

# The 20 Hz V-Map *Air* System from Micro Aerial Projects L.L.C for precise UAV-camera exposure positioning.

## 1. Introduction.

Because of weight constraints most small UAVs are equipped with light weight GPS receivers that yield SBAS (WAAS or EGNOS) refined, real time, code based absolute positioning at accuracies typically ranging from one to three meters. While these accuracy levels are sufficient for most navigational purposes, higher levels of accuracy are needed for payloads specifically employed for precision measurements such as 3D modeling of structures by means of photogrammetry or airborne laser scanning. Furthermore, using V-Map to accurately determine camera exposure positions in Structure from Motion (SfM) mapping methods, the need for ground control points can be significantly reduced or, in certain cases, entirely eliminated.

To meet centimeter level positioning requirements, we have designed a hardware configuration that integrates dual frequency GPS (optionally with GLONASS) post-processed kinematic (PPK) positioning capabilities with event marking, thus enabling precise positioning of a connected aerial camera at the moment of exposure. To limit impact on flying time we kept the weight as low as possible. Although not included in our standard issue, RTK capabilities can however be implemented by special request at the time of ordering.

The V-Map solutions have been designed to be platform independent. Hence no direct integration with the flight control system is wanted or necessary. All you need is a connection between the V-Map unit and the hot-shoe of a compatible camera and a reliable external power source of 5 to 16 V. So, any programmable drone capable of carrying a compatible camera and an extra 120g – yes, that is the total weight of the V-Map receiver and accessories – can be converted into an efficient mapping platform.

And if you wanted to perform any accurate point-by-point surveys on the ground, like for example surveying check points or ground control points, you can mount V-Map and your camera on a survey rod for centimeter accurate surveying.

CamPos, our user-friendly post processing and camera positioning software comes free of charge with all V-Map equipment.

V-Map essentially improves affordability and simplicity in aerial mapping operations. It opens the door to precise 3D-modeling capacities for many people – professionals and aspiring beginners alike – people who would never have dreamt that they would attain the ability to produce accurate maps and spatial models.

## 2. Description of the V-Map System.

The standard V-Map system now features the following components and functionalities:

- L1/L2 GPS phase measurements recorded on a micro SD card at 20Hz
- Power input ranging from 5V to 36V
- LED indicator to monitor satellite reception
- LED indicator to monitor proper data storage
- Event marker port
- One PPS outputs
- Removable micro SD card for data retrieval
- Dual frequency helix antenna

The weight of the receiver including external cables and antenna is approximately 120g.

On special request, we can provide the following optional additions or configurations:

- TTL Communication Port for Data and System Configurations
- Full on board RTK functionality
- Remote RTK (RTK processing done on Laptop on the ground)

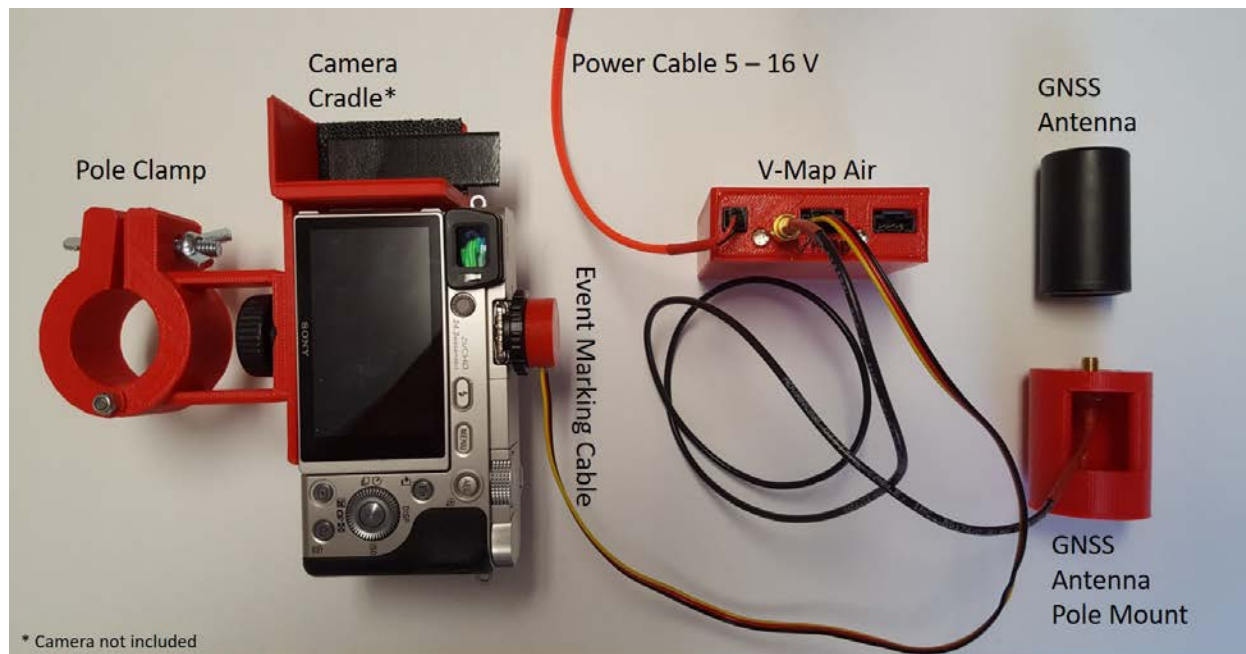


Figure 1: Typical V-Map Assembly (Camera and Battery are NOT included in the system – shown here for illustrative purposes only)

### 3. Operation of the V-Map System

The system does not require any operation other than proper connections to the antenna, a compatible camera and a reliable power source with voltage ranging from 5 to 16V. A micro SD card with sufficient available memory space must be inserted in the card slot of the V-Map Air unit. Maximum power consumption is 500mA at 12V.

### 4. Mounting Options

The V-Map system has been designed to be UAV-independent. It can be used as an air-borne rover, an on-the-pole rover or as a reference station.



Figure 2: V-Map Air mounted on a small Survey Copter

In this example the V-Map system is powered by the UAV flight battery. Note that the navigational GPS unit was moved to the side to allow for centering of the V-Map antenna above the camera (mounted below the airframe).

For typical 'walk and stop' terrestrial point by point surveys, V-Map Air can be mounted on a standard survey rod as shown in Figure 3. In this mode of operation, the surveyor places the tip of the rod on the marker (survey monument, ground control point etc.), centers the bubble on the rod and then takes a picture with the camera before moving on to the next point.



Figure 3: V-Map Air mounted on a Survey Rod

As shown in Figure 4 below, V-Map Air can be used as rover or reference receiver.



Figure 4: A pair of pole mounted V-Map Systems being employed in a post-processed kinematic survey.

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