Can we use our own GPS as base stations (both for RTK & PPK)? If so, do you offer RTK & PPK solutions without the GPS base stations? Are major brands ok (Leica/Geomax, Trimble etc)?

PPK yes, RTK no.

Since PPK is performed post-mission using RTD-Post, the base station does not need to communicate in real-time with the Geo-MMS payload. As long as the data recorded on the base station can be converted to RINEX 2.1 format, it can be used with RTD-Post to implement PPK.

Since RTK is performed in real-time, the base station must communicate via radio modem to the Geo-MMS payload on the drone during the flight. This can only be achieved if 1) the radios (one attached to the base station on the ground and the other attached to the Geo-MMS on the drone) are compatible i.e. can communicate with one another and 2) the data transmitted from the base station to the drone through these radios is in the RTCM 3.0 format accepted by Geo-MMS.   (We cannot confirm compatibility with any of the established RTK base stations as they are usually designed to communicate to other ground based survey rover units. However, we do offer our own RTK base station in the RTK bundle that works with our system.

PPK Bundle - What kind of increase in accuracy could be expected using the GPS base station and RTD program. I understand this may be location and job specific.

Without the PPK GPS base station and RTD bundle (or the RTK bundle), the GPS accuracy is limited to that achievable with WAAS assistance (in areas covered by SBAS systems such as WAAS in the U.S. and EGNOS in Europe), which is typically 50cm - 2.5m depending on conditions. Thus the relative accuracy of the point cloud (within itself) will be good, but the absolute accuracy (relating to your geoid-based Earth coordinate frame) will be up to 2.5m. With PPK and RTD-Post (or RTK) typical absolute accuracies will be in the 3cm to 5cm range (depending on actual conditions).

Regarding the RTD Post program. Is the license fee an annual fee? You mentioned a free trial period, is that something you offer before purchasing or is that intended for trial once we have the sensor in use.

The RTD-Post software license is a single machine, perpetual license. We can offer you a free trial period prior to purchase (of the software) if you wish. You may start the 30-day clock whenever you choose (pre- or post-purchase of the system).

How easy is it to configure your product with a drone?

Once you have physically mounted the Geo-MMS components to the drone, there is a one-time configuration and setup process performed via the Geodetics supplied software. It is important to configure the software correctly as errors in configuration parameters will lead to poor quality point clouds. The parameters describe important values such as the

lever arm measurements and orthogonal axes relationships between the IMU, the LiDAR, and the GPS antennas. These parameters are described in detail in the documentation provided with the system. Please take the time to review this information prior to configuration of the system. We stand by to assist you with any questions that arise.

We have to be careful with labels here. 'The LiDAR unit' describes only the LiDAR sensor e.g. Velodyne VLP-16, HDL-32 etc. Geo-MMS is the complete system of components including the LiDAR sensor, the Dual-GPS/IMU/Timesync/Storage device (see the Geo-hNAV product on the Geodetics website – www.geodetics.com), the antennas, all cabling, connectors and software. To answer what I think you're asking, if you purchase the Geo-MMS package, you have everything you need, apart from the mounting hardware e.g. brackets etc., to install Geo-MMS on a drone. You must provide the mount itself to affix the Geo-MMS system components to your drone.

For the commonly used DJI Matrice M600/Pro, we offer a Geo-MMS mounting assembly separately if you decide you would like it. We also offer a turn-key solution (Geo-MMS-TK) which is the Geo-MMS system, mounting kit and M600 Pro and spare batteries, Tablet, travel case etc.

Does the purchase of this product include any necessary software for post-processing of raw data?

The product includes everything you need to get to a 3D geo-rectified point cloud in industry standard .las format. If you need to correct the GPS to improve the absolute accuracy from WAAS level accuracy (typically 50cm - 2.5m depending on conditions) to PPK accuracy levels (3cm - 5cm) then you will need to purchase Geodetics PPK bundle at extra cost. You will no longer require GCPs (difficult to use for LiDAR) for the PPK method.

Does this product have any flight planning software or will this be specific to the drone that is purchased?

We recommend UgCS for our product, but the customer is free to use whatever they wish as the only requirement from the Geo-MMS perspective is being able to program the correct flight profile for the payload. There is no connection between the Geo-MMS and the drone (truck) except on the M600 where we use the power from the drone for the payload (insignificant drain compared with the drone motors so the flight time is not noticeably affected).

RTD-Post / LiDARTool – Are these software solutions provided with the system? Will you give other software please clarify.

