

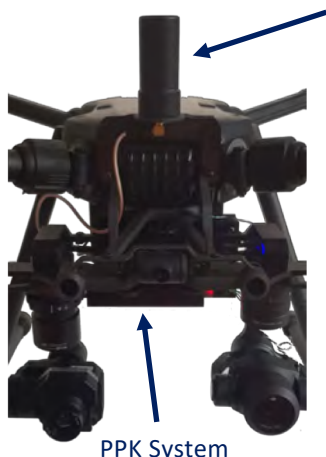
## Material Stockpiles

Volumetric surveys are undertaken to provide critical information on the volume of material stockpiles (e.g. coal) which when coupled with a certified survey for density, provide monetary value and can also facilitate shipping management. These surveys are also required to provide quantification of the amount of material removed in comparison to previous surveys.

Conventional  
Manual Method



Onboard Geo-  
reference Aerial



## Innovation

Historically, volumetric surveys were done with somewhat manual approach, whereby measuring instruments such as theodolites (GPS receivers more recently) were used with someone walking over stockpiles or inside pits taking spot measurements. Modern aerial survey techniques utilising PPK Geo-referenced Photogrammetry are replacing these old methods for many compelling reasons.

As an example, a study was undertaken where manual point locations were done on a typical stockpile by walking over it, providing 275 locations, whilst the PPK Aerial Survey Method that CAM provides would typically result in the equivalent of 368,400 datum points. Manual stockpile measurements return results with a tolerance of around +/- 10%. CAM has used one of its volumetric surveys for a typical coal stockpile and calculated that the tolerance using the PPK Aerial Survey Method to be less than 1%, which is materially more accurate.

Additionally, for a typical coal stockpile at a power generation plant, the manual method of survey takes about 3 days. Utilising CAM's PPK Aerial Survey Method, flight time is approximately one hour with the full report provided the following working day at a very realistic cost. This provides a substantial reduction in potential safety issues with personnel climbing over stockpiles. Additionally it also provides the additional benefit of ensuring the full survey is taken quickly, as normally stacker/reclaimer equipment runs without stop changing the volume of the stockpile over time, rendering a 3 day survey period inaccurate.

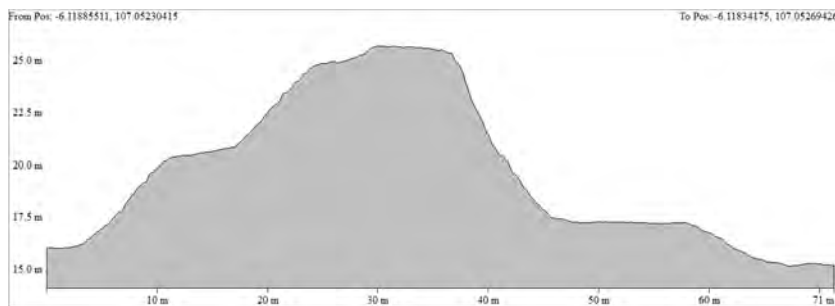
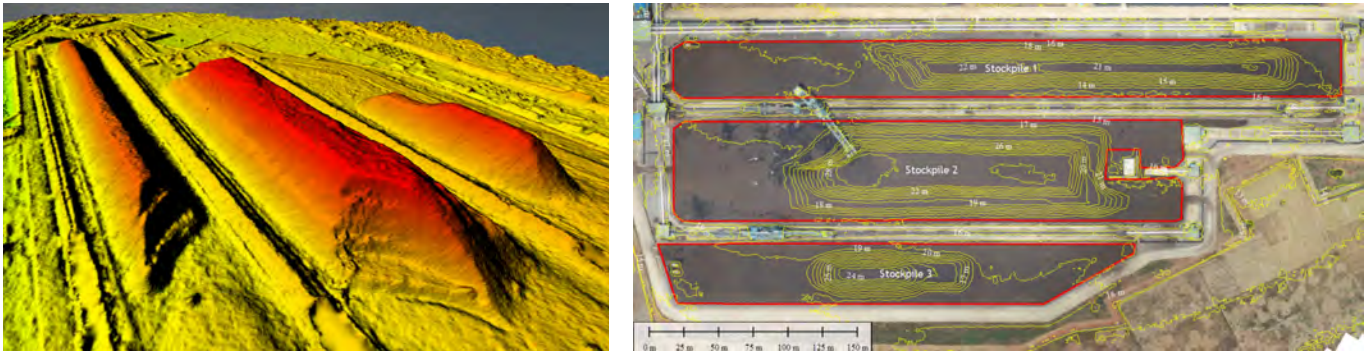
# Cloud Asset Management

## PPK Geo-referenced Photogrammetry

The science of volumetric surveying can be complex and involves employing the latest in survey technology. Using drones together with PPK Geo-referencing, CAM provides computer generated 3D models with down to 3cm XYZ accuracy providing highly accurate volume measurements.

CAM provides our clients with reports that are done in a number of software platforms providing full Digital Elevation Models (DEM's). They are not only suitable for stockpiles, but also suitable for volume surveys and modelling of quarries and open pit mines, as well as facility or operational land survey and mapping.

These accurate DEM's provide an extraordinary ability to apply 'what if' scenarios in terms of being able to model mining or earthworks to determine volumes that have been mined, or need to be mined or moved. This allows much better planning for any type of mining, earth works or construction. The DEM's can also allow some early warning in terms of pit wall movement over time, which could be critical identifying potential safety hazards.



## Certification

CAM can provide quick, safe, cost effective and accurate DEM surveys with industry leading safety procedures. Additionally, CAM can also provide Independent Surveyor Certification (member of Ikatan Surveyor Indonesia) for volumetric and other surveys as well as certified density sampling.

Please allow CAM to assist you with your survey needs with an innovative, fast, cost effective and safe service, providing the best survey and planning tools and modelling for your operation?

**PT. CAM Sistem Indonesia**

Alamanda Tower 25th Floor, Jl. T.B. Simatupang Kav. 23-24, Jakarta, 12430, Indonesia

Office: +62 21 2965 7993 Mobile: +62 811 875 4019 Facsimile: +62 21 2965 788

