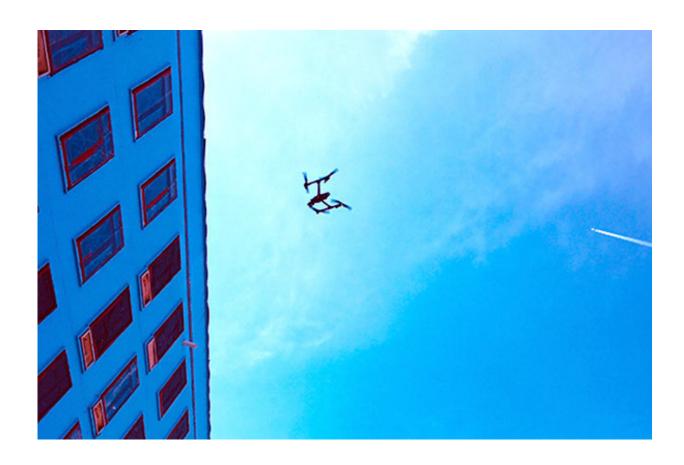# Drone-based thermal imaging and analytics for energy efficiency

April 30 2018, by Edward Mason

A thermal imaging test flight by an Airworks drone. Credit: MIT Sloan School of Management

Say the word drone, and you're likely to conjure up images of the latest military technology, the newest e-commerce delivery device, or

something you snap a GoPro camera onto for aerial shots of the Grand Canyon.

All of that is true. Increasingly, though, drone technology is entering traditional industries. One example is the construction industry, where drones are demonstrating their potential to assist in building inspections. AirWorks, an MIT aerial analytics startup, is taking that process a step further. The Cambridge-based company is combining drone technology with artificial intelligence software of its own design to transform the way conventional building inspections and land surveys are performed.

"We're in the business of making aerial data accessible and useful," said co-founder David Morczinek, MBA '18. "That can be to construction companies, governments, and city planners."

Since its founding in 2017, AirWorks has provided aerial analytics to the construction industry, using data captured by its drones and analyzed by machine learning-based processing software. AirWorks created the software, which converts the aerial data into land surveys with accuracies within one-tenth of a foot and building information modeling, a digital representation of the physical and functional characteristics of a facility.

While drones become more common in the construction industry, it's speed that AirWorks believes will separate it from the competition, Morczinek said. Currently, competitors go out and capture the data for construction companies, but then it'll take experts hundreds of hours to convert that data into a usable format, Morczinek said. AirWorks artificial intelligence software slashes the time it takes to conduct surveys and inspections to days.

In early April, AirWorks conducted a test of its newest software, which the company hopes to have on the market in early 2019, during an energy audit of a seven-story building in Cambridge, Massachusetts. The

entire inspection, from collecting the data to analyzing it, took less than 10 hours.

AirWorks used thermal imaging cameras attached to drones circling above the building to identify possible anomalies in the building's facade, according to Nourhan Bayomi, SM '17, head of 3-D modeling and thermal analytics for AirWorks. Those anomalies might include air leaks, cracks, deterioration, rust, missing or damaged insulation and areas with moisture content that would affect a building's energy use. Using data from an inspection like this, AirWorks might recommend fixing issues of thermal bridging, or examining the durability of construction materials, said Bayomi, who is pursuing a PhD at MIT. The project was conducted as part of Bayomi's work with Mohammed VI Polytechnic University and with MIT professor John E. Fernandez and Tarek Rakha, PhD '15, of Syracuse University.

Thermal imaging is an important technique for assessing energy efficiency, Bayomi explained. A building may be recently constructed and with a newly installed and energy efficient system, but it's all for naught if the building's facade leaks, Bayomi said. Drones hovering above with thermal cameras can capture wasted cooling or heating energy leaking through a faulty facade.

The drone inspection market is poised to become a multi-billion industry, as those unmanned vehicles make the once dangerous and time-consuming work safer and far less expensive. Within three to four years after finishing the company's software, Morczinek estimates AirWorks can obtain annual revenues between $10 million and $20 million.

AirWorks' potential customers are construction companies, contractors, civil engineers, and real estate developers, Morczinek said. The company is already profitable, according to Morczinek, and is involved in 10 projects locally. They include providing mapping services to the

developers of Maine's [Scarborough Downs racetrack](#) and [Union Point](#), a massive retail, commercial, and residential development planned south of Boston.

The concept for AirWorks sprouted from the mind of Morczinek. A licensed pilot, he began his career at Airbus. Driven by an interest in the impact aerospace has on society, he pursued an MBA at MIT Sloan.

Once considered toys, drones have evolved dramatically in recent years. They're synonymous with a [new kind of warfare](#). They're [used](#) to race competitively, for search and rescue operations, scientific studies, wildlife conservation, and to connect people to faraway places. And, now famously, part of [Amazon's plan](#) to change e-commerce.

Still, the U.S. Federal Aviation Administration strictly limits who can operate drones and where they can fly. AirWorks has obtained FAA authorization to operate in Boston and Cambridge airspace, according to Morczinek.

Morczinek acknowledges drones have a mixed reputation that may slow their acceptance by some player in the construction industry. He prefers to call drones by their alternate name, UAVs—unmanned aerial vehicles—to avoid the negative connotations that dog them. But Morczinek said he's confident the [construction industry](#) will be won over by the usefulness of drones.

"Companies are starting to understand more and more the potential of [this] kind of information," Morczinek said. "I think the opinion of the public will change a bit as it sees what value aerial data capture by UAV can bring."

Provided by MIT Sloan School of Management