Current and Near Future Application of Drones to Munitions Projects

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Presented by: KEMRON

NATIONAL ASSOCIATION OF ORDNANCE CONTRACTORS • NAOC

Overview of Drone Applications

- Unmanned Aircraft Systems (i.e. Drones) offer increased safety and cost savings
- Drones becoming more common on environmental related projects industries
- Concerns on FAA and DOD approval have prevented widespread use
- Acceptance rapidly increasing with new applications in variety of fields

Jobs for Drones

As more industries look at drone technology, the list of jobs drones can do—or could do—is growing. But what's real?

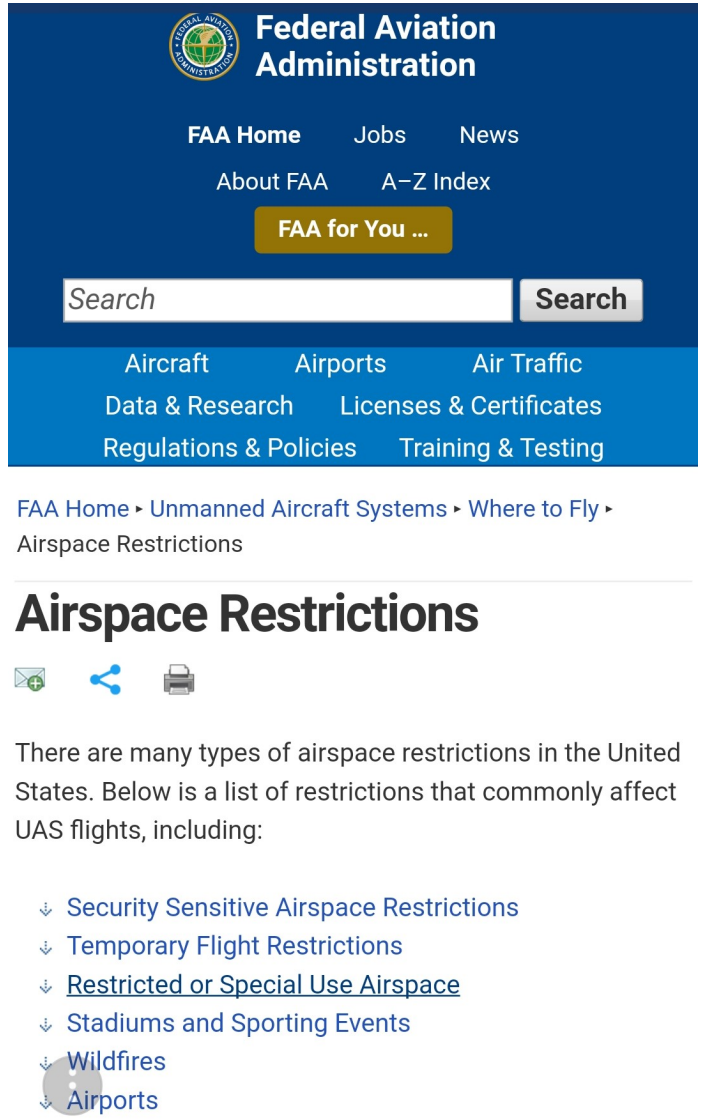
DEVELOPMENT STAGE

Early	Mid	Late
Mail/small package delivery	Construction/ real estate images and monitoring	Aerial photography
	Emergency management	Border patrol
	Filmmaking/ other media	Precision agriculture
	Infrastructure monitoring	Public safety
	Oil and gas exploration	
	Weather forecasting/ meteorological research	
	Wildlife/ environmental monitoring	

SOURCE "DRONE INDUSTRY REPORT,"

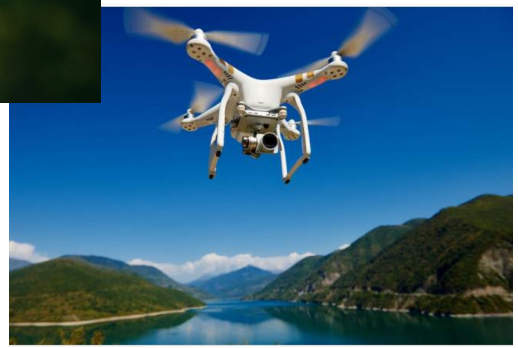
Current FAA Guidance/Restrictions

- FAA Small UAS Rule (Part 107)
  - Drones under 55 lbs
  - Remote Pilot Certificate from FAA
  - Fly within line-of-sight
  - Do not fly over people
  - Fly below 400 feet
  - Outside controlled airspace
- Section 333 Exception Process
  - Drones over 55 lbs
- LAANC: New FAA/Private program
  - Provide access to restricted airspace near airports
  - “Near real-time basis”



