules, changes, legal issues,

emergency event restrictions, etc.

### 33. Conclusions:

- It is feasible to safely integrate UAS in shared airspace.
- Additional TTXs may benefit the safe and effective integration of UAS in the airspace during different scenarios.
- Additional policy and guidelines are required and recommendations provided in the Final Report.
- A Field Training Exercise (FTX) involving all expected parties should be held annually.

### **Pennsylvania DOT (John Melville: Risk Management)**

#### 1. UAS Anticipated Use:

- Roadway Inspection
- Airport 'Airspace' Surveys
- Bridge Inspections
- Disaster Response Support

#### 2. Draft UAS Policy –To establish:

- Who can conduct the flight operations.
- The parameters they can operate.
- Required training prior to ops
- Coordination procedures
- Documentation expectations
- Risk Management Worksheets

#### 3. UAS Policy Challenges

- Personnel:
  - I. Operators
  - II. Supervisors
  - III. Bureau UAS Coordinator(s) - \$\$\$
- a. Training:
  - I. Operator Flight Training
  - II. Risk Assessment Worksheets

#### 4. State UAS Management Center:

- Establish common operational standards and training for the use of drone technology by all State agencies
- Facilitate drone operator training and evaluation.
- Validate 'consultant' accreditation for State drone contracts.
- Assist Municipalities in training of operators.
- Coordinate public outreach efforts.
- Provide UAS mission support as necessary

#### 5. State UAS Management Center

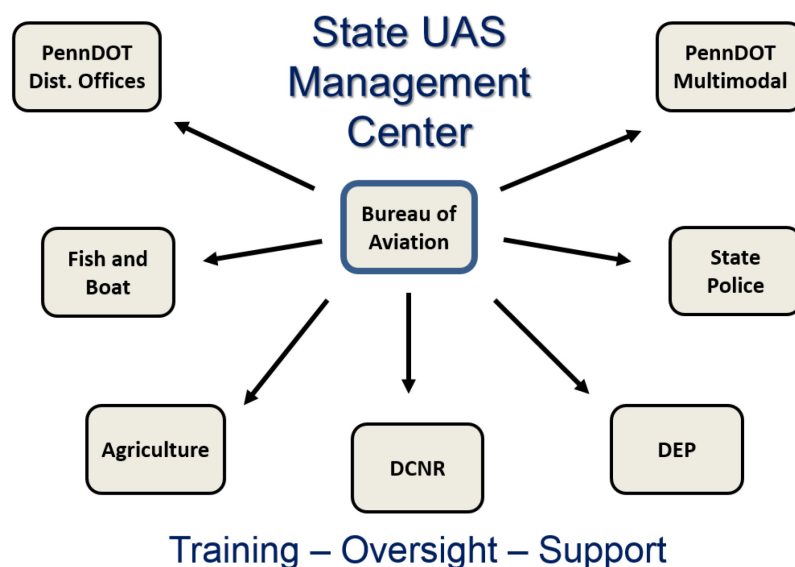


Figure 12. State UAS Management Center

#### 6. UAS Legislation

- So far 40 states have enacted legislation.
- 18 states enacted warrant requirements for law enforcement.
- 17 states established criminal penalties for misuse.
- 14 states offer protection from other citizens (voyeurism).

#### 7. Hunting and Fishing

- 13 states passed laws relating to hunting and fishing.



- 6 prohibit using UAS for hunting and fishing
- 7 prohibit using UAS to interfere with others who are lawfully hunting or fishing

**Delaware DOT Josh Thomas:** UAS Overview & Task Force Projects, Pedestrian Bridge & Grade Separated Intersection Rendering

1. DelDOT Aeronautics:

- Statewide Aviation System Planning
- Airport Improvement Program (AIP) Grants
- Delaware Aviation Advisory Council (DAAC)
- 5010 Inspections
- License Airports
- Evaluate Potential Airspace Obstructions
- No full time staff
- No Aviation Revenue

2. UAS Task Force

- DelDOT
- Law enforcement
- Economic development
- Private UAS companies
- Delaware River & Bay Authority
  - i. DE colleges and universities
  - ii. Safety & Homeland Security
  - iii. Hobbyists
- Mission
- Economic development
- Operational safety
- University training programs
- Issues
- State legislation
- Security concerns
- Accomplishments
- Coordination of DE House Bill 195
- Outreach Events
- “Drones for Delaware” – Delaware Technical Community College
- Demonstration for state legislators

