QUALITY MATTERS

Experiences in UAS Photogrammetry

3D model of an open pit.

UAS mapping is widely accepted as a new method for acquiring spatial image data. The main business opportunities clearly lie in projects which are too small to be of interest for aircraft and helicopter platforms and too big for field mapping. Nevertheless, performing UAS operations profitably and with high-quality results is quite demanding. At the end of the day, the paying end customer is not really interested in whether the data was produced using UAS or more traditional methods; data quality is all that matters. This article focuses on UAS mapping productivity topics, shedding light on the practical challenges of UAS operation and data processing.

Today's Unmanned Aerial System (UAS) mapping market is divided into three main groups: UAS manufacturers, data-processing technology providers and aerial operators who fly the systems to meet the needs of paying end customers. While there are alliances between UAS manufacturers and processing technology providers, it is important to note that each of the three technological and service-providing roles require quite different know-how and operational processes (Figure 1).

A mapping UAS typically comprises the following components: unmanned aircraft with autopilot (fixed or rotating wing), mission planning and ground station software with radio link, camera and optionally a launch and landing control system for high-speed fixed wing systems (Figure 2). Photogrammetric software is used to process the acquired images into data products, orthomosaics and 3D point clouds so that they are ready for use in GIS and planning systems.

Performance factors

A UAS is a decisive working instrument for an operator, which in terms of investment is comparable to a robot tachymeter or a terrestrial laser scanner system. There are number of commercials systems to choose from. When planning a system purchase, the component which has by far the greatest effect on the end product results is the on-board camera. Nowadays, options range from high-performance and lightweight full frame (35mm) consumer cameras to metric cameras specifically built for UAS applications. Another fundamental choice is whether to select a rotary or fixed wing device. Fixed wing vehicles usually fly faster and are capable of covering larger areas of interest. Meanwhile, rotating wing systems typically have lower cruising speeds but are capable of operating in limited spaces and in urban areas without problems.

There are a number of design features which have a direct impact on operational performance and thus on the productivity of a UAS. Since the system should be suitable for one-person operation in order to typically reduce operating costs by half, system design is being forced towards simplicity. Moreover, operators should be able to control a UAS manually in the air – not only to comply with legal requirements by the relevant authorities, but also as an important safety feature in the case of unexpected mechanical failure or air traffic.

A mapping mission using lightweight systems can be started with a manual toss whereas heavier systems need a launcher system – a trade-off between operation simplicity and added hardware enabling larger areal capacity. Lighter system cans usually be landed manually into a small space. Meanwhile, a heavier system should have an option for parachute landing; to land a UAS on its belly may require quite a lot of open space, which cannot always be provided, and expose the sensitive camera to repeated bumps and shocks during landings.

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