Agenda for Drone Applications Presentation

- Drone applications on M2S2 projects by KEMRON
- Drone applications on HTRW projects directly applicable to M2S2 projects
- Near future developments for drones with application to M2S2
  - Larger drones with increased payloads
  - Increased instrumentation



Aerial Photography on Project Sites

- Initial use of drones for site photos & videos on project sites
  - Demonstrate progress on major elements
  - Develop panoramic or promotional/ marketing materials

Drones continue to offer perspective on project sites and provide great marketing materials for M2S2 projects

Remote Observation of Detonation

- Confirmation non-essential personnel are outside safety arc
- Observation of setup for consolidated shot or Blow in Place (BIP)
- Initial inspection of items after detonation

Increased safety from remote observation/inspection and cost savings over traditional security measures

Remote Observation of OB/OD Activities

- Observe OB/OD process from ignition through burning process
  - Ensure personnel/vehicles do not enter EZ
  - Confirm ignition at all pans with appropriate delay
  - Inspection of pans after burning to ensure fire out
  - Real-time verification fire does not spread to vegetation

Observe OB/OD process real time without endangering personnel and ensure personnel/vehicles do not enter EZ

Inspection of Targets and MEC Hazards

- Complete observation of ranges often not feasible during Operational Range Clearance site visits
  - Distance between targets, location of targets or number targets
- Inspect target condition and evaluate MEC hazards with drones
  - Evaluate condition prior to mobilization of UXO crew
  - Utilize as UXO crew approaches target

Increased safety from remote inspection and optimize crew size/equipment during planning

Suggestion - Incorporate Drone Surveys into Bidding Process

- Quantities currently based on notes and limited site photos
- Provide drone survey to bidders during RFP process
  - Reduce uncertainty on condition and quantities

Reduce B&P costs for contractors and increase accuracy of bids for Government

Site Inspection on HTRW Projects

- Routine inspections of slope stability, liner and surface water levels on tailings pile
  - Complete routine inspections in ¼ time
  - Video documentation of condition
- Personnel not required to traverse steep slopes for inspection

Utilize drones to inspect land use controls (fencing and signage) and document conditions on 5 Year Site Reviews on M2S2 projects

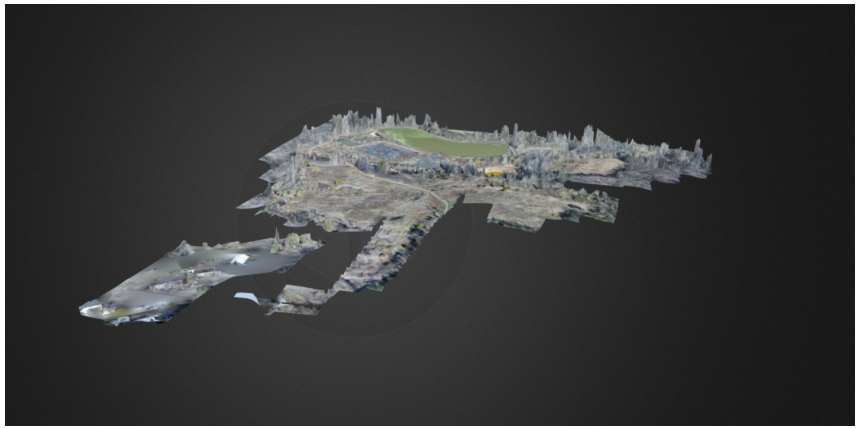
Observation of Hazardous Operation on HTRW Project

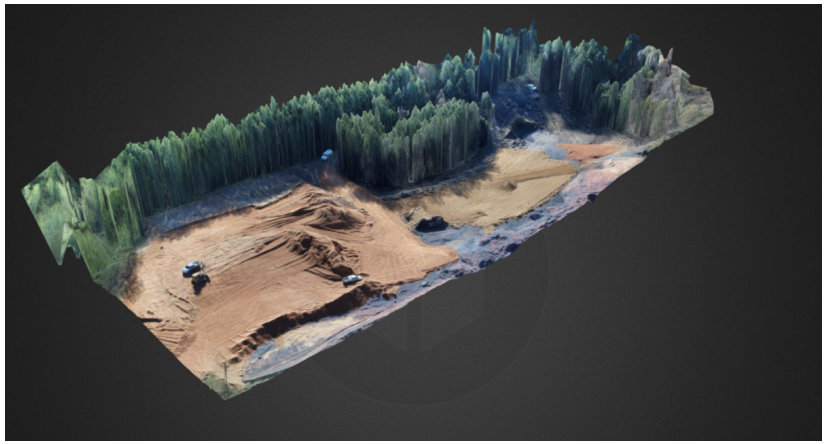
- Drilling conducted in Level B
  - Install vapor extraction system below landfill with drummed waste
- Observation of drilling activities conducted by drone
- Reduce personnel in exclusion zone

