

# SIEAERO

## Overhead Line Inspection Service

### Introduction

Reliable energy supply is essential and energy transmission assets are considered to be critical infrastructure. Operators of energy transmission lines put great effort into identifying potential faults to ensure high reliability. They conduct regular visual inspections of the overhead lines, the components and the power line environment. Today, overhead line inspection is accomplished with expensive helicopter flights. Conventional visual inspections deliver mostly rough and imprecise results, even with HDTV and DSLR cameras. Documentation of the lines' condition is tedious, requires a lot of manual work and is often incomplete.

### Features

**SIEAERO** introduces a number of innovations to bring overhead line inspection to the next level.

The flights are performed with high-performance long-range UAVs (Unmanned Aerial Vehicles) for beyond visual line-of-sight operation with a high payload capacity.

The UAV carries the **SIEAERO high-end multi-sensor system** which was specifically developed to meet the complex requirements of overhead line inspections. Since all necessary sensors and cameras are combined in one multi-sensor system, all relevant inspection data is recorded in one go: 3D laser data, ultra-high definition color images, infrared images and corona images.

The extensive amount of multi-sensor data generated during the flights is handled by the **SIEAERO smart data analytics software**. The software was developed by Siemens and is based on artificial intelligence and deep learning for automated detection and assessment of faults and issues along the overhead lines. The documentation of the complete lines as well as the relevant findings and results can be directly integrated into the customers' existing asset management systems. It can be used for trend monitoring and preventive maintenance.

Until local regulations allow for beyond visual line-of-sight flights with UAVs helicopter will be utilized.

### Benefits

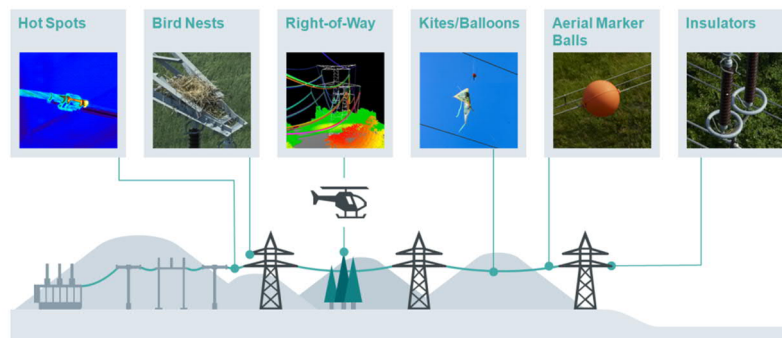
SIEAERO provides comprehensive overhead line documentation and fault detection:

Fully digitalized service with fast and easily accessible data through

**Today, TSOs and utilities inspect their power lines with helicopters at least once a year**





interactive web interface or integration into customer asset management system

- High definition data and highly accurate 3D localization of all sensor data
- Comprehensive and precise inspection results
- Comprehensive and precise documentation of the complete transmission lines and transmission line right-of-way
- Fast results after completion of inspection flights
- Condition trend monitoring by combination of data from subsequent flight missions from previous years
- Recommendations and information for preventive and predictive maintenance
- Ability to edit and annotate findings and plan maintenance work
- Cost efficient overhead line inspection including data storage, access, assessment, reporting and the ability for any other kind of digital use for assessment management
- Reduced EHS risks through the use of UAVs



SIEAERO overhead line inspection service use cases

# SIEAERO smart data analytics for overhead line inspections: precise, easy and cost-efficient

<p><b>Today</b> Current inspections via helicopters are</p> <ul style="list-style-type: none"> <li>Inaccurate </li> <li>Slow </li> <li>Mainly manual work </li> <li>Dangerous </li> </ul>	<p><b>SIEAERO</b> Next generation service with the following features</p> <ul style="list-style-type: none"> <li>More precise</li> <li>Faster</li> <li>Automatic detection and evaluation</li> <li>Integrated</li> <li>Safer</li> <li>More cost efficient</li> </ul>	<p><b>Multi-Sensor System</b> Integrated system with highest resolution (incl. patents)</p> <p>RGB UV 3D IR</p> <p>More precise/More comprehensive</p>	<p><b>Artificial Intelligence</b> Advanced algorithms due to domain know-how</p> <p>Faster, Automated, more cost effective</p>	<p>Main elements and benefits of SIEAERO overhead line inspection service</p>
		<p><b>Cloud Computing and Customer System Integration</b> Highest data security</p> <p>Integrated</p>	<p><b>Helicopter (Short Term)</b> Most advanced UAV, Partnerships</p> <p><b>Long Range UAV (Mid Term)</b></p> <p>Safer</p>	

## Scope of delivery

SIEAERO is a digital service providing you with comprehensive and easily accessible data.

