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PREF. SUBJECT : 2
QUESTION N° : 2.1

Hyperspectral camera for the condition assessment of painted metallic towers

In response to the Special Reporter's request to present practical experiences of using hyperspectral scanners, I would like to report on a use case under investigation in Belgium.

Project Specific Context

In a context of aging infrastructure, **metallic towers** are an important component to define and plan the replacement needs. Three thousands of them (nearly 20%) are reaching their theoretical end of life in the coming years (the oldest ones will be 100 years next year).
Therefore, a reliable condition assessment is crucial in order to determine their remaining lifetime and/or their repair needs. A benchmark with several TSO's on that topic, confirmed the following 2 findings:

- Visual inspections are not sufficient to assess the condition of painted towers.
- Climbing inspection is still the reference method: locally "scratch" the surface (removing paint and rust) to visually inspect the state and to measure residual thickness of the profiles.

This method is quite invasive, requests resources, involves safety risks (working at height, vicinity of high voltage) and requests outages to assess above the safety limits.

We believe that combining the new technology of hyperspectral camera (as described in paper 10302 for assessing insulator shed contamination) with drone, offers a promising alternative **to be used onsite when the line is energized**.

Project description

That is the reason why Elia (the Belgian TSO) started a proof of concept to explore the possibility of using the hyperspectral camera to properly detect the status of painted metallic towers in terms of corrosion, and automatically classify these damages according to their severity with a non-invasive method.

The project will be delivered in three main parts:

1. **Technical feasibility (ended 31/12/2021)** consisting mainly in **laboratory** testing
   - to detect and evaluate corrosion on metallic towers,
   - to compare and align the results with current climbing inspections.
2. **Practical utilization (Q3-Q4 2022)** consisting in **on-site** use of hyperspectral camera
   - to manage appropriate distance and special resolution,
   - to deal with atmospheric and environmental correction,
   - to develop/fine-tune AI for classification of damages and define reporting modalities.
3. **Prototype of drone integration (Q1-Q2 2023)** consisting in mounting **on drone**
   - to develop the fixing elements on drone,
   - to test and validate on site,
   - to define sourcing strategy and develop methodology for future inspections.

Results of step 1

The first step took place with two partners and with different approaches:
Method 1 (IMEC) was based on **empirical classification of corrosion** samples

- Development of corrosion classification
- More than 80% match with traditional method (climbing inspections)
- Good identification of coating morphology (bubbles, cracks, etc.)

For Method 2 (DNV) the classification was based on a **spectral library of corrosion** types and paint

- Possibility to see different type of corrosion products
- Potential to penetrate beyond the paint surface
- Distinguish different type of paints under the surface
- Algorithm able to handle pixel mix (corrosion + paint)

Conclusion

Based on the promising results of step 1, Elia will pursue the investigation and is looking for interested parties.