

Surveying and inspecting safely from the air

by Friederike Nielsen and Robert Lautenschlager

UAVs – Unmanned Aerial Vehicles – are now employed in many areas of surveying. This is not restricted to land surveys, but also includes open-cast mines, landfill sites and roads or buildings. In addition, these versatile little aircraft open up entirely new possibilities for the more efficient management of major construction sites. Before building work has even started, they can deliver a fast, low-cost aerial overview of local conditions and generate accurate and meaningful data for calculation and quotation purposes. Once building work has started, aerial photographs taken by UAVs provide regular documentary records of interim steps. Besides making it much easier to monitor construction progress, it also facilitates the control of internal processes. Once construction work has been completed, it is no problem for a UAV

to carry out an inspection of the building and provide evidence that the work has been carried out as agreed and expedite final acceptance.

The Swiss power company Axpo is using the UAV Aibot X6 to survey and document the major construction project “Linthal 2015” in the Glarus Alps region. In an initial step, the entire Linthal valley was surveyed from the air and a point cloud with an accuracy of up to one centimetre (0.4 inch) was generated. This data will now form the basis for planning subsequent steps of the construction process.

The Swiss power company Axpo is building a new, underground pumped storage plant – the largest in the country – in the Canton of Glarus. In future, the plant will guarantee the future electricity supply to northeastern and central Switzerland. The plan is for the plant to pump water from Lake Limmernsee back up to Lake Muttsee – an altitude difference of



630 metres (2,070 feet) – where it can be used again to generate electricity when required. This large-scale project, which involves investment costs of around 1.85 billion USD (1.7 billion EUR) and is expected to take the best part of five years to complete, will employ up to 500 people at various construction sites. The plant should start to deliver electricity at the beginning of 2016.

Fast, flexible data collection

Hundreds of thousands of cubic metres of soil and rock will have to be removed to build the tunnels and caverns for the pumped storage plant. Most of this spoil will be transported to the Muttentalp mountain by cable car and used to build the dam, which will be more than a kilometre long and rise to a maximum height of 36 metres (118 feet). The rest of the material will be deposited in front of the existing Limmern dam. In October 2014, Axpo used the Aibot X6 for the first time to survey this area, which is known as

the Limmerntobel Inert Matter Disposal Site. Because the surrounding mountains blocked satellite signal reception, the aircraft was flown manually without GPS navigation. Photographs of the terrain were taken at a vertical angle during the flight to create high-resolution images of the disposal site with a 60% to 90% overlap. Before the flight, 14 ground control points were plotted evenly in a distance of approximately 50 to 80 meters (160 to 260 feet) in seven corners of the surveyed area for subsequent geo-referencing of the images. "This was the first time the Aibot X6 had been deployed at an altitude of 2,000 metres (6,562 feet), but the rarefied atmosphere had no adverse effects on its flight characteristics," explains pilot Robert Lautenschlager.

The 50,000 square metres (12.5 acres) of land was surveyed in two flights lasting ten minutes each. Agisoft photogrammetry software was used to process the data collected and a precise point cloud with an



accuracy of up to one centimetre (0.4 inch) was generated. The whole evaluation processed lasted about 120 minutes. The point cloud was then integrated in the local coordinate system of the construction site, enabling Axpo's surveyors to calculate the volume of the deposited material.

Periodic photographic records of the disposal site had previously been created using an external filming system suspended from a helicopter. Not only can high-precision geographical data be recorded within a short space of time using the Aibot X6, but it is also possible to create complete and seamless documentation of the current status of construction work. At any given moment, the UAV can give contractors an immediate overview of how building work is progressing, thus helping them to plan and control processes better.

