

Lidar: Expanding Beyond Framework Elevation Data Source to the Smart Community Infrastructure

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Light Detection and Ranging (lidar)

Lidar now synonymous with framework elevation

- Must not limit expectations framework and enhanced elevation data source
- Emerging lidar technology broadening the domain of lidar apps and analytics
- New lidar tech offer unique competitive advantages for given apps even introductory knowledge on their operation is valuable





Framework Elevation



National Spatial Data Infrastructure NSDI Geodetic Control Orthoimagery **Flevation** Transportation Hydrography **Governmental Units** Cadastral Addresses (coming soon?)

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Enhanced Elevation

Lidar – discrete, multi discrete, waveform, reflectivity... Data – vector, raster, point cloud, intensity...

Moving beyond topographic measurements...

3D coordinates with attribution..

Feature assessment, feature analysis, trend analysis...

Asset management, infrastructure management...

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Smart Communities



Aerial Linear Lidar

Typically 2-30 pts/sq m Attainable accuracy -5cm RMSE ~1-2 million

measurements/second





- Contraction

Aerial Linear Lidar Pros/Cons

<u>PROS</u>

Multiple Discrete Returns Full Waveform Intensity Data High Accuracy Operate Day or Night Greater Commercial Availability

<u>CONS</u>

Single Field of View (FOV)? FOV Data Occlusions? Linear Compression/Expansion Lowest Operating Sq Mile/Flight Hour Coverage



Emerging Photo Counting Lidar

"One to Many" - laser pulse spit into multiple sub-pulses. Higher Sensitivity – allows longer laser range Operates at higher flight altitudes – pressurized aircraft Palmer Scanner – elliptical scan pattern - 2x ground measurements

> Typically 8-30+ pts/sq m Attainable accuracy - 5cm – 10cm RMSE 6 - 205 million measurements/second



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Geiger Mode Lidar Pros/Cons

<u>PROS</u>

Highest Sensitivity Highest Operating Sq Mile/Flight Hour Coverage Multi FOV Highest Sample Rate

CONS

Highest Operating Ceiling – Lowest Fidelity

Daytime Performance Concerns Greatest Sample Size – Noise All that Data! Aggregate Intensity Data

Single Photon Lidar Pros/Cons

<u>PROS</u>

Moderate Sensitivity

Moderate Operating Sq Mile/Flight Hour Coverage

Multi FOV

Moderate Sample Rate

Bathymetry?...

<u>CONS</u>

Moderate Operating Ceiling – Lower Fidelity

Less Daytime Performance Concerns Moderate Sample Size – Noise Aggregate Intensity Data

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Final Thoughts

- Enhanced elevation will maintain the framework on which the smart community operates
- New aerial surveys will need to address competing priorities assigning the most appropriate lidar tech is critical
- Linear lidar highest accuracy and fidelity, more flexible with greater availability still highly applicable on a majority of applications
- Photon counting lidar higher sensitivity, higher operating efficiency, logistically more constraints not as applicable now, but gaining traction

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Thank You

Questions?

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References

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