From drone to airplane: new method of conducting aerial thermography leading towards predictive analysis

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Thanks to the DigiSky SmartBay® technology, Wesii is able to capture high quality images to perform our AI driven analysis.

The world of photovoltaic aerial inspections is changing. Today the solar industry seems to have already gotten used to the new technologies that have taken over the market; inspections by drone and plant digitization. Plant owners and managers, if not already, are heading in this new direction, leaving manual inspections behind. Companies providing inspection and data analysis services, us included, are all providing the new industry norm.

There is a reason for this, drones and the specific types of cameras used, produce top quality images that allow for exceptional data processing and clear results. The geometrical resolution is incomparable with other types of inspections, with drones you can reach previously unreachable plants and can detect anomalies within the plant that can only be seen from a bird's eye view.

Furthermore, drones, for obvious reasons, are quicker than conducting manual inspections and also much safer for the personnel involved.

That being said, we've now introduced an even faster, more efficient and economical way of conducting inspections: by plane: with a cooled radiometric camera.

THERMAL SENSOR TYPE	UNCOOLED	COOLED
THERMAL SENSITIVITY (NETD)	<50 mK	<40 mK
THERMAL SENSOR FRAME RATE	Up to 30 Hz	Up to 60 Hz
THERMAL SENSOR ACCURACY	±5°C	±1°C
PERMISSION TIME (Notam, HSE)	Binding, up to 45 days	Easy, HSE not required
CLIENT EFFORT	In-field technicians required, HSE, etc	None
THERMAL SENSOR COST (€)	<10.000	>100.000

This table shows the radiometric advantages of inspecting solar PV plants by plane with a cooled camera.

Airplane vs. drone inspections

Previously airplanes have not been utilized due to the fact that the spatial resolution is lower than the drone. However, keeping a height of flight of about 300m from the ground level, we can still reach a spatial resolution in the range of 7cm/px in the infrared spectrum. Being less than the size of the solar panel cells, the minimum unit possibly affected by anomalies, that resolution is more than enough to detect the shapes of all the types of anomalies that our Artificial Intelligence is used to classify from drone inspections.

By securing the geometrical requirements of the collected data, we can then exploit the full potential of our new sensors. The camera we are using with the airplane, thanks to our partnership with DigiSky and their SmartBay technology, is a cooled thermal camera which has an accuracy that is 5x higher than the drone. Due to this high radiometric resolution, we are able to detect anomalies just as accurately as with the drone from fewer pixels.

The fact that airplanes are able to produce quality results can completely change the way we do inspections in the solar industry. As you can imagine, a lot of planning and preparation go into drone inspections, while airplane inspections require simplified planning, the timing and process is more efficient.

To fly a plant by drone you need HSE documents, a technician to open the gates and be in the field, while the pilot inspects the plant, multiple days to conduct the inspections depending on the plant size and limit your working time to secure high solar irradiance in order to get accurate results.

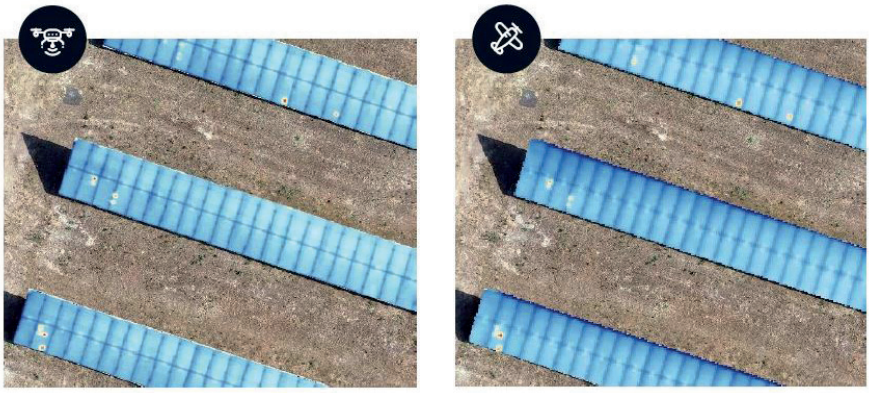
By collecting data with airplanes, we are able to eliminate these steps and requirements. No HSE documents are required when flying a plane, which previously could take a long time depending on the location of the plant. Additionally, there doesn't need to be a technician in the field when operating the plane, which cuts costs, time and of course is safer by eliminating the amount of personnel involved.