The Geo-MMS is supplied with multiple Geodetics software tools. The most significant of

these are LiDARTool and VYO. LiDAR Tool combines the position/attitude data and the LiDAR data to create the geo-referenced point cloud in industry standard .las format. VYO is viewing software that allows the Time Space Position Information (TSPI) from the Geo-MMS to be viewed in real time (if the Real-Time Visualization bundle is purchased) providing a dynamic graphic display of the point density being achieved, overlaid on a map.

RTD-Post is a separate piece of Geodetics software (included in the optional PPK Bundle) used to apply differential GPS corrections to the GPS files prior to combining them with the LiDAR files in LiDARTool.

Is the RTK mode via GSM with a CORS?

No, the RTK mode is using a Geodetics supplied reference base station (Geo-RR) and a radio datalink that transmits the corrections to the UAV in real time.

The system uses double receiver/antenna to initialize?

Yes, the system initialization is achieved much quicker with the dual GPS-antennas/receivers than with a single antenna solution.

Just enquiring as to the current capabilities of your Geo-MMS system to support Australian Coordinate Systems, in particular, Geographic Coordinate System - Geocentric Datum of Australia 1994 (GDA94), Projected Coordinate System - Map Grid of Australia 1994 (MGA94) and also support for vertical coordinate system (national standard) - Australian Height Datum (AHD).

Currently the Geo-MMS system software provides the following a choice of output coordinate systems:

1. Local East/North/Up, which is east/north/up in meters in a local tangent plane
2. WGS84 LLA, which is WGS84 longitude (degrees) / latitude (degrees) / altitude (orthometric height in meters)
3. WGS84 XYZ is in meters.

There are many Point-Cloud viewers that require coordinates in LLA, and there are many software programs that require the XYZ coordinates for visualization and analysis.

The XYZ coordinates are based on ECEF WGS84 datum, and the LLA output is for WGS84 datum.

To convert to the Australian coordinate systems you mention would require a coordinate conversion tool with those options.

Also is there support using your package to integrate survey-grade ground control into the post-processing of the LiDAR?

This is called strip adjustment and is typically done in software downstream from us. We provide the geo-referenced point cloud in LAS and other software performs the strip adjustment.

Here are a few software packages that offer this:

Terra Solid

ENVI - Harris.

We also sell PPK and RTK base station packages that will be required to increase GPS accuracies below SBAS limits (1m -3m).

With our base stations (PPK or RTK), you should not need to use ground control points for most applications. Typical accuracies should be 3cm-5cm depending on environment and circumstances.

How long does is takes to process the captured data on field to get the point cloud (after RTK or PPK process)

The included LiDARTool software makes it very easy to take the corrected GPS files and combine them with the LiDAR data file to create the point cloud. A few minutes to get to the .LAS point cloud output. After that, it will depend on the customer's requirement. Advanced processing with third party software can take much longer depending on the required output.

Is dust an issue for the accuracy of points? Please consider we are working on mining facilities

We have not heard of or seen dust as an issue for accuracy from any customers or in the industry news. If you clean the lens on the LiDAR, be sure to follow the correct procedures to avoid scratching and damage.

How does licensing Works with your software?, Is this an annual subscription?, how much does it cost?

Our software requires an unlock code that restricts it to one PC but it is a perpetual license (no annual subscription)

Does it require any external software?

You do not need any external software to get to the .las point cloud output. As mentioned above, if you want to do further post-processing such as volumetric calculations or digital terrain modeling etc. then you will need to find software that can do that for you. The reason we don't go further than an .las point cloud is that every application uses different software from that point forward.

Could you give us an estimate for the point cloud density?

Point cloud density depends on the height from the ground, the forward speed and the rotation speed of the Lidar sensor. For more explanation, please see our website:

https://geodetics.com/geo-mms-lidar-mapping-principals/

At 20 meters flight altitude, 10 meters/second forward speed and 900 rpm for the LiDAR rotation speed, the point density is approximately 130 points per meter^2. It will decrease with increasing altitude, increasing forward speed and decreasing rpm.

Our real-time visualization bundle will enable you to see point density as the LiDAR is scanning: https://www.youtube.com/watch?v=yfZpwGkKdew

You can use this to confirm that your point density requirements are being met.

I notice that the Geo-MMS Payload package includes a pre-configured laptop. What if I don't need another laptop?

This is a commonly asked question and we understand that some customers would like to use their own PC for the Geo-MMS package. The reason we decided to introduce a standardized pre-configured laptop in every payload package is to ensure that every customer has an exceptional and predictable out-of-the-box experience. We want to provide the best service possible to every customer and help them achieve the quickest path to using the Geo-MMS LiDAR system successfully.