CITY OF PHILADELPHIA PENNSYLVANIA OFFICE OF THE CONTROLLER

Utilizing Drones to Improve Public Safety in the City of Philadelphia

Creating efficient & effective government operations with the latest technology

JANUARY 2016

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Background:

As part of the City Controller's Office (Controller's Office) ongoing efforts to explore how latest advancements in technology can be utilized to improve government functions, the Controller's Office launched a drone with video capabilities to visually inspect dangerous buildings in neighborhoods across the City of Philadelphia. This initiative joins prior actions by the Controller since 2006 which have included improving transparency by posting campaign finance reports online, launching the nation's first mobile application, "Philly Watchdog" to allow citizens to report fraud and abuse instantly from their phone or tablet, and the numerous recommendations made to create a more efficient and effective government.

Dangerous buildings in Philadelphia have become the root of extreme blight and have caused fear for many residents, as many families live near structures that are on the verge of collapse. Over the last year, the Controller's Office has identified hundreds of vacant, dangerous buildings through data cross-matching techniques and mapping. The former Administration was provided with lists of addresses and photos of these properties to demolish but minimal action was taken.

Under new Mayoral leadership, the Administration has indicated that it is open to exploring opportunities to improve public safety – as well as operating in an efficient and effective manner.

Under the guidance of a professional videographer and compliant with the Federal Aviation Administration's (FAA) guidelines, our objective was to get a broader view of collapsing buildings and the impact they have on the public safety of entire neighborhood blocks. In addition, the Controller's Office reviewed best practices from cities around the U.S. to assess how drones were being used by other governments. We believe the video and photography the drone captured can be essential to improving our citizens' quality of life.

Scope of Work:

The Controller's Office identified neighborhoods with dangerous buildings through prior work and tips received by concerned residents. This included portions of South Philadelphia such as Point Breeze and near Pennsport, Hunting Park in North Philadelphia, and a section of West Philadelphia.

The Controller's investigators conducted the aerial observations with a professional videographer who met the regulations proposed by the FAA [see appendix I]. The drone was equipped with a GroPro camera that had the ability to record high-resolution video as well as 4K – ultra-high definition. The Controller's staff compiled and examined the video and photographs produced by the drone.

Findings:

Previously, when the Controller's Office selected properties, it would visually inspect only specific parcels, as it could take significant resources to cover just one property. With the drone, the Controller's investigators could cover the targeted parcel along with an entire block of dangerous buildings within a few minutes. The immediate advantage of utilizing a drone was realized with the ability to cover more ground in less time, making the process more efficient and effective.

In addition, many of the properties contain unsafe conditions that cannot be visually observed from the ground level. When examining the video footage from the drone, the Controller's inspectors identified several concerning conditions such as missing roofs, weak structures and adjoining properties that need to be immediately addressed - which could be seen only from an aerial view provided by the drone.

Conditions observed by the drone included the following:

400 Block of South Manton Street - 19147



A property, which has caused nearby residents troubles for years, has a large hole in the roof. The parcel next to the dilapidated property in the picture was recently demolished. As depicted in the photo, this structure needs to be demolished immediately.

3800 Cambridge Street - 19104



While conducting the aerial inspection on this block, it was discovered that one of the row homes had significant damage to the roof, which could weaken the overall structure. It appears cardboard was placed over a portion of the hole in the roof.

4000 Block of N. 5th Street - 19140



The drone footage revealed individuals are accessing the vacant, former Roberto Clemente Middle School. The placement of furniture and abundance of graffiti was clearly visible in several rooms throughout the old school, including the roof of the six-story building.

1500 S. Taylor Street - 19145



This selected block in South Philadelphia included several vacant properties with conditions that were more than just eyesores. Two of structures had holes in the roof where construction debris was located. However, neither had any work permits or active vacant building licenses, according to the Department of Licenses & Inspections' Eclipse system.

The costs associated with video drones are minimal. Depending on the features and users' needs, the costs for professional drones can range anywhere from a few hundred dollars to a few thousand dollars. The drone utilized by the Controller's Office cost less than \$1,000. It had GPS, WiFi capabilities, and a 4K camera mounted to it.

We found a visual inspection of one block consisting of 56 row homes, each row with 28 parcels, could be completed in less than 30 seconds. While the use of drones to inspect properties would not be a substitute to inspections conducted by licensed city inspectors, they could enhance and expedite inspections. As was illustrated in our investigation's findings, drones have the ability to identify and target large sections of properties that are in need of constant monitoring.

In many instances, properties that need to be demolished are handled by the court system. While a property might be deemed unsafe on a Friday, a weekend of heavy snow or rain could drastically change the building's conditions, causing for the need of an immediate demolition. A drone could provide visual support for the condition changes and provide a judge with clear evidence to call for the immediate demolition of the property.