### • Digitalization

All generated data, data models, and reports are digitally available. They are easy to access and easy to handle via interactive web interface or via direct data integration. Data can be integrated in the asset management system and any other customer systems. This allows customers to extensively use the data for various asset management and maintenance applications. Customers receive all inspection results and flight data without having to manage various IT or vendor interfaces. Also data from previous years can easily be accessed and compared (trend monitoring).

### • Data models

Complete and highly accurate digital terrain model (DTM), digital surface

model (DSM), and 3D model with pylon, conductor and vegetation. Besides assessing the critical distance of vegetation to the lines also a tree fall simulation is provided. Illegitimate constructions along the power line are identified. Sagging of the conductor is assessed as well.

### • Inspection reports

Customers receive a customized inspection report with identified faults and findings. This includes issues and defects on the conductor, the pylons and on various components along the overhead line, like insulators, corona rings, spacers, clamps, spirals, vibration dampers, aerial markers, bird protection devices, jumper cables and cable terminators.

Potential issues may include damage on the components, missing or misaligned parts, hot spots, foreign objects, partial discharge/ corona or arcing.

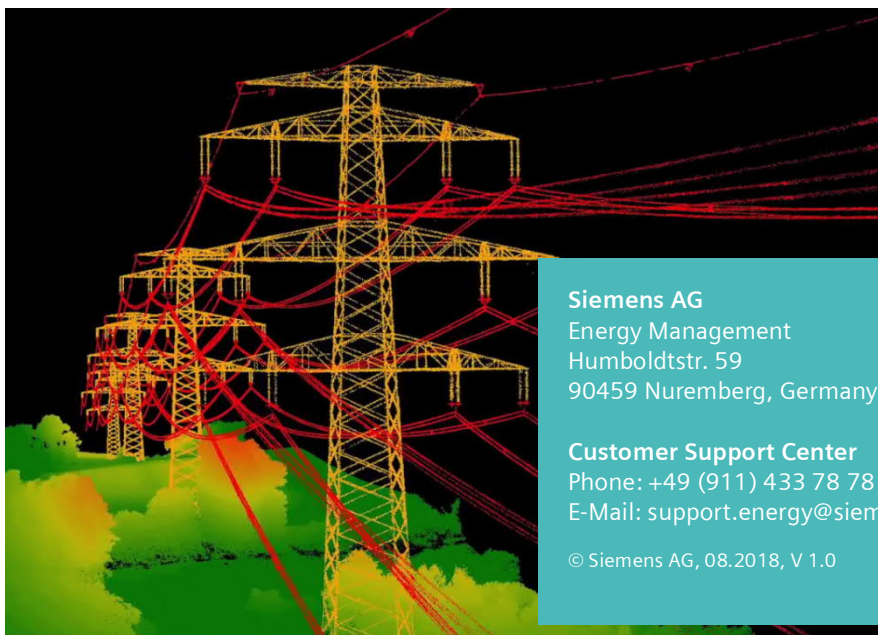
## Technical Details

The SIEAERO high-end multi-sensor system was specifically developed for overhead line inspection made use of high definition sensors:

- Up to five 100-megapixel ultra-high definition color cameras
- 3D laser scanner
- Infrared sensors
- Corona sensors

During a normal inspection flight up to 100 GB of data per km of overhead line is generated (up to 160 GB per mile of overhead line). Highly accurate 3D localization of all sensor data is ensured.

Customers can select the required data and data analysis according to their needs. Depending on the use cases, customers may provide specific requirements and thresholds for implementation into the SIEAERO analytics system to modify the analysis and assessments.



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