- Community safety messages
- Economic development video produced

### 3. State UAS Regulations:

- H.B. 195
  - i. Defines unlawful uses of UAS, such as:
    - Interference with law enforcement
    - Flights around critical infrastructure
    - Flights over stadiums/mass gatherings
- State preemption of local governments
- Delaware State Parks Restriction
- DE Title 7, Section 9201, Aviation 15.2

### 4. UAS at DeIDOT

- Planning – Aeronautics
- Policy coordination
- Community outreach
- Operations
  - i. Traffic
  - ii. Training coordination
  - iii. Operational standards
  - iv. Maintenance
- Business Management
  - i. Consultants
  - ii. Project specific uses
- We have **9** Part 107 certified UAS pilots
- We have 10+ aircraft
- Our traffic team has packaged UAV kits
- DJI Inspire is primary aircraft type
- Labeled with N numbers and DeIDOT stickers
- All operations are under Part 107

#### Example Uses:

- Traffic monitoring and incident management.
- Smyrna prison uprising.
- Coordinated missions with first responders.
- Airport data collection.
- 5010 Inspections.
- Airspace obstruction validation.

- Project specific uses.
- Design renderings.
- Photo documentation.

5. DelDOT UAS Operational Policy:

- #T-06, in effect for 1 year.
- Traffic Management Center (TMC) has oversight.
- Requires a flight plan with the TMC.
- For DelDOT staff flights
- For any contractors flying on behalf of DelDOT
- Appropriate signage when in Right-of-Way
- Pilot certification and training requirements
- Requires a pilot and visual observer
- Aircraft certification

6. Delaware UAS Training Committee:

- Coordinates training for state agencies
  - i. Standards, best practices, troubleshooting
  - ii. More stringent than federal requirements
- Flight training courses at the fire school (Dover, DE)
  - i. UAV Ground School (1 day)
  - ii. UAV Pilot Qualification (2 days)
  - iii. UAV Tactical Operations (2 days)
  - iv. UAV Maintenance, Operations, and Safety (4 days)
  - v. UAV Indoor Flying (2 days)

7. Challenges in Delaware:

- Too many state employees want to be pilots!
- A shortage of missions
- More outreach is needed, but limited resources
- Colleges trying to anticipate future training needs
- The economic development vision isn't there.

**State Police UAS Team (Sgt. Ron Leach & Det. Mike Ward: UAS Challenges for Law Enforcement)**

1. UAS Challenges for Law Enforcement:

- Meadowlands Complex
- Disaster/Major Incidents

- Sensitive Infrastructure
- Crime Scenes/Police Activity
- Residential areas

## 2. Current Legislation:

- No specific 2C violation for UAS operation
- Possible applicable statutes

### Assault 2C:12-1

- Resulting from injury of operation
- Intentional or Unintentional

### Trespassing 2C:18-3

- When used on private property
- Meadowlands Complex

### Invasion of Privacy 2C:14-9

- Video recording of private homes
- Includes peering into windows

## 3. Countering UAS:

- Education
  - i. Law enforcement
  - ii. Operators
  - iii. Venue Security
- Signs/Venues
  - iv. Ticket sales websites
  - v. Sign boards at entrances
  - vi. Printed on tickets
- Intelligence Campaign
  - vii. Collaborative / Inter-Agency
  - viii. Threat Awareness
  - ix. Collection Requirements
- Mitigation Recommendations
- Information-Sharing Partnerships + Platforms
- Safety + Reporting + Response
- Countermeasures
  - i. Attempt to identify operator location
  - ii. Observe direction or origin of flight
  - iii. Operators may draw a crowd

- iv. Firearms/Aircraft not feasible to neutralize
- v. Signal jamming prohibited by FCC
- vi. Override of signal creates other issues
- vii. Responsible for UAS damage or injury

#### 4. LE Response to UAS Threat D.R.O.N.E.

**D) Direct Attention** outward and upward to attempt to locate individuals possibly operating the UAS. Be sure to check windows/rooftops/balconies.