Utilize drones to observe operations in hazardous environments and increase on M2S2 projects

Topographic Surveys on HTRW Project

- Developed topographic survey to evaluate man made features
  - Ponds and dams on abandoned property
- Utilized topographic survey to evaluate grading alternatives in 3D rendering
  - Drone based photogrammetry prior to detailed topographic survey during remedial design

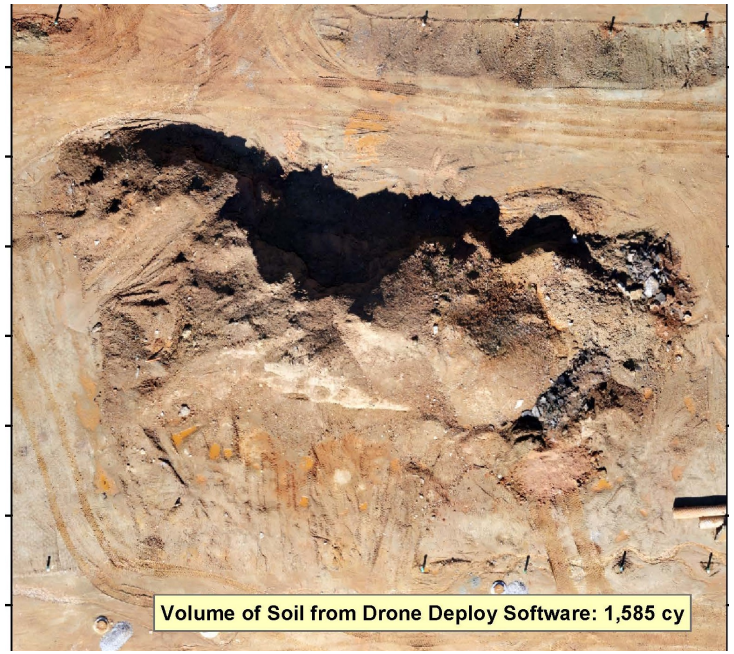




Develop topographic surveys early in process to evaluate munitions related features at a reduced cost on M2S2 projects

Volume Estimates on HTRW Projects

- Topographic survey of stockpiles or excavations
- Calculated volume after post-processing
- Estimated volumes within 15% to 20%
  - Supported budgetary estimate for client



Develop volume estimates for small arms cleanups or during sifting/sieving operations M2S2 projects

Near Future Use of Drones – Prescribed Burns

- Development of drone for small prescribed burn
- Helicopters required for larger burns due to payload
  - Helicopters also provide burn suppression

This drone is designed to start controlled burns of grassland. (University of Nebraska-Lincoln)

Cost savings from drones for ignition of smaller prescribed burns compared to helicopters

Near Future Use of Drones - Remote Monitoring & Testing

- Development/ testing for fire fighting applications
- Extend technology to monitoring
  - Air monitoring in hazardous environment
  - Collect air samples
  - Testing building exterior for explosive residues

Significant increase in safety to allow air monitoring and sampling in hazardous environments

Near Future Use of Drones – Delivery of Materials

- Testing for delivery of goods and medical equipment
  - Not ready for packages or pizza
- Larger drones to move materials on project sites
  - Increased payload from larger drones

Delivery/retrieval of materials from remote areas or hazardous environments

Any Questions?

Safety:

Observations, inspections and monitoring using drones increases safety on M2S2 project sites by limiting access in hazardous environments.

Cost & Quality:

Drone applications reduce manpower for inspections and observations with digital data and offer cost-effective topographic and volume estimates.

Contacts:

John Dwyer
President
jdwyer@kemron.com

John England, PE, PMP
Vice President
jengland@kemron.com

Tom Thrower
Senior Estimator/ Response Manager
tthrower@kemron.com

Tel: 404.636.0928
http://www.kemron.com