CASE STUDY

Intel Falcon™ 8+ Drone

Drones Aid Conservation Efforts at Halberstadt Cathedral

The use of drone technology helps preserve delicate structures, captures explicit detail, and extends budget for conservation

At a Glance:

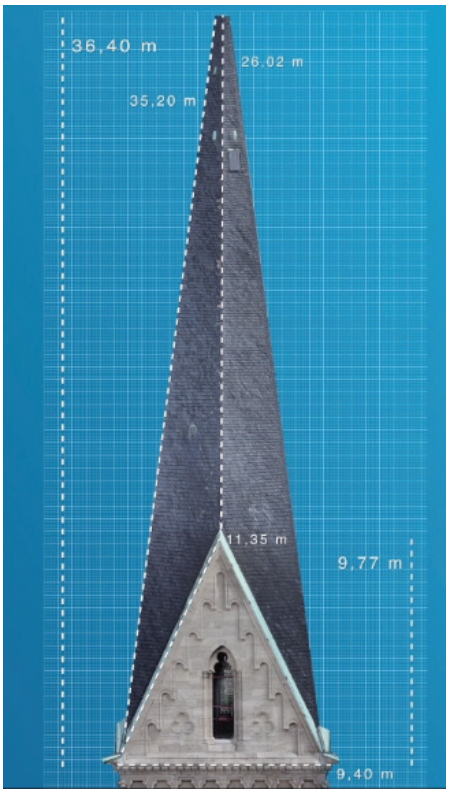
Intel drone technology proves invaluable for conservation efforts through these key advantages:

- Hands-free structural assessment
- Easy to deploy for hard-to-reach locations
- Increased inspection accuracy to improve restoration efforts
- Reduced cost compared to traditional restoration assessment methods

Kulturstiftung Sachsen Anhalt, Germany and Bauhaus Universität Weimar, have entered into a three-year project focusing on monument and heritage conservation of the Halberstadt Cathedral, also known as the Church of Saint Stephen and Saint Sixtus (Dom zu Halberstadt).

This Gothic church in Saxony-Anhalt was predominantly constructed in the early 15th century. Historical buildings like this suffer from changing environmental conditions that damage structures. Careful stock condition surveys, and structural health monitoring and planning, are required to protect structures and to choose the right conservation measures.

Visual inspections of historical structures are very costly and require technical, logistical, and personnel resources. In particular, accessing hard-to-reach places requires expensive equipment, scaffolding, and qualified personnel. Using the Intel Falcon™ 8+ Drone mitigated risk to the structures, while saving time and resources.



Challenge

A rough survey of the cathedral and plaza, a detailed survey of the North portal, and an indoor[1] high-accuracy survey for statues were required in order to assess and initiate the correct preservation efforts for the Halberstadt Cathedral.

The statues are located inside the cathedral at hazardous heights nearing 20 feet. The conservators were concerned that traditional inspection methods, such as workers accessing the statues using ladders or scaffolding, could further damage the statues and the delicate pigment color which is now a detached shell on the stone surface. The fragile condition of the cathedral's statues and structures necessitated a new approach.

Solution

The contracting authority chose Intel's unmanned aerial system (UAS) to navigate the precarious heights and delicate infrastructure, and to capture crucial precision data more efficiently and effortlessly than traditional inspection methods. Redundant features in the system along with its reliability, efficiency, and high-quality data collection were reasons for choosing the Intel Falcon 8+ drone.

Intel's small electric highend multi-rotor flight systems, equipped with high-quality cameras, have enormous potential for use in structural monitoring. In addition to visual damage detection, flight systems like the Intel Falcon 8+ drone can be used for vision-based surveying (photogrammetric analysis) and generating 3D structural models. This drone is equipped with a redundant autopilot, plus redundant communications, to provide remarkable stability and reliability during critical missions.

The approach was comprised of three automated flights and one manual flight using the Intel Falcon 8+ drone with a Sony* A7R Payload and AscTec* Navigator software.