Best Practices

Cities and municipalities across the country are utilizing professional drones with video capabilities to improve government functions. Many governments have implemented drones as a means to gain highquality video and photography of locations that might not be easily accessible or extremely dangerous. A concise review of various sizes of government and their use of drones includes the following:

Building Conditions

Somerville, Massachusetts – utilizes a drone to shoot video of municipal buildings' roofs so the city will know how much snow has to be cleared. The new tool has joined the city's fight against snow-covered roof collapses. Dan Hadley, chief of staff to the Mayor's Office, described the drone as, "This is the easiest, quickest way we could possibly inspect them. As long as we are keeping safety concerns in mind, it's the perfect use of technology for government." (NBC4, Feb. 20, 2015)

Duxbury, Massachusetts – along with utilizing a drone to help search for someone missing in the water or lost in the woods, the Duxbury Fire Department indicated it would also be helpful in assessing storm damage to buildings. Officials in other communities near Boston have indicated drones would be helpful to inspect the accumulation of snow on a building, which pose a risk to collapsing.



Benefit to Philadelphia: The Controller's Office in January 2015 identified 100 vacant, dangerous buildings that were on the verge of collapse throughout Philadelphia. There are hundreds if not thousands more considered hazardous or unsafe that poses a risk to public safety. Any accumulation of snow or heavy rain could result in these buildings to crumble. Utilizing drones to monitor these targeted buildings during and after inclement weather would improve public safety measures and advance demolitions procedures when needed.

Bridge Inspections

Minneapolis – the Minnesota Department of Transportation utilizes drones for bridge inspection. Instead of closing down roads and having an inspector operate an \$800,000 machine that is used for bridge inspections, the drone can get to areas where an inspector cannot. Inspections for the largest bridge in Minnesota can take up to three weeks, but with a drone it can be done in two weeks.

Benefit to Philadelphia: Recent transportation reports indicated that Pennsylvania has the highest number of structurally deficient bridges in the U.S. More importantly,



eight of the top 10 bridges statewide are located in Philadelphia. Many of these bridges are located over water or active railroad lines which are operated by various transportation authorities. This can make it difficult to coordinate train schedules in an effort to safely conduct an inspection. A drone could eliminate the public safety hazard of having inspectors work around active train tracks.

Construction Sites

Sacramento – The new Sacramento Kings arena is being monitored by drones and software to track the progress of construction. Once per day, several drones patrol the work site and collect video footage. The video is examined with architectural software to determine where efficiency improvements can be made. This allows project managers to establish what resources the construction workers need to be more efficient. A regional manager for virtual design and construction at prominent firm stated, "The aerial images and software analysis provides a more comprehensive picture of what's going on, and can highlight how a slowdown in one area may affect the entire project." (MIT Technology Review, Aug. 26, 2015)



Benefit to Philadelphia: With the increase in both small and

large construction projects around the city, L&I inspectors could deploy drones to maintain the pace of required inspections. In addition, drones could assist inspectors with ensuring that projects are meeting construction regulations and codes. In 2012, the Controller's Office conducted a special review of construction activity in North Philadelphia and found public health, safety and quality of life concerns for the surrounding residents. While drones could monitor construction progress as done in Sacramento, they could also aid inspectors in identifying on-site violations and provide support to construction managers to correct any issues.

Transportation Improvements

Ann Arbor, Michigan – The Michigan Tech Research Institute (MTRI) is utilizing drones to better understand transportation infrastructure, making the process easier, quicker and safer. MTRI evaluates the number of potholes in a road, identifies rutting conditions in a roadway, drainage issues and examines the density and severity of road and bridge problems. According to a MTRI senior research scientist, prior to drones the agencies responsible for roads have been reactive, checking out problems after someone calls to complain. The new technology has changed the reactive response into a proactive method to improve management practices. (Michigan Tech Research Magazine 2014)

Benefit to Philadelphia: The Streets Department's Highway Unit is responsible for building and maintaining the city's 2,525



miles of roads and highways. Over the last several years and with the advancement of technology, several websites allow residents to post pothole or road repair issues in an effort to get the poor road conditions resolved. While allowing residents to notify government agencies in a reactive manner can be an effective tool, deploying a drone could identify these road conditions prior to them becoming a problem for citizens.

Utility Inspections

Allentown, Pennsylvania – PPL Utilities recently received Federal Aviation Administration approval to deploy drones to inspect distribution and transmission lines. The utility company plans to use the new technology for preventive maintenance to identify loose bolts and damage to utility poles, especially after large storms. A spokesperson for the utility company stated, "The cameras on these give you a really good close-up view of the equipment so you can get an idea of what's needed so you can dispatch a crew with the right equipment. They'll be used to augment, not replace, current line inspections." (Allentown Morning Call, Oct. 19, 2015)

Benefit to Philadelphia: As with many aging structures across the city, electric lines can pose an increased risk to inspectors, especially lines connected to vacant, dangerous buildings. The



use of a drone could determine the extent of damage to a utility pole or electric line prior to deploying an inspector to an area that might be more dangerous than initially anticipated. In many instances, the Controller's investigators observed properties where electric lines were caught in collapsing structures which were connected to homes occupied by individuals or families. Knowing the extent of utility damage would significantly reduce public safety to employees and surrounding residents.