**R) Report Incident** to dispatch center and request additional resources if needed.

**O) Observe** the UAS and maintain line of sight. Observe direction of travel. Avg. flight times are 20-30min.

**N) Notice Features**: Identify the type of device; fixed wing, multi-rotor, size, shape, color, payload etc..

**E) Execute Police Action**: If device payload is suspicious, call local Bomb Squad. ID Operator, seize UAS if cited. Obtain warrant to view video. Follow agency sop on search and seizure.

#### 5. Summary

UAS proliferation is expected to continue to explode in popularity. The cost of this platform is within reach of a large segment of society who foresee the benefits of operating. Specialized equipment and sensors for UAS increases capabilities and usefulness which will create new venues for growth.

### **NJ Forest Fire First Responders (Robert Gill: UAS Challenges for First Responders**

#### 1. New Jersey Forest Fire Service Current Operational Fleet:

- 3 UH1 Huey Helicopters
- 2 Jet Rangers
- 1 Bell 47
- 2 Cessna 206
- 1 Cessna 182
- 1 Piper Super Cub

#### 2. Contract Aviation:

- 1 802 Airtractor (4 additional on call when needed)
- 1 602 Airtractor (1 additional on call when needed)

3. Missions:

- Fire Suppression
- Fire Observation
- Fire Detection
- Fire Logistics (Troop shuttle, Sling loads)
- Aerial Ignition (PSD, Helitorch)
- Training (Pilot, Aircrew, HECM)
- Survey & Recon. and Mapping
- SAR
- Forestry and Forest Health
- Water Quality, DEP Surveys and Data collection (Cessna U206G State Owned)
- MOST MISSIONS AT 500 AGL & BELOW

4. Our Top Challenge is UAS:

UAS has interfered with forest fire air operations more this year than any other on record. One confirmed instance of a UAS strike by a Fire Detection Aircraft.

5. Factors Adding to the Problem:

- Social Media
- Fire Buff Groups
- Uneducated pilots
- Ease of access to UAS
- Baselines are just being developed for use and abuse

6. NJFFS Policy and USFS Policy:

- TFR will be established
- If we detect an unauthorized UAS in the area of our aviation operation, all aircraft are to leave the area. This could lead to both state and federal charges.

7. Response to Problem:

- Inform public
- Out reach through local clubs
- Enforcement
- Develop policy and procedures

## 8. UAS Integration

- Looking into UAS integration into our program
- Writing Ops manual
- Have 1 pilot , more on the way
- FEPP
- State Purchase
- With Forestry

## KEY TAKEAWAYS

	Merrill Atwater Kansas DOT	Terrence McKenna MassDOT	John Melville PennDOT	Andrew Mihaleg MassDOT	Josh Thomas DelDOT	Basil Yap N. Carolina DOT
<b>Day 1</b>						
<i>Did today's discussion meet your expectations</i>	Well Done. First Day Outstanding	Yes Great people with great insight	Yes Good Start Macro view of UAS OPS to the state level	Yes Great takeaways and benefit Service for state Program	Yes. I learned a great deal from my peers about the accomplishments and challenges in other DOTs.	Yes lots covered and broad depth
<i>Please provide three key take aways?</i>	No Standard on how to use UAS.  Enjoyed the States and other Programs.  Lots of UAS Safety Management	lots of great use cases and now ideas hadn't thought about  Insurance companies are playing a bigger role than expected  we are all equally new to this all in the same boat together  looking forward to post expo collaboration. That's where we'll make programs together	(Kansas); broader outreach program to general population Various applications of UAS for DOT's and Law Enforcement (acct investigation)  Federal Overview of UAS	Various approaches to interstate drones  NCDOT use at DIRFOXES  Hi Mass program sources	There is still much to do in educating the general public about how to fly in the NAS  The transfer of airspace from ground to 400' is something we should all pay attention to As DOTs we need to monitor our roads. Under 107, we can't do that effectively. Maybe we need a coalition to do a "proof of concept" with the FAA. I think the content was a good mix of higher level vs technical. Kansas DOT is taking very holistic approach which is more forward thinking and patient then other states.	Additional training to Part 107 required  Data management is an issue  V.O. required in addition; Partnering with industry and university is key
<i>Other Information to share</i>	Well Done; learning about the other states was interesting			Will send university of Mass research project		
<b>Day 2</b>						
<i>Did today's discussion meet your expectations</i>	Outstanding ; Today as even met and exceeded all expectation	Indeed Excited to turn this into actionable interviews			The discussion exceeded my expectations. This event is proving to be very positive and productive experience State should have some control over UAS security counter measures. This is an important conversation that needs to happen with FAA Not many states are using UAS for accident/collision science reconstruction. Delaware should be exploring this too Policies and procedures should include risk assessment and data management/acceptable use of data rules	Yes much more detail  Risk assessment or SMS is key to policy and procedure development  Need for research HRB to not duplicate research efforts Standardize training across states so responses to natural disasters can be coordinated better
<i>Please provide three key take aways?</i>	3D Rendering by using Drone  Collision reconstruction  Night waiver; safety issues  Quite enjoyable some of the same basis moving through out the states, Lots of common interest to share	Will be collaborative on SOPs  Part B5 would apply well for UAS  Education and training crucial  What sort of data will we be disseminating among the panel after the event			Is there a national clearinghouse for states? It would be helpful to collect state policies; training videos; Procedures so we call have a central place to go. It would help us deal with limited resources.	Great to talk with other states on a variety of issues not worth speaking in front of a group IE purchasing issues.
<i>Other Information to share</i>						