Combination of surveying and inspection

The use of UAVs means that surveying and inspecting tasks can now be combined more and more frequently. The Axpo example is a perfect illustration of this: in future, the company intends to use the Aibot X6 not only for the creation of digital models of terrain for planning and building power plants, but also for vital inspection tasks. It will be possible to fly over existing dams and take photographs that will allow the condition of the concrete surfaces on the

airside and waterside of the dam to be assessed in detail. In this case, the hexacopter will again be fitted with a digital camera and flown to locations where it will take high-resolution pictures of all critical areas, thus enabling even the smallest cracks and other anomalies to be detected.

The Aibot X6 can also be used to inspect electricity pylons. The hexacopter offers a number of advantages here, such as flexibility of deployment and availability at short notice in the event of a malfunction or defect. As the inspection is performed by a remote-control, unmanned aircraft, it is also safer and much cheaper than an inspection by helicopter or steeplejack, since it is not even necessary to switch off the current beforehand. In future, Axpo will also rely on unmanned airborne help in the environmental sector, where UAVs will be used to take pictures of mountain streams as part of residual water experiments. ■

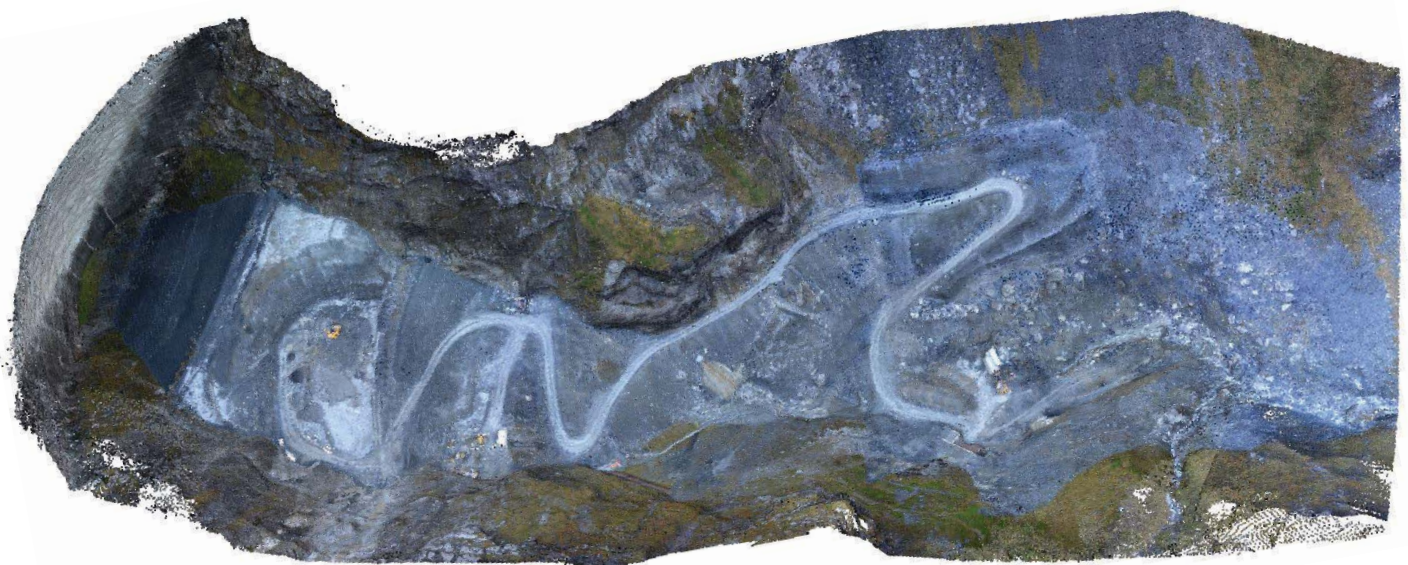
About the authors:

Friederike Nielsen is the Director of Marketing Communication at Aibotix.

friederike.nielsen@aibotix.com

Robert Lautenschlager is a solution engineer and UAV pilot at Aibotix and is involved in the development of Aibotix's UAV technology and workflows.

robert.lautenschlager@aibotix.com



■ Generated point cloud of the area with an accuracy of up to one centimetre (0.4 inch).