

When dilapidated structures are too dangerous for human access, UASs provide a safe, cost-effective way to complete surveys and inspections.



# TOO *DAM* DANGEROUS?

When a conservation agency needed accurate data on a crumbling dam too treacherous for human access, they relied on an unmanned aerial system.



## MISSION ACCOMPLISHED

**Challenge:** A preservation agency needed to survey a crumbling dam that was too damaged for humans to access.

**Solution:** We deployed a microdrones md4-1000 UAS with an Applanix APX-15, which allowed us to fly over the dam collecting accurate information while using only a minimal number of ground control points.

**Impact:** The agency was able to collect the data and images they needed at the required accuracy without putting any human lives in danger.

**The microdrones difference:** Our UAS saved the agency valuable time, money, and hassle. The md4-1000's long flight times, resilient design, and GCP reduction allowed the mission to be completed quickly and efficiently – even in windy conditions.

## Too Dam Dangerous?

Just 20 minutes south of a bustling metropolis, along a broad canal, is a popular bike path that offers a peaceful refuge from city life. Here, locals and tourists enjoy a 19-kilometer stretch of quiet waters, green fields, and trembling aspens. In addition to the functioning locks and the ruins of a pre-revolutionary fort, a popular stopping point along this path is a historic dam. Set in a particularly tranquil location, the shores near the dam provide the perfect spot for a rest or picnic – perfect except for the glaring danger signs.

Built in 1937, the retired dam is now in crumbling condition. As a result, the dilapidated dam causes a wide range of ecological, functional, and aesthetic problems, but the biggest concern is safety. While red and yellow signs posted all over the structure caution visitors to stay away, it is common to see people climbing and fishing on the dangerous dam. When an enormous slab of concrete broke from the dam and slid into the canal, an agency in charge of protecting these types of places and structures knew they had to take action to ensure the safety of visitors and avoid legal risk. They decided to begin the process of restoring and converting the dam into a safe, usable walkway.

The first step was to open up a request for proposals from engineering firms. But there was a problem. To solicit design ideas and cost estimates, they would need accurate measurements and a three-dimensional model of the dam. How could they achieve this, when the dam's life-threatening condition made access too risky for traditional survey methods?

### BY FOOT, BY BOAT, OR BY TRADITIONAL AIRCRAFT?

The dam was too old and fragile to inspect traditionally by walking on it, so the preservation team began considering other methods of inspection. One option was to use a small boat, but it was quickly determined this would not work, since measurements of the top of the structure were needed. A helicopter could provide the necessary aerial views, but the costs would be tremendous. They decided to seek out estimates to collect the data and photos they needed via an unmanned aerial systems (UAS), or drone.

“When this client contacted us, we’d never surveyed a dam,” explained Sebastien Long, sales manager for microdrones. “It was a huge job that would involve many challenges and flight hours, but we knew we had the technology to achieve their goals.”

That technology was the microdrones™ md4-1000 aerial vehicle, a VTOL (Vertical Take Off and Landing) aircraft that supports up to a 1.2 kg payload. This UAS was equipped with a camera, sensors, and the Applanix APX-15, a component designed to drastically improve the efficiency of mapping missions. APX-15 accomplishes these goals by:

1. allowing data to be accurately collected without surveying an extensive number of ground control points
2. decreasing the amount of overlap that needs to be flown, saving flight time.

These advantages were especially important for this dam mission because GCPs could not be placed on the dam and long flights were required.

A pilot flies a microdrones UAS over the dilapidated Fryer Dam, collecting critical data and images from a safe distance.



## WHY WAS THE md4-1000 A PERFECT FIT?

The md4-1000 solution from microdrones was uniquely qualified for this mission because of these key benefits:

**Safety.** Thanks to the APX-15, it was not necessary to place ground control points on the crumbling dam. This allowed the pilots to collect highly accurate data from a position of safety at all times.

**Flight Time.** This mission required the UAS to stay in the air for a very long time as it flew back and forth, surveying the dam in rough winds over the wide canal. With the longest flight times on the market, the md4-1000 was the perfect vehicle for this mission. Depending on load and weather, the md4-1000 can stay in the air for about 45 minutes to an hour and a half, depending on payload.

"We achieve our long flight times through a collection of key design elements, three of the most important being our number of motors, battery pack, and engine configuration," said Long. "We can fly longer than other UASs because we fly on only four motors, where others normally fly on six, eight, or even ten. We don't need the additional motors because ours are so well made, reliable, and powerful. The German engineering translates to a better product. Our 6S24 battery is another feature that gives the UAS exceptional endurance. Plus, our system flies in a cross pattern instead of the usual X pattern seen on other platforms. This is a much more complicated design for us, but it is much more economical on the battery."

**Durability.** md4-1000's resilient carbon fiber housing made it an ideal choice for flying in the rough winds above the canal. The UAS's structural and electronic components can stand up to high maximum temperatures of 130°C (266°F).

**Stability.** Another major advantage of the md4-1000 is its stability, which is due mostly to its large propellers. "Our propeller size allows our motors to fly at a lower RPM, averaging 2000 RPM as opposed to 8000 RPM," explained Long. "Plus, the large propellers impact the wind differently than smaller ones. This makes the vehicle much more stable in the air. It's also much quieter; other systems sound like swarms of mosquitoes. Our large propellers hardly make a sound."

**Accuracy.** The APX-15 allowed us to know exactly where the UAS was, within 2-3 centimeters, at any given time. This integration contributes heavily to the exceptional accuracy of the UAS.

**Reliability.** microdrones systems are made from German-engineered components and assembled in North America, so they offer superb reliability. "These aren't thrown together in the cheapest factories in the world, like so many UASs. And that's important. Things happen when you're flying – things fail! But you don't want them falling out of the sky when they're carrying a \$50,000 payload. Customers certainly don't want their name associated with a failed mission," explained Long. "They can prevent that by choosing a well-made UAS they can trust."





Using highly accurate data collected using a microdrones UAS, a preservation agency was able to create a 3-dimensional model of the Fryer Dam that engineers could use when drafting their proposals.

The microdrones team spent one day setting up two ground control points on each side of the dam and were able to make the 1-2 hour flight the next day. Afterward, the microdrones team was able to create a complete mosaic image from which highly accurate measurements could be taken. From there, they were able to develop a 3-D model of the dam.

With the UAS, the agency was able to:

- Attain the information they needed at the required accuracy levels so they could effectively communicate their needs to engineering firms
- Accomplish their goals **safely** by not sending surveyors onto the dam
- Acquire **aerial data** that couldn't have been procured via boat
- Achieve **cost savings**, especially when compared with the costs of renting a helicopter

By choosing the microdrones md4-1000 over other UASs, they saved considerable time, money, and hassle. They have since moved forward with the \$7.4 million restoration of the dam.

But that's not the end of the story. The md4-1000 configuration worked so well for this type of project that microdrones has since configured the technology into its mdMapMaster package that is available for immediate order. "We made a few minor changes to the UAS package to make it more efficient and it's ready to go for those who need it to complete precision mapping missions," said Long.

The mdMapMaster package comes complete with the UAS, a Sony Cyber-shot RX1R II, the Applanix APX-15, and a powerful base station loaded with all the software you need to receive and process video and telemetric data on the ground. It is ideal for completing surveying applications in difficult environments.

## HAVE A QUESTION?



We love talking about this stuff! Whether you have a specific question about our technology or want to discuss a current challenge, don't hesitate to contact one of our UAS experts.

We look forward to helping you achieve your goals more efficiently. E-mail your questions to:

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