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## Survey Drones

### Intro and brief history, evolution of technology.

The art of land survey has been around for some time, dating back to almost 3000 BC . in ancient Egypt. Each civilization has had its way of developing this technology and it was not until the Roman Empire that land survey was established as an actual profession. It even has biblical references, such as Proverbs, Job, and Deuteronomy. Since ancient times, the technology has progressed significantly to the point of drones being able to assist with land surveys. According to the article *How Drones Have Changed the Face of Land Surveying*, “Great advances in processing software and miniaturization of cameras and sensors, in general, happened simultaneously with the emergence of uncrewed technology as a viable alternative to expensive crewed aircraft and cumbersome analog stereo plotters” (Plaza 2). What this fact is saying is that drones and survey equipment have evolved to the level where one person can perform a topographical survey of the same quality as the traditional ways but in an even shorter amount of time. The drones can cover rough terrains that a person would normally have to walk, not only being quicker, but safer as well. They also will cut costs on construction projects and be able to meet tight deadlines. With all that said, it is time to dive into what the world of drone surveying is.

So, what exactly is meant by the term drone survey? “A drone land surveying refers to the use of a drone, or unmanned aerial vehicle (UAV), to capture aerial data with downward - facing sensors, such as RGB, multispectral or LIDAR sensors to capture aerial data and create accurate 3D models and terrain maps.” (Wingtra 3). There are many different varieties of data drones can map, some of them are Orthomosaic maps, 3D Models, and LiDAR Data. Orthomosaic maps are photos that are stitched together after they have all been collected. Building information, modeling or BIM software allows drone professionals combine the photos into one orthomosaic map. 3D Models are drone footage from multiple angles used to generate a 3D model of that surveyed land. And LiDAR (stands for Light detection and ranging) uses lasers to find distances, also can generate digital terrain models. These provide importance for many industries around the workforce. Next is covering the physical drone and equipment needed or used with the drone survey.

Now, a lot of drone survey technology is like the traditional method, however, they need to find a way to attach the rovers, cameras, and sensors to the drone itself. The additional required hardware and software for a drone survey is each drone is equipped with GNSS receiver (the rover that receives the signal from the base rover to triangulate a point) and a drone flight planning software. This allows the drone operators to plan their flight in advance. This is all put into one of three drone platforms, the multirotor UAVs, the fixed - wing UAVs, or the single - rotor UAVs. The choice of the drone platform depends on a multitude of factors, size of the job, available flight time, the drone payload, and altitude with his, her, their, etc. field of view.

First is the multirotor drone and it is the most common type of drone According to an article by YellowScan, “Most are smaller in size, but for example, the hexacopter or octocopter

variant is larger and can handle multiple missions. Octocopter and hexacopter options provide more safety, because if one of the rotors fails you still have a few able to fly, whereas a quadcopter would fall out of the sky. Larger multirotor drones can also provide the most flexibility in equipment options, making them more useful in different mission profiles. They are also ideal for terrain that are tricky to access.” (Bo 6). These are some of the main benefits of the multirotor drone. The next drone type is the fixed - wing drone, it offers a longer flight time and can cover large areas. It tends to be a bit more expensive, but they bring in the extra benefit if they offer vertical take - off and landing. Last is the single rotor drone, or the helicopter drone. This drone offers similar capabilities to the multirotor drone however you would consider this drone based on what you wanted to accomplish. “If you need to mount a larger solution for LiDAR mapping, its size and power capability make a single rotor drone the best option” [6].

Lastly, the real question is how accurate is drone surveying? These surveys can measure down to centimeter level accuracy, which is very valuable when it comes to making any maps, blueprints, and or construction drawings, where accuracy is of the utmost importance. “Perfect accuracy does not exist as every step in the data collection process and creating the outputs potentially adds a small error factor to the result. The achieved accuracy with any drone survey project reflects the value of this error factor as accurately as possible” [5]. The main cons against drone surveys are the required permits, the limited visibility from the air, and the obtrusive user experience.

Land survey has stood and will stand the test of time and for good reasoning. It has proven to be majorly important throughout human history and through massive development has grown to a level some would never dream of. To the level of being able to use drones to assist with our land surveys. From understanding the changes in land surveys and what led it to where it is today, to what a drone survey is, then the technology needed for a drone survey, into the drone itself and what drone types are available, and lastly to the validity of a drone survey vs. the traditional method. Drone survey is safer and quicker and provides the same quality survey as the traditional method. The future of the survey world is bright and has much room for growth. Main industries will see the benefit of drone surveys and I believe it will become the new standard. Only time will tell.

(1004 word count)

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