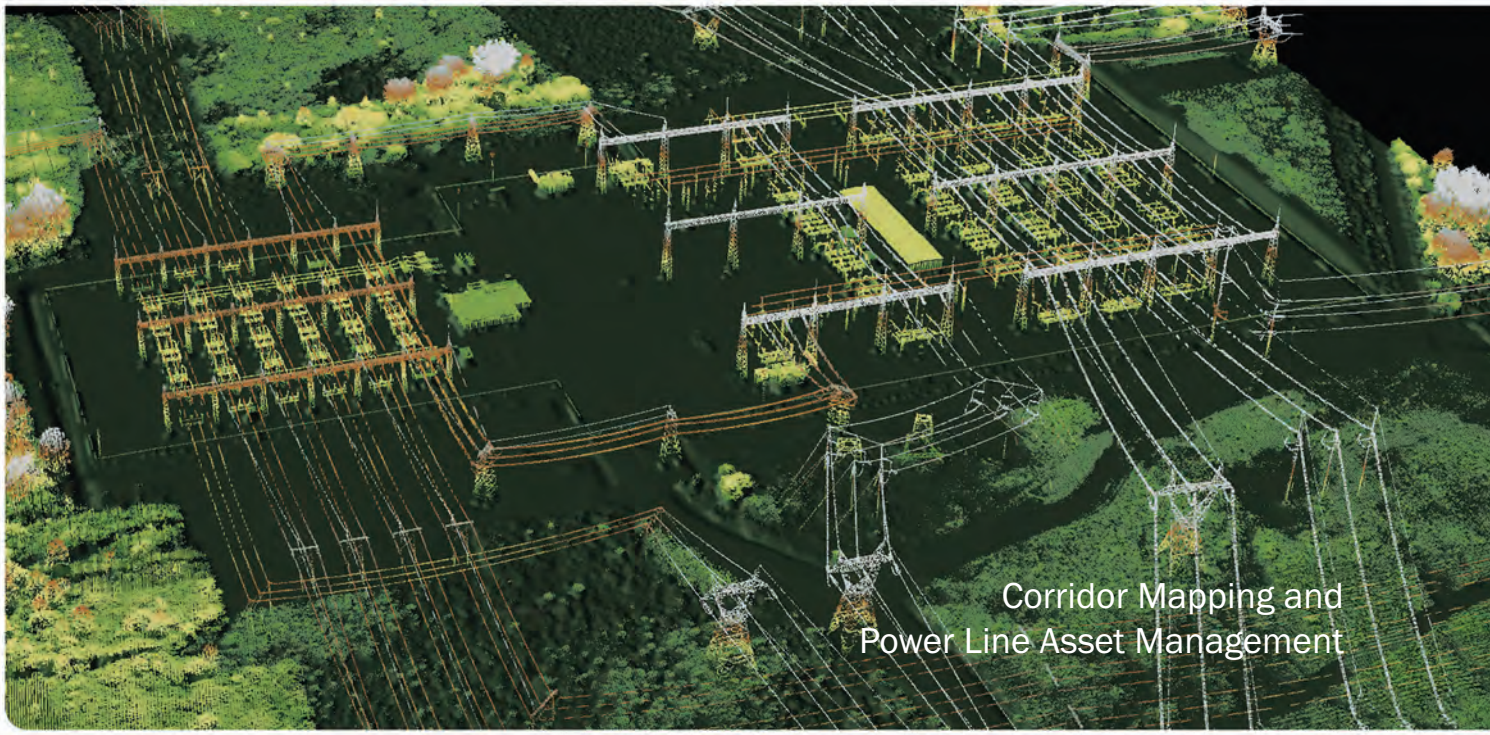
Corridor Mapping

ALTM Application Note: OR-001 Rev A



Electric utility companies continually face the challenge of providing an adequate energy supply to markets with ever-growing demands. To keep up with these demands, utility companies have to plan new power lines (transmission and distribution) and maintain existing power line corridors. Both efforts require comprehensive surveying based on accurate geo-referenced measurements.

New power line design and construction

- Identify construction sites
- Survey new line routes and surrounding area to develop DTM
- Optimize/modify during project licensing
- Survey completed line for as-built record
- Route modeling using existing towers and new wire models
- Engineering analysis/calculations: sag analysis, physical parameters, load modeling, thermal uprate
- Failure analysis

Monitoring/change detection

- Vegetation encroachment analysis
- Failure/accident/disaster analysis
- Modeling/prediction of weather-related changes

Ultra-compact design

To serve this segment of the lidar community, Optech developed a new class of airborne lidar mappers, the ALTM Orion. The Orion-C was designed specifically for maximum efficiency in corridor mapping applications. At 57 pounds and a 1-cubic foot volume, the Orion-C is the lightest and smallest complete lidar solution in the marketplace.

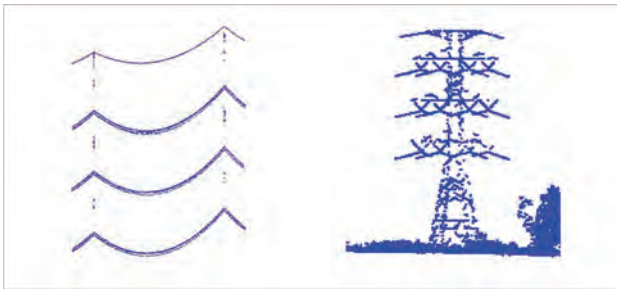
Designed for minimum space and maximum efficiency, the Orion-C consumes less than 280 W, a drastic reduction from conventional power-hungry instruments. Consuming less power even in full operational mode enables multiple payloads on small aircraft platforms, a crucial consideration in corridor applications using multi-sensor data collection methods.