## KEY TAKEAWAYS

	Merrill Atwater Kansas DOT	Terrence McKenna MassDOT	John Melville PennDOT	Andrew Mihaley MassDOT	Josh Thomas DELDOT	Basil Yap N. Carolina DOT
<b>Day 3</b>						
<i>Please provide three key take aways?</i>	NCDOT 1077 pilots in all divisions of DOT		various typed of checklists needed need for NASAD to collect and disseminate UAS activities/ initiatives/ case studies outreach efforts - to Both UAS operators and the UAS commercial community of opportunities in your		Night operations may become increasingly important. Night training should be part of the curriculum	
	VO is very important				States should considers specific training, procedures, and checklists for visual observers.	
	Need to develop checklist; Drone park				States should create drone-friendly areas to promote an acceptable culture for drones (Drone state Parks)	
<i>Other Information to share</i>	Not at this time				Nothing else - Thank you! Very beneficial.	

## Appendix A – UAS Peer Exchange Agenda

### Day 1 Agenda (October 3, 2017 – 8:30am – 4:00pm)

8:30	<b>Registration</b>	
9:00	Welcome to NJDOT	NJDOT Assistant Commissioner, Michael Russo
9:10	Intro of UAS Panel Attendees	Glenn Stott, NJDOT UAS Coordinator
9:20	<u>Keynote Speaker</u> Overview of the Regulatory Environment for UAS Public Operators	Skip Wiegand, FAA Eastern Region UAS Manager
10:15	Q&A with Skip Wiegand Blanket COA's, Waivers, Authorizations, and successful mitigations	Skip Wiegand, Moderator
10:30	Break	
10:45	NJDOT	Glenn Stott: HMLP Structural Inspections, Roadway Photogrammetry, & Maritime Projects
11:20	MassDOT	Andrew Mihaley: Showcase of UAS Pilot Projects. Highway Bridge, Tunnel Inspection, Runway Inspection, Rail & Bridge, Public Safety at Boston Marathon
12:00	Lunch	
1:00pm	Kansas DOT	Merrill Atwater: UAS Legislation, Air Traffic Management Implementation, and the UAS Task Force
1:50pm	North Carolina DOT	Basil Yap, Collision Reconstruction, UAS at Airports, First Responders, Education and Outreach
2:50pm	Break	
3:05pm	PennDOT	John Mellville, Risk Management
3:45pm	Complete the "TakeAway" Survey	Panelists
4:00pm	Adjourn	

**Day 2 Agenda (October 4, 2017 – 9:00am – 4:00pm)**

9:00	Delaware DOT	Josh Thomas: UAS Overview & Task Force Projects, Pedestrian Bridge & Grade Separated Intersection Rendering
9:35	UAS Challenges for Law Enforcement	Sgt. Ron Leach & Det. Mike Ward, NJ State Police UAS Team
10:05	UAS Challenges for First Responders	Robert Gill, Jr. NJ Forest Fire Service Aviation Officer
10:20	Break	
10:35	Review of NC Case study, “UAS Collision Scene Reconstruction and Investigation”	Panel discussion led by Basil Yap, NCDOT
11:00	Discussion and Sharing of Research	Panel discussion led by Glenn Stott, NJDOT
12:00	Lunch	
1:00pm	Getting the Most from UAS Studies	Panel discussion led by Merrill Atwater, KDOT
1:15pm	Task Force and Advisory Boards	Panel discussion led by Merrill Atwater, KDOT
1:30pm	Risk Management Concerns	Panel discussion led by John Mellville, PennDOT
2:00pm	Policies and Procedures Round Table	Panel discussion led by Glenn Stott, NJDOT
3:00pm	Break	
3:15pm	Training and Qualifications	Panel discussion led by Merrill Atwater & Basil Yap
3:50pm	Complete the “TakeAway” Survey	Panelists
4:00pm	Adjourn	