While drone inspections take multiple days, the airplane can cover vast distances and capture a site of 100MW in less than an hour. For large plant owners, this means receiving all their data from the same day and weather conditions, and providing them with more consistent data. The same indeed goes for small plant owners as there is less land to cover, but we also have the opportunity to cover more plants in a single day. This will cut out drive time between plants that was previously considered for price and timing for drone inspections.

Regarding solar irradiance, drone inspections require more than 600 W/m^2 to deliver accurate results, meaning flights can easily be postponed due to external weather conditions. However, the cooled thermal cameras used with the airplane inspections allow data to be collected even with lower solar irradiance of up to 400 W/m^2 without diminishing the quality.

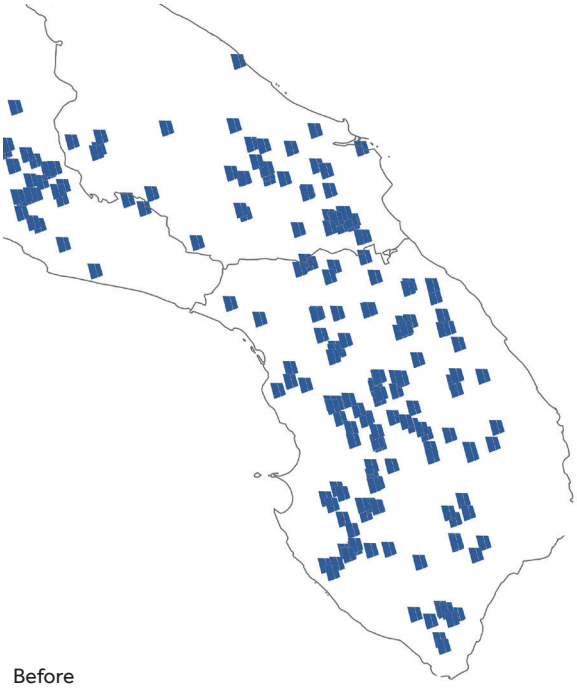
Taking into consideration all of the aforementioned factors, photovoltaic plant owners and managers can expect to see lower prices for aerial thermography and reduce the steps and attention it takes to plan plant surveys.

An important thing to note is that with

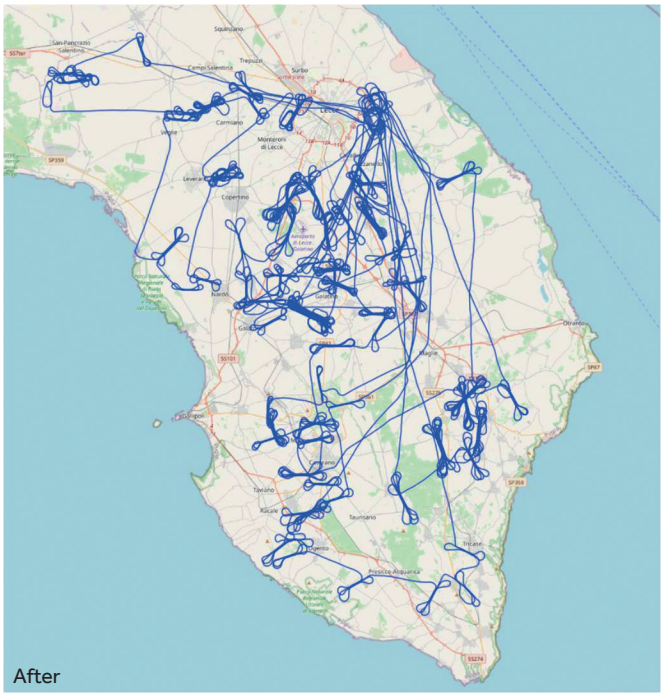


ALL ANOMALIES DETECTED - SAME QUALITY

Drone capture vs. airplane capture. The results from the airplane inspections provide adequate data to perform the same analysis as done with drone inspections to detect the same anomalies.