A list of additional uses that could benefit Philadelphia is located on the following page.

Additional Opportunities to Benefit Philadelphia:

In addition to emulating other cities' uses for drones, the City of Philadelphia should consider the feasibility of using a drone for additional services that would benefit many departments and agencies. Some of these included the following:

Department/Agency	Usage Example(s)
Fire Department	As drones progress, the technology could allow for fire and ambulance vehicles to survey traffic and street conditions in route of an emergency. The aerial imagery could help vehicles rushing to an emergency in real time as a means to increase overall response time – either to arrive on scene of a fire quicker or get a patient to a hospital faster.
Mural Arts	Having the ability to closely navigate exterior walls and quickly pinpoint damage could allow the city's arts division assess the condition of paintings on large surfaces, as well as identify buildings where future art could be displayed.
Office of Property Assessment	The former Mayor altered the city's property assessment system in order to record full market values for tax purposes. As a result in many neighborhoods, property owners realized significant increases in their property taxes, while others realized decreases. Aerial imagery could provide a better assessment of properties to provide fair, equal assessments based on real property features and conditions.
Parks and Recreation	Fairmount Park, which consists of 9,200 acres, could benefit from having aerial imagery to assess stream conditions, ecological patterns, vegetative health and wildlife population, e.g. deer herds.
SEPTA	As the fifth largest overall transit system in the U.S., SEPTA covers almost 300 stations, 450 miles of track and almost 200 routes. During inclement weather or other instances of issues regarding track conditions, a drone could navigate a service line to determine the problem (or potential problems) and provide instant feedback to get the transit agency's services up and running smoothly and quickly.
Streets	There are possibilities for preventative and monitoring actions regarding instances of inclement weather. For example, prior to a snow storm, the Department could utilize drones to determine what areas still need sanitation services. These areas would be deemed a priority to avoid a larger trash problem when the storm clears. In addition, drones could monitor streets that haven't been plowed and allow crews to dispatch trucks to clear the snow from these areas.
Water	Commercial water customers are billed for stormwater usage based on the specific square footage of impervious area covering the property and the total square footage of the property. Drones could be utilized to accurately assess these charges and indicate any improvements made by property owners to reduce runoff water.
City Planning/ Zoning Commission	The aerial imagery provided by drones could assist with updating zoning maps, support data-gathering techniques and provide high-quality media for new construction, floodplains, districts and building facades.

Conclusion

There are a number of ways to utilize drones to improve daily government functions. Even though the technology is new and the federal government is still reviewing proposed regulations, many municipalities and cities have already realized the advantages of drones, as depicted in this report.

Most importantly, and as many government agencies have indicated, the use of drones does not eliminate inspectors or other agency staff needed to perform important, daily tasks. This technology can prove to be beneficial by enhancing workers' abilities to perform their jobs quicker, easier and in a safer manner – thus completing their tasks more efficient and effective. Drones can cover a larger distance in a shorter amount of time, allowing inspectors to cover more ground and have the ability to view high-quality videos and photographs.

In addition, all FAA regulations need to be followed and drone operators should be trained and held accountable for operating the aerial technology responsibly and safely – many of the same qualities that they currently uphold as City of Philadelphia employees. This would include the City applying for a Certificate of Authorization from the FAA, which permits public agencies and organizations to operate a particular aircraft, for a particular purpose, in a particular area [see Appendix II].

Working with the FAA and the City's Aviation Division would provide extra oversight of the drone operators as well as maintain an open channel of communication and guidance. This government partnership could include reviewing detailed flight plans and providing usage reports, ensuring the drones are not used in an improper manner.

We recommend the City of Philadelphia explore the opportunity of drone usage to enhance government functions. The costs would be minimal, and several agencies could benefit, including Licenses & Inspections, Streets Department, Fire Department, Water Department and the other utilities that support the city. A drone "pilot" program should be implemented to determine which agencies could benefit the most as well as gain an understanding of what specific government functions could be enhanced.

We believe that as technology advances, the City of Philadelphia should implement cutting-edge tools that can improve the lives of all the residents it serves.

APPENDIX I

MODEL AIRCRAFT OPERATIONS – RECREATIONAL USE



Model Aircraft Operations

Model aircraft operations are for hobby or recreational purposes only.