First flight: a single automated circle-of-interest flight around the cathedral at 100 meter altitude. Camera angle set to 45 degrees. Flight time around 14 minutes, with 169 images captured.

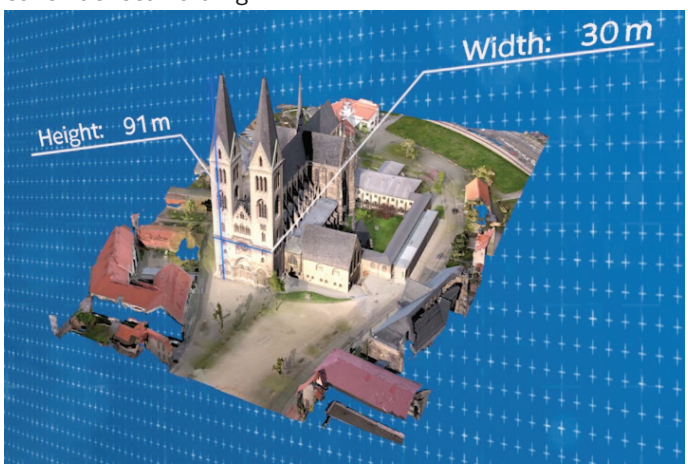
Second flight: a single automated city mapping flight at 100 meter altitude. Camera angle set to 90 degrees down, flight time around 5 minutes, with 91 images captured.

Third flight: a single automated vertical flight along the façade, for a detailed survey of the north portal. Camera angle 0 degrees, at a distance of 7 meters, flight time around 16 minutes, with 325 images captured.

Manual indoor flight: this flight had a distance of 2-3 meters, lasted around 16 minutes, and collected 235 images.

Result

The images of the North Portal, the cathedral, and statues, were collected without risk of damage to delicate structures and without incurring additional costs to construct scaffolding.



Using the Intel® Falcon 8+ drone with A7R payload, several hundred detailed images were taken of every statue and put through post-processing.

Cathedral data post-processing: 727 images, took 26 hours of computing time with mid resolution, using a PC with an Intel® Core™ i7 6700K Processor and NVIDIA GeForce GTX 1070 graphics card. 46 million point dense point cloud, 9.2 million faceted mesh, and 12 mm/pixel GSD m/Pixel.

Sculpture post-processing: 235 images, took 23 hours of computing time at high resolution using a PC with an Intel® Core™ i7 6700K Processor and NVIDIA GeForce GTX 1070 graphics card. 48 million point dense point cloud, 2.2 million faceted mesh, with less than 1 mm/pixel GSD.

The effort resulted in 3D models and rectified mosaics of the statues, with great detail and accurate surface texture. The 3D models created are being used for inspection measurement, including volumetric estimations, and evaluation profiles.

The refurbishment and conservation team will use these models to begin restoration planning, including commissioning of the different crafts required, to ensure the cathedral and statues remain in good condition for centuries to come. All costs saved through use of the innovative drone technology will be used to further conservation efforts.

More Information

Learn more about the Intel Falcon™ 8+ system and how it helped the Halberstadt Cathedral's conservation team achieve their goals:
intel.com/content/www/us/en/drones/drone-applications/commercial-drones/case-study/halberstadt-cathedral.html
For more information on the Intel Falcon 8+ system visit:
intel.com/commercialdrones

[1]Warning: Indoor spaces are a GPS denied environment. Before using the Intel Falcon™ 8+ system indoors, you must isolate it and the Intel Cockpit controller from any other 2.4 GHz Wi-Fi or RF signals because, if you do not, the Intel Falcon™ 8+ drone may lose control. As the ETSI standard EN 300328 requires, this device performs a Clear Channel Assessment and other devices – such as 2.4 Ghz Wi-Fi, Bluetooth, and ZigBee devices - transmitting in the 2.4GHz ISM band in very close proximity to the Intel Falcon™ 8+ system may disturb its control link. Comply with applicable laws.