**Day 3 Agenda (October 5, 2017 – 9:00am – 12:00pm)**

9:00	Public Operator Manuals & Checklists	Panel discussion led by Basil Yap, NCDOT
10:00	Break	
10:15	Open Panel Discussions	Open panel discussion led by Glenn Stott, NJDOT
11:35	Complete the “TakeAway” Survey	Panelists
11:45	Summary and Closing Remarks	Glenn Stott, NJDOT
12:00	Adjourn	

## Appendix B – Attendees

Name	Organization	Title
Carole Mattessich	Cape May County	Director, Cape May County Drone
Bahman Moghimidarzi	CUNY/UTRC	Graduate student, CUNY
Dr. Anil Agrawal	CUNY/UTRC	Professor of Civil Engineering, CUNY
Ehssan Hoomaan	CUNY/UTRC	Doctoral student, CUNY
Josh Thomas	Delaware DOT	Planning Supervisor
Skip Wiegand	FAA	NE Region UAS Program Mgr
Ekaraj Phomsavath	FHWA NJ	ITS Engineer
Matt Zeller	FHWA NJ	Tech Services Team Lead
Roger Lall	FHWA NJ	Director of Engineering
James McDavitt	Homeland Security	NJ Senior Planner
Scott Gibson	Homeland Security	NJ Senior Planner
Merrill Atwater	Kansas DOT	Director of Aviation
Andrew Mihaley	Mass DOT	UAS Coordinator
Basil Yap	N. Carolina DOT	UAS Project Manager
Glenn Stott (Host)	New Jersey DOT	UAS Coordinator
Nicole Minutoli	New Jersey DOT	Director, MultiModal
Sal Cowan	New Jersey DOT	Director, Traffic Operations
Robert Gill Jr.	NJ Forest Fire Service	Forest Fire warden/Fire Aviation Officer
Det. Mike Ward	NJ State Police	NJ State Police UAS Team
Lt. Dan Engelhardt	NJ State Police	NJ State Police UAS Team
Sgt. Ron Leach	NJ State Police	NJ State Police UAS Lead
Amanda Gendek	NJDOT	Section Chief, Research Bureau
Clare Mansfield	NJDOT	Adm Analyst 3, Aeronautics
Dennis Caltagirone	NJDOT	Incident Mgmt, Traffic Ops
Deven Patel	NJDOT	Section Chief, MGaP
Elizabeth Falcon	NJDOT	Incident Mgmt, Traffic Ops
Gerry Leipfinger	NJDOT	Aero Ops Specialist, Aeronautics
Laura Alexander	NJDOT	Admin Assistant, Aeronautics
Max Patel	NJDOT	Manager, MGaP & Aeronautics
Mike Moran	NJDOT	Manager, Incident Management Response Team Program
Ron Harbist	NJDOT	Aero Ops Specialist, Aeronautics
Rudolph Manz	NJDOT	Incident Mgmt, Traffic Ops
Dhaval Jagirdar	NJDOT	CPM, Structural Inspections
Jack Evans	NJDOT	CPM, Structural Inspections
James Coyle	NJDOT	CADD/Survey
Jonathan Martinez	NJDOT	Traffic Operations
Ridwan Ahmed	NJDOT	Traffic Operations
Sharif Ismail	NJDOT	Engineer, Maritime Resources
Thomas O'Hara	NJDOT	CADD/Survey
William Henderson	NJDOT	Principal Engineer, Maritime
Dr. Joyoung Lee	NJIT	Assistant Professor, Department of Civil Engineering
John Mellville	Pennsylvania DOT	UAS Coordinator
Bethany Dennis	Rutgers University	Scribe
Dr. Pat Szary	Rutgers University	Associate Director, Center for Advanced Infrastructure & Transportation (CAIT)
Dr. Camille Kamga	UTRC	Director, UTRC and Professor at City College of New York