Before



After

To maximize our flight efficiency and sustainability we are using sophisticated tools to produce proper flight plans, which has allowed us to inspect a high number of plants in a short period of time. A plant as big as 100MW can be inspected in approximately 1 hour.

airplane inspections, owners will still be able to receive all of the same important information and deliverables. After the first flight, Wesii creates an orthomosaic for the client, providing a digital, thermal and visible overview of the plant. Furthermore, owners and managers can view the anomaly classified plant on the digital platform where they can create reports based on their needs.

Airplane to aid in the path to predictive analysis

Airplane inspections will have an immediate effect on yearly inspections in terms of price, accuracy and timing. However, we are also looking into the future for the long-term benefits. Wesii's mission is to help asset owners and managers keep their plants functioning at full capacity by providing tools for predictive maintenance.

The key to predictive maintenance is to establish the baselines of the operating system, collect a sufficient amount of data and frequently, and apply a machine learning model that shows plant managers when the optimal operation has been compromised, what happened, when these anomalies are likely to occur and then to schedule maintenance activities at an optimal time, and finally to allow the AI algorithm to use the feedback and spot when the plant is performing outside of its normal operating conditions.

We can achieve this in 3 steps:

1. Data Collection: Wesii + Fly-It-Yourself Inspections

To understand the baselines of the photovoltaic system and to collect a sufficient amount of data, Wesii flies 1-2 yearly inspections using the plane plus gives the client the tools to perform Fly-It-Yourself inspections with EliosField Dronino and App. By conducting the plane inspections, Wesii is able to digitize the plants and create an orthomosaic, giving the owners a digital twin of their plans.

2. AI and Machine Learning Powered Analytics

Wesii adds each inspection into our database where our Artificial Intelligence algorithm detects and classifies each anomaly using the supervised learning approach, meaning we have taught the model our specific classification rules between certain inputs and outputs.

This information is stored in our in-house digital platform where you can view all statistics, data, predictions and comparisons, plus create custom reports to see the data you're interested in.

3. Predictive Analysis + Maintenance

The more inspections and data submitted, both by Wesii and the client, the more our machine model learns and quicker at that.

Over time the predictions become more accurate and the machine model learns using the feedback cycle created by the data and maintenance activities performed. This is how the machine model can spot when the photovoltaic system is operating outside of its normal operating conditions.

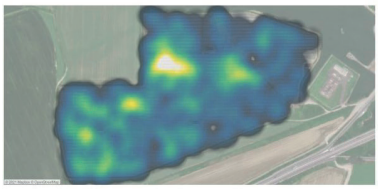
With the output from the algorithm, owners and managers can get the most out of their equipment and plan maintenance at an optimal time.

The future of solar inspections

As mentioned above, the world of solar survey inspections is changing rapidly. We watched as drones took over the niche, and now as airplanes disrupt the market once again. The most important goal is to make the world a greener place. We aim to do so by achieving predictive analysis and giving our clients the tools they need, to keep their solar plants functioning at full capacity and make the smartest decisions for their businesses and our planet.

Contact Wesii for more information at sales@wesii.com

www.wesii.com



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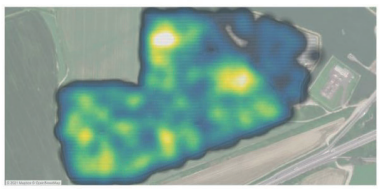

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Multiannual analysis and predictive maintenance: with more time efficient flights we are able to make inspection comparisons and create statistical, spatial predictive models.