The FAA has partnered with several industry associations to promote <u>Know Before You Fly</u>, a campaign to educate the public about using unmanned aircraft safely and responsibly. Individuals flying for hobby or recreation are strongly encouraged to follow safety guidelines, which include:

- Fly below 400 feet and remain clear of surrounding obstacles
- Keep the aircraft within visual line of sight at all times
- Remain well clear of and do not interfere with manned aircraft operations
- Don't fly within 5 miles of an airport unless you contact the airport and control tower before flying
- Don't fly near people or stadiums
- · Don't fly an aircraft that weighs more than 55 lbs
- Don't be careless or reckless with your unmanned aircraft you could be fined for endangering people or other aircraft

The statutory parameters of a model aircraft operation are outlined in <u>Section 336 of Public Law 112-95</u> (the FAA Modernization and Reform Act of 2012) (PDF). Individuals who fly within the scope of these parameters do not require permission to operate their UAS; any flight outside these parameters (including any non-hobby, non-recreational operation) requires FAA authorization (www.faa.gov/uas/civil_operations/). For example, using a UAS to take photos for your personal use is recreational; using the same device to take photographs or videos for compensation or sale to another individual would be considered a non-recreational operation.

More about the Know Before You Fly campaign

Read the <u>FAA's Interpretation of the Special Rule for Model Aircraft</u> (www.faa.gov/uas/media/model_aircraft_spec_rule.pdf) (PDF)

Read the Do's and Don'ts of Model Aircraft Operations

View FAA YouTube videos on safe model aircraft operations.

The "Model Aircraft Do's and Don'ts"

(www.faa.gov/uas/publications/model_aircraft_operators/assets/media/model-aircraft-infographic.pdf) (PDF)

APPENDIX II

PUBLIC CERTIFICATE OF AUTHORIZATION



Public Operations (Governmental)

Public Aircraft Operations (www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1023366) are limited by federal statue to certain government operations within U.S. airspace. Title 49 U.S.C. § 40102(a)(41) provides the definition of "Public Aircraft" and § 40125 provides the qualifications for public aircraft status. Whether an operation qualifies as a public aircraft operation is determined on a flight-by-flight basis, under the terms of the statute. The considerations when making this determination are aircraft ownership, the operator, the purpose of the flight, and the persons on board the aircraft.

Decision Flow Charts for Public Aircraft Operations (media/Decision Flowcharts for PAO.pdf) (PDF)

Public COAs

For public aircraft operations, the FAA issues a <u>Certificate of Waiver or Authorization (COA)</u> (<u>www.faa.cov/about/office_org/headquarters_offices/ato/service_units/systemops/aaim/orqanizations/uas/coa/)</u> that permits public agencies and organizations to operate a particular aircraft, for a particular purpose, in a particular area. The COA allows an operator to use a defined block of airspace and includes special safety provisions unique to the proposed operation. COAs usually are issued for a specific period – up to two years in many cases.

The FAA works with these organizations to develop conditions and limitations for UAS operations to ensure they do not jeopardize the safety of other aviation operations. The objective is to issue a COA with parameters that ensure a level of safety equivalent to manned aircraft. Usually, this entails making sure that the UAS does not operate in a populated area and that the aircraft is observed, either by someone in a manned aircraft or someone on the ground to ensure separation from other aircraft in accordance with right-of-way rules. Common public uses today include law enforcement, firefighting, border patrol, disaster relief, search and rescue, military training, and other government operational missions.

The FAA manages <u>public aircraft COAs</u> through its <u>COA Online system (https://ioeaaa.faa.gov/oeaaa/)</u>. Before the FAA grants an agency access to COA Online, the agency (or proponent) will be asked to provide the FAA with a "declaration letter" from the city, county, or state attorney's office assuring the FAA that the proponent is recognized as a political subdivision of the government of the State under Title 49 of the United Stated Code (USC) section (§) 40102(a)(41)(c) or (d) and that the proponent will operate its unmanned aircraft in accordance with 49 USC. § 40125(b) (not for commercial purposes). An agency's accountable executive <u>cannot</u> self-certify their agency is a "public" agency.

The typical COA application approval process is completed within 60 business days of receipt, provided there are no submittal errors, missing information, or safety or airspace issues. Please email the FAA/UAS Integration Office at <u>9-AJR-36-UAS@faa.gov</u> to get started.

Related Links

- <u>Advisory Circular 00-1,1A</u>, <u>Public Aircraft Operations</u> (<u>http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/10233661</u>, February 12, 2014
- <u>Clarification of June 13. 2014 Interpretation on Research Using UAS</u> <u>(www.faa.gov/about/office_org/headquarters_offices/agc/gol_adjudication/agc200/interpretations/data/interps/2014/williams-afs-80%20clarification%20-%20%282014%29%20legal%20interpretation.pdf)</u> (PDF), July 3, 2014