## Appendix C – After Action Review Form



Day \_\_\_\_\_

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

**2. Please provide three key takeaways from today's sessions?**

**3. Other information to share:**

**4. May we contact you regarding your comments? (Optional)**

Name \_\_\_\_\_ Email \_\_\_\_\_ Phone \_\_\_\_\_

## Appendix D – Completed After Action Review Forms



Day 1

### **NJDOT Peer Exchange** October 3, 2017 – October 5, 2017 **Informal After Action Review Form**

1. Did today's discussions meet your expectations?

Well done. The First day was outstanding

2. Please provide three key takeaways from today's sessions?

- 1) No standards on how to use UAS
- 2) Enjoyed the states and the different programs
- 3) Lots of UAS safety management.

3. Other information to share:

The program was well done.  
Learning about the other states  
was exciting

4. May we contact you regarding your comments? (Optional)

Name Merrill Atwater Email Merrill.Atwater@KS.gov Phone \_\_\_\_\_



Day 2

## NJDOT Peer Exchange

October 3, 2017 – October 5, 2017

### Informal After Action Review Form

**1. Did today's discussions meet your expectations?**

*- Yes! Great people and great insight*

**2. Please provide three key takeaways from today's sessions?**

- Lots of great use cases <sup>and new g's</sup> we hadn't thought about*
- Insurance companies are playing a bigger <sup>bigger</sup> role than <sup>than</sup> expected*
- We are all equally new to this*  
*all in the same boat together*

**3. Other information to share:**

*Looking forward to post-expe  
collaboration. That's where  
we'll make real progress  
together*

**4. May we contact you regarding your comments? (Optional)**

Name \_\_\_\_\_ Email \_\_\_\_\_ Phone \_\_\_\_\_





Day 1

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

YES - GOOD START

**2. Please provide three key takeaways from today's sessions?**

- MACRO VIEW OF UAS OPS AT STATE LEVEL (KANSAS)  
BROADER OUTREACH PROGRAM TO GENERAL POPULACE
- VARIOUS APPLICATIONS OF UAS FOR DOT'S AND LAW ENFORCEMENT  
(ACCT INVESTIGATION)
- FEDERAL OVERVIEW OF UAS PROGRAM

**3. Other information to share:**

**4. May we contact you regarding your comments? (Optional)**

Name JOHN MELVILLE Email \_\_\_\_\_ Phone \_\_\_\_\_



Day 1

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

Yes, GREAT TAKEAWAYS AND BENEFIT SEVERAL  
STATE PROGRAMS.

**2. Please provide three key takeaways from today's sessions?**

VARYING APPROACHES TO INTELLIGENT DRONES.  
ACCOMMODATE USE OF AIRPORTS  
HIGHWAY PROGRAM SUCCESS

**3. Other information to share:**

WILL SEND UNIVERSITY OF MASS  
RESEARCH PROJECTS.

**4. May we contact you regarding your comments? (Optional)**

Name D. MINARLEY Email ANDREW.MINARLEY@STATE.NJ.US Phone



Day 1

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

Yes. I learned a great deal from my peers about the accomplishments and challenges in other State DOTs.

**2. Please provide three key takeaways from today's sessions?**

- ① There is still much to do in educating the general public about how to fly in the NAS.
- ② The transfer of airspace from ground to 400' is something we should all pay attention to.
- ③ As DOTs we need to monitor our roads. Under 107, we can't do that effectively. Maybe we need a coalition to do a "proof of concept" with the FAA.

**3. Other information to share:**

I think the content was a good mix of high-level vs. technical. Kansas DOT is taking a very holistic approach - which is more forward thinking and patient than other states.

**4. May we contact you regarding your comments? (Optional)**

Name Josh Thomas Email joshua.thomas@state.de.us Phone



Day 1

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

YES, LOTS COVERED AND BROAD DEPTH.

**2. Please provide three key takeaways from today's sessions?**

1. ADDITIONAL TRAINING TO PART 107 REQUIRED
2. DATA MANAGEMENT IS AN ISSUE
3. V.O. REQUIRED IN ADDITION
4. PARTNERING WITH INDUSTRY & UNIVERSITY IS KEY

**3. Other information to share:**

**4. May we contact you regarding your comments? (Optional)**

Name BASIL YAP Email BYAP@NJDOT.GOV Phone \_\_\_\_\_



Day 2

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

**2. Please provide three key takeaways from today's sessions?**

1. Drone interference w/ fire suppression.
2. Excellent discussion on use of drones for crash reconstructions.
3. Technology exists to scramble/block drone signals. Forest Fire has technology that will scramble the drone and return it to homebase. Currently not legal to do.