Orion installation

Lidar data

One inherent feature of lidar data is that it is acquired, processed, and delivered in digital format. Lidar data can be imported and exported by most commercially available 3D software packages, including PLS-CADD, one of the most common software packages for power line applications.

Lidar data collected in power line surveys typically includes ground features, vegetation, structure attachment points and conductor point clouds. Lidar data uploaded to PLS-CADD enables the user to analyze sag, clearance, conductor physical parameters and vegetation encroachment.

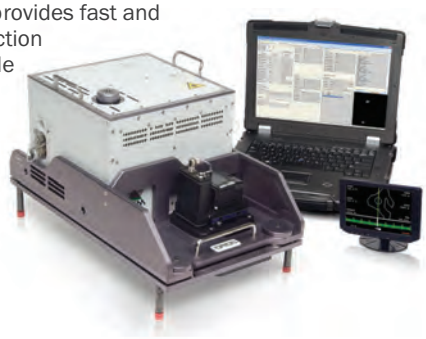


Power line and tower point cloud output from ALTM Orion-C data. Data set reveals complete top wire detection, wire separation within a 4-wire bundle, and detailed tower architecture delineation for easy tower type detection.

ORION-C ADVANTAGES

High data collection rate and ground point density

The Orion-C operates at effective data collection rates of up to 200,000 points per second (200 kHz). In combination with programmable scan settings covering a 0-50° field-of-view (FOV), the Orion-C provides fast and efficient data collection with a highly flexible selection of ground point densities, which can be optimized specifically for power line surveying.



Its unrivaled small size and lightweight configuration give the Orion-C exceptional flexibility—quick to install in any type of aerial vehicle, including helicopters, fixed-wing aircraft and even UAV platforms. Fast-mounting, with minimal cabling and easy to transport, the Orion-C delivers optimized and cost-effective data collection missions.

Roll compensation

In surveys involving a complicated aircraft trajectory over highly non-uniform terrain, it is essential that the scan FOV remain aligned with the center of the scan line under the aircraft. The Orion-C's roll compensation feature automatically adjusts the system's FOV center as it scans the flight line, compensating for deviations in aircraft roll, and enables the Orion-C to track the corridor accurately.

Dynamic range of intensity (12-bit)

Very thin linear targets (e.g., power wires) suspended close to the ground present a demanding challenge for signal detection capability. This is because weak returns from wires occur alongside strong returns from the ground underneath. If variations in the return signal exceed the dynamic range of the lidar receiver, either weak signals from the wires will be missed (data voids), or strong signals from the ground underneath will saturate the receiver, compromising range measurement accuracy owing to errors in the range measurements.

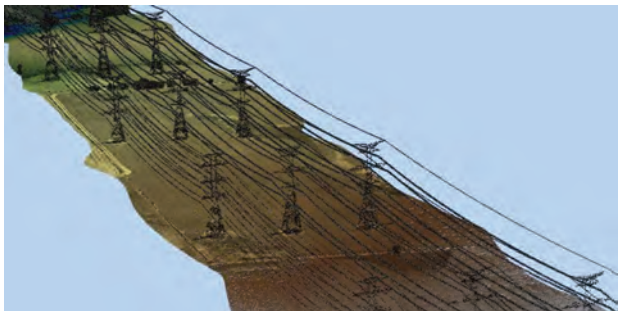
The Orion-C overcomes this challenge because its unique receiver electronics system was designed with true 12-bit intensity capture. This crucial capability ensures data accuracy in surveys where strong variations in return signals are expected—precisely the case in power line surveys.

Eye-safe operation

The Orion-C employs a 1.5 micron laser, which delivers eye-safe operation at altitudes as low as 35 meters in densely populated areas—a critical feature as low-altitude surveying is often required for power line surveys.

SSD data storage

The Orion-C uses an internal 256-GB solid state drive (SSD) with a SATA II interface. The advantages of SSD over traditional HDD include: high data integrity resistant to vibration, higher tolerance to shock, and a wider operating temperature range—conditions normally associated with helicopter installations. An additional external SATA II SSD offers added storage flexibility for easy drive swapping and data archiving. It provides a cost-effective, commercial solution when compared to a traditional embedded HDD system.



Power line data collected by ALTM Orion-C

Altitude: 950 m AGL
Laser pulse rate: 100 kHz
Scan frequency: 40 Hz
Aircraft velocity: 120 knots
Scan width: ± 20°
Top wire diameter: 10.4 mm (000 gauge)

High data accuracy

The Orion-C employs the most advanced rangefinder electronics and optics, delivering outstanding range accuracy and precision, independent of laser sampling rates. The resulting high-quality data features exceptional resolution for detailed imaging of small objects such as power lines. The distribution of a 3D point cloud of a power line conductor is now in the millimeter range instead of the centimeter range. This capability translates to a significant increase in the accuracy of catenary modeling in PLS-CADD, and consequently to more reliable engineering calculations based on modeled catenary parameters.

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