**3. Other information to share:**

Very informational. Great to see and compare what the different States are doing.  
Excellent discussions & presentations.

**4. May we contact you regarding your comments? (Optional)**

Name \_\_\_\_\_ Email \_\_\_\_\_ Phone \_\_\_\_\_



Day 2

## NJDOT Peer Exchange

October 3, 2017 – October 5, 2017

### Informal After Action Review Form

**1. Did today's discussions meet your expectations?**

Yes. Excellent discussion  
on drone policies

**2. Please provide three key takeaways from today's sessions?**

- Bridge inspection challenges
- Drone policies in NJ
- Risk management & amendment

**3. Other information to share:**

Will be great to develop  
scholars on drones in NJ  
as a part of continuing  
education

**4. May we contact you regarding your comments? (Optional)**

Name ANIL Email AGIRAWAL@CRAY.COM Phone 908.224.1234  
AGIRAWAL



Day 2

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

Yes, thanks for another great session.

**2. Please provide three key takeaways from today's sessions?**

- ~~2~~ 1. I enjoy the panel sessions & interactive discussions w/ the audience.
2. It's the most I've learned at one location, thank you.
3. Enjoy learning the other States DOT WAs programs that varies on organizational

**3. Other information to share:**

~~Structure~~ Structure, business process, collaboration, technology deployment, etc.

**4. May we contact you regarding your comments? (Optional)**

Name \_\_\_\_\_ Email \_\_\_\_\_ Phone \_\_\_\_\_



Day 2

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

*Some parts of discussions were similar to the day 1 topics.*

**2. Please provide three key takeaways from today's sessions?**

*In terms of regulations, there is a lot to be done.*

**3. Other information to share:**

*—  
Thank you for your seminar!*

**4. May we contact you regarding your comments? (Optional)**

Name \_\_\_\_\_ Email \_\_\_\_\_ Phone \_\_\_\_\_





Day 3

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

- wonderful Experience. Thank you.

**2. Please provide three key takeaways from today's sessions?**

- 1) DNC Dot uses 107 pilots in all Division @ Dot.
- 2) VO is very Important.
- 3) Need to develop a Check List.
- 4) Drone Park.

**3. Other information to share:**

Not At this time.

**4. May we contact you regarding your comments? (Optional)**

Name Merrill Atwater <sup>KS, Gov</sup> <sub>DOT</sub> Email Merrill Atwater Phone \_\_\_\_\_



Day 3

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

YES - GOOD DISCUSSIONS

**2. Please provide three key takeaways from today's sessions?**

- VARIOUS TYPES OF CHECKLISTS NEEDED
- NEED FOR NASAD TO COLLECT AND DISSEMINATE UAS ACTIVITIES / INITIATIVES / CASE STUDIES
- ASPECTS OF UAS OUTREACH EFFORTS - TO <sup>STATE</sup> UAS OPERATORS - AND THE UAS COMMERCIAL COMMUNITY OF OPPORTUNITIES IN YOUR STATE <sup>BOTH</sup>

**3. Other information to share:**

**4. May we contact you regarding your comments? (Optional)**

Name JOHN MELVILLE Email \_\_\_\_\_ Phone \_\_\_\_\_



Day 3

**NJDOT Peer Exchange**  
October 3, 2017 – October 5, 2017  
**Informal After Action Review Form**

**1. Did today's discussions meet your expectations?**

Yes, again... a great discussion. I think ending with an open discussion was a very good idea.

**2. Please provide three key takeaways from today's sessions?**

- ① Night operations may become increasingly important. Night training should be part of the curriculum.
- ② States should consider specific training, procedures, and checklists for visual observers.
- ③ States should create drone-friendly areas to promote an acceptable culture for drones.  
[Drones in state parks!]

**3. Other information to share:**

nothing else — thank you! very beneficial!

**4. May we contact you regarding your comments? (Optional)**

Name Josh Thomas Email joshua.thomas@state.de.us Phone \_\_\_\_\_